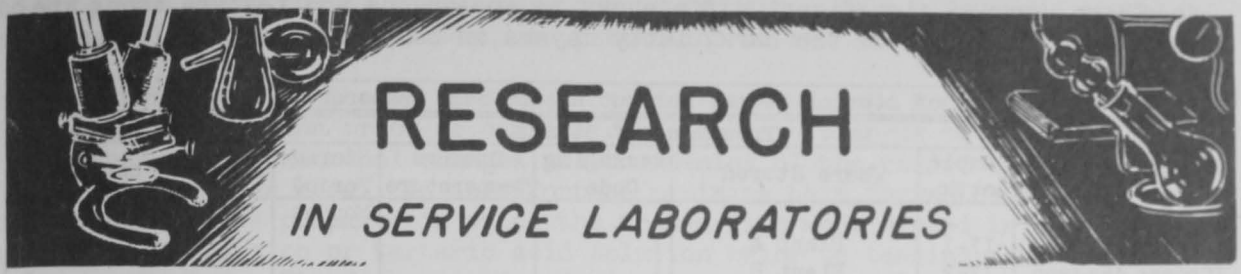

Progress in Projects, March 1953

REFRIGERATION: Cold-Storage Life of Frozen Halibut: The purpose of this project is to provide information on the cold-storage life of frozen halibut packed according to present commercial methods, and to compare various packaging and storing methods. This information will be of value to producers and distributors engaged in packaging, storing, and marketing frozen halibut. It will also serve as a basis for the requirements set forth in the Federal specifications for frozen fishery products. Four series of samples were prepared. A description of the samples and the results of the storage tests are as follows:

Five dressed (heads off and eviscerated) halibut, weighing from 20 to 40 pounds each, were obtained from each of three commercial fishery firms. These fish were sharp frozen and then glazed with potable water. Four halibut from each firm were packed in paper-lined wooden boxes and held in the company's cold-storage room at 0° F. for periods of 6 to 9 months as needed to prepare the test series. The fifth halibut from each firm was steaked immediately after freezing and glazing. These steaks were glazed and packaged for storage as indicated in each series. One of the following packaging methods was adopted for the steaks and in each series of tests the packaging method used is indicated by the packaging code letter:

Description of Packaging for Frozen Halibut Steaks	
Packaging Code	Method
A	Glazed steaks were packed in layers in a 15-pound corrugated-type cardboard carton lined with parchment paper. A sheet of parchment paper was placed between each layer of steaks.
B	Glazed steaks were placed in MSAT cellophane bags. The bags were heat sealed and packed in 15-pound corrugated-type cardboard cartons.
C	Glazed steaks were packed in layers in a 60-pound fibre board box in accordance with military requirements.

For the organoleptic tests the halibut steaks were examined while frozen, after thawing, and after baking in an oven.

Series I - Quality of Steaks Prepared from Frozen Dressed Halibut Stored for Various Periods

Sample Lot Number	Description of Samples	Treatment of Steaks			Total Storage Period	
		Packaging Code	Storage Temperature	Storage Period	Dressed Fish	Steaks
				Months	Months	
I-1	Steaks from frozen dressed halibut which were stored for 0 days at 0° F.	A	0° F.	9	0 +	9
I-2	Steaks from frozen dressed halibut which were stored 6 months at 0° F.	A	0° F.	3	6 +	3
I-3	Steaks from frozen dressed halibut which were stored 9 months at 0° F.	Steaks not packaged, but tested immediately after cutting.	-	0	9 +	0

There were no significant differences in appearance and texture among the three lots. Portions of the dark, fatty layers in samples from lots I-1 and I-2

Series II - Effect of Storing Frozen Halibut at the Same Temperature at Different Plants

Description of Sample	Treatment of Steaks					Total Storage Period	
	Sample Lot No.	Where Stored	Packaging Code	Storage Temperature	Storage Period	Dressed Fish	Steaks
					Months	Months	
Steaks from frozen dressed halibut which were stored 6 months at 0° F.	II-1 II-2 II-3 II-4	Plant A Plant B Plant C Fishery Technological Laboratory	A	0° F.	3	6 + 3	

varied from slightly rancid to definitely rancid in flavor. No rancidity was found in the samples from lot I-3. Preference was given to samples from lot I-3 and second preference to lot I-2. All three lots were acceptable.

