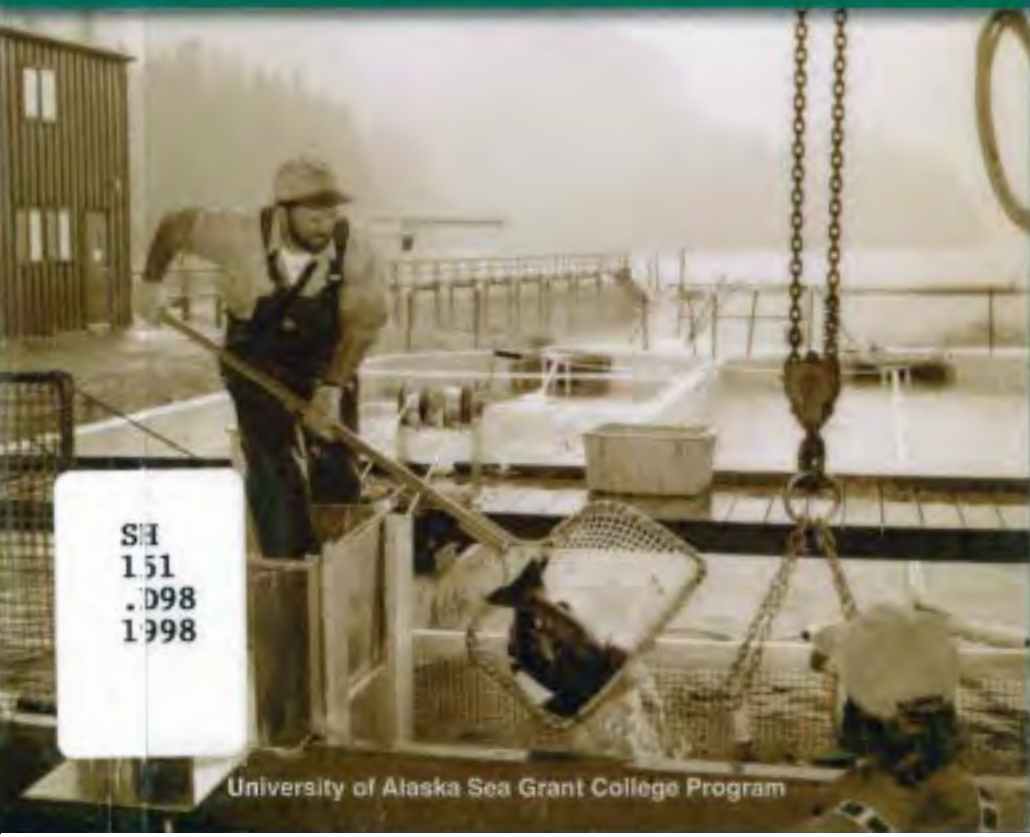
Spawn, Spat, and Sprains

A Manual for Aquaculture Safety in Alaska



University of Alaska Sea Grant College Program

Seven Steps to Survival

In a survival situation, the decisions you make will be more important than the equipment you carry!

Make the decision to live. Follow the seven steps:

Recognition: Admit that your life is in danger. Act!

Inventory: Decide what can help and hurt. Do first aid.

Shelter: Preserve body heat with insulating materials.

Signals: Help rescuers find you.

Water: Find a safe source of water, drink six pints a day.

Food: After you are safe and warm, food will help long waits.

Play: Stay busy and keep a positive mental attitude.

Caution and creativity are your best friends. **USE THEM.**

Spawn, Spat, and Sprains

A Manual for Aquaculture Safety in Alaska

Jerry Dzugan
and
Dan Falvey

Alaska Marine Safety
Education Association

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Alaska Marine Safety Education Association
AMSEA is an independent nonprofit group of people and organizations united to promote education aimed at reducing the rate of accidental injuries and fatalities in the Alaska marine environment.

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Introduction

This aquaculture safety manual is a source of information for the aquaculture employee. The primary purpose is to provide information on safety risks and methods of risk reduction for employees. In addition to requiring employees to read the safety manual, an aquaculture operation may want to develop a safety plan for their site. Regularly scheduled safety sessions are recommended to provide an excellent, proactive approach to incorporate safety into the workplace. Regular training sessions with employees ensure adequate and uniform safety training, to alert employees to safety issues related to work activities.

An aquaculture operation may also elect to set up a safety training program for their facility. To assist with this, safety training schedules for salmon ranching and aquatic farming are suggested below. When making your safety plan, consider the Alaska Marine Safety Education Association (AMSEA) as an additional training resource.

Salmon Ranching

Salmon ranching has specific seasons of activities and associated risks. Although many activities are year-round, the intensity of certain activities changes with the seasons.

Salmon ranching safety instruction program, topics and seasons:

Activity	Season	Safety Training Topic
Remote egg-take	Fall	Workplace hazards Airplane safety Ergonomics/lifting and moving Injuries from fish Bears Small boat safety Cold water survival Cold injuries Shore survival Fire fighting and prevention
On-site egg-take	Fall	Workplace hazards Ergonomics/lifting and moving Injuries from fish Cold injuries Electrical hazards on the water
Egg incubation	Winter	Workplace hazards Heavy lifting Chemical hazards Fire fighting and prevention
Smolt rearing and release, egg-take	Spring/fall	Airplane safety Small boat safety Cold water survival Cold injuries

Aquatic Farming

Aquatic shellfish farming differs from salmon ranching in several ways. The main difference is that operating a fish hatchery is primarily a land-based activity, and aquatic farming is not. Working on floating farm structures, and transporting equipment and products to and from aquatic farms subject aquatic farmers to risks more like those of commercial fishermen. Also, aquatic farming does not have the strict seasonal sequence of tasks required in salmon culture. Alaska aquatic farmers manage their farms year-round, except in the most northern areas of Prince William Sound

and Kachemak Bay. Being on the water much of the time requires that farmers be more concerned with marine and water safety.

Shellfish farming requires employees to handle thousands of shellfish on a regular basis in a wet marine environment. Employees risk falls, repetitive injury, injuries caused by lifting heavy objects, hypothermia, and infections caused by lacerations.

Aquatic farmers also transport workers and guests to and from the farm site. Boat transportation is therefore an integral part of a farm operation and farmers need to be aware of safety requirements for boats used for human transportation. Since boat transportation is not paid for by those being transported, the U.S. Coast Guard regulations for recreational boaters apply. The best source of information concerning these safety requirements is the U.S. Coast Guard.

Although the entire safety manual is important, all aquatic farmers and their employees should study more intensively the sections of this book listed in the following table.

Aquatic farming safety instruction program, topics and seasons:

Activity	Season	Safety Training Topic
Farm maintenance	All	Small boat safety
All farm activities	All	Cold water survival
Shellfish handling	All	Fish poisoning and infections Repetitive motion injuries
Winter farm activities	Winter	Cold injuries

Safety Sessions

Attaining an attitude of safety is important to preventing injury at an aquaculture facility. For every task a set of risks must be identified and deliberate action initiated to prevent injury. Read this manual, hold regular safety meetings, and provide safety training to create and maintain a safe workplace.

In addition to covering information in this safety manual, safety sessions should also include:

1. Review of past safety performance.
2. Input from employees concerning past activities and suggestions to improve safety.
3. Description of upcoming activities.
4. Review of safety considerations shown in the table.

Safety training should include the following:

1. Review of potential safety problems and past experiences.
2. Safety briefing for each piece of equipment used.
3. Review of the hazardous materials safety data sheets (MSDS) for all chemicals used.
4. First aid instruction for treatment of injuries that may result from the activity.
5. Review of injury reporting requirements.
6. Discussion of consequences when emergency procedures are not followed.

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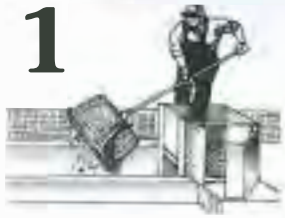
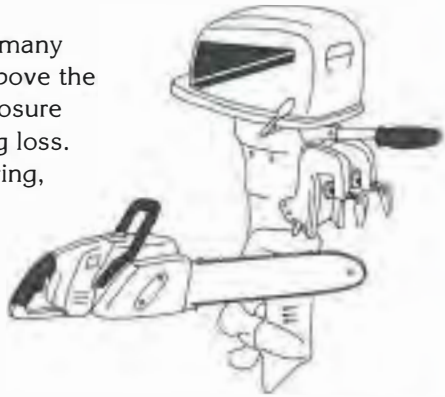
Workplace Hazards



Aquaculture operations in Alaska often involve working with equipment and/or chemicals in cold, wet locations. All workers should be aware of the hazards associated with the environment they are working in and the materials they are working with.

Physical Hazards

Noise



Outboards, chain saws, and many power tools produce noise above the level at which long-term exposure will cause permanent hearing loss. In addition to damaging hearing, excessive noise can make one unaware of alarms or dangers and also places a strain on the heart. Noise levels above 70 decibels (dB) can mask a warning given by someone only a short distance away. Hearing protection should be worn when operating loud equipment or when the average noise level exceeds 85 dB—when you need to shout to be heard. (See Noise Range of Common Sounds, page 11.)

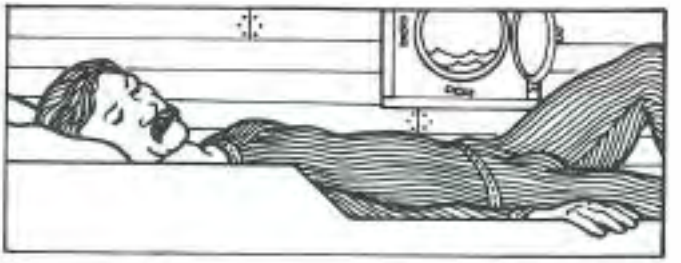
Tools and Machinery

Power tools offer great time-saving convenience. However, they should only be used by those familiar with their operation. Inexperienced operators should receive an orientation emphasizing proper use of the equipment and potential hazards. Maintenance and safety instructions should be accessible and reviewed periodi-

cally. Cutting edges should be kept sharp and safety guards should not be removed from tools. When not in use, power tools should be unplugged.

Sleep Deprivation

Human error is responsible for 80% of the casualties in the maritime industry. Fatigue affects our cognitive abilities more than our physical abilities, and is often responsible for falls, knife cuts, and other injuries. Fatigue also causes routine tasks to be performed more slowly, slows learning of new tasks, hinders reaction time, and impairs decision making.



SLEEP is the only solution for fatigue. The highest quality sleep is deep sleep which allows rapid eye movements (REM). REM cycles last 1½ to 2 hours. Usually two to three REM cycles must be completed for a person to feel well rested.

Although sleep is the only solution for fatigue, you can follow these recommendations to reduce injuries due to sleep loss.

- Allow 15 minutes for people to fully wake up before they begin dangerous tasks.
- Mental tasks are best performed in the morning, physical tasks in the afternoon.
- Rotate jobs to reduce boredom.
- Spirited music, fresh smells, tasty drinks, and fresh socks all provide important stimulation.

- Keep an eye out for others, especially when working in hazardous areas.
- Let break times be known so workers can pace themselves.
- Stimulants such as caffeine are effective in the short term, but over the long term they challenge the cardiovascular and digestive system.
- Use full spectrum lights.
- Encourage a positive work environment and teamwork.
- Eat regular and nutritious meals.
- If you have to work around the clock, six-hour shifts are more effective than four-hour shifts.
- If only a few hours of sleep are possible, sleep between 2 am and 4 am in a spot where you won't be disturbed.

Dehydration

The resting human needs at least three quarts of water a day for respiration, digestion, and urination. A one- to two-quart water loss can cut the body's efficiency by as much as 50%. Many workers do not take in enough water during the course of the day. Cold environments, sweating, and the intake of diuretics such as coffee and sodas can increase the need for water to a total of 16 quarts per day.

The most common symptom of dehydration is a headache. Often it is the glass of water you take with an aspirin, not the aspirin itself, that helps relieve a headache. There is no substitute for water or an electrolyte balanced fluid. To be at your peak, keep a container of water at hand and keep those fluids coming in!

Preventing Falls

Slippery walking surfaces can be treacherous, increasing the potential for a variety of injuries or unexpected falls into cold water.

- Identify fall hazards and make a plan to address each one.
- Wear proper non-skid footwear for the job, such as felt-soled boots for walking on slippery rocks in streams.
- Install guard rails around the edge of floating structures.
- Texture traffic paths with non-skid surfaces, including

- Non-skid paint.
- Roofing shingles or other rough material nailed to wood floors or decks.
- Non-skid grate material.
- Wire mesh.

Physical Agent Data Sheet (PADS)

Additional information on physical hazards can be found on the Physical Agent Data Sheet (PADS) each employer is required to have. PADS provide specific information on health effects, exposure limits, protective measures, and first aid for conditions found at the job site. These sheets are available from the Alaska Department of Labor.

