

## **Deck Safety for Crab Fishermen**

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## Introduction

# Introduction

Commercial crab fishing is the most dangerous job in America. Commercial fishermen are not only at higher risk than most workers for death while on the job, but also for work-related injuries. While falls overboard or vessel sinkings cause most of the deaths to commercial crab fishermen, most of the non-fatal injuries occur on deck. With this project, we set out to find practical ways to reduce deck injuries and falls overboard, primarily by asking commercial fishermen how they reduce the risk of on-the-job deaths and injuries.

The goal of this booklet is to share ideas for safety improvements that fishermen can make to reduce injuries on their boats, increase productivity and reduce downtime. Project funding has been provided by the National Institute for Occupational Safety and Health, a division of the Centers for Disease Control and Prevention.

We started this project with a thorough review of injury data involving crab fishermen, so we would know where to focus our attention. We found that most of the injuries on crab boats were related to the pot launcher, bait chopper, and slips or falls.

We then interviewed a small group of crab fishermen to benefit from their experience in preventing injuries on their boats. Since we wanted ideas that worked, what better place to start than with working boats? From these interviews with crab fishermen, we developed a list of ideas and improvements.

We then checked our the list of ideas and improvements with crab fishermen in Dutch Harbor before the October 2001 red king crab season started. We surveyed 89 fishermen from 75 boats of many different sizes, types, and ages, asking them their opinions about different safety practices. We wanted to know which ideas were new and which safety practices were already common in the fleet.

The bottom line is always a concern for fishermen. After the survey, we estimated a rough cost for each safety improvement. This cost information will help fishermen make cost-effective safety improvements.

Of course, every boat and every fisherman is different. Some improvements listed here may not fit some boats. This booklet is a guide, and meant to help you identify high-risk areas where you might consider improvements. The most important thing you can do is take a hard look at your boat. Where are the hazards? What injuries have you seen? What can you do to prevent them?

**Consider this:** Between 1991 and 1998, 66 commercial shellfish fishermen were killed on the job. There were almost 600 injuries in Alaska fisheries that required a hospital stay during that period. Those injuries cost the fishing industry over \$5 million in hospital costs alone, and even more in lawsuits. Can you afford not to improve deck safety on your boat?

## **How to Use this Booklet**

In the following pages, the safety improvements are split into four sections: Visibility, Pot Launcher, Miscellaneous Equipment, and Slips and Falls. Each section contains ideas fishermen should consider to improve deck safety on their boats.

For each idea, we have given a general description of the improvement; its advantages and drawbacks; pictures, drawings, or sketches to help the boat owner or shipyard make the improvement; and estimated cost information. The cost information includes basic material and labor in Seattle shipyards. Costs will vary by location.



**Deck Visibility**

## Deck Visibility

If the skipper or crew can't see what is happening on deck, accidents will happen. If the crew doesn't have enough light on the working deck, they won't be as productive or as safe. Closed-circuit TVs and adequate lighting also allow the skipper to monitor the crew as they work the pots.

### Closed Circuit TV

**Benefit:** Help the skipper see the crew

**Cost:** \$200-\$1,500 for a black-and-white system

**Installation:** By vessel crew or marine electronics company

On many house-forward boats, the skipper can barely see the aft deck from the steering station, let alone the pot launcher and working area. A closed-circuit TV system can help the skipper keep an eye on the crew without leaving his chair. If the pot line is snarled or if there's another problem, he'll know right away, with no shouting back and forth between the deck and the pilothouse. If the skipper knows what's happening on deck, he can adjust the speed of the fishing as needed, improving safety and productivity. Even on a house-aft boat, a TV system may give the skipper a better view of the crew as they work.

The camera should be installed where it is protected from heavy seas and weather, under an overhang or behind a fairweather. Most cameras should be installed in watertight housing, which gives even more protection. Aim the camera so that it shows the working area from the power block to the aft end of the launcher. Once a single camera is installed, it isn't much more expensive to add a second camera, which might be used to monitor the engine room or the lazarette. On combination vessels or vessels that longline pots, a camera looking down the working deck at centerline can help the skipper keep an eye on the crew at the stern.

