SECTORAL ACTIVITIES PROGRAMME

Maritime Industries Branch

Working Paper*

Risks and Dangers in Small-Scale Fisheries:

An Overview

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* The views expressed in this working paper are those of the author and not necessarily the views of the International Labour Office.

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Abbreviations

BOBP	Bay of Bengal Programme
COSP	Code of Safe Practice
EPIRB	Emergency position-indicating radio beacon
FAO	Food and Agriculture Organization of the United Nations
FSM	Federated States of Micronesia
IDAF	Programme for Integrated Development of Artisanal Fisheries in West Africa
IMCO	Intergovernmental Maritime Consultative Organization
IMO	International Maritime Organization
LOA	Length overall
MCA	Marine and Coastguard Agency (United Kingdom)
NGO	Non-governmental organization
RNLI	Royal National Lifeboat Institution
SAR	Search and rescue
SOLAS	International Convention for the Safety of Life at Sea
TAC	Total allowable catch
USCG	United States Coast Guard
VMS	Vessel monitoring system

1. Introduction

1.1 General

Fishing takes place in a natural environment that often becomes hostile to people and their vessels. The attitude of fishermen, as that of other sea-going people, is less than perfect for facing the risks and dangers of their vocation before and during their fishing trips. Death at sea is an integral part of the fishing profession and, therefore, the casualty toll must be accepted as a cost of working in this hazardous environment.

Still, this toll can undoubtedly be reduced, if the fishing industry and individual fishermen, national authorities, international organizations and voluntary bodies face this issue with enough thought, consideration, empathy, political will and material means.

Marine fishing has always been the most dangerous of all civilian occupations. According to a 1983 British study, the fatality rate of fishermen in the United Kingdom was 20 times that of workers in manufacturing industries. Labour Canada reported that in 1985 out of every 100,000 workers, 32 construction workers, 74 miners and as many as 212 commercial fishermen died "on the job". Four years later, an American study disclosed that the annual fatality rate for United States commercial fishermen was about seven times higher than the national average for all industries.

The rate of loss of life and other casualties is still higher where artisanal and other small-scale fishermen fish in conditions for which their vessels, and their safety and communication, first-aid, search-and-rescue (SAR) and early warning equipment, are less than adequate. In Guinea, a small country with some 7,000 artisanal, marine fishermen, a survey disclosed that in a year every 15th canoe has an accident and for every 200 registered fishermen one person (male and female fisherfolk, fish traders and their families) dies in a canoe accident.

In Oceania, during the 1989-90 period, some 120 deaths in about 640 accidents were reported. This picture becomes still worse when one adds the sometimes massive losses of life and equipment in tropical storms.

The safety and health of the world's 15-20 million male and female small-scale and artisanal fishermen have yet to attract adequate attention from either national authorities or international organizations. Instead, what prevails in many countries is the tragedy of official inertia to initiate action, legislate, enact and implement rules and regulations, and to invest the funds for establishing the services essential for reducing the numbers of casualties among small-scale fishermen.

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[1] Throughout this text and the relevant international labour standards quoted here, the pronoun "he" is used to refer to, for example, inspectors, seafarers and shipowners. This is not intended to imply that such occupations are exclusively performed by men, and the text applies equally to women in such occupations. The use of fisherman and fishermen should also be understood in this context.

The official, national and international attitude has always been more attentive when it comes to large and medium-scale fishing fleets, although the rate of accidents at sea and casualties among small-scale fishermen is no doubt higher than that in high-seas fishing. Most of the casualties among small-scale fishermen are not covered by the International Maritime Organization (IMO) and very few records or statistics are available. (Ben-Yami, 1998; Binkley, 1994; Johnson and Toure, 1994; Houehou, 1993; McCoy, 1991; Satia, 1993.)

1.2 Small-scale fishermen

"Small-scale" and "artisanal" fishermen are overlapping terms that cover a very wide range of fish producers who use an equally wide range of fishing technology. In particular, one must recognize the great difference between small-scale fishermen in developed countries with a relatively high level of income and living standards, and artisanal fishermen in developing countries. The former are small-scale producers who often use the most advanced fishing technology and electronics on board, however small their quite advanced fishing craft. The latter, mostly poor fishermen, make their living by operating low-investment boats and fishing equipment. The fish they catch are processed and marketed by hard-working women who often suffer from eye diseases and even loss of sight from working in a smoky environment. Most of them live in remote, coastal communities where living standards and the quality of life keep them at the bottom of the socioeconomic pyramid. Malnutrition, poor health and short life expectancy are common in many fishing villages, especially those that are remote.

There is a huge difference when it comes to the health and safety of the fishermen at these two extremes.

1.3 Small-scale and artisanal fisheries

About half the world's seafood is caught or otherwise collected by small-scale fishermen (see *Definition*, below), operating millions of multifarious fishing craft. (Just to give an idea: Portugal alone has over 10,000 fishing boats of less than 10 m in length; there are over 40,000 among the Pacific islands and even Israel has close to 1,000).

During the last quarter of the twentieth century, small-scale fisheries have been receiving much more attention than at any time before. Several reasons can be given. First, developing countries' governments, as well as various development agencies and international development banks, have increasingly recognized the role that small-scale fisheries play in their countries' economies. Second, they have made some rather painful reassessments of their frequently unhappy ventures into large-scale fisheries development. Third, owing to technological and economic factors, small-scale fisheries have been gaining in importance in developed countries as well as in developing countries. Finally, and at least in part as a result of the above, more and more boat and equipment designers and manufacturers are producing designs and products aimed in particular at small-scale fisheries.

In developed and even some developing countries, small-scale fisheries have ceased to be synonymous with backwardness and poverty. This was the result of the development of small fishing craft with a large cruising range, powerful engines, high speed and a fairly high degree of seaworthiness. Many such boats can carry considerable amounts of

fish, are equipped with up-to-date technology and, hence, are able to operate a wide variety of fishing gear. These features enable them to work fishing grounds previously inaccessible to small-scale fishermen.

Management regulations limiting fishing boats' lengths stipulate construction of short, wide, deep and powerful "monstrosities" in both Europe and North America. One example of this is the aluminium-hulled, twin-engined, electronics-laden salmon gill-netters operating in Bristol Bay, Alaska. While limited to 32 ft (9.75 m) in length by law, these boats are very wide, deep and fast. One such boat has three engines with a total power output of 2,000 hp. The investment in a boat of this class may exceed USD 300,000.

At the other end of the range, in developing countries, one may encounter artisanal fishermen operating their traditional fishing gear and craft only little different from those already in use hundreds of years ago. In some places, the only advance has been the introduction of synthetics; in others, the outboard engine.

Nonetheless, in some developing countries substantial progress has been made: fishermen using motorized canoes for ring-netting and purse-seining, continuing motorization of traditional fishing craft, introduction of mechanical haulers and echosounders, and trawling and shrimping from small boats, to mention a few. Clearly, the sophistication of fish-location and gear-handling techniques, as well as the level of working and living conditions on board vary from place to place, depending on the general and local technology level, the availability of capital and the economic output of the fishery.

Definition

Further discussion of risks and dangers in small-scale fisheries, especially in view of the legal aspects, requires stricter definitions. There are two main ways of defining small-scale fisheries: by socioeconomic criteria, and by technical criteria.

Socioeconomic criteria define small-scale fisherfolk as people of both genders who usually operate their own fishing craft and equipment, and go to sea themselves either alone or with a few crewmembers (preferably their own relatives). Nonetheless, in many places small-scale fisheries are run by small boat-owners employing hired hands and sharing fishermen, etc. In other cases small-scale fishermen may rent out boats and gear from smallholders, usually from their own community. In this respect, company-owned fleets of small fishing craft do not fall under the definition of small-scale fisheries.

However, although socioeconomic status, as we shall see later, has a major influence on fishermen's health and safety, in terms of risks and dangers, and the means of preventing and alleviating them, the technical criteria are more relevant.

Technical criteria (used in this overview) define small-scale fisheries as a sector in which fishermen fish and collect aquatic organisms from beaches, from under ice, either by swimming, diving, or wading, or using small-scale fishing craft. Small-scale fishing craft are defined, for developed countries, as boats of less than 10-12 m LOA and less than 12-15 MT displacement, powered by engines not exceeding 200-300 hp (150-225 kW). For developing countries, this definition also covers canoes, pirogues and open-deck dhows up to 16 m LOA, powered by engines not exceeding 200 hp (150 kW).

2. A short review of typical risks and dangers

Bad weather

Sudden gales, major storms and heavy fog are significant causes of small-boat accidents often resulting in capsizing, grounding, becoming lost and collisions. Several types of artisanal fishing craft are buoyant and do not sink even when capsized, which increases the survival chances of their crews. Where weather warning systems and radio communication with fishermen at sea are poor or non-existent, casualties due to bad weather are more frequent.

Loss of power

This is a major cause of accidents. Many small fishing boats are powered by an outboard motor and do not carry either a spare engine or sailing rig.

Fire on board

This is less common on board small fishing craft, as most of them are open boats or rafts where fire detection is usually instantaneous. However, fire on board canoes (and pirogues) powered with outboard engines and carrying large amounts of spare fuel is extremely dangerous.

Inadequate boat construction standards

Many small-scale fishing boats are not designed and constructed to sufficient safety standards. Frequently, also, the boats' design and construction are unsuitable for the conditions they are used in.

Unsuitable boats

During the last decades of the twentieth century, small fishing craft are sailing farther offshore on prolonged fishing trips. Many of these craft, built for inshore fishing and day trips and often lacking basic safety equipment, are too small and otherwise unsuitable for offshore operations. Consequently, their crews' safety has steadily deteriorated.

Fisheries management

Certain management strategies may motivate fishermen to increase their earnings by taking risks that they would not take otherwise. Such strategies involve, for example, limiting fishing time and area, and transferring and leasing catch quotas, as described below in *Short case study 6: Canada*.

Economic hardship

Economic hardship, or even transitory financial difficulty, often causes fishermen to take extra risk, when their better judgement might suggest otherwise.

Inadequate communication

Lack of radio contact essentially precludes efficient SAR action. Additional problems may arise where radio-telephone contact exists, but there is no adequate common language between the people at sea and the people who may help them. Consequences may be tragic.

Fishing operations

Trawling vessels of any size may capsize when their gear snags on a fastener (any snaggy obstacle on the sea bottom), while small seiners may capsize under the downward pressure of a large catch of fish "sinking" during the last stage of net hauling. People can be swept overboard if caught up in nets or because of ropage running out while they are setting the gear. Various injuries may occur during fishing both from contact with fishing gear and deck mechanisms, and from bites, stings and tail kicks by fish and other marine animals. Wading and diving fishermen are particularly at danger from large predators and various poisonous creatures.

Lack of accessible shelters

In many parts of the world, small-scale and artisanal fishermen are unable to operate from fishing ports or shelters and are forced to cross oceanic or other surf on the way to and from the beach or to enter badly accessible shelters and anchorages. Surf-crossing takes a big toll on lives and equipment.

3. Review of safety approaches to small-scale fisheries

3.1 International and regional efforts

Unfortunately, there are no internationally agreed legal instruments in force either for the construction of small (less than 12 m LOA) fishing vessels and the safety equipment required, or for the training and certification of personnel in small-scale and artisanal fisheries. Even the 1993 Protocol to the Torremolinos International Convention on the Safety of Fishing Vessels, which addresses only fishing vessels of 24 m in length and over, has yet to be ratified by most States.

In the mid-1970s, the Food and Agriculture Organization of the United Nations (FAO), ILO and Intergovernmental Maritime Consultative Organization (IMCO) drew up a code of safety for fishermen and fishing vessels in two parts: Part A for skippers and crews and Part B for vessel construction and equipment. It is obvious from the contents of Part A that it was not designed for small-scale fishing boats, while Part B is designed explicitly for vessels longer than 24 m. For fishing vessels of 12-24 m there are the 1980 FAO/ILO/IMO *Voluntary guidelines for the design, construction and equipment of small fishing vessels*. But, judging from the contents of some recent revision proposals to the *Guidelines* it is clear that they are not applicable to small-scale and artisanal fishing boats.

Of all the international instruments, only Chapter 5 of the International Convention for the Safety of Life at Sea (SOLAS) makes specific reference to all small and medium-sized fishing vessels, merely requiring "ships of less than 150 tons gross" to be fitted with a steering compass. And that seems to be all there is.

Governments are reluctant to ratify and enact international standards and conventions concerning fishermen's safety, probably because of the costs to themselves and the industry, and the inconvenience and costs associated with legislating, enacting and enforcing existing ones. They no doubt shun any involvement in new conventions concerning small-scale fisheries because enforcement is even more difficult and costly.

