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FINAL REPORT

ON

CAVIAR PROCESSING

AND

MARKETING

WDATCP CONTRACT #8072

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A. INTENT AND BENEFIT TO WISCONSIN FISHERIES

The intention of the project was to improve the economical impact of commercial fishing by optimizing the use of whitefish, chub and lake herring caviar. The processing and markets of salmon caviar were also investigated in view of Wisconsin fish farming. In the past Wisconsin has produced large quantities of fish roes, but they have been sold to out-of-state companies as a partially finished product. The goal was to make it possible for the Wisconsin caviar processors to produce finished and packaged, high quality caviar to be sold to the world markets.

For producing **high quality caviar** from Wisconsin the following conditions were needed:

1. A proper processing method
2. Knowledge of customer needs and specifications
3. Quality control parameters and methods
4. Appropriate packaging and labeling

For a successful **marketing of caviar** the following was needed:

1. Knowledge of caviar markets overseas and domestically
2. Promote Wisconsin caviar in international food shows
3. Advertise in foreign food magazines
4. Develop an aggressive sales program
5. Develop "value added" products for the domestic market

Fulfillment of the above tasks brings the following **benefits:**

1. Production of even and high quality caviar
2. Increase the demand for caviar
3. Higher revenue to both fishermen and processors
4. "Value added" products provide opportunities for Wisconsin dairy industry
5. Expand the reputation of Wisconsin as a producer of gourmet foods
6. Create jobs

B. THE PROJECT ACHIEVED THE FOLLOWING OBJECTIVES:

1. Created 10-12 new jobs in caviar processing and will create an addition 10-15 next season
2. Wisconsin caviar has been sold to Scandinavia, Central Europe and Japan
3. "Value added" products will provide new expansion opportunities for Wisconsin dairy industry
4. Improved quality has given Wisconsin caviar a competitive advantage over caviar from other states
5. Processing of the roe into caviar enhances the use of Wisconsin fish resources

C. THE PROJECT HAS MET ALL PROPOSED OBJECTIVES:

1. An optimal processing method has been developed *(see Processing Manual of Whitefish, Chub and Lake Herring Caviar).*
2. The specifications for caviar have been established based on the information on the customer needs (*see Quality Control Manual*)
3. Quality control parameters and methods have been developed *(see Quality Control Manual).* A HACCP program has also been developed for the caviar processing *(see Hazards Analysis and Critical Control Point Program for Caviar)*
4. Research on the "value added" products and test marketing accomplished (see *"Value added" Caviar Products*). The feedback from the consumers indicated an enthusiastic response for three of the developed "value added" products. These products can be frozen and they have a shelf life from one week to four weeks after defrosting. These products contain from 10 to 30% caviar while the other major ingredients are dairy products. The consistency of these "value added" products allows the use of lower grade caviar, e.g., brownish eggs. Smoked caviar has a much greater acceptance among American consumers than the plain caviar.
5. Market research was done in Scandinavia, Central Europe, Japan and the USA. Because of a severe shortage of caviar due to a hard winter, markets outside Scandinavia could not be fully utilized. While the long-term customers in Scandinavia could not get half of their demand, no caviar was available for the new markets. A continuing effort is taking place in Japan where it takes a long time to introduce a new product.
6. Worldwide exposure of Wisconsin caviar was established by attending two international food shows and by advertising in two international food magazines.
7. The project created 10 new jobs in caviar processing during last season and it will create an additional 10-15 jobs next season.
8. Caviar was promoted as a gourmet food from Wisconsin.

D. DURING THE PROJECT THE FOLLOWING MANUALS WERE WRITTEN:

1. Processing Manual of Whitefish, Chub and Lake Herring caviar
2. Quality Control Manual
3. Hazard Analysis and Critical Control Point Program
4. "Value added" Caviar Products

A talk on Wisconsin caviar business was given by Seppo Kolehmainen at the Commercial Fishing and Aquaculture Banquet on January 29, 1994.

E. FUTURE PROJECTIONS:

Wisconsin caviar can gain a high reputation and be sold at a higher price than today, if the quality is maintained high. In Sweden, e.g., a poor quality of American caviar in the past has lowered the price to 50-70% of the domestic product. The price of Wisconsin caviar will improve over the years with a constant high quality.

