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SAINT LUCIA CONSULTATION REPORT: Fisheries Early Warning and Emergency Response

CRFM Secretariat
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Saint Lucia 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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SAINT LUCIA 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 Alerting Protocol
CARICOM	Caribbean Community
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
CVQ	Caribbean Vocational Qualification
DANA	Damage and Needs Assessment
DOF	Department of Fisheries
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EAF	Ecosystem Approach to Fisheries
ECLAC	Economic Commission for Latin America and the Caribbean
ECHO	European Commission Humanitarian Aid
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 United Nations
FEWER	Fisheries Early Warning and Emergency Response
FMP	Fisheries Management Plans
GPS	Geographic 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
Met	Meteorological
MHEWS	Multi-Hazard Early Warning Systems
MORI	Mona Office for Research and Innovation
MOU	Memorandum of Understanding
MPU	Marine Police Unit
NEMO	National Emergency Management Organisation
NOAA	National Oceanic and Atmospheric Administration
NTRC	National Telecommunications Regulatory Commission
PGIS	Participatory Geographic Information Systems

PPCR	Pilot Program for Climate Resilience
RDS	Radio Data Service
SAME	Specific Area Message Encoding
SAR	Search and Rescue
SLASPA	Saint Lucia Air And Sea Ports Authority
SLFCSL	Saint Lucia Fisherfolk Cooperative Society Ltd.
SOCMON	Socio-economic Monitoring for Coastal Management (Global Programme)
SRS	Software Requirements Specification
TVET	Technical and Vocational Education and Training
UNDP	United Nations Development Programme
VCA	Vulnerability and Capacity Assessments
VHF	Very High Frequency
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 Lucia from 14-16 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.

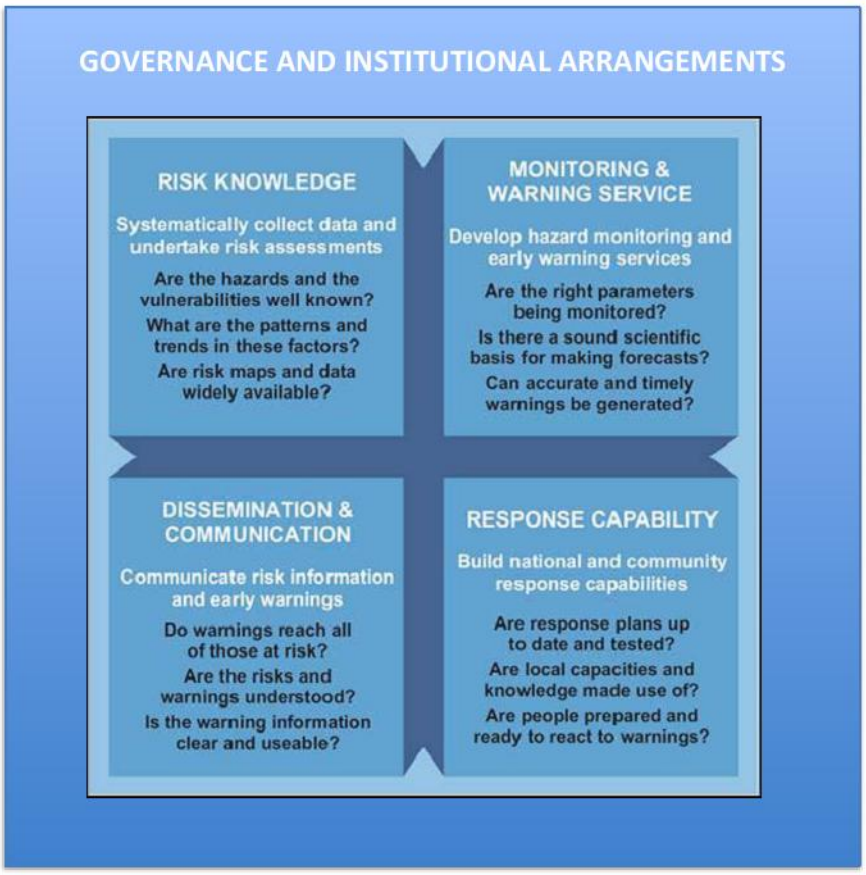


Figure 1. EWS are underpinned by governance

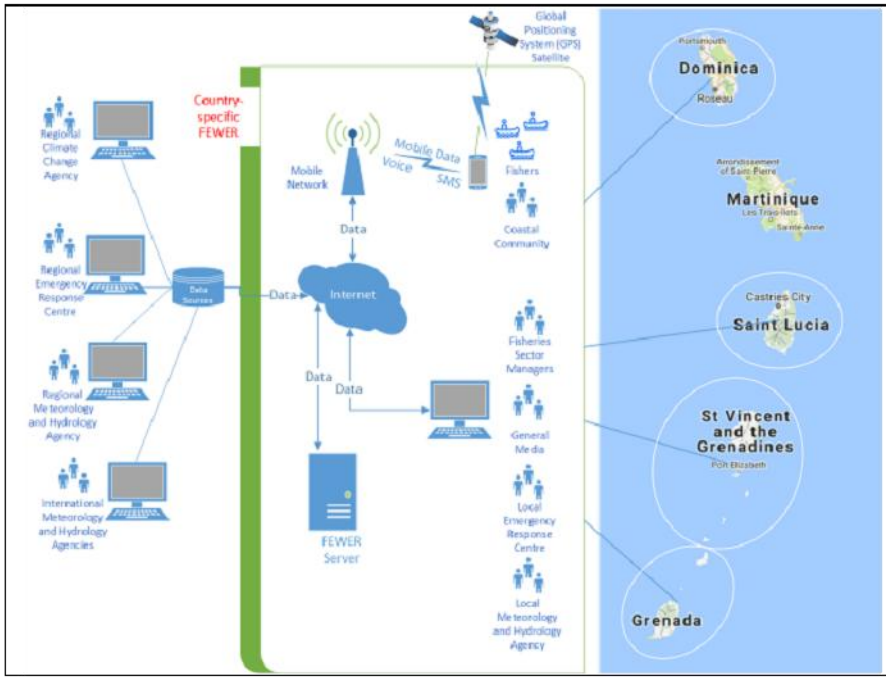


Figure 2. FEWER schematic for country specific solutions

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 Lucia, 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/marine police unit, 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 most recent national report on disaster risk reduction (DRR), the PPCR project and the report of the 2016 CDEMA-led Caribbean Early Warning System Workshop.