Costs vary quite a bit depending on the quality of the system and the number of cameras. A simple household system can cost less than \$200 off the shelf. More elaborate marine-grade systems may run as much as \$1,500 for several black-and-white cameras, a monitor, and switching gear. Color cameras, split-screen capability, and flat screen monitors all add to the system cost. However, a simple black-and-white system will provide a good enough picture to improve safety. The vessel's engineer may be able to install a simple system, or a marine electronics company can install a more complex system.



A Closed Circuit TV Camera, in a protected area of the deck

## Lighting

**Benefit:** Improve visibility

**Cost:** Depends on number and type of lights installed

**Installation:** By vessel crew or marine electrician

Crews need light to work productively and safely. Before your next season, go out to your boat at night and turn on all of the deck lights. Walk around the deck to find the darkest spots. Is there enough light for the crew to work? Make sure you look at both the hauling station and the aft deck. Would adding a light by the bait chopper or pot launcher help the crew see their work? Would re-aiming some of the lights eliminate any dark areas? If you don't have one already, consider adding a light shining over the side at the pot launcher. This light can be mounted on the foc'sle overhang or on the end of the picking boom.

You'll also want to make sure that the lights are aimed so that they don't shine into the crew's eyes. Add screens or re-aim lights as necessary to prevent glare around deck machinery or in the wheelhouse.

Costs for additional lighting vary depending on the number and type of lights, as well as whether the vessel crew installs the lights themselves. A professional installation of a single sodium wide light would cost approximately \$2,500, while a similar wattage quartz light would cost approximately \$1,000 installed. Fluorescent lights are generally cheaper than sodium or quartz lights, but can only be used in protected locations.



These lights on the boom illuminate the hauling station

## Rear-View Truck Mirror

**Benefit:** Help the skipper see the pot line as it is being hauled

**Cost:** \$50-\$100

**Installation:** By vessel crew

The truck mirror serves a similar function to the closed circuit TV camera, but doesn't allow the skipper to see as much of the working deck. Generally, the skipper can only see the pot line and the rail at the pot launcher. However, the mirror does let the skipper monitor the pot line for snarls and knots, and helps him adjust the speed of the boat to keep the pot line coming aboard smoothly. With the truck mirror, the skipper will also know just when the crew has brought the pot aboard the boat, and can keep track of how full the pots are.

The main drawback to truck mirrors is that they can be broken off by heavy seas. If your pilothouse is low to the water, or if you regularly get green water or heavy spray by your pilothouse, you may not want to install a mirror. Truck mirrors generally cost less than \$100 at auto-supply stores. The crew can easily install this mirror on the boat.



A truck mirror gives a good view of the pot line



**Pot Launchers**

## Pot Launchers

Accidents and injuries around the pot launcher are very common. Fishermen are frequently caught between the pot and the launcher, or between the launcher and the deck or bulwark. The simplest ways to prevent these injuries are to control the pots and to help the crew know where the launcher's danger zones are.

