UTILIZATION OF ALASKA SALMON CANNERY WASTE AS A SOURCE OF FEED FOR HATCHERY FISH

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ABSTRACT

COMMERCIAL-SCALE TEST SHIPMENTS WERE MADE OF SALMON TRIMMINGS FROM A CANNERY IN PETERSBURG, ALASKA, TO THE STATE OF WASHINGTON. THIS WASTE MATERIAL, VISCERA AND EGGS, ORDINARILY DISCARDED BY THE CANNERIES, WILL BE USED IN FEDERAL FISH HATCHERIES AS AN EXCELLENT SOURCE OF PROTEIN AND VITAMINS IN THE DIET OF HATCHERY FISH. THE VISCERA WERE PACKED IN 0.002-INCH THICK POLYETHYLENE TRANSPARENT BAGS (19 INCHES WIDE BY 42 INCHES LONG) PLACED INSIDE A BURLAP BAG (18 INCHES WIDE BY 36 INCHES LONG). THE MATERIAL WAS FROZEN AND SHIPPED TO WASHINGTON BY REFRIGERATED VESSEL. ALTHOUGH THE BAGS OF MATERIAL WERE ROUGHLY HANDLED DURING ALL PHASES OF THE OPERATIONS AND DURING TRANSIT, OVER 100,000 POUNDS OF THE FROZEN MATERIAL WERE DELIVERED TO FEDERAL FISH HATCHERIES IN THE STATE OF WASHINGTON WITHOUT THE LOSS OR DAMAGE OF A SINGLE BAG. THE EGGS WERE PACKED IN 30-POUND BERRY TINS. COST RECORDS INDICATE THAT THE COLLECTION OF ALASKA SALMON CANNERY WASTE FOR USE IN THE STATES IS COMMERCIALLY AND ECONOMICALLY FEASIBLE. SALMON VISCERA BAGGED AND FROZEN BY THE METHOD INDICATED HEREIN ARE ACCEPTABLE FOR SHIPMENT FROM ALASKA TO SEATTLE ON REGULAR COMMERCIAL REFRIGERATED VESSELS.

INTRODUCTION

Research toward utilization of Alaska salmon cannery waste has been carried out since 1947 by the U. S. Fish and Wildlife Service. Particular emphasis has been placed on utilization of visceral portions of the waste as a feed for hatchery fish and on the use of the whole waste or the waste excluding heads for fur-animal food. This research has shown that the waste and the soft visceral parts, in particular, are an excellent source of protein and vitamins and that much of the vitamin content and the best protein are concentrated in the fish eggs. In developing a practical method of utilizing these materials from Alaska salmon canneries, several problems had to be overcome.

Transportation charges from Alaska are an important item in the over-all cost of collection and delivery of such material to potential users. Transportation companies have insisted that salmon offal would be acceptable for transportation only if it were packed in metal containers. This, in effect, would virtually double the freight on such materials, because the cost for shipping the empty containers to Alaska would approximately equal the cost of returning the filled containers (of course, the freight rate for any frozen material on the return shipping would be slightly higher). Experiments with different types of containers resulted in development of a method of bagging the salmon waste in an inner plastic (polyethylene) bag with an outer burlap bag. Laboratory tests indicated that such a container would withstand the bagging and freezing operations and the subsequent rough handling that it would normally encounter.

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Another problem that had to be overcome was the development of a practical method for the separation of the soft visceral portion and of the eggs alone from the entire waste. The waste as it comes from the "Iron Chink" contains heads, tail portions, fins, viscera, and eggs. Preliminary observations made at canneries during the summer of 1950 indicated that several approaches to the problem were possible. However, the most desirable method, if feasible, would involve complete mechanical separation right at the Chink--such that the desired, soft visceral portions might be diverted separately from the other waste onto a packing table. This would avoid any costly hand separation of the individual constituents of the waste.