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. The national workshop and main site visit were well publicised (Appendix 2) with the assistance of the liaisons. The consultants prepared to use and adapt to the checklist (Appendix 3) for context-specific analysis.

Table 1. National consultation liaisons

Liaison	Affiliation
Hardin Jn Pierre	Fisheries authority
Yvonne Edwin	Fisheries authority
Alva Lynch	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 Kim Mallalieu. Key informant interviews on the first day guided the information exchange in the national consultation workshop held at the Department of Fisheries on the morning of the second day. Seon Ferrari was the local host. The afternoon fish landing site visit to Dennery (location selected using criteria in consultation with the fisheries authority) was supplemented by an impromptu visit to Gros Islet (also highly ranked in site selection) next day. Along with the Castries fisherfolk at the national consultation, the country visit targeted three sites (Figure 3). The Fisheries Department provided transportation for the duration of the

visit on a fuel cost recovery basis. Appendix 3 lists people contacted in the country consultation interviews and workshop. Slides were used only for the workshop stages shown in Figure 4.

Figure 3. The three fish landing sites focused on in Saint Lucia were Castries, Dennery and Gros Islet

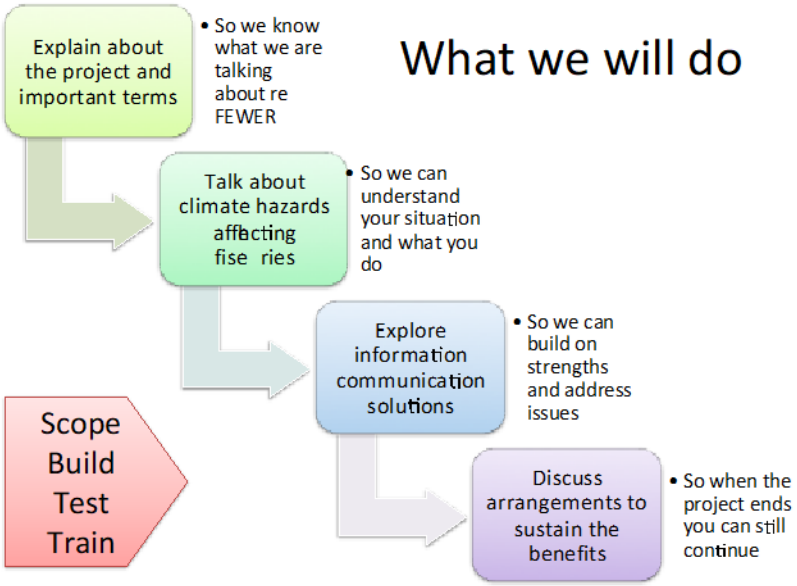


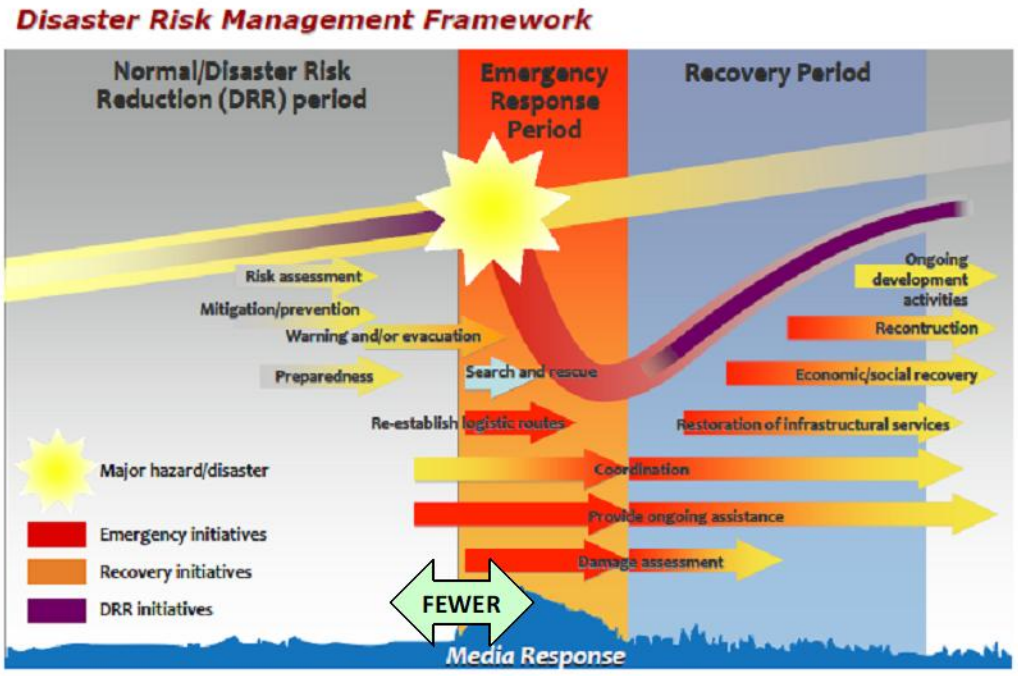
Figure 4. Organisation of the national workshop

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.



Source: Disaster Risk Management Cycle (DRMC) Diagram (modified from TorqAid; http://www.torqaid.com/default.asp).

Figure 5. FEWER at the interface between EW and ER

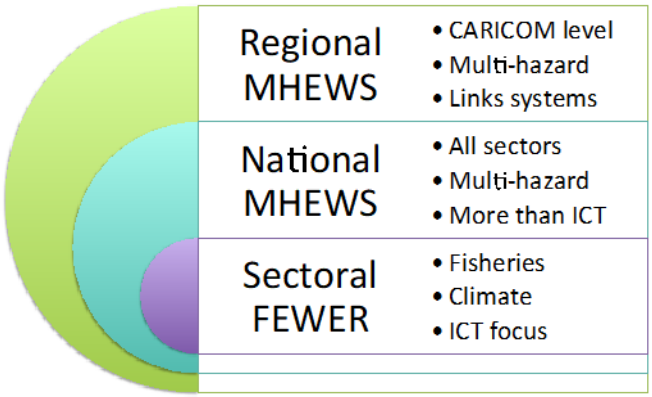


Figure 6 FEWER as a part of a larger multi-hazard and cross-sectoral, nationally to regionally networked EWS

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].

