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Inexpensive plastic containers stacked nine high keep fish in good condition aboard ship.

Effect of Draining Method on the Quality of Fish Stored in Boxes

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ABSTRACT

To determine if specially constructed fish boxes which drain the meltwater to the outside of the box are required to protect the fish in the lower layers from contamination by drainage from the upper layers are necessary for successful boxing at sea, trials were conducted in the Center using readily available plastic tote boxes.

Results of taste panel and microbiological tests on haddock stored with ice in these boxes showed no significant difference in quality between fish from the upper and from the lower boxes.

Therefore, fish can be boxed at sea using inexpensive containers rather than expensive, specially constructed fish boxes.

INTRODUCTION

It has long been known that bulk stowage of fish in pens hastens quality loss through crushing and bruising of the fish. Also, bulk stowage causes weight losses of up to 7 percent in cod and up to 15 percent in haddock at the bottom of a 3-foot deep pen (Burgess, et al., 1965).

Boxing of fish has been a fairly common practice on inshore vessels in many countries (Anonymous, 1970, p. 13), but until recently it has not been practiced on vessels fishing the more distant grounds. However, since 1965 when successful trials were conducted by the White Fish Authority aboard the Aberdeen, Scotland, vessel, M. T. *Summervale*, and in subsequent trials aboard other vessels in which it was found that boxing fish extended the storage life by 1½ to 3 days, resulted in a weight gain of about 5 percent as opposed to the losses cited above, and an increased fillet yield of about 5 percent (Anonymous, 1965, 1967a, 1967b), the adoption of boxing at sea has spread and is now becoming almost common practice in the United Kingdom.

In the United States, however, boxing at sea has not been adopted on the larger vessels. One of the reasons given is the cost of the special boxes specified by the Torry Research Station and the White Fish Authority, where an important requirement is that when the boxes are stacked, the water from the melting ice drains to the outside and does not pass through the lower layers of boxes and thus contaminate the lower fish with bacteria-laden slime (Anonymous, 1965 and Hopper, 1970).

But if the meltwater does not in fact hasten spoilage of the lower layers of fish, it would then be possible to use inexpensive, readily available, plastic nest and stack tote-boxes or non-returnable wooden wire-bound boxes such as are commonly used in shipping poultry, produce, etc. To settle this point, a test series was set up to determine the effect on quality of stowing fish and ice in plastic boxes stacked so the meltwater from the upper layers percolated down through the lower layers.

Results of a similar test have been reported by Houwing (1971); however, in his tests, the boxes were stacked four high compared with the stacks of nine boxes used in the tests reported here.

PROCEDURES

Polyethylene tote-boxes with a capacity of about 50 pounds of fish and 25 pounds of ice were used in these tests. After having been filled with eviscerated haddock (Figure 1) and flake ice, the boxes were stacked nine high in a cool room at 37°F (Figure 2). Control samples were prechilled fish, put in rectangular tins (Figure 3), covered, buried in ice, and held in the same storage room. Duplicate tests using the same procedures were conducted.

At intervals during the storage period, two fish were removed from the top, middle, and bottom tote-boxes and from the control tins and tested for total bacterial count and organoleptic acceptability.

For the total plate counts, a sterile 202 × 309 can, open at both ends, was

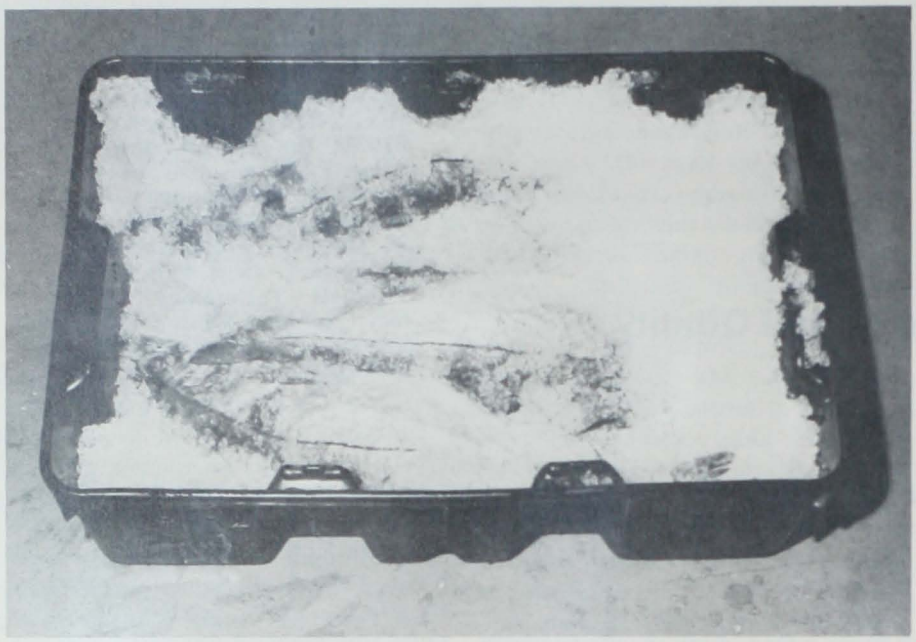


Figure 1.—Haddock packed with ice in plastic tote box.

