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FOREWORD

The National Institute for Occupational Safety and Health (NIOSH) was proud to be a co-sponsor of the Second National Fishing Industry Safety and Health (FISH II) Workshop. This Workshop provided an excellent opportunity for professionals from the occupational safety and health community and the fishing and transportation industries to come together and discuss issues, problems, and solutions in the commercial fishing industry.

Using the National Traumatic Occupational Fatalities (NTOF) surveillance system, NIOSH has found that occupational fatality rates in Alaska are dramatically high, especially in the agriculture, forestry, and fishing industries. Focusing on the commercial fishing industry, NIOSH surveillance data indicated that over 145 commercial fishing fatalities occurred in Alaska from 1991-1996. The occupational fatality rate for commercial fishing in Alaska is 20 times that of the overall U.S. occupational fatality rate. In the last five-year period, there has been a one-third reduction in the number of fishing fatalities. Despite improvement, there is still much that can be done.

The goal of the FISH II Workshop was to build on the accomplishments of the FISH I Workshop, with an emphasis on increasing awareness, supporting coalitions, sharing information and experiences, and encouraging action to prevent injury in the commercial fishing industry. These Proceedings capture information presented at the Workshop. We hope that they will be a useful tool for other researchers, public health practitioners, and policy-makers.

I would like to acknowledge and congratulate all of those who participated in the Workshop, and recognize those without whom this Workshop would not have been possible: Alaska Marine Safety Education Association, National Transportation Safety Board, Northwest Center for Occupational Health and Safety, North Pacific Fishing Vessels Owners' Association, Occupational Safety and Health Administration, United States Coast Guard, and the NIOSH Alaska Field Station.

Linda Rosenstock, M.D., M.P.H.
Director, National Institute for
Occupational Safety and Health
Centers for Disease Control and Prevention

PREFACE

Since the first National Fishing Industry Safety and Health Workshop was held in Anchorage in 1992, much has changed in this industry. By 1997 fishing in Alaska was resulting in much fewer deaths than at the beginning of the 1990s (indeed, a total of 28 commercial fishermen died annually in Alaska from 1996 and through 1997, versus the 71 who died in 1991 through 1992).

The Commercial Fishing Industry Vessel Safety Act of 1988, by requiring many improvements in safety equipment on vessels and training of fishermen, has likely saved many lives since it began being implemented in 1991. However, the news is not all good–in 1996 through1997, 70 vessels still capsized or were lost in Alaska's waters (versus 73 in 1991 through 1992), and 198 fishermen ended up in Alaska's icy seas (versus 206 five years earlier). So, we are salvaging fishermen quite effectively once disaster occurs, but not preventing these events as we should.

During the last 5 years, we have also been able to much better enumerate and understand the many injuries which fishermen suffer in the North Pacific, and have gathered much data on those injuries resulting in hospitalization.

The 1997 Workshop, in its own way, posed a more difficult challenge than in 1992, as during the earlier years, the problems were so egregious that common sense often sufficed for understanding these events, and what must be done. There was also a tremendous sense of urgency. By 1997, the picture is more complex, with some real successes overlying other persistent failures, and satisfied complacency potentially supplanting the old urgency. Our goal in meeting in Seattle, Washington, in November 1997 was to describe current circumstances and plan next steps to ensure that North Pacific fishermen have the kind of relatively safe workplaces that all Americans deserve.

This compilation of talks and recommendations represents real progress toward that goal.

George A. Conway, M.D., M.P.H.
Chief, Alaska Field Station
Division of Safety Research
National Institute for Occupational Safety and Health

ACKNOWLEDGMENTS

Convening the Second National Fishing Industry Safety and Health (FISH II) Workshop was a team effort as was preparing these *Proceedings*. In addition to the planning committee, the presenters, and the session moderator, we wish to thank the following staff and editorial advisors for their diligent work at the FISH II Workshop and for their help in the preparation of this document.

Foremost in our appreciation, we thank Sharon Smith and Linda Ashley who worked with dedication and superb attention to detail in all phases of the publication of these *Proceedings*. They are responsible for the completeness of this document.

A special thanks is extended to Jennifer Lincoln for compiling and clarifying the FISH II safety recommendations. A special thanks is also extended to Joyce Spiker and Herb Linn for preparing the camera ready version.

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by Mr. Michael Klatt
Public Health Advisor, NIOSH Alaska Field Station

The Second National Fishing Industry Safety and Health (FISH II) Workshop was co-sponsored by the Alaska Marine Safety Education Association (AMSEA), National Institute for Occupational Safety and Health (NIOSH), National Transportation Safety Board (NTSB), Northwest Center for Occupational Health and Safety (NCOHS), North Pacific Fishing Vessel Owners' Association (NPFVOA), Region X Occupational Safety and Health Administration (OSHA), and the Thirteenth and Seventeenth Districts of the United States Coast Guard (USCG). The purpose of FISH II was to increase awareness, build coalitions, share information and experiences, and encourage action to prevent injury in the commercial fishing industry.

WORKSHOP OPENING

Dr. Linda Rosenstock, Director, NIOSH, began the Workshop by explaining that although NIOSH and OSHA were both created by the Occupational Safety and Health Act of 1970, they have very different and separate mandates. OSHA has regulatory and enforcement responsibilities, while NIOSH conducts research, makes recommendations, and provides training. She went on to explain it was because Alaska had the highest occupational fatality rate of all states for the decade of the 80s that NIOSH responded by opening its only field station in the nation, the NIOSH Alaska Field Station. Finally, she discussed the many benefits of partnering with other agencies and the most notable partnership accomplishment, the National Occupational Research Agenda (NORA) and its 21 priority areas.

Mrs. Peggy Barry, Member, Coast Guard Advisory Committee, provided the Keynote Address: "The Long Haul." Mrs. Barry, whose son, Peter, perished when the fishing vessel (F/V) Western Sea sank in Alaskan waters, stated how delighted she was that the new Secretary of the Department of Transportation listed safety as the first of five strategic goals. She spoke about issues identified at FISH I (1992) and the progress that has been made toward addressing those issues. One of the main issues of concern at FISH I was the lack of data to identify injury causes and to formulate prevention strategies. She feels that in the 5 years since FISH I, great strides have been made in this area. Mrs. Barry states, "There are those who say that we don't need more numbers, that more numbers are not going to save lives. But information involves more than numbers, and information is only as good as the investigation which produces it."

Mr. John Hammerschmidt, Member, National Transportation Safety Board, provided the Opening Remarks. Mr. Hammerschmidt stressed that NTSB remains quite concerned that masters of commercial fishing vessels are not licensed despite such an NTSB safety recommendation to the Coast Guard in 1985. This recommendation urged the Coast Guard to seek legislative authority to

require the licensing of captains of commercial fishing vessels, including requirements that they demonstrate minimum qualifications in vessel safety, including rules of the road, vessel stability, fire fighting, water-tight integrity, and the use of life-saving equipment. In 1990 NTSB placed the licensing recommendations on its new program known as the "Most Wanted Transportation Safety Improvements." Stability testing for commercial fishing vessels is also on NTSB's "Most Wanted" list.

Dr. George Conway, Chief, NIOSH Alaska Field Station, presented the Workshop Charge. Dr. Conway stated that not only is he concerned about the safety of fishermen, but also those who attempt to save fishermen in trouble, the search and rescue (SAR) personnel of the Coast Guard. Additionally, he emphasized that approximately the same number of fishermen have to be rescued annually as in the past, and that more emphasis has to be placed on preventing the fishermen from becoming immersed in Alaska's icy waters in the first place.

DEFINING THE PROBLEM AND IDENTIFYING THE POPULATION AT RISK

Ms. Jennifer Lincoln, Occupational Safety and Health Specialist, NIOSH Alaska Field Station, presented "Epidemiology of Vessel Casualties and Commercial Fishing Fatalities in Alaska." Ms. Lincoln addressed three broad areas that result in commercial fishing fatalities: lost vessels (capsized/sunk), falls overboard, and diving-related events. She also stressed the importance of not just reacting to these emergencies after the fact but preventing them from occurring.

Mr. Brad Husberg, Occupational Safety and Health Specialist, NIOSH Alaska Field Station, presented "Non-Fatal Injuries in the Alaskan Commercial Fishing Industry." Mr. Husberg began his presentation by describing the Alaska Trauma Registry (ATR), a state-wide, population-based data source for traumatic injuries whose data are used to identify work-related injuries for analytic purposes. For example, ATR data show that the most non-fatal commercial fishing injuries requiring hospitalization are to the upper extremities (hands and arms) and the most frequent type of injuries are fractured bones. This information, along with other data gleaned from the ATR, can be used to formulate prevention strategies.

Mr. Jim Herbert, Instructor, Alaska Vocational Technical Education Center, presented, "The Financial and Human Cost of Commercial Fishing." Mr. Herbert addressed in great detail the immense financial burden to fishermen, fishermen's families, the USCG, insurance companies, and society as a result of commercial fishing injuries and deaths. He went on to say, "But in purely human terms, the loss of your spouse, parent, child, or sibling, cannot be measured in monetary terms. Through your efforts at engineering better solutions, education and training, and most importantly, evolving people's attitude, the financial and human costs of commercial fishing in America will be reduced."

COMMERCIAL FISHING SAFETY

Mr. Ken Lawrenson, Fishing and Vessel Safety Coordinator, USCG Marine Safety Office Portland, gave a "History of Commercial Fishing Legislation." Mr. Lawrenson stated that as early as the 1930s, attempts were made to establish mandatory safety standards and regulations for the commercial fishing industry. However, it wasn't until 1988 that the first comprehensive safety regulations for the commercial fishing industry were signed into law, the Commercial Fishing Industry Vessel Safety Act of 1988 (CFIVSA). The implementation of the CFIVSA, that requires specific safety equipment and training, and mandatory on-board drills, has resulted in a marked reduction in commercial fishing fatalities.

LT Alan Blume, Senior Investigating Officer, USCG Marine Safety Office Anchorage, presented "Alaskan Commercial Fishing Vessel Casualties: An Overview 1992-1996." LT Blume listed three basic types of vessel casualties: those related to the navigation of the vessel, including allision, collision, and grounding; those related to the vessel's stability or watertight integrity, including flooding, capsizing, and sinking; and those related to vessel maintenance or marine engineering, including fire and explosion, and equipment failure. He went on to state that the CFIVSA primarily reduces the risk to fishing vessel crews by improving their chances of surviving a catastrophic vessel casualty, rather than by reducing the probability that such a casualty will occur. The focus of future efforts to substantially improve commercial fishing vessel safety must be on reducing the risk of a catastrophic casualty from occurring. Owners and operators of commercial fishing vessels must take steps to develop a climate of safety within the industry, and vessel crews must make the transition from fishermen who operate vessels to professional mariners who fish.

Mr. Charlie Medlicott, Fishing Vessel Safety Program Coordinator, USCG Marine Safety Office Anchorage, gave an overview of the "USCG Voluntary Dockside Exam Program." Mr. Medlicott explained that a voluntary dockside exam is intended to educate and train, and that it's a comprehensive examination of the vessel's safety gear, lifesaving equipment, administration requirements, navigational publications, and pollution compliance. However, in Mr. Medlicott's opinion, dockside exams do not address the root causes of fishing vessel losses; therefore, the USCG fishing safety mission should move from voluntary dock exams to a risk-based prevention program.

Mr. Barry Noll, Director, OSHA Anchorage Area Office, presented "OSHA Interventions in the Alaska Commercial Fishing Industry." Mr. Noll explained that those areas of worker safety and health not covered by a specific Coast Guard standard are covered by OSHA within Alaska's territorial waters. He went on to explain that for a complaint to trigger an inspection by OSHA, that complaint must be made by a current company employee, relative, or representative. The only OSHA tool allowed by Congress to motivate the employer to correct workplace hazards is a monetary citation.

Ms. Leauri Lopes, Safety Director, Icicle Seafoods, Inc., presented "Safety Culture from Management's Perspective." Ms. Lopes stated that the four cornerstones of Icicle Seafoods' safety

culture are commitment, completion, communication, and continuity. Icicle Seafoods has done a great job developing a strong safety culture as evidenced by them having the only floating processing vessel in the Star Level of OSHA's Voluntary Protection Program (VPP). Additional evidence of her company's successful safety culture is that the number of individual worker's compensation claims has decreased 50 percent, and the cost of these claims has decreased 90 percent over the last 4 years.

CAPT Ed Thompson, Commanding Officer, USCG Marine Safety Office Anchorage, shared his thoughts on the "Effect of Resource Management Decisions on Fishing Vessel Safety." CAPT Thompson discussed five areas that affect safety: legislation, vessel owners, financial institutions, insurance companies, and resource managers. It was his opinion that the owner had the greatest effect on prevention because he hires the crew, he maintains the boat, and he sets the tone. Changes to the resource management system have already proven to be a very effective safety measures, for example, changing from halibut derby openers to an IFQ fishery has greatly reduced deaths in the longline fisheries.

INTERVENTION STRATEGIES AND SAFETY PROMOTION

Dr. George Conway, Chief, NIOSH Alaska Field Station, described "Using Epidemiology and Surveillance Data to Develop Prevention Strategies." Dr. Conway began his presentation by listing the many data sources for the Alaska Occupational Injury Surveillance System (AOISS). He next described an epidemiologic tool, the Haddon Matrix, which divides injury events for analysis into three phases and three factors: pre-event, event, and post-event, and host/human, agent/vehicle, and environment. He went on to state that the CFIVSA focuses on the event and post-event stages and that future emphasis needs to be placed on the pre-event phase, prevention.

Ms. Leslie Hughes, Executive Director, North Pacific Fishing Vessel Owner's Association (NPFVOA) Vessel Safety Program, explained "Why Safety is Good Business." The NPFVOA Vessel Safety Program was established in 1985, in conjunction with the USCG, as a voluntary effort to improve the commercial fishing industry's unacceptably-high casualty rate through education and hands-on training. It is truly a program by fishermen for fishermen. Ms. Hughes' presentation could be summed up with the following quote, "...the reality is that poor safety practices result in poor bottom lines. Anyone who thinks safety is expensive need only try having an accident...When companies realize tangible benefits for their commitments to safety, there is an increased desire to continue these efforts."

LCDR Geoffrey Rowe, Senior Controller, U.S. Coast Guard (CG) North Pacific Search and Rescue (SAR) Center, presented "CG District 17 SAR." LCDR Rowe began by explaining that the CG District 17 SAR's responsibility includes 33,000 miles of coastline and encompasses 3,853,500 square miles of water; an area much larger than the entire land mass of the continental U.S. Due to the large expanse of the area of responsibility, low population density, the relative scarcity of rapid-response surface assets, and the urgent nature of distress in the frigid maritime environment, CG air assets provide a critical element to SAR. The "customers" of the CG District 17 SAR include

commercial fishing vessels, recreation vessels, cruise ships, other commercial vessels, commercial and private aircraft, and remote communities. Commercial fishing vessels provide SAR with the greatest challenge because they work further off shore, in worse weather, and with more dangerous equipment.

Dr. Bruce Adee, Professor, Mechanical Engineering Department, University of Washington, presented "Fishing Vessel Stability: The Effect of Time and Modification on a Vessel's Stability." Dr. Adee stated repeatedly that a small modification to an existing vessel may require a completely new stability test and analysis. Also, it is not just the last modification which affects a vessel's stability. Every change made since the last stability analysis has an effect. The totality of changes must be considered, not just the most recent. Dr. Adee went into great detail as he graphically showed how a vessel's stability changes through a series of slight modifications.

Mr. Jerry Dzugan, Executive Director, Alaska Marine Safety Education Association (AMSEA), shared the results of a study that answered the question, "Does Safety Training Make a Difference?" Mr. Dzugan began his presentation by stating that many risk factors in commercial fishing are difficult to control; however, training and education efforts in safety and survival are areas that we do have control over and play an important role in the safety equation of commercial fishers. Most trainers who have been involved with safety training in fisheries have only anecdotal evidence supporting the role training has played in survivability. The purpose of the AMSEA study was to determine if AMSEA training had contributed to the lessening of fatalities. The study showed that AMSEA training played a statistically significant role in reducing the number and rate of fatalities on lost (capsized/sunk) vessels.

Mr. Bob Hopkins, Meteorologist-In-Charge, Weather Service Forecast Office Anchorage, discussed "Forecasting Marine Weather and Icing." Ship reports and satellite data are used to determine initial conditions for wind, waves, water temperature, and air temperature. Computer atmospheric projections are used to forecast wind velocity and air temperature. Forecaster knowledge of localized terrain-induced conditions is combined with other data to produce a forecast. Superstructure-icing conditions are generally not difficult to forecast, because the contributing components with the required properties are well within the skill range of available tools.

Dr. Ray Jarris, Medical Director, Maritime Health Services, presented "Optimizing Medical Care at Sea." Dr. Jarris stated that in over 90 percent of the cases reviewed, an injured or ill crew member was able to stay on the vessel following contact with a physician consultation service. He went on to discuss disease and injury prevention measures that would reduce the number of medical evacuations and vessel diversions. For disease prevention, he encouraged routine immunizations (i.e., tetanus, influenza, pneumonia, and hepatitis A and B), dental screenings, availability of condoms, elimination of inexpensive or free cigarettes to reduce smoking and the resulting upper respiratory infections, and maintaining an adequate supply of medications on board. For injury prevention, he recommended preconditioning, drug testing, educating (e.g., frost bite and cold injuries), training (i.e., first aid and

CPR), wearing personal protective equipment (i.e., eye protection, hard hats, and personal flotation devices), and being aware of medical resources.

CHAPTER I
WORKSHOP OPENING

INTRODUCTION

By Dr. Linda Rosenstock
Director, National Institute for Occupational Safety and Health

Welcome everyone. I am delighted to be able to join you to kick off this important Second National Fishing Industry Safety and Health Workshop.

I know that many of you are familiar with the National Institute for Occupational Safety and Health, or NIOSH, but I thought it might be useful for those of you less familiar for me to begin with a brief overview of NIOSH, of what we are doing in general and then focus on some of our activities in fishing, about which you'll hear much greater detail in the next two days.

NIOSH and the Occupational Safety and Health Administration, or OSHA, have a common history in that both were created by the same legislative act. NIOSH has a very different and separate mandate from OSHA, however. We have essentially no regulatory nor enforcement responsibilities, and our responsibilities really fall in the realm of: conducting research; providing what we call health hazard evaluations and technical assistance to workers, employees, state and local agencies; making a scientific basis for recommending standards; and training occupational safety and health professionals. I think the creators of the Occupational Safety and Health Act were really quite wise in the sense that they separated OSHA's regulatory and enforcement activities into a completely different department in the government with NIOSH in Health and Human Services and OSHA in Labor.

NIOSH is geographically quite spread out. Our headquarters are in Washington, D.C., and we have our original field offices and major research laboratories in Cincinnati, Ohio, and Morgantown, West Virginia. We recently added the laboratories of two functions that were formerly part of the Bureau of Mines, one in Spokane, Washington, and the other in Pittsburgh, Pennsylvania. We have some smaller regional offices and, of course, an important office relevant to today's discussion, the NIOSH Alaska Field Station.

I want to put into context the significant issue of injuries, illnesses, and fatalities in commercial fishing relative to the overall national picture, using NIOSH-based surveillance data. With the National Traumatic Occupational Fatalities (NTOF) system, NIOSH has been able to track overall trends, including state and regional trends in the United States, by industry and occupation. We have found that occupational fatality rates in Alaska are dramatically high. In the national distribution, with the lowest fatality rates in the Northeast and with Washington state in the middle ground, a few

other states come close, but none as high as Alaska. When you look at the actual rates for the state, a lot of the clustering of that danger is in the industry sector of agriculture, forestry, and fishing.

These high rates led NIOSH to establish the Alaska Field Station. I'm delighted that they've taken the lead in this area and are working with many partners, as we'll discuss in a moment. This is an office that's still relatively young; it was created in 1991. George Conway, who leads the office, will be sharing some of their significant accomplishments a little later.

The NIOSH Alaska Field Station was set up to use a public health approach to the problems of injuries particularly, but also of illness for workers in Alaska. From the outset the Alaska Field Station took the lead for NIOSH in trying to demonstrate the power of partnerships with other agencies as well as other interested sectors in terms of being able to leverage activities, resources, and actions to prevent this high toll of injury and illness.

The Alaska Interagency Working Group for the Prevention of Occupational Injuries has been involved in a number of activities. For example, the helicopter logging story, although not directly germane to fishing, is an interesting one. At the time that the Working Group was formed, helicopter logging was taking off in Alaska. About 16 percent of all helicopters were actually involved in crashes in a year. Since the formation of the Working Group and their multiple activities and recommendations during 1993, there has been only one crash. This shows the remarkable ability to make a difference when you target a high risk sector.

I want to also mention the relatively new addition to the NIOSH portfolio of an agricultural research center in Seattle, Washington, which serves as a regional center that includes Alaska. It is one of eight centers that comes out of a broad-based congressional initiative that addresses research and prevention for the high toll of injuries and illnesses in the agricultural sector, which is configured broadly and does include forestry and fishing. The Pacific Northwest Agricultural Safety and Health Center is now less than one-year old and has had a highly successful start. Some of the members of the Center are in the audience today. We strongly encourage their intention to enhance the activities to date that deal with commercial fishing.

NIOSH has just released a Current Intelligence Bulletin on commercial fishing. Our surveillance data indicated over 400 occupational fatalities occurred in Alaska from 1991-1996. I should mention that this same surveillance effort has looked into serious injuries in over 2,500 cases, as well. In perspective, the occupational fatality rate for commercial fishing in Alaska is 20 times that of the overall U.S. occupational fatality rate. Despite these dramatic numbers, there have been improvements, but there's certainly still room for more. In the last 5-year period, as detailed for you in the Current Intelligence Bulletin, there has been a one-third reduction in the number of fishing fatalities, which are mostly due to drownings resulting from falling overboard, sinkings, or capsizing events. Interestingly, the number of vessels lost has stayed roughly the same. In our epidemiologic jargon, this demonstrates an improvement in the "case fatality rate", although the risk of a vessel being lost has remained constant, the odds of surviving that event have improved.

This improvement can be attributed to many factors. For example, you're going to be hearing shortly from Mrs. Barry, who had an important role in passage of the Commercial Fishing Industry Vessel Safety Act of 1988.

In addition to the safety issues and the high rate of injuries in commercial fishing, I've had personal experience, when I was at the University of Washington in Seattle before going to Washington, D.C., in dealing with some very serious respiratory illness problems among fish-processing workers. NIOSH is preparing to evaluate this situation in cooperation with one of the land-based processors.

I've personally taken care of a number of very young workers who have gotten such severe asthma that they've been effectively disabled from working, not just in the commercial fishing industry, but when diagnosed too late in the game, from having effective employment in virtually any industry. As in the case of drownings, better etiologic research, intervention investigations, and prevention would help us address this serious public health problem.

I mentioned the NIOSH Current Intelligence Bulletin earlier, which you'll be discussing more over the next few days. This document contains a series of recommendations to either implement or evaluate a number of actions that, based on the science as we now know it, should improve the health and safety of commercial fishing. These fall into many areas, such as examining training issues, looking at issues of guidelines for staffing and watch keeping, and evaluating training of crews as well as skippers. The recommendations also suggest consideration of labor/management policies that have to do with health and safety and trying to make them more integral to the overall effort by improving monitoring of sea and weather conditions, continuing development of personal flotation devices, and implementing and evaluating man-overboard alarms.

I would like to close by identifying the issue of trying to reach out and work with a broad array of stakeholders including industry, labor, other federal, state, and local agencies, health professionals, academia, and the public. This is an approach that NIOSH has increasingly used, we think to great success, not just in this arena, but really in all of our missions.

Perhaps our most notable accomplishment recently in terms of partnership is the National Occupational Research Agenda, known as NORA. This was an effort where NIOSH, starting several years ago with remarkably broad input from over 500 individuals and organizations, developed a national research agenda for the next 10 years, not just for NIOSH but for the country as a whole. I think we were able to demonstrate that although sometimes the world of the workplace is polarized, with tensions between labor and management and tensions between regulators and researchers, this broad community had a strong and quite impressive consensus about the top research priorities. And this wasn't just doing research for research's sake. This whole process was geared to doing research in areas where we thought we could learn enough to ultimately have a measurable impact in decreasing illness and injury.

We ended up with 21 priorities in three different categories. We anticipated at the very beginning of the process that with any given work sector, one could target appropriate NORA priority areas. For example, in agriculture, top priorities include injuries, asthma, reproductive abnormalities, and hearing loss. This type of sector approach in occupational safety and health research has already been very effective for promoting research and preventive actions.

I'd like to share my personal rough cut of the NORA priority areas most applicable to commercial fishing. For example, respiratory disease and asthma, as I've already noted, is a real concern and very much understudied. Obviously, musculoskeletal concerns and traumatic injuries should be included. I think there are some other priority areas that intersect very nicely with the work before you in the next two days. These include looking at issues about how work is organized (issues of when people work and the conditions of their employment, whether it be part-time work, shift work, or contingent employment), looking at who's doing the work, recognizing the changing workforce and demographics in the United States, as well as trying to get much smarter in a variety of research tools and approaches that we think will have a beneficial effect (such as trying to improve technologies that promote worker health at the front end of production rather than after we've identified them as problems).

I appreciate the opportunity to make these introductory remarks and put some of NIOSH's broader work in context. I also truly appreciate the work of our NIOSH Alaska Field Station staff who are here and who I get to see all too rarely, since we are very much separated by distance. It's nice to meet in the middle, in Seattle.

Thank you.

KEYNOTE: THE LONG HAUL

By Mrs. Peggy Barry
Member, Coast Guard Advisory Committee

I was delighted when Mike Klatt called and asked me to speak today. I learned a great deal through my participation in FISH I in October of 1992, and came to appreciate the unique perspective of NIOSH in its approach to fishing vessel safety. I had high hopes for some of the initiatives underway at that time, and I am eager to see what changes have been brought about through NIOSH and other government agencies that work in this field.

Five years is enough time to really make a difference. It's long enough for projects which were only ideas at that time to be implemented, unfortunately, it's also long enough to have lost some of the gains we thought we'd made at that time. I'd like to revisit some of the topics which were covered 5 years ago, and I'd like to take a broad look at fishing vessel safety today within the context of the men and women who harvest fish.

One of the obvious problems with fishing vessel safety is that it doesn't fit easily into a bureaucratic slot. We are here today under the auspices of the U.S. Department of Health and Human Services and the National Transportation Safety Board (NTSB), among others. But the U.S. Coast Guard, which is responsible for the administration of maritime safety, is under the Department of Transportation (DOT).

I was delighted to find that the mission statement of our new Secretary of Transportation, Rodney Slater, included five strategic goals, of which the first--the first, mind you--is safety. It came before mobility, which was second.

According to the DOT strategic plan for Fiscal Years 1997-2000, the achievement of this goal of safety includes research in human performance and behavior; the promotion of public/private partnerships to develop cost-effective safety technologies; the utilization of information technology which will assure that the department's systems are not responsible for disruptions in service; and an ongoing list of functional exercises, which if applied systematically to the Coast Guard, go a long way toward solving a lot of the problems out there.

Next year Secretary Slater will be largely responsible for the appointment of a new Commandant of the Coast Guard. I challenge him to keep his number one strategic goal before him at that time--to choose a person for whom safety is a vital personal goal--a "before all else" standard. It should be someone who is unembarrassed to insist on safety when faced with industry or government forces which attempt to put other goals first. It should be someone ready to give safety in commercial fishing vessels as high a priority as more traditional areas of Coast Guard concern.

I want to turn now to one of the issues which was identified in FISH I. The first three sessions of the workshop held in 1992 could be combined under the generalized, if unexciting, title of "Record Keeping and the Availability of Information." It's interesting to go back to the written record of those sessions and to pick out specific comments.

"We will not be able to describe or fully understand the problem until we have better data. The data we have at present are not really reliable and they are certainly not sufficient..." (Gunnar Knapp)

"Lack of information will prevent the identification of causes and formulation of prevention strategies that would be effective against non-fatal injuries." (Paula Trapp)

This was an area that NIOSH was interested in then, and according to the program ahead of us, continues to be. And in a very real way, it has become the impetus for any national safety program: the more emphasis there is on making government "results-based", the more important are the investigative and data-collecting functions. It is clearly of importance to Secretary Slater, who keeps returning to the necessity of first-rate "information technology" as the basis for developing a measurement of performance.

My personal interest in this issue grew as I became increasingly involved in trying to pass safety legislation in 1986. When I first testified before a congressional committee, I had only the information which the Coast Guard supplied about the F/V Western Sea. I knew what she had on board and the many things she didn't have on board. I had a rough idea of her structural integrity and her stability. But this was only one vessel. In 1987 NTSB came out with its safety study of uninspected commercial fishing vessels and the whole picture changed. The F/V Western Sea, with her lethal problems, was not an isolated instance. She was just one within a whole fleet of fishing vessels; one of the worst, but just one. I believe that NTSB's report actually made it possible to get the Commercial Fishing Industry Vessel Safety Act of 1988 (CFIVSA) through Congress.

There are those who say that we don't need more numbers, that more numbers are not going to save lives. But information involves more than numbers, and information is only as good as the investigation which produces it. This is brought out in the Coast Guard's own Quality Action Team Report on Marine Safety Investigations, submitted on September 18, 1995. In this excellent report, there is a candid review and analysis of current marine casualty reporting and investigation criteria, followed by concrete suggestions for their improvement. The questions are, "How many of the suggestions are being implemented? Is there serious intent on the part of the senior leadership to do so, and if so, how are they going to go about it?" It seems to me that these are the sorts of questions that should be put to candidates for the highest position in the Coast Guard.

To be fair, some of the suggestions are being implemented, at least in a limited way. One of the "areas for improvement" discussed in the report is that an investigator's career path should be developed, which would help raise the level of expertise. Since an assignment as an investigator is for a limited number of years and doesn't lead directly to anything else, it is considered something of a

dead end. Today a concentrated program for investigators is being developed, which should soon begin to have an impact.

Other suggestions in the report appear to lie dormant. One of the simpler ones involves improving feedback to customers. Casualty reports, and the lessons to be learned from them, should be available, in a timely manner, to those who can make the most use of and get the most benefit from them. With the availability of electronic bulletin boards, that shouldn't be a problem, but it is. Complete casualty reports, including enclosures, are often unavailable even to Coast Guard districts. Like the NTSB, the Coast Guard should regularly publish complete reports including enclosures, which often include useful information. The general public should not have to resort to the Freedom of Information Act to gain access to such material.

I said in the beginning that I would like to talk briefly about fishing vessel safety within the broadest possible context. One of the reasons that it took so long for fishing vessel safety to come to the attention of Congress was that the American public in general didn't know much about the fishing industry. This was not only because commercial fishing occurs in limited coastal areas, and that there were some in the industry who wanted to avoid the attention of Congress, but because the whole nature of commercial fishing has been in such a state of change during the last 40 years. Beyond the communities which were involved on a daily basis with the industry, fishing was viewed as dangerous, difficult, and challenging, and perhaps as slightly romantic. There have always been books written about fishermen and their adventures at sea, and there's been much truth in these books. You can go back to the classic of them all, Herman Melville's *Moby Dick*, putting aside the fact that Moby Dick was not a fish. But there is a different kind of book being written today.

Five years ago, Spike Walker had just written *Working on the Edge*, a riveting description of king crab fishing in Alaska, in which he told the dramatic and wrenching stories of many vessels --ones that came home and others that didn't. Only a few months ago, Sebastian Junger's *The Perfect Storm* became a runaway success, last week celebrating its 23rd week on the New York Times Best Seller List. One journalist, who interviewed the people whom he wrote about in Gloucester, Massachusetts, as well as the author, reported that those people felt that they had been presented in a fair and candid manner, and that they felt that he had given them a renewed pride in their profession. I know of at least one other book by Patrick Dillon, which is due to come out in the next 6 months based on the twin sinkings of the F/V Americus and the F/V Altair north of Dutch Harbor in February 1983.

These books are introducing the culture of modern commercial fishing to the American public in a way which makes the men and women who engage in this profession real, as well as the men and women who are engaged in trying to save those who fish when things go desperately wrong, the Coast Guard and the Air National Guard.

These books are not, of course, ABOUT fishing vessel safety, but it is always there as an undercurrent. Walker's book is dedicated to "the hope that the youthful tide adventuring north each year may know the perils awaiting them, and that the slaughter may end." And *The Perfect Storm* is

perhaps the exception which proves the rule, “Sometimes, not often but sometimes, there is nothing that can be done. But that in no way diminishes the necessity to anticipate and prepare for everything that is possible.”

Over the long term, I persist in being optimistic about moving forward the process of developing a safer fishing industry, and it is because today the message is being broadcast at a greater rate than ever before and to a wider audience. It's being delivered by these books, by the journals of the fishing industry, and by workshops and conferences such as this one.

It's certainly necessary to have EPIRBs, life rafts, and survival suits on board. It's real progress to have at least a minimum of safety training required. These things have been demonstrated to save lives, but the conspiracy of silence, the time when a fishing journal wouldn't publish an article on safety, is over. And I think that's important.

In January of 1986, only months after the disappearance of the F/V Western Sea, the United Fisherman's Marketing Association in Kodiak published a little pamphlet which it gave out to every crewman purchasing a commercial fishing license there. It was entitled, "*It’s Your Life*..." and it suggested some basic gear which should be on board, and some precautions which should be taken before leaving the dock. It tells the skipper that he should familiarize his crew with emergency procedures BEFORE the emergency occurs. The woman who wrote and designed the pamphlet told me that skippers were storming into her office, tearing up the pamphlet and shouting at her that she must be trying to put them out of business.

Early this year, when Brad Matson was writing a 10-year assessment of the Fishing Vessel Safety Act for the *National Fisherman*, he asked the skipper of a salmon trawler how often the issue of safety came up on his boat. "When’s safety on my mind?" he asked, "All the time," he answered. I like that.

OPENING REMARKS

By Mr. John Hammerschmidt
Member, National Transportation Safety Board

Good morning, Dr. Rosenstock, Mrs. Barry, Dr. Conway, Mr. Klatt, and everyone assembled here at this, the Second National Fishing Industry Safety and Health Workshop.

Before I launch into my prepared remarks, I would like to make a few observations and introduce a few folks. It should be mentioned right at the start that the National Transportation Safety Board (NTSB) is pleased that the Alaska Field Station of the National Institute for Occupational Safety and Health (NIOSH) took the lead to organize this safety and health workshop.

In fact, last year and again this year, I have been very fortunate to have also addressed another workshop held in Ketchikan, Alaska, focusing on accidents involving helicopter safety in the logging industry, an area that was pointed out by Dr. Rosenstock in her presentation. Those workshops, of course, were also organized by the NIOSH Alaska Field Station.

The NTSB is pleased to cosponsor such seminars and workshops that bring together, as in this case, larger groups of professionals, fishermen, and others, to increase awareness and to encourage action to prevent injuries and death that result from working in the commercial fishing industry.

On a personal note, it is great to be here again in Seattle. Three of us from NTSB were here in 1994 at Fish Expo '94. NTSB, as many of you may remember, had an exhibit that year. Among other things, we conducted a survey of commercial fishermen pertaining to defined safety issues, which was very helpful with the work that we are still doing in this area.

Also at Fish Expo '94 and the NTSB exhibit were Mr. Bill Gossard and Mr. Don Tyrrell. I mention that because Mr. Tyrrell, who is the Chief of Major Investigations in the Safety Board's Office of Marine Safety, and I had the occasion of touring and spending practically an afternoon aboard the factory trawler (F/T) Alaska Ocean, which was docked here in Seattle. That was a very interesting and educational opportunity.

Along that line, and speaking of books and quotes and authors, I've long enjoyed what was attributed to the mystery author John Le Carre, who is quoted as saying that "a desk is a dangerous place from which to view the rest of the world." Hence, it is good to get away from Washington, D.C., and to be here to mix and talk with so many folks whose day-to-day lives involve commercial fishing. I know that Dr. Conway and Michael Klatt have heard me say this before, but my favorite definition of Washington, D.C. is that Washington, D.C., is simply 67 square miles surrounded by reality. That's my perspective on perspectives!

NTSB also knows very well the work of the Alaskan Marine Safety Education Association (AMSEA), which, if my numbers are even close to correct, has trained in excess of 3200 fishermen as drill instructors to meet Coast Guard requirements for emergency drills on certain vessels. AMSEA has trained fishermen not only in Alaska, but in other parts of the United States and worldwide.

The North Pacific Fishing Vessel Owners Association (NPFVOA) Vessel Safety Program also is a leader in many different safety training areas, such as safety equipment, survival procedures, and fishing vessel stability. The information provided to me indicates that over 17,000 fishermen have completed at least one NPFVOA training course.

Let me ask of those in attendance here, how many of you are commercial fishermen? I see four people raise their hands.

The Coast Guard's role in fishing vessel safety can never be ignored, and I congratulate the 13th and the 17th Coast Guard Districts for co-sponsoring this workshop, and also the Northwest Center for Occupational Health and Safety.

I would now like to quickly introduce the NTSB staff attending this workshop; please stand up when I call your name. Dr. Meg Sweeney, Office of Research and Engineering, who is currently working on the Board's second fishing vessel safety study. Mr. Bill Gossard, who was the primary author of the Board's first fishing vessel safety study released in 1987 and is currently working on the second study. I might mention that Bill is moving from the Office of Research and Engineering to NTSB's newly-organized Office of Safety Recommendations and Accomplishments. Mr. Mike Brown is also currently working on the second fishing vessel safety study and has moved to the Office of Safety Recommendations and Accomplishments to provide a strong maritime presence there. Mike previously worked in the Office of Marine Safety. The four of us from NTSB are here to look, listen, and learn, as well as to try answer any questions that you may have.

It is certainly important that we meet to explore intervention strategies and safety promotional activities that will reduce the number of commercial fishing vessel losses. We are all aware that commercial fishing by its very nature can be dangerous. Fishing vessels must be seaworthy, masters ever vigilant to their surroundings, and crew members alert to the dangers of the sea and the equipment that they are required to operate.

The NIOSH Alaska Field Station provides us a snapshot of the industry with some good news and with some bad news. Although these figures have already been presented by Dr. Rosenstock, because they are important figures, let me reiterate them.

First, the bad news is that 146 commercial fishermen died in Alaskan waters alone in the past six years. This equates to about 24 deaths annually, and represents the highest number of workers lost in any Alaskan industry.

Secondly, the number of commercial fishing vessels, about 35, that are total losses each year remains at about the same level.

The good news is that overall, commercial fishing deaths in Alaska in 1996 were down 33 percent from 1991. Further, in 1991 only 73 percent of commercial fishermen survived a vessel sinking or capsizing, whereas 89 percent of commercial fishermen survived vessel sinkings or capsizings in 1996.

NTSB has continued to focus on commercial fishing vessel safety. Our 1987 study, with the groundwork and constant pressure of many of you here today, set into motion the completion of a number of positive safety improvements.

For instance, the Commercial Fishing Industry Vessel Safety Act of 1988 (CFIVSA) required certain safety equipment, such as buoyant apparatus, emergency position radio indicating beacons (EPIRBs), fire extinguishers, life preservers, and flares for fishing vessels operating at sea. Vessels that operate beyond the boundary line or carrying more than 16 persons on board had to meet more stringent requirements, such as immersion suits, lifeboats or life rafts, and other safety equipment.

These requirements for safety equipment, NTSB believes, have played an important role in improving the ability of the Coast Guard and other search and rescue responders to save the lives of many fishermen.

And I might mention for those of you who have not seen this booklet entitled, "*Federal Requirements for Commercial Fishing Industry Vessels*," which I just saw yesterday, I would recommend this to you. At first read, it appears to be exceptionally well done.

Also, as a result of the 1987 safety study and the prodding of many of you, the Coast Guard required mandatory emergency drills for crew on board federally documented fishing vessels operating beyond the boundary line or carrying more than 16 persons on board. Important was the fact that the drill instructor had to meet some minimum training and/or licensing requirement.

Even though we have achieved some successes in these areas, the Safety Board remains concerned that masters of commercial fishing vessels are not licensed. In 1985, 12 years ago, the Safety Board issued a safety recommendation to the Coast Guard, as the result of the loss of the F/V Amazing Grace.

This recommendation urged the Coast Guard to seek legislative authority to require the licensing of captains of commercial fishing vessels, including requirements that they demonstrate minimum qualifications in vessel safety, including rules of the road, vessel stability, fire fighting, water-tight integrity, and the use of life-saving equipment.

This recommendation was reiterated in several other major accidents, including the loss of the F/V Santa Rosario, F/V Americus and the F/V Altair. These accidents resulted in the loss of 16 lives and occurred shortly after the loss of the F/V Amazing Grace.

In the Safety Board's 1987 safety study this recommendation was again reiterated. Subsequently, the Board investigated four more accidents involving the F/V Lark, F/V Uyak II, F/V Wayward Wind, and the F/V Nordfjord. These accidents resulted in the loss of 14 more lives and property damage loss estimated at four million dollars.

In 1990 the Safety Board placed this licensing recommendation on the Board's new program known as the "Most Wanted Transportation Safety Improvements." This is a listing with backup justification for the safety areas in the different modes of transportation where the Board believes a specific action will provide positive safety results in the immediate future.

The other maritime areas on NTSB's "Most Wanted" list include mandatory education and/or licensing of the operators of recreational boats, strengthened state alcohol and boating laws, and small passenger vessel safety issues including crew drill training to evacuate passengers and pre-departure safety orientations for passengers.

To the credit of the Coast Guard, they did submit two licensing plans for commercial fishermen to Congress, one in 1992 and another in 1993. The 1992 plan was required by the CFIVSA. The second plan was the result of the Coast Guard's advisory committee and the Coast Guard seeking an alternative. No Congressional action was taken on either plan.

NTSB, however, remains committed to action in this area. Currently NTSB is completing a follow-up study to examine further any evidence that commercial fishing vessel safety as a whole has improved, or conversely, if conditions have remained the same.

That's the study that Bill, Meg, and Mike are working on. The issue of licensing of captains of commercial fishing vessels will most likely be addressed again.

Two other areas that remain on NTSB's "Most Wanted" list that apply to commercial fishing vessels are stability tests and load lines for fishing, fish tender and fish processing vessels. The stability issue was first addressed in the tragic loss of two vessels, the F/V Americus and the F/V Altair, in the Bering Sea in 1986.

As a result of the loss of these two vessels on the same day, NTSB recommended that the Coast Guard seek legislative authority to require stability tests, and that complete stability information be provided to the captains of commercial fishing vessels.

The Coast Guard did submit a legislative package asking for the authority to inspect commercial fishing vessels--within that authority to require stability testing and to modify guidelines for the setting of load lines--but no action has been taken.

The load line recommendation came from the 1990 catastrophic accident involving the U.S. fish processing vessel, F/V Aleutian Enterprise. This accident involved 31 persons and it was fortunate that all 31 did not perish. Fortunately, rescue vessels were only ten minutes away, and the F/V Aleutian Enterprise was able to transmit an emergency message. The vessel, valued at about six million dollars, was a total loss.

Anecdotally, I might mention that when we were here at this gathering in 1994, we brought with us a healthy supply of a variety of NTSB marine accident reports to offer to those who stopped by the NTSB exhibit. Although we had a good many copies, we probably should have brought three times as many because, due to the significant interest among commercial fishermen about many of these accident investigations, we quickly ran out of reports. Their interest appeared to be in learning the details of exactly what the investigative work revealed, which dovetails with what Mrs. Barry has just pointed out, i.e., the importance of thoroughly documenting the investigative work. Also, there was a great deal of interest in the F/V Aleutian Enterprise report in particular; after giving out all the copies we had of that report, we then collected names so that we could mail additional copies from headquarters.

These reports will soon be available on the Internet. And, for those of you interested in the Board's "Most Wanted" list, it is currently available in its entirety on the Internet. The Internet address is simply: www.ntsb.gov. I believe Bill Gossard has a hard copy of the list, as well as the safety recommendations for which NTSB continues to seek action, and he can get you copies of those today.

Let me also mention two U.S. fish-processing vessel fires investigated by the Safety Board. The first involving the F/V All Alaskan occurred near Unimak Island, Alaska, in the Bering Sea on July 24, 1994. One person died. The Safety Board determined that the probable cause of the fire aboard this vessel was the failure to isolate heat tape from combustible, rigid, and polyurethane insulation, and the lack of heat tape standards for fish-processing vessels.

Contributing to the severity of the fire was the lack of adequate fire-fighting standards, i.e., detection and suppression systems. Also contributing to the loss of life was the lack of formal fire-fighting training of the fire team. This vessel was also a total loss and the vessel and cargo were estimated at a value between 25-31 million dollars.

The second fish-processing vessel fire involved the F/V Alaska Spirit in 1995. This vessel burned while moored alongside the dock in Seward, Alaska. The master of the vessel died. Damage was estimated at about three million dollars. NTSB determined that the probable cause of this accident was the failure of the fishing company to address inadequate fire safety conditions and practices on

the vessel. Contributing to the severity of the damage and the loss of life was the lack of fire-safety standards for commercial fishing industry vessels.

I will not go into the fire safety standards issues. However, if you wish copies of either of these reports, please see our staff here today.

The most current accident that we have investigated, and from which we issued safety recommendations, is one of the six accidents we investigated for the upcoming Board safety study. This was the tragic loss of the F/V Northwest Mariner in January 1995.

The accident resulted in the death of six crew, and the total loss of the vessel, valued at about 2.1 million dollars. NTSB determined that the probable cause of the capsizing and sinking of the F/V Northwest Mariner was a loss of vessel stability due to heavy ice accumulation on the super structure and crab pots and issued two safety recommendations to the Coast Guard. First, to inform commercial fishermen that thermal protective aids can save lives, and secondly, that Coast Guard approved training, such as that provided by AMSEA and NPFVOA, should emphasize the existence, benefits, and use of all such equipment.

