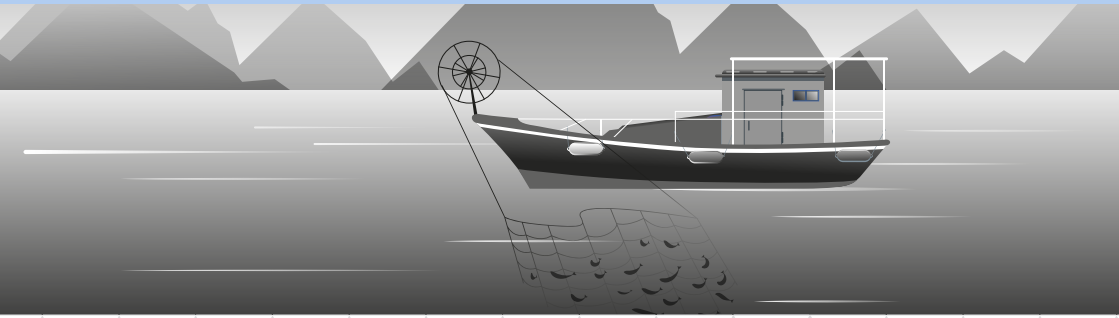
Lloyd's Register Foundation

Insight report on safety in the fishing industry

A global safety challenge



June 2018

Lloyd's Register Foundation
Report Series: No. 2018.3

About the Lloyd's Register Foundation

Our vision

Our vision is to be known worldwide as a leading supporter of engineering-related research, training and education, which makes a real difference in improving the safety of the critical infrastructure on which modern society relies. In support of this, we promote scientific excellence and act as a catalyst working with others to achieve maximum impact.

The Lloyd's Register Foundation charitable mission

- To secure for the benefit of the community high technical standards of design, manufacture, construction, maintenance, operation and performance for the purpose of enhancing the safety of life and property at sea, on land and in the air.
- The advancement of public education including within the transportation industries and any other engineering and technological disciplines.

About the Lloyd's Register Foundation Report Series

The aim of this Report Series is to openly disseminate information about the work that is being supported by the Lloyd's Register Foundation. It is hoped that these reports will provide insights for the research community and also inform wider debate in society about the engineering safety-related challenges being investigated by the Foundation.

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Contents

Executive summary

Fishing is one of the world's most dangerous occupations.

Fishing is one of the world's most dangerous occupations. For nearly 20 years the estimate of 24,000 fatalities per year has been mentioned in conference publications, industry guidelines, and other documents. This fatality figure is also usually described as an underestimate, due to inaccurate reporting in the developing world.

Most of the world's 3.8 million fishing vessels and 36 million full and part time fishers operate from Asia, and the majority of the deaths also occur in that region.

Lloyd's Register Foundation identified fishing as a safety challenge in its Insight report on global safety challenges, in 2017[1]. Since then the Foundation has investigated further to better understand the nature of the safety challenge in the fishing industry. It has drawn on expert knowledge and opinion to understand what activity is already underway to improve fishing safety, what is further needed, and to explore if there is a unique role for the Foundation in line with its charitable mission.

The investigation has focused on establishing:

- the countries or locations where the most fatalities are occurring
- the predominant causes of accidents in these countries
- the practical measure(s) which could save the most lives.

This Insight report on safety in the fishing industry presents the key findings. These are:

- Fatality causes differ in the developed and developing worlds and are generally considered to be related to the economic status, value placed on life, and social outlook of the fishers in the respective countries.

- In countries with relatively favourable economic conditions, examples of fatality causes include:
  - failure to fully and stringently enforce existing regulations
  - suboptimal vessel design
  - suboptimal technology informing captains and crews of vessel status, in particular real-time stability and location information
  - incomplete or suboptimal safety training
  - suboptimal emergency equipment
  - suboptimal work 'safety culture', for example exhibiting dangerous behaviour and decisions.
- In poorer countries, causes can be quite different, including:
  - lack of any form of enforceable regulation
  - use of small, unseaworthy and very dangerous vessels (for example dug-out canoes)
  - lack of visibility of small fishing boats, which promotes collisions with larger vessels
  - lack of weather information, leading to sometimes being at sea in very dangerous conditions
  - fishers who feel they have no choice but to fish each day to feed their families, regardless of weather conditions and the state of their equipment.

This report recommends an international programme is established, focused on local community partnerships, to improve safety in ways that are appropriate for local communities. An initial pilot programme in the Philippines is recommended. A phased approach is suggested with a key element being local community buy-in. The phases are:

1. Research to establish current fisher numbers and fatality rates, accident causes and risk; and an evaluation of existing initiatives.

2. Multi–stakeholder training (regulators, public, fishers).

3. Application of technology, appropriate to local capability and culture.

It is suggested that the Foundation could initiate the pilot programme, in the distinct phases described above.

Foreword

When we published the Insight report on global safety challenges we identified 12 topics that affect the lives and property of people internationally in both the present and the emerging future. Identifying these themes was the first step of a journey for us, now we are gaining a better understanding of these challenges, who is active in addressing them and ultimately if there is a role for the Foundation to do something unique that enhances safety.

In this report we focus on the global safety challenge in the fishing industry.

In this report we focus on the global safety challenge in the fishing industry. For many of us our relationship with the fishing industry starts and ends with the purchase of fish or consuming a meal. Estimates place the number of fish caught globally to be between 0.97-2.7 trillion per year[2], with operations to catch these fish ranging from large commercial fishing vessels to individuals who rely on catching fish for their survival. Estimates cited in this report indicate that around 24,000 fishers lose their lives each year. Although statistics for injuries in the fishing industry are very rare, if we follow a common observation from other industries then the numbers injured will be orders of magnitude greater than the fatalities.

This insight report makes a valuable contribution to understanding the safety challenges in the fishing industry. It takes a closer look at where accidents are occurring, why they happen and what steps the Foundation can take to reduce the lives lost in this global industry… because life matters.

Professor Richard Clegg
Foundation Chief Executive
Lloyd's Register Foundation

Background

Lloyd's Register Foundation is a charity and owner of the 258-year old Lloyd's Register Group Limited (LR). LR is a leading global provider of engineering and technology-centric professional services to clients in a range of sectors, primarily in energy and maritime, but also in food, healthcare and manufacturing.

The Foundation's Insight report on global safety challenges[1], published in 2017, included the following text related to safety in the fishing industry:

> "Fishing is widely understood to be a very dangerous profession. In the UK in 2015, seven fishermen died at work[3], out of an estimated total of 12,107[4], representing a fatality rate of 57.81 per 100,000 workers. This compares to a UK all-industry fatality rate of 0.46 per 100,000[5] The next worst industry for fatal accidents is agriculture with a fatality rate of 7.73 per 100,000. This makes fishing seven times more dangerous than the next most dangerous profession in the UK. Worldwide the problem is just as serious - the Food and Agriculture Organization estimates that over 24,000 fishermen die every year globally[6].
>
> The consultation included many stakeholders in the fishing industry from governmental organisations, trade unions, foundations and experts in fisheries law.
>
> From the consultation it became clear that safety problems stem from a variety of causes. Some are intrinsic to fishing such as the need to operate at sea in a dangerous environment subject to extreme weather. Others were related to design such as the construction of fishing boats, floatation devices, and protection from cold. Others were caused by the paradox of regulation that can incentivise unsafe activity. Finally, there is considerable tolerance of risk, both by fishermen themselves and by society, 'fishermen risk their lives putting food on the table'[7]."