The production can be increased especially for lake herring caviar, if a greater demand is created for the fish itself. While the whitefish and chub production is relatively constant due to the quotas and the demand, the large population of herring in Lake Superior remains largely untapped.
The countries outside Scandinavia will provide well-paying markets in the future when the caviar production allows the expansion. Japan is the largest market for caviar, but it takes a long time to develop a market for a product that is unknown to the Japanese.

The production of salmon caviar will become economically important when the salmon farming is expanded. An important source of salmon roe can also be the King salmon hatchery program. When the environmental contaminant level in the roe of King salmon allows its use for caviar, a large quantity of Ikura caviar can be made for the Japanese markets.

PROCESSING MANUAL

OF

WHITEFISH, CHUB

AND

LAKE HERRING

CAVIAR

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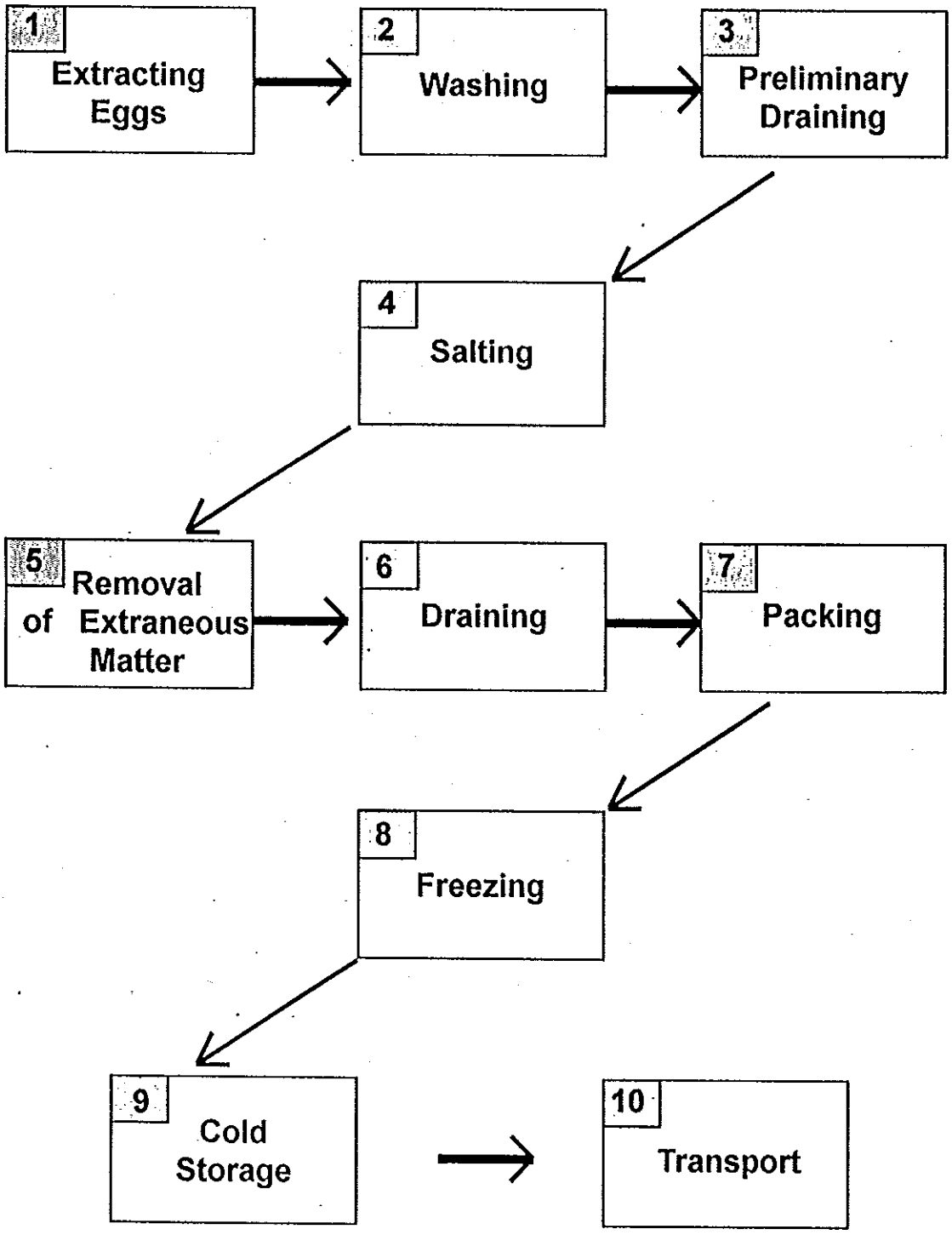
FLOWCHART OF CAVIAR PROCESSING WITH HACCP POINTS