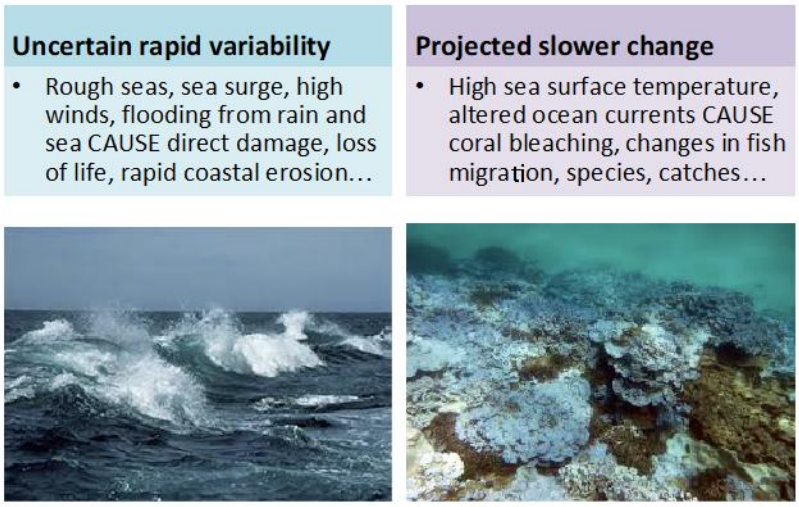


Figure 7 FEWER focuses mainly on rapid onset climate hazards, but slow onset changes cannot be ignored in longer term fisheries plans

[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

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). Disaster practices are often best understood in the context of livelihoods (Figure 10). That is, we sought the reasoning behind actual actions, perceptions and aspirations through probing narratives. Thus, we also sought a spread of information ranging from normal everyday practice to actual hazard event experiences to what the diverse contacts thought was desirable for the future.

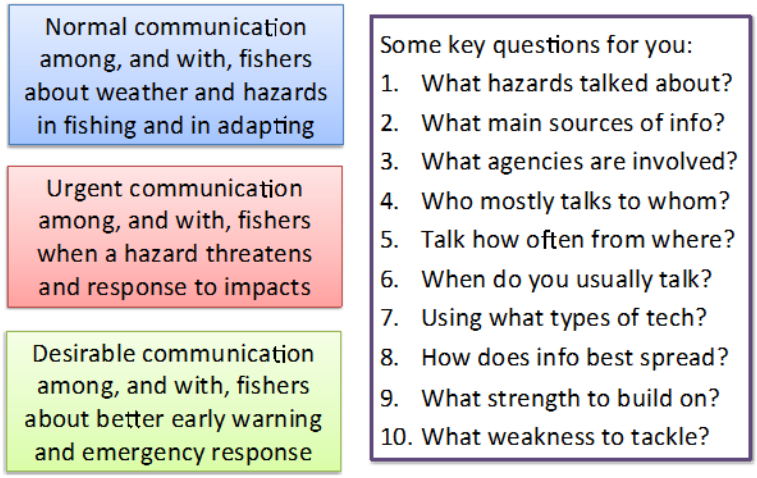


Figure 9. Seeking information on communication practices in real-life experiences through stories

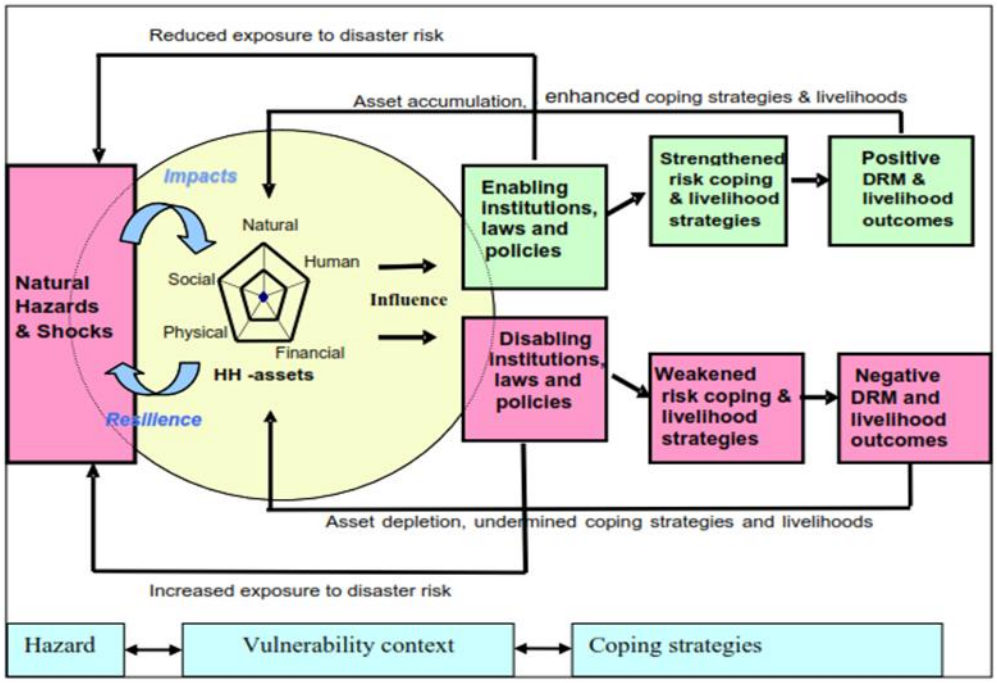


Figure 10. Disaster practices are taken in the context of livelihood assets, institutions and strategies (Source: Baas and others 2008)

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 captures 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).