To follow up the Foundation has since conducted a consultation and desk study to establish:

- the countries (or locations) where the most fatalities are occurring
- the predominant accident causes in these countries
- the practical measure(s) which would save the most lives.

This Insight report on safety in the fishing industry gives the findings of this work. The Foundation consulted broadly with organisations having direct experience of fishing industry challenges, concluding with a two-day workshop held in London in March 2018 bringing together international experts to address the three questions above.

This insight report reflects the experience and insights of those that participated in the consultation process and the Foundation is grateful to all that have contributed.

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Fishing safety: an overview

In 2001, the UN Food and Agriculture Organization (FAO) estimated[8] there to be:

- 15 million fishers employed globally aboard decked or undecked fishing vessels (98% on vessels less than 24 metres in length)
- 36 million fishers involved in full time or part time fisheries related work.

15 million fishers employed globally aboard decked or undecked fishing vessels - 98% on vessels less than 24 metres in length.

It is commonly estimated[8] that the fishing industry suffers 24,000 fatalities per year on average.

The global fleet

The FAO[8] reported the following with respect to the world fishing fleet:

- 3.8 million vessels, most operating in Asia
- one third are decked vessels, almost all of which are motorised
- two thirds are undecked, generally less than 10 metres in length, mostly un-motorised
- highest proportion (80%) of non-motorised vessels is in Africa
- highest proportion (70%) of decked vessels is in Europe
- fewer than 40% of vessels in Asia have decks
- vast majority of decked fishing vessels (and all undecked vessels) are less than 25 gross registry tonnes (GRT).

This FAO report from 2001 is considered to be the best estimate of data available even today. Although there have been other attempts to collect data, the international spread of the fishing industry across multiple geographies, communities and demographics make it difficult to report better data.

Science magazine[9] has investigated global fishing activities based on vessel location as indicated by vessels' automatic identification systems (AIS), which provide near-continuous location information. The results, in figure 1, show how much more fishing (from relatively large boats) occurs in China than in any other nation.

It is also noteworthy that nations which are often mentioned by experts as experiencing the most fatalities, including Bangladesh, the Philippines and Indonesia, do not appear at all on the chart. This supports the common expert belief that most fishing in the developing world takes place from small boats having little or no modern technology.

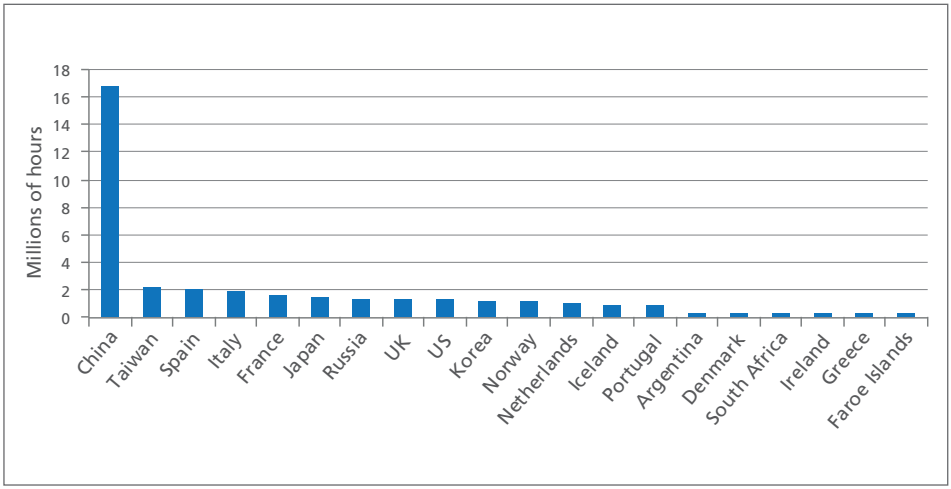


Figure 1: Millions of hours fished by vessels with automatic identification systems, by country, 2016.
Source[9] www.bbc.co.uk/news/science-environment-43169824

Locations of most fatalities

Data for lives lost in the developing world's fishing industry are nearly impossible to reliably source. Expert opinion and anecdote, however, universally agree that there are many more fatalities in the developing world than in developed countries. Much of the information available in the literature and described in this section is biased toward wealthier countries highlighting a need for better methods of recording and reporting data in developing nations.

The FAO[8] provided comparisons of the ratio of fishing fatality rates to average national industry fatality rates in several countries, as shown in table 1 overleaf.

Another way of representing fatality rates is by reporting number of fatalities per 100,000 person hours worked which is provided for several countries in table 2.

Couper, Smith and Ciceri[15] present statistics for fishers' lives lost from 2000-2010 in cases where the vessels were totally lost. The small number (452) of reported total lives lost in figure 2 is significantly less than the 24,000 per year that is commonly quoted. This can be explained by the limitation of the data available. Nevertheless, Asia is shown to be the region experiencing the most fatalities, as is confirmed by anecdotal comment.

In consideration of the consistent emerging theme of the majority of fatalities occurring in Asia and the overwhelming opinions of experts, it was decided to focus further attention in three specific countries: Bangladesh, Indonesia and the Philippines (BIP).

Country	Ratio of fishing fatality rate: national industry average rate
United States	40
Denmark	25-30
Italy	21
Australia	18
Korea	15
Estonia	11
Lithuania	11
Poland	9
Spain	6
Canada	3.5

Table 1: Ratio of fishing fatality rate to national industry average[8]

Country	Fishing fatalities / 100,000 person hours
Sri Lanka[10]	900 - 1500
West Africa[11]	300 - 1000
South Africa[12,13]	585[12] (162)[13]
Guinea[8]	500
Canada[13]	206
New Zealand[13]	167
Nordic countries[8,14]	90 - 150
Australia[8]	143
United Kingdom[3]	120
United States[13]	119

Table 2: Fishing fatality rates in several countries

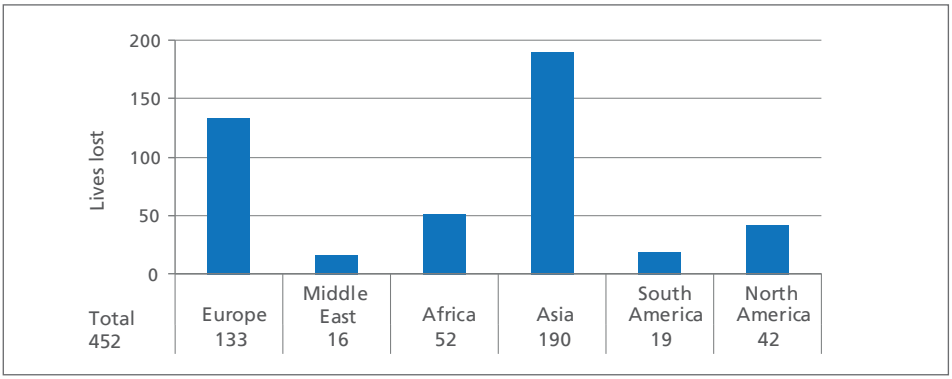


Figure 2: Regional distribution of lives lost in the fishing industry, 2000-2010.
Source: Lloyd's Register of Shipping, World Casualty Statistics, London.

