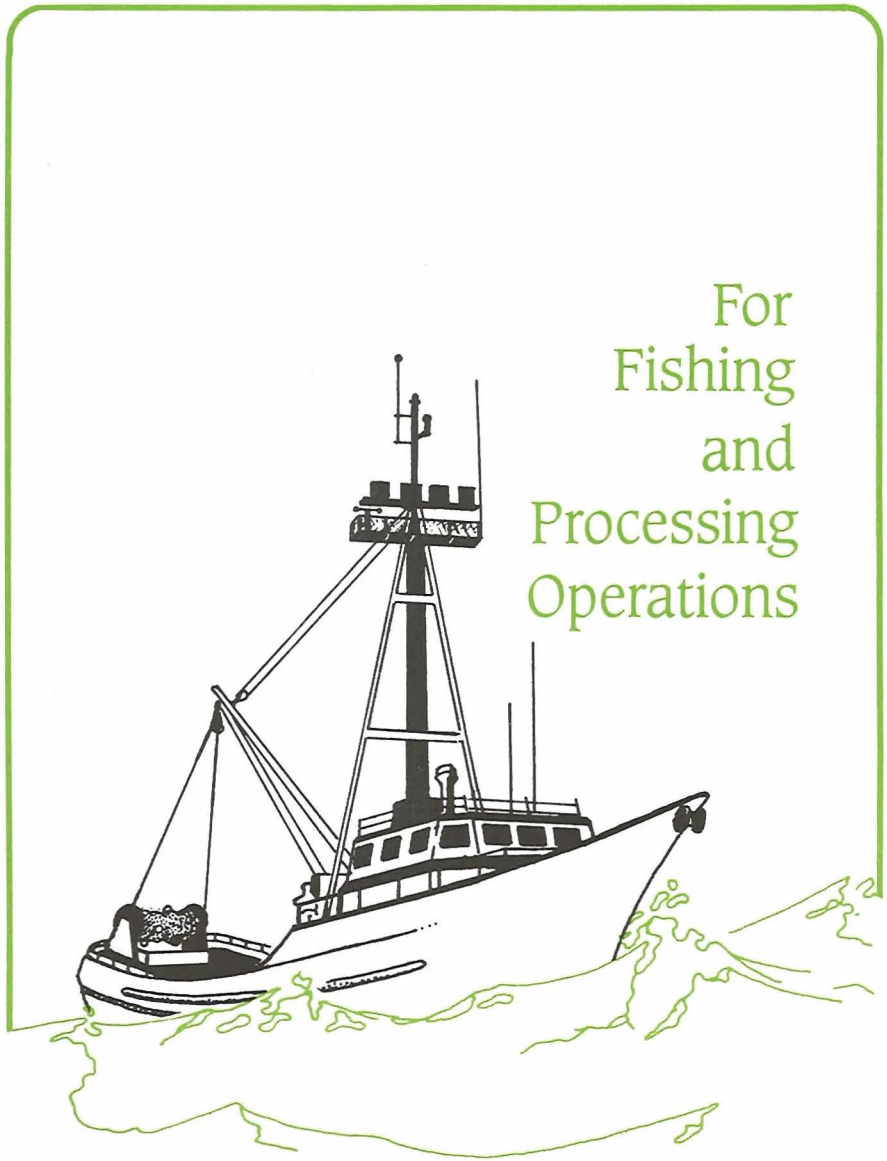
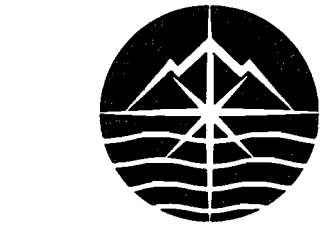
ALASKA

Recommended Whitefish Quality Guidelines



For Fishing and Processing Operations



ALASKA

Whitefish Quality Guidelines

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Introduction

To successfully achieve its potential in world markets, the Alaskan whitefish industry must become a leader in product quality. Production of a high quality fishery product requires the collective efforts of all who participate: fishermen, processors, distributors and resource managers. The Alaska Seafood Marketing Institute's (ASMI) quality assurance program is designed to unite the efforts of the seafood industry and government agencies into an effective partnership. ASMI believes that this cooperation will be helpful in assuring the consistent high quality of all Alaska seafood products sold in national and international markets.

Because of the complexities of harvesting, processing, transporting and distributing seafoods from remote points along Alaska's 34,000 miles of coastline, there is a need for industry education to assure the quality of seafoods produced in all areas of the state. These guidelines are an important part of that educational effort.

These general guidelines are intended to assist fishermen and processors in producing high quality whitefish products. They are not intended to replace the advice of trained and experienced technologists and should not be construed as replacing state or federal regulations.

I
Scope

These guidelines apply primarily to those whitefish of the family Gadidae (Codfishes, Whiting and Pollock) but may be adaptable to other species of whitefish which are harvested and/or processed in the state of Alaska.

II
Definitions

Fish or whitefish mean those fish of the Order: *Pleuronectiformes* – Flounders, Soles (excepting Halibut) and of the families *Gadidae* – Cod, Pollock and Whiting and *Scorpaenidae* – Rockfishes, Scorpionfishes and Thornyheads.

Process means an activity which modifies the physical condition of a fish or fish product, including but not limited to, butchering, drying, freezing, packing, salting, etc.

Processing facility means any facility, whether shorebased or aboard a vessel where fish is processed for human consumption, including the premises, buildings, structures, facilities and equipment.

Sanitize means to treat surfaces so that the number of microorganisms is substantially reduced.

Vessel means a watercraft engaged in harvesting, transporting and/or processing fish or fish products for human consumption.

III
Product Quality

Although there are many aspects that fishermen and processors must consider when defining what is meant by high quality fish products, two major ones are: 1) the intrinsic quality of the fish before it is harvested, and 2) the extrinsic quality of the fish as it is delivered to the processor, and ultimately, the consumer.

The intrinsic quality of the fish is determined by the physical condition of the fish at the time it is harvested, and is affected by species, size, sex, stage of maturity and other physiological characteristics. These characteristics are inherent to a particular fish, and the method of handling that fish will *not* significantly alter these characteristics. For example, a noticeable change in quality occurs in whitefish such as cod and pollock during the six to eight week period following spawning. Fish harvested at this time usually exhibit a higher percentage of body fluids, and, upon processing, often result in decreased yields.

The extrinsic quality of the fish is determined by the methods employed in the harvesting, handling, processing and storing of that fish. Proper handling procedures will result in fish of high extrinsic quality; improper handling methods will result in loss of extrinsic quality.

Deterioration of extrinsic quality is also caused by the action of microorganisms and enzymes, and other chemical changes that take place in the fish after death. The flesh of live fish is normally considered to be sterile, but all of the external surfaces of the fish are exposed to bacteria. These bacteria flourish after the fish dies, deteriorating quality.

Enzymes are secreted into the fish's digestive tract so that it may digest and utilize the food it eats. After the death of feeding fish, the action of these enzymes does not stop and is not controlled as it was during the life of the fish. These enzymes will leach out of the stomach and intestines and begin to digest the proteins in the flesh of the fish, resulting in what is commonly called "belly burn."

This digestive action by enzymes is part of the decomposition process, causing undesirable changes in the fish and making it easier for bacteria to invade the flesh of the fish, causing it to spoil more rapidly.

