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**GRENADA COUNTRY PROPOSAL:
Fisheries Early Warning and Emergency Response**



**CRFM Secretariat
2018**



Grenada Country Proposal: 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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GRENADA COUNTRY PROPOSAL: FISHERIES EARLY WARNING AND EMERGENCY RESPONSE

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ACRONYMS AND ABBREVIATIONS

Admin	Administrator
App	Application (related to application program interface)
CAP	Common Alerting Protocol
CC4FISH	Climate Change Adaptation in the Eastern Caribbean Fisheries Sector (Project)
CCA	Climate Change Adaptation
CCCCC	Caribbean Community Climate Change Centre
CCCFP	Caribbean Community Common Fisheries Policy
CDEMA	Caribbean Disaster Emergency Management Agency
CDM	Comprehensive Disaster Management
CDRT	Community Disaster Response Team
CERT	Community Emergency 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
DANA	Damage and Needs Assessment
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DVRP	Disaster Vulnerability Reduction Project
EAF	Ecosystem Approach to Fisheries
EBM	Ecosystem Based Management
ECHO	European Commission Humanitarian Aid
ECLAC	Economic Commission for Latin America and the Caribbean
ECTEL	Eastern Caribbean Telecommunications Authority
ER	Emergency Response
EW	Early Warning
EWS	Early Warning System
FAD	Fish Aggregating Device
FEWER	Fisheries Early Warning and Emergency Response
FMP	Fisheries Management Plans
GRENCODA	Grenada Community Development Agency
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
Met	Meteorological
MHEWS	Multi-Hazard Early Warning Systems
MORI	Mona Office for Research and Innovation
MOU	Memorandum of Understanding
MU	Marine Unit
NADMA	National Disaster Management Agency
NEMO	National Emergency Management Organization
NFO	National Fisherfolk Organization

NGO	Non-Governmental Organization
NIC	National Inter-sectoral Coordinating mechanism
NOAA	National Oceanic and Atmospheric Administration
NTRC	National Telecommunications Regulatory Commission
PGIS	Participatory Geographic Information Systems
PM&E	Participatory Monitoring and Evaluation
PPCR	Pilot Program for Climate Resilience
RDS	Radio Data Service
RDVRP	Regional Disaster Vulnerability Reduction Project
SAME	Specific Area Message Encoding
SAR	Search and Rescue
SDG	Sustainable Development Goals
SocMon	Socio-economic Monitoring for Coastal Management (Global Programme)
SRS	Software Requirements Specification
TELCOS	Telecommunications Service Providers
TNC	The Nature Conservancy
TOR	Terms of Reference
UNDP	United Nations Development Programme
VCA	Vulnerability and Capacity Assessments
VHF	Very High Frequency (marine radio)

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)¹ from February 2017 to May 2018. The PPCR is executed by The University of the West Indies through its Mona Office for Research and Innovation (MORI)², with the marine subcomponent in partnership with the Caribbean Regional Fisheries Mechanism (CRFM)³.

As a programme of the Climate Investment Funds (CIF)⁴, 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)⁴, 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 proposal sets out a country-specific FEWER solution. The proposal is based primarily on findings from a country consultation visit and literature review. The consultation slide presentation, consultation report and Software Requirements Specification (SRS) were previously distributed to country contacts. A proposed memorandum of understanding (MOU) was also prepared and is included as Annex 1 to this proposal. The proposed MOU seeks collaboration among national agencies, stakeholder groups and the CRFM Secretariat for development, implementation and administration of the FEWER solution.

1.2 Document arrangement

The proposal follows a layout similar to the consultation report using the early warning system (EWS) checklist⁵ in Appendix 1. The contextual section on *Cross-cutting governance and institutional arrangements* is followed by the substantive FEWER proposal divided into sub-sections that focus on *Risk knowledge*, *Monitoring and warning service*, *Dissemination and communication*, and *Response capability*. *Risk management and sustainable financing* are then addressed. *Monitoring, evaluation, learning and adaptation* comes before the *Conclusions* and *Appendices*.

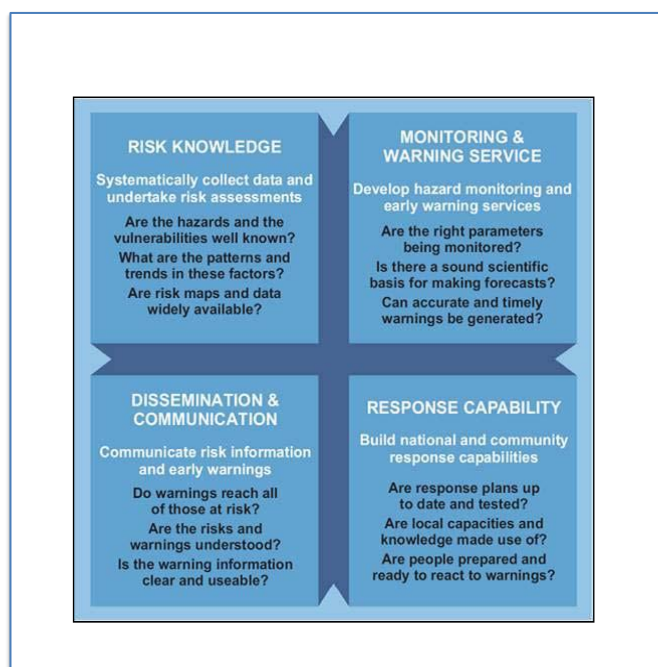
¹ <https://www.climateinvestmentfunds.org/fund/pilot-program-climate-resilience>

² <https://www.mona.uwi.edu/mori/>

³ <http://www.crfm.int>

⁴ <http://www.iadb.org/en/inter-american-development-bank,2837.html>

⁵ 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



*Figure 1. Early warning and emergency response has four main components all underpinned by governance and institutional arrangements
(Source: UNISDR Platform for the Promotion of Early Warning)*

1.3 Audiences and reading

This proposal is intended for all parties and stakeholders in the country and region who are interested in FEWER. These include the fisheries authority, fisherfolk organizations, individual small-scale fishers and boat owners, meteorological services, disaster management agency, physical planning unit, coast guard (Marine Unit, MU), telecommunications regulator, CRFM Secretariat, Red Cross and others. These agents have different perspectives and interests, and are unlikely to see the national situation in the same way. Yet, their agreement with the proposal is needed for FEWER co-design, implementation and sustainability.

Readers may wish to refer to the country consultation report for the situation assessment underpinning each section. Given the diversity of audiences, the proposal is as concise and non-technical as possible. In preference to references at the end, we have used footnotes for convenient access to resources, and to constantly remind readers of the wealth of initiatives and materials to which FEWER connects. Each section has content geared towards enabling fisheries management as well as content addressing the Information and Communications Technology (ICT) aspects of FEWER that are the focus of the proposal. Fisheries management contexts into which the FEWER ICT proposal is embedded need to be addressed for sustainability, but many of these are beyond the scope of FEWER. Readers may use this proposal as a resource for sustaining and further developing FEWER beyond the initial project. Intended audiences include agents who wish to modify or extend FEWER, as well as those who wish to address associated fisheries-related challenges and opportunities

2 CROSS-CUTTING GOVERNANCE AND INSTITUTIONAL ARRANGEMENTS

In this section, before we go into more specific aspects of the proposal, we frame and embed FEWER in the larger context of marine governance and institutions as called for in the EWS good practice checklist. We do so also in the context of telecommunications regulatory and procedural frameworks as essential to

adequately and efficiently effect communications in support of checklist practices. As issues of data and information sharing, and related data formats, feature strongly in early warning and emergency response, these matters are treated as necessary. An understanding of these arrangements is necessary in order to build, operate, and sustain an enabling environment with adaptive capacity for the FEWER ICT solution. This is why we have put this section first in the proposal despite it being last in the checklist. Much of this background is from literature and well-documented fisheries initiatives rather than consultation.

2.1 Fisheries, climate adaptation and disaster management

Governance and institutional arrangements underpinning the four components of any functioning EWS are multi-level. Global, regional, sub-regional, national, local/community, household and individual are all levels of interest. Most fisheries stakeholders should be aware by now from several regional projects and publications that the levels connect across different types of scales (spatial, temporal, jurisdictional, institutional, etc.) and boundaries (maritime, technological, social, institutional, organisational, etc.)⁶. They know that diverse actors in marine governance serve as nodes in networks with vertical and lateral linkages⁷, and that social-ecological system resilience in their small-scale fisheries depends heavily on adaptive capacity⁸.

The above concepts have been, and are being, used in marine projects in the Eastern Caribbean such as:

- Marine Governance in the Eastern Caribbean (MarGov) Project⁹
- Caribbean Large Marine Ecosystem (CLME) and CLME+ Projects¹⁰
- Climate Change Adaptation in the Eastern Caribbean Fisheries Sector (CC4FISH)¹¹

Ecosystem based management (EBM) and the ecosystem approach to fisheries (EAF), that all CRFM countries are actively pursuing, also incorporate resilience concepts in addressing climate change adaptation (CCA) and disaster risk management (DRM)¹². **FEWER must be deeply embedded into the regional resilience context, and not treated as a separate technical intervention.** The dilemma is that operationalizing many of these resilience concepts within governance and institutional arrangements is a work in progress. Not all conditions are ideal yet. **FEWER must evolve with new achievements in fisheries governance, as well as contribute towards such evolution in the face of a changing climate.** The Caribbean Marine Climate Change Report Card 2017¹³ and its set of Scientific Reviews¹⁴ that include fishery resources¹⁵ and fisheries¹⁶ clearly set out the best available scientific information on the projected

⁶ Mahon, R., L. Fanning, and P. McConney. 2014. Assessing and facilitating emerging regional ocean governance arrangements in the Wider Caribbean Region. *Ocean Yearbook* 28: 631-671

⁷ Parsram, K. and P. McConney. 2011. A network approach to understanding coastal management and governance of small scale fisheries in the eastern Caribbean. Pages 334-350. In R. Ommer, R.I. Perry, P. Cury and K. Cochrane (eds.). *World Fisheries: A Social-Ecological Analysis*. Wiley-Blackwell, Oxford, UK. 440pp.

⁸ Mahon, R., P. McConney and R. Roy. 2008. Governing fisheries as complex adaptive systems. *Marine Policy* 32:104-112

⁹ CERMES. 2012. Final Technical Report 1 March 2007– 29 February 2012. CERMES MarGov Project Document 28. 16 pp.

¹⁰ <https://clmeplus.org>

¹¹ <https://www.thegef.org/project/climate-change-adaptation-eastern-caribbean-fisheries-sector>

¹² Fanning, L., R. Mahon and P. McConney. [Eds]. 2011. *Towards marine Ecosystem-Based Management in the Wider Caribbean*. Amsterdam University Press, Netherlands. 428pp.

¹³ CMEP. 2017. *Caribbean Marine Climate Change Report Card 2017*. (Eds. Paul Buckley, Bryony Townhill, Ulric Trotz, Keith Nichols, Peter A. Murray, Chantalle Clarke- Samuels, Ann Gordon, Michael Taylor). Commonwealth Marine Economies Programme. 12pp.

impacts of climate change and variability. Risks to fishes, fishers and fisheries are many and likely interact in a complex manner. Exposure, sensitivity, adaptive capacity and other variables that change with time, location and situation specifics complicate impact projections at national-island and local-site levels¹⁷. Outcomes are uncertain, especially when several hazards interact with each other and social-ecological systems¹⁸. The current evidence reinforces the need for adaptive governance in the form of state and non-state institutional arrangements with adaptive capacity that strongly supports early warning (EW) and emergency response (ER) within a framework for participatory monitoring, evaluation and learning¹⁹. These frameworks are not all fully in place. The above projects (especially the CLME+ Project²⁰) and others that are planned such as one on Developing Organizational Capacity for Ecosystem Stewardship and Livelihoods in Caribbean Small-Scale Fisheries (StewardFish) address these arrangements, but FEWER may have to be an entrepreneur in piloting, testing, learning and adapting without the optimal enabling environment. **The Caribbean Community Common Fisheries Policy (CCCFP), CRFM's Strategic Plan, Caribbean Fisheries Forum, annual Scientific Meeting, working groups, D-group communication etc. all need to incorporate FEWER in order to strengthen the sub-regional enabling environment²¹.**

The other components of the PPCR can contribute to this enabling environment through their processes and products. These are:

- Component 1. Improving geospatial data and management for adaptation planning, sea level rise and storm surge impact analysis
- Component 2. Consolidating and Expanding the Regional Climate Network and Global Platform Linkages
- Component 3: Downscaling and Expanded Climate Projection Models and High Resolution Maps
- Component 4: Applied Adaptation Initiatives (Health, Agriculture and Water)

FEWER is part of the marine focus in Component 4, and one of the first to be implemented. Since others are at early stages the lead agencies may be in a position to determine if or how to establish or strengthen their integration of FEWER. More and better fisheries-relevant marine data, and downscaled model

¹⁴ Commonwealth Marine Economies (CME) Programme: Caribbean Marine Climate Change Report Card Scientific Reviews [<https://www.gov.uk/government/publications/commonwealth-marine-economies-cme-programme-caribbean-marine-climate-change-report-card-scientific-reviews>]

¹⁵ Oxenford, H.A. and I. Monnereau. 2017. Impacts of Climate Change on Fish and Shellfish in the Coastal and Marine Environments of Caribbean Small Island Developing States (SIDS). Caribbean Marine Climate Change Report Card: Science Review 2017: 83-114

¹⁶ Monnereau, I. and H.A. Oxenford. 2017. Impacts of Climate Change on Fisheries in the Coastal and Marine Environments of Caribbean Small Island Developing States (SIDS). Caribbean Marine Climate Change Report Card: Science Review 2017: 124-154