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INTRODUCTION

Caviar is a salt cured fish roe produced by a labor intensive process. Roe obtained from skeins (egg sacks) or from entrails containing, not only skeins but, all the internal organs of the fish. Typically caviar processing consists of ten different steps (see the Flow Chart of Caviar Processing, Figure 2).

In principle the fish eggs are separated from the skeins or entrails by rubbing them against a screen having a suitable mesh size. The screen allows the eggs to go through but retains as much as possible of the extraneous material, such as membranes, blood, internal organs and fat. After separating, the eggs are washed, drained, salted, packaged and frozen. The entire process requires great skills and careful monitoring of the quality. The person is charge must have good knowledge how caviar should look like and taste. Many quality control tests are based on the organoleptic judgement (see the Quality Control Manual).

The processing facility must be licensed for food processing. It must have a source of clean, nonchlorinated water. There must be a large enough cooler for storing the raw material and intermediate products it below 38 F (3 C). The area used for draining the excess moisture from caviar must be below 45 F (6 C). The processor must have, or have an access to, a blast freezer or cryogenic freezer. During the processing the ambient temperature in the processing areas should never exceed 60 F (16 C).

PROCESSING STEPS

1. EXTRACTING OF FISH EGGS

Fish roe is highly perishable. The skeins and entrails must be processed as soon as possible after the dressing of fish. Eggs must be separated in less than two days from the entrails and in less than three days from skeins (see Hazard Analysis and Critical Control Point Program for Caviar).

A. QUALITY OF ROE

Before accepting the roe or entrails, the processor must check the following:

* The date of dressing the fish must be within specified time limits.
* The smell of the product must show freshness.
* The color of eggs must be as given in the Quality Control Manual.

B. RUBBING THE EGGS

Eggs are separated by rubbing the skeins (or entrails) by hand against a screen having a mesh size of 1/8" - 1/4", or by a special rubbing machine. After the eggs are forced through this coarser screen, they are forced through a smaller mesh screen. The purpose of these screens is to separate the eggs from as much foreign material as possible.

2. WASHING

Washing removes the blood, fat particles, microorganisms and other undesirable substances from the roe. The addition of 2% salt with the washing water improves the removal of blood and fat from the roe. Salt also reduces the microbial action. Make sure to always use the same amount of salt. Variable amounts of salt during the washing may affect the final salt concentration in caviar.

Washing time should not be too long. Overwashing makes the eggs water-logged and they lose their flavor.

3. PRELIMINARY DRAINING

After washing the roe has a high moisture content. Excess water is removed by draining the eggs on a fine screen for 30 minutes.

4. SALTING

Salt is the only curing agent used in caviar. It must be very fine powder of pure sodium chloride. It should have an anti-caking agent and stored in a dry place to prevent caking.

A. **Amount of salt needed**
Weigh the roe. Calculate the amount of salt needed for the quantity of roe to obtain the desired salt percentage. Below is an example of the calculations for caviar having 3.5% salt concentration.

3.5% Salt = Weight of caviar (lbs.) x 0.035

A 50-pound batch of caviar needs 1.75 lbs. (1 lb 12 oz.) salt.

Make sure that the salt added while washing does not effect the final concentration of salt in caviar. Samples of caviar must be tested in-house with a salinometer, or they should be sent to an outside lab for testing.

B. **Mixing of salt**
Fine salt dissolved very rapidly into roe. To prevent an uneven distribution of salt in caviar, the roe must be mixed thoroughly while adding the salt. A slow speed mixer works the best. It can also be done by hand with a paddle. Make sure not to crush the eggs during mixing. Do not mix salt into roe on a screen. You will never get an even distribution. Place the roe into a Food Grade container for the salting process.. The addition of salt will draw moisture from broken eggs and the mucus surrounding the eggs. Though the roe is wet at this point, the moisture should not be drained. Let salt cure the roe overnight in a cooler below 45 F.

