SafeCatch Final Report to Search and Rescue Secretariat New Initiatives Fund

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SafeCatch Final Report

Executive Summary

Commercial ocean fishing is a very dangerous occupation. High rates of fatalities and injuries can be attributed in part to the inherently dangerous working conditions involved. Yet, since actual levels and types of occupational health and safety risks vary across fisheries, jurisdictions and time, social, economic, cultural and regulatory factors must also be playing a role.

The SafeCatch project was designed, as a part of the broader SafetyNet research program in workplace health and safety, to deepen our understanding of trends in SAR incidents and injuries and fatalities in the Newfoundland and Labrador fisheries during the period between 1989 and the present. The project is composed of six linked components: the Comparative Analysis of Regulatory Regimes (CARR) component; the Fishing Vessel Safety Longitudinal Analysis (FVSLA) component; the Perceptions of Risk (POR) Component; the Safer Sea-Keeping Component; the Injured Fishers Component (not funded by SAR-NIF) and the Community Healthy Fisheries Component (CHFP).

1. Comparative Analysis of Regulatory Regimes Component

The CARR component has studied the contribution of regulatory regimes to health and safety risks in fishing. It has developed a comprehensive framework of the potential impacts, both direct and indirect, of regulatory regimes on health and safety in order to identify possible pathways from regulation to fishing safety. Using this framework, it has generated a comprehensive description of the regulatory regimes that directly or indirectly affect fishing safety in Canada and five other countries (the U.S., the U.K., New Zealand, Iceland and South Africa). We highlight the similarities and differences in these regulatory regimes. We also sought to compare data across our six cases in order to document and compare trends in the recent history of accidents, fatalities and SAR incidents in these countries. We have established collaborative efforts with researchers and regulatory agency representatives in relevant countries, with the intention of meeting near the end of the study in order to review and disseminate the results of the CARR project and to encourage the development of research initiatives designed to extend this work.

Our framework and the resulting national profiles have confirmed our understanding that the factors contributing to fishing health and safety risks are multiple and include not only environmental risks but also labour conditions, culture, vessel design, fisheries management, transport and safety regulatory regimes. These factors interact with one another in complex ways that our various projects seek to describe and understand. Comparing our six cases, we also found a broad pattern of overall similarity among the relevant regulatory regimes. In all cases, safety regimes have expanded over time from an initially narrow focus on vessels and survival equipment to more comprehensive and mandatory, policies covering a wider range of risks and a wider range of vessel sizes and occupations. Overall, we found that the six CARR countries have generally similar

administrative structures in terms of the agencies responsible for policies directly affecting fishing health and safety. Similarly, in all our countries, we found that regulatory regimes affecting the fisheries were highly compartmentalized, with jurisdiction within the purview of many agencies. Thus regulations and policies initiated by administrative agencies that are directly responsible for fishing OHS, as well as those initiated by agencies with responsibility for other aspects of the fishery, can both influence OHS. Given this simple truth, it is surprising that the majority of national and international fisheries policies, especially those governing fisheries management, have traditionally been developed without regard for their potential impacts on health and safety.

Our review of the available international data for fishing-related accidents was disappointing. We found a serious lack of consistency in the manner in which countries categorize and count fishing health and safety outcomes. Approaches to tracking injury, fatality, and illness varied not only among countries but also among the sub-national jurisdictions of individual countries. This lack of standardized reporting and the uneven quality of the data are particularly troubling given that commercial fishing is consistently ranked as one of the most dangerous of occupations and that accurate information on levels of risk is essential to assessing and improving the effectiveness of health and safety policies. Given these problems with the data, the compartmentalization of administrative responsibility, and the spatial and temporal diversity and dynamism of fisheries, we found that it is difficult to correlate trends in fishing fatalities with the implementation of specific regulatory policies. The Fishing Vessel Safety Longitudinal Analysis (FVSLA) component of SafeCatch seeks to rectify this situation for the Newfoundland and Labrador case by linking available accident statistics from multiple sources in order to provide more complete and reliable data.

2. Fishing vessel safety longitudinal analysis (FVSLA) component

Longitudinal analyses using linked datasets can deepen our understanding of fishing occupational health and safety issues. The primary research tool for the FVSLA component of SafeCatch is a new, linked database that has been designed, negotiated and established for the purposes of this research. This linked database includes data extracted from:

- the Newfoundland and Labrador Workplace Health Safety and Compensation Commission (NL WHSCC) Claims Database for the Newfoundland and Labrador Fishing Industry from 1989 to 2001 inclusive;
- the Search and Rescue (SAR) SIRSAR Database of resources tasked to fishing vessels in Newfoundland and Labrador waters from 1994 to 2001 inclusive; and
- the DFO Catch and Effort Database which combines the Trip Logs and Purchase Slip Databases for fishing vessels sailing from Newfoundland and Labrador from 1989 to 2001 inclusive.

The FVSLA linked database will provide many opportunities for analysis over the next several years. To date, we have completed a descriptive summary of the NL WHSCC data for trends over time in incidence of reported accidents and fatalities, nature of accident, body part injured, source of injury, severity of injury, and time lost. We are now preparing a pilot project that will allow us to use data from the other databases to deepen our understanding of the larger context associated with workers' compensation claims and SAR incidents. We are using a small linked database to pre-test our methods before testing hypotheses generated from the NL WSHCC data as well as from other Safecatch component studies. For example, we are interested in what kinds of accidents and injuries are related to crab fishing in comparison to shrimp fishing: we want to know when and where these accidents occur in relationship to the trip cycle and how fishing effort on these vessels changed over time and with what impact on fishing safety. For this pilot project, we have linked 28 WHSCC claims with 28 SAR incidents, and then successfully linked these cases to the DFO database. Through this process we can see the connections among the variables, identify the difficulties associated with integrating the databases, and perfect the techniques that must be used to handle these large datasets.

3. Perceptions of Risk (POR) Component

The insights on accidents and injuries made possible by these linkage-enhanced data are supplemented by the Perceptions of Risk (POR) component which explores many of the same questions from a different angle through interviews with fish harvesters. The main objective of this component of SafeCatch was to document harvesters' experiences with risky situations, their perceptions of fishery risks, and their perceptions about the ways safety training, regulatory and other changes introduced in the Newfoundland and Labrador fishery have influenced risk. The component explores gaps between perceived and real risks among fish harvesters but our main focus is on gathering harvesters' observations and knowledge in order to deepen our understanding of risks, their origins and how they interact with fish harvesters' knowledge and practice to influence decision-making and ultimately safety and health within our fisheries. We used three methods: focus groups, a phone survey, and boat tours. 17 focus groups were completed involving 94 fish harvesters (83 men and 11 women) from the island portion of the province. Forty-six harvesters participated in our phone survey and we have completed seven boat tours.

Component results suggest widespread under-reporting of accidents, injuries and near-misses in fishing administrative data. This suggests that data trends revealed through the FVSLA study may be under-estimated and should be interpreted with caution. A very wide range of risky situations and types of injury were described by our participants. Exactly 50 percent (23) of those surveyed in the phone interviews reported having an accident in the past 10 years and 44 percent said they have health problems that are related to fishing. Of the 23 harvesters who reported having an accident, 14 of those described experiencing injuries. Harvesters tend to see some injuries as part of the job. Harvesters also tend to normalize the risks to safety posed by bad weather. However, they also see weather risks as mediated by forecasting, by experience with the vessel and with different types of conditions, as well as by regulations.

Regulations can both mitigate and enhance risk. The regulations our participants think matter most to risk include those that limit vessel length, set season lengths, that include strict rules about when gear can be in the water, and that require mandatory safety equipment and training. Study participants often described fishing for crab in inappropriate vessels and without vital equipment such as radar and survival suits during the early years of the temporary permit snow crab fishery. Most were “experienced” harvesters with many years on the water, but their experience and vessels were tied to particular fisheries and to coastal locations. As they moved offshore and into this new fishery, they discovered new challenges and risks. Since the beginning of the small boat crab fishery, many harvesters appear to have adjusted their vessels and equipment to better suit the risks associated with snow crab fishing. However, serious challenges persist. These impacts of regulations on fishing OHS are also discussed in detail in the CARR component.

Since the early 1990s, there has been more attention to safety training in the media and in fish harvester organizations. The focus group and the survey data suggest a tension between experiential approaches to fishing safety and reliance on formal safety training. Respondents also indicated that harvesters tend to follow the example of others when deciding whether to invest in more safety equipment. Harvesters reported numerous strategies to fish safely, including traveling to and from the grounds with other vessels, routine maintenance and related record–keeping. Harvesters also reported modifying their deck space to prevent chronic injuries by adding anti-fatigue mats or tables on which to pick cod out of their nets or sort crab thereby reducing bending and the risk of back injury. The high cost and limited availability of safety training were among the issues discussed in the focus groups and the phone surveys. We noted a tendency for some harvesters to equate safety with owning safety and navigational technologies, an attitude that could contribute to a tendency to take greater risks and to over-reliance on the technologies based on the assumption that, should something go wrong, they will be able to save themselves and the boat. Despite the significant risks associated with fishing identified by participating harvesters, most report a high level of satisfaction with their jobs.

4. Safer Fishing Vessel Sea-Keeping (SFVS) Component

In the last three-to-four years, the Institute for Ocean Technology (IOT) and Memorial University of Newfoundland (MUN) have joined together to establish motion profiles of the Newfoundland fishing fleet. The objective has been to develop and validate a numerical tool, called MOTSIM that will be used to evaluate motion stress profiles using the notion of Motion Induced Interrupts (MIIs) (or any other similar parameter) and their impact on crew safety. The aim of this component is to develop and validate a numerical prediction tool for ship motions with the intention of using it to assess the physical stress levels on fishers associated with vessel motions on board fishing vessels. Stress levels are evaluated on the basis of the number of ‘motion induced interrupts’ (MII) per minute that occur at a particular location on a boat. A MII is effectively a ‘loss of balance’ incident, where the fisher has to make a special effort to avoid ‘tipping or slipping’ either by adjusting his stance or by holding on. Such incidents are associated with accelerations due to the boat's motions and depend on where the fisher is working. The boat motions depend on the sea conditions and the shape and size of the boat. If the boat motions can be correctly predicted, then so can the number of MII per minute that occur at any location on the vessel. In this research, the prediction of a 'loss of balance' incident is based on a 'rigid body' modeling of the fisher and may, therefore, under- or over-predict the 'destabilizing' effects of particular accelerations acting on the human body (which of course is flexible).

The project has conducted sea trials of vessels representative of the Newfoundland and Labrador fleet and run corresponding model tests in the wave basin of IOT (only the smallest of the vessels has been tested at IOT to date). In parallel, MOTSIM has been further developed and validated using the full scale and experimental results. The project encountered substantial numerical challenges in simulating these trials and the model test. Some methods were developed to overcome these challenges. Based on the results, the numerical simulations seem to correlate reasonably well with the trials and the experiments. There is now sufficient evidence to have some confidence that the motion and MII predictions of MOTSIM will allow us to analyse the motion stress levels on vessels in the Newfoundland fleet. An example is presented of the methodology involving MII values to demonstrate the effect of fishing vessel length on crew comfort and safety. This engineering-based research provides additional insight into the findings by both the CARR and the POR components that the specifically Canadian regulatory approach of vessel-length limitation has unintended negative impacts on safety.

5. Injured Fishers (IF) Component

This component had four main aims: 1) to describe the character of the fish harvesters' work and the most common types of accidents and injuries; 2) to describe the impact of the injuries on the fish harvesters' everyday lives; 3) to describe the fish harvesters' experience of current support services; and, 4) to develop recommendations for improvements in support services for injured fish harvesters. The NL WHSCC identified from their records a total of 206 fish harvesters who were currently receiving extended earnings loss (EEL) benefits. WHSCC sent a package of information about the project to these injured fish harvesters. A total of 35 fish harvesters replied and, of these, 26 were interviewed. All of the injured fish harvesters stressed the intense satisfaction they had gained from their work. Their whole identity and lifestyle and that of their families were closely intertwined with the fishery. They defined themselves as fish harvesters. The participants had experienced a variety of accidents. The most common types were slips and falls on the boat and on the wharf. Accidents involving equipment or machinery on the boat or onshore were often mentioned. Out at sea the fishing boat is constantly in motion. In order to do their work the fishermen have to hold their bodies in a certain way so as to maintain their balance. The fishermen felt that this in itself could cause wear and tear on them physically. Related to this were the cramped working conditions many of the fishermen had to work in. Both groups of fish harvesters also emphasized the role of the skippers who were under considerable pressure to maximize the catch even in dangerous waters contributing to pressure to intensify the pace of work and associated risk. These accounts enrich the analysis of many of the risks identified in the POR component and provide a context within which to assess the accident data reported in the FVSLA component.

Serious injuries had a major impact on the lives of these fish harvesters. The initial shock was followed by an open-ended period of readjustment. The initial shock was compounded by the realization that they could not go back to sea. These early days post-injury were described as 'unreal.' For many of the fish harvesters, the shock continued for an extended period. Participants experienced loss of identity, of purpose, of physical ability, of financial investment, of income, of opportunity, and of family role. The most common long-term impact was depression. Harvesters recounted interactions with the WHSCC and its predecessor as time-consuming and frustrating. An on-going complaint was the perceived lack of respect and suspicion shown not only by some of the caseworkers but also by neighbours. A second complaint was the perceived lack of understanding of the nature of the disability. A constant source of frustration was the amount of compensation. The orientation of WHSCC staff seemed to be to get the injured worker back to work despite evidence that this might be foolhardy. Several of the deep-sea fishermen had participated in some form of retraining, but all of them found it to be a waste of time for different reasons. Although they recognized that they could not return to the fishing industry, the injured fish harvesters still wanted a job with some of its qualities such as freedom and independence. Some felt that fishermen need to take more responsibility for their actions and be safety conscious.

6. Community Healthy Fisheries Project (CHFP) Component

Government agencies and the fish harvesters' unions have pursued a range of strategies designed to reduce the number of accidents in the industry. These programs have focused on improving individual fish harvesters' knowledge of basic safety regulations and the procedures to follow in case of an emergency. Together they have contributed to creating a safer industry. However, there is a need to explore new ways of promoting a safety culture throughout fishing communities, particularly since other components of SafeCatch have revealed serious deficiencies in many aspects of fishing OHS. The aim of this project was to explore the potential role of different community arts activities in promoting increased safety awareness in fishing communities. The project was conducted in three fishing communities in Newfoundland: Bonavista, St. Brides/Cuslett and Petty Harbour/ Maddox Cove. It was designed to encourage community control and ownership of the program. Project activities varied from community to community and included schools-based activities, play and video production, ecumenical services and other activities. Informal discussion with the key project participants confirmed their enthusiasm not only to participate in the project but to initiate similar activities in subsequent years. This impact was particularly noticeable among those community residents who were not themselves fish harvesters suggesting that the participation of teachers, town officials and plant workers in the project made them aware of their potential role in increasing safety in the fishing industry. Community arts workers also became aware of their role in promoting awareness of safety in fishing communities. While they had taken up a variety of issues in their previous work, they had not focused on safety as an issue. The success of this approach appears to be linked to a number of factors including reliance on a community development approach; the presence of local capacity in the form of community leaders with appropriate expertise; effective planning, shared responsibility and tools for maintaining morale and support of committee members. Community resources such as schools, community centres, local media, the presence of members of the arts community and involvement of church, union and council leaders were also important to the success of these projects. Challenges included limited resources, unanticipated delays, and the need for stronger engagement of local fish harvesters.

Introduction

This document summarizes the research conducted by SafeCatch, a six-part research program carried out by SafetyNet. Funded primarily by the Canadian Institutes for Health Research (CIHR), SafetyNet is a Community Research Alliance on Health and Safety in Marine and Coastal Work based at Memorial University in St. John's and linked to partner organizations and researchers in Newfoundland & Labrador, the Maritime Provinces and elsewhere in Canada., SafetyNet is the first major research program investigating occupational health and safety in Atlantic Canada's marine, coastal and offshore industries.

SafeCatch is the largest of the eight research projects being carried out by SafetyNet. SafeCatch has been jointly funded by CIHR, the Search and Rescue Secretariat's New Initiatives Fund (NIF), Memorial University, and the Newfoundland and Labrador Centre for Applied Health Research at Memorial. Other contributions to the project have been provided by: the Institute of Ocean Technology; the Workplace Health, Safety and Compensation Commission of Newfoundland and Labrador; the RURAL program at Dalhousie University ("Research Towards Understanding Rural Health in Atlantic Canadian Landscapes"); the Offshore Safety and Survival Centre of Memorial University's Marine Institute; the Professional Fish Harvesters Certification Board of Newfoundland and Labrador; the Canadian Coast Guard; and the Fish, Food and Allied Workers.

A multi-faceted, interdisciplinary research program, SafeCatch is designed to include an unusual degree of involvement by community partners of various kinds— provincial government units, public regulatory agencies both provincial and national, private firms, associations of workers and of employers, and local community groups. Using these partnerships, SafeCatch has, incorporated a substantial knowledge exchange component from the design phase of the research right through to its final dissemination stages.

The central objective of SafeCatch is to identify the regulatory, economic, social, psychological and vessel-design factors associated with accidents, injuries and fatalities in fish harvesting in Newfoundland and Labrador in a context of rapid and substantial industrial and regulatory change. We have sought to interpret the factors that influence the occupational health and safety of fish harvesters, assess how those factors inter-relate, and to deliver results that can be used directly in communities and workplaces or that can inform and improve the development and implementation of prevention programs, the planning and delivery of SAR and other public services, and the development of fishing safety policy at the regional and national levels.

A Changing Industry

Many changes took place in the Newfoundland and Labrador fishery between 1983 and 2002. As indicated in Figure One, the relatively large, industrial offshore groundfish dragger fleet has virtually disappeared. During the same period, there has been a roughly 50% drop in the number of licensed vessels in the < 35 foot fleet sector with many of the remaining vessels in this fleet sector increasing somewhat in length up to the limit permitted in the regulations. The number of licensed vessels in the 35-45 foot fleet has also declined. In contrast, the number of vessels between 45 and 65 feet has stayed relatively constant or even increased slightly. Some expansion in offshore, industrial factory freezer trawler activity, particularly within the shrimp fishery, has also taken place since the early 1990s.

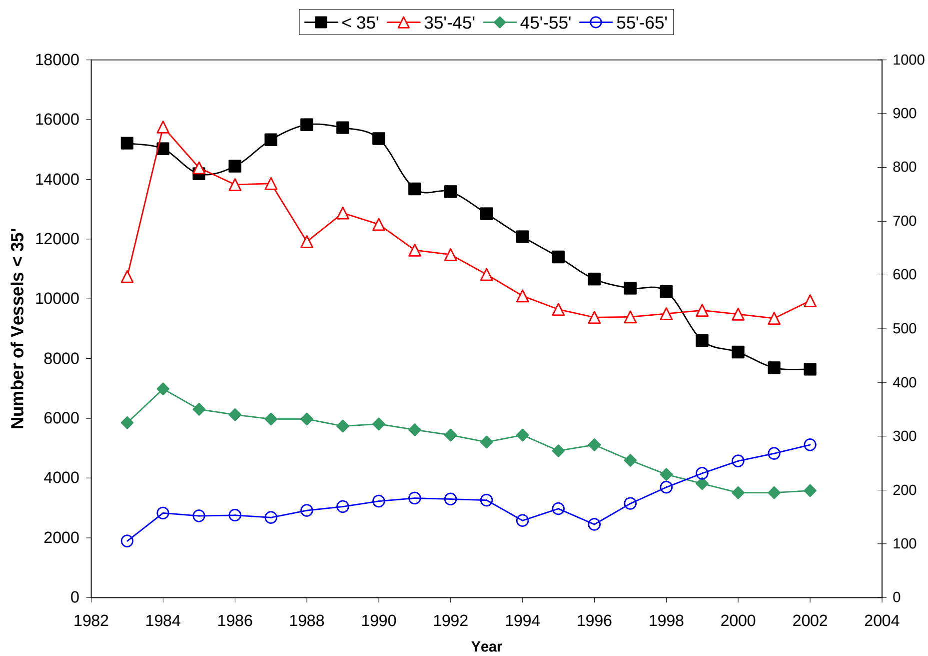


Figure 1. Number of licensed fishing vessels in Newfoundland and Labrador by length category, 1983-2002.

This fleet transformation reflects the virtual disappearance of the cod fishery in many areas, reductions in other groundfish fisheries, and substantial increases in effort, landings and landed value within the lobster, snow crab and shrimp fisheries. There has also been a substantial increase in sealing activity over the period under study linked to increased quotas and prices for seal pelts and fat. Related changes have taken place in the seasonality of fisheries; in the intensity and distribution of fishing activity (Pelot 2000); in fishing, navigation, fish-finding and gear-handling technologies; and in the regulatory regime governing both fishing and fishing safety (See the Comparative Analysis of Regulatory Regimes (CARR) component; Wiseman and Burge, 2000; Pelot, 2000). Requirements and realities of fish harvester safety training have changed along with the overall costs of fishing and the relative importance of different species for harvesters' incomes. Changes have also taken place in the relations between harvesters and processors (CCPFH 2005); in the average age and gender composition of the fish harvester labour force (Grzetic 2005; CCPFH 2005); in the distribution, maintenance and management of fishing infrastructure such as docks and wharves (Coastal Communities Network 2004); and in the location of weather forecasting capacity.

The SafeCatch Research Program

The SafeCatch research program has six main components. All the components share the core objective of producing and translating results that will:

- reduce the number and severity of fish harvester injuries and fatalities and of SAR incidents;
- promote safety awareness;
- support the development of improved safety education programs for fish harvesters; and
- help to improve decision-making related to fishing practices, training, vessel design and public policy.

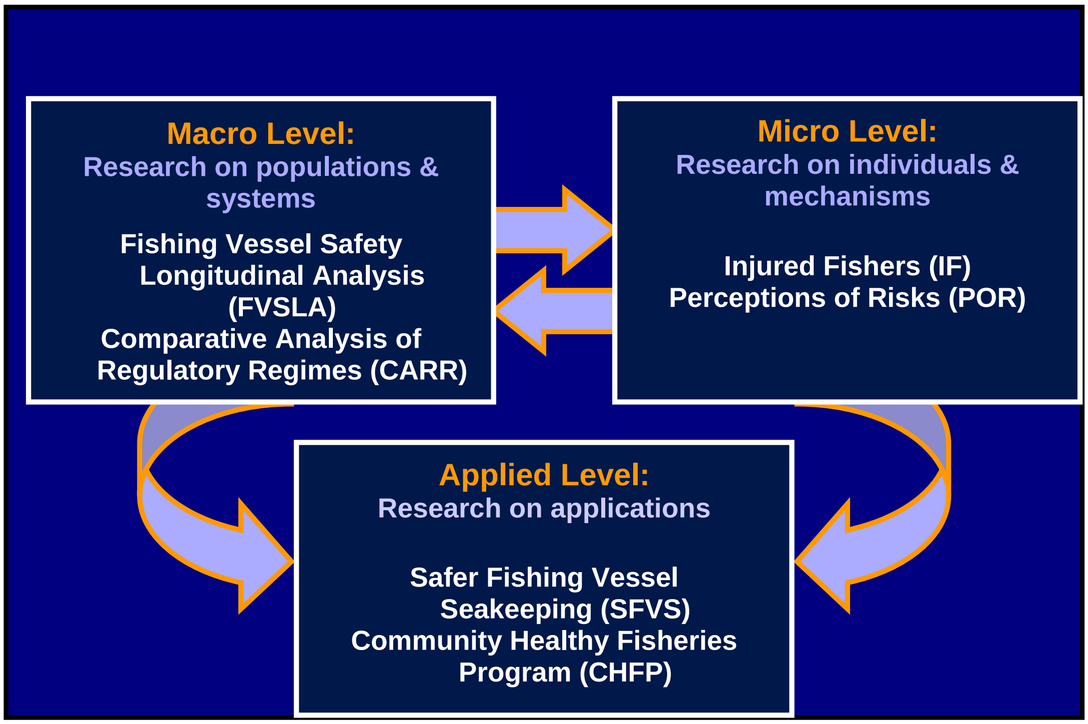
The component projects are:

1. **Comparative Analysis of Regulatory Regimes (CARR)**: A comparative analysis of fishery regulatory regimes and management practices and of their impact on fishing accidents in Canada and other countries.
2. **Fishing Vessel Safety Longitudinal Analysis (FVSLA)**: A longitudinal analysis (1989-2001) that uses a new comprehensive, inter-sectoral linked database to identify and interpret the factors that influence the rates of injuries, fatalities and SAR incidents.
3. **Perceptions of Risk (POR)**: A study based on focus groups and interviews conducted with fish harvesters on their perceptions of the causes of accidents and near-misses and their suggested solutions.
4. **Safer Fishing Vessel Seakeeping (SFVS)**: An engineering study to collect sea-trial data in order to complete and validate a computer model for predicting the impact of vessel design on seakeeping characteristics and fish harvester occupational safety.
5. **Injured Fishers (IF)**: An interview-based study of injured fishers, investigating their experiences and the psychological and social impacts of occupation- related

long-term disability **(this component was <u>not funded by SAR-NIF</u> but we have included a summary report because of its relevance to the other study components)**.

6. **Community Healthy Fishery Program (CHFP)**: The development of an interactive, community-based OHS and fishing vessel safety education program for fish harvesters.

These project components have been designed and implemented to operate at three levels: the macro level of research on populations and systems; the micro level of research on individuals and mechanisms; and the applied level of policy and implementation.



SafeCatch was designed so that relevant questions and results from each component would be relevant for the research design and interpretation of results in the others. Several of the components are yielding results of direct relevance to SAR in relation to the planning, development and implementation of programs and services. Working in collaboration with our partners and with other relevant stakeholders, we are developing a series of policy and management recommendations to promote safety in the fishing industry in Newfoundland and Labrador and in Canada more broadly. In addition, the research should both inform and promote the development of effective inter-sectoral collaboration to reduce accidents and SAR incidents in the fishing industry.

Fishing Occupational Health and Safety:
A Comparative Analysis of Regulatory Regimes

M. J. S. Windle, B. Neis, S. Bornstein, P. Navarro
SafetyNet, Memorial University of Newfoundland,
95 Bonaventure Avenue, St. John's, NL, A1B2X5
phone 709 777 6768 fax 709 777 6734
www.safetynet.mun.ca

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INTRODUCTION

Commercial ocean fishing is a very dangerous occupation. In a 1999 report, the International Labour Organization estimated that, worldwide, 24,000 fatal and 24 million non-fatal injuries occur annually in the fishing industry (ILO, 1999). Available statistics for countries with significant commercial fisheries indicate that fishing occupational fatalities and injuries occur at rates much higher than national averages for occupational fatalities and injuries, regardless of the level of industrialization (FAO, 2001). These high rates of fatalities and injuries can be partially attributed to the inherently dangerous working conditions involved in the industry. These include: an unpredictable and often hostile marine environment; unstable work platforms; resources that are mobile, variable, diverse, often dangerous (bites, poison, allergies) and often located in remote offshore areas; moveable and often heavy equipment, and a dependence on vessels for shelter and survival. Furthermore, shift work and the intense and prolonged working activity typically associated with fishing can cause fatigue, a common factor in many fishing-related incidents (ILO, 1999). Processing activities on vessels and in factories expose workers to industrial diseases such as occupational asthma and allergies (ILO, 1999; Beaudet *et al.*, 2002) and a variety of soft-tissue injuries and chronic conditions (ILO, 1999; Ben-Yami, 2000; Thomas *et al.*, 2001).

While fisheries are inherently dangerous, the actual levels and types of occupational health and safety risks vary across fisheries and over time, thus pointing to the role of social, economic, cultural and regulatory factors in influencing risk within the industry. At a macro-scale, there is some evidence that risk varies from country to country (ILO, 1999). Similarly, risks associated with small boat fisheries tend to differ from those associated with large vessel fisheries with the former more subject to foundering, etc., and the latter sometimes more subject to the risk of industrial-type accidents, such as getting caught in machinery. Risks may also vary with the types of fishing activities, area of operation, vessel condition, and crew experience.

Research has shown, moreover, that the nature, extent and type of risk that harvesters encounter, as well as their consequences, can change over time. This has become particularly relevant in the context of the fisheries of Newfoundland and Labrador (Canada). In response to a perceived high rate of fishing incidents in Newfoundland in the late 1990s, the Canadian Coast Guard conducted a fishing vessel safety review in 2000 that incorporated SAR data and DFO fisheries data from 1993 to 1999 to highlight trends in safety (DFO, 2000). The review concluded that injury rates, workers compensation claims, and Search and Rescue (SAR) incidents appeared to be on the rise in the Newfoundland fishing industry and correlated with a shift in target species from inshore groundfish to primarily offshore shellfish. The review data were also subjected to a comprehensive analysis by a Dalhousie University researcher who correlated SAR incidents with vessel length classes, species fished, distance from shore, and location (Pelot, 2000). Both reports revealed significant trends in SAR incidents for the less than 65-foot Newfoundland fishing fleet: SAR incidents increased between 1993 and 1999 and were highest in the 35- to 45-foot length class; the mean distance of activity from shore has noticeably increased for the 35- to 45-foot and 45- to 65-foot length classes; the fishing sectors with the largest number of incidents were those targeting crab and groundfish; and sealers had the highest incidence of all. This pattern of SAR incidents, accidents and injuries points to the potential influence on risk of a range of factors including not only vessel size but also targeted species. Underlying this pattern and these spatial and sectoral trends in SAR incidents are substantial and rapid industrial changes triggered by environmental degradation (linked to fisheries mismanagement) and industrial and policy change (Dolan *et al.*, 2005). These changes are dealt with in more detail in other parts of this report.

COMPARATIVE ANALYSIS OF REGULATORY REGIMES

One prominent approach to risk reduction is regulation. Regulatory regimes governing fishing safety are becoming increasingly complex and are being extended to a growing proportion of fisheries, including small boat fisheries (Ben-Yami, 2000). As in other industries, but perhaps particularly in fisheries, regulations directly aimed at promoting occupational health and fishing vessel safety are only one set of regulations with potential consequences for risk. Others types of regulation can have an indirect and sometimes unintended impact. These include fisheries management regulations, regulations that influence labour markets and thus training, incomes, employment alternatives and crew turnover, as well as regulations that influence industrial structure and patterns of ownership and control.

The scope and interaction of these regulatory regime components affecting commercial fishing are often poorly understood in terms of actual or potential effects on health and safety (NRC, 1991). In many cases, there has been no attempt to correlate the implementation of such policies with fishing health and safety outcomes. To our knowledge there have been no comprehensive reviews of all regulatory policies directly and indirectly affecting fishing risk within countries with significant commercial fisheries. Similarly, there is an even greater lack of comparative international research related to this issue. It is these gaps that the Comparative Analysis of Regulatory Regimes (CARR) component of SafeCatch was designed to document and begin to address.

Study Objectives

The objectives of the CARR component of SafeCatch are as follows:

1. to review the literature related to fishing health and safety in order to identify sources of risk and to provide international contextual information and insights as a frame for a multi-levelled case study of Newfoundland and Labrador fishing safety (the remainder of SafeCatch);
2. to develop a comprehensive framework that identifies potential sources of direct and indirect risks to fishing health and safety in order to identify potential pathways from regulation to fishing safety;

3. to generate a comprehensive description of the regulatory regimes in Canada and five other countries (the U.S., the U.K., New Zealand, Iceland and South Africa) with a focus on regulations that potentially impact (either directly or indirectly) on areas of risk identified through our framework;
4. to highlight similarities and differences in these regulatory regimes across countries;
5. to the extent possible, to document and compare trends in the recent history of accidents, fatalities and search and rescue incidents in these countries; and,
6. to establish collaborative efforts with researchers and government representatives in relevant countries, with the intention of meeting near the end of the study in order to review and disseminate the results of the CARR project and to encourage the development of future research initiatives designed to extend this work.

Subsequent sections of this report lay out the methods and findings for each of these objectives.

CONCEPTUAL FRAMEWORK

Methodology

The first stage of the CARR project involved a number of key activities. First, we started by defining what we meant by a regulatory regime. A commercial fisheries regulatory regime may be described as the body of rules that direct the industry; it can consist of laws, policy statements, rules, guidelines and standards (Howlett and Ramesh, 1995). Fisheries regulatory regimes are often complex, with administrative jurisdiction falling simultaneously within the scope of sub-national, national or international authorities. Furthermore, coordination both within and between administrative agencies is often limited, with the result that different policies within a regulatory regime may have conflicting objectives and/or impacts. This may create situations in which regulatory regime components inadvertently increase risks to persons employed in the commercial fishery, despite having the opposite intention. The development of our conceptual framework involved a review of existing research on fishing safety to identify potential sources of risk (Figure 1).

