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Commercial Fish Handling and Sanitation on Great Lakes Vessels  
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# Commercial Fish Handling and Sanitation on Great Lakes Vessels

Cooperative Extension Service • Michigan State University  
Michigan Marine Advisory Service

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Commercial fishermen on Great Lakes vessels may be inclined to neglect proper on-board handling and sanitation. Short trips and limited space make provisions for on-board gutting and sophisticated cooling and storage systems unattractive and largely unnecessary on the Great Lakes. However, some procedures are extremely important to insuring a high-quality product. Remember that days or months after shipping your catch, consumer acceptance will eventually determine price. Top dollar and potential markets for your catch tomorrow requires care in handling your fish today.

This bulletin suggests some important on-board handling and sanitation methods designed to maintain fish quality and to extend shelf life.

## Bacteria—the No. 1 spoilage agent

Bacteria, the tiny living microorganisms often referred to as germs, grow well on fish. Those found in fish digestive tracts, gills, slime and exposed blood are quick to multiply after the fish are brought on deck. Contact with unsanitized sorting boxes, hands or other contaminated handling and stowage items further accelerates the growth of bacteria and subsequent spoilage. When established, even low temperatures are unable to destroy these bacteria, and the flesh soon develops changes in texture, odor, flavor and color.

Once lost, quality cannot be restored.

A combination of proper icing, handling and sanitation greatly delays spoilage. Eliminate unnecessary sources of contamination to decrease initial numbers of bacteria. To make conditions unfavorable for bacterial growth, quickly lower fish temperature to below 40°F and avoid their physical damage.

## Bruises and Cuts

Fish are a delicate food product and are easily damaged. As the catch is lifted on deck, sorted and stowed, take care to avoid bruising. Even minor bumps may release enzymes which soften the flesh and make nutrients available to bacteria. Bruises and cuts provide bacteria access to otherwise sterile tissue and are unsightly. Figure 1 illustrates the effect of bruises on bacterial growth. Note that even the unbruised flesh taken from bruised fish contained 10 times more bacteria than did flesh from unbruised fish. Reduced shelf life and market value result.

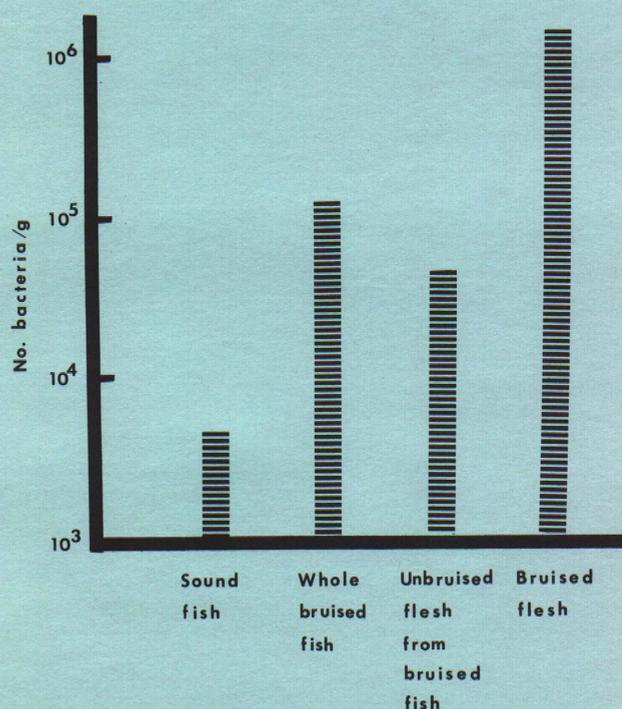


Figure 1—Effect of bruises on bacterial growth after 7 days in ice. Source: R.B. Nair et al, 1974, J. Fd. Sci. Tech. 11: 118-122.

In impoundment and other catch gear some fish become entangled in net meshes and are thereby pinched. These fish should be separated from sound fish and reserved for personal use, properly disposed of or processed as soon as possible such that bruised flesh is removed. Do not try to merchandise severely injured fish, since time of death is frequently unknown and excitement prior to death may result in poor texture. A few highly contaminated fish will accelerate spoilage of the rest.

### Ice and Icing

Rapid on-board icing is the most effective means of controlling bacteria.

Benefits of ice include:

1. cools fish rapidly
2. slows bacterial and enzymatic activity
3. flushes away bacteria as it melts
4. prevents drying
5. delays rigor mortis (for improved texture)
6. resists freezing in cold weather (for improved texture)

Ice is inexpensive and convenient. Never postpone its use until arrival at dockside. Figure 2. summarizes a Michigan State University study demonstrating the importance of on-board icing. Although air and water temperatures were lower during Trial II (no ice on board) bacteria and hypoxanthine (a product of degradation) increased more rapidly during storage than in Trial I when fish were iced on-board. This supports the recommendation that fish be iced regardless of weather conditions.

