

# SALT CONTENT OF SALMON CANNED FROM BRINE-FROZEN FISH

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## ABSTRACT

REPORTS ON HOW THE AMOUNT OF SALT CARRIED BY BRINE-FROZEN SALMON TO THE CANNED PRODUCT IS AFFECTED BY METHODS OF STORING AND OF THAWING. STUDIES INDICATE: THAT (1) THE AMOUNT RETAINED BY BRINE-FROZEN RED SALMON HELD IN DRY STORAGE AND THEN THAWED IN RUNNING WATER, STILL WATER, OR STILL AIR IS NOT EXCESSIVE AND (2) THE AMOUNT RETAINED BY BRINE-FROZEN CHUM SALMON HELD FOR TWO WEEKS IN REFRIGERATED BRINE AT 50° F. AND THEN THAWED IN RUNNING WATER IS LESS THAN 0.5 PERCENT. THIS SALT RETAINED FROM BRINE FREEZING CAN BE COMPENSATED FOR BY ADDING TO EACH CAN ONLY 50 TO 80 PERCENT AS MUCH SALT AS IS USED WITH CANNED FRESH SALMON.

## INTRODUCTION

This report is presented in answer to inquiries made to the Seattle Fishery Technological Laboratory on the amount of salt carried to the canned product as a result of using brine-frozen salmon. Studies were made to determine how the amount of salt is affected by (1) the method of storing the brine-frozen salmon and (2) the method of thawing them.

USE OF BRINE-FROZEN SALMON IN CANNING: Until recent years nearly all the salmon taken in Alaskan waters for canning were processed in Alaska from fresh fish. However, by 1951, freezerships became established in the Alaskan salmon industry as a result of economic developments and a change in fishing regulations to allow the use of power vessels in the Bristol Bay fisheries. In that year, nine freezerships took salmon from Bristol Bay for subsequent canning in the Puget Sound area. In 1952 the freezerships operating in Bristol Bay doubled in number to 18. In both years a few freezerships also operated in the districts of Central Alaska and Southeastern Alaska.

The freezerships are equipped with wells in which the salmon are frozen by immersion in brine. The frozen salmon are then transferred to dry refrigerated storage. Sometimes, however, it is convenient to hold some of the frozen salmon in the refrigerated brine until the ship arrives at the cannery. Varying opinions have been expressed as to the extent of salt penetration into the salmon stored in such a manner. Studies made at the Fishery Technological Laboratory at Boston on brine freezing cod and haddock at sea (Pottinger, Holston, and McCormack 1952) have shown that salt continues to penetrate the meat of the fish if, after being frozen, the fish are allowed to remain in the brine, especially at temperatures above 10° F.

Several days before the freezership arrives at the cannery, the refrigeration is turned off to facilitate the separation of salmon that may have frozen together. The final thawing is completed at the cannery, where any of a number of different methods may be used. At some canneries the salmon are loosely stacked 2 to 3 feet high on the floor or in bins and are then sprayed with fresh water either continuously from overhead nozzles or intermittently from a hose. At other canneries the fish are placed in large tanks or fish bins and covered with running fresh water. With any of these procedures, thawing usually requires 12 to 24 hours.

After the brine-frozen salmon have been thawed, they are canned in the same manner as are fresh salmon, except that less salt is added.

## EFFECT OF THAWING METHOD

An experimental pack of canned brine-frozen salmon was prepared to determine what effect the method of thawing has on the salt content of the canned product.

PREPARATION OF CANNED SAMPLES: For this experiment, Bristol Bay red salmon (*Oncorhynchus nerka*) were obtained from a freezership. These salmon had

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been frozen by immersion for approximately 12 hours in brine cooled to about 5° F. and had then been held in dry storage, also at 5° F., until unloaded at Seattle.

After the salmon had been taken to the laboratory, they were divided into three groups and thawed as follows:

1. In running water. The salmon were placed in a barrel in which tap water was run in at the bottom at the rate of 4 gallons per minute and allowed to overflow at the top; thawing time, 4 hours.
2. In still water. The salmon were placed in a barrel and covered with tap water; thawing time, 12 hours.
3. In still air. The salmon were placed in a large wooden fish box; thawing time, 14 hours.

After being thawed, the salmon were butchered, cleaned, cut into slices of proper thickness, and packed into half-pound cans, all by hand.

Instead of 1/8-ounce (0.125 ounces) of salt being added to each can, as with fresh salmon, the amount was varied according to the method of thawing used. Four 10-grain salt tablets (0.091 ounces) were added to each can of the salmon thawed in running water, and 3 tablets (0.068 ounces) were added to each can of the salmon thawed either in still water or in still air. After the salt was added, the cans were vacuum sealed, retorted for 90 minutes at 240° F., and cooled in air at room temperature.