### Pot Guides

**Benefit:** Control the pots

**Cost:** Less than \$2,500

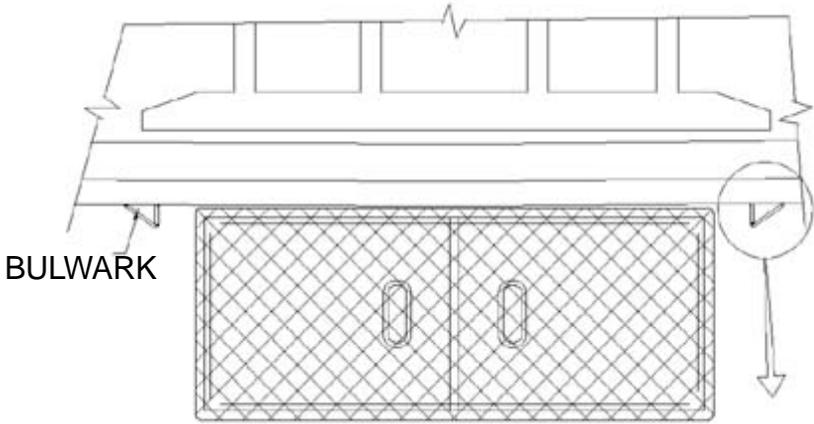
**Installation:** By shipyard

In heavy weather, do your pots swing fore-and-aft after they're out of the water but before they are in the launcher's dogs? If so, consider installing simple steel pot guides on the outside of the bulwark above the deck guard pipe. The guides will help stop the pot from swinging, reducing the chance of the pot hitting a crew member or your hauler. Since the crew doesn't have to work as hard to control the pot, they'll also be less tired, more productive, and safer. The photos in this section show two different styles of pot guides. In the top photo, the guides go all the way to the top of the rail, while they are below the rail in the second photo. Some boats only have one guide (typically on the forward end of the pot launcher).

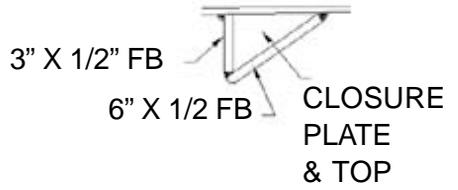
The guides should be centered on the pot launcher and at least 12 inches further apart than the width of your pots (see sketch on the next page). The guides shouldn't be any further apart than the width of the top bar of the pot launcher. Make sure that the top of the guides are at or below the top of the rail, so they don't create a pinching hazard.

Pot guide costs will vary depending on where you have the work done. In a Seattle shipyard, the total cost should be less than \$2,500.