¹⁷ Monnereau, I., R. Mahon, P. McConney, L. Nurse, R. Turner, and H. Vallès. 2015. Vulnerability of the Fisheries Sector to Climate Change in Caribbean Small Island Developing States. Proceedings of the Gulf and Caribbean Fisheries Institute 67: 20-23

¹⁸ Nurse, L. 2011. The implications of global climate change for fisheries management in the Caribbean. Climate and Development 3:228-241

¹⁹ McConney, P., Charlery, J., Pena, M., Phillips, T., Van Anrooy, R., Poulain, F., Bahri, T. 2015. Disaster risk management and climate change adaptation in the CARICOM and wider Caribbean region – Formulating a strategy, action plan and programme for fisheries and aquaculture. Regional workshop 10–12 December 2012, Kingston, Jamaica. FAO Fisheries and Aquaculture Proceedings. No. 35. Rome. 123 pp

²⁰ <http://www.clmeproject.org>

²¹ For further information on all visit the CRFM web site <http://www.crfm.int>

projections are needed, among other inputs. Marine capture fisheries are not high priority for Caribbean Disaster Emergency Management Agency (CDEMA), Caribbean Community Climate Change Centre (CCCCC) and Caribbean Institute for Meteorology & Hydrology (CIMH)²², and realistically may never be, but institutionally linking closer with CRFM could be beneficial. CDEMA may be key to coordinating this given its mandate. **The several regional agencies implementing the PPCR components need to ensure that they contribute to the further development and sustainability of FEWER.**

Mention of fisheries was rare in much of the disaster literature reviewed. Neither the detailed 2014 national report on DRR²³ nor the Collymore's comprehensive desk review²⁴ that preceded the 2016 regional workshop on EWS²⁵ paid much attention to fisheries. However, this may be mainly due to inadequacy of national inter-sectoral coordination mechanisms (NICs) and governance arrangements for integrating fisheries into CCA and DRM at national and local levels, given the interest observed during the country visit. Collymore refers to the 'EWS triangle' to visualize the relationships and responsibilities of categories of agents in EWS (Figure 2) who will be important to engage²⁶.

In his desk review Collymore also identified several issues with EWS in the region (Figure 3). His recommendations do not directly address an ICT solution but provide insight into the environment within which the solution must exist whether or not improvements are implemented. **The FEWER solution must be co-designed for resilience in an overall fisheries and EWS environment that is not currently enabling.**

There are serious and persistent systemic deficiencies in EW and ER at regional and national levels, including links within and between; that DRM experts are actively tackling. The situation is dynamic, and the systemic issues are beyond the scope of FEWER to fix. Collymore offered recommendations to address the deficiencies (Figure 4) along with details on their means of implementation.

National contacts validated the observation that EW and ER need to be made more visible in regional and national strategies and programmes. The checklist speaks of engaging role models and champions to advocate EW and ER to promote their benefits. **FEWER can support advocacy in the fishing industry through fisherfolk leaders in institutions such as the Caribbean Network of Fisherfolk Organisations (CNFO).**

²² <http://www.cdema.org>; <http://www.caribbeanclimate.bz>; <http://www.cimh.edu.bb>

²³ NaDMA 2014. Country document on disaster risk reduction for Grenada, 2014. National Disaster Management Agency (NaDMA): St George's. 105 pp.

²⁴ Collymore, J. 2016. Early warning systems in the Caribbean: a desk review. Final report to the International Federation of Red Cross and Red Crescent Societies and the United Nations Development Programme (Barbados and OECS).

²⁵ <http://eird.org/americas/caribbean-early-warning-system-workshop-in-barbados/#.WTyJfKZNn4>

²⁶ Villagran de Leon, J C, J Scott, C Cárdenas and S Thompson. 2003. Early Warning Systems in the American Hemisphere. Context, Current Situation and Future Trends. Hemispheric Consultation on Early Warning. UNISDR.

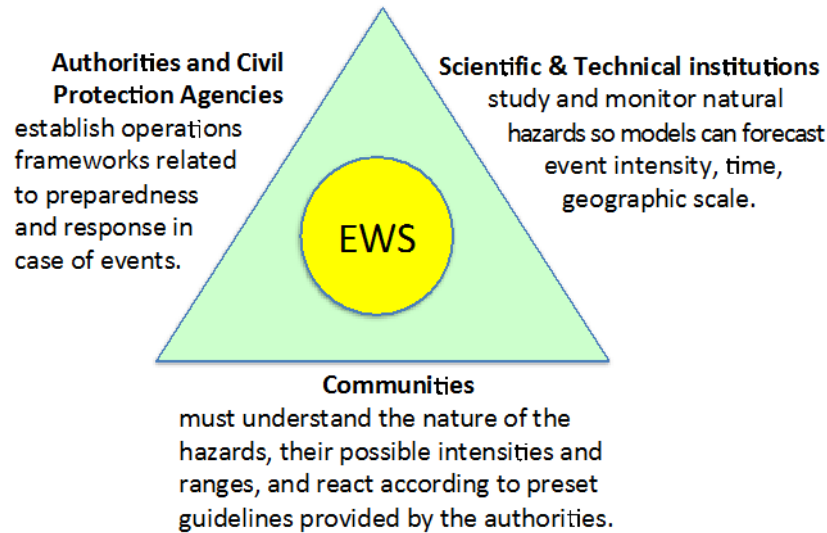


Figure 2. EWS triangle (Adapted from Villagran de Leon et al 2003 and Collymore 2016)



Figure 3. Issues that surfaced in the EWS desk review (Source: Collymore 2016)

A fundamental component of fisheries governance is an implemented fisheries management plan (FMP) based on EAF. None of the FEWER countries have yet achieved this, but formulating such plans is included in the CC4FISH project that seeks to integrate climate and disaster planning. **FEWER should be co-designed from the outset for incorporation into the national FMP and implemented in order to test and learn from the experience in one or more fisheries or locations.**

Although national policy and legislation in support of EW and ER exist, the regional study and national contacts concluded that they could be improved. This is beyond the scope of FEWER, but **defining clear roles and responsibilities for all state and non-state organisations in the proposed MOU can facilitate governance arrangements required for larger scale of multi-hazard early warning systems (MHEWS).**

The country visit revealed that the national (secondary) and local (primary) fisherfolk organizations were not well integrated into fisheries CCA and DRM despite the latter having a commendable governance arrangement from national to local level with attention to households as well. In talking to fisherfolk leaders it was evident that they had not highly prioritised CCA and DRM among their objectives for collective action. **In order to support FEWER, institutional arrangements that better integrate**

fisherfolk organizations into CCA and DRM need to be devised, taking into account the realities of fishing as an economic sector and the practical aspects of the leadership, livelihoods and capacities in fisherfolk organizations and of individuals.

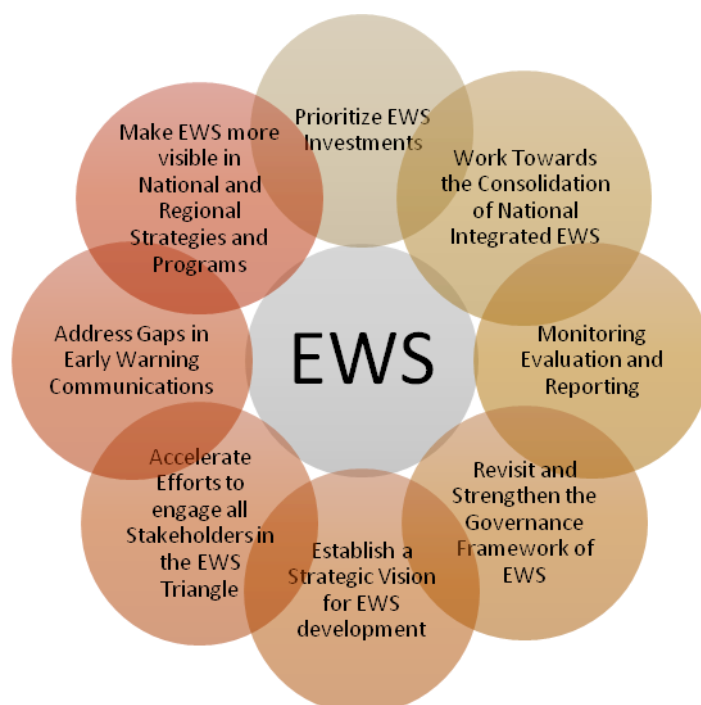


Figure 4. Recommendations for enhancing EWS in the Caribbean (Source: Collymore 2016)

While the FEWER project does not directly assess institutional capacities it is poised to enhance them in ways beyond ICT given diverse but easily achievable skills required to comprehensively implement the solution. **FEWER should be incorporated into state, non-state and private sector plans and programmes for fisheries sector capacity development.**

2.2 Information and communications for disaster risk management

Information and communications play essential roles in all stages of the disaster management cycle: mitigation, preparedness, response and rehabilitation. The current state of ICT in regional DRM practice has been assessed by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) in 2013 through a survey of disaster management organizations and an Expert Group Meeting attended by several of their heads. Among the recommendations advanced in the meeting report²⁷ was the formalization of agreements which oblige telecommunications operators to provide support for disaster response and recovery operations. In 2017 ECLAC followed by assessing the state of coordination between telecommunication service providers (telcos) and disaster offices in Caribbean countries. That report²⁸ outlines issues and recommendations for formalized inter-agency arrangements comprising a mix

²⁷ ECLAC (Economic Commission for Latin America and the Caribbean) (2013), "Report on the expert group meeting on information and communication technologies for disaster risk management in the Caribbean." LC/CAR/L.419. Port of Spain.

²⁸ ECLAC (Economic Commission for Latin America and the Caribbean) (2017), "[Strengthening cooperation between telecommunications operators and national disaster offices in Caribbean countries.](#)" LC/CAR/TS.2017/1. Port of Spain.

of policy and regulatory instruments as well as MOUs. Figure 5 illustrates ECLAC's view of the relations among telecommunications and disaster management entities.

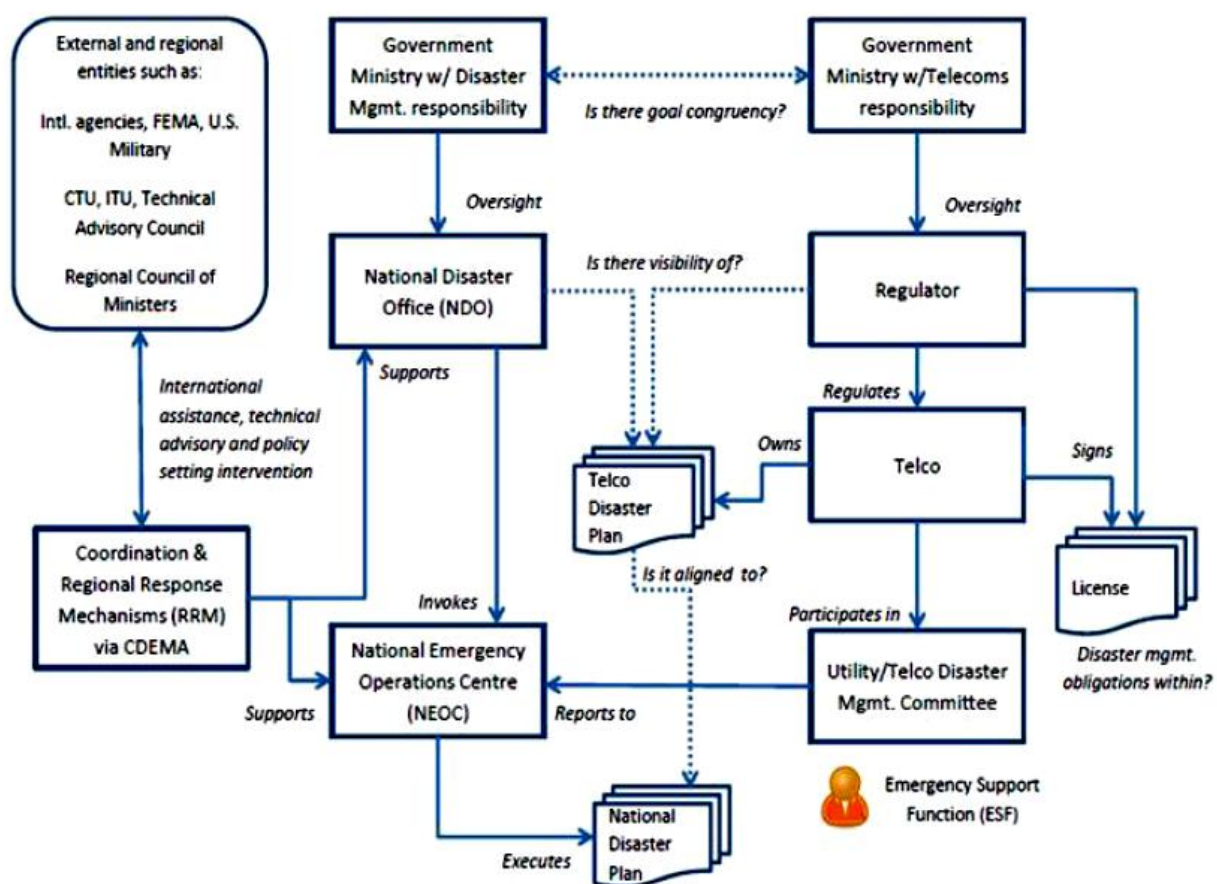


Figure 5. Relations among telecommunications and disaster management entities (Source: ECLAC 2017)

In the figure, the role of the telecommunications regulator is primarily captured in the specification of licence agreements which authorize operators to provide service. These licenses, among other things, may oblige providers to utilize mobile phone-based alerting technology in the event of an emergency. At the same time, telecommunications regulations may impose obligations for collaboration between service providers and national emergency agencies. These provisions are of vital importance to FEWER's primary beneficiaries, small-scale fishers, who are particularly vulnerable to natural hazards. **Regulatory obligations of telcos should include provisions for enhanced and accessible emergency communications for small-scale fishers for example through (i) minimum specified requirements for cellular coverage at sea and (ii) zero-rated FEWER messaging for emergency alerts and relief.** The former is an extension of existing obligations of concessionaires who hold national licenses, with the relaxation that the capacity requirements are dramatically reduced. The latter, triggered zero-rated service, is already in place in many jurisdictions though a mix of formal and informal arrangements with national emergency management authorities²⁸.

