SECTION 19 – PROCESSING OF STURGEON CAVIAR

General considerations

In the context of recognizing controls at individual processing steps, this Section provides examples of potential hazards and defects and describes technical guidance that can be used to develop control measures and corrective actions. At any particular step, only the hazards and defects that are likely to be introduced or controlled at that step are listed. It should be recognized that in preparing a Hazard Analysis Critical Control Point (HACCP)[27] and/or defect action point (DAP) plan it is essential to consult Section 5, which provides guidance for the application of the principles of HACCP and DAP analysis. However, within the scope of this Section, it is not possible to give details of critical limits, monitoring, record-keeping and verification for each of the steps as these are specific to particular hazards and defects, and to the process used.

This Section applies to products covered by the *Standard for Sturgeon Caviar* (CODEX STAN 291-2010) and covers the production of caviar by extraction of non-ovulated eggs and the production of caviar from ovulated eggs by induction of ovulation using natural means as well as by the use of authorized products. Potential hazards and defects that may be introduced at each processing step are identified. A summary of major defects and additional prerequisites programmes are listed below:

Microbial hazards: Ovaries remain sterile as long as they are located in the belly cavity. Contamination may occur through contact with hands, equipment and utensils, air, water, additives, fish skin and guts. Therefore, implementation of good hygienic practices (Section 3), use of potable or clean water and regular monitoring are very important. Time/temperature control (shortest possible processing time under cold chain conditions) followed by rapid transfer to cold area will reduce the risk of microbial growth and related toxin production.

Proteolytic and non-proteolytic *Clostridium botulinum* are spore-forming microbial hazards which should be controlled in packed caviar. These pathogens are controlled by an adequate quantity of salt (product salt content ≥ 3g/100g; ≥ 5 percent salt in the water phase; a water activity of < 0.97) and cold storage, (temperatures of ≤ 4 °C). Other controlling factors shown to prevent *Clostridium botulinum* growth and toxin production in the caviar can be used when shown to be effective by scientific studies. In addition to the control of *C. botulinum*, countries producing caviar should ensure that the process used (e.g. pasteurization

[27] Refer to Annex II for a comprehensive list of the acronyms used in this Code.

step, use of permitted food additives, percentage salt, microbiological testing, temperature controls) will control non-spore forming mirco-organisms (e.g. *Salmonella*, *Listeria monocytogenes*).

Chemical hazards: Consideration must be given to contaminants such as heavy metals, pesticides, oil derivatives, residues of veterinary drugs, including hormones. The technical guidelines mentioned in Section 6 should be considered. Potential chemical hazards can also come from the water used for washing fish eggs and from other processing steps; potable or clean water should therefore be used for that purpose. Contaminants from the salt and additives may also introduce chemical hazards.

Physical hazards: Sharp and hard fish body fragments, glass and metal (from utensils and packaging materials) may be introduced. The introduction of such hazards should be controlled and the control measures should be monitored and verified.

Defects: Potential defects could be classified in three categories:

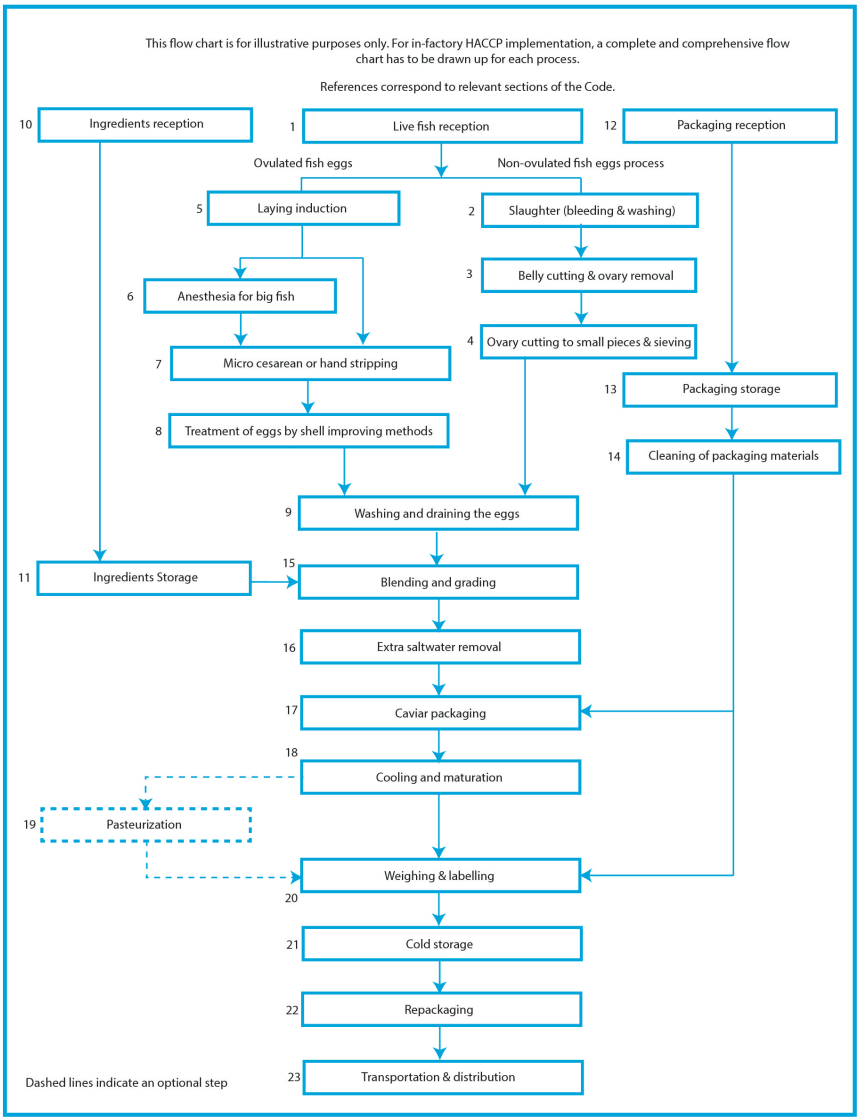
1. Development of chemical decomposition due to temperature abuse during caviar production process, handling and storage. This can be prevented by controlling time and temperature.

2. Fat tissues, ovarian follicles and blood clots in caviar (from slaughtered sturgeon) can be avoided by proper bleeding, careful sieving and ovarian washing.

3. A number of factors can have an effect on the physico-chemical and sensory properties of caviar, such as egg breakage, shell loosening, egg-softening or -hardening owing to excessive pressure on caviar and temperature abuse. Impure salt or additives, dust, smoke and aromatics in detergents or disinfecting agents can be absorbed by caviar and affect flavour and taste.

This Code provides guidance for the common steps used for processing caviar as shown in the Example flow chart for caviar production (Figure 19.1).

Figure 19.1
Example flow chart for caviar processing



19.1 Live fish reception (Processing Step 1)

Potential hazards: *chemical contamination (e.g. oil pollutants, heavy metals, pesticides, drugs residue)*

Potential defects: *decomposition, physical damage*

Technical guidance:

- Refer to Sections 6.1, 6.2 and 6.3.
- Farmed fish should be harvested from growing areas where water quality should comply with Section 6.1.2.
- Fish handling should be undertaken in a manner to avoid stress (e.g. direct sunlight, high temperature, oxygen depletion) and contamination.
- In order to prevent the mortality of live fish, which could result in decomposition of fish eggs, they should be handled with care, stored in clean (filtered), oxygenated water, and rapidly prepared for ovary removal.
- Live fish should be transported to a processing establishment quickly without causing physical damage.
- Training should be provided to persons who harvest, handle or receive fish.
- All documents relating to the health status of farmed fish, such as veterinary drug or medicated feed dosage and period of treatment as well as feed composition, should be reviewed at the reception point. For example, it should be ensured that the fish has been subjected to the proper withdrawal time for the specific products in question (e.g. antibiotics or hormones).
- To facilitate the traceability/product tracing of the fish, a record-keeping system should be in place, including the name and address of the farm sites (in case of farmed fish). If fish is kept out of water, the period of time should be short and the places used for this purpose should be clean.
- In the case of fresh dead fish, the fish should be stored under refrigeration or in cold clean water.

