Fisheries and aquaculture emergency response guidance

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Preface

People who depend on fisheries and aquaculture for their livelihoods face both an increasing number and intensity of natural disasters. Most small-scale fishers and fish workers live in developing countries, and often face a range of diverse problems that increase their vulnerability to hazards including food insecurity, poverty, pollution, environmental degradation, overexploitation of resources, high levels of accidents at sea and conflicts with industrial fishing operations. The specific characteristics of fishing and fish farming operations (such as location and exposure) also increase vulnerability to hazards.

Assistance to countries and partners in responding to disasters is becoming a greater part of the work of international agencies, including FAO. To date there have been no systematic guidelines available to support those responding to an emergency involving the fisheries and aquaculture sector. This document aims to fill that gap and to improve the effectiveness of such interventions. These guidelines were developed following a meeting of experts in 2013 (FAO, 2013a). They draw on best practice and lessons learned during response to disasters that have affected fisheries and aquaculture sector. The sections (which are laid out to support the main elements of the Code of Conduct for Responsible Fisheries (CCRF)) include general good practice and technical areas such as; Fisheries and Aquaculture Policy and Management; Capture Fisheries Gear, Vessels and Engines; Landing Sites, Harbours and Anchorages; Aquaculture and Post-harvest, Trade and Markets.

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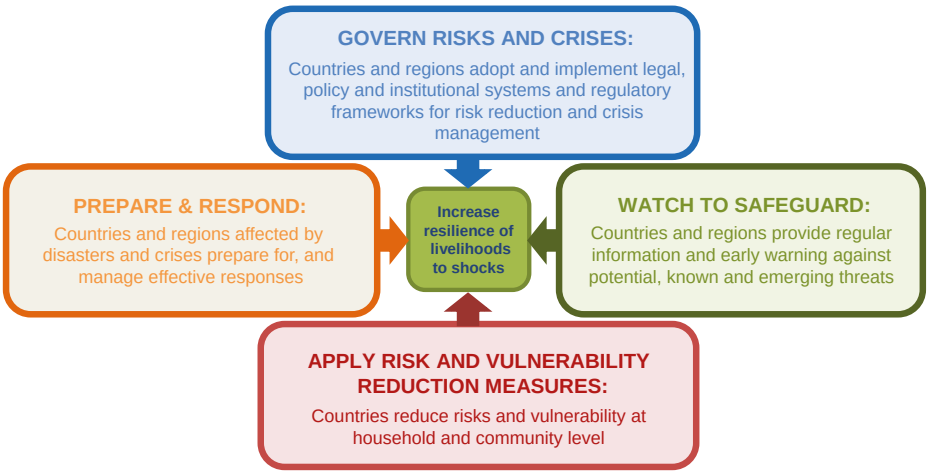


Resilient Livelihoods: Disaster Risk Reduction for Food and Nutrition Security - The four pillars of the FAO's Disaster Risk Reduction framework are aligned to support countries in implementing action plans under the Hyogo Framework for Action. FAO's strategic objective within this framework is to increase the resilience of livelihoods, including those of fishers and fish farmers, to threats and crises.

Introduction

WHAT IS THE FISHERIES AND AQUACULTURE EMERGENCY RESPONSE GUIDANCE?

The Fisheries and Aquaculture Emergency Response Guidance aims to help to save the lives and livelihoods of people in the fisheries and aquaculture sector who have been affected by disasters and humanitarian emergencies. It aims to do this by improving the quality of the design, implementation and assessment of interventions in fisheries and aquaculture in the wake of disasters. It draws on best practice and experience in responding to disasters that have affected fisheries and aquaculture and in supporting people working in the sector to rebuild their livelihoods.

THE ORIGINS OF THE GUIDANCE

People who depend on fisheries and aquaculture for their livelihoods face both increasing natural hazards (influenced by the impacts of climate change) as well as hazards caused by human activity. Effective responses to emergencies that affect the fisheries and aquaculture sector require an understanding of the specific features of the activities of this key food production sector and of the people who work in and depend on them – in fishing, in fish handling, processing and marketing, in fish farming and in the wide range of services that support these activities. To date, there is no widely available guidance to assist donors, programme managers and technical experts in the design of fisheries and aquaculture interventions in emergencies. The Guidance has been developed to fill this gap.

WHO SHOULD USE THE GUIDANCE?

The Guidance is intended to support all who are involved in fisheries- and aquaculture-based interventions in emergencies. In particular, the Guidance will support:

- **Planners** – It provides a framework for FAO, partners and donors to develop and assess proposals for disaster response rapidly and it will raise the profile and accessibility of fisheries and aquaculture in the international disaster risk management (DRM) community.
- **Implementers** – While the Guidance does not cover the "how to" element, it is designed to provide a framework (or a **first stop shop**) to make technical support, tools and more detailed guidance accessible to those involved in the implementation of disaster response interventions.

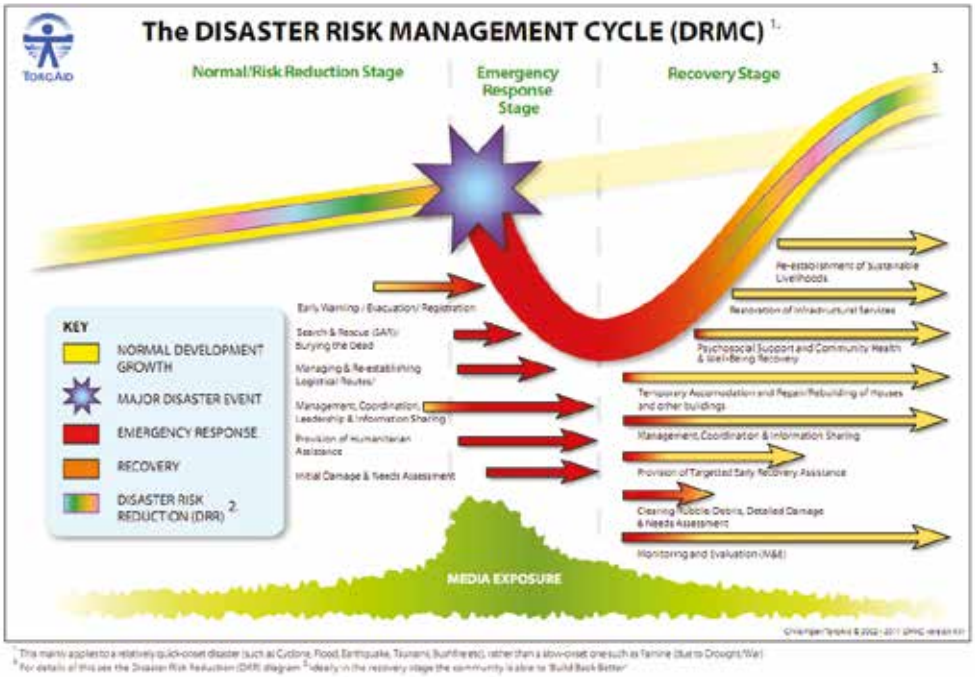
- **Monitoring and evaluation officers** – It will provide a basis for improving monitoring and evaluation of response and recovery efforts in fisheries and aquaculture.

WHAT DOES THE GUIDANCE COVER?

The Guidance is designed to provide those planning, implementing, monitoring and evaluating relief and recovery interventions in the fisheries and aquaculture sector with the key technical information they require in order to be able to carry out their tasks more effectively. For those with limited experience or knowledge of fisheries and aquaculture, it highlights those factors that need to be understood and taken into account when dealing with relief and recovery. For technical specialists with extensive knowledge of the sector, it provides a checklist and summary of best practice based on experience that they need to bear in mind when undertaking their work.

The process of DRM, to which the Guidance contributes, deals with three key phases of emergencies, which are illustrated in Figure 1.

FIGURE 1 **The Disaster Risk Management Cycle**



Source: www.torqaid.com/index.php?option=com_content&view=article&id=47&Itemid=58

The **first** phase in this cycle, that of risk reduction, is **not** dealt with in detail by this Guidance as it is covered extensively in other sets of publications.

The **second** phase of the DRM cycle, that of immediate response to disasters and humanitarian emergencies, inevitably tends to focus primarily on satisfying needs that are **not specific** to the fisheries and aquaculture sector: the saving of life in the wake of a disaster; the treatment of injury and trauma; and ensuring that people have access to the basic needs of food, water, sanitation and shelter.

In the **third** phase of the cycle, the recovery phase, the specific needs of the fisheries and aquaculture sector needs to be considered in more detail, and this is where the use of this guidance is likely to prove most fruitful – in undertaking an initial assessment of the specific needs of the sector for recovery and reconstruction; in understanding underlying issues in the sectors that can be addressed during the recovery and reconstruction process; and in identifying those areas where the performance of fisheries and aquaculture, and the livelihoods of those involved in the sector, can be improved. At this stage, improving the resilience and adaptive capacity of the fisheries and aquaculture sector in the face of future hazards is also critical and feeds into the first stage of the DRM cycle by reducing future risk.

When a disaster turns into an emergency, the moral imperative is first to satisfy immediate humanitarian needs. These include medical assistance, food, clean water, shelter and assistance with coming to terms with a dramatically changed life. Once this stage is completed, the focus can switch to planning and delivering support for fisheries and aquaculture.

HOW TO USE THE GUIDANCE

The Guidance is primarily intended as a planning and decision-making tool to support the development of appropriate emergency responses. However, the statements of best practice that it contains may also be useful as benchmarks for reviewing and evaluating emergency responses, either in real time or post-operation.

Chapter 2 – Fisheries, aquaculture and emergencies. This chapter gives an overview of key issues to consider when planning fisheries- and aquaculture-based interventions, particularly in relation to: hazards, emergencies and disasters; livelihoods; fisheries and aquaculture management and development; and food and nutrition security. It also outlines the stages of rapid, slow and complex emergencies and covers those issues that cut across the challenges of emergency response.

Chapter 3 – Emergency response in fisheries and aquaculture. This chapter discusses the vulnerability of the fisheries and aquaculture sector to different types of hazards and provides information about different types of framework that can be used to approach disaster response in relation to fisheries and aquaculture.

Chapter 4 – Common best practice. This chapter highlights those elements of best practice in disaster response that are common to **all** fisheries and

aquaculture interventions. It provides information and guidance on the ways of working that should be common to all types of emergency interventions. The chapter consists of **statements of best practice**, **key indicators** and **guidance notes** for each of the statements. These are arranged as follows:

- A brief introduction of the **context** for that type of intervention and relevant policy considerations.

Statement of best practice

- These are **qualitative** in nature and **specify the desired standards to be attained during the response process.** They should be applicable in any disaster situations and are, therefore, formulated in general terms.

Key indicators

- **The key indicators are attached to each statement** and serve as "signals" that **show whether it has been attained**. They provide a way of communicating the processes and results of key actions. The key indicators relate to the statement of best practice, not to the actions.

Guidance notes

- **The guidance notes outline particular issues that should be considered** in conjunction with the statements of best practice. These include specific points to consider when applying the minimum standards, key actions and key indicators in different situations. They do **not** provide guidance on exactly how to implement a specific activity**.** They provide guidance on tackling practical difficulties, benchmarks or advice on priority issues. They may also include critical issues relating to the standards, actions or indicators, and they describe dilemmas, controversies or gaps in current knowledge.

  If the required levels of best practice cannot be met, the resulting adverse implications for the affected population should be appraised and appropriate mitigating actions taken.

Chapter 5 – Best Practice in Emergency Response in Fisheries and Aquaculture. This chapter covers those elements of best practice that are **specific** to the interventions in the fisheries and aquaculture sector. The technical interventions covered by the Guidance are grouped according to:

- fisheries and aquaculture policy;
- fisheries management and fishing operations;
- aquaculture development;
- post-harvest practices and trade.

Under each of these sections, the format for statements of best practice, indicators and guidance is the same as that used in the preceding chapter.

All of the chapters are interconnected. Frequently, the statements of best practice described in one sector need to be addressed in conjunction with statements of best practice described in others.

2

Fisheries, aquaculture and emergencies

FISHERIES AND AQUACULTURE

Capture fisheries and aquaculture contribute to economies at national and local level, to export earnings, and to food supplies and employment. It is estimated that in 2010 they supplied around 148 million tonnes of fish, with 128 million tonnes being used for human consumption. The total value of the sectors was estimated at US$217.5 billion in 2010. Fish and fish products also contribute to more than 16 percent of the world population's average intake of animal protein and 6.5 percent of all protein consumed. This provides around 3 billion people with almost 20 percent of their intake of animal protein. In some countries fish makes up a far greater percentage of animal protein. Fish products are one of the most highly traded food and feed commodities, globally. Number of fishers and fish farmers employed and those depending on the industry has been growing faster than that in agriculture during the past three decades (and mainly in developing countries). Fish has a highly desirable nutrient profile as it is a good source of quality animal protein, essential fatty acids, vitamins and minerals (FAO, 2012a).

HAZARDS, DISASTERS AND EMERGENCIES

Natural or human-induced phenomena or events that have the **potential** to cause a disaster or a humanitarian emergency are referred to as **hazards.** Hazards do **not** constitute disasters in themselves – a hazard only becomes a disaster when people are affected or costs are incurred.

A hazard becomes a **disaster** when it causes:

- disruption of the basic fabric and normal functioning of a society (or a community);
- casualties and/or damage or loss of property, infrastructure, essential services or people's means of livelihood;
- impacts on a scale that is beyond the normal capacity of the affected communities to cope with unaided (FAO, 1997a).

The FAO categorizes disasters into three main groups as follows:

- **Natural disasters:** hydrometeorological hazards (e.g. floods, waves and surges, storms, droughts), geological hazards (e.g. earthquakes, volcanic eruptions) and biological hazards (e.g. epidemics, insect infestations).

- **Technological disasters:** directly related to human activity and as a result of failure of a technology or of management e.g. oil or chemical pollution from tankers, pipelines and drilling accidents, nuclear disasters.
- **Complex emergencies:** humanitarian crises resulting from military conflict and for which external assistance is needed.

The term "**emergency**" means "a sudden and usually unforeseen event that calls for immediate measures to minimize its adverse consequences" (FAO, 1997a). In relation to disasters, the term is often used to refer to a formally recognized state that is declared by the appropriate authorities when particular thresholds are recognized as having been reached. These thresholds generally refer to the ability of people in an affected area to meet their basic survival needs, the seriousness of "immediate threats to human life and well-being" and the capacity of authorities and mechanisms at different levels to respond effectively to these levels of threat or crisis (FAO, 1997a). The declaration of local, national or international emergencies implies the setting in action of a series of recognized response mechanisms at different levels to deal with these emergencies.

VULNERABILITY OF FISHERIES AND AQUACULTURE TO DISASTERS

Fishing and fish farming communities are often characterized by high levels of exposure to natural hazards (Box 1). The majority of natural hazards that lead to disaster situations are of hydrometeorological origin and, with fishers and fish farmers often living and working close to waterbodies or the sea shore, this inevitably means that they have a relatively high-level of exposure to these natural disasters (Alcantara-Ayala, 2002; Badjeck *et al.*, 2010) (Box 2). With global warming, it is widely predicted that both the severity and the frequency of hazards such as tropical storms, extreme weather and storm surges, as well as drought and flooding, are likely to increase in the coming decades and, thus, the exposure of those involved in fisheries and fish farming to these hazards will also increase (IPCC, 2001).

BOX 1
Exposure to hazards

In relation to disasters and emergencies, exposure refers to the nature and extent to which people, the communities they live in, their assets and the different activities they depend on for their livelihoods, are exposed to the physical effects of a particular hazard.

Sources: IPCC (2001).

Aquatic systems can also become vectors for pathogens, pollution and predators that can have destructive impacts on the livelihoods of fishers and fish farmers. Fish farmers may be particularly vulnerable to these types of impact where disease enters the aquatic system from other fish farms and is spread through the water supply necessary for fish farming downstream (Brown *et al.*, 2010; Campbell, 2010). Pollution, which may either be directly

produced by industries or the result of other human activities (such as logging or land clearance), in upstream areas or watersheds can also have serious and catastrophic impacts downstream on fisheries and fisheries-related livelihoods (Campbell *et al.*, 2006).

Once fishers or fish farmers encounter a hazard, the impacts that a hazard may have on them depends on a wide range of more complex factors that determine the sensitivity of fishers and fish farmers to disasters (Box 3). Understanding these factors, especially in the aftermath of a disaster, can be particularly challenging but it is important if disaster relief efforts are to be appropriate.

Important factors affecting sensitivity to disasters can include:

- The relative poverty of people involved in fishing and fish farming. While by no means all fishers and fish farmers are "poor", a large proportion of fishing and fish farming activity worldwide is carried out by small-scale operators in developing or less-developed countries. Among these small-scale operators, many live are either already poor or are vulnerable to falling into poverty.
- The frequent constraints faced by small-scale fishers and fish farmers that may increase their sensitivity to disasters and their capacity to cope with the impacts of disasters. These include: their limited reserves or savings to help them deal with periods of crisis or fluctuations in production; their lack of access to supporting institutions and agencies; their inability to influence policy and decision-making in their favour; poor infrastructure, housing and services; and their high levels of dependence on a single activity.
- The highly mobile nature of fisheries work, particularly capture fisheries, and the frequent migratory nature of fishing. This means that identifying the location of fishers when a disaster strikes, or where they are to be found the wake of a disaster, can be particularly difficult, leaving fishers at risk of not being properly taken into consideration as part of relief efforts.

BOX 2

Exposure to disasters in coastal areas

In recent decades, several of the most dramatic natural hazards to have occurred have been geological in origin (caused by earthquakes such as the massive quakes off the west coast of Sumatra in Indonesia in December 2004 and the Japanese quake in March 2011) but their impacts have been linked to hydrology – the catastrophic tsunami generated by those earthquakes. In both of these cases, fishing communities in coastal areas were among the groups most affected.

BOX 3

Sensitivity to hazards

"Sensitivity" to hazards refers to the extent to which any particular population is liable to suffer impacts as a result of encountering a hazard. Sensitivity constitutes the reasons why exposure to a hazard turns into a disaster, with its accompanying impacts on human life and livelihoods.

Sources: IPCC (2001).

BOX 4

Adaptive capacity in the face of disasters

"A combination of all the strengths and resources available within a community, society or organization that can reduce the level of risk, or the effects of a disaster." Capacity may include physical, institutional, social or economic means, personal or collective attributes, or capabilities. "The ability of people, organizations and systems, using available skills and resources, to face and manage adverse conditions, emergencies or disasters." This definition of "coping capacity" includes

Sources: UNISDR (2009).

- The dependence of fishing activities on markets and market linkages. Where such linkages survive a disaster intact, they can represent an important asset helping the process of rehabilitation and reactivation of people's livelihoods, but where they are disrupted by the effects of a disaster, the lack of access to functioning markets can inhibit the process of livelihood recovery.

The vulnerability of fishing and fish farming communities to disasters is also determined by their capacity **to adapt to, or cope with**, the effects of a disaster once it has struck (Box 4). This will be influenced by many of the same factors that determine people's sensitivity to disasters, but the degree to which people are supported in the relief and recovery process by effective institutions and agencies is liable to be a particularly important aspect determining their coping and adaptive strategies.

The relatively rapid cycles involved in capture fisheries activities means that, with appropriate rehabilitation of equipment and infrastructure, recovery times can be relatively rapid, depending on the scope and severity of the disaster and access to markets for produce. Recovery in fish farming activities can require more time as culture cycles are longer and more similar to agriculture cycles.

The scale and level of sophistication of fishing and fish farming activities also affects their capacity to adapt to a disaster and recover in its wake. Smaller-scale fisheries may be technically easier to adapt to new, post-disaster circumstances and require less outside input, while larger-scale operations may require higher levels of technical expertise.

CROSS-CUTTING ISSUES AFFECTING VULNERABILITY AND EXCLUSION

Vulnerability among those involved in fisheries or in aquaculture can also depend on a range of cross-cutting features that need to be taken into account when considering relief and rehabilitation in the wake of a disaster. Many of these factors influencing people's vulnerability in the face of disasters can represent factors that may increase their risk of exclusion (Box 5) during relief and recovery efforts in the wake of a disaster. All of these factors are relevant to all population groups affected by disasters (not just those in the fisheries and aquaculture sector), but they may all be manifested in communities

depending on these sectors in specific ways. Therefore, they need to be continually kept in mind at all stages of the DRM cycle. These key cross-cutting issues include those listed in Table 1.

BOX 5

Social exclusion

"... process by which certain groups are systematically disadvantaged because they are discriminated against on the basis of their ethnicity, race, religion, sexual orientation, caste, descent, gender, age, disability, HIV status, migrant status or where they live."

Sources: DFID (2005).

THE IMPORTANCE OF REBUILDING FISHERIES AND AQUACULTURE

The fisheries and aquaculture sector plays a number of key roles that make its rapid restoration particularly important in a post-disaster situation.

TABLE 1

Cross-cutting issues affecting vulnerability and exclusion

Gender – FAO/WFP (2008) estimates that the 180 million people involved in fisheries worldwide are roughly evenly divided into men and women. Gender roles in fisheries and fish farming are usually clearly defined. Vulnerability to disasters, the impacts of disasters once they have occurred, and the impacts of interventions to support recovery from disasters will **always** have important gender dimensions that need to be understood and taken into account.	**Caste and class** – Socio-economic class, or caste structures in some cultures, may have important implications for the status of particular communities and their relations with outside institutions. Fishing and fish farming communities can often be associated with particular socio-economic groups and this may affect their vulnerability and their levels of participation in decision-making and in local institutions.
Age – The elderly and the young are particularly exposed to hazards, because of their dependence on others and relative lack of mobility, and they have particular levels of sensitivity to disasters once they occur. Similarly, the risk of exclusion of these groups from relief and recovery is high and they will often require special efforts and approaches.	**Ethnicity and language** – Differentiation between population groups according to their ethnic origin or their language can often represent a fundamental determinant of exclusion from economic, social and institutional participation. Fishing and fish farming communities may often be distinguished from other occupational groups by ethnicity and language, and this will influence both their vulnerability to disasters and their capacity to take part in relief and rehabilitation efforts.
Disability – The World Health Organization estimates that 7–10 percent of the world's population lives with disabilities of one form or another. These groups are extremely vulnerable in the face of disasters and require high levels of attention and support in order to recover from the loss of care and the stable environment on which they normally depend.	**Migrant and internal displacement status** – People who are migrants or internally displaced due to conflict or crises are always particularly vulnerable in a disaster situation and special efforts are likely to be required in order to take account of their special status.
HIV/AIDS – Mobile and migrant fishing communities are often characterized by high levels of HIV/AIDS infection and, as with other affected population groups, this often has implications for patterns of dependence within communities and vulnerability during an emergency.	**Chronic poverty and marginalization** – Disasters often tend to affect population groups that are among the poorest and most marginalized, often simply because these people tend to live in areas that are more exposed to the risk of disasters. This is also the case with many fishers and fish farmers. Dealing with the chronically poor and marginalized will often represent an additional challenge during relief and recovery operations.

Restoring the contribution of fisheries and aquaculture to food and nutrition security

Fisheries and aquaculture make a critical contribution to ensuring that people have access to a source of high-quality animal protein. Worldwide, the fisheries and aquaculture sector produces an estimated 115 million tonnes of fish for food, of which about 46 percent comes from aquaculture and the remainder from capture fisheries, in both marine and inland waters. An estimated 1.5 billion people worldwide depend on fish for almost 20 percent of their intake of animal protein, and a further 3 billion people for at least 15 percent of their consumption of animal protein. In low-income food-deficit countries (LIFDCs), where consumption of animal protein is relatively low, fish is estimated to make a particularly significant contribution, accounting for about 20.1 percent of animal protein consumption. These figures are generally regarded as being conservative estimates as much of the production in these countries comes from the small-scale and artisanal sectors in fisheries and aquaculture and is poorly documented and under-reported, and, locally, the importance of fish as a source of food and nutrition can be even higher (FAO, 2012a).

In the wake of a disaster or an emergency where the productive capacity of these sectors has been affected, rehabilitation of fish production, whether from capture fisheries or from aquaculture can restore access to the animal protein and vital nutrients that play such an important role in the diets of many people worldwide. Particularly in the case of capture fisheries, there is also the added advantage that fish production can often be restored relatively quickly in the wake of many forms of disaster. Unless serious damage has been caused to the aquatic environment (for example, by a major technological disaster such as an oil spill or chemical leak at sea), as soon as the equipment is available to enable fishers to return to their activities, fish supplies can be rapidly restored, at least locally.

Fish are rich in micronutrients, essential fats and fatty acids, and the key role that these play in brain development and cognition is widely recognized (Siekmann and Huffman, 2011). Restoring people's access to this high-quality source of food after a disaster can therefore support wider development processes and human capacity building. In many less-developed regions of the world, poor people in particular are highly dependent on fish as a source of essential nutrients in which their diet may otherwise be relatively poor.

Restoring fisheries livelihoods

As well as offering relatively rapid options for the restoration of supplies of high-quality food for local consumers affected by a disaster, livelihoods based on fisheries can also be rehabilitated relatively quickly once the appropriate equipment and materials are available. Those involved in the sector can therefore rapidly re-establish their means of living and earnings, enabling them

to ensure adequate food for themselves and their families and the capacity to contribute to their own post-disaster rehabilitation.

Restoring local economic activity and demand for goods and services

Fisheries activities can also have important local multiplier effects. They have a rapid, often daily, turnover and, at least where markets are intact and functioning, they generate cash income that will often be used locally for goods and services, thus re-establishing opportunities for employment and income generation that may have been seriously affected by a disaster. The geographical concentration of fisheries activities can play an important role in stimulating local economic activity and growth and, with proper support after a disaster, this role can be re-established relatively quickly.

Restoring the safety net function of fisheries

Aquaculture and, to a greater extent, fisheries can also play an important safety net role in local societies, and the rapid restoration of fisheries and aquaculture after a disaster can help to ensure that this role is re-established and maintained. In some capture fisheries, such as in inland or shallow coastal waters, the low entry costs and limited skills required for fishing and, in many situations, the open-access nature of the resource mean that poor people can easily fall back on fishing as an occupation of last resort. Both small-scale fisheries and small-scale aquaculture generate fish production at diverse dispersed sites (fish landings or fish ponds). This can also help to generate a multiplicity of opportunities for very small-scale fish handling, processing and marketing – representing an important opportunity for poor people, particularly in remote rural areas, and particularly for women who may have relatively few alternative forms of employment open to them.

While this safety-net function of fisheries, and the open-access arrangements that underpin this function, may have serious long-term implications for the sustainability of fisheries resources and the livelihoods that depend on them, this function may be particularly important in the wake of a disaster.

Emergency response in fisheries and aquaculture

EMERGENCY RESPONSE OBJECTIVES – BUILDING BACK BETTER

There is increasing recognition that emergency response should focus not just on saving human lives but also on protecting and strengthening livelihoods and ensuring that people, communities and nations are more resilient in the face of future shocks and longer-term processes of change. This approach to emergency response has been endorsed by the UN General Assembly and articulated by the evaluation of the response to the 2004 Indian Ocean tsunami disaster in terms of "building back better" (UN, 2006).

In the fisheries and aquaculture sector, the ecosystem approach to fisheries and aquaculture is recognized by FAO as representing a critical approach to ensuring long-term sustainable benefits. In the wake of a disaster or emergency, ensuring that the key elements that make up this approach are addressed is therefore a critical part of achieving the objective of building back better. The key elements of the ecosystem approach are:

1. **Community**
   - Support local people to build on their strengths to lead the recovery and transition to long-term development.
   - Promote the contribution of fisheries to food security and food quality, giving priority to the nutritional needs of local communities.
2. **Economy**
   - Be supportive of the recovery of the fisheries and aquaculture sector and its transition to long-term economic growth and development.
3. **Ecological**
   - Support the recovery of, and promote the protection of, living aquatic resources and their environments and coastal areas.
4. **Governance**
   - Strengthen the capacity of governments to establish and/or to improve the legal and institutional framework required for the exercise of responsible fisheries and aquaculture.

A HOLISTIC APPROACH TO DISASTER ASSESSMENT AND RECOVERY

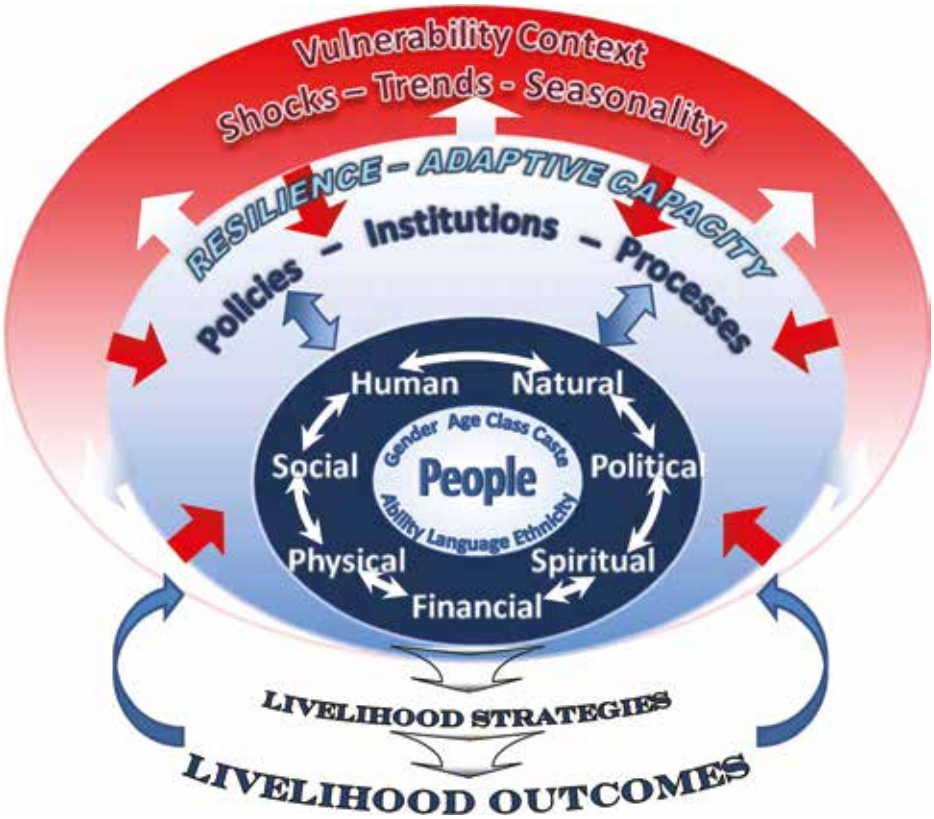
Understanding sustainable livelihoods

The impacts of any disaster affecting the fisheries and aquaculture sector have the potential for being extremely complex (FAO, 2013b). Understanding and differentiating between these impacts on different groups and their activities

will be extremely challenging. Disaster impacts cannot be reduced to a simple set of material losses but are likely to involve the interrelationships between material, human, social and institutional assets and the complex relationships that people depend on to support their livelihoods.

Figure 2, based on the Sustainable Livelihoods Framework, illustrates these complex relationships.

FIGURE 2 **Building sustainable livelihoods**



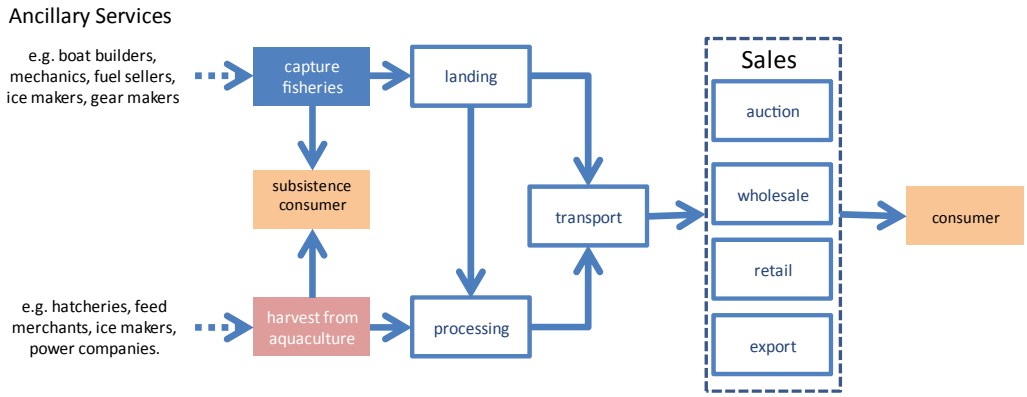
Understanding the complexity of people's livelihoods, including the factors that produced people's vulnerability to a disaster, is key to the implementation of the principle of building back better. Both the assessment of the impacts of a disaster and the subsequent recovery process have to respond to the complex relationships that make up people's livelihoods and identify appropriate means of both restoring these and improving the outcomes that people experience. Material losses – to equipment, productive assets, housing, and infrastructure – represent one part of these but close attention is also required to the non-material aspects of people's livelihoods.

In order to rebuild livelihoods, and improve their resilience in the face of future shocks and trends, and their long-term sustainability, particular attention is required to the quality of the relationships within people's livelihoods. Key relationships include: the possibilities that people have to use the assets at their disposal to gain access to, or be converted into, other forms of asset; the quality of the relationships that people have with service providers and institutions, and the extent to which these agencies are responsive to their needs; and the levels of support that people can obtain from policies, institutions and processes to ensure that they are able to reduce their vulnerability and achieve the livelihood outcomes they aspire to.

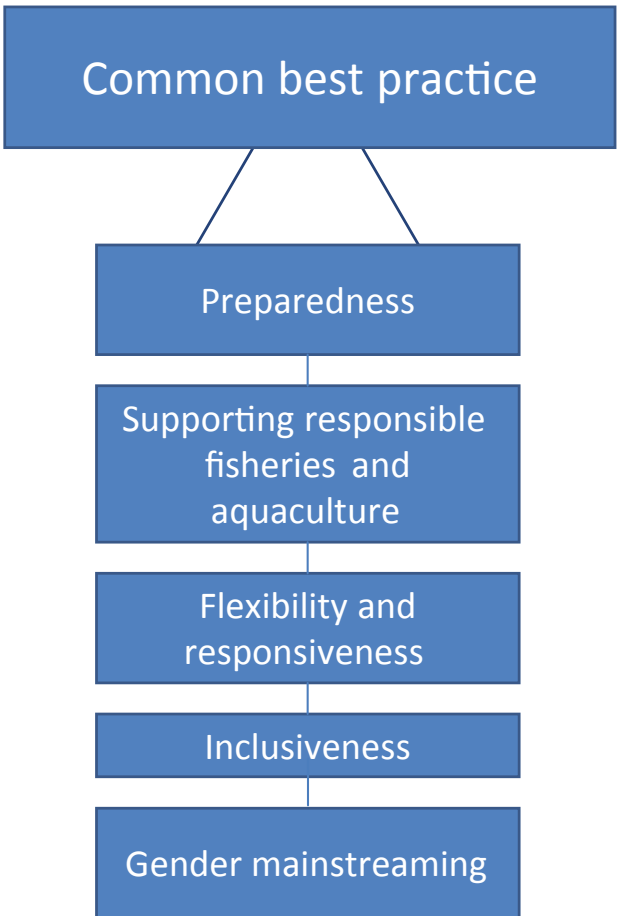
Understanding fisheries value chains

As well as understanding the complexity of people's livelihoods, a holistic response to post-disaster assessment and recovery also requires an understanding of the entire process involved in transferring fish from its point of production, whether by capture or culture, up to its point of consumption. In the wake of a disaster, this whole "value chain" needs to be understood – the impacts of a disaster on different stages in the chain, and the different actors involved, as well as the sometimes complex relationships linking together different actors and agencies found along this chain. Typical fisheries and aquaculture value chains are summarized in Figure 3.

FIGURE 3 **Fisheries value chains**



Common best practice



Introduction

This chapter presents core areas of best practice that are common to each of the interventions described in this chapter. These common areas of best practice describe processes or principles that are of overarching concern to relief efforts across the fisheries and aquaculture sector. They also represent areas of best practice that need to be put into action in order to ensure that the more-specific best practice in emergency relief described in Chapter 5 are effective and achieve their intended results.

Common best practice 1: Preparedness

Preparedness and contingency planning is undertaken to support effective and efficient emergency response.

Key indicators

- All relevant stakeholders (including the vulnerable and marginalized) are identified through a stakeholder analysis and co-opted into preparedness planning (see guidance note 1).
- Contingency plans and emergency response planning for policy and management action is in place prior to disasters (see guidance note 2).
- Training and capacity development is provided to relevant stakeholders in policy and management issues as part of disaster preparedness, based on existing capacities and expected needs, and using appropriate delivery mechanisms (see guidance notes 3, 4 and 5).
- Management information systems and data collection mechanisms are established as part of disaster preparedness. Relevant information (including local knowledge) is used to inform risk assessments, contingency planning, and response preparedness strategies. Management information systems are resilient, and measures are taken to ensure that they will continue to function and be accessible during emergencies, that they are based on appropriate technology, and that they are cost-effective (see guidance note 6).

Guidance notes

1. **Participation and stakeholder involvement**. Wide stakeholder involvement, both in preparing for potential emergencies/disasters, and in responding to them, is essential for the identification, design, and implementation of fisheries and aquaculture sector policy and management interventions. The definition of relevant stakeholders should be broad and encompassing, to ensure that all those involved with, or who have an interest in, the sector are involved. Stakeholders are most obviously both government at different administrative levels (central, regional, local), and the private sector (all those in the supply chain and providing inputs to it, including the more marginalized or vulnerable groups [see other indicators and guidance notes on vulnerable groups]). Civil society organizations may also be important stakeholders. Involvement and participation means that all stakeholders involved in preparedness and response have a right to be involved and to make contributions based on their specific skills and (local) knowledge that improve effectiveness and efficiency. The requirement for wide stakeholder involvement is premised on the fact that active participation by all stakeholders is more likely to result in incorporation of social, cultural and religious beliefs and practices into responses and, therefore, in sustained benefits and services, and the appropriate and equitable distribution of benefits. While there are significant challenges in achieving good levels of participation from all relevant stakeholders,

participation and stakeholder involvement is a key goal of fisheries and aquaculture policy and management.