Biochemical changes take place in the fish that also result in deterioration. The progress of these changes is most evident as the muscles of the fish change from soft and flexible to hard and rigid as rigor mortis sets in, and then return to a relaxed state.

The deterioration of fish and fish products caused by bacteria, enzymes and other chemical actions cannot be stopped, but it can be slowed down. You should:

(a) Control temperatures to keep bacterial and chemical activity at the slowest rate possible,

(b) Prevent unnecessary contamination through good sanitary prac tices and proper design and construction of equipment and facilities, and

(c) Handle the product to minimize physical damage (bruising, crushing, etc.).

IV
Fishing and Fishing Vessels

IV-A Vessel Specifications

General Design: The design and construction of a fishing vessel must take into consideration both efficiency and performance as a seaworthy harvest unit, as well as capabilities necessary to deliver a high quality catch to the processor. Design and construction must therefore ensure:

(a) rapid and efficient handling of fish,

(b) adequate facilities for proper storage and temperature control, and

(c) use of materials and design that will facilitate cleaning and disinfection, and prevent damage or contamination of the catch.

Due to the limited space available on a fishing vessel, there is a high potential for contamination of the fish with bilge water, sewage, fuel, oil, grease, smoke, chemicals or other objectionable substances. Design and layout must consider these potential problems in the organization of space, functional areas and facilities.

These specifications provide guidance for design, construction, or retrofitting of vessels to ensure adequate facilities necessary for proper handling and consistent delivery of a quality catch.

Deck Areas and Fish Holds or Tanks: Portions or areas of the deck where fish are unloaded, bled, gutted or otherwise handled should be adequate in size and used exclusively for these purposes. These areas should be well defined and constructed of materials which can be easily cleaned.

Except for bulk storage in refrigerated sea water or refrigerated brine, bulk storage without the use of removable shelving and vertical dividers is not recommended. Pounds or pens should be of adequate number and size to prevent movement of the fish due to vessel motion.

All wood and steel surfaces should be treated with a durable, smooth, nontoxic, coating which can be easily cleaned. For metal surfaces it is recommended that the coating also be anti-corrosive. Deck pounds or pen

stanchions and dividers should be constructed of smooth, durable materials which can be easily cleaned. Deck pound or pen dividers should be removable and fitted with gates and drain notches to facilitate cleaning and drainage of blood and slime.

Fish holds or tanks should be of completely water tight construction.

The lining of fish holds should be durable, smooth, impervious, non-toxic material. Fish holds or tanks should not be of unfinished wood construction.

Each fish hold or tank should be equipped with a central drain discharging directly into a sump or well located so the tank can be completely and efficiently drained at all times. (Bilge pump connections to these sumps should be equipped with coarse screen filters and a check valve). A passageway to the sump should be incorporated in the design of fiberglass holds to ensure that blood and ice will not block drainage.

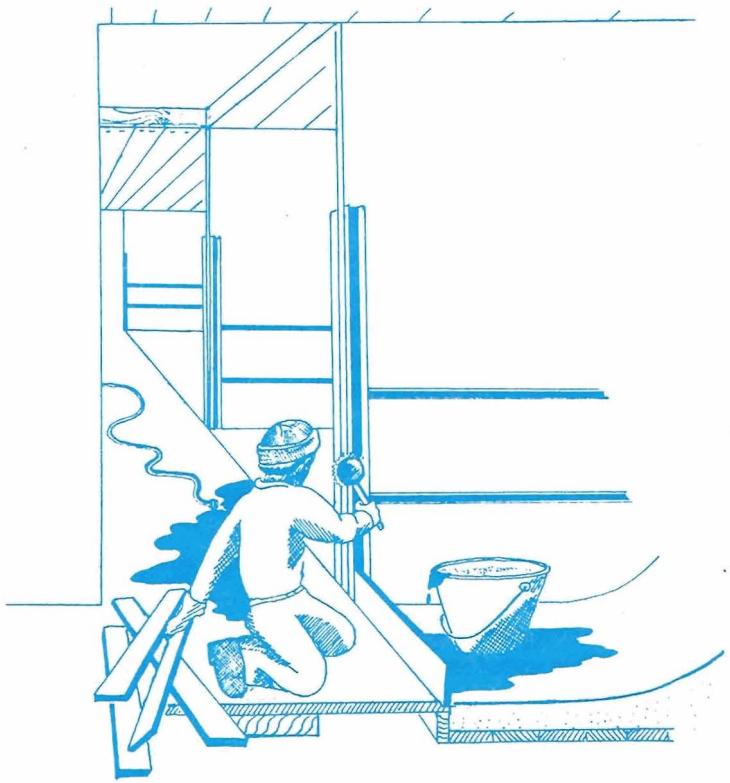


Figure 1: Fish hold surfaces should be smooth, durable, watertight, non-toxic and easily cleanable.

Fish holds or tanks should be insulated to minimize heat transfer into fish storage areas. A minimum "R" factor of 10 is recommended for fresh (chilled) storage areas and a minimum "R" factor of 20 is recommended for frozen storage areas.

Insulation should be installed so that it is completely sealed to prevent seepage of water, blood, and slime into the insulation, reducing its effectiveness.

See the following table for "R" values of a one inch thickness of commonly used insulating materials.

MATERIAL (one inch thick)		"R" VALUE
Ordinary Wood	–	1.00
Urethane Foam	–	6.25
Glass Fiber	–	4.00
Expanded Polystyrene (depending on density)	–	4.00 - 5.00
Foam Glass	–	2.60
Expanded Perlite	–	2.70
Wood Fiberboard	–	1.67
Styrofoam (depending on density)	–	4.00 - 5.00

"R" values can be calculated by multiplying the factor for the material by the thickness (in inches) of the insulation.

Fish holds or tanks should be fitted with covers and combings.

Fish hold or tank interior corners should be rounded and interior surfaces should be free from projections such as valves, pipes, beams or ribs.

When bulk storing, shelves should be installed so the maximum depth of fish does not exceed one-half meter or approximately 20 inches.

Shelves and vertical dividers in fish holds and tanks should be portable or removable boards with a smooth, nonabsorbent, non-toxic, noncorrosive finish.

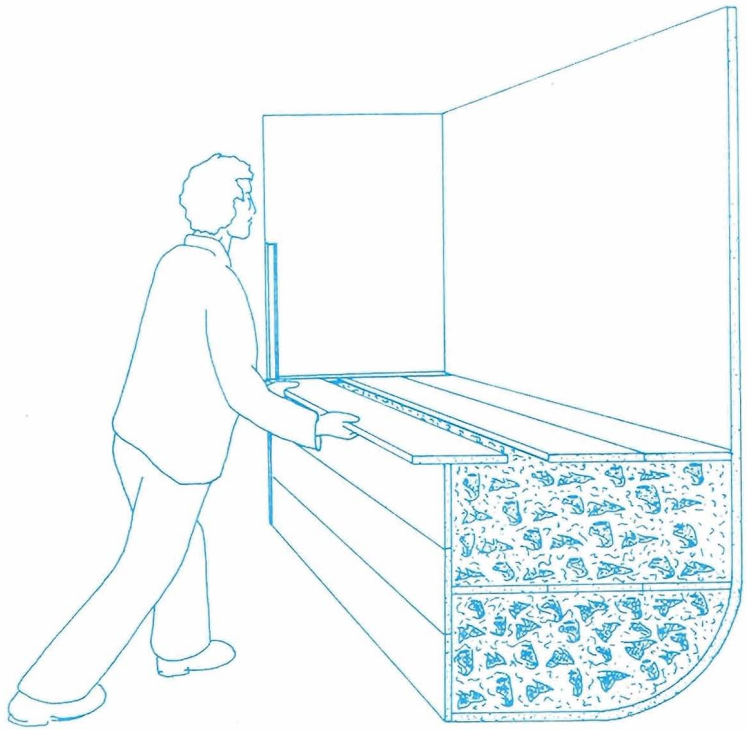


Figure 2: For bulk storage, shelves keep the maximum fish depth at 20 inches

When storing fish in boxes, shelves and other dividing structures should be arranged to prevent large air gaps between boxes.