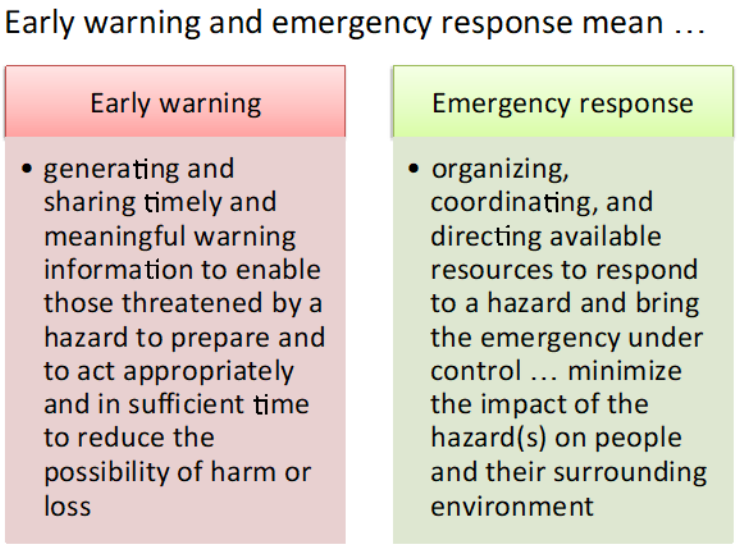


Figure 11. Early warning and emergency response explained

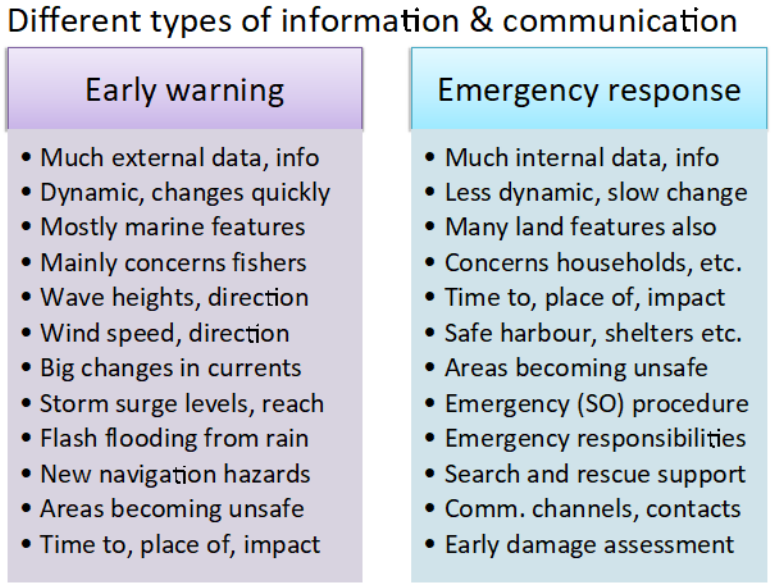


Figure 12. EW and ER differ in information characteristics

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 Department of Fisheries (DOF) 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.
- Making separate collaborative agreements with public agencies included in the national MHEWS is not the norm for NEMO, but there are agreements with the private sector such as for ER supplies and food warehousing and distribution in declared emergencies.

- 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, climate change adaptation (CCA) and disaster risk management (DRM). The recently started United Nations' Food and Agriculture Organization (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, United Nations Development Programme (UNDP) and PPCR initiatives may address this.
- 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 the DOF is planning 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	x
- Wind waves, in open ocean					x
- High surf, mainly near to shore			x		
High wind, maybe >20 knots					x
Wind dir+ indicator of weather				x	
Currents, speed and direction for certain fishing					x
Storm surge, how high and far				x	
Rain flood, flash flooding likely				x	
Water temp., coral bleaching?			x		
Visibility, hazy atmosphere					x
Wave period short					x

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 fairly well defined hurricane season
- Northerly sea swells (mainly in the first quarter of the year) generated by distant storms
- 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

Fishers and fisheries officers in various locations also voiced views on 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 exists 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.
- Flash flooding damages boats when watershed debris from 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, disability, access to infrastructure, economic diversity and environmental impacts.
- 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 stakeholders online. This can be via participatory geographic information systems (PGIS) coupled with visualisation.

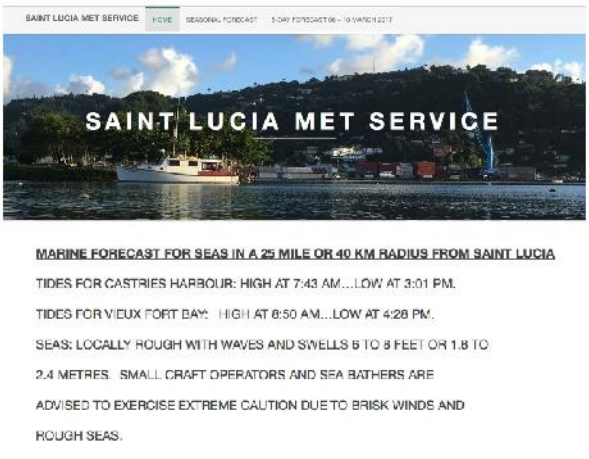
- Capacity for PGIS was said to be low in the key agencies but is increasing such as through the use of SocMon Spatial.
- The physical planning authority was the lead for such information in other climate projects including under the PPCR and with the Caribbean Community Climate Change Centre (CCCCC).
- 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.

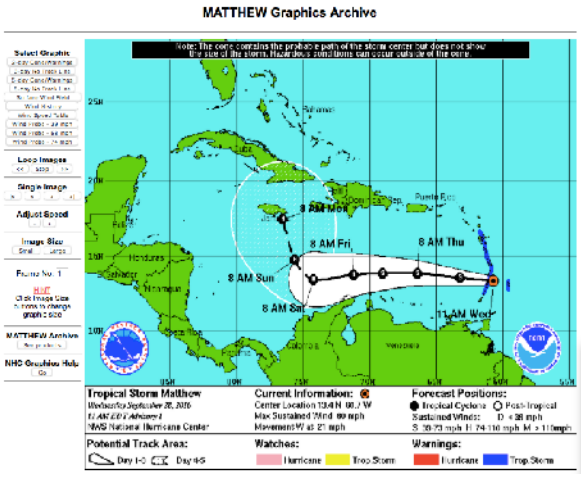
The full potential for incorporating risk assessment into fisheries sector plans, and hence a FEWER solution, is not yet realised for many of the above reasons. However, this is a good time to bring together several compatible initiatives to build more coherent policy, planning and management.