Figure 3 illustrates the need for ice even when fish are held at 30°F. In this study, the flushing action of melting ice extended shelf life. Similarly, rinsing fish in water prior to storage helped to maintain quality by reducing the initial number of bacteria.<sup>1</sup>

Ice must be made from drinkable water and be kept clean. For maximum cooling and flushing effect, use crushed rather than chunk ice and store at 5 to 10°F to reduce clumping. Clumping may also result in crushed (bruised) fish.

Proper icing involves making a 1 to 2 inch bed

<sup>1</sup> On-board rinsing of Great Lakes fish should not be required if properly handled. However minimizing bacterial contamination is very important.

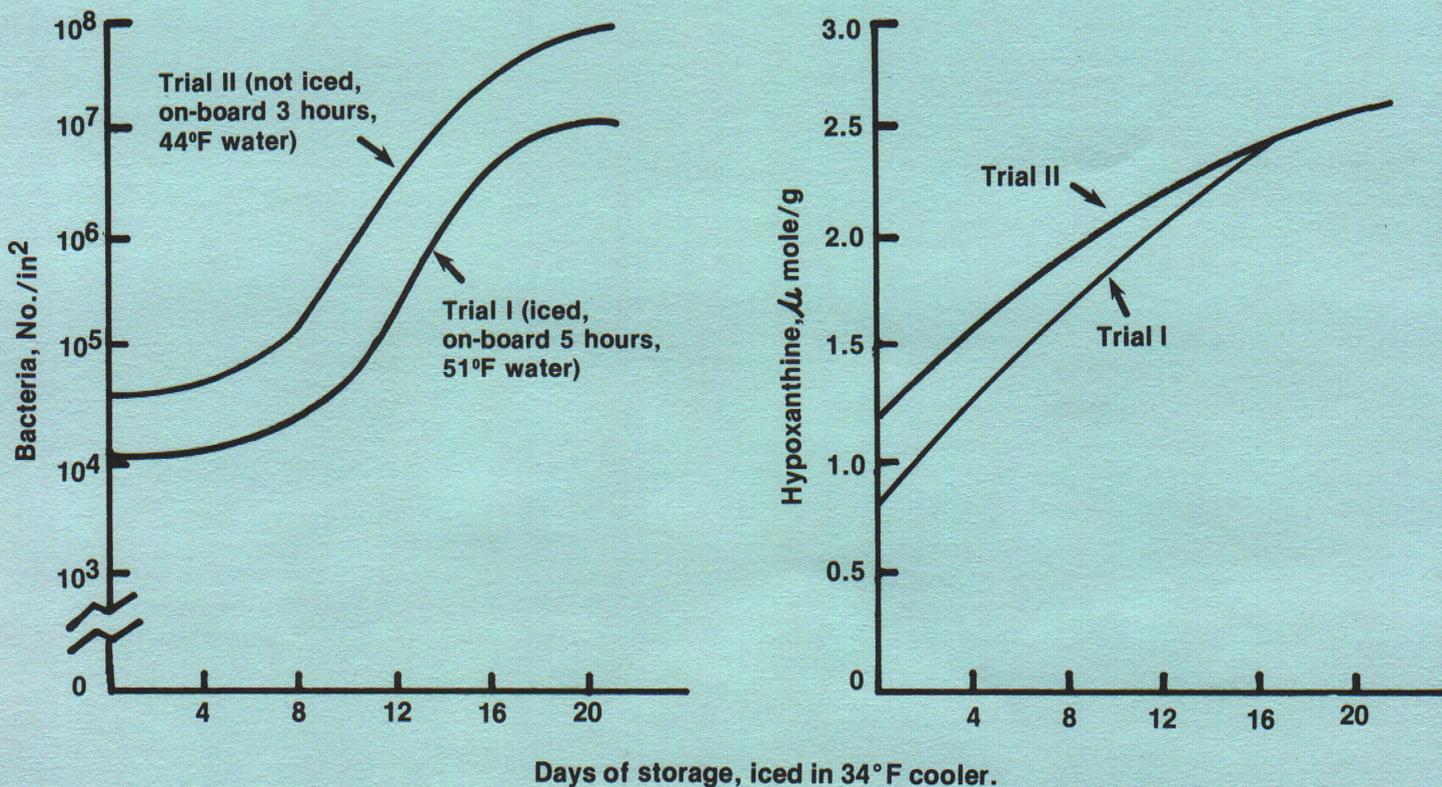


Figure 2—Two indicators of deterioration (hypoxanthine accumulation and surface bacterial load) in lake whitefish stored in waxed fiberboard boxes.

of ice in each box, interspersing some with the fish and topping with 2 to 3 inches of additional ice. Avoid overfilling fish boxes, since crushing can result if they are stacked. Make certain that shovels, buckets or other gear used for icing fish are clean and free of sharp edges.