5. REMOVAL OF EXTRANEOUS MATTER

After rubbing and washing there are still blood spots, scales and other foreign particles in the roe. These can be sucked out with a vacuum tube that has a 1/16" to 1/8" orifice. Use a vacuum bottle between the nozzle and the vacuum pump. The pump will get ruined if water and particles get into the pump chamber.

The **picking of foreign particles** is done as following:

A. Pour the roe onto a light table made of frosted glass lit from underneath with fluorescent lights. The table should be at a convenient height to be able to lean over the table while sitting on a stool or chair.
B. Spread the roe into a 1/2" to 3/4" thick layer onto the glass.
C. Search systematically over the whole surface area for any lighter or darker spots in the roe. Scales and worms show as lighter spots and other material as darker spots in the roe.
D. When spotting a foreign particle, insert the vacuum nozzle over the spot. The vacuum will suck out the particle with very little loss of eggs.
F. Go over the whole batch of roe on the table. Spread out the thicker areas to make sure you do not miss any particles. After the batch is clean, transfer it to the draining rack.
G. Pour a new batch of roe onto the light table and repeat the picking process, etc.

6. DRAINING

After the roe is picked from extraneous matter, it is drained from excess moisture. Draining is normally done on fine screens. Since the draining takes from one to two days, the draining must be done at below 45 F. The roe layer must not be deeper than two to three inches on the screen. In order to save space the screen can be stacked one foot apart with a slanted sheet of plastic or fiberglass in between. Drained liquid runs down on the plastic sheets and is collected by a drain pipe for disposal.

Testing of dryness:

1. Take a clean, dry teaspoon.
2. Scoop a spoonful of caviar with a smooth rotating motion.
3. Keep turning the spoon with a steady motion horizontally around its long axis a full turn.
4. If caviar does not fall off the spoon, it is sufficiently dry. If it falls off, caviar is too wet.

7. PACKING

After making the final quality control (see Quality Control Manual) for color, salt content, odor, taste, moisture, and extraneous matter, caviar is ready for packing. Observe the following recommendations:

* Use Food Grade glass or plastic packaging having a good, tight lid.
* Make sure the container has about 5% extra space for caviar to expand during freezing.
* Fill the container to 101% of the intended weight.
* Mark each container with the lot number, e.g., a stamped date on the bottom of the jar. This number is necessary for tracing the given lot, if there is a quality complaint. Mark in the production log the number of jars in the lot.
* Attach the correctly printed label on the jar.

8. FREEZING

Freeze the jars in a blast or cryogenic freezer below -10 F. Make sure to leave a minimum of a 1/2" space between the jars to guarantee rapid freezing. Caviar must freeze within 12 hours. **Do not use a household chest freezer!** It does not freeze caviar fast enough because there is no movement of cold air in the chest. Due to the salt content caviar does not freeze until the temperature in the product has cooled below 20 F. This can take a couple of days, if the chest freezer is full of caviar jars. Do not overfill a blast freezer. The cold air has to move around the freezer. Avoid overloading the freezer because too much warm product will retard the freezing process.

9. COLD STORAGE

After blast freezing, load the jars into a carton. Seal it and label with the same lot number as that of the jars. Move frozen caviar to a cold storage to be kept at between -10 and -20 F.

10. TRANSPORT

Frozen caviar must be kept frozen throughout the transit time. If caviar is shipped by air, make sure to included a sufficient amount of dry ice to secure that the shipment arrives still frozen. If the shipment is sent by a reefer container, specify that the container is set at -18 C. It is advisable to include a few temperature monitoring strips with the shipment. These will tell by a color change, if the shipment has warmed up too much during the shipping. Make sure to insure the shipment for its value shown in the Proforma Invoice.

QUALITY CONTROL MANUAL

FOR WHITEFISH, CHUB AND LAKE HERRING

CAVIAR

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INTRODUCTION

Caviar is a food appreciated by true, demanding gourmands. When a caviar lover tastes the cured fish eggs, he or she expects that it has a pleasant texture, fine flavor and an inviting odor. A mushy texture or consistency resembling the rubber balls is not acceptable for fine caviar. Likewise, a roe that tastes or smells foul is going to end up in the garbage rather than at the feast table.