Chemical Hazards

A wide variety of chemical agents is used in aquaculture operations. Many of these agents such as formalin, chlorine, iodophor, diquat, and quaternary ammonia are considered hazardous materials. A hazardous material is any chemical or physical agent that is:

- Ignitable—has a flash point under 140°F.
- Corrosive—has a pH less than 2.0 or greater than 12.5.
- Reactive—explodes or releases harmful fumes.
- Toxic—is poisonous.

Hazardous materials can be used safely if the proper protective equipment is worn and handling instructions are followed.

Labels and Information

All hazardous materials are required by law to be labeled by the manufacturer. These labels identify the chemical and give precautions about its use. If a hazardous chemical is transferred to a secondary container and not immediately used, the secondary container must also be labeled.

Additional information about the chemical can be found on the Material Safety Data Sheet (MSDS). An MSDS covers the physical and chemical properties of the agent, physical and health hazards, methods of exposure, safe handling precautions, and emergency first aid measures. Employers are required to have an MSDS on each hazardous chemical used, and employees should read the MSDS on any chemical or solution they are not familiar with.

If you are using a chemical, and experience any of the following symptoms, you should immediately find out more about the chemical and the appropriate protective equipment to use.

- Any burning of the inside of the nose, mouth or throat, face or ears.
- Anything that makes you cough or makes your eyes water.
- Any numbness or tingling of the lip, gums, or tongue.
- Headaches or light-headedness.

Personal Protective Equipment

Working safely around chemical agents or physical hazards requires the proper protective equipment. In most aquaculture settings, this begins with warm clothing, rain gear, gloves, and rubber boots.

Clothing

Wearing multiple layers of clothing is the best way to dress for Alaska's climate. The layer next to your skin should be made of a material that wicks perspiration away from the skin toward outer layers of clothing where it can evaporate. Polyethylene and polypropylene are good choices for an inner layer. The middle layers need to provide enough insulation to keep you warm both at work and while resting. The outer layers must protect you from the elements which, in coastal Alaska, usually means wetness. Rain gear and float coats are good choices for outer garments. Rain gear should also be worn when handling chemicals to prevent spills and splashes from coming in contact with the skin.

Gloves

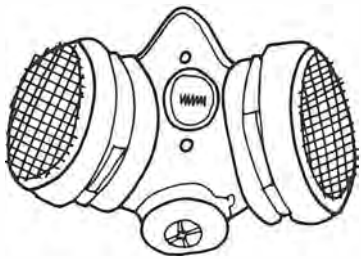
The gloves you wear must be made of a material resistant to the chemicals being used. The orange PVC gloves that have become very common are resistant to many chemicals, but are not recommended when handling ketones or chlorinated hydrocarbons, and are marginal when handling petroleum products or aromatics like toluene. Polyethylene gloves are good protection for handling these materials.

Gloves also provide protection from physical hazards that cut and abrade skin. The second highest cause of injury in aquaculture is from cuts. A number of manufacturers are now producing cut-resistant gloves of Kevlar material or gloves which have a fine stainless steel mesh inside a fabric layer. Most of these gloves are not waterproof, but disposable latex gloves can be worn underneath. This type of glove system can also be worn when you are using power tools.

Eye Protection

Safety glasses with side panels are a must whenever the work you are doing throws particles in the air. Goggles or a full mask should be worn when handling chemicals to prevent splashes from reaching the eyes. Contact lenses should be removed as they can absorb fumes or trap droplets of hazardous fluids against the eye.

Respirators



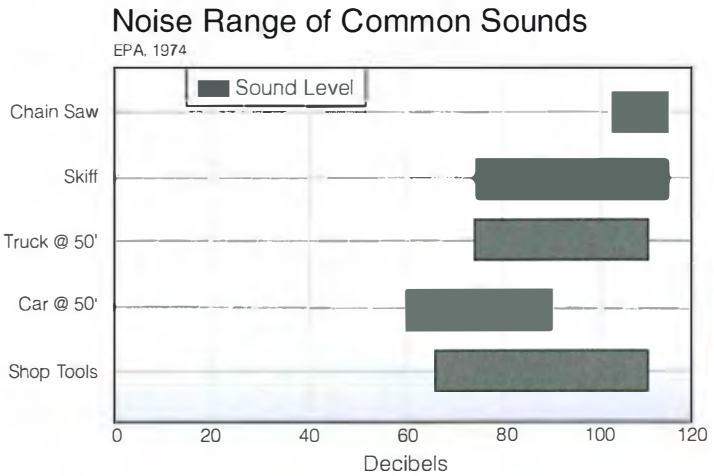
Disposable face masks can be used to prevent inhaling particles or dust. However, when using chemicals which generate fumes, you must use an air purifying respirator with a filter cartridge. In enclosed environments with high concentrations of fumes, full protective gear with an external air supply is sometimes needed.

Be sure the respirator you are wearing and the cartridge in the respirator are effective for the chemical you are using. For example, cartridges for organic vapors, lacquers, enamels, dusts, and pesticides may not be rated for paints containing isocyanates (polyurethane and acrylics) or amine-producing epoxies. Read the labels to be sure the filter cartridge is appropriate for the job.

Before you begin the job, check your respirator to make sure it is in good working order. Make sure the mask fits snugly. Wear it during the mixing, application, and cleanup process. With a good fitting respirator and a fresh cartridge, you should not be able to smell the vapors of the compounds you are using. Store the respirator (or at least the cartridge filters) in an airtight bag. The filters continue to work when left out in the open. Replace filters as recommended because they lose their effectiveness over time.

Hearing Protection

Most hearing protectors have a noise reduction rating (NRR) printed on the side. Choose the hearing protection with the highest NRR rating that allows you to still work comfortably at your job.



Earmuffs

Earmuffs can be conveniently placed near loud machinery and worn by anyone. They are effective at filtering out the harmful high frequency sounds while still enabling you to hear your coworkers. Be sure to get the ones with soft rubber ear pads, not hard muffs.

Earplugs

Disposable earplugs are very inexpensive. They are small foam cylinders that squeeze into the ear and are good at filtering out high frequency sound. Cotton wads in the ear and rubber earplugs

are ineffective. They cut out only the low frequency noise which does little harm. Custom-fitted earplugs are also available. They are very effective and the most comfortable since they are custom fitted to your ear.

Remember, the most effective noise protection is the one you will wear.

Sources and Further Reading

1996 Emergency Response Guidebook. U.S. Department of Transportation. Available at (800) 621-5808.

Hazardous Materials On Board, by C. Hild. University of Alaska Sea Grant, MAB-43, 34 pp., 1997 2nd edn.

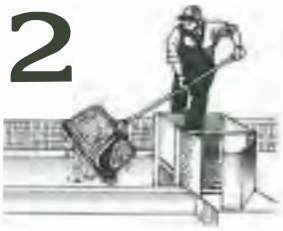
NIOSH Pocket Guide to Chemical Hazards. National Institute for Occupational Safety and Health, No. 94-116, 1996, (800) 356-4674.

Physical Agent Data Sheets (PADS). Alaska Department of Labor, Labor Standards and Safety, (907) 269-4952.

Safer Chemical Use in Alaskan Aquaculture. Alaska Department of Fish and Game, FRED Division, Version 1.2, 68 pp., 1998.

Ergonomics: Lifting & Moving

2



According to Alaska Worker's Compensation data, strains, sprains, and repetitive motion disorders are the single largest source of injuries in Alaska's aquaculture industry. These injuries cost hundreds of thousands of dollars in claims, and thousands of hours of lost time each year.

Because there is no "magic bullet" or single trick for the prevention of these widespread injuries, a systematic or holistic approach is needed to reduce these injuries.

An ergonomics safety program should include at least some of the following components.

- Fall prevention
- Appropriate use of back braces
- Proper lifting procedures
- An exercise program

- Ergonomically designed tools
- Appropriate gloves
- Work tables at the correct height
- Facilities that are ergonomically designed
- Proper nutrition
- Adequate sleep
- A work rotation schedule which includes rest periods for repetitive jobs
- Keeping body weight within acceptable ranges
- Proper attitude

Fall Prevention

Maintaining solid footing is the first step to prevent moving and lifting injuries. Alaska's wet and slippery coastline is a hazard at the best of times. Soles of shoes worn on the job should have good gripping action. Working surfaces should be textured to improve traction. Roofing materials and non-slip paints can be used on smooth surfaces to reduce fall hazards. Planks used to access remote sites in the woods should be etched with chain saws to allow water to run off. Pay special attention to areas of higher risk, or near the water.

Back Braces

Back braces are controversial. However a recent study among hundreds of air cargo handlers has demonstrated that back braces are effective **IF USED WITH PROPER LIFTING TECHNIQUES.** It is important that braces are worn only when lifting—long-term use of braces when not lifting can lead to muscle degeneration.

Proper Lifting and Moving Procedures

The spine naturally has a gentle "S" shape, curving inward at the neck and small of the back. This helps absorb the shock of walking and running. Any activity that straightens out one of these natural curves (like

bending over at the waist to pick up a heavy object) will cause strain. This increases pressure on the liquid-filled cartilage, called disks. Over time and with acute strain, the liquid can leak out, resulting in a ruptured disk.

Steps for Lifting and Moving

- Warm up muscles before using them.
- Estimate the weight of the article to be lifted or moved and set up the job.
- Slide, don't lift, whenever possible.
- If an object is more than 60 pounds, at least two people should lift it.
- Pair up weak and strong lifters.
- Two or four people are better than three people, for balancing.
- Keep your back in a normal "S" position. Use a squat lift:
  - ➡ Place your weak leg forward and place your other foot flat on the ground.
  - ➡ Bend your body 30 to 50 degrees and lock your back.
  - ➡ Make sure your upper body comes up before your hips.
  - ➡ Keep your heels on the ground.

- Use your leg, buttocks, and abdominal muscles while lifting.
- Keep the weight as close to your body as possible.
- Communicate with your partners about what you are doing. Have a plan before lifting large or very heavy objects.
- Avoid lifting above the waist and then bending backward.
- Avoid carrying heavy weights with just one arm.

- Avoid bending. If you **MUST** bend, bend from the hips and not the waist.

Rules for Reaching

- Keep your back in its natural "S" position.
- When reaching overhead, avoid a sway-backed position.
- Never twist your back when reaching.
- Try to avoid reaching more than 15 to 20 inches.
- Design reaching poles for your specific job if more reach is needed.

Rules for Pushing and Pulling

- Keep back straight and locked. Don't bend over and round the spine.
- Keep the effort at a height between your waist and your shoulders.
- If heavy object is below your waist level, push or pull from a kneeling position.
- If given a choice, push rather than pull.

Rules for Sitting

- Do not sit for more than 45 minutes at a time.
- Use a lumbar roll for the small of your back (a small rolled up towel will do).
- Keep feet flat or crossed at ankles.
- Don't slouch.
- Bend from the hip, not the waist, when moving forward.

Exercise

Any injury prevention program should include some exercise to keep muscles in tone. Exercise should be gentle and not cause pain. Remember to work at your own pace; low impact exercise is the goal.

Repetitive Motion Disorders

Repetitive motion disorders such as carpal tunnel syndrome (CTS) and tendonitis are common in the aquaculture industry. They can be debilitating and lead to long-term loss of function that affects both the quality of your work and your quality of life away from the job site.

Carpal Tunnel Syndrome (CTS)

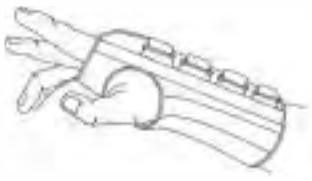
CTS is a debilitating condition of the hand. It occurs when stress on the palm of the hand causes the tendons to swell and put pressure on a tunnel through which the median nerve passes. This nerve carries signals from the brain to the hand, allowing it to open and close. If CTS is not corrected, permanent damage can result.

Signs and Symptoms

- A prickly sensation is felt in the hands. If severe enough, it can prevent sleep.
- A dull throbbing ache is felt in the wrist. It can extend to the shoulders and the neck.
- A weakness and clumsiness develops in the grip.
- A numbness in the fingers; a burning sensation in the hand; a swelling of the hand and forearm; or changes in the hand's sweat, touch, and temperature sensation develop.
- The symptoms seem to worsen during the night.

Treatment

- Rest and immobilization with splint.
- Anti-inflammatory drugs (aspirin or ibuprofen).
- Acupuncture is effective for some people.
- Surgery is 75% to 90% effective.



- Changes to work habits are the key to prevent recurrence.

Tendonitis

Tendons are tough tissue that connect bones to muscle. Tendonitis is the swelling of tendons caused by stress, such as long periods of pulling with hands. Repetitive work, sudden peak loading, and cold working conditions typical of aquaculture sites can cause this condition and make it worse.

Signs and Symptoms

- Swelling, pain, stiffness, and tenderness.
- Crepitus (or creaking, squeaking sounds made in tissue).
- Weakness and loss of function in limb.

Treatment

- Short-term use of mechanical supports such as splints may be useful.
- Non-steroid anti-inflammatories such as aspirin, ibuprofen and, according to some authorities, vitamin B-6. These are also helpful as a preventative.
- Steroid injections help in 75% of the cases over a period of several weeks, but steroids have other negative side effects.
- Consult a physician for an accurate diagnosis.