2. **Ensuring continued policy and management functions in emergency situations through emergency plans being in place**. The role of government (and other stakeholders involved in policy and management through comanagement arrangements) in defining and implementing fisheries and aquaculture sector policy and management must continue to function in post-disaster situations, so as to provide the overarching governance and guidance needed for the sector. Ensuring the resilience of policy and management institutions and functions can be greatly increased if emergency plans are put in place **prior** to disasters. These plans can outline potential policy and management scenarios that might be faced in emergency situations, and how government would plan to respond to them. Scenarios can include different types and scales of impacts potentially resulting from different types of disasters. However, perhaps even more important for ensuring continued policy and management of the sector in emergency situations is the need for recognition in such contingency plans and response planning scenarios that those involved with policy and management may themselves be affected by the disaster. This may be especially the case for policy-makers and managers from government and other stakeholder groups who are based at the local level. Contingency planning (and responses in emergency situations) should recognize that it may not be possible or realistic to expect all policy and management functions to continue as before, owing to human capacity limitations. In turn, this may require prioritization of management activities, with a focus on ensuring the resilience of those functions deemed to be of most importance. Ensuring resilience of policy and management activities in emergency situations can be increased by ensuring that key policy and management responsibilities and functions have backup/replacement staff nominated should they be unavailable to complete the duties as a result of the disaster.
3. **What is human capacity development?** While there are many different definitions of capacity development, a useful definition is "the process by which individuals, groups, organizations, institutions, and societies develop their abilities – both individually and collectively – to set and achieve objectives, perform functions, solve problems and to develop the means and conditions required to enable this process". The definition serves to highlight two important attributes of capacity development. First, it requires a consideration of capacity development **at different levels**, e.g. in individuals, organizations, and networks (with individuals sitting within organizations, and organizations within networks). Each level represents a level of analysis, and importantly, a possible entry point for initiatives aimed at capacity development. Second, it is a **process** and

not a passive state and must build on existing core capacities. This process may require individuals to build constantly on existing core skills and capacities. New learning and abilities of individuals eventually feed into, and become embedded in, a collective unit, i.e. they are more than the property of individuals and indicate some sort of systemic or structural improvement – an institutional, sectoral or societal change takes place that supports a new level of performance with collective behaviour forming new patterns. These new behaviours must then remain in some form even when particular individuals leave or certain organizations are disbanded, i.e. a sense of permanence or sustainability is achieved.

4. **What human capacity needs to be developed?** Knowing what capacity development is required involves assessing the current and required capacities of those involved in policy and management, and thinking about which policy and management issues are likely to be of most relevant in emergency response situations. With regard to the former, identifying appropriate needs for different individuals/groups in response situations requires a benchmarking assessment of "knowledge, attitude, skills and ability" (KASA) against an idealized KASA profile for that person's position, so that gaps can be identified and capacity development delivered to address these gaps. In respect of the latter, capacity development must include a strong focus on the wide range of best practice guidelines and policy/management tools available for the sector, but most importantly the Code of Conduct for Responsible Fisheries, and an ecosystems based approach to fisheries management.
5. **How should capacity development be delivered?** There are a wide range of possible delivery mechanisms that can be used for capacity development, and which can be usefully categorized into face-to-face mechanisms and remote mechanisms. Face-to-face mechanisms include: classroom-based training, seminars, conferences and workshops; research programmes; exchange programmes; demonstration trials; and on-the-job training. Remote mechanisms include: publications; manuals/training material; mentoring; distance-based training/learning; and mechanisms based on information and communication technology (ICT). It may be that mixed use of mechanisms is appropriate, and that mechanisms need to be delivered through partnerships of service providers.
6. **Information.** Preparing for and responding to emergencies are critically dependent on information. Planning for policy and management responses must be based on sound information/data, and the use of local knowledge. A lack of information should not be used in response situations as an excuse for a lack of action. Information should be used in preparedness to reduce exposure to risk (for example, both through adaptation to reflect known high-risk areas, and through information being rapidly disseminated about impending events through the use of early warning

systems). Information about previous responses should be shared and built into future contingency plans so as to ensure that 'lessons are learned'.

Common best practice 2: Supporting responsible fisheries and aquaculture

Response efforts contribute to healthy ecosystems and sustainable fisheries and aquaculture.

Key indicators

- Emergency response efforts incorporate the principles of the ecosystem approach to fisheries (EAF) and the ecosystem approach to aquaculture (EAA) (see guidance notes 1, 2 and 3).
- Assessment of the capacity of ecosystems to sustain fisheries and aquaculture development is conducted, and interventions for the reconstruction of fisheries and aquaculture are designed accordingly (see guidance note 4).

Guidance notes

1. **Incorporating the principles of the EAF into emergency response.** An EAF/EAA is intended to ensure that planning, development and management meet social and economic needs without jeopardizing the options for future generations to benefit from the full range of goods and services provided by marine ecosystems (FAO, 2003). For capture fisheries, these principles include those listed in Table 2.

TABLE 2
Principles of the ecosystem approach to fisheries

• Ensuring human and ecosystem well-being	• Institutional integration
• Resource scarcity – accepting that the resources in aquatic ecosystems are finite	• Take account of uncertainty, risk and precaution
• Maximum acceptable levels of exploitation – ensuring that living resources are not endangered by overexploitation	• Seek to make management measures at different levels of jurisdiction compatible
• Maintain maximum biological productivity	• Implement the polluter pays principle
• Ensure impact reversibility and minimization	• Apply the user pays principle
• Rebuild resources where they are overexploited	• Apply the precautionary principle and precautionary approach
• Ensure the integrity of ecosystems	• Take account of the governance principles of subsidiarity, decentralization and participation
• Take account of the interdependence of species	• Aim to achieve equity in the distribution of benefits from interventions

Source: (FAO, 2003).

2. **Incorporating the principles of the EAA into emergency response.** The EAA subscribes to the following three broad principles:
   - Aquaculture development and management should take account of the full range of ecosystem functions and services and should not threaten the sustained delivery of these to society.

- Aquaculture should improve human well-being and equity for all relevant stakeholders.
- Aquaculture should be developed in the context of other sectors, policies and goals.

3. A range of opportunities are available for improving the implementation of the ecosystem approaches to fisheries and aquaculture in post-disaster response in the fisheries and aquaculture sector. These are dealt with in more detail in the specific best practice for the environment in the following section but include:
   - improved stock assessments;
   - improved fishing capacity assessment and management;
   - introduction of lower-impact and more-selective fishing gear;
   - reduced greenhouse gas (GHG) emissions through efficient engineering;
   - improved use of feeds in aquaculture;
   - responsible sourcing of seed and broodstock for aquaculture.
4. Interventions in fisheries and aquaculture undertaken as part of the disaster response process should be designed based on assessments of the capacity of local ecosystems to sustain such interventions. In the case of capture fisheries, this means developing the best possible assessment of existing fish stocks and the state of the fisheries ecosystem, while in aquaculture this means understanding both aquatic and terrestrial ecosystems and their interactions and health.

Common best practice 3: Flexibility and responsiveness

Flexibility and responsiveness in the planning and implementation of relief and reconstruction in the fishing and aquaculture sector should be maintained to ensure that the needs of vulnerable groups can be responded to.

Key indicators

- The different needs and capacities of vulnerable groups are specifically identified as part of the assessment process (see guidance note 1).
- A mix of interventions are taken into consideration for implementation, and the relative impacts and appropriateness of different interventions for vulnerable groups are explicitly taken into consideration (see guidance notes 2 and 3).
- A mix of modalities and time frames for interventions are taken into consideration to ensure that those most appropriate for vulnerable groups are included (see guidance notes 4 and 5).
- Criteria for the selection of interventions are based on experience on the ground and priorities expressed by local people (rather than by donors or outside agencies) (see guidance note 6).
- The design and implementation of interventions should include mechanisms that ensure constant feedback, including from vulnerable groups, and opportunities to learn and adjust interventions based on experience (see guidance notes 7 and 8).

Guidance notes

1. **Being open to diversity:** Vulnerable groups will often have different needs and different capacities compared with the majority of people in fishing and aquaculture communities. To respond to these differences, those involved in the design, planning and implementation of relief and rehabilitation need to maintain an open mind and considerable flexibility regarding the types of intervention that are likely to be appropriate for these vulnerable groups.
2. **Appropriate interventions:** In order to address the needs of the most vulnerable section of the population effectively, a mix of interventions is likely to be required. This may mean that technical agencies involved in providing relief and recovery support to the fisheries and aquaculture sector need to consider interventions that are outside their normal, purely technical spheres of competence and seek opportunities to work with other agencies that can provide more appropriate forms of support for vulnerable groups. For example, rather than focusing exclusively on technical support and replacement of equipment and infrastructure, for some vulnerable groups longer-term capacity-building and empowering activities may be more appropriate while, to cover their immediate needs, direct cash transfers or opportunities to earn cash or food-for-work may be more appropriate.
3. **Flexibility:** Flexibility will often be key when dealing with more vulnerable groups as it may be very difficult to predict what sort of interventions are likely to be appropriate for them, and it may take time to build the confidence of some vulnerable groups to the point where they can identify appropriate forms of support.
4. The **modality of operation** (for example, working at the community level, at the group level, or at the individual household level) also needs to be kept very flexible in order to ensure that appropriate modalities that enable the participation of more vulnerable groups are employed. In particular, it is important to recognize how some vulnerable groups – for example, women in some cultures, the very old or very young, or the very poor and marginalized – may not effectively participate in community-level or group-level activities. Such groups may require specific modalities of operating that are quite different from those regarded as effective for the rest of the population.
5. The **timing and distribution** of different types of intervention may well be different for different vulnerable groups, and this requires considerable flexibility on the part of planning and implementation teams.
6. Externally determined criteria for selection of interventions and modalities of implementation are unlikely to respond to local priorities and may well lead to inappropriate interventions that miss vulnerable groups or are even detrimental to their situation. Criteria for selecting interventions need to be

established in concert with local people, and with the specific participation of vulnerable groups, in order to ensure that their requirements are responded to.

7. Given the inherent difficulties in working with vulnerable groups, and the frequent lack of background information on them, the establishment of learning mechanisms within interventions that allow progressive learning about local conditions and capacities and problems of vulnerable groups are essential. These mechanisms need to be explicitly incorporated into project design and used to reassess and adjust interventions constantly, as well as identify possible new areas of intervention, in order to address the issues faced by vulnerable groups.
8. The capacities of vulnerable groups to absorb inputs and adopt new forms of activity or behaviour are often more limited, and these groups may be more conservative in their attitudes to new types of activity. This means that it is often very difficult to determine the time frames of interventions in advance, and considerable flexibility is required in order to ensure that the time allowed for interventions to become effective is sufficient.
9. Donors, particularly in post-disaster situations, will often be subject to strong pressure to demonstrate that their funding has been spent within a limited time frame. Therefore, there will often be a need to inform and educate donors regarding the time and approaches required to address the requirements of vulnerable groups effectively.
10. Some key questions to be asked relating to assessment, planning and implementation mechanisms to ensure that the specific concerns of vulnerable groups have been considered include those listed in Table 3.

TABLE 3
Key questions to ensure that the specific concerns of vulnerable groups are considered

• How clearly have the distinct needs and priorities of different vulnerable groups been identified?	• Have these different measures been matched with the capacities of vulnerable target groups to absorb them and benefit from them?
• What range of measures is available for relief and reconstruction and how effectively will they respond to the needs of vulnerable groups?	• What modes of operation are foreseen and are they appropriate for different vulnerable groups? Will women, older people, young people, disabled people, ethnic minorities, etc. be able to participate effectively?
• Is there a good mix of technical support, hardware provision, capacity building, cash inputs, etc. that will respond to the different needs of different groups?	• Have the time requirements of different vulnerable groups been adequately taken into account and is the time frame for interventions flexible enough to accommodate them?
• What means of learning from experience with vulnerable groups have been developed?	• How well do donors and counterparts understand the time and resource requirements for working effectively with vulnerable groups? How can this be improved?
• How will learning be incorporated into ongoing interventions?	• How has flexibility been built into the design of interventions, and how can it be improved?

Common best practice 4: Inclusiveness

Decision-making regarding relief and rehabilitation measures is taken in consultation with the affected population, paying attention to the inclusion and engagement of vulnerable groups.

Key indicators

- Operators involved in the disaster response process are trained in the use of participatory, consultative approaches (see guidance note 3).
- Appropriate measures and mechanisms for ensuring the identification of vulnerable groups and their inclusion in consultative processes are specified in the process of assessment, planning and implementation of relief and rehabilitation (see guidance notes 1, 2 and 3).
- The time frames for planning are appropriate to allow time to identify, engage with and ensure participation by vulnerable groups (see guidance notes 3 and 4).
- Diverse forms of assistance during the relief and recovery phases are encouraged in order to ensure that options appropriate for more vulnerable groups are available (see guidance note 5).
- Planning and reporting, monitoring and evaluation formats make specific demands on coverage of vulnerable groups, including disaggregated data and consideration of impacts (see guidance note 6).

Guidance notes

1. Ensuring proper inclusion of vulnerable groups in decision-making during emergency relief and rehabilitation depends on the use of proper **process**. Vulnerable groups – whether they are defined by gender, age, ethnic group, caste or class, disability, HIV status, or their poverty status – are often vulnerable because they are difficult to identify and engage with, and the process of working with them requires more time and specialized skills. Therefore, ensuring that adequate time is allocated to the process of identifying and engaging with these vulnerable groups is an essential part of the process of ensuring that their needs are addressed and taken into proper account. Failures to take into account the needs and priorities of vulnerable groups in post-disaster situations are often the result of the time pressure on relief agencies, which does not leave them with enough time to undertake the careful analysis and field assessment required to identify, engage with and plan for vulnerable groups.
2. Information on vulnerable groups will often be lacking both in baseline information and in assessments after an emergency situation. In order to identify effectively who the most vulnerable groups are and how they can be contacted and engaged with, a process of consultation with local people, including local institutions and leaders, is likely to be required. However, the possibilities of biases influencing the information provided by local people need to be constantly borne in mind and compensated for as far as possible.

3. Skills and experience in the use of participatory consultative tools for conducting assessment and planning in the field can help to ensure that local people are effectively engaged in assessment and planning processes. They can also ensure that operators identify more vulnerable and "hard to reach" groups in the population and ensure that they are involved on an equal footing with others. However, particularly when making use of participatory approaches, special care is required to ensure that the specific methods used are appropriate for engagement with vulnerable groups. For example, community-level meetings where mapping exercises or other participatory tools are used may **not** ensure proper inclusion of vulnerable groups, who may either not attend or not contribute owing to their lack of confidence and low self-esteem. Vulnerable groups such as women, old people or members of ethnic minorities may feel more comfortable working in smaller, common-interest groups where they can express themselves more freely. In adopting participatory assessment and planning approaches, considerable flexibility may be required in order to ensure that appropriate ones are deployed.
4. Working with more vulnerable groups will often require more time compared with working with other population groups. For example, old people, or the very poor, may be diffident towards outsiders and unused to expressing themselves with strangers. Overcoming their initial shyness and finding a mode of communication that they are comfortable with may take some time. In an emergency situation, there will often be considerable pressure on operators to work quickly, but it needs to be recognized that insistence on **speed**, in carrying out assessments and in planning interventions, will often lead to the **exclusion** of more vulnerable groups.
5. The forms of assistance most appropriate for vulnerable groups may not correspond with those appropriate for other population groups. During the relief and recovery process, maintaining a diversity of options and flexibility over which of these options should be pursued may be important to ensuring that vulnerable groups are able to receive appropriate support.
6. Agencies, and donors supporting emergency work in fisheries and aquaculture communities, need to specify that the concerns of vulnerable groups must be addressed during assessment, planning and implementation, and that reports on these different phases of the relief and recovery process should include sections where vulnerable groups are identified, their needs and requirements addressed, and possible impacts on them of different interventions discussed. While information may not always be available regarding all groups, it is important that a demand for taking these groups into consideration is created. Key measures to encourage that these concerns are taken into consideration include:
   - Specific sections in reports that deal with vulnerable groups.

- Where data are collected, and wherever it is possible and appropriate, disaggregation according to key vulnerable groups should be a requirement.
- Where outcomes and impacts are discussed for any intervention, the consideration of possible effects on vulnerable groups should be required.
- Monitoring and evaluation mechanisms should include specific coverage of vulnerable groups and mechanisms that are appropriate for their involvement in assessing the effectiveness of different interventions for them.

7. Key issues that are likely to need addressing when considering how to engage with vulnerable groups and ensure that their requirements are catered for include those listed in Table 4.

TABLE 4
Key issues in engaging with vulnerable groups

• What tools are most likely to be effective in engaging with vulnerable groups during assessment of needs and planning of interventions?	• To what extent do vulnerable groups take part in community-level and group-level activities, and what contributions do they make?
• How can the skills to use those tools be developed or incorporated into the team?	• Do vulnerable groups require alternative mechanisms in order to participate in consultations and decision-making?
• How effectively have different vulnerable groups been identified and catered for?	• How will the impacts of interventions on vulnerable groups be measured and assessed?
• What mechanisms are in place to ensure that vulnerable groups are able to participate in key decision-making processes?	

Common best practice 5: Gender mainstreaming

Specific attention to gender-related issues, and efforts to address those issues in interventions, should be regarded as a requirement at all stages of the emergency relief and rehabilitation process.

Key indicators

- Teams include members with skills and experience in gender analysis, and attention is given to undertaking analysis of gender dynamics and issues both generally and specifically in the fisheries and aquaculture sector (see guidance notes 2 and 3).
- Approaches used for engaging local populations in assessment, planning and implementation of relief and recovery measures ensure the inclusion and participation of women (see guidance note 4).
- Interventions for relief and rehabilitation in fisheries and aquaculture include activities specifically targeting women in these communities, as well as

men, and take into account both primary production and post-harvest and marketing subsectors (see guidance note 5).
- Expected impacts, and monitoring and evaluation mechanisms for impacts, pay specific attention to the impacts of all relief and rehabilitation interventions on the workload of women and their capacity to control the use of household resources (see guidance note 6).
- Planning, reporting, monitoring and evaluation formats make specific demands on disaggregation by gender, including disaggregated data and consideration of differential impacts on men and women.

Guidance notes

1. Gender issues require particular attention and are liable to represent the single most important set of issues relating to vulnerability. This does not mean that women should automatically be regarded as "vulnerable" but special attention will always be required to ensure that their perspectives, concerns and priorities are being included in the relief and rehabilitation process.
2. While a gender balance within post-disaster assessment teams is important, it should be recognized that skills in gender analysis are a specific set of skills that are not necessarily ensured by the presence of a mix of men and women in the team. It is important that the team has access to experts with the experience and skills required to enable them to analyse properly the gender dimensions of the impacts of the disaster and the issues that need to be addressed during the relief and reconstruction phases.
3. Key gender analysis skills that need to be included in assessment and planning teams include:
   - Analysis of women's time use and activities, in order to understand in detail both their existing activities and the capacity to take on new or different activities.
   - The division of labour between men and women in fisheries. While men are commonly engaged in fish capture and women are involved in post-harvest activities, the division of labour in fisheries can be more complex.
   - Life-cycle analysis to understand the stage at which women and men engage in different forms of activity in fisheries and aquaculture.
   - Power relations between men and women, in particular how control of earnings from different activities in fisheries and aquaculture is controlled. Understanding these power relations often requires analysis on intrahousehold relations, which can be particularly challenging in a post-disaster environment.
   - Understanding hierarchies of power within "vulnerable" groups, for example how some women involved in fish marketing may wield more power and influence compared with others.

- Understanding differential access to key livelihood resources between women and men and the patterns of access and control of fisheries resources, land, ponds and common property resources. Women, along with other vulnerable and poor groups in fishing communities, are often particularly reliant on the use of.

4. Not all approaches for consultation with affected populations will necessarily ensure the inclusion and participation by women. At "community" meetings and consultations, participation by women may be considered inappropriate. Communication, particularly between outsiders and women, may be considered so unusual or culturally unfamiliar that creative solutions to enable their participation and the inclusion of their ideas and requirements in discussions may need to be sought out. Often, this may require additional time and resources, but creating an appropriate space for effective engagement with women should be regarded as a priority.
5. Attention should be paid to ensuring that relief and recovery interventions do not focus exclusively on primary production activities in fisheries and aquaculture, where men often play the lead role, but also take into account impacts and opportunities for improvement during the reconstruction phase, in the post-harvest and marketing subsectors, where women play a larger role. The dual roles of women in productive activities and in reproductive labour should also be taken into consideration and, for all interventions, possible implications for women's workloads should be specifically analysed.
6. The impacts of different interventions, whether they specifically target women or not, on the workload of women and their capacity to control and make decisions about the use of household resources need to be given special consideration. These impacts are often ignored and, as a result, interventions that may apparently have been very positive in restoring fisheries or aquaculture production or improving productive mechanisms may actually have had unseen and unmeasured negative impacts on women. Women's double workload – reproductive household labour as well as income or food producing work – is frequently not taken into account, and this is a particularly important area that requires special attention. Similarly, changes in the types of technology being used and who controls that technology can also result in important changes in decision-making within the household and control of the resources and benefits that interventions produce.
7. In reporting formats for assessments, project design, monitoring and evaluation, and assessment of the impacts and outcomes of interventions, data should be disaggregated by gender and, in all elements in reporting, differences between men and women should be considered and specified.

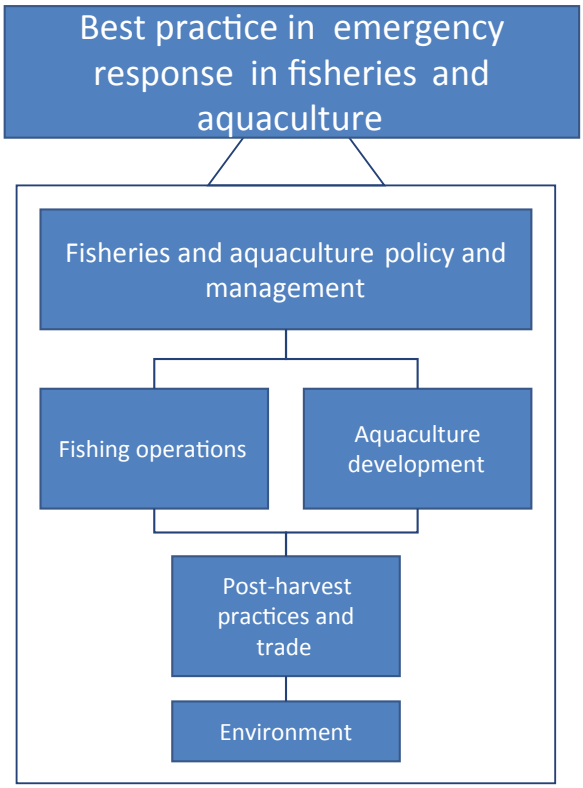
This will often represent a challenge and data may be scarce, but it is only by establishing a demand for this that agencies involved in relief and recovery work in fisheries and aquaculture will ensure that they seek out, or generate themselves, the information required in order to determine how both women and men may be being affected in different ways by different interventions.

8. Key issues relating to gender that teams involved in post-disaster assessments in fisheries and aquaculture, and in the design and implementation of interventions, need to consider include those listed in Table 5.

TABLE 5
Key issues relating to gender in post-disaster assessments and in the design and implementation of interventions

• How will the analysis of gender-related issues be carried out and who will guide it?	• What contributions do women make to productive activities undertaken by the households?
• What secondary information and studies on gender issues are available?	• What control do they have over decisions on how to use the outputs of these activities?
• What mechanisms are in place to ensure that women are engaged with and participate in decision-making and discussions about relief and rehabilitation?	• How will different interventions affect women, their workloads and their control of household resources?

Best practice in emergency response in fisheries and aquaculture



HOW TO USE THIS CHAPTER

This chapter is divided into four main sections:

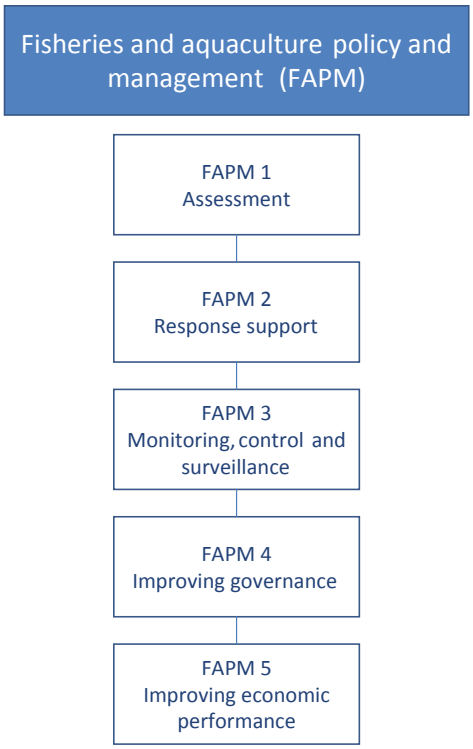
1. Fisheries and aquaculture management and policy;
2. Fisheries operations:
   - Fishing gear,
   - Fishing vessels,
   - Fisheries infrastructure;
3. Aquaculture;
4. Post-harvest practices and trade;
5. Environment.

The common best practice must be used consistently with this chapter. Although primarily intended to inform response to a disaster, the recommendations for best practice may also be considered during disaster preparedness and the transition to recovery activities.

The first draft of content of the guidance within this section has been informed by a group of experts, who each drafted a background paper (FAO, 2013). The experts are:

1. Responding to the needs of Vulnerable Groups in Fisheries and Aquaculture Emergencies	Philip Townsley
2. Food and Nutrition Security	Shakuntala Thilsted
3. Fishing Vessels and Safety at Sea	Daniel Davy
4. Fishing Gear	Jean Gallene
5. Fisheries Infrastructure	Jo Sciortino
6. Aquaculture Development	Pete Bueno
7. Fisheries Management	Graeme Macfadyen
8. Post-harvest and Markets	David James
9. Environment	Fiona Nimo

BEST PRACTICE IN EMERGENCY RESPONSE IN FISHERIES AND AQUACULTURE 1: FISHERIES AND AQUACULTURE POLICY AND MANAGEMENT (FAPM)



Introduction

"Policy" is the course of action to meet an objective that is adopted by a government, a person or another party. More specifically, government policy can be considered as the principled guide or political vision of the State. It may consist of formal and well-documented policy documents including targets and objectives, legislation and/or regulations, or more informal decisions. Fisheries and aquaculture policy thus forms the basis on which the sector is managed. Examples of the sorts of policy content that may be associated with fisheries and aquaculture are shown in Table 6. Importantly, it should also be recognized that policy may be specified not just at the national level, but also at a wider geographical scale (e.g. by regions or the international community), as well as at a smaller regional or

Fisheries and aquaculture policy

It can be:

- formal or informal;
- created locally, nationally and internationally;
- influenced by policies from many different sectors.

local level within a country. Thus, national fisheries policy may be influenced by international policies, guides or strategies for the sector.

Fisheries and aquaculture management is the means, actions and capacity by which policy is implemented. The term "fisheries and aquaculture management" refers to the tools used to control and guide the sector in a way that conforms to the policy vision (see Table 6 for an example).

TABLE 6
Examples of fisheries and aquaculture policy and management

"Ecosystem approach to fisheries" dimension	Examples of policy objectives	Examples of management tools
Environment	• Ensuring sustainable resource exploitation with catches not exceeding a maximum sustainable yield (MSY) • Minimizing ecosystem impacts of fisheries • Reducing levels of illegal, unreported and unregulated (IUU) fishing • Reducing greenhouse gas (GHG) emissions	• Licensing and registration of vessels • Restricting inputs to the fisheries (i.e. limiting vessels, gear or space) • Setting catch limits or minimum sizes • Monitoring, control and surveillance (MCS)
Social	• Maximizing employment creation • Ensuring food security	• Supporting access to fish • Welfare payments in closed fishing seasons
Economic	• Increasing value-added • Increasing export values • Increasing the value of aquaculture and/or fisheries production	• Support for exporting • Traceability requirements and strategies • Support for value addition • Provision of credit and microfinance • User payments and charges, e.g. landings charges, licence fees, harbour dues
Governance	• Strengthening of organizations representing fishers • Improved cross-sectoral linkages • Human capacity development of government organizations • Supporting devolved decision-making powers	• Inclusion of fisheries in poverty reduction strategies • Development of information and data collection/sharing systems • Transfer of technology, sharing of lessons learned, and replication of successes • Comanagement and community management arrangements, often accompanied by decentralization.

Source: Adapted from Macfadyen (2012).

Fisheries and aquaculture policy and management in the emergency context

In the context of responding to emergencies, policy may legitimately need to be adapted to respond to the radically altered environmental or social

conditions, or to respond to short-term needs (such as allowing for relaxation of management measures to accommodate emergency fishing). Policies that are able to do this are those that have incorporated sufficient risk assessment and contingency planning. Such new or changed policies may in turn require different or amended management strategies, while at the same time disasters may seriously affect the ability of governments to ensure good management of the fisheries and aquaculture sector, for example owing to loss of government assets or personnel, or owing to a lack of political will to adhere to good management practices.

Fisheries policy-makers and managers (whether employed by government or as part of community and/or industry management bodies) have a number of crucial roles to play in facilitating an emergency response. These can include:

- helping to coordinate fisheries and aquaculture with other sectors (see FAPM 2);
- supporting the provision of assets (vessels, gear, processing equipment) to the sector (see FAMP 2), for example:
  - providing advice that the inputs planned will not lead to overexploitation of the fisheries resources,
  - supporting fishing gear and vessel registration, or at least keeping track of the new inputs into the fisheries to understand how the pressure on the resource may change,
  - providing details of the regulations to ensure that new gear and vessels are consistent with these, and to ensure that plans for rebuilding or relocating aquaculture operations are consistent with strategy,
  - re-establishing processing and landing infrastructure, and re-instating supply chain linkages (and the quality of product) to market;
- installing safety standards and consumer confidence:
  - ensuring contaminated fish and shellfish does not enter the supply chain,
  - initiating area closures based on impact assessment of the contamination events,
  - setting up and supporting monitoring and sampling programmes;
- supporting the sector through monitoring, control and surveillance (see FAPM 3);
- to support the transition from emergency response to long-term development (see FAPM 4 and FAPM 5).

In addition to these roles that managers and policy-makers must play, the post-disaster situation represents a timely opportunity to make positive changes to policy and management practice so as to build back better. With this in mind, it is important to ensure that lessons learned from the emergency response are incorporated so that new policies are better suited to facilitating both emergency response and the transition from this into long-term development.

Building back better

The emergency context presents a number of opportunities for improving fisheries and aquaculture management and policy. These include:

- **Improved fishing capacity assessment and management**. Reducing the numbers of fishing vessels and the amount of gear used to levels that are sustainable is, in many fisheries, one of the greatest challenges facing fisheries policy-makers and managers. Where vessels and gear have been affected by a disaster, there may be an opportunity to introduce fewer and, perhaps less-destructive, vessels and gear. For such an opportunity to be taken, managers should have a clear understanding of what the sustainable levels of fishing effort may be and how best to reach these in the affected fisheries. Such an initiative would also need to be accompanied by other aspects of post-disaster responses focused on helping people to take alternative livelihood opportunities.
- **Introduction of lower-impact and more-selective fishing gear**. With appropriate expertise and financial assistance, lost gear can be replaced with more-selective gear that has lower habitat impacts and lower rates of bycatch. A high level of stakeholder consultation is typically required to ensure that such techniques are both appropriate and can be adapted to local conditions. This particular issue is the subject of the background thematic paper on fishing gear.
- **Improved aquaculture**. The replacement of aquaculture facilities, such as ponds, supply canals and supporting infrastructure, provides the potential for either a straightforward rebuild or a more considered restoration. Many aquaculture developments were planned long ago, and there have been considerable improvements in spatial planning since then, thus offering the opportunity to restore aquaculture in a more sustainable way, thereby enhancing yields, improving efficiencies and reducing the risk of biosecurity issues. Coastal aquaculture is also dependent upon the status of the local ecosystem. Natural systems such as mangroves may have been lost in a disaster, and replacement of these should be factored into the disaster response.
- **Developing clear and transparent strategies for short-term income support, subsidies and access to resources for recognized emergency situations**. An important policy element is a consistent response to the short-term disruption to livelihoods and household incomes as a result of emergency situations. While reducing long-term dependence on government support may be a legitimate policy aim, it is important to recognize that vulnerable communities may need to be supported during unusual situations, and that in some cases subsidies may be justified. Such decisions are best made on a planned basis, rather than in the heat of an emergency situation.
- **Increased participation of local communities in fisheries and aquaculture planning and development**. Disasters may provide an opportunity

for previously disparate groups to work together, especially over the initial response phase. This provides an opportunity to forge longer-term partnerships, with potential for participatory policy development and comanagement arrangements. Involving stakeholders in the needs analyses process and, for example, in environmental rehabilitation (e.g. mangrove replantation) can improve "ownership" of the restoration process and form the basis for, or improve, positive ongoing relationships with government.

- **Building resilience and improvements into the seafood supply chain**. Supply chains and infrastructure can be disrupted by natural disasters (damage to ports, roads, bridges, chill/cold storage, and other infrastructure) and complex emergencies (lack of security and reduced maintenance). In the building-back process, particular focus can be given to improving infrastructure so as to correct previous weaknesses and imperfections, not just in infrastructure location and design and its implications for cold-chain management and supply chains, for example, but also in the management of infrastructure, i.e. provision of new infrastructure can be associated with improved management of such facilities to ensure proper administration, maintenance, and user payments.

Linkages with the other sections

In approaching emergency response in fisheries and aquaculture, it is important that agencies take a holistic approach. This does not mean that they have to do everything, but it does mean that they need to understand how the support that they are providing will affect the fisheries and aquaculture system as a whole. Fisheries and aquaculture policy and management strategies provide the overall framework for guiding the sectoral linkages, and also, potentially, for the linkages with support from other sectors.

Fisheries aquaculture policy and management (FAPM) best practice

FAPM 1: Assessment

Damage and needs assessments rapidly undertaken to understand the suitability of policy and management capacity to facilitate the emergency response.

Key indicators

- Baseline surveys and needs assessments are completed quickly after disasters, and include an assessment of the extent to which the policy framework and management capacity are suitable for supporting an effective emergency response (see guidance note 1).
- Risk assessments are completed for post-disaster policy and management responses in the absence of perfect information so that lack of information does not delay action (see guidance note 1).
- All relevant stakeholders (including vulnerable and marginalized groups) are identified through a stakeholder analysis and co-opted into needs

assessments and targeting criteria after disasters. They are engaged in actions and co-management responses, and are consulted during evaluations on the successes/failures of policy and management responses (see common BP ? and guidance note 2).

Guidance notes

1. **Understanding policy and management capacity:** The key requirements in identifying policy and management needs and capacities are threefold. First, a review should be completed of existing policy and management content and processes, and the extent to which the policy framework is already enabling for post-disaster responses (i.e. it is clear, it is flexible, it is robust and based on best practice, etc.). Second, existing data and information of relevance should be obtained from secondary and/or tertiary sources about the affected area (e.g. vessel numbers, area-specific management measures, species landings volumes and values). Third, field-based surveys should be completed of the affected areas. The completion of these three steps should be consultative and participatory, and completed by government and sector experts working with local communities and civil society to ensure that policy and management needs and potential actions are fully supported by local stakeholders.

   Completing these steps requires a certain level of skill and capacity in policy and management issues, and in dealing with response situations. Assessment of such capacities before disasters occur can also help governments and outside agencies to prepare for emergencies and to assess whether the policies and capacities are likely to be suitable and sufficient in a post-disaster situation (and can therefore help to identify what is needed before disasters occur). Their completion before disasters occur may also be beneficial as they can be completed in a more robust and thorough way than after disasters (when less time may be available).

   Whether completed before or after disasters, the completion of these three steps can help to determine the extent to which existing policy and management processes and content:

   - Are already robust and relevant, and therefore provide a good framework for post-disaster responses.
   - Are generally robust, but require modification owing to the special circumstances resulting from the disaster (e.g. whether particular management measures should be relaxed for certain periods, or whether special subsidies should be used that would otherwise not be approved.
   - Are generally weak, and the post-disaster situation thus provides an opportunity to build back better (e.g. longer-term objectives should be given greater priority; weaknesses in vessel licensing and registration and overcapacity in the fleet can be addressed through the process to control the provision of new vessels to communities; and management support

can be used to establish fisheries management plans that were previously not in existence).

Once the three steps above have been completed, those involved in post-disaster responses can assess the potential costs of the fisheries and aquaculture policy and management requirements compared with the resources available.

2. **Information:** Preparing for, and responding to, emergencies, is critically dependent on information. Planning for policy and management responses must be based on sound information and data, and the use of local knowledge, while a lack of information should not be used in response situations as an excuse for a lack of action. Information should be used in preparedness to reduce exposure to risk (for example, both through adaptation to reflect known high-risk areas, and through information being rapidly disseminated about impeding events through the use of early warning systems), and information about previous responses should be shared and built into future contingency plans so as to ensure that lessons are learned.

FAPM 2: Response support

Fisheries and aquaculture emergency response is facilitated by, and based on, principles of good governance (participation, resilience, consistency and adaptation, good information, accountability, conflict minimization, and good cross-sectoral coordination and integration).

Key indicators

- A mechanism for emergency relief coordination and a sector specific task force is established, if not previously done so, and is functioning (see guidance notes 2, 3 and).
- Core management services and functions are maintained at appropriate levels in emergency situations, and replacement staff are nominated for any individuals with key policy and management responsibilities and functions who are unavailable to complete their duties (see guidance note 2).
- Support provided so that emergency responses are consistent with existing international and national legislation, policy documents, and management measures, and based on best practice, while recognizing that responses to emergencies may require a change in the balance of policy objectives and/or changes in management actions (see guidance note 4).

Guidance notes

1. **Mechanism for relief coordination:** This mechanism should aim to allow for sector stakeholders to engage and coordinate with one another so as to reduce conflicts, and with those involved with non-fisheries/non-aquaculture sector responses to ensure that policy and management responses are included in, and coherent with, other national and/or

sectoral response frameworks. Fisheries and aquaculture policy and management preparedness and response can be improved by formalizing the stakeholder involvement discussed above into a mechanism for relief coordination. This should involve establishing a sector-specific task force, with representatives from all relevant stakeholders. The task force, and those participating, should have clearly agreed key tasks and responsibilities. The task force should: meet and report regularly; ensure that the sector is adequately represented in broader multisectoral response implementation; and ensure that all initiatives and responses are justified (in terms of their technical feasibility and their economic, social and environmental impacts).

2. **Conflict minimization:** Balancing and maximizing social, economic and environmental goals is not always easy, especially in the context of emergencies. Similarly, different stakeholders will have different priorities for response. These different goals and priorities have the potential to generate conflict, which can have serious negative impacts on response activities. Minimizing conflict can be achieved through good levels of participation in an environment (such as the sector task force for relief coordination) in which all involved feel that their views are being heard and respected. However, the interactions of different stakeholder groups may also need to be carefully managed and facilitated.
3. **Consistency (and adaptation where appropriate):** Policy and management planning (and responses) must strive to adhere to any robust policy and management frameworks, and relevant guidelines and standards that may already be in place, rather than ignoring best practice or attempting to start from scratch in terms of policy and management. It is important for information about appropriate policies and strategies to be made available to those agencies planning to provide inputs to the sector. At the same time, policy and management response in emergency situations must be responsive to conditions on the ground, and responses may need to adapt policy and management measures to the specific needs faced in emergency situations. Where such actions are taken, these should be documented in a way that enables the government to understand and respond to the possible implications for its long-term development strategy.

FAPM 3: Monitoring, control and surveillance

Recognition is given to the importance in post-disaster situations of the need to ensure a continuation of effective monitoring, control and surveillance.

Key indicators

- Monitoring, control and surveillance (MCS) operations completed and recorded (see guidance notes 1 and 2).
- Sanctions imposed for non-compliance (see guidance note 1).
- Community involvement in policing (see guidance note 3).