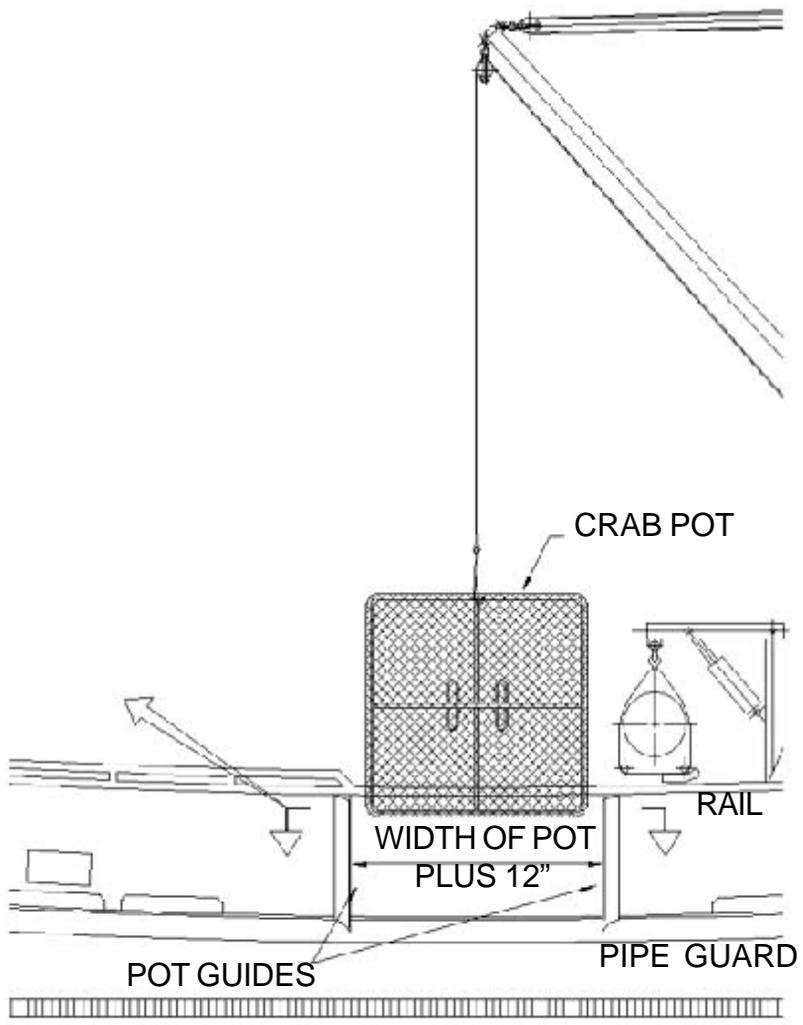
# POT LAUNCHER



## BULWARK PLATE



Looking Down- Pot Guides



A Side View

## Launcher “Footprint”

**Benefit:** Help the crew be aware of the launcher’s danger zone

**Cost:** Less than \$300

**Installation:** By shipyard or vessel crew

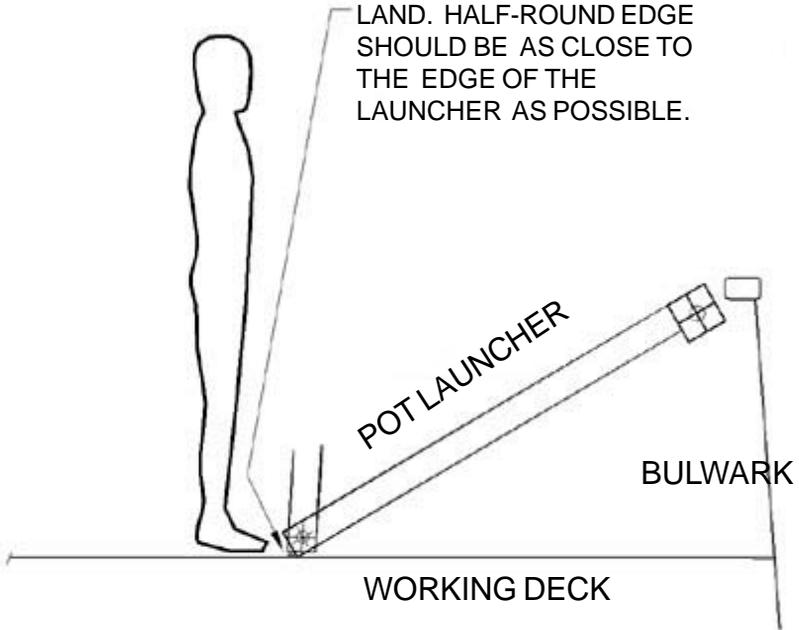
While the crew is working pots, they may not be able to tell where the launcher’s end bar will meet the deck. The launcher could easily crush a foot caught underneath the end bar. Crew members could wear steel-toed rubber boots in order to protect their feet. A raised line, either a half-round or half-oval, will also help the crew feel where the danger zone is and keep their feet safe.

The sketch on the next page shows how to install the half-round or half-oval strip around the launcher. On boats with wood wear decks, attach the strip with countersunk flathead screws. The strip can be welded down on boats with steel wear decks around the launcher.

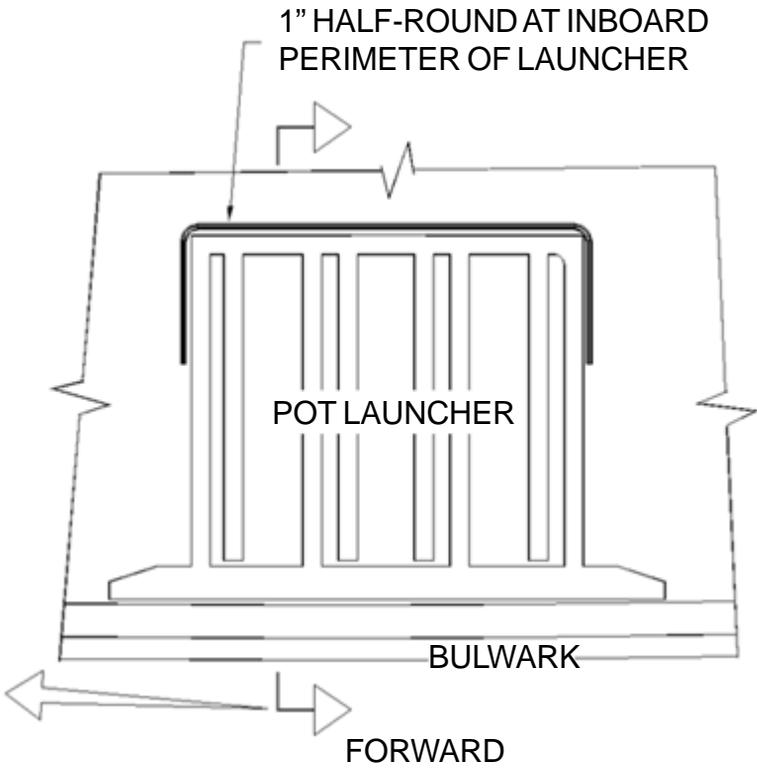
It is important to make sure that the strip is as close to the pot launcher end bar as possible so that pots won’t hang up on the strip when the launcher lifts them up on end on deck. The footprint strip is best suited for boats with launchers that land directly on the wear deck. On boats with recessed launchers, the strip may cause a pinching hazard.