Findings

We found that the primary literature has for the most part focussed on the frequency and attributed causes of fishing-related injuries and incidents (e.g., vessel accidents) using national and sub-national case studies. For all countries, studies reporting rates of fishing-related illnesses were rare (for review (Matheson *et al.*, 2001). Even fewer studies have approached fishing safety from the perspective of OHS management systems (NRC, 1991; Van Noy, 1995). Many of the available and most recent studies on injuries and accidents have come from the U.S. and the U.K. These include studies of injury and incident rates in Alaska (Schnitzer *et al.*, 1993; NIOSH, 1997; Lincoln and Conway, 1999; Thomas *et. al.*, 2001; Lincoln *et al.*, 2001), North Carolina (Marshall *et al.*, 2004), the north-eastern U.S. (Jin and Thunberg, 2005), and the entire U.S. fishing industry (Jin *et al.*, 2001), as well as sub-national and national case studies of the U.K. (Hopper and Dean, 1992; Matheson *et. al.*, 2001; Lawrie *et al.*, 2003; Roberts, 2004; Wang *et al.*, 2005). The frequency of fishing accidents has also been studied for Poland

(Jaremin *et al.*, 1997; Jaremin and Kotulak, 2004), Sweden (Torner *et al.*, 1995), Denmark (Jensen, 1996; Jensen, 2000), Australia (Driscoll *et al.*, 1994) and New Zealand (Norrish and Cryer, 1990). The most widely cited Canadian reference is a 15-year-old study focussing on fishing mortality rates for Atlantic Canada (Hasselback and Neutel, 1990). A 2002 report by Transport Canada examined trends in national fishing accidents and injuries between 1990-2000 (Transport Canada, 2002a). Given the relative importance and size of the Canadian fishing fleet in the global industry, we note an especially large gap in the literature focussing on Canadian fishing injuries and incidents, and particularly in recent analyses. The Fishing Vessel Safety Longitudinal Analysis (FVSLA) component of SafeCatch addresses this gap for the Newfoundland and Labrador fisheries through a comprehensive analysis of trends in occupational injuries and fatalities, SAR incidents and their relationship to industry changes.

A number of comprehensive studies have focussed on fishing health and safety, both the work sponsored by international organizations (ILO, 1999; Ben-Yami, 2000; FAO, 2001; ILO, 2003) and initiatives led by individual governments (CCG, 1987; NRC, 1991; U.S.C.G., 1999; DFO, 2000; Pelot, 2000; Transport Canada, 2002a; MSA, 2003). These studies examine not only the frequency and attributed causes of accidents, injuries and illnesses, but also a range of issues and risks related to safety in the fishing industry. Many include recommendations for reducing various risks in the industry. Of particular relevance to our study was a recent report by the ILO that examined existing legislation concerning labour conditions in the fishing sector in member states and highlighted similarities and differences in the regulatory approaches that various nations have taken regarding a) prerequisites to working in the fishing sector; b) employment; c) occupational safety and health and the provision of food and water, accommodations and medical care; d) social security; and e) administration and enforcement (ILO, 2004).

A portion of the published literature has been devoted to the study of the attitudes and perceptions of fish harvesters towards safety (Poggie *et al.*, 1995; Pollnac *et al.*, 1995; Murray *et al.*, 1997; Pollnac *et al.*, 1998; Kaplan and Kite-Powell, 2000; Eklof and Torner, 2002). Most studies have noted that fishers tend to deny, trivialize, or divert blame for fishing safety problems, and that fatalistic attitudes towards fishing risks are common. Such attitudes may pose a serious obstacle to the development of a safety culture and the effectiveness of regulatory instruments. The Perceptions of Risk (POR) component of SafeCatch is interested in gaps between real and perceived risks among fish harvesters in the Newfoundland and Labrador case study. However, its main focus is documenting harvesters' experiences with risk and injury and their experiential knowledge of the things that put them at risk. The Community Healthy Fishery Program component of SafeCatch explores the potential to improve safety culture at a local level through various community arts activities.

Our review has shown that factors affecting fishing health and safety are multiple and include not only environmental risks but also labour conditions, culture, vessel design, fisheries management and the influence of regulations. It has also pointed to the fact that these factors frequently interact with one another to influence risk (NRC, 1991; Dyer, 2000; Dolan *et. al.*, 2005). Commonly cited direct risks to fishing health and safety include those related to the safety of the fishing vessel (U.S.C.G., 1999; Ben-Yami, 2000; Lincoln *et. al.*, 2001; Roberts, 2004), fishing equipment and handling of the catch (Hopper and Dean, 1992; Dyer, 2000; Thomas *et. al.*, 2001; Marshall *et. al.*, 2004), lack of safety and survival equipment (NRC, 1991; ILO, 1999), lack of experience and training (NRC, 1991), attitudes towards safety, the physical environment including weather (Ben-Yami, 2000), and human error (NRC, 1991; U.S.C.G., 1999). Mismanagement of fisheries resources can indirectly influence safety through excess fleet capacity, increased competition among, and economic pressures on, fish harvesters, and the promotion of unsafe behaviours resulting from stock uncertainties (CCG, 1987; NRC, 1991; NRC, 1999; Dyer, 2000; Ben-Yami, 2000; Woodley, 2000; FAO, 2001; Kite-Powell and Jin, 2001). Because of perceived economic burdens, fishers operating in marginally successful fisheries may resist the implementation of new regulations despite the apparent benefits to safety (ILO, 1999). Requirements for insurance may also indirectly influence safety (NRC, 1991).

In order to understand the range of ways occupational health and safety in fishing might be mediated by various agencies and their respective regulatory policies, we have organized potential risks to fish harvesters into broad categories (Figure 1). This makes it easier to visualize potential linkages between risks and regulations. Regulations and policy initiatives that might potentially impinge on any one or more of these areas of risk are then identified and explored in terms of their real or potential relationship to fishing OHS. In this analysis, we distinguish between regulations that are intended to enhance fishing OHS (direct) and those that are associated with other aspects of the fishery but that could also impinge on fishing OHS (indirect).

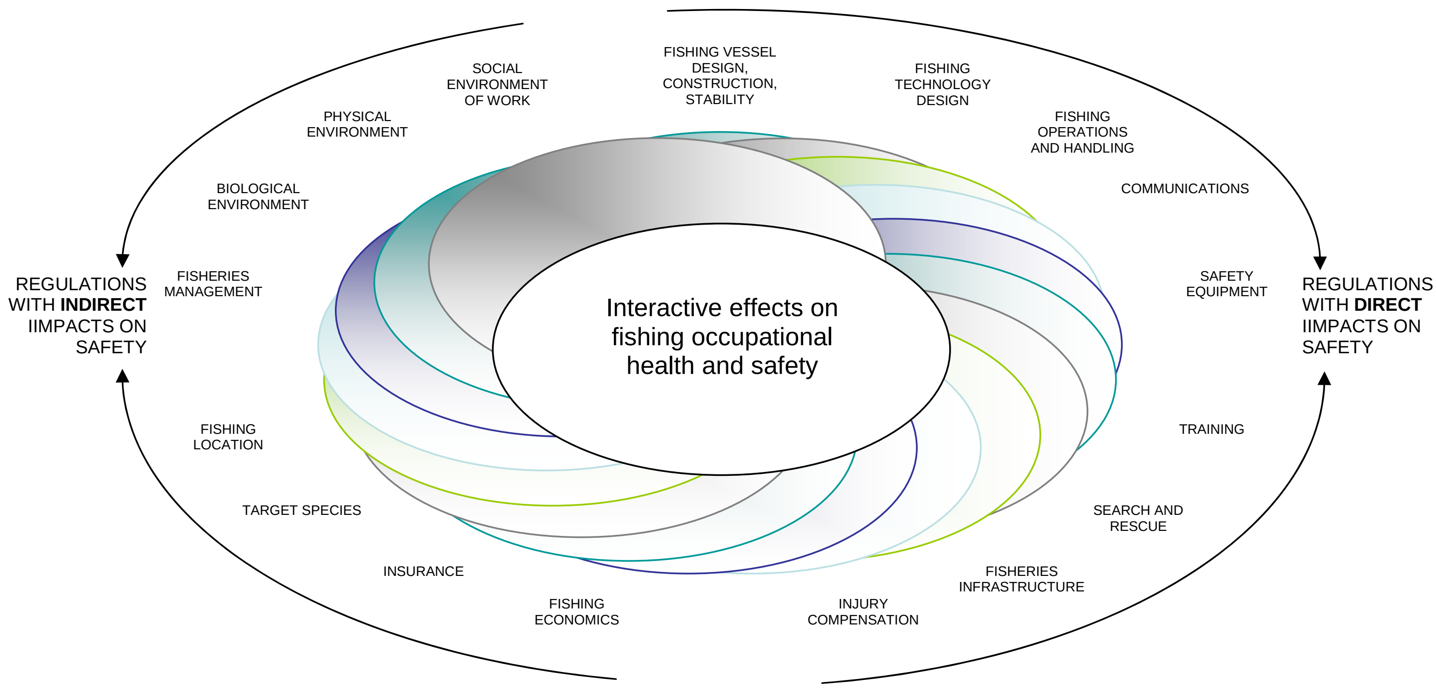

Figure 1. The CARR framework identifies potential sources of risk to fishing health and safety and illustrates possible interactive effects (direct and indirect) of regulations on health and safety outcomes.

DESCRIPTION OF REGULATORY REGIMES

Methodology

In phase two of the project we developed a comprehensive description of the regulatory regimes for the commercial fisheries of Canada, the U.S., the U.K., New Zealand, Iceland, and South Africa (henceforth referred to as 'the CARR countries'). These countries were selected in order to cover a range of differing geographical locations, as well as occupational conditions, government and organizational structures, and management approaches to fisheries resources. Common criteria included a significant commercial marine fishery, an industrialized fishing fleet, and information sources available in English. Given that specific laws affecting fishing health and safety may vary between provinces (e.g., workers' compensation systems), the Canadian case study is focused on the Newfoundland and Labrador fishery.

The analysis of regulatory regime components for each country in the CARR project involved a comprehensive review drawing on a number of information sources. The principal resources included international standards, national statutes and regulations that were available on government websites and published in gazette form, reports from government and industry organizations, primary and secondary literature, media releases, and, where available, interviews with government and industry representatives.

Using risks identified by our literature review (Figure 1), regulatory regimes were divided into two broad categories for comparative purposes: the first category encompasses all regulatory regime components that explicitly address some aspect of health and safety in the fisheries; the second category encompasses all other regulatory regime components that do not explicitly target health and safety, but may have indirect impacts (real or perceived) nonetheless. Each category was further organized into themes that are common to all developed fisheries. For regulatory regime components that directly impact OHS, these themes include proactive policies (related to the prevention of injuries and illnesses) and reactive policies (related to immediate and long-term measures following an injury or illness). For regulatory regime components that indirectly impact OHS, these themes include fisheries management, ecosystem and natural resource management, and fishing economic and financial systems. The comprehensive descriptions of regimes for each country are posted to the SafeCatch website (www.safetynet.mun.ca/projects_1c1.htm).

Findings

Our regulatory review found that, for many of the selected countries, safety regimes tend to have progressed over time from an initially narrow focus on aspects of vessel safety or survival equipment to more comprehensive and mandatory policies covering a wider range of occupational risks. In addition, the applicability of safety policies has tended to expand in terms of the size of vessels and the types of occupations covered.

Overall, the six CARR countries were found to have mostly similar administrative structures in terms of the types of agencies responsible for policies directly affecting fishing health and safety. The compartmentalized nature of fisheries regulatory regimes, and the recognition that factors that affect fishing health and safety fall within the purview of many agencies, point to the need for intersectoral collaboration between relevant agencies and organizations in order to ensure that regulatory frameworks promote OHS. Intersectoral collaboration can link sectors horizontally (e.g. fisheries management, transportation, social services, etc.), as well as vertically within each sector (e.g. local, regional and national) (Health Canada, 1999). In addition, the effective monitoring and evaluation of regulatory regimes in relation to their impacts on fishing OHS fundamentally requires intersectoral action among relevant parties, without which large and potentially important gaps, both in information and in action, may exist.

Using a systematic methodology based on our conceptual framework, the comparative analysis of policies across the six CARR countries revealed many subtle and significant differences in the coverage and content of regulations with potential direct and indirect impacts to fishing health and safety. Detailed findings of the analysis will be posted to the SafetyNet website. We note the presence of both proactive and reactive types of regulations in all CARR countries, with some key differences:

Direct proactive policies

- In Canada and South Africa, shipping and transportation regulations apply to fishing vessels based on vessel tonnage categories; in the U.S., U.K., New Zealand and Iceland, these regulations apply based on vessel length categories.
- Stability requirements (e.g., incline test) apply to vessels > 24 m in the U.S., > 15 m in Iceland and the U.K, > 15 GT (~10 m) in Canada, > 12 m in New Zealand, and > 100 t South Africa.
- Canada and the U.S. do not implement standards for crew accommodations, in contrast to the other CARR countries.
- Scheduled inspection is mandatory for fishing vessels > 15 GT in Canada, > 15 m in Iceland and the U.K., and all vessels in New Zealand and South Africa. In Canada and the U.K., self-inspections using a checklist are mandatory for all smaller uninspected vessels, which represent over half of each country's fleet. Inspection in the U.S. is implemented through random dockside and at-sea boarding by the Coast Guard.
- Training in terms of survival, safety and fire-fighting courses is mandatory for all fish harvesters in Canada, Iceland, and the U.K. New Zealand incorporates safety training and orientation as part of each ship's mandatory safety management system. Basic safety induction training is required for all fish harvesters in South Africa, while U.S. regulations require only onboard safety orientation.
- The U.S. does not require competency training for most fish harvesters, in contrast to all other CARR countries.
- Crewing requirements such as minimum complements and the minimum number and types of certificates apply to all vessels in Iceland, New Zealand and the U.K., vessels > 5 GT in Canada, vessels > 25 t in South Africa, and vessels > 24 m in the U.S.
- Safety management systems involving safety committees and risk assessments are mandatory on most New Zealand and U.K. vessels, and many Icelandic vessels. Safety management systems are not required for fishing vessels in Canada, the U.S. or South Africa.

- All countries require some form of monthly safety drill to be performed and recorded in the vessel's log, although the applicability varies: drills are required only on large fishing vessels in Canada (> 150 GT or ~24 m) and South Africa (> 100 t), vessels > 15 m in Iceland and the U.K., vessels with > 2 crew in New Zealand, and all vessels in the U.S.

Direct reactive policies

- Carriage requirements for safety equipment (life-saving and fire-fighting) are based on vessel length and operating region in Canada, the U.S., Iceland, and the U.K., and on a risk-based approach that incorporates operating distance from shore in New Zealand and South Africa.
- Medical stores are required on all fishing vessels in Canada, New Zealand and the U.K., U.S. vessels > 5 t or > 16 crew or fish tender vessels in Aleutian trade, vessels > 15 m in Iceland, and > 25 t in South Africa.
- No-fault compensation and rehabilitation benefits are available to all injured fish harvesters in Canada, Iceland, New Zealand, the U.K. and South Africa, although these differ in terms of required qualifying hours vs. automatic coverage, calculation of benefits as a proportion of earnings vs. fixed rate, the duration of benefits, and the types of injuries and illnesses covered by compensation. Workers' compensation in Canada applies to fishers in NL and BC, while fishers in the Maritimes (NS, NB, PEI) are explicitly excluded. In NL, workers' compensation benefits do not count towards qualifying hours for employment insurance, which is relied on heavily during the off-season. For some workers, this may be a factor in the decision whether or not to report, or seek compensation for, an injury or illness. In the U.S., where the compensation system combines no-fault compensation and fault-based liability, fish harvesters are not eligible for compensation. Coverage is automatic for fishers in New Zealand and Iceland.

Policies with indirect influences on fishing OHS

- Fisheries management acts and subordinate legislation in Canada (Fisheries Act), New Zealand (Fisheries Act 1996) and Iceland (The Fisheries Management Act 1990) deal strictly with resource conservation issues and do not incorporate explicit safety objectives. In contrast, the main policy instrument directing fishing activities in the U.S. (Magnuson-Stevens Fishery Conservation and Management Act), the U.K. (Common Fishery Policy) and South Africa (Marine Living Resources Act 1998) contain specific requirements and provisions to promote safety. In recent years, a number of integrated fisheries management plans (IFMPs) in Canada have included a provision stating that the plan is consistent with relevant federal and provincial requirements for safety at sea.
- In all countries, the development of fisheries regulations and management measures involves some form of consultation with industry stakeholders. This mechanism provides an opportunity for impacted parties to raise possible safety concerns. Generally, this has led to a reactive approach in which existing fisheries management measures are modified based on trial and error. For example, in response to safety concerns raised by industry, supplementary vessel replacement rules were introduced in Atlantic Canada in 1997 with the objective of allowing more flexibility for fishers

to choose a vessel size appropriate for their fisheries, provided that conservation objectives were met. In the New England surf clam and quahog fisheries, safety concerns associated with rules restricting fishing effort led to the revision of management measures to allow more days at sea (Lassen and Van Olst, 1986). Small adjustments to fisheries plans as a result of safety experiences have likely taken place in all countries of interest, although this has not been examined in any detail.

- Fisheries management regulations that restrict the length of fishing vessels are common in Canada but not in other CARR countries. Fishing vessel length restrictions may encourage fish harvesters to modify vessel design parameters such as width and height in order to increase fishing capacity and this can lead to stability problems (NRC, 1991; DFO, 2000; Friis, 2006). Vessel design issues are examined in the Safer Fishing Vessel Seakeeping (SFVS) component of SafeCatch. Design modifications may also lead to slower, less fuel-efficient fishing vessels, with potential impacts on the profitability of fishing enterprises. Vessel length restrictions may make it difficult to adapt to changing fisheries and evolving shipping regulations by limiting available deck space for multi-species gear, storage of safety equipment, and storage capacity to preserve higher value catches (Friis, 2006). Fish harvesters who fish in offshore waters may also be limited to using smaller vessels that are unsuitable for such conditions (DFO, 2000; Pelot, 2000). The POR component of SafeCatch presents findings regarding how fish harvesters within the Newfoundland and Labrador fishery have adapted to these regulatory restrictions and indications of ways their actions have influenced safety.
- Individual quotas (IQs) are a relatively new tool in fisheries management (for review, see NRC, 1999), and have been promoted in many cases as a means to improve fishing safety. IQs have been applied to the majority of fisheries in New Zealand and Iceland, many fisheries in Canada and the U.K., and relatively few fisheries in the U.S. South Africa recently implemented a national policy for the redistribution of fishing allocation rights, which are similar to ITQs but differ in that they cannot be automatically transferred and have a finite term (Branch and Clark, 2006). However, it has been argued that the introduction of long-term allocation rights in 2006 will essentially implement a de facto ITQ system in the South African fishing industry (Nielsen and Hara, 2006).
- Requirements for fishing vessel insurance were noticeably lacking in all countries studied.

Differences in the applicability and specifics of safety regulations must be interpreted with caution, given that fleet characteristics, weather conditions and operating areas differ greatly between countries. For example, policies requiring immersion suits may be more appropriate in the cold climates of Canada and Iceland than in South African waters, while scheduled inspections may be more difficult to implement in the case of the large U.S. fishing fleet compared to the relatively small New Zealand fleet. Rather, it is perhaps more useful to describe the scope of policies within each country.

Overall, CARR countries were relatively similar in terms of many of their key features. The notable exception was the U.S. regulatory regime, which primarily involves reactive strategies, focuses on the worker rather than the workplace, does not cover many of the risks associated with fishing activities, and lacks substantial enforcement of mandatory requirements. These deficiencies have been noted in several U.S. publications (NRC, 1991; Van Noy, 1995; Lincoln and Conway, 1999; U.S.C.G., 1999; Dyer, 2000; Thomas *et. al.*, 2001). Of the CARR countries, only Iceland has implemented the Torremolinos Protocol 1993, the first and main international Convention covering safety requirements for the construction and equipment of new, decked, seagoing fishing vessels >24 m. However, most other countries have incorporated parts of the Protocol in their national legislation. Detailed information on the implementation of international standards is included in the regulatory summaries for each CARR country that have been posted to the SafetyNet website.

COMPARISON OF FISHING HEALTH AND SAFETY DATA

Methodology

A potential indicator of the effectiveness of regulatory regimes in promoting safety is the rate at which injuries, fatalities and illnesses occur in a specific industry. We conducted a comprehensive review of international peer-reviewed publications and government reports in order to gather information on past and current trends in fishing-related accidents, incidents and near-misses.

Injury, fatality and illness rates are most often calculated as the number of occurrences divided by the total number of people employed in an industry and are standardized to reflect rates per thousand or hundred thousand people. These rates are limited by the accuracy and scope of the reporting systems that exist within a country, as well as the accuracy with which the population at risk is defined (Thomas *et. al.*, 2001). An alternate and more accurate reflection of accident rates is based on the number of occurrences per unit of effort, as represented by total hours worked. However, hours of effort remain difficult to quantify in the fishing industry, given the seasonal nature of work, widespread self-employment, and the informal relationships that exist between employers and employees (Matheson *et. al.*, 2001). As such, the reported injury, fatality and illness rates of fishers are typically calculated using total employment estimates.

Findings

Our review of the available international data for fishing-related accidents revealed a widespread lack of consistency in the manner in which countries categorize and count fishing health and safety outcomes. Injury, fatality and illness data varied not only between countries but also among individual countries' sub-national components. For example, we note discrepancies in the number of fishing fatalities recorded for Newfoundland by federal and provincial agencies based in Newfoundland over the same time period (see Appendix 1). These differences are likely due to the different mandates and methods of data collection that are employed by relevant agencies, as well as different data treatments. This lack of standardized reporting and uneven data quality is particularly troubling given that commercial fishing is consistently ranked as one of the most dangerous of occupations, and that accurate information on the levels of risk is necessary for assessing and improving the effectiveness of health and safety policies.

In the literature, the most common types of accidents reported are fatalities (Appendix 2). This is likely due to several factors, notably the fact that fatalities generally receive more official inquiry than non-fatal injuries and accidents and fatalities are more easily associated with conditions of work. In many cases, information on non-fatal injuries and illnesses is also available but it seems probable that the reported rates are well below the actual rates, as many accidents, incidents and illnesses go unreported or are not recorded adequately by the proper authorities. Given that, even for fatalities, health and safety reporting systems may vary between countries and that population-at-risk estimates typically do not reflect hours of exposure to various dangers, reported fatality rates should be approached with caution. Furthermore, comparisons of fatality rates should be avoided in cases where the populations at risk have been calculated using different methods, as rates using a workforce estimate in the denominator are generally much lower than rates based on effort (i.e. full-time equivalents). We found several examples in the published literature where comparisons were made without regard for this distinction (Abraham, 2001; Roberts, 2004). In many cases, moreover, reported fatality rates were over 10 years old, limiting their usefulness to the analysis. Given these many data restrictions we were able to make only a superficial comparison of the reported fatality statistics.

Our review of the literature found estimates for fishing fatality rates in a number of countries with significant commercial fisheries, including all six CARR countries (Appendix 2). The rates were obtained from both the secondary literature and government sources. The most recently reported fishing fatality rate per 100,000 workers was 36 for Canada from 1990-2000 (Transport Canada, 2002a), 43 for Alaska from 1991-1998 (Thomas *et. al.*, 2001), 120 for the U.K. from 1976-1995 (Roberts, 2004), 162 for South Africa from 1996-2002 (Campbell, 2003), and 167 for New Zealand from 1985-2000 (MSA, 2002). Fatality estimates based on measures of effort (i.e., number of hours worked) were only available for the U.S. (119 per 100,000 full-time equivalents) and Iceland (89 per 100,000 person-years). A Canada-wide analysis of fishing vessel accidents between 1990 and 2000 found that fatalities and injuries remained fairly constant, and that the majority of deaths and injuries occurred on smaller vessels (< 15 GT) and mid-sized vessels (15-150 GT) respectively (Transport Canada, 2002a). Between 1990-2002, the majority of commercial fishing-related injuries (88%) and fatalities (85%) on Canadian vessels occurred within 15 NM of shore (Transport Canada, 2002b). Similarly, an analysis of accidents within the north-eastern U.S. fishing fleet revealed that accidents are more likely to occur closer to shore (Jin and Thunberg, 2005). Canadian shipping regulations, including those impacting fishing safety, have remained relatively unchanged over the past decades but are currently in a state of regulatory reform. While Canadian fishing fatalities remained relatively constant from 1990 to 2000 (Transport Canada, 2002a), it remains to be seen if the regulatory restructuring will result in an improved safety record.

It is difficult to correlate trends in fishing fatalities with the implementation of specific policies that may directly or indirectly influence fishing health and safety, given the confounding effects of fleet restructuring and modernization, shifts in target species, gear types and fishing locations, fishing economics, and changes in fisheries management policies. Recent implementation of national policies that were explicitly designed to improve OHS have correlated with reduced fatalities in the U.S. (Lincoln and Conway, 1999), New Zealand (MSA, 2002), Iceland (Rafnsson and Gunnarsdottir, 1992), and South Africa (Campbell, 2003). Fatality rates in the U.K. fishery remained fairly constant from 1976 to 1995 (Roberts, 2004) but have declined following the recent implementation of new safety regulations, with particular reference to the Fishing Vessels (EC Directive on Harmonised Safety Regime) Regulations of 1999. While fishing fatalities appear to be decreasing in some countries, there is evidence that non-fatal occupational injuries remain alarmingly high in the U.S. (Dyer, 2000; Thomas *et. al.*, 2001) and the U.K. (Roberts, 2004). This may be due to a lack of regulations specifically designed to improve fishing OHS conditions on deck.

We also attempted, where possible, to investigate any major trends in fishing OHS in relation to the types and changing patterns of fisheries management policies. In particular, our analysis focussed on specific types of fisheries management policies that have been purported in the literature to have either positive or negative outcomes for fishing safety. While individual quota (IQ) systems have been promoted as a means to improve fishing safety levels (NRC, 1999; Sigler and Lunsford, 2001), our review found that the evidence in support of this contention remains unclear. Some fisheries have experienced significant improvements in health and safety following the implementation of IQ programs, including the Nova Scotia offshore fishery (Binkley, 1995), the Alaskan halibut and sablefish fisheries (CDC, 1993; Lincoln and Conway, 1999; Woodley, 2000), and the British Columbia geoduck fishery (Heizer, 2000); others have maintained relatively high accident and fatality rates under the IQ system, such as the surf clam and ocean quahog fisheries of New England (U.S.C.G., 1999; NRC, 1999; Woodley, 2000), and the national fisheries of Iceland (NRC, 1999) and New Zealand (MSA, 2003). Our analysis suggests that the maximum amount of quota that individuals or organizations are permitted to aggregate within an industry may be an important factor influencing safety, as fisheries in the U.S. that restrict quota aggregation (e.g., sablefish and halibut fisheries of Alaska) have documented significant declines in fatality rates and vessel incidents following the implementation of IFQs (Lincoln and Conway, 1999), while fisheries with no defined aggregation limit (e.g., surf clam and ocean quahog fisheries) have had continued problems with major vessel accidents and fishing fatalities (U.S.C.G., 1999). Small operators are often limited to leasing quota from large corporations or non-fishers, or working under contract for vertically integrated businesses. In such examples, the expected safety benefits of IQs (e.g., reduced incentives to rush for fish or operate in poor conditions) may be removed if pressures from quota holders supersede the independent decision-making abilities of vessel owners. This may have safety implications for the fisheries of Atlantic Canada, where owner/operator and fleet separation policies are being undermined by so-called “trust agreements” whereby processors essentially pay for licenses and vessels on behalf of small-scale vessel owners and subsequently exercise some control over their fishing activities (CCPFH, 2005).

COLLABORATIVE EFFORTS

Collaborators have been found in New Zealand, the U.S., Iceland, and South Africa, and they have been sent materials relating to the methods, conceptual framework, and individual case studies of the CARR project. Collaborators have been asked to aid in the development of fuller case studies for their respective countries. This task includes gathering relevant information on regulatory regime components with direct and indirect influences on fishing health and safety, providing information relevant to fishing fatalities and injury rates, and reviewing outputs from the CARR project. In addition, SafetyNet is organizing an international conference in June 2006 in St. John's, Newfoundland and we have organized a session where the results of this comparative analysis of regulatory regimes will be presented. Research collaborators from South Africa, New Zealand, and Alaska are planning to attend this conference and will make presentations at the CARR session on topics related to ongoing fishing health and safety issues in their respective countries.

DISCUSSION

Fishing health and safety is an exceptionally complex problem. Previous studies have promoted the vision of fishing safety as a complicated interaction of many factors (NRC, 1991; ILO, 1999; U.S.C.G., 1999; Dyer, 2000; DFO, 2000). Common themes that emerge from the literature include vessel safety, occupational health and safety, training and awareness, and the dire need for a safety culture among fish harvesters. The consolidation of risks, including those that may indirectly impact fishing, into a single conceptual framework helps to illustrate these complex interactions, and to identify types of regulations that may mitigate such risks.

Regulations and related policy instruments that influence health and safety in the fishing industry find their roots in various parts of government. Thus regulations and policies initiated by administrative agencies that are directly responsible for fishing OHS, as well as those originating from agencies with responsibility for other aspects of the fishery, can both influence OHS. The complex administrative structure associated with most fisheries, in which responsibility is often partitioned between transportation, fisheries management, and labour agencies, tends to foster an environment where agencies and organizations function under mandates that do not include the requirement to evaluate policies based on their impact on fishing OHS. Furthermore, the compartmentalization of administrative responsibility has generally precluded systematic evaluation of fishing regulatory regimes with respect to OHS.

Each group involved in the fishing industry (fish harvesters, legislators, fisheries managers) has a unique perspective, training, and goals that may interact in a complex fashion. Fishers are the main actors, involved directly with day-to-day consequences of work on moving platforms. They must deal with economic pressures and work arrangements, transportation regulations, fisheries management regulations, insurance regulations, and other policies that dictate their behaviour within a constantly changing environment of moveable and uncertain resources, weather, and market conditions. It is important to acknowledge that fishers are not ignorant participants. They have knowledge based on experience, training and culture and represent an important source of information regarding the real impacts of direct and indirect regulations on health and safety. Through interviews with a subsample of participants in the Newfoundland fishery, the POR component of SafeCatch examines among other things how regulatory changes and current policies have affected perceived and real risks in the industry. Regulations have the potential to modify behaviour in many directions – they can improve safety, but can also promote unsafe behaviours. We recommend that policy makers, particularly those that may indirectly influence fishing occupational health and safety, should include safety objectives wherever possible in relevant regulations.

We note the presence of both proactive and reactive types of regulation in all countries examined, with some key differences. Overall, the U.S. regulatory regime stood apart from the other CARR countries for its relative lack of proactive safety policies. Most of the current legislation pertaining to fishing health and safety in the U.K., South Africa, Iceland, and New Zealand has been implemented recently (~10 yrs) and incorporates many provisions from relevant international conventions on marine safety. The main policy instrument dealing with fishing safety in the U.S. was implemented in the early 1990s and lacks many of these international provisions for smaller vessels. In Canada, safety-oriented policies have remained relatively unchanged for several decades, though new and updated policies are expected to be implemented within the next few years following a significant regulatory reform project.