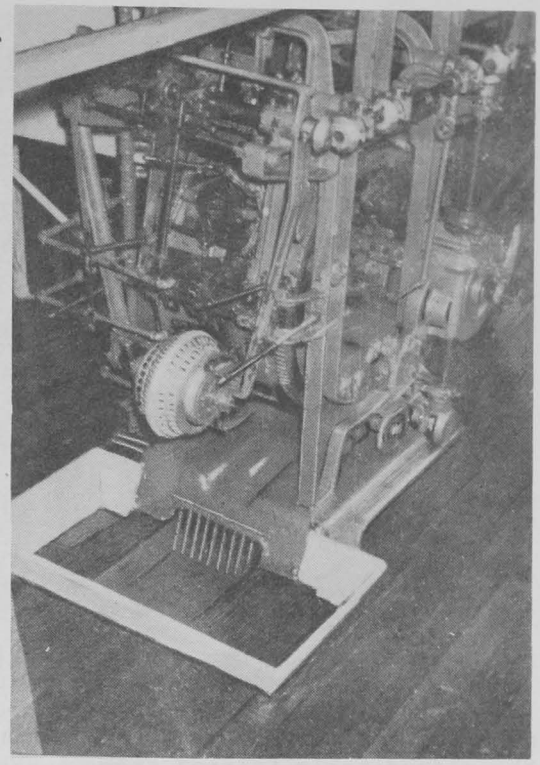

FIG. 1 - REAR VIEW OF IRON CHINK SHOWS THE GRATE IN THE FLOOR THROUGH WHICH THE VISCERA WERE DIVERTED INTO A WOODEN CHUTE UNDERNEATH THE CANNERY FLOOR.

COMMERCIAL-SCALE TEST

A large-scale collection of approximately 100,000 pounds of frozen salmon viscera and 3,000 pounds of frozen salmon eggs was made at Petersburg, Alaska, during the summer of 1951. The purpose of this collection was to test out on a commercial scale the feasibility of bagging and freezing viscera and to demonstrate to the commercial transportation concerns that such materials could be successfully handled in this way. This would possibly clear the way for a change in the regulations to allow shipment in bags rather than in cans, since use of cans is not economically feasible. The materials collected are being used by Fish and Wildlife Service hatcheries in the state of Washington for regular fish feeding. Careful records were kept of all costs involved in the collection so that in the future some basis would be available for estimating such costs for even larger scale operations. It was anticipated that if the collection of the salmon waste for use in fish hatcheries proved to be economically feasible, a much larger potential market (a feed for fur-bearing animals) would be opened up and that many millions of pounds of such materials might be marketed each year.

Details concerning the laboratory research on this project will be published at a later date. The balance of this report deals with results of the large-scale collection of salmon viscera and eggs at Petersburg, Alaska, during August 1951.

INSTALLATION OF EQUIPMENT AND COLLECTION OF WASTE

After consultation with operators of the cannery at Petersburg, shields were devised and installed at the rear of the Iron Chink to separate the viscera from the bony portions of the salmon waste. Besides the shields, the following equipment was installed at the cannery: A gurry chute, 10 by 10 inches by 60 feet; a work platform, 12 by 20 feet, located 7 feet below the dock level; a draining table, 8 feet by 29 inches, made of 2 by 4-inch pieces placed on edge and spaced three-eights of an inch apart; and a slide, 15 feet long, from the surface of the dock to the work platform, on which an elevator moved.[1/]

1/COMPLETE DETAILS ON THIS CONSTRUCTION WORK MAY BE OBTAINED BY WRITING TO THE KETCHIKAN (ALASKA) OR SEATTLE (WASHINGTON) TECHNOLOGICAL LABORATORIES.