The U.S. Department of Labor has reported CTS and other cumulative trauma disorders have multiplied so that they now affect over 5 million U.S. workers, and are responsible for 48% of all workplace injuries. However, with the implementation of prevention programs, this injury rate has leveled out.

Injury Prevention Programs

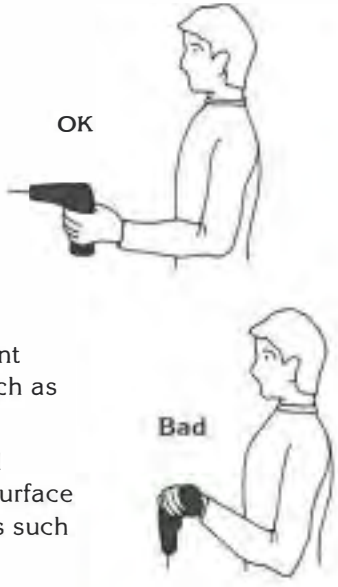
Most of these injuries are avoidable or can be minimized by implementing some basic changes to the way the job is done. As with lifting and moving, there is no easy single solution. All aspects of the job and the person performing it must re-evaluated and redesigned. The following are some tips.

Maintain Your Joints in a Neutral Position When Doing Repetitive Tasks

- Do not bend forward more than six to ten inches from the vertical.
- Do not reach more than 15 to 20 inches forward. Design a grab stick if longer reaches are needed.
- Turn your body using your feet, not your waist.
- When cutting, hold your upper body directly over the object being cut and use both hands to push down on the knife (much as an ulu is used). Cleavers or hatchets for cutting may be easier.
- Grip with your full hand rather than using a few fingers in a pinch grip. A pinch grip requires four to five times the muscle and tendon force as a full grip.
- Keep work at a level where elbows can be kept close to the body and hands can be kept at waist level. As fish are processed, keep product at this same level as much as possible to reduce the amount of lifting needed.

Select the Proper Tools and Equipment for the Job

- Use knives and tools with built-in bends at the handle so the wrist can be kept in a neutral position. Non-slip handles should be 1¼ to 1¾ inches in diameter, with ridges to improve grip. Short blades are more effective than long blades when cutting with the blade tip. Repetitive motions with bent wrists will lead to problems such as CTS. Wrist braces may help.
- Use the correct glove size, and choose a style with a gripper surface when handling slippery objects such as fish.



- Use stand/sit stools to alleviate back and leg strain. A foot rest four to six inches high alleviates back strain and foot fatigue.
- Cold seems to increase the incidence of tendonitis and CTS. When working in cold temperatures, use neoprene wristers to keep lower arms warmer and in a neutral position. (A wrister is a waterproof sleeve that covers the forearm and wrist, worn over clothing to keep sleeves clean and dry. Neoprene wristers keep the wrist area warm and provide some support. They are available at marine supply stores.)
- Avoid tight clothing on the hands, wrists, and arms.

Go Easy on Your Body

- Switch hands to perform repetitive tasks if possible.
- Use smooth motions when possible. Lift slowly and evenly. Do not use jerking motions.
- Avoid pulling with line wrapped around your wrist or arm.
- Alternate repetitive jobs to spread the load among as many people as possible.
- Keep musculoskeletal system in shape with a regular exercise program.

Keep Ergonomics in Mind When Setting up the Job

- Examine ways to reduce the need for lifting.
- Keep storage and work levels at the same height, where possible.
- Locate work stations near needed materials.
- Design work areas with input from experienced workers.

Remember, it will be much easier to implement an ergonomics program if it has been designed into the facility from the start.

Sources and Further Reading

Back belts: Do they prevent injury? National Institute for Occupational Safety and Health, No. 94-127, (800) 356-4674.

Ergonomic Hazards in the Fish Processing Industry, Parts I-III, edited by R. Fairfax. Applications of Occupational Environmental Hygiene, April-June 1997.

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Reduction of Acute Low Back Injuries by Use of Back Supports, by Kraus et al. International Journal of Occupation and Environmental Health, Vol. 2, No. 4, Oct.-Dec. 1996.

Repetitive Motion Injuries Preventable, by J. Dzugan. AMSEA Marine Safety Update, Vol. 13, No. 2, 1997.

Tendonitis and Related Afflictions in Fishermen and Processing Workers, by R. Steiner and A. Embick. University of Alaska Sea Grant, ASG-27, 4 pp., 1987.

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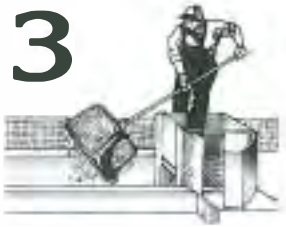
Source for figure on page 13: Data from Alaska Dept. Labor, Workers' Compensation Div., research by Larry Bussone, Alaska Dept. Health and Social Services. Injuries 1983-97; $ paid 1994-97.

Small Boat Safety

3



When using small boats in Alaska, you never really know how your trip is going to end. Alaska waters are cold. Unexpected falls into the water are life threatening. Alaska weather is often harsh and unpredictable. Aquaculture sites are located in remote areas and rescuers are often not very close.

Familiarity with small boats can sometimes lead to complacency and that can lead to trouble. However, by recognizing the hazards and taking several easy steps before you leave, you can greatly increase your chance of surviving the unexpected.

Personal Safety

Clothing

Before you leave on a trip, take a moment to select the right kind of clothing for the conditions you will be experiencing. Clothing must provide insulation for warmth and protection from wind and wetness. Wool and some synthetics like polypropylene and polyester trap air for insulation and wick water and moisture away from the skin when wet. Cotton is a poor choice because it does not wick moisture away and provides little insulation when wet. Obviously in rainy, coastal Alaska, good quality rain gear is also a must.

When working on the water, sunglasses with UV filters are also beneficial. Studies have shown that there is a direct correlation between cataracts and the amount of time spent on the water without adequate eye protection from the sun.

Hearing protection is a good idea for those operating outboard motors. The noise level of most outboard motors is above the level at which long-term exposure will cause permanent hearing loss. Many outboards now have kill switches attached to cords. For people who are operating outboard boats alone, these cords should be clipped to the operator so the engine will shut off if the operator is unexpectedly thrown out of the boat.

Personal Survival Kits

A personal survival kit should be "on your person." "On your person" is important since most people end up in an emergency with only the clothes they are wearing, and the contents of their pockets. Basic to a personal survival kit should be four elements: signaling devices (mirror, strobe lights, small flares); personal health aids or medication; something to help build a beach debris shelter (twine, trash bag, pocketknife, etc.); and fire-starting material.

The boat should have its own emergency kit in a waterproof floating container, such as a plastic bucket. The same four categories of contents apply, but there is room for more and better emergency gear, such as a VHF radio, tool kit, tube tent or tarps, stove etc.

Personal Flotation Devices (PFDs)

Most small boat fatalities are caused by drowning. Alaska's cold water causes disorientation, numbness, cramps, and a lack of coordination that exhaust even the strongest swimmers within a few minutes. Wearing a Personal Flotation Device (PFD) is one of the most effective actions you can take to increase your chances of survival in a boating mishap. A study of commercial fishing in Alaska recently conducted by the National Institute of Occupational Safety and Health (NIOSH), showed that 63% of the people wearing PFDs survived while only 12% of those not wearing PFDs survived.

All operators and passengers in open vessels should be wearing the PFD of their choice, appropriate for the conditions they are operating in.

Vessel Safety

Float Plans

Whenever you plan a trip, it is important to leave a float plan with a responsible person. If you end up missing, a float plan will reduce the search area and result in a faster response time.

A float plan has five components:

1. Who is going.
2. Where you are going (be sure to include routes and alternative routes).
3. When you expect to arrive at your destination **AND** when you expect to return.
4. What you are carrying for survival gear.
5. Description of your vessel.

Float plans are simple and cheap. They should be an integral part of the safety plan for people using any vessel.

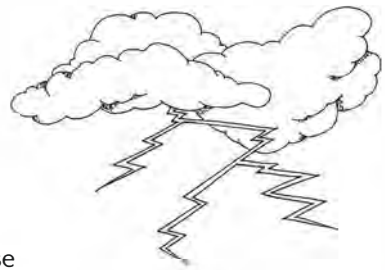
Orientation

Before you leave the dock it is important for all on board to receive a safety orientation. During the orientation, be sure and point out:

- Where the PFDs are stored and assign each person one that fits. Don't forget to explain how the PFD is used (inflation cartridge firing systems, beaver tails on float coats etc.).
- Where the radio is and how to give a proper MAYDAY.
- Emergency procedures, such as how to retrieve a person who falls overboard.
- Anchoring instructions.
- Where to sit and vessel balancing characteristics.
- Where the vessel's survival kit is stored.
- Basic engine operation and steering.

If taking passengers or visitors, it is important to recognize that they are your responsibility! They may not be as knowledgeable as you are about the local area and they are putting their welfare in your hands.

Weather



Weather can easily overpower small vessels. Since most travel to aquaculture sites is by water and air, weather becomes a prime factor in making a go or no-go decision. The "I think we can make it" attitude has been responsible for many close calls and fatalities in Alaska.

Four weather considerations should be reviewed before leaving on a trip.

1. Get the most recent weather forecast available for your area.
2. Check the barometer. Over the course of a day, your barometer is an important weather indicator.
3. Look at the sky. Experience and local knowledge will give you a good estimate of what the weather may be doing. Double check weather conditions at your destination as well.
4. Have a contingency plan ready. Are there spots along the planned route where you can duck out of unexpected rough weather? Do you have the necessary gear to stay onshore if needed? Did you leave a float plan with someone so that you can be found if there is an emergency?

Don't let someone put you at risk just because they need the spare parts or the next food order that you are bringing with you. If the weather is questionable remember the adage, "When in doubt, sit it out!"

Stability and Loading

In Alaska, small open vessels are often used to carry construction materials, people, and other gear. Because open vessels can easily take on large amounts of water and become swamped, loading and stability are critical in small boat safety. The stability and loading guidelines below should be rules of thumb you always follow.

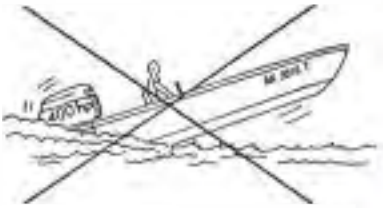
- Read the capacity plate posted in the stern of your boat and make sure you follow the guidelines posted there. This

plate gives important information on the carrying and design parameters of your boat. Operating beyond these parameters is asking for trouble.

- If you have no capacity plate, use common sense to determine how much gear to carry. To determine passenger capacity, use this formula for calm water conditions.

$$\text{Number of People} = \frac{\text{Length of Boat} \times \text{Width (in feet)}}{15}$$

- If the weather is rough, carry less.
- Make sure the boat is balanced front to back and side to side. Tie the load down so it will not shift. Be aware that different sea conditions may dictate different loading patterns.
- Use the correct horsepower motor on your boat. Having a motor that is larger than the vessel is rated for is extremely hazardous.



- All vessels, whether commercially made or home-made, should have built-in flotation that enables them to float horizontally even when capsized. If you have built-in flotation, don't remove it to make more room for gear! If you don't have this flotation, add it!

Equipment

Law requires that you carry the following equipment on your vessel.

- One Coast Guard approved PFD for everyone on board (preferably worn).
- One throwable PFD with a line attached.
- Visual distress signals (if water body is over two miles wide).

- Appropriate lights when operating at night.
- A sound-producing device.
- Fire extinguishers if your vessel has an inboard engine, closed living quarters, compartments in which portable fuel tanks are stowed, permanently installed fuel tanks, or double bottoms not sealed to the hull or which are not filled with flotation materials.

In addition, common sense dictates that you have the following extra equipment on board.

- A VHF radio, EPIRB, and signal mirror.
- Oars suitable for the vessel.
- An anchor with suitable line.
- A bailer.
- A first aid kit.
- An emergency shelter.
- Fuel (⅓ to get there, ⅓ to get back, ⅓ to spare)
- A water separator filter in the fuel line between the tank and the engine.
- A tool kit for engine, and spare parts.

Common Problems to Avoid

Many of the most common problems that turn a boating trip into a survival situation are easily avoided. Some of these common problems are:

- Water in the gas.
- Improper mixing of fuel and oil.
- Overheated engines caused by kelp, plastic, or debris blocking the water intake.
- Losing control of the tiller arm at high speeds.
- Hitting submerged rocks.

Alcohol and Drugs

Needless to say, alcohol and drugs have no place on the work site. Even more hazardous is their use on vessels. Nationwide, alcohol is responsible for 50% of boating fatalities; in one South-

east Alaska community alcohol has been involved in over 90% of boating fatalities.

Alcohol has several negative effects on boating. One primary effect is the role that alcohol plays in judgment and decision-making. Recognition of inherent danger is delayed and risk taking increases. Night vision and peripheral vision are reduced. Balance and coordination are negatively affected, increasing the likelihood of falling overboard. Once a person is in the water, dilated blood vessels of the alcohol-influenced body give up even more body heat to the surrounding cold water. These are just a few of the negative effects of alcohol use on the water.