Causes of fishing fatalities

An initial consultation and desk review identified a wide range of safety issues associated with fishing across diverse geographies. A full description of these, along with suggested measures to address them, is given in Appendix B, however in summary these are:

- lack of regulation or lack of implementation of regulation
- lack of vessel identification, monitoring and tracking capability
- lack of basic safety tools, equipment and weather data
- poor vessel design and construction
- fishers' resistance to assistance (poor safety culture), and
- insufficient master and crew competence.

This initial review provided a framework for a workshop of fishing safety experts. The workshop participants focused upon identifying the accident causes leading to the loss of life in Bangladesh, Indonesia, and the Philippines (BIP). These three countries were chosen because it was felt the greatest impact on safety could be had by focusing on areas with the highest fishing fatalities.

Three primary themes emerged during the discussions. These were: incomplete stakeholder understanding of issues unique to BIP; incomplete stakeholder capability and competence; and failure to implement appropriate technology. These are discussed in more detail below.

Incomplete understanding of the issues and risks: Bangladesh, Indonesia and the Philippines

There is a lack of available information about the numbers of fishing vessels and scale or specifics of the safety problem in the BIP region. While relatively detailed fisheries information exists in richer countries, much less is known about the number and causes of injuries, ill-health and vessel losses in the BIP region.

In addition risk factors in BIP are different from those in developed countries. The following issues were identified based on personal and industry experience.

- **Poor understanding and recognition of risk.** Fishers experience various types of pressure (for example financial, social, community, and peer) to fish each day to provide for families, regardless of circumstance. A lack of knowledge, combined with tradition-led or change-resistant cultures leads to normalised acceptance of risk taking behaviour. Insecurity of income is a powerful factor leading to fishing when it would be safer to stay ashore.

- **Absence of or failure to heed weather warnings.** Fishing often takes place in adverse weather conditions due to inadequate weather forecasting capability, lack of available weather forecast information or failure to act on weather warnings.
- **Vessels unsuited to sea conditions.** Traditional vessel design and construction skills utilised in BIP are often learned informally from previous generations. However, traditionally built vessels are now often additionally fitted with equipment such as motors and use heavier fishing gear allowing fishing further offshore to counteract declining inshore fish stocks. Risks associated with this include:
  - reduced stability (resulting from additional weight)
  - lack of watertight integrity
  - immediate, unplanned, and unbudgeted expense of maintenance
  - inadequate early warning systems
  - inability to control flooding
  - lack of fire-fighting capability
  - inadequate machine guarding.
- **Distrust of regulators and officials.** This prohibits the flow of critical information between the fleet and regulators, as well as between fishers themselves - increasing risky behaviours in the absence of good, up-to-date information.

Insufficient stakeholder capability and competence (including designers, fishers and communities)

Poorer communities such as those in the BIP have fewer resources to dedicate to training and professional development. Some examples are:

- **Lack of understanding of vessel design issues,** particularly those associated with stability, seaworthiness, vessel loading capability and introduction on newer equipment.
- **Lack of suitable training** for fishers including a lack of qualified safety educators and a poor understanding of the most effective methods of training.
- **Deficient safety and risk knowledge of fishers themselves** arising from the lack of fishing safety educators.
- **Insufficient support for fishing groups.** Fisher associations and community and family groups have an important role to play in promoting safety. However, it appears that these are not as influential as expected, and could be better supported to improve safety and effect a positive change in fishing communities.

Image courtesy of MI International, Marine Institute.

Failure to use the most appropriate safety technology

Most modern safety equipment and related technology used in developed countries is not available to fishers in BIP. Identified issues included:

- **Lack of availability of safety equipment.** Vessels are often not equipped with adequate or suitable safety and survival equipment. This may arise from the expense involved in purchasing this equipment, a belief that the possibility of death while working is inevitable, an acceptance of risk, or lack of knowledge about suitable equipment. Examples of such equipment include:
  - Life jackets. These would be particularly useful in BIP, where the water temperature allows for relatively long-term survival, compared to the situation in northern climates where survival times are usually described in minutes rather than hours.
  - Lightweight, easily deployable life rafts. Life rafts (where they do exist) are often tied down securely to avoid accidental loss. This inadvertently prevents them from being available in an emergency. The equipment is often inadequately serviced or maintained, and crews may not be trained in their safe use.
- **Lack of adequate search and rescue resources.** When vessels experience difficulty, they are often unable to alert authorities, and even where they can, the capability for swift rescue is not often available. There may be opportunities to use appropriate technologies. Examples include:
  - Tracking technology which would allow multiple shore-based stakeholders, including rescue services and family members, to be made aware when the vessel or individual is in trouble, particularly individuals going overboard.
  - Technological aids in rescue. Drone technology, which has the capability of sighting individuals in the water and delivering floatation equipment which facilitate swimming to safety, as demonstrated in a recent highly publicised case of stranded swimmers off the coast of Australia[16].

Areas for action: improving safety in Bangladesh, Indonesia and the Philippines

The overarching interconnected issues considered to have caused the most fishing fatalities in Bangladesh, Indonesia and the Philippines were:

- incomplete understanding of the issues and risks in each location
- insufficient competence of stakeholders (including designers, fishers and communities)
- failure to use the latest safety technology.

The consultees proposed three interventions which are interdependent and are all component parts of improving fishing safety.

Intervention one: Research to improve understanding

It is critical that local communities, associations and fishing groups must be fully engaged in order to understand the real risks to safety.

Research should include:

- Evaluation of work currently underway by other organisations, including the IMO, ILO, FAO and NGOs.
- Detailed local risk analyses to fully identify all safety issues.
- Identification (mapping) of all stakeholders (including allied fishing organisations, family and community groups, insurance industry representatives).
- An identification (and / or assignment) of local safety champions and engagement of local stakeholders to identify and support added value solutions.
- An examination of examples of successful interventions and lessons learned leading to safety improvements, both within the fishing and maritime communities, as well as other high-risk industries.
- Establishment of baseline data, including:
  - number of fishing boats and fishermen
  - number and frequency rate of total vessel losses
  - number and frequency rate of fatalities / serious injuries
  - local input related to the assumptions on top fishing risks.