An exception is probably the Nordic Boat Standard for commercial boats, which deals with construction and stability for fishing vessels under 15 metres. It is jointly produced by Denmark, Finland, Iceland, Norway and Sweden.

Following a disastrous cyclone, which struck the coast of north-east India in 1996, FAO's Bay of Bengal Programme (BOBP) initiated, along with interested governments and some non-governmental organizations (NGOs), an ongoing activity directed at fishermen's safety. BOBP is trying to bring the governments and the NGOs together in a concerted effort. This proves to be an uphill task for several reasons, one of them being that some junior government staff apparently have problems in working with the NGOs.

Other FAO-sponsored activities include a regional workshop and seminars with participants from Bangladesh, India, Philippines, Thailand and Viet Nam. They are aimed at drafting legislation on small vessel safety, as well as training inspectors and boat-builders to ensure their capacity to adopt, inspect, certify and enforce new legislation. FAO is also sponsoring the preparation of reports and guidelines addressing the subject of improving the safety of both decked and non-decked small vessels, but these have yet to reach the regulation stage. Unfortunately, few boat owners are willing to voluntarily bear the costs of implementing FAO's recommendations.

FAO is also planning regional activities for the Caribbean and the Pacific islands where loss of life of fishermen going further offshore in poorly designed and built craft is increasing. The Caribbean regional project is planning to propose obligatory standards for construction and modification of fishing vessels and to train fishermen, fishing vessel inspectors and boat-builders. Governments of the region are already contemplating enforcement of prescribed standards for the construction of small fishing vessels through (a) amendments to Fisheries Regulations of East Caribbean States and Barbados and (b) an authorized system for inspecting fishing vessels.

In 1993, the BOBP published the pertinent and very good *Safety guide for small offshore fishing boats*, targeted at the fisheries of south and south-east Asia. (P. Calvert, 1996; IMCO, 1976; IMO, 1998; J. Turner, personal com.)

3.2 Selected developing countries

Developing-world, small-scale (including artisanal) fisheries are defined, for the purposes of this report, as fisheries operating at generally low-technology and low-income levels in developing countries, as well as in certain areas of fairly developed countries where government control of and contribution to services, safety systems, SAR and communications, etc., is poor or non-existent.

As far as the available information goes, government legislation and efforts to alleviate risks and dangers among fishermen are scarce, to say the least, while those already initiated have still to achieve success. In some areas, NGOs are active, mainly concentrating on training in safety measures and emergency equipment and trying to bring the issue to official and public consideration and, occasionally, in actual SAR service.

3.2.1 India

India's Merchant Shipping Act contains provisions stipulating that all fishing vessels should carry safety equipment and be subject to inspection. Since the Act defines a fishing vessel as a ship with mechanical propulsion, it can be assumed that this law also covers small, motorized fishing boats.

India has a cyclone warning system based on satellite synoptic observations and a network of coastal radars coupled with a network of S-band receivers. The receivers can be selectively activated as soon as atmospheric conditions indicate development of a cyclone, which gives 48 hours warning. Siren signals are sounded and radio warnings in the local language are broadcast. If a cyclone changes its course, this operation is repeated at the coastal area likely to be affected. Additionally, India's meteorological centre sends cyclone alert messages to government agencies, with 24-hour warning bulletins repeated by coastal radio stations hourly around the clock.

The main problem, therefore, is bringing the warnings in good time to all fishermen at sea and on the beach. Following the cyclone of 1990, which caused heavy damage in Krishna District, a scheme was set up by India's Department of Fisheries in Machilipatnam to alert artisanal fishermen of approaching cyclones through a VHF radio system. A programme was initiated to provide radio warnings by means of a purpose-built radio station and the distribution (without cost) of 125 walkie-talkie sets. However, it was reported to have failed for technical and other reasons. (P. Calvert, 1996, 1998; *World Fishing*, 1996; J. Turner, personal com.)

3.2.2 West Indies

Safety regulations specific to small-scale fisheries have been enacted or are being planned in several island-nations of the West Indies. (P. Medley, J. Turner, personal coms.)

3.2.3 Senegal

Senegal is typical of West African countries with very developed artisanal fisheries, tens of thousands of seagoing fishermen, and reportedly considerable and in places alarming fishermen's death rates, largely due to their crossing surf and entering partly sand-barred estuaries.

In 1994, the Ministry of Fishery and Marine Transport prepared a draft Code of Conduct aimed at registration, boat and skipper licensing, mandatory equipment and even insurance, for fishing and passenger canoes (pirogues). It is not known whether this Code has since been amended and/or enacted. With respect to safety, the draft stipulated basic equipment to be carried on board including a spare outboard engine, obligatory boat-driver's tests for skippers and annual inspections. (J. P. Johnson, personal com.; Rayment and Fossi, 1994.)

3.2.4 Guinea

A Canadian bilateral project, assisted by FAO/IDAF (Programme for Integrated Development of Artisanal Fisheries in West Africa), was an attempt to set up fishermen's sea safety committees in Guinea and provided some basic emergency equipment and relevant training. While these reportedly have not survived, a local activist has since followed up by modifying the structure and dynamics of traditional fishermen's mutual aid societies to include sea safety.

The organizer's approach is to persuade the members of mutual assistance groups to contribute after each fishing trip a predetermined amount of fish to be sold for the benefit of the group's safety fund. This money can then be used to buy fuel for SAR action, to pay for emergency medical care, or to repatriate a fisherman's body to his village for burial.

These artisanal sea safety committees are recognized by Guinea's Port Authority. Members have received some training on survival after capsizing, fire-fighting, emergency first aid, avoiding collisions, and being rescued without getting killed by the rescuing boat, etc. There are about a dozen such active committees in Guinea at the moment.

This initiative, reportedly, has also spread to Benin, where fishermen's own sea safety committees have started expanding in a small way. (Johnson and Toure, 1994; J. P. Johnson, personal com.)

3.3 Selected developed countries

The situation in developed countries is quite different. Safety measures and SAR systems involving radio-communication and specialized rescue craft are common and efficient, and in some countries a matter of long-standing tradition. But even so, legislation and regulations relating to maintaining safety standards, personnel training, certification and obligatory equipment on board small-scale fishing craft remain either absent or problematic (see below, *Short case study 1: United Kingdom*).

There are different traditions and arrangements among the developed countries regarding how SAR services are provided. Three basic forms exist: civilian, voluntary organizations; marine police and coastguard units; and military (navy and air force) units. While SAR is the only purpose of the SAR civilian organizations, the police, coastguard and military forces also have to perform many other duties.

3.3.1 New Zealand

According to New Zealand statistics, every fifth person in the 320 drowned during the 1986-96 period was a commercial fisherman. A voluntary coastguard federation (RNZCF) provides SAR in the country. It responds annually to some 2,000 calls involving twice as many people. It responds to direct calls for help, as well as to calls passed by the New Zealand Police. The RNZCF also provides safety education and a radio network for boats. Operating sea-borne rescue units and an air patrol, it aims to cover most of New Zealand's waters within the 12-mile coastal zone.

New Zealand has had a real-time vessel monitoring system (VMS) in place for some eight years. It is mandatory only for vessels larger than 28 metres LOA. It is operated by the New Zealand Ministry of Fisheries (Management) compliance unit and is monitored 24 hours a day, all year. VMSs are tamper-proof and are remotely programmed for frequency-of-position reporting by Ministry compliance staff, depending on the degree of perceived risk or previous record of each vessel, skipper, company, etc. Individual vessels can also be specifically polled by the Ministry at any time to spot check position reports, etc. For safety at sea purposes, such a system makes the search element of SAR easier and faster.

3.3.2 Canada

The Canadian Coast Guard is the federal agency in charge of marine safety and the SAR provider. Canada also has several NGOs providing SAR. The Canadian Lifeboat Institution has its own SAR and towing and pumping services. It also uses owner-operated vessels and assists citizen groups to develop community marine-safety groups.

Another Canadian voluntary group is CASARA, an aviation association sponsored jointly by the Department of Transport and the Department of National Defense which provide training in aviation safety, meteorology, survival awareness and search techniques and procedures. In return, CASARA participates in support services.

In 1972, the Fisheries Association of British Columbia published the *Fishermen's safety manual*, much of which is relevant to small-scale fishermen. (Safety Committee, 1972; P. Copes, personal com.)

3.3.3. United Kingdom

SAR services in the United Kingdom are based on the Royal National Lifeboat Institution (RNLI) lifeboats, operated by volunteers (frequently fishermen themselves) and coastguard and military helicopters; they save some 1,300 people every year. There seems to be a feeling among the fishermen that as the coastguard and armed forces budgets are getting tighter, SAR resources are being reduced. The coastguard also monitors radio and other distress-alerting means, including emergency position-indicating radio beacons (EPIRBs).

The United Kingdom Department of the Environment, Transport and the Regions has recently stated that commercial fishing is a particularly hazardous industry and that the continued high incidence of accidents to fishermen and losses of fishing vessels mean that safety standards must be raised and awareness within the industry increased.

The Marine and Coastguard Agency (MCA) targets a reduction in deaths and accident rates on fishing vessels. MCA's initial aim is compulsory basic safety training in the prevention of accidents, management of emergencies, survival, fire-fighting and first aid. Implementation of the Standards of Training Certification and Watchkeeping for Fishermen (STCW-F) Convention provides MCA with an opportunity for a fundamental review of the existing training and certification structure for fishermen on vessels of all sizes. MCA is now working on a revised Code of Safe Practice to replace the Fishing Vessel (Safety Provisions) Rules 1975 for those vessels under 12 m.

However, as the following case study shows, this is not so simple.

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Short case study 1: United Kingdom

Some 6,000 small-scale (under 12 m long) commercial fishing vessels operate in the United Kingdom, many from beaches and tidal harbours on the south coast. They generally sail on day trips within a 20-mile coastal zone. Many of them are operated by a single fisherman. Sea conditions can be treacherous, especially in the winter when a constant stream of low-pressure systems comes cross the Atlantic. Some of the busiest shipping lanes in the world are in that area, with resulting loss of fishing boats from collisions with merchant ships.

The Marine and Coastguard Agency (MCA) was recently formed through a merger of the Marine Safety Agency with Britain's coastguard services. It is now the authority enforcing Notices to Mariners and other statutory instruments, including safety regulations.

The MCA successfully introduced a series of Codes of Safe Practice (COSP) aimed at chartered angling boats, workboats, sail training vessels and similar craft. These codes have been worked out jointly with representatives of the interested parties. The MCA finds it difficult, however, to complete the work on a revised Code for commercial fishing boats under 12 m in length to replace the Fishing Vessel (Safety Provisions) Rules, 1975 for these vessels. The new COSP would bring everything under one law, replacing dozens of different Notices to Mariners and statutory instruments enacted over the last 30 years.

For years, attempts to apply more rigid controls to this fleet have been met with opposition. One reason may be that the inshore fishery is not the one with the worst safety record. According to coastguard statistics, out of 29 fatalities in 1997 only eight happened in the small-scale sector, the worst safety record belonging to the 12-24 m sector. Opposition increased when the new COSP was formulated with little industry input and approval and, in 1997, the inshore, small-scale fishermen woke up to the fact that the new rules might bring unbearable pressure on them. They claim that the enormous new list of requirements is too complex, depending rather on area of operation than on the size of the boat. It includes fire extinguishers, flares and life-jackets for every crewmember and over a certain size also life-rafts, which many small boats simply do not have space for. There are also regulations for bilge pumps, bilge alarms, gas alarms and fire alarming systems. The proposed regulation was tested when all the proposed obligatory equipment, including a four-man life-raft, was put on board an 18 ft (6 m) beach boat, leaving hardly any space for the two-man crew, fishing pots and baskets.

But it was the provision for mandatory inspections that was met with near universal opposition, for their cost was seen as being too much for an industry already under serious economic pressure. At GBP 60 per hour (approximately USD 100), an inspection including travelling time for the surveyor might produce a bill for GBP 60. Fishermen also complain bitterly that, as it is staffed mainly by ex-merchant navy officers, the MCA has no understanding of the small-scale fishing sector that they are determined to regulate. Thus, in spite of the almost two years of long negotiations and consequent COSP revision which brought it down from a 150-page book to a dozen or so pages, it has not yet been enacted.