A diverse set of data and information contributors and consumers constitute the national early warning and emergency response landscapes. There is therefore need for agreement on data formats, in particular to convey hazard information. Considerable progress has been made in the adoption of the Common Alerting Protocol (CAP) for all-hazards alerting in the Caribbean. CAP specifies a data format for public warnings and emergencies communicated by and between different alerting technologies. It is well-suited

to at-sea alerts as it is compatible with traditional formats including NOAA Weather Radio's Specific Area Message Encoding (SAME)²⁹. CAP is an internationally accepted and deployed standard, adopted by the International Telecommunication Union, Telecommunication Standardization Sector (ITU-T) in 2007³⁰.

CAP enables a consistent warning message to be disseminated simultaneously over many different warning systems and supports the manual and automatic interruption of normal communications through the respective channels such as broadcast radio and TV. The protocol's many features include but are not limited to three-dimensional geospatial area representations, phased and delayed effective times and expirations, enhanced message update and cancellation features, custom warning messages and support for digital images, audio and video.

In the Caribbean, the EU-funded Regional Risk Reduction Initiative (R3I), 2009 – 2012³¹, developed CAP based EWSs in St. Maarten, Montserrat, Aruba, and Anguilla. An European Commission Humanitarian Aid (ECHO)-funded Community Alerts Project 2013-2014³² expanded the CAP-based EWS to St. Vincent and the Grenadines, Dominica and Grenada. An UNDP initiative, Strengthening Resilience and Coping Capacities in the Caribbean through Integrated Early Warning Systems³³, improved previous provisions targeting vulnerable communities and groups in Barbados, Dominica, St. Lucia and St. Vincent and the Grenadines over the period 2015 – 2017. It also developed a regional framework for facilitating multi-hazard CAP EWS³⁴. **FEWER must integrate with national EW systems, to include CAP-compliance.**

Assessments have been undertaken for each Caribbean CAP initiative. In the case of St. Vincent and the Grenadines Community Alerts Project, which focused mainly on flooding from rainfall and coastal hazards such as storm surges, a number of cross-cutting matters relating to institutional arrangements and lessons learnt were noted. FEWER proposals inspired by these 2014 findings are as follows:

- **All stakeholder groups must collaborate in FEWER co-design, development, deployment, operations and maintenance**
- **Roles and responsibilities of various parties in the EW and ER systems must be captured in formalized agreements prior to deployment**
- **FEWER must draw on and integrate with established and emerging infrastructure, services, social networks and relevant programmes**
- **NADMA must be able to view FEWER alerts and activate its dissemination channels**
- **FEWER and NADMA should trial crowd-sourced alerts at sea to assess the value of supplementing marine forecasts with now-casts**

²⁹ NOAA. 2011. US National Weather Service Instruction 10-1712 October 3, 2011: [Operations and Services Dissemination Policy NWSPD 10-17 NOAA WEATHER RADIO \(NWR\) ALL HAZARDS SPECIFIC AREA MESSAGE ENCODING \(SAME\)](#)

³⁰ International Telecommunications Union Telecommunication Standardization Sector, ITU-T. 2007. [SERIES X. Data Networks, Open System Communications and Security. Telecommunication security. Common alerting protocol \(CAP 1.1\)](#)

³¹ Agrico. 2012. [R3I Outcome Evaluation and Vulnerability Benchmarking \(B-tool\) Exercise](#)

³² ECHO. 2015. [Community Alerts Project \(CAP\) RFQ141017-1630 Final Evaluation Report](#)

³³ UNDP Barbados. 2015. [Strengthening Resilience and Coping capacities in the Caribbean through Integrated Early Warning Systems Project Summary](#)

³⁴ Aggarwal, Dinesh. 2017. Evaluation: [“Strengthening resilience and coping capacities in the Caribbean through integrated early warning systems”](#)

- **FEWER training (procedural and situated) must be replicable, after adaptation if necessary, in any future fisheries sector capacity development by any entity interested in fisheries, including donors.**

Critical outputs of the UNDP's 2015 – 2017 initiative include templates for national warning system policies fashioned after those of the Anguilla Warning System Policy (2015) authored by the Department of Disaster Management, Anguilla³⁵. Among other things, these set out important matters for inter-institutional agreement on the ICT-based EWS including:

1. the vocabulary of EWS terms and definitions
2. ranking of decision making powers (e.g. Governor via Deputy Governor, Deputy Governor, Commissioner of Police / Fire Chief (incident dependent), Director Department of Disaster Management and Deputy Director Disaster Management)
3. system testing
4. activation rules, process and protocols
5. lists of approved requesters, activators and authorizers for use of EWS
6. contact Information
7. CAP Alert Templates

FEWER must recognize the vocabulary, protocols and rules used in established EW systems in Grenada.

FEWER must be explicitly included in the national warning system policies, for example with respect to system testing, activation channels, contact information and CAP Alert Templates for incidents at sea.

A Primary CAP Server is installed physically in each UNDP project country and a secondary server is located out of country for resilience. The server application makes provision for the conveyance of emergency alerts via the following means where technically feasible:

1. Cable TV Interrupt
2. FM Radio Interrupt
3. Marine Radio
4. Weather Radio
5. Email
6. RDS receivers
7. Smartphones via a custom application for the national EWS
8. Sirens
9. SMS Text Message

FEWER must be included as an activation channel for the national warning system and a check box incorporated into the Alert Creation screen of the *web alert origination* software subsystem.

2.3 Summary

FEWER is consistent with many recent, on-going and planned initiatives that employ EAF and resilience thinking. The fit should be good, but there are gaps. Although filling these gaps is beyond the scope of FEWER as an ICT solution, FEWER can contribute indirectly to addressing them. The fisheries-related and ICT aspects of the proposal are summarised below (Table 1).

³⁵ [Department of Disaster Management Anguilla](#)

Table 1. Summary of proposals on governance and institutional arrangements

Fisheries, climate adaptation and disaster management	FEWER institutional arrangements
FEWER must be deeply embedded into the regional resilience context, and not treated as a separate technical intervention	<ul style="list-style-type: none"> • FEWER must integrate with national EW systems, to include CAP-compliance • FEWER must be explicitly included in national EWS policies e.g. wrt testing, activation channels, contact information and CAP alert templates for incidents at sea • Regulatory obligations of telcos must include provisions for enhanced and accessible emergency communications for small-scale fishers for example through (i) established requirements for radio and cellular coverage at sea and (ii) zero-rated messaging for emergency alerts and relief.
FEWER must evolve with new achievements in fisheries governance, as well as contribute towards such evolution in the face of a changing climate	<ul style="list-style-type: none"> • All stakeholder groups must continue to collaborate on FEWER co-design and implementation updates past the life of the current project • FEWER MOU updates and software templates to accommodate additional CAP servers, hydro-met sources etc. • FEWER and NaDMA should trial crowd-sourced alerts at sea to assess the value of supplementing marine forecasts with now-casts
The Caribbean Community Common Fisheries Policy (CCCFP), CRFM's Strategic Plan, Caribbean Fisheries Forum, annual Scientific Meeting, working groups, D-group communication etc. all need to incorporate FEWER in order to strengthen the sub-regional enabling environment	<ul style="list-style-type: none"> • FEWER must draw on and integrate with other relevant fisheries programmes • Regional fisheries stakeholders must provide inputs through all stages of the FEWER design and development cycle through to its deployment and operation. Requests to commence in July 2017
The several regional agencies implementing the PPCR components need to ensure that they contribute to the further development and sustainability of FEWER	<ul style="list-style-type: none"> • PPCR implementing agencies to be included in FEWER stakeholders and encouraged to provide inputs into FEWER co-design starting July 2017
The FEWER solution must be co-designed for resilience in an overall fisheries and EWS environment that is not currently enabling	<ul style="list-style-type: none"> • All stakeholder groups must provide inputs through all stages of the FEWER design and development cycle through to its deployment and operation. Structured requests to commence in July 2017
FEWER can support advocacy in the fishing industry through fisherfolk leaders in institutions such as the Caribbean Network of Fisherfolk Organisations (CNFO)	<ul style="list-style-type: none"> • FEWER field liaisons from CNFO community and Fisheries Division to act in the roles of ICT stewards and champions. FEWER Fishers', a co-design forum, to commence for this purpose July 2017
FEWER should be co-designed from the outset for incorporation into the national FMP and implemented in order to test and learn from the experience in one or more fisheries or locations	<ul style="list-style-type: none"> • National fisheries stakeholders must provide inputs through all stages of the FEWER design and development cycle through to its deployment and operation. Structured requests to commence in July 2017
Defining clear roles and responsibilities for all state and non-state organizations in the proposed MOU can facilitate governance arrangements required for larger scale of multi-hazard early warning systems (MHEWS)	<ul style="list-style-type: none"> • Roles and responsibilities of various parties must be captured in FEWER MOUs • FEWER must draw on and integrate with established and emerging infrastructure, services,

Fisheries, climate adaptation and disaster management	FEWER institutional arrangements
	social networks and related programmes
In order to support FEWER, institutional arrangements that better integrate fisherfolk organizations into CCA and DRM need to be devised, taking into account the realities of fishing as an economic sector and the practical aspects of the leadership, livelihoods and capacities in fisherfolk organizations and of individuals	<ul style="list-style-type: none"> • FEWER must be included as an activation channel for the national EWS and a check box incorporated into its server (web) application • NaDMA must be able to view FEWER alerts and activate its dissemination channels • FEWER must recognize the vocabulary, protocols and rules of established Grenada EWS • FEWER must recognize established protocols for elevation of network priority for disaster communications with national systems
FEWER should be incorporated into state, non-state and private sector plans and programmes for fisheries sector capacity development	<ul style="list-style-type: none"> • FEWER training (procedural and situated) must be replicable, after adaptation if necessary, in any future fisheries capacity development by any entity interested in fisheries, including donors

Due to social-ecological system linkages, and the fact that governance and institutional arrangements underpin everything else, several of the above elements of the proposal will resonate in the following sections. We seek to avoid direct duplication by building upon them from the perspective of the subject addressed in the section. Except for literature reviewed, the findings for the section are set out in the country consultation report.

3 PROPOSED FISHERIES EARLY WARNING AND EMERGENCY RESPONSE (FEWER)

FEWER must make valuable contributions within a national collaborative framework for DRM. It is proposed that it does so through geographically-targeted mobile phone-based early warning tools, as independently recommended by ECLAC (2017)³⁶, as well as through web portals for the different categories of agents. The FEWER software requirements specifications (SRS) sets out, among other things, relevant acronyms and abbreviations, purpose, background, scope, information and user classes, functional requirements, product perspective, system and user interfaces, hardware and software requirements and assumptions regarding user characteristics and usability. It also includes sample use cases and FEWER CAP templates. The SRS has been shared with participants of the country visit and other key stakeholders in June 2017. Readers of the FEWER Grenada country proposal are directed to the SRS for detailed proposals for the software product.

As described in the SRS, the five FEWER user classes envisioned are as follows:

1. **Public:** The public class refers to general users who are able to receive and transmit messages and alerts about the marine environment without playing any managerial, administrative or technical role in FEWER. They are primarily small-scale fisherfolk and are expected to use the FEWER mobile application (app).
2. **Coast Guard:** The Coast Guard, or Marine Unit as it is known in Grenada, are responsible for search and rescue at sea. The Marine Unit is expected to use a dedicated FEWER web application.

³⁶ ECLAC (Economic Commission for Latin America and the Caribbean) (2017), "Strengthening cooperation between telecommunications operators and national disaster offices in Caribbean countries." LC/CAR/TS.2017/1. Port of Spain.

3. Agency administrators: FEWER agency administrators represent local, national or regional communities of fishers; or are responsible for disseminating or moderating communications relating to early warning and/ or emergency response within other communities. They are primarily fisherfolk organizations (primary and national) but may include disaster management authorities, meteorological services, the Red Cross and the Caribbean Regional Fisheries Mechanism. FEWER agency administrators are expected to use the general FEWER web application with privileges in accordance with their user class.
4. Country administrators: FEWER country administrators are responsible for the configuration, management and administration of the national FEWER installation with country-level moderation privileges. It is expected that country-level FEWER administration will rest with the Fisheries Department. FEWER country administrators are expected to use the general FEWER web application with privileges in accordance with their user class.
5. Technical administrators: The technical administrator is responsible for the technical aspects of the overall configuration, management and maintenance of FEWER and its underlying frameworks. It is expected that technical administration will rest with government ICT units or with an external contracted entity. FEWER technical administrators are expected to mainly use the general FEWER web application with all privileges.

It is proposed that FEWER early warning mechanisms consolidate weather information from a variety of authoritative as well as informal sources. They will facilitate the generation of pre-structured, scheduled weather reports from authorized sources; pre-structured, irregular alerts (both warning and emergency) from FEWER users and local authorities; and irregular, unstructured messages from all users. Alerts will be CAP-formatted. Fisheries-related organizations and public users may generate and broadcast alerts to fisherfolk within their communities. Forwarding to other communities or to other CAP channels is moderated by FEWER administrators (admins). Administrators can enable and disable the delivery of SMS messages for alerts and the confirmation of alert delivery. Historical information of relevance to disaster risk management will be captured and available for access through GeoNode data repositories.