Fish roe is a highly valuable resource. It is also highly perishable, so the processing of caviar must be done with a great skill. The producer must know how to judge the quality of the roe and how to process it properly. Since the processing involves many critical steps, the producer must learn what can ruin the product and how to obtain the best quality.

The processor must know what a high quality caviar is like and how to control its quality. Although different markets have different specifications, the all share the same requirements for quality. Knowledgeable caviar buyers will always view the color and extraneous matter, smell the odor for freshness, test the moisture content and consistency. If the caviar passes those tests, the buyer will taste it for the flavor and texture.

Since whitefish, chub and lake herring caviars are sold mainly to the European markets, this manual is written for caviar intended to those markets. The same specifications apply for the North American market. Japanese markets differ greatly from those in Europe. Since the Japanese products are still under development, they are not covered in this manual.

The purpose of this manual is to give the specifications, quality control parameters and practical quality control methods for the processor of whitefish, chub and lake herring caviar.

SPECIFICATIONS AND QUALITY CONTROL PARAMETERS FOR CAVIAR

COLOR:	Whitefish: Golden yellow Chub and Lake herring: Yellowish orange - orange
SALT CONTENT:	2.5% - 5.0%
MOISTURE:	<5% drainage after defrosting in 30 minutes
EXTRANEOUS MATTER:	< 30 particles per kilo of caviar
ODOR:	Fresh, not too strong
TASTE:	Pleasant with a rounded aftertaste
BACTERIAL COUNT:	Negative for pathogens
SHELF LIFE:	> three days at 35 F (2 C) after thawing out for 2.5% salt > seven days at 35 F (2 C) after thawing out for 3.5% salt

IN-HOUSE QUALITY CONTROL METHODS

Preparation of reference standards

Since many quality control test are organoleptic, it is necessary to have small samples of good quality caviar as a reference. Fill a large number of small jars with good quality caviar. Label them as the reference standard and freeze. Whenever a reference standard is needed, thaw out a jar and use it for comparison. One jar can be used for three days as a reference.

1. COLOR

   The color of **whitefish caviar** range from golden yellow to yellowish orange, **chub caviar** from yellowish-orange to light orange, and **lake herring caviar** from light orange to orange. The roe turns brownish, if it has been kept unprocessed too long or blood has not been washed out. Brown or brownish caviar is inferior to the correctly processed product. The processor should find a color chart or use a reference sample to compare the color of each lot being processed. The processor should reject any skeins or entrails containing browned eggs.

2. SALT CONTENT

   A. In different European countries the salt content of caviar varies from 2.5% to 4%. Caviar eaters are very good in judging the level of salt. Therefore, it is very important that the salt content of caviar is consistent from lot to lot. In practice the salt concentration should be within 0.3% of the intended percentage.

   B. Caviar eaters are very good in judging the salt content. It is, therefore, important that the salt concentration is correct and homogeneously distributed throughout the batch. Salt dissolves quickly into the roe, thus the roe must be mixed at the same time when salt is added.

   C. Because mistakes can be made in the salting, it is necessary to test each batch to verify the right salt content. Every lot must be tasted for the saltiness by comparing it to a reference standard.

   D. There are many types of instruments for measuring the salinity. Most of them are made for water testing, but there are a few models sold specifically for food testing. The latter ones are less prone to the interference by proteins and fat. Salinometers for water testing range from $60 to $500 while the food testers cost from $1500 to $4,000. The authors tested two models sold by AKZO SALT, Inc., Clarks Summit, Pennsylvania 18411, DICROMAT I and DICROMAT II. The latter is more sophisticated.

   E. The testing of salinity requires accurate standard solutions and sample some preparation. Salt in caviar is in the eggs, the mucus surrounding the eggs and in the interstitial water. Therefore, the sample has to be homogenized with a fast speed blender. The interference of proteins and fat is reduced by diluting the sample five times with water.