The MCA is faced with solid fishermen's opposition, some of whom see it as an unnecessary bureaucratic exercise aimed at keeping the inshore fishing sector in line with other marine sectors, while others suspect that it is, in fact, an effort to reduce the fishing industry, a notion rejected by the MCA. No doubt, however, that with all the other COSPs in place, the shipping authorities intend to complete the task of having all the small commercial marine sectors regulated by enacting the new COSP in the inshore fishing sector as well. For this purpose, the MCA would have to decide whether the new COSP would come with all the parts that the industry refuses to accept and thus with major enforcement problems, or whether it would be in a form worked out jointly with the industry so that both sides can live with it. (Bates, 1999 and personal com.)

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3.3.4. Japan

The Marine Safety Agency operates SAR services employing patrol vessels, helicopters and aircraft. In 1995, 86 fishermen died in various accidents, while 673 Japanese fishing boats, among them 567 fishing boats less than 20 GRT (a 20 GRT boat is about 15 m in length) needed SAR action. On the whole, the accident rate of fishing boats has been slightly decreasing with time.

Small fishing vessels (under 20 GRT) employed in harvesting seaweed, as well as any other small fishing vessels operating only within the 12-mile coastal zone, must have pyrotechnics or cellular telephones on board. All other small fishing vessels must carry EPIRB and radar transponders.

For fishing vessels of 20 GRT or over there are mandatory detailed safety standards and government inspection. For fishing boats between 3 GRT (a 3 GRT boat is about 8 m in length) and 20 GRT, a mandatory "non-detailed" safety standard is provided jointly by the Ministry of Transport and Ministry of Agriculture, Forestry and Fisheries. It covers watertight hull integrity, essential engine tools and equipment, bilge pump, steering, mooring and anchoring equipment, life-saving equipment, fire-fighting equipment, evacuation equipment, navigation instruments, and stability and manoeuvrability requirements. Inspections are carried out by the Japan Craft Inspection Organization.

Additionally, the Fisheries Agency provides voluntary guidelines for fishing boats between 3 and 20 GRT which cover operation practice, daily maintenance, hull structure, accommodation, navigation aids, pump, engine and electrical facilities, and requirements for freeboard, metacentric height, righting arm and roll period, and life-saving and fire-extinguishing equipment. There are no mandatory safety requirements or inspections for boats less than 3 GRT, except if they operate outside the 12-mile coastal zone in which case they are inspected according to the mandatory standard.

To sum up, since most boats under 3 GRT operate within the 12-mile coastal zone, a large section of the Japanese small-scale fisheries is not subject to any mandatory regulation and inspection. (N. Umeda, personal com.)

3.3.5 Republic of South Africa

All boats under 25 tons must be licensed with the Department of Transport's Marine Division. Fishing boats are inspected for seaworthiness and certificates combining a licence and safety certificate are issued, which must be renewed each year. Recreational and sport craft are exempt. Licensed boats may not be used without the person in charge of the boat holding a Small Vessel Certificate of Competency (applies to motorized boats). The certificate specifies the area in which the boat and the skipper may operate. In addition, a Fishing Licence must be obtained from the Department of Sea Fisheries. Nonetheless, especially in more remote areas, there are many artisanal fishermen who go to sea in small boats, as for example, the 8-15 ft dinghies (*bakkies*), some powered by small outboard motors, and others on tow, to which the safety rules are not applied. (M. Shenker, personal com.)

3.3.6 United States

The commercial fishing fleet is regulated under a variety of laws and regulations, most of them promulgated by the United States Coast Guard (USCG). Following a series of highly publicized losses in the 1980s and an increased push towards safety, some of the regulations were amended and additional ones enacted. Most of the rules, however, do

not apply to the small-scale fleet. For example, skippers of fishing vessels under 200 GT (that do not carry paying passengers) are not required to hold a USCG Mariner's License. Also, stability-related rules apply only to vessels over 79 feet (24 m) in length.

Title 46, Code of Federal Regulations Part 28, spells out the regulations for commercial fishing vessels. Subpart A discusses the general safety requirements that all commercial fishing vessels have to comply with. These include fire-fighting equipment, life-saving gear (EPIRB, exposure suits, rafts, etc), navigation lights and many other elements. USCG boarding officers perform inspections at sea and fines may be imposed for non-compliance. To help fishermen, the USCG has a shoreside Commercial Fishing Vessel Safety Program – a voluntary compliance programme – and a recently introduced training programme. The Commercial Fishing Vessel Safety Program involves completely voluntary inspections and gives an opportunity to the skipper to bring the vessel into compliance with the regulations without fear of being cited for a violation. The training programme involves mobile training units and distribution of a Best Practice Guide to Vessel Stability. All this, however, is relevant only in part to small fishing boats. In Alaska, for example, many fishing vessels engaged in salmon fishery are under 12 m in length. These boats are all subject to a lengthy list of requirements which varies with overall length, size of crew, whether the vessel is USCG documented or state registered and the maximum distance offshore that it operates. The USCG implements safety rules and measures, and SAR.

On the other hand, the USCG has reportedly strongly resisted any form of licensing programme for smaller-scale commercial fishermen, fearing enforcement and administration difficulties, and that it would be politically difficult to implement since the fishing industry wants to stay as unregulated as possible. (J. Van Amerongen, K. Codel, B. Meloy, T. Nies, personal coms.)

3.3.7 Israel

In a recently published Notice to Mariners 101/99, the Small Vessels Division of Israel's Shipping and Ports Authority specifies in great detail the safety and first-aid equipment to be carried by small vessels in accordance with their size, type of business and area of operation. Among others, two classes of fishing craft are explicitly covered:

– fishing boats less than 7 m in length; and

– fishing boats 7-24 m in length not exceeding 100 GRT,

both types operating within Israel's (12-mile) national waters.

The list is quite demanding, especially for the 7-24 m class and rich in distress signals. All craft must have the prescribed equipment on board for the obligatory annual inspection and renewal of certificates of seaworthiness. The new regulation was formulated by a commission which studied the relevant Australian, British, Canadian, Scandinavian and United States regulations and standards.

There is no specific SAR agency. SAR services are provided by Police Coast Guard craft and, when necessary, by naval craft and air force aircraft. But, in most cases, also thanks to good radio and cellular-phone contact, fishermen in trouble are helped out by their peers fishing in their vicinity. (Ministry of Transport, 1999; S. Pisanty, personal com.)

3.3.8 Uruguay.

SAR in Uruguay is provided by ADES, a civilian institution supported by government organizations, private companies and proprietors of the vessels that seek assistance. Its members are voluntary sailors providing emergency assistance at sea, free of charge. Based in Montevideo, it operates several stations along the ocean coast. It has a modern lifeboat fleet. Since its foundation, ADES has carried out over 1,000 SAR sorties and has saved approximately 1,500 lives.

4. Accidents associated with the marine environment

4.1 Crossing surf

Surf-crossing has been practised all over the world since prehistoric times and continued after motorization. Today it takes place wherever natural or artificial harbours and smaller shelters are rare, and beaches are low and physically accessible to beachable craft.

Such craft evolved with time, assuming various shapes in different parts of the world. Among the best-known examples of artisanal beachable fishing craft are sailing rafts such as the Brazilian *janghadas* and Indian *kattumarams*, African canoes, Caribbean pirogues and the outrigger canoes of Oceania. In Israel, outboard-powered 6-8 m *khassakas* – fishing boats – have been developed from beach-rescue paddled rafts with a double purpose – beaching and speed.

Fishermen in Northern Denmark, Southern England, Yorkshire, Scotland, Ghaza and other places also are accustomed to beaching their small fishing vessels. They apply various techniques to pull them through the surf and onto the beach, such as beach-mounted winches, capstans or tractors (a practice that evolved from boat-beaching with the help of beasts of burden, still practised some decades ago).

Crossing oceanic or other surf on the way to and from the beach or estuarine and other shelters is taking a big toll in lives and in equipment. Boats that are not of unsinkable construction, such as rafts and some canoes or *khassakas*, founder, but capsizing is the predominant form of accidents. Capsized African canoes may stay afloat after the catch and the fishing gear spills out. Sometimes the crew manages to straighten them back. In the tropics, people who manage to cling to floating capsized hulls until the craft is thrown onto the beach, without getting smashed in the process, can survive (with or without major injuries). Notwithstanding, capsizing in surf has been found to be the principal cause of accidents and fatalities in 13 West and Central African countries. (Gallene, 1995, 1997; Houehou, 1993).

4.2 Bad weather

4.2.1 Poor visibility

In dense fog, small fishing craft are common victims of collision with large vessels. Small boats are rarely equipped with radars, radar reflectors or other means of detection, neither are they able to signal their presence to large vessels. Since they produce weak

traces on the radar screens of large vessels their being on a collision course often remains unseen.

Poor visibility caused by, for example, haze overlying the horizon and hiding coastal orientation markers, may result in fishermen losing their way, running ashore or grounding (see section 5.2).

4.2.2 Major storms

Small-scale fishermen who venture in their canoes, pirogues and other small craft, sometimes for tens of miles into the ocean are the first casualties of hurricanes, cyclones, typhoons and tsunamis.

Ten or 11 years ago the typhoon Wayne, although classified as moderate, caused havoc to the fishing fleets of the islands of Taiwan and the Pescadores. It sank, destroyed or damaged beyond repair at least 1,500 fishing craft and is thought by some as the most damaging storm of the century in the area. Considering the extent of the damage, the loss of life was light - "only" 60 fishermen were dead or missing.

In 1977, a cyclone in the Bay of Bengal killed 10,000 people; in 1990 another one killed 967 people, while in June 1996 another cyclone took 120 lives. Many of the casualties were small-scale fishermen killed at sea or on the beach.

The events of 6 November 1996, when a cyclone caused extensive loss of life in the East Godavari District of Andhra Pradesh, indicated that India's Cyclone Contingency Plan of Action was of little help when there was a missing link in the chain of communication of cyclone warnings (see *Short case study 2: India*). (P. Calvert, 1998; R. Ramachandran, J. Turner, personal coms.)

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Short case study 2: India

The densely populated coastal area of the East Godavari River delta (Andhra Pradesh State, India) is extremely vulnerable to cyclone-induced flooding. The population density of the coastal strip of Konaseema, which was worst affected by the November 1996 cyclone is 800 people per sq. km, more than double that of the whole district. It is very flat and little land is higher than two metres above sea level. During the storm surge resulting from the cyclone, the sea level rose by between two and four metres.

Thus, of all cyclone damage, the most destructive phenomenon is usually the storm surge, which accounts for more than 90% of loss of life and property. About once a year, a severe cyclone crosses the coast of Andhra Pradesh, leaving behind a wake of destruction with an average width of about 30 km.

Early on 5 November 1996, the meteorological service detected a cyclone and communicated warnings to the relevant state and district authorities. The cyclone followed a straight westerly course, crossing the East Godavari River delta between 20:00 and 22:00 hours on 6 November. Maximum wind speeds were 220 km/hour and the storm surge was reported as 2.2 metres in height. It took fishermen by surprise because of a lack of normal natural warning signs and killed over 1,400 of them.

Out of the 400 strong Kakinada-based fleet of motorized boats, 110 were lost at sea along with 569 crewmembers. Most of them had sailed several days before the cyclone to fish along the coast to the north and south of Kakinada, though not beyond

the 70-fathom line (typically 35 km offshore and well within the range of All India Radio transmissions). Boats that carry transistor radios had heard the warnings, but this did not stop the good fishing. Some reported that heavy radio noise interfered with the weather forecasts.

About 100 survivors whose boats had either capsized or foundered swam or drifted for up to 36 hours to shore, while some saved themselves by clinging to the insulated hatches of their boats. Few life-rafts or life-jackets (if any) were carried on board. According to a press report an official noted that life-rafts are not normally carried "because hatch covers serve that purpose", in spite of the fact that hatches should be battened down in bad weather to reduce the risk of foundering. Survivors expressed an opinion that, had there been a timely SAR response, some of the 569 lives lost at sea might have been saved.

According to the Department of Fisheries, of the 1,435 fishermen dead or missing (presumed dead) in the Kakinada, Rajahmundry and Amalapuram Divisions of East Godavari District, 830 were killed by the storm surge while fishing shrimp seed on the beaches of the Godavari estuary, far from their villages and from any possible shelter. Fortunately, the storm surge passed through the area at low tide (22:35 hours). Had the cyclone occurred six hours earlier or later, many of the 10,000 fishermen who survived in the two worst affected villages (Bhairavapalem and Balusutippa), by standing in water up to chest level with children placed on high shelves in houses built of reinforced concrete, might also have been lost.

Questions were asked how, in spite of the modern INSAT-based Cyclone Warning Dissemination System, a not very severe cyclone took so many fishermen's lives, while only one month later, over 300,000 Andhra Pradesh coastal residents were evacuated in a timely manner when another cyclone developed in the same area.