- Use of risk assessment to ensure appropriate targeting of MCS operations (see guidance note 3).
- Compliance with tasks covered in contracts with specific provisions for delivery and completion (see guidance note 4).
- Farmer group involvement in monitoring and surveillance of compliance with better management practices (see guidance note 5).

Guidance notes

1. **Recognition is given to the importance in post-disaster situations of the need to ensure a continuation of effective MCS:** The emergency situation can be viewed by rogue operators, in fisheries, as an opportunity to catch valuable resources illegally, either in terms of the fishing methods used, the quantities caught or the areas fished. In the context of aquaculture, threats may come from: poachers stealing fish from cage farms; farmers using banned chemicals or discharging untreated effluents in their rush to restart operations may; or building farms in socially or environmentally sensitive areas. Fisheries and aquaculture managers should continue to protect resources, and to liaise with non-fisheries sectoral responses to ensure that suitable provisions are made to reduce IUU fishing.
2. **Types of MCS operations and a record of activities:** MCS operations may require a combination of marine, aerial and land-based assets (vessels, aircraft, and vehicles) in order to conduct surveillance and inspection activities. Inspection activities can be backed up by administrative checks, e.g. cross-checking logbook data against data from a vessel monitoring system (VMS). Operations should monitor the activities of vessels against all management regulations related to input controls (e.g. limited licensing), output controls (e.g. quotas), and technical measures (e.g. mesh-size limitations). Records should be kept on all inspections, infringements and sanctions/penalties to allow for indicators to measure changes in compliance and inspection effectiveness and efficiency over time.
3. **Planning MCS operations:** Different inspection means (sea, air, and land) have different cost implications and efficiencies, and they have differing capabilities to detect different types of infringements. For example, sea-based inspections may be especially effective at detecting gear infringements and discarding of fish, while VMS and aerial surveillance are both effective at detecting infringements of any closed areas. Therefore, the balance of inspection means should be based on a careful assessment of the potential/likely infringements, the main management measures in place, the potential illegal gains/benefits accruing to fishers from infringing different types of management regulations, and the respective costs of inspection means. This approach can serve to ensure that MCS operations provide the best value for money possible. The planning of MCS operations should be a joint activity of all relevant inspection organizations (typically, the coastguard,

navy, department of fisheries, and the police), with operations based on an agreed and documented risk management strategy whereby high-risk fleets, areas, or times of the year are identified and become the focus of inspection activities. In emergency situations, where financial and human resources for MCS operations are likely to be limited, it is especially important to focus MCS operations on key infringement risks so as to ensure efficiency and effectiveness. Efficiency and effectiveness can be further enhanced by the involvement of community stakeholders in surveillance activities.

4. **Contracts cover reconstruction and construction works:** Contracts specify a monitoring of status timeline, completion of project date, and payment against delivery.
5. **Specific provisions of better management practices:** Provisions such as non-use of banned drugs and chemicals and the treatment of wastewater before discharge into public waters, are more effectively monitored by farmers themselves. The response efforts should encourage farmers' representatives or collectives to take the lead in MCS. Training in best management practices should be provided to the farmers, and this training should stress the financial as well as the social risks that everyone could suffer from a single member's non-compliance of critical provisions in a best management practice.

FAPM 4: Improving governance

Where possible, opportunities for improving governance for communities and resource management are taken.

Key indicators

- Lessons learned during and from emergency situations are used to improve fisheries and aquaculture policy and management governance (see guidance notes 1 and 4).
- Linkages and partnerships established during response situations to take policy and management decisions, established as potential longer-term policy and management arrangements. (see guidance note 2).
- Evaluations of, and lessons learned from, post-disaster responses used to inform governance improvements, such as necessary institutional changes or capacity development programmes (see guidance note 2).
- Opportunities are analysed and taken to improve policy by ensuring an appropriate emphasis on environmental objectives (see guidance note 3).

Guidance notes

1. **The mobilization of resources:** In an emergency response, financial and human resources, together with the special motivation in such situations to improve previous policy and management measures on sustainable resources and ecosystems, can be harnessed to make policy and management improvements for improved environmental sustainability.

2. **Improving governance:** Good fisheries and aquaculture policy and management depend on good governance (e.g. participation, transparency and accountability) in their formulation and implementation. Emergency response situations provide the potential for both: (i) identification of governance weaknesses and gaps in terms of institutional capacity and processes; and (ii) improvements in institutional arrangements and processes for policy and management, where emergencies themselves act as a catalyst for improvement. Gaps and weaknesses in good governance, along with improvements resulting from the emergency response, must be documented during and after the emergency response. This is so that appropriate steps can be taken to embed improved governance mechanisms in policy and management processes.
3. **Environmental objectives in policy:** Balancing environment, economic and social objectives in policy is frequently a considerable challenge. It is often the case that governments tend to give greater emphasis in policy to economic and social objectives, as evidenced by the use of targets in policy for increases in production and employment. Fulfilling economic and social objectives in the long term requires that environmental objectives be given sufficient emphasis in policy, as environmental sustainability underpins economic and social sustainability.
4. **Management plans:** Management plans provide the specific means to manage species or ecosystems in a sustainable manner. Emergency response can be used to mobilize resources and stakeholders to ensure that they are put in place. Management plans should be based on EAF principles. Ideally, they should be multispecies in nature and consider ecosystem issues e.g. bycatch; endangered, threatened and protected (ETP) species; and habitats. They should include harvest control rules and trigger/reference points, and the use of an appropriate and improved range and mix of input, output and technical management measures so as to ensure that fish catches do not exceed the maximum sustainable yield (MSY).

FAPM 5: Improving economic performance

Improved market discipline is introduced into fisheries and aquaculture management to ensure incentives promote sustainable growth.

Key indicators

- Provision of subsidies for specific periods only, only to groups in special need, and serving to support business viability without negatively affecting environmental sustainability (see guidance note 1).
- Credit and microfinance schemes are available to, and used by, those affected by disasters (see guidance note 2).
- Introduction of user charges (see guidance note 3).

Guidance notes

1. **Subsidies:** In emergency response situations, support for the provision (either free or at a reduced market price) of fixed costs (e.g. vessels, infrastructure) or operational inputs (e.g. fuel, fish fry as inputs to aquaculture) represent a subsidy to the sector. Provision of subsidies may be necessary in support of the short-term objective of responding to disasters so as re-build the fisheries and aquaculture sector and to support the social welfare and financial viability of businesses and individual operators. However, without careful consideration of their use, subsidies may have a negative impact on long-term sustainability. Therefore, great care must be taken in deciding who should receive support (see guidance note 10 on targeting), for how long, to what extent, and in what form. Some subsidies can be considered "bad" subsidies in terms of their potential impacts on environmental and financial sustainability by reducing the costs of doing business so that inefficient operators, or those engaged with unsustainable environmental practices, are assisted to stay in operation. However, subsidies can also be "good" if used to incentivize and direct the re-building process towards more sustainable practices. For example, subsidies or special support can be provided for fishing or aquaculture methods with low environmental impacts, or for businesses known/felt to be more financial viable. This statement of best practice thus has relevance to all statements in this Guidance document that relate to the provision of any form of asset or input, e.g. vessels, infrastructure and gear, and to the general objective of building back better.
2. **Microfinance:** The lack of access to formal credit and the inability to generate savings are major constraints for many fishers and fish farmers at the best of times, especially for the poor, and even where commercial banks are encouraged by governments to provide cheap and/or subsidized credit. Informal credit mechanisms, while having some benefits in terms of availability, often lack transparency and have high interest rates associated with them. The problems of informal credit markets and formal traditional credit institutions (e.g. banks) suggest a strong need for microfinance as a crucial tool for emergency response. Microfinance is the provision of a broad range of financial services, such as deposits/savings, loans, payment services, money transfers and insurance. It is characterized most commonly by small loans. As with all credit provision, loans must be provided based on careful screening and application processes, and at rates affordable to borrowers. Based on whether there is a legal infrastructure that provides recourse to lenders and protection to depositors, microfinance providers may be formal financial institutions (e.g. public and private development banks and commercial banks), semi-formal institutions (non-governmental organizations [NGOs], credit unions and cooperatives) or informal

providers (i.e. entities operating outside the structure of government regulation and supervision). Lending models may include: self-help groups (SHGs) as a financial intermediary; groups as guarantors of loans; and lending to individuals in solidarity groups. Lending methodologies and procedures must be carefully tailored so that they appropriately serve the financial needs of the fishing, trading and fish farming communities concerned. The ability of microfinance schemes to support deposits and savings mechanisms may also serve to increase the resilience of fishers and fish farmers to future disasters.

3. **User charges:** Paying for fisheries policy and management functions and related infrastructure, and the research that must underpin good policy and management, costs money. Since the 1980s, there has been an increasing willingness by governments to consider the scale of the costs they incur, which types of costs should be recovered, from whom, and using what cost recovery mechanisms. In many cases, fisheries and aquaculture activities generate considerable levels of profits and make important contributions to gross domestic product (GDP), and it is now considered best practice for those generating profits to make contributions to the costs of policy development and management in their sector. Therefore, private-sector fishing and fish farming operators are increasingly being expected to pay for, or at least to make contributions to, the costs of MCS operations, running government administrations, investments in public infrastructure that benefit the sector, research, etc. Charges can be levied through a variety of mechanisms, such as landings charges, user fees, payments for licences/access to resources, and import and export taxes. In emergency response situations, it may be especially difficult for users to afford to pay user charges because of the negative impacts that a disaster may have on business viability.
4. However, emergency response actions may provide an opportunity for the introduction of user charges where they were not previously in place, or the setting of charges that better represent the costs of management. For example, following a disaster, the building and running of a new or improved fisheries harbour may provide an opportunity to introduce new harbour charges or to raise the level of charges that were already in place. Similarly, provision of ice plants may be tied to, and conditional on, the cost of the ice sold being sufficient to cover management, maintenance and re-investment costs. Through such initiatives, the emergency response can support the long-term sustainability of the facilities provided, and improved policy and management.

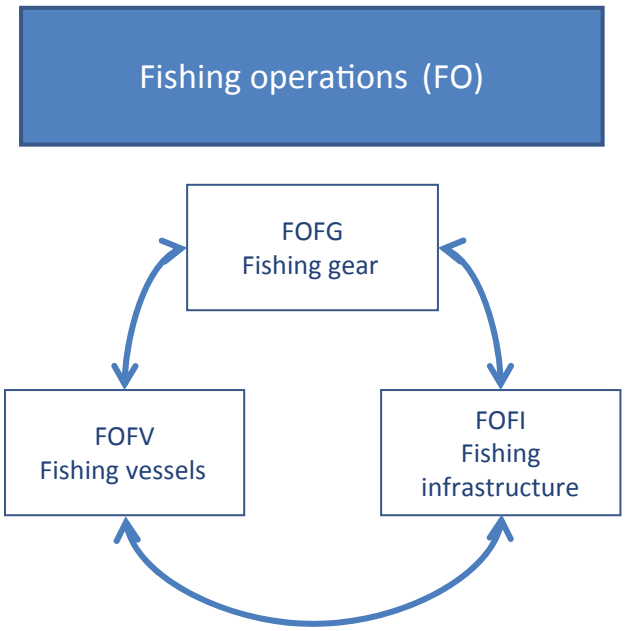
Resources and tools

Information resource	Web link	Relevance to the technical challenge
Fisheries policy and management		
FAO. 1995. *Code of Conduct for Responsible Fisheries*. Rome. 41 pp.	www.fao.org/fishery/code/en	Defines key issues relating to fisheries policy and management.
FAO Technical Guidelines for Responsible Fisheries (FAO, 1996).	www.fao.org/fishery/publications/technical-guidelines/en	A complete set of technical guidelines supporting the implementation of the Code, including guidelines specifically relating to fisheries management, aquaculture development and implementation of the ecosystem approaches to fisheries and aquaculture.
Garcia, S.M., Zerbi, A., Aliaume, C., Do Chi, T. & Lasserre, G. 2003. *The ecosystem approach to fisheries: issues, terminology, principles, institutional foundations, implementation and outlook.* FAO Fisheries Technical Paper No. 443. Rome, FAO. 71 pp.	ftp://ftp.fao.org/docrep/fao/006/y4773e/y4773e00.pdf	Outlines the key features of the ecosystem approach to fisheries and issues arising from its implementation, including issues for policy and management.
Cochrane, K.L. & Garcia, S.M., eds. 2009. *A fishery manager's guidebook –- Management measures and their application.* Rome, FAO, and Oxford, Blackwell Publishing. 544 pp.	www.fao.org/docrep/015/i0053e/ioo53e.pdf	A collection of papers on key aspects of fisheries management and issues arising from experience in implementing fisheries management programmes.
Fletcher, W.J., Bianchi, G., Garcia, S.M., Mahon R. & McConney, P. 2012. *The ecosystem approach to fisheries (EAF) management planning and implementation*. Rome, FAO.		A technical guide and supporting tools for decision-makers and advisors.
Macfadyen, G., Cacaud, P. & Kuemlangan, B. 2005. *Policy and legislative frameworks for co-management.* FAO Background paper for a workshop on mainstreaming fisheries co-management, held in Cambodia, 9–12 August 2005. Poseidon Aquatic Resource Management Limited.	ftp://ftp.fao.org/docrep/008/a0390e/a0390e00.pdf	Case studies and lessons learned from comanagement experience in Asia and the Pacific.

(cont.)

Information resource	Web link	Relevance to the technical challenge
FAO. 2005. *Consortium to Restore Shattered Livelihoods in Tsunami-Devastated Nations (CONSRN). Regional strategic framework for rehabilitation of fisheries and aquaculture in tsunami affected countries in Asia.* (CONSRN, 2005).	http://www.apfic.org/apfic_downloads/tsunami/2005-09.pdf	
FAO. 2006b. RAP Publication 2006/08 Regional workshop - *One year later – The rehabilitation of fisheries and aquaculture in coastal communities of tsunami affected countries in Asia.*	http://www.apfic.org/apfic_downloads/tsunami/	
Aquaculture policy and management		
FAO. 2010a. *Aquaculture development. 4. Ecosystem approach to aquaculture.* Technical Guidelines for Responsible Fisheries No. 5, Suppl. 4. Rome. 53 pp.	www.fao.org/docrep/013/i1750e/i1750e.pdf	Outlines the key features of the ecosystem approach to aquaculture and provides guidance on how to implement it.
Arthur, J.R., Bondad-Reantaso, M.G., Campbell, M.L., Hewitt, C.L., Phillips, M.J. & Subasinghe, R.P. 2009. *Understanding and applying risk analysis in aquaculture: a manual for decision-makers.* FAO Fisheries and Aquaculture Technical Paper No. 519/1. Rome, FAO. 113 pp.	www.fao.org/docrep/012/i1136e/i1136e.pdf	Guidance for policy and decision-makers on assessing risks in aquaculture and aquaculture development.
Brugère, C., Ridler, N., Haylor, G., Macfadyen, G. & Hishamunda, N. 2010. *Aquaculture planning: policy formulation and implementation for sustainable development.* FAO Fisheries and Aquaculture Technical Paper No. 542. Rome, FAO. 70 pp.	www.fao.org/docrep/012/i1601e/i1601e00.pdf	A review of key issues in aquaculture policy formulation and implementation, and guidance on key steps in improving these processes.

BEST PRACTICE IN EMERGENCY RESPONSE IN FISHERIES AND AQUACULTURE 2: FISHING OPERATIONS (FO)

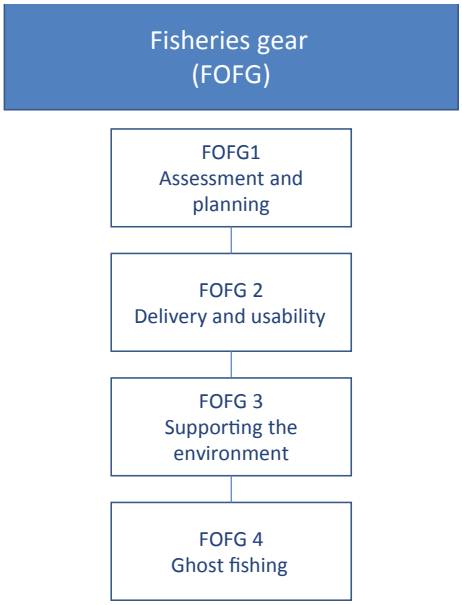


The need for an integrated approach

The following three subsections (Fishing Gear, Fishing Vessels, and Infrastructure) are presented under the umbrella of Fishing Operations. For the vast majority of fishing operations all around the world, a fishing vessel is needed together with its associated fishing gear. In many cases, both components are inseparable. Gear can be supplied relatively quickly to people that still possess working boats. However, for those whose boats have been destroyed, boatbuilding will take time. Building boats in a hurry will inevitably result in low-quality boats. Fishing operations require a port or landing site where the fish can be landed in hygienic conditions and then the infrastructure that allows it to be transported to market. Associated with these sites, fishers need facilities where gear can be constructed and repaired. Without these, the opportunities to use the gear and extend its working life will be greatly compromised.

The linkages and dependence between fishing vessels, port and landing site facilities and fishing gear require an integrated approach to the emergency rehabilitation.

FISHING OPERATIONS (FOFG) Fishing gear



Introduction

For a basic overview of fishing gear:

Nédélec, C. & Prado, J. 1990. Definition and classification of fishing gear categories. Définition et classification des catégories d'engins de pêche. Definición y clasificación de las diversas categorías de artes de pesca. FAO Fisheries Technical Paper No. 222, Rev. 1. Rome, FAO. 92 pp.

The types of fishing gear are very diverse. They are constructed or assembled according to: the species targeted; the ecosystem that they are used in; the skills and preferences of the fisher; the equipment/facilities available to deploy the gear; the size of the fishing operation; the materials available; and the season or time of the year that they are used. The quantity that any one fisher may use is determined by: the size of the boat; the amount of investment needed to purchase; and whether the gear is individually owned and or operated by a group of fishers.

The challenge of dealing with the diversity and complexity of fishing gear manifests itself especially when people are challenged to prepare specifications for new gear. Usually, fishing gear is made of different parts that have to be assembled to make the complete gear. For example, a gillnet is made up of a main net panel, floats, the lead, the floatline and the leadline, and the twine to assemble the gear. There will also be a need for marker floats and marker

float rope and, in some cases, anchors to keep the net in position. This means that the entire package with all the necessary parts should be replaced. Providing only parts of the gear may lead to selling of the gear, rejection, or to the recipients becoming dependent on intermediaries that will purchase the remaining parts in return for fish at a low price.

Many women and children take part in constructing and repairing fishing gear. This is often a skilled job that can make an important contribution to a household's income. When agencies are planning to provide replacement fishing gear, careful consideration needs to be given to the ancillary service providers that support its uptake and use – and particularly the role that women and children play in this.

Fishing gear in the emergency context

While it is not possible to predict exactly how fishing gear will be affected by different types of emergencies, different types of hazards bring different risks. Table 7 sets out the typical risks that come with particular types of hazards.

TABLE 7
Hazard types and risks to fishing gear

Hazard types	Typical risks to fishing gear
Cyclones, tidal surges and tsunamis	Fishing gear onshore is washed away or tangled up within itself or with other objects. Fish traps are lost at sea, creating marine debris and ghost fishing. Damage can also occur after traps are lost – wave and storm conditions can move them around within a marine habitat or into inland aquatic habitats.
Earthquakes	Loss of gear stored in buildings damaged by earthquakes. Uplifting of undersea areas causes navigation hazards.
Volcanic eruptions	On land, there is limited risk of loss or damage to fishing gear, with the exception of direct exposure of gear storage buildings to lava and pyroclastic flow.
Floods	Boat taken out to sea or slammed against fixed objects, destroyed or damaged (particularly engines and machinery) by raging torrents of water. Gear, workshops, materials and gear tangled and taken out to sea by flood waters.
Oil and chemical spills	Oil spills can cause damage to fishing and aquaculture resources by physical contamination and toxic effects, and they can also damage fishing gear. The nature and extent of the impact of an oil spill on seafood production and fishing gear depends on the characteristics of the spilled oil, the circumstances of the incident and the type of fishing activity or businesses affected. In some cases, effective cleanup and protective measures can prevent or minimize damage. Oiled nets can be cleaned provided they are not too heavily fouled and the oil is not highly weathered and persistent. Chemical deterioration of the synthetic materials of the fishing gear. Both heavy and light oils and petroleum products have a degrading effect on fishing gear made from synthetic materials such as polyamide, polyethylene, polyester, and polypropylene nets and ropes. Hard plastic floats may be less affected and can be cleaned; however, rubber and styrofoam floats will be damaged and lose their buoyancy. Risk of fire from petroleum and toxic fumes.
Complex emergencies (civil unrest)	Experience has shown that, in complex emergencies, gear is pillaged or stolen, and boats are used to transport armed groups. Fishing may be conducted to produce food for armed groups. Gear may be destroyed as punishment or stolen and used; moreover, fishers may be forced to fish to supply fish and fish products to armed groups.

Assessment challenges

In assessing impacts of a hazard on fishing gear, an integrated approach that covers all other aspects of fisheries is important. Consideration needs to be given to: the construction of fishing gear; fishing operations; fish landings; fish handling, processing and conservation; and fish marketing. These all need to be considered within the context of people's livelihoods and the extent to which the emergency has affected them. Tool 2 gives a decision tree that outlines some of the key questions that need to be asked in forming a response to an emergency.

Very often, in the initial stages right after a disaster, carrying out in-depth and technically sound needs assessments is challenging. This is usually due to a lack of technical expertise and consistent data on various aspects of fisheries in the damaged area. Inaccessibility of certain areas because of difficult conditions or a lack of transport and the strong emphasis being placed on providing humanitarian assistance increase these challenges. Many different relief agencies conduct their own assessments and, often, the data collected are not harmonized and contain important data gaps such as seasonality of the fisheries, ownership patterns, gender roles, marketing and the actual state of the resources. Without recognizing these information gaps, relief agents may quickly move into replacing boats and fishing gear without a proper understanding of what the situation of the fisheries was before the disaster struck.

Building back better

Under normal circumstances, fisheries are conducted at both commercial and subsistence levels. Fisheries managers have the responsibility to put in place and implement laws and regulations to manage resources in a sustainable manner. However, many countries face challenges in managing their fisheries resources owing to a lack of technical and financial resources, difficult logistics, and a lack of scientific research and statistical information on which to base their decisions.

After a disaster, and in countries where there is uncertainty about the status of the fish stocks, or where there is a lack of scientific information about the fishing effort, there is a danger that either too much or the wrong type of fishing gear will be provided as part of disaster relief efforts. Either scenario presents a threat both to the fishing communities and to the natural resource base. As a very general rule, fishing gear should be replaced to levels that do not exceed pre-disaster levels. However, an emergency situation presents an opportunity to review and improve fishing operations and fisheries management. This can include introducing changes to both the quantity and the quality of gear used. Changes to quality can include: improving the selectivity of gear; improving marking of gear; reducing the impacts of gear on marine habitats; and introducing biodegradable escape hatches to reduce the impacts of ghost fishing. The challenges of taking these opportunities for building back better are outlined further in the best practice statements.

Fishing operations (FOFG) best practice

FOFG 1: Assessment and planning

Fishing gear is delivered according to the needs of the community.

Key indicators

- The fishing gear replacement plan demonstrates compliance with the existing national legal and regulatory framework, and aligns with the Articles 6, 7 and 8 of the FAO Code of Conduct for Responsible Fisheries (see guidance note 1 and FAPM 2).
- The rehabilitation service provider has contact with the national fisheries administration and international support agencies (such as FAO) to ensure that appropriate expertise is available to identify and support the requirements for fishing gear replacement and rehabilitation, and contacts with the national fisheries administration and international support agencies are in place (see guidance note 2 and FAPM 2).
- The plan has identified the different types of fishing gear used by different fishers in different ecosystems and at different times of the year along with the potential impacts that they may have (see guidance note 7 and FOFG 3).
- The plans reflect the appropriate quantity of gear that any one fisher may use (see guidance notes 3 and 6).
- The plans recognize and respond to the impacts that lost gear and changing patterns of supply can have on women and children (see guidance note 4).
- Fishing gear is distributed only to experienced bona fide fishers, who have been identified by their community and/or from reliable sources (see guidance note 5).

Guidance notes

1. **Policy alignment**: Often, there are national fisheries regulations, policies and strategies in place, but because of a lack of adequate resources, fisheries administrations are unable to monitor and control and, therefore, ensure, in a systematic way, that the fisheries sector complies with the laws and regulations. In the rehabilitation of fisheries after a natural disaster, the provision of fishing gear should therefore not undermine efforts to control fisheries but rather complement and support existing regulations and policies (see FAPM 2).
2. **Coordination:** Where there is a UN cluster or fisheries technical working group in place, seek technical advice from the technical working group and the cluster on the right type of gear and the correct quantities before ordering fishing gear. If no such group exists, then advocate for the formation of such a technical exchange, coordination and guidance mechanism (see FAPM 2).
3. **Economic viability:** The type and quantity of a particular fishing gear determines the economic viability of the fishing gear. If the quantity of

fishing gear being contemplated for distribution is inferior to the quantity actually needed to make a fishing operation economically feasible, then fishers will be forced to look for additional gear from other sources, which may include intermediaries or other operators in the value chain. Where possible, a calculation of the catch per unit of fishing effort (CPUE)[1] for each fishing gear type should be used to determine the types and quantities of gear provided under gear replacement plans. A fisheries specialist may be required in order to make such calculations where they are not available from existing literature or local specialists.

4. **Appreciating the role of women and children in fishing gear provision:** Women and girls play important roles in the repair and production of small-scale fishing gear in developing countries. In developed countries, they often work in fishing gear manufacturing establishments. In an emergency response, women and girls can be provided with materials to make gear, which can then be sold, leased or used by fishers within the community. This approach will empower women and reinforce livelihoods for their future involvement in the fishery. Women may also become owners of boats or fishing gear even though they do not fish directly. Opportunities for engaging with women and ensuring their access to the benefits generated by gear replacement activities should be sought out, while at the same time paying attention to other demands on women's time and their multiple roles in supporting their family's livelihoods.
5. **Identification of fishers:** Fishing operations can be dangerous, and the use of fishing gear by inexperienced people can lead to death, severe injury and loss of property. People without skills or experience in fishing may also use gear in a way that creates undue adverse effects on the environment. Therefore, fishing gear should only be distributed to people who have the skills and knowledge to use it safely and sustainably. Bona fide fishers are likely to be known to the community and the fisheries administration. In some cases, fishers may be registered and carry a card. Understanding this and accessing this information should help. However, in all cases, such information should be validated with government officers and community representatives. This is because documents may have been lost, systems for registration could be incomplete or missing, or marginal groups (such as migrants or ethnic minorities) may have been excluded from the registration process.
6. **Ordering the right quantity:** The quantity of gear that a boat can carry is limited by boat size, shape, propulsion and distance to the fishing ground. In trap and pot fisheries, it is common for boats to take small quantities of pots or traps to the fishing grounds and leave them there, only returning to remove the fish or crustaceans from the trap or pot. The number of traps or pots being distributed should never exceed the numbers stipulated in the regulations. If no regulations exist, then consultations with the

community and the fisheries administration should be undertaken to agree on the appropriate number. This number should be conservative and precautionary. The weight of wet fishing gear can destabilize a boat, causing it to capsize and the loss of the boat, gear and life.

In addition to local-level consultations, information regarding the fisheries resource should also be used to calculate the quantity of a particular fishing gear that should be distributed within any particular area. Consultation with experienced fisheries biologists and biological studies of the fisheries resources and the status of fish stocks should be used, wherever possible, to calculate patterns of gear replacement.

7. **Understanding gears use:** Gather and analyse existing fishing gear information from local, regional and international knowledge institutions. Local fishing gear technologists should be contacted to assist in defining the seasons, diversity, seasons for different gear and the results discussed with the potential beneficiaries in the disaster-affected area. Table 8 provides an example of a seasonal fishing chart for different gear types over different fishing communities A, B and C.

TABLE 8
Example of a seasonal fishing chart

Town	Type of gear	Species	J	F	M	A	M	J	J	A	S	O	N	D
A	Bottom-set nets	Croaker	■	■	■						■	■	■	
		Threadfin			■	■								
A	Surface drift net	Tuna	■	■							■	■	■	■
C		Spanish mackerel				■	■	■	■	■				
B	Small-mesh drift nets	Sardines			■	■	■	■	■	■	■	■		
A, B, C	Lobster pots	Spiny lobster	■	■	Closed season					■	■	■	■	■
C	Beach seines	Shrimp					■	■	■	■				
A + C	Bottom longline	Snapper	■	■	■							■	■	■
		Grouper	■	■	■	■	Closed season					■	■	■
		Tile fish	■	■	■	■	■	■	■	■	■	■	■	■

FOFG 2: Delivery and usability

Fishing gear is delivered in an efficient manner that facilitates the early re-establishment of livelihoods.

Key indicators

- Fishing gear is obtained locally and distributed through established channels as a first line, as this will boost economic activity in the area. Where not possible, quality gear from reliable sources should be sought (see guidance note 1).

- The gear is delivered in kits, undamaged, and the identified beneficiaries receive the correctly specified gear in the correct quantities (see guidance note 2).
- The delivery of the replacement gear and equipment is based on good planning and investigation to reduce delays (see guidance note 3).
- The gear provided should be of good quality, which increases its life span and the ability of the fisher to save enough from the fishing operations to replace the gear (see guidance note 5).
- Capacity building on good operational practices and care and maintenance of the gear may be included for fishers and/or boat operators, as well as for fisheries officers and national NGOs (see guidance note 6.)

Guidance notes

1. **Local purchasing:** As far as possible, fishing gear should be purchased locally for four main reasons: (i) acquiring supplies locally or regionally means that assistance can be delivered more quickly as it avoids long transit times as well as customs, storage and other costs; (ii) purchasing from local markets supports the economic recovery of the local area; (iii) purchasing locally will minimize the risk of lowering local prices of similar goods and ensure easy access to spare parts; and (iv) it increases the chance that the gear will be appropriate for local needs. Through surveys, it will be possible to determine the local cost of fishing gear. Making comparisons with prices of imported fishing material will be easier.
2. **Fishing gear kits**: The supplier should be requested to supply the fishing gear in individual fishing kits. Each kit should contain all the components required to make one particular gear for one fisher. The advantage of this method is that it saves times and reduces confusion when the gear is distributed. The disadvantage of ordering all the individual components in bulk is that, when it comes time for distribution, a lot of time is spent dividing up the components between the beneficiaries and there is strong possibility that an individual beneficiary will not receive all the components.
3. All kits should be packaged in strong and adequate packaging materials to withstand transport by land and by sea and rough handling. In addition, the packages should be clearly marked so as to identify the contents as they relate to the shipping documents and cargo manifest. It is important to deliver fishing gear packages that are complete, contributing to the rapid assembly of the gear by the recipients. A certificate of delivery of the fishing kit, stating the name of the beneficiary, the name of the organization distributing it, with the delivery date, should be remitted to each stakeholder upon delivery. Copies should be given to the fisheries administration for statistical purposes and to register that the beneficiary has a proof of ownership.

4. **Planning for distribution:** It is important to prepare a distribution plan. This plan will be useful when preparing the logistics for the movement and delivery of gear, and it serves as a checklist. Tool 1 below gives an example of a map prepared to show the distribution of fishing kits to stakeholders who had been victims of unrest in North Maluku Province, Indonesia, in 2003–04.
5. **Ensuring the specifications are correct**: Care should be taken to provide suppliers of fishing gear with precise details regarding the specifications of fishing gear. When in doubt, as much detail as possible should be provided to ensure that time is not wasted in repeating orders. FAO (1990) provides guidance on developing the specifications of fishing gear.
6. **Fishing gear quality:** In ordering and preparing the specification of fishing gear, it is important to specify the **quality** of the gear that is required. This is particularly important where administrative procedures require that the lowest bid be given the highest consideration or priority for purchase. To non-experts, high-quality and low-quality gear with the same specifications may often seem identical, but high-quality fishing gear will have a significantly longer working life. The difference between higher- and lower-quality gear lies in the price, the manufacturing practices used and the quality of the raw chemical compounds used in the manufacturing process. These translate into differences in strength, resistance to abrasion, endurance in water, and resistance to sunlight (which degrades the chemical compounds from which modern gear is made) (Klust, 1973). It should be remembered that, in many rehabilitation projects, gear will only be distributed once to the beneficiaries and, therefore, providing longer-lasting, good-quality gear is particularly important. Fishers are often the best source of information regarding the relative quality of different types of fishing gear. Their responses should be checked with a national fishing gear expert – do not ask the sales representatives as representatives of different fishing gear suppliers are unlikely to give unbiased assessments of quality.
7. **Protecting the gear:** Fishing gear is made of synthetic and natural fibres, plastics, metals, etc. The equipment may be electronic, electric and chemical. The aquatic environment and the sun have a strong deteriorating effect on gear. To prevent degradation, rotting and to have an increased life span, it is necessary to protect the gear appropriately. Protecting the gear from the sun, cleaning and repairing the gear, making and using protective covers, and regular maintenance contribute to the longer useful life of the gear. Therefore, it is important to train the beneficiaries in the proper care of the gear distributed.

FOFG 3: Supporting the environment

The conditions under which fishing gear is provided should strengthen the protection of the fisheries resources and the ecosystems in which they live.

Key indicators

- The fishing gear distributed maximizes selectivity and reduces ecosystems and environmental impacts (see guidance notes 1 and 2).
- The plans take into account the risks of the impacts of gear replacement on fish nurseries, reproduction grounds and seasonal fish spawning (see guidance note 3);
- Recovery efforts provide information that will strengthen the national knowledge base for fisheries management and policy (see guidance note 4).

Guidance notes

1. **Reducing the impact of fishing gear**: Where it is apparent, either through the reports of fishers and fisheries officials, or through data on fish landings and catches, that the fishery resources may be under unsustainable fishing pressure, efforts should be made to identify any particular types of fishing gear that might be exerting this pressure. Where damaging gear types can be positively identified, appropriate programmes can be designed and implemented to replace these with other, more appropriate types of gear or to convert them by modifying their physical and operational characteristics so as to be less damaging. A fishing gear technologist should be hired to provide the necessary technical advice from the beginning in order to develop and implement any such a programme.
2. In order to introduce these types of gear, it would be necessary to undertake fishing trials with the alternative gear types to ascertain their adaptability to local conditions, their catch rates, their acceptability by the fishers, and any possible risks. It should be kept in mind that it will not **always** be necessary to introduce new fishing gear types. Modification of existing gear can make some more environmentally and resource friendly. For example, increasing the mesh size or changing the hanging ratio of the webbing material for certain gillnets and traps can reduce the catch of juvenile fish. Similarly, bycatch reduction devices can reduce the impacts of trawl gear.
3. **Understanding the impacts of different fishing gear types on the fisheries ecosystem**: Different fishing gear types have different impacts on different ecosystems. It is important to know and understand the types of ecosystems present in the locality where the fishing gear will be distributed. Sensitive corals, reefs, seagrass meadows, sandy and muddy bottoms, rivers mouths and basins, lakes, rice fields, mangroves, open ocean, and costal zones all offer different habitats for different species at different stages in their life cycles, and the types of fishing gear being used, or introduced through gear replacement programmes in the wake of a disaster, will

affect these different ecosystems in different ways. The **quantities** of gear provided will also have an impact. Many sets of gear concentrated in a relatively small area may have negative impacts on the resources and the ecosystem, whereas when spread over a larger area there impact may be attenuated. Types of gear that are prone to be easily lost or abandoned may be particularly damaging. Where funds permit, rehabilitation agencies should seek out, or generate, information on local ecosystems and hire experts to provide guidance on the possible impacts of different gears on these ecosystems.

4. **Strengthening the knowledge base:** Research and information are key to good decision-making and ensuring that the supply of fishing gear does not compromise fisheries livelihoods in the medium and long term. A range of technical expertise is likely to be required in order to strengthen the knowledge base required to ensure appropriate choices in fishing gear during the process of relief, reconstruction and longer-term development in fisheries. Expertise in fisheries technology and the process of testing out new technologies will be important, as will skills and experience in analysis and planning for the management of natural resources in coastal areas. Expertise in tourism development, conservation and aquaculture development may also be important.

FOFG 4: Ghost fishing

Action is taken to mitigate the effects of ghost fishing.

Key indicators

- Analysis of the amount of debris and lost fishing gear is conducted and inventories are made (see guidance notes 1, 2 and 3).
- Post-disaster clean-up programmes are implemented to find and retrieve lost gear on land and at sea (see guidance note 4).
- Fishing traps and pots are fitted with biodegradable escape panels to reduce the impact of ghost fishing (see guidance note 5).
- Fishing gear is marked in order to improve identification and monitoring of numbers of gear, fishing effort and gear losses (see guidance note 4).
- Where available, technology (such as transponders) may be used to locate lost gear (see guidance note 5).

Guidance notes

1. **Lost fishing gear**: Fishing gear is often lost or washed out to sea after a disaster and may end up becoming entangled in ecologically sensitive areas or remain drifting at sea and catching aquatic organisms long after being lost. Other debris, such as household articles and other solid materials, is also washed out after floods, tsunamis and cyclones. It can end up on beaches and on sensitive coral reefs and other important fish nursery areas.

All these materials can have negative impacts on the environment and it is important to attempt reduce their effects after a disaster (as it is when they are lost under normal conditions). Analysis of the types and quantities of debris and reported losses of fishing gear by fishers should be made to ascertain their potential impacts on sensitive areas.

2. **Aquaculture equipment and gear**: Natural disasters may have especially large impacts in terms of lost aquaculture gear (marine cages) when such gear cannot be removed from the water prior to a disaster. In this case, the anchoring systems should be properly maintained and reinforced prior to the disaster, if foreseen.
3. **Estimating gear loss**: It is not always easy to verify gear loss in natural disasters. However, Table 9 gives an idea of the gear that is lost, abandoned and discarded under **normal** fishing conditions. After a disaster, one may expect much higher losses.

   Interviews with survivors as well as local fishing technologists about the normal fishing operations, catches and production rates will give a good idea of the number of gear that were deployed in a particular fishery, and comparison with gear still functioning or available after a disaster can facilitate calculation of eventual losses.

TABLE 9
Summary of gear loss, abandonment and discard indicators from around the world

Region	Fishery/gear type	Indicator of gear loss (data source)
North Sea & NE Atlantic	Bottom-set gillnets	0.02-0.09% nets lost per boat per year
English Channel & North Sea (France)	Gillnets	0.2% (sole & plaice) to 2.11% (sea bass) nets lost per boat per year
Mediterranean	Gillnets	0.05% (inshore hake) to 3.2% (sea bream) nets lost per boat per year
Gulf of Aden	Traps	c. 20% lost per boat per year
ROPME Sea Area (United Arab Emirates)	Traps	260,000 post per year in 2002
Indian Ocean	Maldives tuna longline	3% loss of hooks/set
Australia (Queensland)	Blue swimmer crab trap fishery	35 traps lost per boat per year
NE Pacific	Bristol Bay king crab trap fishery	7,999 to 31,000 traps lost in the fishery per year

(cont.)