In bulk holds on small vessels where shelves and dividers are not used, the hold should be equipped with removable, smooth, nonabsorbent floor boards that will permit drainage and prevent fish from lying in accumulated melt water, blood and slime.

If used, cooling grids should be properly installed and operated.

Water and Ice: An ample supply of cold potable water or clean sea water under adequate pressure should be available at a sufficient number of appropriate locations throughout the fishing vessel.

It is recommended that, where practical, vessels be equipped with a system for disinfection of sea water. A chlorine injection system for chlorination of sea water is recommended.

Sea water intakes should be located on the opposite side of the vessel and well forward of waste and engine cooling discharges. Sea water should only be taken in when the vessel is in forward motion and in unpolluted waters (never in harbors).

Plumbing should be installed to prevent back siphonage and should have no cross-connections with engine and refrigeration cooling systems, bilge water systems or other potential sources of contamination.

Ice should be protected in a sanitary way during manufacture, transit, storage or use.

Equipment and Utensils: All equipment used on board fishing vessels for handling, conveying and storage of fish should be designed for rapid, efficient and gentle handling of fish. Chutes or other means of conveying fish should be installed to prevent physical damage to fish.

All equipment and utensils (shovels, rakes, knives, etc.) used on board fishing vessels for handling, conveying and storage of fish and ice, should be constructed of durable, smooth, nonabsorbent, non-corrosive materials, and be easily disassembled if necessary for thorough cleaning.

When boxes are used for storage of fish, they should be of smooth, nonabsorbent, durable construction and finish. Wooden boxes should not be used unless coated with an appropriate finish or material.

Each fishing vessel should be properly equipped for bleeding and gutting of fish, when necessary. Where cutting benches or grates are installed for this purpose, they should be equipped with a continuous flow of clean water, and chutes or channels to carry blood, water, slime and offal (guts) away for disposal. Discharge of fish wastes should be conducted in accordance with applicable state and federal requirements.

Toilet Facilities and Waste Disposal: Toilet and handwash facilities should be provided convenient to fish handling areas and be provided with toilet paper, clean running water (preferably hot and cold), soap and clean towels (disposable towels are recommended).

Waste disposal lines and systems should be adequate in size and design for the quantity and types of waste generated, free from leaks and cross

connections with any other system, and should not be routed through fish holds or areas where fish are handled or stored.

IV-B General Operating Procedures for Fishermen

Product Handling: The best designed and constructed vessel and equipment will do very little to ensure delivery of a high quality catch if fish are not handled and stowed properly. The following procedures are recommended to assist you in delivery of a quality catch:

Duration of fishing trips and length of hauls should be determined by the vessel and crew's capabilities to handle the catch, keep it well chilled and deliver it in good condition to the processing plant.

All decks, gear and equipment that may come in contact with fish should be washed down with cold potable water or clean seawater just prior to fish coming on board.

Handling and sorting of the catch should begin as soon as the fish come on board.

Adequate measures should be taken to protect fish from contamination by birds, animals and insects. Dogs, cats or other animals should not be permitted on board the vessel. Vessels should be protected from, and periodically inspected for, infestation by rodents and insects.

Fish should be protected from sun, wind and excessive temperature at all times.

Some species of fish should be bled immediately after they are caught and while still alive. Bleeding methods vary, but cutting one or more of the gill arches commonly produces the desired result. The method of bleeding should conform with buyer's specifications. Utilize cuts that do not damage the heart or cause a sudden decline in blood pressure. Depending upon species and size, fish should be allowed to bleed freely for 5 to 30 minutes. Live fish, and fish that are dead but have not yet entered the stage of rigor mortis should be treated with the greatest care, as physical mishandling at this time causes severe discoloration which becomes evident when the fish is filleted.

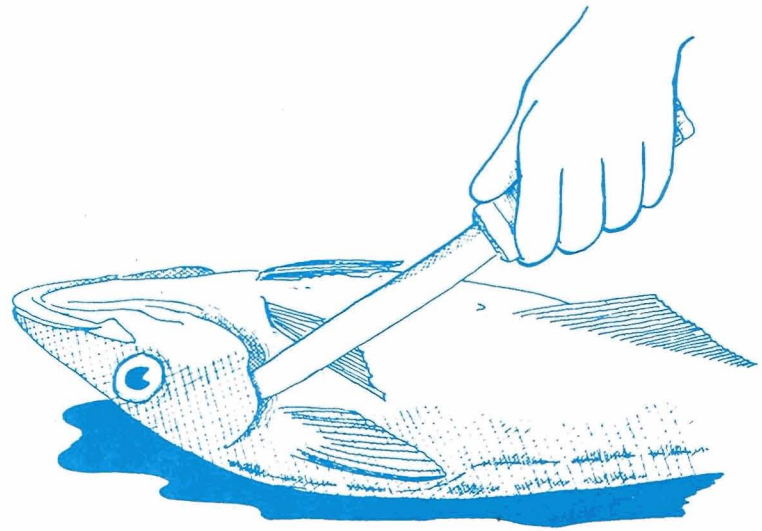


Figure 3: To bleed fish, cut one or more gill arches.

Gutting, where practical, should take place as soon as the fish come on deck.

If gutting cannot be done promptly, fish should be washed and chilled until gutting takes place.

Fish should be thoroughly washed in clean, cold water immediately after bleeding and gutting.

The gutting process and equipment should be set up for efficient removal of offal and to prevent contamination of other fish with guts or gut contents.

Poor gutting or gutting that cannot be accomplished promptly may be worse than not gutting at all.

Gutting is not recommended if fish are to be stored in refrigerated sea water or brine.