Sources and Further Reading

Beating the Odds on the North Pacific: A Guide to Fishing Safety, edited by S.C. Jensen. University of Alaska Sea Grant MAB-41, 244 pp., 1998 3rd edn.

The Sober Truth about Alcohol and Boating. Boats/U.S. Foundation, 880 S. Pickett St., Alexandria, VA 22304. (Brochure)

Injuries from Fish

4

The ocean is a rich soup containing both the smallest organisms and the largest creatures on earth. Although many of these organisms are not harmful, some microorganisms can cause illness and even death. These microorganisms can enter the human body through a number of routes. For aquaculture workers, the most common points of entry are through the skin, by means of cuts, scrapes and punctures, or via the mouth. Shellfish growers are especially susceptible to cuts and scrapes from handling oyster shells and the barnacles that grow on them.

Preventive measures are the best solution. Some general rules include:

- Wear protective gloves when handling fish or shellfish, especially while shucking.
- Wash your hands several times a day in hot, soapy water or with Betadine solution. Good general hygiene will help you avoid infections.
- Replace waterproof gloves as soon as they are worn. Bacteria love the warm, dark, wet environment found on the inside of wet gloves.
- Disinfect cuts immediately. Infections that become systemic can result in a week in the hospital on antibiotics, or lead to death.

Infection (Fish Poisoning)

Signs and Symptoms

Symptoms of infections from handling fish and shellfish include redness, swelling, and tenderness at the site of skin penetration, spreading to a wider area over time. If symptoms spread up the affected limb (toward the heart), it is a sign the infection is becoming systemic. Fever and/or chills may develop as the infection progresses.

Treatment

- When a cut, scrape, or puncture occurs, wash the area thoroughly with Betadine or hot water and soap. Apply an antibiotic ointment such as Neosporin, Buckley's (a local ointment found in Southeast Alaska), or another commercially prepared product. Some sources say that a black tea bag wrapped over the wound for ten minutes several times a day will help.
- At the first sign of infection, soak the wound for half an hour in hot, soapy water three times a day. Dry and bandage the wound to prevent reinfection.
- Keep the wound dry and bandaged.
- Monitor the site of infection closely. If the infection does not improve or if it becomes worse, consult a physician.

Fish Cuts and Punctures

A number of fish such as sculpin, ratfish, and rockfish have spines that can cause puncture wounds. Other fish, such as male chum salmon, have sharp teeth that can cause cuts or punctures. These wounds can be very painful and can lead to serious infections because they drive bacteria deep into tissue.

Signs and Symptoms

Serious infections from fish cuts and punctures may include difficulty breathing, nausea, vomiting, cramps, and paralysis as the infection spreads.

Treatment

- Treat all punctures immediately.
- Pull out the spine, being careful not to break it (if it is in the eye, call a physician immediately for instructions). Check the spine for any broken remnants left in the tissue.
- Treat as on page 32 for infection (fish poisoning).
- Monitor for infection or spread of infection. Consult a physician if the infection persists or becomes worse.
- Monitor the patient closely for trouble with breathing.

Jellyfish Stings

Jellyfish stings occur when the stinging cells on the tentacles touch your skin. Bare skin and eyes are the areas most commonly affected. Beware of wiping your eyes with a hand or glove that has been in contact with a jellyfish. For protection from jellyfish, wear rain gear, gloves, and goggles. Petroleum jelly can also protect skin that is exposed to jellyfish.

Signs and Symptoms

Instant burning pain and rash will occur at the point of contact. In serious cases, the victim may develop difficult breathing, cramps, nausea, vomiting, and shock.

Treatment for Skin

- Pour vinegar on the injured skin. This will counteract the toxin.
- Put a paste of baking soda and water on the injury. After 15 minutes wash off with saline solution or clean seawater.

- Apply a second baking soda paste to the injury for 5 minutes.
- Gently scrape paste off with a knife.
- Contact a physician if needed.

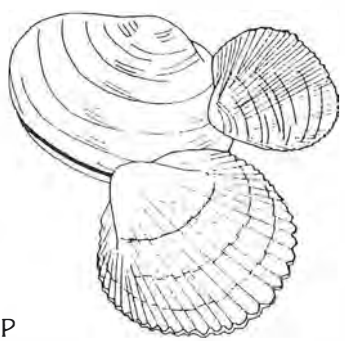
Treatment for Eyes

- Rinse eyes with clean saline solution until the burning stops.
- Contact physician for further advice.

Paralytic Shellfish Poisoning (PSP)

PSP is caused by toxins produced by a single-celled dinoflagellate alga of the genus *Alexandrium*. The toxicity of PSP is 1,000 times greater than cyanide. It kills by blocking nerve impulses which leads to paralysis and death. There are at least 21 different forms of the toxin. This variety and the toxin's ability to change forms in the body has made it very difficult to design a simple field test for detection.

Coastal Alaska has almost perfect growing conditions for *Alexandrium*. Some beaches in Southeast Alaska have a 200-year history of PSP. Techniques of detection such as avoiding clams in months without an "R," putting a small piece of clam between cheek and gums to detect numbing, and feeding them to your cat, are poor indicators for the presence of toxins. These "home tests" lead to many reported and unreported incidents of PSP poisoning every year in Alaska. A single shellfish can contain enough toxin to make 200 people ill. There is no antidote available. For these reasons, one should exercise extreme caution when eating shellfish in the field, away from a hospital.



Signs and Symptoms

Tingling sensation, numbness, nausea, vomiting, weakness, immobility, shortness of breath, dizziness, floating sensation, dry mouth, double vision, difficulty speaking and swallowing, and diarrhea.

Treatment

- If the person is conscious and can speak clearly, and if ingestion was less than 30 minutes earlier, have the person drink at least two glasses of water, each well-mixed with three tablespoons of activated charcoal (found in most pharmacies).
- Find out when shellfish were ingested, how many were eaten, and what kind of shellfish.
- Treat for shock.
- If the person is unconscious, monitor their airway, breathing, and heartbeat. Perform CPR if needed.
- Transport the person to a medical facility.

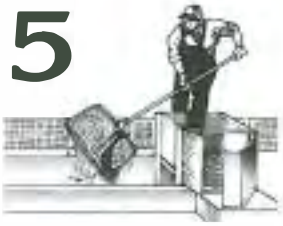
Sources and Further Reading

The First Aid Book. Southeast Regional Area, Regional Health Consortium, Sitka, AK, 87 pp., 1992 2nd edn.

Marine Safety Instructor Training Manual. Alaska Marine Safety Education Association, Sitka, AK, 256 pp., 1992.

Paralytic Shellfish Poisoning: The Alaska Problem, by R. RaLonde (and other articles). Alaska's Marine Resources, Vol. 8, No. 2, 20 pp., 1996. Available from University of Alaska Sea Grant, phone (907) 474-6707.

5 Electrical Hazards on the Water



Electrical equipment near water is common at aquaculture sites. A shellfish farm may have a portable 120 volt AC generator supplying pumps, power tools, or a battery charger in a floating workshed. A larger hatchery site may use municipal power or large hydro- or diesel-powered generators to supply electricity to shore-based buildings and facilities anchored offshore.

As common as electrical use is, you need to be aware of specific hazards and take precautions when using electricity around the water.

Electrical Shock

An electrical circuit is a loop where electricity travels from a source (battery, shore power, generator, or power grid) through a conductor (wire) to a piece of equipment, and then travels back to the power source through a separate conductor. In a properly set up and maintained system, these conductors are isolated from each other and from other conductors such as water, metal, or wet boards that could provide an alternate path for the electricity.

A person receives an electrical shock when he or she comes in contact with faulty wire or improperly grounded equipment. The person's body acts as a conductor between this wire and another conductor—such as water, metal, or wet wood—which returns the electricity back to the ground of the power source.

For example, if the wires in a power tool become old and cracked and a person touches the tool or the wire, an electrical current will likely

flow through the person to the wet float and back to the ground of the power source via the water. The person touching the tool will receive an electrical shock. If the power cord is hanging in the water, a person who touches the cord or falls into the water near the tool will also receive an electrical shock.

Severity of Electrical Shock

It is the current flowing through the body, not the voltage, that determines the severity of electric shock. Very small currents, measured in milliamperes (0.001 ampere), can cause injuries or even death. Currents of 10 milliamperes or more lead to "muscular freeze" which prevents the victim from releasing their grip, and can be fatal. If a person is in the water when shocked, the muscular freeze will prevent them from swimming and cause them to drown. Currents over 50 milliamperes are mostly fatal.

Because systems operating at higher voltages are more likely to cause higher currents, there is a greater risk of fatal electrocution around high voltage systems. Low voltage systems such as 12 volt DC systems are safer because there is less "pressure" behind the current.

Fire

As electricity travels through wire or equipment it can generate heat. If a lot of electricity goes through a wire that is too small or too long, it can generate enough heat to melt the nonconductive coating on the wire. This exposes the bare wire which creates further shock and fire hazards, and can create short circuits which ignite flammable materials and/or gases.

Corroded or broken contacts increase resistance which can also cause a fire. A bent or corroded plug on a shore power cord can develop 0.5 ohm resistance. Under a full 30 amp load, this plug will generate 450 watts of heat and can become a fire hazard.

Remember, if an electrical fire starts, the electricity must be turned off to extinguish it.

Fire and Shock Prevention

The National Electrical Code (NEC or Code) and the National Fire Protection Association's 302 (NFPA) Standards describe safe ways to handle electricity around the water. The NEC code ap-

plies to facilities which are permanently connected to shore power. The NFPA 302 Standards apply to vessels which may temporarily plug into shore power. The State of Alaska has adopted these guidelines and applies them to all electrical applications statewide. Aquaculture facilities whether shore- or water-based, are subject to it. Although the Code provides volumes of detail on AC systems, it contains little on low voltage DC currents. Fortunately the NFPA 302 Standards cover both AC and DC systems on vessels.

Safe Electrical System

While this is not a complete list, a safe electrical system on or near the water should include:

Correct Wire Sizes and Types for Your Application

Tables in the Code list the proper wire sizes and types for the load and physical conditions at your work site. Type designation refers to a wire's maximum allowable wire temperature when carrying a full load, and to what degree the wire can be exposed to water. Any wire type designation containing a "W" is appropriate for use in dry, damp, or wet applications.

A Properly Sized Power Supply

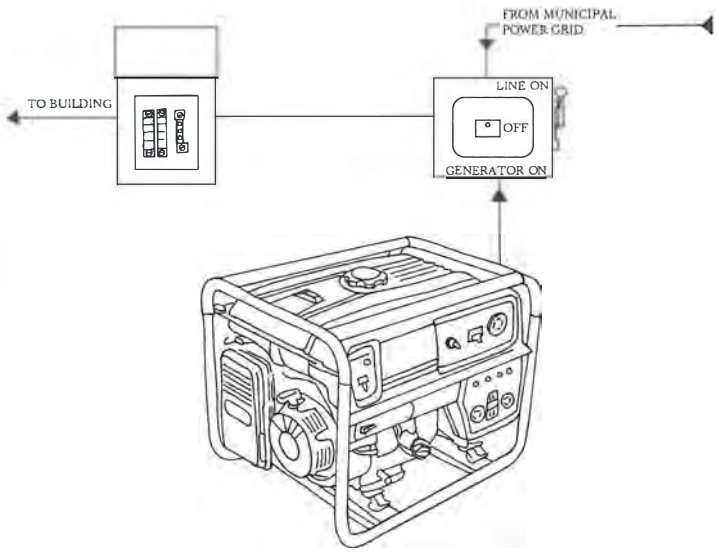
Generators are rated in amps at their designated voltage. For example, a typical portable generator would be rated at 100 amps at 120 volts. Equipment and power-using devices are rated in watts. To determine how many watts your system can power at one time or to determine the ideal generator capacity use the equation:

$$\text{Amps} = \frac{\text{Watts}}{\text{Volts}}$$

A Properly Grounded Power Supply

Follow the Code to properly ground electrical systems permanently connected to shore power. Follow the NFPA 302 standards to properly ground vessels and floats temporarily connected to

shore power. The difference between the two systems is the way the neutral or white wire is grounded. On board vessels, the neutral wire "floats" and is not connected to any ground. This provides an added layer of safety in the event either the plug or the shore power receptacle is not properly wired. An improperly grounded system may create a severe shock hazard, and electrify the nearby water.



A Main Disconnect Adjacent to the Generator/Power Source

Always have the capability of de-energizing your circuits at the source. If you are connected to multiple power sources such as shore power and a generator, your system must include a transfer switch. This three-position switch allows you to connect to a municipal power system, no power, or an auxiliary generator.

Properly Sized Circuit Breakers for Every Circuit

The purpose of a circuit breaker is to protect the circuit and the electrical equipment it serves. A breaker disconnects the circuit from the power source when too much current is being drawn. Refer to the Code or other reference manuals to size circuit breakers appropriately.