Intervention two: Training

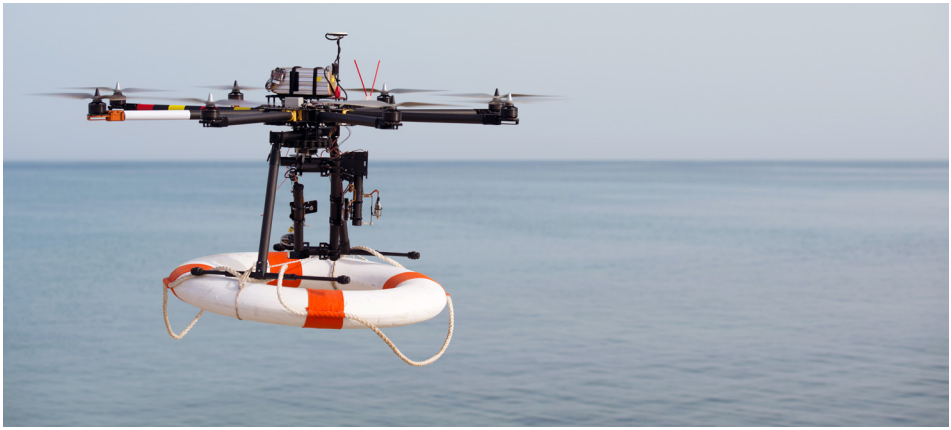
Training to build capability and competence and support training needs of all stakeholders (including regulators, fishers, the local public (including families, faith groups, and schools), and designers). The following are suggested actions:

- An evaluation of the practicality of eLearning platforms to determine whether implementation is appropriate.
- The establishment of local e-communities and face-to-face groups to share ideas and enhance synergies.
- The development and uptake of technology to educate and communicate as appropriate, including: creation of an eLearning/communication platform; initial population with existing material; education to include both technological and human factor considerations; and focus on safety culture and risk communication.
- Sharing of lessons learned in other more advanced industry sectors, as well as other related industries (for example transport, maritime).
- Develop locally based training infrastructure, including: 'train the trainer' sessions; locally appropriate training material development (visuals, posters, comic book formats, local language information); practical hands-on training; and provision of full 'body of knowledge' data to trainers.

Intervention three: Enhancing safety through technology

To ensure the optimal technology is applied for the improvement of fishers' safety, the following should be explored in partnership with local stakeholders:

- The use of the most appropriate safety equipment (especially jackets and life rafts) commensurate with local economics and culture.
- Search and rescue – evaluate and use best current technology when appropriate (including drone technology).
- Research and development to ensure best practice hardware, design and maintenance, including: evaluate new designs and materials; focus on sinking prevention, for example the use of physical 'stability' models to best convey understanding; consider retrofit solutions (rather than the costlier replace option); and promote best maintenance practices.
- Explore mandatory vessel monitoring systems and automatic identification systems as tools to improve safety of fleets.



Further thoughts on addressing fishing safety

Following on from the expert workshop, some additional approaches have been suggested:

The **FISH Safety Foundation**[17] suggested a programme of extensive collaboration with local communities, with features that include:

- targeted interventions locally with fishing communities, companies and industry participants
- onsite advisory sessions
- occupational health promotion in fishing communities
- local conferences
- online and social media focus
- provide 'interesting' information to make site attractive (news)
- promote the platform as a tool for communities (for example local education, safety meetings, and local meetings)
- create a pathway for professional development (for example certificates, diplomas)
- illustrate what 'good' looks like
- promoting 'wellness'
- incorporating incentives for engagement.

The **Memorial University of Newfoundland** (MUN)[18] suggested a pilot programme, to be executed in the Philippines or Indonesia, which will:

- investigate and evaluate the training certificate regimes in maritime jurisdictions
- lobby for programme support from in-country governments, maritime safety agencies and in-country maritime colleges.
- provide 'on the water' training and certificates in a manner similar to practice in other countries
- review in-country rescue co-ordination centres to evaluate the effectiveness and ability to respond locally to EPIRB / PLB and satellite distress warning systems
- if deemed appropriate, provide or facilitate affordable local access to EPIRB / PLB systems via equipment loan or hire
- if successful, expand the pilot to a 3-5 year programme operating first across the BIP region, and then wider, taking the training and maritime safety aspects to small scale operators wherever deemed appropriate.

Recommendations to Lloyd's Register Foundation

While there are strong efforts currently being made to improve fishers' safety in the developed world which have the potential to improve safety significantly, the greatest impact in terms of lives saved is achievable in countries such as Bangladesh, Indonesia and the Philippines (BIP).

... the greatest impact in terms of lives saved is achievable in countries such as Bangladesh, Indonesia and the Philippines.

Improvements in developed countries are primarily directed toward enforcement of regulations and technological enhancements in larger fishing boats and ships. With a few exceptions, it is generally recognised that this approach would produce little effect in BIP, where many citizens fish from less advanced vessels and for the immediate food needs of themselves and their families.

The main recommendation from this consultation is for co-ordinated action that focuses on supporting the safety needs and challenges faced by the local communities.

A three part action plan is proposed to reduce fishing related deaths in BIP. A key element of the approach is partnership with and delivery through the local community. The phases are:

1. Research, primarily related to a current assessment of fatality rates, accident causes and risk; and an evaluation of existing initiatives.
2. Multi-stakeholder training enhancement, directed towards designers, fishers, the public, regulators, and other stakeholders.
3. Application of appropriate technology, commensurate with local capability and culture.

To test the approach, a pilot programme should be explored, preferably in a BIP community having already achieved at least some success in improving fishers' safety. The pilot could be rolled out to other countries once proven. Due to its central location, the prevalence of English as the marine working language, and its significant infrastructure, the Philippines is considered the best choice for the pilot's location.

The Foundation is well positioned to support this pilot programme, to establish appropriate impact measures, to convene stakeholders, and to attract support that will sustain the maintenance and growth of the programme in future years.

An additional recommendation is that experts on fishing safety around the world need a way to share their expertise, experience, knowledge and good practice, and a platform from which to engage with policy makers, industry and the wider public on safety issues in the fishing industry. The Foundation can play a catalytic role in supporting the development of such a community of practice.

Appendix A: Glossary

AIS	Automatic identification system
BIP	Bangladesh, Indonesia, and the Philippines
CHIRP	Confidential hazardous incident reporting programme
EPIRB	Emergency position indicating radio beacon
FAO	Food and Agriculture Organization
GRT	Gross registry tonnes
ICT	Information and communications technology
ILO	International Labour Organization
IMO	International Maritime Organization
KRISO	Korea Research Institute of Shipbuilding and Offshore Engineering
NAVTEX	Navigational Telex
PLB	Personal locator beacon
SOLAS	Safety of Life at Sea
UN	United Nations

Appendix B: Fatality causes and solutions identified prior to the workshop

Causes of fishing fatalities

Prior to the workshop, participants offered opinions on the most significant causes of fatalities in the fishing industry in Bangladesh, Indonesia, and the Philippines (BIP). The causes have been grouped into categories and summarised in a table at the section's conclusion on page 26.

