

SENSORY METHODS FOR FISH INSPECTION AND QUALITY ASSURANCE

1- Introduction

Certification of fish and fish products requires sampling and sensory assessment of freshness and quality at the landing sites, during processing, storage or prior to shipment.

2- Assessment of fish freshness

The scheme described in table 1 can be used to distinguish fresh from spoiled fish.

Table 1. Assessment of fish freshness

	Fresh fish	Spoiled fish
Odor	Light, desirable, characteristic of the water weeds,	Undesirable, acrid, acid, putrid, ammonia-like,
General aspect	Bright, iridescent pigmentation, no blood spots around the head, along the vertebral column	Dull pigmentation with no shine or reflections
Rigidity of the body	Rigid body. Firm and elastic	Flaccid body. Soft consistency. A slight pressure by the finger leaves a mark
Secretions	Humid fish, transparent mucus, no visible secretions	Presence of sticky secretions
Scales	Bright and firmly attached	Come out easily
Skin	Tight and adhering well	wrinkled, discolored, easy to detach and cut
Eyes	Clear and bright pupil, convex (bulging), occupy all the orbital cavity, transparent cornea	Tern, opaque pupils, concave, glassy, completely sunken
Gill-cover	Adheres firmly with no blood spots	Slightly detached with dark-red spots
Gills	Humid, shiny, pink or red	Dry, grayish or opaque
Abdomen	Neither swollen, saggy, tight or cut	Flaccid, deformed, often swollen, with dark blue, green or black spots
Anus	Tightly closed	Open, often prominent
Viscera	Smooth, clean, bright, nacreous, peritoneum sticks tightly to flesh	Sunken, swollen, fragile peritoneum
Vertebrate Column	Sticks firmly to muscles	Does not stick
Flesh	Firm and elastic, smooth surface, nacreous reflections	friable, red colored, especially along the vertebral column

The schemes in tables 2 and 3 are for fish stored in ice and at ambient temperature.

Table 2. Assessment of raw, gutted fish stored in ice

	Outer Appearance						
	Skin	Gill color	Gill odor	Eyes	Texture	Grade	Score
Freshness allowing distribution, if kept in ice	Natural brilliance, metallic, golden, pink-silver, scales firmly attached	red-purple, maroon, no slime	Fresh seaweedy	Transparent, Yellow sheen	Firm, hard (<i>rigor</i>), elastic	1 st . Quality	9
	Brilliance, few dull patches, darkening, scales firm	Reddish, bleached patches, slime	Neutral, fresh, light, sourish	Reddish, yellow sheen	Firm, reduced elasticity		7
							6
Reduced freshness, allowing for regional or local distribution if kept in ice	Dull, few metallic patches, dark or dorsal side, yellow streaks on belly area, scales loose at belly area	reddish with brown, bleached patches, slime	light stinky, sweetish, sour, slightly rotten off-odors	red, milky, turbid, flat	Soft	2 nd . Quality	5
							4
Unfit for human consumption, sometimes limited consumption after frying	Dull, dark, yellow slime, scales loose	reddish, brown, thick slime	Rotten, stinking, sulphidic, strong off-odors	red, bloody, concave	very soft, fingerprints leave impressions	Reject	3
							2
							1

Table 3. Assessment of raw, gutted fish stored at ambient temperature (20-30°C)

	Outer Appearance						
	Skin	Gill color	Gill odor	Eyes	Texture	Grade	Score
Freshness enabling limited local distribution	Natural brilliance, metallic, golden, pink-silver, scales firmly attached	red-purple, maroon, no slime	Fresh seaweedy	Transparent, Yellow sheen	Firm, hard (<i>rigor</i>), elastic	1 st . Quality	9
	Brilliance, few dull patches, scales firm	Reddish, little pinkish slime	Neutral, fresh	Reddish, convex	Firm, reduced elasticity		7
							6
Reduced freshness, allowing for quick sale	grayish, darkening loss of metallic brightness	bleached patches, slime	light rotten off-odors	red, milky, flat	Soft	2 nd . Quality	5
	Scales loose on the belly						4
If preserved, local distribution						Reject	3
	Yellow slime, greenish fins, dull appearance scales loose	green, slime brown	Rotten, sour strong off-odors	Sunken, turbid	soft, buttery, fingerprints leave impressions		2
							1