At Least One Ground Fault Circuit Interrupter Outlet (GFCI) Installed in Every Circuit

A GFCI can save your life if you fall in the water with an electric drill in your hand. GFCIs monitor the current difference between the wires in and out of the outlet. If they detect a short drawing electricity in a different path they can disconnect circuit within 1/40th of a second.

Limited Use of Extension Cords

An extension cord is not intended to become a permanent part of the circuit, so should not be used in permanent applications. If you use extension cords on an occasional basis, make sure they are sized appropriately for the items they serve, have a green grounding wire, and are rated for outdoor use. Check frequently for fraying and other physical damage.

Sources and Further Reading

Alaska Department of Labor, Division of Electrical Inspections. Information and locations (907) 465-4871.

Electrical Engineering Requirements for Commercial Vessels (46 CFR 110-113), and Electrical Requirements for Recreational Vessels (33 CFR 183), Code of Federal Regulations, U.S. Government Printing Office.

Bob Loeser, Marine Electrical Consultant, 121 Lakeshore Drive East, Palm Harbor, FL 34684. (Personal communication)

Pleasure and Commercial Motor Craft Standards (Publication 70), and National Electrical Code (Publication 302), National Fire Protection Association, Battery March Park, Quincy, MA. (800) 344-3555.

Standards and Recommended Practices for Small Craft. American Boat and Yacht Council. (410) 956-1050.

Local building departments and licensed electricians in your community or in neighboring towns are good sources of information.

Cold Injuries

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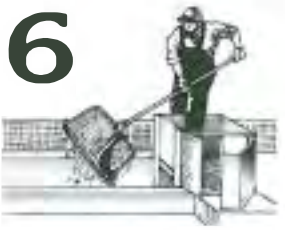


The human body can become hypothermic in air temperatures less than 80° and in water temperatures less than 91°F. We can work and play in temperatures much colder than this, but only with the aid of clothing which provides insulation. Many hypothermia cases in Alaska occur when the temperature is well above freezing. The cool, wet environment aquaculture workers operate in is an ideal setting for cold injuries.

Hypothermia

Hypothermia is a general cooling of the body's core temperature. It can occur slowly over a long period, or it can happen suddenly such as by an unplanned fall into the water. In either case, the result can be fatal and the condition can be difficult to treat. In Alaska's climate, the body must do a delicate balancing act between producing and retaining heat.

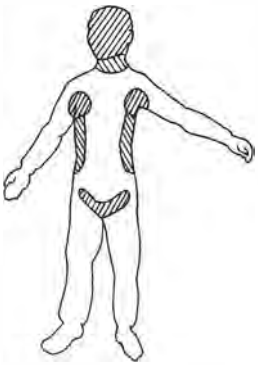
Three Ways the Body Gains Heat

- External heat sources—The sun, stoves, and heaters all produce heat that makes the body's job easier.
- Food—Food provides fuel the body needs to produce energy. Heat is also a byproduct of the body's digestive process.
- Exercise—The body gives off heat as calories are consumed while doing physical labor.

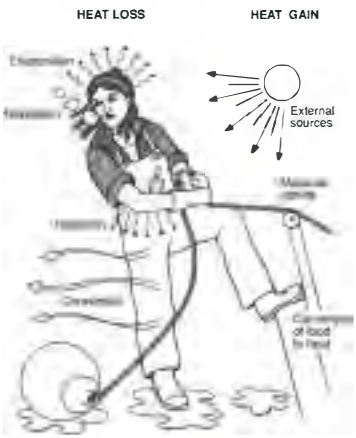
Each of these ways to gain heat is finite. We can lose our external heat sources, run low on fuel, and sooner or later we need to stop exercising to rest.

Five Ways the Body Loses Heat

- Radiation—We radiate heat from areas on our body that have blood vessels close to the surface of the skin and are not well protected with insulating fat. These high heat loss areas are our head (50% of our radiated heat loss), neck, armpits, sides, and groin. To prevent heat loss through radiation, wear good insulating clothing, especially a hat!



- Respiration—Our body needs to heat up and moisturize the air we breathe. Unfortunately we lose 60% of this heat when we exhale. To reduce this heat loss, breathe with your nose through a scarf or wrap.
- Evaporation—We lose tremendous amounts of body heat when we sweat, through the evaporative process. Thousands of calories of heat can be lost very quickly when you sweat. When you want to conserve heat loss from evaporation, keep your work activity level below that which will produce sweat.
- Conduction—Heat loss by conduction occurs when you are in contact with a cold object. This is why falling in the water is such a quick route to hypothermia. Water conducts heat away from the body 25 times faster than air. To help prevent or slow down heat loss from conduction, stay dry. Conduction also takes heat away from the body when you are in contact



Conduction (being in contact with cold surfaces)

with the ground or in the bottom of a boat. When sleeping or sitting on cold surfaces, place insulating material under you, like excess clothing, nets, or bags.

- Convection—Heat loss by convection is caused by wind or current flowing past and robbing the body of heat. The most common example is "wind chill." To stop this heat loss, get out of the wind or use the "huddle" position in the water to reduce water flow.

Any of these heat loss routes can lead to hypothermia. The key to hypothermia protection is to recognize some of these heat gain/loss routes and take positive action when the early signs and symptoms of hypothermia present themselves. There are three stages in the hypothermic process.

Stages of Hypothermia

1. Cold Reaction

Signs and Symptoms

The body core temperature falls by 1 to 1.5°F but remains stable. There is no shivering. However, fingers and toes feel cold and air feels cold to the skin. No other symptoms or problems are present. The body is compensating.

Treatment

None is needed. The body has adapted to a cold environment by beginning to reduce peripheral circulation. This often occurs in a normal day of working outdoors in Alaska. The risk of hypothermia is present, however, and will increase if conditions change.

2. Mild to Moderate Hypothermia

The body has now begun to lose the ability to keep up heat production or retention.

Signs and Symptoms

A person feels cold but **DOES NOT** yet exhibit signs of disorientation, confusion, a lack of coordination, or depressed vital signs such as reduced pulse or breathing. The person may or may not be shivering.

Treatment

Reduce areas of heat loss and increase ways to gain heat. At this point the person can still exercise and eat to produce heat. Place them in a warm environment with padded heat packs placed in high heat loss areas. A sleeping bag or blanket with two warm people works well. Alert patients can be placed in a warm bath or shower. Do not give alcohol. When recovering a person from the water, lift them horizontally if possible.

3. Severe Hypothermia

The body loses the ability to produce heat. A person is considered severely hypothermic when body temperature is 90°F or less.

Signs and Symptoms

A person feels cold and has **ONE OR MORE** of the following signs: disorientation, confusion, a lack of coordination, depressed vital signs such as reduced pulse or breathing, a body core temperature lower than 90°F, or no shivering.

Treatment

Treat very gently due to the risk of a cardiac event. Do not rub or manipulate the extremities or try to get the person to exercise. Place them in a warm environment with padded heat packs placed against their high heat loss areas. Follow the same treatment as for mild to moderate hypothermia **EXCEPT, DO NOT** immerse them in a bath and **NOTHING** should be given by mouth until they have a clear level of consciousness.

If you come across a person who has collapsed, give them a 45-second pulse check as the heartbeat may be slow and difficult to detect. Initiate CPR if necessary. Monitor the person closely. Transport as gently as possible to a medical facility. Remember, a person is not considered dead until warm and dead.

Special Note about "After Drop"

The body temperature will continue to fall once the person is placed in a warm environment. This is a very critical stage. Handle gently and monitor closely. Hypothermic patients take a long time to rewarm!

Cold Water Near-Drowning

In the last 25 years, thousands of people have survived after being submerged for up to an hour under water. Studies show that the people who survived cold water near-drowning (CWND) all had two things in common. First, they were submerged in water colder than 70°F. Second, they received prompt, appropriate, and effective treatment.

How is it possible for people to survive that long without oxygen? Cold tissues have less need for oxygen due to a lower metabolic rate while in a cold environment. Also, when nerves in the face are immersed in water colder than 70°F they trigger a lower metabolic rate in the body. This is called the mammalian dive reflex. These phenomena allow victims of drowning in Alaska a chance of survival if they are treated promptly.

Signs and Symptoms

Drowning victims appear cold, ashen, and rigid; they lack perceptible respiration or heartbeat; and they have dilated pupils. You will note that these are the symptoms of someone who has died. Yet if the victim has been under water less than one hour, we know that resuscitative measures should be started.

Treatment

- Do not become a drowning victim yourself during the recovery!
- Stabilize the head and neck as soon as possible. Many drowning victims have head or neck injuries.
- Breathe for the patient as soon as possible. Use abdominal thrusts only when you suspect the airway is obstructed by a foreign body.
- Conduct a 45-second pulse check and begin CPR if needed.
- Treat for hypothermia. (This is only a secondary problem.)
- Send patients to a medical facility even if they recover. Pulmonary edema and other complications which are fatal could develop within 24 hours.

The mortality rate of cold water drowning patients is still high. Prevention should be stressed on the job. The most important of these preventive measures is to have employees wear personal flotation devices whenever working on or around the water.

Frostbite and Frostnip

When caring for hatcheries or shellfish farms during the winter, frostbite can be a problem. Frostbite occurs when water crystallizes between the body's cells. It is generally a localized condition affecting the most exposed and peripheral body parts—the face, hands, and feet. Inadequate clothing, impaired circulation from tight clothing or shoes, fatigue, high altitude, immersion, injuries, circulatory disease, poor nutrition, dehydration, hypothermia, and alcohol, drug or tobacco use can make a person more susceptible to frostbite.

Cases of frostbite occur frequently in Alaska. Fortunately most frostbite is superficial and can be treated at home. Deep frostbite, however, involves in-hospital treatment over an extensive period of time.

Frostnip

Signs and Symptoms

The skin is white, has a waxy feeling, and does not hurt. A key difference from frostbite is that skin with frostnip is still soft and resilient to the touch.

Treatment

None is needed at this point. Get into a warm environment and out of the wind. Beware that further exposure may lead to frostbite.

Frostbite

Signs and Symptoms

The skin is blotchy, pale to black. The key sign is skin that is hard and non-resilient.

Treatment

No rubbing of the affected part, no smoking, no dry heat, and no refreezing. Remove restrictive clothing and jewelry from the affected area. Cover the affected area with sterile dressing and put pads between the toes and fingers. Keep the patient warm, lift the affected limb occasionally, and transport. Rewarm the frozen part in 100-106°F circulating water only if thawing can be maintained.

The decision to rewarm in the field is a difficult one, since it commits the care provider to a course of pain control, maintaining constant water temperature, and protecting the affected part from further injury while rewarming and during transport. Advice on rewarming in the field should be obtained from a physician. Realize that if the extremity is rewarmed in the field, that extremity will not be functional for walking.

Prevention is the key. Frostbite leads to long-term disability and the affected areas may always be sensitive to cold afterward. Frostbite can occur in any temperature below freezing, especially with wind and inadequate clothing. Exposed flesh should be covered with clothing and companions should watch each other for early signs and symptoms of frostnip. Avoid clothing that cuts off circulation, such as tight boots. Eating well and avoiding alcohol

and tobacco are also important. Careful planning and trip preparation will usually prevent frostbite.

Immersion Foot

Working at aquaculture sites on Alaska's cold, wet coast is a perfect environment to cause immersion foot. It occurs when feet are kept in wet boots over a long period of time. This condition is easily preventable—simply keep your feet dry. This means keeping your boots in good shape and always having a spare set of dry wool or polypropylene socks to change into if your feet get wet.

Signs and Symptoms

Redness, swelling, blisters, numbness, or prickly sensations like tiny electric shocks. Gangrene occurs in rare cases.

Treatment

Dry off feet and warm them. Put on dry socks and elevate feet to reduce swelling. Prevention is the best fix. After recovery, a victim of immersion foot will have reduced tolerance for cold and nerve damage in the foot.

Most cold injuries can be traced back to improper preparation and planning. By being prepared for the conditions found in Alaska's cold and wet coastal climate, you can prevent most of these debilitating cold injuries. Many of the early signs of cold injuries are more easily detected by others. Look out for your coworkers, and take corrective action before a case develops.

Sources and Further Reading

Cold Injuries and Cold Water Near Drowning Guidelines. Alaska Department of Health and Social Services, Community Health and Emergency Medical Services, Juneau, AK, 32 pp. 1996. (907) 465-3027, www.hss.state.ak.us/DPH/ems/ems_home.htm.

Cold Water Survival

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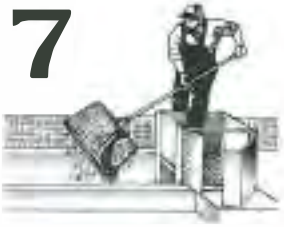


The average water temperature in coastal Alaska is approximately 45°F. Sudden immersion in this cold water can cause gasping, loss of breath, disorientation, loss of coordination, and muscle cramps. It causes your blood pressure to increase dramatically and your heartbeat to accelerate. These combined effects can cause expert swimmers to drown or to die from hypothermia in a short time. Falling unexpectedly into Alaska's waters is a serious emergency, but there are steps you can take to greatly increase your chance of survival.