In summary, these are some of the areas that NTSB has addressed in commercial fishing vessel safety. I am sure that as we listen to the speakers that follow, we will begin to formulate countermeasures and ideas about how we all might better be able to advance safety by implementing certain safety initiatives.

If we can be of any assistance to you in providing information from the Safety Board or addressing issues that you think are important, please feel free to contact us at any time. If any of you are in Washington, D.C., please stop by our offices.

WORKSHOP CHARGE

By Dr. George Conway
Chief, NIOSH Alaska Field Station

One of the hazards of following three excellent speakers is that they will have said everything I intended to say, and that's largely the case.

Giving the Workshop Charge is probably a little presumptuous in this setting, because I really don't think there's any question at all that anyone in this room would need any external motivation to try to do what they could about fishing safety. I think I know probably two-thirds of the people in the room, and I know that you're all very committed to doing that. However, I do want to reiterate some of the things that the previous speakers have said, and maybe provide a slightly different perspective about the opportunity that the next couple of days afford us.

There's a balance here that we have to strike. The Commercial Fishing Industry Vessel Safety Act of 1988 (CFIVSA), as landmark legislation, has led to impressive results in what I would call the salvage of fishermen. Today, in spite of the persistence of horrific events, we have much higher survivorship among fishermen. That's largely due to the availability of the EPIRBs, survival suits, and life rafts on all the cold-water vessels now. Also largely due to, and dependent upon, the efforts by many of the search and rescue (SAR) personnel of the Coast Guard. On the other hand, we haven't made much progress in another major area: there is still an average of 35 vessels a year going over or sinking in Alaskan seas, virtually all of them in one way or another unstable, or at least unsuitable for the circumstances in which they find themselves. As a result, there's an average of over 100 Alaskan fishermen ending up in the icy seas every year. Their salvage is largely dependent upon efforts by USCG SAR personnel, often under extreme conditions.

So I'm actually concerned about two workforces. I was very concerned a few years ago about one work force, the fishermen, and now I'm almost as concerned about the SAR personnel who are largely relied upon to affect that salvage.

We will have an opportunity today to hear a wide variety of talks about the current status of commercial fishing safety. This should provide us by the end of the day with a fairly accurate picture of where things stand for this industry: that there's been substantial progress, and the fact that we can make that kind of progress should energize us toward trying to go the rest of the distance.

The other thing that should become clear is that there are still some large gaps, and we're not doing a very good job yet of actually preventing the events that place these fishermen at tremendous risk. Tomorrow we'll have an opportunity, through a process that's both sharing and deliberative, to come up with resolutions and recommendations to do something about this problem, given the tools that we now have.

Over the last few years, while trying to make a difference in mortality in a number of different industries in Alaska, we've learned that there's often more benefit to people concentrating on what they can do rather than what they can't do. Ignoring or transcending any bureaucratic boundaries and obstacles that may come initially to the fore will likely strengthen our chances for success.

The other thing that's going to be very important is collaboration in looking at who can do what among the members of the team: the fishermen themselves, industry leaders, voluntary and nongovernmental organizations such as AMSEA, and the government agencies that are responsible for doing something about these problems.

So, I look forward to the next two days, and I hope that it proves to be productive time for all. I appreciate your all being here.

CHAPTER II
DEFINING THE PROBLEM AND IDENTIFYING THE POPULATION AT RISK

EPIDEMIOLOGY OF VESSEL CASUALTIES AND COMMERCIAL FISHING FATALITIES IN ALASKA

By Ms. Jennifer Lincoln
Occupational Safety and Health Specialist, NIOSH Alaska Field Station

The NIOSH Alaska Field Station collects information on all types of occupational fatalities. Our comprehensive surveillance system collects data from a variety of sources including U.S. Coast Guard reports, National Transportation Safety Board (NTSB) preliminary and final investigative reports, Alaska State Trooper reports, medical examiner reports, death certificates, and local news media reports.

Commercial fishermen comprised a large portion (146, 34 percent) of the occupational fatalities in Alaska from 1991-1996, and have an occupational fatality rate of 140/100,000/year, 28 times the national average. The fatalities occurring in May, June, and July were primarily in the salmon fisheries. The high number in September were associated with the halibut derbies that took place in 1991-1994. The high numbers in January, February, and November represent the fatalities associated with the winter fisheries such as the crab fisheries in the Bering Sea. (Figure 1)

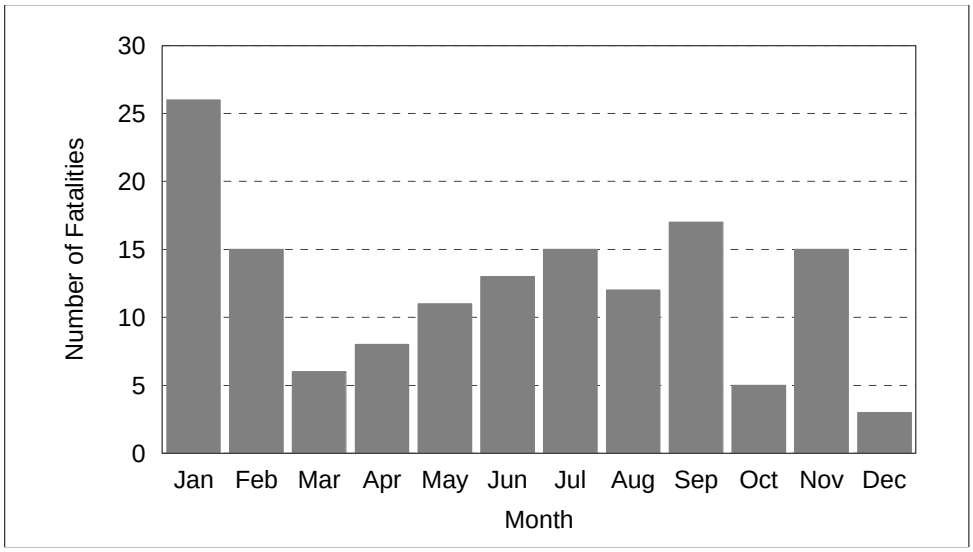

Figure 1. *Fishing Fatalities by Month, Alaska, 1991-1996, n=146*

Not surprisingly, most fishermen die as a result of drowning, usually combined with hypothermia. These deaths result from either vessel-related events (i.e., capsizings/sinkings), falling overboard, or diving-related incidents. Fishermen were also crushed by crab pots, entangled in winches, and asphyxiated in fires. (Figure 2)

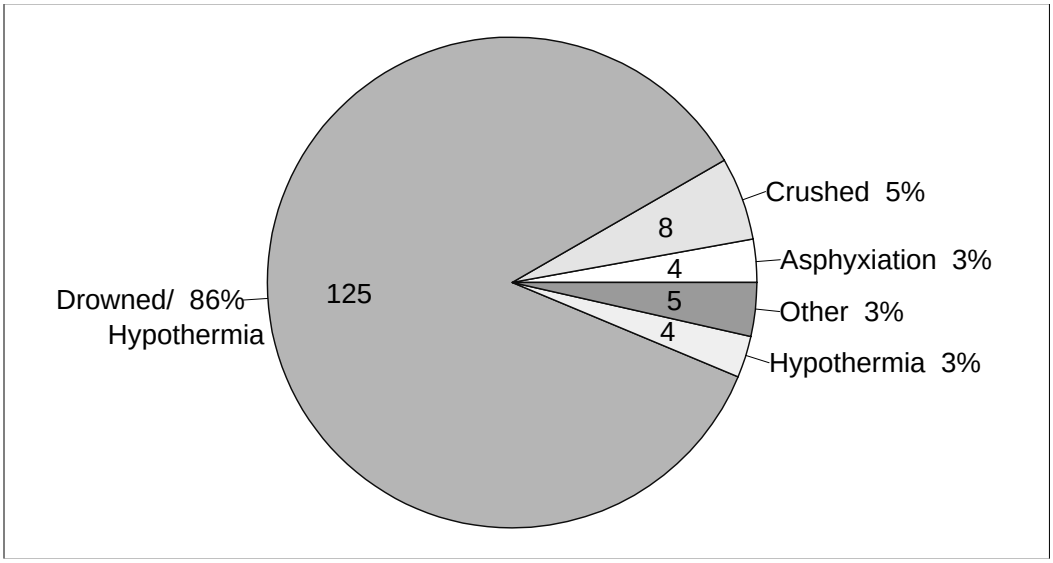

Figure 2. *Cause of Death for Fishing Fatalities, Alaska, 1991-1996, n=146*

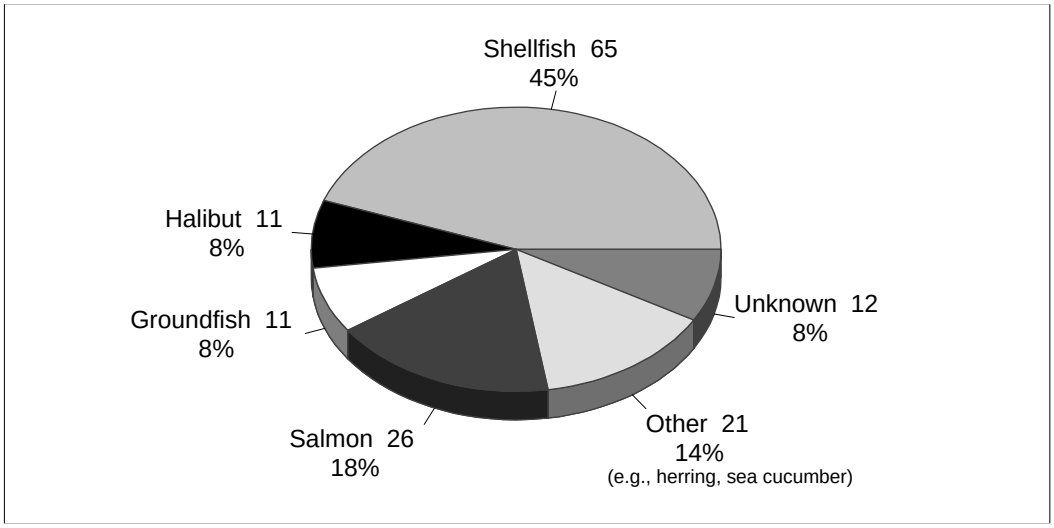

Figure 3. *Fishing Fatalities by Fishery, Alaska, 1991-1996, n=146*

Fisheries vary in a variety of ways: a) type of gear used, b) location of fishing grounds, c) duration, and d) time of year. The shellfish (crab) fishery makes up the highest number of fishing-related fatalities in Alaska. (Figure 3)

When we calculated rates, the shellfish fishery had a much higher rate than any other fishery in Alaska, followed by the herring fishery and halibut fishery. (Figure 4)

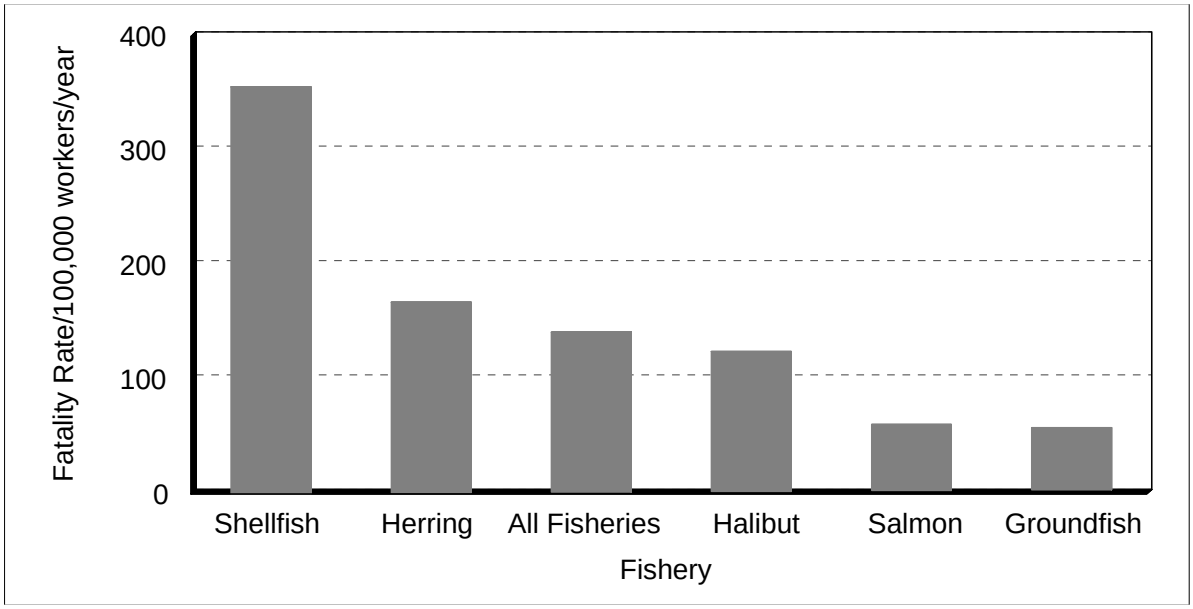

Figure 4. *Commercial Fishing Fatality Rates by Fishery, Alaska, 1991-1996*

There has been a reduction in fishing fatalities since the early 1990s. This reduction has occurred primarily in fisheries other than the shellfish fishery. People on board are calling the Coast Guard sooner and using emergency equipment that is required on board, such as electronic position indicating radio beacons (EPIRBs) and life rafts. I'd like to challenge this group to shift its focus on not just reacting to these events when they arise, but also preventing them from occurring in the first place.

The four areas that we're going to discuss tomorrow are areas of prevention on which we need to focus: a) vessel-related events, b) falling-overboard events, c) diving-related events, and d) non-fatal injuries.

Table 1. Recent Decrease in Case Fatality Rate, Alaska Commercial Fishing Industry, 1991-1996

Year	Number of Vessels Lost*	Persons on Board*	Fatalities**	Fatality Rate***
1991	39	93	25	27 %
1992	44	113	26	23 %
1993	24	83	14	17 %
1994	36	131	4	3 %
1995	26	106	11	10 %
1996	39	114	13	11 %

* SOURCE: U.S. Coast Guard, 17th District, Fishing Vessel Safety Coordinator.
** Fatalities from capsized or lost commercial fishing vessels only.
*** Fatality Rate = (number killed/number at risk) X 100 percent.

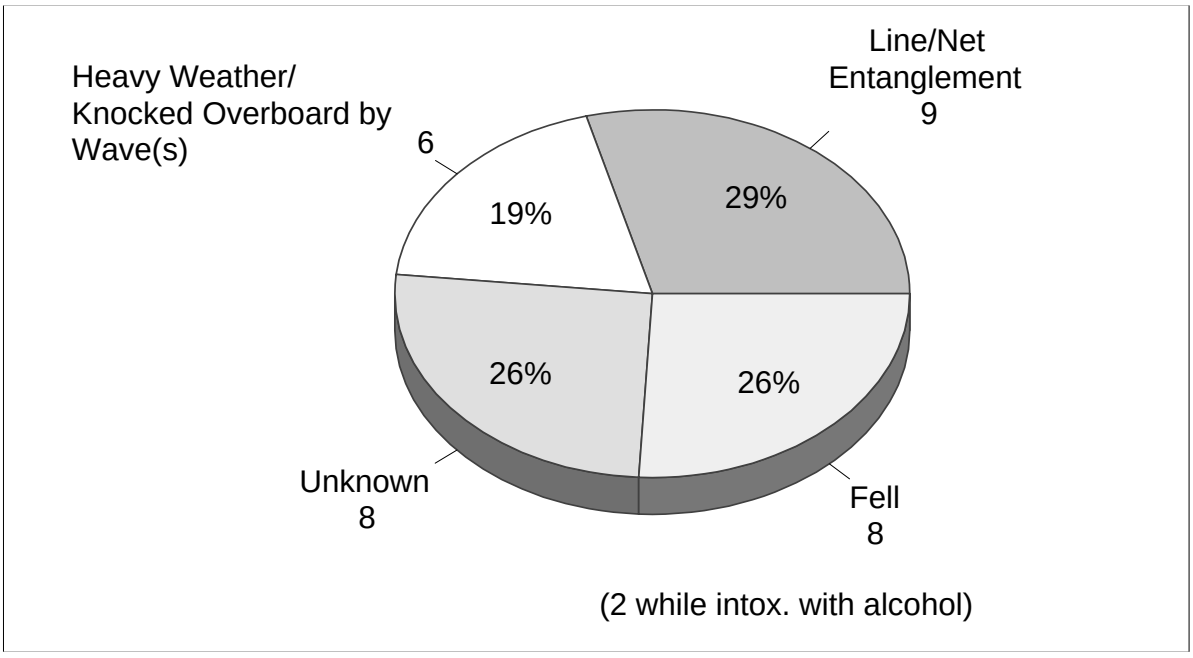

Figure 5. *Man Overboard Events by Circumstance, Alaska, 1991-1996, n=31*

Vessel-Related Events

There has been an increase in the number of people who are saved from distressed vessels; however, we still lose an average of 35 boats a year, putting approximately 100 people aboard these vessels at much greater risk of succumbing to Alaska's frigid waters. In 1991, 73 percent of the people involved in vessel-related incidents survived as compared to 89 percent in 1996. So this reinforces the fact that survival equipment is being used, and that people are being rescued after they get in trouble, but it also reinforces the fact that something needs to be done about preventing these vessel capsizings and sinkings in the first place. (Table 1)

Falling Overboard Events

Thirty-one fishermen fell overboard and drowned during the 6-year period from 1991-1996. None of them were wearing a personal flotation device (PFD). These falling-overboard fatalities can be divided further into the reasons for the victims being immersed in water: entangled in a net or line (9, 29 percent), unobserved fall (victim missing from vessel) (8, 26 percent) , observed fall (8, 26 percent), and washed or blown into the water (6, 19 percent) (Figure 5). The problem of falling overboard events needs to address two areas: a) preventing the fall, and b) retrieving the victim successfully.

Diving-Related Events

There was a one-day conference that took place on July 25, 1997, in Sitka, Alaska, to address dive-related emergencies. For the 3-year period from 1993-1995, there were six fishermen that died as a result of diving incidents. All six of them were white males, and they ranged in age from 20- to 32-years of age. Three of them were sea cucumber divers, and the other three were clearing either nets or lines from the boat propellers or the ocean floor. Four of them were using SCUBA equipment and two were using surface-supplied air. They were diving at water depths between 10 and 44 feet. They drowned after either getting entangled in what they were trying to untangle or exhausting their air supply. And it's unknown what happened to one victim. Only one of these men was highly trained, and the other five were either newly-certified recreational divers or had no training whatsoever.

Non-Fatal Injuries

Finally, the next presenter will discuss the non-fatal injuries that are collected by the Alaska Trauma Registry.

I hope bringing representatives from all sides of these issues will result in some attainable objectives to further reduce the unacceptably-high number of fatal and non-fatal injuries in the commercial fishing industry.

NON-FATAL INJURIES IN THE ALASKAN COMMERCIAL FISHING INDUSTRY

By Mr. Bradley Husberg
Occupational Safety and Health Specialist, NIOSH Alaska Field Station

In the past, there has not been extensive published research on work-related, non-fatal injuries. The main reason for this has been the lack of data available for tracking non-fatal injuries.

The Alaska Trauma Registry

In 1991 the Alaska Department of Health and Social Services began collecting certain information from hospitals in Alaska. These data are compiled in the Alaska Trauma Registry (ATR), and can be used for research in work-related injuries.

I would like to begin with a brief background on the ATR. To begin with, I'd like to point out that all 24 hospitals in Alaska contribute data and information to the ATR, making it a statewide, population-based data source.

The Alaska Department of Health and Social Services in Juneau oversees the collection, cleaning, and storage of ATR data. Our office in Anchorage has a partnership with the state and focuses on the analysis of work-related injuries in the ATR.

For an injury to be included in the ATR, it must meet specific criteria. First, the patient must sustain a traumatic injury. In addition, patients who suffer from the effects of hypothermia or near drowning are also included in the ATR. These patients must also be either admitted to a hospital, transferred to a hospital with a higher level of care, or declared dead in an emergency department. (Figure 1)

- Patients who sustain traumatic injuries;
- hypothermia; or
- near-drowning/drowning

and who are either:

- admitted to the hospital;
- transferred to a higher level of care; or
- declared dead in the emergency department

Figure 1. *ATR Case Definition*

You can see from the case definition that most of the injuries qualifying for the ATR would have to be of a serious nature. All the information I will give in this presentation will come from the ATR and focus on non-fatal, work-related injuries.

Presently, the ATR includes data from January 1, 1991, through December 31, 1995. It contains information on 20,842 injuries, of which 2,421 are work-related and of those, 392 are in the commercial fishing industry.

The ATR breaks down work-related injuries into 11 different target industries. Commercial fishing is one of these target industries, and currently rates highest in total number of non-fatal injuries. (Figure 2)

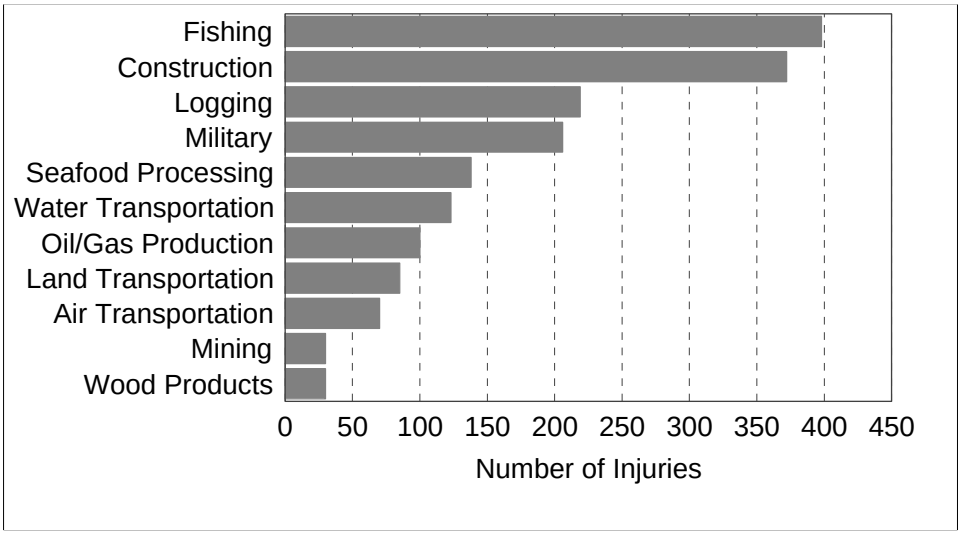

Figure 2. *Number of Injuries by Industry, Alaska Trauma Registry, 1991-1995*

Injuries in the Alaskan Commercial Fishing Industry

When the number of injuries are converted to a rate, which is comparing the percent of occurrence with the defined worker population, commercial fishing ranks sixth, below logging, water transportation, wood product manufacturing, construction, and mining. Using the ATR case definition, commercial fishing has a non-fatal injury rate of 459 per 100,000 workers per year. (Figure 3)

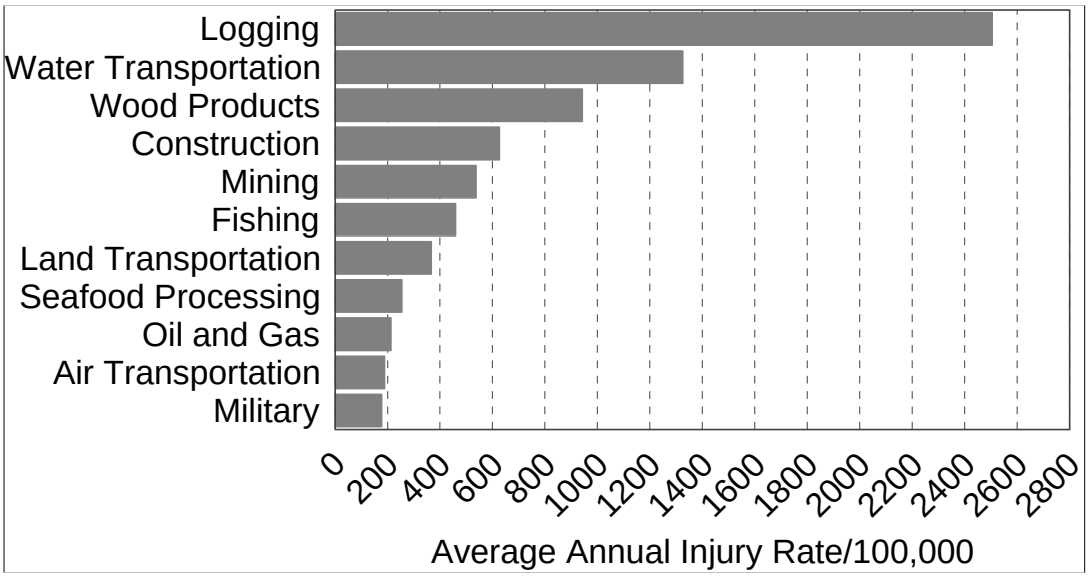

Figure 3. *Injuries/100,000 Workers/Year by Industry, Alaska Trauma Registry, 1991-1995 Preliminary Incidence Data*

To provide a better understanding of who is being injured in the Alaska commercial fishing industry, I've included information focusing on this group of workers.

Looking at age distribution, we find that the majority of injuries occur in fishermen between the ages of 20-49, with the 20-29 year-old group with the highest number of injuries. (Figure 4)

The majority of injuries occur during the summer months. However, there is also an increase in non-fatal injuries during the months of February and March. (Figure 5)

The bulk of the injuries occur in the geographic area of the Aleutian and Pribilof Islands, presumably in the Bering Sea, followed by Southeast Alaska, Kodiak, and Bristol Bay. (Figure 6)

To get an even better understanding of the injuries in the commercial fishing industry, I have included information on the cause of injury, body region injured, and type of injury. Information detailing the cause of injury is taken from the medical cause of injury, or ECODE, in the ATR. Unspecified injuries from machinery and falls, all occurring on a watercraft or boat, rank highest in the list for cause of injury in commercial fishing.

Another field in the ATR is the injury description field, which is an open-text field where the data abstractors can write a short description about the injury. This field has become extremely useful in gathering details of the injury event.

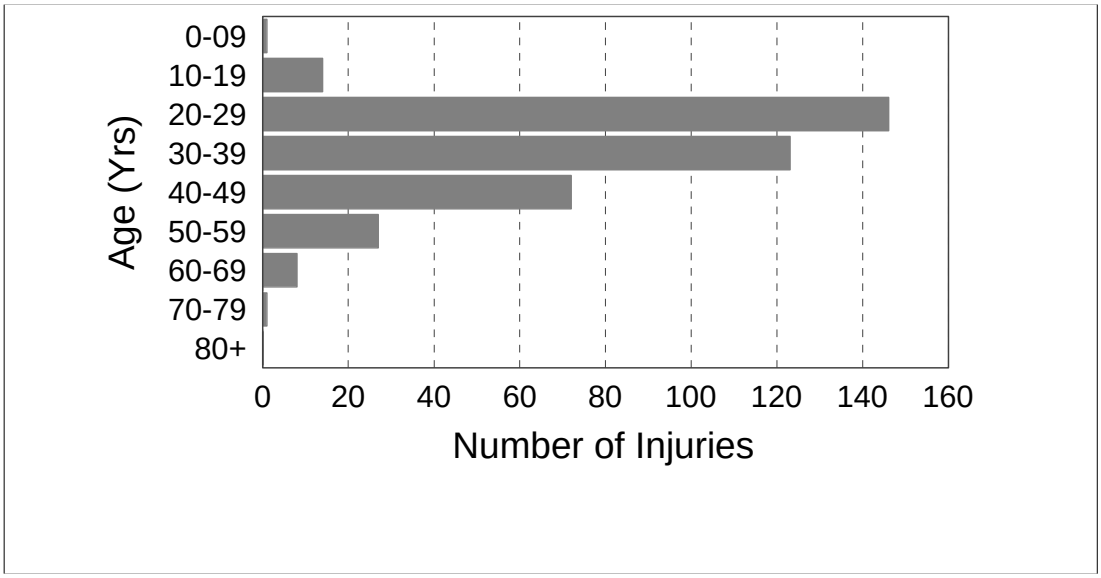

Figure 4. *Victim Age, Work-Related Injuries, Alaska Trauma Registry, 1991-1995*

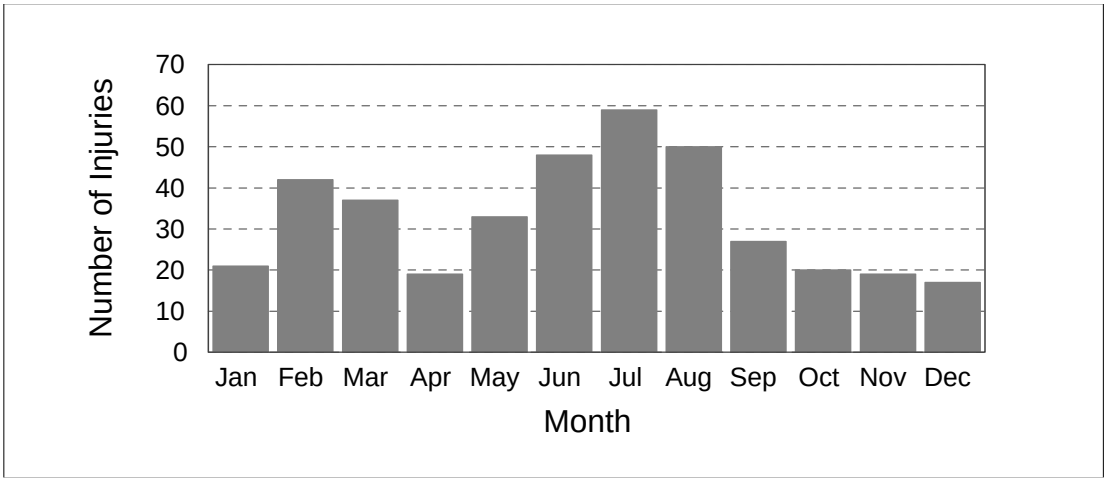

Figure 5. *Month of Work-Related Injuries, Alaska Trauma Registry, 1991-1995*

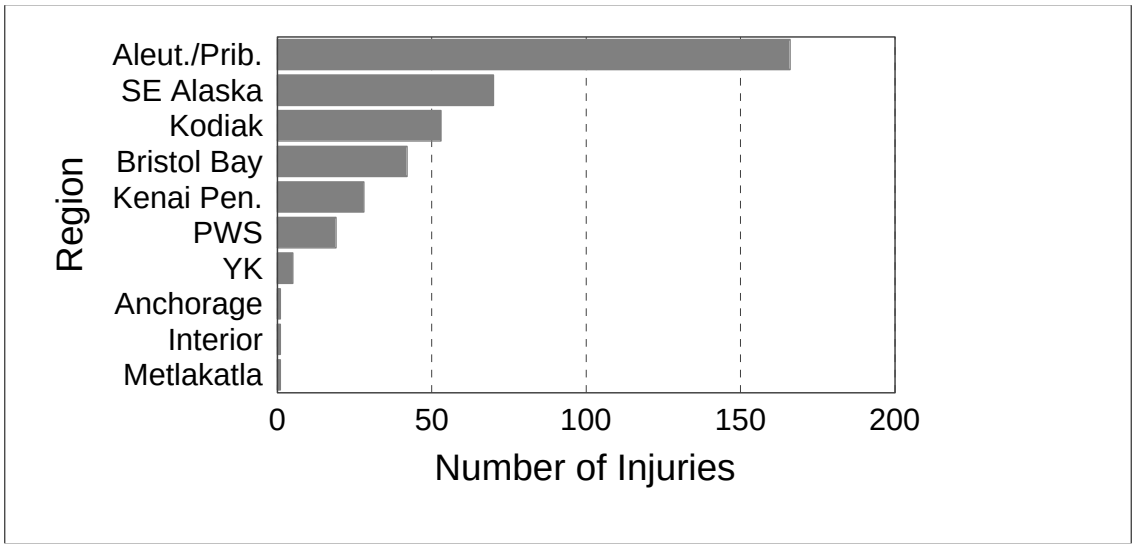

Figure 6. *Region of Occurrence, Alaska Trauma Registry, 1991-1995*

Cause of Injury

The top ranking category for cause of injury was unspecified injury occurring on a watercraft or a boat. From the injury description field we can look at the re-occurring themes that may be contributing to these injuries. Crab pot, net, line, and crushed between boats or a boat and pier were repeatedly mentioned as factors involved in the "unspecified" injury category.

A frequently mentioned factor in the injury description involving injuries with machinery on watercraft was the crab pot launcher. Pulley, winch, rollers, and bait chopper were also frequently mentioned.

For falls that occurred while on a water craft or a boat, falling from a ladder was mentioned most often. Other factors mentioned in the injury description include falling into a hold, or ice on deck, or rough seas that contributed to the fall. (Figure 7)

Body Region of Injury

The body region most often injured is the upper extremity, the arms and the hands, followed closely by the lower extremities, the legs and feet. Knowing the body region of injury can help in injury prevention planning, such as assessing for personal protective equipment needs and guarding on machinery and/or equipment. (Figure 8)

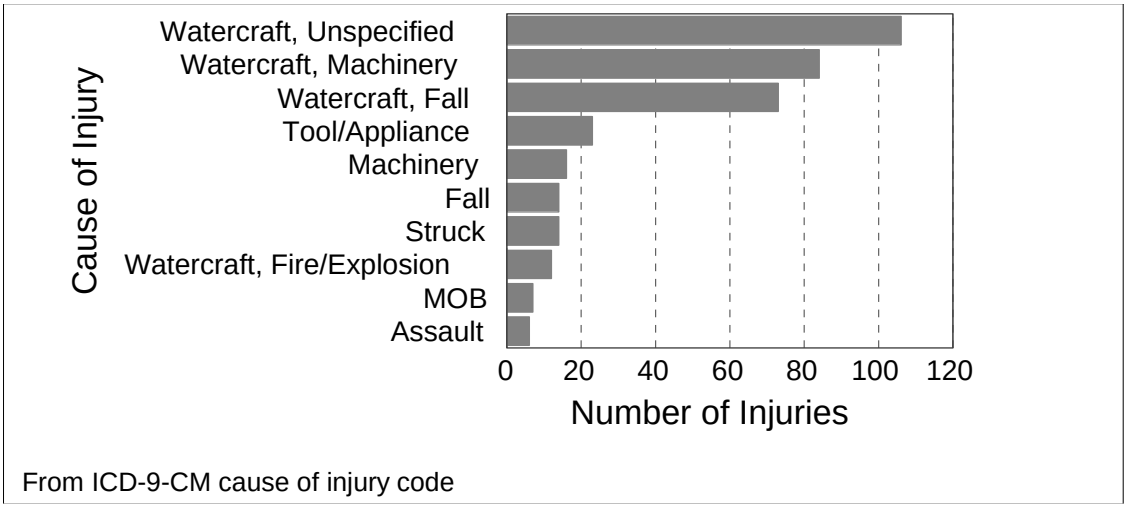

Figure 7. *Cause of Injury, Alaska Trauma Registry, 1991-1995*

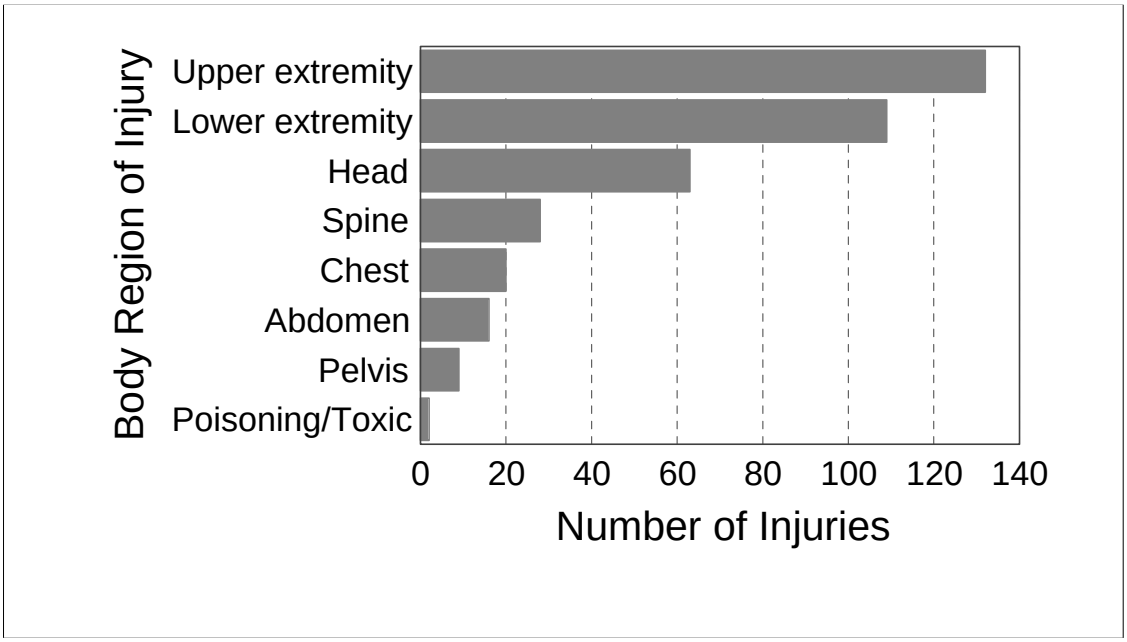

Figure 8. *Body Region of Injury, Alaska Trauma Registry, 1991-1995*

Type of Injury

We obtain the type of injury from the medical diagnosis field in the ATR. Fractured bones were the most common type of injury, comprising almost three times the number of injuries as open wounds, which ranked second. (Figure 9)

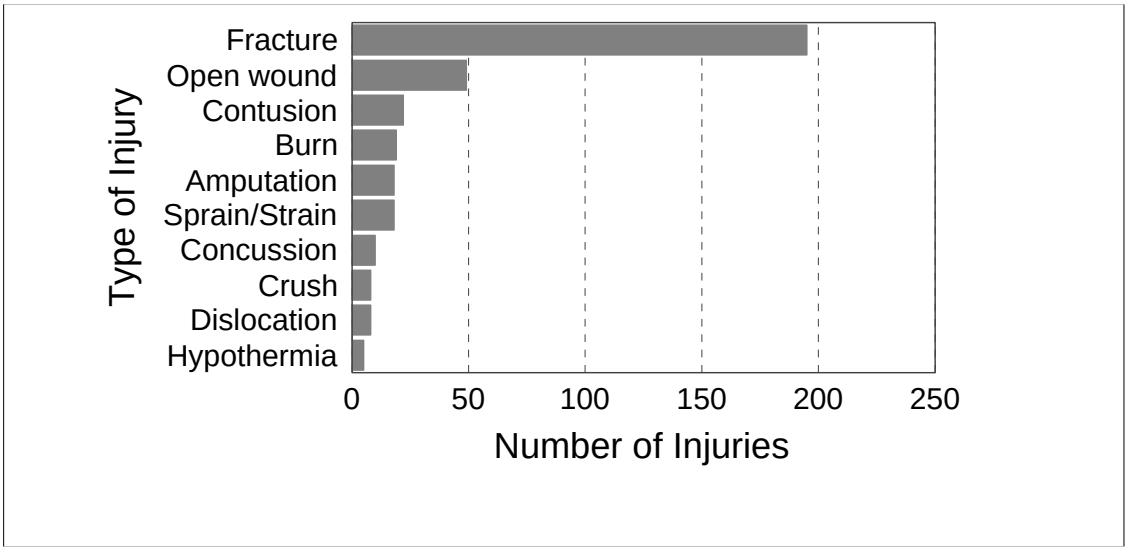

Figure 9. *Type of Injury, Alaska Trauma Registry, 1991-1995*

Injury Descriptions

To help understand more about these injuries, I thought I would read direct quotes from the injury description field, along with the results and medical diagnosis. The quotes I have chosen to read are representative of some of the most common injury scenarios in the ATR data.

The vessels that I've shown or will be showing on these slides are not the vessels where these injuries occurred, but they are of a similar type. Figure 10 shows a crab pot launcher, currently undergoing repairs on a fishing boat which is docked. For those not familiar with this type of equipment, I have drawn a box where the crab pot would be positioned before being slid over the side of the boat and into the water. Quotes from the injury description field include, "Caught foot in hydraulic pot launcher on fishing boat." This injury led to fractured metatarsal bones, which are bones in the foot.

Figure 10. *Crab Pot Launcher*

Figure 11. *Lines and Nets*

Figure 12. *Machinery on Fishing Vessels*

Another quote states, “Caught between crab pot launcher and crab pot. Sixteen hours out of port, immobilized on deck.” This injury led to a fractured femur, which is the long bone in the upper leg.

Common descriptions of injuries using machinery besides crab pot launchers include working with lines and pulleys. (Figure 11) Another quote, “Working on boat during commercial salmon season. Caught finger between line and wheel.” This injury led to an amputated finger.

Injuries with nets (Figure 12) were common, with some injuries resulting from a considerable amount of force. In one case the injury was described as, “Drug across trawler deck by net full of fish. Smashed and squashed into deck.” This event led to a fractured upper leg, along with other injuries.

In conclusion, I'd like to reemphasize that the commercial fishing industry has the highest number of non-fatal injuries for any industry in Alaska. Quite a few injuries occurred in the crab fishery involving crab pots and/or crab pot launchers. Nets, lines, and falls also contributed to a high number of injuries in this industry.

I hope this information will be helpful to those of you attending the work group on non-fatal injuries in the commercial fishing industry that will be meeting tomorrow. I will have handouts with additional information on these injuries for those who attend that work group.

Are there any questions about the ATR or non-fatal fishing injuries?

MS. SWEENEY: Meg Sweeney, National Transportation Safety Board.

Has there been any attempt to associate injury severity with the Abbreviated Injury Scale?

MR. HUSBERG: Yes. The ATR includes a couple of different measures where you can look at severity, and one of them is the AIS, the Abbreviated Injury Scale. And I haven't focused on severity with fishing yet. However, I have done it with all ATR injuries as a whole.

In fishing, I've done a preliminary breakdown, looking at severity. But I haven't come up with anything in detail yet, but it is possible with the ATR.

MR. NOLL: I'm Barry Noll with OSHA, and it would seem to me that the ATR is only capturing part of the population, and that's injured people who are transported to shore. So how are you going to capture the information for those that are treated on the vessels, and don't actually land in Alaska, but may come to Seattle or somewhere else. How are you going to deal with that, because that's a rather large population you're missing?

MR. HUSBERG: Actually, not only does it not capture the people who are treated on the vessel, if they actually are transported ashore and treated in a physician's clinic or an outpatient clinic and not admitted to a hospital, they're not in the trauma registry either.

So, basically, one might best think of the ATR as containing the more severe injuries, not the less severe ones. There are some cases where they're actually transferred to a hospital outside of Alaska. For example in Southeast Alaska, there have been patients sent directly to Harborview Hospital and some of the other hospitals here in Seattle. We do collect data from Harborview Hospital. However, the data from Harborview would have to be manually entered in the ATR and some of the fields that we use in the ATR are not included in the data we receive from Seattle. At this time we have not entered the Harborview information into the ATR, but we have that information available.

MR. NOLL: Now, what about things like the Coast Guard 2692 form, Report of Marine Casualty, that a vessel operator is required to do anytime there is an injury on board the vessel, can you get that data? Because it seems to me it would be much more accurate.

MR. HUSBERG: Yes, actually, that would be a good source of data. In fact, that's an area that we might focus on in the future for looking at some of the less severe non-fatal injuries. That's a good suggestion.

DR. JARRIS: I'm Dr. Ray Jarris in Seattle with Maritime Health Services, which is a medical consultation service, and I'll talk about that during my presentation at the end of the day and present a study where we looked at about 900 cases of things that happened at sea. There are some very striking parallels to what you've learned from the ATR. But we have data available, and we'll certainly make it available to OSHA or NIOSH, whomever would like it.

THE FINANCIAL AND HUMAN COSTS OF COMMERCIAL FISHING

By Mr. Jim Herbert
Instructor, Alaska Vocational and Technical Education Center

The American commercial fishing industry is diverse and often regionally specific. Its activities have long been financially important to local and regional economies. I would like to give you a brief overview of the importance of fishing and a view of the financial costs associated with a few aspects of the industry with particular focus on Alaska. I will cite some statistics as to the financial costs associated with various vessel losses and loss of life aboard fishing vessels. I will review some of the specific injuries that occur in Alaskan fisheries from the files of the Alaska Fisherman's Fund. I also have some data regarding USCG Search and Rescue (SAR) costs.

Importance of Fishing

In the United States we can look at the top ten fishing ports ranked by poundage as in Table 1. Those familiar with the industry will recognize the species associated with the ports listed. For example, Dutch Harbor's huge landing is largely pollock and crab, much of which goes to the Orient. By contrast, some of the southern ports register their landings by taking large volumes of menhaden which is considered an industrial fish used for oil and fishmeal.

Table 1. Top U.S. Fishing Ports 1996 (By Weight)

Fishing Port	Weight (In Pounds)
Dutch Harbor, AK	579,000,000
Empire-Venice, LA	316,000,000
Cameron, LA	315,700,000
Seattle, WA	241,200,000
Kodiak, AK	202,700,000
Intercoastal City, LA	199,000,000
Morgan City-Berwick, LA	162,900,000
Los Angeles, CA	157,600,000
Pascagoula-Moss Pt, MS	148,000,000
Ketchikan, AK	136,800,000
Total Pounds	**2,458,900,000**

SOURCE: U.S. Commerce Department

Another perhaps more meaningful way to look at the top ten fishing ports is by dollar value of the landings. Table 2 gives this breakdown and we see a significant shift in the players. Dutch Harbor still reigns supreme because of crab and ground fish. However, many of the other players land many fewer pounds of high value products like shrimp or tuna They assume financial importance because of their proximity to key markets and because of demand for their products.

If Alaska were an independent country, it would rank among the top ten world seafood producers, ahead of Canada, Norway, Iceland, and other famous fishing nations. The more than 5 billion pounds of seafood harvested in Alaska represent more than half of all seafood harvested in the United States. The total value of Alaska seafood production in 1996 was more than $2.5 billion, and direct exports of seafood total more than $1.4 billion.