Unfortunately, in November the warnings failed to reach either some of the fishermen on land or the small-boat fishermen at sea in time, and certainly the gravity of the situation was not conveyed to them. In addition, the cyclone had developed abnormally fast and had not created either the cloud formations or the winds and downpour which usually convince fishermen to take an alert seriously. Lack of severe storm experience might have been another factor that kept some of them from seeking shelter.

Although the authorities had at least 36 hours warning, the required action might not have been urgent enough. Also, a warning sounded onshore, even if timely, may have little effect on the safety of fishermen at sea, because of inadequate shore-to-sea communication. Less than one third of crews take transistor radios to sea, their only means of communication, which are anyway not necessary continuously tuned to stations broadcasting the relevant weather reports. Reportedly, even larger vessels fishing farther offshore are often not equipped with wireless and radio sets. Altogether, while modern, sophisticated technology can supply early warnings, bringing these warnings in a timely and effective manner to the fishermen at sea and on the beach, and to their families at home, remains an urgent issue. (*World Fishing*, 1996).

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5. Accidents associated with navigation

5.1 Loss of power at sea

According to several reports, since the introduction of outboard motors the loss of life at sea has increased, although even without hard statistical evidence such an idea makes

sense. This is because with a motorized craft fishermen tend to travel greater distances offshore, putting them at risk if the engine fails. Moreover, although they used to use sails, they have stopped taking them to sea and the younger ones are not even trained in their emergency use and do not know what to do with them. The art of sailing, an important skill, has been lost in many developing countries. In Oceania, for example, apart from other accidents and fatalities, eight small fishing vessels and 30 crews are reportedly lost annually without any indication of their fate. Many other vessels drift for prolonged time periods, sometimes for months, before being found. Engine failure, either due to breakdown or running out of fuel, appears to be the predominant cause.

Outboard engines are as a rule less reliable than most inboard diesels. Small boats that do not carry spare engines, masts, sails, oars, paddles and anchors – and they rarely do – start drifting when engine power is lost. If they have any means of signalling or radioing their position, fellow fishermen, the SAR service or any fortuitous vessel may pick them up. Otherwise their fate depends on their position in relation to coast, and the state of the sea, winds and currents. The peril increases on isolated islands with steady winds blowing them offshore or strong winds driving them towards heavy surf or a rocky beach. (Gulbrandsen, 1992; T. Adams, personal com.)

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Short case study 3: Micronesia

According to observations during 1992-1995, many of the fishermen of Pohnpei Island, Federated States of Micronesia (FSM), who fish in small skiffs powered by 25-75 hp outboard motors, ventured beyond the safety of the lagoon without proper safety and survival gear. Due to economic constraints only a few carried emergency motors. Usually, they had no EPIRBs, no flares and no hand-held radios. All they had on board was fishing gear, water and food for the day.

When fishermen did not return as scheduled, the families would usually wait 24 hours before taking action, allowing for the probability of the fishermen taking shelter in one of the atolls in the area. When it became clear that they were unaccounted for, a search was usually launched. Given the strong trade winds in the area and few shelters on *terra firma*, the likelihood of the skiffs drifting quickly out of the searchable area was very high. The SAR team usually consisted of family members and friends who ventured out (also usually in such poorly equipped skiffs) and began combing the area where the missing fishermen were supposed to be last fishing. Australian patrol vessels based in some of the Micronesian islands did not usually become involved in SAR for missing fishermen unless already out on active patrol.

A local Pacific Missionary Aviation (PMA) unit would also send out their light aeroplane for an air search. Most often, due to the lack of any radio-direction signals, the pilot had to rely on a purely visual search. However, the PMA plane would often be on other assignments and unavailable for SAR. Other islands in the FSM chain were not as lucky in having a PMA plane based at their airport. Even so, in 1995 the PMA plane in Pohnpei was scheduled to relocate to Yap Island due to a disagreement with the Pohnpei Airport Authority which, although PMA was performing most of its SAR operations free of charge, had increased hangar charges. (C. F. Heberer, personal com.)

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5.2 Loss of way

Loss of way in small fishing craft is dangerous, because in most cases they do not carry large amounts of fuel, food or drinking water. In normal conditions, experienced artisanal fishermen rarely lose their way at sea, in spite of sailing without navigation instruments, often even without a magnetic compass. Their navigation skills bring them, in a way not comprehensible to seafarers from developed countries, to underwater banks and reefs, through narrow passages among underwater obstacles and to spots on the shore they aim for. Such skills are based on traditional knowledge, experience and intuition, and an intimate acquaintance with coastal and sea-bottom features, stars and constellations, and daily wind rotation for the time of year.

However, things may go awry when conditions change unexpectedly. Dense fog, cloudy nights combined with an unusual wind direction or abnormal lack of wind, etc., may bring about temporary or even fatal loss of way. Being in the wrong place in stormy weather is when the danger starts.

5.3 Grounding and running ashore

In areas where light, artisanal fishing craft are employed in operations over shallows, alongside and over coral reefs, and among rocks, grounding is a frequent event, usually without any serious consequences, the boat or raft being pushed or pulled off the shallow, either manually or by a flood tide.

If, however, grounding occurs in rough weather and tall waves, the craft may be smashed to pieces and its crew left in serious distress. The absence of life-rafts, life-jackets, lifebuoys, etc., may result in fatalities. Staying afloat alone does not ensure survival, if there are no other fishermen in the vicinity or it is impossible to call SAR.

The situation is quite different in case of heavier, western-type small-scale fishing vessels (European-made 12 m trawlers may have a displacement of over 25MT and a draught of 1.7 m). Although they are much more difficult to get off the shallow, they are usually equipped with radio-communication, navigation and adequate safety equipment; they also usually operate in areas well covered by SAR services.

5.4 Collisions

Small fishing vessels are often involved in collisions, especially in areas of heavy traffic of merchant shipping (see also *Short case study 1: United Kingdom*). Collisions and bizarre accidents involving submarines fouling trawling gear sometimes end in capsize-sinkings and fatalities. Big merchant or naval vessels may cut a fishing boat in two and carry on without even being aware of it.

5.5 Fire on board

Fire accidents on board fishing boats often end in injuries, largely burns, which are sometimes fatal. In small-scale fisheries, fire on board is much more likely in decked fishing vessels with cooking-gas galleys, electric installations and spare fuel under or on the deck, than on board artisanal fishing craft. On the latter – mostly partly or fully deckless boats or rafts – fires can be immediately detected and dealt with. Nonetheless,

where petrol-driven outboard motors are used and spare fuel is carried on board, fires, sometimes disastrous, do happen, especially when outboard-driven large canoes operate at a large distance from their base and have to carry substantial amounts of spare petrol.

In modern, decked small fishing vessels the danger and management of fire are basically similar to those in larger fishing and merchant vessels. One frequent cause of fires and explosions in fishing vessels is leakage of (cooking) gas in closed, poorly ventilated compartments. When the gas concentration is strong enough, it may ignite and explode on contact with an electric spark, or if someone smoking enters the compartment. There are records of injuries and fatalities of fishermen who have died from burns inflicted in such circumstances.

Leaking fuel or lubricant may seep and be gradually absorbed by the wooden parts of the boat and accumulate in various cracks and hollows. This may make extinguishing a fire on board very difficult. Other common fires are "foc's'le fires", which occur mainly when tired fishermen fall asleep in their bunks with cigarettes burning and "galley fires", which are self-explanatory. Fire on board due to lightning striking a mast not fitted with a lightning conductor is rarer. (Satia, 1993).

6. Accidents associated with fishing operations

6.1 Injuries from fish and other animals, and poisoning

Fisherfolk of both sexes and all ages are more prone to injurious and even fatal contact with marine animals than other sectors of the population, except perhaps of course, frequent beach swimmers. Such contacts, much underreported, may result in stings, bites, penetrations, envenomation and external or internal poisoning. As a rule, they are all painful and some are fatal. The reaction and resistance of the afflicted person are individual and depend in many cases on the person's immune system and the strength of its allergic reactions. Records of swimming beach accidents indicate a great proportion of children among the fatalities, who may be less resistant to poisons and venoms. Since children, especially in developing countries, often participate in shallow-water fishing activities, they quite probably suffer many casualties.

There are three main ways in which such injuries by contact with aquatic animals occur, namely in the water, on board fishing craft and eating fish that contains toxin.

6.1.1 In water

Many types of fishing operation require people to be partly or fully submerged: beach-seining; extracting fish from shallow-water setnets and tidal stopnets; fishing and collecting "seed" fry for aquaculture while wading in mangrove channels, estuaries, backwaters, tidal flats and other shallows; diving and collecting sea cucumbers and molluscs; harvesting seaweed; diving for lobsters, pearl shells and trochus; commercial spear gun fishing; and undertaking such illicit practices as fish poisoning and fishing with explosives.

Wading carries the risk of stepping on thorny, venomous animals such as sea urchins, certain shells (*Conus spp.)* and starfish, or getting stung by a stonefish or stingray. Encounters with sharks in very shallow waters are rare, but people pulling on beach-

seine sweeps have been hit and even severely wounded by panicking large and toothy fishes, such as barracuda, bonito or bass. Attacks by estuarine crocodiles are on record, some with fatal results. Bites by venomous sea snakes have been known, though they are rare. Many, frequently painful and lingering, and sometimes even fatal, injuries occur in shallow water due to contact with venomous jellyfish, especially the Portuguese man-of-war, sometimes blown in great swarms onto beaches. This siphonophore, particularly its Atlantic variety, *Physalia physalis*, is believed responsible for many deaths.

In Okinawa alone, some 40-50 deaths occur annually among wading and swimming fishermen when gathering sea shells and swimming, owing to contact with sea animals.

Swimmers and divers have a greater risk of encountering large marine predators. Many attacks by sharks and barracudas on pearl and shell divers are undocumented and have received scant scientific attention. A rather bizarre way to die is fishing with electric torches, as worn by divers or boatmen to attract fish. Needlefish (*Tylosorus spp.*) swimming towards the light can penetrate a fisherman's torso or head, causing sometimes fatal injuries.

Unfortunately, as far as small-scale fishermen are concerned, such accidents mostly occur at sites remote from centres where the casualties can get professional first aid and medical treatment; this increases the number of victims. Also, where such services are present, the animal that has caused the venomous injury is often unidentified, or antivenins are unavailable. (Williamson et al., 1996).

6.1.2 On board fishing craft

Injuries on board fishing craft occur mainly due to contact with the fish caught and with some of the bycatch, that is, undesirable species hauled in together with the catch, particularly in trawl-nets.

Large fish hauled while still alive and fighting may hurt fishermen. Sharks and other large fish may cause injuries by a sudden flip of the tail (mainly sharks and stingrays), or a jab by the beak or "sword" (billfishes) or saw (sawfish). Sometimes an apparently dead, but large, toothy fish suddenly bites at a fisherman's limb or finger. Stingrays can flip their tails for quite a while after they have been taken out of the water and there are recorded cases of serious wounds inflicted by large stingrays whose strong and sharp tail spines may reach 15-20 cm in length.

Painful stings are inflicted by various fish that carry venom in their spines, indeed by any fish whose sharp teeth and spines are strong enough to penetrate human skin. Jellyfish and Portuguese men-of-war are also dangerous out of the water. They carry allergens and their strong smell causes allergic reactions in more sensitive people. (Williamson et al., 1996).

6.1.3 Poisoning by marine toxins

Ciguatera poisoning is the most common and most lethal risk (over 12% fatalities) of eating certain fish species caught in a tropical environment, usually near coral reefs. The problem is that while naturally fishermen are great fish eaters, ciguatera toxin in the flesh of the fish does not change its flavour and is undetectable by humans or other animals. Certain shellfish and finfish may be carriers of other toxins, like tetraodon, the

toxin occurring in puffer meat that presents a danger rather more frequently to clients of exclusive Japanese restaurants than to fishermen. (Williamson et al., 1996).

6.2 Injury by deck machinery and equipment

Such injuries are less common in small-scale fisheries, because most of the world's small fishing craft have little machinery on board. But in technically advanced fisheries one may find on vessels under 12 m in length most modern deck machinery, i.e. small trawlers with winches and netdrums, gill-netters with netdrums and nethaulers, seiners with seine winches and power blocks, longliners with linehaulers or automated baiting-setting-hauling systems, and vessels equipped with automatic pole-and-line and jigging fishing machines.

Injuries are frequent, consisting of fingers and whole limbs caught in winch drums and barrels, or components of fishing gear under tension; fishing hooks and "spines" in steel-wire ropes sticking in the hands or any other parts of the body; contusions and wounds caused by ropes, cables and various links parting under tension, etc. Fatalities, however, are rare.