Region	Fishery/gear type	Indicator of gear loss (data source)
NW Atlantic	Newfoundland cod gillnet fishery	5,000 nets per year
	Canadian Atlantic gillnet fisheries	2% nets lost per boat per year
	Gulf of St. Lawrence snow crab	792 traps per year
	New England lobster fishery	20-30% traps lost per boat per year
	Chesapeake Bay	Up to 30% traps lost per boat per year
Caribbean	Guadeloupe trap fishery	20,000 traps lost per year, mainly in the hurricane season

*Source: (*Macfadyen, G., Huntington, T. & Cappell, R. 2009).

4. **Clean-up programmes:** Organizing a beach clean-up is a good way to avoid marine debris and other flotsam from re-entering the marine environment. Beach clean-ups should be organized at the earliest possible opportunity after a disaster strikes in order to prevent debris being taken back into the sea or waterbody by the next high tide or by rains. This will reduce impacts on fauna and flora. Local populations and fishers or fish farmers, volunteer programmes, schools, and environmental group organizations can be included in clean-up efforts. However, prior to initiating any clean-up work, the team responsible for organizing the clean-up should ascertain the extent of the risks for the clean-up crews, either from physical debris, chemical, oil or nuclear residues, or from other hazards that might affect beach areas during the clean-up exercise.
5. In all cases, safety and protective clothing should be worn by the persons involved in beach clean-up. Equipment should include (but not be limited to): strong gloves; sturdy shoes or boots; basic facial masks; transport bins; hand tools such as rakes and shovels; wheel barrows; garbage bags; sorting tables and motorized transport. Daily briefing and planning is important for effective clean-up. Wherever feasible, local labour, environmentally sustainable materials and socially responsible businesses should be used in order to benefit the local economy and promote recovery. Where funds permit, and if the water is shallow enough, divers can also be employed to remove debris and fishing gear, especially from sensitive areas such as coral reefs, thus improving breeding habitats and promoting early recovery of the fishery.
6. **Taking measures to avoid losses and reduce ghost fishing:** In order to mitigate the harmful effects of ghost fishing, biodegradable panels can be fitted in different types of fishing gear. In some countries, certain types of fishing gear can only be used if biodegradable escape panels are part of the construction of the gear. Escape panels, or fasteners, made from

biodegradable materials, are commonly used in major lobster and trap fisheries. Biodegradable materials include ferrous metal fasteners, cotton, hemp, jute or soft wood that will deteriorate over time. The period before the escape panel deteriorates depends on the fishery and the materials used, and this is usually calculated through experiments and is part of the regulations.

7. Where available and appropriate, technologies such as transponders and sonar can also be promoted and introduced to mark, find and monitor fishing gear. However, these are likely to represent a high level of technology and investment, and the capacity of local fishers to bear eventual replacement costs should be borne in mind when considering such measures. Technologies for marking and monitoring fishing gear also generally require appropriate land-based facilities and personnel to conduct monitoring activities and follow-up on location-finding measures. The availability and sustainability of such arrangements will need to be considered.

Resources and tools

Information resource	Web link	Relevance to the technical challenge
FAO. 1995. *Code of Conduct for Responsible Fisheries.* Rome. 41 pp.	www.fao.org/fishery/code/en	Article 6 relates to conservation of resources; good resource management and conservation, biodiversity and prevention of overfishing. Articles 7 and 8 are relevant to fishing operations and fishing practices and concerns.
FAO. 1996. *Fishing operations*. FAO Technical Guidelines for Responsible Fisheries No. 1. Rome. 26 pp. + 6 annexes.	ftp://ftp.fao.org/docrep/fao/003/W3591e/W3591e00.pdf	In addition to providing general guidelines to States, Flag States and Port States, the publication provides guidelines on fishing gear and reinforces what is in the Code. It also gives guidance on policies related to removal of redundant offshore structures, creation of artificial reefs and deployment of fish aggregating devices.

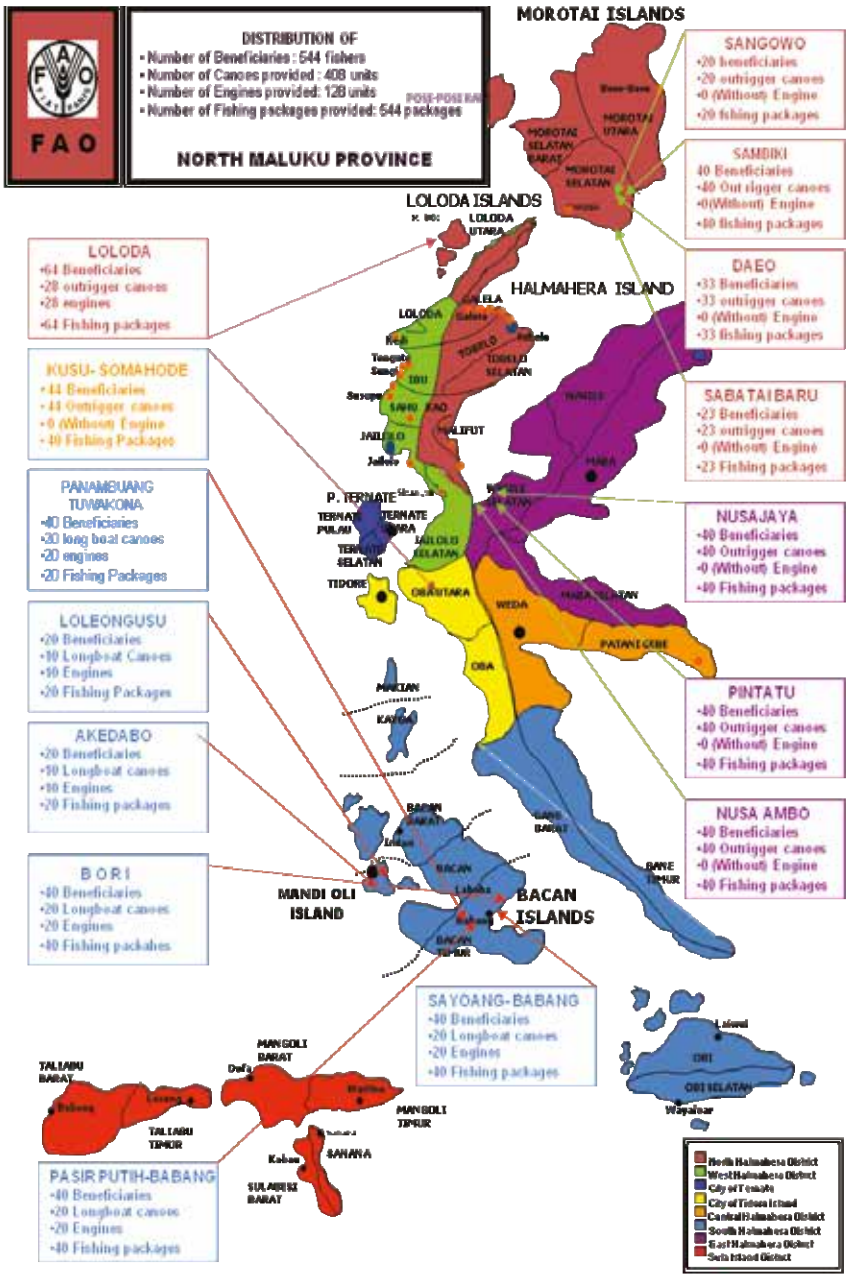
(cont.)

Information resource	Web link	Relevance to the technical challenge
FAO. 1998. *Fishing operations. 1. Vessel monitoring systems.* FAO Technical Guidelines for Responsible Fisheries No. 1, Suppl. 1. Rome. 58 pp.	ftp://ftp.fao.org/docrep/fao/003/w9633e/w9633e00.pdf	These guidelines are relevant particularly with respect to replacement of larger vessels, which have larger fishing capacity. Vessel monitoring systems (VMS) have greatly increased the potential efficiency of the monitoring, control and surveillance of fishing vessels (MCS). The costs of MCS systems are indicated. This document summarizes the state of the art of VMS and gives guidance to fisheries administrators considering implementing VMS in their fisheries management systems and to all other personnel involved in fisheries MCS.
FAO. 2009. *Best practices to reduce incidental catch of seabirds in capture fisheries.* FAO Technical Guidelines for Responsible Fisheries No. 1, Suppl. 2. Rome. 49 pp.	www.fao.org/docrep/012/i1145e/i1145e00.pdf_	The guidelines provide general advice and a framework for the development and implementation of seabird plans and seabird monitoring and assessment reports prepared at national, regional and subregional levels.
FAO. 1997b. *Inland fisheries.* FAO Technical Guidelines for Responsible Fisheries No. 6. Rome. 36 pp.	ftp://ftp.fao.org/docrep/fao/003/W6930e/W6930e00.pdf_	The guidelines provide general advice on the management of inland fisheries.
FAO. 2000. *Fisheries management. 1. Conservation and management of sharks.* FAO Technical Guidelines for Responsible Fisheries No. 4, Suppl. 1. Rome. 37 pp.	www.fao.org/docrep/003/x8692/x8692e00.htm_	The guidelines provide general advice and a framework for joint shark plans for shared transboundary species of shark. It is important to understand these guidelines when considering the provision of gear, which may be used to target sharks.
FAO. 2005a. *Increasing the contribution of small-scale fisheries to poverty alleviation and food security.* FAO Technical Guidelines for Responsible Fisheries No. 10. Rome. 79 pp.	ftp://ftp.fao.org/docrep/fao/008/a0237e/a0237e00.pdf	Information about small-scale fisheries and their importance, vulnerabilities and resilience. The objectives of these technical guidelines are to provide a special focus on small-scale fisheries and their current and potential role in contributing to poverty alleviation and food security by expanding on relevant principles and standards set forth in the Code, and to make practical suggestions about ways to ensure that this role can be enhanced.

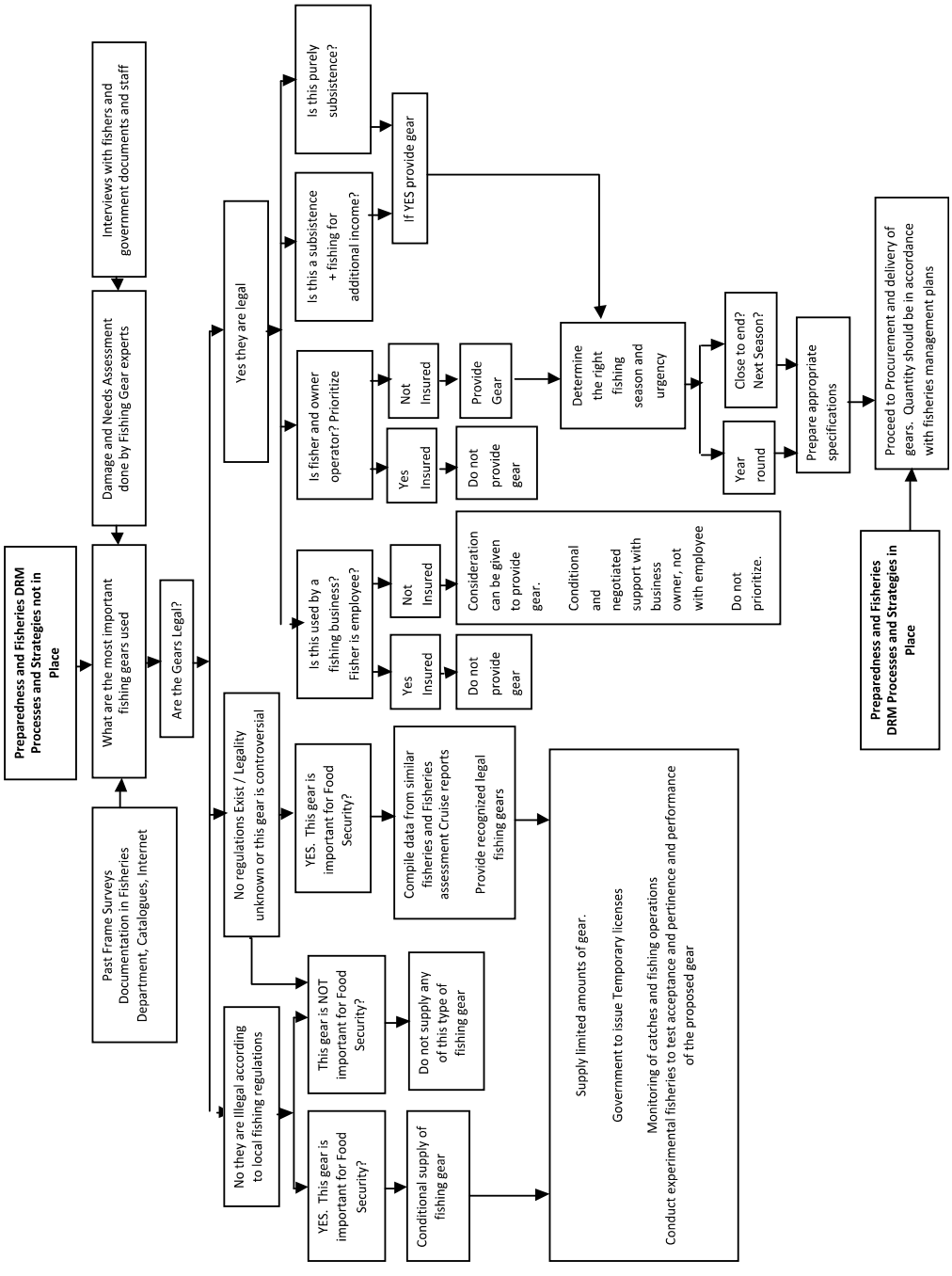
(cont.)

Information resource	Web link	Relevance to the technical challenge
Southeast Asian Fisheries Development Center (SEAFDEC) – fishing gear categories	www.seafdec.org/	Technical specifications and drawings of 13 different fishing gear categories. Inventory of fishing gear categories for Brunei Darussalam, Cambodia, Myanmar, the Philippines, Thailand and Viet Nam.
Prado and Dremiere. 1990. *Fisherman's Workbook.*	English ftp://ftp.fao.org/docrep/fao/010/ah827e/ah827e.pdf	The *Fisherman's Workbook* is a tool intended for field use, to carry with you for easy reference on land or sea. It contains essential information about the choice and use of a variety of materials and equipment necessary for commercial fishing. This includes: • "Fishing gear and operations", will help with the choice of particular types of fishing gear, their characteristics and use. • "Equipment for deck and wheelhouse", outlines the characteristics of echo-sounders and deck machinery for handling fishing gear and gives examples of such equipment. • "Fishing vessel operation", gives information about the most effective use of fishing vessels. Guidelines for calculating the costs and benefits of fishing operations are presented. • "Formulae and tables", gives tables for converting units and numbers between different systems of measurement. • "Ordering equipment" gives recommendations about the specifications to be listed when ordering fishing gear and equipment.

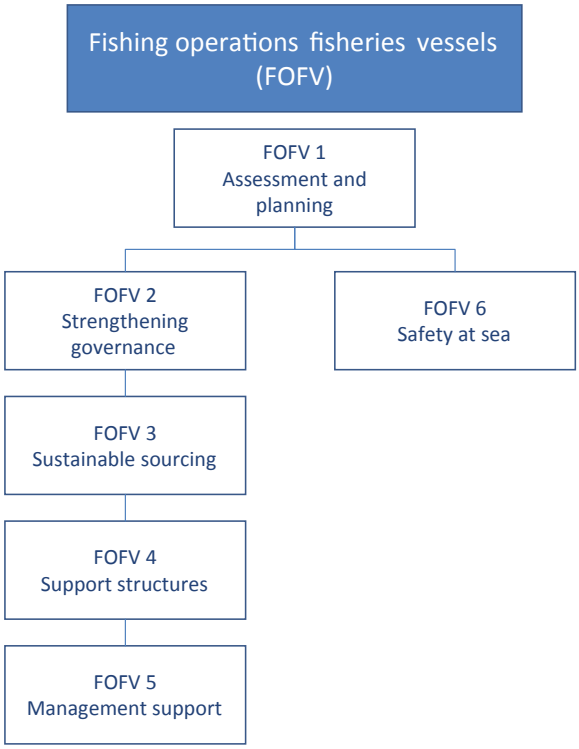
Tool 1: Example of a distribution plan



Tool 2: Decision tree on how to identify the need for fishing gear replacement (FAO, 2013a)



FISHING OPERATIONS - FISHING VESSELS (FOFV)



Introduction to fishing vessels

Fishing vessels are like local languages and food – extremely complex and diverse. This is because they are part design, part evolution and part tradition and are adapted to suit a number of factors including environment, fishing gear, materials, sea conditions, social factors and customs. The variations in vessel design can be numerous and subtle, and it is possible to encounter many different categories of vessels in a small geographical area.

The differences between vessel types can appear minor or even irrelevant to the untrained eye, but fishers can be conservative and they like what they know. This is understandable from the risk point of view as fishing can be dangerous to both health and wealth, and exposing oneself to an unknown vessel could be disastrous. While the importance of tradition should not be underestimated, there are also situations where changes to vessel design or type are adopted rapidly by fishers. Therefore, it is important to understand the factors that affect the fishers' preferences and to discuss these with the communities before planning the manufacture of a particular vessel.

It is important to recognize the key factors that influence a vessel's design and construction details. Where these factors are ignored, or not openly discussed, it can lead to new designs of boat being disliked or rejected. Examples of these factors include:

- **A small vessel that needs to be manually hauled** onto a muddy shore. It is likely that the hull shape and keel design will be influenced by the need to slide easily over mud, and a flat bottom without a keel may be best suited.
- **Hand bailing** water from a small vessel. Many undecked vessels are bailed with a scoop or bucket, and the motion involved is **across** the vessel. If an internal keel (hog) is introduced for improved strength, this interferes with the scooping motion and fishers may object (even if the introduction of a keel could be a better and stronger design).
- **Inboard versus outboard motors**. An inboard diesel motor is more fuel efficient than a petrol outboard motor. However, an outboard motor has advantages, such as lower vibrations (which can shake the boat's structure apart) and the fact that it can be removed from the boat and taken home (to avoid being stolen or swamped if the boat sinks). Introducing a diesel for improved economy will not impress the fisher if the boat is swamped and engine flooded.
- **Increase in vessel speed.** As the propulsive power of a vessel increases, so does its speed and so its hull form will need to be adapted accordingly. There is an optimum hull shape for any given operating speed, and deviating from this will reduce efficiency. Step changes in power need step changes in design, for example, the change from sail to outboard motors, and the change from outboard to powerful inboard motors;
- **Sea conditions.** A vessel will need to be suitable for the expected sea conditions, and these can vary locally according to water depth, tidal currents and weather variations. What is suitable one side of a headland may not be appropriate on the other side. In Aceh, Indonesia, there is a marked difference in the vessel types used in fisheries on the east and west coasts as the prevailing wind and sea conditions can be very different.

Fishing vessels are quite unlike most other inputs required in an emergency situation, being more varied and complex than other items of equipment. Fishing vessels cannot simply be bought off the shelf to match the user's requirements. They have to be manufactured to a particular specification. This manufacturing process requires specialist knowledge of fishing vessels and the materials used in their construction. Without this specialist knowledge, poor-quality, unsuitable and potentially unsafe vessels can result.

It is important to realize that fishing vessel builders may have a long history of work in the sector; on occasions, several generations of the family may have been involved in vessel construction. This history can represent a huge body of knowledge of the subtleties of design (and the evolution of that design) of

fishing vessels to match the technical, environmental and social needs of the local fishery. However, it is also possible that more recent changes, such as loss of traditionally used timber species, new materials such as glass reinforced plastic (GRP) and the switch to motorized vessels, can be challenging to those trying to adapt. In Sri Lanka, post-tsunami boatbuilding and repairing activities revealed a lack of basic GRP boatbuilding skills in some of the boatyards, a fact that affected the quality of the work. The lack of clean, dry and shaded work areas and the poor mixing and application of materials highlighted the need for training.

Fishing vessels and the emergency context

The main threats to fishing vessels are hurricanes/cyclones, tidal surges, tsunamis and floods. However, different types of vessels are likely to be exposed to different risks. For example, at sea, a tsunami can have very different effects on different types of vessels, and it is necessary some of the basic divisions in vessel types (such as by size) in order to understand these effects. Larger vessels are often at sea for long periods and, in deep water, the passing tsunami waves may have little or no effect on them. However, by contrast, smaller vessels, which spend more time on shore or operating near to the shore, are very vulnerable to the effects of a tsunami. By contrast, in a port or harbour, almost all the hazards mentioned above are dangerous to **all** vessels, in particular where they may be floated out of their normal berths onto shore and into built-up areas, or damaged by falling debris.

The table below describes some of the common impacts on different fishing vessels that come from different types of hazard. (see Tools 1 and 2 for further information about different types of vessels).

The main implications of these impacts on peoples livelihoods are loss of assets and loss of income resulting from disasters are complex and far reaching as there is a long chain of other activities that both service fishing vessels and depend on all fishing operations.

TABLE 10
Impacts on fishing vessels and safety at sea

Vessel category	Smaller (under 10 m length)	Larger (over 10 m length)
Hurricanes/ cyclones	Vessels at sea and in port can be affected. Small vessels may suffer severe damage or total loss. Small vessels may be hauled out and thus possibly protected.	Vessels at sea and in port can be affected. Larger vessels may be more seriously affected as they cannot be hauled out and severe damage may result although total loss is less likely. Vessels at sea may be overwhelmed by the wind and resulting waves. Proximity to shore may not be helpful as waves increase in height and steepness as water depth diminishes.

(cont.)

Vessel category	Smaller (under 10 m length)	Larger (over 10 m length)
Tidal surges / tsunamis	Vessels in port will be more severely affected than those at sea. Small vessels are very vulnerable both in water and hauled out, with severe damage, total loss or relocation resulting.	Larger vessels at sea may be unaffected by and even unaware of a tsunami.
Earthquakes	Vessels in port may be affected; those at sea less affected (see tsunami). Small vessels very vulnerable to severe damage or loss.	Large vessels vulnerable to severe damage or loss.
Volcanic eruptions	Vessels in port may be affected if in path or area of fallout. Those at sea are unlikely to be affected.	Vessels in port may be affected if in path or area of fallout. Those at sea are unlikely to be affected.
Floods	Vessels in port and especially river ports may be affected where flooding is violent. Small vessels may be severely damaged or relocated.	Large vessels may be severely damaged or relocated unless away at sea.
Oil spills / chemical spills	Safety issues from chemicals. Small vessels near shore likely to be more affected. Damage unlikely.	Larger vessels far offshore may be less affected.
Nuclear leaks	Safety issues from radiation. Small vessels near shore likely to be more affected. Damage unlikely.	Larger vessels far offshore may be less affected.
Complex emergencies (civil unrest)	Vessels may be used for various non-fishing tasks, and severe damage or total loss may result.	Larger vessels at risk of being forced into use for transport of food, equipment, civilians, refugees or army/insurgents. Sea-based activities can become dangerous or subject to additional controls.

Assessment challenges

Understanding the diversity of vessel designs – It is important to identify correctly the type and class of vessels affected by a disaster and to understand the differences in design and equipment. In order to understand this diversity and complexity, it is useful to consider fishing vessels in approximate groups or classes (see Tool 1). Each of these will have typical features, activities and equipment.

Ensuring that the construction is right – A major threat from poorly planned emergency responses is the delivery of poorly built and potentially unsafe boats produced in attempt to respond rapidly at an early stage after a

disaster. This is a threat to fisher safety as well as the longevity of the vessel and thus its economic usefulness. Such outcomes may result from poor planning and supervision and a lack of understanding of the technical issues. In addition, boatbuilders may be pushed by implementing agencies to deliver numerous boats, quickly, at a low price and perhaps with materials that they are not familiar with; the result is often boats of very low quality. Moreover, the loss of skilled boatbuilders (such as during the 2004 tsunami) may leave a gap in the market that will be filled rapidly by people with little or no experience in boatbuilding, claiming that they have the necessary experience (perhaps as carpenters) to build good boats.

Supplying the right quantity – The oversupply of vessels, or the supply of vessels to those who were not owners prior to the disaster, can have a negative impact on the livelihoods of fishers and on the fish resources on which they depend. As an example, fully exploited resources can become overexploited as the result of poorly planned emergency responses that increase overall fishing effort.

Complying with the rules – The restoration of vessels of specific designs that were engaged in illegal or discouraged fishing activities requires careful consideration. While possibly acceptable in an early phase of the emergency in order to restore food and livelihoods, this is unlikely to be an acceptable long-term strategy.

Understanding and dealing with ownership patterns – While it may sound simple to pursue the objective of replacing like for like, agencies need to consider carefully the many social, political and economic factors that may surround the patterns of ownership of fishing vessels. For example, it is common to find exploitative relationships between vessel owners or creditors and fishing crew. These may include poor employment conditions or being tied to poor trading agreements or high interest payments. Conversely, these arrangements may support traders and processors (often women) who may be marginalized from long-term development by the shift in power caused by any eventual reallocation of fishing assets as part of emergency response measures.

Providing support – Lack of technical support, training and maintenance for the vessels provided can result in these vessels failing prematurely, becoming unsafe at sea or being discarded by the beneficiaries. As a result, attempts to restore their livelihoods may prove to be unsustainable. Lack of training in the proper use and maintenance of new assets such as fishing craft or engines can also result in vessels becoming damaged and unusable.

Delivering the complete package – The delivery of incomplete vessels, or packages of fishing vessels, equipment, engines and fishing gear, can also result in vessels becoming unsafe at sea or being abandoned by beneficiaries (possibly in favour of a better offer from an enthusiastic donor). Examples include delivery of a boat without key technical items that may have appeared

to donors to be cheap and readily available – say, a rudder or a propeller – but which, for the intended beneficiaries, are too expensive or unobtainable, particularly in the post-disaster environment.

Strengthening safety at sea – Consideration given to safety at sea is often related to wealth – the wealthier the nation and fishery, the higher the standard of work place safety. Much of the equipment considered vital to safety at sea may not be available in country or only available at a cost that is out of proportion to the vessels or the fishing revenue generated. For example, a 6-m canoe-style vessel might cost less than US$500 to build. Any additional equipment, especially if imported, will (in the owner's eyes) add significantly to the cost, and a life jacket that complies with international standards typically costs at least US$80.

Changing design details to match safety-at-sea requirements can meet with resistance from fishers as the vessel may not look, feel or function like vessels to which they are accustomed. For example, improved construction may increase the weight of vessel, and this may be resisted by fishers if it means pulling a much heavier vessel on to shore.

Therefore, in the repair and replacement of fishing vessels, while safety at sea is of paramount importance, it is also necessary to understand how this fits into the existing wealth and technology situation and, in so doing, to provide assistance for fishers to achieve improved safety at a cost that is proportional to their operations and capacity to pay.

Building back better

By careful consideration of fish resources and the alternatives available, a replacement vessel (and associated gear) can lead to a more sustainable activity and a more profitable long-term future than was being pursued prior to a disaster. In essence, a redirection of fishing effort away from destructive or unsustainable practices can be effected. Fishers are often aware of this possibility but do not have the means or experience to make a change without assistance.

Introducing minor changes to vessel design and equipment can provide improvements in operating efficiency and improved revenues. Opportunities exist with refining hull shapes, introducing different motors or the addition of a gearbox. Even a simple change, such as correctly sizing and installing a propeller and stern gear, can dramatically increase fuel efficiency. Davy (2012), notes that there are always opportunities for improvements, even in relatively developed fisheries.

Establishing or updating systems of vessel registration and documentation can both strengthen the knowledge base for fisheries management and support increased safety and confidence in the community. Knowing where and when vessels are fishing, and what others are in the same fishing area, can be life-saving in the event of a marine accident, or in the event of a future hazard

or emergency. Involvement of the community, and in particular the family members of the fishers, is important here.

Provision of training and skills upgrading in boatbuilding can improve the strength and longevity of vessels as well as improving efficiency in material use. Achieving such improvements is all about detail, and the arrangement and connection between timber components can make the difference between a poor-quality craft and strong, long-lived vessels. Understanding the available timber and using it effectively within the design can allow savings in materials, which have obvious cost benefits.

Provision of training in safety at sea at a basic level can, at little cost, reduce the likelihood of serious accidents. At the same time, this can improve the confidence of those remaining on shore that members of their family and community will return from their time at sea in safety. Simple checks and maintenance on the boat and machinery can be life-saving, as can the use of inexpensive items such as a torch, a mirror and a life buoy.

Fishing operations – fishing vessels (FOFV) best practice

FOFV 1: Assessment and planning

Plans include a detailed assessment of the technical details of the boats lost, their fishing activities and other activities that the vessels may be used for.

Key indicators

- Technical experts are used in assessments (see guidance note 1).
- Skills and knowledge of the community are recognized and utilized in the planning and implementation of the response (see guidance note 2).
- Inventories of persons, boats and equipment are established (see guidance notes 3 and 5 and tool?).
- Patterns of vessel ownership and credit/finance are established (see guidance note 3).
- Pre-existing problems in the fishery are identified and alternatives discussed (see guidance note 4).
- Factors that contribute to the design and development of vessels are fully considered and documented (see guidance note 7).
- Unregistered or poorly documented vessels are included in vessel numbers (see guidance notes 2 and 8).

Guidance notes

1. **Technical competencies:** Agencies working with vessel repair/replacement may lack experience or technical competence in this sector. In this case, it is vital to acknowledge this and seek the assistance of experts before detailed plans are formulated. Experts may have diverse experiences in boatbuilding, boat design and boat production. The areas of knowledge that are beneficial include:

- Understanding factors affecting vessel selection
- Identification of appropriate vessel designs
- Understanding of fishers and communities
- Improving vessel safety
- Improving vessel economy
- Improving vessel longevity
- Improving use of materials

In addition to the basic knowledge required, experts should have the relevant experience and capabilities, which for projects involving vessel replacement might include at least the following:

- Identification of the most common types of fishing (multipurpose) vessels used by the fishers affected by the disaster, by working with relevant authorities, boatbuilders and fishers.
- Identification of boatbuilding companies capable of constructing fishing vessels in the affected area, making use of the appropriate materials (timber, GRP, etc.).
- Preparation of drawings and technical specifications, either preliminary or final (detailed) for appropriate vessels. To include strength, safety and equipment to match relevant regulations and promote better safety at sea.
- Preparation of detailed instruction manuals on the construction of vessel designs.
- Preparation of technical reports detailing findings, conclusions and recommendations regarding the work undertaken.

2. **Using local skills and knowledge**: An established fishing community will have a detailed understanding of the types of vessels and gear used locally and the fishery they are used to targeting. They will also understand the local conditions and the other factors that affect their fishing activities. It is therefore important to ensure that the skills and knowledge of the community are recognized and utilized in the planning and implementation of the response.
3. **Quantifying damage and loss:** Inventories of lost and damaged vessels and affected fishers should be established accurately and rapidly. Such data are vital to avoid inappropriate project design, distortion of the community or overexploitation of resources in the future. Where an emergency response coordinating body is in place, this information may be available through it. Where new information is collected, it should be made available for other agencies to access and use. Typically, minimum information required might include the following:

Vessels:

Physical

- Type and local name
- Registration data
- Dimensions: length, beam, depth
- Decked or open
- Construction material and detail
- Engine make, type, power
- Fishing gear used and dimensions
- Features: ice box, fish hold, net hauling, cooking, sleeping, toilet, safety equipment, etc.

Operational

- Fishing activity type
- Fishing ground location and distance
- Fishing effort, days per month or year
- Seasons fished and limitations
- Fish species targeted
- Catch rates: daily, annual
- Crew number
- Fuel use per day or month

Fishers:

Job position

- Skipper and owner
- Skipper and employee or renter
- Skilled crew
- Labourer

Community position

- Boat owner, sole or group
- In debt to purchase assets
- Linked to fish trader
- Marketing own catch

4. **Understanding the pre-disaster issues:** The disaster-affected fishery may have had numerous pre-existing problems that were affecting its environmental, economic and social sustainability. These could include the use of illegal gear, overcapacity, overfishing, and conflict with an existing government strategy for fisheries. It is likely that the community will be aware of some or all of these issues but may lack the knowledge, means or will to take action to mitigate their negative impact on livelihoods and environment. Efforts should be made to ensure that communities are engaged in identifying such problems and in the development of reconstruction plans that will help re-direct activities in such a way as to improve sustainability. In some cases, there may be a case for not replacing lost assets with the same vessels and equipment; instead, re-directing the fishery to fit in better with community or government policy and strategy and/or international best practice.
5. **Using existing data:** Local or national authorities can be consulted to establish data on important aspects of fishing activities. Information available may include vessel enumeration and registration (which should include vessel size, type and other details), ownership details and fish landing information (weight and value). However, such information may not present a complete picture of the fishery, perhaps because it is not accurately kept or updated, or because vessels are missed from the records,

or because they are in remote locations, or they are of a class not normally registered. Any information gained is useful as a background check and basis for further (community) assessments but it should not be treated as a complete representation of the situation.

6. **Understanding the different uses of vessels**: Disasters may have huge impact on vessels other than full-time fishing boats. Other classes such as family boats and multipurpose boats may have been severely affected, and these often belong to the poorest families. Such vessels are often small and unlikely to be registered by authorities, who mainly consider full-time fishing vessels over a certain size. They may be used for shopping or to sell from, to take children to school or for part-time agriculture, aquaculture and/or fishing. Boats are an important means of communication and transport. In some locations, they are part of the fabric of society especially where waterways are more numerous than roads.
7. **Key considerations in vessel design**: In the rush to build or supply replacement vessels and return to fishing, some key factors affecting their design and appearance can be overlooked. Fishers can be conservative and may only want to use boats that fit within their existing experiences, traditions and work practices. Consideration may need to be given to maintaining traditions such as ensuring that the shape and style of the vessel remain appropriate or that particular features are incorporated. Consider the following:
   - Vessel traditions based on community or geographical norms.
   - Vessel traditions based on culture and superstitions.
   - Vessel operating environment – e.g. seasons of use, sea conditions, river conditions.
   - Consideration of landing facilities – beach, river or port.
   - Consideration of crew needs when working or resting.
   - Tides and water levels. Is boat hauled out of water or left afloat?
   - Operational features such as removal of water or storage of fishing equipment.

   See Tool 3 for further key questions.
8. **Vessel registration:** Not all vessels affected will have been registered or documented either because they are outside the classes covered by government authorities or because they simply have been overlooked or have avoided such formalities (see also guidance note 2). Economically less-viable boats are less likely to be registered or documented. It is therefore imperative that community groups are consulted in assessing the number of boats lost. Consultation should reach beyond the fishing community to include all individuals who may have lost a boat, for example, some individual fishers may live and work outside the main community but may be equally disadvantaged by the loss of their boat.

FOFV 2: Strengthening governance

Activities involving replacement and repair of vessels should contribute to, and be part of, the process of achieving better governance in fisheries and a more sustainable fishery that can provide long-term livelihoods.

Key indicators

- Relevant authorities are consulted to establish pre-existing situation and areas for concern (see guidance note 1).
- Safety-at-sea regulations or guidance are checked against actual situation on vessels (see guidance note 2).
- New vessel designs and/or requests are consistent with government policy and strategy for the fishery; where this is absent, they are consistent with international codes and standards (see guidance notes 1 and 3).
- Discussions are held with fishers and authorities to establish which areas can be re-directed and the changes required in achieving this (see guidance notes 1 and 3).

Guidance notes

1. **Establishing the rationale for the response**: Planning for new vessel construction should take into account the state of resources in the affected fishery and the formal objectives where they have been established by the management agency. The information referenced should include discussions with relevant authorities (fisheries department) and inspection of reports and records as well as reports of assessments made by fisheries experts. The anecdotal evidence of fishers, traders and the community is also important in establishing the picture. Where no such information is available, consideration should be given to involving experts in this work before finalizing plans. The objective is to have the best available information on resources either from scientific assessments, advice from government and/or discussions with communities.

   The objective should be to ascertain whether replacement of vessels is compatible with the current situation or whether re-direction of fishing activities will be needed to ensure sustainability.

   Key areas to consider might include:

   - Use of illegal gear
   - Conflict with government strategy
   - Signs of overfishing
   - Degraded ecosystems
   - Diminishing catch rates
   - Comparisons and changes to previous data
   - Diminishing species and size
   - Shifts in fishing activities and grounds
   - Fishers relocating
   - Fishers taking up other work

Assessments need to consider the resource situation not only of the fishery itself but also of local materials, such as the timber required for the boats in the fishery. Where timber is an issue, there may be widespread use of illegally cut or poor-quality timber unsuitable for boatbuilding.

2. **Registration and regulation:** Vessel registration and regulation are always linked; however, regulations regarding safety at sea may vary in their application to small fishing vessels. There may be cases where none is relevant, cases where some are relevant but not applied or cases where there may be many regulations, some applied and some ignored. Vessel size may be critical in the application of regulations – the smaller the vessel, the less likely are in-force regulations. Vessels of less than 6–7 m in length may escape regulations entirely. Consultation with communities in affected areas is essential to understand the situation and how this affects their fishing activities.
3. **Policy direction**: The relevant government (fisheries) authorities will be able to provide strategy and planning advice and documents regarding fishing. These should provide an overview of the important issues, obstacles and proposed direction for development and legislation. Where such guidance is incomplete or not available, there are numerous sources of best practice information including, but not limited to, the following:
   - FAO Code of Conduct for Responsible Fisheries (FAO, 1995)
   - The FAO/ILO/IMO Safety Recommendations for decked fishing vessels of less than 12 metres in length and un-decked fishing vessels (FAO/ILO/IMO, 2012)
   - The FAO/ILO/IMO Code of Safety for Fishermen and Fishing Vessels, 2005 (FAO/ILO/IMO, 2005)
     - Part A – Safety & Health Practice
     - Part B – Safety & Health Requirements for the Construction & Equipment of Fishing Vessels
   - The FAO/ILO/IMO Voluntary Guidelines for the Design, Construction and Equipment of Small Fishing Vessels (IMO, 2005)

FOFV 3: Sustainable sourcing

Sources of boatbuilding materials, such as timber and GRP, are demonstrated to be sustainable, suitable and economically viable.

Key indicators

- Projects liaise with relevant authorities, such as the forestry department, and receive advice on procurement of materials (see guidance note 1).
- Agencies receive and maintain documentation regarding source and legality of timber products used (see guidance note 1).
- Where materials and equipment have to be imported, such as glass and resin (GRP), projects establish understanding of customs requirements and the cost and time implications (see guidance note 2).

Guidance notes

1. **Sustainable sourcing:** In countries commonly affected by natural disasters, it is also common for there to be significant pressure on timber resources, and this can lead to illegal logging activities being encouraged as a result of vessel replacement efforts in the wake of a disaster. The relevant government authorities should be able to supply information on the situation and help to identify approved sources of timber. Any agencies sponsoring boatbuilding that is using timber should seek their advice. When agencies purchase timber products, documentation should be obtained from the trader to verify the origin and legality of the timber. Timber products derived from the informal or illegal sector may well be less expensive but come at a high environmental price and may not be of the quality or correct preparation for good boatbuilding.
2. **Understanding import regulations:** Depending on the situation in each particular country affected, it may be regarded as appropriate to design projects and plan inputs that require as few imported items as possible or only require those that are available through normal commercial channels in the affected country. Where this is **not** possible and imported items are important for vessel replacement, customs authorities should be consulted in order to obtain advice on the functioning and timing of the import system and the likelihood of needing special measures for international reconstruction projects. There may also be import taxes to consider and these will need to be factored into costs.