The seafood industry is vitally important to the Alaskan economy. It is the state's largest private sector employer, nearly 20 percent of Alaska employment is attributable directly or indirectly to the Alaska seafood industry.

Table 2. Top U.S. Fishing Ports 1996 (By Catch Value)

Fishing Port	Catch Value (In Millions)
Dutch Harbor, AK	$118.7
New Bedford, MA	$100.5
Kodiak, AK	$ 82.3
Key West, FL	$ 62.8
Brownsville-Port Isabell, TX	$ 60.0
Honolulu, HI	$ 50.1
Point Judith, RI	$ 46.0
Empire-Venice, LA	$ 45.4
Dulac-Chauvin, LA	$ 45.2
Portland, ME	$ 38.6
Total Value	**$649.6**

SOURCE: U.S. Commerce Department

Loss Data

We all know by following the media or looking at statistics that commercial fishing is not without its problems. Table 3 is a broad brush approach by the USCG as to the segments of the maritime industry causing problems. Obviously there is great concern because commercial fishing contributes 42 percent of the average annual marine fatalities. Table 4 is based on USCG data and follows the number of fishing vessel deaths from 1/1/85 through 10/15/97. Rates vary because of the increases or decreases in the estimated work force as calculated by the U.S. Department of Labor. Regardless, the loss of 102 individuals in 1985 and 109 in 1987 stand out starkly and sadly. Mercifully, we see the number of deaths and rates in a general downward trend over the past 5 years.

In Table 5 we see loss data for 1996 broken down by USCG Districts. A few words of explanation: The second column shows total fishing vessel deaths, with the number in parentheses being non-operational deaths such as heart attacks. In column three is the number of deaths associated with a vessel loss. The parentheses indicate the number of vessels lost. The last column indicates the number of vessels lost in that district in 1996 with the number salvaged in parentheses. The salvage data is far from perfect according to my source, LT Joe Paitl at USCG Headquarters. You will also note the discrepancy in deaths on this and the previous table. This is due in part to cases still being investigated by certain sections of the USCG and not officially closed.

Table 3. Problem Areas

Industry	Fatalities	Oil Spills
Fishing	42%	3%
Towing/Barge	11%	23%
Tankships	3%	60%
Passenger	10%	<1%
Offshore Supply	3%	<1%

SOURCE: USCG

Table 4. Fishing Vessel Deaths – USCG Date–All Districts		
Year	**F/V Deaths**	**Fatality Rate**
1985	102	89
1986	80	57
1987	109	77
1988	88	80
1989	97	78
1990	63	50
1991	67	56
1992	95	77
1993	90	70
1994	75	75
1995	66	53
1996	71	61
1997*	54	–
* 1997 numbers are preliminary and only through October 15, 1997.		

Table 5. 1996 Loss Data			
District	**Total Fishing-Related Deaths**	**Deaths With Vessel Loss**	**Vessel Loss**
1	11 (3 Non-Op)[1]	4 (from 2 boats)[2]	15 (2 SAL)[3]
5	6 (1)	3 (2)	13 (1)
7	4 (2)	0 (0)	14 (4)
8	17 (2)	4 (3)	28 (0)
9	0 (0)	0 (0)	1 (0)
11	11 (1)	6 (5)	20 (0)
13	6 (0)	3 (2)	6 (0)
14	7 (0)	4 (1)	3 (0)
17	23 (1)	13 (4)	47 (6)
Totals	85 (10)	37 (19)	147 (13)

[1] Non-traumatic injury deaths, e.g., heart attack
[2] Deaths associated with vessel loss
[3] Number of vessels salvaged

SOURCE: LT Joe Paitl - USCG F/V Safety

Large Vessel Losses

The loss of large fishing vessels can be costly. It is presumed by the National Transportation Safety Board that the F/V Northwest Mariner (LOA 106 feet, 192 gross tons) was lost in the Bering Sea on January 15, 1995, because of icing conditions. It was well funded and operated by a well-respected skipper and crew. Property damage was estimated at $2.1 million which was covered by hull insurance. The tragedy of this incident was the loss of all six persons on board. P&I insurance undoubtedly paid the survivors a monetary sum, but the emotional and other intangible costs are not easily quantified.

In my hometown of Seward, Alaska, the F/V Alaska Spirit (LOA 203 feet, 1418 gross tons) caught fire at the dock on May 27, 1995. This fire caused an estimated $3 million in damage to the vessel and took the life of the ship's master.

Probably the most costly recent fishing vessel accident in terms of physical damage was the fire aboard the F/V All Alaskan in July 1994. The 379 foot vessel sustained damage in the range of $25-30 million and one person died. On the bright side, the rest of the 132-person crew, familiar with emergency drills and safety equipment, safely evacuated to a tug that stood by for rescue while the F/V All Alaskan burned.

According to USCG records, from January 1, 1992, to March 15, 1994, a total of 2,214 fishing vessel accidents were reported and investigated. Of these, 228 (10.3 percent) involved fires. The dollar loss of $24.8 million caused by fires was 29.5 percent of the total for fishing vessel accident losses ($84.2 million) during this period. The losses of the F/V Alaska Spirit and F/V All Alaskan rapidly had a major effect on these types of figures. When looking at the many compilations of accidents aboard fishing vessels, it is acknowledged by the USCG that there is significant underreporting.

Equipment Costs

Based on data you have seen, I think we are all encouraged by the drop in commercial fishing industry fatalities over the past 10 years. It is most likely that the safety and survival equipment mandated by the Commercial Fishing Industry Vessel Safety Act of 1988 and USCG regulations have had the most pronounced effect on these numbers. In Alaska it seems the number of vessel losses has not really dropped appreciably over the years, yet less people are dying when vessels sink. The equipment seems to be the factor.

Table 6 shows the cost of equipment that is required aboard various types of vessels. As a percentage of vessel value, this equipment will cost a smaller, low priced vessel more than a larger expensive vessel. Similarly, it could be argued that the smaller vessel is more at risk and is more likely to benefit from its use. In any case, for those not familiar with specific costs of some of the primary life saving equipment and maintenance costs, let us look at Table 6. A 4-6 person vessel fishing offshore has probably spent at least $8000 on this type of equipment and prorating maintenance costs over a 5-year period should figure $1000 per year. Those that fish year-round are less inclined to grumble about the money, but those who are seasonal or part-time fishers do grumble.

Table 6. Cost of USCG Approved Survival Equipment Required by Regulations	
Survival Craft	Buoyant Apparatus - $600
	Inflatable Buoyant Apparatus - 4 Person - $1,250
	Inflatable Liferaft - 4 Person Coastal - $2,500
	Inflatable Liferaft - 6 Person - SOLAS B - $4,100
	Inflatable Liferaft - 6 Person - SOLAS A - $4,500
	Annual Repack of 6 Person SOLAS Raft - $500
Signals	Flares >50NM Offshore - $275 Every 3 Years
	406 MHZ Category I EPIRB - $1,000
	406 MHZ Battery Replacement - $500 Every 5 Years
	Hydrostatic Release for EPIRB - $135 Every 2 Years
Immersion Suits	$260 - $375 Each--Suits for 6 Person Boat =Approximately $1,950
	Suit Testing by Service Station - $40 Each

Search and Rescue Costs

The costs associated with USCG SAR can be significant, especially compared with the money allocated to education and training efforts of the USCG directed toward the commercial fishing industry. This is largely due to the costs of operating aircraft and ships as well as their maintenance. In Table 5 we saw that the 17th USCG District, Alaska, has had the highest fatality and vessel loss numbers. It spends a high percentage of its SAR budget on fishing-related events. Table 7 shows the breakdown of SAR cases and costs for the period 1/1/97 - 10/17/97. Remember not all of the cases are fishing vessels. Some are recreational. Under the category "Other" we would have responses to downed aircraft, persons overdue on hikes, dealing with foreign shipping, etc. Please note the large number of cases and largest cost is in the area of medical emergencies and medivac. EPIRB responses include the largest number of cases, but because of the large number of false alarms costs are not proportionally high. Direct response to MAYDAY situations is not a huge set of figures.

During the recent king crab season in the Bering Sea that began November 1, the USCG positioned a C-130 aircraft in Dutch Harbor and a Jay Hawk rescue helicopter in Cold Bay. Three large USCG vessels were on station near the crab grounds. While costly, this was a concerted effort by the USCG to be able to respond to this high-risk fishery. The units responded to a man overboard call and potentially spent $100,000 in man and machinery costs before the missing individual was found hiding in a stack fidley aboard the F/V Arctic Wind. It was later reported he had suicidal tendencies.

Table 7. USCG 17th District SAR Cases and Costs 1/1/97 - 10/17/97				
Nature of Distress	**Case Total**		**Sum of Costs**	
EPIRB Responses	284	(22.7%)	$745,820	(8.8%)
Adrift	75	(6.0%)	$138,264	(1.6%)
Aground	41	(3.3%)	$106,371	(1.2%)
Fire	31	(2.5%)	$99,728	(1.2%)
Flares	24	(1.9%)	$65,858	(0.8%)
Medical	255	(20.4%)	$2,323,421	(26.9%)
Law Enforcement	46	(3.7%)	$1,190,890	(13.8%)
Mayday	30	(2.4%)	$278,521	(3.2%)
Overdue (PERS/VES)	109	(8.7%)	$613,551	(7.1%)
Person in Water	33	(2.6%)	$359,578	(4.2%)
Taking on Water	64	(5.1%)	$882,710	(10.2%)
Other	261	(20.8%)	$1,831,552	(21.2%)
Total	**1,253**		**$8,636,264**	

Fisherman's Fund

I have recently begun a term of service on the Alaska Fisherman's Fund Advisory and Appeals Council. The Fisherman's Fund was set up in 1959, prior to statehood, to provide financial relief to commercial fishermen in Alaska injured while engaged in their profession. Sixty percent of the fees collected by the state of Alaska for commercial fishing licenses and permits is deposited in the fund. It is one of the state's few dedicated funds and provides up to $2500 towards appropriate medical expenses. Benefits may be extended in exceptional circumstances. Administrative costs and benefits currently total $700,000 per year and exceed contributions.

In recent years the fund has received approximately 1000 claims per year. This is certainly not the sum total of injuries that transpire in the fleet. Some fishermen pay for treatment through their own insurance or savings, the skipper's boat insurance, or the outcome of litigation. Nonetheless, it is a significant barometer of the types of injuries that occur in Alaska's various fisheries and the costs associated with those injuries. No other state has a program like this and I believe it represents a significant pool of injury data.

I would like to cite some representative figures for the cost of some specific injuries to Alaskan commercial fishermen in 1997 (Table 8). Keep in mind these are the direct costs of primary medical care. Fishermen in virtually all cases have lost much more. Regardless, injuries can significantly reduce the quality of a person's life.

Table 8. Medical Costs of Fishing-Related Injuries

Battery Acid in Eyes - $235	Suturing a 3 cm Laceration - $350
Crushed Fingers - $300-$1,000	Head Injury - $850
Broken Wrist - $1,150	Hypothermia Treatment - $1,300
Infected Knee - $1,550	Aspirated Screw - $1,600
Inguinal Hernia Repair - $7,100	Broken Ankle and Surgery - $9,500
Heart Attacks - >$10,000	

SOURCE: Alaska Fisherman's Fund

Acid sprayed into a deckhand's eyes from an exploding battery cost $235 for emergency room supplies and examination. No lasting damage.

For a person who cut himself with a knife and required the suturing of a 3 cm laceration, medical costs average $350.

Removing bits of metal from a person's eyes because they were grinding without eye protection cost $350 for medical service and medicine.

The six stitches needed to close a cut caused by dropping a propeller on a man's foot cost $500.

Crushed fingers seem to be a very common occurrence in the fleet as a whole but even more so in the big crab fisheries. Treatment varies with extent of injury, but typically runs between $300 and $1000.

One dislocated shoulder cost the fisherman $300, but another situation resulted in a $1000 bill and a recuperation period of 4-6 weeks.

Having been hit in the head with a heavy hook, X-rays and services cost one crewman $850.

The survivor of a sinking was treated in an emergency room for hypothermia. Without an overnight hospital stay his expenses ran $1300.

Sea urchin divers seem to have a knack for jabbing themselves with spines. Numerous spines in one man's knee became infected and cost him $1550 for treatment.

A skipper broke his ankle while preparing his boat for fishing. Medical bills ran $7800. In his situation though he had protection and indemnity insurance for his vessel, as the skipper/owner he was excluded from benefits. Further, due to long-term health problems, he was not able to secure personal health insurance.

Heart attacks are among the most costly medical events I saw in the routine claims. Fishermen as young as 40 incur expenses well in excess of $10,000 if a heart attack puts them in an intensive care unit. As a side note, the USCG does not count heart attacks on board as an occupational injury or fatality. They feel it could just as easily happen on shore. Fisherman's Fund pays claims when there is a clear link that the heart attack was precipitated or aggravated by commercial fishing activities.

For many of you the high cost of medical treatment comes as no surprise. What we need to keep in mind is the deductible on most P&I policies is $2500-$5000 and excludes the owner/operator. A significant number of small operators have neither boat or personal health insurance. Their incomes are usually modest as well and some of the fees I have cited are a real burden. In an unknown number of cases, the health care provider winds up absorbing the costs, or more appropriately passing them along to those people who can afford to pay.

Knowing the types of injuries associated with commercial fishing in this region can certainly focus attention on means of prevention and treatment. For example, knowing that crushed fingers and cellulitis or fish poisoning are common occurrences, skippers can equip their first aid kits with appropriate supplies. First Aid trainers should tailor their classes to treatment of the specific traumas encountered aboard fishing vessels, not a generic course for suburban America.

Skippers should not be surprised to realize that they or their crew can save themselves a lot of pain, suffering, and lost time and money by standard safety precautions like wearing safety goggles when grinding metal. Similarly attention to basic hygiene goes a long way toward preventing expensive treatments and disability for infections causing cellulitis and fungus infections.

Extended Costs

It is obvious that the pain and aggravation of any injury is just the start of its cost. Medical costs as those cited above can be appreciable and especially hard on individuals without personal health insurance. Also, there is the disruption to normal fishing operations while the patient is being helped on deck and transported to a medical facility. Missing just one tide in the Bristol Bay salmon fishery might mean 20,000 pounds of fish not caught. A Chignik fisherman with a torn knee cartilage estimated his lost revenue due to his knee was $40-50,000 in 1996. Table 9 was presented at the FISH I Workshop by Carl Hild and further develops the domino theory of just how costly virtually any injury is to an individual, the crew, the vessel, the company, and society.

It is particularly galling when an injury leaves a fisherman unable to continue in his chosen profession. A seiner hit on the back of the head with a mass of seine rings and web sustained nerve damage from fractured vertebrae. After a life focused on hard physical labor and commercial fishing, his disability left him with very low self esteem and difficulty in providing for his family.

Insurance

Major insurance claims and legal suits that are the outcome of injuries and fatalities associated with commercial fishing are likely very significant. I made several attempts to get claims information from marine underwriters, but was unable to get meaningful responses. The information is closely guarded and not for public view.

The Marine Index Bureau (MIB), a private firm in New Jersey, has been designated by the USCG as the central collection entity for fishing vessel insurance information. Such collection was part of the Commercial Fishing Industry Vessel Safety Act of 1988. The MIB sends quarterly reports to the Investigations Branch of the USCG in Washington, D.C. It would be of interest to us all to see the types and costs of claims for both vessel losses and casualties, as well as those paid for loss of life and injuries. I have been unable to gain access to even generic summaries of this data from either the MIB or the USCG because they regard it as confidential. It is not clear to me that the USCG is making any use of this data at present. In the future, perhaps some of you in more official capacities may be able to access, review, and analyze these numbers. It should be quite useful, though we must keep in mind that an unknown, but significant percentage of commercial fishing vessels, operate without insurance of any kind.

Fatigue

Commercial fishing often puts men and women in a very demanding physical environment. Compared with a generic 9 to 5 job on land, most fishermen would be happy if their workday went from 5 to 9. In certain fisheries, such as the Individual Fishing Quotas for halibut and black cod, people are free to set their own working hours. In others, the regulating agencies like Alaska's Department of Fish and Game set seasons and openings within the season. Herring and salmon are examples of this type of fishery. The Olympic style fishing for opilio crab or pollock causes the typical skipper to push things to the limits of endurance. How would you adjust to an 18-hour on, 6-hour off schedule on board a processor or average less than 4 hours of sleep a day for a 10-day crab trip? Remember, the physically demanding work on an unstable work platform only makes the fatigue factor all the more present.

I have no doubt that fatigue is very much underrated as a major cost of doing business on the fishing grounds. Significant research has been conducted by Dr. Anita Rothblum (USCG R&D Center, Groton, CT) on fatigue contributions to marine casualties. It leads to the inescapable conclusion that erroneous actions, erroneous decisions, slow reactions, and improper procedures are the consequences of fatigue and sleep deprivation. Mental impairment is higher than physical impairment, but the end results are accidents large and small. Understanding the way the body works with regard to things like Circadian rhythms and using countermeasures proven by long-haul commercial airline crews can ease the burden of fatigue common to virtually all fishermen.

Table 9. Fishing Industry - List of Costs of an Injury Based on *The Role of the International Labor Office in the Improvement of Safety and Working Conditions Aboard Fishing Vessels*

1.	Cost of lost time of injured worker.
2.	Cost of time lost by other crew members who stop work. a. To assist the injured worker. b. Out of curiosity. c. Out of sympathy. d. For other reasons. e. Cleaning up the area to prepare it for work.
3.	Cost of lost time by vessel officers and shore management. a. Assisting the injured worker. b. Investigating the cause of the injury. c. Arranging for the worker's job to be continued by another. d. Selecting, training, and breaking in another worker. e. Preparing mandatory accident reports and attending hearings before regulatory officials.
4.	Cost of time spent on the case rescue and hospital staff; many workers are not adequately covered by insurance carriers.
5.	Cost due to damage of equipment or other property, or due to spoilage of material and harvest. a. Loss of entire catch or trip due to return to port. b. Loss of income to the entire crew.
6.	Incidental costs due to interference with fishing and processing activities, failure to fulfill orders on time, loss of bonuses, payment of forfeits, and other similar causes.
7.	Cost to employer under employee welfare and benefit system, if one exists, or cost to governmental health and welfare system.
8.	Cost to employer of continuing wages of the injured worker in full after his return although he may not be fully productive; or cost to government to support an unemployed, disabled worker.
9.	Cost due to the loss of profit on the injured worker's productivity and on idle equipment.
10.	Cost that occurs in consequence of the excitement or weakened morale of the remaining crew due to the accident.
11.	Overhead cost per injured worker, the expense of running the vessel which continues while the injured worker is a non-producer.

This list is non-exclusive and non-exhaustive and does not include the personal costs to the worker. Safety and health training and considerations are surely less costly. List modified by Carl M. Hild, M.S., Alaska Health Project, 1992.

Human Life

We are aware of the losses of vessels and lives in the fishing industry. The actual value of a lost vessel may be estimated from market values and insurance and may range from several thousand to several million dollars. The monetary value of a human life, however, is a very nebulous number. I have seen figures that range from $1,000,000-$25,000,000. These numbers factor in lost wages, support of family, costs to society, contributions to society, etc. But in purely human terms, the loss of a spouse, parent, child, or sibling, be it in a fishing accident or otherwise, cannot be measured in monetary terms. All the wealth on earth cannot bring back those that have died. There is only the cold reality of emptiness, the attempt to understand what happened, the unanswerable, "Why did it happen?", and the slow reorganization of one's life and learning to deal with a new reality. While money makes life easier, it has no deep answers for those who grieve. It is love, friends, family, and time that help those who are left behind to cope with their loss and move on.

The sea is an uncaring and potentially hostile environment. Commercial fishing can be a financially rewarding and satisfying vocation. But when humans make mistakes or exceed the safe working limits of their vessels, injuries and calamities can result. None of these is without a cost to someone. Through your efforts at engineering better solutions, education and training, and, most importantly, evolving people's attitudes, the financial and human costs of commercial fishing in America will be reduced.

Table 10. $(AD)^2 = (AG)^2$

IF YOU <u>ALWAYS DO</u>
WHAT YOU HAVE
<u>ALWAYS DONE</u>,
THEN YOU WILL
<u>ALWAYS GET</u>
WHAT YOU HAVE
<u>ALWAYS GOT</u>

CHAPTER III
COMMERCIAL FISHING SAFETY

HISTORY OF COMMERCIAL FISHING LEGISLATION

By Mr. Ken Lawrenson
Fishing Vessel Safety Program Coordinator, USCG Marine Safety Office Portland

When we were in school our motto was, "cooperate and graduate." Now that we're professionals, it's "steal without shame," but you still have to give credit, and I do want to acknowledge the work that Lurilla Lee did for me. She was originally scheduled to give this presentation, but she couldn't be here today.

I drew heavily upon an article that CMDR Raymond Magno and Mr. Rich Hiscock did for the *Proceedings of the Marine Safety Council*, a Coast Guard publication, back in November and December of 1991, as well as some Congressional Records. The legislative history of the present state of regulations and how we got here, is what I'm addressing for you this afternoon.

There have been attempts for quite a while to get mandatory safety standards and regulations for the commercial fishing industry. There were efforts in the 1930s, there were efforts in 1941, but that came to a grinding halt because of World War II, and it started up again in 1974.

The Coast Guard had proposed a fishing vessel safety act, and at about the same time the Department of Commerce, based on a National Marine Fisheries Service study, thought that they could do a better job of inspecting vessels than the United States Coast Guard. So the Coast Guard stepped back for a minute to see what would happen with that, and nothing happened. The Department of Commerce's efforts, the Vessel Safety and Fishermen's Benefit Act in 1975, never went anywhere in Congress, and it effectively stopped regulatory efforts for a few years.

The Coast Guard did a cost-benefit study of alternative safety programs in 1971 for the purpose of looking at different options for how the Coast Guard wanted to expend resources to solve some of these problems. Some will say it laid the foundation for future legislation. It documented early in the process that the fishing industry did indeed have a poor safety record. One of the primary conclusions that they came to was that the historically poor safety record was a result of the traditional exemption from safety regulations.

In that study, the Coast Guard recommended licensing of the masters, mandatory safety standards, full inspection of new fishing vessels, and mandatory and voluntary standards for inspection of existing vessels. Those study recommendations were included in the proposed 1974 Fishing Vessel Safety Act, which was then withdrawn because of the Department of Commerce proposal.

In 1978, CMDR W. J. Ecker (later to become a Rear Admiral) prepared a study titled "A Safety Analysis of Fishing Vessel Casualties" for the 66th National Safety Congress and Exposition. He looked at fishing vessel casualties among specific fishery types and geographic areas. He concluded

that there was a lot more study that needed to be done to try to look at the circumstances and conditions that led to accidents, before trying to get to the root causes.

At about the same time, the Coast Guard proposed a voluntary dockside examination program. Forty-five new examiner billets were requested, but budget cuts in 1981 halted this effort.

Another paper coming out of the Coast Guard's Office of Maritime Safety in 1980 was presented to a Society of Naval Architects and Marine Engineering symposium that drew upon some of these earlier studies, and they emphasized a safety approach through vessel design and operation. The paper also suggested that casualties would be reduced through crew training and some sort of a voluntary dockside boarding program.

They concluded that the casualty rates were increasing at an alarming rate, and that the industry really needed to step up and address some of the problems. While new equipment was starting to save lives, the root causes were still the vessels themselves, their design, and the way that they were being operated. They also concluded that education and training could have a positive impact. Lastly, that 1980 study predicted that there would be government intervention if the casualty rates continued, which of course they did, and the process continued.

In 1983, Congress codified the Motorboat Act of 1940, which put some restrictions on future Coast Guard efforts. Specifically, the Coast Guard was restricted from imposing any construction or operating standards, and it created Chapter 41 in the U.S. Code that related to "Uninspected Vessels Generally," creating the niche where future commercial fishing vessel regulations would fit.

Also in 1983, the House Merchant Marine and Fishery Subcommittee held a series of hearings. At those hearings they heard a number of things, but they heard three very different viewpoints. First, there was a marine safety consultant who testified that the Coast Guard needed to do more. Specifically, establish some sort of dedicated fishing vessel safety program, improve casualty data collection, coordinate ongoing safety projects, and act as a clearing house for some of the projects that were going on, lending some consistency. He also pointed out a need to update some of the earlier studies to see if there had been any changes, and that the codification of the Motorboat Act was something that needed to be changed, so that the Coast Guard would have the authority to make more comprehensive regulations.

Secondly, the Subcommittee heard from the National Federation of Fishermen, who opposed mandatory requirements. They testified that safety should be left to voluntary efforts of the industry and industry organizations, such as some of the Alaskan groups, the North Pacific Fishing Vessel Owners Association (NPFVOA) and the like.

Lastly, the Pacific Seafood Processors Association, representing the large Seattle-based processor vessel owners, testified and specifically opposed any future inspection requirements for their fish-processor and fish-tender fleets.

In 1984, Congress did amend 46 U.S. Code to include definitions for fishing, fish-tender, and fish-processing vessels, laying another important legislative step for future regulation. Congress exempted fish-tenders less than 500 gross tons and fish processors less than 5,000 gross tons from inspection. At the same time, they adopted a Chapter 45, which established another niche in the law for placement of future requirements for fish-processing vessels.

In 1984, the Coast Guard once again looked at what they could do without regulation and, in the traditional Coast Guard spirit of doing more while spending less, set a goal to reduce fatalities by ten percent by the year 1991, without any increase in the level of resource expenditure for commercial vessel safety. The Coast Guard envisioned a two-prong approach: first, promote voluntary standards, resulting in the publication of Navigation and Vessel Inspection Circular 5-86; and second, cooperate with the NPFVOA in developing and promoting a crew safety manual. The NPFVOA has just printed their fourth edition of the *Vessel Safety Manual*.

In 1984, the House Merchant Marine and Fisheries Subcommittee held more hearings to address the skyrocketing cost of insurance for commercial fishing vessels. Things were getting so out of hand that the insurance industry was paying out $1.56 for every dollar that was being paid into the system. This was a crisis that the industry was not going to tolerate for very long. The insurance industry cited the high costs that were due to special treatment afforded to seamen because of Admiralty Law and the Jones Act. The existing legal system was not only costly to the vessel owners, but as the laws were written there was actually an incentive for an injured seaman to litigate.

As a result, members of Congress began legislative efforts to limit liability. The story of legislation now changed from looking at improvements in safety to vessel owners' liability caps and insurance costs.

In 1985, the F/V Western Sea, a 70-year old purse seiner with six crew, sank. The incident galvanized support from a number of families, not only the Barrys, but folks out in New England, as well. The loss emphasized again to Congress that there needed to be support for mandatory safety requirements.

Three bills were introduced to Congress in 1986. Some of them proposed lifesaving equipment carriage requirements, but mostly addressed the insurance and liability issues. There was a compromise bill that fell out of those three bills, to be called the "Commercial Fishing Vessel Liability and Safety Act." However, that bill was defeated in the House after intense lobbying by the American Trial Lawyers Association, who specifically objected to the liability caps.

In 1986, another major milestone occurred to further safety efforts. Congress amended Chapter 41 of the U.S. Code to require EPIRBs aboard fishing vessels that go out beyond three nautical miles. This change was ushered in as part of the Coast Guard Authorization Act of that year.

In 1987, two more bills were introduced to the House. The first was HR 1836, which dealt with inspection, equipment carriage requirements, licensing, and crew training. The second was HR 1841 which addressed liability and safety issues, but it did not propose inspection or licensing. The "Uninspected Commercial Fishing Vessels" study from the National Transportation Safety Board

(NTSB) recommended mandatory minimum safety standards for training, equipment carriage, rafts, radios, EPIRBs, inspection, specific drug and alcohol prohibitions during fishing, and reiterated the need to further research vessel stability.

In 1988, HR 1836 and HR 1841 were still being debated. Industry objected strenuously to the inspection requirements that were being proposed in HR 1836. As for HR 1841, the liability and compensation portions were dropped, as the trial lawyers and the insurance industry failed to reach an agreement.

But as it appeared that HR 1841 was going to stay alive, Congress did go ahead and do some serious amending to the bill. They dropped the provisions regarding liability and liability caps. Instead of mandatory licensing, they required the Coast Guard to propose a licensing plan and to study vessel inspection. Congress also included some additional requirements, such as the required injury notification to employers.

HR 1841 was passed by the House and the Senate. In September of 1988 President Reagan signed HR 1841 into law as the Commercial Fishing Industry Vessel Safety Act of 1988 (CFIVSA). The results were the first comprehensive safety regulations for the commercial fishing industry.

CFIVSA required the Coast Guard to produce regulations for safety equipment and operations. It also formed the Committee on Fishing Vessel Safety, mandated collection of casualty data, and required the Coast Guard to submit a licensing proposal to Congress, which they did in 1992, again in 1993, and again a couple of years later. Licensing has consistently failed to achieve any support by Congress.

CFIVSA also required the Coast Guard to make recommendations to Congress regarding an inspection regime. So it was now up to the Coast Guard to come up with these regulations, and that was another long process. The Coast Guard had a preliminary set of regulations ready to go in October of 1988, and these were published as an Advanced Notice of Proposed Rule Making. Nearly 200 comment letters were received in response.

A year-and-a-half later the Coast Guard had digested the comments and published a Notice of Proposed Rule Making. The response now was nearly 500 comment letters, and as a result, the Coast Guard held 13 public hearings nationwide to gather more input.

In August of 1990, the Coast Guard published their intention to separate from the present rulemaking process some of the more contentious issues: stability requirements for vessels less than 79 feet; survival craft exemptions for the smaller boats; and some administrative items. These topics were to be handled in a Supplemental Rule Making so that the Coast Guard could continue the process of getting the safety and equipment carriage requirements into law. The Coast Guard was able to do that finally in August of 1991. The resulting regulations were published as a Final Rule and made effective on September 15, 1991.

Legislatively, we're about caught up. There have been a small number of changes since then, for example, some of the aspects that were separated off into the Supplemental Rule Making have been published into Final Rule now. A couple of them are still outstanding, notably the stability regulations for vessels less than 79 feet.

Successful, as far as the regulations? I will leave that question for a lot of the other presenters, seeing as I'm really just supposed to be talking about the legislative history. But I think that the point can be made that the regulations are more reactive in nature than preventive. We have seen a dramatic increase in the number of people being saved and surviving their vessel casualties. But the rates at which the vessels are being lost is really unchanged.

Second National Fishing Industry Safety and Health (FISH II) Workshop
Convened by the National Institute for Occupational Safety and Health
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ALASKAN COMMERCIAL FISHING VESSEL CASUALTIES: AN OVERVIEW, 1992 - 1996

By LT Alan Blume
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Introduction

The requirements of the Commercial Fishing Industry Vessel Safety Act of 1988 (CFIVSA) became effective in 1991 and were fully implemented for documented commercial fishing vessels in 1993. To assess the overall impact of these requirements on fishing industry vessel casualties in Alaskan waters, a review was conducted of all fishing vessel-related casualties reported to Seventeenth U.S. Coast Guard District marine safety offices between 1992 and 1996. The results of this review will be used by the Coast Guard to build on the successes of the CFIVSA by better targeting the efforts of the District's fishing vessel safety examiners as well as to establish partnerships with appropriate federal and state resource managers and commercial fishing vessel operators.

The Fleet

Any vessel that lands fish commercially in Alaska is required to have a license issued by the Alaska Department of Fish and Game (ADF&G). Since the majority of fishing vessels operating in the Seventeenth Coast Guard District land their catch in Alaska, the number of ADF&G-issued licenses was considered a good indicator of the number of commercial fishing vessels operating in Alaskan waters. Other potential sources of population data, including the Coast Guard's Marine Safety Information System (MSIS), were considered; however, they were not used due to concerns regarding accuracy. For example, MSIS data indicated there are approximately 20,000 commercial fishing vessels operating in Alaska whereas, on average, ADF&G issued 12,518 vessel licenses each year between 1992 and 1996. (Table 1)

The ADF&G vessel license data contain a significant amount of vessel-specific data, including the vessel's identification number, registered gross and net tonnage, and registered length. The tonnage data were considered suspect because the field size for this information is limited to three characters, whereas it is known there are fishing industry vessels with registered gross tonnage (GT) over 1000 GT. In order to establish an accurate profile of the fleet, registered gross and net tonnage, registered length, and build date for documented vessels were obtained from the Coast Guard's vessel documentation files.

As shown in Table 1, the number of commercial fishing vessels operating in Alaska declined approximately 6.5 percent between 1992 and 1996. There was no significant change in the composition of the fleet when broken down by registered gross tonnage. The tonnage breakdown used for the analysis was based in part on Coast Guard licensing and watch requirements. The Officers Competency Act of 1936 requires all seagoing motor vessels 200 GT and over to be operated by licensed mariners (46 U.S.C.A. §8304). The number of required watches is based on a

number of factors: whether the vessel operates as a fish-processor or tender; when the vessel entered into that service; and whether more than 16 persons are carried.

Table 1. Number of Fishing Vessels by Gross Tonnage

Registered Gross Tonnage	1992	1993	1994	1995	1996	Average
Not Recorded	142	115	109	95	72	107
Less than 100 GT	12,146	11,521	11,548	11,516	11,448	11,636
100 - 199 GT	593	574	560	543	527	560
200 GT and over	222	217	209	221	206	215
Total	13,103	12,427	12,426	12,375	12,253	12,518

Source: ADF&G and U. S. Coast Guard

The remainder of the fleet was divided into those vessels less than 100 GT and those between 100 and 199 GT. This division was made based on the fact that most vessels between 100 and 199 GT have an operating profile very similar to vessels larger than 200 GT. In addition, vessels that admeasure more than 100 GT also tend to be approximately 79 feet or more in length.

The division of vessels by length was also based, in part, on regulatory requirements. However, a detailed analysis to determine the effectiveness of particular regulatory requirements was not conducted due to the relatively limited number of incidents, as well as the need to determine specific applicability based on where the vessel was operating when the casualty occurred and if the vessel underwent a major conversion on or after 15 September 1991. The breakdown into those vessels less than 20 feet and those between 20 and 36 feet was intended to distinguish skiffs from vessels such as small trollers and gill netters.

Table 2. Number of Fishing Vessels by Length

Registered Length (FT)	1992	1993	1994	1995	1996	Average
Not Recorded	167	139	133	119	95	131
Less than 20 FT	1,941	1,745	1,714	1,697	1,782	1,776
20 - 35 FT	6,959	6,647	6,662	6,650	6,618	6,707
36 - 78 FT	3,392	3,267	3,312	3,306	3,182	3,292
79 FT and over	644	629	605	603	576	611
Total	13,103	12,427	12,426	12,375	12,253	12,517

Source: ADF&G and U.S. Coast Guard

Based on Tables 1 and 2, it is evident the majority of vessels operating in Alaskan waters are less than 36 feet in length. These vessels are generally admeasured at less than 20 GT. This is significant with regard to risk insofar as these smaller vessels generally are engaged in fisheries such as salmon and herring that occur when weather conditions are less severe. In addition, the population of fishers exposed aboard any one of these vessels to a casualty is limited insofar as they fish with two to three persons on board.

Vessels between 36 and 78 feet have a more varied operating profile that includes participation in both near- and off-shore fisheries. Therefore, they are more likely than vessels less than 36 feet to be exposed to more extreme weather conditions. Many of the larger vessels in this group participate in off-shore winter fisheries, including the Bering Sea crab fisheries. In addition, there are more fishers exposed to an individual vessel casualty insofar as these vessels operate with average crew sizes of four to six persons. Vessels 79 feet and over, which include the large fish processors, also operate near shore and off shore. They are likely to be exposed to the most severe weather conditions encountered by the Alaskan fishing fleet. The number of fishers exposed on these vessels varies from less than 10 to as many as 250 to 300 persons on factory processors.

In addition to growing smaller between 1992 and 1996, the fleet also grew older. In 1992 the average age of fishing vessel operating in Alaskan waters was 20.9 years. In 1996 the average age was 22.8 years. As shown in Figure 1, almost 25 percent of the fleet was more than 25 years old. Approximately 15 percent of the fleet was between 25 and 60 years old with a significant concentration of vessels between 40 and 60 years old.

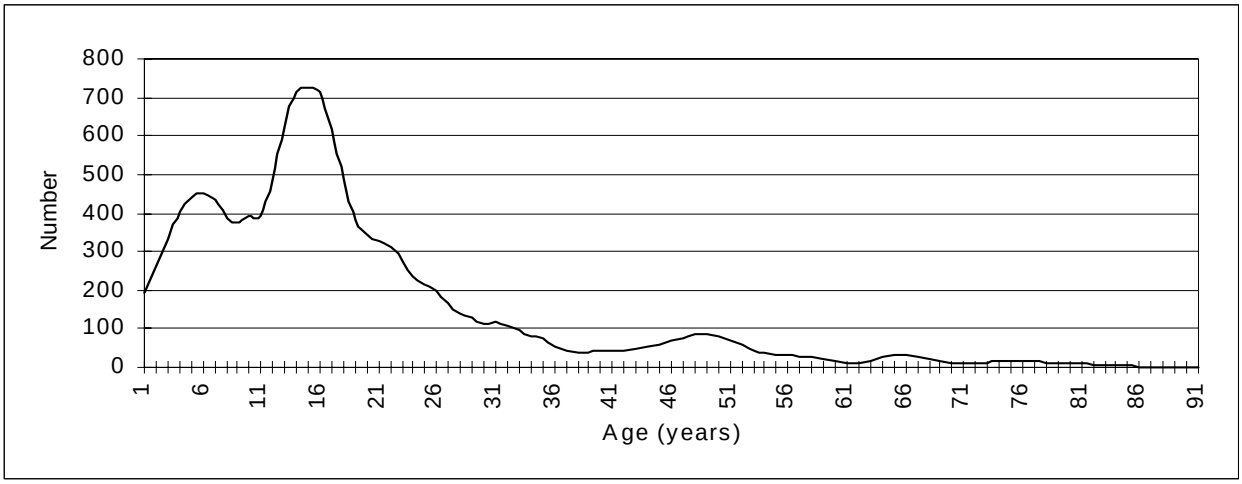


Figure 1. *Number by Age of ADF&G Licensed Fishing Vessels, 1992-1996*

Casualty Trends

Not only did the number of reported vessel casualties decrease between 1992 and 1996, but the rate, when normalized against the fleet, also decreased, see Figure 2. In 1992 the rate of reported casualties was 13.89 for every 1000 vessels licensed by ADF&G. In 1996 the rate had decreased by almost 30 percent to 9.71 reported casualties for every 1000 vessels licensed by ADF&G. The most significant decreases occurred between 1994 and 1996. Although there are a number of factors potentially impacting this trend, including the transition to an individual fishery quota for halibut and sablefish in 1995, it is a good indicator the CFVISA has had a positive impact on fishing vessel safety.

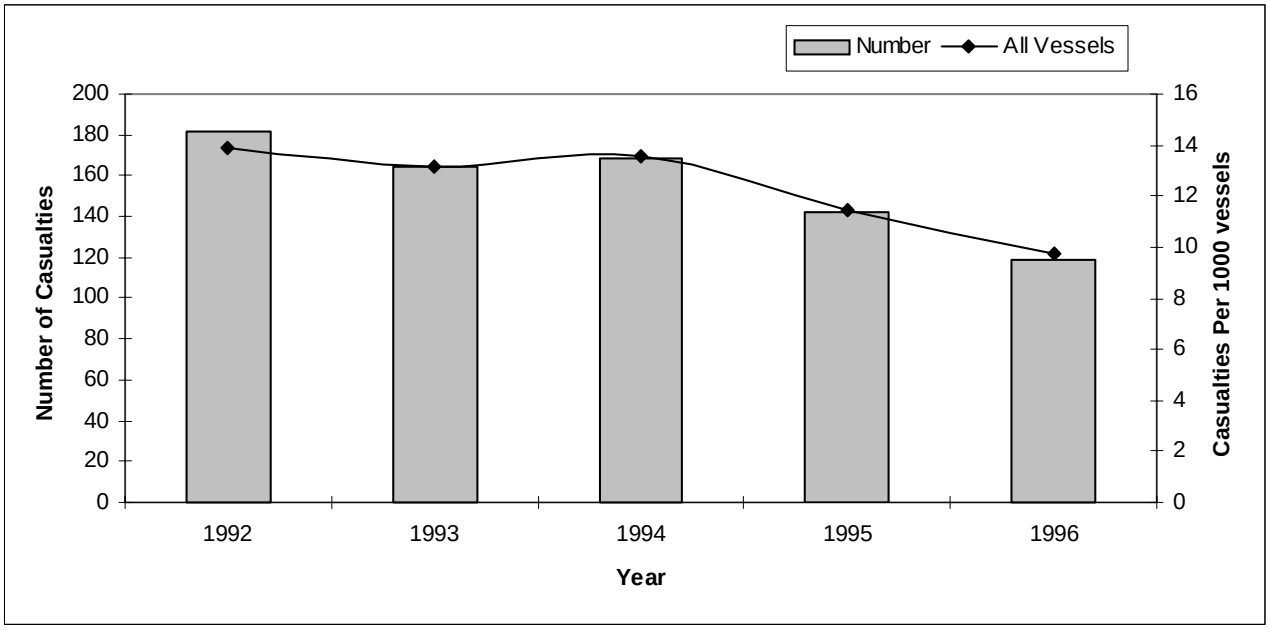


Figure 2. *Reported Commercial Fishing Vessel Casualties in Alaska, 1992 - 1996*

Reported casualty rates were calculated based on vessel length, see Figure 3. Because of the limited casualty data available for vessels less than 20 feet, rates were not calculated for this group of vessels. The casualty rate for vessels between 20 and 35 feet was approximately half of the fleet rate throughout the period. The large number of vessels in this group, more than 50 percent of the entire fleet, has a strong influence on the calculated rate for the fleet as a whole. Therefore, the validity of any conclusions regarding the effectiveness of the CFIVSA and related Coast Guard fishing vessel safety initiatives based on overall casualty rates will be directly influenced by how well operators of these vessels comply with regulatory reporting requirements.

Many fishing vessel casualty investigations in Alaska are initiated based on reports received initially from insurance claims adjusters and internal Coast Guard search and rescue reports, rather than notification from the vessel operator. This includes casualties that result in the loss of the

vessel without loss of life. In general, corporate vessel operators are more likely than operators of individual vessels to report a vessel casualty. However, even corporate operators are less likely to report a vessel casualty than they are to report an injury to a crew member. No doubt this is due, at least in part, to issues surrounding personal injury claims. Based on comments from various sources, including vessel operators during dockside exams and observations from marine surveyors, it is considered highly probable fishing vessel casualties are significantly underreported. Although all sectors of the marine industry do not notify the Coast Guard of every casualty meeting the reporting requirements, the highest underreporting is associated with fishing vessels. Because fishing vessel casualties are known to be underreported, the rate calculations used in this review are low. With the exception of fatalities associated with vessel casualties, actual casualty rates could be as much as two to three times higher than the calculated rates.

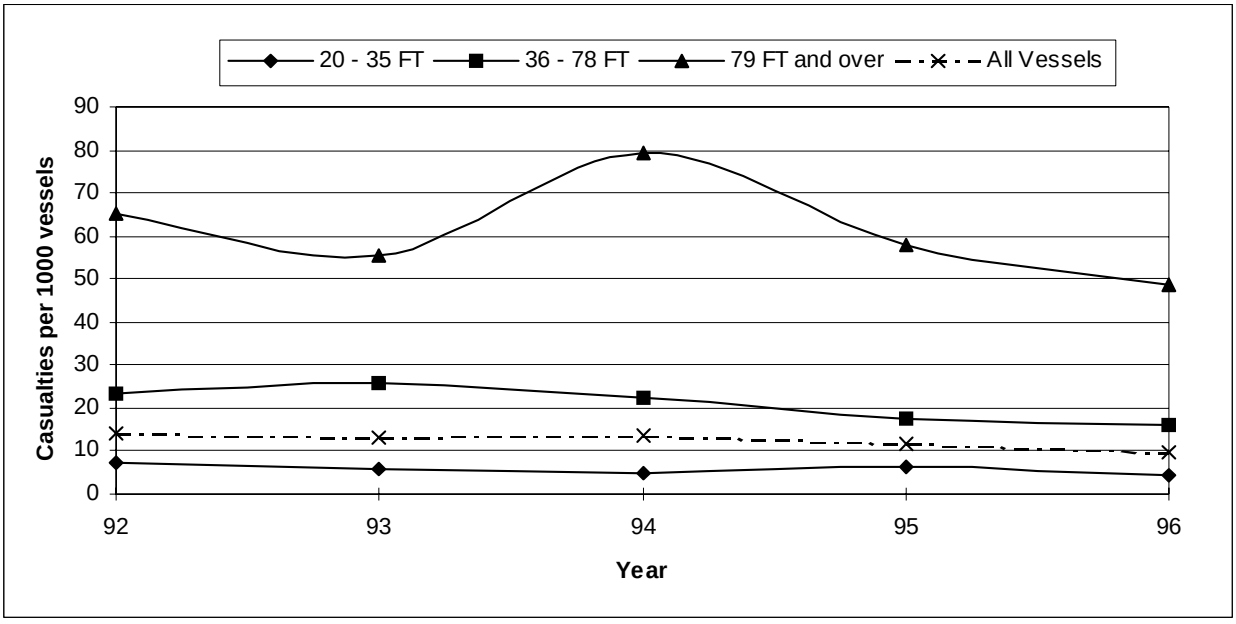


Figure 3. *Reported Commercial Fishing Vessel Casualties Per 1000 Vessels in Alaska, 1992 - 1996*

Based on the calculated rates, it is evident that vessels 79 feet or more in length experienced a significantly higher casualty rate than the fleet as a whole. These vessels, which comprise approximately 4.8 percent of the fleet, experienced 203 of the 776 vessel casualties reported to the Coast Guard in Alaska between 1992 and 1996. Although the casualty rate for vessels 79 feet or more in length decreased between 1992 and 1996, it remained approximately three times higher than the aggregate fleet rate. Insofar as these vessels are already the most at risk, because they operate offshore throughout the year, are exposed to more severe weather conditions, and carry larger crews, the fact they have such a high casualty rate means they are more at risk than originally thought. Because of the relatively small number of vessels in the fleet 79 feet or more in length, this rate is sensitive to small changes in the number of reported casualties.