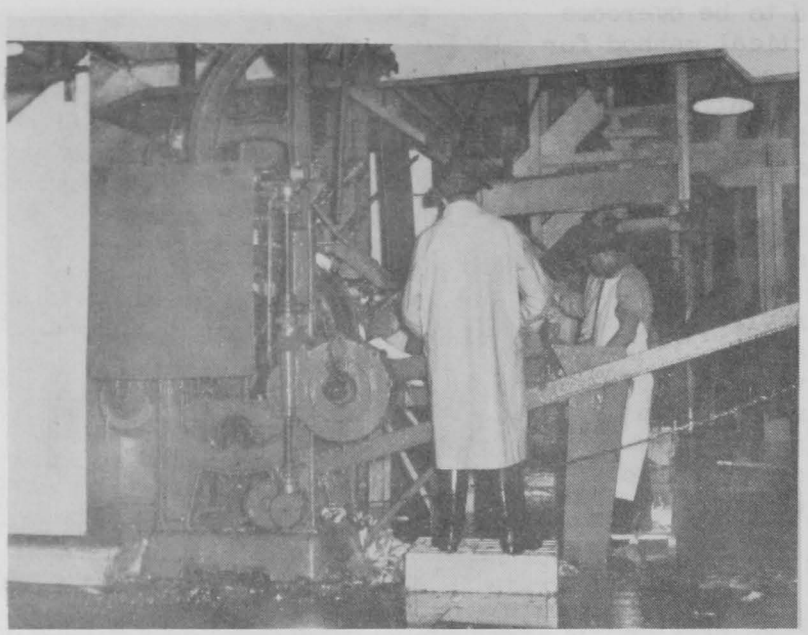

FIG. 2 - SIDE VIEW OF IRON CHINK. SHOWS (AT LEFT) THE SHIELD BUILT AROUND THE VISCERA GRATE AND (LOWER CENTER) THE FINS PILED OVER THE FIN GRATE.

By means of shields (figures 1 and 2) installed at the rear of the Iron Chinks, the viscera were diverted through a grate in the floor of the cannery into a wooden chute (10 by 10 inches by 60 feet) installed underneath the cannery floor. The viscera were carried down the chute by water from the sprays on the Chinks onto the draining table. A series of trap doors installed in the chute was used to control the rate of flow. As the viscera from the three Chinks, with much excess water, flowed onto the draining table (figure 3), any undesirable portions were picked out and discarded. Four men were necessary for the operation. One man controlled the flow and raked the viscera down the sloped table (sloped approximately 6 inches in 8 feet) to the second man (figure 4), who sacked the drained material (figure 5). The filled sack was passed to the third man who knotted the top of the polyethylene bag and wire-tied the outside burlap bag (figure 5). The secured sack was then placed on the elevator (figure 6). The fourth man hand-winched the loaded elevator (six sacks) up to dock level, removed the sacks, and returned the elevator to the platform. The fourth man also made up sacks, that is, placed the polyethylene bag inside the burlap bag (figure 7).

FIG. 3 - DRAINING TABLE. VISCERA FLOW ONTO AND ARE RAKED DOWN THE SLOPED TABLE; THE WATER FALLS THROUGH THE OPENINGS. ONE OF THE TRAP DOORS TO CONTROL THE RATE OF FLOW IS LOCATED AT THE END OF THE CHUTE (RIGHT CENTER).

At approximately 3:15 p. m. each day, a dump truck transported the day's output to the cold-storage plant. Two trips were usually necessary. The collection crew of four men loaded the truck, and two of the men (cold-storage workers) accompanied the truck to the cold-storage plant where the sacks were dumped near the freezer door. These men then hand-trucked the sacks into the freezer (average temperature of -18° F.) and placed them on the freezer plates (figure 8). This operation usually took two men approximately one hour per 100 sacks. Each day two hand-truck loads of sacks (10 sacks per truck) were weighed. The average weight was approximately 65 pounds per sack.

Normally the sacks of viscera were

solidly frozen in 24 hours. After 300 to 400 sacks accumulated in the freezers, they were moved to the storage room by the regular cold-storage plant crew (figure 9).

PROBLEMS ENCOUNTERED

Following are the two main problems encountered during the collection: (1) Fish missed by the Iron Chink (that is, the fish fed into the Iron Chink that were not carried through but dropped) would fall onto and clog the fin grate (figure 2). The fins would then rapidly pile up on the floor. When this build-up of material became too high the fins would wash underneath the Chink, down through the rear grate (figure 1) into the viscera chute, and then onto the draining table where they had to be picked out from the visceral portion. The only remedy for the above problem, without interfering with the cannery operation, was to periodically clean off the fin grate. This solution was not ideal. (2) Separation of the soft visceral portions made disposal of the remainder of the trimmings more difficult. Ordinarly, the whole waste flowed easily from the gurry bin into the scow. Since approximately 85 percent[2/] of the viscera, or soft portions, were diverted for the collection operation, very little of this material entered the cannery's gurry bin. The mass of heads, tails, and fins were difficult to remove from the bin. This difficulty required the use of additional personnel to empty the bin and then to dump the scow; normally, one man carried out the entire operation. This problem could possibly be solved by building more slope into both bin and gurry scow.