Research that links theory and practice in terms of regulations is particularly important, as a comparative analysis based solely on prescribed laws and regulations without attention to their actual interpretation and implementation would be of limited value. Compliance with regulations is difficult to measure; however, there are indications in the published literature that compliance is generally low and that fishers lack a safety culture. In South Africa, the detention rate for small fishing vessels that are deemed unseaworthy following ad-hoc inspections is 21%, with approximately 50% non-compliance with basic safety tenets (Campbell, 2003). In Newfoundland and Labrador, approximately 75 % of fishing vessels not exceeding 15 GRT inspected for acceptance in the Canadian Coast Guard Auxiliary fail to meet the standards (DFO, 2000). Interviews with fish harvesters in the U.S. reveal a poor safety culture and suggest that compliance with safety regulations may be superficial (Poggie and Pollnac, 1997). The issue of compliance in the Newfoundland fishery is also discussed in the POR component of SafeCatch. **Examination of compliance with safety regulations is critically important to a meaningful analysis of regulatory regimes.**

The actions and behaviours of fish harvesters are largely influenced by fisheries management regulations that set out who can fish, where, when and how they can fish, and the amount of fish they are permitted to take. Given this simple truth, it is surprising that the majority of national and international fisheries policies have traditionally been developed without regard for their potential impacts on health and safety. Fisheries management systems have the potential to affect safety at sea by indirectly encouraging unsafe behaviour or by leading to the reduction of safety features of fishing vessels (FAO, 2001). Regulatory regimes that do not address fleet overcapacity, limited entry, fishing effort, gear selectivity, and biological factors such as minimum sizes, sensitive fishing seasons, and areas closures will likely result in declining fisheries resources, with subsequent impacts on factors affecting fishing safety such as marginal profits per capita and increased competition (Lassen and Van Olst, 1986). Rather, it has been recommended that fisheries managers adopt more flexible policies and reassess policies that have potential impacts to safety such as inflexible opening dates for competitive fisheries (NRC, 1991; Kaplan and Kite-Powell, 2000), limited crew sizes to restrict fishing effort (U.S.C.G., 1999; Kaplan and Kite-Powell, 2000) and vessel replacement restrictions (CCG, 1987; DFO, 2000). To date, there has been no comprehensive and comparative analysis of the impacts of various fisheries management measures on safety outcomes. **This represents a significant research gap with important policy implications.**

Our analysis of published fatality statistics highlights a key problem in fishing safety research. **Our results suggest that fishing fatality, injury and illness data should be interpreted with caution and that a meaningful comparison of international data is not possible at this time.** There is a critical need for a standardized system of identifying, recording and reporting fishing-related occupational injuries and diseases. The variability of fishing accident statistics in terms of availability, study period, methodology, and reliability poses a significant obstacle for the comparison of regulatory regimes. For example, it is unclear why the Alaska fishing industry, characterized by a dangerous environment, few proactive safety policies and relatively limited enforcement of safety regulations, reports a significantly lower fatality rate than countries with tougher safety standards such as New Zealand, Iceland and the U.K. The use of fatality rates is not an ideal method of gauging the safety levels of the fishing industry. Fatality rates may be misleading, especially where numerous fatalities are the result of a few vessel incidents (e.g., the sinking of large vessel). Non-fatal injury, illness and near-miss data are more appropriate for discussion of safety outcomes, as they are more representative of the types of incidents that are common throughout the fishing industry. However, these data are not available in the international published literature and those thar are available are insufficient for comparative purposes. Data linkages initiatives such as the ones carried out as part of the FVSLA component of SafeCatch have the potentially to substantially improve the quality of administrative data available for the study of fishing safety. The Injured Fishers component of SafeCatch reports on common types of injuries to fish harvesters in the Newfoundland and Labrador fishery, as well as the impacts of long-term disability in terms of social consequences and support services.

We point to the need for comprehensive and systematic national case studies based on similar methods and data treatments, similar to the SafeCatch project. Such studies are essential to improve our capacity to do meaningful comparisons not only of regulatory regimes but, in addition, on their relationship to safety and safety outcomes. Of particular import is the collection and synthesis of standardized data (preferably rates) on fishing-related injuries, illnesses, accidents and near-misses, SAR incidents, and claims for social benefits.

Reference List

Abraham, P. P., 2001. International comparison of occupational injuries among commercial fishers of selected northern countries and regions. Barents Newsletter on Occupational Health and Safety 4: 24-28.

Beaudet, N., Brodkin, C. A., Stover, B., Daroowalla, F., Flack, J., and Doherty, D., 2002. Crab allergen exposures aboard five crab-processing vessels. Aiha Journal 63: 605-609.

Ben-Yami, M., 2000. Risks and dangers in small-scale fisheries: An overview. International Labour Organization.

Binkley,M. 1995. Risks, dangers and rewards in the Nova Scotia offshore fishery. McGill-Queen's Press, Montreal.

Branch, G. M. and Clark, B. M., 2006. Fish stocks and their management: The changing face of fisheries in South Africa. Marine Policy 30: 3-17.

Campbell, N. South African Maritime Safety Authority. Safety at Sea for Small Scale Fishers Workshop. 2003. Marine Institute International, Memorial University of Newfoundland. 3-18-2003.

CCG, 1987. A Coast Guard Study in to Fishing Vessel Safety. Coast Guard Working Group on Fishing Vessel Safety.

CCPFH, 2005. Setting a new course: Phase II Human Resources Sector Study for the Fish Harvesting Industry of Canada. Canadian Council of Professional Fish Harvesters.

CDC, 1993. Commercial fishing fatalities: Alaska, 1991-1992. MMWR 42: 350-359.

DFO, 2000. Fishing Vessel Safety Review (less than 65 feet). Maritime Search and Rescue.

Dolan, A. H., Taylor, M., Neis, B., Ommer, R., Eyles, J., Schneider, D., and Montevecchi, B., 2005. Restructuring and health in Canadian coastal communities. EcoHealth 2: 195-208.

Driscoll, T. R., Ansari, G., Harrison, J. E., Frommer, M. S., and Ruck, E. A., 1994. Traumatic Work-Related Fatalities in Commercial Fishermen in Australia. Occupational and Environmental Medicine 51: 612-616.

Dyer, M. G., 2000. Hazard and risk in the New England fishing fleet. Marine Technology and Sname News 37: 30-49.

Eklof, M. and Torner, M., 2002. Perception and control of occupational injury risks in fishery - a pilot study. Work and Stress 16: 58-69.

FAO, 2001. Safety at Sea as an integral part of Fisheries Management. No. FAO Fisheries Circular No 966.

Friis, D. A. Redesigning fishing vessels for today's changing fishery. Speaking of Engineering lecture series, Memorial University of Newfoundland . 2006.

Hasselback, P. and Neutel, C. I., 1990. Risk for commercial fishing deaths in Canadian Atlantic provinces. British Journal of Industrial Medicine 47: 498-501.

Health Canada, 1999. Intersectoral action…towards population health. Report of the Federal/Provincial/Territorial Advisory Committee on Population Health. Health Canada.

Heizer, S., 2000. The commercial geoduck (Panopea abrupta) fishery in British Columbia, Canada – An operational perspective of a limited entry fishery with individual quotas. Journal of Shellfish Research 19: 621.

Hopper, A. G. and Dean, A. J., 1992. Safety in fishing - learning from experience. Safety Science 15: 249-271.

Howlett,M. and Ramesh,M. 1995. Studying public policy: policy cycles and policy subsystems. Oxford University Press, Toronto.

ILO, 1999. Safety and Health in the Fishing Industry. Report for discussion at the Tripartite Meeting on Safety and Health in the Fishing Industry.

ILO, 2003. Conditions of work in the fishing sector: a comprehensive standard (a Convention supplemented by a recommendation) on work in the fishing sector. International Labour Office.

Jaremin, B. and Kotulak, E., 2004. Mortality in the Polish small-scale fishing industry. Occupational Medicine-Oxford 54: 258-260.

Jaremin, B., Kotulak, E., Starnawaska, M., Mrozinski, W., and Wojciechowski, E., 1997. Death at sea: certain factors responsible for occupational hazards in Polish seamen and deep-sea fishermen. International Journal for Occupational Medicine and Environmental Health 10: 405-416.

Jensen, O. C., 1996. Work related injuries in Danish fishermen. Occupational Medicine-Oxford 46: 414-420.

Jensen, O. C., 2000. Non-fatal occupational fall and slip injuries among commercial fishermen analyzed by use of the NOMESCO injury registration system. American Journal of Industrial Medicine 37: 637-644.

Jin, D., Kite-Powell, H., and Talley, W., 2001. The safety of commercial fishing: Determinants of vessel total losses and injuries. Journal of Safety Research 32: 209-228.

Jin, D. and Thunberg, E., 2005. An analysis of fishing vessel accidents in fishing areas off the northeastern United States. Safety Science 43: 523-540.

Kaplan, I. M. and Kite-Powell, H. L., 2000. Safety at sea and fisheries management: fishermen's attitudes and the need for co-management. Marine Policy 24: 493-497.

Kite-Powell, H. and Jin, D. Commercial fishing vessel safety and fisheries management. Proceedings of the Marine Safety Council (U.S.) 58, 14-15. 2001.

Lassen, T. J. and Van Olst, K., 1986. Study on the use of fishery management regulations and techniques to improve the safety of commercial fishing operations. National Council of Fishing Vessel Safety and Insurance, 92 pp.

Lawrie, T., Matheson, C., Murphy, E., Ritchie, L., and Bond, C., 2003. Medical emergencies at sea and injuries among Scottish fishermen. Occupational Medicine-Oxford 53: 159-164.

Lincoln, J., Husberg, B., and Conway, G., 2001. Improving safety in the Alaskan commercial fishing industry. International Journal of Circumpolar Health 60: 705-713.

Lincoln, J. M. and Conway, G. A., 1999. Preventing commercial fishing deaths in Alaska. Occupational and Environmental Medicine 56: 691-695.

Marshall, S. W., Kucera, K., Loomis, D., McDonald, M. A., and Lipscomb, H. J., 2004. Work related injuries in small scale commercial fishing. Injury Prevention 10: 217-221.

Matheson, C., Morrison, S., Murphy, E., Lawrie, T., Ritchie, L., and Bond, C., 2001. The health of fishermen in the catching sector of the fishing industry: a gap analysis. Occupational Medicine 51: 305-311.

MSA, 2002. Fatal accidents in the New Zealand fishing industry, 1985-2000. Final Report. Maritime Safety Authority, Ministry of Transport.

MSA, 2003. Fishing Industry Safety and Health Advisory Group Final Report. Maritime Safety Authority, Ministry of Transport.

Murray, M., Fitzpatrick, D., and O'Connell, C., 1997. Fishermen's blues: factors related to accidents and safety among Newfoundland fishermen. Work and Stress 11: 292-297.

Nielsen, J. R. and Hara, M., 2006. Transformation of South African industrial fisheries. Marine Policy 30: 43-50.

NIOSH, 1997. Current intelligence bulletin #58, commercial fishing fatalities in Alaska, risk factors and prevention strategies. DHHS (NIOSH) No. 97-163.

Norrish, A. E. and Cryer, P. C., 1990. Work Related Injury in New-Zealand Commercial Fishermen. British Journal of Industrial Medicine 47: 726-732.

NRC, 1991. Fishing vessel safety: blueprint for a national program. Committee on Fishing Vessel Safety.

NRC 1999. Sharing the fish: toward a national policy on individual fishing quotas. National Academy Press, Washington.

Pelot, R., 2000. Newfoundland Fishing Incidents: Perspective and Analysis. Dalhousie University.

Poggie, J. and Pollnac, R., 1997. Safety training and oceanic fishing. Marine Fisheries Review 59: 25-28.

Poggie, J., Pollnac, R., and Jones, S., 1995. Perceptions of Vessel Safety Regulations - A Southern New-England Fishery. Marine Policy 19: 411-418.

Pollnac, R. B., Poggie, J. J., and Cabral, S. L., 1998. Thresholds of danger: perceived risk in a New England fishery. Human Organization 57: 53-59.

Pollnac, R. B., Poggie, J. J., and Vandusen, C., 1995. Cultural-Adaptation to Danger and the Safety of Commercial Oceanic Fishermen. Human Organization 54: 153-159.

Rafnsson, V. and Gunnarsdottir, H., 1992. Fatal Accidents Among Icelandic Seamen - 1966-86. British Journal of Industrial Medicine 49: 694-699.

Roberts, S. E., 2004. Occupational mortality in British commercial fishing, 1976-95. Occupational and Environmental Medicine 61: 16-23.

Schnitzer, P. G., Landen, D. D., and Russell, J. C., 1993. Occupational injury deaths in Alaska's fishing industry, 1980 through 1988. American Journal of Public Health 83: 685-688.

Sigler, M. F. and Lunsford, C. R., 2001. Effects of individual quotas on catching efficiency and spawning potential in the Alaska sablefish fishery. Canadian Journal of Fisheries and Aquatic Sciences 58: 1300-1312.

Thomas, T. K., Lincoln, J. M., Husberg, B. J., and Conway, G. A., 2001. Is it safe on deck? Fatal and non-fatal workplace injuries among Alaskan commercial fishermen. American Journal of Industrial Medicine 40: 693-702.

Torner, M., Karlsson, R., Saethre, H., and Kadefors, R., 1995. Analysis of serious occupational accidents in Swedish fishery. Safety Science 21: 93-111.

Transport Canada, 2002a. Analysis of Canadian Fishing Vessel Accidents 1990 to 2000. Report prepared for Transport Canada - Marine Safety by MIL Systems No. MIL Project 2127/01.

Transport Canada, 2002b. Risk assessment study: Group 3 small fishing vessels. Report prepared for Transport Canada by GeoInfo Solutions Ltd.

U.S.C.G., 1999. Dying to Fish, Living to Fish. Report of the Fishing Vessel Casualty Task Force. Department of Transportation.

Van Noy, M., 1995. Toward a systematic approach to safety in the commercial fishing industry. Journal of Safety Research 26: 19-29.

Wang, J., Pillay, A., Kwon, Y. S., Wall, A. D., and Loughran, C. G., 2005. An analysis of fishing vessel accidents. Accident Analysis and Prevention 37: 1019-1024.

Woodley, C. Quota-based fishery management regimes. Proceedings of the International Fishing Industry Safety and Health Conference DHHS/NIOSH Publication No. 2003-102. 10-23-2000.

APPENDIX 1

Comparison of fishing-related fatality statistics for Newfoundland from four sources.

Year	WHSCC (FVSLA Database)[1]	WHSCC Fishing Industry Fact Sheet[2]	Coast Guard SAR[3]	TSB Marine[4]
1989	9			16
1990	13			6
1991	4			3
1992	5			3
1993	3		10	4
1994	10		9	7
1995	4		3	3
1996	4		3	2
1997	2		7	4
1998	7		4	2
1999	1	1	0	1
2000	10	10	10	7
2001	4	3		4
2002		4		4
2003		1		0
2004				2

[1]Email from Maureen Keough (Dalhousie) to B. Neis, April 28/2005
[2]Injury statistics from WHSCC Industry Fact Sheets "Fish Harvesting Industry" (http://www.whscc.nf.ca/pubs/industry.htm)
[3]DFO. 2000. Fishing Vessel Safety Review (less than 65 feet). Canadian Coast Guard, Maritime Search and Rescue, Newfoundland Region.
[4]Email from Melissa Donovan, Project Officer, TSB, June 2/2005

APPENDIX 2

International comparison of commercial fishing-related fatality statistics. Fatality rates (per 100,000 fishermen/year) are reported where available.

Country	Scope	Authors	Year Published	Study Period	Fatalities	Population at risk	Fatality rate/yr
Australia	National	Driscoll *et al.*	1994	1982-1984	47	32867	**143**
Canada	Newfoundland	Neis	1990	1975-1988	30	14579 (Trawlers)	**206**
	Newfoundland	DFO	1999	1993-2000	46	N/A	**N/A**
	Newfoundland	WHSCC	2001	1989-2001	76	N/A	**N/A**
	Newfoundland	MIL Report	2002	1990-2000	59	N/A	**N/A**
	Maritimes	Hasselback and Neutel	1990	1975-1983	84	183378	**46**
	National	MIL Report	2002	1990-2000	287	788425	**36**
Iceland	National	Rafnsson and Gunnarsdottir	1992	1966-1986	132	147649	**89**
New Zealand	National	Norrish and Cryer	1990	1975-1984	79	30385	**260**
	National	Feyer *et al.*	2001	1985-1994	58	N/A	**226**
	National	MSA	2002	1985-2000	105	63040	**167**
Norway	National	Thomas *et al.*	2001	1961-1975			**150**
Poland	Baltic Sea	Jaremin *et al.*	1997	1975-1984	33	48113	**69**
	Deep Sea	Jaremin *et al.*	1997	1975-1984	11	64044	**17**
	Small-scale fishing industry (<24 m)	Jaremin and Kotulak	2004	1960-1999	177	198920	**89**
South Africa	National	Campbell	2003	1996-2002	198	122180	**162**
Sweden	National	Torner *et al.*	1995	1975-1986			**110**
UK	National	Reilly	1985	1961-1980	711	420710	**169**
	National	Hopper and Dean	1989	1971-1980			**170**
	National	Roberts	2004	1976-1995	527	440355	**120**
	National	Matheson *et al.*	2001	1994-1998	120	N/A	**N/A**
US	National	NIOSH	1994	1982-1987	648	1378723	**47**
	National	U.S.C.G.	1999	1994-1998	396	N/A	**N/A**
	National	U.S.C.G.	2004	1994-2000	466	N/A	**N/A**
	Alaska	Knapp and Ronan	1990	1981-1984	103	32227	**320**
	Alaska	Thomas *et al.*	2001	1991-1998	167	392000	**43**
*	Alaska	Schnitzer *et al.*	1993	1980-1988	278	67052	**415**
*	Alaska	CDC	1993	1991-1992	70	34800	**201**
*	Alaska	Lincoln and Conway	1999	1991-1998	162	139200	**116**
*	Alaska	Lincoln and Conway	2001	1990-1999	217	175000	**124**
*	Alaska	Thomas *et al.*	2001	1991-1998	167	140000	**119**

*Indicates fatality rates are based on units of effort (hours of work) and not on workforce estimates

Fishing Vessel Safety Longitudinal Analysis:

1989-2001

FINAL REPORT for NIF

By

Marian Binkley, Dean, Faculty of Arts and Social Science, Dalhousie University, Barbara Neis and Stephen Bornstein, SafetyNet, Pablo Navarro

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Introduction

Research to date has shown that work-related accidents are a major source of disability and death for fish harvesters. The general objectives of the Fishing Vessel Safety Longitudinal Analysis (FVSLA) component of SafeCatch are to develop a new, longitudinal, linked database linking claims data from the Newfoundland and Labrador Workplace Health Safety and Compensation Commission (NL WHSCC) with Department of Fisheries and Oceans (DFO) inter-departmental datasets for catch and effort and Search and Rescue (SAR) SISAR data in order to better identify trends in occupational injuries, fatalities and SAR incidents among fish harvesters from 1989 to 2001 and to explore some of the factors responsible for these trends. The period between 1989 and 2001 was characterized by substantial change in the industry that included restructuring of the fleet, changes in the volume and location of fishing activity, changes in targeted species, and in fisheries management initiatives. This period was also associated with the introduction of a professionalization program for fish harvesters that included requirements for safety training. Starting in the mid-1990s, for vessels less than 65 feet, fish harvester injuries and fatalities increased, as did Search and Rescue (SAR) incidents (Pelot 2000; Wiseman and Burge 2000) but without effective attribution or significant correlation to any known factors.

Linked datasets can potentially deepen our understanding of fishing occupational health and safety issues. Pelot (2000) linked SAR incidents data with Fisheries and Oceans inter-departmental datasets for catch and effort, but the latter datasets from Fisheries and Oceans were not linked with the database on injury claims at the NL WHSCC. The primary research tool for FVSLA is a new, linked database that has been designed, negotiated and established for the purposes of this research.

To date, it has taken approximately two years to design, obtain permissions, and to develop this new research tool and another 18 months to clean and link the datasets. During the design phase, the FVSLA research team consulted with representatives from the DFO Statistics and Licensing Offices; NL WHSCC; fish harvester organizations; and third-party research groups and individuals. After consultation, it was agreed that the most appropriate available data structure for the FVSLA would be a cross-institutional, anonymous data linkage at the level of individual injury or fatality created by a neutral third party (the Newfoundland and Labrador Centre for Health Information) and anonymized prior to release to the research team. This kind of linked data structure would permit the development of analyses and analytical models that could substantially extend findings available from separate manipulation of these datasets.

The principal sources of information for the FVSLA are a set of electronic and paper databases administered by various partners in the Fishing Vessel Safety project. The databases currently involved in this study include:

- The NL WHSCC Claims Database for the Newfoundland and Labrador Fishing Industry which combines the Administrative Claims Database and Employers Database from 1989 to 2001 inclusive;
- The SAR SIRSAR Database for resources tasked to fishing vessels in Newfoundland and Labrador waters from 1994 to 2001 inclusive; and,
- DFO Catch and Effort Database which combines the Trip Logs and Purchase Slip Databases for fishing vessels sailing from Newfoundland and Labrador from 1989 to 2001 inclusive.

Other databases, such as weather data from Environment Canada for the area and period under study and data from the DFO licensing database could be added in the future.

Development of a data linkage process acceptable to all parties and to university ethics committees required an extensive consultation process. The result of this consultation process was the NL WHSCC Data Sharing Agreement 2004. This agreement sets out the terms and conditions between NL WHSCC and SafetyNet, the Newfoundland and Labrador Centre for Health Information (NLCHI), Memorial University of Newfoundland (MUN) and Dalhousie University for data sharing within the research project including privacy protection. The Interdisciplinary Committee on Ethics in Human Research at Memorial University and the Health Sciences Human Research Ethics Board at Dalhousie University gave ethical approval for this project.

Several ethical considerations emerged during the consultations and were addressed in the Data Sharing Agreement and in our applications to ethics committees. To protect individual privacy and to maintain anonymity and confidentiality throughout the process, the NLCHI[1] played the role of trusted third party. In this role, staff at the NLCHI received the original databases from the suppliers containing the limited personal identification information necessary to carry out the linkage. These staff formatted the datasets into Microsoft Access, carried out some preliminary data cleaning, devised a method for linking the databases through the introduction of new variables, prepared the datasets for linkage, and then removed or encrypted any personal data or unique identifiers so that confidentiality and anonymity were assured while still maintaining the integrity of the database. The three databases in their anonymized form were encrypted and then transferred to Dalhousie University's Office of Research. When the Dalhousie University's Office of Research received evidence of ethics clearance and once the teams' research office had been set up in compliance with the Data Sharing Agreement,

[1] "Established by the Newfoundland and Labrador provincial government in 1996, the NLCHI is the only organization in the province that has the resources, mandate and authority to act as a Trusted Third Party. It is a non-profit, partially publicly funded centre that is responsible for designing and implementing the provincial Health Information Network. For further information on the NLCHI, please consult their website at http://www.nlchi.nf.ca/.

the Office of Research released the data to the data steward, Dr. Marian Binkley, in January 2005. The encrypted files were then decoded and transferred to SPSS format (the statistical package used for data analysis) for further cleaning, recoding and analysis.

Throughout the analysis and preparation of the data we are attempting to assure the highest level of confidentiality. To prevent the possibility of residual identification of an individual, any reported results with less than five claims are masked and indicated by the symbol "<5". Throughout this report, the privacy of employers has been protected in a similar manner. In order to avoid identifying the employers, pertinent information was encrypted or removed by all three agencies prior to the transfer of data, and reported results with less than five employers were also indicated by the symbol "<5".

Preparing the Databases for Linkage

Linking databases creates interesting challenges. One of these challenges is that each database uses a different unit of analysis. The unit of analysis for the NL WHSCC database is the claim. An incident generates one or more claims depending on the number of individuals involved. Moreover, one individual may, through the course of the study, be involved in more than one incident, and thus may be associated with more than one claim. The unit of analysis for the SAR database is "resource tasked". This means that a new line of information is generated whenever the Coast Guard uses a resource. But an individual incident may only require one resource, or it may require five or six and it may or may not result in claims to NL WHSCC. In the case of the DFO database, the unit of analysis is the trip or voyage. Each time the vessel leaves port on a fishing trip it generates a line of information whether they actually fish or not. Thus an incident on a fishing trip may result in one or more individuals submitting claims to NL WHSCC (or no one submitting claims), and/or in SAR tasking one or more resources. One of this project's aims is to create a database that reflects this interaction.

Another interesting challenge was that the NLCHI staff who prepared the databases for linkage had never actually linked or used the linked database for analysis. However, their work was crucial to the development and conduct of an ethical procedure for sharing information across agencies in a form that protects anonymity and confidentiality, and to the creation of the database. Subsequent analysis depends on their expertise in its preparation. Thus it is important to understand how they went about this process. The DFO catch and effort database formed the core database for the linkage. The data linkage for the FVSLA consisted of matching SAR SISAR incidents (which may have contained more than one record), or NL WHSCC claims, to individual fishing trips that were recorded in the DFO Catch and Effort database (which also may have contained more than one record per fishing trip).

NLCHI staff created the following fields and then used them to link the DFO database with the SAR and NL WHSCC databases: CFV (Fishing Vessel Number, Side Number, Vessel Code) which identifies the fishing vessel with a registration number; FV NAME (Fishing Vessel Name, Vessel Description) a secondary identifier for fishing vessels which may be useful for linkages with the SAR and NL WHSCC data where CFV are missing; FIN (Fisher Identification Number) which identifies a holder of a fishing license with a unique identifier; and FH NAME (Fisher Name, Fish Harvester Name) which identifies a holder of a fishing license by name. NLCHI staff also created a new field in the Catch and Effort database, LOG TRIP, which represented one unique fishing trip and was defined as all of the Catch and Effort records associated to a unique fishing vessel within the time that the vessel left its homeport and the time that the vessel returned to its port of landing.

In order for NLCHI staff to link a SAR SISAR incident or NL WHSCC claim to a fishing trip, the following criteria had to be met:
1) A match on the fishing vessel identifiers in both databases (DFO Catch and Effort and the SAR SISAR or NL WHSCC claims databases), determined by the CFV and/or FV NAME, or;
2) A match on the fish harvester identifier in both databases (DFO Catch and Effort and the SAR SISAR or NL WHSCC claims databases), determined by the FIN number, and;
3) The SAR SISAR incident or NL WHSCC claim had to occur within the time of a fishing trip, the range for which was determined by the date sailed (the date that the fishing vessel left its homeport) and the date landed (the date that the fishing vessel returned to land and sold its catch). Then the NLCHI staff created the LOG TRIP variable for both the SAR SISAR and the NL WHSCC claims databases.

Where the above criteria were satisfied, the data for the LOG TRIP field in the SAR SISAR and NL WHSCC databases were matched to the LOG TRIP data in the DFO Catch and Effort database. Therefore, the SAR SISAR and NL WHSCC claims databases each have a field that will link, where the criteria were met, the incidents or claims to an individual fishing trip.

Using SPSS, the NLCHI staff created a working standard index that combined fishing vessel identifiers (i.e., name, CFV#, side number, and license number) from the licensing database with raw data in the ZIF files. The index was used to fill in missing information in the DFO data, and to fill in missing information or to correct inaccurate information in the SAR and NL WHSCC databases. The NLCHI team also used this index to fill in missing data on vessel descriptors, namely tonnage, length and brake horsepower[2]. NLCHI generated a similar index to the vessel identifier index for fish harvesters based on the FIN (i.e., fisher identification number) and other fish harvester descriptor variables. They used this index to fill in missing data and then encrypted it to assist with the linkage between the DFO ZIF database and the NL WHSCC claims database. The NLCHI team found the programming for this index problematic and requested assistance from a DFO statistician, as well as a NLCHI database manager on site.

[2] The Licensing database also includes other descriptors, including breath and hull type, but since these variables are not included in the ZIF file, they cannot be included in the final linked database because of the Data Sharing Agreement.

In order to link individual incidents in the SAR SISAR database to fishing activity, as represented by records in the DFO Catch and Effort database, the NLCHI team required the following types of information:

1) Temporal information related to the date of the incident. There are several temporal fields in the SAR SISAR database, relating to various aspects of the search and rescue operation, including date and time of alert, length of rescue operation and reaction time. The main field used for linkage was INCIDENT OCCURRED (UTC). This field recorded the estimated date and time of the incident, where time was recorded in Universal Time Code (UTC), also known as Zulu Time or Greenwich Mean Time.

2) Vessel identifier fields. As with the temporal fields, there are several fields that serve to identify the vessels involved in the SAR incident. The fields of interest were those shared by the DFO Catch and Effort database, in particular the CFV (certified fishing vessel) number and the FISHING VESSEL NAME. There are additional fields in the database, including CALL SIGN, LICENSE NUMBER, and LLOYD'S NUMBER.

NLCHI staff developed a measure of linkage integrity to distinguish the quality of the linkages since there were records in the NL WHSCC and SAR database, which did not have unique identifiers that could be used in a confirmed one-to-one linkage. The working scale has three levels:

1) Level 1: A record specific one-to-one linkage, based on matching at least one unique identifier, date and at least one other variable, e.g. region.

2) Level 2: A record specific one-to-one linkage, based on matching two non-unique identifier variables, one each for vessel and fish harvester, date, region, and at least one other variable, e.g. buyer.

3) Level 3: A record specific one-to-one linkage, based on matching one unique identifier variable, date, region, and at least two other variables.

Once the NLCHI staff had prepared the databases for linkage, they removed or encrypted all the identifying information from the database before releasing the datasets to the data steward. Thus no new linkages can be made based on the data available.

Linking the Dataset

Once all the databases had been cleaned and prepared for linkage, we developed, using SPSS, a "subfile" structure for each individual database that maintained the integrity of the original dataset yet allowed the merger of linked files for all or some variables in those files. Thus each database had two subfiles – "linked" and "unlinked" files. This structure allowed us to compare linked and unlinked files within a given database as well as to examine the connection between databases. Because the SAR database only recorded cases from 1994 onwards, each of the other databases had their files also divided into two subfiles – "before 1994" and "1994 and after." This allowed us to link files for the whole time period when we were examining connections between the NL WHSCC and DFO databases, but limit the number of cases involved when examining connections among all three databases, or the SAR database with variables either in the SAR or DFO databases. In the case of the SAR database a subfile based on the "status" variable separated out the "legitimate" fishing vessel files from other cases (e.g., pleasure boats). Efficiency was also improved by limiting the number of variables (e.g., through SPSS "keep" command) in each database for particular runs.

Development of the FVSLA Linked Database

Once the individual databases arrived at Dalhousie University they had to be cleaned and modified before they could be linked and used for analysis. Much of the data arrived in string format, or in the form of non-numerical variables. String variables were converted to numerical format that significantly increased the possibilities for statistical analysis.

Dates had been entered into the databases using different formats and in some cases different formats were used in the same databases. It is imperative that the format for dates be consistent and that the format be readable by SPSS, accordingly we have chosen the format "yyyy-mm-dd." Variables denoting the date of some events in the format "dd-mmm-yyyy" were recoded to create three new variables expressing the year, month, and day – as stand-alone data - of the same event. From these three new variables we reconstructed a new variable in "yyyy-mm-dd" sequence. For some DFO variables, such as *date landed* and *date caught*, the process was more complex because they were formatted "yyyy-mmm-dd" with the month indicated with three letters. Again we created three new variables expressing the year, month, and day – as stand-alone data of the same event. We then converted the month variable from alphabetic to numeric and reconstructed a new variable in the preferred format.

The NL WHSCC database, which comprised 5260 viable cases, is the core database of the analysis to date carried out through the FVSLA. Data fields include demographic parameters, occupational code, nature of injury, source of injury, type of accident, part of body injured, compensation granted and time lost, and employer's characteristics. In order to maintain confidentiality -- for both claimant and employer -- we recoded a number of variables. The stochastic variation in the numbers of births per year meant we had to use cohort analysis -- five-year, ten-year, and twenty-year cohorts -- to maintain confidentiality. We also recoded the region variable into larger units.

Our main concern about data quality in the NL WHSCC database relates to changes to the coding system for variables over the study period. The NL WHSCC claims database contains four fields that describe the occupational injury or fatality. In 1997, there was a major shift in the coding protocol: some older codes were removed and some newer ones were introduced. A related issue arose from the high degree of specificity of some of the codes that give detail to individual cases but make aggregation and generalisation of results difficult. We addressed these problems by following the re-categorisation process outlined in Navarro and colleagues (2004) for similar NL WHSCC data on forestry workers:

> The objectives of the re-categorization are to group the codes into categories that are meaningful and may be reasonably expected to apply evenly over the study period. The coding standard for occupational injury and fatality claims is

developed by the Canadian Standards Association and is referred to as CSA Z795. The Association of Worker Compensation Boards of Canada assists in updating the coding system on a yearly basis and promotes its usage in Canada.

The coding system is hierarchical, with a small number of upper level categories that are differentiated by three sub-levels. This taxonomy works the same way as that used in biology. The system allows, to a limited degree, for more detailed, lower-level codes to be grouped together without reviewing the occupational injury or fatality report. Also, the higher levels have remained largely unchanged during the study period.