It is proposed that FEWER emergency response mechanisms facilitate the initiation of an automated distress call to the Coast Guard (MU), the generation and broadcast of unsafe-area alerts by fisheries-related agencies to fisherfolk within their communities, the recording and sharing of images and video of disaster-related damage, the display of national and community-based emergency contact information and emergency procedures, and the submission and display of local knowledge.

Central to FEWER's functionality is the aggregation of multiple data contributors and the conveyance to multiple consumption channels. Though FEWER-originated information may only be created from the application's web and mobile components, it is proposed that the application convey information to non-FEWER software and hardware end points in a richly multi-modal solution environment as shown in Figure 6.

The following sub-sections of the proposal link the FEWER response in terms of features, action required and allocation of responsibilities to the components of the EW and ER set out in the checklist (Appendix 1). These sub-sections also fit within the cross-cutting opportunities and challenges of the overall regional and national EWS environments. The main points in **bold** tie to country-specific findings in the consultation report that concern fisheries, climate adaptation and disaster management best practices.

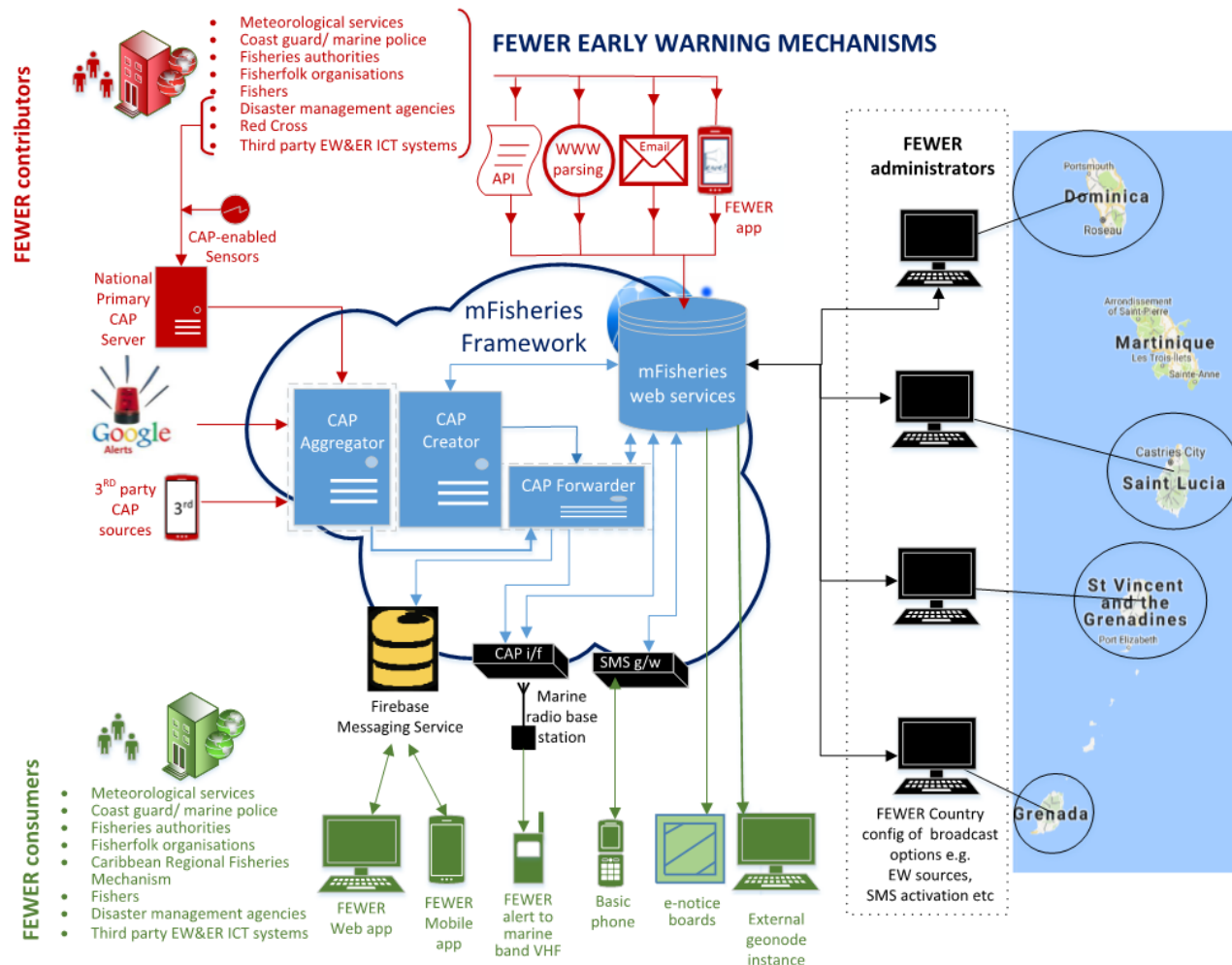


Figure 6. FEWER Data Flow Mechanisms

3.1 Risk knowledge

Risk knowledge is about understanding the nature, pattern and trends of fisheries sector vulnerability and resilience based upon which hazards pose serious threat where, when, how and to whom. Climate and disasters are not the only threats to fisheries. However, they tend to amplify other risks such as from overfishing, habitat degradation and pollution. These were identified in the CLME transboundary diagnostic analysis as the three greatest threats to the sustainability of the region's living marine resources³⁷. **Co-design of FEWER linkages must take into account not only MHEWS but also risks from other aspects of EAF relevant to fisheries management and FMPs, including the mandates and initiatives of the agencies responsible.**

Grenada has adopted CDEMA's Comprehensive Disaster Management (CDM) Framework³⁸. FEWER aligns well with many aspects, but overall with Outcome 1 on Strengthened Institutional Arrangements

³⁷ Whalley, P. 2011. Caribbean Large Marine Ecosystem Regional Transboundary Diagnostic Analysis. Report prepared for the UNDP/GEF CLME Project

³⁸ CDEMA. 2014. Regional Comprehensive Disaster Management (CDM) Strategy and Programming Framework 2014-2024. Caribbean Disaster Emergency Management Agency, St. Michael, Barbados. 40pp.

for Comprehensive Disaster Management implementation at national and regional levels and its accompanying Output 1.4 on Effective and efficient coordination for preparedness, response and recovery at the national and regional levels. **FEWER needs to be implemented within the CDM context.**

Motivated in part by the experience of Hurricane Ivan in 2004, Grenada has invested in enhancing its DRM^{39,40}. Grenada has developed National Disaster Management Plans^{41,42}. They comprise sector and operational plans, and provide a framework for preparedness, prevention, mitigation and response activities to any emergency situation. The plan and associated documentation describe the overall responsibilities of the National Disaster Management Agency (NaDMA)⁴³ and the role of various sectors in assisting in minimizing loss of life and suffering. Country contacts emphasized that **although the fisheries authority is important, NEMO must also have a sense of ownership of FEWER in order for it to develop and be sustained within the risk management of a MHEWS.**

NaDMA has a well-developed system of District and National Emergency Operations Centres as the coordinating hubs for emergency operations. Within the system, NaDMA, Red Cross and other agencies aim for capacities enhanced, vulnerability assessments conducted, hazard maps created and local disaster emergency plans developed through participatory processes. There is on-going review and revival of the system in preparation for whenever an event may occur. **In order to benefit fisherfolk households at the local level FEWER must be closely tied into national and district systems for DRM.**

NaDMA coordinates the multi-hazard early warning system (MHEWS) policies, plans, operations and information management. The previously cited national DRR report found that technical capacity and human resources at NaDMA and other key ministries should be improved for DRM and climate change⁴⁴. Risk knowledge needs to be better managed and institutionalized in both the public sector and fishing industry. **FEWER must take current capacity deficits, frequent staff movement and poor institutional memory into account, and seek to develop all-round capacity.**

Fishing is not among the economic sectors assigned critical roles and responsibilities for DRM except as part of agriculture, the parent ministry. Sectoral response mechanisms are tested occasionally, but the national consultation revealed some weaknesses in the inter-agency coordination required in comprehensive disaster management. **The positioning and links of FEWER within the DRM arrangements of NEMO and parent fisheries ministry must be made clear in the MOU and based on experience to include any risk or benefits to FEWER posed by such positioning and links.**

Country contacts, and especially fishers on the site visits, cautioned that climate hazards are not major causes of getting into difficulty at sea compared to mechanical failure, running out of fuel, navigation

³⁹ CDERA. 2005. Survey on the status of disaster preparedness in Grenada. National Disaster Management Agency of Grenada (NaDMA). Prepared by: Arturo López-Portillo Contreras. 10 May 2005. 105pp

⁴⁰ CDERA and CDB. 2006. Grenada National Hazard Mitigation Plan. Prepared for the Caribbean Disaster Emergency Response Agency (CDERA) and the Caribbean Development Bank (CDB). Consultant, JECO Caribbean Inc. October 2006. 95pp

⁴¹ NaDMAC and NaDMA. 2005. National Disaster Plan. Version 3.1, 7 September 2005. National Disaster Management Advisory Council and National Disaster Management Agency of Grenada. 48pp

⁴² GOG. 2011. Grenada, National Disaster Management Plan. Government of Grenada.

⁴³ <http://www.gov.gd/departments/nadma.html>

⁴⁴ Meincke, M. 2016. Adapting to climate change in Grenada. Vulnerability and adaptation assessment in Grenada: A qualitative approach. Presented at Adaptation Futures Conference 2016, 11 May 2016. PowerPoint presentation slides.

challenges and other issues. Not all fishers believed that the model projections of climate change and variability such as extreme weather events were cause for immediate alarm and review of personal risk perceptions. Climate risks may be deemed acceptable. Consequently **FEWER needs to collaborate with initiatives that provide new knowledge on climate and disaster risks, and to increase the value of risk knowledge among fishers in order to obtain widespread buy-in and a reasonable rate of adoption.**

Fish aggregating devices (FADs) are of increasing importance to Grenada's fishing industry and the safety of fishers. There is public and private sector replacement and addition of FADs around Grenada. **Obtaining and updating information on the geographic coordinates of FADs, oceanographic conditions around them, and the practices of FAD fishing are important elements of risk knowledge for FEWER.**

The national fisherfolk organisation in Grenada has limited organizational capacity. It is not yet able to nationally mobilize members and take collective action. **Meaningfully engaging the national fisherfolk organisation is critical to build their capacity in all aspects of FEWER co-design, implementation and sustainability, but especially for understanding risk knowledge networks and how fisherfolk are likely to, or actually, relate to FEWER.**

Geospatial vulnerability and resilience information is of particular importance to FEWER. NaDMA and Grenada's Red Cross Society⁴⁵ have implemented or partnered in several projects for hazard mapping, vulnerability and capacity assessment (VCA), flood management, community disaster planning, early warning systems, climate change, knowledge enhancement and more. For example, there is a VCA report⁴⁶ for areas around the coastal town of Grenville where fishing is important and the citizens have local knowledge of hazards and capacities. The Red Cross has been quite proactive in collaboration with other organizations such as The Nature Conservancy (TNC)⁴⁷ and others⁴⁸ to address vulnerability in the context of climate change⁴⁹. The Fisheries Division has the opportunity to partner with NEMO and Red Cross in the CC4FISH project to create outputs specifically for fishing communities. **FEWER should be integrated into future projects to improve fisheries risk knowledge especially for hazard mapping and vulnerability and capacity assessments.**

Historical records and local knowledge are useful for determining trends. The Red Cross has used historical matrices and profiles as means of collecting and visualizing historical data with communities. The Fisheries Division and community organizations have engaged in Socio-economic Monitoring for Coastal Management (SocMon) Caribbean⁵⁰ that uses a variety of visualization and geospatial tools based on participatory geographic information systems (PGIS). These tools are particularly pertinent to the local knowledge inputs into FEWER and possible FEWER outputs into other databases such as the static layers

⁴⁵ <http://www.ifrc.org/en/what-we-do/where-we-work/americas/grenada-red-cross-society/>

⁴⁶ Grenada Red Cross Society. 2013. Vulnerability capacity assessment of Grenville Area (Marquis, Soubise, Grenville, Telescope). March 2013. 166pp

⁴⁷ <http://www.ifrc.org/en/news-and-media/news-stories/americas/grenada/at-the-waters-edge-the-nature-conservancy-works-with-the-grenada-red-cross-society-on-environmental-resilience/>

⁴⁸ <http://www.iccas.gd/>

⁴⁹ GOG. 2011. Grenada Strategic Program for Climate Resilience (SPCR). Prepared for the Pilot Program for Climate Resilience (PPCR), March 2, 2011, Grenada. 101pp

⁵⁰ <http://www.socmon.org/regions.aspx?region=Caribbean¢erpoint=17.5,-72.0&zoomlevel=5>

of the DEWETRA platform⁵¹ managed by CIMH. For example, fishers are aware of places where flash flooding combined with storm surge produce dangerous coastal conditions with watershed debris added to the hazards. Such spatial information can be obtained by semi-structured interviews and various interactive visualization techniques. Authorities and NGOs are already sensitive to socio-economic factors affecting risk such as gender, poverty, disability, access to infrastructure, economic diversity and environment. However, field methods for obtaining this information with validity and reliability need to be more widely known and practised. **In order to get the risk information needed to develop and sustain FEWER, organizations will need to acquire skills or partners in the social sciences and PGIS.**

The geospatial storage of fisheries-related risk knowledge, and its combination with other knowledge products is possible using the GeoNode open source platform. GIS layers for Grenada are already publicly available via the Caribbean Handbook on Risk Information Management (CHARIM) portal⁵² that offers several EWS resources⁵³. There is disaster and vulnerability information among the layers that are currently available for Grenada, such as for flash flooding⁵⁴. More marine fisheries information such as FAD locations and vulnerable vessel haul-out sites or safe harbours can be added from official, scientific and local knowledge. **FEWER should contribute fisheries risk knowledge to GeoNode layers to disseminate static information to fisherfolk and the public beyond those subscribed to FEWER.**

The disaster legislation in Grenada is sufficiently broad to form the legal basis for the establishment and initial operation of FEWER as it has for other initiatives. However, for the future, **FEWER could benefit from an assessment to determine what legal strengthening, if any, is required in respect of telecommunications, data, intellectual property (local knowledge) and other dimensions.**

The full potential benefit of incorporating CCA and DRM risk knowledge into fisheries sector plans and practices using EAF, and hence supporting a FEWER solution, has not yet been realized for the many reasons given. However, this is an opportune time to bring together several compatible initiatives to formulate and implement more coherent FMPs that incorporate risk knowledge. The fisheries-related risk knowledge aspects of the proposal and corresponding aspects of the FEWER solution are summarized below (Table 2).