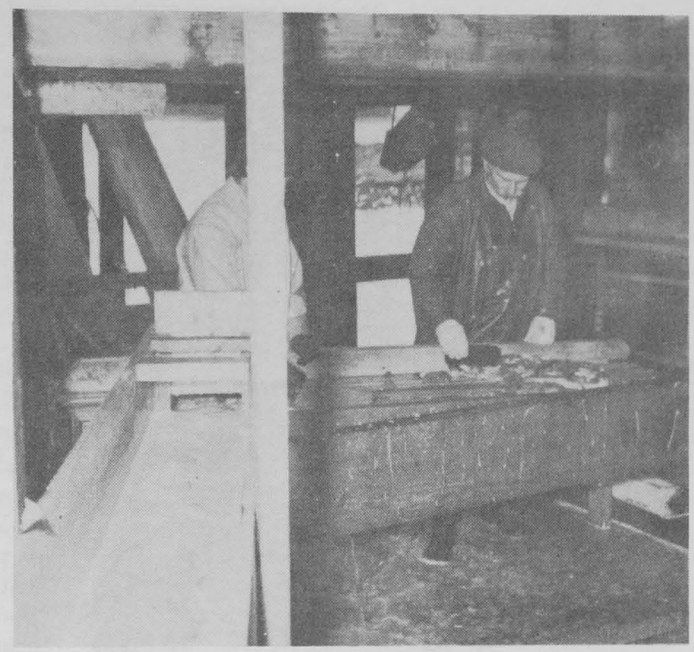

FIG. 4 - ANOTHER VIEW OF THE DRAINING TABLE SHOWS THE VISCERA FLOWING DOWN THE CHUTE, THROUGH THE TRAP DOOR, AND ONTO THE DRAINING TABLE.

FIG. 5 - THE DRAINED VISCERA ARE SACKED (RIGHT) AND THE BURLAP BAG IS WIRE-TIED (CENTER).

Under optimum conditions (when this particular cannery was running all three Iron Chinks steadily), a maximum of thirty-five 65-pound sacks of viscera were collected in an hour. These conditions were seldom attained because most of the

2/ IT IS ESTIMATED THAT 60 TO 70 PERCENT OF THE THEORETICAL YIELD OF VISCERA WAS COLLECTED. THIS VALUE WAS BASED ON THE ESTIMATE OF 25 POUNDS OF WHOLE WASTE PER CASE OF SALMON. THE VISCERA REPRESENT 29 PERCENT OF THE WHOLE WASTE OR 7.3 POUNDS OF VISCERA PER CASE OF SALMON. SOME OF THE LOSS OF VISCERA, PROBABLY UP TO 15 PERCENT OF THE TOTAL AMOUNT, OCCURRED AT THE DRAINING TABLE WHERE THE SMALL PORTIONS FELL THROUGH THE SLOTS.