The re-categorization process grouped individual fourth sub-level codes into a higher level code grouping. The initial step was to re-code all of the original codes to the first/highest level. These categories were then sub-divided on an ad hoc basis with the objective of obtaining approximately 10 codes that had a high degree of descriptive validity. The process of defining categories relied on feedback from the entire research team (Clothier & Laflamme 1985) (c.f., Navarro, Neis, MacDonald, and Lawson, 2004).The re-coding of the four variables – “Nature of Injury”, “Source of Injury”, “Type of Accident” and “Part of Body” -- followed the format described in this earlier study.

For the NL WHSCC database, sectors of the fishing industry derived from the Newfoundland Industry Codes, where “0310 Fishing (per $100 of fish purchased)” indicated the “Offshore Fishery,” “0311 Salt Water Fishing Industry” indicate the “Inshore Fishery,” and “8171 Factory Freezer Trawler” indicate the “Factory Freezer Trawler Fishery.” Occupational classification within the fishery was recoded. All cases were placed into one of three sectors: fishing, service including support and shore crew, and processing. The fishing sector was also recoded into inshore, offshore and trawler (factory freezer trawler) sectors. The latter were broken down by categories of officers, crew, and engineers. In 51 cases NL WHSCC miscoded marine engineers as “engineers and architects.” Sub-groups based on the claimant’s occupational classification were employed where applicable. In order to preserve confidentiality, when numbers of claimants of specific occupational groups were less than five claimants they were either collapsed into another related category or the results were indicated by the symbol “<5”.

The DFO Catch and Effort Database describes fishing activity from 1989 to 2001 (inclusive) and links two individual databases. The “catch” database describes the landings made by fish harvesters and collected by dockside monitors. The dockside-monitoring program now applies to all fisheries; however, since the government phased the program in during the 1990’s, coverage was not uniform for all fisheries over the study period. The “effort” database describes fishing activity at the level of individual fishing vessels and is derived from information in captain’s logs. All vessels that are 35 feet or longer in length must maintain log books as do some special fisheries for which DFO wants data on effort. For the vessels under 35 feet in length, effort is estimated from catch information. The database comprised 3,799,106 cases based on individual fishing trips. Data fields include homeport, NAFO areas and divisions, gear, port of landing and species (caught, sought and landed), buyer, as well as variables describing

Comment [b1]: Or 1990s?

the fishing effort, including days at sea, days on ground, days fished, hours fished, date caught, latitude and longitude.

> The Catch and Effort Database underwent a major revision in 1997. DFO had been reviewing the data from the earlier years in an effort to increase the data quality. Starting with the 1998 fishing season, the database was maintained using Oracle (relational database) software and new data fields were added, which greatly increase the data quality. The Catch and Effort Database, made available to the project in Zonal Interchange File (ZIF) format, presents the data in a flat file format or as one big table. Since the original databases were programmed as relational databases with multiple tables nested in a hierarchical structure, the ZIF format had a relatively high degree of redundancy built into it.

The catch and effort data have four levels which model fishing activity during the fishing trip: Log Trip, Log Day, Log Set and Log Catch. An individual fishing trip consists of a fishing vessel leaving its homeport, going to sea, trying to catch fish and if successful, actually catching fish, and finally returning to the port of landing where a dockside monitor records the catch. The Log Catch is a captain’s logbook entry for a catch, and is the most basic level of catch and effort data. The next level up is the Log Set level. Depending on the type of fishing taking place, a fishing vessel may have one or more catches for each set. For example, a trawler might have an individual Log Set that lasts half of the working day, during which time the vessel may haul in its nets several times (each time being one Log Catch). The next level, the Log Day, describes a working day at sea for the fishing vessel. When fishing there may be one or more Log Sets for any given Log Day, but the fishing vessel may be at sea for days when it is not fishing at all, for example if the fishing grounds take several days to reach. The highest level, the Log Trip, incorporates all activity from the time a fishing vessel leaves its homeport to the time it brings in its catch at a port of landing.

Since the ZIF file is a flat file, each row represents one Log Catch entry. In some cases, the entry is a dummy entry since no Log Catch information is actually recorded. The same may be true for the Log Set and Log Day levels. However, where complete data have been collected and entered into the database, each row represents one Log Catch datum. This means that Log Set, Log Day and Log Trip data are repeated within each subsequent level, as illustrated below:

Log Trip	Log Day	Log Set	Log Catch
A	Monday	1	15 kg
A	Monday	1	2 kg
A	Monday	2	0 kg
A	Monday	2	14 kg
A	Tuesday	1	6 kg
A	Tuesday	1	8 kg
A	Friday	1	2 kg
A	Friday	2	17 kg
A	Friday	2	18 kg

A	Friday	3	10 kg

In this example, the above table represents one Log Trip for a vessel. The thick black lines delineate the Log Day and the double lines delineate the Log Set. The example highlights how the data are structured in the ZIF format. Within the Catch and Effort Database, several fields may be used to differentiate individual Log Sets, Log Days and Log Trips.

For some variables in the DFO database, both variable names and value labels had to be added. We relied on the publications DFO Value Codes and Pelot, R., M.Buckrell, H.J. Zhu, C. Hilliard (2000) as well as personal contacts with DFO staff, and Ron Pelot and his research assistants to help us sort out the correct labels for the variables.

The SAR database comprises of 10,498 records of resources tasked representing 2571 incidents encompassing the years 1994-2001. Each record represented a tasked resource associated with a specific incident, thus one or more records may represent an individual incident. Records belonging to the same incident have been grouped and given the same incident number in a separate field. Only records related to fishing vessel incidents were to be included in the dataset: records without enough information to determine that the incident was related to a fishing vessel from Newfoundland and Labrador were excluded as were incidents related only to pleasure boats or international vessels. A new variable, STATUS, was created to label the records as eligible or not for linkage. Only records deemed eligible were further cleaned and prepared for the data linkage by NLCHI staff.

For most variables in the SAR database both variable names and value labels had to be added. We relied on the Canadian Coast Guard, Search and Rescue SAR V.8.0 User Guide, SAR Value Codes and Pelot, R., M.Buckrell, H.J. Zhu, C. Hilliard (2000) Maritime Activity and Risk Investigation Network, Newfoundland Incidents: Data Cleaning Process as well as personal contacts with SAR staff and Ron Pelot and his research assistants to help us sort out the correct labels for the variables.

Findings to Date

The FVSLA linked database will provide many opportunities for analysis over the next several years. Our group started by examining WHSCC data for trends over time in the incidence of reported accidents and fatalities, the nature of accident, the body part injured, severity of injures, and seasonality. To date, we have completed a descriptive summary of the NL WHSCC data for trends over time in incidence of reported accidents and fatalities, nature of accident, body part injured, source of injury, severity of injury, and time lost.

Some of our preliminary findings are:
After 1992 the number of NL WHSCC claims declined dramatically, reached its low point in 1995, and gradually increased before starting to level off in 2000 and 2001 (See

Figure 1.) The early decline in the number of claims is probably partly due to the decline in the workforce wrought by the imposition of the Groundfish Moratoria in 1992/3 and to related reductions in hours of exposure for individual harvesters during the early years of the moratoria. But over the same period the make-up of the fishing fleet changed dramatically as well and was reflected in a change in the proportions of claims from the various sectors, notably the decline in the offshore fishery, and the relative and absolute growth in the inshore. About 3436 or sixty-five percent of the 5260 claims reported to WHSCC over the study period occurred in the inshore fishery, 1660 or 32 percent in the offshore fishery, and 164 or 3 percent on factory freezer trawlers. It is apparent from this distribution that the increase in the number of claims from 1995 to 2001 came predominantly from the inshore fishing sector (see Figure 2).

With respect to age of the overwhelmingly male claimants, at the time of filing a claim, the mean and the median birth years were 1955, and the mode was 1953 with the range of birth years from 1922 to 1996 (See Figure 3.) The age distribution for all claimants approximates a normal distribution; however, inshore claimants were younger. We do not know if the age distribution of claimants is representative of the total population of fishers.

In terms of occupation within the fishery, about 97 percent of all claims were made by fishers, 2 percent were by processing workers including those on factory freezer trawlers, and 1 percent came from employees servicing the industry.

Of the 5260 claims, 49 claims were report only, 1676 claimants received medical aid only, 3159 claimants received compensation for lost time, and 76 claims represented fatalities. The average number of "lost time in weeks" for claimants was 21.9 weeks; the average "lost time in dollars" was $8,106.68; and the average "Medical aid" payment was $2,942.62. However, the high standard deviations for these variables indicate that there is a great deal of variability in the claim amounts for "lost time,"(ranged from an hour to 288.7 weeks), "lost time dollars" (ranged from $13.49 to $98,212.6) and "medical aid" (ranged from $9.40- $96,631).

Tables 1 through 4 summarize all the claims during the study period in terms of Nature of Injury, Source of Injury, Type of Accident, and Part of Body respectively for all claimants and by fishery sector. These tables provide basic descriptions of the accidents involved in the claims and an indication of the most common characteristics of the accidents for fishers. Tables 5 through 8 describe the cross-tabulations for Nature of Injury, Source of Injury, Type of Accident, and Part of Body by year for all fishers. These tables provide a temporal map for the accident descriptors during the thirteen-year study period.

Accidents and resulting injuries can be assigned into three general groupings: contact with equipment, slips and falls, and overexertion. Accidents involving contact with equipment result in injuries, including deep to surface wounds, bruises, and traumatic injuries to bones, nerves and spinal column, to the upper and lower extremities, head and neck. Slips and falls on hard surfaces result in traumatic injuries to joints, muscles and other soft tissues, primarily of the back and lower limbs, while falling overboard can result in drowning. Over time, transportation accidents have increased while slips and falls on vessels have declined. Overexertion can result in a wide range of injuries ranging from traumatic injuries to joints, muscles and soft tissue to heart attacks. These injuries have increased in relative terms over the research period. All of these types of accidents can occur across sectors; however claims for drownings came only from the inshore fishery. Claims for accidents associated with contact with equipment have increased relative to the total number of accidents. With the decline of the offshore sector, accidents associated with contact with machinery have ceased, but as inshore activity has expanded and changed, accidents associated with commercial fishing equipment (e.g., crab pots, lines) have increased.

Through the linked database we can start to find out how these groupings of accidents and related injuries relate to different types of fisheries. Preliminary work indicates that in comparison to other commercial fishers, crab fishers experience relatively fewer accidents from slips and falls and overexertion but more accidents related to being caught in gear.

We are now preparing a pilot project using a small linked database to pre-test our methods before testing hypotheses generated from the NL WSHCC data and other projects in the study. For example, we are interested in what kinds of accidents and injuries are related to crab fishing in comparison to shrimp fishing: we want to know when and where these accidents occur in relationship to the trip cycle, and how fishing effort on these vessels changed over time and with what impact on fishing safety. For this pilot project we linked 28 WHSCC claims with 28 SAR incidents, and then successfully linked these cases to the DFO database. Through this process we can see the connections among the variables, identify the difficulties associated with integrating the databases, and perfect the techniques that must be used to handle these large datasets.

Conclusion and Future Directions

The linkages of the databases can occur in four ways: DFO with SAR; DFO with NL WHSCC; SAR with NL WHSCC; and DFO with SAR and NL WHSCC. It should be noted that there are SAR incidents that do not result in WHSCC claims, such as a person thrown overboard whom SAR recovers. Similarly, many WHSCC claims are not associated with SAR incidents, such as a person with a back problem caused by a slip on deck. However, a person caught and crushed in machinery on deck who is airlifted from the vessel and flown to the hospital will be included in both the SAR and WHSCC databases.

In theory, there should be a perfect match among the databases; however, we have identified a number of problems. The NLCHI identified 409 NL WHSCC claims representing 392 incidents or approximately eight percent of the database that could be linked. This low percentage was primarily due to the lack of recording of the fishing vessel name or vessel description in the database, mostly for company employees and in the later years of the study. Only 576 or eleven percent of claims had this information noted. In the case of the SAR data NLCHI identified 1,765 resources tasks representing 490 individual incidents or approximately seventeen percent of the database that could be linked (the SAR database only recorded cases from 1994 onwards). In this case, nearly eighty-six percent of the cases had either the vessel name or description recorded. Approximately thirteen percent of all fishing trips in the DFO database did not have the fishing vessel name or identifier recorded. The same percent of cases in the DFO database did not have the date the vessel set sail recorded. The systematic recording of data needed for linkage (notably fishing vessel number and/or fisher identification number) for all the databases has improved over time; however, throughout the study there was a systemic under representation of vessels under 35 feet. Since the full implementation of the dockside monitoring program in 1996, there has been more consistent recording of the catch, yet there is still much information, particularly date sailed and identifiers, not recorded especially for vessels under 35 feet. With the changes in recording this vital information, the potential for linking the databases has improved in more recent years, suggesting that in the future the linkage capacity and hence the capacity to trace patterns and trends will be stronger.

In order to put the information we are analysing in context, we are drawing on existing demographic and other secondary data to develop a profile of the fleet sectors in the province, the harvester population, the physical characteristics of different vessel types and lengths, and a profile of catches by species, location, and type of gear/technology. The fleet profile will include information on geographical distribution, vessel size, gear type/licenses, and crew size (if available). The harvester profile will include demographics, information on licenses, and information on incomes (if available). It will provide the basis for assessing the representativeness of samples involved in focus groups and interviews conducted as part of the Perceptions of Risk project. It will also allow us to make systematic comparisons of the types of vessels, the characteristics of crew, and the fishing activities associated with SAR incidents and NL WHSCC claims with those of the wider fleet. The addition of Environment Canada data to the linked database would allow us to identify weather conditions associated with higher incident rates, to select vessels or trips experiencing similar conditions, and to compare those that experienced claims or SAR incidents with those that did not. We have also identified a downward trend in the NL WHSCC claims in the fish-harvesting sector since 2001, which suggests that the bulge in claims and SAR incidents we saw in the late 1990s was a phenomenon that needs to be explored in more depth. With the capacity to obtain routine updates of the linked database every five years, dramatic improvements should be possible in our capacity to monitor long-term trends and the factors associated with them.

References Cited

Canadian Coast Guard, Search Rescue (2005) SAR V.8.0 User Guide, Search and Rescue Application (SAR), Ottawa: Queen's Printer

Canadian Coast Guard, Search Rescue SAR Value Codes

Cloutier, Esther & Lucie Laflamme, (1985) Organisation du travail et sécurité des opérations forestières (Work organization and the safety of forestry operations)

Institut de reherche Robert-Sauvé en santé et en sécurité du travail (IRSST) website. http://www.irsst.qc.ca/fr/_publicationirsst_154.html). Accessed 27 Oct 2005
Department of Fisheries and Oceans DFO Value Codes
Department of Fisheries and Oceans (2000) Species Codes generated by Jim LeBlanc Commercial Data Division, Maritimes Region, on Feb 1, 2000
Navarro, Pablo Barbara Neis, Martha MacDonald, and James Lawson (2004) Newfoundland & Labrador Forestry Occupational Health and Safety Project: Statistical report on forestry and forestry-related WHSCC claims, 1990-2002
Pelot, R., M. Buckrell, H.J. Zhu, C. Hilliard (2000) Maritime Activity and Risk Investigation Network, Newfoundland Incidents: Data Cleaning Process, MARIN Report: #2000-03 Halifax, Dalhousie University
WHSCC Data Sharing Agreement (2004) January 19 2004. Agreement between Workplace Health, Safety and Compensation Committee of Newfoundland and Labrador, Newfoundland Centre for Health Information, SafetyNet, Memorial University of Newfoundland and Dalhousie University
Wiseman, M and H. Bruge DFO Intra-Departmental Working Group, (2000) Fishing Vessel Safety Review (less than 65 feet) St. John's Newfoundland: Search and Rescue Newfoundland Region

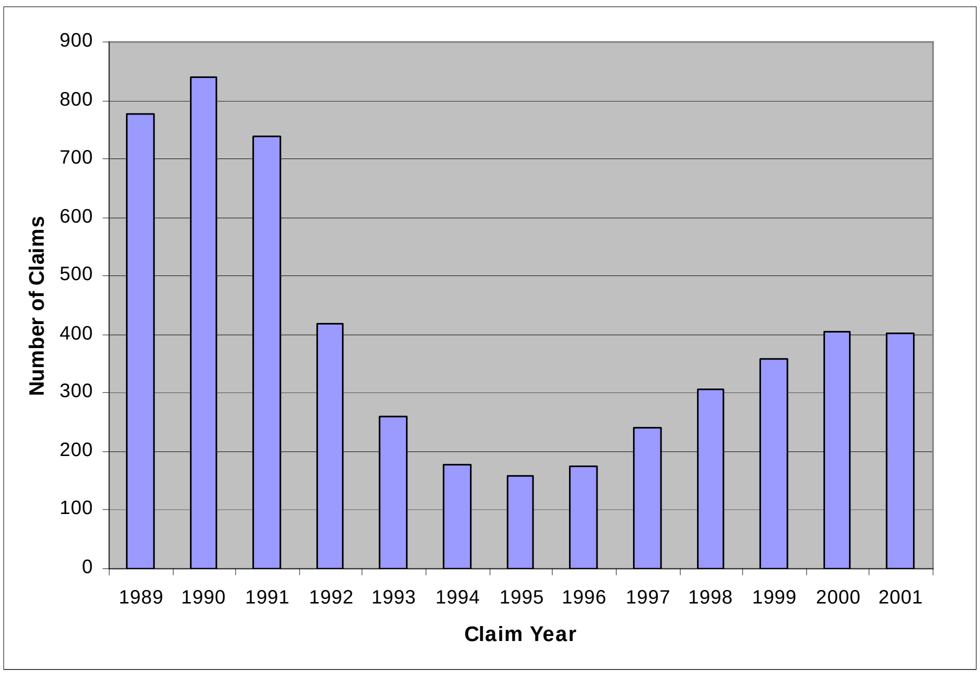

FIGURE 1: DISTRIBUTION OF CLAIMS IN THE FISHING INDUSTRY FROM 1989 TO 2001 N=5260, MISSING CASES=0. SOURCE: NL. WHSCC

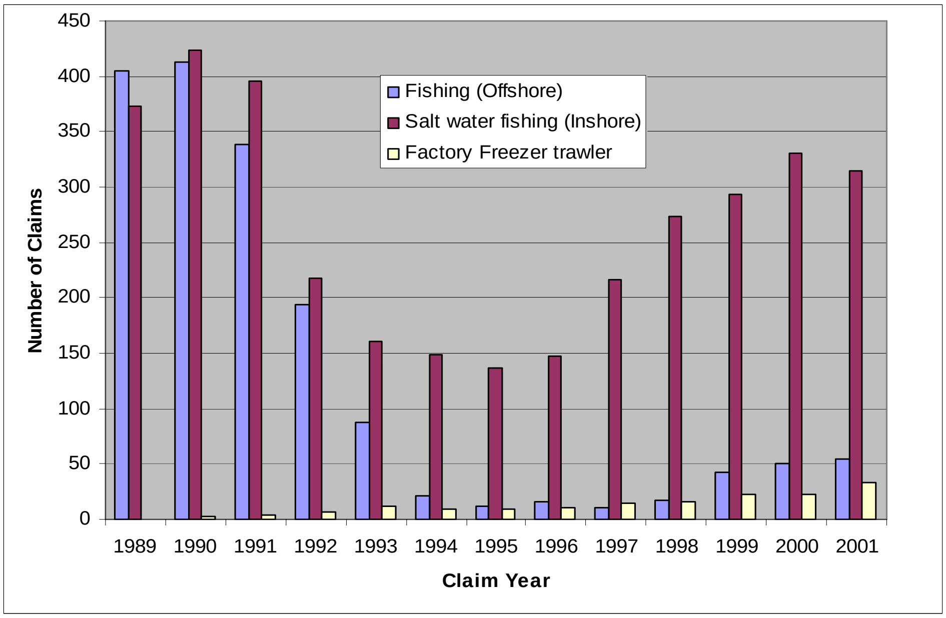

Figure 2: Distribution of Claims Broken Down by Fishery Sector 1989-2001.
N=5260, Missing Values=0. Source: NL WHSCC

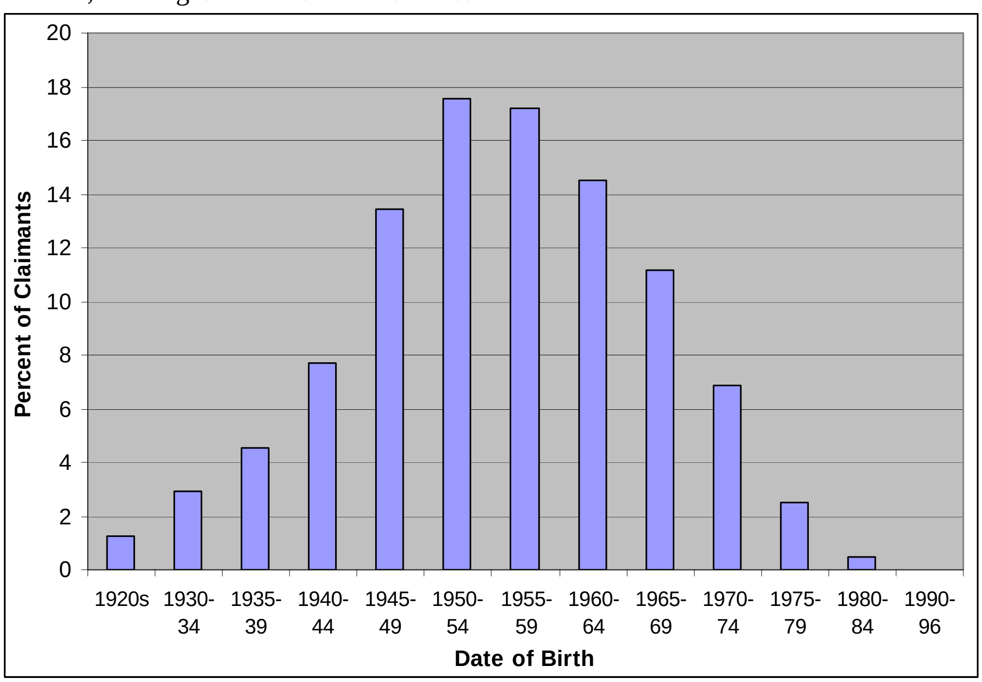

FIGURE 3: DISTRIBUTION OF CLAIMANTS BY BIRTH YEAR IN FIVE-YEAR COHORTS (IN PERCENTAGES**) N=4479, MISSING VALUES=781. SOURCE: NL WHSCC**

	Inshore		Offshore		Trawler		All	
Nature of Injury	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**
Traumatic injuries to bones, nerves, spinal cord, cranium	298	10.8	51	4.0	9	6.5	358	8.6
Traumatic injury to muscles, joints, etc.	1055	38.1	644	50.8	29	20.9	1728	41.4
Open wounds	330	11.9	139	11.0	6	4.3	475	11.4
Surface wounds and bruises	372	3.4	266	21.0	21	15.1	659	15.8
Burns	21	0.8	12	0.9	0	0	33	0.8
Multiple traumatic injuries and disorders	55	2.0	16	1.3	3	2.2	74	1.8
Drowning	48	1.7	0	0	0	0	48	1.1
Non-specific injuries and disorders	263	9.5	66	5.2	33	23.7	362	8.7
Non-specific injuries and disorders: Back pain, hurt back	135	4.9	19	1.5	15	10.8	169	4.0
Nervous system and sense organ disorders	56	2.0	19	1.5	13	9.4	88	2.1
Musculoskeletal system and connective tissue disorder	50	1.8	20	1.6	0	0	70	1.7
Other	84	3.0	16	1.3	10	7.2	110	2.6
Total	2767*	100	1268**	100	139***	100	4174	100

Table 1: Distribution of Nature of Injury for all Claimants. N=4174, Missing Values=1086, *Missing Values = 669 **Missing Values=392 ***Missing Values =25. Source: NL WHSCC

	Inshore		Offshore		Trawlers		All	
Source of Injury	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**
Containers	286	12.4	128	10.8	6	8.3	420	11.8
Furniture and fixtures	13	0.6	18	1.5	<5	<5	32	0.9
Machinery	49	2.1	39	3.3	7	9.7	95	2.7
Commercial fishing equipment	138	6.0	9	0.8	7	9.7	154	4.3
Parts and Materials	377	16.3	232	19.7	9	12.5	618	17.4
Persons, plants, animals and minerals	72	3.1	33	2.8	<5	<5	107	3.0
Bodily motion or position of injured, ill worker	268	11.6	174	14.7	11	15.3	453	12.7
Structures and surfaces	257	11.1	234	19.8	11	15.3	502	14.1
Tools, instruments, and equipment	114	4.9	105	8.9	<5	<5	220	6.2
Vehicles – land	23	1.0	7	0.6	0	0	30	0.8
Water vehicles	416	18.0	75	6.4	6	8.3	497	14.0
Chemical and chemical products	8	0.3	5	0.4	0	0	13	0.4
Environmental elements	46	2.0	38	3.2	10	13.9	94	2.6
Other	242	10.5	83	7.0	<5	<5	326	9.2
Total	2309*	100	1180**	100	72***	100	3561	100.0

Table 2: Distribution of Source of Injury for all Claimants. N=3561, Missing Values=1699, *Missing Values= 1127 **Missing Values= 480 ***Missing Values= 92. Source: NL WHSCC

	Inshore		Offshore		Trawlers		All	
Type of Accident	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**
Contact with object/equipment: Struck against object	129	5.6	122	10.3	7	9.7	258	7.2
Contact with object/equipment: Struck by object	232	10.0	125	10.5	8	11.1	365	10.2
Contact with object/equipment: Caught in or compressed by object.	287	12.4	85	7.1	6	8.3	378	10.6
Contact with object/equipment: Rubbed or abraded by friction	115	5.0	111	9.3	<5	<5	227	6.4
Fall	334	14.5	250	21.0	13	18.1	597	16.7
Bodily reaction and exertion	260	11.3	167	14.0	9	12.5	436	12.2
Bodily reaction/exertion: Overexertion	569	24.6	269	22.6	7	9.7	845	23.7
Bodily reaction/exertion: Repetitive motion	15	0.6	0	0	<5	<5	17	0.5
Exposure to harmful subs. or environment	73	3.2	36	3.0	11	15.3	120	3.4
Exposure to harmful environment: Lost at sea	39	1.7	0	0	0	0	39	1.1
Transportation accidents (on land)	11	0.5	5	0.4	0	0	16	0.4
Transportation accidents (at sea)	240	10.4	19	1.6	6	8.3	265	7.4
Other	6	0.3	<5	<5	<5	<5	9	0.3
Total	2310*	100	1190**	100	72***	100	3572	100.0

Table 3: Distribution of Type of Accident for all Claimants. N=3572, Missing Values=1688, *Missing Values=1126 **Missing Values=470 ***Missing Values=92. Source: NL. WHSCC

Table 4: Distribution of Injured Body Part for all Claimants

	Inshore		Offshore		Trawlers		All	
Part of Body	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**
Head	71	2.1	53	3.2	6	3.7	130	2.5
Head: Ear(s)	36	1.0	22	1.3	11	6.7	69	1.3
Head: Eye(s)	83	2.4	48	2.9	7	4.3	138	2.6
Neck (incl. throat)	44	1.3	20	1.2	<5	<5	68	1.3
Trunk: Chest	387	11.3	186	11.2	18	11.4	591	11.2
Trunk: Back (incl. spine)	822	24.0	370	22.3	29	17.7	1221	23.2
Trunk: Lower Abdomen	100	2.9	66	4.0	<5	<5	169	3.2
Upper Extremities: Arm(s)	156	4.5	160	9.6	11	6.7	327	6.2
Upper Extremities: Wrist(s) and Hand(s)	349	10.2	154	9.3	9	5.5	512	9.7
Upper Extremities: Finger(s)	476	13.9	194	11.7	15	9.1	685	13.0
Upper Extremities: Multiple	48	1.4	10	0.6	<5	<5	59	1.1
Lower Extremities: Leg(s)	258	7.5	142	8.6	23	14.0	423	8.1
Lower Extremities: Ankle(s) and Feet	216	6.3	99	6.0	8	4.9	323	6.1
Lower Extremities: Multiple	39	1.1	8	0.5	0	0	47	0.9
Body Systems	47	1.4	5	0.3	<5	<5	56	1.1
Other	299	8.7	122	7.4	15	9.1	436	8.3
Total	3431*	100	1659**	100	164***	100	5254	100.0

N=5254, Missing Values=6, *Missing Values=5 **Missing Values= 1 *** Missing Values= 0 Source: Nfld. WHSCC

Table 5: Distribution of Nature of Injury over Time for all Claimants

	Accident year													
Nature of Injury	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**Total**
Traumatic injuries to bones, nerves, spinal cord, cranium	32	39	43	34	13	9	12	15	25	39	35	29	33	358
Traumatic injury to muscles, joints, etc.	305	359	293	153	80	37	48	69	82	103	61	72	66	1728
Open wounds	82	83	68	36	16	17	7	17	18	28	40	33	30	475
Surface wounds and bruises	140	89	68	57	39	32	31	25	40	40	42	35	21	659
Burns	<5	7	5	<5	0	<5	<5	<5	<5	<5	0	<5	0	33
Multiple traumatic injuries and disorders	0	<5	11	12	<5	<5	<5	5	12	7	5	6	6	74
Drowning	7	0	<5	<5	<5	8	<5	<5	<5	5	<5	8	<5	48
Non-specific injuries and disorders	0	0	0	<5	0	0	0	0	7	13	88	121	132	362
Non-specific injuries and disorders: Back pain, hurt back	0	0	0	0	<5	<5	0	0	0	6	37	59	65	169
Nervous system and sense organ disorders	0	<5	0	<5	5	0	<5	<5	8	11	17	10	25	88
Musculo-skeletal system and connective tissue disorder	<5	11	10	<5	<5	<5	<5	<5	<5	<5	13	11	<5	70
Other	<5	10	11	5	8	<5	<5	<5	6	20	9	15	17	110
Total	575	602	512	308	170	110	117	146	205	277	348	403	401	4174

N=4174, MISSING VALUES=1086, SOURCE: NFLD. WHSCC

Table 6: Distribution of Source of Injury over Time

	Accident year													
Source of Injury	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**Total**
Containers	57	65	57	29	22	17	12	25	10	25	30	36	35	420
Furniture and fixtures	7	8	4	<5	<5	0	0	<5	<5	<5	<5	<5	0	32
Machinery	14	19	19	11	<5	5	5	<5	5	<5	<5	<5	<5	95
Commercial fishing equipment	0	0	<5	0	0	0	0	0	21	23	33	38	38	154
Parts and Materials	80	137	139	64	34	18	15	18	24	20	25	27	17	618
Persons, plants, animals and minerals	17	17	21	14	6	<5	<5	<5	<5	<5	<5	6	<5	107
Bodily motion or position of injured, ill worker	56	72	48	53	19	10	19	23	22	38	29	43	21	453
Structures and surfaces	70	139	115	37	39	14	12	19	9	15	12	13	8	502
Tools, instruments, and equipment	54	50	42	19	11	7	<5	<5	<5	5	9	6	7	220
Vehicles - land	7	0	9	<5	<5	<5	<5	<5	0	<5	<5	<5	0	30
Water vehicles	85	28	31	32	9	5	10	11	36	51	70	60	69	497
Chemical and chemical products	0	9	<5	0	0	0	0	0	0	<5	0	<5	0	13
Environmental elements	11	8	<5	<5	<5	<5	<5	<5	<5	12	11	8	20	94
Other	112	45	22	37	20	26	14	12	<5	10	6	13	5	326
Total	570	597	513	305	170	109	98	122	146	212	234	258	227	3561

N=3561, Missing Values=1699, Source: Nfld. WHSCC

Table 7: Type of Accident in Claims over Time

	Accident year													
Type of Accident	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**Total**
Contact with object/equipment: Struck against object	47	44	38	31	8	15	7	8	8	12	14	13	13	258
Contact with object/equipment: Struck by object	40	59	73	26	13	16	7	14	24	17	30	24	22	365
Contact with object/equipment: Caught in or compressed by obj.	62	49	37	41	19	11	14	16	18	27	29	31	24	378
Contact with object/equipment: Rubbed or abraded by friction	96	58	21	22	11	5	<5	<5	<5	<5	<5	<5	<5	227
Fall	102	142	136	51	46	20	23	23	12	13	10	7	12	597
Bodily reaction and exertion	68	65	48	48	21	10	19	23	15	37	23	41	18	436
Bodiliy reaction/exertion: Overexertion	145	167	139	78	41	22	17	28	24	36	38	61	49	845
Bodily reaction/exertion: Repetitive motion	0	0	0	0	0	0	0	0	<5	<5	6	<5	<5	17
Exposure to harmful subs. or environment	13	13	9	8	6	<5	5	<5	5	14	12	10	19	120
Exposure to harmful environment: Lost at sea	0	0	<5	0	<5	8	<5	<5	<5	5	<5	8	<5	39
Transportation accidents (on land)	0	0	8	<5	<5	0	0	<5	0	<5	<5	0	0	16
Transportation accidents (at sea)	<5	0	0	0	0	0	0	<5	31	46	66	57	62	265
Other	0	<5	0	0	0	0	<5	<5	0	<5	0	<5	<5	9
Total	574	601	512	307	170	109	97	124	146	213	234	258	227	3572

N=3572, Missing Values=1688, Source: Nfld. WHSCC

Table 8: Distribution of Injured Body Part in Claims over Time

	Accident year													
Part of Body	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**Total**
Head and Neck	64	47	34	25	17	13	12	10	20	39	42	40	42	405
Trunk	280	326	291	160	102	62	63	71	76	102	139	160	149	1981
Upper Extremities	277	279	240	134	73	54	35	43	77	69	92	106	104	1583
Lower Extremities	115	129	114	60	38	25	27	31	49	49	52	50	54	793
Body Systems	9	10	<5	<5	7	9	<5	<5	<5	<5	<5	<5	<5	56
Other	31	49	58	38	23	16	15	14	17	45	33	47	50	436

Total	776	840	739	419	260	179	156	173	242	306	359	404	401	5254

N=5254, Missing Values=6, Source: Nfld. WHSC

Newfoundland and Labrador Fish Harvesters' Perceptions of Risk

By

Dr. Nicole Power, Postdoctoral Fellow, Newfoundland and Labrador Centre for Applied Health Research, Memorial University; Dr. Barbara Neis, Professor, Department of Sociology and Co-Director, SafetyNet; Sandra Brennan, Masters student, Department of Sociology; Dr. Marian Binkley, Dean, Faculty of Arts and Social Sciences, Dalhousie University.