When fish are manually beheaded, gutted, skinned or filleted on board, injuries from knives are frequent and sometimes result in loss of fingers.

6.3 Falling overboard and hypothermia

Falling overboard is very common. Fishermen performing a range of tasks associated with bending overboard, or keeping balance on a spray-washed and slimy, slippery deck of a small boat that rocks and rolls heavily in even moderate seas, are liable to finding themselves falling overboard or being swept into the sea. In small, decked fishing craft, gunwales are often very low and railings or manropes usually absent. Fatalities are frequent, especially if the fall is unnoticed. One way to fall overboard unnoticed, especially at night, is when a crewman keeping a watch on the wheel sets the boat to make way on autopilot, sits on the gunwale to defecate and falls back or is suddenly swept over by a surprise wave. Alcohol and drugs are also great killers at sea, and are frequently an element in people falling overboard.

Someone falling overboard and swimming until noticed in the sea simply means a salty bath of uncertain duration. However, in colder waters, low temperatures may quickly cause often lethal hypothermia. Immersion for even a few minutes in ice-cold water and for longer periods in temperate water is dangerous, especially given that the onset of hypothermia is very slow and its symptoms are not obvious even to the affected person, who may just lie down to rest, and then die. In water, even the best swimmers will drown once they have lost their body heat. In areas with water temperatures in the winter often below 5°C, immersion suits are absolutely essential for survival if people are forced into the water. (Berkow et al., 1997.)

6.4 Capsizing and other accidents associated with operating fishing gear

Fishing vessels may capsize while fishing for a number of reasons, including poor stability in bad weather, often associated with overloading, or a combination of factors.

One problem is that fishing vessels often capsize or otherwise sink before crewmembers are able to access onboard survival equipment; consequently, lives are lost.

Trawlers, mainly small and medium-sized, may experience extreme listing, or even capsize, when their gear becomes snagged on a fastener. This danger increases in tall swell or in rough seas when the pull in one of the warps acting at the vessel's side downward combines with an additional downward force due to a list caused by a wave. This may cause people and poorly lashed objects to be swept across the deck or overboard, or the whole boat to capsize. Such accidents can be avoided if the means for releasing snagged warps are devised and used.

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Short case study 4: Colombia

In 1981, a small shrimper capsized in the Golfo de Uraba (Colombia) during warps hauling, after her trawling gear got caught on a fastener. It happened so suddenly that there was no time for sending or exhibiting any distress signal. Her crew of five stayed alive owing to a waterproof air box fitted in the bow, which kept the boat afloat. They clung to the hull for nine hours before being saved by the crew of a passing artisanal fishing canoe. (P. Medley, personal com.)

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Small seiners may capsize under the combined action of swell or high waves and the downward pressure from a large catch of fish "sinking" during the last stage of net-hauling on power blocks suspended from masts or mounted on tall pedestals. The consequences are similar to those in trawlers (see above). This danger is much less in small purse-seiners, where the net hauling process is manual.

Fouling a propeller or a rudder usually occurs during gear-hauling with the propeller working astern to help with the hauling process and when a current and wind combination brings the boat over the net. In some cases the fouling is heavy, especially if steel-wire ropes are involved, the vessel being immobilized until the propeller is made clear. In cold water and in vessels with relatively deep-set propellers, this operation may require diving suits and Scuba gear, equipment that is rarely carried on board small-scale fishing vessels. A boat immobilized in this way and her crew may find themselves in a dangerous situation (see section 5.1).

6.5 Risks from Scuba diving and explosives

Self-contained underwater breathing apparatus (Scuba) is becoming increasingly available throughout the world, including areas at a low level of technological development. However, where high profits are expected, diving fishermen either invest in such equipment themselves or are recruited, often from among traditional "naked" divers, by dealers. Such fishermen are often poorly trained and do not keep to decompression tables and other rules of skin diving. In addition, where decompression chambers are available, their very presence encourages some people to take risks.

In the Indian Ocean and in some parts of Oceania, more fisheries-related deaths and injuries among untrained village divers fishing with hookah and Scuba gear seem to occur than among those who become lost or injured on fishing boats.

In Indonesia, fishermen use Scuba-gear while fishing with explosives and cyanide and while collecting fish and *trepang* (sea-cucumbers). They are, no doubt, aware of the possible consequences, for many fishermen are partially paralyzed, having lost limbs. To make a living, fishing divers must obey the *pungawa* (boss/middleman) who keeps sending them for longer and deeper dives if they do not come up with enough catch. This is also a major problem in the Philippines – particularly as a result of the very profitable live-fish export trade – in the Caribbean Sea and in the Mexican spiny lobster fisheries. The Miskito Indians of Nicaragua seem to be so prone to diving accidents that they have attracted particular assistance on the part of an NGO, Sub-Ocean Safety. (P. Medley, L. Pet, personal coms.)

7. Problems associated with boat design and construction

7.1 General

Small-scale fishing fleets, mainly in developing countries, consist of a large variety of fishing craft, either of traditional designs and often well-adapted to local conditions, or of imported designs. They are too often built with no regard to modern rules of construction that ensure good stability and seaworthiness under specific operating conditions. With the almost universal absence of mandatory criteria and inspections, many poorly trained boat-builders have produced unsafe and otherwise inefficient boats, due to lack of experience, financial constraints, lack of appropriate materials, and lax or even criminal practices.

7.2 Developing country small-scale fisheries

In the Caribbean region, West and East Africa, South America, Asia and Oceania, most small-scale fishing vessels are less than 12 m in length and their actual design and construction have evolved largely from experience, rather than from a structured approach to fishing vessel development and safety. Nevertheless, in many cases, traditional designs meet their specific conditions of operation quite well.

For example, large (up to 16 m in length) ocean-going West African canoes, whether of the Senegalese or Ghanaian type, comprise features which make them superior to many modern types of boat that were imported to West Africa with a view to replacing them. One important feature, staying afloat after capsizing in surf, was described in section 4.1, above. The other is their banana-shaped profile which enables their crew to zigzag the canoe up the beach by pressing down on either end of the canoe alternately, thus lifting the central part from the ground and turning the boat by some 45 degrees each zig or zag. This is a very fast process that requires relatively little effort, making the beaching stage easier and safer than with any modern western or Japanese type of boat that have straight keels or straight flat bottoms.

A great advantage of the artisanal fishing rafts, such as the Brazilian *janghadas* or the Indian *kattumarams*, apart from their shallow draft for beaching, is that they are practically unsinkable.

In some cases, however, successful technical assistance projects or gradually imported technological influences have resulted in modifications to local designs, or in the purpose-design of fishing boats fitting the local marine and socioeconomic and cultural conditions. If successful, such innovations have been adopted and disseminated, such as in the ocean-going motorized "pirogues" of the West Indies and the similar boats of Ecuador, the small shrimp-trawlers and purse-seiners of India, or the fast tuna pole-and-line launches of Tahiti. Such successes, however, may entail unforeseen hazards.

One such case occurred in Samoa where a small aluminium catamaran called the *alia* was designed and introduced under an FAO programme. The *alia* was designed to enable fishermen to safely reach outlying reefs and beyond to fish with hooks and lines. Economic success resulted, the number of *alias* produced rose to the hundreds and even serious losses in two severe cyclones failed to reduce their numbers for long. But with *alia* fishermen venturing further offshore, beyond the range for which they had been designed, accidents became more frequent and the number of casualties increased (see *Short case study 5: Samoa*). (T. Adams, L. Lambeth, personal coms.)

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Short case study 5: Samoa

According to its Central Bank, in the fourth quarter of 1998 Samoa's exports earned USD 14.5 million, a 41% increase over the same period of the previous year. This increase was driven by booming fresh fish exports, mainly to canneries in American Samoa, which has emerged as the country's biggest market.

However, during the 1997/1998 period, Samoa was losing its longline fishermen using *alias* at an alarming rate. There were 20 fatalities even before the end of the year. Often whole crews and boats just vanished and it is thought that some of the boats were breaking up and sinking. Hardly any safety equipment is carried on board, crews are often inexperienced, but are drawn into the business by the relatively high earnings. There is a VHF radio system in place, with a 24-hour staffed base in Apia, but in case of trouble, without GPS or often even a compass, fishermen are seldom able to supply helpful information on their actual position.

The problem is due to a number of factors, all related to the rapid expansion of the tuna longline fishery in Samoa. In the 1970s DANIDA (a Danish assistance agency) financed an FAO boat-building project in Samoa that introduced the *alias* (8.5 m catamarans, powered by a 25-40 hp outboard motors) which soon became the preferred vessel for the developing demersal and pelagic fishery.

Over the past five or six years the offshore longline fishery has boomed. Although severe cyclones in 1990 and 1991 had reduced the original fleet, in June 1994 there were some 87 *alias*, while four years later their number reached 237. Many of these boats are now being used to fish much further offshore than they were ever designed to, employing skippers and crews with little or no training. Furthermore, new, bigger *alias* are being built by just expanding the original design with no thought to stability or potential stresses. It is also possible that some of the aluminium welding is not up to standard. Consequently, in 1998 the Government decided to introduce boat surveys at

the design stage, as well as a training programme for skippers and crews.
(L. Lambeth, personal com.)

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7.3 Developed country small-scale fisheries

Many modern small fishing boats are well designed and well constructed, some even made unsinkable owing to airtight or plastic-foam-filled, lifeboat-style compartments. Large heavy-displacement vessels, of the 10-12 m LOA class, are usually naval-architect designed and constructed in serious boatyards. However, even where the environment is one of highly developed technologies, the situation is far from satisfactory. There are still problems stemming from inadequate, traditional and even modern designs in some countries where there are neither obligatory design and construction standards nor mandatory inspections. The main design problems include inadequate freeboard and basic stability, inadequate stability under various working conditions, and poor accommodation, sometimes at the expense of unneeded fish-hold space.

8. Various risks and dangers

8.1 Fishermen's know-how and attitudes

Fishing is a profession associated with risk-taking. Varying degrees of risk are inherent in almost every decision made by a skipper or individual fisherman on when and where to go fishing or run for shelter, what method/gear to use, whether or not to change a fishing spot, which direction to set the gear, when and where to land the catch, etc. Such decisions are taken against the background of changing weather, the condition of the fishing vessel and equipment, and the dexterity of the crew. They depend on the skipper's cultural and individual attitude, experience and skill; the element of hazard is omnipresent.

8.1.1 Modern technology in traditional fisheries

In traditional fisheries of long standing, artisanal fishermen have inherited time-proven responses to crises at sea, survival strategies and weather perception that, along with their fishing know-how, have evolved through ages of operating traditional technology in local conditions. However, the introduction of modern technologies into the traditional systems has frequently upset the traditional way of doing things, not always for the better. Abandoning sails and neglecting the art of sailing, as mentioned above, is only one example. Another is the lack of understanding of the limits of modern technology and hence unheeded risk-taking.

This is often compounded by insufficient technical training in engine operation and by inadequate maritime training in navigation, use of electronic aids and safety equipment, first aid, and behaviour in emergencies.

There is also deskilling in traditional knowledge not only due to the shift to strange technologies, but also to changes in the age composition of the crew. With many unemployed youth, for various reasons older, experienced fishermen more often stay

ashore. Young fishermen, apart from lacking the traditional survival skills and equipment, like young car drivers, feel less vulnerable to accidents than their elders who are more experienced in survival at sea, though may be less skilled in operating machinery.

8.1.2 Mistrust

Another factor is mistrust of modern weather-forecasting systems and, perhaps more so, their messengers. That landlubber officials and white-collar boys seem to be able to predict an imminent typhoon or hurricane, when even old fishermen cannot see a sign of it, may not go down very well with some fishermen.

For example, when the deadly November 1996 cyclone hit the Kakinada coast, the warnings were met in some places with derision by the fishermen who could not discern the usual storm-indicating symptoms in the sky and sea. On the day of the cyclone, crews in tens of fishing boats were taking good catches, did not anticipate bad weather and paid no heed to the radio warnings. (*World Fishing*, 1996; J. Turner, personal com.)

8.1.3 Insufficient technical training

In many countries, skippers of small fishing vessels are not required to obtain certification, undergo mandatory marine training, nor pass examinations. This leads, especially in developed countries where small-scale vessels may have considerable cargo capacity and heavy machinery on deck, to many stability-related accidents. Most decked small fishing vessels can be made top-heavy by ignorant skippers who have not been taught the difference between a "stiff" but stable boat and one that is rolling gently and slowly but is either inherently unstable or its stability has been impaired by overloading.