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 several 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.

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.





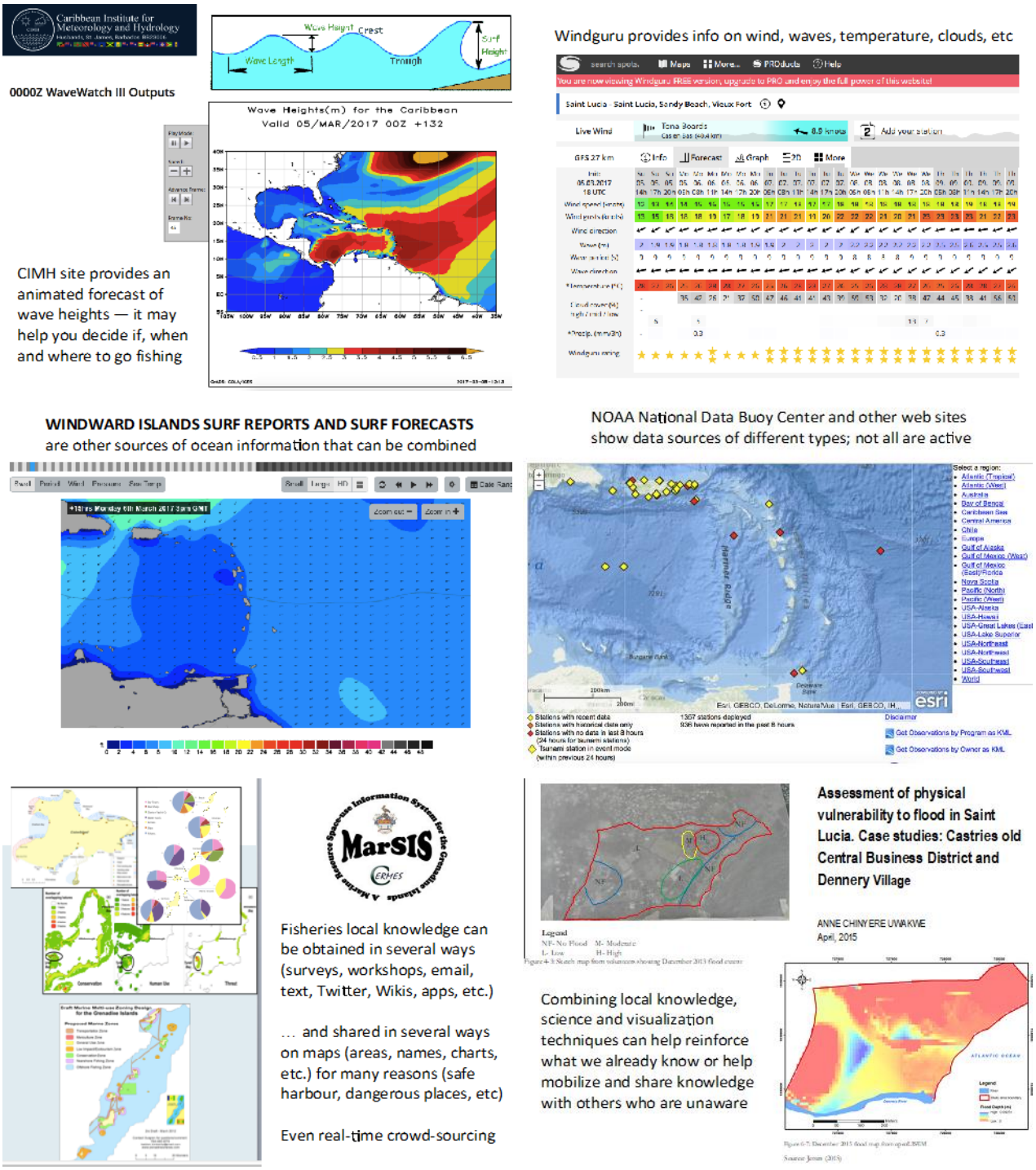


Figure 15. Sources and visualisations of hazard monitoring information form the basis of early warning and emergency response

Referring to the EWS checklist, and ignoring redundancy with points addressed previously under risk, a critical finding was that St Lucia, and NEMO in particular, is already heavily 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 Requirements Specification (SRS) and other parts of FEWER. NEMO was testing CAP (in Dennery) and stated clearly that FEWER

proposals needed to take CAP into account as the core of the current and proposed MHEWS. Other points, many made by the Met Service and others in the national consultation workshop, were:

- NEMO's institutional mechanisms for fisheries-related monitoring and warning were reasonably adequate, but a more targeted effort such as by FEWER would be welcomed especially by the DOF
- 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
- Met Service operates 24 hours, but other public sector agencies and fishing cooperatives do not
- Many online products presented in the consultation are used regularly by Met Service forecasters
- Marine forecasts out to 25 miles (40km) around St Lucia are valid for 24 hours and are issued to list agencies and the public at 0600, 1200 at 1800 daily
- Met Service validates model projections with real-time Météo-France buoy for wave height, but buoys are often not working; the closest buoy about 4 miles north of St Lucia is very useful
- Marine forecasters need more hydro-met buoys at sea for obtaining real-time validation data
- Previously installed sensors, e.g. under CPACC, were either destroyed or went out of service over time beyond project lifespans as there was no maintenance follow-up to previous climate projects
- Met Service may cautiously consider assisting and endorsing a value-added layman's advisory such as 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.
- TS Matthew was cited as a case in which warnings were timely and well done despite challenges
- Fishers want marine forecasting to include currents, wave period and water temperature
- Some fishers may look at a tree's movement before setting to sea to get wind speed and direction, so local knowledge and practices that provide simple useful information must not be dismissed
- The Marine Police Unit currently flies coloured flags in event of bad weather in Castries and Vieux Fort. They can arrange for the Police to replicate flying of pennants at other sites
- 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

Rodney Bay Marina, adjacent to the Gros Islet fishing community, provided an interesting case of self-help in monitoring and warning that we were told is fairly common in marinas. Marina staff creates an in-house composite of weather services information from online sources and prints it daily for clients. In addition, a client sailor voluntarily shares his daily analysis of weather via marine VHF radio based on his own interpretation and experience. This comes with cautions that it is not an official product, but it is highly valued by peers. Some contacts said that perhaps the commercial fishing industry could organise a similar service through cooperatives. The marina and fishers normally have little interaction outside of an arrangement on emergency shelter. There seems to be room for innovation to improve fisheries-specific services, and the next section addresses where FEWER can perhaps be most influential.