FOFV 4: Support structures

The structures to support the repair and/or replacement of fishing vessels are economically viable and are re-established in a timely manner.

Key indicators

- The site of new boatbuilding operations takes into consideration transport links with suppliers and the availability of supportive infrastructure (see guidance note 1).
- Plans for new boatbuilding sites, which are intended to become established businesses (rather than project sites for delivery of short-term inputs), include economic feasibility assessment (see guidance note 2).
- Plans include collaboration with organizations that provide training, technical support, prototype development and a knowledge base (see guidance note 3).
- New facilities conform to process and safety guidelines (see guidance note 4).

Guidance notes

1. **Support structures:** An effective boatbuilding programme requires facilities, resources, equipment, communications and labour. These may not be readily available in a disaster-affected area. The initial assessment for the rebuilding activities needs to balance the need to use local skills with the need to consider proximity to infrastructure and services. Where new

boatbuilding facilities are being established, locations within a project area will need to be easily accessible and preferably not too numerous as travel can be difficult in emergency situations.

A boatbuilding facility will need access to at least the following:

- Power supply or generator
- Training facilities
- Cover from sun and rain
- Accommodation for trainees
- Secure storage facilities for materials and tools
- Accommodation for trainees
- Local service suppliers such as mechanics
- Local suppliers of materials, such as timber

2. **Economic sustainability:** Where the aim is to establish boatbuilding activities that are viable in the long term, it is important that the facility is designed with economic sustainability in mind. Assessments of this might include some of the following:
   - Personnel and facilities available in the area (see guidance note 1).
   - Resource availability for boatbuilding in the area. This is particularly important for timber boatbuilding.
   - Communications linkages – road or rail networks and links with supply sources.
   - State or health of the fishery in the area. What is the position regarding fleet, catches and incomes?
   - The likely demand for new boats or boat repairs is crucial to the viability of a boatbuilding facility.
3. **Technical support:** Agencies planning boatbuilding as part of their relief and recovery operations may not have the necessary technical expertise. In this case, they should collaborate with or seek assistance from a competent agency or authority that can provide the necessary technical assistance, coordination and knowledge resources.
4. **Best practice and support:** There are numerous sources of best practice and standards relating to fishing vessels and their construction and safety.
   - FAO Code of Conduct for Responsible Fisheries (FAO, 1995)
   - The FAO/ILO/IMO Safety Recommendations for decked fishing vessels of less than 12 metres in length and un-decked fishing vessels (FAO/ILO/IMO, 2012)
   - The FAO/ILO/IMO Code of Safety for Fishermen and Fishing Vessels, 2005 (FAO/ILO/IMO, 2005)
     - Part A – Safety & Health Practice
     - Part B – Safety & Health Requirements for the Construction & Equipment of Fishing Vessels
   - The FAO/ILO/IMO Voluntary Guidelines for the Design, Construction and Equipment of Small Fishing Vessels (IMO, 2005)

FOFV 5: Management support

The scale of boatbuilding activity planned should reflect the management and supervision capacity available.

Key indicators

- Management plan established, covering monitoring, supervision and follow-up of vessel construction projects (see guidance note 1).
- Adequate resources are made available for project management (see guidance note 2).
- Construction projects are monitored regularly, and assistance and quality control are provided where necessary (see guidance note 3).
- Vessels are delivered according to original schedule (see guidance note 3).
- Vessels delivered are of good quality and meet the desired specifications (see guidance note 4 and FOFV 6).

Guidance notes

1. **The value of project management:** Building large numbers of boats is challenging and will require good management, inspection and supervision services. The task is unlike delivering some other inputs such as farm machinery or livestock as the input has to be manufactured *in situ*. Lack of appropriate support can make it difficult to achieve the planned objectives. Visible effects might include poor quality of vessel construction, non-compliance with specifications and regulations, and ongoing delays in delivery.
2. **Allocating resources to project management:** Project design, management and supervision in a technical/engineering sector such as boatbuilding require skilled, experienced personnel and a sufficient budget to cover the full duration of the project. For example, in commercial boatbuilding, it is understood that there will be significant design, management and supervision costs (on top of the shipbuilding contract value), and these are allowed for in planning. Typically, these could add 10 percent or more to the cost of the vessel. For a reconstruction project that aims to deliver 250 small boats costing US$5 000 each, this would mean an overall value of craft of about US$1.25 million. The significant management and supervision inputs required for such a project could be expected to add in the region of US$125 000 or more to the total cost of the boats.
3. **Monitoring and quality control:** These activities are best carried out by technically experienced persons on a regular basis and/or at critical points in the vessel construction process. For example, if a component is to be fitted that obscures other areas of the vessel, rendering them inaccessible for future inspection, then inspection should be made prior to this. In addition to inspecting the vessel itself, progress should be checked against the planned schedule. In doing this, **any** delay is significant and should be discussed with the builder. Boats are almost always delivered late, and

continuous efforts will be needed to minimize this delay. It may be possible to make use of another party to provide the required monitoring and quality control services, for example, companies or individuals specializing in such work, or another agency with appropriate in-house expertise such as FAO.

4. **Specification:** Vessel construction contracts should be accompanied by a written specification. This provides a measure of the compliance of a vessel with the contract, of the quality of a vessel and of its state of completion. Tool 4 sets out a typical small-vessel specification.

FOFV 6: Safety at sea

The improvement of safety at sea is central to the reconstruction efforts.

Key indicators

- Users are consulted for feedback on safety versus suitability of vessels delivered (see guidance notes 1 and 2).
- The improved and safer vessels delivered are used by the fishers – they are visibly acceptable (see guidance note 2).
- Boatbuilders and fishers adopt better vessel construction and safety-at-sea practices in their own work (see guidance notes 2 and 4).
- Support, training and awareness upgrades are provided to fishers and the wider community, including vessel owners, boatbuilders, service providers, and women and children (see guidance note 3).

Guidance notes

1. **Cost-effectiveness:** Often the amount of consideration given to safety at sea can be related to wealth – greater wealth equals higher standards of workplace safety. Much of the equipment considered vital to safety at sea may not be available in country or only available at a cost that is disproportionate to the vessel cost or the revenue obtained from fishing. Therefore, in this area, there will be a need to understand how the introduction of improved safety at sea can be adapted to the existing wealth and technology patterns in the fisheries. Assistance for fishers to achieve improved safety needs to be at a cost that is proportional to their capacity to pay and make use of appropriate technology. For example, a small (about 6 m) canoe-type vessel might cost about US$500 to build. As a result, any additional equipment, especially if imported, will add significantly to the cost. For example, a lifejacket that complies with an international standard typically costs at least US$80.
2. **Managing change:** Significant changes in design and equipment of vessels to match safety-at-sea requirements could meet with resistance from fishers as the vessel may not look, feel or function like vessels to which they are accustomed. For example, improved construction, which can often mean increased vessel weight, is likely to be disliked by fishers if it

means that hauling the vessel onto the shore becomes much harder. Where problems are considered significant by the fishers, the vessels concerned may end up left on the shore and seldom used for fishing.

3. The acceptability of safety-at-sea improvements can be verified by the visible adoption of the new technologies and equipment on active fishing vessels. However, it is all too common for regulation, guidance and safety best practice to be ignored in the reality of a working fishing vessel.
4. **Building skills in safety at sea:** Provision of training in safety at sea at a basic level can, at little cost, reduce the likelihood of serious accidents and can improve the confidence of those remaining on shore that members of their family and community will be safer at sea. Activities could include the development of training manuals, the training of national trainers and the demonstration of the importance of carrying safety equipment on every fishing voyage. In addition, simple checks and maintenance on the boat and machinery can be life-saving.
5. **Following standards:** The strength and safety of a vessel is best measured against a known, documented standard. This will allow judgments made by inspectors to be consistent and can also be transparent as the builder of the vessel can have access to the same documentation. There are numerous sources of best practice and standards including:
   - FAO Code of Conduct for Responsible Fisheries (FAO, 1995)
   - The FAO/ILO/IMO Safety Recommendations for decked fishing vessels of less than 12 metres in length and un-decked fishing vessels (FAO/ILO/IMO, 2012)
   - The FAO/ILO/IMO Code of Safety for Fishermen and Fishing Vessels, 2005 (FAO/ILO/IMO, 2005)
     - Part A – Safety & Health Practice
     - Part B – Safety & Health Requirements for the Construction & Equipment of Fishing Vessels
   - The FAO/ILO/IMO Voluntary Guidelines for the Design, Construction and Equipment of Small Fishing Vessels (IMO, 2005)

Resources and tools

Information resource	Web link	Relevance to the technical challenge
International standards and guidelines		
The FAO/ILO/IMO Safety Recommendations for decked fishing vessels of less than 12 metres in length and undecked fishing vessels. (FAO/ILO/IMO, 2012)	www.safety-for-fishermen.org/50769/en/	Information on the design, construction, equipment, training and protection of the crew of small fishing vessels with a view to promoting the safety of the vessel and safety and health of the crew. The provisions of these recommendations apply to 85% of the world fishing fleet

(cont.)

Information resource	Web link	Relevance to the technical challenge
The FAO/ILO/IMO Code of Safety for Fishermen and Fishing Vessels, 2005 Part A – Safety and Health Practice	www.safety-for-fishermen.org/50769/en/	The purpose of Part A of the Code is to provide information with a view to promoting the safety and health of crew members on board fishing vessels. This part of the Code may also serve as a guide to those concerned with framing measures for the improvement of safety and health on board fishing vessels but is not a substitute for national laws and regulations.
The FAO/ILO/IMO Code of Safety for Fishermen and Fishing Vessels, 2005 Part B – Safety and Health Requirements for the Construction and Equipment of Fishing Vessels	www.safety-for-fishermen.org/50769/en/	The purpose of Part B of the Code is to provide information on the design, construction, and equipment of fishing vessels with a view to promoting the safety of fishing vessels and safety and health of the crew.
The FAO/ILO/IMO Voluntary Guidelines for the Design, Construction and Equipment of Small Fishing Vessels, 2005	www.safety-for-fishermen.org/50769/en/	The purpose of the Voluntary Guidelines is to provide information on the design, construction and equipment of small fishing vessels with a view to promoting the safety of the vessel and safety and health of the crew. The provisions of the Voluntary Guidelines apply to decked fishing vessels of 12 m in length and over but less than 24 m in length.
The 1993 Torremolinos Protocol relating to the Torremolinos International Convention for the Safety of Fishing Vessels, 1977 (Consolidated edition, 1995)	www.IMO.org	This publication contains the regulations for the construction and equipment of fishing vessels of 24 m in length and over. This instrument is not yet in force.
IMO International Code on Intact Stability, 2008	www.scribd.com/doc/49852375/Intact-Stability-Code-msc-267-85-08	This Code presents mandatory and recommendatory stability criteria and other measures for ensuring the safe operation of ships, to minimize the risk to such ships, to the personnel on board and to the environment.
FAO/ILO/IMO Document for Guidance on Training and Certification of Fishing Vessel Personnel, (FAO, 2001)	www.IMO.org	It covers training and certification of fishing vessel personnel on small and large fishing vessels and fishing on an industrial scale.

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Information resource	Web link	Relevance to the technical challenge
ILO. The Work in Fishing Convention, 2007 (No. 188) and Recommendation, 2007 (No. 199)	http://www.ilo.org/wcmsp5/groups/public/@ed_dialogue/@sector/documents/publicaction/wcms_161220.pdf	Providing comprehensives set of standards concerning working conditions on board fishing vessels. These include, among other things, standards on accommodation, occupational safety and health, and medical care at sea.
ILO. Guidelines on occupational safety and health management systems (ILO, 2001)	www.ilo.org/public/english/region/afpro/cairo/downloads/wcms_107727.pdf	Guidelines aim to contribute to the protection of workers from hazards and to the elimination of work-related injuries, ill health, diseases, incidents and deaths. They provide guidance for the national and enterprise level, and can be used to establish the framework for occupational safety and health management systems.
ILO Training Manual on the Implementation of the Work in Fishing Convention, 2007 (No. 188), (ILO, 2002)	http://www.ilo.org/sector/Resources/training-materials/WCMS_162879/lang_eng/index.htm	The training material is primarily directed at those persons who will carry out flag State inspections for compliance with national laws, regulations and other measures for the implementation of the Work in Fishing Convention, 2007, and for those persons who will carry out port State control inspections of foreign vessels. It is a valuable tool for any persons that seek a better understanding of the requirements of the Work in Fishing Convention, 2007 (No. 188).
FAO. 1995. *Code of Conduct for Responsible Fisheries.* Rome. 41 pp.	www.fao.org/fishery/code/en_	FAO uses the Code as a vehicle to promote various issues relating to safety at sea. The articles of the Code that are related to safety at sea are: 6.17, 7.1.7, 7.1.8, 7.6.5, 8.1.5, 8.1.6, 8.1.7, 8.1.8, 8.2.5, 8.2.8, 8.2.9, 8.2.10, 8.3.2, 8.4.1, 8.11.1, 8.11.4 and 10.1.5.

Resource materials

Information resource	Web link	Relevance to the technical challenge
Fishing operations		
FAO. 1996. Fishing operations. FAO Technical Guidelines for Responsible Fisheries No. 1. Rome. 26 pp. + 6 annexes.	www.fao.org/DOCREP/003/W3591E/W3591E00.HTM	The technical guidelines are given in support of the implementation of the Code of Conduct in relation to fishing operations. They are addressed to States, international organizations, fisheries management bodies, owners, managers and charterers of vessels, and fishers and their organizations.
Safety at sea		
FAO. 1989. The standard specifications for the marking and identification of vessels. Rome. 69 pp.	ftp://ftp.fao.org/docrep/fao/008/t8240t/t8240t01.pdf_	This document contains the specifications of a standardized system for the marking and identification of vessels as endorsed by the FAO Committee on Fisheries, Rome.
Petursdottir, *et al.* 2001. Safety at sea as an integral part of fisheries management. FAO Fisheries Circular No. 966. Rome, FAO. 39 pp.	www.fao.org/DOCREP/003/X9656E/X9656E00.HTM	This paper provides a comprehensive overview of sea safety issues, and concludes that safety at sea should be integrated into fisheries management.
Gulbrandsen, O. 2009. Safety at sea – safety guide for small fishing boats. FAO/SIDA/IMO/BOBP-IGO REP 112. 52 pp.	www.fao.org/fi/oldsite/eims_search/1_dett.asp?lang=en&pub_id=261572	The purpose of this safety guide is to present simple measures to ensure that new boats will satisfy internationally accepted safety standards. The target group consists of boat designers, skippers and government officials responsible for drafting new regulations and for safety supervision. The guide mainly deals with small boats of less than 15 m in length, which, from experience, are those most prone to accidents.
Fishing boat design and construction		
Haug, A.F. 1974. Fishing boat designs: 1. Flat bottom boats. FAO Fisheries Technical Paper No. 117, Rev 1. Rome, FAO. 46 pp.	http://archive.org/stream/fishingboatdesig034778mbp#page/n0/mode/2up	This publication presents some basic designs of boats that are simple to construct, for use in small-scale, non-industrial fisheries.

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Information resource	Web link	Relevance to the technical challenge
Gulbrandsen, O. 2004. Fishing boat designs: 2. V-bottom boats of planked and plywood construction. FAO Fisheries Technical Paper No. 134, Rev. 2. Rome, FAO. 64 pp.	www.fao.org/docrep/007/y5649e/y5649e00.htm	This publication includes the designs of four small vessels (from 5.2 to 8.5 m), with comprehensive material specifications and lists, and provides detailed instructions for their construction, both planked and of plywood.
Fyson, J.F. 1980. Fishing boat designs: 3. Small trawlers. FAO Fisheries Technical Paper No. 188, Rev. 1. Rome, FAO. 51 pp.	ftp://ftp.fao.org/docrep/fao/012/t0445e/t0445e.pdf	This publication contains designs of a range of small trawlers suitable for operation in coastal waters. It provides detailed technical information and guidance on the choice of appropriate vessels to fisheries officers, vessel owners and boatbuilders.
Fyson, J.F. 1988. Fishing boat construction: 1. Building a sawn frame fishing boat. FAO Fisheries Technical Paper No. 96, Rev. 1. Rome, FAO. 63 pp.		The purpose of this publication is to explain how a designer draws the curved shape of a boat and shows where to look for the details of construction and the dimensions necessary to build a boat.
Coackley, N. 1991. Fishing boat construction: 2. Building a fibreglass fishing boat. FAO Fisheries Technical Paper No. 321. Rome, FAO. 84 pp.	www.fao.org/DOCREP/003/T0530E/T0530E00.HTM	This publication is intended to give the reader a sound basic knowledge of GRP and its possibilities and limitations in boatbuilding.
Riley, R.O.N. & Turner, J.M.M. 1995. Fishing boat construction: 3. Building a ferrocement fishing boat. FAO Fisheries Technical Paper No. 354. Rome, FAO. 149 pp.	www.fao.org/docrep/003/v9468e/v9468e00.htm	The publication is intended to provide the reader with a sound basic knowledge of ferrocement and its potential and limitations in boatbuilding.
Anmarkrud, T. 2009. Fishing boat construction: 4. Building an undecked fibreglass reinforced plastic boat. FAO Fisheries and Aquaculture Technical Paper No. 507. Rome, FAO. 70 pp.	www.fao.org/docrep/012/i1108e/i1108e.pdf	
Mutton, B. 1980 (a). Engineering applications: 1. Installation and maintenance of engines in small vessels. FAO Fisheries Technical Paper No. 196. Rome, FAO. 127 pp.		This publication provides a basic handbook covering all details of installation and the necessary maintenance procedures to be adopted for small boatyards, boat owners and fishers.

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Information resource	Web link	Relevance to the technical challenge
Mutton, B. 1980 (b). Engineering applications: 2. Hauling devices for small fishing craft. FAO Fisheries Technical Paper No. 229. Rome, FAO. 146 pp.		This publication provides an introduction to the basic principles involved in the planning and building of a simple hauler.
Czekaj, D. 1990. Engineering applications: 3. Hydraulics for small vessels. FAO Fisheries Technical Paper No. 296. Rome, FAO. 199 pp.	http://books.google.it/books?id=2kjAgBppTC4C&printsec=frontcover&hl=it&source=gbs_ge_summary_r&redir_esc=y#y=onepage&q&f=false	This publication provides some ideas and basic rules for general design principles, to mounting details, construction, installation and maintenance of various machines, besides all the other elements that compose a hydraulic circuit.
Gudmundsson, A. 2009. Safety practices related to small fishing vessel stability. FAO Fisheries and Aquaculture Technical Paper No. 517. Rome, FAO. 54 pp.	www.fao.org/docrep/011/i0625e/i0625e00.htm	This document introduces basic principles on the stability of small fishing vessels and provides guidance on what fishing vessel crews can do to maintain adequate stability for their vessels. It is aimed at fishers and their families, vessel owners, boatbuilders, authorities and others who are interested in the safety of fishing vessels.
Anmarkrud, T., Danielsson, P. & Gudmundsson, A. 2010. Guide to simple repairs of FRP boats in a tropical climate. BOBP/MAG/27. Rome, FAO,		This booklet would be useful for fishers and small workshops in the fishing villages to undertake minor repairs on the FRP boats. It may also serve as a guide for officials of the department of fisheries and other concerned agencies with training in matters of simple repairs of FRP boats.
McVeagh, J., Anmarkrud, T., Gulbrandson, Ø., Ravikumar, R., Danielsson, P. & Gudmundsson, A. 2010. Training manual on the construction of FRP beach landing boats. BOBP/REP/119. Rome, FAO. 148 pp.	www.fao.org/docrep/012/al360e/al360e.pdf	This manual on construction of fibreglass reinforced plastic (FRP) beach landing boats was prepared primarily to assist small boatyards in Tamil Nadu, India, that build beach landing fishing boats. However, it may also be used as a guide for making good-quality FRP boats as well as for FRP training in the region.

(cont.)

Information resource	Web link	Relevance to the technical challenge
Davy, D. & Svensson, K. 2009. Building small wooden boats in Myanmar - 12 ft and 18 ft multi-purpose boats. Project OSRO/MYA/805/SWE. Rome, FAO. 39 pp.	www.fao.org/docrep/012/ak202e/ak202e00.htm	This step-by-step manual contains information on the construction of small multipurpose boats typical of those found in the Ayeyarwady Delta. Its purpose is to give organizations access to detailed information on boatbuilding, which will allow the production of small boats appropriate to the Delta. The manual is also intended to assist organizations in their understanding of the boatbuilding process and to provide guidelines on good practice. It should assist in the review of contracts and quality control in boatbuilding.

There are a wide range of sources of information to support vessel construction and safety at sea. Some of these are shown in the table below:

Information resource	Summary of the information	Web link
FAO Fisheries and Aquaculture Department	Information, fact sheets and publications relating to fisheries and aquaculture	www.fao.org/fishery/en Search for publications here: www.fao.org/fishery/publications/en See technical papers at: www.fao.org/fishery/publications/technical-papers/en Regarding responsible fisheries, see: www.fao.org/fishery/publications/code/en www.fao.org/fishery/publications/technical-guidelines/en
Safety for Fishermen website	Information related to the Safety for Fishermen on website is hosted by FAO. Managed by experts from the fisheries sector	www.safety-for-fishermen.org/50769/en/
SeaFish (UK)	Services and support to seafood industry, covering: information, safety, environment, regulation, standards, consumers	www.seafish.org/
Maritime and Coastguard Agency (UK)	Maritime safety organization has guides on training and safety for fishers	www.dft.gov.uk/mca/mcga07-home/workingatsea/mcga-fishing.htm

(cont.)

Information resource	Summary of the information	Web link
The Bay of Bengal Programme (BOBP)	Intergovernmental organization to enhance cooperation among countries and organizations in the region and provide technical and management advisory services for sustainable coastal fisheries development and management	http://www.bobpigo.org/safetyatsea/
Kyoto University Graduate School of Global Environmental Studies	Handbook for fishers on typhoons and strong winds in Viet Nam	www.iedm.ges.kyoto-u.ac.jp/aboutus_e.htm

Tool 1: Basic vessel categories

Length (LOA)	< 10 m	10–15 m	15–24 m	> 24 m
Type	Artisanal	Semi-industrial	Industrial	Industrial
Decked	Rarely	Sometimes	Mainly	Always
Propulsion	Frequently sails or paddles but also motorized with inboard or outboard (petrol or diesel)	Mainly motorized often with inboard (diesel)	Motorized with inboard (diesel)	Motorized with inboard (diesel)
Crew	1–6	3–12	Various, could be from 6 to more than 15	Various, could be more than 15
Trips	Typically 1 day	3–7 days	7 days and over	7 days and over
Area	Inshore	Coastal	Offshore	Distant waters
Design & construction	Often of simple traditional designs and fairly crude construction	Based on traditional or modern designs, either timber or modern construction	Often of modern design and mainly modern construction	Mainly of modern design and construction
Material	Mainly timber in traditional style construction. Increasing numbers of simple GRP (glass reinforced plastic) vessels.	May be timber, GRP, steel or aluminium construction according to location and fishery. Overall the majority will still be timber.	May be timber, GRP, steel or aluminium construction according to location and fishery. Non-timber construction becoming favoured.	As with 15–24 m vessels, non-timber construction becoming favoured. Unless timber is readily available, steel can be the material of choice.

(cont.)

Length (LOA)	< 10 m	10–15 m	15–24 m	> 24 m
Gear	Often small gear, manually handled	Large gear, often mechanically handled	Large gear, mainly mechanically handled	Very large gear, mechanically handled
Safety at sea	Record likely to be poor owing to simple construction and poor equipment	Improved record, especially in decked vessels	Vessel increasing in safety but gear and equipment increasing in danger	Concern can centre on deck equipment and crew protection. Such vessels also venture far from safe haven so require good communication and lifesaving equipment
Registration	Unlikely	Likely	Likely	Often mandatory
Ownership & finance	Often individual fisher. Own or informal finance	Cross-over from fisher ownership to investor and from informal to formal finance	Wealthy investor. May have formal finance	Wealthy investor. May have formal finance

Tool 2: Vessel categories

There are various methods of classifying vessels other than by length, and many international organizations and governments have their own methods. In Indonesia and Peru, tonnage (GT) measurements are used to classify fishing vessels. In the United Kingdom of Great Britain and Northern Ireland, the Seafish Construction Standards (widely referred to by designers and administrators) make use of Cubic Number (CUNo) for identifying vessel size.

In the region/nation of proposed project activity, it is important to understand and adopt the local system of classing vessels when discussing boatbuilding, and important to understand the correlation between methods, such as length (L/LOA) and tonnage (GRT/GT).

The following table provides some commonly used methods of vessel categorization:

Categorization	Description	Comments
Tonnage (GRT/GT)	A measure of usable internal volume based on ship volume with correction factors. Gross registered tonnage (GRT) was fully replaced by gross tonnage (GT) in 1994 and is no longer widely used in the industry. For information and calculation method, see Annex 2.	Standard in shipping for vessels of 24 m in length (L) and over and sometimes used in fishing vessel categorization. For example, in Indonesia (0–5, 5–10, 10–30 and 30+).

(cont.)

Categorization	Description	Comments
Cubic Number (CUNo)	A measure of boat "box" volume, represented by: Length × Beam × Depth. For measurement and calculation method see Annex 3.	Often used in fisheries as it can allow comparison of vessel size in terms of weight (displacement). A more accurate measure of true vessel size than length.
Motorized and engine power	Whether fitted with a motor or not	Motors can be single, twin, inboard, outboard, petrol, diesel or kerosene. The power is usually quoted in kilowatts or horsepower.
Decked	Whether fitted with a deck or not	Note that to be considered decked, a vessel requires a continuous watertight deck rather than small areas of deck or removable decking.
Wooden	Whether constructed from wood or not	In the recent past, the vast majority of small (say, < 12 m in length) boats worldwide would have been constructed from timber. This has changed, and continues to change, towards GRP and other materials.
Distance from safety	The distance the vessel operates from a safe haven.	Usually given in nautical miles (nm) in categories such as 5 nm, 20 nm, 100 nm, 200 nm and unrestricted. Other distances are used according to region.
Design category	A description of the wind and sea conditions for which a vessel is considered suitable, developed by the ISO and used in the FAO/ILO/IMO Safety Recommendations. Generally used for recreational craft.	Categories defined as: A – Ocean B – Offshore C – Inshore D – Sheltered waters See Annex 4 for details

Tool 3: Key questions

In identifying vessel replacement and/or repair requirements, there are some critical questions to be considered:

- Identification of affected boat owners or users and details about ownership and of vessels. Are the planned inputs attracting new or inexperienced owners to the fishery? Were existing ownership patterns inequitable?
- The design and size of the vessel, the machinery and equipment used and the gear deployed. Are requests being made that increase fishing power, engine size and gear? Are these justified of simply opportunistic upgrades?
- Existing safety and design, construction or safety problems that were concerns before the disaster. Perhaps existing timber cost and availability

was forcing lower-quality and potentially unsafe boats to be produced. Were existing boats safe?

- Existing maintenance and equipment supply problems that were concerns before the disaster. Were the technical aspects of the designs sustainable?
- The areas fished including distances covered and likely sea conditions. This information is critical to appropriate vessel design.
- Details of the impact of the emergency on the individual vessels, such as damage and loss of equipment and machinery.
- The numbers of vessels lost in terms of various design categories and locations. This information may be available from field workers and government sources. However, it is worth noting that the smallest and most vulnerable vessels (say, 6 m or less in length) are often unregistered and of unknown number.
- What is the strategy for the fishery in the area and what are the current concerns, such as overfishing and illegal gear? Does the disaster actually present an opportunity to re-direct the activities towards a more sustainable future?

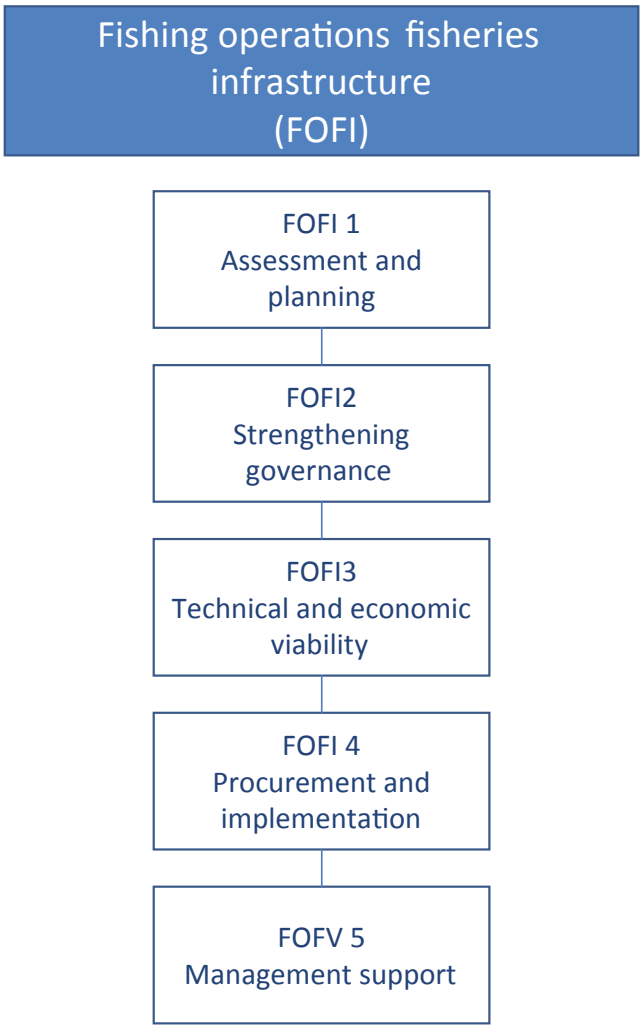
Tool 4: A typical small vessel specification

Group	Item	Notes
000	General	
001	General description	Description of vessel and typical use
002	Main particulars	Length, beam, depth and other particulars
003	Regulations	Regulation or standard to which vessel should comply
004	Weight	Expected weight of completed vessel
005	Stability	Stability standard to which vessel should comply
006	Trials	Tests conducted before vessel is accepted
100	**Construction**	
101	General details	Description of construction and general comments
102	Tolerances	Allowable deviation from given dimensions
103	Materials	Type and quality of materials to be used, including sources
104	Fastenings	Material and specification of nails, bolts, etc.
105	Welding	Expected standard of welded components
106	Scantlings	Dimensions of each part of vessel structure
107	Bulkheads	Number and position of watertight divisions
108	Built-in buoyancy	Method and material providing built-in buoyancy
109	Foundations	Construction of supports for heavy items, e.g. engine
200	**Machinery**	
201	Main machinery	Make, power and other details of engine

(cont.)

Group	Item	Notes
202	Gearbox	Make, rating, ratio and other details of gearbox
203	Stern gear	Propeller, shaft, stern tube, bearings and other items
204	Performance	Expected speed of vessel at known power
205	Steering	Details of steering system, including construction
300	**Electrical**	
301	General	Description of electrical system and general comments
302	Cables	Type and quality of cables to be used
303	Batteries	Type, number and quality of batteries
304	Lighting	Internal and external lights required
400	**Electronics**	
401	Communications	Radios and communications equipment
402	Navigation	GPS, radar and other electronics
500	**Systems**	
501	General	Description of piping systems and general comments
502	Seawater	Pipes, pumps, valves, etc. Materials and design
503	Bilge	Pipes, pumps, valves, etc. Materials and design
504	Fuel	Pipes, pumps, valves, etc. Materials and design
505	Exhausts	Pipes, hose, connections, etc. Materials and design
506	Fire	Systems and equipment for fire prevention
600	**Outfit and equipment**	
601	General	Description of outfit and general comments
602	Anchoring	Size and weight of anchors, chain/rope and equipment
603	Mooring	Size and no. of bollards, mooring ropes and equipment
604	Hull protection	Fender on hull sides and rails; material and design
605	External outfit	Fittings and equipment mounted on deck
606	Internal outfit	Interior including bunks, galley, etc.
607	Fishing outfit	Fishing equipment on deck including winches, etc.
608	Sailing rig	Design and construction of spars and sails if fitted
609	Equipment	General equipment to be provided on vessel
609	Safety equipment	Safety equipment to be provided on vessel
610	Spares and tools	Items provided on vessel for simple maintenance
611	Painting	Type and quality of paint including colours
Annex A	**Technical guidance**	Technical guidance as appropriate; this may include reference to construction standards or "how to publications.

FISHING OPERATIONS – INFRASTRUCTURE (FOFI)



Introduction to infrastructure

Fishing is not only about vessels and gear. All fisheries operations require the support of a wide range of different infrastructure that enables the fishers, the processors, the service sectors and the consumers to come together. Examples include:

- Open beaches
- Breakwaters
- Piled jetties
- Quay walls
- Buildings
  - Port management offices
  - Processing and/or auction halls
  - Equipment sheds
  - Processing plants.
- Electricity supply
- Potable water supply and storage
- Hygiene facilities
- Liquid waste treatment facilities
- Fuel storage
- Machinery (generators, cold rooms, etc.,)
- Roads

The challenge of supporting infrastructure involves not only these different physical structures, but also dealing the complex web of ownership patterns, social networks and power relationships. This demands both practical engineering skills but also social, political and economic skills. The following example from Ghana provides an illustration of this complexity (see Sciortino, 2012). A reconstruction effort is considering the provision of solid landing jetties in villages that use the beach as a landing for canoes. However, the local canoes, by their very nature, do not have vertical frames that support the planks forming the sides of the hull. This renders them very fragile to side impact and, in the presence of swell, owners tend to shy away from solid vertical structures. The large tidal range also makes it impractical to discharge at certain times of day owing to the difference in height between the canoe deck and the jetty. Canoes store their catch in bulk in wells or compartments, with or without ice, depending on the duration of the fishing effort. Hence, queuing for a berth with a full catch of small pelagics (such as sardines, mackerel or anchovies) stored without ice is an impractical proposition if the catch needs to be offloaded in the early hours of the day and before the temperature rises to unbearable levels. The current system of beaching the canoe on sand provides as many instantaneous berths as the landing effort requires and should always be maintained.

TABLE 11
Infrastructure components at risk from different types of hazards

	Typical risks to infrastructure	
Hurricanes/ cyclones	• Beaches – can change the profile – affecting access • Damage to electricity wires	• Buildings • Fuel stores
Tidal surges / tsunamis	• Can change the profile of beaches – affecting access • Buildings • Roads • Wires on poles affected by the debris carried by the wave • Damage breakwaters (particularly rubble-mound breakwaters)	• Piled jetties • Shallow water wells • Mains supply water (where roads and bridges are washed away) • Wastewater treatment • Machinery • Fuel stores
Earthquakes	• Buildings • Roads • Damage breakwaters • Piled jetties • Fuel storage	• Quay walls • Mains supply water (where roads and bridges are washed away) • Wastewater treatment
Volcanic eruptions	• Buildings • Build up of ash on wires can cause damage	
Floods	• Buildings (particularly furnishings within) • Roads	• Shallow water wells • Wastewater treatment • Machinery
Oil spills / chemical spills	• Can restrict access and use of beaches	
Nuclear leaks	• Can restrict access and use of beaches • Buildings	
Complex emergencies (civil unrest)	All infrastructure can be adversely affected in complex emergencies – particularly where it is seen to have "strategic value" to one side or another or where there are valuable materials or equipment that can be stolen.	

Infrastructure and the emergency context

The many different components of fisheries infrastructure can be affected by hazards in many different ways. While it is impossible to predict these impacts with complete certainty, Table 11 indicates components of infrastructure that are particularly at risk from the different types of hazards.

Assessment challenges

To aid agencies, infrastructure replacement can seem to present many good opportunities for building back after a disaster, particularly in the clamour for fund allocation that can arise in the emergency context. Given the complexity of the challenge, this runs the risk of poor decision-making, particularly where the relevant experts are not engaged. Aside from the difficulties of understanding the role of infrastructure within a fisheries system, the

emergency context presents its own challenges:

- **It takes time**: The reconstruction effort for larger elements of infrastructure is likely be a long process. Depending on national procurement procedures, it may take up to six months before contracts are drafted. Therefore, the damage and needs assessment report, or DNA, needs to be prepared and submitted as soon as possible in the aftermath of the disaster.
- **Bigger is not necessarily better**: For a sustainable industry, the size of the shore facilities, whether a beach landing or port proper, should be based on the sustainable yield of the resources. A major threat to the industry during the assessment stage of the relief effort is the overestimation of the amount and size of infrastructure to be reconstructed, especially if the previous infrastructure was already operating unsustainably. In very general terms, the larger the port facilities are, the more and the larger the vessels that are attracted to fish in the area. This can both open up a pathway to unsustainable fishing effort, and incur unsustainable operating costs;
- **Changing population:** The make-up of the resident population surrounding a fish landing site or port after a major disaster may or may not be the same as the one that existed prior to the event. In the case of a tsunami or earthquake, entire sectors of the population may go missing. During slow-onset disasters, the local population may be outnumbered by internally displaced persons (IDPs) with no knowledge or interest in fisheries.

Building back better

The aftermath of a disaster can also present important opportunities for longer-term development. For example, improved road access constructed as part of a major relief effort can greatly increase the potential for improved post-harvest handling and marketing, as can improved electricity and water supplies. An understanding of the **whole** of the fisheries sector (from catch to plate) during damage assessment and planning of relief and reconstruction efforts can help agencies to identify those components that can yield the greatest benefits.

The process of rebuilding provides a great chance to improve the quality and resilience of the fisheries infrastructure. For example, many of the infrastructure components that support fishing operations may have been designed and built decades earlier when design practices and building codes were either unsatisfactory or improperly applied. Building codes, design practices, environmental awareness programmes and risk management practices, together with internationally binding conventions, have improved over time and now provide many tools to mitigate the effects of all but the most-destructive disasters. Except for locations with heavy demands on

power for cooling, such as cold rooms and ice plants, renewable energy and solar power now provide viable alternatives for reducing energy consumption and the carbon footprint of fisheries operations, particularly for remote sites. Similarly, shallow, open-dug, water wells can be replaced with deep bore wells that are less susceptible to damage from disasters and will not be prone to contamination by sewage waste.

Fisheries operations – fishing infrastructure best practice

FOFI 1: Assessment and planning

The infrastructure plans are aligned with community aspirations, fisheries and aquaculture development strategies and the long–term development plans for the nation.