Insufficient training is also a reason for skippers' and crews' ignorance of the ways to deal with emergencies such as fire on board or taking water. A skipper of a small fishing vessel not trained in handling her in tall waves and strong currents, especially in narrow passages, represents a risk to all on board.

8.1.4 Prestige considerations

This is an important sociocultural and psychological aspect of the fishing trade. Fishing is a highly competitive activity and competition is an important part of fishermen's lives. Highly successful fishermen ("highliners") enjoy tremendous prestige among other fishermen and their own communities. Prestige considerations, therefore, force skippers to take excessive risks.

8.2 Fishery management measures and economic factors

8.2.1 Economic and financial pressures

Fishermen often take risks leading to danger to themselves and their boats owing to economic need, passing financial difficulty such as temporarily low earnings, and pressure by fish-dealers, boat owners, banks and other creditors, etc. Such behaviour, especially when it involves sailing out despite a storm forecast, or trying to make an

extra haul when better judgement advises seeking shelter, or overloading the boat, sometimes leads to tragedy.

Large catches lead to overloading in artisanal fisheries as well. Canoes and small boats often leak and water has to be constantly bailed out. A purse-seining canoe with all the net on board and a large catch leaves little freeboard, and has to be bailed at a rate that may exceed the crew's ability. Sinkings and capsizes then occur.

8.2.2 TAC-type management

Fisheries management systems often exert pressures leading to risk-taking. For example, total allowable catch (TAC) systems without individual quotas produce incentives to fish in bad weather and travel at high speed in risky waters, as each fishing unit competes to increase its proportion of the TAC, especially when the fishing season is, naturally or by regulation, short. The problem may become severe in a very short season with very high net daily revenues where the excess size of the fleet may exhaust the TAC in a very few days.

8.2.3 Quota systems

The individual fishing quota (IFQ), individual vessel quota (IVQ) and individual transferable quota (ITQ) management systems might reduce risk-taking motivation, because staying in port in bad weather hardly affects the practically guaranteed total catch of each fishing unit involved. However, in terms of the landed fish value, high prices in periods of bad weather may drive fishermen working under quota systems out on risky fishing trips, which may be the only way to obtain the best price for what they land against their quotas.

A "rush for fish" may also occur under the individual quota system, if fishermen suspect that the stock size has been overestimated and that lower catches may not meet their running expenses unless they move quickly. Another ramification of the quota system is that it may lead eventually to concentration of ownership in fewer hands. This brings into the fishery non-owner-skippers, who are generally less experienced than owner-skippers. Also, hired skippers may tend to overload their vessels because of pressure or bonuses from the owner and fear of losing their job if they land less catch than their colleagues. Additionally, where quotas are costly, fishermen may push their luck. (Rayment and Fossi,1994; P. Copes, T. Nies, personal coms.)

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Short case study 6: Canada

In British Columbia, salmon gill-net "openings" (limited-time fishing permitted in a given area) tend to be very short and often widely distributed along the coast. This has led to the development of a rather unique specialized fleet of 10-12 m long, fast, planing-hull salmon gill-netters.

The particular stock management strategy motivates fishermen to fish one opening, sometimes for perhaps 24 hours and then speed off, at 20-30 knots, to another opening several hundred miles distant. In addition to the dangers to planing-hull craft in open-sea waves, fishermen, like drivers on highways, sometimes fall asleep at the wheel, resulting occasionally in groundings and collisions. Another risk stems from the Canadian practice of allowing for the leasing of fishing permits/quotas.

As long as the halibut fishery was managed by an IVQ (Individual Vessel Quota) system, small boats could refrain from fishing in inclement weather and were able to catch their quotas when it suited them best. Hard-working fishermen, however, are leasing additional quota for around 75% of the fish's market value. The result is that the leasing fisherman, to pay his way, has to fish in rough weather. Another area of danger for British Columbia's small boat operators has to do with language. The small-scale fleet has always been manned by immigrants, many with little knowledge of English, for whom fishing has served as an entry-level job. This frequently results in communication problems that become dangerous in distress situations when misunderstandings occur, sometimes leading to the coastguard searching for boats and people in trouble in the wrong areas. (A. Haig-Brown, personal com.)

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8.4 Wars, pirates and other hostilities

Fishermen fishing in areas of actual or suspected hostilities may become unintended victims if their boats are thought to be enemy forces or terrorist craft. For example, during Eritrea's independence struggle against Ethiopia, Ethiopian armed forces destroyed many fishing dhows claiming that they were used for smuggling war supplies to the rebels. Reportedly, there were casualties among the fishermen.

Piracy has been expanding in several areas, and some of the pirates target fishermen. Reports from Eastern Nigeria tell of pirates attacking and even killing fishermen just to get their outboard engines. Piracy against fishermen has also been reported from other African countries.

Many fishermen have been killed and their vessels lost due to sea-mines and other military objects containing explosives. Explosions occur when people handling such objects are unaware of or neglect the dangers involved.

Fishermen have also been killed in clashes between small-scale and larger vessel crews, and in conflicts between fishermen of different tribes and nationalities fighting over access to fishing grounds. (Gallene,1995, 1997).

8.5 Working conditions

In several areas, large, often itinerant fishing ships take on board a large number of artisanal fishing craft with their crews for handlining on relatively distant fishing grounds.

Living conditions of the artisanal fishermen on board such ships are usually very bad. Their food supply is limited and they have to sleep on deck. Their safety at sea is a low priority. At least one case of abandoning a canoe with five on board by a Portuguese-flag "mothership", that led to two dead from starvation, was reported in 1994. (Rayment and Fossi, 1994).

9. Evaluation

9.1 Regulations, codes and enforcement among small-scale fisheries

In general, it seems that countries without large-scale fisheries pay more formal attention to small-scale fisheries than some of the fishing leviathans.

While, for example, United States regulations hardly touch small-scale fisheries and Japan's regulations cover boats only down to some 8 m in length, Barbados' Fisheries Act specifies mandatory safety equipment for three classes of fishing boats: less than 6 m LOA, 5-12 m LOA and 12-20 m LOA. Grenada's Statutory Rules provide for mandatory safety equipment for fishing boats of both less and more than 28 ft (8.54 m). Senegal's Code of Conduct prescribes equipment, skippers' examinations/certification and annual inspections. Israel specifies mandatory safety equipment and requires inspections for fishing boats under 7 m, as well as 7-24 m, in length.

A wider survey would probably discover more countries that have legislated safety rules covering small-scale fishermen and their boats, but the general picture would still remain grim. Even where fishing licenses are mandatory, they are not always stipulated by seaworthiness certificates, safety equipment inspection, and personnel training and certification.

Unquestionably, the great majority of the world's small-scale fishermen have been left to their own design and means, as far as their safety at sea and on the beach goes, with reasonable to good SAR services only in developed countries.

In some countries, safety legislation is subject to political "anti-regulation" pressure, as well as to official opposition based on implementation difficulties. On the other hand, in some countries any insurance of fishing boats and crews is stipulated by valid seaworthiness and safety equipment certification and the presence on board of certified personnel. Thus, on a global scale and especially in countries where tens or even hundreds of thousands of active fishermen support small-scale fisheries, their safety is only to a limited extent taken care of by legislation and enforcement.

Even if regulations prescribe mandatory boat and equipment inspections, enforcement is often ineffective. One reason is corruption, as regulation simply means that fishermen have to pay their way out of inspections or examinations. Another reason is that in many places fishermen can hardly afford to acquire the safety equipment prescribed. The way out is to cheat by borrowing equipment just for the inspection. It appears that there are only a few countries, worldwide, where the various aspects of safety of small-scale fishermen are effectively regulated and the regulations effectively enforced.

9.2 SAR services and small-scale fisheries

Two basic types of SAR services are relevant to small-scale fisheries:

- Civilian, often voluntary inshore and even offshore lifeboat services that may be the main ones, or auxiliary to the State's, are characteristic of some developed marine countries, such as Australia, New Zealand and the United Kingdom.
- Naval, air force, coastguard or police units that provide SAR services to people and vessels in trouble, such as Israel, the United States and most other countries.

Fishermen in trouble at sea, however, are mostly found and rescued by their fellow fishermen, not only because of traditional (and logical) solidarity – I help you today, you help me tomorrow – but also because in most cases small-scale fishermen fish while in visual or other contact with others. This is why such contact among small

fishing boats is so important for their safety and where it exists, whether through radio, or by agreed visual signals, the rate of fatalities is significantly less than otherwise.

Nonetheless, external aid is often called for in emergencies, and saving lives and boats depends on the availability and efficiency of the SAR services.

Unfortunately, among most developing small-scale fisheries, where the majority of the millions of small-scale fishermen are found, SAR services are usually fairly ineffective, if they exist at all. Therefore, any international or NGO activities aimed at improving existing national SAR services are extremely important (see *Short case study 3: Micronesia*) and highly recommendable where SAR services are lacking.

9.3 Prevention and warning systems

Cyclone, typhoon or hurricane warning systems, even those based on the latest technology, are only partly useful in saving fishermen's lives if the warnings do not reach the people at sea and on the beaches, and if the people have no trust in the system or its messengers. Unfortunately, both conditions applied to some degree during the deadly cyclone that hit Kerala, India, in 1996 and were partly responsible for the huge death toll (see section 3.2.1 and *Short case study 2: India*).

The Marine Department in India and an NGO commissioned a study that concluded that education in precautionary measures and provision of the means for delivering messages of cyclone warnings at sea would save lives and vessels. Therefore, FAO's initiatives in the West Indies and the Bay of Bengal, both potential trouble areas for hurricanes and cyclones, respectively, are of utmost importance, because they focus on education and training on the one hand, and on finding technical solutions for improving the delivery of warnings on the other.

However, in areas prone to strong storms, and often flooding, warnings alone and even bringing all fishing vessels to the shore in time, do not save fishermen and their boats. Experience teaches us that the evacuation of whole populations further inland is rarely feasible and that effective storm shelters of whatever form are seldom available in sufficient capacity in the coastal areas where rural fishermen dwell predominantly in destructible houses. (P. Calvert, 1998; R. Ramachandran (press report); J. Turner, personal com.)

9.4 Evaluation of state of safety in small-scale fisheries

The actual state of safety in small-scale fisheries worldwide ranges from unsatisfactory (in most developed countries) to miserable (in most developing countries). Without doubt, in view of the magnitude of the problem and its tragic ramifications, too little is being done to correct this situation anywhere.

In developed countries, where weather warnings, communication and SAR services are effective, boats and engines relatively safe and reliable, and all the necessary technology accessible, most small-scale fishermen are incomparably better off safety-wise than their fishing peers in developing countries. However, in some countries this situation could be compared with having modern, fast cars and motorcycles that are unlicensed, whose brakes are not regularly checked, safety belts and lights are faulty or missing, etc., and some of them driven around by people without sufficient training or

experience. Many modern small-scale fishing vessels have many features of the larger ones, including relatively heavy engines and large fish cargo capacity that make them sinkable as soon as they capsize or take on large volumes of water. This is a waste of human lives, as boats' staying afloat after accidents has saved hundreds of lives (see *Short case study 4: Colombia*).

In developing countries, SAR is still a painful issue. There is too little concern with fishermen's safety and the provision of effective SAR services. The causes are numerous and include:

- insufficient awareness,
- lack of funds,
- lack of personnel knowledgeable in marine safety problems or specialized in marine safety and SAR,
- lack of suitable craft,
- the huge numbers of fishing craft and of fishermen who are spread over long coastlines and numerous, often remote islands, and
- inadequate technical and institutional infrastructure.

The extent of official interest in fishermen's safety depends not only on national priorities and political will, but also on local capacity to deal with the issue. Even in countries where the level of science and technology is high enough to establish sophisticated, satellite-linked weather forecasting services and modern navies and air forces, SAR services at their fishing clients' end are still a far cry from the level of the former.

This can be compared to the gap between nuclear and military capacities of some countries and the standard of living of their rural and poorer urban population. Public and press interest is low and official statistics underreported about fishermen who do not return from a trip. Loss of fishing craft and people at sea is not news, except in the immediate communities of the missing ones, or when the dead become newsworthy because of their huge numbers.

Fishermen in most countries are politically weak and have neither the political clout nor the lobbying power to influence the authorities to invest money and effort to improve their safety. Usually, also, they are preoccupied with their daily struggle for survival and if they were to take political action it would be aimed at their immediate economic problems. Informal SAR can be found in some areas among fishermen; additionally, where NGOs are active, awareness of the problem grows and survival chances may increase.