Although vessels between 36 and 78 feet make up approximately 25 percent of the ADF&G-licensed fleet, 359 of the 776 reported fishing vessel casualties in Alaska between 1992 and 1996 occurred in this group of vessels. The casualty rate for these vessels in 1992 was approximately twice as high as the rate for the fleet. After a slight increase in 1993, the rate steadily decreased. By 1996 the rate was one-and-a-half times the fleet rate.

Types of Fishing Vessel Casualties

There are three basic types of vessel casualties: those related to the navigation of the vessel, including allision, collision, and grounding; those related to the vessel's stability or watertight integrity, including flooding, capsizing, and sinking; and those related to vessel maintenance or marine engineering, including fire and explosion, equipment failure, and structural failure. Although these categories are somewhat arbitrary, they are useful since they facilitate review and analysis.

Navigation Casualties

The overall number of navigation casualties reported to the Coast Guard by fishing vessels operating in Alaska is shown in Figure 4. Of the 335 navigation-related casualties reported, over 90 percent were either groundings or collisions. Although there was a significant decrease in the number of reported groundings and collisions between 1992 and 1994, it appears the downward trend is beginning to flatten out. In fact, the calculated incident fleet rate for all navigation-related casualties for 1994 through 1996 has been relatively steady at approximately five casualties per 1000 vessels.

Collisions are generally of particular concern to the extent they involve two or more vessels. In addition, high energy collisions can cause both significant damage to the vessels involved and serious injuries to their crews. As shown in Figure 5, the rate of collision for vessels 79 feet and over in length was reduced from almost five times the rate for the fleet as a whole in 1992 to approximately three times the fleet rate in 1996. This reduction represents an improvement in general navigation safety. Since most of the collisions involving these vessels occurred while the vessels were in transit or maneuvering in a harbor rather than while actively engaged in fishing, the reduction also represents a reduced threat to other non-fishing vessels using a waterway.

During this same period, the rate of collision for vessels less than 79 feet did not change significantly. Although exact numbers are not available, experience indicates the actual number of collisions involving fishing vessels less than 79 feet is actually higher. This is because many of these vessels engage in fisheries, such as the Bristol Bay salmon fishery, involving a relatively large

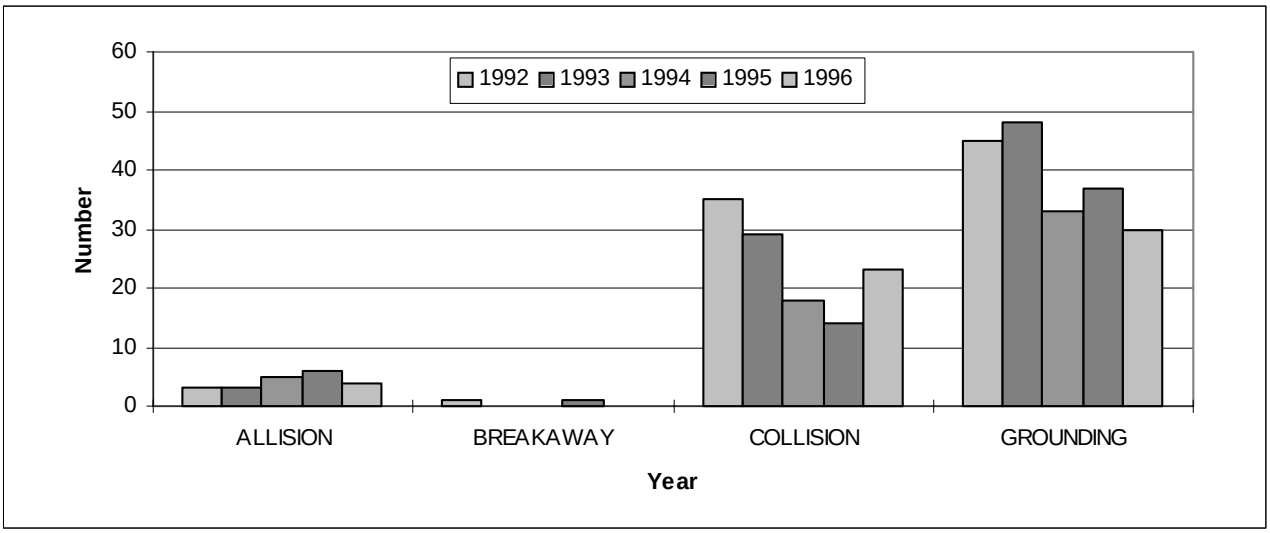


Figure 4. *Reported Navigation-Related Commercial Fishing Vessel Casualties in Alaska, 1992 -1996*

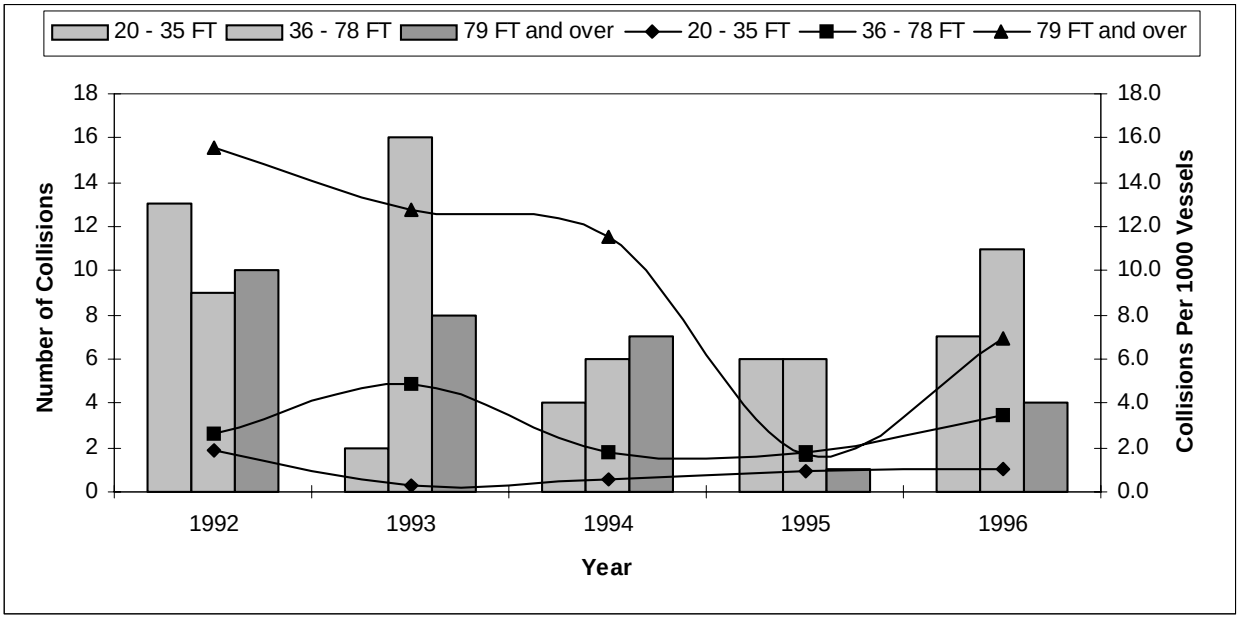


Figure 5. *Reported Collisions Involving Commercial Fishing Vessels in Alaska, 1992 - 1996*

number of vessels not only operating in close proximity to one another, but which are also attempting to out maneuver each other in order to have a better position to set their gear. However, the majority of the collisions occurring while vessels are actively fishing are relatively low energy and pose a minimal threat to the safety of the vessels and their crews.

Groundings account for most of the navigation-related fishing vessel causalities. In addition, groundings are the most frequently reported fishing vessel casualty in Alaska. Of the 193 reported groundings between 1992 and 1996, almost 58 percent involved fishing vessels 36 to 78 feet in length. The remainder of groundings were divided evenly between vessels 20 to 35 feet in length and those 79 feet or more in length. The calculated rates are shown in Figure 6. In general, there was a reduction in the rate of groundings between 1992 and 1996, however there was no significant change for the fleet as a whole. Although there was a reduction in the rate of groundings involving vessels 79 feet or more length, the overall trend for each of the three groups of vessels is relatively flat. This is significant since almost half of all fishing vessel losses in any given year are due to groundings.

The relatively flat trend in the grounding rate also illustrates a significant fact about the size and qualifications of fishing vessel crews; crew size and qualifications are based first and foremost on fishing operations rather than safe navigation. This is in direct contrast to the fact that crew size and qualifications for other commercial vessels, inspected and uninspected, are based primarily on safe navigation first and vessel operations, such as cargo handling, second. This is supported by the fact a primary cause of most fishing vessel groundings is that the individual on watch either fell asleep or was not qualified to navigate the vessel in pilotage waters.

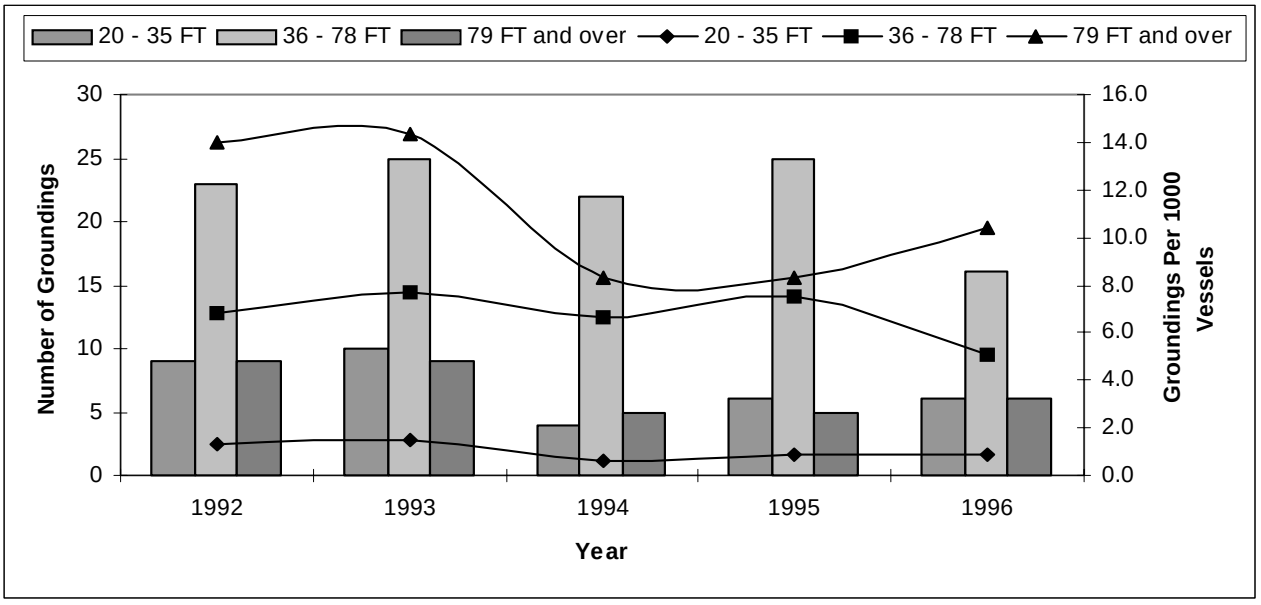


Figure 6. *Reported Commercial Fishing Vessel Groundings in Alaska, 1992 - 1996*

Engineering Casualties

Engineering casualties include fire and explosion, equipment failure, and structural failure. Equipment failures are a primary indicator of vessel safety, because the failures required to be reported to the Coast Guard are failures of components of a vessel's vital systems: lifesaving, fire fighting, propulsion and steering, electrical generators, and bilge systems. Between 1992 and 1996, a total of 287 engineering casualties were reported to the Coast Guard by fishing vessels operating in Alaska. Of these, approximately 68 percent were equipment failures, 32 percent were fire and explosion. Less than one percent were structural failures. The primary cause of the majority of these casualties was either inadequate maintenance or improper engineering and installation.

The number and rate of engineering casualties on fishing vessels operating in Alaska is shown in Figure 7. Overall, the number of reported engineering casualties on fishing vessels operating in Alaska is down from 63 in 1992 to 42 in 1996. However, any improvement is based only on 1995 and 1996, since there was an increase in the number of reported engineering casualties in both 1993 and 1994. Following the implementation of the CFIVSA there was increased awareness among vessel operators regarding requirements to report vessel casualties to the Coast Guard. It is probable the awareness level has dropped in recent years. Although the reduction may indicate an improvement in the material condition of Alaskan fishing vessels, it is more than likely a function of underreporting.

Based on information received from a variety of sources, including fishing vessel operators, engineering casualties onboard all fishing vessels are significantly underreported. This is particularly true for equipment failures. Frequently engineering casualties are reported only after a Coast Guard marine safety office initiates contact with a vessel operator based on information received from other sources, such as insurance adjusters or Coast Guard search and rescue assets. Although underreporting by operators of smaller vessels is particularly significant, there are also more equipment failures on larger vessels than are reported to the Coast Guard. Coast Guard personnel conducting dockside fishing vessel safety exams have not noted an obvious improvement in the overall physical condition of the vessels they have been aboard. Therefore, the lower numbers of engineering casualties in 1995 and 1996 most likely indicate a waning awareness of reporting requirements, rather than an actual improvement in the material condition of the Alaskan fishing vessel fleet. The number and rate of reported equipment failure rates by vessel length is shown in Figure 8.

Almost 96 percent of all the reported equipment failures between 1992 and 1996 on fishing vessels operating in Alaska, regardless of size, involved either the vessel's propulsion or steering systems. Depending on location and existing weather conditions, the reduction or loss of vessel control due to propulsion or steering problems represents a significant risk to the safety of the vessel and crew. For example, approximately 10 percent of the equipment failures associated with fishing vessel propulsion or steering resulted in the vessel going aground. The failure or reduced capability of any vital system due to an equipment failure can result in the loss of a vessel.

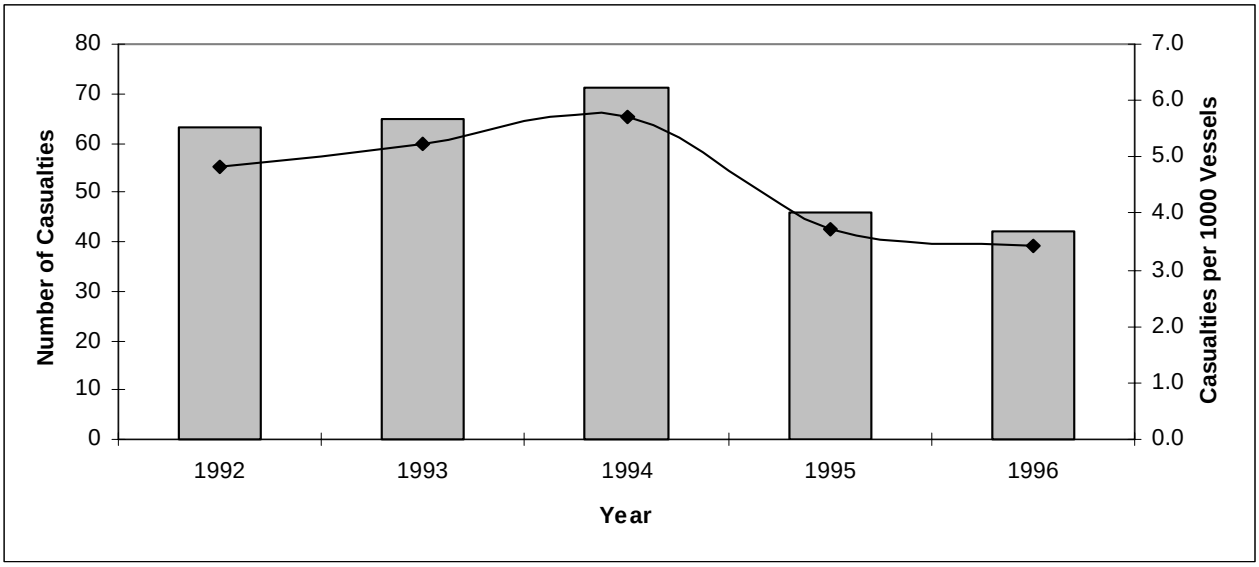


Figure 7. *Reported Engineering Casualties on Commercial Fishing Vessels in Alaska, 1992 - 1996*

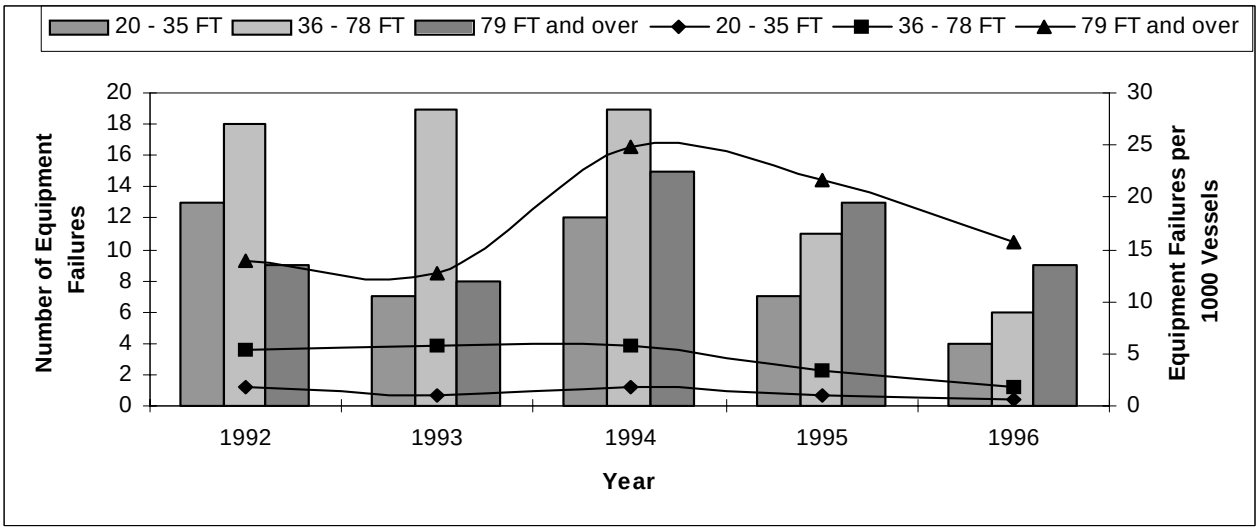


Figure 8. *Reported Equipment Failures on Commercial Fishing Vessels in Alaska, 1992 - 1996*

Fire at sea is a serious threat to the safety of both the vessel and the crew. Approximately half of the fishing vessel fires reported between 1992 and 1996 resulted in the loss of the vessel. The rate of fires on board commercial fishing vessels operating in Alaska by length is shown in Figure 9. Following an initial decline between 1992 and 1994, the rate of fires aboard fishing industry vessels 79 feet and over in length increased steadily in 1995 and 1996. The rate of fires on fishing vessels less than 79 feet remained relatively constant throughout the period.

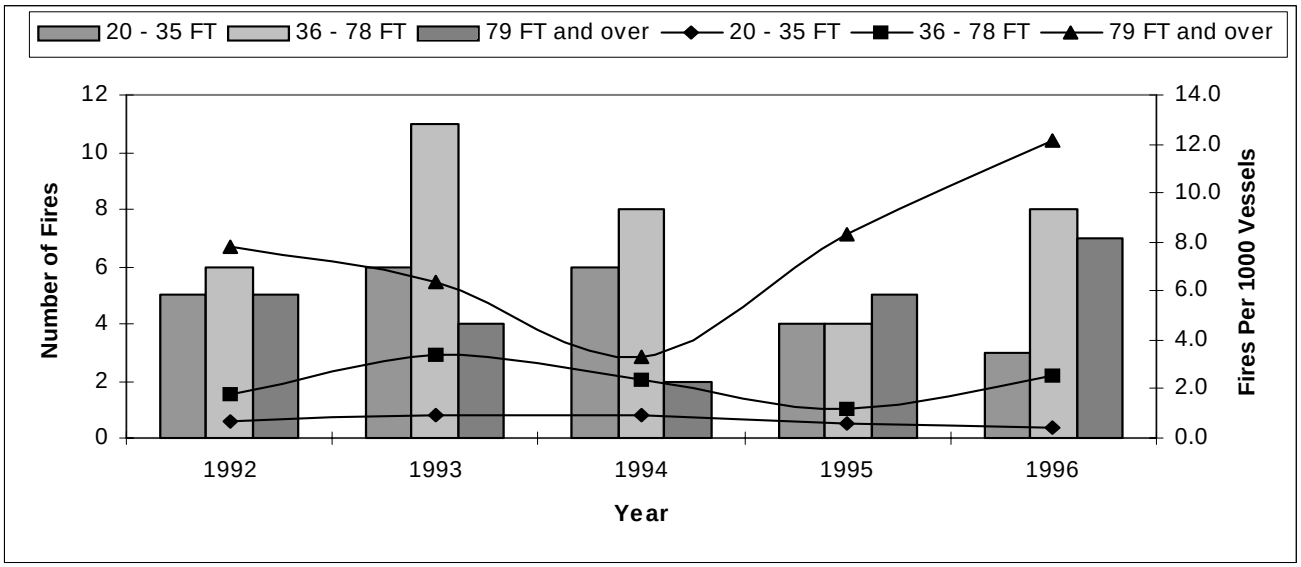


Figure 9. *Reported Fires On Commercial Fishing Vessels in Alaska, 1992 - 1996*

Although the rate of fires onboard fishing industry vessels 79 feet and over in length decreased in 1993 and 1994, the rate in 1995 and 1996 was higher than the 1992 rate. Overall there was a 56.6 percent increase in the fire rate between 1992 and 1996. This increase is of particular concern since fires onboard these vessels pose a significant threat to life. Primary risk factors include: the larger number of persons onboard; the heavy fire load in the form of fiber and non-fire retardant insulation that produces toxic gases when burned; and the complete absence of structural fire protection requirements.

Stability- And Watertight Integrity-Related Casualties

Stability- and watertight integrity-related casualties are good indicators of the risk fishing vessel crews are potentially exposed to insofar as these casualties account for the majority of all lost fishing vessels. A total of 232 stability- and watertight integrity-related casualties were reported on fishing vessels

licensed to operate in Alaska between 1992 and 1996. There was relatively little change in the number of stability- and watertight integrity-related casualties reported annually between 1992 and 1995, see Figure 10. It is too early to state whether the lower number for 1996 is the beginning of a downward trend or an exception.

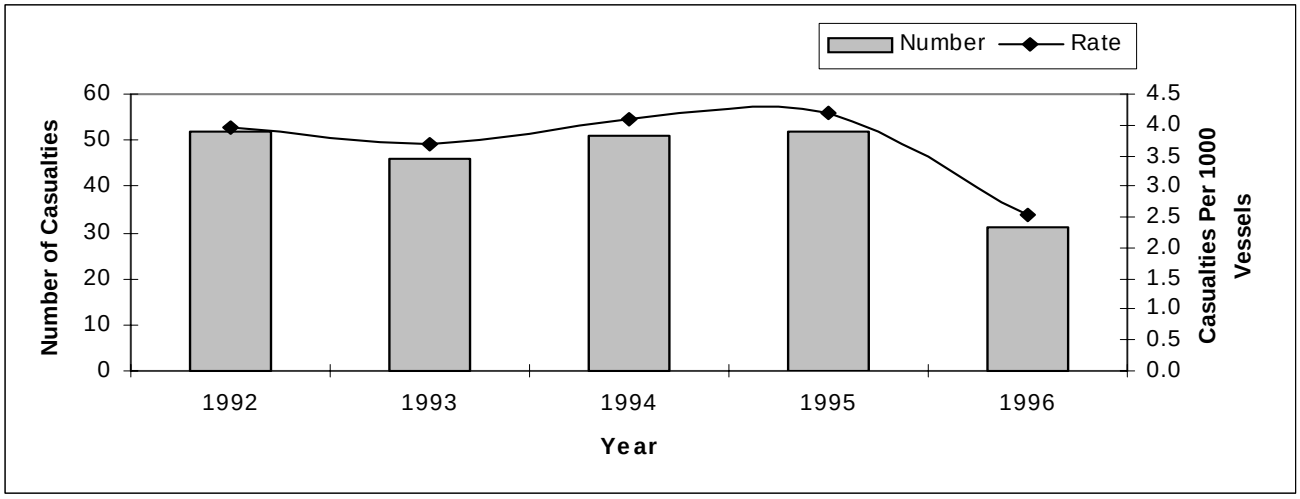


Figure 10. *Reported Stability- and Watertight Integrity-Related Casualties on Commercial Fishing Vessels in Alaska, 1992 - 1996*

The essentially flat trend in the number of reported stability- and watertight integrity-related casualties highlights an important characteristic of the CFIVSA. With some notable exceptions, such as operating stability requirements for vessels 79 feet and over in length built by 15 September 1991, the CFIVSA primarily reduces risk to fishing vessel crews by improving their chances of surviving a catastrophic vessel casualty rather than by reducing the probability that such a casualty will occur. Although the increased lifesaving equipment carriage requirements mandated by the CFIVSA were long overdue, they are reactive rather than preventive. To significantly improve the safety of life on commercial fishing vessels it is necessary to place additional emphasis on preventing catastrophic casualties for the entire fishing vessel fleet. A breakdown of the number and rate of these casualties by vessel length is shown in Figure 11.

There was approximately a 50 percent reduction in the number of stability- and watertight integrity-related casualties experienced on vessels 36 to 78 feet in length between 1992 and 1996. Using the data available it cannot be determined what impact the requirement had on vessels 36 feet and over that were fitted with high-water alarms. The overall flat trend in the number of stability- and watertight integrity-related casualties for the Alaskan commercial fishing vessel fleet is primarily based on the number of these casualties reported by vessels less than 36 feet or more than 78 feet in length.

Approximately 53 percent of the 232 stability- and watertight integrity-related casualties reported by fishing vessels operating in Alaska between 1992 and 1996 were vessels that sunk. In less than 10 percent of these casualties the vessel capsized. With the exception of 1993, each year between 1992 and 1996, approximately one-third of the stability- and watertight integrity-related casualties were limited to flooding. In 1993 flooding events accounted for 50 percent of this type of casualty. Although some number of the reported sinkings or capsizings resulted from the vessel being overwhelmed, the vast majority of these casualties started as flooding events and could potentially have been prevented. The fact that on average just a third of these casualties were limited to flooding

indicates approximately only one-third of the fishing vessel crews, who experienced flooding, had both the equipment and knowledge necessary to control flooding and minimize the potential impact. This is a significant safety concern.

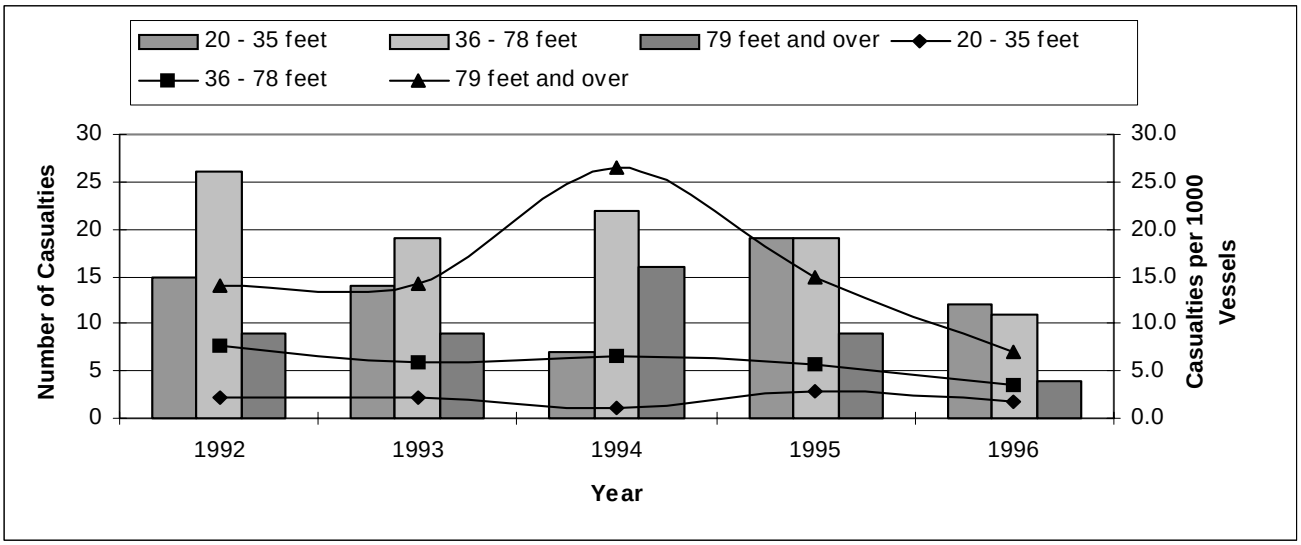


Figure 11. *Stability- and Watertight Integrity-Related Commercial Fishing Vessel Casualties in Alaska, 1992 - 1996*

Approximately 53 percent of the 232 stability- and watertight integrity-related casualties reported by fishing vessels operating in Alaska between 1992 and 1996 were vessels that sunk. In less than 10 percent of these casualties the vessel capsized. With the exception of 1993, each year between 1992 and 1996, approximately one-third of the stability- and watertight integrity-related casualties were limited to flooding. In 1993 flooding events accounted for 50 percent of this type of casualty. Although some number of the reported sinkings or capsizings resulted from the vessel being overwhelmed, the vast majority of these casualties started as flooding events and could potentially have been prevented. The fact that on average just a third of these casualties were limited to flooding indicates approximately only one-third of the fishing vessel crews, who experienced flooding, had both the equipment and knowledge necessary to control flooding and minimize the potential impact. This is a significant safety concern.

Figure 12 represents the ratio of flooding events to other stability- and watertight integrity-related casualties. This ratio was calculated for the Alaskan commercial fishing vessel fleet as a whole as well as by length. When the value of this ratio is equal to one, there were an equal number of flooding and other stability- and watertight integrity-related casualties. When the value is greater than one, there were more flooding casualties. When the value is less than one, there were more sinkings, capsizings, and vessels missing than flooding casualties. Therefore, an increase in the value of this ratio is an indicator that fishing vessel crews were able to control flooding and prevent a serious situation from becoming worse.

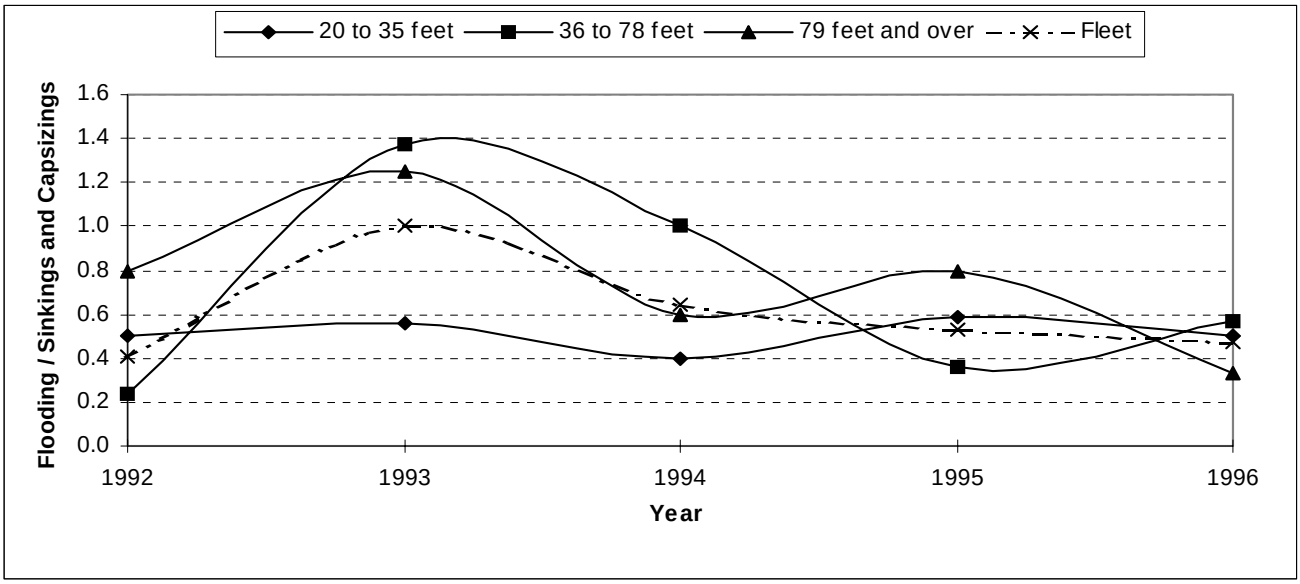


Figure 12. *Ratio of Flooding* Casualties to Other Sunk and Capsized Commercial Fishing Vessels in Alaska, 1992 - 1996

Although both the overall number and rate of stability- and watertight integrity-related casualties declined between 1992 and 1996, there was very little overall improvement in the ratio of flooding to more serious stability- and watertight integrity-related casualties. This is in spite of a fairly significant improvement between 1992 and 1993. This trend supports the statement that the CFVISA primarily reduces risk to fishing vessel crews by improving their chances of surviving a catastrophic vessel casualty, rather than by reducing the probability such a casualty will occur.

Casualty-related Fatalities

Casualty-related, operational fatalities are those which are the result of a vessel casualty. These are distinct from fatalities due to a crew member falling overboard or becoming entangled in gear and being pulled over the side. Figure 13 shows the number and rate of vessel casualty-related fatalities on commercial fishing vessels in Alaska between 1992 and 1996. The 77 percent reduction in the number of deaths from 1992 to 1994 illustrates the ability of the CFIVSA to improve the chances of a fishing vessel crew to survive a catastrophic vessel casualty. This reduction was offset by the increased number of casualty-related fatalities in 1995. Of concern is that although the overall trend in the number of vessel casualty-related fatalities is downward, the trend between 1993 and 1996 is relatively flat. Given the significant initial reduction in the number of these fatalities between 1992 and 1994, it should be expected that over time the number of casualty-related fatalities will continue to decline. However, the ability to successfully continue to reduce the number of commercial fishing vessel casualty-related fatalities is compromised by the fact the CFVISA does not significantly reduce the potential of a catastrophic vessel casualty from occurring.

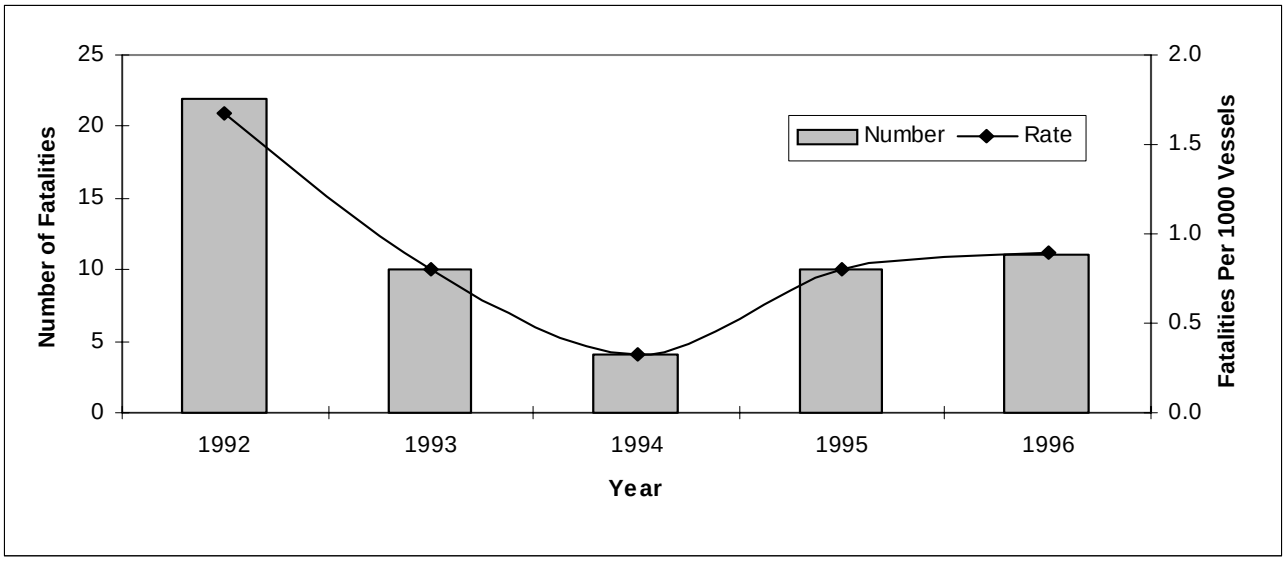


Figure 13. *Commercial Fishing Vessel Casualty-Related Fatalities in Alaska, 1992 - 1996*

The reality that the ability to successfully continue to reduce the number of vessel casualty-related fatalities is highlighted by the fact that out of the 57 casualty-related fatalities between 1992 and 1996, 55 occurred when a vessel sank or capsized. The other two were associated with vessel fires. The number and rate of casualty-related fatalities in Alaska by vessel length for the period is shown in Figure 14. The majority of the casualty-related fatalities on vessels less than 79 feet in length in 1992 and 1993 occurred during fisheries regulated by derby style openers. Of concern is the increase in the number of casualty-related fatalities on vessels 79 feet and over since 1994, particularly since almost all of these fatalities in a given year are associated with a single casualty. Two casualties in the Bering Sea account for 87 percent of the casualty-related fatalities in 1995 and 1996. Six crew members were killed when the F/V Northwest Mariner capsized in 1995 and seven crew members were lost when the F/V Pacesetter was reported missing and presumed sunk in 1996. Both vessels were engaged in the tanner crab fishery.

Conclusions And Recommendations

There is not a single "quick fix" solution to improve safety on commercial fishing vessels. The CFVISA has had some positive impact with regard to reducing the loss of life following a catastrophic casualty. However, because the focus of the equipment requirements of the CFVISA are primarily reactive rather than proactive, the risk of such an event occurring has not been substantially reduced. The focus of future efforts to substantively improve commercial fishing vessel safety must be reducing the risk of a catastrophic casualty from occurring. This can be done without additional legislative or regulatory fixes, provided individual fishing vessel owners, operators, and crews are committed to establishing a culture of safety within the industry. Although the Coast Guard and other regulatory agencies have a role to play, the impact of their efforts will be limited if personnel engaged in the commercial fishing industry are not themselves committed to improving safety.

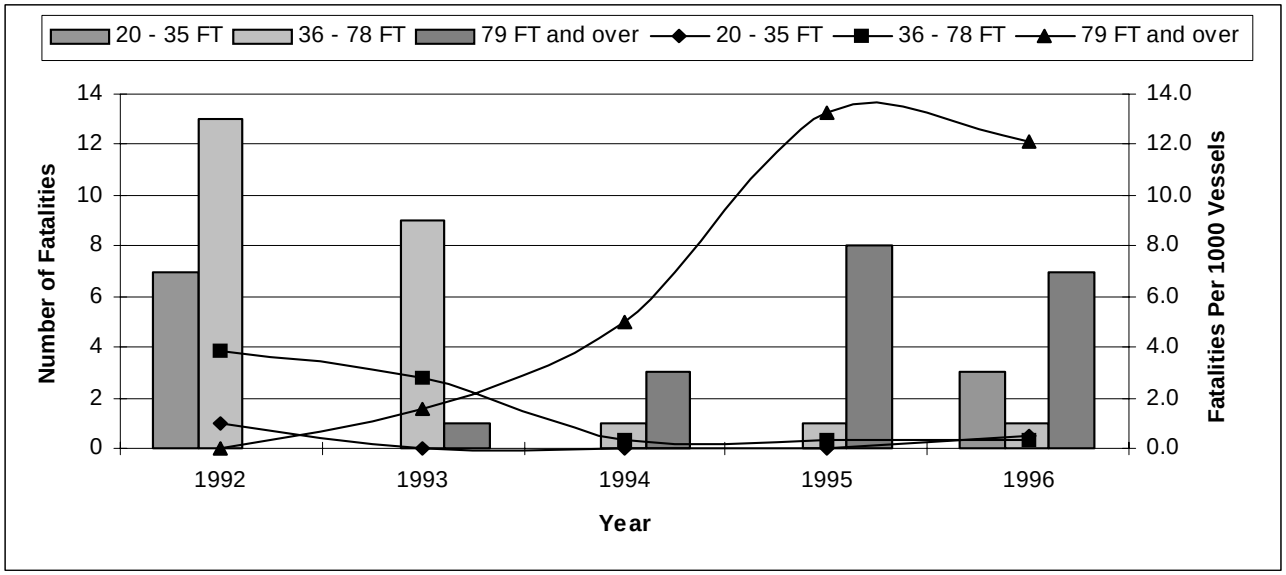


Figure 14. *Commercial Fishing Vessel-Related Fatalities in Alaska, 1992 - 1996*

The casualty data illustrate the fact there are a number of areas that must be addressed by vessel owners and operators. These include crew size and competency, operating procedures and policies, vessel maintenance, and stability. In the absence of regulatory licensing and manning requirements, the primary consideration for hiring vessel crews is fishing operations rather than safe navigation. This is apparent by the number of groundings caused by the crew member on watch falling asleep. This is not surprising, considering the fact it is common for an individual who just finished working on deck for 18 to 20 hours to go on watch in a warm wheelhouse while the rest of the crew sleeps. Depending on the fishery, this cycle can go on for upwards of 2-3 weeks without much break.

Although there may be one or two members of a crew who possess some modicum of knowledge regarding navigation, the majority of crew members are not qualified to operate a vessel in near-shore waters. There are even fewer who possess a working knowledge of vessel stability. An essential element for establishing a culture of safety on commercial fishing vessels is to start understanding crews of fishing vessels as professional mariners.

Vessel owners and operators can positively impact vessel safety by establishing procedures or safe work practices for the various operations that take place on board their vessels. Standard operating procedures function to establish how an operation will be performed. Good procedures are not complicated and can be developed by the vessel owner or operator working in conjunction with the crew. To be effective a procedure should include: how many personnel are required; what their duties are; what safety precautions are to be followed, including what safety equipment is required; under what conditions a particular procedure can be performed; and the specific steps that must be performed and in which order.

A well-maintained vessel communicates the owner and operator's commitment to safety. Following an established schedule of routine maintenance is essential to reducing the potential for equipment failure as well as for identifying problems requiring additional attention. A good maintenance program will ensure the owner and operator are aware of the material condition of every system on a vessel. For a maintenance program to achieve it's maximum effectiveness, it should establish a frequency for checking or performing maintenance on a particular system or component. It should also incorporate a checklist completed by the individual responsible for performing the inspection or maintenance. There should also be a log to establish a record of when required inspection and maintenance functions were performed.

Although there are exceptions, "seat of the pants" engineering is all too common on commercial fishing vessels of all sizes. Vessel owners and operators could improve vessel safety by using existing marine industry standards and guidelines when installing or modifying systems on their vessels. There are a variety of standards in use on commercial vessels appropriate for use on commercial fishing vessels. Organizations with standards appropriate for use in commercial marine applications include: the American Bureau of Shipping, the American National Standards Institute, the American Society of Mechanical Engineers, the American Society for Testing and Materials, the Institute of Electrical and Electronics Engineers, and the Underwriters Laboratory. For smaller vessels, the American Boat and Yacht Council (ABYC) Guidelines might be more appropriate for some applications. The engineering and electrical requirements for inspected vessels can also be used as guidance. It goes without saying that there are some existing requirements in the regulations governing uninspected commercial fishing vessels with which any installations should comply.

Vessel owners and operators can also improve safety aboard their vessels by retaining the services of a qualified naval architect or marine engineer to plan and oversee the installation or modification of vessel systems. This is particularly important when modifications affecting vessel stability are being made. For smaller vessels it may be adequate to consult with a marine surveyor who has experience with commercial vessels. Although naval architects and marine engineers are more frequently consulted for major modifications, vessel crews commonly modify systems based on what they think is right. Although the system as modified may be serviceable, it is not likely that it complies with existing industry standards or guidelines. The result is that the likelihood for a system failure, with potentially disastrous consequences, is increased.

The Coast Guard can seek legislative authority to develop additional regulations to improve safety onboard commercial fishing vessels. However, the impact of any such regulations will be limited as long as the owners and operators of commercial fishing vessels do not take some of the steps outlined above to develop a climate of safety within the industry. Vessel crews also have a responsibility to make the transition from fishermen who operate vessels to professional mariners who fish. Such changes will, in the long run, do more than additional government regulation toward developing and sustaining a culture of safety and reducing the risk associated with the commercial fishing vessels.

USCG FVS DOCKSIDE EXAM PROGRAM AND ALASKAN FV CASUALTY RATES

By Mr. Charlie Medlicott
Fishing Vessel Safety Program Coordinator, Marine Safety Office Anchorage

Commercial Fishing Vessel Safety Program

The Commercial Fishing Industry Vessel Safety Act of 1988 (CFIVSA) was enacted in response to the unabated losses of fishers and their vessels. In accordance with the Act, an inspection plan for fishing vessels, as well as a licensing plan for fishing vessel captains, has been submitted to Congress; however, sponsorship and legislative action are not forthcoming. Safety equipment regulations have been published (in 1991) and a Commercial Fishing Industry Vessel Safety Advisory Committee has been established as required by the Act.

The U.S. Coast Guard (USCG) requirements established lifesaving equipment, communications equipment, navigation publications, and basic administrative and training requirements. These requirements apply to vessels based on length, tonnage, area of operation, the number of people aboard, and the vessel's service. Generally, the smaller the vessel, the smaller the crew, and the closer vessel operations are to shore--the less required by the regulations.

There are presently minimal standards for construction, fire protection, electrical systems, watertight integrity, and stability. For new vessels, and vessels having undergone a major conversion, there are additional requirements. These additional requirements apply to few vessels at present.