The total cost of a footprint strip around a pot launcher should be less than about \$300 for a mild steel strip. A stainless steel strip will be slightly more expensive.

1" HALF-ROUND WELDED OR SCREWED TO WORKING DECK. CREW CAN "FEEL" WHERE FOOTPRINT OF LAUNCHER WILL LAND. HALF-ROUND EDGE SHOULD BE AS CLOSE TO THE EDGE OF THE LAUNCHER AS POSSIBLE.



Pot Launcher Foot Guard, Side View



Plan- Pot Launcher Footprint

## Paint the Launcher or the Deck

**Benefit:** Help the crew see the danger zone

**Cost:** Less than \$100

**Installation:** By vessel crew

While you're out on a typical day on land, you'll see painted lines marking dangerous areas. Unless you're in a factory, most of the lines will be on the road, marking out lanes, shoulders, passing areas, etc. Lines help you stay on the road where you belong.

Consider putting these lines and their safety benefits to work on your boat. Paint a yellow line around the base of the launcher, or even on the launcher itself. Obviously, the paint will wear off of areas where the pots rub the decks or the launcher. However, on the deck right next to the launcher there is a clean strip where the pot never touches. Also, anywhere on the launcher that hasn't had all of its regular paint worn off will be a good place to put safety paint. While you're at it, you could also make the paint reflective by using glass beads in the final coat. If you don't want to use paint, consider colored or reflective tape instead. Total paint and/or tape costs for a typical pot launcher will be less than \$100. This solution won't last as long as the footprint strip previously described, and will require more maintenance.





**Miscellaneous Equipment**

## Miscellaneous Equipment

The pot launcher is only one of the hazards on deck. Other machinery, including the crane and bait chopper can also be dangerous. Relatively minor modifications to these pieces of machinery can greatly improve safety on your boat.

### Bait Chopper Guards

**Benefit:** Protect the crew from the chopper

**Cost:** Less than \$50

**Installation:** By vessel crew

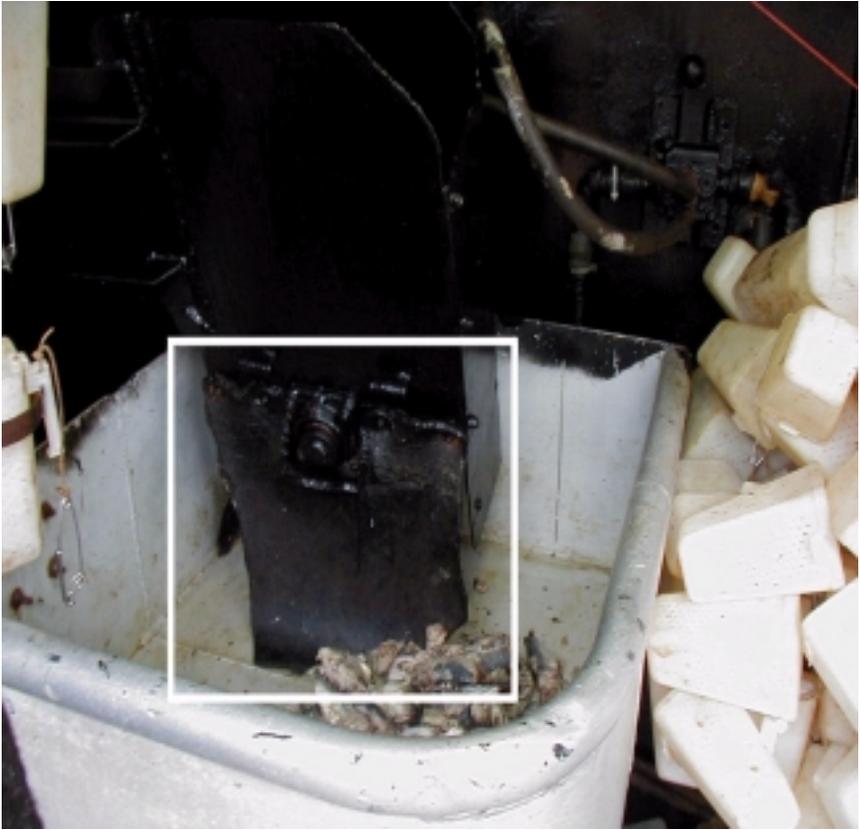
Take a look at your bait chopper. Could a green or tired crew member put his arm in far enough to chop up his fingers as he pushes on the bait block? Could he unintentionally touch the blades on the bottom as he scoops out bait? If so, a guard will help protect your crew. A standard warning sticker may remind the crew to keep their hands out of the chopper. You may think that nobody would put his hand into a bait chopper, but someone is badly injured this way once a year, on average.