Table 2. Summary of proposals on risk knowledge

Fisheries, climate adaptation and disaster management	Corresponding FEWER aspects
Co-design of FEWER linkages must take into account not only MHEWS but also risks from other aspects of EAF relevant to fisheries management and FMPs, including the mandates and initiatives of the agencies responsible	<ul style="list-style-type: none"> • FEWER co-design to include inputs from different agents involved in EAF, fisheries management and the development of FMPs • Initial and subsequent FEWER software interfaces to accommodate data sources and types identified by these agents in co-design exercises, once technically feasible

⁵¹ [https://ams.confex.com/ams/98Annual/webprogram/Handout/Paper336393/Poster-Caribbean Dewetra Platform.pdf](https://ams.confex.com/ams/98Annual/webprogram/Handout/Paper336393/Poster-Caribbean_Dewetra_Platform.pdf)

⁵² <http://charim-geonode.net>

⁵³ CHARIM. 9.2. Design of early warning systems. Caribbean Handbook on Risk Information Management. <http://www.charim.net/methodology/92>

⁵⁴ <http://charim-geonode.net/layers/geonode:floodhazardgre160412>

Fisheries, climate adaptation and disaster management	Corresponding FEWER aspects
FEWER needs to be implemented within the CDM context	<ul style="list-style-type: none"> • FEWER to make available CDM-compliant information as specified by domain experts, e.g.: • emergency contacts & procedures (mobile) • response coordination info (Coast Guard /MU and NEMO web portals)
Although the fisheries authority is important, NEMO must also have a sense of ownership of FEWER in order for it to develop and be sustained within the risk management of a MHEWS	<ul style="list-style-type: none"> • As the primary FEWER agency administrator with functions specified in an MoU, NEMO can access the FEWER alerts feed and it is authorized to activate FEWER dissemination channels
In order to benefit fisherfolk households at the local level FEWER must be closely tied into District Emergency Committee activities	<ul style="list-style-type: none"> • ER procedures and contact information are sourced from District Emergency Committees • FEWER public users, including members of fisheries households, are expected to use the FEWER mobile application
FEWER must take current capacity deficits, frequent staff movement and poor institutional memory into account, and seek to develop all-round capacity	<ul style="list-style-type: none"> • FEWER to store historic events for later retrieval to preserve institutional memory • FEWER's structured training materials to be in electronic form for easy access at any time
The positioning and links of FEWER within the DRM arrangements of NaDMA and parent ministry must be made clear in the MOU and based on experience to include any risk or benefits to FEWER posed by such positioning and links	<ul style="list-style-type: none"> • Functions of user classes defined in MOU • Activation procedures and rules defined in MOUs: absolutely or by reference • Each local institutional FEWER contributor of weather information to specify and update on change: <ul style="list-style-type: none"> ○ the semantic format of data presentation ○ URLs for weather info
FEWER needs to collaborate with initiatives that provide new knowledge on climate and disaster risks, and to increase the value of risk knowledge among fishers in order to obtain widespread buy-in and a reasonable rate of adoption.	<ul style="list-style-type: none"> • As the FEWER country administrator, the Fisheries Department is to identify new sources and ensure they are configured • FEWER co-design partners to specify how value of risk knowledge can be increased for small-scale fishers
Obtaining and updating information on the geographic coordinates of FADs, oceanographic conditions around them, and the practices of FAD fishing are important elements of risk knowledge for FEWER	<ul style="list-style-type: none"> • FEWER to collect FAD information through the local knowledge and peer-generated alerts on mobile client, as appropriate • FEWER to display this information on request
Meaningfully engaging the national fisherfolk organisation is critical in all aspects of FEWER co-design, implementation and sustainability, but especially for understanding risk knowledge networks and how fisherfolk are likely to, or actually, relate to FEWER	<ul style="list-style-type: none"> • The national fisherfolk organisation to be represented and to actively participate in FEWER Fishers to commence July 2017
FEWER should be integrated into future projects to improve fisheries risk knowledge especially for hazard mapping and vulnerability and capacity assessments	<ul style="list-style-type: none"> • FEWER informational and promotional materials to be prepared for use by the CRFM, regional project teams and local fisheries organizations to ensure that there is support for FEWER in future projects • Local and regional stakeholders to continue to participate in FEWER development and maintenance to ensure fitness for purpose

Fisheries, climate adaptation and disaster management	Corresponding FEWER aspects
In order to get the risk information needed to develop and sustain FEWER, organizations will need to acquire skills or partners in the social sciences and PGIS	<ul style="list-style-type: none"> To supplement organizations' capacity building in social sciences and PGIS, FEWER training to include situational learning that ties use of the tool to its context and related tools such as PGIS
FEWER should contribute fisheries risk knowledge to GeoNode layers to disseminate static information to fisherfolk and the public beyond those subscribed to FEWER	<ul style="list-style-type: none"> FEWER local knowledge consumers to include Grenada's GeoNode FEWER local knowledge contributors to include Grenada's GeoNode
FEWER could benefit from an assessment to determine what legal strengthening, if any, is required in respect of telecommunications, data, intellectual property (local knowledge) and other dimensions	<ul style="list-style-type: none"> FEWER outputs to include recommendations for enabling strategies

3.2 Monitoring and warning service

This section of the proposal addresses mainly the data management aspects of the EW and ER services. In the consultation report a wide selection of hydro-met data sources and models are set out. FEWER must work with readily available (preferably open) data, often already processed (e.g. via models) into information suitable for issuing a warning. This imposes limitations. However, it also adds value to the data and information while keeping the costs (funds, time, human resources) reasonable.

Ultimately, NaDMA is responsible for monitoring and warning about hydro-met hazards within disaster management. It does so by coordinating with various departments of government, and other regional, national and local institutions and organizations. For hydro-met hazards the most important of these collaborations is with the Meteorological (Met) Services. The hydro-met hazards forecasting system has several steps and uses the online services discussed in the national consultation. Warnings of various types are issued by email blasts if situations warrant. Such warnings may be area-specific, but most are national. No warnings are automated using sensors alone. All warnings currently involve decision-making by DRM practitioners, and none are sector-specific. **FEWER should facilitate a future monitoring and warning service that incorporates automated warnings, real-time data validation including by crowd-sourcing, modification by local knowledge, area-specific and sector-specific impact forecasting.**

Country contacts validated the 2014 country DRR report contention that areas of recurring impact or high exposure do not have early warning and monitoring sensor systems in place. Contacts described several initiatives to install sensors (usually for floods) and their relationship with the CAP⁵⁵. **FEWER must accommodate several sources and types of data as inputs, including expert judgment.**

The Grenada component of the Regional Vulnerability Reduction Project (RDVRP) includes environmental assessment⁵⁶. Hydro-met monitoring sensors to be supplied under various, although not specifically intended to support national to community fisheries EW and ER development, could be relevant to FEWER. **FEWER must adopt, through a recognized regional or national system, clear**

⁵⁵ UNDP. 2012. A Blueprint for CAP-Based Alerting Systems: Overcoming the Challenges in Small Island Developing States. United Nations Development Programme, Barbados and the OECS

⁵⁶ GOG. 2015. Environmental assessment (EA) and environmental management framework (EMF). Regional Disaster Vulnerability Reduction Project (RDVRP). February 2015

standards and protocols for dealing with raw, real-time data should this become available from sensors.

Met Service standard technical terms, forecasting processes and use of online climate service tools are not well known by fisherfolk leaders and organizations. Fisherfolk are unaware that the bulk of forecasting services are publicly available online and can be interpreted to a useful extent by trained laypersons. Being unfamiliar with the services and their use impairs fishers understanding and trust of the system behind the monitoring and warnings. **FEWER training can include information sessions and practical desktop exercises to build the awareness and capacity of fisherfolk for CCA and DRM so that features of FEWER are better understood.**

NaDMA organizes area and national DRM exercises in collaboration with several agencies. **FEWER should promote collaboration between NaDMA, Fisheries Division and the national fisherfolk organisation in organizing exercises that highlight its features in order to accelerate the spread of awareness and adoption at fishing enterprise, household and organization levels.**

FAD projects may demonstrate the potential of ICT to provide data on oceanographic conditions at FADs. This would be beneficial for fishers, fisheries managers and Met Service validation of forecasts, and to facilitate ‘now-casts’ where urgent communication of presently prevailing conditions is crucial. **Future FAD projects should consider incorporating hydro-met sensors in order to serve FEWER as well as fish harvest.**

Currently the fishing industry is a rather passive participant in the DRM system and simply one of many audiences receiving warnings. **If reducing risks from climate hazards is important to the fishing industry, then the national and local level cooperatives need to be proactive in supporting and developing FEWER, via the MOU and otherwise, through active leadership.**

The national fisherfolk organisation is interested in developing the capacity to collaborate with and better interpret the information coming from, and needed by, the Met Services. This includes translating meteorological terms into communication better understood by fishers. It also encompasses training in the use and interpretation of publicly available online forecasting tools used by the Met Service and others. This is so that the cooperatives can share risk knowledge with members while being aware of the limits to their interpretation capacity and to forecasting services. **It is important for FEWER to include training in desktop services for the cooperatives and fisheries households, and to foster learning-by-doing by the Met Service and Fisheries Division to strengthen collaboration.**

The Met Service could benefit from real-time accurate validation of its forecasts by mariners at sea, including fishers. Of considerable concern is the ability of untrained citizens to provide consistently accurate observations of complex parameters such as sea state. **At an advanced stage FEWER should be able to facilitate crowd sourcing of forecast validation information using sea state visualization and other means of easy interpretation.**

FEWER largely has to adapt to the data and information landscape with which it is provided as to do otherwise exceeds the scope of the ICT solution. However, FEWER can add value to this landscape by demonstrating practical use as guided by the purpose of this component of the PPCR. The monitoring and warning service aspects of the proposal with corresponding aspects of the FEWER solution are summarized below (Table 3).

Table 3. Summary of proposals on monitoring and warning service

Fisheries, climate adaptation and disaster management	Corresponding FEWER aspects
FEWER should facilitate a future monitoring and warning service that incorporates automated warnings, real-time data validation including by crowd-sourcing, modification by local knowledge, area-specific and sector-specific impact forecasting	FEWER to include: <ul style="list-style-type: none"> • automated warnings <i>on configuration by administrator</i> user classes • crowd-rating of peer-generated alerts on mobile client • extensibility to: <ul style="list-style-type: none"> ○ provide area-specific, sector-specific impact forecasting ○ modify forecasts by local knowledge
FEWER must accommodate several sources and types of data as inputs, including expert judgment	FEWER to support the following channels for data and information contribution: <ul style="list-style-type: none"> • FEWER web and smart phone clients • CAP Feeds • Application Programming Interfaces • Machine-readable Web Content • Email
FEWER must adopt, through a recognized regional or national system, clear standards and protocols for dealing with raw, real-time data should this become available from sensors	FEWER to support the collection of raw, real-time data from sensors once: <ul style="list-style-type: none"> • the sensor is authorized by FEWER agency or country administrators as a legitimate source • the format of the raw, real-time data is well-specified and documented • the data is available through supported FEWER channels • no incremental communications costs is incurred by FEWER
FEWER training can include information sessions and practical desktop exercises to build the awareness and capacity of fisherfolk for CCA and DRM so that features of FEWER are better understood	<ul style="list-style-type: none"> • CCA and DRM experts to provide authoritative content in segments for FEWER to include in its emergency procedures • FEWER to specify structure and segmentation requirements for different media • FEWER to recommend inclusion of additional content in companion applications
FEWER should promote collaboration between NaDMA, Fisheries Division and the national fisherfolk organisation in organizing exercises that highlight its features in order to accelerate the spread of awareness and adoption at fishing enterprise, household and organization levels	<ul style="list-style-type: none"> • FEWER to provide NaDMA, Fisheries Division and the national fisherfolk organisation with informational materials • MoUs to require inclusion of FEWER in outreach activities to coastal communities
Future FAD projects should consider incorporating hydro-met sensors in order to serve FEWER as well as fish harvest	<ul style="list-style-type: none"> • FEWER development team to be included in local and regional conversations regarding the provision of all sensing and communications capabilities at sea
If reducing risks from climate hazards is important to the fishing industry, then the national and local level cooperatives need to be proactive in supporting and developing FEWER, via the MOU and otherwise, through active leadership.	Representatives of the national fisherfolk organisation to: <ul style="list-style-type: none"> • take on ICT stewardship and champions roles • actively participate in FEWER Fishers' to commence July 2017