Stay Rules

The **STAY** rules were created to help remember a few simple steps you can take to increase your chance of rescue and survival when immersed in cold water.

- **Stay** afloat
- **Stay** warm
- **Stay** dry
- **Stay** still
- **Stay** with the boat

Stay Afloat

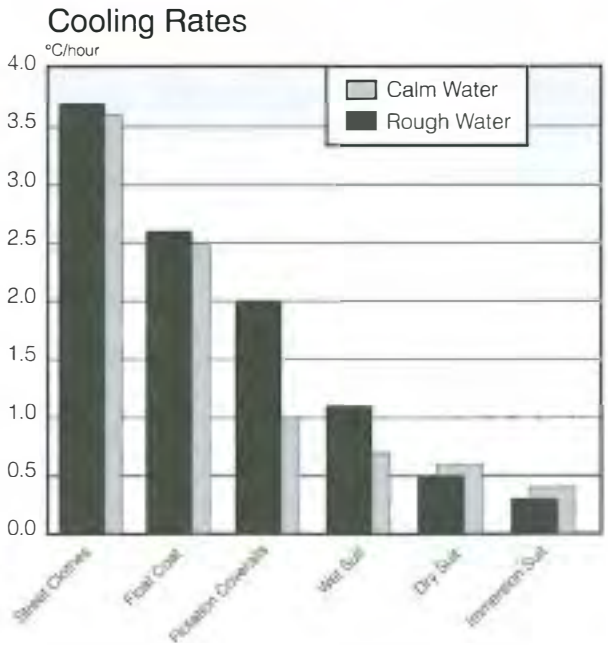
Wear a Personal Flotation Device (PFD). The physiological effects of sudden immersion in cold water can exhaust even the strongest swimmer in a short time. In a recent study conducted by

the Institute of Naval Medicine in the United Kingdom, an Olympic silver medal swimmer wearing street clothes was put in 40°F water. After four minutes her ability to swim was severely decreased and after ten minutes, panic set in as she was barely able to stay afloat. Wearing a PFD is one of the most effective actions you can take to extend your in-water survival time.

Hang on to floating objects. Whether or not you are wearing a PFD, gather together as many floating objects or as much debris as possible and hang on. This will give you added flotation, especially in rough weather.

Stay Warm

Water takes heat away from the body 25 times faster than air of the same temperature. Your ability to survive in cold water is directly linked to your ability to reduce heat loss and prevent or slow the onset of hypothermia. Although physical factors such as body type, physical condition, and age affect how quickly your body loses heat, there are several ways you can reduce your heat loss and prolong survival time.



Source: U.S. Coast Guard 1985

Clothing—Multiple layers of clothing will trap air between the layers. This air helps keep you afloat and provides insulation for warmth. If possible, cinch clothing so it is snug around the wrists, ankles, and neck to hold the air for as long as possible. Also, keep your boots on if possible. Contrary to popular belief, boots will not cause you to sink. Instead, they restrict the flow of water around your feet, and will become invaluable when you reach shore.

PFD—Choose a PFD that provides thermal protection to your high heat loss areas (head, neck, armpit, sides, and groin). The graph on page 52, based on tests conducted by the U.S. Coast Guard, shows how effective different clothing and PFDs are at preserving body heat. Remember, the lower the cooling rate, the better.

HELP and Huddle Position—The Heat Escape Lessening Position (HELP) is designed to cover the high heat loss areas of the body while floating. It simply consists of tucking your elbows into your sides, crossing your arms over your chest or behind the neck, crossing your legs, and bringing your knees up to your chest. In rough weather, cross your legs and drop them back down for stability. To maintain the HELP position you need to be wearing a PFD.

The huddle position can be used when there are several people in the water. In this position, three to six individuals gather together in a tight circle with their sides pressed together and arms under each others' shoulders to hold the group together. People with injuries or without a PFD can be put in the center of the huddle and supported by the rest.

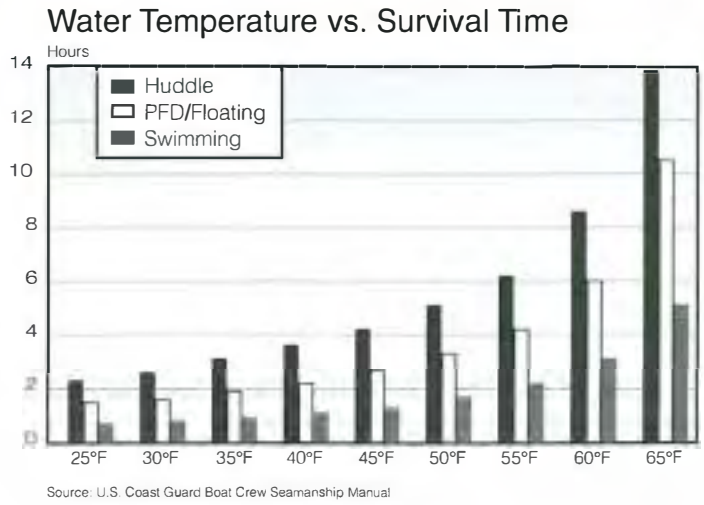
By covering the high heat loss areas of the body, the HELP position or huddle position can extend your survival time 50% over simply floating with a PFD.

Stay Dry

Keep as much of your body out of the water as possible. Most important, keep your head out of the water. The average person loses up to 50% of their body heat through the head. Remember, wind chill cooling applies only to exposed skin. Covering exposed areas cancels the effect of wind chill and will keep you warmer.

Stay Still

Do not try to swim unless help is **VERY** close. Swimming increases the amount of cold water in contact with your body and removes heat faster. Swimming also increases circulation to the arms and legs where the blood is cooled and, upon returning to the core, decreases your core temperature, hastening the onset of hypothermia. Studies conducted by the U.S. Coast Guard show that a person staying still and assuming the HELP or huddle position can survive three times longer than a person swimming.



Source: U.S. Coast Guard Boat Crew Seamanship Manual

Stay with the Boat

The best strategy is to stay with the boat if possible. Capsized or swamped boats still provide a large target for rescuers to spot from the air or water. They also drift more slowly than a person in the water, so the boat remains closer to your last reported position.

All commercially built skiffs under 24 feet, and some larger vessels, have built-in flotation to keep them floating horizontally even when capsized. This allows you to climb on top of a capsized boat and keep as much of your body out of the cold water as possible.

Remember, never abandon the boat until the boat abandons you.

Will to Survive

Perhaps the most important factor in surviving a cold water immersion is the will to survive. People often survive seemingly hopeless situations against overwhelming odds because they believe they **CAN** survive. Do not underestimate the importance of the will to survive. It is the determining factor in many situations.

Sources and Further Reading

Beating the Odds on the North Pacific: A Guide to Fishing Safety, edited by S.C. Jensen, University of Alaska Sea Grant MAB-41, 244 pp., 1998 3rd edn.

Fire Fighting & Prevention

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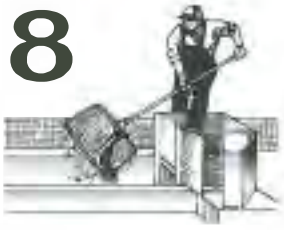

In remote locations, you and your coworkers are often the only fire department there is. A fire can grow to five times its starting size each minute. Knowing ahead of time what action to take and which extinguisher to use can save property, and most important, it can save lives.

Fires

A fire must have fuel, heat, and oxygen, plus the chemical chain reaction combining these components in order to burn. Fire prevention and fire fighting are aimed at removing one or more of these components from the fire source.

Types of Fires

Fires are categorized into four classes—A, B, C, and D—depending on their fuel source.

Class A fires are fueled by ordinary combustible materials such as wood, bedding, clothing, canvas, rope, and paper.

Class B fires are fueled by flammable or combustible liquids such as gasoline, oil, paint, grease, etc., and flammable or combustible gases such as acetylene and propane.

Class C fires are electrical fires.

Class D fires are those caused by combustible metals such as magnesium and powdered aluminum.

Fires can be a combination of several classes. A fire in the generator room would most likely be a BC fire, but could easily be an ABC fire. The key to successful fire fighting is to choose the extinguishing agent that will most effectively put out the fire.

Fire Extinguishing Agents

Many types of extinguishing agents are available. Each agent is designed to work on a specific class or classes of fire. Some of the more common agents likely to be found on site are listed below.

Water

Water extinguishes a fire by dissipating heat as it turns from a liquid to steam. It is most effective on class A fires. On class B fires, a special nozzle called a fog nozzle must be used. Without a fog nozzle, water often causes class B fires to flare up and spread. Water should **NEVER** be used on class C electrical fires and is ineffective on class D fires.

Foam

Foam extinguishes a fire by cutting off oxygen as the blanket of foam spreads over the burning surface. Foam will extinguish class A fires, but is most effective on class B fires. Like water, foam should never be used on class C fires and is ineffective on class D fires.

CO_2

Carbon dioxide (CO_2) extinguishes a fire by displacing the oxygen and by cooling. It is effective against class B and C fires. Because CO_2 is a gas, it works best in a windless, confined space. However, because CO_2 displaces oxygen, people should be evacuated before a confined space is flooded with CO_2.

Halon and Halon Substitutes

Halon is no longer manufactured. However, many workplaces continue to maintain their existing halon system because halon is effective in fighting fires. Halon and halon substitutes act on the chemical chain reaction of a fire. They are effective on class B and C fires, and if the extinguisher is larger than 10 pounds, it is rated for class A fires as well. Because these agents are also gases, they work best in a windless, confined space. Halon is three times more effective than CO_2 and does not displace the oxygen in a confined space. Halon substitutes include Halitron, FE 241, and FM 200. Like halon, they extinguish fires by disrupting the chemical chain reaction. However, fixed systems designed for halon must be modified to accept the new agents.

Dry Chemical

Several dry chemical compounds are used in fire extinguishers. Most extinguish a fire by cutting off the oxygen, however some also interrupt the chemical chain reaction. Sodium bicarbonate and "purple K" are common dry chemical agents that are effective on class B and C fires. Mono-ammonium phosphate is a dry chemical that is effective on class A, B, and C fires.

Dry Powder

Dry powder extinguishing agents are the only agents effective against class D fires. They extinguish a metal fire by forming a crust that cuts off oxygen and dissipates heat. Because of their special application, dry powder extinguishers are not commonly available.

Portable Extinguishers

In order to put out a fire, you must use an extinguisher classified for that type of fire. For example, using a class A extinguisher on a class C fire will not put the fire out and could make it worse. Choose extinguishers for fires that are most likely to occur in a particular area. For example, extinguishers in generator rooms should be rated at least BC, as a fire in this location is likely to

involve flammable liquids or gases (class B) and electrical equipment (class C).

Portable fire extinguishers are classified and clearly marked by both a letter and number (except for class D fires, which have no number). The letters—A, B, C, or D—identify the class of fire the extinguisher will put out if it is used properly and the fire is not too large for the extinguisher. The number defines the extinguisher size, and is expressed as a Roman numeral. Some extinguishers work on more than one class of fire and will specify that on their label. For example, an extinguisher might be labeled BC and would be effective on class B, class C, or class BC fires.

Using Portable Extinguishers

Having the proper extinguisher is no guarantee that a fire will be put out. Each worker must be trained to use extinguishers effectively. The sequence ("PASS") for using portable extinguishers is:

1. **P**ull the pin.
2. **A**im low.
3. **S**queeze the trigger.
4. **S**weep the base of the fire.

The pin on portable fire extinguishers must be pulled out before the extinguisher will work. Aim the extinguisher at the base of the flame. Keep your face away from the top of the extinguisher, and release the contents by squeezing the two handles together, or by opening the valve. On a cartridge-operated, dry chemical extinguisher, the puncturing lever must be activated before using the extinguisher.

Do not hold directly onto the horn of a CO_2 extinguisher. It can get cold enough to cause frostbite. CO_2 extinguishers can also build up a static charge while they are discharging. This makes them potentially dangerous to use when explosive gases such as propane are present. To prevent a static buildup, keep the CO_2 cylinder in contact with the ground while discharging.

As the extinguisher is discharging, **STAY LOW** and sweep the base of the flame. If the fire is electrical (class C), first turn the electricity off, then aim the extinguisher contents at the source of the fire. Work quickly and aim accurately—some CO_2 and halon extinguishers empty themselves in eight to ten seconds.

Fire Fighting Steps

Now that you are familiar with the components of a fire and some basic types of extinguishers, it's time to put it all together into a strategy. When a fire is detected, follow these five steps (some of which may occur simultaneously).