19.2 Slaughter (bleeding and washing) (Processing Step 2)

Potential hazards: *microbiological contamination*

Potential defects: *blood remaining in fish organs*

Technical guidance:

- Stunning may be used to reduce stress after fish are harvested. It should be done by a skilled person and in accordance with the technical guidelines established by the World Organization for Animal Health (OIE) in order not to harm or damage the fish or eggs.
- As soon as the live fish have been slaughtered, the fish should be bled to prevent blood dispersion into the eggs.
- Fish should be bled by cutting gills in both sides or by cutting the tail.

- The bleeding process should be completed before ovary removal.
- After bleeding, fish should be washed with potable or clean water to remove all residual blood from surface and reduce the risk of contaminating the eggs.
- Suitable facilities for hygienic waste disposal should be available at the bleeding site.

19.3 Belly cutting and ovary removal (Processing Step 3)

Potential hazards: *microbiological and physical contamination*

Potential defects: *physical damage to the eggs, off flavour, off odour, decomposition*

Technical guidance:

- Prior to cutting, the belly part (around cutting area) should be thoroughly brushed using potable or clean water to remove all foreign matter (e.g. sand and blood) and to reduce microbial load on the skin.
- All equipment/utensils used for cutting the belly, such as tables, knives and bowls used for ovary transfer and storage, should be cleaned and disinfected.
- Cleaning and disinfection agents used for hand washing and on equipment should not affect the flavour or odour of the eggs.
- Belly cutting should be done by trained and skilled personnel using an appropriate method to preclude any contamination with viscera and damage to the eggs.
- All utensils that come in contact with fish eggs should not be used for other purposes and should be carefully cleaned, disinfected and stored in a proper place to avoid any contamination.
- Knives that are used for belly cutting should be distinct from those used for ovary cutting.
- If appropriate, the personnel performing the abdominal incision should be different from that in charge of cutting the ovaries.

19.4 Cutting ovaries into small pieces and sieving (Processing Step 4)

Potential hazards: *microbiological contamination*

Potential defects: *physical damage to the eggs, off flavour and off odour, eggs with bad consistency*

Technical guidance:

- Prior to cutting into small pieces, ovaries may be placed in cold potable or clean water or cold potable or clean water with added salt to improve

consistency.

- To prevent microbial contamination:
  - all caviar processing steps should be performed in areas set apart from belly cutting and gutting areas.
  - all utensils and work surfaces may be cleaned and disinfected using agents that will not affect the flavour or odour of the eggs.
  - staff should be trained and have appropriate experience in cutting and sieving.
  - sieves should be washable and made from suitable material; mesh size should match egg size.
- Ovaries should be cut into small pieces to improve the sieving process and reduce friction among eggs.
- Sieving should be performed in a manner that minimizes damage to the eggs to the extent possible while removing ovary follicles and other undesirable matter (fat and blood).
- The ambient temperature and duration of exposure to the ambient temperature should be controlled and monitored to prevent microbial growth.

19.5 Laying induction (Processing Step 5)

Potential hazards: *chemical contamination (residues of veterinary drugs), use of unapproved drugs*

Potential defects: *quality deterioration*

Technical guidance:

- If hormones are used to induce ovulation (or to assist in the release of eggs), the hormones should have undergone regulatory assessment and be approved for use for the purpose of food production by the competent authorities having jurisdiction.
- Hormone dosage and treatment time should be applied in accordance with fish size and manufacturer's instructions.
- Eggs should only be harvested after the appropriate withdrawal period following hormone injection has passed.

19.6 Anaesthesia for large fish (Processing Step 6)

Potential hazards: *chemical contamination (residues of veterinary drugs), use of unapproved drugs*

Potential defects: *physical damage to the eggs, off flavour and off odour, quality deterioration*

Technical guidance:

- If electric shock is used, skilled personnel should administer correct voltage to minimize stress to fish and physical damage to eggs.
- If anaesthetics are used, they must be approved by the competent authorities having jurisdiction for use in sturgeon intended for human consumption.
- Anaesthetic dosage and treatment time should be applied in accordance with fish size and the manufacturer's instructions.
- Refer to Section 6.3.2.

19.7 Microcaesarean or hand-stripping (Processing Step 7)

Potential hazards: *microbiological contamination*

Potential defects: *physical damage to the eggs, foreign matter, off flavour and off odour*

Technical guidance:

- Prior to cutting, the belly area should be appropriately brushed and washed with potable or clean water to remove all foreign matter (e.g. sand, blood) and reduce microbial load.
- Cleaning and disinfection agents used on hands and equipment should not affect the flavour or odour of eggs.
- Belly-cutting and the extraction of the eggs should be done by skilled personnel to minimize contamination with fish guts and faecal matter and reduce physical damage to the eggs.
- Hand-stripping should be performed gently taking into account the anatomical position and direction of the oviduct in order to release the eggs quickly.