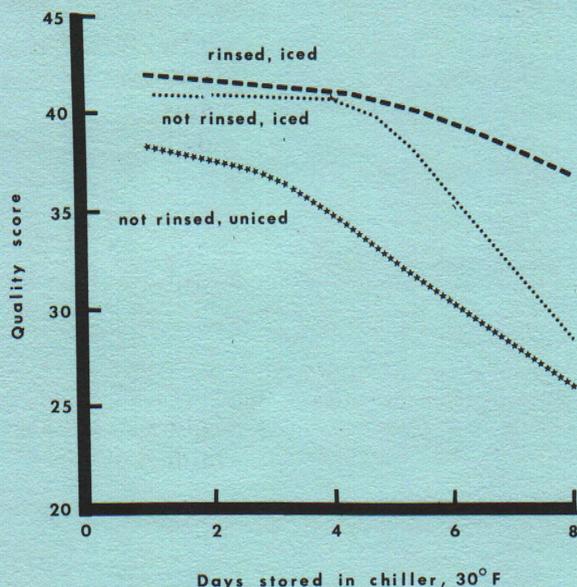


Figure 3—Effect of rinsing and icing on quality of red snapper. A score below 30 is considered inedible. Source: E.R.A. deZylva, 1974, New Zealand, J. Sci. 17 (3): 309-318.

### Stowing the catch

Fish boxes should be constructed with the following properties:

1. easily cleaned and sanitized
2. free of overlapping joints and sharp edges
3. readily drain water
4. durable
5. offer some insulation
6. resist sliding
7. stackable and nestable

Wood boxes have been a mainstay of the fishery industry since its beginning. However, due to their porous nature, wood sorting and fish boxes cannot be adequately cleaned and sanitized. Many studies conclude that, even with vigorous detergent washing and sanitizing, high initial concentrations of bacteria account for a substantial surviving population. Wood surfaces are a potential source of gross contamination and harbor varieties of bacteria that spoil fish most rapidly.

Plastic boxes are much more effectively washed and sanitized. They are easier to clean, readily air-dry and are more durable.

Avoid stacking full fish boxes when possible. Melt water, containing many bacteria, collects at the bottom of boxes and should be drained. If stacked, lower boxes receive the run-off from those above, including any material on the outside bottom of upper boxes. Most importantly, crushing can occur. Never stack fish boxes such that upper boxes rest directly on the contents of lower boxes!<sup>2</sup>

Stow fish in a hold free from engine fumes, lubricants, fuels or other material which might contribute to off-flavors or bacterial contamination.

### Washing and Sanitizing

All surfaces that come in contact with fish should be thoroughly washed with a detergent and then sanitized after each voyage. This includes sorting boxes, fish boxes, slickers and hand nets. Remember, once quality is lost, it cannot be regained.

Proper cleaning involves the **separate application of detergent and sanitizer**. Combining the two will largely neutralize the sanitizer's bacteria-killing effect. Detergent alone does little to destroy bacteria but is needed to expose them to the sanitizer.

### CLEANING STEPS

1. Rinse surfaces to remove blood, scales and other matter.
2. Brush with a warm noncaustic detergent solution.
3. Rinse.
4. Brush on chlorine or iodine sanitizer.
5. Allow to dry on plastic and wood (rinse metal surfaces with water if a hypochlorite sanitizer is used).
6. A final clean water rinse shortly before use is recommended due to legal considerations.

If these steps are followed, contamination can be significantly reduced and shelf life extended.

Chlorine sanitizers, called hypochlorites, are

<sup>2</sup> Note: Fish boxes are commercially available that drain on the outside of lower boxes when stacked.

widely used in food-handling systems, since they are effective, relatively inexpensive and leave no residue. However, they are somewhat corrosive to metal and are short-lived. Many fine hypochlorite products are commercially available. In a pinch, a suitable sanitizer is made by mixing 1 pint of fresh household bleach in approximately 12 gallons of water.

Iodine sanitizers, or iodophors, are also highly effective when properly used. They are more stable and less corrosive than chlorine solutions and may be no more expensive. Occasionally, they stain clothing or gear. Iodophors are well-suited as hand dip sanitizers in processing facilities.

Fishermen may also encounter quaternary ammonia or phenolic sanitizers. "Quats" are most useful where long residual activity is desired, such as deck or hold areas. Phenolics may impart off flavors to fish and should not be used.

### Personal Hygiene

Controlling the spread of bacteria and disease begins with a clean food supply. People are the major carriers of disease organisms. All individuals should wash their hands before handling a fish product, wear clean clothing and observe sensible health practices. Sanitation dictates the use of high-quality, washable clothing on-board—rubber boots, aprons, rubber gloves or complete rain gear.

### Fisherman's Motto:

**Keep fish clean — Keep fish cold — Keep fish moving toward the consumer's table.**

### Acknowledgement

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