Key indicators

- Damage and needs assessment missions that assess the damage to fisheries infrastructure are informed by fisheries experts assisted by public utilities engineers (see guidance note 1).
- A reconstruction management plan and construction schedule is set up and agreed on by all stakeholders prior to start of physical work on site (see guidance notes 2 and 3).
- The provision of safe drinking-water on tap (not only imported bottled water) and liquid waste treatment facilities is included in the list of priorities (see guidance note 4).
- The reconstruction plan incorporates an impact assessment of the surrounding environment and, where appropriate, provide for re-planting of mangroves, re-instatement of coastal sand dunes and the setting up of marine protected areas (see guidance note 5).
- The reconstruction plan incorporates a social-impact assessment (see guidance note 6).
- Strategic planning for fish landing sites and ports is undertaken in the context of proper governance and management of fisheries (see guidance note 7).
- Opportunities for the provision and/or improvement of public utilities and infrastructure (water, electricity, public lighting, sanitation, and road access) in remote areas are explored in the reconstruction plan (see guidance note 8 and 9).

Guidance notes

1. **Expertise:** Experienced fisheries agencies or experts will know the typical infrastructure requirements of a fishing community and this will include knowledge of the fish species harvested, fishing methods, vessel types, post-harvest handling, marketing, water supply and hygiene. Experienced

local engineers will also be knowledgeable in suitable construction materials and methods.

2. Humanitarian relief agencies are always in the forefront when it comes to rapid intervention and the provision of aid during the initial phase of an emergency. However, the highly technical nature of the fisheries sector and the potential for large negative environmental impacts require an in-depth knowledge that only specialized agencies or consultants can provide.
3. **Reconstruction management plan:** When reconstruction is likely to have a large impact on a fishing community, a management plan needs to be drawn up to include input from the local fishers, the department of fisheries, local municipality and utilities such as water, electricity and sewerage. There is also significant potential to draw upon experience from other humanitarian agencies in the fields of water and sanitation management and housing.
4. **Procurement and construction management:** A construction schedule should be developed to plan procurement and building activities. The schedule should be subordinate to the overall reconstruction management plan (see FOFI 1) and should include key milestones such as target completion dates and major building activities. A responsive, efficient and accountable supply chain and construction management system for materials, labour and site supervision should also be established. This should include sourcing, procurement, transportation, handling and administration, from point of origin through to the respective sites as required.
5. **Priority issues**: Fish is a highly perishable commodity and improper post-harvest handling has a negative impact on the market value of the fish. Improper handling also has the potential to create health problems when personal hygiene is lacking. The early provision of safe running water and liquid waste treatment will ensure that fishers can generate maximum benefits from their fish catches in the shortest time possible.
6. **Surrounding environment**: The impact of the reconstructed infrastructure on the surrounding environment should be assessed (see Tool 1 for an outline of an environmental impact assessment). If the infrastructure to be replaced was already having a negative impact on the environment, the replacement should be designed in a precautionary manner as prescribed in the Code of Practice for Responsible Fisheries. Degraded mangroves and coastal dunes should be included in the reconstruction effort as these will protect the coastal areas from further damage in the event of inundation from the sea. Marine protected areas (MPAs) should be instituted along sensitive coastlines as these provide a natural way for a degraded coast to heal itself.
7. **Social impact studies:** While temporary measures may be required to support fishing communities in an emergency, such as food hand-outs,

shelter and fishing gear replacement, a proper social impact study should be carried out. This should include careful consideration of the local marketing set-up prior to the emergency, the various roles played by sectors of the community in the day-to-day running of fishing operations and any hierarchal or gender preferences particular to a specific community. Aside from the actual fishing operation on board a vessel, these roles might include unloading of the fish, sorting of the fish, wholesale and retail, transport, smoking and any other local processing. In many countries, some roles are gender-specific.

8. **Strategic planning:** Currently, overfishing is seriously affecting the sustainability of fisheries in many countries and any reconstruction effort must first be assessed for its sustainability *vis-à-vis* the proper governance and management of fisheries. New fishing ports and new markets create or increase demand for resources and services, and unless a proper environmental assessment has been carried out to determine their sustainability, the reconstruction effort should only replace the infrastructure lost or destroyed in the emergency. The important opportunities that arise in the aftermath of an emergency must be used to improve the sustainability of fisheries, even if this means fewer goods.
9. **Provision of utilities:** Depending on the remoteness of the sites, the provision of utilities should be a priority in the reconstruction effort. In very remote areas, recent advances in solar power technology may enable most day-to-day activities. These include public and indoor lighting, borehole water pumping, mobile telecommunications, household refrigeration, computers and the Internet. Only refrigeration and freezing on an industrial scale are currently beyond the capabilities of solar power, and these industrial-scale activities, where required, should be coordinated with the relevant commercial sectors. In any case, these activities require mains power and should never be attempted using generators.
10. **Road access:** In poorly connected areas, road access is normally improved temporarily to permit large vehicles and trucks to reach remote villages with humanitarian aid. These same improvements, that in many cases are of a temporary nature, should be included in the reconstruction effort with the aim of improving their durability, especially in areas of heavy rainfall. Two planning tools have recently been devised to assist planners, donors and agencies:
    - integrated rural accessibility planning (IRAP);
    - basic access provision.

    The objective of these two planning tools is to integrate formally the factors influencing accessibility within a comprehensive framework to allow trade-offs among them and, at the same time, to ensure that choices

are made locally. Roads are normally planned by the ministry of transport, and implementing an accessibility approach requires close departmental cooperation between the various ministries (i.e. that of education for access to schooling, or that of health for access to hospitals) to the point of subordinating budgetary sums and allocations to an arbitration centred on accessibility.

FOFI 2: Strengthening governance

Reconstruction activities are designed to strengthen community and national management regimes.

Key indicators

- Where management bodies are not in place, a process is set up to establish an appropriate management body with the involvement of all relevant stakeholders (see guidance note 1).
- Inventories of all inputs are kept and provided to the government in a form that is appropriate and accessible to them (see guidance note 2).
- Government officers are engaged in the process of design and delivery of the reconstruction inputs – and provided with training to do so where required (see guidance note 3).
- Skills and capacity for managing infrastructure are developed early on in the reconstruction process to increase likelihood of sustainability after it has been handed over (see guidance note 4).

Guidance notes

1. **Management:** Fisheries infrastructure, whether it be a small landing or a port proper, must be managed and every effort must be made to ensure that fishing communities are directly involved in the management of landing sites. Ports require more technical input and this may not be available within the local community. In all instances, adequate training should be provided to the management body. FAO has published several books on this topic covering small artisanal landing sites all the way up to industrial fishing ports.
2. **Inventories**: Donors and agencies alike should discuss with the relevant government departments the most appropriate platform to provide and store inventories of all inputs. One of the industry standard packages is called SANDS (Shoreline and Near Shoreline Data System). It is a comprehensive Windows application geographical database system that over the past 20 years has evolved into an industry leading data capture, monitoring and analysis suite for asset managers, engineers, researchers and scientists. The software is now licensed to users around the world, ranging from national government agencies to research institutes.
3. **Government officers:** Government officers with experience in the fisheries sector will be knowledgeable in the local species harvested, fishing gear

in use, site selection and building materials and how and by whom construction may be implemented. Every effort must be made to utilize expertise during the reconstruction effort. Where opportunities arise, government officers should be engaged in training activities to develop their skills and knowledge of new approaches.

4. **Exit strategy:** Adequate training in the management of the facility should start early in order that the management body is fully capable of taking over the day-to-day management of the facility by the time reconstruction is complete. The types of challenges that the management body will need to be equipped to deal with include:
   - compliance with the laws, regulations and other environmental directives governing the fisheries sector (overfishing legislation, sizes of nets, closed seasons, etc.);
   - compliance with the regulations for the use of the facility (landing fees, bulk handling charges, sale of potable water, bulk fuel, etc.);
   - compliance with environmental conservation measures adopted by the planning authorities (waste recycling, spent-oil recovery, wet wastes disposal, etc.);
   - integration with other users as in the case of a non-exclusive facility for fishing vessels (landing jetty may double as a passenger landing stage for coastal taxi boats);
   - transparency in the decision-making process (to prevent private interests from taking over a public facility through unfair practices).

In order for the management body to perform its duties effectively, it must be commensurate with the size of the facility and the responsibilities expected of it, adequately funded and represent the whole spectrum of users.

FOFI 3: Technical and economic viability

The design of new or replacement infrastructure is based on robust technical and economic assessments of viability.

Key indicators

- Plans for reconstruction incorporate the latest revisions of the building codes even if these mean higher overall costs (see guidance note 1).
- An assessment of the availability and needs for power is undertaken prior to decisions being made on the provision of new equipment and facilities (see guidance note 2).
- The locations for reconstruction of fisheries infrastructure are selected based on an objective study of costs and benefits (see guidance note 3).

Guidance notes

1. **Building codes**: Agencies involved in the reconstruction effort should draw upon the experience of local building engineers or, where this is not

feasible, international consultants with experience in that particular field. Although this may mean higher overall costs, it is also a basic requirement for building back better. Standards and guidelines on construction should be agreed with the relevant authorities to ensure that key safety and performance requirements are met.

2. **Electricity:** In planning a reconstruction effort, agencies should carry out a power audit to decide how best to provide a community with its power requirements in a sustainable manner. The provision of mains power is the preferred option. However, in remote areas, for example, this may include converting public lighting and household illumination to run on solar power, which, though more expensive, is sustainable. The use of fuel-run generators should be kept to a minimum.
3. **Reconstruction of infrastructure**: Traditional sites for fisheries landings or ports may not necessarily be the best sites for reconstruction. Agencies and donors alike should be aware that life-cycle cost estimates that include maintenance and repair may indicate that a site should be abandoned in favour of a more protected site elsewhere.

FOFI 4: Construction procurement and implementation

Safe building practices, materials, expertise and capacities are used where appropriate, maximizing the involvement of the affected population and local livelihood opportunities.

Key indicators

- Where possible, materials and labour are sourced from local areas to support the local economy (see guidance note 1).
- Changes to building standards and practices incorporate measures to reduce the risks to the users of the facilities (see guidance note 2).
- The construction processes and sourcing of materials for all shelter solutions demonstrate that the adverse impact on the local natural environment has been minimized and/or mitigated (see guidance note 3).

Guidance notes

1. **Sourcing of materials and labour:** Where possible, local livelihoods should be supported through the local procurement of building materials, specialist building skills and manual labour – informed by rapid market assessments and analyses. If the local sourcing of materials is likely to have a significant adverse impact on the local economy or the natural environment, the following may be required: the use of multiple sources; alternative materials or production processes; materials sourced regionally or internationally; or proprietary shelter systems. The re-use of materials salvaged from damaged buildings, having identified the rights to such material, should also be promoted.

2. **Disaster prevention and risk reduction:** Construction resilience should be consistent with known climatic conditions and natural hazards and should consider adaptations to address the local impact of climate change. Changes to building standards or building practices as a result of the disaster should be applied in consultation with the disaster-affected population and the relevant authorities. If the national standards have not been updated to reflect adaptations, international standards should be selected in conjunction with local authorities and the stakeholders.
3. **Sourcing of construction materials:** The environmental impact of sourcing local natural resources, such as water, construction timber, sand, soil and grasses, as well as fuel for the firing of bricks and roof tiles, should be assessed. Customary users, extraction and regeneration rates and the ownership or control of these resources should be identified. Alternative or complementary sources of supply may support the local economy and reduce any long-term adverse impact on the local natural environment. The use of multiple sources and the re-use of salvaged materials, alternative materials and production processes (such as the use of stabilized earth blocks) should be promoted. This should be combined with practices to mitigate any potentially adverse impacts, such as complementary replanting of trees where local timber is being used for reconstruction purposes.

Resources and tools

Information resource	Web link	Relevance to the technical challenge
Maritime infrastructure		
Permanent International Navigation Congresses. 2010. *Mitigation of tsunami disasters in fishing ports.* Report 112. Brussels (PIANC, 2010).	http://www.pari.go.jp/en/files3654/389490581.pdf	A detailed review of experience of tsunami disasters and their impacts on ports worldwide along with recommendations on measures to mitigate impacts and cope with tsunami disasters, including structural countermeasures.
Sciortino, J.A. 2009. *Fishing harbour planning, construction and management.* FAO Fisheries and Aquaculture Technical Paper No. 539. Rome, FAO. 337 pp.	www.fao.org/docrep/013/i1883e/i1883e00.htm	A manual for both technical and non-technical personnel involved in the planning, construction and management of fishing harbours, highlighted key measures required to ensure integration of international standards into the design and operation of fishing harbours.

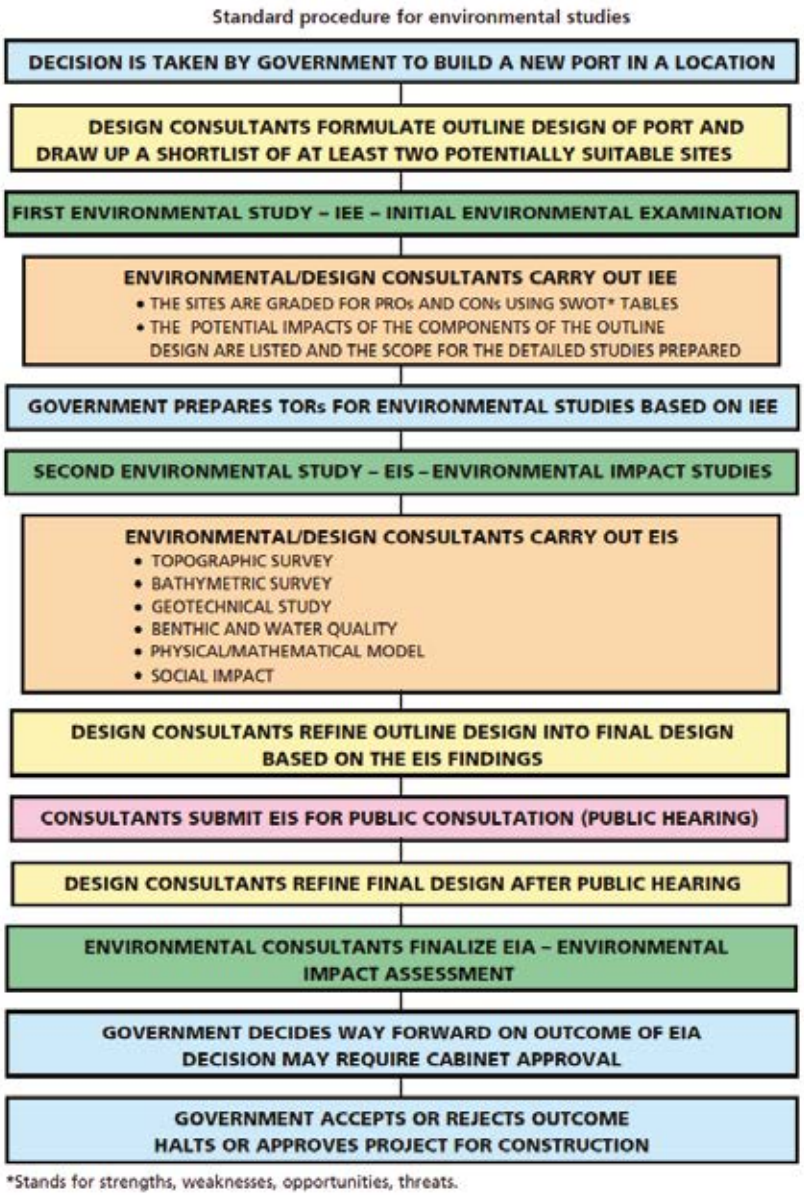
(cont.)

Information resource	Web link	Relevance to the technical challenge
Sciortino J.A. 2008. *Guide for the selection of location and design of sanitary standards for landing sites.* ART023GEN, EuropeAid OCT-ACP Programme. Brussels.	http://acpfish2-eu.org/	Guidance specifically addressing the issues regarding design and siting of sanitary facilities at fish landing sites
Building infrastructure		
Thusyanthan, N.I. & Madabhushi, S.D.G. 2008. Tsunami wave loading on coastal houses: a model approach. *Proceedings of the Institution of Civil Engineers: Civil Engineering,* 162(2): 77–86.	www.icevirtuallibrary.com/content/issue/cien/161/2	Description of experience in developing a design for houses with greater resistance to the effects of tsunami waves.
Medina Pizzali, A.F. 1988. *Small-scale fish landing and marketing facilities.* FAO Fisheries Technical Paper No. 291. Rome, FAO. 69 pp.	www.fao.org/docrep/003/T0388E/T0388E00.HTM	Reviews basic infrastructure and services needed at small-scale fish landing and marketing sites, with particular attention to the identification, planning and basic design concepts for fish landing and marketing infrastructure. Also provides case studies of fish landing and marketing facilities from Africa, the Caribbean and the Indo-Pacific regions.
Water supply and infrastructure		
Lytton, L. 2008. Deep impact – why post-tsunami wells need a measured approach. *Proceedings of the Institution of Civil Engineers: Civil Engineering,* 161(1): 42–48.	www.icevirtuallibrary.com/content/issue/cien/161/1	
World Health Organization. 1991. *Guidelines for drinking water – water quality.* Volumes 1, 2 and 3. Delhi, India, CBS Publishers.		
Ice and refrigeration in fisheries		
Graham, J., Johnston, W.A. & Nicholson, F.J. 1993. *Ice in fisheries.* FAO Fisheries Technical Paper No. 331. Rome, FAO. 75 pp	www.fao.org/docrep/T0713E/T0713E00.HTM	FAO Technical Papers dealing with different key areas of the cold chain in fisheries.
Londahl, G. 1981. *Refrigerated storage in fisheries.* FAO Fisheries Technical Paper No. 214. Rome, FAO.		
Johnson, W.A., Nicholson, F.J., Roger, A. & Stroud, G.D. 1994. *Freezing and refrigerated storage in fisheries.* FAO Fisheries Technical Paper No. 340. Rome, FAO. 143 pp.	www.fao.org/docrep/003/V3630E/V3630E00.HTM	

(cont.)

Information resource	Web link	Relevance to the technical challenge
Ice and refrigeration in fisheries *(cont.)*		
Shawyer, M. & Medina Pizzali, A.F. 2003. *The use of ice on small fishing vessels.* FAO Fisheries Technical Paper No. 436. Rome, FAO. 108 pp.	www.fao.org/docrep/006/y5013e/y5013e00.htm	
Huss, H.H., ed. 1995. *Quality and quality changes in fresh fish.* FAO Fisheries Technical Paper No. 348. Rome, FAO. 195 pp.	www.fao.org/docrep/V7180E/V7180E00.HTM	Technical paper outlining important aspects of fish quality and handling.
Port management in fisheries		
Verstralen, K.M., Lenselink, N.M., Ramirez, R., Wilkie, M. & Johnson, J.P. 2004. *Participatory landing site development for artisanal fisheries livelihoods. Users' manual.* FAO Fisheries Technical Paper No. 466. Rome, FAO. 139 pp.	ftp://ftp.fao.org/docrep/fao/007/y5552e/y5552e00.pdf	Papers giving guidance and discussing key issues relating to the management of fish landings and harbours, with a special emphasis on participatory processes and stakeholder engagement.
Ben-Yami, M. & Anderson, A.M. 1985. *Community fisheries centres: guidelines for establishment and operation.* FAO Fisheries Technical Paper No. 264. Rome, FAO. 94 pp.	www.fao.org/docrep/003/X6863E/X6863E00.HTM	
Siar, S.V., Venkatesan, V., Krishnamurthy, B.N. & Sciortino, J.A. 2011. *Experiences and lessons from the cleaner fishing harbours initiative in India.* FAO Fisheries and Aquaculture Circular No. 1068. Rome, FAO. 94 pp.	www.fao.org/docrep/014/am432e/am432e.pdf	

Tool 1: Standard procedure for and environmental impact assessment



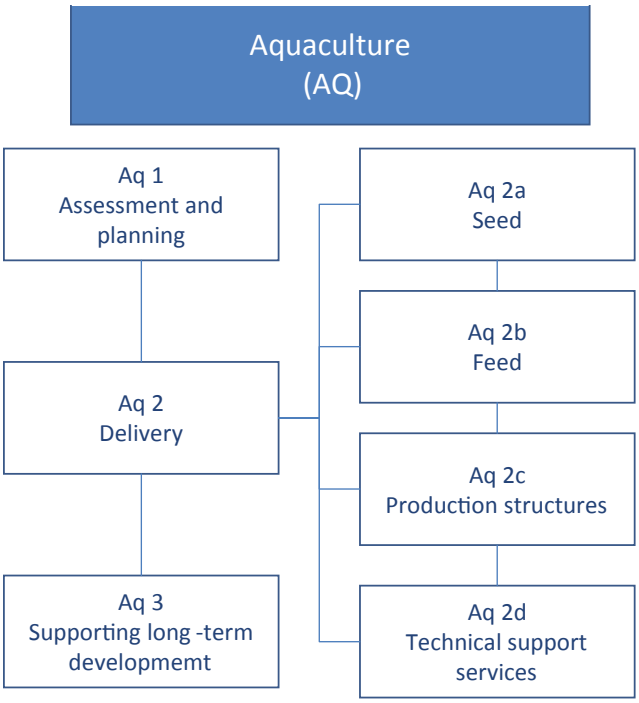
Tool 2: Building more resilient buildings

Tsunamis in Japan are a regular occurrence and this is reflected in the Japanese national building codes. Among other things, these codes specify that buildings in areas of probable impact are elevated on stilts and should include

a shear wall in axis with the probable direction of impact and that low-lying areas are provided with elevated safety evacuation platforms on which people may shelter until the water-level subsides.

Source: JICA.

BEST PRACTICE IN EMERGENCY RESPONSE IN FISHERIES AND AQUACULTURE 3: AQUACULTURE (AQ)



Introduction to aquaculture

Aquaculture can be an important economic activity both locally and nationally. It supplies protein for human consumption and, in some areas, is the only or the major source of high-quality animal protein. It also generates family income and local employment. Some aquaculture systems convert what would otherwise be waste into food and increase the productivity of a unit of farmland through integration with other on-farm activities. Through the use of polyculture and multitrophic farming, aquaculture adds value to water that in some places is scarce and it produces food in what might otherwise be unproductive waterbodies or land areas.

However, along with potentially significant benefits, aquaculture can also have impacts on both the environment and society. Other factors which should be considered include:

- the range of environments in which aquaculture is carried out, i.e. inland freshwater, coastal, land-based, brackish-water and marine areas. Culture sites in a landscape may straddle highlands, rainfed uplands, irrigated lowlands, floodplains, lakes, rivers and reservoirs, intertidal zones, and near-shore and offshore waters;

- the diversity of species that are cultured, i.e. invertebrates, vertebrates, molluscs and plants – the number of species now domesticated for culture exceeds 360;
- the types of production systems and containment mechanisms used in production, i.e. earthen ponds, floating cages, pens, raceways, tanks, recirculating closed and semi-closed systems, integrated with crop and/or livestock, enclosures in open water, or simply open water with ownership claim on the product;
- the range of production scales from small households to industrial scale. Very often small-scale production co-exists with large commercial operations;
- many of the regulations applied to aquaculture have their origins in other sectors, such as forestry, capture fishery, agriculture, transportation, irrigation, and health, and, where a code or law specific to aquaculture is yet to be enacted, these regulations from other sectors may be used to define responsibilities and regulations for the sector;
- the range of uses for aquaculture products, from wholly subsistence use to partly home consumption, partly for sale to entirely marketed or commercial operations;
- multiple interactions with other economic sectors;
- having to use and often compete for common property resources, especially water, with other sectors.

These represent a complex mix of biological, technical, economic, environmental, social and cultural factors, creating complications for the task of managing the risks that threaten, or the impacts on, the sector.

Aquaculture in the emergency context

The various components of the aquaculture production and supply chain are vulnerable to most risk events, which makes the tasks of protection and rehabilitation complex and demanding. Impacts on any one of those components will affect the system as a whole. For example, where hatcheries are affected by a hazard, the supply of seed for the next crop will be stopped or reduced and the impacts on aquaculture production can be prolonged. Table 12 sets out some of the typical risks to the different components of the production and supply chain.

TABLE 12
Typical disaster-related risks to aquaculture operations

Disaster types	Risks to aquaculture operations
Hurricanes/ cyclones	• Disruption of power if farm is connected to grid. • Spat collection rigs and farm structures damaged. • Damage to marine cages and seaweed crop and lines would be extremely severe. • Marketing timetable is upset; transport to market could be cut off or disrupted.
Tidal surges / tsunamis	• Coastal aquaculture – ponds, cages, mollusc poles and racks, rope, seaweed lines would be very severely damaged. • Farm structures destroyed; probable death of workers. • Ponds could be silted up or buried in silt, stones and debris. • Water intake systems could collapse or also be silted up; boundaries of farms could be obliterated.
Floods	• A sudden short duration flood can wash away land-based farms, erode topsoil and destroy water intake and outlet systems. • Influx of a huge volume of freshwater can shock and kill marine cage fish situated on estuaries; this can also affect seaweed and marine mollusc growing sites. • A long-duration flood would submerge farms and affect pond productivity.
Droughts	• Water conservation measures such as recycling, re-use and multiple use gain higher attention; potential for recirculation aquaculture systems and small ponds in integrated farms for water storage. • Water-use conflicts are exacerbated by scarcity. • Eutrophication and intense algal blooms of stagnant inland waterbodies such as lakes as well as enclosed bays where cage culture and mussel culture are sited. • Pond-based freshwater systems and floating cages on lakes and rivers cannot operate owing lack of freshwater supply. .
Severe winters	• Cultured species that cannot be overwintered or species that are not tolerant to cold temperature are killed. • Farm structures may be destroyed. • Energy supply may be disrupted.
Earthquakes	• Land-based systems: ponds; farm buildings, farm roads damaged; water intake and outlet system could collapse. • Farm to market roads could be rendered impassable. • Support services such as ice supply and refrigeration could be inoperable.
Volcanic eruptions	• Lava flow, ash, or lahar (fine silt) can smother vast areas of land and close all agricultural activities. • Operations cease and rehabilitation could be long term and costly; farms buried in lava could be beyond restoration.
Oil spills / chemical spills / chemical runoff	• Cage culture in coastal waters and seaweed culture (using monofilament lines or rafts) are also highly at risk to oil spills. • Closure of culture grounds for a relatively extended period until clean-up is complete.
Nuclear leaks	• Contamination of water and soils will force cessation of operations; obvious health hazard from radioactive exposure.

(cont.)

Disaster types	Risks to aquaculture operations
Epizootics / fish disease outbreaks	• Destruction of stocks to prevent spread of pathogens. • Impacts on broodfishes. • Limited operation with strict on-farm biosecurity measures.
Harmful algal blooms and hypoxia	• Closure of farming areas (molluscs and cage culture). • Early harvest if crop is marketable. • Fish kills or contamination of stocks; an extensive area of a waterbody is affected and the causes can be from aquaculture itself (excessive feeding and high-density culture), or another sector usually upstream or on land. • Mollusc farms are highly vulnerable and operations could cease. New areas may need to be opened for cage culture, which has implication for site access by cage farmers that have to relocate.
Complex emergencies	• Complete cessation of farm operations; paralysis of services (supply lines and market chain) would render production impossible or even irrelevant. • Threat to life and property. • Possible confiscation or destruction of physical assets.

Assessment challenges

Response to a disaster requires quick action and, given the complexity of aquaculture policy and operations, the appropriate expertise to plan and carry out relief and rehabilitation activities. In most disaster recovery efforts, local expertise has to be complemented by external specialists. However, familiarity with the social and economic circumstances, culture and political dynamics of the area make the local personnel invaluable to the work.

Larger-scale, commercial aquaculture operations may require different responses compared with small-scale operations. The crop and structures of these larger-scale operations are likely to be insured, and the investors and operators will have a greater capacity to access resources for rehabilitating their operations. Market-based but easier-term loans to enable such operators to rebuild and resume operation, along with technical advice from government scientific institutes, are likely to be the best way to support the recovery. A related question is whether their workers, who would probably be out of employment until the industry recovers, should be provided with relief assistance and temporary employment by government.

A more difficult situation is where the sector that is struck by a disaster consists of small-, medium- and large-scale operations, as with the milkfish (*Chanos chanos*) industry in the province of Pangasinan in the northern of the Philippines. In an emergency response in this industry, careful consideration would need to be given to ensure that larger operators did not end up monopolizing the benefits from the emergency response.

In the response period, the availability of labour to undertake reconstruction of aquaculture facilities may be in short supply – given the widespread demands in other sectors. This may have an impact on the timescale for the reconstruction work.

Harmful algal blooms, epizootics and hypoxia

Aquaculture operations are particularly susceptible to a range of hazards that have direct impacts on the health of the fish. These include epizootics, harmful algal blooms (HABs) and hypoxia. The first lines of response to these hazards are largely technical in nature and designed to ensure the maintenance or resumption of aquaculture operations.

Some of the key elements of the response to these hazards are outlined below, and direction is given to more detailed resources specific to these types of hazard. However, there are elements of guidance for emergency response to sudden-onset disasters given in the best practice section that are relevant to the response to these biological hazards (these are highlighted). This is particularly so where these hazards are not avoided or mitigated (i.e. where no early response system exists) and where they significantly undermine the aquaculture operations and the livelihoods of the fish farmers.

Epizootics: These hazards relating to fish disease usually have impacts predominantly on aquaculture, although some wild fish populations may also be affected. As a result, the immediate response tends to be very specific and technical in nature in order to address the biological hazard itself, although policy measures such as a restriction or ban on the trade and movement of fish and an information strategy may also be needed.

The options to mitigate the impacts include:

- implementation of containment measures to prevent the spread of the disease to uninfected areas;
- implementation of on-farm protection measures to prevent entry of disease in uninfected farms;
- destruction of stocks in infected farms;
- epidemiological research to determine the origin and pathway of the pathogen;
- diagnostic work to identify the causative agent, if it is unknown or not fully understood.

A communications strategy is also important, both for the farmers (to update with current status and required actions in relation to a disease outbreak) and for consumers. Similarly, training programmes to help farmers to cope with future occurrences of disease and avoid its occurrence in the future should be initiated (see aquaculture best practice – AQ 3).

For detailed guidance on responses to an epizootic emergency, see Reantaso and Subasinghe (2008).

Harmful algal blooms or **HABs,** particularly red tide events, may have impacts on aquaculture as well as wider impacts on coastal communities, on tourism, on wild fisheries and, in some cases, directly on people's health.

Some response options to mitigate the impacts of HABs on aquaculture include:

- For cage-based operations, move cages away from affected areas (if possible). This is often not possible – particularly for small-scale farmers who lack resources to move operations. In densely populated coastal areas, the competition for space may restrict the possibilities of movement.
- Transfer fish to land-based tanks.
- In bivalve farms, farmers can harvest the harvestable sizes. Otherwise, there is no way to prevent contamination of the standing crops. If the HAB species is not fatal to bivalves, farmers can delay cropping.
- Find viable alternative activities for small-scale operators, bearing in mind the complexities involved in livelihood diversification or change.
- Develop safety testing procedures for the aquaculture species.
- Strict regulatory enforcement to ensure that affected products do not reach market.
- A communications campaign for both fish farmers and the public.

Hypoxia, the condition of depleted oxygen content in water, can be the result of various factors, including pollution in enclosed bays and inland lakes. It can cause massive fish kills of cultured species in cages and pens.

Possible measures to avoid the occurrence of episodes of hypoxia, where intensive aquaculture development may represent a contributing factor, range from reducing the density of culture units to good management practices, especially in feeds and feeding. Aquaculture activity in areas subject to such events can also be restricted. A more strategic response (such as that of the Government of the Philippines in the case of the Philminaq project) might include: better management practices at the farm level; management and regulation of fish farming areas by local government; organization of fish farmers associations; and technical services such as environmental monitoring, training and extension. These are mitigation responses to reduce the likelihood and magnitude of risk of future occurrences.

Building back better

The emergency response process provides an opportunity to strengthen management of the aquaculture sector and improve the livelihoods of those who depend on it. Some of the key areas that can be strengthened include:

- improved zoning or density of culture units in order to reduce the risks of pollution and hypoxia;
- re-designing aquaculture facilities in order to reduce their footprint on the environment;
- in coastal areas, support for mangrove replanting to strengthen or re-establish wild nurseries for aquatic species;
- improved access to financial services to support aquaculture growth and development;
- improved risk management for small-scale fish farms;

- improved water-use regimes that provide a fair allocation of water for both crop irrigation and aquaculture and increase resilience of fish farming to drought.

Linkages with fishing operations in emergency response

There is a clear need to promote awareness and understanding among planners of the linkages between the production systems of fisheries and aquaculture. What happens in one sector can have significant implications for the other.

Where aquaculture and capture fisheries have both been affected by a disaster, trade-offs will inevitably need to be made in the allocation of resources to different sectors, including fisheries and aquaculture. This is the case particularly at the point where the focus in the response process shifts from humanitarian needs to the restoration of production and earnings capacity. Often, in making choices between capture fisheries and aquaculture, a greater emphasis will be placed on restarting capture fisheries that can yield fish for local consumption in a shorter period. However, provided planners understand the linkages between the sectors, aquaculture can also benefit from these early response efforts to restart capture fisheries. For example, the renewed supply of fish – particularly low-value fish – may benefit cage culture as it will make an important source of fish feed available.

Aquaculture can also benefit from the restoration of fisheries infrastructure (see FOFI), such as ice plants, processing plants and roads and the restoration of market linkages.

Possible negative linkages may include competition for labour and materials where major efforts are under way to repair fishing boats and gear, so limiting the labour and materials available for the rehabilitation of aquaculture activities.

Aquaculture (AQ) – best practice in emergency response

AQ 1: Assessment and planning

Aquaculture rehabilitation takes place in the context of ecosystem functions and services with no degradation of these beyond their resilience capacity.

Key indicators

- Assessments of damage cover the full aquaculture production chain (see guidance note 1).
- Rehabilitation is informed by an environmental impact assessment (EIA) (see guidance note 2).
- Rehabilitation projects are aligned with national development strategies and national aquaculture development plans, where they exist (see guidance note 3).
- Rehabilitation is based on appropriately informed and justified zoning and land/water-use planning (see guidance note 4).

- Rehabilitation is based on assessment of environmental carrying capacities and suitable production systems (see guidance note 5).
- An appropriate monitoring and evaluation system for the implementation of the production programme and the results is established (see guidance note 6).

Guidance notes

1. **Aquaculture production chain:** The production chain begins with the sources of inputs (suppliers of feed, seed [i.e. hatcheries], fertilizer, prophylaxes, and sources of operating capital and farm labour). Downstream of production are the post-harvest handling facilities (such as ice and containers), transport of product from farm to market, processing facilities and market infrastructure. The impacts of a disaster on these different components of the production and post-production chain need to be assessed so that the response can include a plan to either rehabilitate these linkages along the chain or find alternatives where this is not feasible. This may involve identifying alternative culture species and systems or alternative sources of seed.
2. **Environmental impact assessment:** For information about environmental impacts for aquaculture, the following FAO publication provides a comprehensive and practical guide: FAO. 2009. *Environmental impact assessment and monitoring in aquaculture*. FAO Fisheries and Aquaculture Technical Paper No. 527. Rome. 57 pp. Includes a CD–ROM containing the full document (648 pp.) (also available at ftp://ftp.fao.org/docrep/fao/012/i0970e/i0970e.pdf).
3. **National development strategies and sector strategies:** An aquaculture development strategy broadly defines the contribution of aquaculture to social goals (e.g. food security and sustainable livelihoods), economic goals (e.g. higher incomes, more employment, more export earnings or foreign exchange savings), and environmental goals (e.g. habitat protection and biodiversity conservation). It may also specify the desired outputs such as production, jobs generated and other tangible, measurable targets over a certain period, and the means to achieve those targets, and appropriate indicators. Very few countries have yet to formulate an aquaculture development strategy and plan, and those that have no specific plan for aquaculture usually include provisions for aquaculture within their fishery plan.

   In the absence of either a fishery or an aquaculture development strategy, those involved in emergency response for the aquaculture sector should consult with the state, provincial or local authorities to determine their social and economic priorities and the actual and potential role of aquaculture in helping to achieving them. This would be an opportunity

to incorporate aquaculture into local development strategies and plans and raise its profile in wider development planning.

4. **Zoning:** The most important reason for aquaculture zoning – which means designating a geographical area for fish farming in a broader agro-ecological zone – is to avoid conflicts with other users (e.g. other farmers, fishers, tourism operators and shipping companies). It is also easier to regulate and provide appropriate technical and marketing services to farmers if they are in a designated aquaculture zone. An aquaculture zone, coupled with transparent rules and regulations, is a signal to farmers and investors of government's intention to provide a favourable climate for aquaculture development and protect aquaculture investments. From a narrow environmental perspective, proper zoning in a coastal area that has mangroves could help re-establish a greenbelt where fish ponds had been built. The new zone could demarcate the areas where fish ponds can be established, leaving previous mangrove tracts to regenerate or to be reforested. In inland areas, aquaculture development may need to be incorporated into wider plans determining optimum use of land and water so as to avoid conflicts with agriculture and other rural sectors.
5. **Understanding carrying capacities:** The risks from exceeding the carrying capacity of a culture area are pollution of the water and the adjacent environment, conflict with other resource users, risks of disease spread and poor growth of cultured stock. The kinds of species and culture systems that should be promoted in a particular area depend on many factors but the important determinants would be:
   - The experience of the farmers with the species;
   - The market for the species;
   - How soon can the farmers harvest their crop of fish.

   Some species take a longer time to grow, which can tie up the capital of farmers looking for a faster turnover, particularly in the wake of a disaster or crisis. A good rule of thumb is to use the species that farmers have been farming in the past and are familiar with, but to introduce better farming techniques as needed, and develop a better link with buyers where possible.
6. **Monitoring and Evaluation (M&E):** The overall work plan for the production assistance can serve as the basis for M&E. The monitoring of its status can be assisted by the farmer clusters through a periodic reporting scheme. Monitoring and evaluating the implementation of the recovery plan and the result of production can be done on a cluster or group basis. An M&E system should capture the technical and economic performance of the farms. The system can help to show farmers the value of adopting "best practices" and improving their technical efficiency. For the donors, the system can help to show the value of their interventions. Some of the key elements of this system will be:

- A record-keeping form and protocol is developed, and the farmers and their wives are trained in record-keeping.
- A simple cost and return analysis of either the aggregate results or the results of a sample of farms is carried out.
- Indication of the total cropped area in hectare for pond culture. If cage culture, the total area of cages per crop per farm should be converted into hectares;
- Indication of the variable costs: cost of seed, cost of feed, total wages for hired labour, cost of fertilizer, cost of drugs and chemicals, cost of energy, interest paid on loan.
- Measurement of output: total harvest for the crop × price.
- Measurement of product directly consumed by producers. The spreadsheet provides a column that assumes that the difference between the volume harvested and the volume actually sold is consumed. It does not cost this consumed amount of harvest. However, the team may decide to cost the output regardless of whether part or all of it is sold; in this case, the total harvest is equal to the quantity sold. A zero value will appear in the "consumed" column.
- The average return per hectare per crop for individual farms and the average return per hectare per crop for all farms.

AQ 2: Delivery

The essential physical components and technical support for resumption of production are in place.