If you have space above the bait chopper, extend the chopper box so nobody can reach the chopper blades from outside the box. If you can't extend the box, consider installing a guard over the top. In either case, also consider adding a guard on the bottom of the chopper. The guards do not have to be complex. A simple piece of conveyor belting with a rope can be a very effective cover guard (see photo on page 26). If the teeth on the chopper are getting dull, the crew member can pull on the cover guard to push the bait through the chopper, keeping his hands outside the chopper box. This cover guard also helps keep all of the bait in the chopper, rather than out on your deck.

On the bottom of the chopper, make sure that the crew's hands are well protected by installing a flap of flexible heavy rubber or conveyor belting (see photo). As the crew reach under the chopper, they'll push the bottom guard up over the bottom of the chopper box, protecting their hands. The photos in this section show guards for the top and bottom of your bait chopper.



Bait Chopper Cover Guards can save fingers!



A bait chopper bottom guard protects the crew's hands as they scoop out bait

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Another alternative is the newer “brush cutter” style bait chopper that doesn’t require pushing on the block, chops bait faster, and increases productivity.

A bait chopper guard like one shown here can easily be made for less than \$50 by the vessel crew. A new “brush cutter” style bait chopper costs about \$2,000-\$3,000, depending on the manufacturer.

## **Crane Maintenance and Markings**

**Benefit:** Prevent crane breakdowns

**Cost:** Varies

**Installation:** By vessel crew and/or crane contractor

The boat's crane can be one of the most under-appreciated pieces of machinery on board. Remember that if any part of the crane fails, one of your crew may be injured or killed. At the very least, you will have to stop fishing until you can make repairs.

You should inspect your boat's crane before each season to make sure that it is in good repair. Make sure that the wire rope is in good condition, with no broken strands or corrosion. The controls should work smoothly and use a standard configuration. The safe working load should be marked on both sides of the crane boom, and properly labeled. Make sure that everyone who uses the crane respects the safe working load limits. Overloading the crane could cause an injury or death, will shorten the crane's life, and make for expensive repairs.

If you have a straight-boom crane on board, you can make it easier for the crane operator to bring a pot from the stack to the pot launcher. Align the crane boom and hook directly over the center of the launcher. Now paint a stripe across the fixed and moving parts of the crane pedestal and/or the telescoping boom. When you are bringing a pot to the launcher, you'll know at a glance that it is exactly lined up with the launcher when the stripes are aligned with each other.

Consider taking a crane safety class and/or having your crane inspected by an outside inspector. Classes cost less than \$200 and will give you a new respect for your cranes and lifting gear. A crane inspection and certification will cost approximately \$500 if the boat is in the Seattle area. If the crane inspector does find problems with your crane, remember the consequences of failure when you are deciding whether or not to make repairs.

## Hydraulics System

**Benefit:** Make your hydraulics system work more efficiently and safely

**Cost:** Varies

**Installation:** By vessel crew and/or hydraulics contractor

The boat's hydraulics system must work well for you to fish efficiently and safely. Your equipment will also last longer if the system is well designed and maintained.