1. Size up the emergency and sound the alarm. Notify others in the area of the fire and its location. Provide information on the fire type, location, and size.
2. Rescue trapped people. Verify that a coworker is really trapped before risking other people in a rescue. Wear protective clothing and special breathing gear if available. Stay low to avoid as much smoke and heat as possible, and always have a second person back you up in case of trouble. You may need to extinguish the fire as you conduct the rescue.
3. Confine the fire to its present size and location. This is the time to shut doors and windows, close off ventilation and exhaust systems, and turn off electricity and fuel lines in the fire area. Remember to check all sides of the burning area, bottom, and top.
4. Extinguish the fire with the least damage to people and property. The fire fighting method will depend on the location of the fire and the available equipment. A coordinated, trained crew will do steps 3 and 4 simultaneously, causing the least damage to the area. However, it is better to extinguish the fire with some damage, rather than lose everything.
5. Overhaul. This involves examining areas affected by the fire, cleaning up, and restoring machinery and equipment to operational status. Make sure closed areas where halon or CO_2 has been released have cooled sufficiently before opening. Where other extinguishing agents have been used, examine the fire area for hot spots or embers that need to be cooled or extinguished. Do not try to remove embers

and burned material from the spaces. Instead, fill a drum or trash can with water, and immerse all involved materials before removal and disposal. Be prepared to fight new fires during the overhaul.

Training

Training is extremely important, especially in remote areas where you **ARE** the fire department. All employees should know the location of fire fighting equipment and hydrants. Employees should also practice using fire extinguishers and should know the basics of fighting fires, how to evacuate from all areas of the building, and how to sound the alarm.

Fire Fighting Tips

- Alert a trained fire fighting team, if one is available. Before fighting a fire yourself, make sure you are properly outfitted. If professional fire fighting clothing is not available, wear wool clothing and wear leather gloves—not synthetic or rubber. Do not wear cotton, polypropylene, or synthetic clothing; they ignite at low temperatures and will cause severe burns. In enclosed spaces, use a self-contained breathing apparatus (SCBA) with a safety line.
- Always stay low to the floor. Mattresses, insulation, plastics, and a host of other common items give off toxic gases when burning. These gases will rise to the ceiling with the smoke and can be fatal to anyone who inhales them.
- Check doors with the back of your hand to make sure the room beyond is not too hot to enter.
- Always keep your escape route open and clear. To maintain an uninterrupted flow of extinguishing agent to the fire, have backup extinguishers and coworkers immediately available.
- Although you must be fairly close to the fire to successfully fight it with portable extinguishers, do not approach the fire too quickly. Be familiar with the range of your

extinguishers so you don't have to go closer than necessary.

- If you need to retreat, back away and keep your eyes on the fire. Never turn your back on a fire.
- Halon and CO_2 tend to blow away in windy conditions, so keep the wind at your back.
- Fire fighting is dangerous business. Fires and decomposing halon produce poisonous gases, and CO_2 displaces air. Because the vapors are invisible, you cannot determine their level of concentration by the amount of smoke in the air. When halon decomposes, it produces a sharp, acrid smell. This should be a signal to leave the area immediately. When using these extinguishing agents or fighting a fire in an enclosed area, you must either exit the area quickly or wear self-contained breathing apparatus.

How to Fight Specific Classes of Fires

Class A

Class A fires will re-ignite if they are not totally cooled or covered with the extinguishing agent. Be very cautious working around burning fiberglass laminates, epoxies, and urethane insulating foam. They give off extremely toxic vapors.

Class B

Class B fires must be smothered or blanketed with the proper extinguishing agent. Be very careful not to scatter the fuel while fighting these fires.

Class C

Shut off the electricity before attempting to extinguish class C fires.

Sources and Further Reading

Beating the Odds on the North Pacific: A Guide to Fishing Safety, edited by S.C. Jensen. University of Alaska Sea Grant MAB-41, 244 pp., 1998 3rd edn.

Bears

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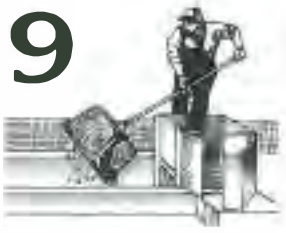


It seems that everyone working in rural Alaska has had a bear encounter at some point. A bear in a natural setting is always a magnificent sight, but coming upon bear can be startling and dangerous if you do not react properly.

Bears in Alaska

Alaska has three species of bears—polar, brown (grizzly), and black, in descending order of size. Only the last two are of concern to aquaculture workers. Bears are curious and intelligent, and have incredible strength. Brown bears can weigh over 1,000 pounds yet move silently and with surprising speed. Bears have been clocked running at speeds up to 40 miles per hour. It is understandable that so many people have a fear of bears.

Yet statistics demonstrate that much of the fear of bears is unfounded. In Alaska, for example, from 1900 to 1985 only 20 people were killed by bears. Compare this to the 19 people in Alaska who were killed by dogs between 1975 and 1985 alone. In the United States, more people die from encounters with bees, bulls, and lightning than from encounters with bears.

Respecting bears, rather than fearing them, is a much healthier approach to bear-human encounters. Negative bear encounters

can be minimized by adopting appropriate behavior which includes respecting a bear's territory, food sources, and offspring. Bears tend to avoid people if given a chance. The following tips are some ways to give bears that chance.

Avoid Surprises

Make your presence known, especially where visibility is limited due to terrain or vegetation. Talk loudly, sing, or use bells tied to your pack. Metallic sounds are not found in nature and may work particularly well. Working in groups makes it easier for bears to detect you. The woods can absorb sounds readily; if you really want to be heard, use a boat air horn. If possible, work with the wind at your back so your scent can make bears aware of your presence downwind. A bear's eyesight is better than is usually thought, but bears trust their sense of hearing and smell more. When working around noisy running water or in heavily vegetated country, always keep an eye out for bears to avoid a surprise!

Give Bears Their Space

Bears are the dominant species in rural coastal areas of Alaska. They have no predators other than humans. Because of this they tend to avoid humans, especially if they have not been conditioned to associate humans with a food source. Bears need more personal space than humans do, and will react aggressively if they feel their space is threatened. Remember that it is their territory you are in. Let them have it to avoid aggressive behavior.

Don't Give Bears Food

The Alaskan summer is a short time for bears to build up the fat reserves needed to get through the winter. Anything that smells like a possible food source will be examined. One of the quickest ways to shorten a bear's (or your own) life expectancy is to condition it to human food or garbage as an

easy meal. It is both foolish and illegal to purposefully or accidentally feed bears. Be sure that all cooking is done indoors and you are fastidious about washing dishes and keeping the camp clean. Keep fish in running water if possible to eliminate fish smells. Avoid getting food smells on your clothing or body. Store food in secure airtight containers and keep it indoors. Burying food is not effective because bears are great diggers. Remember that pets and their food can also attract bears.

Dispose of Trash Properly

Proper garbage disposal in bear country is a must. Every camp should have and follow a garbage management plan. Meats and fish carcasses should not be stored in garbage containers. Bear-proof containers are available for other garbage. Keep the garbage area clean, tidied up, and as non-smelly as possible. Composting is not recommended in bear country. Remember that you are held responsible for problem bears that have been drawn into an area because of your inadequate garbage disposal.

Don't Get Between a Mother and Her Cubs

Sows protect cubs! Mother bears are fierce defenders of their cubs. It's a serious mistake to let yourself get between them. When a bear is spotted in your area, assume that a cub is also in the area until proven otherwise and act accordingly. Innocently passing between a mother and its cub can lead to disaster.

Bear Defense

The best defense against bears is adjusting your behavior to work around the bear's behavior. If you have done this properly, you can avoid most encounters. However, there are several ways to protect yourself if this fails.

Firearms

Firearms should never be considered as an alternative to common sense. Firearms in inexperienced hands around bears are double trouble. Generally speaking, high caliber rifles or 12 gauge shotguns with slugs are needed to stop bears. Pistols and small caliber firearms are usually a very poor substitute. Alaska law allows you to shoot a bear in self defense but you must salvage the skull and hide and turn it over to state officials. If the bear attack was found

to be provoked by your behavior or improper garbage handling, you could be fined.

Bear Sprays

Using aerosol sprays that contain capsicum (red pepper extract) for bear defense is controversial. Their effective range is less than 25 feet, and a charging bear covers that distance in less than one second. The spray's effectiveness is considerably reduced if you are spraying in the rain or into the wind. The can must be accessible, not in the bottom of your pack. And as is the case with firearms, the user must have practiced with these defense devices to make them effective.

Close Encounters

Identify Yourself

If you meet up with a bear, talk in a normal voice and wave your arms slowly up and down. Let it know that you are a human. A bear standing on its hind legs is trying to identify you; it is not being aggressive.

Move Away Slowly and Avoid Sudden Actions

Move in a diagonal direction away from the bear if possible. Do not run. This may associate you with prey and the race (which you will lose) will be on. Bears can run downhill and they can do so faster than you! If the bear continues to move toward you, be more aggressive. Raise your voice. Bang loud objects together. Never make bear sounds or high pitched squeals. Avoid direct eye contact which could be interpreted as aggressive.

Climb a Tree

Although both black and brown bears can climb trees, full-grown brown bears have a hard time doing so. If you do climb a tree to avoid a bear, be sure you are out of a bear's reach by climbing at least 10 to 15 feet above the ground.

If Attacked

Aggressive bear behavior includes ears laid back, hackles up on the back of the neck, chomping teeth, pawing at the ground, woofing sounds, and head swaying back and forth. This is the bear warning you to get out of its way.

Fortunately, most attacks are false charges with the bear stopping just short of you. This may be repeated several times. If you are actually attacked, drop anything that will play to the curiosity of the bear. Surrender and play dead. Lie on your stomach and protect the back of your neck by covering it with your hands. Leave packs on your back for protection. Try to remain motionless as long as possible. Generally the bear will break off the attack once the perceived threat has been eliminated. Before moving make sure that the bear is really gone since it might stay in the area.

If the bear continues biting you after you have assumed a defensive posture, fight back as vigorously as possible. It is now a predatory attack.

Finally, it is important to recognize that bears are individuals and will not necessarily act in a predictable manner. Beware of statements like "bears always do this" or "bears never do that." The vast majority of bears work hard to avoid human contact. Try to design your work program so that bears can use their routine avoidance techniques.

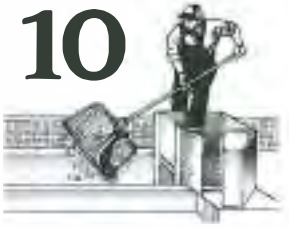
Sources and Further Reading

Bear Aware, by Bill Sneider, Falcon Press, Helena, MT, 125 pp., 1996. (Small pocket-sized booklet, good general information.)

Bear Attacks, by Stephan Herrero, Lyons & Burford Publishers, 296 pp., 1988. ISBN 0-941130-82-1.

Shore Survival

10



When traveling around Alaska, it is not uncommon to find yourself spending an unplanned night on a remote beach or shoreline. Unless you are near a house or cabin, you must take serious action to survive being stranded overnight. Knowing in advance what actions to take can turn a survival situation into an overnight camping trip.

Seven Steps to Survival

Interviews with hundreds of survivors have yielded several elements common to all successful survival situations. These elements have been distilled down to the seven steps to survival, an easy way to remember the actions you need to take to survive being stranded in a remote location.

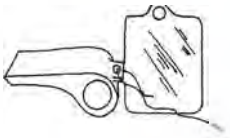
The seven steps are:

1. Recognition
2. Inventory
3. Shelter
4. Signals
5. Water
6. Food
7. Play

1. Recognition

Recognize that your situation has changed and that you need to take action.

2. Inventory



Take time to inventory your circumstances and resources, and to determine what is working for and against you. Where are you? How is the weather? What skills do you and your companions have? Is there useful debris on the beach? How is everyone's physical and emotional state? Is anyone injured or hypothermic?

Be creative as you think of items for shelter, signals, water, food, and play. Don't throw things away; you may need them later. A torn piece of plastic can become a rain jacket, part of a shelter, a water collector, or bag for food. A belt can be an essential part of a shelter, its buckle a reflective signal. Remember, inventory starts with invent.

3. Shelter

Your biggest enemy in a shore survival situation is not starvation, dehydration, or bears. It's the quiet killer—hypothermia, the lowering of the body's core temperature. The best way to prevent hypothermia is adequate protection from the elements. In an emergency, you need to be concerned with finding or making shelter.

Building a Shelter

Your emergency shelter may be your clothing, piles of moss and leaves, or a shelter that you construct. To be effective, shelter must provide insulation for warmth and protect you from the elements.

Look for the natural beginnings of a shelter. You may be able to build in a cave, or next to a fallen log or overhanging cliff.

Build a small shelter that will trap your body heat and slow further heat loss. A large shelter may keep wind, rain, and snow away, but it will do a poor job retaining your body heat. Build your shelter so its ceiling and sides are no more than six to eight inches from your body when you are lying down inside. If you have a tendency to get claustrophobic, you may need to make your shelter a little larger or sleep with your head near the doorway.

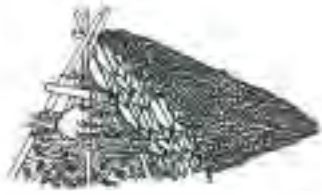
When you choose a site, make sure ground water or rain won't collect in your shelter. Select a location that is protected from the wind, rain, and snow, yet is close to construction materials, sig-

nals, and a source of water. Balance your need to be protected from the elements with your need to be visible to rescuers.