Standard solutions

1% Stock solution:

1. Weigh exactly 1.0 oz. of salt
2. Weigh 100 oz. water (do not use liquid ounce as measure)
3. Dissolve salt into water

0.5% Standard: Mix 5 parts of stock solution with 5 parts of water
0.6% Standard: Mix 6 parts of stock solution with 4 parts of water
0.7% Standard: Mix 7 parts of stock solution with 3 parts of water
0.8% Standard: Mix 8 parts of stock solution with 2 parts of water

Standard curve

1. Pour half a cup of each standard solution to four disposable cups and half a cup of plain water into a fifth cup as a blank. Make sure the solutions are at the same temperature as caviar.
2. Measure each standard solution and the blank. Make the measurement according to the procedure recommended for the salinometer.
3. Take the reading for each one and make a standard curve. An example for the standard curve is given below in Table I and Figure I.

TABLE I

Standard	Reading
Blank	0.01
0.5%	2.48
0.6%	3.03
0.7%	3.52
0.8%	4.03

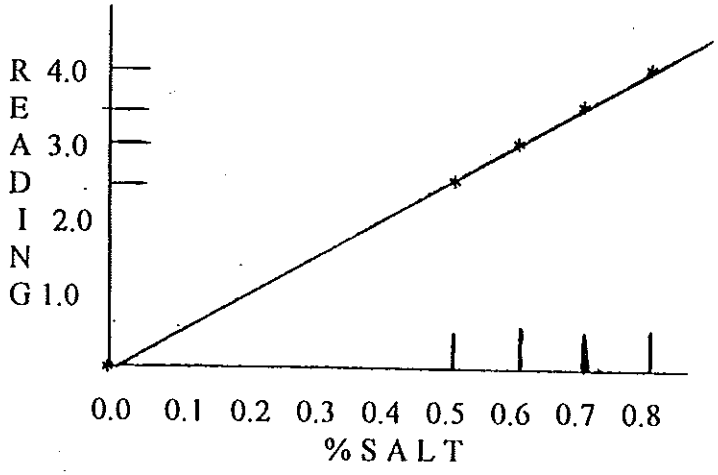

FIGURE I. An example of standard curve using data given in Table I.

A standard curve must be made once a week to check that the unit works properly. Every time a caviar sample is measured, one or two standard solutions should be measured. Select the standard solutions closest to the salt concentration of caviar. For example, if caviar should have a 3.5% salt content, use solutions of 3% and 4%.

Sample preparation for salt measurement

1. Weigh 2 oz. of caviar
2. Weigh 8 oz. water
3. Place caviar and water in the jar of a fast speed blender.
4. Homogenize caviar by blending at high speed for one minute.

Measurement of the salt content

1. Pour half a cup of caviar homogenate into a disposable cup.
2. Insert the probe of salinometer into the homogenate and record the reading after it has stabilized.
3. Rinse the probe.
4. Make a measurement of two standard solutions.
   Compare the readings of standards against those in the standard curve that you have made for your salinometer. If the values are within 5% of those in the curve, use the curve to calculate the salt content of the sample. If the standard reading differ more than 5% from the values in the curve, calculate the salt content of the sample using the readings of the standard solutions measured at the same time as the sample.

Determination of salt content with the standard curve

1. Follow the axis of READING to the value of the sample reading.
2. Go to the right horizontally until you intercept the curve.
3. Go straight down from where the reading intercepts the curve.
4. Read the salt per cent .

3. MOISTURE

Draining of moisture is one of the critical steps in the caviar processing. Since a lot of eggs will break and release moisture during the defrosting, caviar must be dried properly before packaging and freezing. Customers they feel cheated if they have to drain caviar because of the significant loss of product.

An accurate measurement of moisture is cumbersome, but there are practical ways of judging the dryness. After caviar is drained, the so-called **spoon test** will tell if the product is dry or too wet. After freezing and defrosting, the spoon test can be used again, or the actual drainage can be measured.

Spoon test

1. Take a clean, dry teaspoon.
2. Scoop a spoonful of caviar and
3. Keep on turning the spoon in a horizontal position around its long axis until the spoon again has the right side up.
4. If the caviar stays in the spoon, it is dry enough. If it falls off, it is too wet. Be careful to keep rotating the spoon with a steady and even motion.