In the developed world, insufficient ratification of and adherence to regulations are often named as weaknesses in the industry. For example, only seven countries have ratified the Cape Town agreement[19], discussed below, and the signatories exclude countries with significant histories in the fishing industry, such as Canada, the UK, the United States, Portugal, Spain, and Sweden.

Also in developed countries, where a significant proportion of fishing is done using boats of significant size (24 metres in length and greater), a disproportionate number of fatalities result from the total loss of vessels, often by sinking or capsizing due to insufficient knowledge of real time stability. Davis[20] has studied the issue in Canada and provides the following information:

> "Of the 4,084 accidents involving fishing vessels, only 198 were due to sinking / capsizing (4.8%). However, of the 144 fishing vessel fatalities listed by the TSB [Transportation Safety Board (Canada)], a disproportionate number are attributed to sinking / capsizing. Sixty three fatalities were the result of fishing vessels sinking / capsizing, or 43.8% of all fishing vessel fatalities."

In the developing world, lack of even the most basic safety equipment, access to affordable weather information, nearly complete vessel unseaworthiness and lack of visibility of small fishing boats are often mentioned as causes of many fatalities.

In both the developed and developing world, an immature safety culture within the fishing industry is quite often cited as a deterrent to change and improvement.

Although specific to the Maldives, an indication of the typical causes of fishing incidents associated with small artisanal individual fishing operations is shown in figure 3 overleaf[13].

More detail on the suggested fatality causes follow in this section.

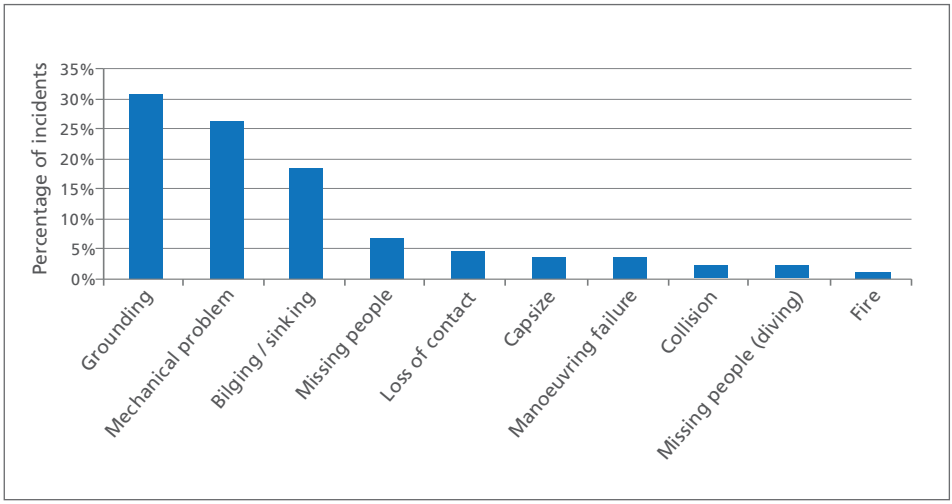


Figure 3: Causes of fishing related incidents in the Maldives in 2015[13].

Lack of regulation or lack of implementation of regulation

The Pew Trusts[19,21] describes how the lack of existence or implementation of regulations endangers the lives of fishers. It also noted[19] the contrast between the highly regulated merchant sector and the fishing industry, which currently has no international regulation for vessel design and construction.

Lloyd's Register (LR)[22] identified the lack of domestic regulation as an issue.

Memorial University of Newfoundland[23] commented on regulatory issues in the fishing industry, mentioning that domestic fishing vessels are not subject to the same stringent requirements as vessels required to comply with the SOLAS Convention.

Some important regulatory documents and conferences related to fishers' safety[24] are listed in Appendix D, together with commentary related to the regulatory process, which has been ongoing for more than 40 years.

Lack of vessel identification, monitoring and tracking capability

The Pew Trusts[25] and LR[22] identified lack of effective vessel identification and tracking as global issues from two perspectives: first, to provide search and rescue services if necessary, and second, as a deterrent to illegal fishing, which can lead to many safety issues for fishing crews.

The Pew Trusts also mentioned that poorly maintained national vessel registers, which can be the case in developing countries, exacerbate the problem of not knowing who is operating, where and when.

Lack of basic safety tools, equipment and weather data

Several experts identified the lack of basic safety equipment and weather knowledge as major contributors to deaths in developing countries.

Memorial University of Newfoundland[23], for example, contributed as follows:

> "Fishing boats right across the region (and in Latin America) go to sea with minimal safety gear. In Kiribati for example, small outboard driven boats operate between north and south islands in the trade wind zone with only mobile phones…..if engine breakdown occurs they can drift downwind rapidly and not be able to send an emergency message. Even an EPIRB system can be out of the range of costs for these vessels and are not universally on board."

CHIRP Maritime[26] proposed weather, or more specifically, the lack of availability of affordable local weather information, as the number one cause of fatality.

CHIRP Maritime[26] also made mention of the lack of basic safety equipment such as:

- standard fitted equipment such as an automatic identification system (AIS)
- weather NAVTEX (Navigational Telex)
- a radar with global positioning system (GPS) capability
- strobe and navigation lights
- standard fishing equipment such as winches, beams, and 'A' frames
- cheap disposable buoyancy aids such as one off use liferafts / lifevests with strobes, AIS, medical kit.

LR[22] highlighted the lack of satellite tracking technology providing weather predictions to fishers in developing countries.

The Fisheries and Marine Institute of Memorial University of Newfoundland[27] highlighted the lack of low-cost weather prediction capability in developing countries.

Poor vessel design and construction

CHIRP Maritime[26] proposed inappropriate design as the second most significant cause of fatality, making the following specific points:

- Fishing vessels identified as most at risk (in developing countries) are not designed to be suitably resilient and serviceable.
- Vessels are not, in many cases, capable of withstanding the maximum environmental conditions experienced in their operational regions.

The Nautical Institute[28] identified 'easily sinkable boats' as one of the two significant causes of fatalities. Specifically, small (10-24 metres in length) craft are not considered to have been designed with sufficient resiliency to keep them afloat in an emergency. The most extreme example of this is fishing boats made by individual fishers carving out tree trunks.

The Nautical Institute[28] also mentioned that fishing boats in the developing world often lack floatation devices such as inflatable chambers or fast expansion foam for floatation.

LR[22] mentioned the lack of systems to give early warning of imminent vessel capsizing.

Fishers' resistance to assistance (poor safety culture)

The FISH Safety Foundation[29] recognises the need to improve safety culture, advocating development of an industry specific safety management system and a fishing body of knowledge (BoK) portal for the fishing community.