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

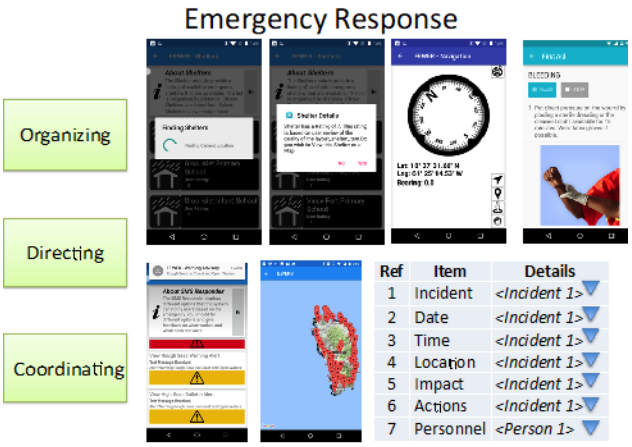


Figure 17. ICT options for features of emergency response

In overview, fishers mainly use cell phones for communication ashore and at sea when within range. 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 is uncommon in St Lucia. Language was also a talking point given the propensity of fishers to be more conversant in creole than Standard English.

Summarising findings from the visit on this checklist topic were:

- NEMO has set out institutional powers, processes and protocols for communication in disasters.
- 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 are associated with Community Disaster Response Teams (CDRTs) and are 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.
- 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.

Contacts provided more details on communication in a national consultation workshop and interviews:

- NEMO has in effect informal agreements with telecommunications service providers for zero-rated SMS messaging
- There are 17 Disaster District Committees but fishers do not know who are the focal points
- Met Services would support development of an app or other means to communicate better
- Many fishers listen to the daily 0600 weather report with marine forecast if not already at sea
- Fishers want a 0300 forecast before most go to sea, and Met Services says this is possible
- Every morning MPU gets weather updates from MET office via email

- Most fishers are said to heed marine advisories and stay ashore or go to sea cautiously
- Met Services would encourage all mariners to contact them when conditions are not as forecast
- A few fishers call Met Services by phone after they experience seas rougher than forecast
- Fishers' phones often have little credit and data services are not usually sought at sea
- WhatsApp and other social networking media are used, but not expressively for fisheries circles
- Met Services uses Facebook and has a web site under development; it is considering using Twitter (not popular) and WhatsApp (very popular) but has no person to manage social media
- 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
- LIME weather bulletins received by cell phone are paid attention to (e.g. by Dennery fishers)
- In the event of an incident at sea, the experience is that search and rescue teams leave property behind so fishers generally call friends instead of the Marine Police Unit
- Simple visual communication could be re-introduced such as having pennants flown at Vigie and Vieux Fort, and also at coastal police stations, to indicate weather outlook or warning
- The St. Lucia Universal Service Fund is managed by the National Telecommunications Regulatory Commission (NTRC) with oversight of the Eastern Caribbean Regulatory Authority (ECTEL)

Public broadcast audiences, language and radio personality were of importance in St Lucia:

- 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
- Low literacy in English can constrain fishers understanding audio broadcasts and text messaging
- Met Service and other stakeholders agreed that creole terms are needed to replace technical jargon where possible, but that this could be challenging as new words or combinations may need to be coined and learned
- Most radio announcers have trouble translating into creole except for Sam (Juke Bois) Flood
- Most fishers listen to Flood's morning show on Caribbean Hot FM for a personalised version of the marine forecast; Met Service says translation remains accurate
- Met Services would be cautious about encouraging layman value-added impact forecasts as they may be misunderstood or spread false information that Met Services would have to correct; to do otherwise would incur liability regardless of disclaimers by citizen communicators

In the national consultation strong points were made for increasing the use of marine band VHF radio:

- The estimated 5% of fishers who carry marine band VHF to sea do so for emergency communication with the port or other vessels such as yachts and ships, not other fishing boats
- Saint Lucia Air And Sea Ports Authority (SLASPA) operates the lighthouses and the signal station equipped with marine VHF, and uses NOAA marine advisories to inform ships when necessary
- There are two radio masts without repeaters at Morne in north and Moule a Chique in south
- The lowest area of VHF coverage is in the NE, whereas in the south the range is extensive
- NEMO has installed 17 terrestrial VHF transmitters (one in each constituency/NEMO area) and would be interested in increasing the use of marine VHF with repeaters (none at present)
- Need to reach marine VHF users on multiple channels e.g. 16 as well as 68 or 72, and 2 others
- A NEMO auxiliary channel is available at 151.325 MHz for public use
- Hybrid radios that can access marine channels as well as NEMO channels are recommended
- 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

- New VHF users will need to be well trained in radio procedures, and taught to use the scan function effectively to listen for both normal and EW communication on different channels
- The St Lucia Marine Police Unit (MPU) has competence to deliver safety at sea training with an emphasis on communications and they estimate that it would take less than a day
- It is strongly recommended that fishing cooperatives formulate agreements to purchase marine band VHF radios in bulk for their members
- 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
- Barrier to VHF is also device cost and distance from shore: at 40 – 50 miles out, can receive from repeater but cannot transmit to repeater.
- There is currently no VHF weather channel available in SLU at the moment so no weather information is currently broadcast on marine VHF by authorities but citizen sharing of weather outlooks was noted in the yachting community (see Rodney Bay Marina example)
- There is no known amateur radio use among small-scale fishers; i.e. no ham radio operators
- The Technical and Vocational Education and Training (TVET) Unit at the Ministry of Education has Caribbean Vocational Qualification (CVQ) training package for young fishers on boats <12m developed by DOF and delivered in part by Coast Guard/Marine Police that includes safety, VHF
- Coast Guard/Marine Police do 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

Site visits to Dennery (Figure 18) and Gros Islet (Figure 19) provided opportunity for interaction with fishers and observation of conditions in coastal communities.