Drainage test

1. Defrost a one kilo jar of caviar.
2. Drain it for thirty minutes through a screen over a container that catches the liquid.
3. Weigh the drained liquid in grams (or in ounces).
4. Calculate the drainage by this formula:

$$\text{\% Drainage} = \frac{\text{grams (or ounces) drained} \times 100}{\text{1000 grams (or 35.3 ounces)}}$$

The drainage must not exceed 5% for high quality caviar.

4. ODOR

The odor of caviar is dependent on the species of fish that it comes from. In general the odor of whitefish, chub and lake herring caviar is mild and pleasant. The processor must learn the odor of fresh, high quality caviar. During the production it is advisable to check the odor (and flavor) of the product against the reference sample.

The following odors indicate an inferior product:

Odor	Reason
Fishy	old, rancid or f freezer-burned
Foul	old or spoiled
Moldy	old or processed with chlorinated water
Musty	old, spoiled or processed with chlorinated water
Rancid	old or spoiled

The exposure to atmospheric oxygen causes an oxidation of fats and oils in the fish eggs. Therefore, the packaging should be as air tight as possible. During the cold storage, whitefish caviar develops a fishy odor already in six months and chub caviar in about two years. At this point they are still wholesome, but not at their prime odor-wise or flavor-wise. A reference sample is the way of comparing the odor of caviar samples.

5. TASTE

The processor must learn the taste of good caviar. There is no other way to test the flavor. Surprisingly, there are processors that boast with the fact that they never tasted caviar. This is very foolish and could be compared to a sausage maker that never tasted his own bratwurst. How can anybody guarantee the quality of a gourmet food, if he never tasted it? Not everybody likes caviar, but if the processor is proud of his product, it must be worth tasting and checking for quality.

6. EXTRANEOUS MATTER

Roe separated from skeins is relatively clean. After rubbing it does contain scales, fat and blood. Roe extracted from the entrails contains many additional particles, such as plankton, worms, clams, sand, sticks, insect larvae, fragments of guts and internal organs. These particles must be picked out before packaging of caviar. Picking of these particles is tedious and is not always done carefully enough. Therefore, there is a need to monitor the number of extraneous particles in caviar in the final product.

The number of foreign particles is determined as following:
1. Spread one kilo of caviar on a light table as a 0.5" thick layer.
2. Count the particles showing either as darker or lighter spots than fish eggs.
3. Less than 20 particles is judged good, while over 20 is too much and would require more thorough cleaning.

7. SHELF LIFE

The shelf life of caviar is dependent on the activity of spoiling microorganisms. Caviar like any perishable food is not a sterile product. Though it is cured with salt, the concentration of salt is not high enough to stop the microbial action, but salt does slow down the growth of bacteria, yeast and molds.. Most microorganisms in caviar do not cause a rapid spoilage, but certain species do. Caviar can contain aerobic and anaerobic bacteria, yeasts and molds. Since the product always has microorganisms, it is important that the processing is done at low temperatures and that caviar is stored at proper temperatures. Every increase of 18 F in temperature doubles the metabolic rate of microorganisms, thus at 70 F caviar spoils four times as fast as at 34 F.

The freezing must be done in a blast or cryogenic freezer at below -30 C to secure a rapid freezing. This stops the microbial action and minimizes the breaking of eggs. Caviar jars should not be in a carton during the freezing. A chest freezer cannot be used as it freezes caviar too slowly. Storing and shipping of frozen caviar must be at below -20 C.

The shelf life after defrosting correlates directly to the concentration of salt content of caviar. Properly processed and stored caviar containing 2.5% salt has a shelf life of over three days after defrosting. Caviar containing 3.5% salt has a shelf life of over seven days.

D. OPTIONAL LABORATORY TESTS

Fish and fish roe can have environmental contaminants, such as pesticides, heavy metals and radioactivity. Testing of environmental contaminants and microorganisms is done by the State agencies or commercial laboratories. The processor should inquire the most recent data of these contaminants from the State and Federal agencies, or have his caviar tested by a commercial laboratory. These data may be requested by the foreign caviar buyers.

HACCP

(HAZARD ANALYSIS AND CRITICAL CONTROL POINT)

PROGRAM

FOR

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The analyzing of the hazards in the caviar processing (see Flowchart of Caviar Processing) reveals several Critical Points. During these stages the product can get spoiled or lose its quality. The steps can be monitored and verified and their effect on the product cannot be corrected for in the later steps.