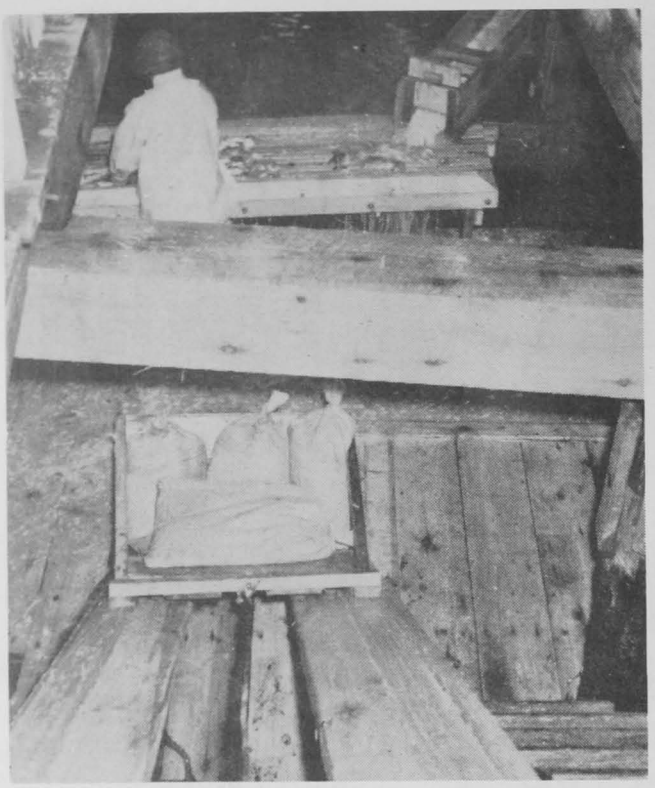

FIG. 6 - THE SACKS OF VISCERA ARE LOADED ONTO THE ELEVATOR AND ARE HAND-WINCHED FROM THE PLATFORM UP TO THE DOCK LEVEL.

collection was made during the first half of the season at a time when the cannery was not operating at full capacity. An average of 120 sacks per day (range of 90 to 150) was collected with the facilities used.

During an eight-hour shift, only one-half to three-fourths of the time of the workers was spent in actual collection of the material. The remainder of the time was spent in taking the material to the cold-storage plant, emptying the gurry bin and dumping the gurry scow, and making minor adjustments to and cleaning the equipment. Also, the collection was carried out over only a portion of the season, and only until the desired quota of 100,000 pounds was reached. Had operations continued for the final ten days of the season, the prorating of certain fixed costs and capital investments for a larger production would have resulted in a smaller unit cost per pound of the viscera and eggs.

COSTS OF COLLECTION OF WASTE

Table 1 lists the costs of collecting the salmon viscera. Only the costs of the actual materials and services necessary for the viscera collection are given.

Cost of all man hours involved in the actual collection are figured at the rate of $2.00 per man hour straight time and $3.00 per man hour overtime.

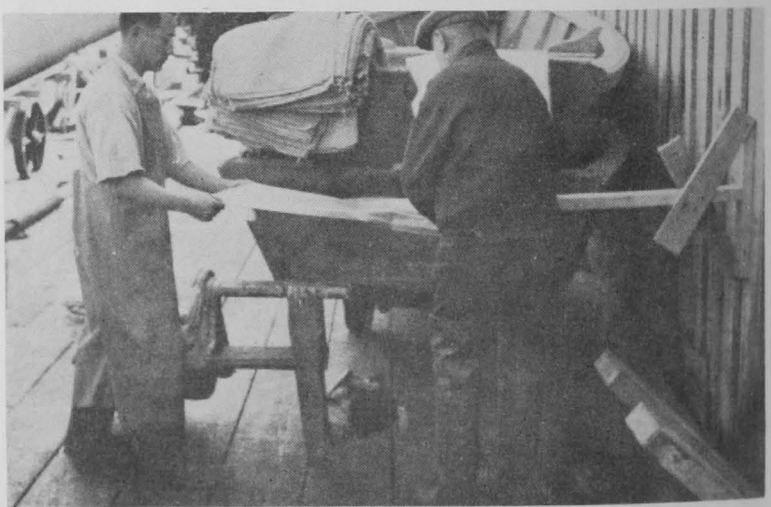

FIG. 7 - THE MEN ARE PULLING THE POLYETHYLENE BAG OVER THE SACK STAND; A BURLAP BAG (UPPER CENTER) IS THEN PULLED OVER ON THE OUTSIDE OF THE POLYETHYLENE BAG. THE COMPLETED CONTAINERS ARE PILED ON THE STAND BEHIND THE MAN ON THE LEFT.

Table 2 gives information on the cost breakdown for the collection of frozen salmon eggs; table 3, information on shipping costs from Petersburg, Alaska, to Seattle; and table 4, costs in cents per pound for collection of salmon viscera and eggs, calculated f.o.b. Petersburg and f.o.b. Seattle. The cost f.o.b. Seattle of the viscera is 5.21 cents, and of the eggs is

7.75 cents per pound (not including capital investments or depreciation). In comparison, the Fish and Wildlife Service hatcheries in 1951 paid 9 cents per pound

Table 1 - Cost of Collection of 100,750 Pounds of Salmon Viscera F.O.B. Steamship Dock, Petersburg, Alaska