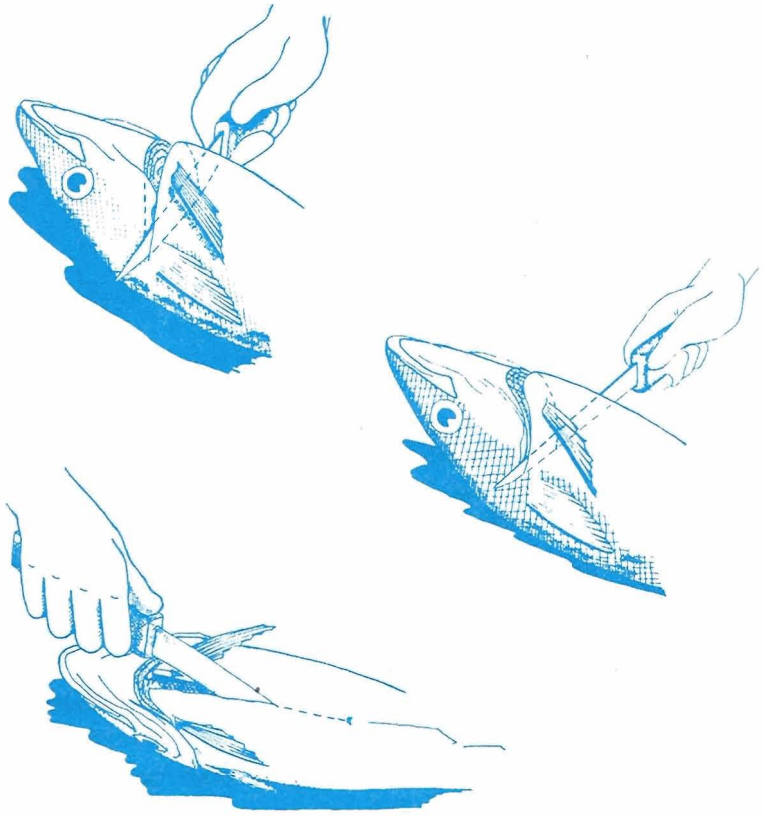


Figure 4: The most common method of gutting ocean whitefish includes the "straight cut" or "J-Cut," followed by a cut from gill cavity to anal vent, and removal of entrails.

Fish should be handled as carefully and rapidly as possible at all times. Chutes or other means of conveyance should be used to transfer fish from the deck area to holds or tanks.

Cod ends and all parts of fishing gear that come in contact with fish should be cleaned after each haul to remove debris. All gear should be thoroughly cleaned at the end of each day's fishing.

General Practices: Decks and all equipment and utensils used in handling, bleeding, gutting, washing and conveying operations should be thoroughly cleaned, rinsed and sanitized after each cycle of operations.

The fish hold bilge sump should be drained regularly during fishing trips.

Immediately after unloading the catch, the deck, all deck equipment, the fish hold, pound boards and sump should be thoroughly cleaned, rinsed and sanitized.

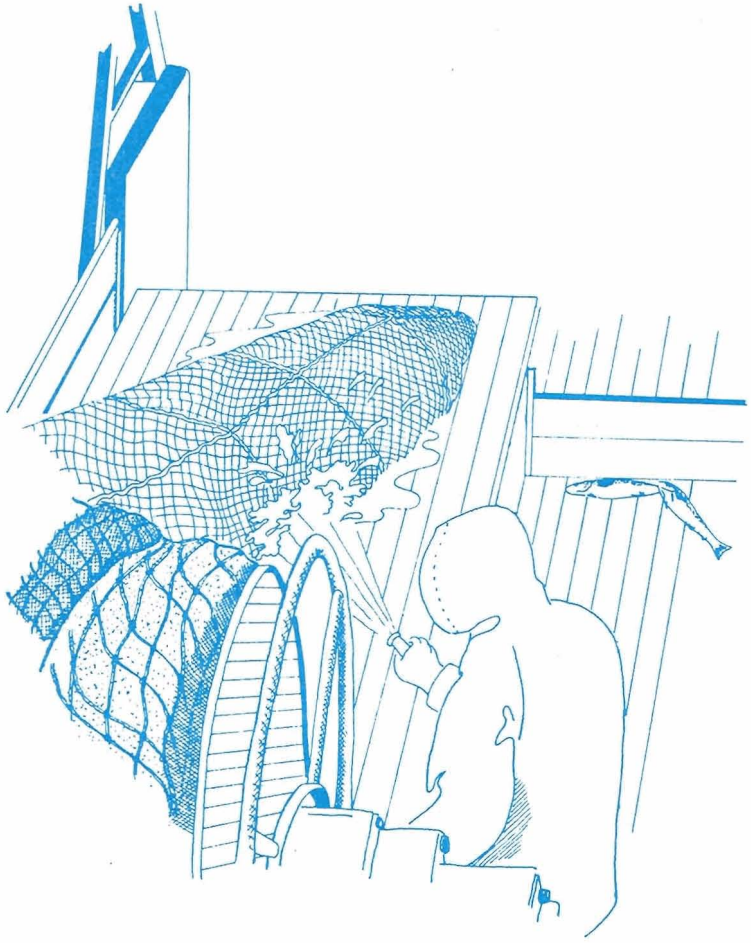


Figure 5: Cod end should be cleaned after each haul.

Vessels equipped with RSW systems should flush all tanks, pumps, heat exchangers and lines with a caustic cleaning agent, potable water rinse, and iodine disinfecting solution. Care must be exercised to avoid the use of cleaning and sanitizing agents which are excessively corrosive to the materials in the system, particularly the chillers. All RSW systems should be designed with a cleaning loop to facilitate the cleaning process.

Only potable water or clean sea water should be used for hosing and cleaning decks, holds and equipment. Water which has been used for cooling engines, condensors or similar equipment should not be used for this purpose.

At the end of each fishing trip, all used and unused ice should be discarded before cleaning begins.

Cleaning and Sanitation Procedures: The following steps should be followed when cleaning and sanitizing a fishing vessel.

(a) Flush all fish contact surfaces with clean fresh water or clean sea water.

(b) Scrub all fish contact surfaces with a brush, using a solution of detergent in warm water.

(c) Rinse with cold fresh water or sea water.

(d) Sanitize with a solution containing chlorine or iodine.

(e) After 5 to 10 minutes, rinse off the sanitizing solution. If a chlorine sanitizer is used, this final rinse may not be necessary.

Wooden boats should *not* be steam cleaned. Fatty and proteinaceous material (fish slime and gurry) can be forced into the wood, making the job of thorough cleaning almost impossible.

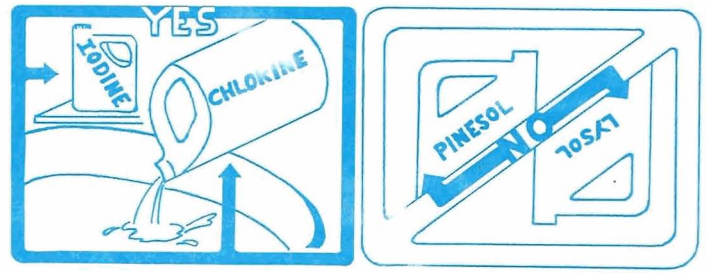
Detergents and Sanitizers: The cleaner used should be one suited to removal of fish gurry. Alkaline detergents are best for removal of fat and protein materials (fish slime and gurry). Most common household detergents are mixtures of alkaline phosphates and a wetting agent and are suitable for use on a fishing vessel.

A sanitizing agent containing either chlorine or iodine should be used to kill bacteria left after the vessels have been cleaned. Ordinary liquid chlorine bleach (5% hypochlorite) is suitable. It is very important that it be diluted in the ratio of one-quarter cup to 5 gallons of water. Due to the properties of hypochlorites, solutions mixed with over one-half cup of bleach will actually demonstrate decreased bactericidal efficiency. This is one instance where it is not true that "if a little is good, a lot will be better." An iodine

sanitizer can also be used; it is less corrosive to metal parts of the vessel, but costs about twice as much. *Under no circumstances* should sanitizers containing phenols (such as lysol and pinesol) be used in a fish hold or on fish handling surfaces. Most phenols are insoluble in water and impart strong undesirable odors which may affect fish taste.