Fisheries, climate adaptation and disaster management	Corresponding FEWER aspects
	<ul style="list-style-type: none"> • be referenced in the FEWER MOU with clear requirements and actions
It is important for FEWER to include training in desktop services for the cooperatives and fisheries households, and to foster learning-by-doing by the Met Service and Fisheries Division to strengthen collaboration	<ul style="list-style-type: none"> • FEWER agency administrators are expected to use the general FEWER web application with privileges in accordance with their user class • FEWER public users, including members of fisheries households, are expected to use the FEWER mobile application • situated learning content to provide appropriate guidelines with the rationale.
At an advanced stage FEWER should be able to facilitate crowd sourcing of forecast validation information using sea state visualization and other means of easy interpretation	<ul style="list-style-type: none"> • FEWER and NADMA should trial crowd-sourced alerts at sea to assess the value of supplementing marine forecasts with now-casts • FEWER to include rating of peer-generated alerts

3.3 Dissemination and communication

Dissemination and communication are the core areas of the ICT solution for fisheries EW and ER. The proposals for these are described in detail following some general points about the country context. Face-to-face personal communication remains very important in the fishing industry. Grenada has a knowledgeable and active fisheries extension service that is capable of engaging fisherfolk organizations, leaders and other fisheries individuals from national to local level. **The fisheries extension service and national fisherfolk organisation must be incorporated into FEWER for it to be efficient and effective.**

Fishing cooperatives are entitled to duty free concessions on goods and services and may pass on lower cost to their members. This principle applies to fishing gear and equipment. **Duty concessions could be applied to the importation of marine VHF radios in order to increase their use and make a FEWER VHF solution more viable.** Also, **FEWER documentation to clearly link its design and use within the ecosystem of national emergency communications technologies and devices in support of device concession considerations.**

The communication responsibilities and channels of several other agencies assist NaDMA. For example, the Government Information Service provides public information, public service announcements and warnings to the public and other media houses. Fishers noted the importance of mass media broadcasts for reaching fisherfolk, and DRM agencies prepare resources for the media⁵⁷. The NaDMA Facebook page⁵⁸ and Met Service web site⁵⁹ are reportedly popular for access to resources and forecasts. **The FEWER solution requires a presence on all the disaster and climate-related normal means of awareness communication in order to be promoted.**

Fisherfolk use social media for everyday communication. Most public agencies do not. This can create a weak link or break in the chain of communication. **FEWER will, to the extent possible, incorporate social media and encourage diversification in channels of communication.**

⁵⁷ CDEMA. 2005. Disaster information kit for the media. Caribbean Disaster Emergency Response Agency. 99pp

⁵⁸ <https://www.facebook.com/nadmagnd/>

⁵⁹ <http://weather.mbiagrenada.com>

The Fisheries Division, in collaboration with the Marine Unit/Coast Guard and other agencies, offers extension training that is respected by fisherfolk. Grenada's fisheries are experienced in operating marine VHF radios under normal fishing conditions and in search and rescue (SAR) procedures. Fishers' use of basic cell phones, rather than smart phones, at sea can be addressed in the training courses. **FEWER should be part of the fisher training curriculum, including more content on use of the apps available for smart phones.**

Marine VHF is commonly used for communicating with fishers who venture far at sea. With a high antenna, VHF line of sight range is greater than cell phone range and the radio reaches all within broadcast range without having contact information for each. Marine VHF is standard among the larger fishing vessels, but handheld sets are also commonly carried on the smaller boats and used at sea. A number of government fish markets are outfitted with Marine VHF base stations but workers do not use them effectively. **In addition to technical training in smart phone use, VHF use as an everyday tool of the trade could be capitalized upon for greater use in Grenada's FEWER solution, including the use of fish market base stations.**

Fisherfolk mentioned that the National Telecommunications Regulatory Commission (NTRC) licensing of marine VHF radios was costly compared to acquiring cell phones. **The Fisheries Division may support marine VHF radio use in FEWER by negotiating with the NTRC for fleet licensing as well as training.**

Fishers' practices at sea do not favour FEWER mobile phone technology. They take basic phones to sea and keep them protected from the elements in a container that is rarely disturbed until the end of the fishing trip. These phones typically have a minimum of credit and data access. Fishers have practical reasons for their behaviour and cannot be expected to change immediately because of FEWER. However, the app suites of mFisheries⁶⁰ and Abalobi⁶¹, for example, are diverse utilities intended to serve the entire fisheries value chain. **FEWER will endeavour to demonstrate to fishers that there are benefits from having smart phones at hand for multiple uses as a tool throughout a fishing trip.** For increased accessibility, **the NTRC should facilitate free WiFi service at established fish landing sites and national fisherfolk organisation within the national universal service programme.**

Given the increasing use of social media and cell phones DRM agencies are becoming more concerned about the rapid spread of false alarms about hazards that, among other things, cause panic and waste resources. **The FEWER solution will provide systems of authorization and validation that minimize the risk of false alarms.**

The FEWER ICT solution includes innovation in communication. This entails changes in practices that not all fishers and agencies will immediately accept and implement. Early adopters must thus be engaged. In this section we proposed several areas of intervention. While there are communication constraints the greatest challenge is developing a genuine demand for a FEWER ICT solution given the current limited interest. The fisheries-related aspects of dissemination and communication in the proposal and corresponding aspects of the FEWER solution are summarized below (Table 4).

⁶⁰ <http://cirp.org.tt/mfisheries/>

⁶¹ <http://abalobi.info>

Table 4. Summary of proposals on dissemination and communication

Fisheries, climate adaptation and disaster management	Corresponding FEWER aspects
The fisheries extension service and national fisherfolk organisation must be incorporated into FEWER for it to be efficient and more effective	<ul style="list-style-type: none"> • FEWER-trained field liaisons to champion FEWER awareness and adoption
Duty concessions could be applied to the importation of recommended marine VHF radios in order to increase their use and make a FEWER VHF solution viable	<ul style="list-style-type: none"> • FEWER documentation to clearly link its design and use within the ecosystem of national emergency communications technologies and devices in support of device concession considerations
The FEWER solution requires a presence on all the disaster and climate-related normal means of awareness communication in order to be promoted	<ul style="list-style-type: none"> • FEWER will provide informational materials to be used by NaDMA and other agencies for promotion
FEWER will, to the extent possible, incorporate social media and encourage diversification in channels of communication	<ul style="list-style-type: none"> • Only authorized communication will be shared to all groups within FEWER's internal social network
FEWER should be part of the fisher training curriculum, including more content on use of the apps available for smart phones	<ul style="list-style-type: none"> • FEWER training portfolio to include a module for delivery within standard fisher training curriculum • FEWER outputs to include high level recommendations for basic ICT training relevant to small-scale fishers
In addition to technical training in smart phone use, VHF use as an everyday tool of the trade could be capitalized upon for greater use in Grenada's FEWER solution, including the use of fish market base stations.	<ul style="list-style-type: none"> • FEWER situated learning will identify the range of communications technologies available for the marine environment • FEWER to recommend inclusion of additional content on communications technologies for the marine environment in companion apps
The NTRC should assist with additional tower, base station and repeater facilities for marine band VHF, as necessary to facilitate reasonable coverage at sea given practical limitations of topography and low handset elevation	<ul style="list-style-type: none"> • FEWER MOU to include recommendations for NTRC assistance with enhanced communications coverage at sea
The NTRC should facilitate free WiFi service at established fish landing sites and NFO within the national universal service programme	<ul style="list-style-type: none"> • FEWER basic communications facilities require Internet access so training includes management tips such as use in free WiFi hotspots
The Fisheries Division may support marine VHF radio use in FEWER by negotiating with the NTRC for fleet licensing as well as training	<ul style="list-style-type: none"> • FEWER MOU to include enhanced regulatory requirements of the NTRC • FEWER to include local CAP-enabled VHF base stations as a dissemination channel
FEWER will endeavour to demonstrate to fishers that there are benefits from having smart phones at hand for multiple uses as a tool throughout a fishing trip	<ul style="list-style-type: none"> • mFisheries modules for navigation, training and other applications to be available with FEWER • These facilities to be included in FEWER procedural and situated training activities
The FEWER solution will provide systems of authorization and validation that minimize the risk of false alarms	<ul style="list-style-type: none"> • All alerts generated by FEWER mobile users to be moderated by FEWER agency and country administrators before broadcasting outside of closed user groups • FEWER to include rating of peer-generated alerts

3.4 Response capability

Contacts agreed that an ICT solution for ER should be more straightforward than for EW. There is already considerable response capability that makes good use of ICT. NaDMA oversees a nationally decentralized structure with a focus on community participation in preparedness and response. District committees prepare plans and seek to ensure that their communities have adequate response capability. Communities in Grenada are reportedly fairly easily mobilized and contribute significantly to disaster recovery and rehabilitation efforts. Primary (local) fisherfolk organizations have the potential to become assets in this system, for example through desktop and mobile FEWER applications that connect fisherfolk to the existing components of the local response. **FEWER will build upon and enhance existing ER networks and arrangements for mobilization by connecting people to information and other resources.**

VCAs, as mentioned earlier for the Grenville area, have been organized and implemented by the Red Cross and partners. Each VCA documents the response resources available as well as hazards. We also mentioned that the CC4FISH project includes VCAs specifically for fishing communities and keen interest has been expressed in having these done as soon as possible. **FEWER will incorporate and share VCA information for EW and ER, the latter being in close collaboration with the Red Cross via the MOU.**

NaDMA works to develop capability in districts and communities to prepare for, respond to, and manage emergencies. Red Cross has collaborated with NaDMA and other agencies to deliver Community Disaster Response Team (CDRT) training. **It would be beneficial for fisherfolk leaders in FEWER to experience CDRT training and similar ER capacity development through the MOU.**

Damage and Needs Assessment (DANA) is one of the key steps in ER following a serious impact. **FEWER will coordinate with agencies such as NaDMA, Red Cross and others to incorporate DANA forms and processes to improve the process for the fishing industry through collaboration with the Fisheries Division and fisherfolk organizations.**

The Grenada Red Cross maintains a Facebook page⁶² that provides access to their multi-hazard and first aid mobile phone apps. Opportunities for synergies with their apps and CAP will be closely examined in addition to the wealth of publications and event reports available online. **If appropriately indexed, as FEWER develops, these resources may be searched to quickly reveal documents and other items with useful information to supplement institutional memory. It would be beneficial for Red Cross to recognize and promote the FEWER app in order to cover fisheries-specific ER that complements its own ICT solution.**

There is a demand for FEWER to incorporate and deliver information that is already available in print or online. There is much opportunity for fisherfolk organizations and households to be part of the ER component. The fisheries-related and ICT aspects of response capability in the proposal and corresponding aspects of the FEWER solution are summarized below (Table 5).

⁶² <https://www.facebook.com/GrenadaRedCrossSociety/>

Table 5. Summary of proposals on response capability

Fisheries, climate adaptation and disaster management	Corresponding FEWER aspects
FEWER will build upon and enhance existing ER networks and arrangements for mobilization by connecting people to information and other resources.	<ul style="list-style-type: none"> • FEWER to feature emergency contact information and emergency response procedures from authorities such as NaDMA and the Coast Guard/Marine Unit (MU) • MU to provide FEWER with emergency response procedures and contact information for emergency call and time-stamped geo-tagged messaging • With authorization, FEWER to share boat registration and description to support search and rescue efforts • MU to incorporate FEWER in its operational procedures • FEWER to recommend operational procedures for MU adoption
FEWER will incorporate and share VCA information for EW and ER, the latter being in close collaboration with the Red Cross via the MOU	<ul style="list-style-type: none"> • Red Cross to provide categorized VCA information for EW and ER. Requests to commence in July 2017 and Red Cross leadership captured in MOU
It would be beneficial for fisherfolk leaders in FEWER to experience CERT training and similar ER capacity development through the MOU	<ul style="list-style-type: none"> • FEWER situated learning to make reference to the importance for CERT training
FEWER will coordinate with agencies such as NEMO, Red Cross and others to incorporate DANA forms and processes to improve the process for the fishing industry through collaboration with the DOF and fisherfolk organizations	<ul style="list-style-type: none"> • FEWER to enable recording and sharing of images and video of disaster-related damage: loss and damage to personal fishing resources • FEWER to ultimately connect with emergency response applications, such as Virtual Badge, for execution of emergency procedures on the basis of DANA forms
If appropriately indexed, as FEWER develops, these resources may be searched to quickly reveal documents and other items with useful information to supplement institutional memory	<ul style="list-style-type: none"> • FEWER forms and content to be classified and archived on the server so as to facilitate searching through functions developed in the future
It would be beneficial for Red Cross to recognize and promote the FEWER app in order to cover fisheries-specific ER that complements its own ICT solution	<ul style="list-style-type: none"> • FEWER to provide informational materials to be used by the Red Cross for promotion as a complementary channel for its operations to ensure inclusion of fisherfolk who are particularly vulnerable to the risks of climate change and variability

4 RISK MANAGEMENT AND SUSTAINABLE FINANCING

4.1 Risk management

All early warning and emergency response capabilities depend critically on communications. Persons outside of service areas are particularly vulnerable. Small-scale fishers are perhaps the most vulnerable of all as standard cellular and even VHF communications do not extend to all fishing zones. Long range capabilities as afforded through traditional satellite service is entirely unaffordable. The primary technical risk to FEWER is therefore the limited communications coverage at sea. Mitigation measures for the former include:

- FEWER caching of key information when outside of coverage
- the proposed obligation of telecommunications service providers to provide low data rate cellular coverage for a specified range at sea, as they are obliged to do for land
- the proposed arrangement for the NTRC to assist with additional tower, base station and repeater facilities for marine band VHF, as necessary to facilitate reasonable coverage at sea given practical limitations of topography and low handset elevation
- Emphasis on the systematic use of FEWER before launch
- Emphasis on the contribution of situated training content from authoritative sources.