The requirements for lifesaving equipment and training do seem to have reduced the number of people killed in incidents related to vessel loss. Fishing vessel loss rates, while decreasing slightly, continue to remain at high levels. However, what were once fatal incidents are now being routinely survived. Insufficient time has passed for an analysis of the effects aging safety equipment, maintenance problems with safety equipment, or the lack of requirements for continuing training of crews, will have on this trend.

If casualty rates remain the same, the failure of a piece of lifesaving equipment during an incident is a certainty. One event, accompanied by the failure of lifesaving equipment on a large vessel, or incorrect action by a poorly-trained crew, and this downward fatality trend could change instantly.

What is most compelling from Marine Safety Information System (MSIS) data is the fact that over 90 percent of all fishing vessel casualties in Alaska occur on vessels under 200 gross tons, operated by unlicensed crews. These are the vessels the regulations were intended to help the most.

Reported fishing vessel casualty rates in Alaska also seem to be on the decline. USCG MSIS data show that the primary causes of most of these accidents are equipment and machinery failure,

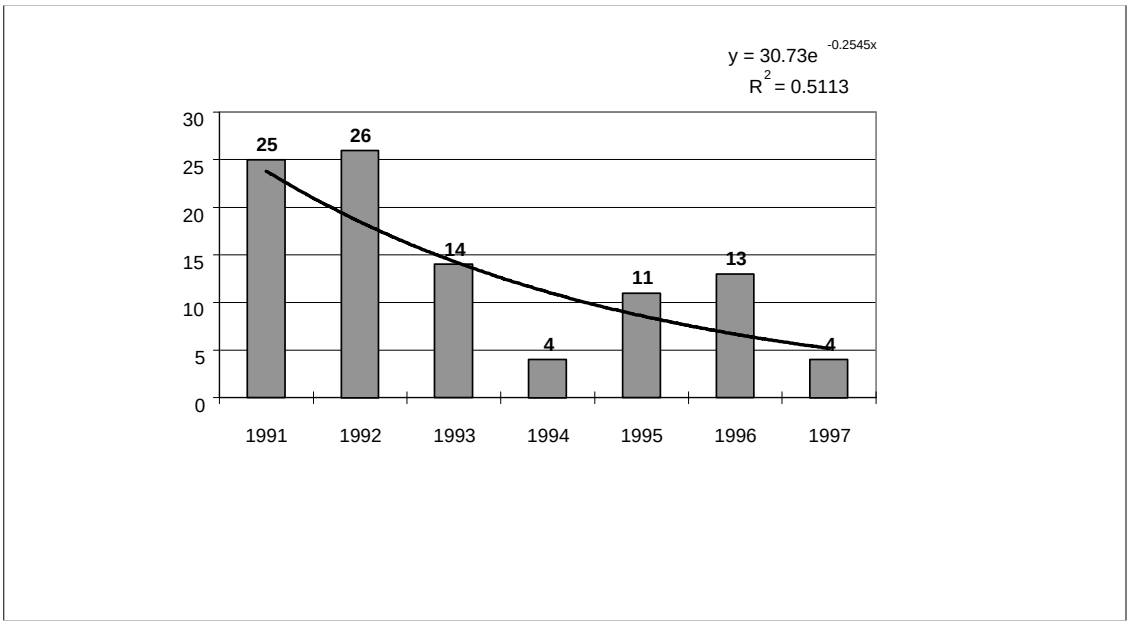


Figure 1. *Alaska F/V Deaths, 1991-1997*

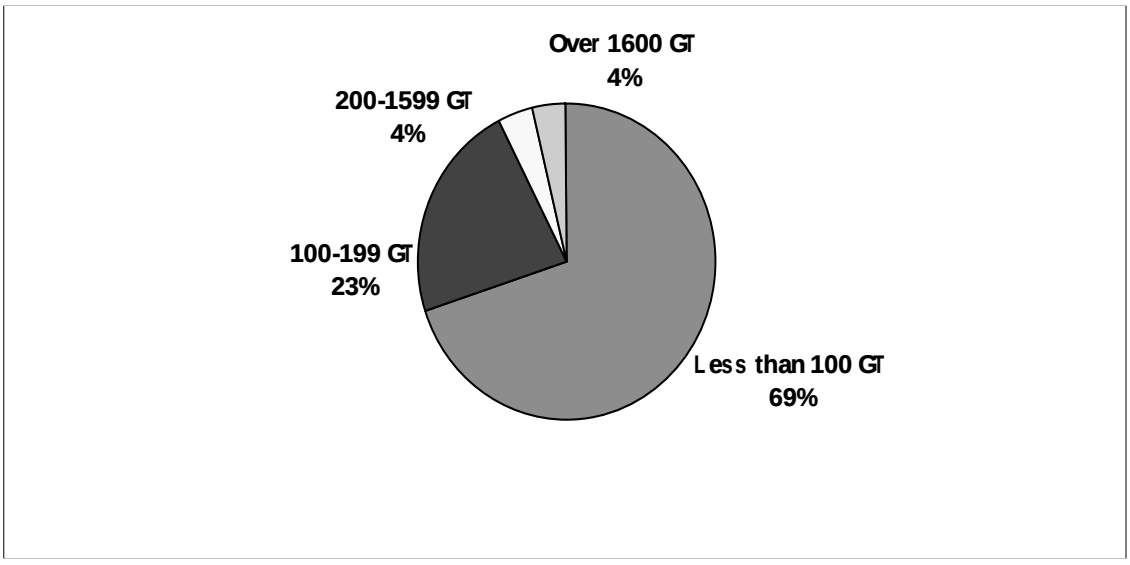


Figure 2. *Percentage of Fishing Vessel Casualties by Gross Tonnage, 1992-1996*

navigational error, and the failure of watertight integrity, all areas the current USCG regulations do not address.

Another trend not anticipated by USCG regulations is the continuing modification of small fishing vessels. As vessel owners are forced to change vessel operations for economic reasons, alterations are being made to small fishing vessels that significantly change their performance. Naval architects are seldom consulted, and no requirement for plan approval or oversight exist. The effect these altered vessels will have on currently decreasing death and casualty rates is unknown.

Fishing vessels are the primary setting for occupational injuries and deaths in Alaska. Personnel casualties not related to vessel loss continue to occur primarily aboard fishing vessels.

The CFIVSA gave the Coast Guard jurisdiction over machine guarding requirements on fishing vessels. Coast Guard boarding officers and examiners are not trained to effectively identify machine guarding or industrial hygiene discrepancies aboard fishing vessels. The Coast Guard's ability to effect personnel injury rates is extremely limited under the current system. While the current fishing vessel safety regulations seem to be working to address the post-incident period, they do little toward prevention.

Dockside Exam

Since legislative change is not at present a reality, the Coast Guard must use the few tools it has effectively. The CFIVSA is intended to educate the commercial fishing industry about safety. It is mostly voluntary, and relies on cooperation from industry. Its most effective tool has been the voluntary dockside exam program.

The Coast Guard has 61 designated billets to coordinate the CFIVSA program, educate the fisher, and conduct dockside exams. The exam is voluntary in nature and is intended to educate and train. The exam is a comprehensive examination of the vessel's safety gear, lifesaving equipment, administrative requirements, navigational publications and pollution compliance. On vessels where it is required, there is also an examination of written procedures for emergencies. An exam can be a day-long evolution on a large fishing vessel, or an hour on a smaller vessel.

The Coast Guard has a wide variety of personnel conducting exams with broad marine experience. The program has been a way for industry to have a positive interaction with the Coast Guard and has forced the Coast Guard, at least on the local level, to gain a much better understanding of the problems the industry faces trying to be safe.

Voluntary Dockside Examinations in Alaska

Seventeenth District Fishing Vessel Safety Examiners conducted 5893 voluntary dockside examinations from 1992 through September 30, 1997. The program experienced significant growth from its inception through 1995. Despite aggressive marketing by the Marine Safety Offices, participation in the voluntary program has declined in 1996 and 1997. These data are compiled by calendar year, so

the 1997 data are incomplete. However, because the majority of our examinations are conducted during the spring and summer, we expect the downward trend to continue through 1997.

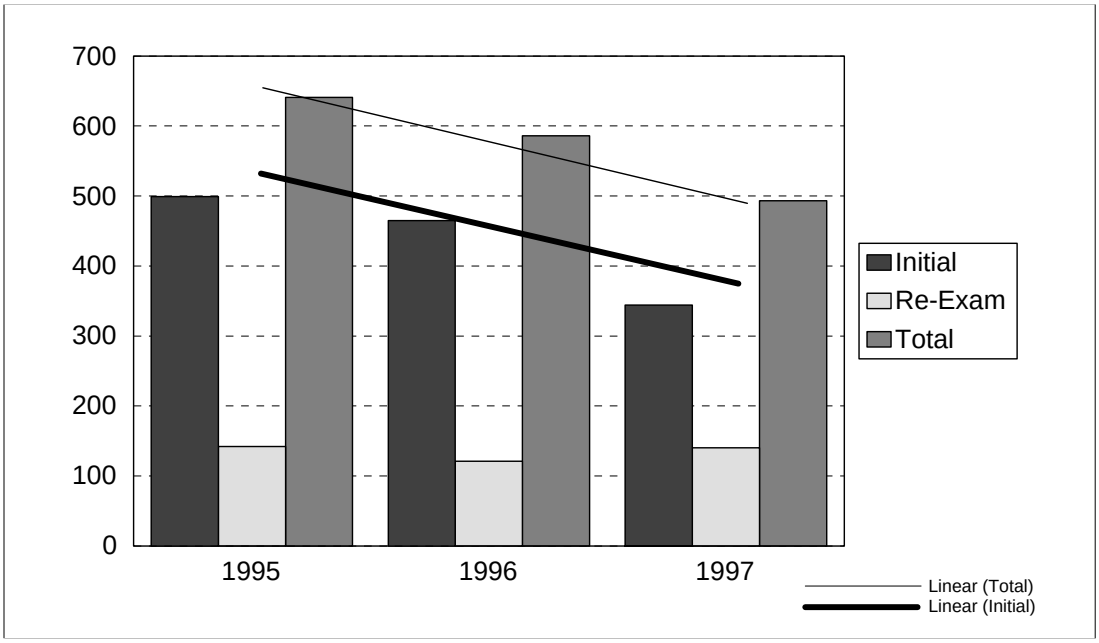


Figure 3. *CFVSE Trends 1995 Through September 1997*

The Seventeenth District's voluntary dockside examination program is one of the Coast Guard's most productive. However, over the last 4 years, fishing industry participation has steadily declined. Although our data are not conclusive, there are two factors which have probably influenced the decline.

First, the regulatory requirements have been in effect for several years. Safety awareness and familiarity with the regulations have increased. We may have been the subject matter experts in the beginning, but many fishers are now comfortable working their way through the regulations, perhaps with the assistance of their safety equipment supplier or other fishers.

Second, and perhaps more importantly, many fishers see no perceived benefit to having their vessels examined. The decal does little to reduce the inconvenience of being boared by the Coast Guard. Also, the insurance companies have not lowered insurance rates for fishers who meet minimum safety standards.

In Alaska we are dealing with a huge geographical area, coupled with great cost in prosecuting this program. We are forced to measure our efforts and focus on the vessels and fishers at greatest risk. We believe we have been successful, and with cooperation and participation from industry it does

appear fatalities have been reduced in the fleets targeted. Ironically, it also appears that 30 percent of the vessels lost in Alaska in the last 3 years have completed an exam. This is not because Coast Guard examiners are sinking boats. It is because the majority of our exams are on the vessels involved in high-risk fisheries.

Of the 39 fishing vessels which were lost during 1996, in Alaska, 13 had a voluntary FVS dockside examination and 10 had valid FVS decals. Of the vessels which had a death on board, the ratio of examined vessels to unexamined vessels is similar; seven had undergone an exam and four had valid FVS decals.

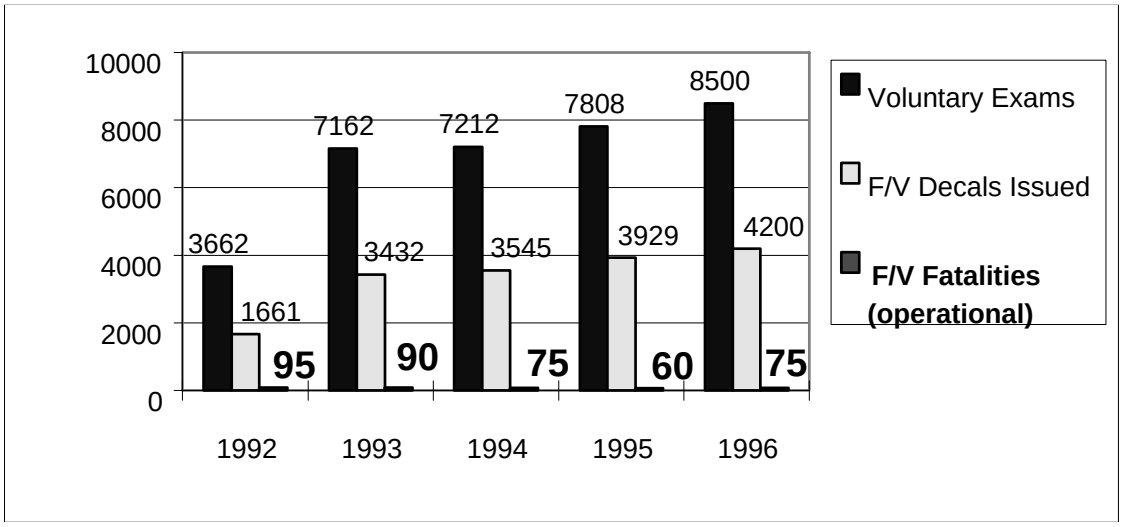
The dockside exam does not address the root causes of fishing vessel losses. It is an educational outreach program, not an inspection program for fishing vessels.

We should not look for numbers of exams as a measure of success. We should look at the reduction in the number of fatalities and vessel casualties as a measure of success. In each of the last 3 years, Marine Safety Office Anchorage has conducted fewer exams than the previous year, but more exams have focused on the high risk fleets. Seventy percent of the crab fleet in western Alaska have participated in the dockside exam program. Deaths are not down significantly in this fishery. When looking at exam or fatality trends nationally, it is very noteworthy that the exam effort has nearly tripled with only a slight reduction in operational fatal events. The continuing emphasis on this voluntary dockside exam program to solve the fishing vessel safety problems in the United States is misplaced. The dockside exam is meant to educate and hopefully change the safety culture of the commercial fishing industry. With the continued cooperation of industry, the exam has a place, but it is not the answer.

The data clearly indicate a significant drop in Alaskan fishing fatalities in 1993. We suspect that one cause for this drop is that 1993 was the first year that CFIVSA equipment requirements were fully implemented for documented commercial fishing vessels. The fact that fatalities have remained fairly constant since then (fluctuating between 18-23 deaths annually) suggests that the 1993 fatality rate was not an anomaly. This year, 1997, has been a positive year with only four fatalities (as of September 30). However, unless this low number continues over a period of years, we must consider 1997 an anomaly.

Equipment requirements, survival craft, immersion suits, drills, and training requirements in particular, have resulted in fewer fatalities per vessel loss. If we compare 1991 fatalities to 1991 people at risk due to vessel losses, we obtain a fatality rate of 89 percent. If we compare the 1996 fatality and people at risk due to vessel loss figures--even with 23 deaths--we discover that the fatality rate has decreased to 58 percent.

Certainly, having fewer deaths on our fishing boats is a positive statistic. On the other hand, the observation of the Alaskan rate of vessel losses remaining relatively constant suggests that we may have fully realized the effects of the commercial fishing vessel safety regulations on our fatality rate.



Source: G-MOC-3

Figure 4. *Exam to Fatality Rate, 1992-1996*

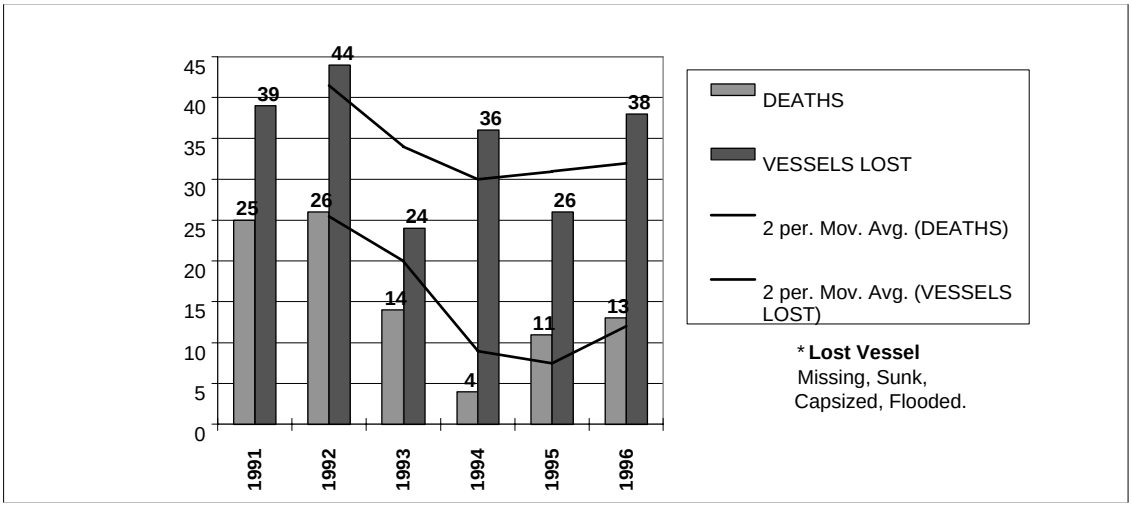
Whether dockside examination participation goes up or down will have little effect on the overall safety of the commercial fishing industry. Even when the dockside examination program was at its peak in 1994, we were only examining seven percent of the fishing vessels licensed to fish in Alaskan waters. In 1996 this percentage had decreased to less than six percent. We would be overly optimistic to conclude that we are significantly impacting compliance or safety by examining such a small percentage of the fishing fleet.

This is not to suggest that the dockside examination program is without value. Although the benefits may be immeasurable, dockside examinations provide opportunities for personal interaction with fishers. The voluntary dockside exam is a vital marketing opportunity.

The number of at-sea enforcement boardings has also decreased steadily since 1993. Cutters patrolling Alaskan waters are being tasked with diverse mission requirements. We have fewer cutter days dedicated to fishery patrols in the Bering Sea. We also have cutters patrolling the Russian/United States Convention Line and the U.S./Canadian A/B Line in Dixon Entrance. Neither of these patrol activities are focused on safety enforcement boardings. Despite the decline in boardings, the compliance rate appears to be fairly constant. During 1996 only seven fishing vessels had their voyages terminated because of especially hazardous conditions.

Coast Guard boarding policy dictates that our boarding teams check compliance with five specific equipment and training requirements, namely survival craft and immersion suits, life ring buoys, portable fire extinguishers, EPIRBS, and crew training and drills. The decrease in enforcement boardings has not had an obvious effect on the vessel loss/fatality rate.

Meaningful correlation of this package of data is difficult. We used several sources: MSIS, LEIS, Alaska Department of Fish and Game databases, locally maintained files, and MSO databases. Commandant is obtaining their figures and measuring our activities and progress based only on what is in MSIS, as would be expected. Which source is most accurate is dependent on one's point of view. This disparity makes the need for standardized data entry and collection glaringly obvious.



Source: USCG, 17th District Coordinator

Figure 5. *Death Rate by Vessels Lost, 1992-1996*

District 17 measurement is not aligned with the fishing vessel safety measurement plan promulgated in the Commandant's Marine Safety business plan. It seems that we are trying to measure the effectiveness of the voluntary dockside examination program, while Commandant has tasked us with measuring our progress towards closing the gap between inspected vessel and uninspected vessel casualty rates. The fishing vessel safety program should be more than just a voluntary dockside examination program. By focusing mainly on this one aspect of the fishing vessel safety program we may lose sight of our ultimate goal of reducing deaths and injuries aboard fishing vessels.

The primary goal of effective data analysis is the ability to base our resource allocation on information, rather than opinion. It is crucial that we work vigorously towards this end so we may focus our limited resources--cutters, examiners, public outreach, etc., on high-risk fishing activities. Another goal is to gather the information necessary to support changes to the commercial fishing vessel safety regulations, specifically, structural and stability standards. Lastly, and perhaps most significantly, accurate information will help us move the USCG's fishing vessel safety mission away from a voluntary dockside exam program (which is focused mainly on survival equipment maintenance) to a risk-based prevention program.

Future safety efforts by the Coast Guard should emphasize prevention and human factors. Several prevention-through-people initiatives are being pursued. One such initiative, the development of

damage control trainers and stability trainers is aimed at improving partnering with the fishing industry, and promoting safety awareness. Joint initiatives with local state and federal agencies are being pursued throughout the Coast Guard. In Alaska, we have pursued partnerships with the National Marine Fisheries Service and the federal observer program. We provide information to regulatory bodies such as the Alaska Department of Fish and Game and the North Pacific Fisheries Management Council. We work closely with our NIOSH office in Anchorage. Throughout the United States, the Coast Guard is working with universities and industry. Industry groups and the insurance companies must be encouraged to take part in these partnerships.

Given that fishing vessel operations still represent the most significant maritime safety of life issue in American industry, and remain a major focus of the Commandant's Marine Safety Business plan, and that additional legislative authority is unlikely, industry and government are only limited by their collective imagination, creativity and willingness to work together to make commercial fishing safer.

For the most part, the commercial fishing fleet in the United States still remains mostly unregulated concerning marine safety and occupational safety and health. Unless standards for the design, construction and operation of commercial fishing vessels are adopted, there is no reason to believe that casualty rates will continue to decline much beyond what has already been experienced.

Questions and Answers:

Q. My name is Mark Hoffman. There seems to be a perception, at least the guys that I know, that you get this dockside safety exam, maybe you won't get tied up so long in the water when you're out fishing and you get boarded. That doesn't seem to be the case. I have a couple of friends that have been boarded multiple times in a short period of time even though they've got this decal. There seems to be the perception that if I've done this dockside stuff, then maybe I won't get tied up so long in the water.

A. Mr. Medlicott: That is a problem and we're aware of it. That was one of the ways the Coast Guard tried to sell participating in the program. But the Coast Guard doesn't board you for safety. They primarily board you to enforce federal fisheries, and safety becomes part of that boarding. But, you're absolutely right. I hear that from fishermen all the time that, "Hey, I did this initially because I thought it would keep the Coast Guard off my boat, and it didn't."

OSHA INTERVENTION IN THE ALASKA FISHING INDUSTRY

By Mr. Barry Noll
Director, OSHA Anchorage Area Office

Summary

The mission of the Occupational Safety and Health Administration (OSHA) is to ensure that every working man and woman in the United States has a safe and healthful workplace. Thus, OSHA is interested in identifying and correcting workplace safety problems before a casualty occurs, not after. This includes the segment of the Alaska fishing industry which falls under OSHA's jurisdiction.

OSHA Jurisdiction

On December 29, 1970, the 91st Congress passed the Occupational Safety and Health Act (OSH Act). The OSH Act lead to the development of OSHA, and charged it with the promulgation and enforcement of occupational safety and health regulations. These OSHA regulations apply to areas of industry that are not already regulated by another federal agency. The OSH Act established OSHA's jurisdiction and limited its offshore authority to a state's territorial waters. A state's territorial waters are considered to extend three nautical miles seaward from the coastline. The exception to this is the Gulf Coast, where the territorial waters extend three marine leagues, or approximately nine nautical miles.

The coastline is the line of ordinary low water along the part of the coastline that is in direct contact with the open sea. Enforcement of OSHA regulations is confined to vessels that are operating within three nautical miles of Alaska's coast. All vessels involved in long-shoring operations are subject to OSHA regulation. Long-shoring operations occur whenever material is moved between vessels or from vessel to dock.

The preemption paragraph in the OSH Act requires OSHA to relinquish its authority to any federal agency that chooses to assume the responsibility for worker safety and health in all or part of an industry. The Coast Guard is the lead federal agency on the water. Regulations issued by the Coast Guard preempt OSHA's. Those areas of worker safety and health not covered by a specific Coast Guard standard are covered by OSHA within Alaska's territorial waters. Beyond the territorial water line, these areas are unregulated.

Uninspected vessels fall under both OSHA and Coast Guard jurisdiction. Inspected vessels are under Coast Guard jurisdiction except for record keeping, discrimination, and long shoring. On vessels under OSHA jurisdiction, OSHA enforces its General Industry Standards, 29 CFR 1910, and Maritime Standards, 29 CFR 1915-1919. Accidents and fatalities which occur on vessels under OSHA jurisdiction will be investigated. By regulation, accidents that result in hospitalization of three or more people, and fatalities, must be reported by employers to the local OSHA Area Office within eight hours of their occurrence.

Alaska Consultation Assistance

The OSH Act which established OSHA also gave the states the right to establish their own occupational safety and health programs. Alaska is one of 25 states and territories which have opted to develop their own programs. A state which develops its own safety and health program is responsible for standards promulgation, enforcement, and consultation. The state consultation program is responsible for providing consultation services to all employers, whether they are under state or federal OSHA jurisdiction. In Alaska employers in the maritime industry operating within three nautical miles of the coastline can request the services of an Alaska safety and health consultant. The consultant will visit a vessel, without cost to the employer, to assist with any safety or health issues.

Enforcement Inspections

The OSHA Anchorage Area Office's primary responsibility is enforcement inspections. Enforcement inspections occur for one of four reasons. In declining order of importance they are:

- An imminent danger to employees.

- A fatality or catastrophe (three or more people hospitalized).

- An employee complaint or referral from another government agency.

- A general scheduled inspection.

When the Area Office receives a report of an imminent danger, an enforcement officer is dispatched to investigate the allegations within 24 hours. In certain instances, the enforcement officer will contact the employer before the inspection to have affected employees removed from the area of imminent danger.

OSHA requires fatalities and catastrophes to be reported to the Area Office within 8 hours of their occurrence. Fatalities and catastrophes are investigated as quickly as resources, priorities, and travel permit. Fatalities or catastrophes occurring at work sites where both OSHA and Coast Guard have jurisdiction are investigated by the Coast Guard, as the lead federal agency on the water. Their declination to investigate would allow OSHA to conduct the investigation.

For a complaint to trigger an inspection by OSHA, the complaint must be made by a current company employee, relative, or union representative. This is termed a formal complaint. All others are termed informal complaints. Informal complaints are handled by telephone and fax machine. The employer is telephoned by an enforcement officer and informed of the allegations. This telephone call is followed by a faxed letter which also explains the allegations. The employer is given 5 days to investigate the allegations, fix any problems, and respond back to the Area Office. If the employer fails to respond, the Area Office can dispatch an enforcement officer to investigate.

Scheduled inspections are the lowest priority for inspection. These inspections, however, account for most of the fishing industry inspections conducted by the Anchorage Area Office. Currently in Alaska, OSHA has a special inspection program emphasizing floating seafood processors. Under this special program, processors can be inspected as often as once a year, and all processing vessels are subject to inspection.

Enforcement officers in Anchorage are responsible for visiting work sites and determining compliance with OSHA regulations. These site visits identify workplace hazards which pose a threat to employees. The enforcement officer then uses the only tool allowed by Congress to motivate the employer to correct the hazard--a citation. OSHA enforcement officers are not allowed to identify hazards for employers without citing them. This could result in the officer being fined or jailed. State programs can offer consultation services in addition to their enforcement program, but OSHA cannot. These regulations are written in the OSH Act itself.

OSHA has developed partnerships with industry groups to educate employers and employees. For the Alaskan fish-processing industry, OSHA Region X is working with industry groups like the North Pacific Fishing Vessel Owners Association (NPFVOA), to provide safety and health training. Staff from the Anchorage Area Office have visited company offices and have also provided safety and health information. These efforts are conducted away from the work sites and are not considered consultation activities.

The Anchorage Area Office enforcement staff visits 40 to 50 vessels a year, on average. Last year, the enforcement officers found violations worth almost $200,000.00 in the fish processing industry offshore in Alaska. The most frequently violated regulations were electrical. Other frequent violations included materiel handling, equipment, access, and egress.

Inspection Conduct

Once an OSHA enforcement officer arrives on board, the officer will present OSHA credentials and hold an opening conference. During the opening conference, the enforcement officer will discuss the reason for the inspection, areas to be covered, and rights of the owner and employees to accompany the compliance officer on the inspection. Before beginning the inspection, the compliance officer will review all the required written programs and injury/illness logs. The written programs required on the vessels are:

- Hazard communication program

- Respirator program

- Hearing conservation program

- Hazardous energy control program (lockout/tagout)

- Exposure control plan for bloodborne pathogens

- Safety and health program

- Confined space entry program

The illness/injury logs for the current year and previous 4 years are required to be kept on the vessels and are subject to review by the OSHA enforcement officer.

During the walk-around, the enforcement officer will discuss the apparent violations observed, interview employees, and listen to concerns about safety and health issues. When the walk-around portion of the investigation is completed, a closing conference will be held. During the closing conference, the apparent violations will be discussed again, along with the employer's rights and responsibilities following an OSHA inspection.

The inspection citations are issued from the Area Office. If possible, copies are sent to both the inspection site and the corporate offices. Once received, the employer has 15 working days to hold an informal conference with the Area Director to contest the violations cited, penalties, or both. The results of an informal conference could be a lowering of the penalty based on abating the cited hazards.

The Budget Reconciliation Act passed by the 101st Congress increased the penalties for violations of the OSH Act. The Budget Reconciliation Act stipulated a seven-fold increase for the maximum penalty limit. This effectively raised the maximum limits of a willful or repeated violation to $70,000, serious or other-than-serious to $7,000, and other violations to $1,000. OSHA has developed a set of factors that include probability, severity, and company size to reduce the maximum penalty so that a typical penalty for a serious violation is now between $1,000 and $2,000.

OSHA and Coast Guard

A discussion of OSHA's presence in the Alaskan fishing industry would be incomplete without discussing the gray area that exists between certain OSHA and Coast Guard regulations. Whenever an issue is encountered that could fall to either agency, the Anchorage Area Office contacts the Coast Guard Marine Safety Office (MSO) regarding jurisdiction, and an immediate decision is made on the proper course of action. Investigators from both agencies share information, and routinely discuss different aspects of each other's enforcement programs. The discussions often concern jurisdiction but have included policy issues, documentation criteria, and inspection conduct.

This coordination and cooperation between the Anchorage Area Office and the Coast Guard are expanding. Both agencies have jointly inspected crab processors in the Pribilof Islands, and catcher processors in Dutch Harbor. Inspections have been coordinated when the Coast Guard has notified the Anchorage Area Office of flagrant safety and health problems. During OSHA inspections of fish-processing vessels, violations of the Commercial Fishing Industry Vessel Safety Act of 1988 are documented by enforcement officers and referred to the 17th Coast Guard District.

The cooperation between OSHA and the Coast Guard will be expanding as the two agencies develop an outreach program for the diving industry in Alaska. This hazardous industry has had, according to

the National Institute for Occupational Safety and Health, six fatalities in Alaska over the last couple of years. The two agencies are developing an educational outreach program for divers which will be followed by an enforcement program.

Conclusion

OSHA will continue to cover those areas of uninspected vessels not regulated by the Coast Guard within three nautical miles of the Alaskan coast. This regulation includes long-shoring work on all vessels.

Except for imminent danger complaints, OSHA inspections are unannounced, follow a prescribed procedure, and are administered by the OSHA Anchorage Area Office. The Coast Guard and OSHA will continue to coordinate the inspection work and improve cooperation. In the future, more referrals will be made between agencies. The outcome of this effort will be an improved, safer processing fleet operating in Alaskan waters.

Questions and Answers:

Q. I'm John Bryant from the Coast Guard, D-17. Can you briefly describe what is OSHA's jurisdiction on board these boats, because certain spaces you have jurisdiction over, certain spaces you don't?

A. Mr. Noll. Well, the jurisdiction between the Coast Guard and OSHA, it's a little bit of a gray area, because no one has actually sat down and drawn a solid line to say these spaces are OSHA's, and these spaces are the Coast Guard's, or even these issues are OSHA's and these issues are the Coast Guards. In years past, the rule of thumb we used was if it had to do with the safety of the vessel, it was the Coast Guard; if it had to do with the safety of a process on board the vessel that mirrored a shore-based facility, it would be OSHA. So things like cooking, housecleaning, and factory spaces were OSHA, but, it's a little more convoluted than that. Now, it breaks down further; things like machine guarding anywhere on the vessel are Coast Guard, but tools anywhere on the vessel are OSHA. You have a requirement for respirators when it comes to firefighting, but we have requirements for respirators that aren't used for firefighting that the engineers may use in the normal course of their work. We have shipyard standards that we enforce whenever maintenance or repair is done on board the vessel, but you have hot work standards now. So, it's a very crooked line that draws the jurisdiction between us. And, I know what I've tried to do is whenever there has been a question, I've always called the local MSO to discuss the issue before we went ahead with any citation.

Q. Mr. Bryant. When you mentioned electrical requirements, electrical problems, I was interested in that.

A. Mr. Noll. Well, we're talking basically the older boats that don't fall under the CFIVSA. I wouldn't do that on one of those. If I found something there, I would refer it to the MSO, because it's clearly not my jurisdiction.

Q. I'm Jeff Ciampa with the Coast Guard Marine Safety Office in Portland, Maine. In 1993 and 1994, we had somewhat of a crisis involving fishery divers which resulted in a lot of deaths, and we worked quite closely with your office in Maine on the issue. There were two incidents when OSHA brought violation charges against the operators of the vessels, and they both were horror stories involving young, inexperienced divers. And your efforts were ultimately frustrated by the permitting system the state had in place; where they were permitting the divers, not the vessels, and therefore no employer/employee relationship. Could you touch on that element of the law?

A. Mr. Noll. Well, we have these exact same situations here, and I can use Washington and Alaska as examples. The Occupational Safety and Health Act says that we have the authority to assure a safe and healthful workplace for employees of employers, but not employers. So basically, under the Act, employers can expose themselves to any hazard they wish, and there's nothing that OSHA can do about it. But, they cannot under any circumstances, expose their employees to that hazard. Now, to diving, in the state of Washington, agricultural divers work off a boat that has the permit, so a boat could have many divers because the boat has the permit. The divers pick up the material they've harvested, and put it on the boat. It goes into a common bow, the boat sells it, and then they divide the profits up, according to shares. Now, in Alaska, the diver has to have the permit. The diver can't co-mingle their catch with anyone else's catch, and the diver is responsible ultimately for selling that catch. What this says is, in the state of Washington, the divers are now employees of the boat, because the owner of the boat or captain of the boat or whoever's operating the boat, is basically telling the divers where they're going to go, receiving the catch, selling the catch, disseminating the money from the catch. We have an employee/employer relationship. In Alaska, since the diver has to have the permit, the diver has to take responsibility for the catch all the way through to selling it to the processor. There is no employee/employer relationship, even though three divers may be working off a common boat. That was the issue in Portland, Maine.

SAFETY CULTURE FROM MANAGEMENT'S PERSPECTIVE

By Ms. Leauri Lopes
Safety Director, Icicle Seafoods, Inc.

I've been invited to speak today about safety culture from management's perspective. Most of the presentations today contain quantifiable data--casualty statistics, research, and regulations. A safety culture cannot always be quantified, although the results of building a strong safety program may result in a reduction in the number of injuries, injury costs, and insurance premiums. We are all well aware of the hazards inherent in the fishing industry. I'd like to share with you how Icicle Seafoods has built a successful safety program in the face of such adversity.

Before I talk about Icicle Seafoods' safety culture, I'd like to give you a brief description of our operations. Icicle operates four floating-processing vessels, ranging in size from 160 to 328 feet. We have three land-processing plants in Alaska and two in Bellingham. We also own Port Chatham, which produces smoked seafood products. Each location has a site safety manager who reports to the vessel or plant manager. The safety manager operates on the same level as the rest of our key staff including the production manager, chief engineer, and captain. As the safety director at Icicle Seafoods, my role is to keep all locations up-to-date on new regulations and research within the area of occupational safety and health. I work to ensure company compliance with Occupational Safety and Health Administration (OSHA) and U.S. Coast Guard regulations for our floating processors, Alaska Occupational Safety and Health for our Alaskan land plants, and Washington Industrial Safety and Health Administration regulations for our Washington facilities.

Several years ago, Icicle made a conscious decision to build a strong safety program. This program permeates all aspects of our operations, creating a culture which refuses to compromise the safety and health of our employees. The four cornerstones of our safety culture are commitment, completion, communication, and continuity.

Commitment

Without commitment from top management--the president and vice-presidents--we wouldn't have a viable program. Icicle's upper management believes in the importance of a meaningful health and safety program. They're extremely supportive of efforts to keep our workers safe, and they demonstrate this in many ways. They don't just say it; they walk the walk as well as talk the talk.

The sincerity of upper management speaks through the amount of money Icicle allocates toward safety issues. Funds are budgeted for both safety equipment and training. I keep a running list of recommended safety improvements and these are incorporated into the following year's budget. Some examples of these expenditures include adding additional emergency exits from an isolated area at our Petersburg facility, upgrading our ammonia detection devices on board our vessels, and purchasing several additional self-contained breathing apparatuses (SCBAs) and spare oxygen cylinders, far beyond the Coast Guard's minimum requirements, for our floating processors. As I mentioned earlier, we have dedicated safety personnel both on our vessels and at our plants. Our human relations

manager conducts periodic salary surveys to ensure we offer a highly competitive package for these safety managers.

Our safety manager's primary job duty is to ensure the safety and health of our employees. Instead of lumping this task into some other job duty, such as expecting the production manager to also function as the safety contact, we have a designated person who is accountable solely to this endeavor. These folks dedicate an abundance of time and energy to our safety program.

Completion

Building a safety culture requires compliance with government regulations. We fall under the jurisdiction of several agencies since we operate over water, in Alaska and in Washington. Icicle maintains written safety programs to comply with various standards. We also have programs in place that have nothing to do with current regulations. We recognize that legislation usually lags behind sound safety practices so we've taken the initiative to implement programs that currently aren't required.

Completing training is never-ending. We're never caught up, but we keep at it. Icicle invests a significant amount of money to train our employees. For example, we spend well over a thousand dollars to train each of our deckhands. They participate in fire fighting, safety equipment and survival, first aid and CPR, crane operations, and 24-hour HAZMAT technician training. Due to the seasonal nature of the seafood processing industry, some of these employees may not stay with our company for very long, or they may be with us season after season. Regardless, Icicle puts that money up front because it's important.

Not only do we provide training to maintain compliance with existing regulations, but we also look at what makes sense. We work closely with the North Pacific Fishing Vessel Owners' Association (NPFVOA) to develop training classes that will benefit our employees. For example, there is no specific OSHA or Coast Guard regulation that requires a safety course for skiff operators. Icicle turned to NPFVOA to develop a skiff safety class for our deck hands. We have used that curriculum to train our folks here in Seattle before the vessel leaves, as well as in Bristol Bay, Alaska. We have worked with an occupational therapist to develop a stretching program for our processing crews, and have sent several managers through the ergonomics course offered by NPFVOA in conjunction with the Joyce Institute.

To build a viable safety culture, we document everything we do. If it isn't written down, it most likely didn't happen. We document drills, trainings, near misses, accident investigations, etc. Paper trails enable us to track our progress and show our good faith effort toward compliance.

COMMUNICATION

Communication is the most important building block for our safety culture. No matter how well I write safety programs, they don't do any good unless someone communicates their contents to our employees. We communicate our expectations through several methods, such as in job descriptions

and training sessions. We use written warnings when they are necessary and appropriate. If someone repeatedly reports to work without wearing hearing protection and verbal reminders aren't working, sometimes a written warning gets through. On our performance reviews, the first area of evaluation is safety.

One of my main responsibilities is disseminating relevant and timely safety and health information to Icicle's safety managers. I gather information from safety magazines, OSHA's quarterly journal, USCG bulletins, and various newsletters. I often route my memos and copies of articles to other managers including vessel and plant managers, maintenance managers, and production managers.

Icicle believes in keeping the lines of communication open between our employees and management. We want our employees to be able to tell us if they have safety concerns or issues. They can inform us verbally or in writing and they may choose to either be recognized for their contribution to our program or to remain anonymous. Many of our employees speak English as a second language, have difficulty writing in English, or are completely illiterate. Because of these challenges, we allow any method of communicating their concern. I've had employees draw a picture of their idea or accompany me out on the line to show me what they mean.

Continuity

Building a safety culture is a never-ending process. If I thought we were done, I'd say we would have to start over again. Keeping up with changing regulations and research requires a continuous, conscious effort to improve what's already in place.

The Bottom Line

Icicle Seafoods has done a great job developing a strong safety culture. Our processing barge (P/B) the P/B Bering Star, has been accepted into the Star Level of OSHA's Voluntary Protection Program (VPP). Currently, the P/B Bering Star is the only floating processing vessel in the VPP. Because of the emphasis Icicle has given to employee safety, we've experienced a dramatic decline company-wide in the number and cost of our Worker's Compensation claims. The number of individual claims has decreased 50 percent, and the cost of these claims has decreased 90 percent over the last 4 years.

Questions and Answers:

My name is Joy Flack with OSHA. I think that your presentation is what we all need to hear here today, and that is you prevent the injury from occurring and then you don't have to fish those people out of the water, you don't have to fish the bodies out.

EFFECT OF RESOURCE MANAGEMENT DECISIONS ON FISHING VESSEL SAFETY

By CAPT Ed Thompson
Commanding Officer, USCG Marine Safety Office Anchorage

I have been asked to talk about the effect of resource management decisions on fishing vessel safety. I believe that several factors affect safety in the fishing industry and will talk about those today.

As you've heard, the loss of life in the Alaskan fishing industry has decreased in recent years. This is due to the actions that occur after the vessel casualty— primarily, the use of safety equipment and successful rescues. According to our data, vessel casualty rates remain level. So our goal at Marine Safety Office (MSO) Anchorage is to identify opportunities for prevention, and then implement a program to establish a downward trend in vessel casualty rates.

The areas that I will discuss today that affect safety are legislation, vessel owners, financial institutions, insurance companies, and resource managers.

Let's first talk about legislation. Frankly, I think legislation in the fishing industry at this point is somewhat moot. Everyone knows what needs to be done. There's no mystery or science to it. It's just a matter of having the will to do it. Is legislation needed? Each and every person in this room has his or her own opinion as to whether additional legislative authority is needed. I can almost guarantee that if a processor burns in the Bering Sea and kills a few hundred people, there's a real potential for new legislation. I do not think that enough people involved in the fishing industry are doing enough to prevent this type of incident. Both industry and government need to be more proactive.

Vessel owners are primarily responsible for fishing vessel safety, because they are primarily responsible for the condition of that fishing vessel and hiring qualified, experienced crews. For example, a vessel that has one man that knows how to drive the boat and five guys off the street with little experience, is not a well-crewed boat. Poor vessel manning practices result in far too many fishing vessel casualties. It's up to the vessel owner to spend the money on qualified people. This is one example of how an owner impacts vessel safety.

I find it difficult to believe that financial institutions that loan money to fishermen are not taking a more active role ensuring that they run their business correctly. Insurance companies are very passive with their approach and this is one cause for a lack of incentive by fishermen to keep up with the maintenance of their boat.

Resource managers have a surprising amount of impact. They choose the time to fish, which is based on biological information. And they set the rules. Is it a derby opener, or is it IFQ? All these things impact safety.

So who has the greatest effect on prevention? I said it. The owner. He hires the crew, he maintains the boat, he sets the tone. I think the presentation from Icicle Seafoods certainly gave you a positive example of setting the tone.

The way the master and the crew operate the vessel affects safety, but let's be honest. If the master stands up to some of these owners and says, "Hey, this is not the right way to go. I need a more qualified crew, the vessel needs repairs . . . " What's going to happen to that guy? He's going to be on the bricks, right? Somebody else will get hired who will comply with the owner's policies.

Changes to the resource management system can substantially affect safety and still provide resource protection. For example, changing from halibut derby openers to an IFQ fishery has reduced deaths in the longline fisheries. The crab fisheries with the derby openers are pretty close to this. It does not matter if it is blowing 90 knots; this is the day allocated for the opener. The possibility of delaying openers due to weather, in some circles of resource management, is taboo. They are on a rigid schedule day to day. So the risk is transferred from prevention to the reaction of Search And Rescue (SAR) systems.

The changes I'm talking about are delaying an opener for just a few hours, or a day. Wait for the storm to pass, wait for the front to pass, on both ends of the opener. Another idea is wet storage for pots. Crabbers who have survived more than 20 seasons have said, "Look, if we could go ahead and wet store the pots and then come back and get our tank check and then be sent out on the fishery, we wouldn't have to carry this mountain of pots." In fact, it used to run that way back in the '70s, but it has changed. It probably changed so government could do a better job of resource protection, but what about the people? Perhaps now there are new technologies that can be utilized to prevent early fishing or cheating. These ideas need to be examined by all players.

If the opener's too short to do it safely—don't do it. The latest red king crab opening in Bristol Bay was essentially a two-pull fishery. The fishermen ran out there, dropped their pots, pulled them once, rebaited, and then pulled the second time and were done fishing. The year before the managers allocated "X" amount of crab and actually pulled 1.5 "X" out of the water during the opener. If it's that close, why are we fishing? Why are we doing it? Obviously, its money that drives this system.

Another idea is vessel tracking systems. This also doesn't make fishermen very happy. However, if wet storage for pots is implemented because it improves safety, maybe we have to improve the resource agency's capability to enforce. Some type of a transponder on a vessel would make that easier.

What is amazing to me is the industry's tolerance for the present level of safety. It is not just an acceptance of mediocrity, it's an acceptance of an absolute disaster. I think sooner or later we're going to see a bad disaster. There must be the establishment of some meaningful industry standards. The industry needs to say this is how fishing boats will be built, manned and operated, as well as a willingness to facilitate enforcement.

So I'm not asking for much. I'm just asking for a logical approach where we stop viewing each other as the enemy and start looking at ways that we can maintain the resource and keep people alive out there. I would prefer a non-adversarial approach. We all have to work together towards the prevention of deaths.