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Introduction

The main objective of this component of SafeCatch was to document harvesters' experiences with risky situations; their perceptions of fishery risks; as well as their perceptions about the ways safety training, regulatory and other changes introduced to the Newfoundland and Labrador fishery have influenced risk. We focus on the period of substantial environmental, industrial and regulatory change between 1992 and 2004. Our "Perceptions of Risk" (POR) component provides information that is vital to interpreting data captured in other components, including insights into the relationship between reporting and actual experience with accidents and near-misses (relevant to the FVSLA component). It builds into the overall project information from harvesters regarding how they assess and respond to risk and regulatory and other changes within fisheries with potential consequences for their health and safety. It also identifies sources of risk that are largely invisible within most fisheries research. Finally, we are able to offer some insight into the things harvesters do to try to reduce risk – an under-researched area of fishing safety with potentially significant policy implications.

Fish Harvesters' Perceptions of Risk

The complex changes that have occurred in the Newfoundland and Labrador fishery since 1990 and the limitations in existing administrative data (i.e., the problem of under-reporting) make it very difficult to document, interpret and fully explain the causal mechanisms influencing the risk of accident, SAR incident, injuries and fatalities in the Newfoundland fishery. Fish harvesters work at the point of interaction between all of these changes, and their attitudes and actions play a critical role in shaping what happens, why and with what consequences for harvesters, vessels, harvester organizations and SAR incidents and outcomes. They also have important insights into the sources of risk and have developed their own strategies for reducing perceived risk in fisheries that can contribute to larger discussions and investigations of these issues.

Most existing research on perceptions of risk has concentrated on gaps between perceived and real risks among harvesters (Murray, 1997; Poggie and Pollnac, 1997). Previous research carried out in the 1980s (Binkley, 1995; Neis and Ripley 1990) concentrated on the offshore groundfish and scallop dragging sectors finding high rates of accidents, injuries and fatalities, and a relationship between increased back injuries and the shift to boxing fish on board large draggers. Normalization of injury, fatalism and denial of risk were also key findings. Research in the early 1990s on the inshore sector (Murray and Dolomount, 1994, 1995) found high levels of anxiety among harvesters. SAR research released in 2000 pointed to a pattern of under-reporting mishaps and injuries to SAR and to workers' compensation.

The Perceptions of Risk component explores gaps between perceived and real risks among fish harvesters but our main focus is on gathering harvesters' observations and knowledge in order to deepen our understanding of risks, their origins and how they interact with fish harvesters' knowledge and practice to influence decision-making and ultimately safety and health within our fisheries. Our approach assumes that all knowledge (lay and expert) is social-ecological knowledge in that it reflects the social and environmental position of the knower. From our perspective there is no single, objective place from which to assess risk and the best way to assess and minimize risk is through interdisciplinary and intersectoral approaches, seeking input from a variety of different knowledge agents focusing on different sources and dimensions of risk and using multiple methodologies. Fish harvesters' experiences on the water, their "positionality" (Fox 1998), inform their observations and interpretations to risk assessment, which may differ from those of scientists and other experts. Inclusion of fish harvesters' safety knowledge in research on risk is particularly important in the context of rapid change and as a means to promote understanding and awareness among those with an interest in minimizing risk through co-management of safety including harvesters, safety experts and policy–makers. We have sought to take into account social and cultural factors that can influence risk and perceptions of risk such as safety training and practices while also seeking harvesters' practical, experience-based knowledge and insights about risks, their origins and about ways to mitigate or reduce those risks.

Ethics and Methods

Ethical approval for this research was provided by the Human Investigations Committee at Memorial University and the Human Research Ethics Board at Dalhousie. We used a mixed methods approach because this provides the opportunity to triangulate findings (look for support for a finding across methods) and to compensate for the weaknesses in individual types of data collection. Our three methods include: focus groups, a phone survey, and boat tours.

Focus Group Method

Recruitment to the focus groups began with a list of names of fish harvesters involved in professionalisation, many of whom instructed safety courses in different areas of the Island, provided by the Professional Fish Harvesters Certification Board (PFHCB). We contacted these fish harvesters and they provided names and contact information for harvesters in their areas who they thought would be interested in participating. The latter were contacted and those we were able to reach were invited to participate in a focus group in their area. Focus groups took place between March 2003 and December 2004. Sessions lasted between 2.5 and 3 hours. Participants were asked to complete a voluntary, short, self-administered demographic questionnaire. Focus group sessions followed an agenda of discussion topics that were distributed to participants at the start of the focus group. Sessions were audio-taped, transcribed and transcripts were analysed using QSR N6 qualitative software.

A total of 17 focus groups were completed involving 94 fish harvesters (83 men and 11 women) from the island portion of the province. The disproportionate number of men reflects the gendered structure of the harvesting sector (Grzetic 2004). Participants ranged in age from 23 to 65 years and the average age was 44 years. The average age when participants had started fishing commercially was 20 years but was much higher for women at 31 years. These harvesters were predominantly from the under 35 foot and 35-65 foot sectors. Snow crab, groundfish, herring, and lobster were the most widely reported species fished by participants. Sixty-eight harvesters reported current involvement in the inshore fishery and 44 in the longliner fishery. Seventy-one respondents had taken formal fishery training courses. At least 65 were skippers, and 68 reported having core status. In terms of professionalisation designations, 64 identified as Level II, five as Level I, and five as Apprentice. Among the 11 women participants only one had core status and only four had Level II status. Eight-seven harvesters were married or living common-law and 51 fished with their spouse or common-law partner. Ninety-one participants had children. Only 11 said they would encourage their children to enter the fishery.

Telephone Survey Method

Phase Two of the Perceptions of Risk component consisted of a phone survey involving professional fish harvesters. The phone survey was developed drawing on insights from the focus groups and on survey questionnaires used in earlier, similar research on fish harvesters' perceptions of risk. Survey questions asked harvesters about where they fish, their vessel, gear, and the species they fished for in 2004. Questions also inquired about accidents and injuries harvesters have experienced, about things they think might affect fishing safety, about safety training and equipment. A few questions discussed their general income level, quality of life, and health status.

The survey instrument was pre-tested and adjusted and was shortened after each pre-test. Our original goal was to survey a random sample of 100 professional fish harvesters stratified on the basis of region and on the basis of level of professional certification. To find our sample, we asked the PFHCB to generate a stratified random sample of 600 names from its list of professional fish harvesters. In the spring of 2005, the PFHCB mailed a package of information to each of these individuals containing information about the study, a letter of support from the PFHCB, a contact reply form and a stamped, self-addressed envelope for those interested in participating. We received only 35 responses to this initial mail-out and, from these, were able to complete 25 phone interviews. We attribute the low response rate to this initial request to turmoil in the industry that erupted in the snow crab fishery around the time of the mailout, and to the fact that the mailout took place after many harvesters were back fishing.

We attempted to increase our response rate for the survey by asking the PFHCB to send a second package of information to the same participants in September. We received 19 responses to this second mail-out and, from these, managed to complete 15 interviews. We also discussed the research during a radio interview with the host of the Canadian Broadcasting Corporation's *Fisheries Broadcast* during which we issued an invitation to harvesters to participate. This advertisement generated an additional three responses (calls to a secure, toll free line) and to the return of one more contact reply form from our original sample. In light of the overall low response rate to these multiple initiatives, we revisited the last few pre-test interviews we had conducted using a version of the survey instrument that was very close to the final version and, with the permission of three individuals, re-classified their interviews from pre-test to test interviews. Thus, our total number of completed surveys for this component is 46. This is not a large enough sample to generalize to the harvester population, but these lengthy surveys have provided a very important source of additional information for this component.

The fish harvesters we surveyed started fishing between the ages of 10 and 32 years (average of 16.8 years), and they ranged in age from 22 to 67 years (average of 47.4). Years fishing ranged: 4 had fished 15 years or less; 18 had fished between 15 and 29 years; and, 24 had fished for 30 years or longer. Forty-one percent of those surveyed had not graduated from high school. All 46 had received some formal training related to fishing ranging from a Basic Safety Training course to qualifications in Marine Engineering or Marine Diesel Mechanics. Sixty-seven per cent of fish harvesters surveyed worked in the less than 35' sector and 32 had Core status. Of the harvesters interviewed, 27 were skippers and the rest crew.

Boat Tour Method

The boat tours took place on harvesters' vessels and combined qualitative interviews, with demonstrations, observation and a mapping exercise. During the boat tours harvesters were asked to identify the location of risky activities on the vessel and then to describe and, where possible, re-enact their strategies for dealing with them. Using a generic diagram of a vessel deck, participants were asked to add details to the generic diagram to make it match their workspace and to identify on the diagram places or tasks they perceive to be risky or dangerous. The map serves as a visual representation of perceived workplace risk and was also used to illustrate steps they took to reduce risk. This mapping tool is adapted from a research approach developed for industrial OHS environments.[3] We completed seven boat tours, four on vessels under 35 feet in length and three on vessels measuring between 35 and 65 feet.

Triangulation

The focus groups allowed us to collect information related to the broad theme of fishing risk. This information provides valuable insights into the safety-related aspects of changes in fishing over the past decade. Focus group discussions can trigger ideas and information that might be overlooked or forgotten in one-on-one interviews but these data lack the depth of experience and information that can be derived from detailed one-on-one interviews. The semi-public nature of focus groups also means some individuals will not speak openly about certain kinds of concerns or events. This is perhaps particularly true for crew. We used our focus group data in the design of the survey questionnaire.

[1] Thanks to Dorothy Wigmore for introducing Nicole Power to this methodology and to Dwayne White for designing the generic map of a fishing vessel deck used in the boat tours.

The survey method does a good job of testing verbal, formal knowledge and allowed us to increase the randomness of our sampling and to conduct surveys in areas where we were not able to hold focus groups. Surveys are not designed, however to explore experiential and embodied dimensions of work and risk and the low response rate (approximately 13%) to the mail-out means that our respondents are not a representative sample of the harvester population limiting the generalizability of these findings. One of the goals of the boat tours was to move from a discussion organized mainly around perceived risks to one that included the strategies used by skippers and captains to keep themselves and their crew safe. We focused our attention not so much on the security or stability of the vessel as on the vessel as a job site or work platform. The boat tours moved safety and risk discussions on to vessels and provided the opportunity for harvesters to act out certain activities and to map sources of risk as well as strategies for dealing with them thereby opening up new opportunities for discussion and exploration and reducing the risk of misunderstanding on the part of the researcher.

Results and Discussion

In the focus groups, participants described a wide range of accidents, injuries, risky situations and near-misses they had experienced or observed. Risky situations included fishing in rough or changing weather, unreliable forecasting, and fishing in cold weather. They also included situations where overloaded boats, especially in the lobster fishery, had led to capsizing and swamping. Crossing shipping lanes was associated with the risk of collision and some near-misses were discussed. Many small boats did not have radar during the early years of the under 35 foot crab fishery. Shooting crab pots, dealing with loose rope and fishing for crab in small, open boats were also discussed. Focus group participants described situations where they had dealt with equipment failure, engine failure and the failure of navigation technologies. Fishing alone or with a reduced crew was associated with risk as were fishing too close to shore (in the lobster fishery), fishing far from shore, fishing in ice, and sealing in the fog. They described ice damaged vessels that began taking on water, grounding, collisions, falls into the hold, getting tangled in rope, falling overboard, slips, and tripping. Rope around the propeller and gear snagging on the bottom or on other gear increased the risk of swamping and breaking the hauler. The types of injuries described in focus groups included getting "squat" in machinery, breaking and losing fingers in equipment and rope, and breaking arms and legs.

Phone survey participants were asked if they had been in certain risky situations in the past ten years. As indicated in Figure One, a large percentage of the sample had experienced "being onboard in extreme weather," "being towed in," "being onboard when the engine failed," and "being onboard when the navigation failed." None had been forced to abandon ship or experienced a collision.

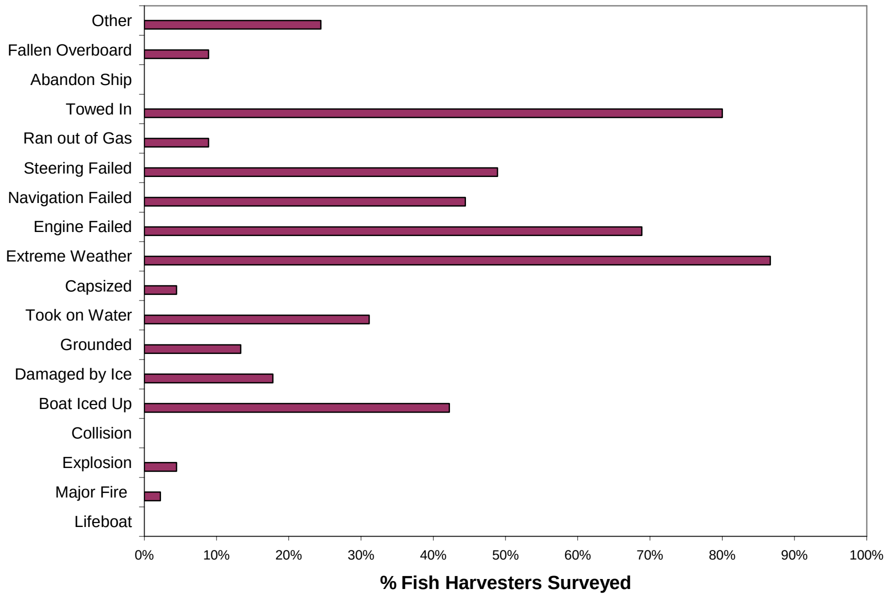


Figure 1. Risky situations experienced by surveyed harvesters in Newfoundland and Labrador.

Exactly 50 percent (23) of those surveyed in the phone interviews reported having an accident in the past 10 years and 44 percent said they have health problems that are related to fishing. Of the 23 harvesters who reported having an accident, 14 of those described experiencing injuries. Slips, trips, and cuts accounted for approximately 48 percent of these accidents; only one participant said he had fallen overboard in the past ten years. Eleven injuries were rated "moderate" or "serious," but 13 required treatment at a hospital or by a doctor suggesting more were actually quite serious. Some injuries were simply dealt with on board. Thus, of 18 harvesters who described a fishing accident, 11 indicated that the vessel went on fishing afterwards while only seven indicated the vessel had returned to port.

Harvesters tend to see some injuries as part of the job. In the words of one harvester, "That's the nature of fishing anyway. You're not going to get clear of all risk at fishing." Phone survey participants were asked if there are certain types of injuries that are a common or normal part of fishing and, if so, what are some of these types of injuries. Forty-three percent (20) of respondents listed "back problems", 37 percent (17) "slips and falls" and 37 percent (17) "cuts" in response to this question. This tendency to normalize injury may reflect real pressures to keep fishing even when seriously injured in highly seasonal fisheries where harvests from a short period will dictate annual income. For example, one focus group participant described becoming tangled in rope and injuring his foot when his hydraulic hauler failed. This did not stop him from fishing the rest of the season. "I had my foot tore up; yeah, an uncomfortable summer fishing." Only five of the 14 injuries reported in the phone survey resulted in a claim to the Workplace Health Safety and Compensation Commission (WHSCC).

When surveyed harvesters were asked: “From your point of view, what are the three things that have the most effect on fishing safety?” the most common answers were: government regulations, weather, and training/knowledge. Harvesters considered the most dangerous situations at sea to be associated with weather-related factors (bad weather, poor forecasts), vessel size factors (including stability and overloading), and problems with or lack of equipment.

Harvesters tend to normalize the risks to safety posed by bad weather. However, they also see weather risks as mediated by forecasting, experience with the vessel and with different types of conditions, and by regulations. Changes in fishing areas can mean exposure to new weather-driven situations and can create experience gaps. Changes in access to timely and accurate forecasts also mediate risk. In March of 2003, the weather forecasting station in Gander was closed and all forecasters were moved to Halifax. Those surveyed commonly agreed that local forecasts do not seem to be as accurate as they were in the past when forecasts were done from Gander. Seventy per cent of phone survey participants thought the quality of the forecast had declined over the last two years. Those who did not share this view tend to fish on larger vessels and to have access to more sophisticated technologies that enable them to directly access weather forecasts from elsewhere. One harvester commented that with appropriate meteorological information and radar maps, an accurate forecast can be given from Australia for fishing grounds in Newfoundland. Thus opinion was divided on the effects of the closure of the Gander office but most identified the closure with a decrease in forecasting quality.

Regulations can both mitigate and enhance risk. The regulations they think matter most to risk include those that limit vessel length, set season lengths, that include strict rules about when gear can be in the water, and that require mandatory safety equipment and training. We began the boat tours by asking participating skippers to describe their ideal vessels. In response, fish harvesters indicated a preference for larger vessels, provided regulations and costs were not factors. They described the main advantages of a larger vessel as including increased deck space for working, improved safety when traveling offshore, and as allowing for the addition of amenities that increased the crew’s comfort during longer trips (such as a galley and toilet facilities).

Competitive fisheries like the lobster fishery are associated with a rush at the beginning of the season to set pots and secure key grounds. To alleviate this pressure, DFO has extended the time for setting lobster pots from 24 to 48 hours prior to season opening. However, local competition can still work to encourage risk-taking, particularly in the context of economic pressures, limited options, and depleted lobster stocks common to some areas. The risks most commonly associated with this fishery include: overloading the boat when setting, moving or retrieving pots; swamping the boat; the risk of entanglement in mechanical haulers used to haul pots; and the risk of entanglement in rope. In the latter part of the season, lobster fishing takes place very close to shore opening up the risk of coming up on the rocks. Mechanical haulers are now common in the lobster fishery and pose different risks from manual hauling. The collapse of the cod stocks was associated with intensified fishing effort in the lobster fishery. Increased effort and competition for dwindling lobster resources have contributed to competition and risk-taking, particularly in some areas like St. John Bay (Whelan 2005).

Over the past decade, individual quotas (IQs) have been introduced into many fisheries including those for snow crab and cod. Harvesters generally reported that IQs have reduced pressures to fish in bad weather and to take other chances related to the race for the fish associated with competitive fisheries. However, they also indicated that the IQ safety dividend can be compromised where declining stocks, management initiatives that unexpectedly shorten the season like the recent provincial government Raw Material Sharing program, or other unanticipated changes in season length or overall quota size undermine the harvesters' ability to choose when they fish. Financial pressures and community norms that encourage competition may also undermine the IQ safety dividend.

Some other recent conservation and management initiatives include the requirement for dock side monitoring and related constraints on where catches can be landed; the requirement, in some fisheries, for on board observers; regulations with specific dates for setting and retrieval of gear including weekend retrieval in some cases. These regulations can contribute to risk because, in the words of one harvester: "We're forced out on the water when we shouldn't be out there." Risk increases when harvesters are fatigued as can happen in contexts encouraging work intensification as a result of management strategies that condense annual fishing time to shorter periods, with seasons for different species overlapping, and where harvesters are fishing from ports that are a long way from their homes adding commuting times.

Some phone survey participants wanted more regulation in the seal hunt with several suggesting that individual quotas are needed to reduce competition and associated risk-taking. When asked if there is one fishery that they consider especially dangerous, 24 percent (11) survey respondents talked about sealing. One former sealer noted "a bullet can go a long way" on the ice, echoing the concerns of others about the use of high-powered rifles. Other dangerous aspects of sealing include walking on and maneuvering a vessel in the ice: "[when you are on the ice] you're in God's pocket." This comment reflects the harvesters' awareness that they lack control over risk when fishing in ice. Focus group participants who had participated in the seal hunt identified a similar range of risks including working in icy conditions, the use of guns, lack of regulation within the fishery and fishing in boats ill-equipped for this fishery.

New Fisheries, New Risks: Turning experienced into inexperienced harvesters

> Like in our sector we were always like inshore, so we knew just to steer away from someone, small boat, right? But out there, they're not stopping. If they've got the right of way, they're keeping on trucking, right … something that we weren't used to first when we start moving off farther.

Many of the harvesters who participated in the focus groups entered new fisheries in the 1990s. Those who began snow crab fishing after all core enterprises became eligible for seasonal temporary permits in 1996 fished for crab much further offshore than they had in the past, using different technologies. Those with a longer history in the snow crab fishery also experienced important changes as they were pushed further offshore (up to 200 miles) when the closer grounds were turned over to the small boat sector.

Study participants often described fishing for crab in inappropriate vessels and without vital equipment such as radar and survival suits during the early years of the temporary permit snow crab fishery. Most were "experienced" harvesters with many years on the water, but their experience and vessels were tied to particular fisheries and to coastal locations. As they moved offshore and into this new fishery, they discovered new challenges and risks. To illustrate and as indicated in our opening quote, skippers of small boats fishing close to shore took responsibility for avoiding each other and had rules for this. In the offshore, particularly in areas where they had to cross major shipping lanes to get to their grounds, the situation was different. Large vessels like tankers and container ships expect small boats to stay out of their way. When traveling to their crab grounds and sometimes when fishing in shipping lanes they need radar to avoid getting run down and improved navigation technologies so they know when they were entering, leaving and, in some cases, fishing in shipping lanes. The volume of gear required for crab fishing, distance to the grounds and the need for mechanical haulers also pose new challenges for harvesters. During the early days of this fishery, some added crab haulers to small, aluminum open boats increasing the risk of swamping their vessels.

Since the beginning of the small boat crab fishery, many harvesters appear to have adjusted their vessels and equipment to better suit the risks associated with snow crab fishing. However, serious challenges persist. The risk of gear entanglement is a major safety challenge for many harvesters in the under 65 foot snow crab fishery. This risk is associated with the combination of cramped deck space and the high volumes of rope and gear required for this deep water fishery. Power and Brennan used their boat tours with skippers to deepen our understanding of the nature of this risk and skippers' strategies for dealing with it. In crab harvesting, crab pots are attached to a main line at intervals of 15-20 fathoms. There are often 50-75 pots on a line with buoy lines connected to the main line at each end, along with staff buoys. Each string or fleet of pots includes 1-1.5 miles of rope and boats often carry multiple strings of pots (200-600 pots and miles of rope) when setting, moving and retrieving gear. Setting, hauling and transporting pots means dealing with rope. When setting, harvesters run the risk of becoming tangled in the rope (losing limbs) and being dragged overboard.

Harvesters have sought to mitigate the risk of entanglement in a variety of ways. At a structural level, they have sought to maximize the deck space available but their ability to do that is limited by the cost and by vessel length and volume limits outlined in the Department of Fisheries and Oceans' vessel replacement regulations. Strategies for reconciling the demand for space with these constraints have included the purchase of longer vessels which are then shortened, widened and deepened, and moving the wheelhouse to the bow. Despite these structural modifications, they end up with extremely limited deck space and miles of rope to manage as they stand on a moving and often wet and slippery platform trying to carry out their work.

Further efforts to limit risk associated with the management of rope in this environment vary from vessel to vessel. Some try to minimize the movement of the gear and rope and to control the pathways through which the rope flows. They do this by striving to shoot in calm weather, keeping stacks of pots low and tied down, putting carpet and non-skid paint on their decks to minimize the risk of slipping, and trying to keep their deck clean and tidy. Buoy lines and main lines are stored by the side of the wheelhouse or pounded off. Some manipulate their shooting speed and limit shooting to daylight hours. Skippers ensure that only the crew required to shoot the pots are on the deck at that time and some hire crew whose job it is to watch the moving rope. They instruct crew to minimize the movement of their feet on the deck by supporting their back with their legs, bracing their legs against the deck, gunnel or railing and keeping their feet on the deck so the rope won't go around them. Crew members tend to do the same job all the time and new crew are assigned to easier, safer jobs. The shooter (or the captain) stays close to the hydraulic controls in case something goes wrong and a knife for cutting the rope is stored near the pot shooter. One way to minimize crew movement and hence risk is to set up an assembly line for shooting in which one worker takes a pot from the stack, baits it, rolls it to another, who then passes it to a third to shoot off the gunnel (See Figure 2.).

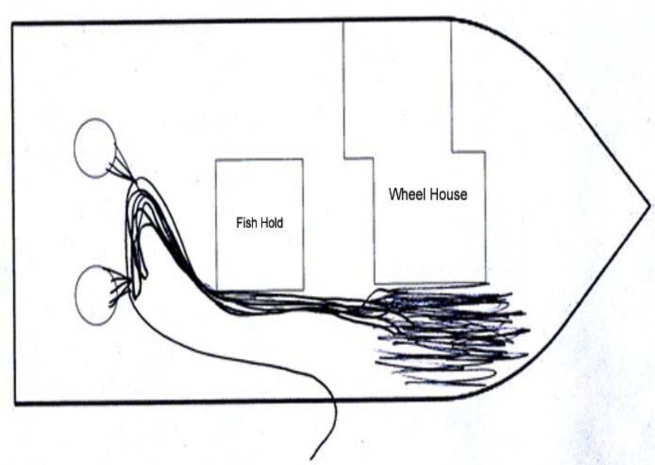


Figure 2. Composite diagram of rope management to reduce risk of entanglement taken from boat tour maps.

Common Sense, Safety Training and Safety Equipment

Harvesters described their strategies for dealing with rope and injury prevention more generally as using "common sense" and commonly attributed incidents involving rope and accidents to "carelessness", that is, not being cautious, aware and alert. Examples of carelessness discussed by participants include: fishing in rough weather; not getting enough sleep; fishing while not well; and being distracted by family or other worries. "Using common sense" involves applying direct and indirect experience and using judgment. Common sense management of rope and of the vessel overall is mediated by larger, contextual factors such as environmental conditions, regulations, social pressures and cultural practices.

Since the early 1990s, there has been more attention to safety training in the media and in fish harvester organizations. The focus group and the survey data suggest a tension between experiential approaches to fishing safety and reliance on formal safety training. This tension was mediated by age and experience, with older fishers less likely to place a lot of importance on training than younger harvesters (see Figure 3.). They were sometimes unlikely to see the value of training for themselves but more accepting of its value for young people. Older fish harvesters learned about fishing and fishing safety through mentorship and through experience on the water. In the survey, they tended to rate the importance of safety training and equipment lower than experience and "common sense" in terms of their relevance for reducing risk. An older focus group participant commented: "And I, assuming I know everything that's … needed to know through experience over the number of years you've been in it, 20 years you've been in it, you've learned it all." Most (including younger harvesters with formal training) recognised inexperience as a risk factor in near-misses, accidents and injuries.

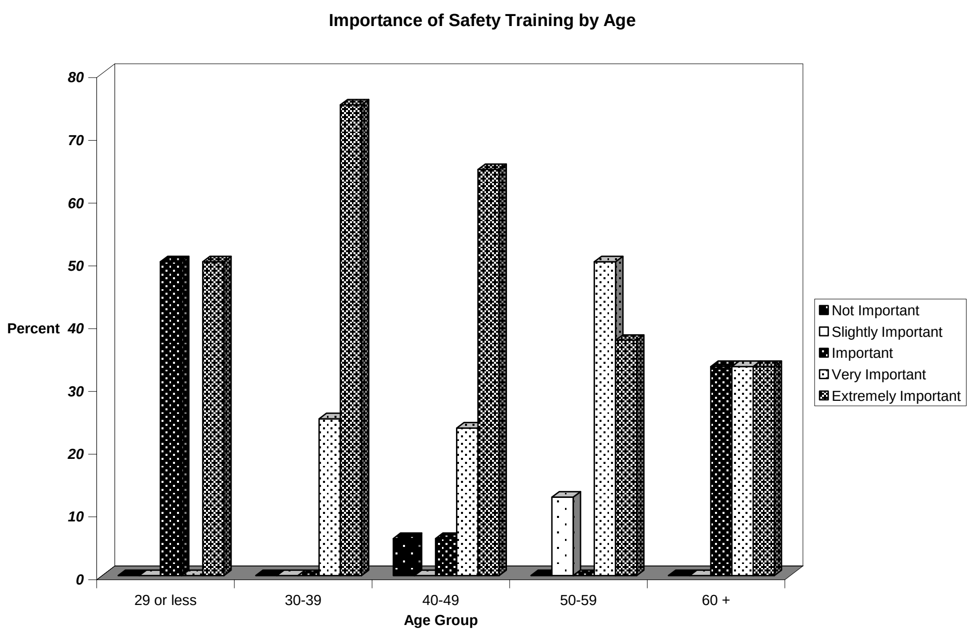


Figure 3. Importance of Safety Training by Age of Phone Survey Respondent.

Some harvesters felt increased seasonality, as well as changes in crew recruitment and turnover patterns had increased the need for formal safety training among younger harvesters.

> [T]alking about safety. All these fellas are fishing all their lives. Maybe they don't need to do courses as much as me or young people in the fishery. But I may fish two months of the year or whatever, coming up through all the time, and we don't know, we need to do safety courses, I think. I mean learn how to even set crab pots and set... new people in the fishery coming in to watch out for the risks. The young people my age don't know nothing about the fishery.

As has been found in other research, harvesters commented that safety training tends to change harvesters' perceptions of risk by increasing their awareness of particular kinds of risks, especially those related to the use of technologies, vessel stability, navigation, and liability. As indicated by one focus group participant, "The safety courses, like they open your eyes to a lot of stuff that you never seen before. You got to laugh at a scatter thing that they're showing you, but you walk away with something." Only four of our phone survey participants had done no safety courses (Lifeline, BST, MED). These four generally ranked the importance of safety training lower than the majority who had done some training. However, the sample is small and it is possible that this attitudinal difference preceded the safety training experience.

Respondents also indicated that harvesters tend to follow the example of others when deciding whether to invest in more safety equipment: "Like a few years ago you'd hardly ever see a fisherman wearing a life jacket or life jackets aboard a boat. One guy starts getting them and putting them aboard the boat the other guy gets them. It's like VHF radios, life rafts and flares and what not. You know everybody now is starting... if one gets it then the other guys says well he got it, he got it for a reason, I'm going to get one."

During the boat tours we asked the question: "How do you stay safe while fishing?" Harvesters' responses highlighted a tension between a regulatory focus on survival equipment and training and their focus on the daily requirements of fishing work. While harvesters generally positively assessed classroom-based survival training (although not always for themselves), and saw the value of navigation, communication and life-saving equipment, they also pointed to the importance of experience in knowing how to fish safely on a day-to-day basis. As one fish harvester said, there is a difference between "being smart and common sense."