Item	Cost
Material: 1,600 burlap bags	$ 479.00
1,600 polyethylene liners	258.00
2,000 wire ties	5.00
1 wire-tying tool	2.00
Shipping Seattle to Petersburg	18.00
Viscera (100,750 lbs. at $0.005 per lb.)	503.75
Freezing and Storage ($7.00 per 1,000 lbs.)	705.25
Hauling by Transfer Co. ($6.00 per hour)	50.00
Labor for the Collection (396.5 hrs. at $2.00 per hr.; 35 hrs. at $3.00 per hr.)	898.00
Cold-Storage Handling Charges	87.00
Longshoring	78.00
	$3,084.00

for eggs obtained in the Pacific Northwest. The price paid for salmon waste has varied with the degree of separation of the heads, tails, and fins from the soft visceral parts. The amount paid for the viscera, equal in quality to that obtained in this collection, has been greater than 5 cents per pound.

Table 2 - Cost of Collection of 3,000 Pounds of Frozen Eggs F.O.B. Steamship Dock, Petersburg, Alaska

Item	Cost
Material: 30-lb. Berry Tins and Lids	$ 38.00
Shipping Cost Seattle to Petersburg	35.00
Eggs ($0.005 per pound)	15.00
Labor for Collection	56.00
Freezing and Storage	21.00
Cold-Storage Handling Charge	2.50
Longshoring	6.50
Hauling by Transfer Co.	3.00
	$ 177.00

Observations on the adequacy of packaging, using the polyethylene bags within burlap, were made by Service personnel during handling at Petersburg and on arrival at destination. Examination by representatives of a commercial steamship company was made at destination.

Table 3 - Shipping Cost of Salmon Viscera and Eggs from Petersburg, Alaska to Seattle, Washington

Item	Cost
Transportation of 1,550 sacks of Viscera (2,722 cu. ft. at $0.675 per cu. ft.)	$1,837.35
Wharfage and Handling (Petersburg and Seattle) (2,722 cu. ft. at $0.12125 per cu. ft.)	330.04
Total	$2,167.39
Transportation of 100 Cans of frozen eggs (66.8 cu. ft. at $0.7125 per cu. ft.)	$ 47.60
Wharfage and Handling (Petersburg and Seattle) (66.8 cu. ft. at $0.12125 per cu. ft.)	8.10
Total	$ 55.70

Table 4 - Summary of Costs for Salmon Viscera and Eggs

Item	Price Per Pound F.o.b. Steamship Dock, Petersburg, Alaska	Shipping Cost, Per Pound, From Petersburg, Alaska, to Seattle, Wash.	Price Per Pound F.o.b. Steamship Dock, Seattle, Wash.1/
	Cents	Cents	Cents
Viscera (in bags)	3.06	2.15	5.21
Eggs (in 30-lb. berry tins)	5.90	1.85	7.75

1/ CAPITAL INVESTMENTS AND DEPRECIATION COSTS NOT INCLUDED, SINCE THEY WOULD ORDINARILY BE PRORATED FOR THE ENTIRE SEASON OVER A PERIOD OF YEARS. ALSO, THE COSTS WILL VARY WITH THE LOCATION OF THE CANNERY, RATES FOR LABOR, TYPE OF CONSTRUCTION, AND ENVIRONMENTAL CONDITIONS. FOR THIS PARTICULAR OPERATION THE COST OF MISCELLANEOUS SUPPLIES AND CONSTRUCTION REQUIRED FOR THE ENTIRE COLLECTION AMOUNTED TO $413.19. THIS AMOUNT, UNDOUBTEDLY, WILL REPRESENT AN AVERAGE INVESTMENT THAT MIGHT BE EXPECTED FOR A THREE-LINE SALMON-CANNERY OPERATION.

The container employed for this purpose was a 0.002-inch thick polyethylene transparent bag, (19 inches wide and 42 inches long) placed inside a burlap bag (18 inches wide by 36 inches long). The burlap bag, being smaller than the plastic liner, takes up most of the strain during packing, freezing, and handling operations. This size of bag would hold, if filled completely, about 100 pounds of material. However, by placing only 65 pounds of material in the bags, handling was greatly facilitated. Greater ease in closing the polyethylene bag resulted inasmuch as it was possible to tie a knot in the polyethylene bag for a rapid, secure closure. It seems that 65 pounds is the best weight for ease of handling; also, this size package fits between freezer plates more readily than a 100-pound size.