The packed steaks adjacent to the inner surface of the boxes were extremely dehydrated. The inner layers of steaks showed little or no dehydration. No sig-

Series III - Effect of Storage Temperature on Frozen Halibut Steaks

Description of Sample	Treatment of Steaks				Total Storage Period		Observations
	Sample Lot Number	Temperature of Storage	Packaging Code	Storage Period	Dressed Fish	Steaks	
				Months	Months		
Steaks from frozen dressed halibut which were stored for 6 months at 0° F.	III-1	20° F.	A	3	6 + 3		The white meat darkened to light-brown tinge. Dark fatty layer was discolored. Cooked samples were rancid. Unacceptable commercially.
	III-2	0°-7° F.	A	3	6 + 3		The exposed portions of dark fatty layer was rancid. Acceptable commercially.
	III-3	0° F.	A	3	6 + 3		Dark meat in a few samples was slightly rancid. Acceptable commercially.
	III-4	-15° F.	A	3	6 + 3		Two out of five steaks showed rancidity in the dark fatty layer. Acceptable commercially.
	III-5	-20° F.	A	3	6 + 3		Only one of 15 steaks showed rancidity in in dark layer. This lot was rated best of all five. Acceptable commercially.

nificant differences in quality were found among the steaks stored at the four different cold-storage plants. There was more variation within a lot than from lot to lot. The four lots of steaks were considered acceptable. However, the packaging method did not provide adequate protection of the samples from dehydration.

Series IV - Effect of Various Packaging Methods and Storage Temperatures on Storage Life of Frozen Halibut

Description of Samples	Treatment of Steaks			Total Storage Period		Observations
	Packaging Method	Temperature of Storage	Storage Period	Dressed Fish	Steaks	
	Code		Months	Months		
Steaks cut from frozen dressed halibut immediately after freezing were glazed, packaged, and stored.	A	0° F.	9	0 + 9		Steaks adjacent to sides of box had lost considerable glaze and showed evidence of dehydration. The fatty layer of about half of the steaks was rancid.
	B	0° F.	9	0 + 9		Steaks were dehydrated slightly in certain areas. Slight rancidity was detected in only one of six steaks.
	A	-15° F.	9	0 + 9		Steaks adjacent to sides of carton showed small amount of dehydration.
	B	-15° F.	9	0 + 9		Very little change was noted in the condition of the samples.
Steaks cut from frozen dressed halibut which had been stored 6 months at 0° F., were glazed, packaged, and stored	B	0° F.	3	6 + 3		Steaks showed practically no loss of glaze. Slight rancidity was noted in fatty portion of some steaks.
	C	0° F.	3	6 + 3		Steaks showed only a small loss of glaze. Slight rancidity was noted in the fatty portion of some steaks.
	B	-20° F.	3	6 + 3		Steaks showed only a small loss of glaze.
	C	-20° F.	3	6 + 3		Steaks showed only a small loss of glaze.

to lot. The four lots of steaks were considered acceptable. However, the packaging method did not provide adequate protection of the samples from dehydration.

Study of Texture Change of Canned Salmon Prepared from Frozen Fish: Freezing and storing salmon prior to canning cause certain changes to occur in the canned product. The principal changes are toughening of the canned meat and the formation of excessive curd. In an effort to minimize this formation of curd, experimental packs were prepared in which the thawed fish were dipped in a salt (sodium chloride) solution or tartaric acid solution prior to canning. Alaska red salmon were used. The fish were frozen in the round at -20° F., glazed, and then stored at 0° F. After 14 weeks of storage, the fish were thawed and the experimental packs prepared. The canned samples (½-flat cans) were examined after one month's storage at room temperature. Description of the packs and the results of the test are summarized in the following table:

Observations on Canned Alaska Red Salmon Processed from Frozen Fish

Lot of Canned Red Salmon	Treatment of Thawed Salmon	Amount of Curd in Cans	Saltiness of the Canned Product
A	Canned in normal "commercial" manner.	Excessive	Acceptable
B-1	Can-height chunks were dipped in saturated salt (NaCl) solution at 65° F. for 1 minute and drained pior to packing in cans and processing. (No salt was added to the can.)	Slight	Insufficient salt
B-2	Same as sample B-1, except that the chunks were dipped for 2 minutes.	Slight	Acceptable
C-1	Can-height chunks were dipped in 5-percent solution of tartaric acid for 1 minute. One-half teaspoon of salt was added to the can prior to sealing and processing.	Very Slight	Acceptable
C-2	Same as sample C-1, except that the chunks were dipped for 2 minutes.	Very Slight	Acceptable

In every instance, the samples dipped in either brine (B-1 and B-2) or tartaric acid (C-1 and C-2) were superior in appearance to the canned salmon prepared in the regular commercial manner (A). The one-minute dips appeared equally as effective as the two-minute dips for each respective solution. The tartaric acid solution (5 percent) dip was more effective than the sodium chloride solution dip. In both the normal and brine-treated lots the canned fish showed a considerable tendency to stick to the lids or ends of the can, resulting in a rough surface when the cans were opened. The tartaric acid dip eliminated the tendency of the fish to stick to the lids. Those canned samples treated with tartaric acid had a smooth surface in the can and were free of curd. A slightly abnormal red-orange coloration of the tartaric acid treated fish was noted, but this was not objectionable even when compared with canned salmon prepared from unfrozen fish.

Penetration tests for comparing texture revealed that none of the dips had any effect on the texture (degree of firmness) of the canned product.

Further tests were carried out to determine the absorption of tartaric acid during the one-minute dip in 5-percent tartaric acid solution. For this particular test, king salmon were used, since they were the species available. These samples had been frozen and held in storage for about 5 months at -10° F. The salmon were thawed and cleaned, and then cut into can-size (½-flat) chunks. The chunks were divided alternately into two lots. One lot was used as a control sample. The other was treated with tartaric acid as follows: The chunks were dipped in 5-percent tartaric-acid solution for 1 minute at a temperature of 60° F. The pH of the solution was 1.9.

Both lots, the control and treated, were packed into cans, one-half teaspoon of salt was added, and the cans processed in the usual manner. The cans were stored two weeks prior to analysis for tartaric acid content.

Free acid in the liquor and in the meat was determined in six cans of fish from each of the two lots. Tartaric-acid content was considered the difference between the combined average of the control lot and the individual can averages of the treated lot. The results are shown in the table.

Tartaric-Acid Content of Canned King Salmon Prepared from Frozen Fish Dipped in a 5-Percent Tartaric Acid Solution Prior to Canning

Can Number	Tartaric Acid Content	
	Liquor	Meat
	%	%
1	0.044	0.010
2	0.088	0.038
3	0.067	0.020
4	0.044	0.010
5	0.091	0.028
6	0.064	0.024
Avg.	0.066	0.022

The average percentage of free tartaric acid in a ½-flat can of salmon was estimated to be 0.029 percent.

Although use of tartaric acid dips shows promise of preventing curd formation in canned salmon prepared from frozen fish, further tests are necessary to confirm the results. It will also be necessary to determine whether or not use of the process will meet the provisions of the Federal Food, Drug, and Cosmetic Act.