Processing companies often will supply fishermen with approved sanitizers and detergents.

Figure 6: Agents containing chlorine or iodine are recommended to sanitize surfaces after the vessel has been cleaned.



V
Refrigeration

Chilling and Chill Storage: Temperature is the single most important factor affecting the keeping quality of fish. The rate of bacterial growth, and therefore the speed at which fish spoil, depends on temperature. The lower the temperature, the slower these processes occur. It is not possible to completely stop bacterial growth by chilling fish, but the rate of growth and spoilage can be significantly reduced by keeping fish chilled as close to freezing as possible.

To assure a good quality product, whitefish should be chilled as rapidly as possible within a temperature range of 31° F to 33° F.

Internal temperature of fish and temperatures of RSW and CSW storage tanks, should be monitored every four to six hours, and the results logged to assure chilling and storage goals are met and maintained.

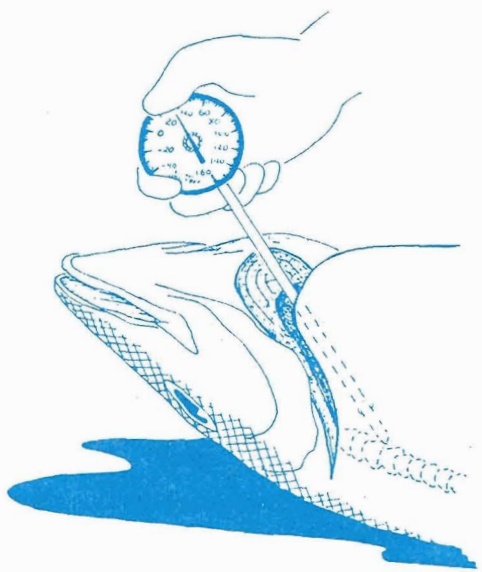


Figure 7: The internal temperature of vessel-stored fish should range between 31 and 33 F.

The primary methods for chilling and storage of fish are ice, and chilled (CSW) or refrigerated (RSW) sea water or brine, each method having its advantages and disadvantages.

Ice: Ice is an excellent, inexpensive medium for cooling and storage of chilled fish, capable of maintaining fish at slightly above 30° F. The amount of heat which must be absorbed from fish to melt ice is approximately 72 times as great as is necessary to increase the temperature of cold water by 2° F. If all of the cooling capacity of ice could be applied to the fish, one pound of ice could cool seven pounds of fish from 55° F to 32° F. In practical use, much of the cooling capacity of the ice is used up by cooling materials and air in the fish area. It is therefore necessary to use approximately one pound of ice per two pounds of fish. This ice to fish ratio is still over twenty times more efficient than cold water.

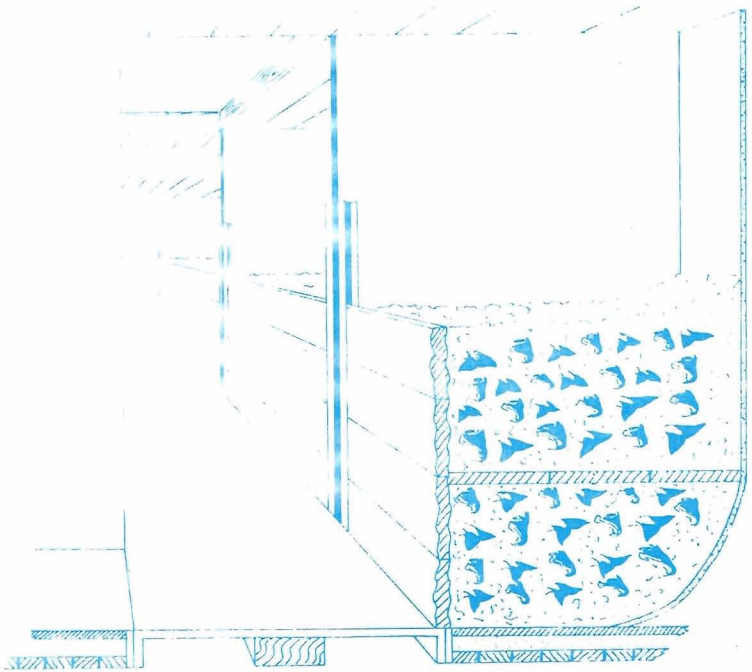


Figure 8: A ratio of one pound of ice per two pounds of fish is 20 times more efficient than cold water.

When ice is used for cooling or storage, it should be finely divided to ensure the greatest surface contact with the fish. Sufficient ice should be used so that fish contact only ice. Fish should not be in contact with each other or the bottom and sides of the container. Fish contacting each other or the container may result in spoilage caused by anaerobic bacteria.

Ice should be protected in a sanitary way during manufacture, transit, storage or use.

Chilled or Refrigerated Sea Water: Refrigerated sea water (RSW) and chilled sea water (CSW) or slush ice, at approximately 30° to 32° F are often used for cooling and storage of fish. The primary difference between the two systems is that RSW uses mechanical refrigeration and CSW is cooled by adding ice to the water.

RSW offers the advantages of rapid cooling, lower holding temperatures and less pressure on fish. The disadvantages are salt and water uptake, potential for greater protein loss, and anaerobic spoilage.

If RSW or CSW is used for cooling and storage of whitefish, storage time should not exceed 72 hours. Sea water used for RSW and CSW should be clean; it should be obtained from open waters, away from harbors, populated areas or fresh streams.

RSW and CSW should *not* be used for storage of dressed (gutted) whitefish.

Freezing and Frozen Storage: Freezing and frozen storage cannot improve the quality of fish, but can keep fish in much the same quality as it was just prior to freezing. If freezing and frozen storage is practiced, whitefish should be frozen as soon after harvest as possible and before quality begins to deteriorate.

The capacity of a freezer is dependent upon the amount of heat that must be removed from the fish to reach the desired temperature. What this means, is that not only the quantity of fish, but the temperature of the fish, relates to the capacity of the freezer and the length of time necessary to reduce the temperature to the desired level. If the capacity of the freezer is exceeded the fish may freeze too slowly and the quality of the fish will deteriorate. Fish may be removed from the freezing medium when a core temperature of 10° F has been reached, *if* they are then glazed and/or protected with a plastic bag, boxed and immediately placed in cold storage at 0° F or below. Since the outside of the fish will be at the temperature of the freezing medium, a period of equilibrium will cause the core temperature to continue to drop. By placing the fish in cold storage at 0° F or lower, an equivalent core temperature will be reached in 8 to 10 hours.

Some basic things to remember about freezing fish and frozen storage of fish are:

Freezing should be fast enough to prevent deterioration of fish quality.

If vertical plate freezers are used, fish should be carefully packed between plates keeping air spaces to a minimum.

Defrost heating of vertical plate freezers should be just long enough to loosen frozen blocks for unloading.

If horizontal plate freezers are used, fish should be packed in trays or forms to produce uniform and compact blocks.

If air blast freezers are used, they should be loaded in a way to ensure sufficient air circulation around the fish.

If brine freezing is practiced, the brine should be rapidly circulated and the brine/fish ratio carefully controlled.

Fish storage temperatures should be maintained at 0° F or below, and should be held constant. Fluctuations in temperature adversely affect quality.

Freezer and storage temperatures should be checked frequently, as should refrigerant pressures.