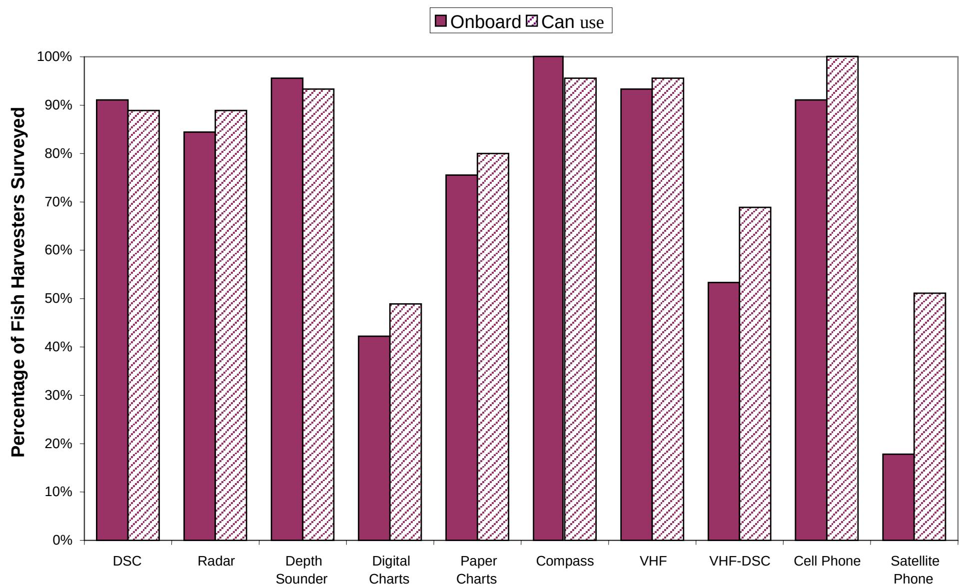
Harvesters reported numerous strategies to fish safely, including traveling to and from the grounds with other vessels, routine maintenance and related record–keeping. Harvesters also reported modifying their deck space to prevent chronic injuries by adding anti-fatigue mats or tables on which to pick cod out of their nets or sort crab thereby reducing bending and the risk of back injury. Modifications such as covering the deck floor with carpet or adding sand to the deck surface also work to prevent potential immediate injuries from slips and falls caused by slippery decks. Other strategies were built into the daily routine of work, for example, securing the boom hauler while steaming in or out. Harvesters also developed ways of managing the movement of their bodies on a moving vessel by bracing a leg against the deck. Decisions about what to wear sometimes reflected safety concerns. For example, some crew kneel to pick crab and wear kneepads to prevent injury. Harvesters referred to these strategies as using common sense, which generally refers to knowledge about safe fishing practices acquired through experience and on-board mentorship by other harvesters. Common sense is accumulated over time, and for those entering a new fishery, like crab, the accumulation of common sense takes time and often occurs by trial and error.

The high cost and limited availability of safety training were among the issues discussed in the focus groups and the phone surveys. The cost barrier was linked to harvester struggles with a cost-income squeeze linked to declining quotas, relatively low prices and increasing fishing costs not only for safety equipment and training, but also for insurance, fuel, bait, licenses, dockside monitoring and observer coverage, vessel purchase, maintenance and repair, and, in some cases, the cost of quota. Strategies for dealing with this cost-income squeeze include letting their vessel insurance lapse; cutting crew sizes – sometimes fishing alone for lobster; greater reliance on family members as crew members, and buddying-up (fishing more than one license from a single boat). Some have also increased the size of the boat share relative to the shares to crew driving down crew incomes and potentially contributing to crew turnover (CCPFH 2005).

All of these changes have potential implications for fishing safety, some positive (buddying-up) and some negative (crew turnover). There was also some indication in the focus groups that so-called trust agreements with processors (agreements where processors gain control over licenses, vessels and/or landings in exchange for credit towards vessel purchase and construction) tend to increase the influence of processors and others who are not on the vessel over decision-making in the fishery including decisions on when to fish thereby increasing risk. Processors sometimes pressure skippers to abandon common sense and begin fishing in bad weather or at night. Important implications for injury prevention arise from conflicting pressures between making a living and putting safety first. On the one hand, fish harvesters certainly recognize the need for safety equipment and training and the need to minimize the risk of injury by monitoring when, where and how they fish, as well as who they fish with. On the other hand, they were quick to point out the financial pressures sometimes associated with purchasing the equipment and responding to the requirements for training in light of the cost-income squeeze in the industry.

Surveyed harvesters were asked to indicate which safety and navigation technologies they carried on their vessels. They were also asked to indicate which items they knew how to use. All items we asked about are carried onboard by over half of the harvesters we surveyed, with the exception of Digital Charts and Satellite Phones. These two particular items are recent evolutions of older technologies, which may suggest why they are not as common. Many fish harvesters carry paper charts (76%) in place of or in addition to Digital Charts, and cell phones (91%) or VHF (93%) rather than Satellite

Phones. These newer items are most likely to be found on larger vessels that venture further offshore. Carriage of PFDs, life rafts and flotation or survival suits is still limited among those surveyed. In general, most harvesters indicated that they knew how to use these technologies (See Figure 4.).



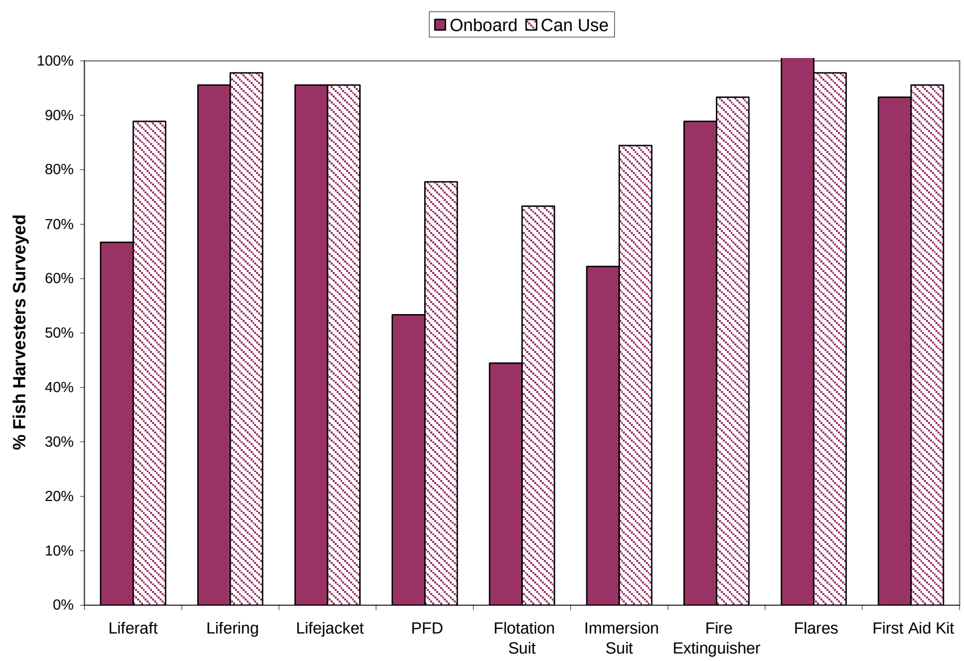


Figure 4. Carriage and knowledge of navigation, communication and safety technologies on fishing vessels in Newfoundland and Labrador.

More in depth research is needed concerning harvesters' knowledge about these navigational and safety technologies and their capacity to use them in challenging environments like an emergency. We noted a tendency for some harvesters to equate safety with owning safety and navigational technologies, an attitude that could contribute to a tendency to take greater risks and to over-reliance on the technologies based on the assumption that, should something go wrong, they will be able to save themselves and the boat. In addition, while navigation, communication and safety technologies can mitigate risk in some contexts they might also contribute to it. Thus navigational technologies, such as GPS, are very helpful when traveling to offshore grounds for gear retrieval, staying on course and reducing the risk of collision. However, over-reliance on these technologies and potential knowledge gaps related to their safe operation can undermine safety. Electronic equipment like GPS technology and laptop computers with digital charts often ceases to operate when power supplies fail and, therefore, can be useless when engines fail. Thus, harvesters should carry paper charts but not all do. In addition, GPS technologies can help plot a course and make it easy to return to particular grounds and gear but may not distinguish between water and land. Thus reliance on GPS technology has been associated with fishing vessel groundings. Finally, some types of safety equipment, such as life rafts and survival suits, take up a significant amount of space on board vessels. Space limitations on vessels under 65 feet in length sometimes force harvesters to limit the equipment they carry and compromise their capacity to store the equipment safely in places where they can access it easily in the event of an emergency.

Some focus group participants saw a tradeoff between fishing efficiency and fishing safety. "Well they could make improvements but then she wouldn't be as good a fishing boat. Like you could have higher rails on the side of your boat but then you'd have job with gear, like that kind of stuff."

Job Satisfaction and Risk

Despite the significant risks associated with fishing identified by participating harvesters, most report a high level of satisfaction with their jobs (See Figure 5.).

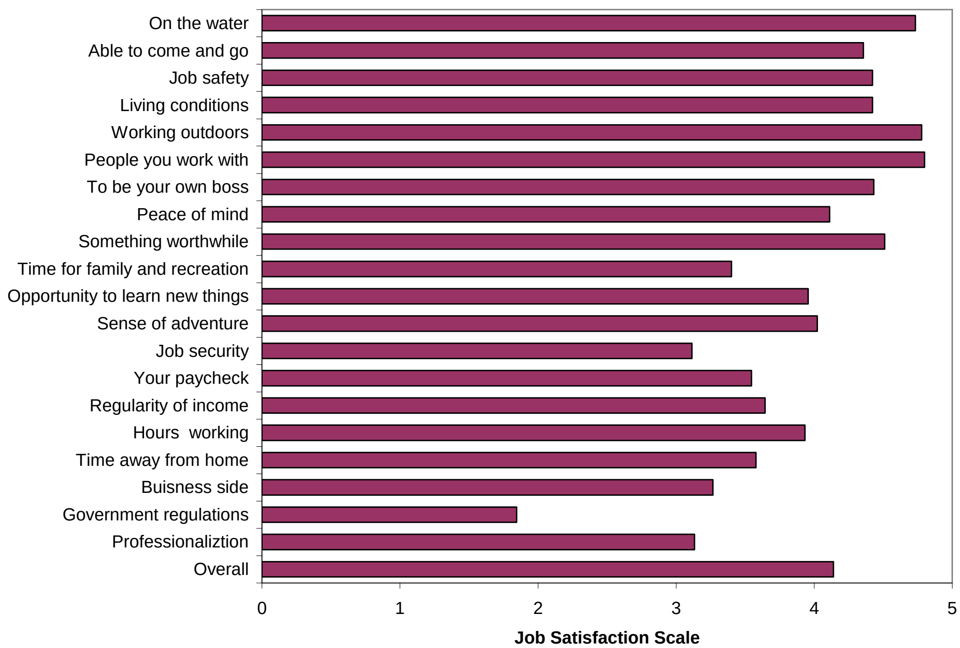


Figure 5. Mean rating of job satisfaction for various aspects of work in the Newfoundland and Labrador fisheries (satisfaction scale: 0 = very dissatisfied 5 = very satisfied)

On the survey question asking them to rate their satisfaction with different aspects of fishing, the items that scored highest on the satisfaction scale were: "being out on the water," "working outdoors" and "the people you work with." The items that scored lowest were: "government regulations," "job security," and "time for family and recreation." Interestingly, the items that scored highest in satisfaction are those that are associated with traditional notions of fishing: being outdoors, on the water, working with familiar people. Government regulations and the notion of job security are rather new developments in the fishery. Fifty-four percent of harvesters said they would definitely go into fishing all over again, but 33 percent said they would only if the industry was like it was when they started fishing. Harvesters' comments suggest they feel that they are now told when and how they should work, and that they have suffered a loss of autonomy and control in their work as a result.

Conclusion

Significantly, fishing safety regulations and training are primarily concerned with ensuring the safety of the vessel and thus minimizing the risk of sinking, collisions, fire and foundering. From a regulatory and training perspective, less attention has been paid to the role of changes in fisheries management in risk and to the fishing vessel as a work environment including workplace design and training related to ergonomics and safety practices during routine work. The management of rope is an example of a set of vessel design issues and safety practices that can play a critical role in reducing risk of injury and death but that has not received substantial attention from safety experts or research. Working on poorly designed or in poorly managed work environments can reduce the potential for common sense to mitigate risk. Attitudes towards safety training appear to be mediated by age and by experience with such training. While older harvesters and young harvesters are less likely to see safety training as very important, younger and older harvesters generally see if as very important for younger people who lack experience. We asked our phone survey participants "Do you or would you encourage your children to fish for a living?" Of the 46 surveyed, only 6 responded yes to this question. Thirty-eight said no and 2 said maybe or somewhat. These results are consistent with the findings from a recent CCPFH (2005) which suggest that traditional recruitment and apprenticeship patterns associated with the <65 foot sectors are breaking down with potentially serious implications for safety in the future.

References Cited

Binkley, M. 1995. Risks*, Dangers and Rewards in the Nova Scotia Offshore Fishery.* Montreal: McGill-Queen's University Press.

Canadian Council of Professional Fish Harvesters. May 2005. *Setting a New Course, Phase III Human Resources Sector Study for the Fish Harvesting Industry in Canada*. Praxis Research and Consulting Inc.

Fox, Nick. 1998. "'Risks', 'Hazards,' and Life Choices: Reflections on Health at Work." *Sociology* v. 32 no. 4: 665-687.

Grzetic, B. *Women Fishes These Days*. Halifax: Fernwood Publishing, 2004.

Murray, Michael, Donald FitzPatrick and Colleen O'Connell. 1997. "Fishermen's blues: factors related to accidents and safety among Newfoundland fishermen." *Work & Stress* v. 11 no. 3: 292-297.

Murray, Michael, and Mark Dolomount. 1995. "Accidents in the Inshore: Safety Attitudes and Practices among Newfoundland Inshore Fishermen." Stage 2 Report: The Survey Study. A report submitted to the Occupational Health and Safety Branch, Department of Employment and Labour Relations, Government of Newfoundland and Labrador.

Murray, Michael, and Mark Dolomount. 1994. "A Constant Danger: Safety Attitudes and Practices among Newfoundland Inshore Fishermen and Related Personnel." Stage 1: The Interview Study. A report submitted to the Occupational Health and Safety Division, Department of Employment and Labour Relations, Government of Newfoundland and Labrador.

Neis, Barbara and Paul Ripley. 1990. Trends in Fatality Rates and Losttime Accidents among Newfoundland Trawlerworkers, 1980-1988. In B. Neis and S. Williams, 1990. *Occupational Stress and Repetitive Strain Injuries: Research Review and Pilot Study*. ISER Report No. 8, St. John's.

Poggie, John J. and Richard B. Pollnac. 1997. "Safety Training and Oceanic Fishing." *Marine Fisheries Review* v. 59 no. 2: 25-28.

Whelan, Jennifer. 2005. Using harvesters' knowledge to develop an individual-based computer simulation model of the St. John Bay lobster fishery, Newfoundland. Unpublished MA thesis, Memorial University of Newfoundland.

Safer Fishing Vessel Seakeeping (Safecatch)

D. Bass[1], J. Vera[1], D. Cumming[2], and A. Akinturk[2]

[1]*Faculty of Engineering and Applied Science, Memorial University of Newfoundland*
St. John's, NL, A1B 3X5, Canada

[2]*Institute for Ocean Technology, National Research Council Canada*
St. John's, NL, A1B 3T5, Canada

Email: dbass@engr.mun.ca

ABSTRACT

In the last three-four years, the Institute for Ocean Technology (IOT) and Memorial University of Newfoundland (MUN) have joined together to establish motion profiles of the Newfoundland fishing fleet. The objective has been to develop and validate a numerical tool, called MOTSIM [13] that will be used to evaluate motion stress profiles using the notion of Motion Induced Interrupts (MIIs) (or any other similar parameter) and their impact on crew safety. This has involved conducting sea trials of representative vessels of the fleet and corresponding model tests in the wave basin of IOT (only the smallest of the vessels has been tested at IOT at this time). In parallel, MOTSIM has been further developed and validated using the full scale and experimental results. This report discusses numerical challenges encountered in simulating these trials and the model test, and reviews the methods developed to overcome these challenges. Comparisons between the numerical simulations and the full scale trials are presented. The simulations are also compared with the model test results. Based on the results, the numerical simulations seem to correlate reasonably well with the trials and the experiments. There is now sufficient evidence to have some confidence in the motion and MII predictions of MOTSIM to allow an analysis of the motion stress levels on vessels of the Newfoundland fleet to be made. An example of the methodology involving MII values to demonstrate the effect of fishing vessel length on crew comfort and safety is presented.

1. INTRODUCTION

SafeCatch is part of an umbrella initiative called SafetyNet [1] , whose aim is to understand and mitigate the health and safety risks associated with employment in a marine environment. The aim of this study is to develop and validate a numerical ship motions prediction tool with the intention of using it to assess the physical stress levels on fishers associated with vessel motions on board fishing vessels. Stress levels are evaluated on the basis of the number of 'motion induced interrupts' (MII) per minute that occur at a particular location on a boat. A motion induced interrupt is effectively a 'loss of balance' incident, where the fisher has to make a special effort to avoid 'tipping or slipping' either by adjusting his stance of by holding on (of course in some instances the fisher may well fall). Such incidents are associated with accelerations due to the boat motions and depend on where the fisher is working. The boat motions depend on the sea conditions and the shape and size of the boat. If the boat motions can be correctly predicted then so can the number of MII per minute that occur at any location on the vessel. The prediction of a 'loss of balance' incident is based on a 'rigid body' modeling of the fisher and may therefore under or over predict the 'destabilizing' effects of particular accelerations acting on the human body (which of course is flexible).

Fishing is the most dangerous occupation in Newfoundland and Labrador. Over the past decade, the rates of reported injuries and fatalities have nearly doubled. These trends have the effect of reducing the sustainability of the fishery, increasing health care and compensation costs, and straining the available search and rescue resources. The tools developed in this study should help to improve working conditions on board fishing vessels. For example parametric studies of fishing vessel designs and their optimization based on MII criteria can be carried out.

In order to achieve this objective, a number of sea trials have been conducted to establish the motion profiles for the fishing fleet of Newfoundland and Labrador. As a next step, possible correlations between motion levels and the physical/motion stress levels will be investigated based on the Motion Induced Interrupts criteria ([2] ,[3] ,[4] , and [5]). The final objective is to develop means to reduce critical motions of fishing vessels from a vessel design and operational point of view.

In this report, selected results of the correlation study between MOTSIM predictions and the sea trial observations are presented.

2. SEA TRIALS

The vessels used in the trials and their lengths are: M/V Louis M. Lauzier (39.6m), CCGS Shamook (22.9m),CCGA Roberts Sisters II (19.8m), CCGA Miss Jacqueline (19.8m), CCGA Nautical Twilight (13.7m) and CCGA Atlantic Swell (10.7m). The last four were the vessels selected from the Canadian Coast Guard Auxiliary Fleet of fishing vessels. M/V Louis M. Lauzier, on the other hand, is the training vessel used by Memorial University and is included to illustrate that some of the difficulties encountered in predicting the motions of the fishing vessels may be related to the size of the vessels.

The target sea conditions would typically range from sea state 2 to 4. Sea trials were carried out nominally 10 nm east of St. John's.

A more detailed description of the vessels and the instrumentation used in their trials are given in [6] through [12].

3. Simulations of Motions Observed in Sea Trials

In this section we describe some of the results of the simulations of motions of the six vessels. In all six sea trials involving these vessels, the seas were complex and multi-directional, making the task of representing the sea states in the numerical simulations particularly difficult and therefore open to doubt. For example identifying what was head seas proved to be no easy task. For smaller vessels the complexity of the sea state probably has more effect on the motions. The larger vessels effectively filter out some higher frequency or lower amplitude waves and possibly only respond to certain waves in certain directions.

Motions simulations were run in MOTSIM, a non-linear time domain code [13]. The code has been modified to output MII values for chosen positions on the vessel along with the six degrees of freedom motion data.

Generally the better predicted motions are pitch and surge acceleration. These are shown below for the 6 vessels. The speed of the vessels was the lower one used in the trials. For the 39.6m vessel it was at 6 kt and the rest at 4 kt.

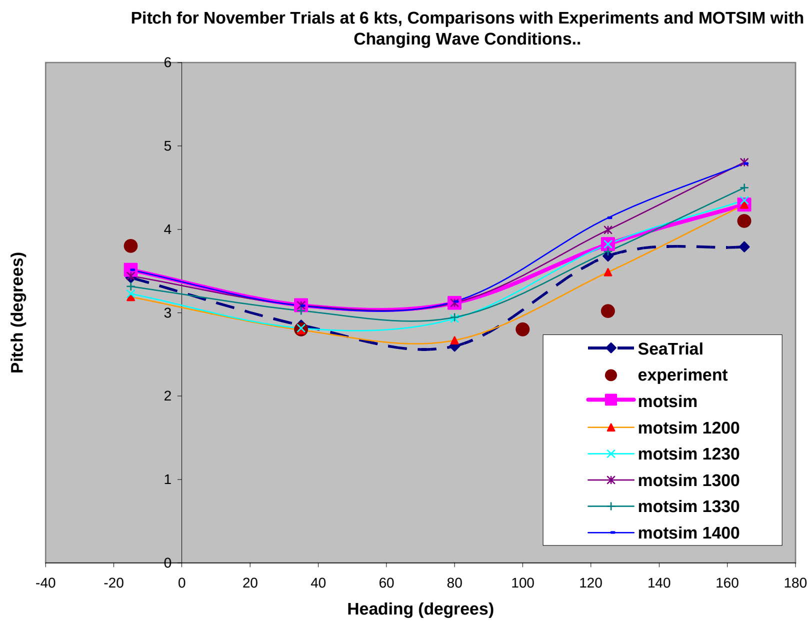


Figure 1. Pitch Motions for the Lauzier (39.6 m); Comparisons of Simulations (Neptune data), Sea Trials and Model Tests.

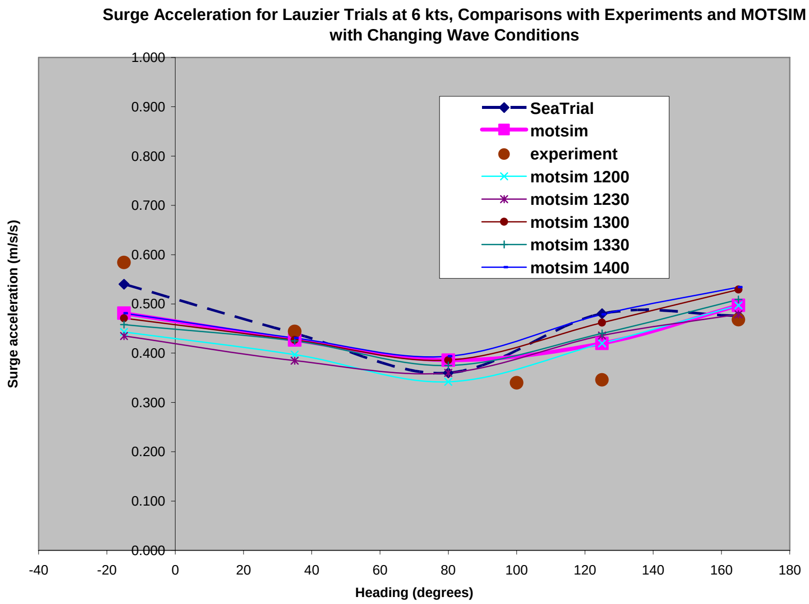


Figure 2. Surge Accelerations for the Lauzier (39.6 m); Comparison of Simulations (Neptune data), Sea Trials and Model Tests.

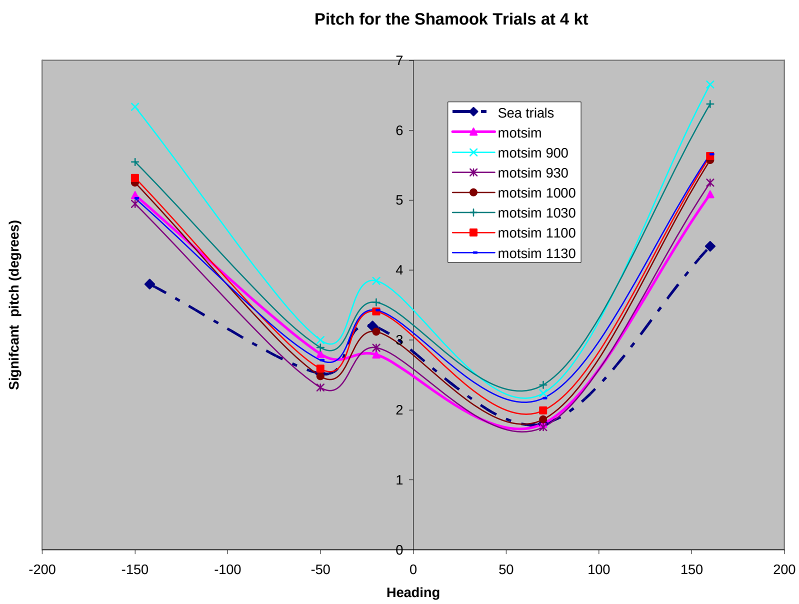


Figure 3. Pitch Motions for the Shamook (22.9 m); Comparisons of Simulations (Neptune data), Sea Trials .

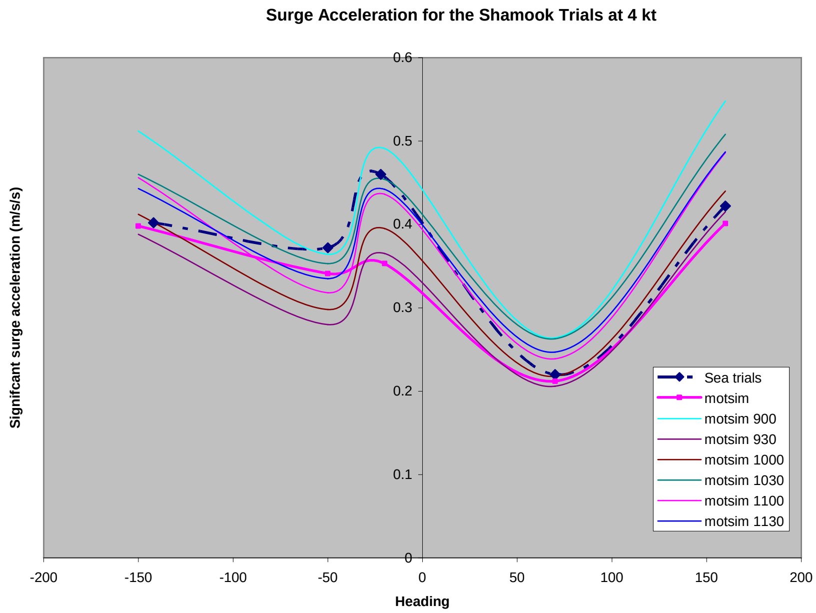


Figure 4. Surge Accelerations for the Shamook (22.9 m); Comparisons of Simulations (Neptune data) and Sea Trials.

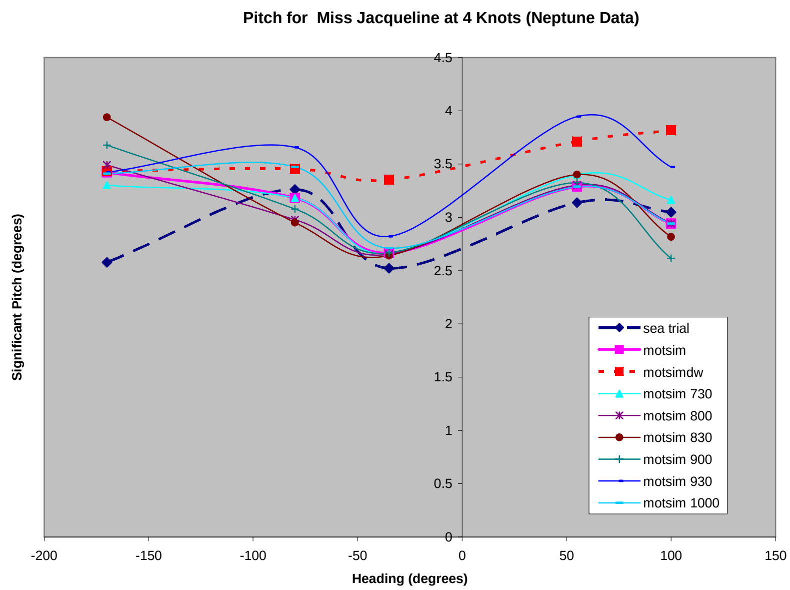


Figure 5. Pitch motions for Miss Jacqueline (19.8 m); Comparisons of Simulations (Neptune data) and Sea Trials .

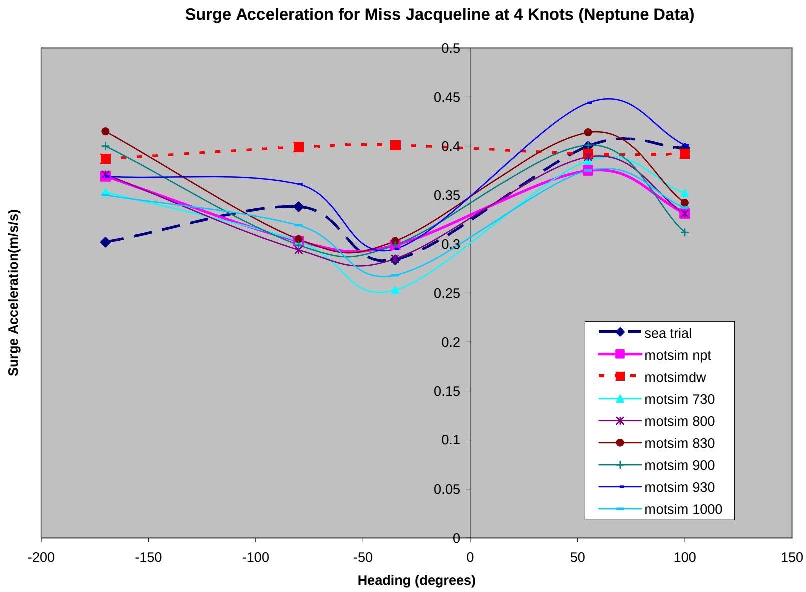


Figure 6. Surge Accelerations for Miss Jacqueline (19.8 m); Comparisons of Simulations (Neptune data) and Sea Trials.

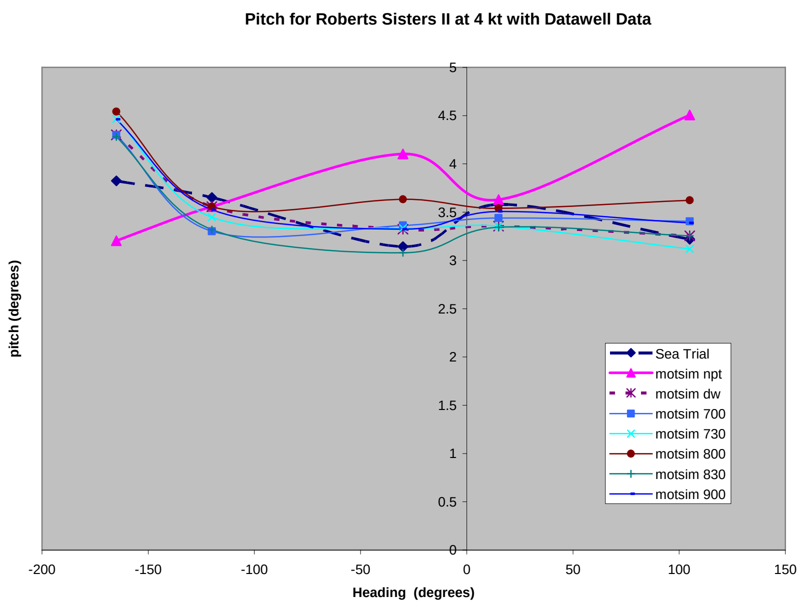


Figure 7. Pitch motions for Roberts Sisters (19.8 m); Comparisons of Simulations (Datawell data) and Sea Trials.