Crane and machinery control valves should work smoothly, without sticking or jerking. If your crane controls are too sensitive or too slow, contact a hydraulics expert to fix the problem. Jerky crane movements will wear out your crane quickly.

If at all possible, your hydraulics system should have an emergency shutdown separate from the machinery controls. The shutdown should be located either on the working deck or somewhere with a good view of the working deck, such as the wheelhouse on a house-aft boat. If you like, you can also have separate shutdowns for different pieces of machinery. For example, you could stop the pot launcher without stopping the crane if the shutoffs were set up properly.



## Slips and Falls

## Slips and Falls

Fishing is a slippery business, and most fishermen accept falls and slips as inevitable. However, most, if not all, of these kinds of events are preventable. While slips on board a ship may not result in fatal injuries, they can lead to broken bones, lost productivity, and a diminished catch. A fall overboard can quickly lead to a crewmember's death. How many slips or falls can you really afford? This section will discuss ways that you can prevent falls and recover a crew member who falls overboard.

### Man-Overboard Recovery

**Benefit:** Recover crew members quickly

**Cost:** Varies

**Installation:** By Vessel Crew

We cannot overemphasize the importance of holding regular safety drills on board your vessel. Safety training is readily available in the Northwest through the North Pacific Fishing Vessel Owners Association (206 285-3383) and the Alaska Marine Safety Education Association (907-747-3287). With a trained drill instructor on board your vessel, you will also have the benefit of a knowledgeable crew member who is able to train other crew members on emergency procedures, and who is able to help run periodic safety drills aboard your vessel.

Regular safety drills will allow your crew to practice man-overboard recoveries. The two most important parts of a man-overboard recovery are making sure that the victim has plenty of flotation and recovering him quickly. You don't have much time to pull a crew member out of the water before he succumbs to hypothermia. To ensure that a man overboard victim remains afloat, make sure that you have plenty of life rings on deck near your normal fishing work-stations. If you can, mount life rings at the aft corners of the working deck, so crewmen can run back to toss a life ring before the victim is too far astern. On combination boats, the stern gantry is a good place for mounting the rings. Wherever they're mounted, the rings should have strobes and smoke bombs either attached or nearby. Life rings typically cost less than \$100. Make sure that you have a survival suit with a lifeline available

for a rescue swimmer if necessary. Consider buying line-throwing bags (about \$50) that allow you to throw a line further and more accurately than a life ring.

The first part of recovering a man overboard is maneuvering your ship back to him to retrieve him from the water. There is no substitute for practicing this! Next time you are transiting, have a crew member throw a floating object over the side without warning you first. Practice your approaches to the “victim” until you can do it in your sleep. When you are choosing what to throw overboard, be realistic. A buoy bag is easier to see than a person and won’t be nearly as hard to pull over the rail as a person, even if the victim is able to help. If you have to use buoys, attach a couple of buckets to the line to simulate the weight of a person.

Now you know how to get back to the victim, how do you get him back on to the boat? Again, this will be different for every boat, but you can practice this, too. Before you leave port for a fishing season, practice man-overboard drills with your crew. Consider putting a crew member into the harbor (with a survival suit) and trying to retrieve him while you are at dock. Can you make the recovery? Could you improve your emergency plan? Next, try having the “victim” pretend to be unconscious, and send a rescue swimmer to recover him. How will you deal with a man overboard at sea? Do you need more equipment to retrieve your crew, such a life ring, Lifesling (about \$200), a dedicated rescue swimmer’s survival suit (about \$300), etc.?

Finally, think about how much easier it is to find and recover someone who is wearing a lifejacket. We have all heard about how modern lifejackets are far more comfortable than they once were, and how current models are light enough that crew members can work in them all day long. Go out and find a lifejacket that you will wear on deck. Make sure that the crew always wear lifejackets on deck, and provide a variety of different styles for them to choose from. Brightly colored lifejackets make it easier for the crew to spot a victim in the water. Lifejacket costs range from less than \$50 for simple work vests to over \$300 for float coats.