CHAPTER IV
INTERVENTION STRATEGIES AND SAFETY PROMOTION

USING EPIDEMIOLOGY AND SURVEILLANCE DATA TO DEVELOP PREVENTION STRATEGIES

By Dr. George Conway
Chief, NIOSH Alaska Field Station

I intend to talk primarily about the data that we have gathered, and how we apply that data. This chart (Figure 1) is just a reminder that we do some on-site investigations when we're invited to assist by the National Transportation Safety Board (NTSB) or the U.S. Coast Guard, but most of our information is through a huge variety of secondary sources and active recovery of data.

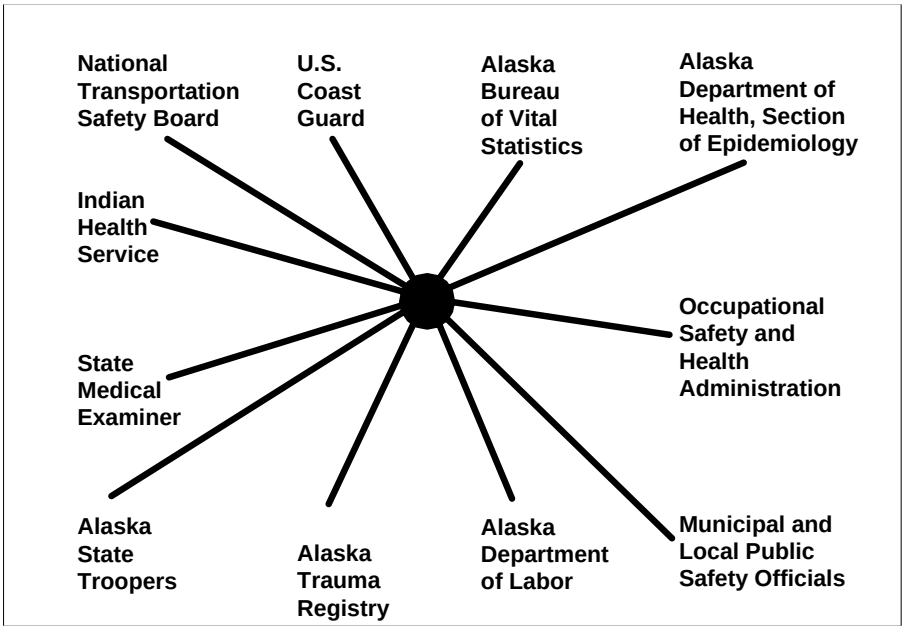


Figure 1. *Sources of Data for the Alaska Occupational Injury Surveillance System (AOISS) Database*

Table 1 illustrates one of the basic epidemiologic tools that we use, a qualitative rather than a quantitative tool. It's called a Haddon Matrix, named after Dr. William Haddon, the father of transportation epidemiology in the U.S. It divides everything into host or human factors, agent or vehicle factors, and environmental factors, and then it breaks up the factors into pre-event, event, and post-event. There's great utility in breaking things down this way, particularly pertinent for today's discussion.

Table 1. Features of Commercial Fishing Injury Events, Alaska

	Host/Human	Agent/Vehicle	Environment
Pre-Event/ Pre-Injury	Captain & Crew Fatigue Stress RX/illegal drugs Alcohol Inadequate training/ exposure	Unstable Vessel Unstable work platform Complex machinery and operations	High Winds Large Waves Icing Short daylight Limited fishing seasons Vessels far apart
Event/Injury	Captain & Crew Reaction to emergency PFD not available or not working	Leaning or capsized vessel Delayed abandonment Emergency circumstance not understood Man overboard (MOB)	High winds Large waves Darkness Poor radio communications Cold water
Post-Event/ Post-Injury	Poor use of available emergency equipment Hypothermia Drowning Lost at sea	Vessel sinking Poor crew response to MOB	High winds Large waves Cold water

Human factors include how knowledgeable people are. Vehicle factors include whether or not your vessel was stable, whether or not you're doing a complex operation. Of course, the weather is the most important environmental factor, with the management regimes probably being the second most important. After that, how prepared people are, and how people respond during and after the event, are the most critical.

The Commercial Fishing Industry Vessel Safety Act of 1988 (CFIVSA) was implemented in the early 1990s, with the last phase of that implementation not taking place until 1995. You can see from this chart (Table 2), as has been mentioned earlier today, that this really didn't do much as far as preventing these events. Basically, the take-home message of this is that while we still have a lot of people ending up in the icy Alaskan waters, on about 35 lost vessels a year, the number that survive that insult has improved greatly. The primary impetus and the primary effect of the safety act has been the salvage of people once they ended up in the water, and in keeping those people alive long enough for the SAR people to fish them out of the water.

In Figure 2, we've superimposed over the years the step-wise implementation of the CFIVSA. This is a stacked bar chart of mortality in Alaska's fishing industry. In each bar, the white area represents the man-overboard events, which haven't changed a great deal through time. The horizontal striping shows vessel-related crab events. The black shows everything other than crab events that was

Table 2. Recent Decrease in Case Fatality Rate, Alaska Commercial Fishing Industry, 1991-1997

Year	Number of Vessels Lost*	Persons on Board*	Fatalities**	Fatality Rate***
1991	39	93	25	27%
1992	44	113	26	23%
1993	24	83	14	17%
1994	36	131	4	3%
1995	26	106	11	10%
1996	39	114	13	11%
1997	31	84	1	1%

* SOURCE: U.S. Coast Guard, 17th District, Fishing Vessel Safety Coordinator.
** Fatalities from capsized or lost commercial fishing vessels only.
*** Fatality Rate = (number killed/number at risk) x 100 percent.

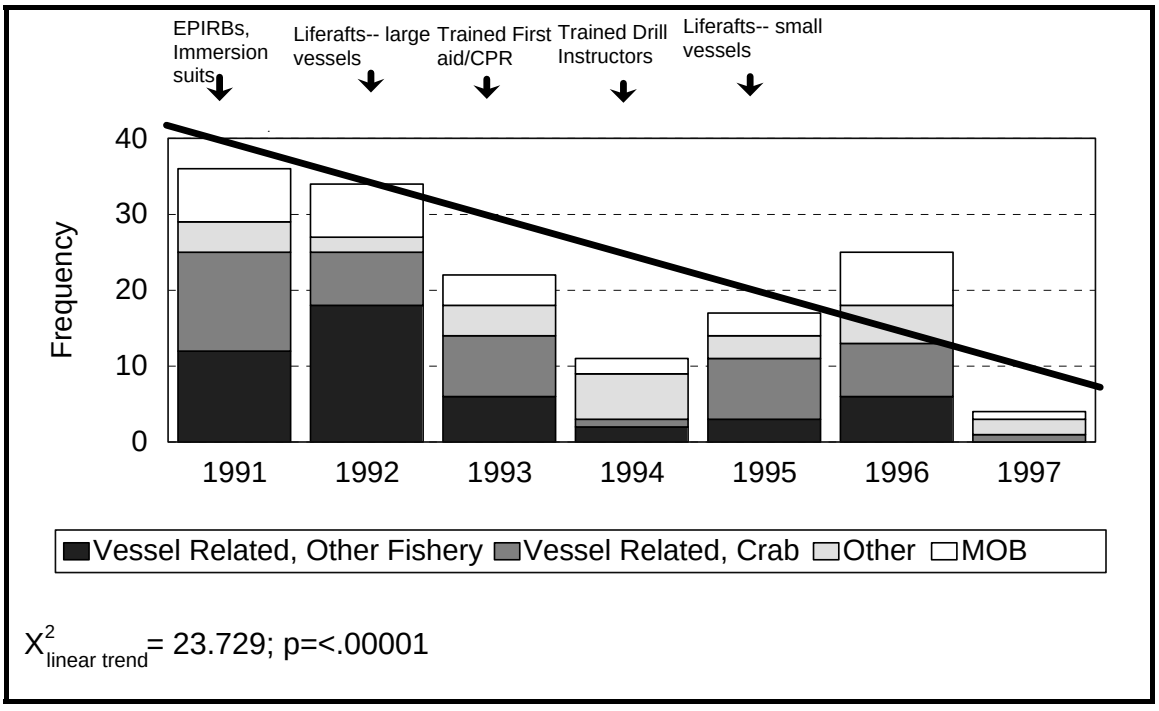


Figure 2. *Implementation of the commercial Fishing Vessel Safety Act of 1988 and Commercial Fishing Fatalities by Year, Alaska, 1991-1997, n=149*

vessel-related. The light gray represents other commercial fishing-related deaths. You can see there has been a steady and significant decrease in these vessel-related fatalities other than in crabbing. In 1994, the Bristol Bay red king crab fishery, which has accounted for much of this mortality in other years, was closed owing to lack of resource. The take-home message here is that there's been tremendous progress made in this black area, vessel-related events other than those involved in crabbing, very little progress made in preventing deaths in crabbing, and very little progress made in preventing deaths in man-overboard events. This is likely because crab fishing often occurs far from shore, during the winter months, and fishing vessels can be caught by foul weather on the grounds.

There is one other piece of good news. It has been mentioned that we have had a change in the management regime for halibut. On January 1, 1995, Alaska went from a progressively shorter and shorter derby fishery, to an individual fishing quota (IFQ) fishery. There was then a precipitous fall in the number of search and rescue (SAR) missions, and there have also been no fatalities since then in the halibut fishery. The Magnuson-Stevens Reauthorization Act requires an assessment to be done by the National Academy of Sciences before there's any additional changes in management regimes to IFQs, so we don't know when or if similar changes may be made in the other limited-entry fisheries with compressed seasons.

There's a strong protective effect from having worn flotation devices, primarily immersion suits, when there are vessel casualties (Figure 2). One of the reasons that we decided to have our second Workshop on this subject is because about half of these people that die fishing in Alaska are from other states, about a third of the total, is from Washington, and most of the rest are from the Northwest.

The countermeasures (Table 3) that we've proposed and recommendations we've made are in the Current Intelligence Bulletin (Appendix). They emphasize pre-event and event interventions.

Table 3. Alaska Commercial Fishing Injury Countermeasures-Commercial Fishing Vessel Safety Act of 1988 (Implemented 1990-1993)

	Host/Human	Agent/Vehicle	Environment
Pre-Event/ Pre-Injury	Drills		Navigation publications Compasses Anchors
Event/Injury	Immersion suits PFDs	Fire extinguishers/systems Fireman's outfits/SCBAs High water alarms Bilge pumps/alarms	
Post-Event/ Post-Injury	Immersion suits PFDs	Distress signals Life rafts EPIRBS	First-aid kits CPR and first aid

WHY SAFETY IS "GOOD BUSINESS"

By Ms. Leslie Hughes
Executive Director, North Pacific Fishing Vessel Owners' Association Vessel Safety Program

The North Pacific Fishing Vessel Owners' Association (NPFVOA) Vessel Safety Program was established in 1985, in cooperation with the U.S. Coast Guard, as a voluntary effort to improve the commercial fishing industry's unacceptably high casualty rate through education and hands-on training. My comments here are based on first-hand observations of the participants whom we most typically service — Seattle-based fishermen who operate in Alaska. Although our portable training programs have been held as far north at the Pribilof Islands and as far south as the Hawaiian Islands, the level of training participation NPFVOA sees locally far exceeds anywhere else in the country.

Participation in our training programs to date (1997) has exceeded 17,000 and annual attendance has generally stabilized since activity spiked to meet new regulations in the early 1990s. The majority of our training activity is for safety classes which are not required, but which are designed to address major safety concerns. This program has largely been successful because it is a non-profit organization with a proactive membership base representing commercial fishermen of all gear types—trollers, seiners, longliners, trawlers, and processors — who originally helped identify the major causes of accidents in the North Pacific, and who have continued to build and use these programs for training their crews. It is truly a program *by fishermen for fishermen.*

During my involvement with this program for the past 13 years, I have witnessed an overall heightened safety awareness, and vast improvements in safety attitudes and practices. In fact, crews commonly state that they would never consider doing a number of things the way they did 10, or even 5 years ago! As a direct result, we are seeing welcomed improvements in casualty statistics in the North Pacific.

So what accounts for this change and why is safety now regarded by the majority of owners and operators as simply "good business"?

The commercial fishing industry's poor safety record has impacted us in many ways. Most paramount has been the tragic loss of lives that all of us involved in the industry have been deeply touched by at some time. Other examples include:

High insurance costs — if insurance could even be obtained.

Increased negative media attention.

Increased scrutiny by agencies such as the United States Coast Guard (USCG), the National Transportation Safety Board (NTSB), the National Institute for Occupational Safety and Health (NIOSH), and the Occupational Safety and Health Administration (OSHA).

Increased claims as employees realize their improved chances of winning attractive monetary settlements. Claims that create a tremendous drain on day-to-day business operations.

Government agencies feeling compelled to regulate—and penalize—when they perceive an industry as unwilling to act as its own watchdog. Regarding safety violations as *criminal* acts has become more common.

All of this often results in multiple agencies stepping in and creating overlapping, and often conflicting, regulations with potentially multiple fines for the same offense (i.e., Coast Guard, OSHA, DOE, EPA, INS, EEOC, etc.).

Because an incident by one company can cast a dark shadow on the industry overall, good operators resent those who are sorely lagging and who add to the perceived "bad boy" image. As important as combating a negative image is, the reality is that poor safety practices result in poor bottom lines. *Anyone who thinks safety is expensive need only try having an accident!* Smart companies are safe companies.

Examples of improved safety practices that result in direct benefits include:

Selective hiring practices are much improved. Owners seem much more willing to have prospective employees undergo training and more orientations, even when not required. Employees are expected to follow safety policies as a condition of employment.

Internal controls have improved for communication between the vessel and management for compliance with operational policies, accident reports, and claims follow-through, etc.

Vessel owners are taking more responsibility for their own claims and designating someone responsible solely for safety implementation, in addition to having safety managers aboard the vessels.

The practice of having written procedures for safety and environmental response plans in place, and making sure the entire crew knows their responsibilities, is becoming much more common.

Recognizing more clearly that fishing is inherently dangerous, crews are more realistic about the risks they face and the need to understand how to operate and maintain their equipment so it is reliable in an emergency.

Owners and operators are more inclined to expect vendors to provide the necessary operational information about the lifesaving products they buy.

Crews independently seek training, even when not required, and expect owners to support their training requests.

Owners and operators who support the well-being of their crews are rewarded with loyal, hard-working crews. In close-knit communities, as typically fishing is, networks thrive and crews compare vessels. Experienced crews know the owners and operators who are regarded as being safety- conscious, and such owners and operators attract the best crews.

Safety is not the afterthought or "nuisance" it used to be. Due to the highly-regulated industry that commercial fishing is now, competition has caused fishermen to become much more professional in their ways of doing business. They equip their vessels with the latest technology in lifesaving and communications equipment and budget for hands-on safety training for their crews as a general course of doing business. As seasons diminish and production competition increases, crews voluntarily take refresher courses because they recognize the value of keeping their emergency preparedness skills as sharp as possible. Good companies have come to realize that the ever-present priority of production does not mean that safety has to be sacrificed. They understand that operating in a safe, productive mode is a matter of total job efficiency.

As company safety programs become more formalized, trends are more easily observed that reflect tangible benefits. Several of our member companies, considered representative of our general membership, shared their injury incident loss rates for this conference. One such company showed a steady decline in their personal and indemnity (P&I) claims and costs from 1990 through 1996. Although the vessel/crew member exposure days are down somewhat from a peak in 1991 - 1992, they experienced a much greater decline in the number of claims/dollars than the reduction in exposure shows. Another company's claims history over a 7-year period shows a dramatic improvement in its loss ratio, from 274 percent of their annual insurance cost in 1991-1992 down to .056 percent in 1996-1997. That company experienced no insurance premium increases for several years, and for the past 3 consecutive years their premiums have been *lowered*.

Another company realized significant benefits once they instigated a full-time safety program in 1993, which meant requiring hands-on safety training for targeted crew members as a condition of employment. They also hired a shoreside safety manager, in addition to their vessel managers, to oversee that the safety programs were all consistently implemented. From 1993 to 1997 their costs dropped company-wide by 79 percent. Since 1993 they reduced the number of injury claims company-wide by over 50 percent. The significance of these improvements can be noted when you consider that in the early 1990s, this company's cost-per-hour claims rate was nearly $1.00 (which means that for every hour worked, they paid $1.00 in claims costs). For the past 2 years, it has been reduced to $0.20!

When companies realize tangible benefits for their commitments to safety, there is an increased desire to continue these efforts. Companies which are recognized for their quality programs can influence others to take more positive steps. In my view, more <u>recognition</u> should be given to good operators so they can set industry standards *by example*.

P&I Loss Ratios Company "X"	
90-91	119.000%
91-92	* 274.000%
92-93	4.500%
93-94	.170%
94-95	.300%
95-96	.040%
96-97	.056%
*One vessel added	

Quantifying safety practices is not a perfect science, and assessing the losses that did *not* occur is impossible, making it difficult to truly discern the effectiveness of many policies and programs. Yet when companies review direct and indirect costs, along with accident numbers and other operational information the organization collects (i.e., review machine downtime and related interruptions), they can assess the effectiveness of their safety culture. Continually assessing safety programs and employing all means to prevent accidents is "good business" and should be an *ongoing* process of vigilant fine-tuning. The rewards cannot be denied.

Safety is not a destination — it is a journey

COAST GUARD DISTRICT 17 SEARCH AND RESCUE

By LCDR Geoffrey Rowe
Senior Controller, U.S. Coast Guard North Pacific Search and Rescue Center

REGIONAL OVERVIEW

Operational Overview

The National Search and Rescue (SAR) Manual designates the Commander, Coast Guard (CG) Pacific Area as the SAR coordinator for the Pacific Maritime SAR Region and designates responsibility for the Northern Pacific Maritime SAR sub-region to the Commander, 17th CG District. The 17th CG's SAR responsibility within this area includes 33,000 miles of coastline and encompasses 3,853,500 square miles of water; an area much larger than the entire land mass of the continental U.S. The 17th District also possesses land SAR responsibilities for all of Southeast Alaska (SEAK) east of 141°W; all areas of the Alaska Peninsula south of 58°N; and all islands within Alaska which include all islands within Prince William Sound (PWS), Kodiak Island, the Aleutian Islands, the Pribilof Islands, St. Lawrence Island, and the Diomede Islands. Due to the large expanse of the area of responsibility (AOR), low population density, the relative scarcity of rapid-response surface assets, and the urgent nature of distress in the frigid maritime environment, CG air assets provide a critical element to SAR.

There are many aspects to be considered due to the unique environment of the Alaskan AOR. These include, in part, the following:

- Large distances encountered
- Mountainous terrain and unique weather environment inhibit "straight line" transit to scene
- Low water temperatures which lead to low survivability rates for a person in the water (PIW)
- Low population densities
- Few commercial alternative SAR resources
- Large scope of inland SAR responsibilities
- Poor communications
- Multi-national cooperation/responsibilities
- Remoteness and the related problems of: minimal fuel alternatives, minimal maintenance and crew support facilities, widely dispersed aeronautical navigation aids and weather reporting stations, lack of medical trauma centers, and sparse hospital facilities

CG District 17 SAR "customers:"

- Commercial Fishing Vessels
- Recreational Vessels
- Cruise Ships
- Other Commercial Vessels

- Aircraft
- Residents of Remote Communities

Capabilities Overview:

Currently SAR assets within the 17th District will be discussed by resource type:
- Aviation
- Cutter
- Small Boats
- Communications
- Personnel
- Shore Facilities

Capabilities by Resource Type:

Aviation

Coast Guard Air Station (CGAS) Kodiak keeps one HC-130H fixed-wing aircraft and one HH-60J helicopter in a ready status at all times. CGAS Sitka keeps one HH-60J in a ready status. Aviation Support Facility (AVSUPFAC) Cordova is a seasonal detachment from CGAS Kodiak. It provides coverage between Kodiak and Sitka in the area of PWS and the Northern Gulf of Alaska. Months of operation are May through September for the coverage of fishing activities out of Valdez, Cordova, and PWS. The AVSUPFAC has one HH-60J in ready status supported by two aircrews from Kodiak.

17th District Aviation Assets:
- HH-60J
  - 3 at CGAS Sitka
  - 4 at CGAS Kodiak, 1 forward-deployed to AVSUPFAC , Cordova (seasonally)
- HC-130H
  - 6 at CGAS Kodiak
- HH-65A
  - 5 deployable-based at CGAS Kodiak

The air assets are crucial for SAR response in 17th District due to their speed and long ranges. CGAS Kodiak has increased the HH-60J's normal range; an HC-130H transports an HH-60J crew to a designated point for refueling and crew changeout thereby enabling the helicopter to be flown an additional leg. The HH-65A helicopter deployed aboard the high endurance cutter (WHEC) operating in Alaska provides a force multiplier and an additional SAR asset.

Both Air Stations have strong partnering relationships with various agencies/groups, such as the Civil Air Patrol, the Department of Defense, the Alaska National Guard, the Alaska State Troopers, U.S. Fish & Wildlife, the Alaska Fish & Game, and a myriad of local SAR groups (e.g., Kodiak Island SAR).

Cutters

17th District Cutters: 17th District standard operating procedure (SOP) requires one ready 110' Cutter or one 41' Patrol Boat (WPB) be maintained in both the Kodiak/Kenai Peninsula Area and in Southeast Alaska. SAR readiness in the local area is augmented by these vessels' small boats.

Pacific Area Cutters: The Coast Guard's primary SAR coverage for the Bering Sea is provided by cutter/helicopter teams. HH-65A helicopters are embarked on 378' WHECs Alaska Patrol (ALPAT). These cutters have multiple missions of Law Enforcement, Marine Environmental Protection, and SAR. In addition, HC-130H aircraft provide an additional resource capability to the cutter team by providing long-range coverage of the cutter's AOR. This extremely flexible team is already on the fishing grounds to react quickly to emergencies and is often pre-positioned to be in the immediate area of dangerous fisheries during high threat periods.

Medium endurance cutter (WMEC) and WPB home ports:

- One PACAREA 230' WMEC based at ISC Kodiak
- One PACAREA 213' WMEC based at ISC Ketchikan
- One 110' WPB based in Ketchikan
- One 110' WPB based in Juneau
- One 110' WPB based in Seward
- One 110' WPB based in Homer
- Several smaller boats aboard the above cutters

Commandant has expressed the intention of homeporting the new 283' WMEC, CGC ALEX HALEY, to Kodiak in winter of 1999. This replaces the lost response capability of the decommissioned, CGC YOCONA.

The 17th District has Buoy Tenders (WLBs), one each in Sitka, Ketchikan, Cordova, and Homer and two in Kodiak. There is an Inland Buoy Tender (WLI) in Petersburg. The Fleet Transition Plan shows the replacement of the 180' WLBs with the 225' WLB Replacements (WLBRs) starting FY01 through FY03. There is to be a one-to-one replacement with the exception of Kodiak where 2 WLBs will be replaced with one WLBR. The impact will be a decrease in the fleet by one cutter in Alaska.

Small Boats

All 17th District Cutters have small boat resources appropriate to their mission and these small boats are used for response when in port.

Both Stations Ketchikan and Juneau have 41' Utility Boats (UTBs). Commandant is replacing these UTBs with 47' Motor Life Boats (MLBs) in April and May 2000. The speed of response combined with the excellent sea-keeping capabilities make the 47' MLB the right platform. The upgrade will

increase response ranges and decrease response times of both stations. Both SAR stations maintain one UTB in ready status at all times.

Summary of Small Boat Assets:
- One 41' UTB based in Juneau
- Two 41' UTBs based in Ketchikan
- 29 USCG Auxiliary vessels based throughout Alaska
- Small Boats on 17th District Cutters

Communications

Alaska's immense coastline poses difficult problems to communications planners, engineers, and operators. Establishing, maintaining, and operating remote National VHF-FM Distress System (NDS) sites in the harsh environment have proven to be tasks that are personnel intensive and very expensive.

Currently, the 17th District's NDS consists of 25 remote sites, located within three geographical areas; SEAK controlled by 17th District Communication Center (11 sites), PWS controlled by Marine Safety Office/Vessel Tracking System (MSO/VTS) Valdez (5 sites), and Western Alaska controlled by CGAS Kodiak (9 sites).

The Alaska portion (17th District's) of the NDS was conceived in the early 1970s, and the first sites were constructed in 1975-77. At that time, Alaska was granted a congressional exemption from the requirement to provide total VHF-FM along the coastline for economic reasons. These exemptions were granted because of the vast coastal areas where there was low vessel traffic density coupled with a prohibitively high cost of returning voice-grade landlines from any existing or prospective site. Over 75 percent of the remote sites are accessible by helicopter only. During the winter, site accessibility for repairs and maintenance is difficult at best, and all too often impossible. Power is mostly supplied by propane-fueled thermoelectric and solar generators. Sites are linked via UHF or microwave systems to the closest location where common-carrier landlines are available.

Enhancing Capabilities through Strategy

The placement of SAR resources doesn't result in full overlap. This would suggest that there are significant delays in SAR responses. However, this is not always the case due to two strategies employed by the 17th District.

Law Enforcement (LE) Asset = SAR Asset

Fisheries are an activity which generate a substantial number of SAR cases. The CG's LE presence near areas of heavy fishing activity provides the additional benefit of a SAR presence. The WHEC/HH-65A combination previously discussed is one example. The deployment of 110' WPBs to Dixon Entrance at the furthest point of CGAS Sitka's and STA Ketchikan's AORs is another

example. A reduction in Fisheries Law Enforcement would not only threaten the viability of the fishery but the safety of the commercial fisherman.

Forward Deployment

An HH-60J helicopter was forward deployed as trial operations from CGAS Kodiak to the Cold Bay and St. Paul Island areas during neighboring crab/fisheries openings, due to the high-threat manner of the opening and the intensive concentration of fishing vessels in the opening area. These forward deployments were 2-4 weeks in duration and usually in conjunction with WHEC/HH-65A helicopter fisheries patrol. This asset placement reduced potential SAR response time by several hours. This tactical strategy required the standing up of an additional ready asset at CGAS Kodiak so as not to have a negative impact on its AOR.

Strategic Situational Analysis

Customer: Recreational Vessels

The recreational boater is a frequent customer assisted by the SAR mission. The majority of recreational boating is confined to Southeast Alaska and South Central Alaska. While there is some activity throughout the year, the largest portion occurs May through August. Southeast Alaska also has significant recreational boating activity during the hunting season, September through December.

Trends: Recreational boating continues to grow 2-5 percent per year with the increasing population of Alaska. Because of the extreme weather and sea conditions, most recreational SAR cases occur relatively close to shore in bays or other semi-protected waters. These cases are more life threatening in Alaska because of the distance to scene for CG vessels and aircraft, coupled with the cold water temperatures, which allow little survival time for PIW.

Customer: Commercial Fishing Vessels

The fishers in Alaska request assistance almost as often as the recreational boater, but the degree of distress tends to be more severe for the fishers. They work further offshore, in worse weather, and with more dangerous equipment.

Significant activity occurs throughout the area at all times of the year. While the busiest season is the summer, the most dangerous fisheries are the winter crab fisheries in the Bering Sea.

Trends*:* Equipment requirements, survival craft, immersion suits, and drills/training requirements in particular have resulted in fewer fatalities per vessel loss. Comparing 1991 fatalities to 1991 vessel losses, the fatality rate is 89 percent. Comparing the 1996 fatality/vessel loss figures--even with 23 deaths--the fatality rate decreased to 58 percent. (The 1997 rate (11.7percent) is considered to be an anomaly.)

Although the fatality rate decrease is a positive statistic, the number of fishing vessels lost continues to be high. The data indicate that the primary causes for fishing vessel casualties are grounding, equipment failure, sinking, and collision. The commercial fishing regulations predominantly address equipment requirements; they do not address the minimum structural engineering and stability standards for existing fishing vessels. With the exception of sinkings, regulations do not provide authority through which we can take measurable action to reduce casualties. Requirements for bilge alarms and bilge pumping systems partially provide the necessary regulatory authority to affect the rate of sinkings. Newer vessels, vessels that have undergone a major alteration after September 1991 and operate with more than sixteen persons on board, and some fish processors, are required to meet minimum structural, engineering, and stability standards. Because structural standard requirements do not apply to the overwhelming majority of fishing vessels operating in Alaskan waters, a significant decrease in fishing vessel casualties requiring SAR response is not anticipated.

Customer: Cruise Ships

Cruising to Alaska is increasingly popular. Over 600,000 passengers will visit SEAK and over 100,000 will cruise in the PWS area annually. While there is always the potential for a major disaster such as the burning of the M/V Prinsendam in 1980, most requests for assistance involve urgent medical evacuations (MEDEVACs). For planning purposes, it is best to recognize that a major cruise ship disaster has occurred every 2 to 3 years in recent history in Alaska.

Trends: Cruise ship MEDEVACs have risen 80 percent in the last 3 years, reflecting the overall increase in the number of passengers embarked on Alaska cruise ships. These cases often involve transport of elderly patients to Sitka, Ketchikan, and Juneau. On an average day during the summer season, 10 cruise liners with a total of 20,000 passengers cruise SEAK and another 2 cruise liners with 5,000 passengers cruise PWS. Units from the 17th District are the only platforms able to initially respond to most of the requests for MEDEVACs. In the last 2 years, CGAS Sitka has responded to 98 percent of all cruise ship MEDEVACs in SEAK.

Customer: Other Commercial Vessels

The Great Circle routes between the West Coast and the Far East traverse the North Pacific. Commercial ships on voyages between Seattle and Japan pass through Unimak Pass in the Aleutians. The Coast Guard routinely handles requests for medical information. On rare occasions, disabled vessels require major SAR efforts.
Trends: No statistical changes.

Customer: Commercial and Private Aircraft Operators

The 17th District has a unique responsibility for inland SAR in SEAK, the Alaska Peninsula, and the Aleutian Islands. As demonstrated by the unsuccessful Boggs-Begich search in 1971, searching for missing aircraft in heavily wooded, mountainous terrain is one of the most challenging SAR missions.

Most small planes flying in the coastal areas of Alaska fly during daylight hours, so the frequency of missing aircraft is lower in the winter with the reduced amount of daylight.
Trends: With the increase in cruise ship passengers comes an increase in flightseeing sorties for the commercial aircraft operators. The Federal Aviation Administration (FAA) estimates an increase in Alaska flightseeing operations of 100 percent from 1995 to 2000 for the State of Alaska. Many of these flightseeing tours are conducted in remote locations. Some of these areas, near Juneau, are heavily glaciated and are the size of the state of Rhode Island. The aircraft are small and seldom equipped for long-term survival. In the last two years, seven aircraft accidents have occurred in SEAK. The FAA estimates a steady accident rate for these types of air operations; therefore, the number of accidents will increase with the increase in flight operations; 100 percent increase in a 5-year period.

Customer: MEDEVACS for Residents of Remote Communities

Coast Guard aircraft typically provide urgent MEDEVACs from remote communities in coastal Alaska. At night and in severe weather, aircraft are typically the only transportation available. These requests occur throughout the year from all the remote regions of the AOR.

Trends: The state has no public aero-MEDEVAC system. Anchorage and Juneau have fixed-wing, air ambulance aircraft typically servicing the "bush" and providing transport to Seattle. The Alaska State Troopers and local Emergency Medical Service (EMS) personnel depend on the Coast Guard and the Alaska National Guard to provide MEDEVAC capability for most of the state. In SEAK, CGAS Sitka responded to 105 MEDEVACs at a cost of $498,313 during 1997. During the last 3 years, MEDEVACs in SEAK have accounted for 15 percent of all SAR cases in the 17th District. This statistic will only increase as populations grow in outlying communities. The vast majority of these cases occurred at night under poor weather conditions when air charter aircraft were unable to fly due to lack of equipment and training.

FACTORS AFFECTING 17TH DISTRICT SAR OPERATIONS

Environmental Conditions

Weather

Alaska weather is marginal at best; with a high probability of unreported, localized restrictions to visibility and cloud bases. Often localized severe weather goes unreported. The National Weather Service (NWS) has only six radar weather sites to cover an area one-fifth the size of the continental United States. Many aviation weather-reporting sites are non-continuous, providing only periodic surface observations. Each year, the air stations execute life-saving missions in low visibility, snow and ice, and or hurricane sea and wind conditions. Seasonal periods of extended darkness only compound other weather-risk management issues.

Water Temperatures

Depending on the time of year and location, water temperatures may vary from 32 degrees to 55 degrees. The prediction of immersion survival time is an important factor in the risk assessment process of SAR operations. Because of the distances involved and the time to get on-scene, body cooling to lethal hypothermia for an individual immersed in Alaskan waters is critical and survival time is almost always minimal.

Topography/facilities

Mountainous terrain, limited locations for refueling, and lack of navigation aids for approaching airports all contribute to the challenging nature of Alaska aviation. Additionally, there are no major trauma centers in Alaska for critically injured patients. These patients must be MEDEVACed to a transfer point for further commercial medical air transport to Seattle.

Resulting Effect

The inland SAR requirement in poor weather precludes point-to-point flight to scene, unlike the Lower 48 where point-to-point transits are the norm. For instance, the direct mileage to high demand MEDEVAC village for CGAS Sitka is 65 nm, but the low visibility route is 230 nm. The inland SAR mission in Alaska results in numerous circuitous transits due to weather and terrain.

Geography and weather are unchanging. The near-term, socio-economic situation in Alaska is not anticipated to provide a growth in airport construction/improvements or expansion of major medical facilities for trauma.

False Alarms

False alarms from Emergency Locator Transmitters (ELTs), Emergency Position Indicating Radio Beacons (EPIRBs), flare sightings, and hoaxes create a significant SAR workload. Controllers do an excellent job of investigating reported distresses. However, the tragedy of not responding to a real distress so outweighs the cost of searching for false alarms that controllers will continue to err on the side of launching SAR units to investigate all reports, risk assessment permitting.

Because of the vast distances and poor communications in the AOR, many suspected false alarms require an aircraft to be launched to determine if the vessel is really in distress. In other Districts, these types of cases can be resolved through precomms to determine the level of distress. Due to less than 100 percent VHF-FM coverage and limited cellular phone coverage, launches are sometimes required to determine the exact nature of distress. In 1997, false alarms that required a launch of an aircraft totaled 48 times at an estimated cost of $663,000.

An improvement in communications technology could reduce these launches significantly. If aviation ELTs change to 406 MHZ beacons, responses to errant 121.5 MHZ signals will become unnecessary.

Improved tracking of callers should eliminate hoaxes, which are phoned to CG units, and if DF equipment is included in the next generation of VHF-FM remote sites, the CG will be able to better identify radio hoaxes. All of these changes and improvements, combined with technological advances in EPIRB technology, including two condition automatic activation EPIRBs and EPIRBs with integrated GPS chips, will reduce false alarms and improve reported distress position accuracy.

Military Downsizing

Closure of military facilities at Adak and conversion of the military activity at Shemya to a Government-Owned Contractor-Operated (GOCO) facility have resulted in the reduction or elimination of medical facilities, which were available at both of these locations. Adak is being turned over to the Aleutian Native Corporation within the next 2 years. The shoreplant is quite extensive and expensive to maintain. If Adak fails to turn a profit and/or the infrastructure (airstrips, navaids) begins to fail, then Adak will be unavailable to the CG. The loss of Adak would complicate the prosecution of SAR and might require 17th District assets to forward deploy in order to cover periods of greater SAR threat. In addition, Shemya as a GOCO facility provides limited support during normal business hours at an expensive rate. Should one or both of these facilities fail to continue operations, noticeable degradation in operational capabilities and flexibility will be realized (i.e., weather alternative for a Kodiak HC-130H en route to Adak, should Shemya close, would be back to Kodiak, thereby greatly reducing the flight hours available for on-scene operations). Current SAR trends show no increase in SAR cases in the extreme western portion of the AOR.

Navigation Advances

Technological advances in navigation including the proliferation of affordable Global Positioning Satellite (GPS), digital GPS (DGPS), and Electronic Chart Display and Information Systems may reduce groundings and decrease SAR response times.

Cellular Telephones

As cellular telephone coverage areas increase in Alaska, distress notification times should decrease and communications with distressed vessels should improve. Increased use of this system, however, may result in an increased number of hoaxes and will complicate homing on the transmissions of distressed vessels.

GMDSS Implementation

As the Global Maritime Distress and Safety System (GMDSS), which combines international marine satellite (INMARSAT), EPIRBs, high-frequency telex, and digital selective calling, is fully implemented, distress notification times will decrease and communications with distressed vessels will improve. At present, this system is plagued by high false-alarm rates and incomplete databases which make its use very time consuming. These problems, however, are projected to improve as this system matures. GMDSS is to be implemented within the U.S. by February 1999.

AOR SAR TRENDS		
Activity	**Trend**	**Remarks**
Commercial Fishing Fatalities SAR Cases	 Decreasing Steady	CFVSA will continue to decrease inherent hazards associated with these vessels. Fatalities are continuing to decrease. However, the number of SAR cases is anticipated to cease its decline.
Recreational Vessels	Increasing	Stable Alaskan economy and advances in navigation and communications technology will allow boaters to extend their normal range of operations, which could increase SAR activity. Population growth in Alaska is increasing at a rate of 2-5 percent per year; recreational boating increases mirror the population changes. New roads and increased accessibility will produce the need for greater SAR response in new areas.
Cruise Ships	Increasing	As cruise ship traffic in Alaska and the capacity of these vessels increases, MEDEVAC requests will increase proportionately. Cruise ship passengers are increasing at rate of 8 percent per year in Alaska market. Years 2000-2003 will see introductions of 2600-3000 passenger-capacity vessels increasing impact upon small communities due to evacuation during cruise ship disasters.
Other Commercial Vessels	Steady	No large change in cargo traffic is projected. Number of cases will remain static.
Aircraft	Increasing	Since 1995, an increase of 100 percent in flightseeing operations. The increase in the number of private aircraft should continue. The accident rate for aircraft in Alaska is higher than the Lower-48 and steady.
Residents of Remote Communities	Slowly Increasing	Urgent MEDEVAC from remote communities in coastal Alaska will increase with increased population until a community is large enough to support a major medical facility.

Second National Fishing Industry Safety and Health (FISH II) Workshop
Convened by the National Institute for Occupational Safety and Health
November 21-22, 1997, Seattle, Washington

FISHING VESSEL STABILITY
THE EFFECT OF TIME AND MODIFICATIONS ON A VESSEL'S STABILITY

By Dr. Bruce Adee
Professor, Mechanical Engineering Department, University of Washington

Introduction

At the First National Fishing Industry Safety and Health Workshop (1992), the author presented a paper which introduced the reader to the fundamental concepts of fishing vessel stability. The concepts were illustrated with a number of examples. The paper printed in the proceedings of the Workshop provides a good background for the current paper and will not be repeated here.

Most people don't consider the fact that a vessel's stability is not constant. Of course, it is widely recognized that a vessel's stability is directly related to the loading of the vessel. Adding a large weight high up in the vessel will reduce stability. Some people may be aware that the lightship, or fundamental, characteristics of a vessel will change over time. In general, naval architects expect the lightship weight of a vessel to increase with time. The addition of equipment, tools, paint, etc., increases the vessel's weight. These become "permanent" additions over time. Owners and operators also often make "small" changes in the vessel. The cumulative effect of a series of small changes can drastically alter a vessel's stability.

In this paper a 54-foot "high-speed" Alaskan seining vessel is examined to determine changes in the vessel's stability over time. A stability test was originally performed on this vessel in 1989 at a shipyard just after the delivery of the vessel. A second stability test was performed in 1997 after the vessel had been in service for 7 years. Examining the differences between the stability of the vessel as originally configured versus the vessel as modified over time is very enlightening.

Original Configuration

The vessel was originally designed as a high-speed seining vessel to fish for herring and/or salmon in Alaskan waters. It is 54 feet in length, has a focsle deck and house forward with an open deck aft. It is constructed of fiberglass, and is powered by two engines driving twin propellers partially enclosed in tunnels in the stern.

The body plan showing the cross-sections of the vessel is shown in Figure 1 (note: there were no changes in the exterior shape of the hull).

A plan view and profile of the vessel are shown in Figure 2. This shows the hold and tank configuration of the original vessel. There are two fresh water tanks: one forward and one aft (in the lazarette). There are four fuel tanks: two wing tanks outboard of the aft hold, and two in the lazarette. There are also two holds, one forward and one aft.

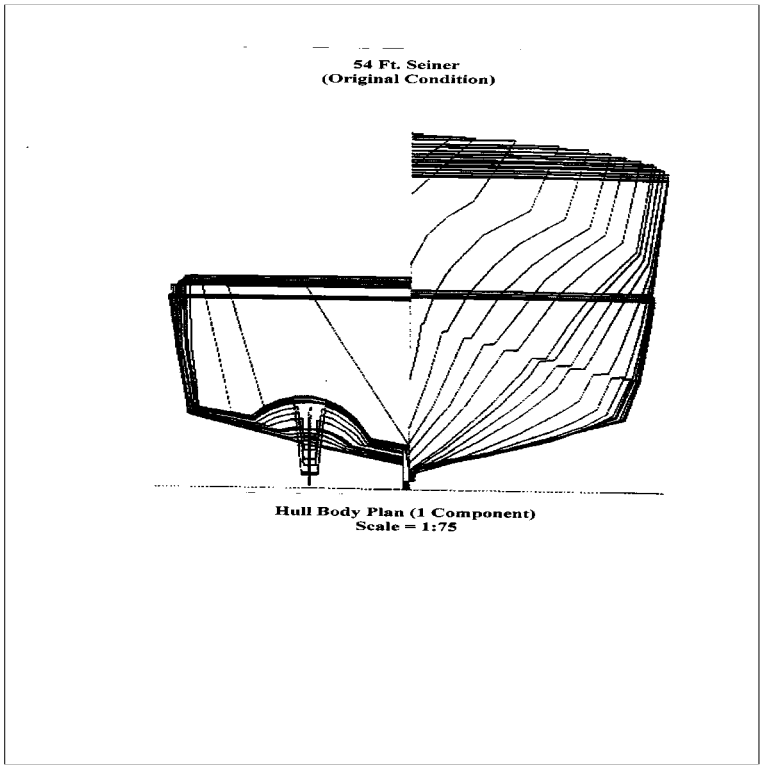


Figure 1. *Body plan, 54-foot seine vessel.*

New Configuration

At the time the second stability test was performed in 1997, the vessel had just completed some modifications in a shipyard in Seattle. A list of the changes is contained in Table 1.

Table 1. Known Vessel changes 1989 to 1997
54-ft Seine Vessel

Change	Result
Replace main engines New engines are lighter	Reduces lightship weight Shifts LCG aft
Remove forward wing fuel oil tanks	Small reduction in lightship weight Reduces fuel capacity Decreases flexibility
Remove bulkheads from aft hold Enlarges aft hold	Small reduction in lightship weight Allows storage of more fish Increases weight of aft hold Increases trim by the stern

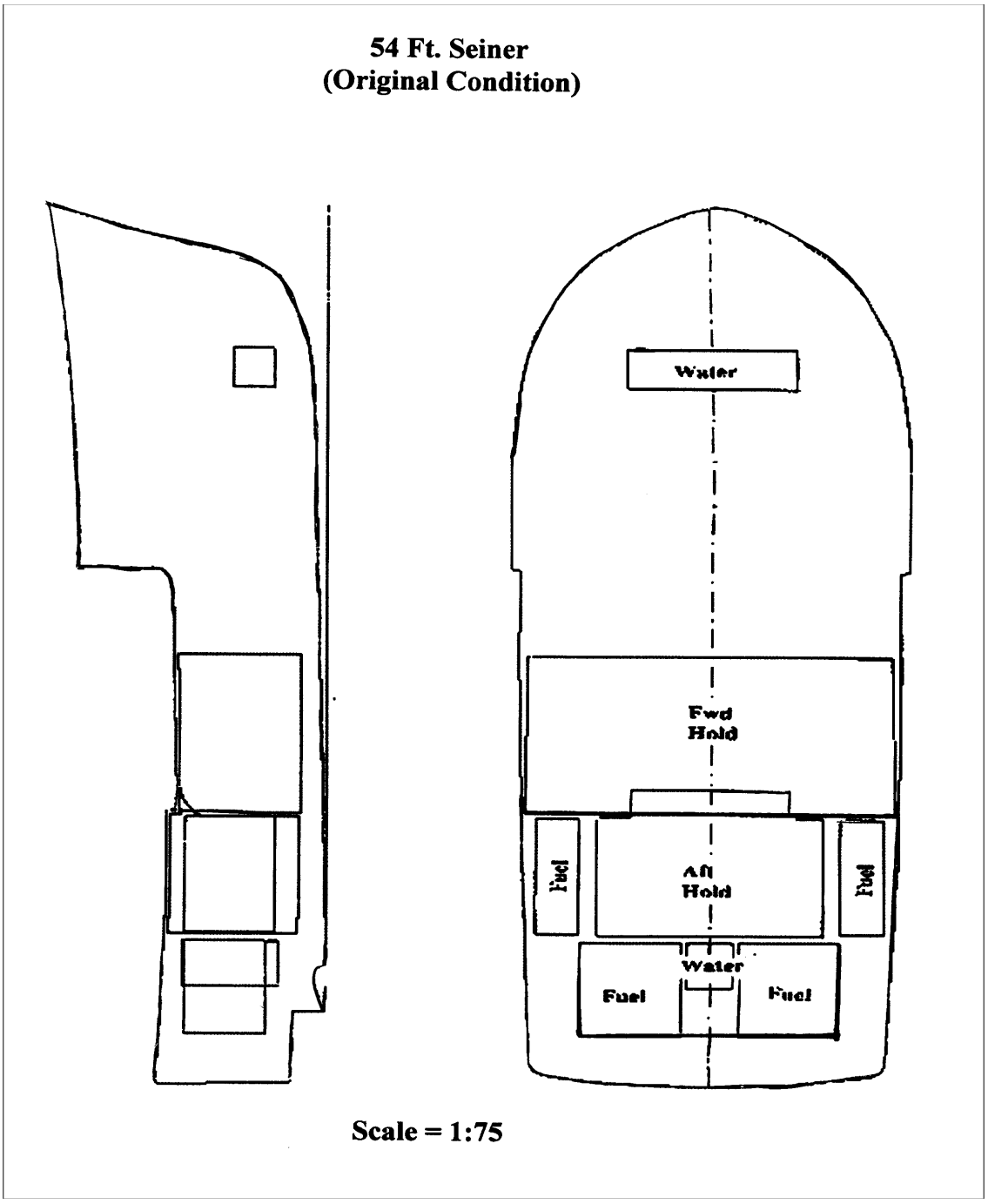


Figure 2. *Plan and profile views, 54-foot seine vessel (original configuration).*

The most visible modification was the alteration of the aft hold. The two outboard wing fuel tanks were removed and the aft hold was enlarged so that it went from side to side. The profile and plan for the modified vessel are shown in Figure 3.