The second phase of this project involves a study of the effect of cell breakdown of the frozen and processed fish on the texture of the canned product. Four experimental packs were prepared in the late summer of 1952 and the canned samples (½-flat cans) examined after about five months of storage. The description of the experimental packs and summary of the results are presented in the following table:

Lot of Canned Alaska Red Salmon	Treatment of Samples	Penetrometer Reading 1/ (Average of 10 Cans)
		Millimeters
1-A	Fresh chunks of fish were canned and processed immediately at 242° F. (steam pressure) for 85 minutes.	14.4
1-B	Fresh chunks of fish were canned; the cans were frozen at -20° F. and then stored at 0° F. After 9 weeks of storage the fish (in the cans) were thawed in cold water then processed at 242° F. (steam pressure) for 85 minutes.	10.3
2-A	Skinned and boned salmon was ground in a blendor. The blended material was packed in cans and processed immediately at 242° F. (steam pressure) for 85 minutes.	10.5
2-B	Skinned and boned salmon was ground in a blendor. The blended material was packed in cans, frozen at -20° F. and then stored at 0° F. After 9 weeks of storage the material in the cans was thawed in cold water, then processed at 242° F. (steam pressure) for 85 minutes.	9.1

1/ THE PENETROMETER READING VARIES INVERSELY WITH THE TOUGHNESS OF THE FISH.

The penetrometer readings for samples 1-A and 1-B show that toughening occurs in canned salmon prepared from frozen fish. The difference in the average penetrometer readings for the fish that had been ground (2-A and 2-B) was not significant. This seemed to indicate that when the cell walls of the fish tissues were ruptured by mechanical means prior to freezing the meat, toughening of the canned product did not occur. Freezing did have considerable effect on curd formation, however, since sample 2-A prepared from unfrozen fish that had been ground showed no curd, while sample 2-B prepared from frozen fish that had been ground showed heavy curd formation. (Ketchikan)

* * * * *

Freezing Fish at Sea, Defrosting, Filleting, and Refreezing the Fillets: The research trawler Delaware was dry-docked at a shipyard in Chelsea, Massachusetts, for annual overhauling and painting. The brine-freezer tank was modified.

A prototype of the new brine-freezer mechanism is being tested in the laboratory pilot plant in order to iron out any kinks that may be inherent to the present design. (Boston)

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BYPRODUCTS: Vitamin Content and Nutritive Value of Fishery Byproducts: Vitamin B_{12} assays of tuna, mackerel, and herring meals were completed. The results are summarized as follows:

Description of Sample		Moisture	Oil	Vitamin B_{12} Content (Moisture- and oil-free basis)
Meal	Sample	%	%	Micrograms per Gram
Mackerel	One sample from one bag.	9.70	10.93	0.32
Herring	Composite sample from 10 bags.	11.23	9.87	0.33
Herring	Composite sample from 30 bags.	11.55	9.84	0.31
Tuna (Albacore)	Three individual samples from each of three bags of one lot.1/	7.06	12.92	0.29
Tuna	Twelve individual samples from each of 12 bags of one lot of 50% skipjack-50% yellowfin tuna meal.1/	5.07	9.48	0.38
Tuna	Four individual samples from each of four bags of one lot of 50% skipjack-50% yellowfin tuna meal.1/	8.91	7.91	0.27

1/RESULTS ARE EXPRESSED AS AVERAGE OF THE SAMPLES.

* * * * *

ANALYSIS AND COMPOSITION: Composition and Cold-Storage Life of Fresh-Water Fish: The proximate composition of the waste portion of certain fresh-water fish was determined. The results are presented in the following table:

Composition of the Waste Portion1/ of Certain Fresh-Water Fish

Species of Fish		Where and When Caught	Composition of Waste Portion1/			
Common Name	Scientific Name		Moisture	Oil	Protein	Ash
			Percent	Percent	Percent	Percent
Buffalofish	Ictiobus sp.	Mississippi River, June 1952	70.0	8.9	15.6	7.5
Bullhead	Ameiurus sp.	Lake Benton, Minn., Aug. 1952	76.9	5.4	14.9	4.0
Carp	Cyprinus carpio	Lake Benton, Minn., Aug. 1952	63.8	15.0	16.2	7.1
		Mississippi River, May 1952	64.9	9.8	17.4	9.3
Chub	Leucichthys sp.	Lake Michigan, July 1952	64.6	21.2	12.3	3.6
Lake trout2/	Cristivomer namaycush	Lake Superior, June 1952	64.3	16.0	15.6	4.7
Perch, yellow	Perca flavescens	Lake Erie, June 1952	68.8	8.7	16.3	7.5
Pike, blue	Stizostedion glaucum	Lake Erie, June 1952	66.8	10.7	15.9	7.0
Pike, yellow	Stizostedion vitreum	Lake Erie, June 1952	71.2	8.9	16.3	5.1
Sheepshead	Aplodinotus grunniens	Mississippi River, May 1952	62.3	18.1	15.5	6.8
		Lake Erie, June 1952	66.3	12.8	15.9	5.5
Squawfish	Ptychocheilus grandis	Dnano Lake, Wash., Feb. 1953	69.5	10.4	16.0	5.9

1/WASTE PORTION CONSISTED OF ALL THAT REMAINED AFTER SKINLESS FILLETS WERE CUT.
2/VISCERA NOT INCLUDED IN THE WASTE PORTION FOR LAKE TROUT.

(Seattle)

Project Reviews

DEVELOPMENT OF SPECIALTY FOOD PRODUCTS FROM ALASKA FISH AND EDIBLE FISH TRIMMINGS--Review for Period July 1952-March 1953

This project was initiated to develop specialty products from Alaska fish and edible fish trimmings in order to encourage off-season industries in Alaska. This is the progress in developing various products during the period July 1952 to March 1953:

CANNED SALMON EGG SPREAD: A canned salmon egg spread was developed that showed good consumer acceptance. Publication of the process must await a final and favorable report on thermal-process determinations.

PICKLED HERRING: An improved pickling formula for Alaska herring was tested. The new formula limits the use of red peppers and quadruples the quantity of sugar previously used. The recommended formula and procedure are as follows: Remove head, viscera, and kidney from the herring. Wash fish thoroughly with fresh water. Place the dressed herring in a 90° salometer brine until "struck through" (7 to 9 days). Remove the fish from the brine and then freshen them in running cold water overnight (15 hours). Drain fish. Cut into fillets, and cut fillets into about 1½-inch pieces. Pack the pieces of fish layerwise in an earthenware crock and sprinkle spices between each layer. Add to the crock a pickling solution made up of 1½ quarts of vinegar, 1½ pints of water, and 8 ounces of sugar. Allow the herring pieces to stand in this pickling mixture for about 2 days, then repack in jars with the spices used in pickling. Packing of fish and spices should be done carefully to make a neat-appearing pack. Fill jars with the pickling solution and add one red pepper and an onion ring to each jar. The spices required to pickle 11 pounds of salted herring are: allspice, 3 oz.; bay leaves, 1 oz.; mustard seed, 2 oz.; black pepper, ½ oz.; cloves, ½ oz.; and sliced onions, 2 oz. The procedure should produce a spiced Alaska herring product excellent in appearance, flavor, and texture.

CLAMS: A canned smoked clam product was developed which was excellent from the standpoint of appearance and flavor, but had a tough texture. Attempts to improve the texture have been unsuccessful.

FISH SPREADS AND PASTES: A smoked chum-salmon spread was prepared. The product received fairly good acceptability from the standpoint of texture and flavor. The color of the product, which was somewhat yellow, seemed to be the limiting factor. Further tests to improve the color will be carried out. The present formula is:

6 lbs. ground smoked chum salmon (skinless and boneless)	1½ tsp. garlic salt
18 oz. tomato puree	36 oz. melted oleomargarine
24 oz. water	3 tsp. gelatin

Mix the ingredients in a large container. Pour into ½-pound cans. Vacuum seal the cans and process for 40 minutes at 242° F. (steam pressure), and finally water cool. (Smoked pink salmon may be substituted for smoked chum salmon.)

SMOKED SHRIMP: Excellent packs of smoked Alaska shrimp in oil have been prepared. Alaska shrimp seem to lend themselves well to the preparation of this type of product. (Ketchikan)