The indicators and guidance for this best practice statement are split into four components, which cover the provision of seed, feed, production structures and technical support.

AQ 2a: Seed

Key indicators

- Species provided for culture to replace destroyed stocks are as much as possible the same species farmed before the disaster (see guidance note 1).
- Hatchery-bred seed are promoted for culture and sourced from reputable hatcheries, screened and assured free of disease (see guidance notes 2 and 3).
- The size of fingerlings is such that it reduces exposure of the stock to risks and enables a quicker harvest (guidance note 4).
- Fingerlings are sourced as locally as possible (see guidance note 5).
- Codes of conduct and better practices are promoted for adoption by seed producers including brood farms, hatchery and nursery operators (see guidance note 6)

Guidance notes

1. **Starting with familiar species:** Aquaculture plays many different roles in different farmers' livelihood strategies. For example, a farmer may want to farm a species solely for sale, or for sale and consumption. It is rare to see fish farmers grow fish only for home consumption. Other farm households may also integrate their aquaculture enterprise with other farm enterprises such as crop, poultry or livestock. Some farmers may have the financial ability to raise a longer-maturing but higher-value species but, in most cases, smaller farmers would want a faster turnover. Many different factors that make up a farm household's livelihood will influence the strategy that it adopts. In an emergency context where time may inhibit an agency from understanding this, a starting point should be that farmers are provided with the same species that they farmed before the disaster.
2. **Seed testing:** The disease-free status of shrimp broodfishes, post-larvae and juveniles are commonly tested for disease by a test for polymerase chain reaction (PCR). Large shrimp hatcheries either have their own PCR labs or use government or private PCR testing services. The team should also be alert to information of disease outbreaks in certain regions or areas of a country and avoid procuring seed from hatcheries located in those areas.
3. **Reputable hatcheries:** A reputable hatchery usually has an established and larger clientele than others operating in the same area. In Bangladesh, for example, some hatcheries in one district serve farmers up to 300 km away because they have established a reputation for producing high-quality seed. They adopt practices such as:
   - aintaining a healthy broodfish of good genetic quality;
   - not competing on price but on quality;
   - establishing a strict on-farm biosecurity measure that prevents pathogens
   - from being brought in by people, animals, other aquatic species or even birds;
   - ensuring that broodfish acquired from other facilities such as government brood farms are certified.
4. **Fingerling size:** The size of fingerlings can be an important factor with finfish that are farmed for local consumption. Providing larger fingerlings can help to shorten the time until the first harvest and reduce the risk from disease. This may be particularly important after a disaster or emergency, as a good first harvest after resumption of production is a morale-boosting outcome for the community and the recovery workers.
   Larger fingerlings usually cost more because the hatchery (or nursery) spends more time and inputs growing them to a bigger size. The age of fry ready for stocking differ with species, and hatcheries. Veteran farmers will know the specifics of this.

Aid agencies will need to address how they should justify higher costs for larger fingerlings in order to support a better outcome. This may conflict with short-term tendering guidelines – which may specify that the cheapest offer should be taken.

5. **Transporting fingerlings:** Fingerlings should be acquired from local hatcheries if possible. This aims to avoid stressful transportation of fingerlings. Working with a local hatchery is also likely to be more convenient, and the required information on the seed is easier to obtain. Other measures that can help to reduce stress on the fingerlings include:
   - On delivery, use holding ponds or tanks for fingerlings before restocking programmes start. This will enable them to recover from the stress of transportation.
   - Where possible, transport fingerlings in the early morning or late afternoon to avoid excessive heat.
   - Use appropriate packing densities and containers to help to avoid stress.
6. **Introducing better management practices:** Having engaged seed producers in the supply of seed for recovery, the project should take the opportunity to introduce, wherever possible, better management practices for hatcheries and seed trading. The Better Management Practices (BMPs) for these segments of the supply chain have been developed in Viet Nam by the Sustainable Development of Aquaculture (SUDA) project (supported by the Danish International Development Agency [DANIDA]). Codes of practice in seed production and trading should complement the training.

AQ 2b: Feed

Key indicators:

- Formulated feed is promoted to replace low-value fish if the cultured species are carnivorous (see guidance notes 1 and 4).
- A proper feed storage and distribution centre for the community should be constructed to enable large bulk purchases and quicker distribution (see guidance note 2).
- Where people do not have the capital to procure feed, a certain percentage of the total support costs of fingerlings, nets and feed is given to support a sufficient growth rate in the first period of stocking (see guidance note 3).
- Training is provided in proper feed and feeding and health management (see guidance note 5).

Guidance note:

1. **Formulated feed:** The type of feed will depend on the species for culture, and it is important to recognize that formulation of the feed needs to be specific to the species and stage of growth, provided in a timely manner, and its quality maintained. There are three sources of nutrition for the

fish: (i) natural pond productivity such as plankton; (ii) supplementary feed, which may be farm made; and (iii) industrial formulations. Some species can simply live off the natural productivity of the pond, which has to be stimulated in growth by fertilization. It is difficult to grow plankton during the rainy season and, thus, supplementary feed is needed at this time. Carnivorous and cage-cultured species have to rely on feed provided to them. Carnivorous species are usually fed low-value fish, which can be readily available and cheaper than formulated pellets. However, this practice is ecologically harmful and there is the ethical issue of using fish to feed fish rather than people. Most studies also show that profitability can be better or the same with formulated feed. In addition, formulated feed is more convenient to store and use, thus saving time for other farm and household tasks. The disaster response can thus be an opportunity to introduce either the use of farm-made feed or industrially produced pellet feed.

2. **Feed storage centre:** Feed storage should have the capacity to contain a volume of feed for from three weeks to one month when the new batch of feed supply, which is specific to the current stage of growth of the stocks, replaces the previous type of feed (which was suitable to the younger growth stage). The storehouse should be dry, well ventilated and kept free of rodents and insects. It should be secure.
3. **Supporting operating costs:** The operating cost (for seed, feed, hired labour if needed, prophylaxis, and other variable costs) will depend on the species and culture system. All of the operating costs may have to be borne by the project if market-based financing (i.e. a bank loan or a microfinance programme) is not available. The feed cost will vary considerably depending on whether the species needs a high-protein diet (e.g. shrimp, groupers, cobia and other carnivorous marine fish) or a lower-protein diet (e.g. tilapia, milkfish and catfish), or simply supplementary diets (e.g. carps). Feed takes represents 40–60 percent of operating costs.
4. **Using bycatch for feed:** Fish bycatch are those fish caught along with the catch that are not of food-grade quality such as small juveniles. Low-value fish could be large food-grade fish that have been spoiled on board the fishing vessel. These are sold to farmers – usually cage culturists – of carnivorous species as the source of protein diet for the fish. Some cage culturists are also fishers and normally fish for food-grade fish but use the bycatch or low-value fish to feed their stock. Farmers believe that fish fed with low-value fish grow and taste better. Studies have shown that this is not the case. Moreover, a four-country study in 2009–2011 in Asia (China, Indonesia, Thailand, and Viet Nam) by FAO and NACA has shown that fingerlings of marine fish cultured in cages can also be trained to take pellet feed (contrary to a widely held belief of farmers). Therefore, whether the seed is from the wild or from a hatchery, marine finfish can be fed on pellet

feed starting from a juvenile stage. A profitability comparison showed that there was no significant difference between farms using low-value fish and pellet feed. However, it is more convenient to use pellet feed because it eliminates the preparation time for low-value fish, which usually takes 3–4 hours a day and is a task often carried out by women. The time saved could be used for other activities.

5. **Training:** A demonstration cage from one farm can be used for other farmers and/or their workers to observe how to feed fish properly. Basically, the aim of proper feeding is to have all of the day's ration consumed. The ration is calculated based on the estimated biomass in the cage or pond. Again, this depends on the species. A manual on feed and feeding milkfish, tilapia, Asian sea bass and tiger shrimp is available from the SEAFDEC Aquaculture Department's website at: www.seafdec.org.ph. Aquaculture research and development centres should have handbooks (see section on resources and tools) on feeding popular local species such as catfish, snakehead, giant freshwater prawn, and they should have a specialist to provide advice or help set up and conduct the demonstration. Feeding frequency is also important. Some farmers feed only once, practically dumping the entire day's ration in one feeding. Others feed twice, in early morning and late afternoon, preferably when the oxygen level of the water is high. Fish feed better when the dissolved oxygen in the culture water is high. The aquaculturist in the rehabilitation team can conduct the demonstration or seek assistance from a specialist.

AQ 2c: Production structures

Key indicators

- Farms that are less heavily damaged are given priority in recovery efforts (see guidance note 1).
- Facilities for culture are rebuilt, repaired or replaced in a way that strengthens their resilience to future hazards and enhances their contribution to long-term development (see guidance notes 1 and 2).
- Designs and construction standards of the facilities are improved (see guidance note 3).
- In a pond system, the layout of the pond system, intakes and discharge channels is designed to minimize the impact of effluent discharge on receiving waters (see guidance note 4).

Guidance notes

1. **Structures:** Culture facilities such as cages, ponds, pens and other containments would either have survived intact or with little damage, which indicates that the design and construction have been up to standard. If most were destroyed, the response would be an opportunity to improve design and construction standard. New materials may have to be introduced.

2. **Increasing resilience to future hazards:** Examples of improving resilience in aquaculture operations include:
   - Improving water intake gates. Water intake gates may have been eroded, broken or swept away because of poor construction; the structure should be built of sturdier material and protected from direct flood water or wave impact.
   - Pond dykes should be compacted better and, if possible, grass grown on top and on the embankment (this takes time, but a pond dyke covered with grass withstands erosion much better).
   - Cages on a protected bay need to be firmly anchored.
   - Replacement of bamboo and wooden cages by sturdier materials such as PVC and light alloys can be much more costly and small farmers may not be able to afford them, but they last longer and are stronger;
   - A powerful tidal surge or a tsunami will probably sweep cages or rip nets anyway so that an early warning system might give farmers time to harvest the stock or transfer them to land-based tanks or ponds (if any), or tow the cages to a more sheltered area, or empty the cages and raise the nets to limit damage.
3. **Building standards:** Opportunities to introduce improved building standards should be taken wherever possible. A range of appropriate materials for this are provided in the references and resources section below.

   Particular care is required in addressing construction issues in more complex aquaculture systems. For example, offshore marine cages are highly specialized structures that need specialist expertise, usually from manufacturers.
4. **Improving a pond system:** Water discharge from a pond aquaculture system in which the species is fed with formulated feed (such as shrimp) can have a high load of effluent. The rehabilitation could introduce an effluent treatment pond for the wastewater before it is discharged to public waters. The treatment pond can have *Gracilaria* seaweed growing in it and/or be stocked with mussels to reduce the effluent load further. Intake channels sometimes can be overgrown with weeds or have leaks or are narrow and prone to being clogged with silt, all of which reduce the efficiency of water distribution. These issues have to be resolved in the reconstruction.

AQ 2d: Technical support services

Key indicators

- Assistance is provided to critical production input suppliers such as feed producers/suppliers, fertilizer suppliers and other supply providers such as ice plants (see guidance notes 1 and 2 and FOFI).
- Contracts between input suppliers and farmers are developed with mutually agreed provisions on quality, schedule of delivery and price (see guidance note 4).

- A standard for quality of feed and seed is agreed as this would have a favourable impact on production outcomes (see guidance note 3).

Guidance notes

1. **Support services:** The quality, price and delivery of critical inputs are important factors. Therefore, the procurement policy and procedure should assure these attributes of the inputs, especially the timeliness of delivery.
2. **Strengthening relationships:** The response is also an opportunity to establish mutually beneficial linkages between the farmers (preferably associated) and suppliers of inputs, especially seed and feed which will be a recurring cost item. One example of a mutually beneficial arrangement is the farmers being able to demand a standard of seed quality but willing to pay a premium price and the seed supplier (hatchery) being able to guarantee the quality and delivery of the quantity needed in time.
3. **Establishing a standard for healthy seed:** The common visual indicator of a healthy seed is that the larvae, fry or fingerlings are swimming actively. PCR laboratory services can provide an analysis for known viruses. Some large hatcheries have their own PCR analytical service or use government or private PCR labs.

   Feed composition, especially protein content, is required by law to be printed on the packaging material. The rehabilitation team can ask for an analysis, as a check, if a feed analytical laboratory is accessible. Alternatively, it can purchase popular brands of feed. These are manufactured by large and well-established feed companies that will not risk their reputation by marketing substandard feed. However, the team should make sure that the feed is not old or contaminated by mould or fungus. New and clean packaging materials (bags, sacks) are a good indicator of freshness.
4. **Establishing contracts:** Contracts for provision of feed and seed should include: agreed purchase price; type of feed (floating or sinking – floating feeds are usually more expensive but sinking feeds can be just as suitable for certain species); and feed pellet size and formulation suitable to the growth stage of the fish, i.e. starter, grower, finisher; volume per delivery, and delivery date. Logistical arrangements can be either the dealer delivering or the rehabilitation team transporting the feed from the dealer's depot.

AQ 3: Taking opportunities to support development

Farmers are supported to build on the opportunities that the rehabilitation brings.

Key indicators

- Farmers are trained in good area management practices at the area level and in better farm management practices at the production level (see guidance note 1).

- Ability of farmers to better access markets is strengthened through organized marketing, access to market information, and adoption of product certification scheme (see guidance note 2).
- Farmers' access to market-based financial services is facilitated (see guidance note 3).
- Capacity of local governments and extension agencies for management and provision of technical assistance is strengthened through training (see guidance note 4).

Guidance notes

1. **Building capacity for communal action:** Experiences in shrimp aquaculture in particular have shown that better management practices and codes of conduct are more effectively adopted and implemented where farmers are organized into clusters or formal associations. Capacity building for adoption of BMPs and adherence to voluntary management mechanisms for farmers and field workers is critical to their successful adoption and sustained practice. There are now available better management practice manuals and good aquaculture practice guides that have been developed for shrimp (India, Indonesia, Thailand, Viet Nam), pangasius catfish (Viet Nam), carps (by FAO SEC, applicable for Central Asia and the Caucasus), brackish-water and near-shore aquaculture (the Philippines), marine cage culture (NACA and FAO for Southeast Asia and China). These have been tested in various situations including the rehabilitation of aquaculture in Indonesia after the Indian Ocean tsunami in 2004 by NACA, FAO and partner organizations. These are freely available and the expertise has been developed in India, Indonesia, Viet Nam and Thailand for their implementation. The principles apply to equivalent aquaculture systems anywhere in the world and the practices can be adapted for a particular production system and species (see References and Resources).
2. **Improving marketing:** At the start of the recovery process, the aggregate volume of product could be small, but pooling the harvest and developing an organized marketing scheme will increase economies of scale. The better management practice guidelines should be supplemented by the introduction of a quality certification scheme to introduce farmers to this market access tool gradually. The success of adoption of a quality certification scheme can facilitate the introduction during the later phase of the response of an environmental certification scheme or label. The Good Aquaculture Practice certification of Thailand for shrimp is basically a market access tool, the core of which are the quality and safety of the product. The achievements of the farming community should be widely disseminated and used to attract prospective buyers.
3. **Microfinance:** An important service that should be brought as part of project activities is microfinance. An NGO with this service or a formal

institution should be engaged to conduct the microfinance literacy training and to develop a microfinancing service, initially for the livelihood options being piloted, and subsequently for the aquaculture sector.

Rehabilitation projects are unlikely to have enough funding at their disposal to support entirely the capital requirements of livelihood projects. Even where they do, it is desirable to develop a market-based credit scheme for farmers and for other livelihood enterprises so that the beneficiaries are not reliant on subsidies, and to develop longer-term, more sustainable capacity to access finance in the future.

4. **Strengthening government:** The strengthening of the capacity of local government units and extension agencies can be achieved by involving their active participation in the planning and implementation of the various activities described in the preceding best practices. An enlightened local government that is made aware of the community's needs is likely to facilitate the processes and public services needed for a speedy rehabilitation. Projects can strengthen the relationships between local governments and farmers training courses – which help them to understand the good practices in aquaculture, or provide forums where local government officers can meet with farmers.

Resources and tools

Information resource	Web link	Relevance to the technical challenge
General Aquaculture		
The code of conduct for responsible fisheries (CCRF), (FAO, 1995).	www.fao.org/docrep/005/v9878e/v9878e00.HTM	
FAO Aquaculture Gateway pages.	www.fao.org/fishery/aquaculture/en and www.fao.org/aquaculture/en/	Extensive technical information available on all aspects of Aquaculture relevant to emergency response and preparedness. Links to networks, partners and technical publications
FAO Aquaculture technical focus areas.	www.fao.org/fishery/affris/species-profiles/en/ www.fao.org/fishery/affris/affris-home/en/ www.fao.org/fishery/topic/2801/en	Technical information on production by species, Technical information on aquaculture feeds and nutrition
FAO Simple methods for Aquaculture.	ftp://ftp.fao.org/fi/cdrom/fao_training/start.htm	A training CD with comprehensive coverage of basic methods in aquaculture

(cont.)

Information resource	Web link	Relevance to the technical challenge
Brugère, C., Ridler, N., Haylor, G., Macfadyen, G. & Hishamunda, N. 2010. *Aquaculture planning: policy formulation and implementation for sustainable development.* FAO Fisheries and Aquaculture Technical Paper. No. 542. Rome, FAO. 2010. 70pp.	www.fao.org/docrep/012/i1601e/i1601e00.pdf	Aquaculture policy and planning guidance.
FAO. 2010a. *Aquaculture development. 4. Ecosystem approach to aquaculture. FAO Technical Guidelines for Responsible Fisheries. No. 5, Suppl. 4.* Rome, FAO. 2010. 53pp.	www.fao.org/docrep/013/i1750e/i1750e.pdf	Guidance on the ecosystem approach to aquaculture
Emergency response and aquaculture		
Cattermoul, B.; Brown D. & Poulain, F. eds. (FAO, 2013a). *Workshop on Best Practices in Emergency Responses for the Fisheries and Aquaculture Sectors.* 15-16 April, Rome, Italy. FAO Proceedings, No. 30 Rome, FAO. 2013.	www.fao.org/docrep/019/i3431e/i3431e.pdf	Guidance on fisheries and aquaculture best practice in emergency response.
Arthur, J.R., Bondad-Reantaso, M.G., Campbell, M.L., Hewitt, C.L., Phillips, M.J. & Subasinghe, R.P. 2009. *Understanding and applying risk analysis in aquaculture: a manual for decision-makers* FAO Fisheries and Aquaculture Technical Paper; No. 519/1. Rome, FAO. 2009.	http://www.fao.org/docrep/012/i1136e/i1136e.pdf	Understanding and applying risk analysis in aquaculture: a manual for decision-makers FAO
Brown, D., Poulain, F., Subasinghe R. & Reantaso, M. 2010. Supporting Disaster Response and Preparedness in Aquaculture. *FAN (FAO Aquaculture Newsletter).* 45: 40-41.	www.fao.org/docrep/012/al363e/al363e.pdf	Supporting Disaster Response and Preparedness in Aquaculture
Bueno, P.B., M.J. Phillips, Arun Padiyar and Hassanai Kongkeo. 2008. "Wave of Change: Coping with Catastrophe". In: K.D. McLaughlin, ed. Mitigating Impacts of Natural Hazards on Fishery Ecosystems. American Fisheries Society Symposium 64. Bethesda, Maryland, USA.	www.fao.org/docrep/009/a0090e/a0090e00.htm	Guidelines on preparedness and responding to aquatic animal health emergencies in Asia

(cont.)

Information resource	Web link	Relevance to the technical challenge
FAO. (2005a). *Preparedness and response to aquatic animal health emergencies in Asia: guidelines.* FAO Fisheries Technical Paper. 486. R. Arthur, Christian Baldock F Subaasinghe R. and F. McGladdery FAO 2005.		
FAO. 2001. *Asia Diagnostic Guide to Aquatic Animal Diseases.* FAO Fisheries Technical Paper No. 402, Supplement 2. Rome, FAO. 2001. 240 pp.		
Bueno, Pedro B., Phillips, Michael J. Phillips, Mohan C.V., Padiyar, Arun, Umesh, N.R., Yamamoto, Koji and Flavio Corsin. FAO. 2007. *Role of better management practices (BMPs) in aquaculture insurance.* In: Secretan, P.A.D., Bueno, P.B., van Anrooy, R., Siar, S.V., Olofsson, Å., Bondad-Reantaso, M.G. and Funge-Smith, S. Guidelines to meet insurance and other risk management needs in developing aquaculture in Asia. FAO Fisheries Technical Paper. No. 496. Rome, FAO. 2007. 148pp.	www.fao.org/docrep/010/a1455e/a1455e00.htm	
FAO. 2009b *Environmental impact assessment and monitoring in aquaculture*. FAO Fisheries and Aquaculture Technical Paper. No. 527. Rome, FAO. 2009. 57p.	www.fao.org/docrep/009/a0583e/a0583e00.htm	

BEST PRACTICE IN EMERGENCY RESPONSE IN FISHERIES AND AQUACULTURE 4: POST HARVEST PRACTICES AND TRADE (PH)

Introduction

Post-harvest practices and trade in the fisheries and aquaculture sector are extremely important because they provide significant employment and result in food for domestic consumption and export. Fish is a product with a high turnover rate and, unless preserved or processed, it needs to be sold and consumed within a short time. Insofar as the post-harvest sector can be considered in isolation from primary production activities, it covers all operations that are undertaken between capture or harvest and the market. In addition, many fishers also engage in post-harvest activities on board their vessels, when they ice or otherwise treat their catches. In most fisheries, the post-harvest sector includes the infrastructure requirements for landing, ice supply, storage, processing, transport and market facilities.

A common way of understanding the components of post-harvest activities and the relationships between them is through value chains, which may focus on areas such as processing, supply of fish or marketing.

Understanding who is involved in the market chains is essential to ensuring recovery efforts are targeted correctly and recovery rapid. Fisheries market chains are in some cases strongly integrated with other productions chains and markets. In theory, they can be simple or more complex. A typical seafood value chain contains elements of: Harvesting or production from Aquaculture => Primary processing => Secondary processing => Wholesale =>Retail => Consumer. An example of a value chain for shrimp – produced both through aquaculture and caught in the wild is shown in annex ?.

The supply chain begins at the landing site with collectors who transfer the fish to wholesalers, as well as retail traders who buy directly. Collectors and/or retail traders can be categorized into those who walk, or use bicycles, motorcycles, canoes, boats, vans, freezer trucks. Their assets may include baskets, weighing scales, insulation/ice boxes and vehicles. Wholesalers and distributors can be located in fishing villages affected by the disaster or in nearby towns, which may or may not be affected.

Fish processing is often done by women and children. It includes handling such as cleaning (washing and gutting) and salting/drying or smoking fish. Cleaning can be done at the household level or is often performed on piece rates in processing camps/sheds (micro/small enterprises) and the extent depends on seasonality. As fish is a highly perishable commodity, during the peak fishing season, processors may work long hours that are geared to the times of fish landings. Drying or smoking fish and/or molluscs might be done at the household level as unpaid labour or in processing camps (micro/small enterprises) for wage labour or on piece rates.

Many different techniques are used to preserve fish quality and to increase its shelf-life. While these can be classified into several main approaches (below), local variations need to be described during the assessment. A significant amount of fish and aquatic product processing for local consumption and markets can take place at the household or community group level. Larger-scale commercial processing can be carried out and contribute to national food supplies and for export. The main types (or combinations) of processing include:

- ice and chilling;
- drying, salting, smoking (hot/cold smoking) and freeze-drying;
- canning (techniques such as cooking, blanching, pasteurizing, sterilizing), ionizing irradiation (for pasteurization or sterilization) or microwave heating;
- fermentation, marinading or pickling sometimes called “biopreservation”;
- vacuum packaging (sometimes with the use of CO_2, O_2 and N_2 and refrigeration).

Post-harvest practices and trade in the emergency context

Depending on the seriousness of a natural disaster, the net result on the post-harvest sector may be destruction of facilities and loss of production. This leads to severe disruption of livelihoods as incomes disappear. Table 13 shows some of the typical risks to the post-harvest sector from different types of hazard.

TABLE 13
Risks to the post-harvest sector from different types of hazard

Disaster types	Typical risks to post-harvest practices and trade
Hurricanes/cyclones	Destruction of infrastructure and disruption of livelihoods. Threats to environment
Tidal surges / tsunamis	Largely as above but more damage to facilities – washed away
Earthquakes	Physical destruction
Volcanic eruptions	
Floods	
Oil spills / chemical spills and long-term release of pollutants	Long-term public health impacts – contaminated environments leading to lack of confidence in product safety
Nuclear leaks	Potential health effect on community, specifically women of child-bearing age and neonates Low demand for seafood from affected areas leads to low earnings
Drought	Lack of water for ice and processing aquaculture production affected
Complex emergencies	Destruction, contamination (possibly long-term), loss of transport and negative impact on resources
Conflict and the aftermath	Impacts on markets and relationships in the value chains

In addition to those hazards that pose a particular risk to the infrastructure and activities within the post-harvest sector, there are also significant hazards that affect the suitability of the fish resources for consumption. The insidious long-term health effects of the release of polycyclic aromatic hydrocarbons (PAHs) from oil spills, polychlorinated biphenyls (PCBs) and dioxins as well as heavy metals from industrial processes into the aquatic environment can result in severe damage to human health if not monitored and controlled (FAO/WHO, 2011).

These include:

- **Polycyclic aromatic hydrocarbons:** PAHs reach the food chain from oil spills either from solution or from particulate matter, sediments or contaminated

feed. They are carcinogenic but are metabolized to polar compounds in the body. These accumulate in the gall bladder and are excreted. Although they rapidly decline in finfish they are more persistent in molluscs. Chemical monitoring is very expensive but sensory analysis is used as a control measure. If a trained taste panel does not detect taint, then the products are fit to eat;

- **Polychlorinated biphenyls:** PCBs cover a wide range of compounds resulting from industrial processes. Their ingestion results in cancer and a number of serious non-cancer health effects on the immune system, reproductive system, nervous system, endocrine system and others.
- **Heavy metals**: In particular, mercury and cadmium from industrial processes and the natural environment enter the aquatic food chain. Both are potent toxins. Mercury is a neurotoxin, causing neurodevelopmental defects in neonates and young children and increased coronary heart disease in adults. Cadmium causes neural tube defects and is toxic to many organs and tissues including the heart and bones. Seafood products have been an important vector for human intoxication by mercury and cadmium.

Long-term pollution effects are considered slow-onset disasters. For example, the pollution of Minamata Bay, Japan, with mercury from mining activities started in 1912, but the critical impact on the health of people consuming fish from these waters was not seen until the 1950s. Droughts and the effects of climate change are other examples of slow-onset disasters.

Assessment

The post-harvest component of the assessment must be integrated with all other aspects of fisheries and coordinated closely, through the national ministry responsible for fisheries, with other government ministries, particularly agriculture, health and trade as well as civil society organizations. Examples of the key assessment challenges include those presented in brief below.

Understanding the supply chain: In planning for the emergency response, it is important to determine which system of supply is in operation in landings affected by the disaster. Supply chains of fish and other aquatic products are intricate and can vary according to landing site, region and country. They also vary for fresh, live and processed fish products, as well as by-products such as fishmeal, chicken feed, lime and fertilizer. At some landing sites, buyers and/or collectors will be organized in an auction system, while others will have monopsony, monopoly or cartel systems, or a combination. In the latter systems, fishers may receive credit from buyers for fishing equipment/inputs, are often indebted and obliged to sell to specific buyers.

Considering the seasonal affects: If the disaster strikes during the high fishing season, the loss of income from processing can have consequences for survival in the low season, as women are more likely to put aside savings (in

the form of cash, jewellery) for lean times. Understanding the seasonality of post-harvest practices and trade is critical to directing the most appropriate assistance. In developing a seasonal calendar, the types of questions that it should cover include:

- What proportion of fish and aquatic products (fresh, live, processed) in the community are consumed vs sold?
- Who is involved in processing – specific ethnic groups, women, men, and male or female children?
- How is processing organized – household labour/wage labour or piece rate in micro/small enterprises?
- What types of fish/other aquatic species during which months – seasonality?
- What kinds of methods – cleaning, gutting, washing, drying, salting and/or smoking?
- What resources are used – utensils, equipment, buildings, water, ice, salt and/or fuel?
- To what extent have the access to these resources been affected by the disaster?

Selecting beneficiaries: Experience shows that the process of selecting beneficiaries to receive assistance must be done carefully, together with representatives from fishers organizations and dedicated, honest local officials. This is particularly true in the replacement of the more valuable assets, such as large items of fish processing equipment and fishing vessels.

The danger of ice plants: A persistent source of failure within the post-harvest sector has resulted from attempts to build ice plants in unsuitable locations, particularly in the absence of electrical power. These have often been gifted to cooperatives, sometimes formed for the purpose. Some well-intentioned donors, as well as some international agencies, have failed to recognize that an ice plant is a sophisticated piece of equipment that needs good management, maintenance and a supply of spares and clean water. These have frequently been unavailable in the locations selected, where electrical power is often sporadic or unavailable. After opening with great fanfare, the classic path to failure includes reliance on one generator, not designed for continuous operation (no back-up set provided), with a breakdown followed by lack of expertise for repairs and funds for spare parts. Operations are suspended and during a period of inaction equipment is stolen and the plant is then in terminal decline. Off-the-shelf plants are often not designed to operate in harsh marine environments and corrosion limits their life span. Funds are seldom set aside for replacement. Unless power and good management are available, it is usually a better option to produce ice in a central location and to distribute to landing centres by insulated truck, which can also return carrying fish.

Linkages with fisheries and aquaculture

Fisheries and aquaculture are food production activities that require a series of linked and coordinated components. The damage and early recovery needs assessment of the whole fisheries sector conducted after an emergency should describe these linkages and demonstrate their interdependence. Some of the specific linkages that are likely to be found are described below.

Food and nutrition security: With regard to food and nutrition security, the loss or damage to post-harvest assets and infrastructure means that for a period the contribution of fish to the food supply is seriously reduced. There may be a simple cause, such as the loss of fish boxes following a flood or cyclone, that can be quickly overcome, or the more serious destruction of infrastructure – ice plants, storage facilities, roads, distribution network, etc. Until these are rebuilt, fish production and marketing will be constrained, and rebuilding may require long-term programmes. This situation can compound the threat to food security caused by lack of incomes and low food availability following destruction of transport links and markets.

In the emergency context, the first priority is to ensure the provision of adequate supplies of clean water and safe traditionally accepted staples, without particular regard to nutritional quality in the early stages, but assuming sanitary conditions are met. Subsequently, the quality of the diet can be improved. Although fishing communities are traditionally fish consumers, the direct role of fish in food security for this community is often overemphasized. Income from fisheries, as wages or profits, allows the establishment of culturally acceptable eating patterns that define a food secure family or community. However, where fish is used for emergency feeding programmes outside the fishing community, great care should be taken that fish is culturally acceptable to the beneficiaries and that it fits within their traditional food habits.

Capture fisheries: In the capture sector, when fishing vessels and equipment are damaged or lost, a vital first link in the value chain is lost. Until they are repaired or replaced, there will be no fish to market. The post-harvest sector will suffer as well. A first priority is the replacement of productive assets of individuals in all sectors of fisheries. These range from vessels and gear to equipment used for processing and sheds for storage.

Infrastructure: The post-harvest sector depends heavily on infrastructure such as landing centres and market facilities that are normally provided by government at a national or local level. Because of the high costs involved, great care must be taken in planning reconstruction.

Much of aquaculture production from developing countries is high-value shrimp destined for export, so it is vital that the linkages be close between the regulatory authorities involved in the control of aquaculture and the competent authority controlling food safety during production. The government's competent authority for issuing health certificates for export (of capture and aquaculture products) also has the responsibility of ensuring that

these products meet the requirements of the importing country. Equally, for the domestic market, there must be close coordination on quality standards and safety between those regulating aquaculture and processing.

Post-harvest practices and trade (PH) – best practice in emergency response

PH 1: Assessment and planning

Response plan is based on a detailed analysis of the post-harvest sector.

Key indicators

- As an immediate follow up to a damage and early recovery needs assessment, a rapid post-harvest overview (PHO) is undertaken before post-harvest interventions start (see guidance note 1).
- The response incorporates the diversity of the stakeholders in the post-harvest sector at the local and national level (see guidance note 2).
- Plans identify opportunities for rapid asset replacement in the small-scale processing sector that can help to restart production and fish distribution (see guidance note 3).
- All equipment provided, at this and later stages, is suitable, familiar, meets any relevant standards and is available locally (see guidance note 3).
- Planning of large infrastructure replacement projects is integrated with future fisheries, community and national development plans (see guidance note 4).

Guidance notes

1. **Understanding the supply chains:** Schematic representations of the supply chains of fresh and processed fish, as well as other fisheries-related products, need to be done through focus groups and key informant interviews to determine the typical patterns for a community affected by the disaster. This is necessary in order to assess the extent to which a given supply chain has been affected and to calculate losses in the various links of the chain. An outline is provided in the Tools section at the end of this document. Post-disaster reconstruction that focuses on delivering fishing craft and gear to producers without a careful assessment of supply chains and the steps to rehabilitate these chains will have adverse consequences for the sector as a whole.

   To assess how the disaster has affected supply chains, the key questions include:

   - What is the predominant form of trading at the fish landing site?
   - What proportion of fishers is indebted to buyers?
   - Who are the collectors and/or traders (gender, ethnicity)?
   - Where do the collectors and/or traders come from (local, regional, national and/or international)?
   - What types of equipment is used in trading?
   - What types of transportation are used?

- What are the most commonly caught fish and/or aquatic species at the landings?
- What prices are paid for these? Are fishers paid at per kilogram, piece or string rates?
- What are the terms of trade for fishers? How do these differ during high and low seasons?

2. **Stakeholder analysis:** Information collected from all those involved in post-harvest activities and from the community at large informs a stakeholder analysis, which indicates the extent of rehabilitation necessary. Assuming funding is available, purchase and distribution of replacement assets can begin. To avoid generating dissent in the community and appropriation of inputs by special interest or elite groups, extensive and public consultation with community representatives, fishers organizations and leaders to identify beneficiaries is essential. Particular attention should be directed to ensure gender equity as women often miss out as beneficiaries – in most cases, more than 50 percent of those working in post-harvest activities are female.
3. **Restarting activities:** Rebuilding the cash economy rapidly as soon as fish landings restart can be encouraged by replacement of small-scale processing assets. However, all the equipment should be familiar to the processors and available from local sources. This may involve racks for simple drying operations, salt and/or fuelwood for production of smoked or salted fish or even bicycles or motorcycles with insulated boxes for the distribution of fresh fish to nearby areas. In general, this is not a good time to introduce new technologies, but checking with beneficiaries and government staff on normal activities in the community will ensure that familiar equipment is provided.
4. **Integrated planning:** Replacement of large items of infrastructure, such as landing centres, markets, ice plant and/or refrigerated storage, should be delayed until the situation stabilizes, but the planning can be initiated earlier. However, consultation with national officials on future fisheries development plans and with the community on its needs is essential.

PH 2: Strengthening governance

Emergency assistance to post-harvest activities and trade strengthens government policy and strategy.

Key indicators

- Government staff are thoroughly involved with international experts in both the planning process and rebuilding activities (see guidance note 1).
- Inventories of inputs to the sector are kept and provided to the relevant government agencies (see guidance note 2).
- Post-harvest sector overview and value chain analysis contributes to the future development plans, which take into account national and regional

provisions and international instruments, such as the FAO Code of Conduct for Responsible Fisheries (see guidance note 3).

- Plans for large infrastructure projects (landing centres, markets, ice plants. etc.) for which the government is responsible use local expertise for design and are tendered in a transparent and accountable way (see guidance note 4).

Guidance notes

1. **Building a working relationship with government:** In cases where there is a competent cadre of government staff, it is important that international experts charged with planning rehabilitation liaise closely with them and ensure that they are empowered and have their capacity enhanced by the opportunity of working together. There are post-disaster situations where local staff are traumatized in the early recovery phase, or alternatively where government capacity is weak. It is the responsibility of international experts to mentor national expertise and to strengthen national competence while conducting their mandated missions.
2. **Transparency:** The international experts should not work in isolation but ensure that the government at all levels is provided with information on and fully understands what rehabilitation efforts have been undertaken as well as receiving copies of all inventories for future reference.
3. **Meeting guidelines:** Where regional or national standards and guidelines are available, these should be followed, but overall compliance with the provisions of international instruments should be ensured. Guidance can be sought from the FAO Code of Conduct for Responsible Fisheries (Code) by checking rehabilitation and reconstruction plans against the general provisions of the Code. More specifically post-harvest reconstruction activities should be in concert with Article 11.1 of the Code, and considerations on restarting trade are governed by Article 11.2 of the Code.
4. **Provision of large infrastructure**: Provision of large infrastructure items for which the government will be responsible must be compatible with what exists elsewhere. For this reason, local knowledge and capacity (i.e. technical people who are familiar with the situation) should be employed in the planning and supervision of construction. To satisfy international donors, all attempts must be made to ensure that the process of tendering for any requirement is honest and transparent.

PH 3: Technical and economic feasibility

Replacement of major infrastructure is appropriate to the community and is based on an analysis of its role in the value chain and technical and economic feasibility.

Key indicators

- Replacement infrastructure is economically justified, professionally planned and constructed following national building codes (see guidance note 1).

- In the absence of power supplies, maintenance facilities and professional management, ice plants are not constructed (see guidance note 2).
- Possible topographical changes as a result of the disaster are considered in infrastructure replacement plans (see guidance note 3).

Guidance notes

1. **Economic feasibility:** Major items of infrastructure such as landing centres, markets, refrigerated storage facilities and ice plants must be justified in economic terms by the expected utilization and operating costs. Investigation of these must take into account the general economic conditions. While it can be very beneficial if large items of infrastructure are rebuilt to better reflect modern technology and demand; this should only be done if the additional expenditure is economically sound and if the technology can be supported by the community. In all cases, it should be planned together with national expertise and follow national codes, if available. Otherwise, the general prescriptions of the FAO/WHO Codex Alimentarius Code of Practice for Fish and Fishery Products should provide the guidance.
2. **Ice plants:** Lack of ice is a serious constraint on the generation of income from fisheries and aquaculture. However, major mistakes have been made with the provision of ice plants. These are expensive and sophisticated pieces of equipment. Unless suitable conditions exist for construction of an ice plant, it may be preferable to distribute ice from a large central plant by truck in insulated containers. A complete checklist adapted to all situations is impossible, but the following conditions must be met:
   - Ice is unavailable nearby (i.e. no opportunity to provide ice from a central plant in insulated containers that can be used for back-freight of fish to markets).
   - Reliable power supplies at appropriate costs are available – failing this, it must be economically feasible to use diesel generators and to provide two generators (one for backup).
   - The community must possess the technical capacity for maintenance and repair as well as access to spare parts.
   - Adequate professional management is available – be very wary of the suggestion of cooperative responsibility.
3. **Topographical changes:** Depending on the nature of the disaster, major changes may have occurred in coastal topography, such as volcanic eruptions, tilting following earthquakes, effects of water impoundment caused by flooding, wind action, and tsunamis. These must be evaluated before any reconstruction planning is started.