10. Recommendations

10.1 General

A substantial reduction of the death rate is achievable if safety legislation and activities are enhanced. Two basic strategies are possible, with regulators, administrators and enforcers focusing on one or both of the following, depending on local circumstances:

- reducing the consequences (casualties) of accidents;
- decreasing the likelihood of casualties by accident prevention.

The first has to do with SAR, safety equipment on board, safety-at-sea communication systems, and skipper and crew performance in an emergency.

The second is mainly about boat design and construction quality, stability, training and licensing of personnel and weather warning systems, as well as reduction (and elimination) of the many fishery management-induced and other financial incentives to take risks. This can be reinforced by enforcement of mandatory insurance stipulating seaworthiness tests and equipment inspections.

10.2 Boat design and construction

It is strongly recommended that design and construction standards for small-scale fishing craft, sponsored by international and intergovernmental bodies, are elaborated and put at the disposal of all nations (see section 10.14).

Those countries without their own could use them as the basis for their own regulations and enforcement. Most of the classification societies have set their own rules for materials and construction of small craft; these could be considered in preparing national, regional and international standards.

Even where artisanal craft are locally built using traditional design and construction methods, improvements can be introduced without changing the overall character of the craft. Small improvements, such as using bolts instead of nails, would contribute to the vessel's reliability. While preparing international standards, regional and even national conditions must be taken into consideration and the necessary elements incorporated. For artisanal and other small fishing craft, for example, buoyancy on capsizing or flooding and, if possible, righting the boat by the crew in the water are important. If necessary, plastic-foam buoyancy blocks should be fitted in appropriate spaces.

The economic situation of fishermen, availability of materials and general technological level and infrastructure must be taken into consideration. In all cases the term "construction" should also include "design" and cover such aspects as watertight integrity, freeboard, stability, and performance in waves and surf.

The special conditions of fishing vessels' operation should not be overlooked. Stability calculations and tests, especially for double-rigged trawling boats and purse-seiners, must consider the probable pulls applied during hauling at the outriggers' and davits' ends, and on power blocks, as well as the effect of the resulting forces combined with the vessel's rolling. The same is also true for artisanal boats, even with manually operated haulers.

Designers and inspectors should insist where necessary on providing "weak-link" elements in the rigging or the fishing gear that would break when the pulls rise to dangerous levels. Boats built or modified to such standards combined with inspection and enforcement will benefit fishermen – both through better safety at sea, and through improving their capacity to obtain credit and insurance. Also, better designed boats provide better working and living conditions alongside more efficient fishing operations, including fuel economy, that should result in better earnings.

The U.S. Coast Guard has published an advice sheet for all commercial fishermen. Rules quoted below are also valid for small-scale fishermen, especially those operating decked boats in the 8-12 m LOA range:

- Follow the stability rules for your vessel;
- Don't overload your vessels with excessive equipment or catch;
- Don't make substantial changes to your vessel or its equipment without taking into account the effects of stability;
- Make sure all hatches, weatherdeck and watertight openings are in good condition with gaskets;
- Keep bilges free of excess water;
- Frequently check the gear store, fish hold and other void spaces for water;
- Ensure that the bilge-pumping system is operational.

It is strongly recommended that guides are produced (or reproduced) and distributed. These would assist those boat-builders who have no formal training in the construction of seaworthy and reliable small-scale craft in various materials.

Some guides have already been published, for example, by FAO and FAO-associated field projects. They should be updated if necessary and reprinted. FAO would be able to distribute them through its field programmes and country representatives. (Coackley, 1991; Fyson, 1980, 1985; Gulbrandsen, 1992; Gulbrandsen and Pajot, 1993; Mutton, 1982; Reinhart, 1975; Riley and Turner, 1995; J. Turner, K. Codel, personal coms.)

10.3 Survival equipment, fire prevention

Emergency and survival equipment should be obligatory on board small-scale fishing craft, with its amount, cost and character fitting the type, earnings and capacity of the boat.

For example, there is no point in compelling buoyant craft, such as African canoes, Indian *kattumarams*, Brazilian *janghadas* or Israeli *khassakas* to carry life-rafts.

A boat of whatever size should carry:

- hooks and line for emergency fishing,
- some sort of signal pyrotechnics, desirably parachute flares,
- a transistor radio receiver,
- an electric torch with spare batteries,
- where feasible, a cellular telephone and a buoyant waterproof container,
- life-jackets fitted with reflective tapes or active lighting system for all persons on board,
- a basic first-aid set,
- buoyant emergency water containers,
- anchor and anchor rope,

– a bucket or two.

If a boat can be rowed,

– paddles or oars,

– a mast and sail, and

– a lamp.

A magnetic compass should be carried in all boats fishing at a distance exceeding 1 n.m. offshore.

Small craft powered by petrol-driven outboard motors should carry all their fuel in extra original outboard-motor fuel tanks and avoid keeping it in larger containers and pouring it into the tanks at sea.

Decked small-scale vessels, larger than 7-8 m in length, should be equipped with hand and mechanical bilge pumps, fire extinguishers and standard navigation lights, and carry additional equipment, such as a small life-raft (if boat not buoyant), a light-buoy and other light and smoke signals.

A buoy with a radar reflector would be desirable in areas where SAR units are equipped with radars and in areas of shipping traffic. Where SAR services have radio-location capacity, EPIRBs are desirable and where economically feasible, should be made obligatory.

Additionally, the following procedure should be followed prior to departure where modern life-saving equipment is available:

– Check the operation of the EPIRB;

– Ensure the inflatable life-raft has been serviced and the crew is familiar with manual and automatic deployment of the raft;

– Check to see that the EPIRB and life-raft are stowed so that no rigging from the vessel can prevent both from floating free;

– Ensure that all members of the crew know how to make a distress call.

Valuable recommendations for small, decked boats that suit conditions in many developing countries are covered by Gulbrandsen's and Pajot's *Safety at sea* manual. (Gulbrandsen, 1992; Gulbrandsen and Pajot, 1993).

10.4 Weather warnings, communication, SAR and survival in water

These aspects of the safety issue can be dealt with through the transfer of know-how and survival technology, education, training and financial assistance. In developing countries this appears to be a particularly wide field for international initiatives and intergovernmental cooperation (see section 10.14).

10.4.1 Education and training

Effective warning and communication systems and SAR, self-evident in developed countries, are rare in many developing country fisheries. Therefore, educational and training efforts are of utmost importance.

Internationally initiated and locally executed courses, seminars and workshops ought to be supported within bilateral and multilateral frameworks. One way for this could be itinerant, regionally adapted courses, well equipped with aids and models, including simulation equipment, which would move among countries and train trainers, SAR activists, extensionists and skippers (see section 10.11).

Additionally, a special project might be jointly sponsored by ILO, IMO, FAO and international donors to prepare popular, well-illustrated guides or manuals on accident prevention and safety at sea for artisanal fisheries.

Such popular or pocket manuals might follow the style and approach of the FAO "Pop Manuals" in the fishing training series, and should be translated into relevant languages and distributed to governments and programmes dealing with safety at sea.

The *Fishermen's safety manual* issued by the Fisheries Association of British Columbia provides useful guidelines for life-saving and survival in water. The *Document for guidance on fishermen's training and certification* prepared jointly by FAO, ILO and IMO comprises a short (rather too short) section on small fishing boats.

In developed countries as well, education and training of fishermen in precautionary safety measures, correct use of life-saving equipment, and other safety-related activities should be developed, especially where such training is not mandatory.

Therefore, governments should be encouraged to undertake educational programmes through, e.g. courses and workshops and itinerant training units (see section 3.3.6).

McCoy (1991) gives some relevant suggestions and guidelines. (FAO/ILO/IMO, 1988; Ben-Yami, 1987; Safety Committee, 1972; Safety Liaison Working Group, 1997; K. Codel, personal com.)

10.4.2 Civilian radio stations

Since fishermen may listen to news and music radio programmes, weather warnings in areas prone to major storms and sudden weather changes should be sent to and then transmitted by national and regional radio stations as soon as they are received, without waiting for the regular weather forecast.

Where this does not happen, IMO and ILO should discuss matters with the governments concerned. Once such arrangements have been made, all sea-going, even artisanal fishermen, may be encouraged by the authorities to carry radio receivers able to receive weather broadcasts. In some cases, provision of transistor radios to fishermen may become a component of various assistance projects.

10.4.3 Armed forces to warn of approaching storms

One solution for delivering a timely warning to fishing fleets at sea, to remote villages and to groups of wading fishermen, where radio contact is unreliable or non-existent, could be the use of military aircraft. Both the navy and airforce have to monitor the weather and have to undertake exercises anyway.

Locating concentrations of fishermen at sea and on the beaches and "bombing" them with, say, red flares as an agreed cyclone warning signal would be both a good exercise and a solution for a missing "last-mile warning". Helicopters could be used for warning

those close to shore and on the beaches, and fighter-bombers and other fast craft for those more distant.

One would expect difficulties in persuading the military authorities to break drill inertia, or civilian politicians to channel military activities towards life-saving duties. This would also require some military units to stand by during stormy periods. On the other hand, only a few aircraft would be needed, because at a jet's speed large areas can be covered in a short time. Air sorties can be coordinated with and by the navy, which usually has good surface radar that can locate boats far away. The response time of such a system should be extremely rapid and even permit timely reaction to sudden changes in the track of a storm.

This idea is not unique since, for example, Vietnamese military aircraft are used for alerting fishing vessels at risk of approaching cyclones. An argument that the cost is too high can be disputed because, as mentioned above, military forces must anyway conduct regular training missions using a whole variety of ships, aircraft and communication and logistics systems.

10.4.4 SAR, fishermen sea and storm-safety action groups

As seen above (section 3.3), most maritime developed countries have implemented effective SAR services, whether state-run or voluntary, and consequently recommendations may seem superfluous. Nevertheless, even there small-scale fisheries should be encouraged to reach the desired level of training and equipment comparable to that practised in larger-scale fishing fleets.

For example, real-time vessel-monitoring systems (VMSs), so far implemented in fishing fleets mainly for monitoring compliance with fishery management rules, facilitate SAR efforts by reducing the time between the monitoring station receiving the emergency call and the arrival of the SAR unit on the scene. With continual shrinking of the size and price of electronic equipment, the use of VMS may soon be available to small-scale fisheries. This also applies to, e.g. automatic emergency and position calls from vessels in danger, and the wider use of EPIRBs.

Organizing government-run SAR in countries where governments are ineffective in other public services may be extremely difficult. Such projects, having received the equipment and basic training, tend to fall into disuse soon after expatriate expertise and external funding are terminated. Also, the introduction of western-type voluntary institutions is unlikely to succeed.

The way to go, therefore, is by identification of local (including traditional) institutions and local leadership that can, with some outside support, organize their own SAR and storm-safety services as well as other related projects. In this respect, NGOs can play a very useful role. Also, international organizations, such as FAO, ILO or IMO, or their joint working group, might develop a programme designed to match national SAR agencies in developed countries with local safety projects in developing countries in "adoption" schemes.

Local action groups and other safety-oriented projects should undertake accident prevention and SAR-facilitating activities appropriate to local conditions. For example, where dense shipping presents a hazard to small fishing craft and/or where coastal radar stations may help in locating missing fishing vessels, construction and installation of

simple radar reflectors on even artisanal boats, such as canoes and sailing rafts, can save lives and equipment.

In addition, local safety groups should set buoys marking dangerous reefs and rocks; set lights or fires on beaches and at shelter entries to make safer the night passage of fishing craft through surf or narrow passages; erect high beacons, if necessary in pairs, to mark safe access courses on beaches that have few coastal landmarks; and operate beaching installations, etc.

Local action groups can also be involved in simple coastal weather warning systems, such as using mosques' loudspeakers, hoisting warning flags and issuing smoke signals, to alert fishermen.

Suggestions collected from Pacific islanders for improving SAR are included in a survey report by McCoy (1991).

10.4.5 Survival in water

To prevent death from exposure (hypothermia) in cold-water areas, immersion (exposure) suits must be carried on board and worn whenever the situation becomes dangerous.

Since boats sometimes sink rapidly with no time left for the crew to get organized properly to abandon ship, all survival equipment should be stowed and maintained so that it detaches itself from the sinking vessel and remains afloat. "Abandon ship" practice should be a part of fishermen's training and for colder waters should include the rapid donning of immersion suits. These suits should be periodically checked for holes or tears and their zips lubricated.

In warmer areas, particularly in the tropics, where the relatively high water temperatures make more prolonged immersion sustainable and where by and large fishermen cannot afford to acquire immersion suits, it is highly recommended that the authorities require sea-going small fishing craft to carry enough life-jackets and if necessary, assist in their acquisition and distribution. It is also recommended that fishermen are trained in water-survival in the presence of sharks.