VI
Shorebased and Floating Processing Operations and Facilities

General Information: All vessels, vehicles and equipment used in the transportation, unloading or processing of fish should be so constructed, operated and maintained as to minimize physical damage, contamination or deterioration of the fish.

Many aspects of fish processing operations, including facility requirements, equipment and utensils, plumbing, sanitary facilities, water supply and ice, thermal processing and waste disposal are regulated by the Alaska Department of Environmental Conservation and the U.S. Food and Drug Administration. *The specifications and procedures outlined in this section are intended to be complementary to applicable state and federal regulations and should not in any way be construed as replacing or conflicting with such regulations.*

VI-A Processing Facility and Equipment Specifications

Facility Design and Construction: The facility should be suitable in size, design, and construction to aid maintenance and sanitary operations for processing purposes.

Floors, walls, ceilings, partitions and fixtures should be constructed in a manner which permits easy cleaning. Floors should be graded to ensure proper drainage. Fixtures, ducts, and pipes should not be suspended over work areas in a way that may allow drip or condensate to contaminate product, product contact surfaces, or materials.

All operations which could cause contamination of fish, fish contact surfaces, or materials should be separated by location and physical barriers such as walls or partitions. Floors in these areas should be sloped to prevent drainage to areas where product and materials are processed or stored.

Each room or area should be provided with adequate artificial or natural lighting.

Light bulbs, fixtures, skylights or other glass if located where fish, fish products or materials are handled or stored should be of unbreakable design, shielded or otherwise protected.

Ventilation should be adequate to minimize odors, noxious fumes and vapors where fish, fish products or materials are handled or stored.

Grounds surrounding the processing facilities should be kept free from litter, waste, refuse, uncut grass or weeds or other conditions that may attract or harbor insects, rodents or other pests.

Outside holding bins, flumes and conveyors, used to transport round or butchered fish should be protected so as to prevent fecal or other contamination by birds, insects and other animals or contamination by dust and dirt.

All areas where fish, fish products or materials are handled or stored should be protected to prevent entrance by insects, rodents, birds, animals and other pests.

Facilities, fixtures and other equipment should be maintained in good repair and sanitary condition. Cleaning and maintenance operations should be done in a manner which minimizes contamination.

Detergents and sanitizers should be safe and effective for their intended use. The use of these chemicals should be closely controlled and monitored; they should be stored only in properly labeled containers and in an area segregated from all other storage and operations, and used only in accordance with manufacturer's instructions.

Equipment and Utensils: Equipment and utensils should be suitable for their intended use. They should be kept clean, and be constructed of smooth, nontoxic, nonabsorbent, corrosion-resistant material. Equipment should be designed, installed and maintained to aid in cleaning of the equipment and adjacent area.

Cleaned and sanitized equipment or utensils that come in contact with fish or fish products should be stored in a manner to protect them from contamination.

Plumbing: Plumbing should be installed and operated in accordance with the Alaska Plumbing Code (AS 18.60.705-18.60.740).

Plumbing should be adequate to carry sufficient amounts of water to all locations necessary in the plant, and to provide adequate drainage for removal of waste water and sewage from the facility.

There should be no cross-connections between potable and nonpotable water.

Example 1: A cross-connection can occur when the end of a potable water hose is placed below the surface level in a wash tank full of water.

Example 2: A cross-connection occurs when a potable water service pipe is directly connected to prime a nonpotable water pump.

Water Supplies and Ice: All fresh and salt water supplies should meet the microbiological requirements of potable (drinking) water, or other standards of quality established by the Alaska Department of Environmental Conservation, depending upon the use of the water.

Ice should be protected in a sanitary way during manufacture, transit, storage or use.

Toilets should be totally enclosed, well-lighted and ventilated to the outside. They should be adequately screened and equipped with selfclosing doors. Facilities should be adequate, operational and in compliance with city and state codes.

Adequate handwashing facilities should be provided with soap, running water of suitable temperature and drying facilities. Directions should be posted which instruct employees to wash hands thoroughly before returning to the processing area. Where practicable, portable hand dips containing a sanitizing solution should be used.

Adequate facilities should be provided for storage and segregation of employees street and outer work garments including aprons and gloves from product handling and storage areas.

Waste and Offal Disposal: Waste and offal disposal methods and systems should be approved by the Alaska Department of Environmental Conservation.

Waste and offal should not be allowed to accumulate and should be promptly removed from the facility and premises.

VI-B General Operating Procedures for Processors

Receiving and Storage of Raw Materials: Unloading of fish from the fishing vessel should be accomplished with as little delay as possible, taking care to avoid damaging the fish. Hooks, shovels, forks, etc., should not be used to handle the fish. Mechanical unloading equipment such as

properly designed conveyors, fish pumps or other similar equipment should be used if possible.

Fish should be carefully inspected at the time of receipt to determine the quality *and* temperature of the fish. Fish of different quality or temperature, mixed species, or fish from different day's catches should be sorted.

Processors should encourage fisherman to use a stowage plan to segregate fish of different day's catch and quality levels to assist in the sorting and segregation process.

Fish should be de-iced (if stowed in ice), washed and stored under conditions which will protect the fish from contamination and maintain a temperature of 31° F to 33° F if not processed immediately.

Processing – General: As part of the grading process fish should be inspected, removing and discarding any fish that are unwholesome, and segregating and clearly identifying and labeling fish of differing quality levels.

If not gutted by the fisherman, fish should be gutted and washed with cold chlorinated water as soon after receipt as possible.

Following the heading and filleting process, fillets may be skinned if required for the finished product being produced.

Whitefish may be processed as "splits" (see Section VII PRODUCT FORMS AND SPECIFICATIONS) if fish are to be salted. Splitting may be accomplished as a mechanical or hand process.

Finished fillets and splits should be thoroughly washed in cold, potable water. Wash water should be circulating with a continuous discharge of dirty water and addition of clean water.

Fillets and splits should be inspected (fillets should be candled) and manually trimmed to remove bones, ragged edges, tears and flaps, parasites, black membrane, blood clots and discolored flesh. Specific trimming requirements depend upon the product form and are defined by product specifications.

Fillets, trimmings or some portions of the fish may be minced by extruding the flesh of these portions through a perforated drum to separate the flesh from skin and bones. If mincing is practiced, care must be taken to prevent contamination of the portions to be minced and to ensure the mincing process is accomplished promptly.

Surimi Processing: Surimi is a Japanese term for mechanically deboned fish flesh that has been washed with water and mixed with cryoprotectants for a good frozen shelf life. Alaska pollock is the only species which is processed in commercial volume for the production of frozen surimi.

Surimi is produced by repeatedly washing mechanically separated fish flesh with chilled water until it becomes odorless and colorless, or, until most of the water-soluble protein is removed. In the commercial process, the washing is continuous, with mechanical agitation in a series of washing tanks and a rotary screen rinser. During repeated washings with continuous agitation, much of the water-soluble protein is removed, along with undesirable substances and enzymes. The washing is followed by dewatering with the aid of a screw press. Fish flesh is then transferred to a strainer which removes residual black skin, bone and scales. Cryoprotectants – sugar, sorbitol and polyphosphates – are mixed into the dewatered flesh at levels which can be adjusted depending upon the type of product to be made.