The 65-pound bags of unfrozen salmon viscera were subjected to extremely rough handling without rupturing the polyethylene liners or otherwise damaging the bags. Unfrozen bags of viscera were loaded into a dump truck for transportation from the cannery to the freezer. Upon arrival at the freezer, they were dumped onto the floor, during which process some bags fell 6 feet or more onto the concrete floor or onto other bags. This rough treatment did not necessitate the rebagging of a single container.

The bags were still in excellent condition after they were handled in the usual manner, at the cold-storage plant and after they were unloaded at Bellingham or Seattle, Washington. No difficulty was experienced in bags sticking to freezing plates or to each other.

FIG. 8 - THE SACKS OF VISCERA ARE LYING ON THE FREEZER PLATES (LEFT) WHERE THEY ARE NORMALLY FROZEN SOLID IN 24 HOURS; THE CANS CONTAINING THE EGGS WERE FROZEN WHILE STACKED ON THE FLOOR.

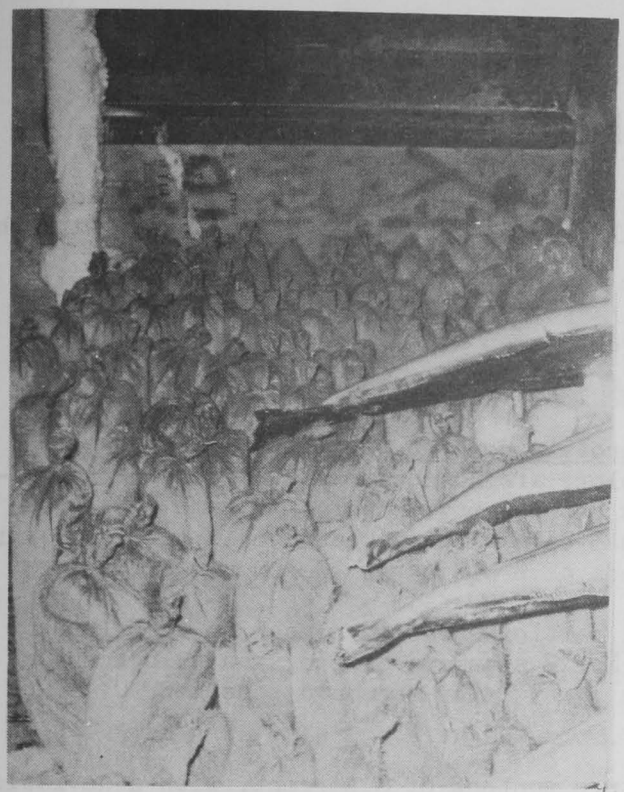

FIG. 9 - THE FROZEN SACKS OF VISCERA ARE STORED IN REGULAR COLD-STORAGE ROOM AWAITING SHIPMENT TO SEATTLE; THE FISH (BOTTOM CENTER) ARE FROZEN HALIBUT.

The containers were clean with no .ish material adhering to them. Inspection of the shipment at different points en route to the hatchery and after arrival at the hatchery failed to show a single bag which had lost any of its contents or which needed rebagging for any reason whatever.

The shipments from Alaska to Washington were made in two lots. The first shipment of about 60,000 pounds would not be accepted by any commercial steamship company because, contrary to regulations, the viscera were packed in bags rather than metal containers. The first shipment was made aboard a refrigerated vessel belonging to one of the salmon canneries, and delivery was made at Bellingham, Washington. Inspection of this shipment by representatives of a regular commercial steamship company convinced them that such a method of packaging would probably be satisfactory. Accordingly, they agreed to ship the second lot of about 40,000 pounds. This shipment was in excellent condition when it arrived in Seattle. The steamship company officials indicated, therefore, that future lots of salmon viscera bagged and frozen as indicated herein would be accepted for shipment from Alaska to Seattle on their regular commercial refrigerated vessels.

ACKNOWLEDGMENT

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