Figure 18. Sharing information at Dennery


Figure 19. Gros Islet is adjacent to Rodney Bay Marina

Several of the points from these visits were reflected in the above lists, but we also noted at Dennery:

- NEMO is quite active at the site with a new river sensor for flood data and a disaster committee
- There is a fishing cooperative, and the manager said she had little problem mobilising fisherfolk
- Fishers claim a cell phone range at sea of 18-20 miles but most of the fishing for pelagics is usually beyond this, around three anchored FADs, but also in open water up to 60 miles way
- About six fishers were said to use smart phones at sea mainly for emergencies, but these fishers who were interviewed had very limited phones and phone use, often with no funds for data

- Interviewed fishers were "shopping" in their responses to get information from the interviewers on technology for use at sea in normal fishing operations (e.g. to give water temperature and current information), prioritised over EW and ER
- Word of mouth communication in person is used most to spread hazard warnings in the small community; women are as valued as men in communication networks in such events
- Dennery has a coastal field used for emergency vessel haul out, but it is not easy to do so from the fishing harbour. This requires considerable human (mostly man) labour, but cooperation is good and it strengthens ties for self-organisation and self-help within the community

Gros Islet provided similarities and different perspectives:

- A river sensor for flood data was provided long ago, and a disaster committee exists
- Much of the fishing is for conch and lobster which are not harvested as far at sea as pelagic fish
- There is a fishing cooperative, and the manager said she had little problem mobilising fisherfolk
- The manager showed a marine VHF base station that had been damaged and said she wanted to reintroduce VHF communication services
- The manager supported handset sales to fishers at discounted prices through the co-operative
- When a few fishers were asked views on VHF it was clear that they did not know the technology, they assumed VHF radios were costly and it is a hassle to get a radio license; fear of license test
- Most fishers carry cell phones to sea, but keep these safely put away in a container while fishing
- It was unclear how many actually used smart phones on land, but few actively used them at sea
- Fishers estimate the cell phone coverage to be about 20 miles in range
- Fishers said EW may make no difference to fishing habits as fish are known to be plentiful when weather is bad; fishers trust their own judgement, and that of peers before any marine forecast
- Gros Islet fishers independent and unlikely to take collective decisions on if to fish based on EW
- Gros Islet fishers recently started training on online banking in a computer lab facilitated by the Bankers' Association but with dismal attendance on first day
- Many Gros Islet fishers have smart phones and carry them to sea. ICT usage by these was reported as shown in Figure 20.

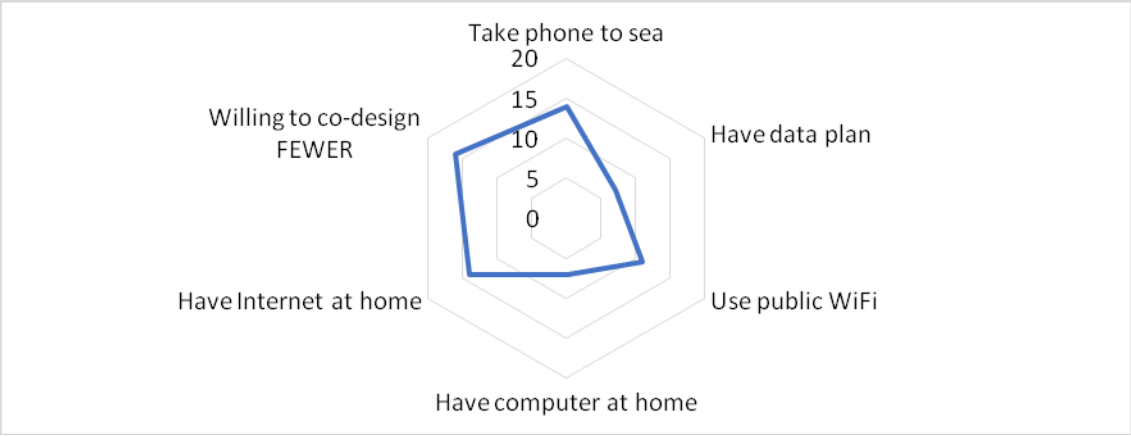


Figure 20 ICT Usage of Gros Islet Smart Phone Users

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. For example, NEMO already has considerable guidance online, as does Red Cross. 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
- 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
- Cooperatives could play a greater role ranging from importing VHF radios duty free if there was a demand, to playing a more active role in organising responses specifically for the industry
- Fishing cooperatives were currently low in capacity concerning climate and disaster awareness
- Cooperatives are interested in all avenues for offering services that would attract and retain members and see it as beneficial to be a leader in ER communication
- Supports the idea of a person in the national co-operative being able to use the online climate products, but uncertain who that would be as no capacity to do so with current staff
- Fishers may find that the co-operative working hours are an obstacle to responsive self-help unless there were higher levels of volunteerism to fill off-duty gaps
- DOF in damage assessment goes straight to fishers for information, not co-operatives but this could change with improved record-keeping of shareable member statistics and fishery assets
- 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 an MOU (Figure 21) as well as the responsibilities to develop, test, implement and sustain FEWER (Figure 22).