Begin your shelter with a bed, using piled-up branches, small driftwood, and other materials to raise you off the cold ground. Then lay down a 2-3 foot deep insulating layer of grass, leaves, moss, and small branches. (It will compress appreciably with use.) A thick, dry, insulating layer underneath you is critical, so use plastic or broad leaves as a waterproof layer on top of the insulation.

Once you have completed your bed, begin the structure. Use driftwood, deadfall logs, or small branches for support beams. Place them close enough to support the insulation and waterproofing layers on the shelter's ceiling and sides, and arrange all branches so the water runs off your shelter. Keep your shelter small. A small, well-insulated shelter can be warmed by your body heat much easier than a big one.

How you insulate and waterproof your shelter depends on your materials and ingenuity. Plastic will help keep you dry (a good reason to stuff a few garbage bags in your survival gear!), but if it is not available, you can use bark, large leaves, or layers of branches.



Construct a door that is weatherproof, insulated, and easily pulled into place when you are in the shelter. Make it easy to remove, too, for quick escape when you need to signal rescuers.

Check the quality of your shelter by looking inside. Every place you see light needs to be filled. While small holes may seem

insignificant, they will let in the wind, rain, and snow, and let your body heat out. If your shelter is too big, pile more branches on the bed, the sides, or on top of you.

A good shelter takes several hours to construct. If there is little time to build before dark, your first night's shelter may be a debris bed made from a pile of moss, grass, leaves, and branches. Make the pile as high and as weatherproof as you can, and crawl into it for protection.

4. Signals

To be effective, a signal must attract attention and say, "HELP!" The best way to attract attention is to make your signals look different from your surroundings. Use square angles, movement, contrast, and noise to your advantage.

Make sure you have signals that can be seen from the air and others that will be visible from the water. The U.S. Coast Guard recommends that each letter in your SOS signal be at least 18 feet long and 3 feet wide to be visible from the air. Place seashore signals well above the high tides to avoid rebuilding.

Signals in groups of three indicate distress, so if you build fires, build three, or hang three space blankets side-by-side. One bonfire looks like a beach party or a hunting camp to passing boats. Three fires in a line, mounds of orange buoys, and waving flags say, "HELP!"

Use both passive and active signals, and build several of each. Passive signals—like flags, SOS, or three buoys hung in a row—work by themselves. Active signals are ones you operate such as flares and signal mirrors.

5. Water

Water is critical for survival. We all need to drink two to four quarts of uncontaminated water every day for normal body function. Without adequate water, most people will die within a week.

Untreated water can be contaminated by several disease-causing organisms, some of them lethal. One organism of particular concern in Alaska is giardia, a parasite invisible to the naked eye. Signs and symptoms of giardia usually occur 10 to 14 days after drinking contaminated water. They include severe abdominal cramps, diarrhea, vomiting, a bloated stomach, and fatigue. Because most people need prescription medication to avoid recurring bouts of giardia, it is wisest to avoid the illness altogether. Don't let it complicate your survival situation.

The best way to prevent all water-borne diseases is to drink treated water. Although you can use chemical and mechanical methods to treat water, the most practical method in an emergency is to boil the water briskly for 15-20 minutes. One minute of brisk boiling generally kills giardia, but the extra time is needed to kill other organisms. Boil melted ice and snow, too—freezing does not kill the giardia cyst.

Some chemical treatments are available to purify water, but they are not 100% effective, especially when the water is cold or cloudy. If you have no way to boil untreated water, get it from the safest available source. Rainwater is generally safer than water from a creek, river, stream, or muskeg. A plastic bag works well as a rainwater collector.

Water is essential for digestion, so don't eat if you don't have water to drink. (Berries and other foods high in water-content are an exception to this.) When you are low on water, lessen your body's demand for water by avoiding excess motion and sweating.

6. Food

Food can often be found in abundance if you know what is edible and where to look. Concentrate your food gathering efforts on plants, berries, seaweeds, animals in the intertidal zone, and fish. Stalking large game often expends more energy than it yields.

Learn to identify edible plants and animals. This knowledge can help you in an emergency and can enhance your daily diet at home. Consult the resources listed in this book, or take an edible foods class for more information on edible plants and animals in your area.

Paralytic Shellfish Poisoning

PSP is caused by poisons in tiny organisms—called dinoflagellates—often found in North Pacific waters. Clams, mussels, geoducks, oysters, snails, scallops, and barnacles are all potential carriers of this potent neurotoxin. Contrary to what many people believe, it is **NOT** safe to eat these shellfish in months whose names contain the letter "R." (See Injuries from Fish chapter for more detail on PSP.)

7. Play

You have recognized the emergency, done an inventory, built a shelter, put up signals, discovered a source of water to boil, and have even found some food. Now what? Play!

Play means staying mentally and physically busy, improving your shelter, signals, water catchment and cooking arrangements, sharing stories and jokes, and emphasizing the positive. Play will keep your spirits up and strengthen your will to survive.

Fire

Fire can be an important part of your shelter, signals, water, food, and play, and can provide a psychological boost, but you can survive without it. Many people have survived in coastal Alaska in the winter for weeks without a fire, even though they were wet when they began their survival experience. One of the important factors in their survival was finding and making shelter.

There is a danger in overemphasizing the use of fire, especially if you are in a wet

environment and are not used to building a fire in these conditions. To be an effective heat source, outdoor fires need both abundant fuel and fairly constant attention. People have tried and failed to build fires, and then died because they neglected to build a shelter and signals.

Summing It Up

Although you never know how your day is going to end, you can take steps to ensure that you will be comfortable should the unexpected happen. Having survival gear and proper clothing, and following these seven steps, should help you turn an emergency into an adventure story to share with friends by the fire upon your return.

Sources and Further Reading

Beating the Odds on the North Pacific, A Guide to Fishing Safety, edited by S.C. Jensen. University of Alaska Sea Grant MAB-41, 244 pp., 1998 3rd edn.

Discovering Wild Plants, by Janice Schofield, Alaska Northwest Books, Anchorage, AK, 354 pp., 1989.

Marine Safety Instructor Training Manual, Alaska Marine Safety Education Association, Sitka, AK, 256 pp., 1992.

Surviving on the Foods and Water from Alaska's Southern Shores, by Dolly Garza. University of Alaska Sea Grant MAB-38, 24 pp., 1989.

Airplane Safety

11

Two travelers were waiting for weather conditions to improve before chartering a float plane to a remote hatchery site in Southeast Alaska. The notorious "Taku winds" around Juneau were creating weather conditions too hazardous for flying. Finally, after two days of squally winter weather, the conditions in Juneau had improved. However due to local severe winds at the hatchery site, the trip was again cancelled.

A short time later, an inexperienced person falsely reported "favorable" weather conditions at the hatchery site and the flight was rescheduled. Unbeknownst to all, the person reporting the favorable weather had run out of cigarettes earlier and had more coming in on this flight.

Upon approaching the hatchery site, the float plane ran into severe turbulence. Winds were in excess of 50 knots and the surface of the water was "smoking" as the tops of the waves were blown off. The plane was like a bug in a breeze hitting 20- to 30-foot bumps in the air pockets. The engine suddenly stopped. A busy pilot got the engine running again. Bouncing from one air pocket to another, the plane crabbed up the bay and made a sideslip landing on ice with a 30 knot crosswind.

After the plane was stopped, and fingers were pried out of the upholstery, both pilot and passengers realized that one person's ill-considered phone call could have easily led to a disaster.

Flying in Alaska

According to the Federal Aviation Administration (FAA), Alaska has three to ten times the general aviation airplane crash rate as the rest of the United States. Alaskans are 75 times more likely to get on a plane than the average American, and 50% of the commuter airplane crashes in the United States occur in Alaska. Also, according to the FAA, airplane casualties in Alaska are not

caused primarily by inexperienced pilots running out of fuel, as is the problem in the rest of the United States; rather they are caused by experienced pilots getting in trouble with restricted visibility caused by poor weather conditions.

Flying in and out of remote aquaculture sites is an important part of the work environment. Although as passengers you usually let the pilot take care of safety when flying, you can take some proactive steps help in your own safety.

- Avoid the get-home-at-all-costs attitude. If possible, get a weather report from at least two sources for the site you are going to. A day's wait will be nothing when compared to a crash due to impatience.
- Dress so that you can spend the night out, in case you make an unscheduled stop. Rain gear, clothing that keeps you warm when wet, and appropriate foot gear are basic necessities. Don't forget your hat!
- Keep a personal survival kit on your body in case of emergencies. Most survivors find themselves with only the clothes on their backs and the items in their pockets in an emergency.
- Wear ear protection. Small planes operate at high noise levels that cause long-term hearing damage. A spare set of ear plugs in your personal survival kit will be useful.
- If you have any questions or concerns about safety, ask the pilot.
- Carry an inflatable jacket or PFD in case of a ditching in the water. However, be aware that wearing inherently buoyant devices in a plane may cause entrapment.
- Follow the pilot's instructions and pay attention to the safety briefings. Most pilots prefer to seat passengers for

proper weight distribution, open and close doors, and load and unload baggage themselves.

- Approach or disembark an aircraft only after you are given an OK by the pilot. Also, let the pilot make the approach to a dock and tie up the float plane unless they request your assistance.

- Baggage on an aircraft should be well-packed without loose or dangling pieces.
- Make sure the pilot is aware of any hazardous materials you are carrying. If hazardous materials are allowed, make sure they are stored in an approved, leak-proof container. Do not take bear spray cans on aircraft.
- Wear seat belts at all times.
- Respect the pilot's right to silence during takeoff and landing.
- Stay alert, and assist your pilot in looking for hazards and pointing them out, such as birds or other aircraft in the area.
- Helicopters have their own set of additional safety considerations. Listen carefully to the pilot's briefing. Follow instructions to the letter. Approach the helicopter only when the pilot signals you, and never approach the helicopter from any direction in which the pilot cannot see you easily. Especially avoid the rear of the aircraft. An especially dangerous time to approach a helicopter is while its rotors are moving during engine start-up and shut-down.
- Try to choose a company that has a good safety record and has experienced pilots.

- Do not try to coerce the pilot to fly overloaded or in bad weather. The pilot is the safety expert, and should have the final word without pressure from other sources.
- Above all else, remember it is **YOUR** decision to board a plane. Do not be led by companions or by commitments if you feel it is unsafe to fly.

Flyer's Rights

Passengers are entitled to ask pilots about:
Location of the Emergency Locator Transmitter (ELT) and survival equipment.
How to exit the airplane during an emergency.
Tying down all cargo.
A seat and seat belt for every passenger.
A preflight safety briefing.
The weight and balance of the aircraft.
The takeoff and landing performance for the aircraft at this weight.
The weather conditions and filing a flight plan.

(From the Alaskan Aviation Safety Foundation)

Emergency Equipment

Required on All Passenger Aircraft

First-Aid Kit

Adhesive bandage compresses
Adhesive tape
Ammonia inhalants
Antiseptic swabs
Bandage compresses
Bandage scissors
Blood-borne pathogen kit
Burn compound (aerosol cans)
Roller bandage
Triangular bandage compresses

Survival kit

1 knife, folding blade
1 signal mirror
6 signal flares
20 matches, waterproof
1 quart water per occupant (not required when operating over areas where adequate water suitable for drinking is available)
1 space blanket or other protective covering per occupant
2-day food supply per occupant

Required on Alaska Passenger Aircraft

2-week food supply per occupant
1 ax or hatchet
First-aid kit
1 pistol, revolver, shotgun, or rifle, and ammo for same
Small gillnet and assortment of tackle such as hooks, flies, lines, sinkers, etc.
1 knife
2 small boxes matches
Mosquito headnet for each occupant
2 small signaling devices such as colored smoke bombs, railroad fuses in sealed metal container
1 pair snowshoes, winter only
1 sleeping bag, winter only
1 wool blanket for each occupant over 4 years old, winter only

Sources and Further Reading

Aircraft Flight Manual and Pilot Procedures, edited by Kenton P. Taylor. Alaska Department of Fish and Game, Juneau, AK, 22 pp., 1995.

Survival Sense for Pilots, by Robert Stoffel and Patrick LaValla. Emergency Response Institute, Tacoma, WA, 160 pp., 1980. Available from Survival Education Association, 9035 Golden Given Rd., Tacoma, WA 98445.

About the Authors

Jerry Dzugan has been the director and training coordinator of the Alaska Marine Safety Education Association since 1986. He has worked as an educator since 1972, and has also been a commercial fisherman, charterboat operator, and emergency medical services instructor. He makes his home and maintains his sailboat in Sitka, Alaska.

Dan Falvey has taught water safety and outdoor survival for the Alaska Marine Safety Education Association since 1993, and has commercially fished in Alaska since 1981. He and his wife Kathy currently live in Sitka.

Quick Reference for Rescuers Trained in CPR

Key Values in Cardiopulmonary Resuscitation (CPR) Assuming single rescuer and adult victim	
Ventilation rate (rescue breathing)	12 breaths/minute (1 breath each 5 seconds)
Compression to ventilation ratio	15:2
Compression rate	60-80/minute
Compression depth	1.5-2 inches

Spawn, Spat, and Sprains

A Manual for Aquaculture Safety in Alaska

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