19.8 Treatment of eggs by shell improving methods (Processing Step 8)

Potential hazards: *chemical contamination (e.g. use of texturizing agents), microbiological contamination, drug residue*

Potential defects: *damage to the egg texture, off flavour and off odour, quality deterioration*

Technical guidance:

- Shell texturizing agents are not permitted in accordance with Section 4 of the *Standard for Sturgeon Caviar* (CODEX STAN 291-2010)
- Eggs should be treated with shell improving methods in such a manner as

to avoid chemical or microbiological contamination or growth, damage to the eggs, modification of their flavour or odour, or deterioration in their quality.

19.9 Washing and draining the eggs (Processing Step 9)

Potential hazards: *microbiological and chemical contamination*

Potential defects: *quality deterioration (damage to texture, off flavours and off odours), residues of undesirable matter (fat, blood and ovary remnant).*

Technical guidance:

- The water used for washing the eggs should be potable or clean, free of any off odour or flavour, and sufficiently cold to prevent any loss in texture quality. Salt may be added to the water in order to prevent water uptake by the eggs.
- The eggs should be washed until they are free of all foreign matter.
- The eggs should be drained using a sieve to remove water that may impact the final weight at packaging.
- Draining should be performed in a chilled cold room or in a temperature-controlled environment away from any source of contamination.

19.10 Ingredients reception (Processing Step 10)

Potential hazards: *microbiological, chemical and physical contamination (impurities), non-permitted additives*

Potential defects: *quality deterioration, foreign matter*

Technical guidance:

- Refer to Section 9.5.1.
- Additives should be used in compliance with requirements mentioned in Section 4 of the *Standard for Sturgeon Caviar* (CODEX STAN 291-2010).
- The ingredients should be inspected to ensure that they are clean and show no visible sign of contamination with dirt, oil or other extraneous materials.
- Ingredients should be sourced from reliable suppliers, received with appropriate documentation about their composition and verified against the specifications requested.
- Salt used for caviar should comply with the *Standard for Food Grade Salt* (CODEX STAN 150-1985).

- Salt impurities such as magnesium (Mg2+) and calcium (Ca2+) can affect the taste of the caviar and the penetration of sodium chloride into the eggs.
- Granule size of salt crystals and permitted additives should be tiny to allow for rapid dissolution and absorption into the eggs and to prevent damage to the eggs.

19.11 Ingredient storage (Processing Step 11)

Potential hazards: *microbiological, chemical and physical contamination*

Potential defects: *loss of effectiveness, moisture absorption, dust and foreign matters.*

Technical guidance:

- Refer to section 9.5.2.
- Salt and additives should be packed and protected from chemical pollutants and foreign matter, such as dust, that may affect safety, odour and other sensory characteristics.
- Suitable procedures and controls should be in place to prevent exposure of ingredients to insects and pests.
- Storage area and packaging materials used for additives and salt should comply with Section 3.
- All stored additives and salt should be kept with labels with the name, expiry date and storage requirements.

19.12 Packaging reception (Processing Step 12)

Potential hazards: *microbiological, chemical and physical contamination*

Potential defects: *improper quality of packaging materials (material, paint coating, construction, sealing, corrosion). Inaccurate or misleading label information, contaminated packaging materials, foreign matter inclusion.*

Technical guidance:

- Refer to Section 9.5.1.
- All packaging materials such as metal or plastic cans, glass jars and rubber bands should be resistant to the components of caviar, especially salt and additives, and able to preserve the product throughout its shelf-life without any quality loss.
- All packaging materials should be verified prior to use by trained

personnel to ensure that specifications are met and absence of damage or contamination.

- Any non-compliant items should be rejected and all corrective measures recorded.
- Prior to their application, labels should be verified to ensure that all information declared meets, where applicable, the *General Standard for the Labelling of Pre-Packaged Foods* (CODEX STAN 1 - 1985) and labelling provisions of the *Standard for Sturgeon Caviar* (CODEX STAN 291-2010).
- Packaging materials and labels should be sourced from reliable suppliers and accompanied by appropriate documentation on the specifications and composition.