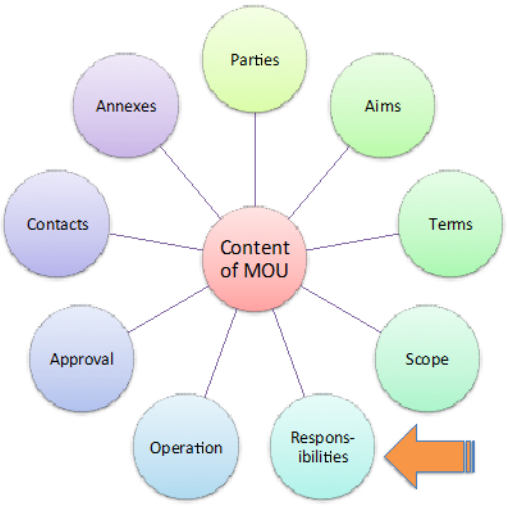


Figure 21. MOUs have a fairly standard content and format

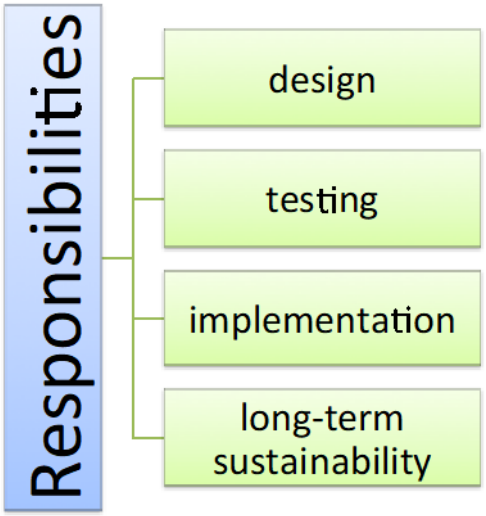


Figure 22. MOU responsibilities are spelled out for FEWER

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:

- Department of Fisheries — extension to fishers at all stages
- Red Cross — linking a fisheries sector ER more closely to their national ER role
- Fisherfolk organisation — increase awareness of fisherfolk colleagues; advocacy for fishers to engage in the solution; logistic support for training; provision and distribution of VHF equipment
- Met Services — sharing information on hazards; improving and incorporating marine forecasts; education on meteorological terms and how to interpret climate products

Contacts were in agreement to having a short, simple and adaptive MOU if one was needed for FEWER. At the end of the workshop the national consultation participants were asked to outline the key features or requirements of the FEWER solution based on the morning's discussion. A summary of responses is:

- Need to use VHF on land and at sea
- Use popular mass media radio broadcasts to share information e.g. by Sam Flood in creole
- Radio is good for creole language; improve timing of broadcasts to suit fishers; phased approach
- Adapt marine forecast to serve fishers better; make it available in text; colour and symbol formats can be used more for easy visualisation in phones; Met Service can try more direct delivery to fishers; greater use of graphics rather than text where possible
- Take into account that Red Cross is involved in the stages of response and recovery; need a 0300 forecast for fishers; colour code forecast on phone to show threat level; acknowledge that there is much dependence on Red Cross in ER and hence collaborate to the fullest
- Identify most appropriate equipment for communication; agree to VHF radio; co-ops can bring in radios duty free and serve as bases for communication; VHF more versatile than appreciated
- Increase VHF uptake; more public broadcasts; consider cell phone use within fishing households; besides online, use flyers and brochures for reference information; co-ops are critical to the solution
- Note that technology used is tied to livelihoods, so cell phone use is expected to continue; need big incentives to increase VHF use; need to demonstrate use and purpose; solution must be diverse including FAD fishing and ways to reduce fuel cost
- Need to inform fishers how to make the necessary changes
- Agree to marine VHF, but incorporate ham radio into FEWER solution too

- Lack of link between marine VHF and mass media broadcasts is major constraint; every fisher uses cell phone and can receive text messages, so focus on this; many fishers usually low on credit in phones; co-ops may assist subsidised SMS service; one set of text has to contain all conditions at a glance
- Fishers need to be sensitised about communication options
- Want a 7-day marine forecast and promotion of proper smart phones with adequate capabilities
- Need an app tailored to fishers with colour-coded info; use creole terms and jargon used by fishers

Contacts provided substantial valuable information for the co-design of the FEWER solution in ways that fit the particular needs of the St. Lucia 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?

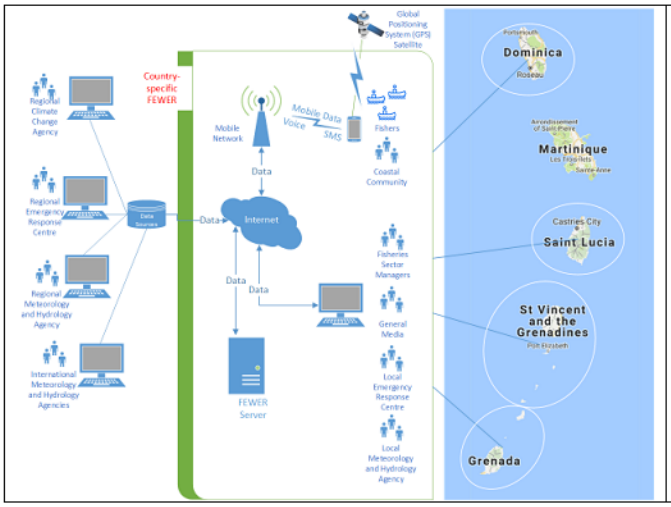
Rough seas, sea surge, high winds, flooding etc. (e.g. from storms, hurricanes)
Other hazards due to any change and variability in climate likely to affect fishers

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.

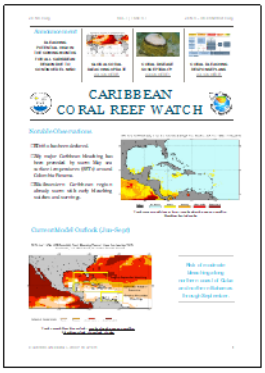
Appendix 2. Meetings notices

UWI PPCR IDB Inter-American Development Bank CRFM Caribbean Regional Fisheries Mechanism

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

Castries morning meeting

Saint Lucia project inception and scoping meeting
0830 -1230 Wednesday 15 March 2017
Department of Fisheries meeting room
Pointe Seraphine, Castries



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

Dennery evening event

Dennery inception and scoping meeting
1600 -1800 Wednesday 15 March 2017
Dennery Fish Market Complex

Agenda

1. Project overview, aims and objectives from scoping to design to training
2. Problems of climate hazards at Dennery, 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

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 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

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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.

CRFM members are Anguilla, Antigua and Barbuda, The Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago and the Turks and Caicos Islands.

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