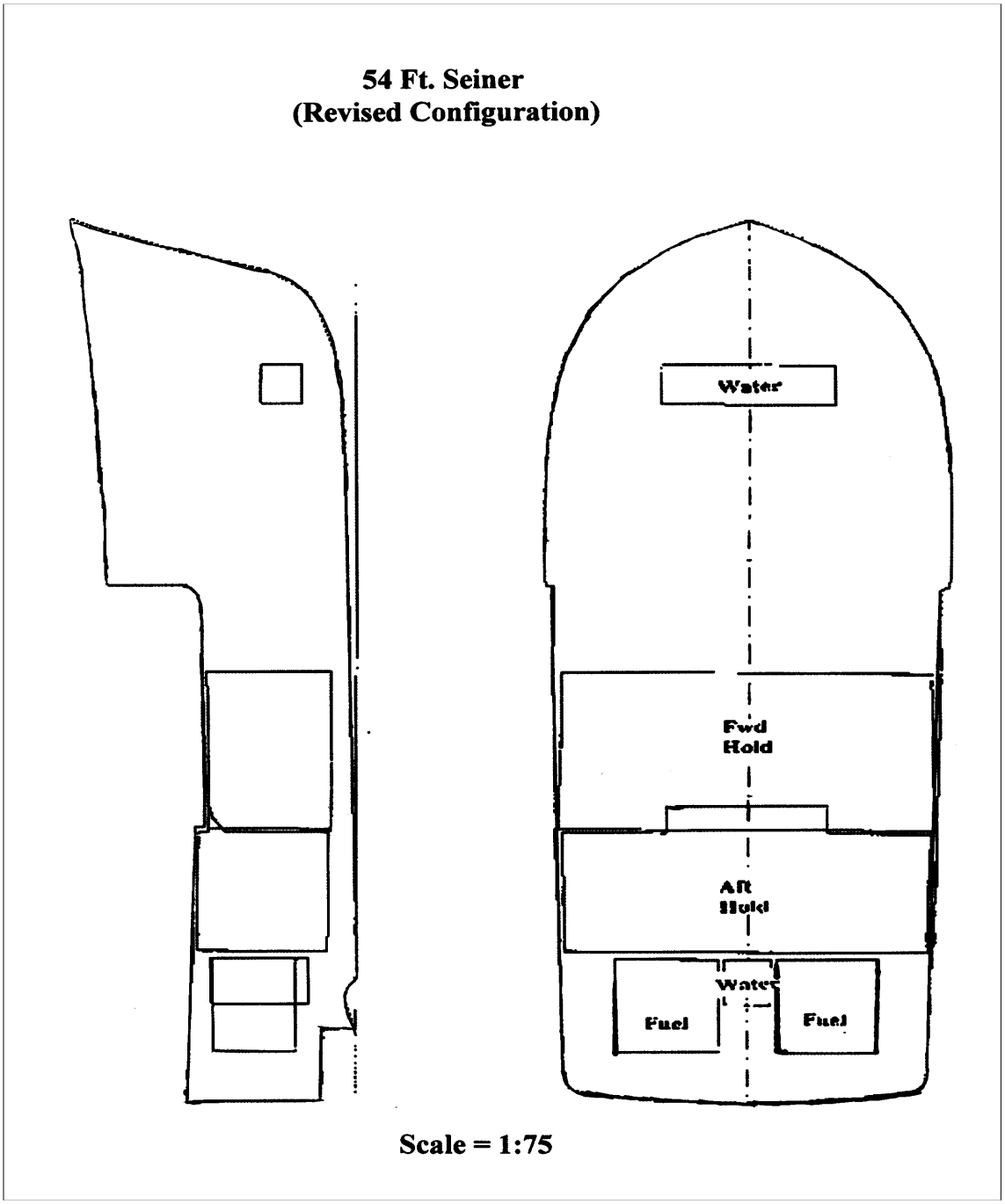


Figure 3. *Plan and profile views, 54-foot seine vessel (modified configuration)*

COMPARISON OF CONFIGURATIONS

The details of the vessel at the time of each stability test are included in Table 2.

Table 2. Comparison Chart 1989 to 1997, 54-ft Seiner

	Original 1989	Revised 1997
Length (ft) On 5 ft Waterline	51.75	51.75
Maximum Beam (ft)	17.00	17.0
Depth (ft) Main Deck to Bottom	6.34	6.34
Length/Beam	3.04	3.04
Length/Depth	8.16	8.16
Lightship Weight (Ton)	27.42	30.30
Lightship LCG (ft) Feet Aft of Sta. # 0	22.31	23.08
Lightship VCG	7.17	7.34
Weight Full (Ton) Salmon Seining Both Holds Filled	71.60	76.48
Weight Full LCG (ft)	30.25	30.47
Weight Full VCG (ft)	5.87	5.98
Weight Full/ Lightship Weight	2.61	2.52
Capacity Fwd Hold (Ton)	19.41	19.41
Capacity Fwd Hold/Lightship Weight	0.71	0.64
Capacity Aft Hold (Ton)	10.93	15.61
Capacity Aft Hold/Lightship Weight	0.40	0.51
Total Fuel Capacity (gal)	2208.00	1388.00
Total Fuel Capacity/ Lightship Weight	0.26	0.15
Total Fresh Water Capacity (gal)	327.00	327.00
Total Fresh Water Capacity/LightshipWeight	0.04	0.04

Although the stability-related regulations contained in the Code of Federal Regulations, Title 46, do not apply to this vessel because it is less than the minimum length, they do provide a basis for comparison.

In Table 3 the definition of "substantial alteration" contained in the regulations and a comparison of the lightship characteristics of the configurations is given. The small changes that were made would trigger the requirement that a new stability test be performed. Although the changes are small, they are sufficient to trigger all three of the criteria listed which would require a new stability test.

Table 3. 46 CFR 28.501 Substantial Alterations

The following changes to a vessel's lightweight characteristics are considered to adversely affect vessel stability:

An increase in the vertical center of gravity at lightweight by more than 2 inches compared to the original lightweight value.

An increase or decrease of lightweight displacement by more than 3 percent of the original lightweight displacement.

A shift in the longitudinal center of gravity of more than 1 percent of the vessel's length.

Lightweight Characteristics

	Original	Revised	Change
Displacement (ton)	27.42	30.30	10.50%
Vertical Center of Gravity (ft) Above Baseline	7.17	7.34	2.04 Inches
Long. Center of Gravity (ft) Aft of Station #0	22.31	23.08	1.43% of Length

Stability: Original Configuration

The stability of the vessel is examined and compared with the requirements using the righting-arm curve. This curve represents the tendency of the vessel to right itself as it is heeled over in calm water. The larger the value of the righting arm, the greater the tendency for the vessel to return to the upright (the greater the stability). Figure 4 is a righting-arm curve for the vessel in the lightship condition. This condition, by itself, is not an operating condition, but it is useful to examine comparisons between the configurations.

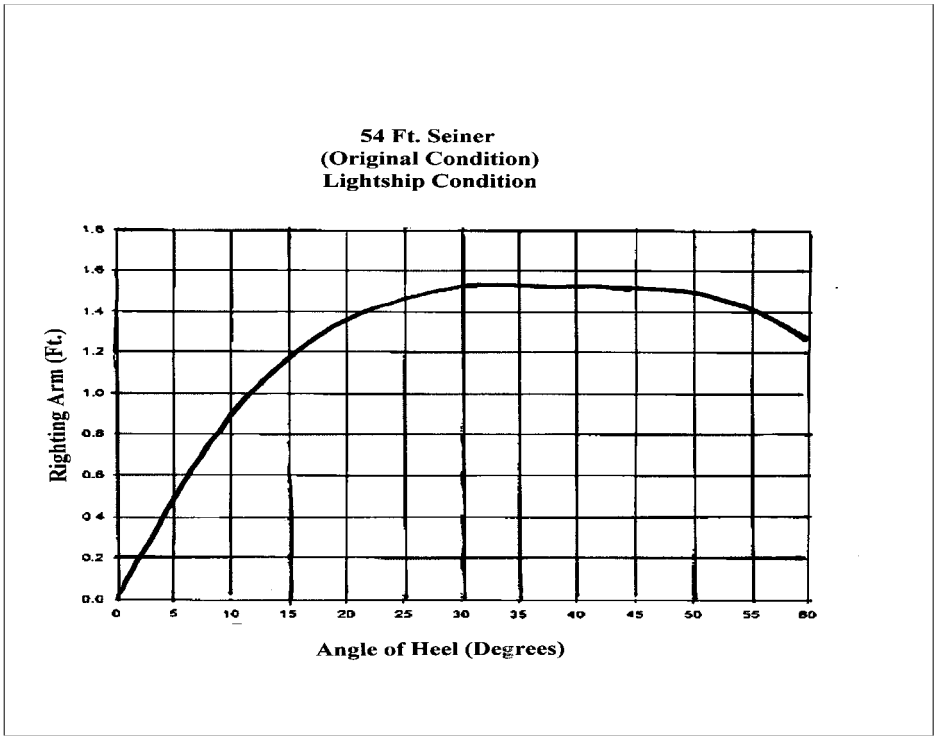


Figure 4. *Righting-arm Curve in Lightship Condition, 54-ft Seine Vessel (Original Configuration)*

Table 4 shows the vessel loading for the salmon seining condition examined. The lightship and fixed loading are shown at the top of the table, while the variable loading of the fuel tanks, water tanks, and holds are listed below. The condition shown in Figure 4 is the fully-loaded, "ready for sea" condition with both holds filled with seawater. The displacement in this condition is 71.60 Tons, which is 2.6 times the lightship displacement.

Figures 5, 6 and 7 show a sequence of loading conditions. All conditions are "ready for sea" with full water and fuel tanks. In Figure 5, both holds are empty. In Figure 6, the forward hold is filled, and in Figure 7, both the forward and aft holds are filled.

It is important to note that this vessel in its original configuration meets all the stability requirements contained in the Intact Righting Energy Criteria. The vessel could be operated in any of the ready for sea conditions without question.

Table 5 shows the detailed loading for the modified vessel in the Alaska salmon seining condition. This is the fully loaded ready for sea condition with both holds filled. The displacement in this condition is 76.48 tons, which is 2.5 times the lightship displacement for the modified configuration. Figures 10, 11 and 12 represent the ready for sea condition for the modified configuration with both holds empty, forward hold filled and both holds filled, respectively.

Table 4. Vessel Loading, Alaska Salmon Seining, Both Holds Filled with Seawater, 54-ft Seiner (Original Configuration)

Weight Status

Trim: Aft 2.36 deg., Heel: Zero

Part			Weight (LT)	LCG	TCG	VCG
LIGHTSHIP			27.42	22.31a	0.00	7.17
Crew and Stores			0.75	18.00a	0.00	12.00
Seine Net on Deck			2.01	42.50a	0.00	9.00
Seine Skiff			2.68	47.50a	0.00	11.50
Total Fixed			32.86	25.50a	0.00	7.75
	Load	**SpGr**				
FWDFW.C	1.000	1.000	0.55	6.83a	0.00	3.51
AFTFW.C	1.000	1.000	0.67	43.76a	0.00	4.27
WINGFO.P	1.000	0.870	2.25	45.22a	3.48p	4.51
WINGFO.S	1.000	0.870	2.25	45.22a	3.48s	4.51
FWINGFO.P	1.000	0.870	1.33	38.20a	6.73p	4.31
FWINGFO.S	1.000	0.870	1.33	38.20a	6.73s	4.31
FWDHOLD.C	1.000	1.025	19.41	29.48a	0.00	4.19
AFTHOLD.C	1.000	1.025	10.93	38.15a	0.00	4.38
Total Tanks			38.74	34.29a	0.00	4.28
Total Weight			71.60	30.25a	0.00	5.87

Distances in Feet

Hydrostatic Properties

Trim: Aft 2.36 deg., No Heel, VCG=5.87

LCF Draft	**Displacement Weight (LT)**	**Buoyancy-Ctr.**		**Weight/ Inch**	**LCF**	**Moment/ Deg Trim**	**GML**	**GMT**
		LCB	**VCB**					
5.618	71.60	30.34a	**3.79**	1.72	28.65a	59.01	47.2	3.73

Distances in Feet Specific Gravity=1.025 Moment in Ft-LT

Draft is from Baseline

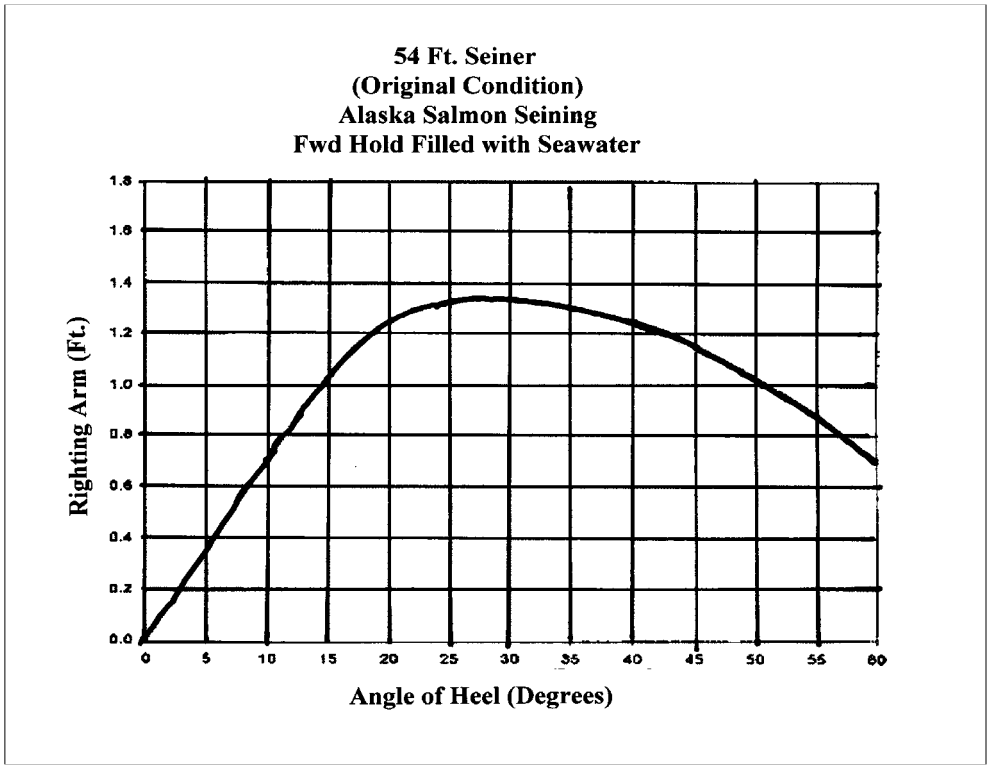


Figure 5. *Righting-arm Curve, Ready for Sea Condition, Both Holds Empty (Original Configuration)*

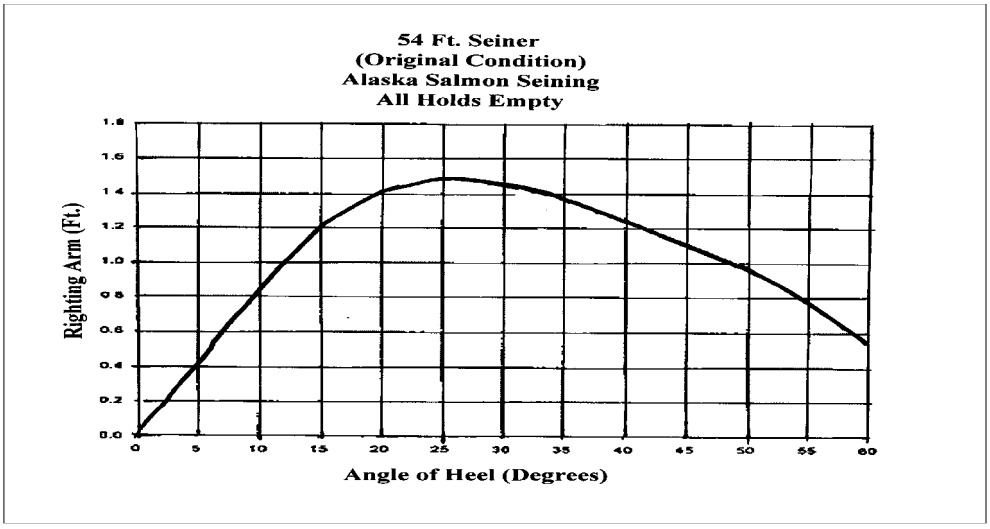


Figure 6. *Righting-arm Curve, Ready for Sea Condition, Forward Hold Filled (Original Configuration)*

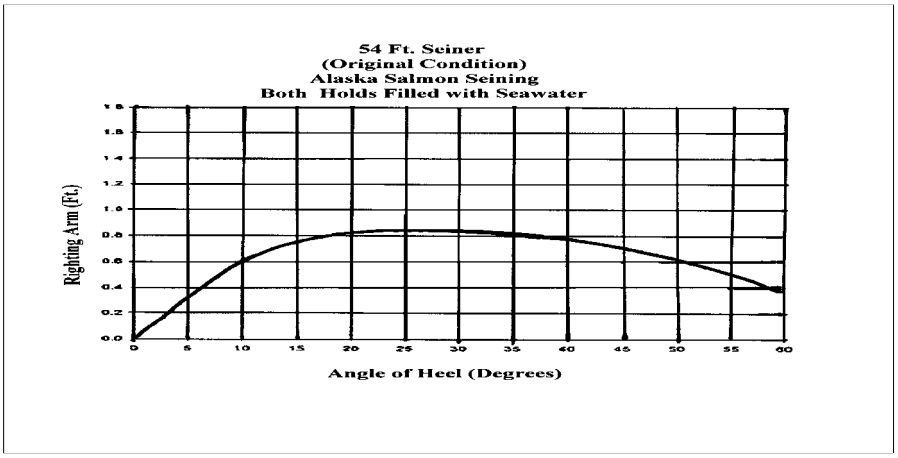


Figure 7. *Righting-arm Curve, Ready for Sea Condition, Both Holds Filled (Original Configuration)*

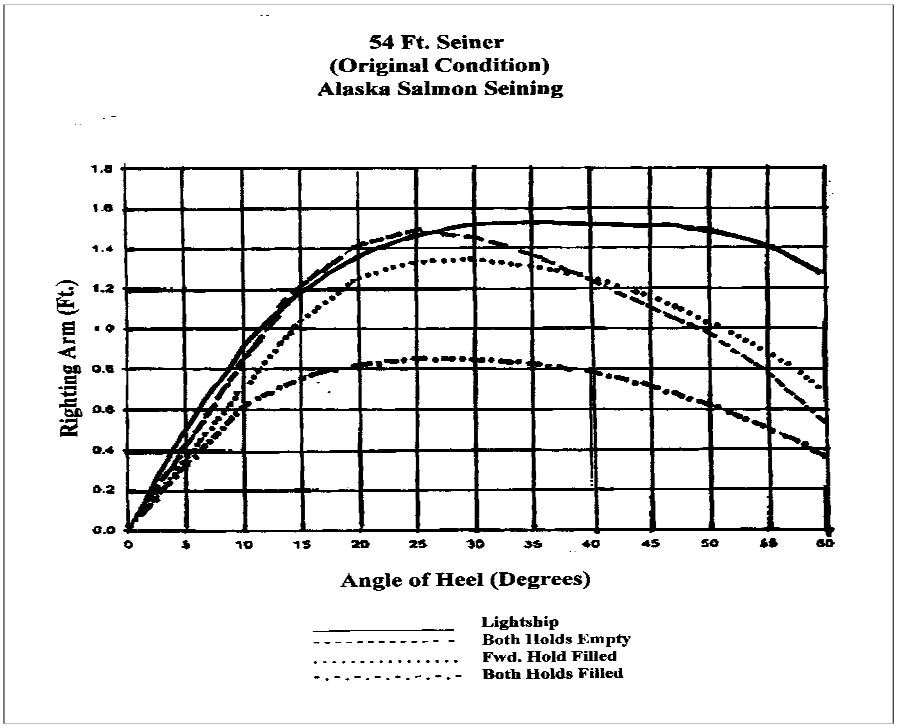


Figure 8. *Righting-arm Curve, Ready for Sea Condition (Original Configuration)*

STABILITY: MODIFIED CONFIGURATION

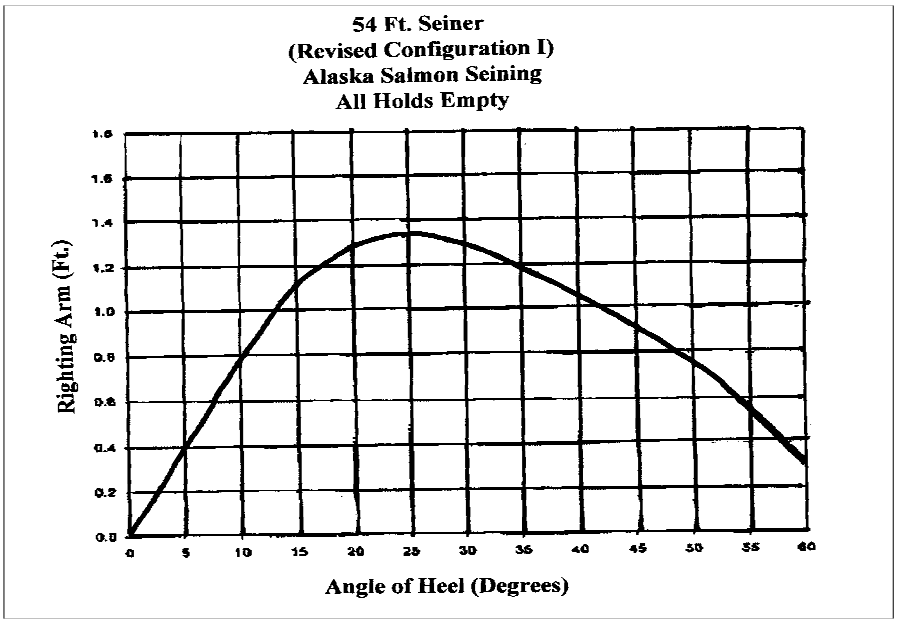


Figure 9. *Righting-arm Curve in Lightship Condition, 54-ft Seine Vessel (Modified on Configuration)*

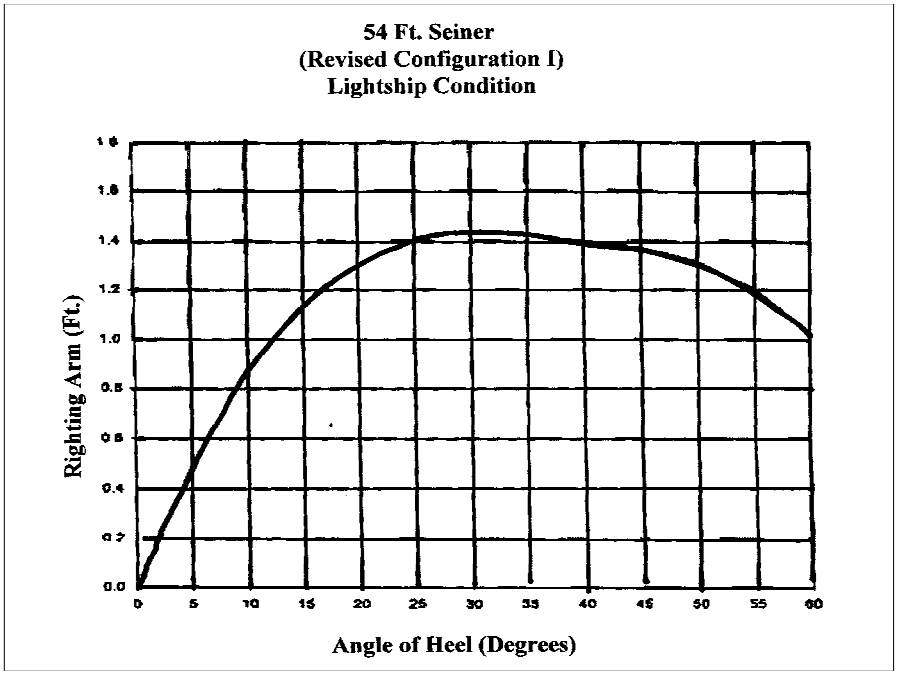


Figure 10. *Righting-Arm Curve, Ready for Sea, Both Holds Empty (Modified Configuration)*

Table 5. Detailed Loading for the Modified Vessel in the Alaska Salmon Seining Condition
54-ft Seiner (Revised Configuration I)
Weight Status
Trim: Aft 2.78 deg., Heel: Zero

Part			**Weight (LT)**	**LCG**	**TCG**	**VCG**
LIGHTSHIP			30.30	23.08a	0.00	7.34
Crew and Stores			0.75	18.00a	0.00	12.00
Seine Net on Deck			2.01	42.50a	0.00	9.00
Seine Skiff			2.68	47.50a	0.00	11.50
Total Fixed			35.74	25.90a	0.00	7.84
	Load	**SpGr**				
FWDFW.C	1.000	1.000	0.55	6.83a	0.00	3.51
AFTFW.C	1.000	1.000	0.67	43.76a	0.00	4.27
WINGFO.P	1.000	0.870	2.25	45.22a	3.48p	4.51
WINGFO.S	1.000	0.870	2.25	45.22a	3.48s	4.51
FWDHOLD.C	1.000	1.025	19.41	29.48a	0.00	4.19
AFTHOLD.C	1.000	1.025	15.61	38.16a	0.00	4.51
Total Tanks			40.74	34.48a	0.00	4.34
Total Weight			76.48	30.47a	0.00	5.9
Distances in Feet						

Hydrostatic Properties
Trim: Aft 2.78 deg., No Heel, VCG=5.98

LCF Draft	**Displacement Weight (LT)**	**Buoyancy-Ctr.**		**Weight/ Inch**	**LCF**	**Moment/ Deg Trim**	**GML**	**GMT**
		LCB	**VCB**					
5.852	76.49	30.57a	3.93	1.73	28.60a	59.64a	44.7	3.47

Distances in Feet Specific Gravity=1.025 Moment in Ft-LT

Draft is from Baseline

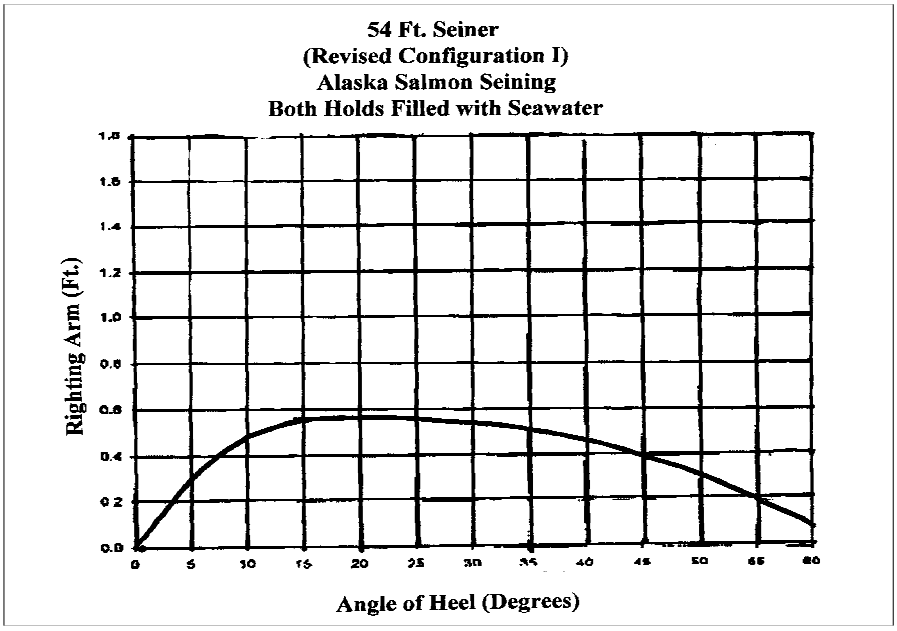


Figure 11. *Righting-arm Curve, Ready for Sea, Forward Hold Filled (Modified Configuration)*

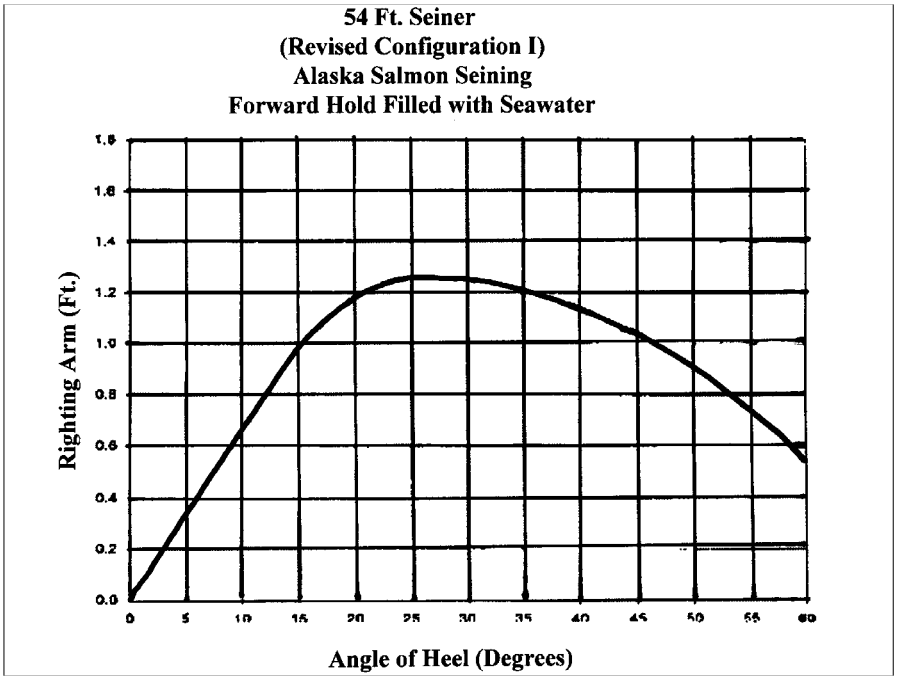


Figure 12. *Righting-arm Curve, Ready for Sea, Both Holds Filled (Modified Configuration)*

Figure 13 is a collection of all the righting–arm curves shown in Figures 9 through 12.

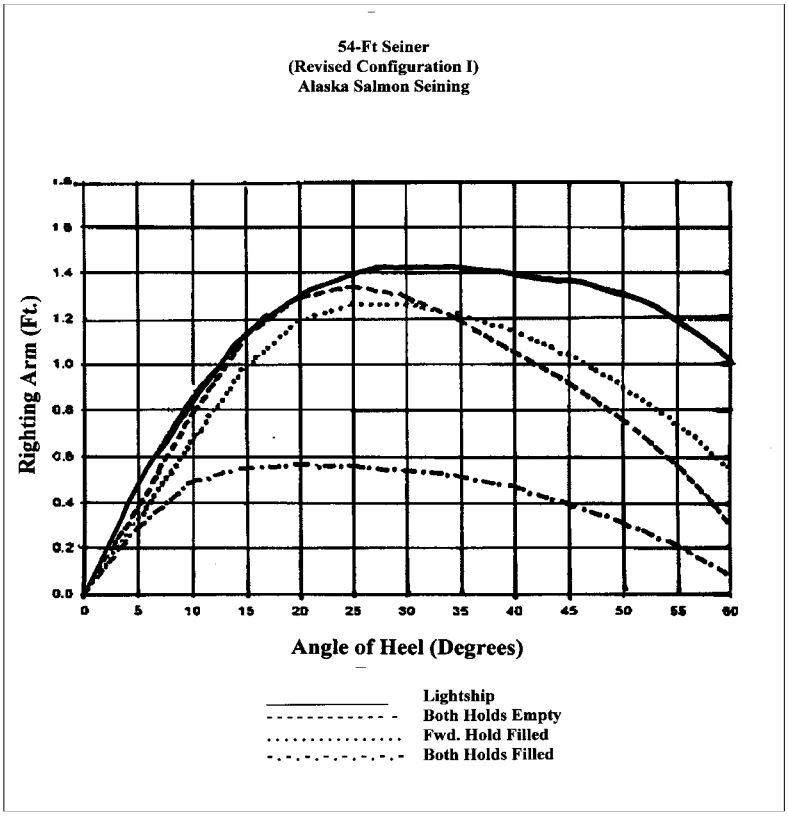


Figure 13. *Righting-arm Curve, Ready for Sea (Modified Configuration)*

Stability: Comparison of Original and Modified Configuration

Figure 14 shows the righting-arm curves for the lightship condition of the vessel in the original and modified configurations. There is only a small difference between the two configurations with the modified configuration having a lower value of righting arms throughout the range of the curve. Righting-arm comparisons for the conditions with both holds empty and the forward hold filled are very similar to the lightship comparison. There is a small difference between the two configurations with the modified configuration having less stability over the range of the curves.

Figure 15 is a comparison of the righting-arm curves for the vessel with both holds filled in the original and modified configurations. Here the difference is larger than the previous plot (Figure 14), and it is very significant. The vessel does not meet the standards in the modified configuration.

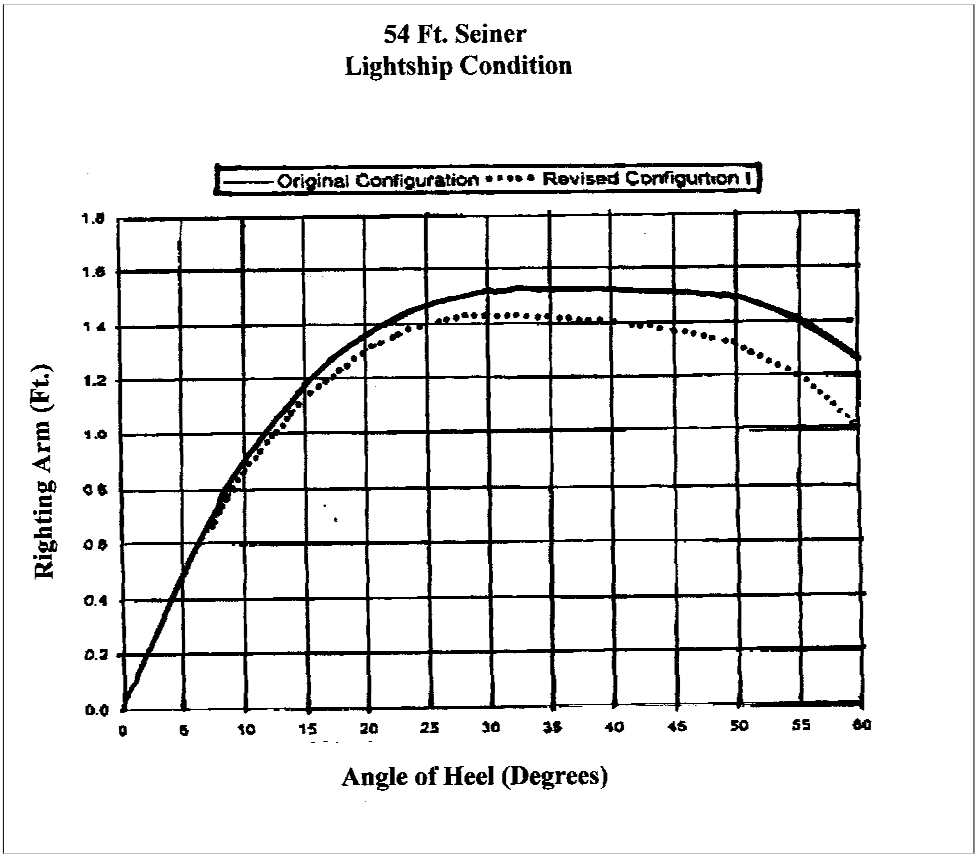


Figure 14. *Righting-arm Curves for Lightship Condition Comparison of Original and Modified Configurations*

The differences between the curves in Figure 15 are very important from an operational perspective. The vessel exceeds the stability criteria in the original configuration, but fails in the modified configuration. One of the goals in making the modifications was to be able to carry more fish by expanding the aft hold. However, the conclusion of the stability analysis is that the aft hold should not be used in this loading condition.

Conclusions

Vessel stability is important.

> A vessel capsizing is extremely dangerous and often leads to the loss of life as well as total loss of the vessel. It is important for the owner and operator to maintain adequate stability. This can only be achieved through careful monitoring and analysis of stability.

Small modifications to a vessel may be critical for stability.

A small modification to an existing vessel may require a completely new stability test and analysis. Even though the stability criteria in 46 CFR may not apply to a specific vessel, they are used as guidelines by most naval architects who perform the stability test and analysis. These criteria were originally written for larger vessels and contain language which uses percentages of the vessel's characteristics to determine whether a substantial alteration has occurred. When these criteria are applied to smaller vessels, they are more likely to be triggered by very small modifications as compared to larger vessels.

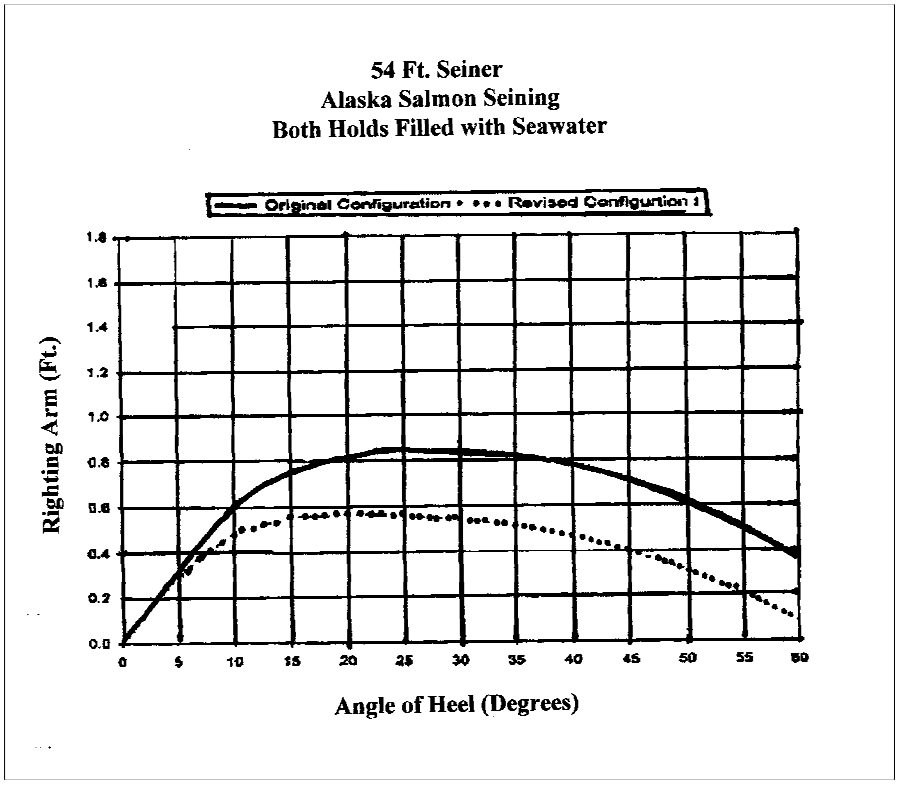


Figure 15. *Righting-arm Curve, Ready for Sea, Both Holds Filled Condition Comparison of Original and Modified Connfiguration*

Modifications are cumulative.

It is not just the last modification which affects a vessel's stability. Every change made since the last stability analysis has an effect. The totality of changes must be considered, not just the most recent. In considering modifications, the effect on stability is critical.

For the vessel used as an example in this paper, the modifications were intended to increase the fish carrying capacity of the vessel. However, to operate in compliance with the stability criteria, the aft hold should not be used. If some stability analysis had been performed before the modification was made, the desired change may have been made in a way which satisfied the stability criteria and the performance goal as well.

Operational flexibility should be preserved.

In the rapidly changing environment in which fisherman find themselves, an owner needs to be able to make changes to a vessel to be economically successful. At the same time, vessel safety and stability remain critical requirements. Careful analysis is the only way to maintain both safety and operational flexibility.

DOES SAFETY TRAINING MAKE A DIFFERENCE?

By Mr. Jerry Dzugan
Executive Director, Alaska Marine Safety Education Association

There are many factors that influence safety at sea for commercial fishermen. Factors as diverse and variable as weather, stability, human attitudes, regulations, fish management regimes, market forces, and even the value of the yen versus the dollar, affect safety in the fishing fleet. Traditional injury prevention programs have tried to control risk factors in the work environment, but many of the risk factors in commercial fishing are difficult to control. Thus, it is especially important to put an emphasis on factors that can be controlled.

Training and education efforts in safety and survival are areas that we do have control over and play an important role in the safety equation of commercial fishers. Currently, training in emergency equipment, survival procedures, and drills is a requirement for documented fishing vessels in the U.S. that fish beyond the Federal Boundary Line. Thousands of fishers have been trained in Alaska and elsewhere since the early 1990s, but has there been any improvement in the fatality rate? And what role, if any, has safety training played in improving safety? These are the questions the Alaska Marine Safety Education Association (AMSEA) wanted to investigate.

Most trainers who have been involved with safety training in fisheries have anecdotal evidence supporting the role training has played in survivability. These trainers can recall fishermen who lost a vessel and stated that the training they received was helpful. But these "successes" due to training had never been quantified before. In order words, was it just by coincidence that these people were helped? Would they have survived anyway? In 1995 AMSEA asked some people, well respected in the injury prevention field, to design a study that would investigate whether or not training really made a difference in fishing vessel loss survivability.

Study Purpose and Procedure

The study was to serve two purposes. One, determine if the training requirement had contributed to the lessening of fatalities. Two, develop an evaluation methodology that could be used by others to evaluate the effectiveness of training on fatality rates.

There were several evaluation types to choose from. A process evaluation measures the number of people trained, test scores, surveys, etc. This type of evaluation only measures the success you had in reaching people, not if the training made a positive impact on safety. This type of evaluation was judged to be too subjective. An outcome evaluation on the other hand, helps answer the question of whether or not training had an impact on lessening the fatality rate. An outcome evaluation is much more objective and thus this evaluation type was used. The independence of the study was also important. The study itself was conducted by the Alaska Native Health Service with information supplied by the NIOSH Alaska Field Station in Anchorage, Alaska, and the U.S. Coast Guard in Juneau, Alaska. (Perkins, *Pub.Health Reports*, 11/95)

AMSEA-trained fishermen based in Alaska were used for the study for several reasons. One of the primary reasons was the hands-on training received in the AMSEA program. All fishermen participated in pool or harbor exercises, on board drills, fire fighting, and other performance-based skills. These skills were chosen to be part of the AMSEA training in part due to U.S. Coast Guard (USCG) requirements. Additional skills were included in this training beyond the minimum USCG requirements. These additional skills in survival were chosen from interviews with survivors and from USCG and National Safety Transportation Board (NTSB) studies involving fishing vessel casualties.

The group studied was a diverse group of people representing residents of 56 different Alaskan ports. They fished in vessels under 32 feet in length to over 500 feet in length. It was a large database of 1,600 trained fishermen, mostly vessel operators. This number represents only about three percent of the number of fishermen registered in Alaska in 1994. These operators became drill instructors and trained an average of three other crew members. AMSEA maintains a database of all fishermen trained, and thus, was able to share this database readily with the researcher to compare to the list of fatalities.

The study period covered 1991 to 1994. This is the same time period given by the Coast Guard for fishermen to be trained in drill instruction. The study also ended the year before Individual Fishing Quotas (IFQs) were in place for groundfish in Alaska. The researcher matched the names of fatalities to those in the AMSEA database to look for trainees lost. Only vessels lost after training took place were counted. A Fisher’s exact two-tailed test was used to determine a "p" value. This "p" value determines the probability that the test results were a random occurrence.

If the victim or survivor was not known by name, they were dropped from the study. About one third fell into this category. A "survivor" was defined as a person rescued from a distressed vessel.

Results

The study found the following: In the four years of this study period, there were 159 vessel incidents including 114 fatalities. None of the fatalities were AMSEA trained. Of the 227 survivors known by name (two-thirds of all survivors), 10 were AMSEA trained. The chances of this outcome happening by chance were determined by the "p" value to be only 3.4 percent. This is a statistically significant finding.

The statistics do not include saved crew-members who were drilled monthly by the trained vessel operators. These figures also do not take into account the one-third of all survivors who were not known by name who may have had training. Anybody in this category who was trained would have lowered the "p" values even more. It is obvious from this study that training seems to have played a significant role in the reduction of these fatalities.

Table 1. Case Fatality Study

Year	No. Of Fishing Vessels Lost	No. of Persons on Board	Fatalities	Case Fatality Rate*
1991	38	86	21	24.4%
1992	43	101	18	17.8%
1993	24	91	13	14.3%
1994**	23	92	1	1.1%

* Case fatality rate = Number of fatalities, divided by number of people on board (at risk)
** January 1, 1994 through September 30, 1994

Discussion

Overall in this time period, one can see a decrease in fatalities over the past 4 years. Generally speaking, the fatality rate for the past 5 years, has been half the fatality rate of the previous 5 years. There are still some variables that cannot be answered by the study. For example, since most of the training took place before the deadline in September of 1994, more safety-conscious operators may have taken the class. Also, 1,600 fishermen were in this study and they do not represent a majority of the fleet. However, the preliminary positive results of this study certainly point to the importance of hands-on training.