The technical risks to FEWER also include the cost of mobile data service. FEWER will optionally disseminate emergency messages to regular phones but the richness of the application revolves around the many facilities that are available through smart phones. While some of these capabilities do not require communications, many do. Measures to reduce risks associated with service cost include:

- situated training on management of data service including the use of WiFi hotspots where available
- the proposed facilitation of free WiFi service at established fish landing sites and NFO within the national universal service programme
- the proposed arrangement for the NTRC to implement a simplified and less costly administrative process for licensing marine band VHF radios.

Another technical risk is the potential for unrealistic user expectations about the reasonable capabilities of a mobile phone and app compared to that of the more powerful, less resource-constrained desktop applications. To mitigate this, situated learning content will provide appropriate guidelines with the rationale.

Additionally, it is proposed that, beyond the FEWER project, opportunities for the provision of low data rate communications at sea be explored. These should include irregular communications for emergency situations as well as regular communications to support automated now-casting and subsequent trending. The current project and future sustainability face the dilemma of only low to moderate current public sector and fishing industry demand for a FEWER ICT solution among many other higher priority matters in fisheries, CCA and DRM arenas. This may result in modest engagement and reduced likelihood of sustainability. This risk may be managed by promoting and demonstrating that the integration of FEWER into fisheries, CCA and DRM arenas will provide beneficial skills, problem-solving and advancement in other areas of greater concern and in fisheries livelihoods, beyond the threat of climate hazards.

At the end of the project FEWER may reflect the minimum viable proposition for the solution, not its full potential that can only be realized if persistent fisheries and DRM problems beyond the scope of ICT (as described in the EWS sections) are first resolved. There may be insufficient incentives and capacity to make advances on the fisheries, DRM and ICT fronts. This risk may be managed by tying FEWER into larger national development initiatives such as concern the sustainable development goals (SDGs) and their targets.

There are perverse incentives in international and regional development initiatives for beneficiaries to perform sub-optimally in order to sustain the flow of direct and indirect benefits of development financing and technical assistance. If this is a risk with FEWER, then achieving full potential will take longer than projected if it is achieved at all. This risk may be managed by clarity about performance targets and outputs with a non-negotiable termination date for external technical and financial support. Practical matters and economic conditions such as high ICT equipment and service costs, low fishing industry profitability, and high telecommunications services and data rates may combine to make an affordable smart phone FEWER solution challenging for fishers. This risk may be managed by engaging

and empowering fisherfolk organizations to play prominent roles in the solution and use collective action to achieve economies of scale and savings where feasible. Organizational strength will be critical.

There are subordinate risks stemming from the above, which are beyond the scope of FEWER. Additional ICT risk management depends mainly on the fisheries, CCA and DRM management risks.

4.2 Sustainable financing

The supporting fisheries, CCA and DRM aspects of FEWER require no additional state or non-state financing beyond what is expected of existing national early warning systems and of fisheries comprehensive good practices such as implementing EAF, developing fishing industry capacity and adapting to climate change and variability in various ways. These costs should already be covered in the budgets of fisheries authorities, their parent Ministries, disaster management agencies and fisherfolk organizations. If they are not, then there is little point in budgeting separately for FEWER under conditions of fisheries management and development that are not adequately enabling and supportive. Table 6 summarizes the worst-case maintenance requirements to run FEWER, that is to say under the assumption of no additional software development. The table entries reflect worst case as it is expected that:

1. The hosting agent for FEWER will already have access to server resources which host other institutional software. If this is indeed the case, item 1 in Table 6 would not be applicable
2. FEWER will be incorporated into regular training programmes in fisheries and disaster management. If this is the case, item 2 in Table 6 would not be applicable until there is need for further development of FEWER, at which time it is expected that training and the development of updated training materials would accompany software development
3. Arrangements for zero-rating of SMS messages under emergency and recovery conditions will be negotiated with the local telcos. If such arrangements are made, item 3 in Table 6 would not be applicable for emergency and applicable recovery messaging
4. Responsibility for the technical administration of FEWER will reside with competent personnel who will be trained during the course of the existing project to perform software configuration and minor coding functions by the ICT4Fisheries Consortium; and who will be competent to follow the guidelines in the project documentation for the execution of such tasks if memory fails.

Table 6 Worst-case maintenance requirements for FEWER (i.e. with no software development requirements)

FEWER Operational Components	Description	Per Country Resources		
		Financial Costs (USD)	Human Resources	Other Resources
1. 3rd Party Hosted Solution for FEWER	Quad-core CPU 1.5 GB RAM 50GB HDD CentOS 6 Apache HTTP Server MySQL Database Server	300 /yr service cost	Technical administrator (to subscribe)	FEWER Administrator Manual
	Wildcard SSL Certificate	70 /yr service cost		
2. Training New Users of FEWER	Train Public user	Current FEWER project covers training of nominated users.	Fisheries Division, Coast Guard/ MU and NaDMA as well as FEWER users: • Public	FEWER User Manual
	Train Coast Guard (MU) users			FEWER User Manual
	Train Agency Administrators	Training materials prepared under this		FEWER User Manual

FEWER Operational Components	Description	Per Country Resources			
		Financial Costs (USD)		Human Resources	Other Resources
	Train Country Administrators	project to be used by Fisheries Division, Coast Guard (MU) and NaDMA to train new users. Costs for training on extended FEWER features to be determined and budgeted in subsequent development initiative/s		<ul style="list-style-type: none"> Coast Guard (MU) Agency Admin Country Admin Technical Admin 	FEWER User Manual
	Train Technical Administrators				FEWER User & Administrator Manuals
3. <i>Optional Connectivity</i>	Send SMS messages using International SMS Gateway -Twilio to:	Grenada - Digicel	0.055 /msg	Technical Administrator (to configure)	FEWER Administrator Manual
	Send SMS messages using local SMS Gateway	Grenada - LIME	0.055 /msg		
4. <i>Reconfiguration of Externally sourced data</i>	Required if sources modify structure to data or access to it, for e.g. the Met Office may change the structure to webpage that delivers forecasts	No incremental cost anticipated		Technical Admin (to program)	<ul style="list-style-type: none"> FEWER Administrator Manual Modified structure of data or access to data

In practice it is expected that there will be need for periodic software updates, extension and development. As continuous assessment and bug-fixing are necessary components of the software life cycle, it is important that in the year following the end of the current FEWER project, a development team continues to provide a range of software support for the deployed product. It is proposed that these activities be conducted within the CC4FISH project. Beyond this time frame, it is proposed that continued FEWER assessment and further software development are featured among the activities for future projects in fisheries, CCA and DRM and associated costs accordingly budgeted.

5 MONITORING, EVALUATION, LEARNING AND ADAPTATION

Participatory monitoring and evaluation (PM&E) is strongly recommend under the MOU or otherwise. The PM&E must not be burdensome. Ideally it must be part of an institutional and social learning process rather than strictly a project requirement. Existing institutions and organizations should be used, and the PM&E incorporated into their normal routines such as board and committee meetings. Bodies such as the Fisheries Advisory Committee or similar NICs, as advocated under the CLME+ Project, would be useful for PM&E, learning and adaptation. Aspects of FEWER can be added to the national science and technology agenda with aim to promote or support entrepreneurship and innovation in ICT.

Project TOR call for “an impact assessment tool for monitoring uptake and usage of the training”. The tool will be developed along with the details of the training, bearing in mind the caveat from outcome mapping⁶³ that observed outcomes and impacts are seldom due solely to a project intervention and may have as much to do with known and unknown external factors as any planned action. An example of a broader outcome is that the uptake of FEWER training may be as a result of a change in fisherfolk organisational culture brought on by the planned StewardFish project that includes a massive component of capacity development. It aims at widely changing fisherfolk knowledge, attitudes and practices. Considerable reference has been made to FEWER training in this proposal. It is proposed that a programme be designed and delivered to all classes of users: public (including fishers), coast guard, agency administrators, country administrators and technical administrators. The target ranges of participant numbers are shown in Table 7. Maximum numbers are specified to ensure adequate instructor-to-trainee ratios in the hands-on sessions. Minimum numbers are specified to ensure coverage across personnel shifts and absence.

Table 7. Target FEWER Training Numbers

Users	Minimum	Maximum
Public	20	30
Coast Guard/ MU	2	10
Agency Administrators	2	10
Country Administrators	2	10
Technical Administrators	2	10

Electronic training materials will be produced for use after the lifetime of the current project. During the project, the training will comprise a remote component on co-design of the prototype FEWER and a subsequent face-to-face component on the production application. Target schedules are as follows:

Co-Design in Prototype FEWER (remote, 2017):

1. Tech admins: Tue 5th Sep, Fri 8th Sep, Tue 12th Sep or Fri 15th Sep
2. Country admins: Tue 19th Sep, Fri 22nd Sep, Tue 26th Sep or Fri 29th Sep
3. Agency admins: Tue 3rd Oct, Fri 6th Oct, Tue 10th Oct or Tue 17th Oct
4. Marine Unit: Fri 20th Oct, Tue 24th Oct, Fri 27th Oct or Tue 31st Oct
5. Public: Fri 3rd Nov, Tue 7th Nov, Fri 10th Nov, Tue 14th Nov, Fri 17th Nov, Tue 21st Nov, Fri 24th Nov or Tue 28th Nov

Field Testing of Production FEWER (face to face, 2018): 22-26 Jan, 5-9 Feb, 19-23 Feb or 26 Feb–2 Mar.

A sample of FEWER training requirements by task, content and user class is shown in Appendix 2.

6 CONCLUSIONS

In conclusion, we reiterate that the usefulness and sustainability of FEWER lies in it being a people-centred, demand-driven solution rather than it being driven primarily by supply of technology. Despite a number of challenges with the fisheries, CCA and DRM environment that are beyond the scope of the FEWER ICT solution, there is every reason to be confident about the long term success of FEWER once it can demonstrate its potential to the multiple users and supporting interested parties.

⁶³ <https://www.outcomemapping.ca>

Following their review of this document, and particularly the FEWER proposal sections, we encourage the organizations involved in FEWER to:

- Indicate whether the proposal sets out a basis upon which to proceed, or provide specific changes and comments to address the parts that do not provide a basis upon which to proceed
- Provide similar endorsement or editing for the FEWER MOU for co-design and sustainability
- Identify any parts of the proposal that are of particular interest in proceeding with as priority
- Identify any parts of the proposal that are thought to be particularly challenging going forward
- Respond to the SRS and stakeholder group questions sent to contacts, if not yet answered

Addressing these follow-up points will lead into the co-design phase in which you actively ensure that FEWER meets the needs of your country to the extent possible, and can be sustained.

7 APPENDICES

Appendix 1. 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 (2006). It can be used as a flexible EWS guide when adapted to specific situations. The major headings rather than bullet points are of general application.

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).

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 Capacity
- 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.
5. Cross-cutting: Governance and institutional arrangements
- 5.1. Early Warning Secured as a Long Term National and Local Priority
- Economic benefits of early warning highlighted to senior government and political leaders using practical methods such as a cost-benefit analysis of previous disasters.
 - Examples and case studies of successful early warning systems disseminated to senior government and political leaders.
 - Early warning role models or “champions” engaged to advocate early warning and promote its benefits.
 - The priority natural hazard risk requiring an early warning system identified, and operational arrangements within a multi- hazard framework established.
 - Early warning integrated into national economic planning.
- 5.2. Legal and Policy Frameworks to Support Early Warning Established
- National legislation or policies developed to provide an institutional and legal basis for implementing early warning systems.
 - Clear roles and responsibilities defined for all organizations (government and non- government) involved in early warning.
 - Overall responsibility and authority for coordination of early warning assigned to one national agency.
 - One political leader or senior government official empowered by law as the national decision maker.
 - Policies developed to decentralise disaster management and encourage community participation.
 - Local decision making and implementation of early warning systems placed within broader administrative and resource capabilities at the national or regional level.
 - Regional and cross-border agreements established to ensure early warning systems are integrated where possible.
 - Relationships and partnerships between all organizations involved in early warning institutionalised and coordination mechanisms mandated.
 - Early warning integrated into disaster reduction and development policies.
 - Monitoring and enforcement regime in place to support policies and legislation.
- 5.3. Institutional Capacities Assessed and Enhanced
- Capacities of all organizations and institutions involved assessed and capacity building plans and training programmes developed and resourced.
 - Non-governmental sector engaged and encouraged to contribute to capacity building.
- 5.4. Financial Resources Secured
- Government funding mechanism for early warning and disaster preparedness developed and institutionalised.
 - Access to funding at the international or regional level explored.
 - Public/private partnerships utilised to assist with early warning system development.