Figure 2.—Tote boxes containing fish and ice stacked in cool room.

held tightly against the side of the haddock just posterior to the black spot, and 100 ml of sterile diluent poured into the can. A sterile glass pipette was used to scrape and lift the scales in the area surrounded by the can. This was followed by rapid stirring to ensure complete mixing of the slime, etc., with the diluent. A one milliliter aliquot of this mixture was taken, appropriate dilutions made and plated in duplicate. The plates were incubated at 20°C for 5 days, the colonies counted, the results from the two fish averaged, and reported as numbers of bacteria per 3.5 square inches of fish surface.

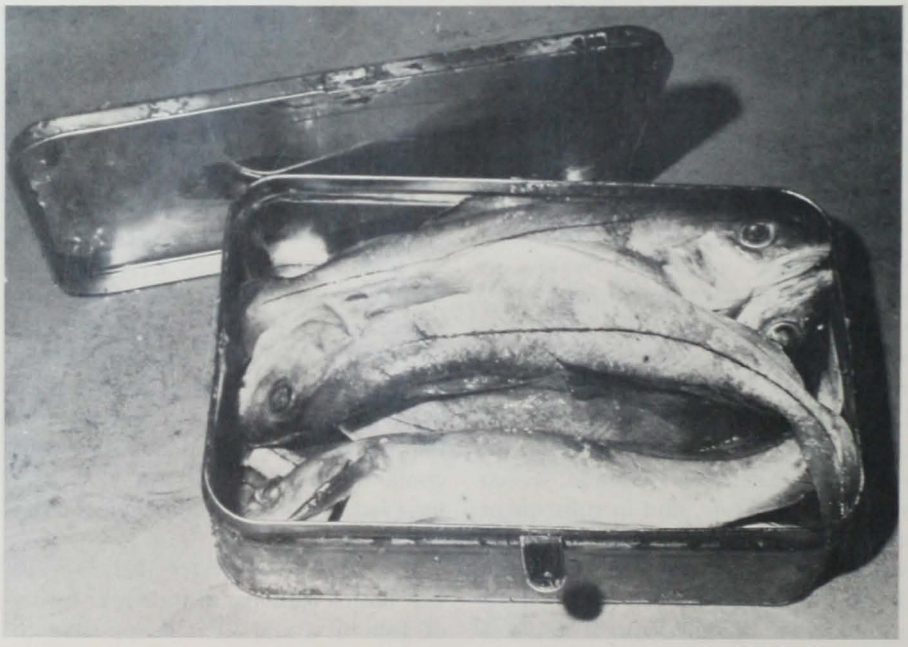
For the organoleptic assessment, the fish used for determining total plate counts were filleted, skinned, cut into pieces, and steamed in a tightly covered pan. The Center's 12-member taste panel rated the fish on a 9-point scale for appearance, odor, flavor, and texture.

RESULTS

The results of the total plate counts are shown in Table 1. No statistically significant differences in counts as determined by analysis of variance are found that can be related to position of the fish in the stack of boxes.

The taste panel scores are shown in Table 2. Here again, there are no

Figure 3.—Control samples packed in 30-pound size cans.



statistically significant differences related to location in the stack of boxes.

CONCLUSIONS

For boxing fish at sea, inexpensive, readily available nest and stack tote-boxes which permit drainage of the melting ice down through the stack of boxes may be used without detriment to the quality of the fish. This fact clears the way for adoption of this technique by those vessel owners who have hesitated to make the investment in specially designed boxes of comparatively high cost.

The benefits will be improved quality of the fish as landed and increased yields in the processing plant.

Table 1.—Total plate counts of fish stored in boxes.

		Logarithms of Numbers of Bacteria per 3½ Square Inches							
Days on ice		Control		Top Box		Middle Box		Bottom Box	
Test No. 1	Test No. 2	Test No. 1	Test No. 2	Test No. 1	Test No. 2	Test No. 1	Test No. 2	Test No. 1	Test No. 2
0	0	5.934	6.672	5.934	6.672	5.934	6.672	5.934	6.672
2	—	6.029	—	5.816	—	5.878	—	5.914	—
—	6	—	6.934	—	5.860	—	7.037	—	7.011
7	—	6.866	—	7.924	—	7.585	—	7.525	—
—	8	—	7.963	—	7.925	—	8.818	—	7.863
9	—	7.813	—	8.690	—	7.778	—	8.816	—
12	12	9.802	9.258	9.602	9.034	9.468	10.207	8.288	8.620

Table 2.—Taste panel scores on fish stored in boxes.

		Taste Panel Scores[1]							
Days on ice		Control		Top Box		Middle Box		Bottom Box	
Test No. 1	Test No. 2	Test No. 1	Test No. 2	Test No. 1	Test No. 2	Test No. 1	Test No. 2	Test No. 1	Test No. 2
—	1	—	8.75	—	8.75	—	8.75	—	8.75
3	3	7.38	6.75	7.75	7.10	7.05	7.68	6.07	6.68
6	—	—	6.32	—	6.38	—	6.87	—	6.93
—	7	7.13	—	6.97	—	7.19	—	7.40	—
8	—	—	6.80	—	6.90	—	4.00	—	6.07
—	9	6.00	—	6.35	—	6.30	—	6.95	—
10	—	—	5.14		4.63	—	6.35	—	6.06
13	13	4.42	4.28	4.95	4.93	6.06	3.00	6.40	4.37

[1] Based on a 9-point scale where 9 = Excellent, 8 = Very Good, 7 = Good, 6 = Fair, 5 = Borderline, 4 = Slightly Poor, 3 = Poor, 2 = Very Poor, and 1 = Inedible.

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