19.13 Packaging storage (Processing Step 13)

Potential hazards: *microbiological, chemical and physical contamination*

Potential defects: *quality deterioration, physical damage, foreign matter inclusion*

Technical guidance:

- Refer to Section 9.5.2.
- Packaging materials and labels should be stored in dry and clean area to avoid any chemical and microbial contamination.
- Storage area should be clean and free of insects and pests.
- Trained personnel should periodically monitor the storage environment and records should be kept.

19.14 Cleaning of packaging materials (Processing Step 14)

Potential hazards: *microbiological, chemical and physical contamination*

Potential defects: *damage of containers*

Technical guidance:

- The cleanliness, integrity and safety of packaging materials should be monitored prior to use to prevent cross-contamination of the caviar.
- Cleaning and disinfection should be performed outside of the processing area. Controls should be performed at the reception step and related records should be checked.
- Packaging materials should be cleaned and disinfected by trained personnel using potable or clean water and permitted detergents and

disinfectants.

- The effectiveness of the cleaning and disinfection of packaging materials should be validated and revalidated after any changes to procedures (e.g. change of disinfectants, cleaners).

19.15 Blending and grading (Processing Step 15)

Potential hazards: *microbiological and physical contamination (e.g. glass and metal inclusion)*

Potential defects: *foreign matters, additive misuse*

Technical guidance:

- The quantity or weight of eggs, salt and, as applicable, additives should be measured adequately with calibrated equipment to ensure that the appropriate percentage of salt and additives are met.
- Additives should be used in compliance with the *Standard for Sturgeon Caviar* (CODEX STAN 291-2010).
- Additives should be used in accordance with good manufacturing practices in compliance with Section 3 of the *General Standard for Food Additives* (CODEX STAN 192-1995).
- Ingredients should be verified prior to use to ensure they are free from hazardous glass or other foreign matters.
- To prevent the growth of and toxin production by non-proteolytic *Clostridium botulinum*, the quantity of salt added should result in at least 5 percent water phase salt or a water activity of < 0.97.
- The ingredients and additives should be blended uniformly with the eggs.
- The ambient temperature and humidity and the duration of exposure to the ambient temperature should be controlled and monitored to ensure they do not affect the homogeneous distribution of ingredients and additives and to prevent microbial growth.
- Grading and blending should be done by trained personnel.

19.16 Extra saltwater removal (Processing Step 16)

Potential hazards: *microbiological contamination*

Potential defects: *quality deterioration due to improper saltwater removal*

Technical guidance:

- Extra saltwater removal (sieving) should be done in such a manner as not to damage caviar quality.
- Extra saltwater removal should be performed by trained personnel.

- The salt content of final product should be equal to or above 3g/100g and below or equal to 5g/100g (≥ 5 percent in the water phase or a water activity of <0.97).
- The ambient temperature and duration of exposure to the ambient temperature should be controlled and monitored to prevent microbial growth.

19.17 Caviar packaging (Processing Step 17)

Potential hazards: *microbiological contamination*

Potential defects: *oxidation, physical damage, off flavour, egg discoloration due to corrosion of container's epoxy coatings, improper coding, rusting*

Technical guidance:

- All packaging materials should be verified prior to use to ensure that they are not contaminated and are free of physical damage. These materials should be dry.
- The cans/jars should be filled to capacity to minimize the air space but should not put pressure on the caviar.
- Vacuum application and sealing of cans or jars should be performed by trained personnel to ensure that air is fully removed from cans/jars to inhibit the growth of aerobic mirco-organisms as well as fat oxidation.
- During the vacuum sealing process, the cans/jars should be kept clean of the salt water removed from the cans/jars.
- The ambient temperature and duration of exposure to the ambient temperature should be controlled and monitored to minimize microbial growth by maintaining caviar temperature ≤ 4 ºC.
- The primary coding should be verified by trained personnel to ensure that it is legible, accurate and permanent.