For production of the best quality surimi, fish should be processed immediately after the fish pass through rigor mortis. Fresh fish which are in good condition and processed one to two days after catching should be used in the production of high quality frozen surimi.

Care should be taken during storage and handling of fish to avoid bending or other damage, particularly while the fish is in a state of rigor mortis.

The paste of good quality surimi becomes tacky, glossy and translucent upon chopping with salt and is extruded smoothly. Surimi of poor quality produces a dull, opaque and less tacky paste which breaks easily when extruded. Good quality surimi can quickly deteriorate as a result of poor frozen storage and temperature fluctuation.

Temperature fluctuation during short-term transportation and storage (less than one week) does not significantly reduce surimi quality, but extended periods of temperature fluctuation (more than three weeks) will impair quality.

Salted Fish: Salting is another method of preserving fish. The length of time the fish will keep is dependent upon the amount of salt it absorbs, the amount of moisture it contains and the temperature at which it is stored. Salt preserves the fish by killing some bacteria, preventing the growth of other bacteria and molds, and killing most parasites.

Salt fish are grouped as light, intermediate and heavy salted fish dependent upon the amount of salt contained in the finished product. These guidelines deal only with heavy salt fish (fish which have absorbed the maximum amount of salt possible resulting in salt saturation of moisture remaining in the fish). Production of heavy salt fish theoretically takes approximately 28 pounds of salt to 100 pounds of fish (assuming the water content of the fish is 80%), but general practices apply a safety margin and 35 pounds of salt to 100 pounds of fish is recommended.

Salt: Salt used in the production of salt fish should meet or exceed the "Codex Alimentarius Specifications for Food Grade Salt" established by the Codex Alimentarius Commission.

Salting Methods: There are two general methods used to salt or cure fish: kenching and pickling. These guidelines deal with kenching only, since it is the most commonly used method in Alaska.

Kenching is usually accomplished by layering salt and fish in alternate layers in containers perforated to allow free drainage, or on pallets. Basically, salt is spread on the surface that will receive the fish. Then the fish are laid skin-side down and salt is spread evenly and smoothly over the meat. After the first layer of fish is salted, another layer of fish is laid on top skin-side down and salted evenly as before. This process should continue until fish are stacked to a height of approximately 4 to 5 feet. After 3-6 days the fish should be restacked and resalted, inverting the pile so that the top layer on the first salted pallet becomes the bottom layer on the second salted pallet. The layers should be skin-side down as before. The meat should never be left unsalted. Splits should normally be "salt ripe" or "salt mature" after 3-4 weeks following this salting procedure; fillets are mature in approximately two weeks.

Drying Salted Fish: Although the high salt concentration in heavy salted fish will allow for a much longer shelf life under refrigeration than fresh fish, long-term, warm storage (up to 85° F) requires that additional moisture be removed from the product, that is, the product must be "dried."

As a general rule, dried, heavy salted fish should not contain greater than 38% moisture (38 pounds of water in 100 pounds of fish).

Salt fish is usually dried by mechanical separation and evaporation. Mechanical separation is accomplished by piling the fish in high stacks and placing weights on top of them, forcing out water. Evaporation may then take place outdoors or in a conditioned-air environment.

Outdoor drying is simple, but very dependent upon weather. Excessively warm temperatures (where the internal temperature of the fish may reach 75° F or greater), lack of air circulation (wind), high humidity, rain and low temperatures can all result in loss of product or poor quality product. Potential for contamination by birds, animals and insects, product loss and variations in product quality due to weather and short seasons of drying weather are all negative aspects of outdoor drying.

Conditioned-air drying permits a round-the-clock operation, twelve months a year. Fish can be dried more rapidly and quality closely controlled. Air circulation is provided by large fans and temperature and relative humidity can be carefully regulated. Due to the obvious advantages in production of consistently high quality dried whitefish products, conditioned-air drying is recommended whenever practical.

Packing and Labeling: Packaging materials should be of food grade quality, airtight, and resistant to penetration of water vapor.

Labels should be clearly printed, comply with all applicable laws, and include storage instructions.

VI-C Processing Facility Sanitation

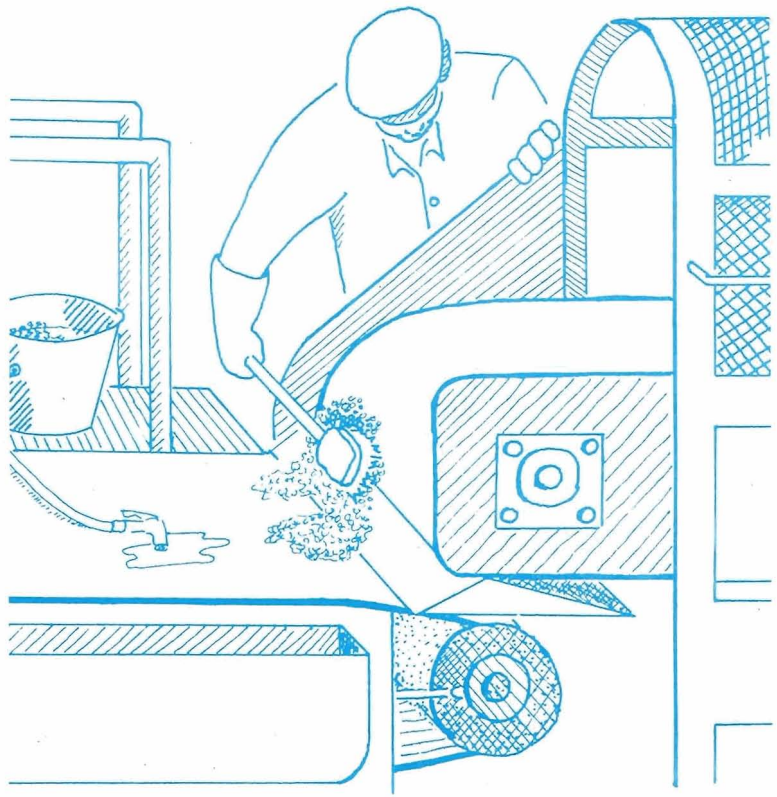


Figure 9: After each cycle of operation, thoroughly clean all deck gear which has contacted fish.

Cleaning schedules and procedures should be established and followed to maintain the processing establishment, equipment and utensils in a sanitary condition. Periodic monitoring of the sanitary condition of the facilities and adherence to clean up schedules is recommended.

Suggested Periodic Cleaning Schedule:

(a) Before the season starts:

(1) Require thorough cleaning of all machinery, tanks, tables, floors, walls and ceilings to remove dirt and bacteria-bearing dust.

(2) Sanitize all working surfaces with a chlorine solution.

(b) Continuous cleaning:

(1) Tables, floors and other working surfaces should be sloped to effect continuous draining, preventing bacteria build-up in standing water.

(2) Rinse each cart or tub each time it is emptied.

(c) Morning clean-up:

Before operations start for the day, rinse all working surfaces with cold water containing chlorine, as a precaution to remove any cleanser and sanitizing agent left from the previous clean up.

(d) Each coffee or rest break:

(1) As practical, run all fish that have come on to the line through processing steps.

(2) Remove all static material from working surfaces; in other words, bits of fish, gurry, etc.

(3) To remove all slime and blood, flush and rinse all working surfaces with chlorinated water.

(4) Shovel all waste from the floor.

(e) Lunch break:

(1) Clear line of all fish.