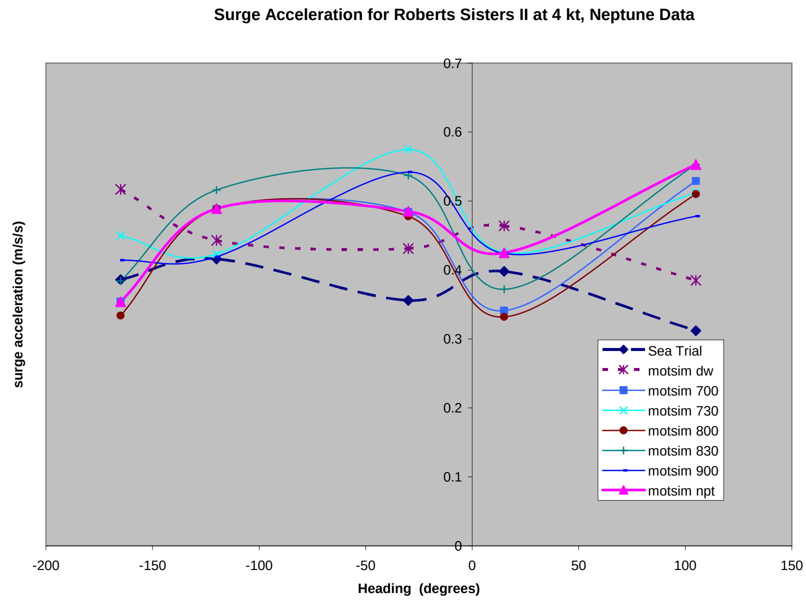


Figure 8. Surge Accelerations for Roberts Sisters (19.8 m); Comparisons of Simulations (Datawell data) and Sea Trials.

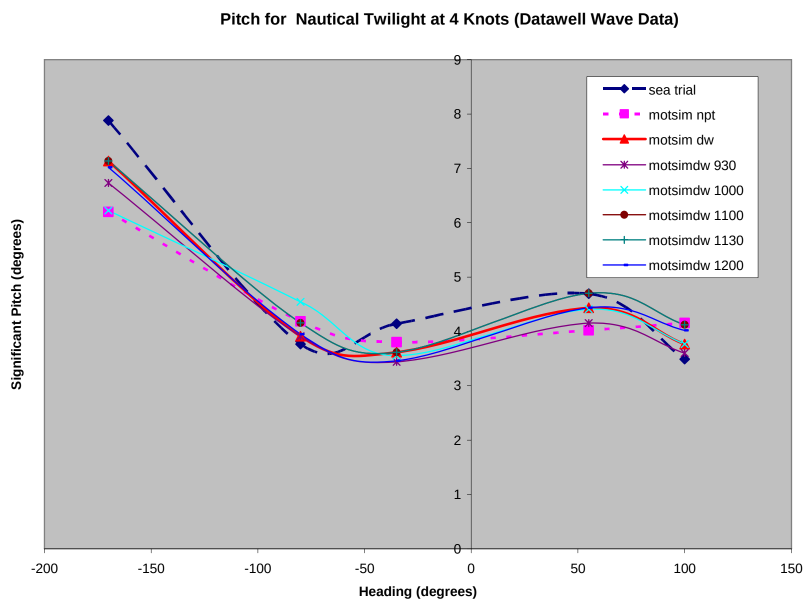


Figure 9. Pitch motions for Nautical Twilight (13.7 m); Comparisons of Simulations (Datawell data) and Sea Trials.

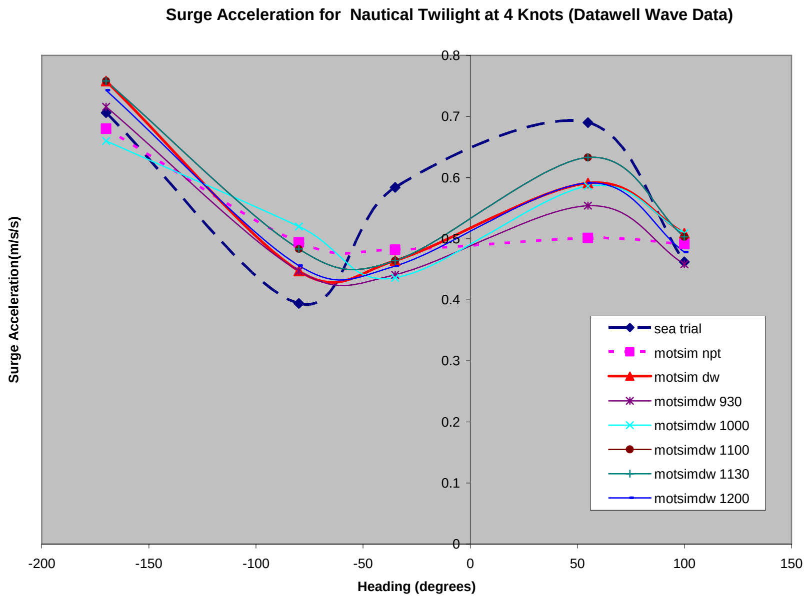


Figure 10. Surge Accelerations for Nautical Twilight (13.7m); Comparisons of Simulations (Datawell data) and Sea Trials.

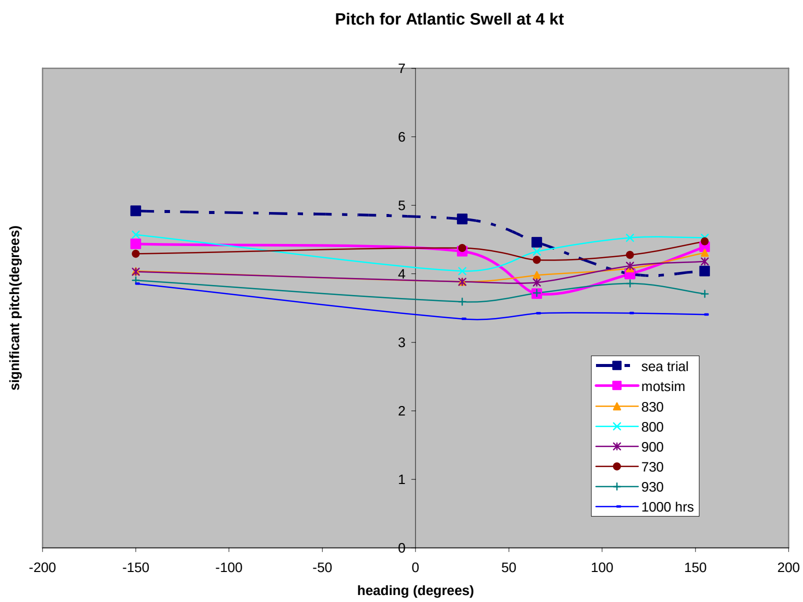


Figure 11. Pitch motions for Atlantic Swell (10.7 m); Comparisons of Simulations (Neptune data) and Sea Trials.

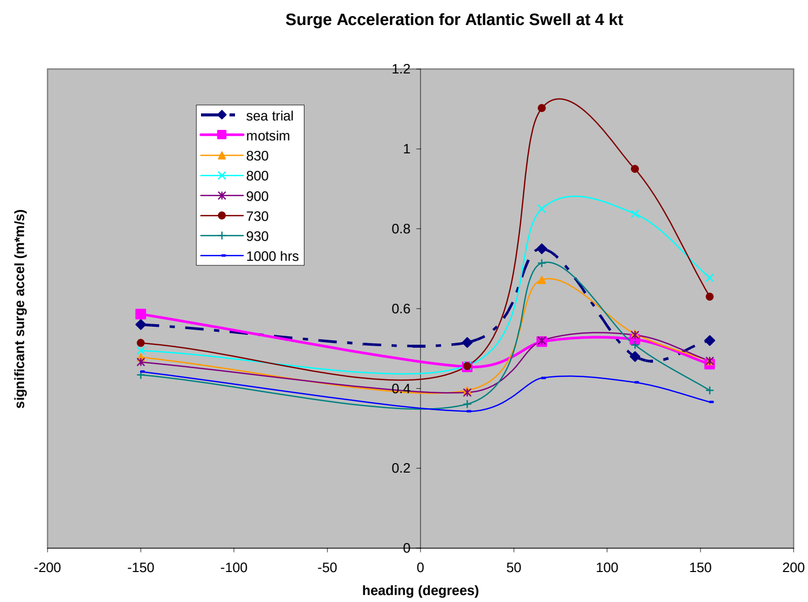


Figure 12. Surge Accelerations for Atlantic Swell (10.7 m); Comparisons of Simulations (Neptune data) and Sea Trials.

The above figures show the results of the simulations using the appropriate wave data recorded at the time of the particular sea trial (approximately). For example if the trial for the heading referred to as bow seas took place at 1200 hours then that is the wave data used to generate the simulated motions at the bow seas heading. These are labeled simply 'motsim' in the legends. Other simulations were carried using one set of wave data for all the headings. For example the 'motsim1200' legend in figure 1 indicates that the wave data recorded at 1200 hours was used to generate motions for all headings. The idea here is to show the possible variation in results due to variations in the wave field representation. In fact in some cases it is clear that the wave field was also changing over the course of the sea trials (e.g. for the CCGA Atlantic Swell trials). It should be made clear that what is referred to as 'head seas' (taken to be 180 degrees) in the trial logs sometimes came out to be quite different based on a more careful analysis of the wave and motion data. Similar remarks apply to other 'named' headings

There is in general a noticeable decrease in prediction accuracy as the vessels decrease in length. The significant wave heights ranged from around 3 m for the Lauzier trial to around 1.5 m for the Atlantic Swell, with the others somewhere in between.

In three of the sea trials shown here (CCGA Miss Jacqueline , CCGA Roberts Sisters and CCGA Nautical Twilight.), wave data were collected from two different wave buoys – a small Neptune wave buoy [14] (20 kg) and a larger Datawell buoy (75 kg). In some of the simulations the Neptune data is mainly used and shown and in others the Datawell data. In each graph, there is one set of data showing results from the other wave buoy. For example in figure 7, most of the simulations are based on the Datawell data, however there is one set of simulations (labeled ‘motsim npt’) for which the Neptune data has been used and is included for comparison. In some cases the results are very similar for both wave buoys and in others there are some clear differences. In some trials, the Neptune based simulations appeared to give better agreement with the sea trial data, but not in others. The reason for that is not clear. What is apparent from these discrepancies is that an accurate modeling of the form of the wave field is vital for good predictions of motions. Generally there were more differences in the predictions of lateral motions (sway, roll and yaw) using the different wave buoy data. These motions are more dependent on wave slope than wave amplitude and that may be less well modeled by the wave buoy wave data representation..

The worst correlation of simulations with sea trial data came from yaw motions. Fortunately yaw motions generally have little effect on the MII rate since they are relatively slow. The yaw motions in the sea trials are dependent on the form of the control parameters for the rudder autopilot and these were not known. In fact in the case of the smallest of the vessels (Atlantic Swell) the vessel was steered by the helmsman – something that is extremely difficult to simulate

4. DISCUSSION

It is apparent from the above results that motions are not always well predicted especially for the smaller vessels. Space does not permit showing all the results. It is apparent however from the above results and from those not shown that generally the correct range of values for each rotational motion or linear acceleration is predicted over the range of headings in the sea trials. For example in the case of surge acceleration for the Nautical Twilight (Figure 10), the range of surge acceleration in the sea trials is 0.4 to 0.7 m/s/s which is also the overall range of values predicted by MOTSIM in the simulations even though heading for heading the results appear less than ideal. A similar remark could be applied to sway acceleration for this vessel (see figure 13) It should be emphasized that there are some doubts over whether the data from the wave buoy(s) and its derived representation as a second order 2 parameter Fourier series represents the sea surface sufficiently well. It is possible that the representation does not sufficiently resolve the changing sea state in the time domain even though it may be adequately resolved in the frequency domain (from a statistical perspective).

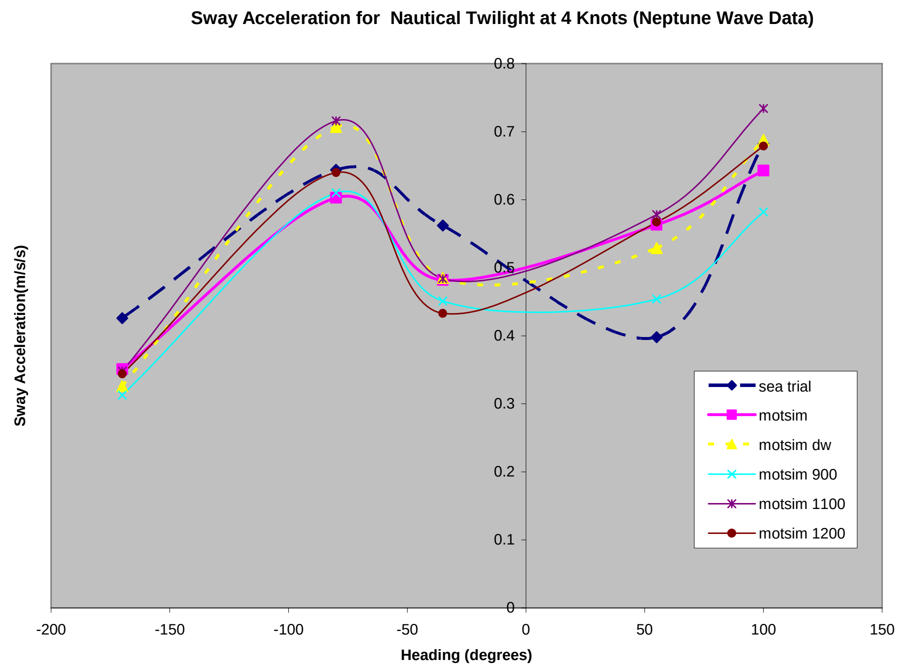


Figure 13. Sway Acceleration *Nautical Twilight*

The motivation for the study was related to the possible assessment of the hazards associated with motions (calibrated from MII's) of fishing vessels using MOTSIM simulations. The question then arises as to whether the above results would give credibility to MII predictions. Firstly it is unlikely that such complex sea states as encountered at the sea trial site (10 nm from St. John's) would persist as the vessels move further offshore. For more unidirectional seas the results (heading for heading) are likely to be better. The Atlantic Swell will probably remain in complex seas and will likely be the most difficult to predict MII's for. Nevertheless it may be fairly claimed that the motion predictions for all these vessels are in the 'right ball park' and that MII's are likely to be at times over-predicted and at others under-predicted, resulting in a generally fair assessment of their magnitudes on average. Note that generally yaw does not play a significant role in MII determination.

An example from a recent study illustrates the usefulness of the predictions in assessing motion stress profiles on vessels of varying lengths and displacements.

Figure 14 shows MII/minute averaged over 5 locations within 5 m of amidships for 4 vessels of varying lengths but similar designs. The parent hull form is a 65 footer (19.8 m) (Chidley). The 80 foot and 100 foot Chidley boats are stretched versions of the parent hull. There is also an 80 foot vessel (designed by TriNav) that is of a similar design but of a deeper draft. The high MII/minute for the Chidley 65 footer are for the vessel at a light displacement (shrimp condition). When the vessel is at a deeper displacement, the comfort level of the vessel increases considerably.

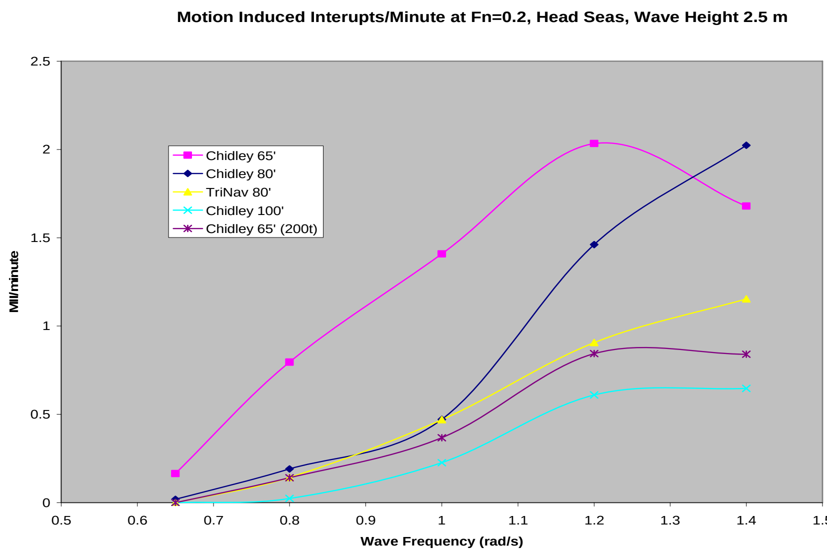


Figure 14. MII/minute for Fishing Vessels of Varying Length in Head Seas.

MII/minute values of greater than 1.6 are considered to be indicative of a significant level of risk of accidents occurring. The 65 foot vessel will quite often be sailing in conditions where this MII level is likely to occur (2.5 m waves are common in spring and fall). The MII/minute values given here are based on averaging values taken from 5 different positions on board the vessel. There are then clearly positions where this level is exceeded. One such position would be in the wheelhouse or on the shelter deck. Positions not considered here, where the levels would be higher, include those further aft and further forward.

The effect of vessel length on MII levels is apparent from figure 14. From other work that has been carried out, it is apparent that these levels increase further for vessels in the 35 foot to 45 foot range. On such vessels fishing in early spring and late fall, when wave conditions are more severe, accidents are more likely to happen. In fact the smaller vessels generally are unable to fish very often at these times of the year, not so much explicitly due to the risk of accidents but rather because the fishers are simply unable to perform requisite fishing tasks due to the excessive motions of their boats.

5. CONCLUSIONS

In this report, some of the results of the correlation study between a time domain numerical code –MOTSIM, and sea trials are presented.

Overall, it seems that the ranges on the motions obtained by MOTSIM match well with the observed ones from the sea trials. Heading for heading the results, on the other hand, appear not so well predicted. Among the reasons suspected for this are

- Doubts on the accuracy of the representations of the measured sea conditions by the wave buoys. Though these representations of the sea states may be adequately resolved in the frequency domain, their time domain representations may not be sufficiently well resolved.
- It appears that the larger the vessel size is, the better the predictions are.
- Issues related to whether an autopilot was in use during the trials or not. Simulating the response of a human skipper has been proven to be very difficult.

In conclusion, the predictions of the present version of MOTSIM are generally better for larger size vessels, while motion predictions for smaller vessels remain a further challenge. It is not clear whether this is more a function of the difficulty in adequately representing (or reproducing) the sea conditions or some general inability of Motsim to predict motions of these small vessels due to an inadequate modeling of the hydrodynamic interactions of waves with small craft. Nevertheless MII predictions for all these vessels should give reasonable estimates of the levels of motion stress to be expected in typical working conditions.

6. FUTURE WORK

At present there is only one set of experimental tests with which to compare the simulations and fishing boat sea trial data (Atlantic Swell). The Lauzier experimental tests were part of another project. The tests on the smallest boat were probably the most difficult to carry out because of the greater sensitivity of the vessel to the wave field representation. It is hoped that model tests on the two 65 foot vessels will be carried out sometime in the next year or so. From these, one might better be able to judge how well tests in a wave tank can reproduce sea trial observations.

As far as validation of Motsim is concerned it would be worthwhile carrying out more sea trials further out to sea where the wave systems encountered are likely to be somewhat less complex. This would help in pinpointing some of the reasons for the discrepancy between the Motsim predictions and the field observations.

Acknowledgements

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REFERENCES

[1] "SafetyNet – a Community Research Alliance on Health and Safety in Marine and Coastal Work", www.SafetyNet.MUN.ca, September 2003.

[2] Stevens, S.C., Parsons, M.G., "Effects of Motion at Sea on Crew Performance: A Survey", SNAME Publication Marine Technology, Vol. 39, No. 1, January 2002, pp. 29 – 47.

[3] Boccadamo, G., Cassella, P., Scamardella, A., "Stability, Operability and Working Conditions Onboard Fishing Vessels", 7th International Conference on Stability of Ships and Ocean Vehicles, Launceston, Tasmania, Australia, February 7-11, 2000.

[4] Crossland, P., Rich, K.J.N.C., "A Method for Deriving MII Criteria", Conference on Human Factors in Ship Design and Operation, London, UK, September 27 – 29, 2000.

[5] Graham, R., "Motion-Induced Interruptions as Ship Operability Criteria", Naval Engineers Journal, March 1990.

[6] Cumming, D., and Fleming, T. "Practical Considerations Related to Carrying out Seakeeping Trials on Small Fishing Vessels". In the Proceedings of the 7th Canadian Marine Hydromechanics and Structures Conference, Halifax, September 21-22, 2005 (in CD).

[7] Cumming, D., Hopkins, D., Williams, J., and Janes, G. "Description of Manoeuvring, Propulsion and Seakeeping Trials Carried out on the M/V Louis M. Lauzier July – November 2001" Technical Report, National Research Council Canada, Institute for Ocean Technology, TR-2003-13, 2003.

[8] Barrett, J., D. Cumming, and D. Hopkins, "Description of Seakeeping Trials Carried Out on CCGA Atlantic Swell – October 2003", IOT Trials Report TR-2003-28, December 2003.

[9] Cumming, D., Hopkins, D., and Barrett, J. "Description of Seakeeping Trial Carried Out on CCGS Shamook - December 2003" IOT Trials Report TR-2004-1, December 2004.

[10] Fleming, T. and D. Cumming, ”Description of Seakeeping Trial Carried Out on CCGA Nautical Twilight – November 1, 2004”, IOT Trials Report TR-2004-13, December 2004.
[11] Cumming, D. and T. Fleming, ”Description of Seakeeping Trial Carried Out on CCGA Miss Jacqueline IV – October 2004”, IOT Trials Report TR-2004-15, December 2004.
[12] Janes, G. and D. Cumming, ”Fishing Vessel Sea Trial Stand-Alone Data Logging System”, IOT Lab Memo LM-2003-27, September 2003.
[13] Pawlowski, J.S. and D.W. Bass, ”A Theoretical and Numerical Study of Ship Motions in Heavy Seas”, SNAME Trans., Vol. 99, 1991, pp. 319-352.
[14] Sentry Wave Buoy Operation Manual, Neptune Sciences, Inc., Slidell, Louisiana, USA.

INJURED FISH HARVESTERS

Introduction

Commercial fishing is one of the most dangerous occupations in the world. Mortality data from a range of countries confirm the worldwide nature of this problem. The high rate of fatalities and injuries has led to a concerted attempt by national and international agencies to introduce regulations and training programs designed to improve safety in the industry. There is evidence that these measures have met with some success. However, a large number of fish harvesters continue to be injured in the industry every year. Those who are seriously injured have little prospect of alternative employment since they often live in small isolated fishing communities. Little is known about the challenges faced by these injured fish harvesters.

Aims of the Study

This study had four main aims:

1. to describe the character of the fish harvesters' work and the most common type of accidents and injuries;
2. to describe the impact of the injuries on the fish harvesters' everyday lives;
3. to describe the fish harvesters' experience of current support services;
4. to develop recommendations for improvements in support services for injured fish harvesters.

Research method

The Workplace Health and Safety Compensation Commission (WHSCC) identified from their records a total of 206 fish harvesters who were currently receiving extended earnings loss (EEL) benefits. These benefits are available for injured workers who are unable to re-enter the workforce or are unable to earn as much as they earned before their injury. A package of information about the project including a summary statement, a letter of support from the fish harvesters' union and another from the WHSCC was sent to these injured fish harvester. To maintain confidentiality, these packages were distributed by the WHSCC. A total of 35 fish harvesters replied indicating that they were interested in the study. These individuals were then contacted and a suitable time for the interview arranged, if possible. Nine potential participants were not able to take part in the study for various reasons leaving a final total of 26 participants who were interviewed. The participants were drawn from 22 communities around the island of Newfoundland and were drawn from both the in-shore and the deep-sea fishery. Individual interviews were held with the injured fish harvesters. They were conducted in the fish harvesters' homes. Each participant was initially invited to describe his or her entry into the fishing industry, their experiences of being a fish harvester, the accident or accidents, the impact of the consequent injury on their everyday lives, their dealings with workers' compensation system and other support services, and their overall thoughts on fishing and safety. All of the interviews were tape-recorded and subsequently transcribed for analysis. The findings are derived from this sub-sample who may not be fully representative of all injured fish harvesters. All but two of the participants were male; 15 had worked in the deepsea fishery and the rest in the inshore fishery; they ranged in age from 46 to 61 years and had been on disability benefit from 4 to 23 years. This report does not provide the perspective of service providers and the various challenges they experience. Despite these caveats, the study provides an opportunity to identify the concerns expressed by injured fish harvesters and how they are managing disability in their lives.

Analyses

Each of the interviews was read and a broad coding scheme developed. The transcribed interviews were then entered into a text analysis software program that allowed a more detailed analysis of the interviews. A review of these codings identified a number of key themes. Following the analysis the major findings were reviewed and a series of recommendations developed. These were designed to address the concerns raised by the fish harvesters. Subsequently three regional meetings were convened at which the findings and recommendations from the study were presented to the study participants. A total of nine people participated in these group discussions. In addition, the findings were presented at a meeting with officials of the WHSCC. A number of suggestions were made by the participants at these meetings and these were integrated into the final report.

FINDINGS

Life as a Fish Harvester

Background

Fishing is a family and community concern. Fish harvesters grow up in a family and in a community where fishing is the dominant occupation and has been for generations. From an early age, they often have accompanied their father or other relative going fishing. The injured fish harvesters recalled that when they left school, often as early as 11 or 12 years of age, they started fishing. Some recalled participating in the seasonal fishery off Labrador and other parts of the province. Some tried in-shore fishing initially and then moved to the deep-sea. It was not unusual for those in the off-shore fishery to have tried work elsewhere but then, on return home, to have got work on a dragger. Thus for both types of fish harvesters, fishing was their primary experience of work. It was an occupation that many of them had inherited from their parents. Many said they found it difficult to imagine an alternative. It was also an occupation that was rooted in their community and in their traditions. For this reason, to be injured out of the industry was a very disorienting experience.

Being a Fish Harvester

All of the fish harvesters stressed the intense satisfaction they had gained from their work. There were several reasons for this satisfaction including the sense of freedom, the excitement, the connection with the sea, and the hard work. There was a certain resentment against what they considered was a popular stereotype of the lazy fisherman. The deep-sea fishery was well paid. Although the hours were long there was great satisfaction in getting well-paid for it. This was especially the case in communities where low incomes were more the norm. The deep-sea fishermen also enjoyed the camaraderie they felt with the other crew members; they were all in this together.

Comments
All of the injured fish harvesters had a very close attachment to the fishery. To understand the impact of injury on their lives it is necessary to connect it with the severing of their strong attachment to the industry. Their whole identity and lifestyle and that of their families were closely intertwined with the fishery. They went to sea at an early age with family members and they worked year round on different aspects of the fishery. They defined themselves as fish harvesters.

Accidents and Injuries

Type of accidents
The participants reported a variety of accidents. The most common types were slips and falls on the boat and on the wharf. Accidents involving equipment or machinery on the boat or onshore were often mentioned. Several of the deep-sea fishermen were injured when equipment or doors fell on them. This often happened in bad weather. Out at sea, with an unstable surface the fishermen often got into a rhythm of working that could lead to accidents.

Causes of accidents
The primary cause of accidents mentioned by the in-shore fish harvesters was the pace of work that many of them followed. The reason for this was that because of the seasonal system they had to maximize their catch within a short period. More recently, various quota systems have been introduced but previously it was a free-for-all once the fishing season opened. Those who worked as crew on the larger boats felt that the skipper often exerted undue pressure on the crew creating greater risk of accidents. Those in the shrimp boats referred to inexperienced crewmembers. These so-called 'greenhorns' often got in the way of more experienced crewmembers and created accidents especially when things got hectic out at sea. Despite this, there was little effort by skippers to improve the training of new crewmembers. Not surprisingly, in view of the high rate of slips and falls, the inshore fishermen often identified greasy decks as a major cause of accidents on boat. Coupled with the slippery decks was the weather that could change quickly, increasing the risk of accidents.

The deep-sea fishermen referred to the dangers of fishing in bad weather. The problem was that when they put to sea the weather might be fine but it could change rapidly. The fishermen felt that many skippers continued to fish in bad weather despite the dangers to their crew. Many of the dragger fishermen referred to the long hours they worked when out at sea. This meant that they were often tired at work and were more likely to be careless. The hours of work on board trawlers used to be very long, indeed some of the fishermen reported that they often had little time for sleep. Experience came with years of fishing at sea. But, conversely having inexperienced crew men could be a hazard. The challenge lay in hiring a balanced and experienced crew. The skipper was often a good judge but many times he was not involved in hiring. Fortunately, there had been improvements over the years and the development of a more professional fish harvester. The union played an important role in this change. The skipper played a central role on the deep-sea boats. Many of the injured draggers reported that the skippers were often harsh and uncaring for their crew. The attitude of the skipper was reflected in the overall operation and maintenance of the vessel.

Out at sea the fishing boat is constantly in motion. In order to do their work the fishermen have to hold their bodies in a certain way so as to maintain their balance. The fishermen felt that this in itself could cause wear and tear on them physically. Related to this were the cramped working conditions many of the fishermen had to work in.

Comments

These findings confirm that the primary types of accident are those involving slips, falls and encounters with equipment and machinery that can occur both on board the ship and on the wharf. When the pace of work is relaxed and the weather is calm, such accidents can often be avoided. But the nature of the fishery is often frenetic and rushed which can increase the risk of accidents. However, even when completing the most routine task, e.g. getting on or off a boat, there is the risk of an accident occurring.

Both groups of fish harvesters also emphasized the role of the skippers who themselves were under considerable pressure to maximize the catch even in dangerous waters. There were many stories of careless or ruthless skippers whose main concern was the size of the catch rather than the safety of their crew. The skippers could potentially play a central role in reducing accidents in the industry.

Disabled Fish Harvesters

Impact of injury

Serious injuries had a major impact on the lives of the fish harvesters. The initial shock was followed by an open-ended period of readjustment. Most of the fish harvesters could vividly recall the injury they had incurred. They could recall the actual event and being informed that they could no longer fish. This initial shock was compounded by the realization that they could not go back to sea. These early days post-injury were described as unreal. For many of the fish harvesters, the shock continued for an extended period. The dramatic impact of the injury on the lives of the fish harvesters was due to a range of losses. These included

Loss of identity: In view of the strength of their association with the fishery it was not surprising that many of the fish harvesters felt that the loss of their identity and the whole lifestyle associated with the fishery was the most negative impact of being injured out of the industry.

Loss of purpose: A common feeling expressed by the fish harvesters was the loss of a purpose in their lives. Previously, their work gave their lives a sense of purpose but now they felt adrift.

Loss of physical ability: The fishermen had been proud of their physical prowess and their ability to perform a wide range of strenuous tasks with ease. Now they felt frustrated that even the most menial tasks took a lot of effort.

Loss of financial investment: There was the loss of daily routine and the frustration at the loss of considerable financial investment.

Loss of income: The limited income from Workers Compensation did not compensate for the loss of income they suffered as a result of the injury. The limited income support they currently received was inadequate especially since they needed extra support because their physical disability limited their ability to perform everyday tasks.

Loss of opportunity: Related to loss of income was the loss of opportunity. Many injured fish harvesters were particularly frustrated that they had been injured at that time in their career when they expected to make big gains.
Loss of family role: Further, the reduced income had a major impact on the lifestyle of the whole family. They could no longer play the breadwinner role in the family. This meant they felt awkward with both their children and their partner. In addition, rather than being at work for most of the day he often found he was drawn into conflict with his wife and children.

The Disabled Life

The most common long-term impact was depression. Many of the fish harvesters felt very depressed. Some had sought treatment with little success. Several of the harvesters reported on-going pain. Often their sleep was severely disrupted. For some, their injury substantially limited the extent to which they could do anything. Instead, they spent lengthy periods lying on the sofa. Most of the in-shore fishermen reported the difficulty in establishing a new routine. Even the smallest task required considerable effort. A lot of time was spent watching television and reading newspapers or books for those who could read. Some of the men took up family or household responsibilities, e.g. taking children to school and doing some domestic chores. The injured women fish harvesters attempted to develop their domestic skills but felt restricted because of their injury. Some had family or friends in their community and they met with them regularly. Some tried to maintain social relations with colleagues in the community, but they found this difficult or frustrating. One particular frustration was that they felt that their neighbors questioned the extent of their injury. A popular past-time was going for a walk around the community. Despite the depression and the pain, the injured fish harvesters accepted after a long period that felt that life had to go on. They began to develop strategies for developing a new life. At a certain stage they felt they had to begin to look to the future.

Comments

The injury had a major impact on the lives of the fish harvesters. They are hard-working people with responsibilities and feel that they do not disserve such misfortune. The stages of adjustment to the injury and subsequent disability are similar to those identified in other studies on the impact of traumatic events. In the case of the fish harvesters, fortunately various forms of income support have alleviated some of the financial concerns. However, over time the amount of financial support declined leading to a more restricted lifestyle. There also remains the more social and psychological concerns around identity and purpose in life. This was something that pervaded the accounts of the injured fish harvesters. An important challenge was the fish harvesters' relationship with their peers and with their family. The lack of their ability to work in the industry meant that they felt that they could not participate in the everyday social life with other fish harvesters. Some of them felt that their peers began to treat him with suspicion. This reaction often led to feelings of shame and anger. Together these feelings can help explain the depression experienced by many of the injured fish harvesters. The challenge was finding another way they could play an important role in their family and in their community. The partner played a very important part in dealing with this challenge.