The pattern of fishing fatalities has changed over the last 10 years. Vessels are still being lost in almost the same numbers as they were historically. Yet crew members are not being lost with the vessels with the same frequency as previously seen. More individual fatalities are now being seen during events such as man-overboards or diving fatalities. There is sufficient evidence in this study, however, to maintain an emphasis on training. Education and training can cause change in three areas: knowledge, skills, and attitudes. With pre- and post-tests, it is relatively easy to demonstrate that knowledge and skills have been increased due to training. But remembering that ultimately all safety decisions are made in the wheelhouse, there is also evidence that training has positively influenced the fleet's attitude towards safety. Keeping this positive safety attitude alive in the future, will continue to be a major challenge for trainers and commercial fishermen alike.

FORECASTING MARINE WEATHER AND ICING

By Mr. Bob Hopkins
Meteorologist In Charge, Weather Service Forecast Office Anchorage

Operation Overview

Alaska's three forecast offices, located in Anchorage, Fairbanks, and Juneau, have marine forecast responsibility for 53 percent of the nation's coastline. The Alaska marine community represents a wide range of operational requirements. Customers include recreational boats, the fishing fleet, fish processors, tugs and barges, large cargo ships, and tankers. The marine community has an extremely large technological and sophistication range. Our marine customers are real people, taking real risks, and facing real weather. We take our job seriously--the risks are all too real. The people of Kodiak hold an annual memorial for fisherman who have lost their lives at sea. A bell is rung once for each life lost during that year; one year the bell rang out 42 times.

Our primary marine forecast products are for winds, waves, superstructure icing, and sea ice. Coastal floods are a significant forecast issue and we are part of the tsunami warning system.

Satellite images and surface analyses are primary marine forecasting tools. Forecasters utilize all available coastal weather reports, buoys, and ship reports. Forecasters rely on their skill and experience in applying computer-produced simulations of the atmosphere (numerical progs), local studies, local forecast rules, and locally-developed, automated applications (elementary expert system) to the forecast challenge.

Dissemination of marine products is done via National Weather Service (NWS) and U.S. Coast Guard (USCG) HF and VHF radio, commercial radio, marine fax, text, the internet (text, graphics, and satellite pictures), and the Alaska Weather TV show.

Challenges and Opportunities

Alaska is called the Last Frontier. The Alaska marine forecast environment is more akin to a frontier environment as opposed to the more mature setting found in the Lower-48. The use and exploitation of our marine environment is rapidly increasing, but has not reached the level of exploitation and sophistication that has already been achieved in the Lower-48.

Alaska marine forecasters work with an enormous marine forecast area with large zones, sparse data, complex marine zone orography, and frequent severe storms for an area of high year-round marine activity.

Marine observations are our first priority issue. Buoys are too few and are not located in the most critical forecast problem areas. Coastal weather reports are sparse and rarely represent the marine environment. Towns and airports are located with intelligence, where the winds are blocked and the

climate is favorable for human habitation. Ship reports are vital, but are available only as opportunity presents.

Communication issues are a particular service-delivery challenge. Technological sophistication of our customers is primary for this one. Some use the internet, some rely on voice radio reception. We must present our products in formats useful for all our customers. Considering communication sophistication and the large forecast zones, we often must sacrifice precision for communication clarity. For example, when winds will change from 50 kts to 20 kts and up to 40 kts within the 26-hour forecast period, we are restricted, by customer preference, to promoting the two most-important wind speeds, directions, waves, etc., leaving the third change group out. Mariners tell us constantly that more than two winds, etc., make the forecast too cluttered and unusable. We likewise restrict outlook content and find innovative ways to communicate small scale variations. For areas with channeled winds we include the statement, " stronger winds from bays and passes." Mariners tell us they know what this means and can apply it to their operation.

We can, or soon will be able to, name each bay and pass and give quantitative wind speed values. But, on the service side, can we put this information in a package which is more useful than the present presentation? Communication issues can be broken into three categories: simple vs. complex, necessary vs. clutter, and providing a manageable number of products from our customer's perspective.

Severe weather frequency in Alaskan marine forecast areas is high. In 1995 Alaska issued 66 percent of all marine storm warnings for the Nation and 59 percent of all gale warnings.

Satellite Applications

The focus of this presentation is the use of satellite images in the forecast process. Specifically, the use of the infrared, or thermal sensor, and the interpretation of cloud formations.

Meteorologists use thermal-sensor data to infer cloud top altitudes and to measure the temperature of the land or ocean surface in cloud-free areas. The satellite thermal sensor is accurate within one degree centigrade. The ocean surface temperatures are used for forecasting areas of potential superstructure icing and to pinpoint areas where sea ice is most likely to form next. Clouds block the satellite sensor from measuring the ocean surface temperature.

The primary use of satellite images is visual interpretation of the shape and movement of cloud formations. This is especially vital over the oceans where little conventional data exist. Meteorologists can accurately locate positions of fronts, storm centers, the jet stream, thunderstorms, fog, and other meteorological phenomenon. The speed, direction, strength, and life-cycle trend of storms can be inferred from satellite images.

Superstructure-icing conditions include:

- Cold water, usually less than 40 degrees Fahrenheit
- Cold air, below freezing
- Strong wind, greater than 20 kts

The degree and severity of superstructure icing depends on many non-weather factors such as vessel type, vessel orientation, and movement with respect to the wind and waves.

Ship reports and satellite data are used to determine initial conditions for wind, waves, water temperature, and air temperature. Computerized simulations of the atmosphere projected ahead in time are used as input to forecast wind velocity and air temperature. Forecaster knowledge of localized terrain-induced conditions is combined with the other data to produce a forecast. Superstructure-icing conditions are generally not difficult to forecast because the contributing components with the required properties are well within the skill range of available tools.

OPTIMIZING MEDICAL CARE AT SEA

By Dr. Ray Jarris
Medical Director, Maritime Health Services

This information was presented at the Second International Symposium on Maritime Medicine, which was held in Maryland in 1995 and is a summary of cases taken from vessel officers who contacted Maritime Health Services (MHS) for medical advice in 1994.

We looked at U.S. flagged fishing and processing vessels working in the North Pacific and Bering Sea. Although this data is from 1994, I don't think things have changed dramatically since, except I believe we're seeing fewer major medical events at sea. This may, in part, be the result of the industry responding very well to the challenge of taking good care of their people at sea.

These data are complementary to what we've heard earlier from the Alaska Trauma Registry. They do include illness as well as injury, so they are a bit different. Our data reflect which instances occur at sea when a physician consultation is provided through MHS. However, there is a lot that occurs at sea that we do not learn about, for instance, we don't get called on every medical incident that occurs because they may be handled independently by the medical officer without physician consultation. Other sources of medical information exist, such as the U.S. Coast Guard, and others may subscribe to medical consultation services similar to MHS. Also, some vessel officers may call their family doctor or an emergency room in their home community.

MHS provided 947 physician consultations to vessels at sea in 1994. Our case volume has increased over the years up to approximately 1700 in 1997. This is because our client base has grown, and the utilization patterns have evolved. For instance, instead of calling only for "emergencies" one of our major clients has instructed their vessel medical officers to call MHS whenever a prescription medication is dispensed. In this way, medical incidents can be aggressively managed and documented, which our client believes has decreased the direct medical and medically-related liability expenses to the vessel owner.

Up until now, much of this workshop has focused on injury at sea, which undoubtedly is very important and can be very dramatic. However, our data demonstrate that illness also occurs at sea, and can be very dramatic as well.

Illness

Respiratory infections are very commonly encountered at sea. Respiratory infections may include a cold or an earache, sore throat, pneumonia, and infections with wheezing or complications of pre-existing asthma and "crab asthma." Very serious complications of upper respiratory infections have occurred at sea and do occasionally result in the need to request a medical evacuation or the diversion of a vessel.

Dental problems are very common as well. You may think, “Well, okay, dental problems, a sore tooth, what's the big deal?” Well, let me give you an anecdotal story. One is of a vessel master, before we were involved with this company, who had dental pain and who was injecting morphine while on the bridge so he could continue to work pain-free! That raised serious safety concerns.

There are the issues of oral analgesics that are potentially sedating. Codeine tablets can be purchased over the counter in Canada. As a medical review officer, I can say that this represents a problem for the federal drug-testing program. However, codeine-containing products may not always be used appropriately or after alternative nonsedating remedies have been tried. I do worry about someone with a dental infection that is taking codeine and working on the deck or operating a crane or other potentially dangerous machines. I am also concerned about the crew member who isn't getting adequate medication, can't sleep well at night, and as a result is fatigued and operating the vessel or working in a dangerous setting.

Infections as consequences of working with fish are frequently encountered. This can occur as a dermatitis that results from repeated saltwater exposure, or working with either very cold or very hot water and over time it may become infected. Ear infections occur fairly frequently. Bladder infections, which usually can be treated without difficulty, can produce more serious problems such as pyelonephritis if not managed properly. Eye infections and changes in eyesight occur which can be very difficult to interpret without sophisticated testing. Another category of high frequency appears to be nonspecific and allergic rashes. And then on the bottom of this list are what appear to be sexually-transmitted diseases, urethritis, and epididymitis.

Injuries

Of injury categories, lower back strains are very common and are possibly preventable to a degree. But the most significant thing that I take from this list is the high frequency of hand, upper extremity, and head injuries. Many of these injuries are managed on the vessel, but some lead to dramatic evacuations such as when a crew member loses multiple fingers, a hand, or an arm.

In passing, I’d like to mention the danger of evacuations such as is illustrated by a case where a processor lost a thumb. He was skiffed ashore because the vessel couldn't dock on the island in order to transport the crew member to the awaiting plane. The deck boss was on the skiff along with two other crew members. Unfortunately, the deck boss wasn't wearing any flotation device. The skiff lost power as it was running back to the mother ship, and flipped resulting in two survivors (both wearing personal flotation devices) and one death, the deck boss. It was tragic. I saw the man who lost his thumb when he arrived in Seattle for hand surgery. He knew something awful had happened. I just didn't have the heart to tell him at that moment that the deck boss, his personal friend, had drowned after bringing him to shore. It was a gut-wrenching experience for all of us who knew the truth.

Eye trauma is also very common, and to a large degree preventable. Frequent causes of eye trauma include chemical exposure and foreign bodies, the most problematic of which often are fish scales.

Perhaps because fish scales are nearly clear and flexible, they are often a significant challenge for the medical officers on the vessels. Major eye trauma including perforations of the globe occur, but not frequently.

In summary, injuries of the upper extremity, head, and lower back are the most frequent sites of trauma among commercial fishermen utilizing MHS for physician consultation services. In over 90 percent of the cases reviewed, an injured or ill crew member was able to stay on the vessel following contact with a physician consultation service. This being the case, these incidents would not likely be captured by the Alaska Trauma Registry. I believe our data and that of the Alaska Trauma Registry represent complementary and not contradictory perspectives on the true incidence of injury and illness incurred by the men and women engaged in the fishing industry. Less than ten percent of injured or ill crew are removed from the vessel for medical reasons following consultation with a MHS physician. Some of these individuals may go to the clinic in Dutch Harbor or St. Paul, get cleared, and fly to their home of origin. Some go to Anchorage by air ambulance or are transported by a commercial jet to another medical center or physician.

What I was hoping to do next was to focus on prevention instead of presenting more data on injuries and illnesses after the fact, when it is too late to make much of a difference. I'd like to give you some of my thoughts, many of which are anecdotal, on what we might do to decrease medical problems at sea in the future.

Disease Prevention

Respiratory system infections are very common. Part of it is because viral infections spread rapidly in the setting of a high-density population such as that found on some of the larger vessels, living in tight quarters, and in working long hours. Typically, we are dealing with viral, upper respiratory infections, and I believe that antibiotics are grossly over-prescribed and are ineffective for viral infections. More often than not, the physician consultant ends up trying to talk the medical officer out of giving an antibiotic for a variety of sound medical reasons.

I strongly believe that one of the things working against those of us interested in disease prevention is the disproportionate number of people in the industry who smoke tobacco. The percentage of smokers in the industry is significantly above the national average. I would estimate that 60 to 80 percent of mariners use smoking tobacco which is at least three times the national average. This is very frustrating to me as a physician. In the beginning, when I was getting the business going, I would walk on many vessels to give my pitch to the captain or mate. It was very frustrating to board a vessel just behind the tobacco salespeople. I really didn't think I was likely to have the full impact on the captain that I had hoped to make. To combat this public health risk, I think that smoking cessation programs are something the industry should consider. It is also frustrating for me as a medical professional, if I understand the legal status of vessels correctly, to accept that commercial vessels are able to purchase tobacco products without paying federal tobacco excise tax. I don't want to take anything away from these hardworking people, but this is one thing I'd be glad to argue about.

In the area of general prevention, many people are not being immunized for common preventable illnesses such as tetanus. By following commonly accepted vaccination guidelines, the general health of the seafarer could be improved. I think a number of additional immunizations are very appropriate to consider. Influenza vaccine is reasonable, although I haven't seen a cost-benefit study of this, but I would think that it's worth considering. Pneumococcal vaccine for people at risk should be considered, an example of which would be a diabetic crew member who's 75 years old and still working. Hepatitis B vaccination is a requirement for medical officers, house cleaning staff, and laundry staff under federal blood-borne pathogen regulations. Because of the uncertainty of the safety of blood products overseas, it is also worthwhile to consider hepatitis B vaccinations for vessel crews traveling to fish where evacuation to a foreign port is a possibility. Hepatitis A vaccination is likewise a consideration, especially for galley staff and crews that may be traveling overseas.

Dental problems can be combated with self-care education. I think the dental hygiene in general in the industry is not good. Many of the processors come from relatively low socioeconomic backgrounds or from overseas, where they may not have easy access to dental care. I think that something can be done to educate the average processor about good dental hygiene both on and off the vessel, even if it is just a simple brochure.

Dental screening examinations in the replacement phase of hiring are going to have an impact on dental complications that occur at sea. It would be useful for the examining physician, dentist, or dental hygienist to tell an applicant seafarer that they will not be declared fit for duty until they have attended to an identifiable dental disease. Perhaps dental insurance for permanent employees is something for vessel owners to consider.

Blood-borne pathogen regulations need to be followed. It is important to always utilize universal precautions when providing first aid or more advanced medical care at sea. This means assuming that every person you are exposed to when providing medical care should be assumed to be infected with something that you don't want to acquire. Condoms for sexually-transmitted diseases and pregnancy prevention are likely a cost-effective strategy from the vessel owner's perspective. This is especially true since pelvic or lower abdominal pain in a woman of reproductive age may represent a tubal pregnancy, which creates a situation that is very difficult to manage in a hospital environment, let alone at sea. Basically, when a tubal pregnancy is a consideration, an evacuation or vessel diversion is likely to result.

Vessel managers and officers need to help their crew members understand that it is critical to bring an adequate supply of prescription medications to complete a contract. Please ensure that crew members don't run out of their medications such as phenytoin, for example, for a recurrence of seizures, with two weeks to go in the season and the vessel is in the Sea of Okhotsk. Trust me, this will complicate things much more than you can imagine.

There are three peaks of death that occur after trauma. The first peak results from deaths where immediate access to advanced medical care is the only chance for survival. This might occur after

a fall from a mast of 40 feet into a hold where death is nearly immediate from massive head trauma or a rupture of the aorta. A second peak occurs within 2 hours of trauma and, in this instance, attempts to provide medical support to assist the medical officers of the vessels can have a major impact on survival and diminishing the likelihood of disability in survivors. A third peak occurs from the late consequences of trauma such as infection and blood poisoning. Again, implementing aggressive and timely medical care on the vessel will have an impact in these circumstances. An illustrative example might be an instance of a crew member with an amputation of the arm. By controlling the bleeding, administering intravenous fluids, analgesics, and antibiotics, this is a survivable injury. It is necessary to work with the vessel owner, the master of the vessel, and the Coast Guard Rescue Coordination Center. If the weather, sea conditions, available Coast Guard Resources, and distance to shore allow for a helicopter evacuation, it may be possible to evacuate the crew member with minimal delay. If the arm can be salvaged and packaged for transportation, it may be feasible to re-implant the extremity in Anchorage or Seattle. For this to occur, it is necessary to coordinate the landing of the helicopter or arrival of the vessel in port with immediate transfer to an awaiting air ambulance. I do believe that because of consulting physicians working with vessel officers and Coast Guard flight surgeons, lives and limbs have been saved. The number of lives saved in this manner are not large such as occur when survivors from sinking vessels are rescued. One or two crew member's lives a season or a year, perhaps, but from my perspective it is a very wonderful experience to help someone in such a challenging time of need.

Preventive Strategies

Preconditioning

One thing I think might be helpful to consider is preconditioning prior to boarding the vessel. We're taking people and putting them in repetitive motion situations, working long hours in awkward positions (with resulting strains, sprains, tendinitis, and bursitis), and, perhaps, increasing the chances that they will develop a long-term problem such as carpal tunnel syndrome.

If the processors and deck crew could physically condition themselves for the work they would be doing at sea on a seasonal basis, I believe that we'd see fewer instances of fatigue-related complications, injuries, and long-term disabilities.

Education

An example of a simple educational intervention would be preventing frostbite and cold injury. This would include teaching people working in freezer holds to regularly check their co-workers for frostbite. Teaching them to wear dry socks instead of wearing wet socks and boots day after day should be relatively simple and low cost. Another example would be to teach welding safety, not only to the people directly welding, but also to workers in the general area who may be splattered by slag or indirectly exposed to the ultraviolet light and who may later develop flash burn.

One thing that is easy to forget in the midst of a major vessel incident or when responding to a serious injury is the requirement for drug testing of individuals involved in the incident. Very often the medical office or hospital emergency department, that may evaluate an injured crew member, attends to the medical needs of the patient, but forgets to collect urine for drug testing. It is important to remember in the instance of an injury, that the victim is not the only individual to be tested, others who may have contributed to or been involved in the incident may be under the influence of illicit substances as well. This is also an issue of liability management that confronts the vessel owner and it is likely that the Coast Guard is going to be concerned about post-accident drug tests for enforcement purposes as well. It is important to send the message to the crew that they are going to be drug tested after a serious accident or injury. They should be advised that if their drug test is reported as positive by the medical review officer, that their position and license will be in jeopardy.

It is important to reinforce the importance of eye protection to vessel officers, managers, and crew. There are numerous examples of serious injuries that occurred when a person at risk was not wearing safety glasses. Such incidents have involved individuals having their eye perforated, or burned while handling chemicals to clean rust from the vessel or while cleaning the engines.

Hard hats prevent head injuries. When on deck the crew must have on a hard hat and flotation device. It is also mandatory to don a flotation device when in a skiff going to shore or when traveling between vessels.

Vessels not only are going far out in the Bering Sea, but they're going over to the Sea of Okhotsk, and they're going down to the South Pacific to fish for tuna. They're fishing the South Atlantic, and the Falklands. We've had evacuations from our Seattle-based vessels in each of these areas. It is important for the officers and shoreside vessel managers to be aware of the medical resources in the vessel's operating area. It should be remembered that hospital resources are not the same in Magadan, for instance, as they are in Anchorage. Knowing this will influence planning when coordinating an evacuation or vessel diversion.

It is advisable when a vessel is going to be overseas that there should be a transportable medical kit on board. In the instance that an injured or ill crew member is disembarked, this kit will be of great value in settings where the local medical care falls far short of what most Americans have come to expect. As an example, a number of hospitals overseas re-use disposable equipment due to a lack or funding, and frequently medications are in short supply or will not be used except when needed for the local population's use.

I think the basis for mandating basic first aid training and CPR is historic rather than founded on a sound assessment of what actually should be required for ocean going vessels. In my estimation the mandated training levels are in no way near to being adequate for the challenges that these people face at sea. I would recommend that the officers, or at least the medical officer, have training in advanced first aid and field medical techniques. It is reasonable for some vessels to

consider hiring a medical professional, paramedic, EMT, or nurse, to serve as the medical officer when working in isolated locations for extended periods of time.

It's important to have key crew members who are permanent employees, so the investment of training such personnel in first-aid techniques is worthwhile. By having multiple crew trained in basic levels of first aid and CPR, it would be possible for an injured person in the engine room to receive ten minutes of first aid or CPR while awaiting the medical officer to arrive.

I suggest that the fishing industry and the maritime industry in general have something important to learn from the construction industry. Both industries are dangerous and involve large groups of people moving massive amounts of material while exposed to significant and potentially dangerous forces. Twice a year, the largest construction firms in the US send their safety professionals to the National Construction Safety Executives meeting. This is a quietly done, self-funded, self-organized, and self-run group. Participation is by invitation only, so not all of the large firms are always represented. Each safety professional puts aside his competitive agenda and shares stories of successful interventions that have worked and those that have not worked well. I think this represents an extremely effective forum for sharing safety information that cuts across corporate boundaries. It's a very good group with a lot of camaraderie, and I think it's having an impact on the construction industry's safety efforts.

I would propose a challenge to the fishing industry that they follow the example of the National Construction Safety Executives. Today, I am very disappointed to see that there is no one that I recognize from the fishing industry, other than Leauri Lopes from Icicle Seafoods. I would have hoped others would have been here today. I think we are preaching to the choir this evening, but I would have hoped that some of my clients and other people would have shown up today to hear and to benefit from this group's deliberations.

Some new things that will be helpful at sea are appearing on the horizon. Pulse oxymetry is a little probe that is placed on the finger and it gives a measure of the amount of oxygen in the person's blood. This can be very important information when caring for an individual with asthma or pneumonia. For the price of $800 this may be a very worthwhile investment, especially for vessels with large crew sizes.

Seaworthy automatic external defibrillators (AEDs) are available now and have been placed on a number of passenger jets and ocean-going vessels. They are useful for electrically shocking a fibrillating heart back into a normal rhythm and are a reasonable consideration for the vessel's medical chest. The weight is approximately three pounds and they require essentially no maintenance except a battery change after use or every year or two. Current models retail for approximately $3200 dollars, but I expect that the price will decrease over the next few years.

Low cost means of communication are greatly improving the ability of vessel officers to communicate with physicians. Satellite telephone vendors have increased in numbers in the past few years. Cellular service now covers greater distances and provides better quality then was

available a few years ago. E-mail is a very low cost means of communicating, and may well replace telex for routine communications. We have tested several televideo systems and I believe that televideo has some potential value worth considering. In some instances it would be helpful to visualize the injury, for instance a hand injury or facial laceration. In such a situation it would be helpful to be able to give the medical officer very specific instructions. However, the quality of the video component currently is less than ideal, but as we all have seen with computer technology and telecommunications, it should improve with time.

CONCLUDING REMARKS

By Mr. Mel Myers
Special Assistant to the Director, National Institute for Occupational Safety and Health

I have four observations to make in my concluding remarks. First, I will compare our results with the results from the First National Fishing Industry Safety and Health (FISH I) Workshop (1992).[1] Second, I want to summarize the full reports of yesterday's session of the current Workshop (FISH II), which I call "Setting the Course." Third, I will identify gaps and fourth, I will speak on the government's role in public health and more specifically, the NIOSH role in fishing safety.

In my 30-year career in the U.S. Public Health Service, I have been challenged many times by competing interests in the controversial area of occupational safety and health. I have found refuge by retreating to defining the public health problem--people dying and getting hurt or sick. All interested can agree that something should be done about the public health problem, and this agreement provides a basis to discuss solutions. At this Workshop there has been a unified concern about the public health problem of sick and injured fishermen, and we have engaged in a dialogue to find solutions to this problem.

FISH I and II Compared

At FISH I, I classified major issues as primary, secondary, and tertiary prevention. Primary prevention attempts to prevent the hazardous exposure, secondary prevention attempts to reverse the adverse health effect after the exposure, and tertiary prevention attempts to assure that injured victims are not injured further and that their quality-of-life improves in to the future. A significant shift in attention has happened from secondary prevention at FISH I to primary prevention at FISH II. FISH I was driven in large part by the new regulations promulgated under the Commercial Fishing Industry Vessel Safety Act of 1988 (CFIVSA). FISH II has been designed to focus on four problem areas: man overboard (MOB), vessel casualties, diving, and non-fatal injuries.

I summarized five major areas at FISH I. First on my list at FISH I was vessel stability. Vessel casualties is one of the focus areas for FISH II. This issue deals with primary prevention. By assuring that fishermen are working on a stable vessel and under stable conditions, we prevent the potential exposure to drowning that emerges from a vessel casualty.

Second on my list was MOB, which was also addressed at our current Workshop. Preventing MOB events is primary prevention, however, preventing the drowning or hypothermic death of an MOB victim is secondary prevention.

Third was ergonomics, which generically concerns the design of the job. We normally think of ergonomics as a way to prevent musculoskeletal disorders. We have heard in the reports here that musculoskeletal problems are prevalent among fishermen. However, job design for safety also

addresses other non-fatal, as well as fatal, injuries. Ergonomics can address the focus area, non-fatal injuries, for FISH II.

Fourth on my 1992 list was survival. Whenever a vessel capsizes or we experience an MOB, a rescue needs to take place. This is secondary prevention, which has been a success since 1992. The success of the CFIVSA can be attributed to the success of search and rescue.

Fifth on my list was other health problems. We have heard a lot about other health problems at FISH I and FISH II. Dr. Ray Jarris mentioned several of these problems, as did Dr. Linda Rosenstock and Jim Herbert. One focus area for FISH II, diving, relates to health problems such as decompression sickness and carbon monoxide poisoning.

Setting the Course

First was yesterday's plenary session where we all heard the same messages. It was a way to calibrate our thinking with a common information base. There were four different sections in yesterday's agenda. These were priorities, problem definition, commercial fishing and safety, and intervention strategies and safety promotion. FISH II has involved three steps. The second step was today's work groups in which we define and discuss solutions to problems. In these work groups, we generated the root causes of problems and addressed approaches to prevent the root causes. Finally today, in our third and final step, we heard reports with a series of recommendations. In contrast to FISH I in 1992, where we had conclusions, we now have recommendations, a major difference at this Workshop.

Priorities

The opening session can best be classified as a statement of priorities from a number of people. The presentations included a Keynote Address, Opening Remarks, a Workshop Charge, and an Introduction.

Dr. Linda Rosenstock addressed current NIOSH research priorities, the National Occupational Research Agenda (NORA). She also reflected back on the success in decreased fishing-related fatalities in Alaska. She spoke of the need to move into the area of trying to prevent the exposures to the drowning incident.

Ms. Peggy Barry reported on differences between FISH I and FISH II, and she reflected back on her efforts to improve safety and health. She found the Department of Transportation priorities to be "refreshing," the first of which is safety. She suggested that safety should be a major criterion in the selection of the next Commandant of the U.S. Coast Guard (USCG). She commended the USCG's recognition of a career path for maritime investigators. She said that this gets rid of the barrier of the past in which safety was perceived as a dead-end career. She also saw a need for developing casualty reports that can go to the users, and the reports need to be usable.

Mr. John Hammerschmidt spoke of priorities at the National Transportation Safety Board (NTSB). Included in these priorities is the licensing of masters, refining stability tests, and implementing load lines. He also discussed NTSB's recent concerns which include vessel fires.

Dr. George Conway charged the workshop with the word, "salvage." He reported on our success to date as salvaging human life from vessel casualties--we are acting after exposure takes place. In his charge for primary prevention, he stated that we need to stop exposure from even taking place and thus avoid the need for rescues.

Problem Definitions

The second part of this session defined the problem. Ms. Jennifer Lincoln defined three problem areas: MOB, vessel casualties, and diving. She presented detailed statistics in each area. Mr. Brad Husberg defined a fourth area, non-fatal injuries.

Mr. Jim Herbert presented data from the Fishermens' Fund from Alaska. In addition, he provided a national perspective of the fishing safety and health problem. He addressed concerns about heart attacks. He also addressed the costs associated with both illness and injury.

Commercial Fishing Safety

The next session addressed commercial fishing safety. Mr. Ken Lawrenson reviewed the history of commercial fishing safety through USCG reports back to the early 1970s. Many USCG recommendations have been acted upon, but the length of time is measured in years and decades. His message was that prevention takes a long time. An example of a recommendation that has yet to be acted upon is requiring master's licensing. The public health experience has also shown that prevention takes a long time. Many professionals invest a career in making an impact, and their investment may require the time-consuming activity of proposing and enforcing standards.

In another presentation, LT Alan Blume provided a detailed classification of vessel casualties. He observed that the age of the vessel, especially large vessels, is a risk factor.

Mr. Charlie Medlicott talked about the status of dockside exams. He observed that dockside exams have not been shown to be effective. Moreover, there is a problem in creating an interest in taking dockside exams.

Mr. Barry Noll spoke about the Occupational Safety and Health Administration's (OSHA) role in fishing safety. Shortly after Mr. Noll came to Alaska, he mentioned to me that the USCG out of Seattle had OSHA investigators provide technical assistance in inspecting vessels. Through interagency collaboration, USCG boarded vessels under its authority and used OSHA expertise to address problems such as machine guarding in fish processing.

Ms. Leauri Lopes reported on the use of OSHA's Voluntary Protection Program (VPP). Through VPP, OSHA entrusts a vessel with managing safety so well that they do not have to intervene, except to assure that a program is in place. The program relieves the employer from comprehensive OSHA inspections. In addition, VPP releases OSHA resources to address more hazardous situations.

CAPT Ed Thompson talked about resource management and said that the vessel owners are probably the most important in terms of intervention because they control the money. This reminds me of the "Golden Rule", "He who has the gold, rules." The owner controls a lot of actions that happen downstream in the flow of money.

Intervention Strategies and Safety Promotion

Next, we addressed intervention strategies and safety promotion. Dr. George Conway discussed epidemiology. By using the Haddon Matrix, he showed the need to move to pre-event actions.[2] He compared the different interventions, such as the CFIVSA and where it intervenes with respect to drowning events. He identified two problem areas where we need to focus, MOB and the crab industry.

Ms. Leslie Hughes talked about safety as good business. MOB and stability are recognized problems, and she said that is where we need to work. She addressed several OSHA priorities for which her organization is providing training.

LCDR Geoffrey Rowe discussed search and rescue and its high cost. He also talked about his challenges in deploying assets such as rescue airplanes and helicopters. For this deployment there is a need for surveillance and collaboration. Surveillance can aid in predicting where the problems are going to happen and targeting interventions. Perhaps resource managers can add surveillance as a feedback into their system to help the USCG deploy assets.

Dr. Bruce Adee spoke at FISH I on vessel stability and integrity. At FISH II, he stated the need to do a lot more in improving stability, especially in small vessels. However, cost is a barrier. This may be an area for automation research. At the Fish Expo outside our doors, I saw a lot of electronics. I keep thinking that there must be a way to link the electronics together in some way to automate and simulate much of what Dr. Adee does when he goes aboard with his weights and pendulums for the stability test. With collected data, Dr. Adee returns to his computer to analyze his observations. Is there a way to automate this stability test, make it dynamic, and reduce the cost so the small vessel owner can use it?

Mr. Jerry Dzugan spoke on marine safety education and training. He had a skills list that was impressive. From a list of 18, he chose skills for teaching based upon critical factors of survivability. It would be interesting to confirm his choices in terms of impact. I was also impressed with his evaluation in which he went beyond the process to evaluate impact. He also said there is a need for re-training and performance-based training.

Mr. Bob Hopkins discussed weather forecasting. He said it is easy to forecast freezing spray, but vessel reports are needed. With remote techniques, he could only locate the temperature on the water surface when there are no clouds. The challenge is to get vessels to report weather conditions so as to increase the data points. I understand that the reason vessels do not provide this information is that they do not want to expose their positions, and thus disclose their favorite fishing sites. If they would report, its appears to be a great way to help predict weather problems, and in the future it could be connected to resource management and asset deployment decision-making.

Dr. Ray Jarris talked about optimizing medical care at sea for primary prevention. He also addressed illness, the most frequent being respiratory disease. The most frequent injuries were lumbar back injuries.

Gaps

A number of common themes emerged--fatigue, standards development, enforcement, and a standard medical kit. The issues of gaps in information from the FISH II presentations and recommendations involve overboard alarms, vessel casualties, human factors, potential interagency collaborations, and sickness.

Overboard Alarms

LCDR Geoffrey Rowe talked about taking the "S" out of “Search and Rescue.” Although, I did not hear much about this, I know it was discussed because I saw a device to signal when a person goes into the water.

I remember investigating one fatality in 1991 in Alaska. The decedent’s wife was convinced her husband was pushed overboard; in other words, a homicide. There was no evidence of that. There was a one page USCG report on the incident in which a crew member said the person was on deck by himself when he went overboard. This points out the need to know when someone goes into the water so as to signal the need for a rescue.

Vessel Casualties

How about a black box on board? Knowing where vessels are located would be useful for search and rescue by being wired into the global positioning system, so the USCG knows vessel locations at sea. The black box could automatically report back weather information too. I think there could be an organized approach to be able to map dynamically vessel locations, MOB warnings, and weather information.

Human Factors

Resource managers deal with ecology, but a broader concept is human ecology. We need to take the person into account in terms of resource-management decisions. In addition, the problem of licensing masters was raised a couple of times, and it appears to be important. The area of diving fatalities could be expanded beyond diving fatalities to include other problems, such as decompression sickness (the bends).

Potential Interagency Collaborations

In addition to OSHA's diving standards, the Navy has standards too. Jerry Scannal, President of the National Safety Council, used to be a Navy diver, and he has said that he had dived into extremely muddy water in South Carolina where he could not see. The Navy has dealt with diving in sediment-filled water, and their procedures may be useful.

As we look at the Alaska Trauma Registry as a basis for discussion, there was a suggestion that we could use USCG injury reports and Harborview Hospital records in Seattle for monitoring non-fatal disabling injuries. Ray Jarris also offered to provide his data from AEA International.

The whole area of machine guarding is ripe for interagency activity. It is an obvious problem that can be fixed, perhaps through USCG-OSHA collaboration.

Sickness

Electronic equipment used on board vessels may expose workers to electromagnetic frequency radiation. Without proper shielding, these exposures can lead to severe chronic problems such as certain kinds of cancer.[3]

Heart attacks are a problem. Work practices related to non-fatal, disabling injuries and poor physical conditioning were addressed. If a fisherman is not properly conditioned, he may be more likely to have a heart attack. This may be an opportunity for research.

In addition, carbon monoxide (CO) is a cardiotoxin, and there may be potential carbon monoxide exposures, such as from compressors used by divers. In an incident in Valdez, I investigated four fishermen on board a sports vessel engaged in a halibut derby. They came back with a heavy load and two diesel engines working hard. Exhaust was bubbling up behind the vessel. There is a phenomena in the automobile industry called the "tailgate effect". This happens when the back window in a station wagon is rolled down and as one drives down the road, the exhaust curls back up into the vehicle through the open window. As a result CO enters and poisons the occupants. The sliding glass doors of this vessel were open in back. They used the automatic pilot as they returned to port. Four crew members were down below. One collapsed, then another collapsed, and finally one fell to the floor. The fourth crew member climbed on top and was able to call the USCG. The USCG responded, towed them in, and saw that they received medical care. Not only

is CO a cardiotoxin, but it can also affect judgment at low levels and thus, it can have an injury implication.

Government Actions and the NIOSH Role

Dr. J. Donald Millar, a former director of NIOSH, and I put together a paper some years ago about what the government can do about some of these problems.[4] We developed a spectrum of coercion along which there are several possible governmental actions. See Figure 1 for a depiction of this spectrum.

Information	*Service*	*Enunciation*	*Incentives*	*Compulsion*
Least Coercive.....				.....Most Coercive

Figure 1. *The Spectrum of Coerciveness for Governmental Action*

The first action is information. An example is a weather report. It goes out to everyone, and it is free. The next action is services. This is where somebody calls and asks for help. An example is a call for help in a rescue. The third action is endorsement, such as NIOSH certifying respirators or the USCG approving floatation devices. The fourth action is incentives, which is typically thought of as being economic, but it could also be a threat. The last action is compulsion. This is enforcement, such as closing down an operation, taking property, or jailing offenders. Force is used. People in this room are actors in different parts of that spectrum, and we need to collaborate.

NIOSH is not authorized to compel. It is on the other end of the spectrum in terms of information and providing services and endorsement. Yesterday, Mr. Dzugan said that in training students, "They learned things that they did not know that they did not know." This was a wonderful observation, because I think that is NIOSH's role. With our surveillance data we try to let people know what they did not know.

I will give you an example. In 1991, LCDR Glen Sicks, the Fishing Vessel Safety Coordinator for the 17th District, was in Juneau, Alaska. He lacked accurate and complete data on commercial fishing fatalities, but had data on vessel casualties. LCDR Sicks collected data from sources such as summaries in magazines that documented drownings annually. NIOSH purchased all the death certificates for that same period, starting in 1980. This data provided an official database for LCDR Sicks to use in his database.

We found that Alaska was very high in fatality rates compared with other States and much higher in the area of fishing. When looking at the industry record of agriculture, forestry, and fishing, fatality rates were extremely high. NIOSH used its National Traumatic Occupational Fatalities (NTOF) surveillance system to count occupational fatalities based on criteria for an occupational fatality. One of the criteria was that the "at work" category on the death certificate category had to

be marked. The presumptive death certificate in Alaska did not have that category and about half the fatalities in commercial fishing were presumptive. Even though we were measuring a high fatality rate, we were only counting half of them because we were not getting the reports from the presumptive death certificates.

Richard Kennedy and I informed the State Registrar of the omission of an "at work" category on presumptive death certificate in 1991. This is an example of a person learning something that he did not know before. In January of 1992, he added the "at work" category to the Alaska presumptive death certificate. As a result, we had more accurate accounting.

Conclusion

When thinking about "value added" that NIOSH brings to fishing safety and health, NIOSH gets facts in a structured and scientific way and presents those facts to as many people as we can. The overall theme at FISH II was to move toward primary prevention. We should attempt to prevent the vessel casualty and MOB. We can use design to reduce hazards of injury and illness.

I have also speculated, why not use the electronics that are prolific on today's vessels to our advantage? Can we automate measures to provide dynamic stability information to the crew in real time? Can we have automatic weather signals go to the National Weather Service to improve forecasting? This would have a universal advantage to the fishermen and their operations and the USCG and their resource deployment. Training is also an issue. Should we require masters' certification?

Finally, I want to acknowledge and thank Mike Klatt for all of his hard work. Thank you Mike.

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SECOND NATIONAL FISHING INDUSTRY SAFETY AND HEALTH (FISH II) WORKSHOP

WORKING GROUP RECOMMENDATIONS

The following risk factors were discussed and corresponding recommendations developed during the four working groups held during FISH II. These recommendations were developed during this two-day workshop and are not a comprehensive list.

Working Group I: Prevention of Vessel-Related Fatalities

The critical etiologic factors that must be addressed by prevention efforts are vessel stability and hull integrity, licensing and training of operators and crew, fatigue and human factor issues, resource management, and the avoidance of the most harsh sea and weather conditions. The working groups' recommendations for each of these factors follow:

Vessel Stability and Hull Integrity

- Conduct periodic vessel inspection and stability reassessment of all vessels, as equipping and retrofitting can substantially affect the stability of vessels.
- Develop, implement, and evaluate minimum specifications for watertight components and bulkheads sufficient to keep swamped or capsized vessels afloat.
- Develop and implement standards for vessel design, hull design, and fishing processes.

Licensing and Training of Skippers and Crew

- Assess current training requirements and efforts, and correct deficiencies immediately.
- Require basic fishing safety training, such as those programs currently offered by the Alaska Marine Safety Education Association (AMSEA) and the North Pacific Fishing Vessel Owners' Association (NPFVOA), before an Alaskan (state) crew license or a commercial fishing permit is issued.

Human Factors

- Establish adequate watchkeeping and staffing requirements for all vessels.

Resource Management

- Examine all current and proposed management regimes from a safety and health perspective.

- Allow for local control of resource management plans when possible so that openings can be adjusted based on local conditions.

- Allow greater use of wet storage of crab pots in Alaska. To verify that vessels store pots in designated areas, consideration should be given to the use of transponders.

Harsh Sea and Weather Conditions

- Plan and conduct fishing operations based on weather information.

- Fully utilize global satellite and other new weather surveillance systems. The USCG might consider emulating FAA's Internet display of weather conditions in select locations in Alaska, by setting up similar cameras and monitoring equipment at headlands near busy fishing passages (e.g., Shelikof, etc.)

Working Group II: Prevention of Man Overboard (MOB) Fatalities in the Commercial Fishing Industry

To reduce MOB fatalities, recommendations in two different areas were developed: preventing MOBs and retrieving the MOBs from the water.

Preventing MOBs

- Conduct/implement the following "housekeeping" helpful hints and policies on fishing vessels to reduce the likelihood of people falling overboard:

  - Install temporary safety railing/line.
  - Apply non-skid surfaces on deck.
  - Keep the decks clean.

- Thoroughly study the handling of lines, especially during deployment of crab pots to reduce worker exposure to this hazard of falling overboard.

Retrieving MOBs from the water

- Conduct/implement the following "housekeeping" helpful hints and policies on fishing vessels to aid in the retrieval of MOBs:

  - Mark the location of safety gear.
  - Leave a line along side the vessel when possible.
  - Install second chance ladder.
  - Implement buddy system policy when crew are on deck.

- Require the wearing of personal flotation devices (PFDs) when on the deck of any vessel.

- Evaluate, and if proven effective, deploy MOB alarms.

- Produce a video to show the effective way to conduct MOB drills. Such a video should include:

  - A more "real life" object to retrieve (i.e., weighted dummy).
  - Different scenarios (e.g., night/day, different people onboard, etc).
  - Different retrieval systems.
  - Section on how to treat a hypothermic person.

- Develop community involvement activities (e.g., fishing vessel safety rodeos and establish PFD or other safety equipment loaner programs) to promote safety.

- Compile a list of manufacturers that provide MOB survival tools (e.g., Life Sling, ALERT, friendly PFDs) should be compiled.

- Develop new technology, such as:

  - Radar enhancement of objects in water.
  - Compact two-way communications.
  - Strobe lights and constant lights.
  - Continued PFD development.

- Compile training resources for MOB drills including:

  - Manufacturers' information.
  - Training organizations (manuals and Internet addresses).
  - Canadian publications.
  - Insurance companies.
  - Newsletters (gear-specific).
  - Video lists.

- Encourage the USCG to enforce drill compliance.

- Compile accurate information of success stories supporting these issues.

Working Group III. Prevention of Diving Fatalities in the Commercial Fishing Industry

This working group was primarily focused on diving fatalities related to fishing and did not include discussion on recreational or other commercial diving. The causes of these fatalities and related safety issues were broken down into three broad categories: vessel-related, harvest-related, and fishing support- related. There is considerable overlap in these areas.

- Determine the extent of the dive fishing industry in the country, with regard to the population involved, the safety and injury issues, and the resource management issues identified.

- Conduct research to identify and establish minimal standards in dive training, operations, and equipment.

- Prevent the use of intoxicating drugs and alcohol at dive sites.

- Develop and disseminate diver education materials with training courses.

- Develop search and rescue (SAR) and emergency medical service (EMS) standards for diving-related events.

Working Group IV. Prevention of Non-Fatal Work-Related Injuries

Most non-fatal injuries are occurring on deck while performing routine fishing tasks. However, most work-related fatalities in the commercial fishing industry are related to the loss of a vessel. The regulations covering worker safety during normal duties while on a fishing vessel are not uniformly enforced. Since many duties on deck parallel tasks that may occur in other industries, safety requirements from these other industries could be adopted. Injuries in the following categories were addressed: work practices, fatigue, training and experience, and post-incident mitigation.

Work Practices

- Perform job hazard analysis on those tasks associated with increased injuries.

- Promote pre-season fitness conditioning, including pre-work stretching and exercising, so the worker is better physically prepared for the strenuous work.

- Provide clear job training to the employee.

- Develop written standard operating procedures for high-risk tasks.

- Develop and distribute clearly defined job descriptions.

- Set clearly established safety recommendations by vessel owners.

- Use personal protective equipment (PPE) (i.e., eye protection, head protection, and personal flotation) when conditions warrant. Workers should be trained in the proper use of PPE and supervisors should be aware of conditions and situations where PPE should be used.

- Recognize employees for jobs performed safely and correctly with awards and incentives.

- Emphasize personal and supervisor's accountability in job safety.

- Perform ergonomic assessments on those tasks which include repetitive motion, and appropriate changes should be made to prevent cumulative trauma disorders.

- Ensure that equipment and tools are properly guarded. Ideas can be taken from other industries where similar machinery is used. Some suggestions include painting an outline of the crab pot launcher on the deck to warn people to stay away from while the crab pot launcher is in motion.

- Enhance safety awareness for all involved in the commercial fishing industry. This could be achieved by workshops with a focus on preventing injuries that occur to these workers, then disseminating the information in trade publications.

- Evaluate interventions.

Fatigue

- Examine all current and proposed management regimes from a safety and health perspective.

- Educate owners, skippers, and crew about the hazards and inefficiencies associated with lack of rest (i.e., increased injuries and decreased production)

- Ensure that boat captains require crew members to take advantage of provided rest periods.

- Establish a zero-tolerance program for drugs and alcohol in the industry.

- Enlighten crewmen of the side effects of over-the-counter medications (i.e., drowsiness).

Training and Experience

- Establish work and safety training programs (multilingual when appropriate).
- Establish minimum industry training standards that address injury prevention and health promotion.
- Establish industry recognition (i.e., awards) for safe and effective operators and crew by vessel class and fishery.
- Establish professional certifications for fishing crews, such as skippers, fishermen, deckhands, processors, managers, foremen, medical officers, etc. These certifications would concentrate heavily with training and safety issues.

Post-Incident Mitigation

- Standardize medical chests on board vessels.
- Establish sample protocols for on-board response to medical emergencies and mass casualties.
- Develop and maintain a database of global port medical facilities that could be available to fishermen. This database would be available for instances when the vessel might be in unfamiliar waters and has an injured or sick crew member on board.

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