Frequent safety drills promote survival

## **Gratings on Hold Manholes**

**Benefit:** Reduce icing on deck, prevent falls into the hold

**Cost:** \$150-\$600 per opening

**Installation:** By vessel crew

Quite a few crab boats have gratings mounted in the manholes or loading hatches into the main holds, instead of the watertight covers. These manholes have two main jobs: the water flowing over the deck helps reduce icing in some conditions, and they allow water to flow out of the hold while preventing crew members from falling in.

The simplest grating is an expanded metal or perforated sheet metal grating . Galvanized steel bar gratings with banded edges are somewhat sturdier. Either of these methods is inexpensive and long lasting. The gratings should be removable so that you can reinstall a water-tight hatch and maintain the watertight integrity of the boat with the hold empty.

However, some fishermen are more inventive: some hatches have covers with holes drilled in them to let the overflow water out. If you have some old, leaky hatch covers, or if your current covers don't seal properly, consider putting them to good use as gratings. Make sure that the holes are no larger than one inch in diameter or they may become a tripping hazard. Also make sure that you have a watertight manhole or hatch cover for each opening.

Hold gratings should cost as little as \$150 per hatch for an expanded metal grating, or about \$600 per hatch for a new hatch cover. The vessel crew can install the gratings.

## Non-Skid Gratings

**Benefit:** Help prevent slips in low-wear areas

**Cost:** Approximately \$20 per square foot

**Installation:** By shipyard or grating specialist

Most crab boats have a few specific areas where the crew spends most of their time. These are places like the bait chopper station, the crane and launcher control station, or the hauling station. These are also places that are protected from pots, and don't see the same wear and tear as the rest of the working deck.

Consider installing non-skid grating in these areas to help the crew keep their footing. There are two general grating options: metal and fiberglass. Aggressive metal non-skids last longer than fiberglass, but may be more likely to injure the crew if they do fall. Fiberglass gratings can be more comfortable to walk on, and will not make a fall injury worse. In either case, the grating must be maintained and broken sections replaced. Gratings typically cost around \$20 per square foot installed. Gratings are normally installed by a specialized installer or a shipyard. The phot on the next page shows a typical fiberglass grating next to the steel wear deck at the hauling station.

An alternative to the non-skid gratings is fiber doormats. These mats are cheap and provide good non-skid protection for a single station, such as the crane control or one side of the hauling station. Lay these mats down wherever you need the extra traction, and consider attaching them to the deck with screws and washers to keep them from shifting. Fiber mats cost less than \$20.



Non-skid gratings in low-wear areas help prevent falls



Fiber mats can prevent falls in slippery areas

## **Rail Height**

**Benefit:** Keep the Crew Aboard

**Cost:** About \$100 per foot of rail

**Installation:** By shipyard

Walk around the deck of your boat. Are any of the rails lower than waist-high? If so, consider adding pipe rails to help keep your crew from being washed overboard by waves. Pipe rails are a cheap, easy way to help prevent a man-overboard emergency. They also provide a convenient spot for you to tie buoys, pots, or other gear. Pipe rails generally cost about \$100 per foot of rail. A 2" or 3" Schedule 40 pipe gives a good combination of strength and light weight.

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## **Seawall/Fairweather**

**Benefit:** Protect the Crew

**Cost:** About \$400-\$500 per foot of bulwark, for raising the bulwark 4 feet plus \$6,000-\$7,000 for a new stability booklet

**Installation:** By shipyard

Most crab boats have some sort of fair-weather or seawall on the port side, usually running from the house back to the crane. This wall helps protect the crew from heavy seas and high winds as they work the pots.

Consider adding to the fairweather on your boat. You could perhaps extend it to the stern on the port side, or even enclose the entire deck except for the hauling station. The crew will be able to work harder and more productively if they don't have to worry as much about the next wave.

Fairweathers are relatively expensive, and the extra weight can reduce your pot load. Fairweathers will also affect vessel stability. For every thousand pounds of steel that goes on the boat, you can expect to lose a thousand pounds of allowable deck load. Depending on your particular vessel, it can be less or more. A naval architect can give you more guidance on this issue.

Typical costs for fairweathers are about \$350-\$400 per foot of rail for raising the bulwark four feet above the current bulwark top. A new stability booklet costs approximately \$6,000-\$7,000.



High bulwarks help protect the crew from the weather