PH 4: Markets and trade

Actions respond to market demands and are consistent with trade regulations.

Key indicators

- Landing centres and auction facilities are appropriately sized to the market requirements, allowing for development (see guidance note 1).
- Transparent information on market prices prevents profiteering by intermediaries (see guidance note 2);
- Seafood imports and exports meet the established quality and safety standards (see guidance note 3).

Guidance notes

1. **Facilities:** In the pressure to rebuild that follows emergencies, there are significant risks that basic planning questions will be overlooked, which can lead to unsuitable landing centres and market premises. Typical problems have been construction of overlarge facilities or unsuitable locations. Site-specific investigations are needed before planning and reconstruction. They should be governed by local knowledge but take into account the following considerations:
   - average daily or peak seasonal volumes;
   - anticipated market demand;
   - management responsibility – if cooperative management is proposed, what is the track record in the community;
   - the technologies involved are within the capacity of local people;
   - vessel landing facilities are adequate for the size of vessel anticipated and have not been affected by topographical changes;
   - access is not constrained by poor roads, and the location is convenient to dwelling areas;
   - freshwater of potable quality, power, fuel and other inputs are available.

2. **Market information:** It is difficult in the short term to establish market information systems to distribute price information to stakeholders, but whiteboards at auction premises can help. In addition, an effective communication strategy can be used to provide prices via the local media (print, radio and television). It may also be possible to build a market information network into post-emergency projects for national fisheries development, such as a system that provides prices in major markets regularly by text messages.
3. **Quality and safety standards:** Quality and safety standards implemented at industry level are best controlled by the application of a comprehensive Hazards Analysis and Critical Control Point (HACCP) and traceability system that covers the whole process from capture or harvesting either to domestic consumption or export. Information for implementation is given in the resources and tools section. The industry must meet the

established required standards, and compliance therewith is monitored by the government's competent inspection authority. Guidance on the role of the competent authority is given below.

PH 5: Monitoring

Systems are established to monitor and report on the safety and sustainability of the resources.

Key indicators

- Following oil spills or toxic chemical releases, the environment and the food chain are surveyed for pollutants (see guidance note 1).
- Systems to check long-term accumulation of pollutants in apical predators are established (see guidance note 2).
- Resource management plans include the economic impacts on fish processing and marketing when determining such things as total allowable catches and allocation of quotas (see guidance note 3).
- Once a disaster is recognized, a scientific risk analysis is conducted of the impacts on the resources and ecosystem, leading to a risk management plan and a risk communication plan, which is applied to consumer safety and used to inform consumers on food safety issues (see guidance note 4).

Guidance notes

1. **Monitoring impacts:** If the government has no regular food chain monitoring programme, or lacks the technical capacity to implement one, this must be contributed by international assistance. All consumers will become concerned by perceived threats to their health, and the result is that sales of fish collapse, with the concomitant loss of livelihoods. As chemical analyses for many pollutants are complex and expensive, surrogate methods, such as taste panel analysis for oil pollution, should be used where possible for routine control, with a small number of chemical analyses for confirmation.
2. **Long-term programmes:** All governments should have in place routine monitoring of mercury and cadmium in apical predators and should be encouraged to contribute their results to regional or international databases.
3. **Post-harvest is included in fisheries and aquaculture assessments:** While the post-disaster resource assessment is not a post-harvest issue, participation in the planning and discussion of the output should ensure that the community remains at the centre of the ecosystem and, within the parameters of good fisheries management, is not disadvantaged by issues such as the allocation of quotas. Mechanisms should be put in place to ensure the future participation of community and fishers association groups in management planning.

4. **Risk analysis:** The principles of risk analysis are covered in detail in various Codex Alimentarius documents. The capacity for adequate risk analysis is a necessary function of a government food safety system and is a prerequisite where fish exports are anticipated. Although not a first priority following a disaster, it should remain at the forefront of follow-up actions and be conducted as soon as possible so that weakened consumer confidence does not cause loss of markets. In summary, the first activity is a risk assessment to determine the level and seriousness of a risk to the integrity of the food chain. This information is used by government food safety authorities to manage or control the risk. Subsequently, through government action, linked to the media and civil-society organizations (including consumer groups), the risk is communicated and explained to the public. A functioning communication strategy is required. Confidence in the safety of the food supply is best maintained by transparency, particularly from the government agencies concerned. Having in place the capacity for scientific risk analysis that can be deployed in an emergency contributes to these goals. The principles of risk analysis are contained in the Codex Alimentarius publication *Food safety risk analysis* and an FAO publication *Guidelines for risk-based fish inspection*.

PH 6: Public health and safety

Public health safety and the quality of fish products are strengthened through recovery activities.

Key indicators

- The rehabilitation of government inspection systems is based on the Codex Alimentarius and its accompanying standards, while following national regulations (see guidance note 1).
- The government's role in fish inspection and quality assurance is resumed after re-equipment and capacity development of staff (see guidance note 2).

Safe products for domestic markets that meet national health and safety standards, and export products that meet the standards of the importing country are ensured (see guidance note 3).

- Reconstruction plans demonstrate the incorporation of the Codex Alimentarius Code of Practice for Fish and Fishery Products as the standard for reconstruction and meet national building codes (see guidance note 4).
- There is close coordination on feed and food product quality and safety between those regulating aquaculture and processing (see guidance note 5).

Guidance notes

1. **Government inspection:** The required national staff capacity and the quality of laboratory facilities depend on the nature of the fishing industry. In the case of a fishery providing fresh fish to local consumers, it is generally sufficient to have routine surveillance by public health or

municipal health inspectors. If any level of processing takes place, and for export in particular, dedicated facilities and staff in a competent authority named by the government are mandatory. For export, the laboratories need to be fully accredited. There are differences among countries as to which government department has the responsibility for food safety aspects of fish inspection; in some cases, it is a responsibility of the fisheries department, in others of the health ministry. However, the fish inspection authorities in importing countries insist that exporting countries implement equivalent levels of control of quality and safety – so there are no shortcuts.

2. **Staff training:** Trained staff and the necessary equipment for complex analyses cannot be provided as emergency assistance. Where these are not available, in-country analyses will have to be done elsewhere. Strengthening of the capacity for fish inspection and the associated laboratory requirements should be planned as part of the longer-term development.
3. **Food safety:** Food safety is an absolute prerequisite and cannot be compromised. This is true for domestic consumers as for those in the countries to which fishery products are exported. National and international standards are clear as are the guidelines on how to achieve them. In the absence of national regulations those in the Codex Alimentarius Standards, supported by the Codex Code of Practice for Fish and Fishery Products should be applied.
4. **Standards:** At the planning stage, it is important to ensure that all facilities and equipment inputs meet any existing national government codes and standards and are coherent with the provisions of the Codex Alimentarius. Unless this is achieved, it will not be possible to guarantee that product quality and safety standards can be met.
5. **Traceability:** Fish inspection and routine analysis are used to ensure the safety of products from capture fisheries. For the products of aquaculture, which are intensively fed, the quality and safety of the feed must also be monitored to ensure that feed contaminated with pathogenic micro-organisms, pollutants or parasites does not enter the production cycle. Frequently, this is under the control of veterinary services, rather than the fish inspection authorities; demanding close coordination between them.

Resources and tools

Information resource	Web link	Relevance to the technical challenge
Fisheries management and governance		
FAO. 1995. *Code of Conduct for Responsible Fisheries.* Rome. 41 pp.	www.fao.org/docrep/005/v9878E/V9878E00.htm_	Present a set of non-binding principles to improve the governance of fisheries and are relevant to guiding rehabilitation efforts.
FAO. 1998. *Responsible fish utilization.* FAO Technical Guidelines for Responsible Fisheries No. 7. Rome. 33 pp.	www.fao.org/docrep/003/w9634e/w9634e00.htm	
FAO. 2009. *Responsible fish trade.* FAO Technical Guidelines for Responsible Fisheries No. 11. Rome. 23 pp.	ftp://ftp.fao.org/docrep/fao/011/i0590e/i0590e00.pdf	
Food safety		
Codex Alimentarius Standards	www.codexalimentarius.net/standard_list.asp	List of all accepted standards, including for fish and fishery products. Essential to meet export quality and safety standards and the best guide for products for the domestic market.
FAO/WHO. 2009. *Codex Alimentarius Code of Practice for Fish and Fishery Products*. Rome. 144 pp.	ftp://ftp.fao.org/docrep/fao/011/a1553e/a1553e00.pdf	Provides guidance on how to achieve standards, maintenance of quality and safety, construction of premises for the handling, storage and processing of fish, cleaning and a wide range of other issues.
Lee, R., Lovatelli, A. & Ababouch, L. 2008. *Bivalve depuration: fundamental and practical aspects*. FAO Fisheries Technical Paper No. 511. Rome, FAO. 135 pp.	www.fao.org/docrep/011/i0201e/i0201e00.htm	Safe, effective bivalve mollusc depuration is essential following disaster events.
FAO. 2009. *Guidelines for risk-based fish inspection*. FAO Food and Nutrition Paper No. 90. Rome. 89 pp.	www.fao.org/docrep/011/i0468e/i0468e00.htm	Describes the food safety hazards associated with fishery products and indicates control measures.
Huss, H.H., Ababouch, L. & Gram, L. 2003. *Assessment and management of seafood safety and quality.* FAO Fisheries Technical Paper No. 444. Rome, FAO. 230 pp.	www.fao.org/docrep/006/y4743e/y4743e00.htm	An introductory manual on all aspects of safety and quality.

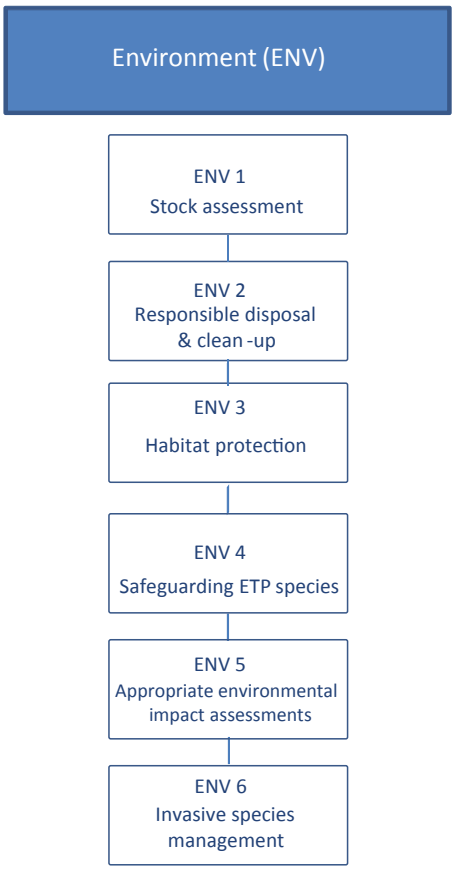
(cont.)

Information resource	Web link	Relevance to the technical challenge
Food safety *(cont.)*		
FAO. 2006. *Food safety risk analysis – a guide for national food safety authorities.* FAO Food and Nutrition Paper No. 87. Rome. 102 pp.	www.fao.org/docrep/012/a0822e/a0822e00.htm	This Codex publication explains the principles of risk analysis that can be applied to safety and to general issues in order to assess, manage and communicate risk.
FAO/WHO. 2009. *Food hygiene. Basic texts.* Fourth edition. Codex Alimentarius Commission. Rome, FAO, and Geneva, WHO. 125 pp.	www.fao.org/docrep/012/a1552e/a1552e00.pdf	
FAO/WHO. 2001. *The HACCP system and guidelines for its application. Annex to CAC/RCP 1-1969, Rev. 3 (1997).* Rome, FAO, and Geneva, WHO.	www.fao.org/docrep/005/y1579e/y1579e03.htm	
WHO. 1991. *Guidelines for Drinking Water – Water Quality.* Volumes 1, 2 and 3. Delhi, India, CBS Publishers.		The definitive manual for water quality for human consumption and food processing.
Taste panel analysis for oil		
Ernst, R.J., Ratnayake, W.M.N., Farquarson, T.E., Ackman, R.G. & Tidmarsh, W.G. 1987. *Tainting of finfish by petroleum hydrocarbons.* Environmental Studies Research Funds Report No. 080. Ottawa, Environmental Studies Research Funds. 150 pp.	www.esrfunds.org/pdf/80.pdf	
Millar, C.P., Craig, A., Fryer, R.J. & Davies, I.M. 2010. *Assessing the presence of PAH taint using taste panels.* Marine Scotland Science Report 07/10 July. Aberdeen, UK, Marine Scotland Science. 19 pp.	www.scotland.gov.uk/Resource/Doc/295194/0103457.pdf	
Trade		
WTO SPS and TBT Agreements	www.wto.org/english/tratop_e/sps_e/sps_agreement_cbt_e/intro1_e.htm	This agreement underpins all aspects of international trade in agricultural and fisheries products. The citation is a training module that is useful to promote understanding.

(cont.)

Information resource	Web link	Relevance to the technical challenge
Facilities		
Medina Pizzali, A.F. 1988. *Small-scale fish landing and marketing facilities.* FAO Fisheries Technical Paper No. 291. Rome, FAO. 69 pp.	www.fao.org/docrep/003/T0388E/T0388E00.HTM	Contains important information for planning landing centres and markets.
Additional support material		
Campbell, J. & Ward, A. 2004. *Fisheries post-harvest overview manual.* An output of the DFID-funded Post-Harvest Fisheries Research Programme. Exeter, UK, IMM Ltd.		
Value chain analysis	www.dfid.gov.uk/r4d/PDF/Outputs/HPAI/WKS081124_Annex16.pdf_ ftp://ftp.fao.org/es/esa/lisfame/guidel_valueChain.pdf	A value chain analysis helps to understand the structure of a fishery as well as to determine the flow of benefits.
Gudmundsson, E., Asche, F. & Nielsen, M. 2006. *Revenue distribution through the seafood value chain.* FAO Fisheries Circular No. 1019. Rome, FAO. 42 pp.	www.fao.org/docrep/009/a0564e/a0564e00.htm	Guidelines for development of a value chain in fisheries.

BEST PRACTICE IN EMERGENCY RESPONSE IN FISHERIES AND AQUACULTURE 5: ENVIRONMENT (ENV)



An ecosystem approach to fisheries and aquaculture is intended to ensure that planning, development and management meets social and economic needs without jeopardizing the options for future generations to benefit from the full range of goods and services provided by marine ecosystems (FAO, 2003). A number of existing standards are fundamental in guiding environmental principles within fisheries and aquaculture management. These include the ecosystem approach to fisheries (FAO, 2003), the Code of Conduct for Responsible Fisheries (the Code FAO, 1995), and the ecosystem approach to aquaculture (FAO, 2010a). The EAF provides a basis for fisheries managers and decision-makers to ensure that the three pillars of sustainability (environmental, social and economic) are supported.

While social and economic dimensions are critical in the EAF, the Code and the EAA, it is the environmental pillar that is the focus of this section.

Environmental considerations can be viewed as cross-cutting and relevant throughout the other thematic areas of this guidance, in particular with policy and management and fishing operations (notably fishing gear). The intention of this section is not to duplicate best practice statements covered within other areas, but to focus on key aspects specific to environmental considerations. The following parameters form the key environmental components discussed in this section.

Fisheries

- Fish stocks: including the stocks for target species, retained species landed in conjunction with the target species, and discarded species.
- Habitats: which are key in supporting the fisheries e.g. spawning and nursery grounds.
- Endangered, threatened and protected (ETP) species: including those species in national or international legislation/agreements and FAO international plans of action.
- Ecosystem: considering the broader ecological community within which the fisheries exist.

Aquaculture

- Stock species: including spat and seed.
- Feed: including the use of wild resources and feed efficiency.
- Habitats: considering the habitats that support aquaculture developments, appropriate siting and environmental impact assessment (EIA).
- Ecosystem: considering the broader ecological community and carrying capacity of aquaculture developments, including the role of EIAs.

Environmental management issues and requirements in the emergency context

Disasters can cause significant environmental impacts that affect fisheries and aquaculture both directly and indirectly. Similarly, disasters can result in impacts by the fisheries and aquaculture sector on the environment.

Direct effects on wild fish resources and product in aquaculture operations may arise from oil or chemical spills, disturbance or damage to fish habitats (e.g. reefs, mangroves, seagrass, fish ponds and/or cages), and changes in water quality (e.g. salinity and turbidity) that might result from extreme weather events. These effects may result in physical or behavioural impacts on fish (e.g. direct mortality, or impacts on migrations, spawning, growth rates and location). In addition, for aquaculture, there is an additional risk of escapes and loss of product. Disasters may also result in direct impacts on the environment by the fisheries and aquaculture sector. Examples include the environmental impacts of damaged infrastructure and assets, e.g. leakages of oil from fishing vessel oil stores, release of harmful greenhouse gases from refrigerants used in

fish cold stores, the ecosystems impacts of escaped fish from fish farms, and the presence of damaged or destroyed fish farm equipment, infrastructure, vessels and fishing gear in the marine, freshwater and terrestrial environments.

Disasters may also have indirect effects on the environment. Complex emergencies, i.e. civil conflicts, and response situations to both natural (e.g. weather events) and technological disasters (e.g. oil spills and nuclear disasters) may result in the weakening of environmental practices in, and controls over, the fisheries and aquaculture sector. This may result from reduced organizational and human capacity for sound environmental management, but may also be the result of a strong focus in response situations on economic and social objectives in the re-building process, and the need for rapid action.

TABLE 14
Types of disaster and environmental impact

Type of Disaster	Associated Environmental Impact
Hurricane/Cyclone/ Typhoon	• Loss of vegetation cover and wildlife habitat • Short-term heavy rains and flooding inland • Mud slides and soil erosion • Saltwater intrusion to underground fresh water reservoirs • Soil contamination from saline water • Damage to offshore coral reefs and natural coastal defence mechanisms • Waste (some of which may be hazardous) and debris accumulation • Secondary impacts by temporarily displaced people • Impacts associated with reconstruction and repair to damaged infrastructure (e.g. deforestation, quarrying, waste pollution)
Tsunami	• Ground water pollution through sewage overflow • Saline incursion and sewage contamination of groundwater reservoirs • Loss of productive fisheries and coastal forest/plantations • Destruction of coral reefs • Coastal erosion and/or beneficial deposition of sediment on beaches/small islands • Marine pollution from back flow of wave surge • Soil contamination • Loss of crops and seed banks • Waste accumulation – additional waste disposal sites required • Secondary impacts by temporarily displaced people • Impacts associated with reconstruction and repair to damaged infrastructure (e.g. deforestation, quarrying, waste pollution)
Earthquake	• Loss of productive systems, e.g. agriculture • Damage to natural landscapes and vegetation • Possible mass flooding if dam infrastructure weakened or destroyed • Waste accumulation – additional waste disposal sites required • Secondary impacts by temporarily displaced people • Impacts associated with reconstruction and repair to damaged infrastructure (e.g. deforestation, quarrying, waste pollution) • Damaged infrastructure as a possible secondary environmental threat, e.g. leakage from fuel storage facilities

Type of Disaster	Associated Environmental Impact
Flood	• Ground water pollution through sewage overflow • Loss of crops, livestock and livelihood security • Excessive siltation may affect certain fish stocks • River bank damage from erosion • Water and soil contamination fertilizers used • Secondary impacts by temporarily displaced people • Beneficial sedimentation in floodplains or close to river banks
Volcanic Eruption	• Loss of productive landscape and crops being buried by ash and pumice • Forest fires as a result of molten lava • Secondary impacts by temporarily displaced people • Loss of wildlife following gas release • Secondary flooding should rivers or valleys be blocked by lava flow • Damaged infrastructure as a possible secondary environmental threat, e.g. leakage from fuel storage facilities Impacts associated with reconstruction and repair to damaged infrastructure (e.g. deforestation, quarrying, waste pollution)
Landslide	• Damaged infrastructure as a possible secondary environmental threat, e.g. leakage from fuel storage facilities Secondary impacts by temporarily displaced people • Impacts associated with reconstruction and repair to damaged infrastructure (e.g. deforestation, quarrying, waste pollution)
Drought	• Loss of surface vegetation. • Loss of biodiversity • Forced human displacement. • Loss of livestock and other productive systems.
Epidemic	• Loss of biodiversity • Forced human displacement • Loss of productive economic systems • Introduction of new species
Forest Fires	• Loss of forest and wildlife habitat • Loss of biodiversity • Loss of ecosystem services • Loss of productive crops • Soil erosion • Secondary encroachment for settlement or agriculture
Sand Storms	• Loss of productive agricultural land • Loss of productive crops • Soil erosion

Source: (Cattermoul, *et al.,* 2012)

Building back better

A range of opportunities are available for improving the environmental considerations in post-disaster responses in fisheries and aquaculture sectors. Many of these opportunities can be cross-referenced with other thematic areas of fisheries and aquaculture and relate to ensuring that the environmental impacts and risks of disasters are minimized. Additional environmental opportunities are summarized below.

Improved stock assessments. To ensure the long-term sustainability of fishery resources, it is essential that exploited stocks be regularly assessed and that the results of these assessments be incorporated into the fisheries management process. "The severity of the situation has been recognized globally and in particular by the United Nations General Assembly, which in 2003 endorsed a global strategy for improving information on status and trends in capture fisheries".

Improved fishing capacity assessment and management. Managing and reducing excess levels of fishing capacity is one of the greatest challenges facing fisheries policy-makers and managers (see FAO, 2008c). Based on best policy and management, and underpinned by a precautionary approach, rebuilding a fishing fleet can take place so that fishing capacity better matches fishing opportunities. This may imply both the re-introduction of fewer vessels than were previously operating in the fishery, as well as the provision of different types of vessels, and it may need to be accompanied by other aspects of post-disaster responses focused on the creation of alternative livelihood opportunities.

Introduction of lower-impact and more-selective fishing gear (FAO, 2012a)**.** With appropriate expertise and financial assistance, lost or damaged gear can be replaced with more selective gear types that have lower habitat impacts and lower rates of bycatch. A high level of stakeholder consultation is typically required to ensure that such techniques are both appropriate and can be adapted to local conditions.

Reduced greenhouse gas (GHG) emissions through efficient engineering. Introducing changes to vessel design and equipment as part of the "building back" approach can provide improvements in GHG emissions while also generating operating efficiency and improved revenues. Opportunities exist with refining hull shapes, introducing different motors or the addition of a gearbox. Even simple changes, such as correctly sizing and installing a propeller and stern gear, can dramatically increase fuel efficiency. Furthermore, and with respect to power generation for onshore infrastructure, solar power is an increasingly viable alternative for remote sites and should be encouraged over the use of generators (except for heavy cooling-load requirements such as in cold rooms and ice plants).

Improved use of feeds in aquaculture. Many aquaculture industries depend on low-value fish as feed, including the use of bycatch. This can lead to competition with use of fish as direct food for humans (directly as smaller lower-value fish, or in fish products e.g. fish sauce). Opportunities exist when rebuilding aquaculture industries to improve feed management practices to reduce the use of low-value fish and/or fishmeal in feeds.

Responsible sourcing of seed and broodstock for aquaculture. A key activity in rehabilitating aquaculture production is to ensure that the rehabilitated small-scale hatcheries, nurseries and seed-collecting activities

TABLE 15

Linkages between environmental considerations and management and other support provided across fisheries and aquaculture

Areas of support provided to fisheries sector in emergencies	Linkages between environmental considerations/management and other support provided	What are the implications for planning? (what considerations should be made)
Food and nutrition security	Levels of contaminants within seafood products as a result of oil or radionuclide pollution that are considered safe for human consumption. Responsible disposal of contaminated or spoiled seafood products ensuring that re-entry to consumer supply chains does not occur.	Decisions on appropriate threshold limits for radionuclides and oil contaminants, including any necessary provision for vulnerable groups (e.g. children and pregnant women). For example: use of Codex Alimentarius or limits set on a national basis. Development of waste management and disposal plans for contaminated and spoiled seafood products.
Vessel repair and/or replacement	Replacement vessels match the capacity necessary for sustainable harvesting of resources.	Registration and licensing of vessels to record total capacity. Ensure that inappropriate donations (of vessels) are not accepted.
Provision and/or repair of fishing gear	Re-introduced fishing gear designed to minimize environmental impacts where possible e.g. lower catches of juveniles, reduced habitat impacts, bycatch reduction measures.	Collaborative approach between fishers, managers and gear manufactures to improve design of gear or introduce environmental design aspects.
Provision and/or repair of infrastructure – e.g. landing sites, market facilities and aquaculture facilities	Environmental impact assessments (EIAs) are undertaken prior to rebuilding of infrastructure in order to avoid further environmental degradation.	Development of rapid EIA process for post-disaster situations.
Post-harvest activities and marketing	Comprehensive recording of landings by species, including artisanal and/or subsistence fisheries.	Development of recording protocols and databases.
Fisheries and aquaculture policy and management	Ensuring that pre- and post-disaster policy and management supports sustainable fisheries and aquaculture and minimization of wider ecosystem impacts.	Provision for environmental considerations to be built into national and local, as well as strategic and specific, policy and management.

are restored with sustainable management as a key principle. Many smaller-scale producers may rely on the collection of larvae or seed from the wild, which can have negative impacts on the environment. Opportunities exist for improved policies that address the issues of certification and the development of incentives for environmentally friendly sourcing of seed and production.

Linkages with other sections

Table 14 describes the linkages that support for good environmental response and capacity has with other services provided to the fisheries and aquaculture sector in emergency response.

Environmental (ENV) best practice

ENV 1: Stock assessment

Management and capacity supports sustainable harvesting of fish resources.

Key indicators

- Developments of new and renewed precautionary harvest strategies on a species or multispecies basis with due regard to stock status assessments.
- Inclusion of harvest control rules and trigger/reference points, and the use of an appropriate and improved range and mix of input, output and technical management measures within the harvest strategy to ensure that fish catches do not exceed their maximum sustainable yield (MSY).
- Appropriate monitoring to inform stock assessment and harvest control rules.

Guidance notes

1. **Harvest strategies:** Harvest strategies should be developed or renewed to support improved management of fish and shellfish resources ensuring that fishing capacity and effort is responsive to fluctuations in stocks that may have been affected by disasters. This will require stock assessments to be undertaken to determine stock status and any disaster-associated affects. Such stock assessments should inform both harvest strategies that are already in place and those under development. A harvest strategy should include limit and reference points for stock biomass and fishing mortality. It should also outline management objectives and procedures if and when these reference points are met. Monitoring will be necessary as part of the stock assessments, but also to determine whether the harvest strategy is achieving its objectives. Harvest strategies should also link with capacity and effort with regard to vessel and gear provision.
2. **Harvest control rules and tools:** Well-defined pre-agreed rules or actions can be put in place pre-disaster and used for determining appropriate management action in response to changes in indicators of stock. Such indicators include setting reference points by management that consider

normal stock recruit relationships as well as any potential impacts on reproductive capacity of changes to genetic structure or sex composition. Management actions may be in the form of input, output and/or technical management measures.

3. **Monitoring:** Undertaking assessments of stock status requires a significant amount of information to determine the state of the stock, set appropriate harvest control rules and establish effectiveness of such controls. Risk analysis should be used to determine the appropriate scale and frequency of monitoring dependent on the type of disaster. Information categories include:
   - **Stock structure** could incorporate information describing the distribution and geographical range of the stock, the relationship of the geographical range to the harvest control, and the age, size, sex and genetic structure of the stock.
   - **Stock productivity** could incorporate maturity, growth, natural mortality, density dependent processes, the stock recruit relationship and fecundity.
   - **Fleet composition** could incorporate information on associated effort by gear type and method of capture, including fleet characteristics in both targeted and non-targeted fisheries taking the species.
   - **Stock abundance** could incorporate information relating to absolute or relative abundance indices including recruitment, age size sex and genetic structure of the stock.
   - **Fishery removals** could incorporate information describing the level, size, age, sex and genetic structure of landings, discards, and illegal, unreported, unregulated, recreational, customary and incidental mortality of the target stock by location and method of capture.
   - Other data may include environmental information such as temperature, weather and other factors that may influence fish populations and fishing

ENV 2: Responsible disposal

Minimization of environmental impacts through safe disposal of spoiled or contaminated catch and clean-up of fuel and refrigerant leakages.

Key indicators

- Safe disposal protocols and procedures are established and being used.
- Efficient and effective clean-up of fuel leakages from onshore storage, and removal and/or replacement of refrigerants within damaged cold and/or chill stores.

Guidance notes

1. **Disposal protocols and procedures:** Power cuts, infrastructure damage, cessation of normal operations and/or disruptions to marketing networks may lead to spoilage of stored catch. Alternatively, stored catch may be

contaminated from on-land pollution such as chemical spills or nuclear fallout. Appropriate testing should be completed of stored produce (Codex Alimentarius, its accompanying standards and/or national standards) to establish safety for human consumption or other feed sources. Where unsafe, procedures and protocols should ensure that such seafood does not re-enter the food chain. It may be appropriate for disposal via landfill, incineration or other means depending on the type of contamination. The quantity of catch disposal, location, date and reason should be recorded and inventoried.

2. **Fuel and refrigerant clean-up**: Fishery and aquaculture infrastructure may lead to pollution through fuel or refrigerant leakages. Efficient and effective clean-up should minimize the potential damage caused to the environment. Removal and/or replacement of refrigerants within cold and/or chill stores should avoid the escape of gases that could contribute to global warming.

ENV 3: Habitat protection

Protection and recovery of sensitive habitats and key fishing grounds.

Key indicators

- Recovery plans identify key sensitive or vulnerable habitats and provide sufficient restrictions to promote recovery.
- Post-disaster clean-up programmes are implemented to find and retrieve debris (which prevents fishing from resuming) within the marine environment.

Guidance notes

1. **Habitat recovery plans:** The resumption of fishing or aquaculture practices should be managed so as to ensure protection of both areas that may have been affected during a disaster (and are likely to recover) and areas of particular importance, sensitivity or vulnerability, e.g. seagrass beds, mangroves and coral reefs. Recovery plans may take the form of implementing restrictions on certain types of gear that have higher seabed/habitat interactions, such as demersal otter trawling, or they may be complete closures and/or no-take zones. Routine monitoring and mapping of key habitats pre- and post-disaster will inform necessary restrictions and effective recovery.
2. **Habitat clean-up programmes**: The resumption of fishing practices may be impeded by the presence of large amounts of marine debris across targeted fishing grounds. Marine debris may affect sensitive habitats and damage fishing gear if snagged. Floating debris may act as natural fish aggregating devices (FADs). Coordinated clean-up programmes should target key fishing grounds to remove and dispose of debris within the marine environment. The efficiency of this clean-up process will minimize further risk to recovering sensitive habitats such as coral reef systems,

which itself will promote recovery of the surrounding ecosystem including reef fisheries.

ENV 4: Safeguarding endangered threatened and protected species

Protection and recovery of endangered, threatened and protected (ETP) species.

Key indicators

- Re-introduced gear incorporates bycatch reduction devices, and provision of replacement fishing gear is accompanied by education on responsible fishing practices to minimize interaction with ETP species, including education on ETP species identification;
- Codes of practice are developed to minimize ETP interactions and impacts.

Guidance notes

1. **Bycatch reduction devices (BRDs):** The resumption of fishing practices should introduce or strengthen measures to protect ETP species. Of particular note is the opportunity to incorporate BRDs as standard into all replacement fishing gear. Appropriate BRDs include turtle excluder devices in demersal trawling gear and circle hooks in longlining. Coordination between gear manufacturers, fishing industry and environmental authorities will be necessary. Appropriate education of fishers in the use and importance of BRDs will be key to successful implementation. It is recommended that education be part of the handover process when gear is supplied to the industry. A high level of stakeholder consultation may be necessary to ensure that BRDs are appropriate to local conditions.
2. **ETP codes of practice:** Bycatch reduction devices may not be appropriate for certain gear types. In such cases, codes of practice should be adopted to minimize risk of ETP interaction – for example, practices to minimize the risk of dolphin or turtle capture in the purse seine fishery through net lowering to allow ETP species to escape. Again, education into the identification of ETP species and effective gear-specific codes of practice should form part of the handover process when gear is supplied to the industry.

ENV 5: Environmental impact assessments

Environmental impact assessments are undertaken at a scale appropriate to the disaster situation.

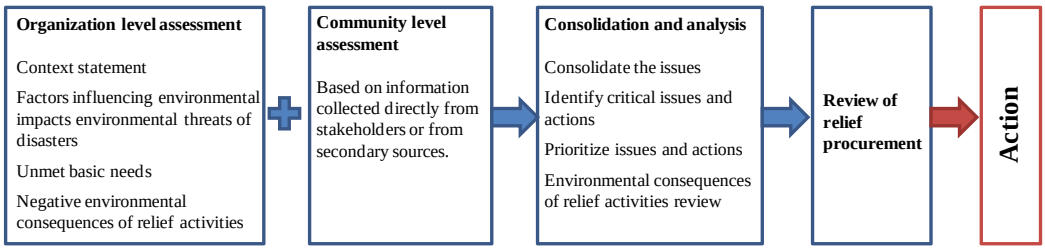
Key indicators

- Replacement infrastructure is based on environmental impact assessments (EIAs)
- EIA requirements are applicable to post-disaster situations, e.g. reduced complexity and evaluation time.

Guidance notes

1. **Environmental impact assessments (EIAs):** Prior to re-development, EIAs are key to improving linkages between sustainable environmental management and disaster responses. An EIA is undertaken on a project or plan basis and is defined as "the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made" (International Association for Impact Assessment, 1999). For example, an EIA of an aquaculture development will assess the potential wider ecosystem impacts, informing appropriate siting, size, species and carrying capacity.
2. **Rapid environmental impact assessment (REA):** In disaster situations, an REA may be appropriate where capacity for a full EIA is lacking based on personnel and/or time. An REA identifies frames and prioritizes environmental issues in such a way as to allow the negative impacts to be minimized or avoided during the immediate response to a disaster. An example of a REA process is shown in Figure 4.

FIGURE 4 **The process for a rapid environmental impact assessment**



ENV 6: Invasive species

Management and procedures reduce the risk of the introduction of invasive species

Key indicators

- Impact assessment and cost–benefit analysis of eradication, containment or management options for dealing with the introduced species.
- Promote contingency planning when building back.

Guidance notes

1. Impact assessm**nt:** In the event of invasive species being introduced from aquaculture operations or aquariums through disaster-induced damage, impact assessments should be undertaken to assess potential risks and appropriate actions. This should include a cost–benefit analysis that considers at least three management options, e.g. do nothing, eradicate/remove invasive species, or contain and manage presence of invasive species to minimize spread/distribution.

2. **Contingency planning:** Managing and planning the location of invasive species in aquariums and aquaculture operations can minimize the risk of introductions in disaster situations. Therefore, EIAs for aquaculture infrastructure should give due regard to the potential escape of non-native species in disaster situations.

Resources and tools

Information resource	Web link	Relevance to the technical challenge
The code of conduct for responsible fisheries (CCRF)(FAO 1995)	www.fao.org/docrep/005/v9878e/v9878e00.HTM	
FAO. 2009c. *Fisheries management. 2. The ecosystem approach to fisheries. 2.2 Human dimensions of the ecosystem approach to fisheries.* FAO Technical Guidelines for Responsible Fisheries. No. 4, Suppl. 2, Add. 2. Rome, FAO. 2009. 88p.		
FAO. 2003. *Fisheries Management - 2. The Ecosystem Approach to Fisheries.* FAO Technical Guidelines for Responsible Fisheries. 4 Suppl. 2 FAO, Rome.(also available at	http://www.fao.org/DOCREP/005/Y4470E/Y4470E00.HTM	
FAO. 2010a. *Aquaculture development. 4. Ecosystem approach to aquaculture. FAO Technical Guidelines for Responsible Fisheries. No. 5, Suppl. 4.* Rome, FAO. 2010. 53p.	www.fao.org/docrep/013/i1750e/i1750e.pdf	Guidance on the ecosystem approach to aquaculture
FAO Aquaculture Gateway pages	www.fao.org/fishery/aquaculture/en and www.fao.org/aquaculture/en/	Extensive technical information available on all aspects of Aquaculture relevant to emergency response and preparedness. Links to networks, partners and technical publications

(cont.)

Information resource	Web link	Relevance to the technical challenge
The International Council for the Exploration of the Sea (ICES) and the European Inland Fishery Advisory Commission	www.fao.org/fishery/topic/14782/en	Codes of practice on the use of introduced species. These codes generally apply to the purposeful movement of aquatic species, for example, in fisheries, biological control, aquaculture, and for research. There are also guidelines and policy concerning species introduced inadvertently through ballast water or on ships' hulls.
FAO. 2012(d). *Environmental impact assessment guidelines for field projects*	www.fao.org/docrep/016/i2802e/i2802e.pdf	
Suuronen, P., Chopin, F., Glass, C., Lokkeborg, S., Matsushita, Y., Queirolo, D., Rihan, D. 2012 (a). *Low impact and fuel efficient - Looking beyond the horizon.*	www.elsevier.com/locate/fisheries	Low impact gear
FAO. 2012c. *Report of the expert meeting on greenhouse gas emissions. Strategies and methodologies in seafood.* FAO fisheries and aquaculture report 1011 FIRO/R1011.	www.fao.org/docrep/017/i3062e/i3062e.pdf	
FAO. 2009b *Environmental impact assessment and monitoring in aquaculture.* FAO Fisheries and Aquaculture Technical Paper. No. 527. Rome, FAO. 2009. 57p.	www.fao.org/docrep/012/i0970e/i0970e.pdf	

(cont.)

Information resource	Web link	Relevance to the technical challenge
Codex alimentarius	www.codexalimentarius.org/	The Codex Alimentarius Commission, established by FAO and WHO in 1963 develops harmonised international food standards, guidelines and codes of practice to protect the health of the consumers and ensure fair practices in the food trade. The Commission also promotes coordination of all food standards work undertaken by international governmental and non-governmental organizations.

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Fishers and fish farmers and those who depend on the sector for their livelihoods are increasingly vulnerable to disasters and the impacts of climate change. Most small-scale fishers and fish workers live in developing countries and face a range of issues that increase their vulnerability to hazards including food insecurity, poverty, pollution, environmental degradation, overexploitation of resources, high levels of accidents at sea and conflicts with industrial fishing operations. Their vulnerability to hazards is further increased by the specific characteristics of fishing and fish farming operations themselves (such as location and exposure) also increase. Whilst responding to these disasters and emergencies has become a greater part of the work of governments, civil society organisations, agencies and communities there are as yet no guidelines for the sector. This document aims to fill that gap and to improve the effectiveness of such interventions. These guidelines were developed following a meeting of experts in 2013 (FAO, 2013). They draw on best practice and lessons learned during response to disasters that have affected fisheries and aquaculture sector. They cover general good practice and technical areas such as; fisheries and aquaculture policy and management; capture fisheries gear, vessels and engines; landing sites, harbours and anchorages; aquaculture and post harvest, trade and markets.

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