19.18 Cooling and maturation (Processing Step 18)

Potential hazards: *microbiological contamination*

Potential defects: *decomposition, quality deterioration*

Technical guidance:

- Packaged caviar should be stored in an appropriate manner prior to final cold storage (e.g. in a refrigerator at a temperature between 2 °C and 4 °C for 24 hours) upon packaging to facilitate salt absorption, equilibrium and maturation (equal salt distribution in caviar, giving enough time for saltwater removal) and to minimize microbial growth.
- Laboratory checks should be performed for proper caviar salt content (e.g.

by water phase salt determination or by water activity measurement and weight as appropriate) after maturation is complete.
- The cooling system should be cleaned and equipped with a thermometer and thermograph to frequently monitor and record caviar temperature.
- The cooling system should be frequently calibrated to ensure accuracy and efficiency.

19.19 Pasteurization (optional step) (Processing Step 19)

Potential hazards: *microbiological contamination*

Potential defects: *taste and flavour change, hardening of caviar grains*

Technical guidance:

- The pasteurization process should be performed and monitored by trained personnel to ensure process specifications are followed and the equipment is functioning appropriately.
- The containers should be sealed hermetically prior to pasteurizing in order to prevent post- processing contamination.
- Caviar cans/jars should be cooled to lower temperature (0 °C to 4 °C) immediately after pasteurization to prevent germination, growth and toxin production of spore-forming mirco-organisms and prolonged heating of proteins that may affect taste or texture.
- Pasteurization time and temperature should be determined in relation to can/jar volume, shape and material, as well as weight of caviar in cans and the type of pasteurization equipment used so as to ensure the required temperature is applied on the caviar for a suitable period of time.
- All thermal equipment and monitoring devices should be regularly checked and calibrated based on a schedule to ensure accuracy.

19.20 Weighing and labelling (Processing Step 20)

Potential hazards: *unlikely*

Potential defects: *incorrect labelling and weighing*

Technical guidance:

- Information printed on the labels should be in compliance with the *General Standard for the Labelling of Pre-Packaged Foods* (CODEX STAN 1-1985) and the *Standard for Sturgeon Caviar* (CODEX STAN 291-2010).
- The cans/jars should be weighed to ensure the quantity of caviar meets the weight declared on the label.
- Net weight, refrigeration instructions and a maximum shelf-life for caviar

should be clearly labelled.

- Caviar cans/jars should not be described or presented on any label in a manner that is false or misleading to consumers.
- Labels should be monitored for accuracy by trained personnel.

19.21 Cold storage (Processing Step 21)

Potential hazards: *microbiological contamination*

Potential defects: *freezing, decomposition and quality deterioration*

Technical guidance:

- The product should be held at cold storage temperatures between -4 ºC and 0 ºC. Care should be taken to avoid temperatures below -5 °C, which will cause freezing and quality deterioration. Normally freezing or frozen storage are not permitted, unless it can be demonstrated that quality deterioration is avoided.
- The caviar cold storage room should be cleaned and disinfected based on a continuous cleaning and disinfection schedule.
- The chilled storage facility should have a temperature-monitoring device and preferably a continuous recording unit to monitor and record ambient temperatures properly.
- The temperature-monitoring system should be equipped with an alarm to alert of any fluctuations outside of the permitted range.
- All time/temperature monitoring and record systems should be calibrated regularly through a permanent schedule to ensure accurate and precise performance.
- Containers of caviar should be periodically checked for loss of vacuum or can corrosion; any affected containers should be rejected.

19.22 Repackaging (Processing Step 22)

Refer to Sections 19.17 and 19.20.

19.23 Transportation and distribution (Processing Step 23)

Potential hazards: *microbiological contamination*

Potential defects: *decomposition, physical damage to the caviar cans/jars*

Technical guidance:

- Refer to Section 20.

- Proper handling and vehicle specifications should be ensured to prevent physical damage to caviar cans/jars.
- Caviar temperature should be monitored during loading to ensure it remains between – 4 °C and 0 °C.
- The temperature of vehicle storage cabin should be maintained between – 4 °C and 0 °C.
- The duration of caviar exposure to surrounding temperatures above 2 °C should be monitored to prevent temperature abuse and pathogen growth.
- Products should be transported in a way that allows cool air to circulate easily around cans/jars and that protects them from physical damage.
- The product cabin should be completely insulated and subject to regular cleaning and disinfection.
- The storage cabin should be equipped with a thermometer and a thermograph to frequently monitor and record the storage temperature.
- Handling should be done by trained personnel.