The Nautical Institute[28] similarly recognises safety culture as a significant problem in the industry, citing the lack of local community champions and communications networks.

The Marine Institute / Memorial University of Newfoundland[27] also recognises safety culture as an issue in the industry, specifically mentioning the need for government driven national safety culture with support from community based organisations and other stakeholders.

Insufficient master and crew competence

CHIRP Maritime[26] has proposed insufficient competence and lack of training as a significant causal factor in fishing fatalities.

The Marine Institute / Memorial University of Newfoundland[27] also recognise insufficient training as an issue in the industry, specifically mentioning the lack of nationally and internationally recognised training and education requirements and access to education.

Summary table – fatality causes as proposed by contributors

	Regulatory	Vessel identification, monitoring, tracking	Lack of safety tools, equipment, weather data	Poor vessel design, construction	Poor safety culture	Competence, training
Pew Trusts	X	X		X		
FISH Safety Foundation					X	
MUN	X		X			
MIMUN			X		X	X
CHIRP			X	X		X
Nautical Institute				X	X	
LR	X	X	X	X		

Figure 3: Proposed fatality causes in the fishing industry
MUN - Memorial University of Newfoundland
MIMUN - Marine Institute / Memorial University of Newfoundland

Proposed solutions (pre-workshop)

Prior to the workshop, attendees offered potential solutions to the issues considered to cause fatalities in BIP. These are described below, in approximately the same groups as were used to categorise the fatality causes. In a few cases, proposed solutions have also been included from literature reviewed by the author.

Lack of regulation or lack of implementation of regulation

The Pew Trusts[25] suggests that benefits would be seen from the provision of technical support to national fisheries and maritime authorities to effectively enforce and implement two specific items:

- the IMO Cape Town Agreement on the Safety of Fishing vessels[20] (for vessels 24 metres in length and over)
- the Fishing Vessel Safety Code and Voluntary Guidelines (for vessels under 24 metres).

The FISH Safety Foundation[29,30] commented on the entry into force on 16 November 2017 of the ILO Work in Fishing Convention, 2007 (188). The Convention applies to all fishing vessels, regardless of size, and is holistic in nature. It is thought that an aggressive implementation and enforcement of the convention would improve safety. The key components are:

- improved fisher occupational safety, including a wide range of vessel safety requirements
- improved fisher health and medical care
- sufficient rest for fishers.

LR[22] recommended:

- increased harmonisation and unification of domestic vessel requirements within an international standard, achieved via a programme of outreach to flag state administrations
- specific attention to imported vessels and conversions.

The Fisheries and Marine Institute of Memorial University of Newfoundland[27] recommended:

- identification of key government agencies in BIP as project stakeholders
- investigation of inadequate government monitoring and safety oversight
- review and enhancement of regulation and enforcement regimes.

It is often considered that lack of regulation or its effective enforcement is an issue in developed countries. However, there are cases where an appropriately crafted and enforced regulatory regime can produce effective safety improvements in less developed countries,

such as has been the case in the Kingdom of Tonga[31]. Starting in 1998, small fishing vessels operating within 20 nautical miles of the coast were required to carry specific safety equipment, including:

- lifejackets for every person on board
- appropriate marine compass
- storm (sea) anchors
- parachute rockets, flares, and smoke signals
- VHF marine radio with the appropriate channel
- engine spare parts and tools for repairs at sea
- first-aid kit
- fire extinguisher
- survival rations or food and potable water for all persons on board, sufficient for at least three days
- waterproof handheld torch or mounted searchlight.

The number of fatalities in Tonga's fishing industry by year shows a drastic and continuing reduction starting in the late 1990's, when the regulation was enacted, as shown in figure 4.

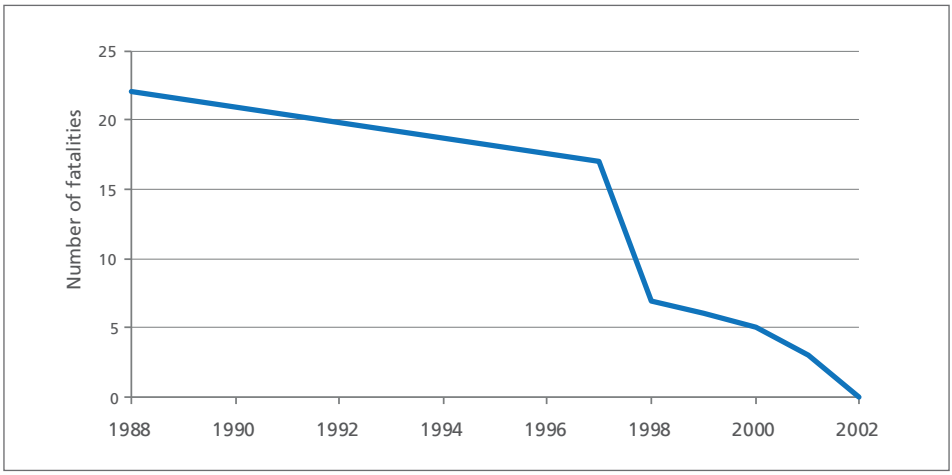


Figure 4: Fishing fatalities in Tonga, 1988-2002.

As employees of SEAFDEC (Southeast Asian Fisheries Development Centre), Chokesanguan, Rajruchithong, and Wanchana[32] have first-hand experience in the Southeast Asia fishing industry. They suggested a strengthening of local authorities and organisations and more stringent application of safety at sea standards among coastal communities.

Dr YS Yadava[33], Director of the Bay of Bengal Programme Inter-Governmental Organisation, has specific experience of fishers in the Bay of Bengal region. Yadava has made country-specific recommendations to improve fishers' safety in Bangladesh. He specifically mentioned more co-ordination of the regulatory environment and better enforcement of safety standards.

Yadava[33] also considered the situation in Indonesia, where many fishing vessels consist of dugout canoes and carry virtually no safety or fire-fighting equipment. While regulations regarding safety equipment have been in place since 1935 and were revised in 1972, enforcement is low. Yadava therefore included stricter enforcement of regulations among his recommendations to improve safety in Indonesia.

Lack of vessel identification, monitoring and tracking capability

The Pew Trusts[25] suggests two initiatives to address the issues:

- Financial support to fisheries authorities, to ensure sufficient resource is available to generate an accurate vessel register and all necessary information is provided for IMO number applications. Eligible vessel owners could then obtain an IMO number (for vessels 12 metres in length and above) or national unique vessel identifier (for vessels under 12 metres), as fishing license pre-conditions.
- Partnership with FISH-i Africa on Operation Vigilance, a project to inspect every fishing vessel operating in eight East African states. The project currently aims to inspect fishing documentation to ensure legality of operations. However, provision of AIS units would enable expansion of the project to cover safety of fishers.