Rehabilitation

Compensation system

Since they could no longer work, the injured fish harvesters turned to the workers' compensation system for financial and other forms of support. This was an agency with which few of them had had previous experience. Now they found that engagement with it took up a large amount of time especially in the initial stages. They often found these encounters to be frustrating.

Lack of respect: An on-going complaint was the perceived lack of respect and suspicion shown not only by some of the caseworkers but also by neighbours. These concerns overlapped since neighbours sometimes contacted compensation system to express their suspicions and they in turn sometimes reassessed the claim or conducted surveillance of the injured worker. Since many of the fish harvesters had left school at an early age they often found it difficult to read some of the forms provided. They also found it difficult to deal with the bureaucracy. The spouses of the fishermen were also frustrated. Related to this perceived lack of respect was the lack of continuity in staff they dealt with. It seemed that either when making inquiries they were transferred from one staff member to another or they had to go through a laborious process to contact a specific individual.

Lack of understanding: A second complaint was the perceived lack of understanding of the nature of the disability. This applied to both the physical and psychological dimensions of it. It was felt that the WHSCC personnel tended to under-estimate the seriousness of the injury. A frequent complaint was the characterization of the disability as purely psychological.

Amount of compensation: A constant source of frustration was over the amount of compensation. The rules regarding rate of compensation seemed unclear and many fish harvesters reported what seemed to them to be arbitrary cuts in their rate of compensation. Some workers had turned to legal sources to obtain advice but found that this was very expensive. Others had tried to bring their spouses to meetings but found that they were not welcome.

Pressure to return to work: The orientation of staff seemed to be to get the injured worker back to work despite evidence that this might be foolhardy. Associated with reports of pressure to return to work was the claim that case workers seemed to ignore medical advice. This was coupled with an apparent ignorance of the type of work performed by the fishermen. If it was apparent that the fish harvester could not return to the industry then it was felt that they were over-pressurized to find alternative employment. A frequent complaint from many of the fishermen was the job search required by the compensation system. It was felt that this was a futile exercise in rural Newfoundland and demeaning to them.

Retraining: Several of the deep-sea fishermen had participated in some form of retraining, but all of them found it to be a waste of time for different reasons. The older workers felt that substantial retraining at their age was not worthwhile. The major challenge was that most of the fishermen had limited education. If they were injured in their middle years then the value of further education was problematic. Despite this, some fishermen felt that there must be other alternatives to lengthy periods of further education – something that would connect with their substantial experience in the fishery.

Type of work: Although they recognized that they could not return to the fishing industry, the injured fish harvesters still wanted a job with some of its qualities such as freedom and independence. Some of them had approached their former employer in the hope of getting some part-time employment ashore but were rejected. This was particularly galling since they felt they had worked for so long for that employer who did not seem to want to accept any responsibility.

Unpaid work: Many of them felt frustrated because of what were perceived as restrictions on the amount of unpaid work they could do, such as jobs around the house. Frustrated with the compensation received many fish harvesters were drawn into a lengthy appeals process. This in itself was very frustrating since it prevented them from addressing what they could begin to do with their lives. Several of the fishermen reported how their frustration with the compensation system turned to anger and an ongoing struggle with them to obtain better benefits.

Treatment

Several of the injured in-shore fish harvesters recalled in detail their encounters with the medical system. This was often frustrating since after assessment by various specialists and for some a range of surgical treatments, there was little, if any, improvement. Many of them had also received a number of sessions of physiotherapy. Some thought that this was beneficial, but access to it was limited. Some thought that it could be better organized. Others felt that the therapy was not beneficial. A common problem was the location of specialist services in St. John's. Some reported use of local services, e.g. Fit for Work. However, these were also not considered particularly useful.

Comments

These reports of the injured fish harvesters illustrate that for many of them their initial distress at the injury is compounded by their frustration with the social and health system. They defined themselves as hard-working individuals who had paid their taxes and thus were entitled to support and compensation from the state for their injury. Instead, they often encountered suspicion and lack of respect. People generally believe that they get what they deserve. Thus if they work hard they expect to be rewarded and if they are not, or even worse encounter negativity, they react with frustration and anger. The anger of the injured fish harvesters was directed at the personnel of the compensation system who seemed to have little understanding of their situation and often treated them with distrust. The failure of various forms of treatment only contributed to feelings of frustration with the system. Often the injured fish harvesters felt alone and even rejected by society. An awareness of such feelings can assist in the design and provision of more sympathetic services. In their dealings with bureaucracy people expect a fair procedure, adequate information, fairness in interpersonal relationships and a fair distribution of rewards and punishments. If this is not th case they become dissatisfied with the system. This dissatisfaction can be expressed in terms of withdrawal or anger. In the case of many of the injured fish harvesters a frequent complaint was the apparent unfairness in procedure, the lack of information and the lack of respect shown by staff. Often they complained about the seemingly arbitrary way in which made decisions. The rules and regulations seemed confusing or obscure. In addition, the extent of compensation often seemed unfair. This was especially the case for those fish harvesters who previously had been used to a high level of income. Attention to these rules of justice could assist in the development of a more accepted system.

Looking Forward

Fishery

The lure of the sea was still strongly felt by the injured fish harvesters. Many years after they had been injured out of the industry, they still longed to return to it but increasingly they recognized that their future was not at sea. Indeed, for most of them the prospect of getting any job was slim. For the few who had managed a partial return to the industry, the satisfaction was intense. For those who had reconciled to the prospect of a life ashore, the aim was to get some sort of job – or more importantly, a 'meaningful' job. As time went on they had gradually reconciled to the idea that they could no longer dream of returning to a life at sea:

Prevention of Accidents

Some felt that fishermen need to take more responsibility for their actions and be safety conscious. Those who had worked on the larger boats felt that it was the responsibility of the skippers. An important issue was the design of the fishing vessel. Some felt that the very size of many in-shore fishing boats was a danger in itself especially with more fishermen fishing further offshore. In addition, there was need to maintain the boats. In view of the large number of reported slips and falls several of the fishermen thought that steps should be taken to develop a less slippery surface on boats. Related to this was the increasing use of machinery in the in-shore fishery. Fish harvesters had to be aware of the dangers of new machinery: Accidents often happened when the fishermen were under pressure. There was a need to slow down. A related factor was the need to insure that fish harvesters had sufficient financial support. It was felt that the pressure to cover all their costs forced many fishermen to take unnecessary risks. Since many accidents occur on wharves, it was also important that they were well maintained. In addition, simply getting off and on boats could be dangerous. Some of the fish harvesters adopted a more fatalistic attitude and felt that there was little that they could do to prevent accidents at sea.

The deep-sea fishermen were more skeptical of the possibility of substantially reducing the rate of accidents. It was widely agreed that there had been improvements in the deep-sea industry. In particular, the men referred to the improvements in working shifts. Several fishermen referred to the progressive role of the union in enforcing safety standards. They felt that new fishermen had to be made more aware of their own role in increasing safety standards. Once again, the issue of making the ship decks less slippery was stressed. These are metal ships which are constantly washed by seawater. There was a need to take steps to reduce their slipperiness. Although it was felt that skippers today were not as vicious as in previous times unless they were restrained somehow, the risk of accidents remained. Now with the introduction of shorter hours, it was felt that it was safer on board trawlers. It was stressed that the company had an important role to play in improving safety standards.

Service Improvements

Now that they were beginning to accept that they would not return to the industry, some of the fish harvesters were able to reflect on possible improvements in service provision. The most popular was local access to specialist services. Many injured fish harvesters were very angry at the service provided by various staff involved in compensation claims and rehabilitation. They were particularly frustrated at the apparent lack of awareness by staff of the significant long-term impact of the disability. They felt that staff should be trained in handling these broader issues. Since a frequent complaint concerned the adequacy of compensation, it was not surprising that many of the injured fish harvesters would like to see increases.

Comments

It is apparent that the injury has a long-term impact on the lives of the fish harvesters. Isolated in small fishing communities many felt that the future held few prospects for them. Years after the injury they felt frustrated at their missed opportunities and the way they had been treated. They still maintained an intense interest in the fishing industry but felt that their contribution had been ignored. In the initial stages after the injury most of the fish harvesters clung to the hope that they could return to the industry. Then as they began to grasp the character of the disability, they began to develop strategies of dealing with it. Then they began to explore the opportunities posed by the disability. Of course, this sequence of reactions is not linear but depends upon social support and opportunities. Awareness of the changing reactions offers the prospect of designing appropriate interventions to improve the quality of life of the injured fish harvesters. At the early stages the injured fish harvester will be very resistant to advice designed to consider alternative opportunities. Their experience of the various support staff only serves to heighten their frustration and anger. But over time they begin to realize the prospect of return to the fishery is unlikely and they begin to consider alternatives.

RECOMMENDATIONS

Background

Based upon the information collected in this study, it is evident that many injured fish harvesters continue to experience substantial distress extended periods after the initial injury. The following recommendations are designed to alleviate some of the problems they have experienced and hopefully contribute to an improved quality of life for them and future injured fish harvesters. Research on both the experience of fishing and on what it is like to be injured out of the industry remains limited.

- There is a need for an ongoing program of research designed to increase our understanding of and contribute to improvements in the quality of life of fish harvesters, both able and disabled, and their families.
- There is a comparable need to investigate the experiences and perspectives of the various providers of services for injured fish harvesters.

Life as a Fish Harvester

- Support workers should be knowledgeable about the character of the fishing industry and of the fishers' intense attachment to it.
- Support workers should be aware of the self-reliant character of fish harvesters and their sensitivity to the charge that they are malingering.

Accidents in the Fishery

- Improvements in safety in the fishery require a multi-faceted approach.

- Transport Canada, the FFAW and other agencies should consider involving injured fish harvesters in fishing vessel safety training programs.
- All skippers should be required to undergo advanced safety training.
- Service providers should recognize the major impact the injury has on the lives of the fish harvesters and their families and recognize that this can continue for an extended period. They should also recognize that it is not simply the reduced earnings but a variety of social and psychological impacts that are important.

The Disabled Life

- Service providers need to be aware of the sustained negative impact of disability on the lives of fish harvesters. Support programs should be longer term. These may be developed in collaboration with health boards and voluntary agencies.
- Opportunities for the injured fish harvesters to expand and develop alternative home/community-based activities should be explored. Their anxiety about participation in any form of physical activity should be addressed.
- Community based programs to raise general awareness of the impact of disability on individuals and families should be explored.

Rehabilitation

- Service providers should ensure that injured fish harvesters have access to information about the various benefits and are involved and advised throughout the assessment process.
- Case workers need to be advised of the need to be understanding of the broad impact of disability when dealing with fish harvesters' claims. While the case workers may not be able to provide a solution to all of the problems expressed, being prepared to listen to the fish harvesters' concerns can begin to address the sense of loss, anger, rejection and isolation experienced by them.
- Support groups for injured fish harvesters should be developed in the regions with the assistance of the FFAW and the health boards. The partners of the injured workers could also be included in these support groups.
- Obstacles to part-time employment, both in the fishing industry and in the community, need to be reduced.
- Opportunities for support services in the regions with greater access from small communities need to be investigated.

Future Prospects

- Support workers should investigate opportunities for a range of activities in which the injured fish workers could become involved that could rebuild their confidence and enable them to become more independent. These could include part-time employment and participation in voluntary organizations.
- Educational opportunities, not necessarily linked to increasing employment opportunities, should be developed. This could be part of an expanded program of adult education by local schools and colleges.

- Service workers should be aware of the temporal variability in reactions to injury/disability and orient their services accordingly.

Principal Investigator
Michael Murray, PhD
Memorial University of Newfoundland
2005

PROMOTING SAFETY AWARENESS IN FISHING COMMUNITIES THROUGH COMMUNITY ARTS

Introduction

Government agencies and the fish harvesters' unions have pursued a range of strategies designed to reduce the number of accidents in the industry. These have ranged from regulations on the size and shape of vessels to a range of safety education programs. These programs have focused on improving individual fish harvesters' knowledge of basic safety regulations and the procedures to follow in case of an emergency. Together they have contributed to creating a safer industry.

However, there is a need to explore new ways of promoting a safety culture throughout fishing communities. Previous efforts have largely focused on the individual fish harvesters who are now required to undergo formal courses in safety. While these have been positive developments there is a need to explore the value of adopting a more collective approach. Such an approach requires engaging whole fishing communities in a program designed to raise safety awareness. This approach is rooted in the principles of community psychology and community development. It is designed to work with communities as a collective rather with individual members of the community. Further, rather than trying to impose a particular framework on the community the challenge is to adopt a more interactive approach. This requires the use of innovative approaches.

There is increasing recognition of the potential role of community arts as a means of promoting community awareness and community change. By community arts is meant all forms of artistic/creative endeavour that are not only based in a community but draw upon the resources and heritage of a community. The traditional fabric of community culture is the medium through which development can best occur. It is guided by three assumptions: community culture has traditional legitimacy for participants in development programs; it contains symbols that express and identify various perceptions of reality; and it serves multiple functions such as entertainment, instruction and learning.

Project aims

The aim of this project was to explore the potential role of different community arts activities in promoting increased safety awareness in fishing communities.

Fishing community awareness project

The project was conducted in three fishing communities in Newfoundland: Bonavista, St. Brides/Cuslett and Petty Harbour/ Maddox Cove. It was designed on the principles of community action that encouraged community control and ownership of the program. As such, the actual details of the program were developed in collaboration with community residents rather than being imposed upon them. There were two restrictions:

1. the program focused on safety in the fishery,
2. the program made use of arts based activities.

Further, the program drew upon related research that had been previously conducted on safety in the industry. Beyond this it was decided that the actual character of the program was dependent upon the community participants. In each community the project evolved differently.

Bonavista

Community context
The town of Bonavista has a very rich history. It has for centuries been a centre of the fishing industry in the province. The advent of the moratorium in the early 90s had a significant impact on the area's economy, particularly of the smaller communities. Over the past five years there have been substantial developments in the crab fishing industry and efforts to develop a tourist industry.

Establishing the program.
An advisory committee was established with membership of three active fishermen and three employees from the fish processing plant. All of the committee members agreed that safety was an issue of major importance. Three local fishermen had recently drowned and one of the committee members was already taking steps to build a memorial monument to fishermen lost at sea. This committee provided ongoing guidance and advice. A local person was hired to coordinate meetings and to keep contact with interested individuals in the community. In addition, this person issued press releases.

The local high school was a major resource for the development of the project. The school principal was very sympathetic to the idea and identified three classroom teachers with whom we could work – the English, Drama and Graphic Arts teachers. After a group discussion these three agreed to develop a range of classroom based activities around safety in the fishing industry. After discussion with the project leaders the drama teacher offered to write a play especially for the project. The play, entitled "A Family Portrait", concerned a recent local tragedy when three fishermen had drowned. It considered the importance of safety and the need to take precautions when out a sea. This play did not make use of specific research material but rather the teacher's own recollection of that particular event coupled with her local knowledge of community life. The cast was recruited from school students and rehearsals were held. The English teacher introduced fishing and safety into her creative writing classes. A number of writing workshops were facilitated by a local writer. The students composed a large number of pieces of prose and poetry about the topic. The graphics teacher challenged his students to design a poster about safety in the fishing industry. They used a computer graphics package as their template. He himself designed a series of large graphic images for several road signs. It was planned that these would be displayed at the entrance to the community. At a later stage the music teacher became involved and the school choir rehearsed a number of songs concerned with the fishery. The staff of the fish processing plant organized a poster competition on health and safety at the local elementary school

A local musician also gave his support to the project. He agreed to compose a song about safety in the fishery. Following a discussion with the musician the project leader supplied him with copies of some of the interviews he had previously conducted with fish harvesters and the subsequent reports. It was agreed that the lyrics would stress the great satisfaction in being a fisherman and the need for caution because of the inherent dangers in the industry. The song was titled *Life on the water*. It was recorded in the musician's own studio.

Community program activities

After several months planning it was agreed to centre all activities round a Fishery Safety Week. This would open with an ecumenical church service, be followed by some safety demonstrations by the Fire Department and the local First Aid Committee, and conclude with a Community Concert. For various reason not all of the events proceeded according to plan.

The church service was held in the town's United Church. An organizing committee developed an order of service that included specially selected readings and hymns. The service was interdenominational and included clergy from the main religious groups in the town as well as members of different church choirs. At this church service the town mayor formally read a proclamation establishing Bonavista as a safe fishing community. A collection was taken up for the erection of a monument to people who had lost their lives off the coast of Bonavista. This was a successful event with almost 100 people in attendance. The attendance would probably have been larger if a second shift at the local fish plant not started on that day. The various churches were keen to participate. Over $200 was raised for the memorial monument.

During the week it was also planned to have a number of public displays of safety related issues involving the local Fire Department and the Red Cross. The former went ahead attracted the interest of local youth. Although the members of the fire department were interested there had been limited promotion of this event and participation was lower than expected.

It was decided to showcase all of the school-based activities in a community concert along with the song composed by the local musician and other local music and songs. After months of planning the concert took place. It lasted over two hours and included songs, readings, a graphics display and a performance of the play. This was a very successful event. It attracted over 100 residents and over $700 was raised for the memorial monument. Considerable effort had gone into planning this concert. The school made available all of their facilities including the sound and lighting system. The school choir and band had been involved in rehearsals. Actors had been recruited from the community and regular rehearsals held. The graphics teacher arranged a special slide show that included samples of the students' safety posters inter-cut with historic slides of the fishing industry that he had obtained from a local archive.

Impact of program

In general the key participants were very enthusiastic about the project. The members of the advisory committee expressed the view that this should not be a one-off event but that rather there should be ongoing events to raise safety awareness in the community. One expressed the view that there should be an annual safety week. In addition, they welcomed the funds raised for the memorial monument.

In the school the principal was similarly enthused. He mentioned that although the school was located in a fishing community there was very limited reference to their location in the school curriculum. The project had made him, his staff and students aware of their fishing heritage. He also was keen to extend the project into other parts of the school curriculum. There was also talk about a similar concert-type event in subsequent years and of building links with the fishing industry through, for example, inviting fish harvesters into the school to speak with the students.

This project received wide publicity through the local newspaper, in classrooms, through the church service and other public activities. The community arts workers were keen to continue to expand their involvement into other areas of community work. Discussions are on-going about the potential extension of the work into other fishing communities.

The project leaders made regular visit to this community. There input was important especially in the early stages of the project. However, the final planning for the concert was largely in the hands of the local residents.

Challenges in developing the program

While the program in this community was very successful, there were many challenges. It is important to reflect upon these and how they can best be addressed in other locations. A public sector strike and a local fishing disaster forced the cancellation of the concert on two occasions. These cancellations led to a certain amount of disorganization in the project. Fortunately the local coordinator was very enthusiastic and it was possible to reschedule the event. In addition, the church service clashed with the work schedule at the local fish plant and possibly contributed to the lower than expected participation. The project in this community relied upon limited resources and substantial volunteer time, especially by the concert organizers. A strong advisory committee consisting of fish harvesters and fish plant workers was established in this community. Members of this committee were important especially in the early stages of the project. However, in view of the many delays they became less involved in the later stages of the project.

<u>St. Brides</u>

Community context

St. Brides is a small fishing community about 160km from St. John’s. It has several smaller linked communities including Patrick's Cove, Angel's Cove, Cuslett, Point Lance and Branch with a total population of about 1500. Together they make up what is known as the Cape Shore. Historically the major industries in this district have been farming and fishing. The district has been very badly affected by the fishing moratorium. The current population of St. Brides is 475 residents, a drop of 19.7% since 1991. However, more recently there has been a certain rebound in the fishing industry with the turn to crab. Currently about 40 fishing boats use the harbour at St. Brides and there is a small fish processing plant.

Establishing the community program.

This community’s program was centered round a local theatre group that for the past five years has offered a short summer season of plays based upon local stories. This group has been very successful in building community awareness and attracts both local people and city residents to performances. The group’s administrator also acted as the coordinator for the project while the artistic director took responsibility for arranging the play. This theatre group is based in the small community of Cuslett about two kilometers from St. Brides. The group operates out of Cuslett Community Center. The actors in the group are drawn from the local community.

A committee was established that included the theatre director and administrator, some local fish harvesters, schoolteachers and a representative of the harbour authority. This committee discussed possible activities and agreed to involve the school.

Fatima Academy is an all grade school located in the community of St. Bride's. For the 2004/2005 academic year the school had a student population of 160 and a teaching, administration, and support staff of 18. The school serves the educational needs of students resident in communities on the Cape Shore. Two teachers agreed to initiate a number of fishing safety related activities in the school.

Community program activities.

There was considerable discussion as regards the type of activities to organize in the community. Following the example of Bonavista it was decided to centre the safety activities round a dedicated Fishing Safety Week. The focal point for this would be a series of cultural activities in the community centre in Cuslett.

It was decided to perform an established play rather than attempt to write a locally based play. The play selected was Riders to the Sea. This play was written in 1902 by the Irish playwright John Millington Synge. Like all of his plays, it was controversial when originally performed because of the supposed negative portrayal of Irish life. The play deals with the drowning of fishermen off the Aran Islands in the west of Ireland. It was felt that because of the strong Irish heritage in the community that this play would be particularly fitting. In this production, the central character was played by a fisherwoman and all members of the cast were local residents. The play was accompanied by traditional music and song. On the walls of the centre were displayed some drawings on the issue of safety at sea that were made by local school children. About 60 residents attended the concert/play when it was performed in the small community centre. A report of the event was published in the local newspaper. This event was very successful. It illustrated the value of using established drama as a means of raising safety awareness.

As a means of broadening discussion of safety in the community it was agreed with Coast Guard that one of their vessels would come into the harbour and invite local residents on board for a tour. Unfortunately, because of the weather this was cancelled. This was a good idea but it was difficult to plan for the weather. The availability of other safety-related material that could be used in a display should be considered.

Two teachers engaged their students in related activities. These included drawings of safety at sea issues that were displayed at the concert. They also initiate a survey of safety issues. The two teachers initiated some good ideas. However, they had limited support and resources.

Impact of program

Interviews were conducted with key personnel involved in this project. Once again they expressed a very enthusiastic perspective. The artistic director thought that although the play was formally set in another country the audience quickly identified with the characters and felt that its message was relevant to their community. She and the local coordinator were keen to initiate other related projects.

One of the schoolteachers mentioned that she was not herself from a fishing community and at the outset had felt very ignorant about the fishing industry. Now that she had participated in the project she felt very knowledgeable about the industry. There was a certain amount of public activity around the play/concert. This included a newspaper report. In some ways this project ran quite independently. It fitted in with the ongoing program of the community theatre. This was a plus since the local administrator was experienced in this sort of work.

Challenges in developing the program

The program in this community was successful. However, there were some challenges that should be considered. It had been planned to have a coast guard vessel call to the community during the week of activities. However, in view of the weather this had to be postponed. This project relied heavily upon the resources of the local theatre company. This considerably eased the introduction of the project. It illustrates the benefit of identifying comparable community arts groups with whom to develop such projects. An advisory committee met at the outset of the project. This was important in giving the project local legitimacy and support. However, its members had limited involvement as the project developed.

Petty Harbour / Maddox Cove

Community context

Petty Harbour / Maddox Cove is a fishing community about 15km outside St. John's. It has a population of 960 in 2001, a drop of 12.8% since 1991. Although it is near the larger metropolitan centre of St. John's, this community has managed to maintain its distinct identity and community spirit.

Establishing the program

This committee took time to establish. It was composed of the town mayor, some local fish harvesters and a fish processing worker. Although it took time it get established when the program was finally sorted out all committee members worked hard to ensure that it was a success. A person was appointed to coordinate the meetings of the local advisory committee and to make the necessary local arrangements. Unfortunately, due to a variety of factors the initial plans were cancelled and the local coordinator left town. Another person took on his job.

Unfortunately there is not a school in this community. The young people attend a school about 8km away and there is limited connection between that school and the local community. Fortunately, the town council has an active youth committee. This committee expressed a strong interest in participating in the planned activities.

It was originally planned to have a play performed in the community. There was discussion regarding what play and initial plans were developed. However, due to shortage of time and resources it was decided to develop a video about safety that could be used as a focus for discussion. In this video six fish harvesters and the tow mayor described their views on safety and the impact of a disaster on a family and community.

Community program activities

A breakfast discussion meeting was held in the community centre. This was advertised throughout the community and was organized by community volunteers, in particular the youth committee and the women's volunteers. This was a successful event. A total of 75 people turned about and included a wide spectrum of community residents. The mayor welcomed people to the event after breakfast was served. The video was then shown. This was followed by a discussion on safety in the fishing industry.

A dinner and dance was organized in the community centre. Again the community youth committee and women's auxiliary played a very active role in preparing the event. A total of 135 people participated. After some introductions by the mayor and a committee member, the song A Life on the Sea was played followed by the video.

The four local church ministers agreed to jointly organize a blessing of the fishing fleet. This was held on the wharf About 100 people attended this event. A special service was organized that included readings, songs and the blessing of the boats.

Impact of program

Interviews were conducted with key personnel involved in this project. They were very enthusiastic about the project. The committee members indicated that they intended to reconvene next year and attempt to organize a similar series of events. Members of the youth group were enthusiastic about the project. They expressed some disappointment that they had not had the opportunity of mounting the play. However, they had learned a lot through their participation and indicated that they might be able to mount the play at a later stage. A total of 300 people attended the different events. This is almost one third of the population of the community. This would indicate that the message of safety reached a large proportion of the population.

Challenges in developing the program

After many delays the program in this community was eventually successful. Certain factors contributed to these delays. Certain events had been planned by the local coordinator but liaison with him was not maintained and then he left the community. A new coordinator was recruited and a new plan of action developed. An important resource in the other two communities was the school. However, this community did not have a school. Fortunately there was an active youth committee who were keen to support the project. After the initial delays a strong advisory committee consisting of fish harvesters and elected officials was established in this community. Members of this committee were important throughout the project and each was keen to participate.

Developing community safety awareness through the arts

Impact of the program

Informal discussion with the key project participants confirmed their enthusiasm not only to participate in the project but to initiate similar activities in subsequent years. It is important to note that this impact was particularly noticeable among those community residents who were not themselves fish harvesters. The reason for this effect may be that their participation in the project made them aware of their potential role in increasing safety in the fishing industry. Rather than being just being bystanders who could comment on the hazardousness of the industry they could now play a role in creating a safer industry. This applied to school teachers, town officials and plant workers. Admittedly this assessment was based on informal discussion.

- There is a need for a more formal evaluation of the impact of community safety awareness projects on fish harvesters and other community residents. It is important that these evaluations are developed in collaboration with the communities and form part of future projects.

In addition, community arts workers became aware of their role in promoting awareness of safety in the fishing community. While they had taken up a variety of issues in their previous work, they had not focused on safety as an issue.

- Community arts workers should be encouraged to consider safety in the fishing industry as a focus for their work.
- Community arts workers should discuss collaborative projects with fishing and other community organizations.

The high participation by residents in the various activities organized in the three communities confirms both their interest in safety issues and arts-based activities. The project also attracted wider media interest.

- Government agencies should be advised of the widespread interest in community arts activities as a means of promoting community safety awareness.
- Future projects should take account of the processes and challenges identified in this project.

Processes

We were concerned with identifying the processes involved in implementing the program. An identification of these factors would contribute to the development of recommendations for future work on building community safety awareness through the arts. Several factors ensured the success of this project: These include:

- **Conceptual framework:** From the outset the project leaders adopted a community development approach of working from the ground up. They emphasized throughout the project that their role should be seen as catalysts and facilitators rather than organizers. This approach insured community ownership of the project and hopefully increased the prospect of sustainability. Future projects should work with the community rather than trying to impose an established project from outside.
- **Local capacity:** The project leaders went to considerable effort to identify local capacity in terms of individuals with particular skills and resources. These included people from the fishing industry, the arts community, the school/youth community, and the churches. These individuals are essential for any comparable project. In our case they collectively had the expertise, interest in the subject matter and enthusiasm to complete the project. Admittedly, the several delays interrupted the project momentum and we were fortunate that several additional individuals were identified who were prepared to take on responsibilities later in the project. Future projects should spend time in identifying local capacity and of providing basic training to those who indicate that they are keen to participate.

- **Expertise:** The project leaders could be considered the experts on certain aspects of the project. However, their expertise would have limited impact without connecting to the local expertise. It is through this symbiosis that the project was able to attain success. Project leaders must work with community leaders to maximize the success of future projects.
- **Planning**: The committee in each town established a planning/advisory committee and developed a clear plan of activities. Although there were many challenges to this plan it provided a framework that kept the project moving. t is important to have a planning committee and to develop a plan of action at the early stages of the project and to work towards its implementation.
- **Individual and shared responsibility**: For the project to succeed people had to take on responsibility for particular aspects of the project. While the project leaders had an oversight of these responsibilities each team member of the team had to accept his or her responsibility. Tam members must be aware of their individual responsibility for particular aspects of the project. A well-organized committee can review these responsibilities and ensure that tasks are being completed.
- **Morale and support:** It was important to maintain the morale of community participants. This required regular contact with the project coordinators. Unfortunately, for various reasons, there were many delays in implementing the project in the communities. This led to a certain frustration among community participants. I is important to maintain community morale among community participants by ensuring successful completion of at least parts of the project.

Resources

- **School:** Having a school in the community was a major resource. This was the case in Bonavista and St. Brides. In Petty Harbour the school had recently closed and the young people were bussed to a school about 10 km away. This meant the loss the teachers, students, meeting rooms and other physical resources. It is important to make contact with the local school or youth committee at an early stage to ensure their involvement in the project.
- **Community centre:** It is vitally important to have a meeting place for organizing and performing certain events. In Bonavista, advisory committee meetings were held in the harbour authority. In Cuslett, we met in the community centre while in Petty Harbour we met in the Town Hall. It is important to identify suitable venues for meetings and performances. These can range from town halls, school halls to union halls.
- **Media:** The local media were very supportive of this project and printed press release when these were provided. Other media outlets, such as television and radio were not accessed. All media outlets should be approached to carry details of events.
- **Arts community:** Members of the arts community played a central role in this project. These included playwrights, musicians and actors. It is important to recognize that many local community members have a range of talents. The challenge is to involve them in the project activities. It is important to involve as wide a variety of local artists in the project.

- **Church:** The church has traditionally played a central role in many fishing communities. However, they have not been actively involved in safety-related activities. In this project, it was found that religious personnel were keen to play a role. Churches and religious personnel are an important resource in developing comparable projects.
- **Union:** The fish harvesters union provided strong support for this project. It is important to work with the local union branch.
- **Council:** The town councils in the communities were very supportive and provided a range of resources. Town councils should be approached to enlist their support.

Challenges to program implementation

It is also important to review the various challenges to the implementation to the project that were encountered in each of the communities.

- **Local circumstances:** In ach of the communities a problem emerged that was not anticipated. These included bad weather, opening of the local fish plant, opening of the crab season, and a local tragedy. While not all challenges can be foreseen it is important that future projects deliberately plan their project to take account of such events.
- **Resources:** The resources available for the project were limited. Despite this considerable initiative was used by local communities to identify resources. The project did not make use resources that may be available from government agencies. The planning committee should review all of the potential resources available and attempt to access these. Future projects should deliberately access and integrate safety material from other agencies.
- **Involvement of fish harvesters:** Each community involved a number of fish harvesters in the planning and implementation of the project. It is important that future project ensure active involvement of fish harvesters.
- **Facilitation guide**: As an aid to the implementation of comparable projects in other communities a facilitator's guide has been developed.

Community arts and community health action

In mixing the community arts with community health action such as that designed to promote community awareness of safety there is often the prospect of conflict. On the one hand community health has the direct aim of improving the health of the community. On the other hand the arts are concerned with entertainment and enlightenment. Fish harvesters undertake formal safety training and are required to purchase expensive safety equipment. The aim of community arts activities is not to provide more knowledge but rather to raise community awareness. This project has demonstrated the success of this strategy. It has shown how it is possible to raise community awareness of safety in the fishing industry through the development of a series of community arts projects.

Principal Investigator
Michael Murray PhD
Memorial University of Newfoundland
2005