These **CRITICAL CONTROL POINTS** (CCP) are:

I. STORING OF THE ENTRAILS AND ROE IN THE SKEINS
II. DRAINING
III. FREEZING

EXECUTION OF CRITICAL CONTROL POINT PROGRAM

I. STORING OF FISH EGGS

A. **Roe in skeins**
Fish eggs must be separated from skeins and washed as soon as possible. In the case that an immediate processing does not occur, roe in skeins can be stored (in Food Grade containers that are covered with closable lids) at below 38 F (3 C) for a maximum of two days after the catching date. The roe in skeins must not freeze at any point. Freezing breaks a portion of eggs, weakens the egg membranes and allows microbes to penetrate the egg sack.

B. **Roe with entrails**
Digestive enzymes, enteric bacteria and bile acids can get in contact with roe if the contact time of entrails and roe is too long. Therefore, the storage time of roe with the entrails must be limited to less than one day after the catching date and the storage temperature must be below 38 F.

C. **Monitoring**
The temperature of the storage area must be monitored by a maximum minimum thermometer. In the case the initial storing is done at the premises of the fisherman, he should monitor the temperature during the storage. The duration of storage must be verifiable by a tag showing the date when the fish were dressed.

D. **Correcting for the failures of the CCP Program**
If no time tag is present with the storage containers, the processor must notify the fisherman of the failure. The processor must record the lack of the time tag in the production log and reject the batch.

II. DRAINING

The draining of excess moisture from the roe takes normally from one to two days. Due to this relatively long time period the temperature of the draining area does greatly affect the quality and shelf life of caviar. To guarantee a high quality and wholesomeness of caviar the draining must be done below 45 F (6 C). If a rapid draining method is that requires a higher temperature, the drainage temperature must be approved by the WDATCP Food Safety Division.

The room or cooler used for draining must have a thermometer showing the temperature. The processor must monitor the temperature daily.

Correcting for the failures of the CCP Program
If the thermometer shows the maximum temperature exceeding 45 F, the processor must check the cooling system for defects and correct them. If cold outside air is used for cooling and the ambient temperature exceeds the required draining temperature, mechanical cooling must be applied.

III. FREEZING

Caviar must be blast frozen or cryogenically frozen in small enough containers to assure a complete freezing in less than twelve hours. Therefore, the freezing temperature must be below -10 F (-18 C) and the fans must create a fast circulation of cold air all around the product. A cryogenic freezing system provides an optimal, rapid freezing. A household chest freezer must not be used.

The temperature of a blast freezer must be monitored daily to assure that the equipment works properly. Any malfunctioning must be corrected by repairs or maintenance.

"VALUE ADDED" CAVIAR PRODUCTS

During the projects the development of "value added" products was done by Soile Anderson of Taste of Scandinavia and the staff of IFF. Below are recipes of products that seem to have good acceptance by the public. These products also have a long enough shelf life for a potential commercial product.

CAVIAR-CREAM CHEESE SPREAD I

10 parts caviar
99 parts cream cheese
1 part lemon juice
potassium sorbate

Blend ingredients in a slow speed mixer. Fill Food Grade glass or plastic containers with the desired weight of the product. The lid should be air tight. Make sure there is enough room for the product to expand during the freezing. This spread has a one month shelf life at 40 F. It can also be stored frozen.

CAVIAR-CREAM CHEESE SPREAD II

30 parts caviar
40 parts cream cheese
10 parts mayonnaise
14 parts finely chopped onion
5 parts finely chopped baby dill
1 part lemon juice

Blend all ingredients in a slow speed mixer. Fill Food Grade containers with the desired weight of the product. Freeze containers. This spread has a one week shelf life after defrosting.

CAVIAR SAUCE

30 parts caviar
30 parts sour cream
25 parts mayonnaise
10 finely chopped onion
2 parts lemon juice
3 parts finely chopped baby dill

Blend ingredients in a slow speed mixer. Fill Food Grade containers with a desired weight of product and freeze the containers. This sauce has a one week shelf life after defrosting.

This gourmet sauce complements any grilled, poached and pan fried seafood. It also goes well with chicken and turkey dishes.