SALTINESS OF THE VARIOUS CANNED LOTS OF SALMON THAWED BY DIFFERENT METHODS: The saltiness of the canned salmon was judged after the cans had been in storage for several months. Samples from each lot were compared organoleptically with those canned commercially from unfrozen fish. No difference in saltiness could be detected among the various lots. In addition to the organoleptic tests, the salt content was determined chemically on the entire contents of several cans from each lot by the methods of analysis of the Association of Official Agricultural Chemists (1950). The results given in table 1 show that the salt content of the samples from the various lots of brine-frozen salmon packed experimentally were within 0.1 percent of that from the unfrozen salmon packed commercially.

Table 1--Effect of the Method Used to Thaw Brine-frozen Bristol Bay Red Salmon on the Salt Content of the Canned Product

Method of Thawing	Amount of Salt Added Per ½-pound Can		Can Number	Salt Content	
				Individual Values	Weighted Average
				Percent	Percent
In running water . . . . .	40	In grains { 0.091	1	1.8	1.6
			2	1.6	
			3	1.6	
			*	1.6	
In still water . . . . .	30	In grains { 0.069	1	1.6	1.6
			2	1.2	
			3	2.2	
			*	1.6	
In still air . . . . .	30	In grains { 0.069	1	2.0	1.7
			2	1.6	
			3	1.6	
			*	1.6	
Control samples com- mercially packed from unfrozen fish . . . . .	-	In grains { 0.125	1	1.6	1.6
			2	1.4	
			3	1.6	
			4	1.6	
			5	1.6	
			6	1.5	

\* COMPOSITE SAMPLE OF 6 CANS.

**CONCLUSIONS:** The data indicate that the amount of salt retained by red salmon brine frozen at about 5° F. and then thawed in running water, still water, or still air is not excessive. This salt retained from brine freezing can be compensated for by adding 50 to 80 percent as much salt as is used with canned fresh salmon.

#### EFFECT OF STORING FROZEN SALMON IN REFRIGERATED BRINE

An opportunity to determine the salt content of the canned product from frozen salmon held in brine came during the autumn of 1952 when a freezership brought a load of brine-frozen chum salmon (*Oncorhynchus keta*) from Southeastern Alaska to a Puget Sound cannery. Part of the brine-frozen salmon (called group A) had been held in dry storage. The rest (called group B) had been stored in brine at 5° F. for approximately 2 weeks.

The following four lots of samples were obtained:

Lot 1: Salmon from group A packed commercially in 4-pound cans.

Lot 2: Salmon from group B packed commercially in 1-pound cans.

Lot 3: Salmon from group B taken to the laboratory, thawed in running water, and packed in  $\frac{1}{2}$ -pound cans with three 10-grain salt tablets (0.069 ounces).

Lot 4: Salmon from group B taken to the laboratory, thawed in running water, and packed in  $\frac{1}{2}$ -pound cans with no added salt.

Samples from each of these four lots were analyzed to determine their salt content. The results are given in table 2.

Table 2--Salt Content of Canned Chum Salmon From Brine-frozen Fish Held Either in Dry Storage or in Refrigerated Brine

Lot No.	Type of Storage Used for Brine-frozen Salmon Prior to Packing	Type of Pack	Size of Can	Amount of Salt Added to Each Can		Can No.	Salt Content		
				Pounds	In grains		In ounces	Individual Values	Weighted Average
								Percent	
1	Dry .....	Commercial	4	?	?	1	1.6	1.3	
						2	1.1		
						3	1.2		
						*	1.3		
2	Brine at 5° F. .	Commercial	1	?	?	1	1.1	1.1	
						2	1.0		
						3	1.0		
						**	1.1		
3	Brine at 5° F. .	Experimental	$\frac{1}{2}$	30	0.069	1	1.2	1.1	
						2	1.1		
						3	1.0		
						**	1.1		
4	Brine at 5° F. .	Experimental	$\frac{1}{2}$	0	0	**	0.47	0.47	

\*COMPOSITE SAMPLE OF 3 CANS.  
\*\*COMPOSITE SAMPLE OF 6 CANS.

**CONCLUSIONS:** The data indicate that brine-frozen chum salmon held for approximately 2 weeks in brine at 5° F. and then thawed in running water carry less than 0.5 percent salt to the canned product. The data further indicate that this retained salt can be compensated for by decreasing the amount added during the canning process.

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