3- Sensory assessment of the quality of finished products (whole or dressed fresh or frozen fish)

3-1 Scope and product description

This method of fish grading applies to whole or dressed fish, whether fresh or frozen, of any species suitable for use as human food and processed and maintained in accordance with good manufacturing practices. It is based on the *Codex Alimentarius* standards and codes of practice for fresh and frozen fish.

3-2 Product forms

Fresh or frozen fish and fish products can be presented dressed-eviscerated, head-on or headless, with or without fins, skin-on scaled or unscaled or skinless. Frozen fish can be presented individually or as solid packs, glazed or unglazed. Other products forms are acceptable as long as they are distinct from the previous ones and their production complies with the sanitary regulations.

3-3. Sampling

Any fish lot presented for inspection will be sampled according to the sampling plan of table 4. The sampling plan of table 5 will be used in the case of re-inspection. Each sample unit will be made of the container's content, except when the content exceeds 10 kg of whole or dressed fish or fillets individually or block frozen. In this case, single fish or fish fillet will represent the sample unit.

3-4. Description of defects

Defects of whole or dressed fresh or frozen fish are of three types:

- ◆ **Tainted fish:** if more than 10% of the declared weight of the sample unit is:
 - rancid (having a characteristic and persistent odor of rancid oil or a characteristic flavor of oxidized oil with a distinctive bitter background taste),
 - or is abnormal because of specific and persistent non characteristic odors or flavors, such as acrid, burned, metallic, digested food, iodine, but are not rancid or decomposed odors or flavors.

- ◆ **Decomposed:** if more than 10% of the declared weight of the sample unit:
 - presents a persistent, distinct and non characteristic odor or flavor such as ammoniacal, fecal, fruity, hydrogen sulphide, moldy, putrid, salted, milky, chalky, sour, cabbage, yeasts,...
 - or presents a discoloration characteristic of spoilage

- or presents broken flesh texture, as indicated by a tough, dry or spongy muscular structure, or in the case of whole or dressed fish, by the presence of holes in the abdominal cavity or broken belly because of enzymatic activity.

Also, a sample unit will be declared defective if more than 10% of the declared weight is either tainted or decomposed.

◆ **Unwholesome:** Because of:

- the presence of critical foreign materials (materials not from fish and that can present a health hazard for the consumer, e.g., glass pieces,...), the presence of distinct and persistent odor or flavor of any matter foreign to the fish but that threatens the consumer health (petroleum, solvent,...)
- the presence of easily detectable foreign matters that do not come from the fish but is not a threat for the health of the consumer (pieces of insects, sand,...)
- The presence of other defects such as:
 - ❖ Dehydration (freezer burn): more than 10% of the declared fish or fillet weight of the sample unit is affected by a dehydration in more than 10% of the surface,
 - ❖ Two or more parasites (nematods, copepods) in 3 pounds of flesh or the presence of parasites per sample unit depending upon the size of the unit (1 parasite/2 lbs., 2 parasites/5 lbs., 4/10 lbs., 6/15 to 16.5 lbs., 7/18.5 to 20 lbs., 17/ 50 lbs.)
 - ❖ Bones (boneless fish products only): any bone with the largest dimension equal or greater to 5 mm.
 - ❖ Undesirable parts such as viscera, heads, tails,... which are not normal parts of the presentation and represent more than 10% of the net weight of the sample unit, making the presentation offensive.