LR[22] have suggested web applications for vessel monitoring systems. Examples and detail follow:

- Inshore UK vessel monitoring (iVMS) - Catch Application by Succorfish - to measure areas of fishing effort, limit overfishing and provide data logging and tracking, providing traceability of vessel movements and operating areas.
- Tracking systems acting as passive radar, assisting with collision avoidance via AIS network and potentially monitoring crew lifejackets.
- Low cost AIS-F feeding into AIS network.

- Link to fish-finding equipment and technology and marine search and rescue resources.
- 'Survey in a box'. Reporting of vessel condition and equipment provisions, pre-departure verification, photo upload, crew list, expected return to port.

The Korea Research Institute of Ships & Ocean Engineering (KRISO)[34] is developing a Korean e-Navigation system, called SMART-Navigation, which provides an electronic tracking and navigation system for small vessels, especially fishing boats, and was designed to implement the IMO's 'e-navigation*' concept.

The SMART-Navigation system provides services to all vessels operating in Korean waters and is comprised of the following components:

S: Sea traffic co-ordination and optimisation.

M: Marine domain awareness.

A: Active and proactive maritime safety management.

R: Remote assistance.

T: maritime Telematics.

The graphic below[34] shows one of the SMART-Navigation services, MESIS, or Maritime Environment and Safety Information Service.

* e-navigation has been defined as the harmonised collection, integration, exchange, presentation and analysis of marine information on board and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment.

Chokesanguan, Rajruchithong, and Wanchana[32] recommended the registration of small fishing boats and the development of an appropriate incident reporting and investigation system, taking into account:

- The draft Guidelines competent authorities in implementing an accident reporting and analysis system for small fishing vessels, currently being developed by FAO
- The possible establishment of incentives for fishers, indemnity programmes, registration systems for fishing vessels and subsidies to the fishing industry.

Lack of basic safety tools, equipment and weather data

CHIRP Maritime[26] suggested the following to address the issue:

- Standard fitted equipment such as AIS, weather NAVTEX, radar with GPS, cheap durable mass produced kit such as standard strobe and navigation lights.
- Standard fishing equipment such as winches, beams, and 'A' frames.
- Cheap disposable buoyancy aids such as one off use liferafts, lifevests with strobes, AIS, medical kit.

The Marine Institute / Memorial University of Newfoundland[27] advocates:

- Development of a low cost weather prediction software platform that can be deployed and utilised globally and a distribution network through text and social media.
- Applied research on technology aids to fisheries safety (for example smartphone applications for real time weather, vessel traffic and vessel stability).
- Research into vessel traffic management for domestic vessels.
- Domestic version of e-navigation (currently under development in Korea).
- Applied research into lower cost lifesaving appliances (life jackets, locators, etc.) that have historically been cost prohibitive and / or not designed for local conditions.

Chokesanguan, Rajruchithong, and Wanchana[32] recommended the use of safety equipment including fire-fighting and life-saving appliances, as well as the development and promotion of appropriate communication systems for weather forecasting information and search and rescue systems.

Poor vessel design and construction

LR[22] mentioned that requirements exist on tug masters for early warning of capsize. Tools to provide assistance in this area are being developed around CFD (computational fluid dynamics) assessment of the dynamics involved. A simple traffic light system based on a fitted inclinometer may assist in many cases in the fishing industry.

CHIRP Maritime[26] suggested the following to address the issue:

- A small crewed vessel (1-4 personnel) fabricated from suitable high visibility materials that the local economy can mass produce, a 'VW Beetle' of the sea.
- Most at risk vessels to be designed to be more resilient yet serviceable as fishing vessels.
- Vessels to be capable of withstanding maximum operational environmental conditions.
- Local boats to be traded in against new boats and destroyed.
- Standard engine designs for ease of maintenance and spare parts.
- Sufficient inherent reserve buoyancy to enable boats to act as survival capsules.

The Nautical Institute[28] suggested as follows:

- Retrofitting resilient designs – research to be conducted around how to keep small (10-24 metre craft) afloat in an emergency. Survival packs or vessel floatation devices such as inflatable chambers or fast expansion foam for floatation to be incorporated.
- New resilient designs – research into new affordable materials and designs offering greater survivability for local fishers in the Southeast Asia region. This solution might benefit from a scrappage scheme for old boats and create new employment opportunities in boat production.

Chokesanguan, Rajruchithong, and Wanchana[32] recommended research on the design and construction of small fishing boats, including the modification of traditional type boats to improve safety in Southeast Asia.

Yadava[33] recommended the development of alternate boat designs to produce safer vessels in Bangladesh.

Fishers' resistance to assistance (poor safety culture)

A holistic approach to addressing immature safety culture is proposed by the FISH Safety Foundation[29], based on the concepts below.

- The causes of fatalities and ill-health are not discrete problems which can be tackled independently. The very nature of fishing means that the vessel provides work premises, living quarters and safe refuge for all on board, and the various factors impact on, and interact with, each other.
- In order to bring about a lasting positive change, the problem is best tackled holistically. A multi-year safety culture change programme is proposed, based on a practical, systematic risk-based safety management system (SMS) approach as advocated by the ILO Work in Fishing Convention.
- Impact will be maximised by targeting 10 to 24 metres long, multi-crewed vessels, allowing for most lives saved per positive intervention.

The proposed approach is summarised as follows:

Phase	Content
1	Initial survey and research to determine scale of problem, development of an associate network.
2	SMS development and testing, utilising network and industry representatives: • Development of an industry-specific safety management system. • Generation of supporting material to assist with implementation. • Development of an incident reporting programme. • Development of a fishing body of knowledge (BoK) portal for the fishing community.
3	Provide product / service delivery assistance, both online, onsite, and on vessels.

The Nautical Institute[28] suggests several initiatives to improve safety culture:

- Local champion identification and activities:
  - Structured programme of experienced fisher professional visits to fishing communities to identify local champions and establish communication networks.
  - Champions to obtain better specific local knowledge about causes of fishing incidents.
- Community engagement. It is estimated that many fishers and their families, particularly in the younger generation can be engaged through social media. This kind of network should be encouraged, and developed to gain operational intelligence and deliver advice. This network should give value to the participants in return, perhaps through e-Learning, safety information, fishing intelligence, community relations or even entertainment opportunities.
- Establishment of an OSHA-style five star voluntary programme to encourage safety by recognising good practice. These systems have proven successful and might allow safer boats to be recognised by their communities. Recognised achievers might also be entitled to benefits including priority port services or educational credits for their families.

The Marine Institute / Memorial University of Newforundland[27] suggest a process as follows:

- Conduct research and analysis of root causes of continued accidents on fishing boats, specifically focusing on economic and cultural factors that result in unsafe vessels continuing to be in use.
- Identify key institutional partners in target countries as project stakeholders (including government agencies, training institutions, and community based organisations).
- Investigate origins of operational pressures, together with inadequate government monitoring and safety oversight that lead to unsafe conditions.
- Specific local safety culture training.

Yadava[33] recommended the development of networks of community organisations to improve safety in Bangladesh.