Appendix 2. Sample FEWER Training Requirements

				<i>Users:</i>				
Software Requirements		Training Requirements		Coast Guard (MU)	Agency Admin	Country Admin	Technical Admin	Public
FEWER Functional Requirements	Module - Component	User Task	Learning Content					
1. EW1 - Consolidates weather information from a variety of authoritative and informal sources	Weather – Web Config.	A. Add new source B. Configure alert thresholds C. Delete source	A. Source information i. Procedural: Source Type, manual check ii. Situated: Source credibility, coverage and suitability B. Configuration of alert threshold: numerical values/ranges, etc. C. N/A		✓	✓		
	Weather – Web Config.	A. Add new source B. Configure alert thresholds C. Delete source	A. Source information (procedural): Coding template, Source Type, manual check B. Configuration of alert threshold: numerical values/ranges, etc. C. N/A				✓	
2. EW2 - Facilitates the generation of alerts, reports and messages 3. EW3 - Broadcasts alerts utilizing the Common Alerting Protocol (CAP) to multiple platforms 4. EW6 - Enables fisherfolk to issue alerts to peers within their communities 5. EW7 - Allows fisheries-related organizations to generate and broadcast alerts to fisherfolk within	FEWER – Web, Mobile and Server	A. Create alert	A. Alert templates and details (situated)	✓	✓			✓

				<i>Users:</i>				
Software Requirements		Training Requirements		Coast Guard (MU)	Agency Admin	Country Admin	Technical Admin	Public
FEWER Functional Requirements	Module - Component	User Task	Learning Content					
their communities								
6. EW2 - Facilitates the generation of alerts, reports and messages	FEWER - Web	A. Cancel alert B. Update alert C. Create alert group D. Delete alert group E. Edit alert group's properties F. Remove fisher from alert group G. View alert delivery status H. Add new CAP alert source	A. Reason for cancellation (situated) B. Reason for update (situated); Info to update (procedural) C. Group's details (procedural) D. Deletion steps (procedural) E. Group's details (procedural) F. Removal steps (procedural) G. Delivery status options (procedural) H. CAP alert source details (procedural)		✓	✓		
3. EW4 - Notifies fishers of generated alerts 4. EW5 - Forwards alerts generated by authorized sources	FEWER - Mobile & Server	A. Install alert module B. Subscribe to alerts C. Receive & view alerts D. Share alerts	A. Installation steps (procedural) B. Subscription steps (procedural) C. Alerts: i. Received on phone indicators (procedural) ii. Viewing steps (procedural) D. Sharing steps (procedural)					✓
5. EW7 - Allows fisheries-related organizations to generate and broadcast	FEWER – Web	A. Create Agency Administrat	A. Creation steps (procedural)			✓		

				<i>Users:</i>				
Software Requirements		Training Requirements		Coast Guard (MU)	Agency Admin	Country Admin	Technical Admin	Public
FEWER Functional Requirements	Module - Component	User Task	Learning Content					
alerts to fisherfolk within their communities		or						
6. EW8 - Displays a list of the fishers who have received a broadcasted alert	FEWER -	A. View alert delivery status	A. Delivery status options (procedural)		✓	✓		
7. EW9 - Allows administrators to enable/disable the delivery of SMS messages for alerts	FEWER - Web	A. Add SMS option	A. Enabling steps (procedural)			✓		
8. EW10 - Allows administrators to enable/disable the confirmation of alert delivery	FEWER - Web	A. Enable delivery confirmation	A. Enabling steps (procedural)			✓		
9. EW11 - Facilitates the rating of peer-generated alerts	FEWER - Mobile	A. Rate alert	A. Rating reasoning and steps (situated)					✓
10. EW12 - Displays all the peer-generated alerts disaggregated by community	FEWER – Mobile & Web	A. Receive & view alerts B. Filters alerts	A. Alerts: a. Received on phone indicators (procedural) b. Viewing steps (procedural) B. Filtering options (procedural)	✓	✓	✓		✓
11. EW12 - Displays all the peer-generated alerts disaggregated by community	FEWER – Web	A. View alerts B. Filters alerts	A. Viewing steps (procedural) B. Filtering options (procedural)		✓			
12. EW13 - Enables fisheries-related organizations to	FEWER - Web	A. View alerts B. Update	A. Viewing steps (procedural)		✓		✓	

Users:				Coast Guard (MU)	Agency Admin	Country Admin	Technical Admin	Public
Software Requirements		Training Requirements						
FEWER Functional Requirements	Module - Component	User Task	Learning Content					
moderate peer-generated alerts		alerts C. Cancel alerts	B. Reason for cancellation (situated) C. Reason for update (situated); Info to update (procedural)					

ANNEX 1: PROPOSED MEMORANDUM OF UNDERSTANDING

This Fisheries Early Warning and Emergency Response Memorandum of Understanding (the “FEWER MOU”) sets out collaboration among national agencies and stakeholder groups, and with regional supporting organisations, for development, implementation and administration of the FEWER for Grenada. The FEWER MOU is not a legal document and does not establish binding rights or obligations. It is for a two-year period from date of final signature. It may be renewed, amended or terminated by agreement of the parties at any time.

1 National Parties and Regional Supporting Organisations

The parties to the FEWER MOU for Grenada are the following:

Fisheries Division

Coast Guard (Maritime Unit)

Meteorological Services

National Fisherfolk Organisation (NFO)

National Telecommunications Regulatory Commission (NTRC)

National Disaster Management Agency (NaDMA)

Red Cross Society

The national parties’ FEWER MOU is supported by these regional organisations:

Caribbean Regional Fisheries Mechanism (CRFM) Secretariat

Caribbean Disaster Emergency Management Agency (CDEMA)

Caribbean Institute for Meteorology and Hydrology (CIMH)

2 Background

FEWER is being implemented under the Caribbean Regional Track of the Pilot Programme for Climate Resilience (PPCR) from February 2017 to May 2018. The University of the West Indies Mona Office for Research and Innovation (MORI) is executing the PPCR 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 leading the activities to reduce the impact of climate change related risks on the fishing industry in the Caribbean, and one of these activities has been the development of the Fisheries Early Warning and Emergency Response (FEWER) ICT-based solution for fishers.

3 Aim and Scope

The national parties and regional supporting organisations agree to collaborate to sustain the development, implementation and administration of the FEWER for Grenada in order to reduce risks to fishers associated with climate change and variability.

This will be through a FEWER information and communication technology (ICT) based solution for fishers, with training in its use and administration. The FEWER will be integrated within existing national and regional disaster risk management, early warning system (EWS) and emergency response frameworks and focus primarily on communications. It is expected to reduce fishers’ vulnerability to the impacts of climate change while at the same time provide for their sharing of local knowledge to inform climate-smart fisheries planning and management decision-making as well as risk management in the fisheries sector.

4 Responsibilities

The responsibilities of parties and regional supporting organisations are expected to change with time and circumstance as FEWER develops and adapts. General responsibilities are set out below with details to be provided in operational work plans negotiated among and agreed to by the national parties in consultation with the regional supporting organisations.

National party or regional supporting organisation	General responsibilities to be elaborated in operational work plans and integrated into national and regional EWS
<i>All parties to FEWER MOU and supporting organisations</i>	
All parties to FEWER MOU and supporting organisations	<ul style="list-style-type: none"> • Provide inputs through all stages of the FEWER co-design and development cycle through to its deployment and operation, and implementation of updates past the life of the current project • FEWER software interfaces to accommodate data sources and types identified in co-design, once technically feasible • Store historic events for later FEWER retrieval to preserve institutional memory • Specify how value of risk knowledge can be increased by and for small-scale fishers • All alerts generated by FEWER mobile users to be moderated by FEWER agency and country administrators before broadcasting outside of closed user groups
<i>Regional supporting organisations</i>	
Caribbean Regional Fisheries Mechanism (CRFM) Secretariat	<ul style="list-style-type: none"> • Facilitate incorporating FEWER into CRFM and sub-regional policies, plans, programmes and projects as appropriate • Promote the integration of FEWER into EAF, CCA and DRM • Facilitate initiatives that build the capacities of fisherfolk organisations and fisheries enterprises to use FEWER • Assist national FEWER parties with transboundary networking to improve communication and capacity • Provide institutional role as FEWER Regional Admin
Caribbean Disaster Emergency Management Agency (CDEMA)	<ul style="list-style-type: none"> • Facilitate incorporating FEWER into CDEMA regional policies, plans, programmes and projects as appropriate • Promote the integration of FEWER into CCA and DRM • Assist national FEWER parties with transboundary networking to improve communication and capacity • Include and promote FEWER in all relevant CAP initiatives, documentation and activities • Provide institutional role as FEWER Regional Admin • Consider TOR for, and host, FEWER after incubation period

National party or regional supporting organisation	General responsibilities to be elaborated in operational work plans and integrated into national and regional EWS
Caribbean Institute for Meteorology and Hydrology (CIMH)	<ul style="list-style-type: none"> • Facilitate incorporating FEWER into CIMH regional policies, plans, programmes and projects as appropriate • Promote the integration of FEWER into CCA and DRM • Assist national FEWER parties with transboundary networking to improve communication and capacity • Provide advice on NOAA monitoring services and products • Strengthen marine forecasting capabilities in the region • Produce, where feasible, a 3-hour companion message per coast for the wave model for Dominica, Grenada, Saint Lucia, and St. Vincent and the Grenadines • Critically assess FEWER thresholds, parameters and sources on a regular basis with a view to improvement • On the basis of a programme of assessment, recommend adjustments to the hydromet components of FEWER • Include & promote FEWER in all relevant initiatives, instruments, documentation and activities • Provide institutional role as FEWER Regional Admin
<i>National parties</i>	
Department of Fisheries	<ul style="list-style-type: none"> • Promote the integration of FEWER into EAF, CCA and DRM • Provide fisheries data and information required by FEWER • Include FEWER in fisheries extension services and training • Develop the capacity to incorporate fishers local knowledge • FEWER liaisons to act as ICT stewards and champions • Identify new sources of knowledge on climate and disaster risks and ensure they are configured • Collect FAD information through the local knowledge and peer-generated alerts on mobile client, as appropriate • FEWER training to include situational learning that ties use of the tool to its context and related tools such as PGIS • Arrange internet access so training includes management tips such as use in free wi-fi hotspots • Make mFisheries modules for navigation, training and other applications available with FEWER • These facilities to be included in FEWER procedural and situational training activities
Coast Guard (Maritime Unit)	<ul style="list-style-type: none"> • Incorporate FEWER into SAR procedures and training • Provide situational content to include in FEWER training • Provide chunked emergency preparation and response procedures to include in FEWER • Provide telecommunications infrastructure for marine VHF • Actively encourage proper use of marine VHF radio at sea
Meteorological Services	<ul style="list-style-type: none"> • Continuously improve marine forecasting and now-casting • Seek out new or improved marine data and climate services • Configure hazard alerts for fishers via FEWER using CAP • Improve the inputs to EWS from automated marine sensors • Provide training in climate service interpretation for fishers • Provide situational content to include in FEWER training • Trial crowd-sourced alerts at sea to assess the value of supplementing

National party or regional supporting organisation	General responsibilities to be elaborated in operational work plans and integrated into national and regional EWS
	<ul style="list-style-type: none"> marine forecasts with now-casts Specify, with prompt updates on change: <ul style="list-style-type: none"> the semantic format of data presentation URLs for weather info
National Fisherfolk Organisation (NFO)	<ul style="list-style-type: none"> Identify fishers for FEWER early adopters and innovators Participate in demand-led co-design and implementation Promote the use of FEWER by fishers as normal practice Support FEWER fisheries extension and training of fishers Encourage fishers sharing of local knowledge for FEWER Establish organisational and community FEWER networks FEWER liaisons to act as ICT stewards and champions Representatives of NFO to: <ul style="list-style-type: none"> take on ICT stewardship and champions roles actively participate in FEWER Fishers WhatsApp group
National Telecommunications Regulatory Commission (NTRC)	<ul style="list-style-type: none"> Reduce regulatory and administrative barriers to the access and use of marine band VHF radio for small scale fisherfolk Offer an annual training programme on appropriate telecommunications equipment, use and maintenance for fishers Introduce regulatory obligations and/ or universal service funded programmes to meet specified minimum requirements for radio and cellular coverage at sea
National Disaster Management Agency (NaDMA)	<ul style="list-style-type: none"> Review and endorse, as appropriate, the proposed FEWER CAP templates for hazards at sea Incorporate the fisheries sector further into national MHEWS Integrate FEWER with national MHEWS including via CAP-compliance, testing, activation channels, contact Information and CAP alert templates for incidents at sea Lead the development and adaptation of FEWER as part of the national MHEWS, especially integrating it with CAP Conduct training and exercises to test FEWER functionality Provide situational content to include in FEWER training Provide chunked emergency preparation and response procedures to include in FEWER View FEWER alerts and activate its dissemination channels As the primary FEWER agency administrator, access the FEWER alerts feed and activate dissemination channels Include FEWER zero-rated messaging for emergency alerts and relief in existing and future negotiations with local telecommunication service providers
Red Cross Society	<ul style="list-style-type: none"> Assist especially in areas of DANA and community teams Include fishers in coastal community teams via the NFO

5 Operation

Specific responsibilities are to be set out in a bi-annual budgeted work plan approved by the fisheries and disaster management authorities and agreed by all parties. Such work plans can be optional annexes to this MOU as part of agreed FEWER collaboration. FEWER should be subject to participatory monitoring and evaluation through an existing body of the fisheries or disaster management authority, such as an

extension of the Fisheries Advisory Committee. The selected body should be aimed at learning by doing for adapting FEWER to changing conditions.

6 Focal Points

Each of the parties will communicate electronically to the CRFM Secretariat, and keep up to date, the contact information for their main focal point and at least one alternate. These can be provided as an annex to the FEWER MOU. The contact information of the main focal points and alternates for all countries participating in FEWER will be accessible online.

7 Signatures

Party	Name	Signature	Date
Department of Fisheries			
Coast Guard (Maritime Unit)			
Meteorological Services			
National Fisherfolk Organisation (NFO)			
National Telecommunications Regulatory Commission (NTRC)			
National Disaster Management Agency (NaDMA)			
Red Cross Society			

8 Optional Annexes

Annex 1: Work plan schedule with budget
(can be provided early in the implementation of the MOU as collaboration commences)

Annex 2: List of focal points and alternates
(can be provided early in the implementation of the MOU as collaboration commences)

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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