Artisanal and other fishing craft designed to remain buoyant upon capsizal should be fitted with hand-ropes or other means by which people in the water can hold on to the hull with ease. These can also help them in cases in which it is possible to upright the craft.

10.5 Prevention of boat accidents

10.5.1 Collisions

Since collisions with larger vessels represent a major hazard to artisanal fishing craft, it is recommended that, especially where shipping is dense, all boats carry simple radar reflectors and have lights on at night. In training courses and workshops and where examinations for skippers or boat drivers are held, emphasis should be given to good knowledge of the rules of the sea.

10.5.2 Beaching

To prevent accidents on beaching (capsizing, sinking, drowning, crashing on reefs and rocks, etc.), it is recommended that locally appropriate beaching installations are considered, especially at sites where accidents are frequent and their cost in lives and equipment is high. Local safety groups supported by the authorities, bilateral or multilateral projects and/or NGOs could be involved. Such installations can consist of buoys anchored beyond the surf zone and connected to the beach by a rope-and-block system which the beaching boat can hook to and be towed ashore by. The towing power at the beach end can be provided by stationary winches, trucks or tractors, or beasts of burden.

10.6 Beach disaster preparedness, evacuation and protection

When fisherfolk, including women and children, are engaged in beach-fishing activities in major storm-prone areas, an effective warning system cannot be based only on sophisticated and expensive equipment (see section 9.3).

Warnings can be issued by various visual means, including flags, smoke signals and pyrotechnics, and from the air. Local and national authorities and fishermen's safety groups should operate simple warning schemes and make sure that, when needed, there is at least one radio transistor tuned to a station that issues storm warnings, and these are then relayed to where people are working in groups.

However, where hurricane-force winds destroy dwellings and carry torrential rains and floods in their wake, warnings are of little value unless safe storm refuges for fishermen are provided. In instances where mass evacuation may not be feasible, communal storm shelters are more effective. Well-constructed (i.e. reinforced-concrete) houses, especially schools, places of worship, community centres, etc., could be used, though in some there may be the need to provide raised flooring to prevent flooding.

Where such buildings do not exist, or they cannot provide sufficient space for all the villagers and fishermen who may find themselves in need of shelter, one option is to construct low-cost community "survival platforms". These may consist of a concrete, well-fenced floor set on concrete pillars tall enough to keep the platform above any possible flooding, caused by a hurricane or anything else. The floor should have a proven, minimum carrying strength of 300 kg/sq.m. The platforms should have good access through wide gangways and stairs, so that stampedes of people do not lead to deaths. With enough surface area, such structures can save large numbers of people and even animals. They should require a minimum of maintenance. Community authorities or local safety groups could be in charge of their operation and maintenance. (J. Turner, personal com.)

10.7 First aid and medical services

10.7.1 Stings and poisons

Marine anti-venom technology and international availability of anti-venoms should be improved both qualitatively and quantitatively. For this purpose:

– research efforts should be encouraged by both governments and NGOs associated with fishermen and other population sectors particularly prone to accidents related to stings at sea (e.g. sport divers, fishermen and swimmers). Studies should be aimed at

developing anti-venoms and vaccinations against poisons such as ciguatera, and at developing simple tests for the presence of ciguatera;

- regulations and recommendations related to minimum first-aid kits to be carried on board small fishing craft should stipulate some regionally selected medicines that may alleviate pain in victims of venomous stings;
- initiatives should be taken and support provided for ambulatory first-aid stations accompanying large numbers of fishermen doing their work by wading, ice-fishing, swimming and diving, or permanently or seasonally established in localities where such activities are frequent.

10.7.2 Hypothermia

Many fishing people die of hypothermia unnecessarily. Fishermen should be trained to recognize the dangers and symptoms of hypothermia, take the steps necessary to warm the person up, even when he/she seems just sleepy and tired, not to give up hope even when the person seems dead, and understand the importance of early hospitalization. (Berkow et al., 1997.)

10.8 Fishing operations

10.8.1 General fishing units

Operating in areas where ship-to-shore and ship-to-ship communication and SAR services are weak, general fishing units should keep visual contact with other units to look after each other.

Overloading, especially when accompanied by leaking, can become very dangerous and should be avoided by any means. All safety-related projects and other activities should make the overloading issue an important component of training, education and examinations. (Rayment and Fossi, 1994.)

10.8.2 Diving

Banning fishing with Scuba gear, usually to protect deep-water stocks, has been hailed as the only way to avoid diving fatalities and the medical problems associated with decompression sickness. Where Scuba gear is used by artisanal and local small-scale fishermen, training and education should be provided, preferably on a mandatory basis, because decompression sickness is not immediately obvious to untrained people.

10.10 Reduction of incentives to take risks

Where the authorities set the days for short-opening fisheries, they should avoid opening the fisheries on days of particularly bad weather.

In any case, mandatory fisheries closures set by the authorities in times of bad weather would, doubtless, offer good protection against the dangers of fishing in bad weather, for no fisherman will be left at a relative disadvantage. Of course, such a policy may be applicable only when all vessels participating in such a fishery are of comparable seaworthiness.

10.11 Training and certification

10.11.1 Manuals and charts

For recommendations concerning manuals, see above (section 10.4.1). National and local authorities should be encouraged to produce easy-to-use, waterproof and small maps where dangerous spots and areas are charted. The use of such maps should not require a large desk in a protected wheelhouse.

10.11.2 Training courses and workshops

Training courses, crash-courses, workshops, seminars, etc. (see section 10.4.1), can be divided into two main categories:

- training of trainers and educators; and
- training of fishermen themselves.

Courses in the first category should be aimed at producing trainers in:

- simple navigation and radio/radar navigation; and
- behaviour in marine accidents and survival at sea with the trainees themselves experienced seamen or fishermen.

Other training activities in this first category can be aimed at producing:

- extension workers who would be employed in propagating and organizing voluntary SAR groups;
- paramedics to teach fishermen first aid with special attention to marine and fishing-related accidents;
- mechanic-instructors who would train fishermen in engine maintenance and repair, including emergency repairs; and
- boat-building instructors to propagate among artisanal boat-builders design and construction modifications and practices to improve the seaworthiness of locally built craft.

If necessary, such courses and workshops could be promoted and supported by international organizations in cooperation with NGOs and involve trainees from several neighbouring countries (see also section 10.14).

Courses in the second category, run by local specialists, including graduates from the first category of courses, should be held primarily in major fishing centres and in areas densely populated by small-scale fishermen. The curricula and instructors of local courses should be selected according to local needs.

10.11.3 Certification

It is strongly recommended that every fisherman in charge of fishing craft carrying at least one additional crewmember obtains certification.

Legislation can exempt experienced "old-hands" during the early stages of implementation. Syllabuses for certificates should be designed to fit local conditions,

the type and size of fishing craft used, their operational range and the educational level of candidates.

10.12 Legislation and regulations

Apart from laws and regulations dealing with safety at sea already in force or proposed, additional laws should be considered. For example, all mandatory safety equipment, especially in developing country small-scale fisheries, should by law be made tax and duty free.

Where feasible, insurance for crew and boat should be made compulsory as a condition for receiving a fishing licence. Minimum safety equipment and seaworthiness requirements and inspection should be imposed (see section 10.13).

In addition, the ILO and IMO should promote legislation and enforcement of rules preventing inhuman and unjust treatment of artisanal crews employed with their craft by motherships. Their legal position on board should be approximated to that of the regular crew and their working and living conditions taken care of accordingly. Such vessels should be obliged to carry insurance policies covering the artisanal fishermen and the boats employed by them (see section 8.5).

All this requires political will from the authorities in charge, the legislature and above all, understanding from fishermen. International assistance, promotion and pressure towards such legislation might help.

10.13 Insurance

The introduction of compulsory insurance may help to reduce accidents where, especially due to political reasons, safety legislation is inadequate or absent, i.e. a policy is issued only once certain safety conditions, such as holding a valid skipper's licence or installing a theft prevention system, have been met.

Thus, the regulation needed is that every fishing boat has to be licensed and must, for this purpose, carry life and injury insurance (boat insurance can be optional). The insurance companies would, in turn, require certain conditions from the insured, such as voluntary training in safety at sea and a certain amount of safety equipment on board, without which the policy would not be valid.

Business motivation would bring the insurers to see that fishermen improve their chances to stay alive and well. At the same time, keeping their policies valid would serve as an incentive to the fishermen and their families to observe the rules and keep the necessary equipment on board.

10.14 The role of intergovernmental cooperation and international bodies

In view of the low priority accorded to the safety problems of small-scale fishermen even in some developed nations, a serious international effort must now be devoted to the matter.

FAO, ILO and IMO are the main intergovernmental bodies interested and able to deal with the safety problems of small-scale fisheries. In view of FAO's decades of experience and involvement in small-scale fisheries, mainly in the various aspects of

development and management, and in boat design and fishermen's safety, it appears that:

- FAO is best suited to assume the leading role in the above aspects of this endeavour;
- IMO is most appropriate to take the lead in general marine matters, such as early warning weather systems and SAR services, as well as certification and inspection;
- ILO could initiate matters in the promotion and organization of training and educational programmes.

It seems to be important that the three organizations take up the whole issue together. A joint programme would carry more weight in the eyes of the governments approached and, no less important, prevent duplication (or even triplication?) of effort. Such an integrated programme should consist of the activities specified in the following sections 10.14.1 to 10.14.3.

10.14.1 International design and construction standards for small-scale fishing craft

The three organizations would create a joint working group for the formulation of international and regional standards for small-scale fishing craft design and construction.

This group should be composed of proven experts (naval architects and boat-builders) in the various types of small fishing craft as given under *Definition* in section 1.3. The group should also include fishing experts – knowledgeable of fishing and environmental conditions in different parts of the world – and a fishery economist to help in appraising the feasibility of proposed design and construction standards in different regional conditions.

The group would discuss and agree on the principles of the variants and select existing designs to be recommended. Finally, the group would order and supervise the selection of existing material and the preparation of new publications in several languages of "reader-friendly" guidelines to be disseminated both as CD-ROMs and diskettes, and in printed form. These would be distributed among the world's fishery and marine departments and other official authorities involved in such international standards.

The distribution list should also comprise: inspection services; NGOs active in small-scale fisheries and fishing communities; boatyards; schools for boat-building, marine engineering and naval architecture; fisheries-oriented projects worldwide; and fishermen's organizations of all sorts.

Further, the group should encourage and promote training activities aimed at the introduction and implementation of these standards among the world's small-scale fisheries (see section 10.11.2). (Coackley, 1991; Fyson, 1980, 1985; Gulbrandsen and Pajot, 1993; Mutton, 1982; Riley and Turner, 1995.)

10.14.2 Warning systems and SAR

The three organizations should either set up another working group, or commission the above group, to review the existing warning systems and SAR services among the nations supporting small-scale fisheries.

IMO seems best suited professionally to lead this activity. With respect to warning systems, regional international cooperation is indicated and should be encouraged and, if necessary, coordinated by the working group.

Regional storm warning systems in the Caribbean, Bay of Bengal, China Sea, South Pacific and elsewhere should be looked at from two points of view:

- storm forecasting and monitoring, and
- broadcasting bad weather warnings to fishermen, including artisanal fishing craft and coastal populations.

If necessary, solutions should be sought, promoted and supported. The working group should promote the strengthening or establishment of SAR services in areas where the need for them is the greatest. It should look for international and NGO financial support and the supply of expertise needed for training and running-in such services where governments are unable or unwilling to take proper care of SAR (see also section 10.11.2).

10.14.3 Training in accident prevention, behaviour in emergencies, survival at sea.

The three organizations should either set up another working group or commission the above one to review the degree of training and know-how in areas with a high casualty record and where necessary initiate or promote training programmes such as those described in section 10.11.2. Where necessary (where governments are unable or unwilling to take proper care of SAR) it should look for international and NGO financial support and the supply of expertise.

10.15 The role of NGOs

NGOs are playing an important role in many developing countries, especially in community-related work. The integrated programme of the three organizations should allow for drawing in NGOs when possible. NGOs providing substantial input into the programme ought to be represented on the programme's working group(s).

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http://members.xoom.com/icefox/page2.html (for worldwide maritime SAR organizations).

http://www.access.gpo.gov (for Code of Federal Regulations, Part 28: Regulations for Commercial Fishing Vessels).

http://www.dnv.com (for Nordic/Scandinavian rules).

http://www.shipping.detr.gov.uk/mca/business/fishing.htm (for British rules and SAR).

http://www.uscg.mil/hq/g-m/moa/filter.htm (for U.S. Coast Guard, including "lessons learned").