In Indonesia, Yadava[33] concluded that poor safety related work practices were at the root of many fatalities, such as:

- Falling overboard in rough weather after having fallen asleep on deck-mounted fishing gear.
- Becoming caught in nets while they were being set.
- Working in enclosed spaces without appropriate prior gas purging activities.

Yadava's implied recommendation for safety improvement in Indonesia is to apply pressure on persons in authority to utilise appropriate safety behaviours and work practices.

Insufficient master and crew competence

CHIRP Maritime[26] proposes to address the issue through the delivery of the following discipline training to target audiences in an understandable manner:

- boat maintenance
- local hazards, (navigational or otherwise)
- dangers of overloading and instability
- interaction with other commercial traffic (COLREGS - collision regulations).

Memorial University of Newfoundland[23] mentioned the Australian Maritime College's delivery of master (of less than 24 metre vessels) training to Torres Strait islanders in a manner that has had high impact (50% less emergency call outs in the region).

The Marine Institute / Memorial University of Newfoundland[27] propose the following steps to fill the training gap:

- Development and delivery of specific training in safety culture.
- Training for national and local officials and administrators in regulation and enforcement regimes.
- Development of training requirements and competencies for recognised vocational, technical institutions and community based organisations.
- General and specific domestic training through online courses, similar to the seafarer certification process being implemented in Canada.

And also:

- Review of the current training and education programmes / levels within national agencies and community organisations.
- Development of capacity within fisheries administrations through the development and / or delivery of training and education in the target sectors.
- Assessment of gaps in current education and training offerings and design / delivery of programmes to fill the gaps (including competency based programming and training for non-traditional learners).
- Build capacity at relevant secondary and post-secondary level institutions through the development and delivery of training and education by key instructors.

- Build capacity at key training institutions in competency based education and training (CBET) and community based education delivery (CBED).
- Assess current institution-industry collaborative mechanisms and develop strategies to enhance collaboration and co-operation.
- Deliver focused training in fisheries safety and general safety culture training to agency, administrators and institutional staff.
- Develop and enhance monitoring and enforcement training for officials and administrators.
- Incorporate use of communications technologies / ICTs including mobile apps, simulation and social media to enhance access and uptake of capacity development initiatives; including use of technology applications to promote access to training and education, including CBET and CBED.

Chokesanguan, Rajruchithong, and Wanchana[32] recommend implementation of training and education programmes for all stakeholders in Southeast Asia, including the fishers, family members, boat builders and others, in the basic requirements of:

- boat design and construction
- equipment and its correct use (including avoidance of dangerous fishing practices)
- search and rescue operations
- occupational health, working conditions and safety awareness
- awareness of the environmental factors.

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Appendix D: List of workshop attendees

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Appendix E: Important safety documents and conferences with commentary

1. The International Conference on Safety of Fishing Vessels (Torremolinos, Spain, 7 March-2 April 1977), leading to the Torremolinos International Convention for the Safety of Fishing Vessels, 1977 (applies to vessels 24 metres in length and over).

   Since fishing vessels were exempt from almost all requirements of the SOLAS and Load Lines Conventions, the convention promoted the safety of fishing vessels by establishing uniform principles and rules concerning the construction of safety related equipment.

2. The International Conference on Safety of Fishing Vessels (Torremolinos, Spain, 22 March-2 April 1993, leading to the 1993 Torremolinos Protocol (applies to vessels 24 metres in length and over).

   The conference addressed perceived difficulties with the 1977 convention, which led to a number of states failing to ratify the document and preventing its entry into force.

   The following states have ratified the 1993 Torremolinos Protocol:

   - Bulgaria
   - Croatia
   - Cuba
   - Denmark
   - France
   - Germany
   - Iceland
   - Ireland
   - Italy
   - Kiribati
   - Liberia
   - Lithuania
   - Netherlands
   - Norway
   - Saint Kitts and Nevis
   - Spain
   - Sweden

3. International Convention on Standards of Training, Certification and Watchkeeping for Fishing Vessel Personnel, 1995 (STCW-F Convention).

   The convention includes basic safety training for all personnel, and certification of skippers, officers, engineer officers, radio operators, and watchkeepers.

4. The IMO Code of Safety for Fishermen and Fishing Vessels, 2005 – Part A: all vessels, Part B: 24 metres in length and over.

5. The IMO Voluntary Guidelines, 2005, 12 metres in length and over, but less than 24 metres.

6. The IMO Safety Recommendations for Decked Fishing Vessels of less than 12 metres in length and Undecked Fishing Vessels, 2012.

7. Cape Town Agreement of 2012 on the Implementation of the Provisions of the Torremolinos Protocol of 1993 relating to the Torremolinos International Convention for the Safety of Fishing Vessels, 1977.

   The agreement produced amendments to the 1993 Torremolinos Protocol in the following areas:
   - exemption of vessels engaged solely in its exclusive economic zone (EEZ)
   - equivalence of length to gross tonnage
   - progressive implementation of the protocol.

   The following states have ratified the 2012 Cape Town Agreement:
   - Congo
   - Denmark
   - Germany
   - Iceland
   - Netherlands
   - Norway
   - South Africa

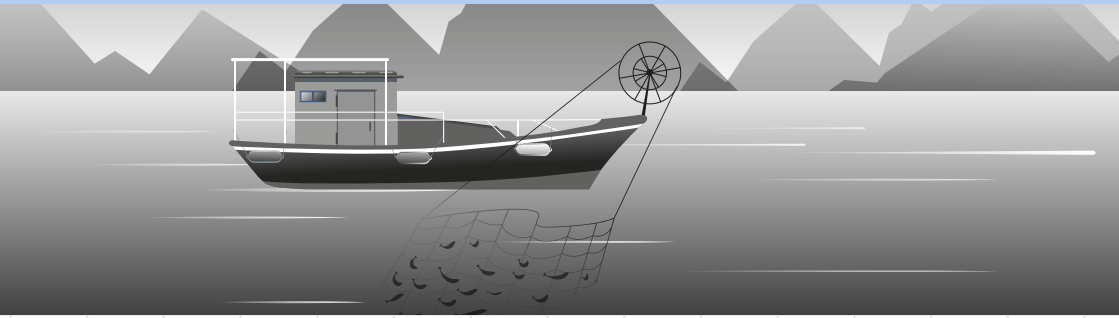
   There has been some resistance to ratifying the Cape Town Agreement, and the IMO has held a number of regional seminars in co-operation with the FAO.

8. Technical Guidelines for Responsible Fisheries, Food and Agriculture Organization of the United Nations, 2015.

9. The International Labour Organization's Work in Fishing Convention, 2007 (188) and accompanying Recommendation (Number 199) which entered into force on 16 November 2017. The convention includes guidelines designed to ensure that fishers:
   - have improved occupational safety, health and medical care at sea
   - receive sufficient rest for their health and safety.

Lloyd's Register Foundation

Life matters



June 2018

Lloyd's Register Foundation
Report Series: No. 2018.3