(2) Remove all gurry from the working surfaces.

(3) Shovel all waste from floor.

(4) Drain all washing tanks.

(5) Rinse working surfaces, wash tanks, tubs, carts, and floor with a high-pressure hose, using a chlorine solution to cut slime and lower bacterial count.

(6) At the end of lunch break, flush all surfaces with chlorinated water.

(f) End of day clean-up:

(1) Clear line of all fish.

(2) Remove all gurry from the working surfaces.

(3) Shovel all waste from floor.

(4) Drain all washing tanks.

(5) Rinse all working surfaces with cold chlorinated water.

(6) Remove cowlings to expose all machinery that comes in contact with the fish.

(7) Scrub all working areas with cleanser and scrub brush, or use a high pressure detergent dispenser.

(8) Scrub all cutting boards and place in a strong sanitizing solution.

(9) Rinse all areas with a strong chlorine solution. Allow 10 minutes contact time.

(10) Scrub down floors and walls. A large floor broom with stiff bristles is effective.

(11) Rinse all surfaces with clean chlorinated water. Low levels of chlorine in this rinse will not cause corrosion of metal surfaces.

(g) End of Week:

In certain areas and on equipment, fish carts and chutes, a hard, dried deposit may accumulate. These organic deposits are often difficult to remove by using detergents and a scrub brush. By using techniques outlined above, this dried-on material should be held to a minimum. If the problem does arise, strong detergents mixed with a jelly or foam suspension will help considerably. The jelly or foam will hold the detergent to the surface. Remember, alkali detergents attack oil and proteins.

Procedures on use of jelly or foam techniques:

(1) Rinse away all loose material, mix chemicals in the tank following manufacturer's recommendations.

(2) Spray all hard-to-clean areas and other surfaces which have a heavy deposit of static material.

(3) Let stand 30 minutes to an hour, then rinse thoroughly. (Strong alkali detergents may corrode metal surfaces).

(4) It may be necessary to use an acid detergent once a month or several times during a season.

Acid detergents will remove the mineral deposits. Do not use acid detergents on concrete floors, as acid will pit the concrete.

VI-E Quality Control/Quality Assurance

All processing operations should have organized quality control and quality assurance programs.

A good *"quality control"* program defines procedures throughout the processing facility and operations, from receipt of materials through shipping of finished product (including maintenance and sanitation procedures), that are to be followed to ensure the production of a quality product. Quality control should be the responsibility of all employees.

A good *"quality assurance"* program defines procedures and schedules to verify that the quality control procedures are being followed and that they are successful in producing the desired quality product. Quality assurance procedures and schedules should include the entire scope of processing plant operations, the same as the quality control program. Personnel responsible for management of quality control and quality assurance programs, and for technical procedures throughout the processing operation, should be well qualified by training and/or experience.

VII
Product Forms and Specifications

Primary Product Forms: Fresh, IQF (Individual Quick Frozen) salted and institutional product forms such as:

(a) Round

(b) Eviscerated, Head on

(c) Eviscerated, Head off

(d) Skin-off, Boneless Fillets – whole, sound fillets with the skin and pinbones removed.

(e) Skin-off, Bone-in Fillets – whole, sound fillets with the skin removed and pinbones left in.

(f) Skin-on, Boneless Fillets – whole, sound fillets with the skin left on and pinbones removed.

(g) Skin-on, Bone-in Fillets – whole, sound fillets with the skin left on and pinbones left in.

(h) Wet-Salted Fillets

(i) Dried, Salted Fillets

(j) Wet-Salted Splits

(k) Dried, Salted Splits

Intermediate Product Forms: Block – Frozen blocks of fillets, generally in one of four sizes: 13½, 16½, 18½, and 24½ pounds.

Laminated Block – Frozen blocks of fillets, belly flaps and minced flesh laminated in prescribed strict proportions.

Minced Block – Generally produced from parasite and blood clot free fillet trimmings and collars.

NOTE: These blocks are usually further processed into breaded fish sticks and fish portions with some extruded and formed products produced from minced blocks.

Product Specifications: (To be developed separately and incorporated with these guidelines at a later date.)

VIII
Fish Quality Evaluation

Fresh Fish: All fresh fish should exhibit the following characteristics:

(a) *Eyes* should be bright, clear and normal in appearance.

(b) *Gills* should be normal in appearance and should smell sea-fresh (practically odorless).

(c) *Skin* should be shiny and wrinkles should not remain when fish is bent slightly.

(d) *Skin color* should be characteristic of fresh fish that is typical of the species.

(e) *Viscera and eggs* should be bright and firm and should smell sea fresh (practically odorless).

(f) *Belly cavity* should have no breaks due to tissue breakdown by enzymatic action.

(g) *Flesh* should be resilient when subjected to finger pressure.

(h) *Flesh color* should be characteristic of a fresh fish that is typical of the species.

(i) *Scale* adherence should be reasonably uniform and nearly complete. (Fish with substantial scale loss should be carefully examined, as this may be an indication of poor handling practices.)

(j) *Odor* should be characteristic of fresh fish. There should be no odor indicating decomposition or contamination.

When evaluating fresh fish, consideration must also be given to factors that will affect the quality in the future, such as the internal temperature of the fish, cleanliness of the fish and prior storage conditions.

Frozen and Salted Fish: (To be developed at a later date.)

IX Recommended References

State and Federal Regulations: Title 21 – Food and Drugs, Part 110, Current Good Manufacturing Practice (Sanitation) in the Manufacturing, Processing, Packing or Holding Human Food. U.S. Food and Drug Administration, effective May 26, 1969, recodified March 15, 1977.

Alaska Fish Inspection Regulations, State of Alaska, Department of Environmental Conservation, 1984.

General References:

(1) Chilled and Refrigerated Sea Water – Easier and Faster Cooling of Fish (Donald E. Kramer), Alaska Seas and Coasts, Volume 8, Number 4 (October-November 1980).

(2) Onboard Freezing Systems: Some Options for the Small Vessel (Edward Kolbe, Oregon State University, Extension Marine Advisory Program, Publication SG 67 (July 1969).

(3) Draft Code of Practice for Frozen Fish, 11/R7, International Institute for Refrigeration (1969).

(4) Recommended International Code of Practice for Fresh Fish, FAO/WHO Codex Alimentarius Commission (1976).

(5) Code of Practice for Frozen Fish, CX /FFP 77/15 (FAO Fish. Circ. C145, Rev. 1).

(6) Fishplant Sanitation and Cleaning Procedures (John P. Doyle), University of Alaska, Marine Advisory Bulletin No. 1 (1970).

(7) Cleaning and Sanitizing Agents for Seafood Processing Plants (Jong S. Lee), Oregon State University, Extension Marine Advisory Program, Publication SG 21 (1973).

(8) Recommended International Code of Practice for Salted Fish, Codex Alimentarius Commission, FAO/WHO, (1979).

(9) Bulletin No. 112, The Processing of Dried Salted Fish, Fisheries Research Board of Canada.

(10) Teaching Manual for Extension Courses in White Fish Processing Technology, Per O. Heggelund, Marine Advisory Programs, University of Alaska Marine Advisory Bulletin No. 8.

(11) Recommended International Code of Practice for Handling Fresh Fish at Sea, (November, 1980). Department of Fisheries and Oceans, Ontario, Canada.

Notes