3-5. Method of examination

- Determine the net weight. If needed, the sample unit can be thawed.
- Examine fish for the presence of dehydration by measuring the affected surface that can be removed only with a knife or other cutting instrument. Determine the total fish or fillet surface and the % of the total surface that is affected by dehydration.
- If needed, thaw the fish or fillets and examine them individually for the presence of foreign materials, undesirable parts or parasites.
- For fresh or frozen fillets, examine the entire sample unit for odor, color and texture. During re-inspection, if in doubt, the sample shall be cooked by any of the following methods: *i) insert the sample into a boilable film-type pouch, fold the open end of the pouch over a suspension bar and clamp in place to provide a loose seal after evacuating the air by immersing the pouch into boiling water. Cook the contents for 20 minutes until the internal temperature of the fish reaches 160 °F. (71°C). ii) Wrap the sample in a single layer of aluminum foil and place on a wire rack suspended over boiling water in a*

covered container. Steam the packaged product for 20 minutes; iii) cooking in a 700 watts microwave oven for 3 to 4 minutes. After cooking, the odor, flavor and texture are evaluated and the percentage of sample unit that is defective is calculated.

- For whole or dressed fish, examine the entire unit to detect whether it is tainted, decomposed or unwholesome as described under § 3.3. Examine thoroughly the abdominal cavity to check for holes or belly burst indicative of enzymatic activity. If so, examine the entire unit to check the flesh odor by cutting it around the neck. If there is no indication of belly burst or holes, examine at least 10% of the declared weight of each sample unit or at least 10 fish (choose the greatest of the 2) to determine odor. Cut the flesh around the neck to determine whether it is decomposed or tainted.

3-6. Determination of grade

A sample unit shall be considered defective if it is tainted, decomposed or unwholesome as described under § 3.3 or if more than 10% of its weight is made of tainted or decomposed products.

The lot is considered unacceptable :

- If it presents one defect for the presence of critical foreign materials,
- or
- if the total number of defective units because of tainting, decomposition or unwholesomeness, exceeds c as per table 4 or 5.

Table 4. Codex alimentarius sampling plan of prepacked products

(AQL = 6.5%) (level of inspection I)

N Number of containers per lot	Sample size n	C Maximal number of acceptable defective units
1- Containers with ≤ 1 kg N = 4800 or less 4801 to 24000 24001 to 48000 48001 to 84000 84001 to 144000 144001 to 240000 >240000	n= 6 13 21 29 48 84 126	C = 1 2 3 4 6 9 13
2- Containers with 1 to 4.5 kg N = 2400 or less 2401 to 15000 15001 to 24000 24001 to 42000 42001 to 72000 72001 to 120000 ➤ 120000	n=6 13 21 29 48 84 126	C = 1 2 3 4 6 9 13
3- Containers > 4.5 kg N = 600 or less 601 to 2000 2001 to 7200 7201 to 15000 15001 to 24000 24001 to 42000 ➤ 24000	n=6 13 21 29 48 84 126	C = 1 2 3 4 6 9 13

Table 5. Codex alimentarius sampling plan of prepacked products

(AQL = 6.5%) (level of inspection II)

N Number of containers per lot	Sample size n	C Maximal number of acceptable defective units
4- Containers with ≤ 1 kg N = 4800 or less 4801 to 24000 24001 to 48000 48001 to 84000 84001 to 144000 144001 to 240000 >240000	n= 13 21 29 48 84 126 200	C = 2 3 4 6 9 13 19
5- Containers with 1 to 4.5 kg N = 2400 or less 2401 to 15000 15001 to 24000 24001 to 42000 42001 to 72000 72001 to 120000 ➤ 120000	n=13 21 29 48 84 126 200	C = 2 3 4 6 9 13 19
6- Containers > 4.5 kg N = 600 or less 601 to 2000 2001 to 7200 7201 to 15000 15001 to 24000 24001 to 42000 ➤ 24000	n=13 21 29 48 84 126 200	C = 2 3 4 6 9 13 19