Seafood Freshness Quality

Introduction

The purpose of this fact sheet is to cover the key points of fish freshness quality with the aim of raising standards and increasing the overall consumption of fish.

The Importance of Freshness Quality

Raw seafood is a highly perishable commodity. To maximise its value, freshness quality must be maintained. It is not impossible to find fish at the point of sale exhibiting off odours and flavours. This is either due to the age of the fish, or a combination of age and poor temperature control. For the past 20 years sales of traditional chilled white fish species have been in decline, whilst frozen, farmed and shellfish consumption has steadily increased. One theory is that consumers are turning to products that offer a consistently pleasant eating experience. Farmed and frozen at sea seafood can often have a higher freshness quality due to a shorter time since capture, or spoilage being greatly reduced by freezing.

How fish spoils

The spoilage process begins immediately after capture. Harmless, natural spoilage bacteria on the skin and in the slime of the fish quickly invade the muscle blocks. However, for the first couple of days, changes in the fish are predominantly due to the intrinsic enzymes in the flesh.

To maximise freshness quality, fish should be held at the temperature of melting ice i.e. 0°C. Both raw and cooked fish is commonly assessed using the Torry system. Tasting correctly stored fish over an extended time period sees a typical pattern in the odour and flavour (fig 1). Take cod as an example: straight out of the sea it has little flavour; after around two days maximum pleasant sweet flavours have developed. After eight days the intensity reduces until the fish has almost no flavour at all. At around 12 days, off flavours are detectable. These flavours then become stronger and more unpleasant over time.

Fish Quality Myths

Chilled or Frozen?

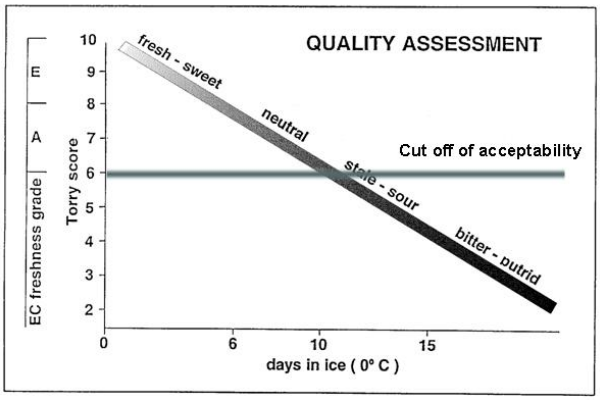
A recent Seafish survey confirmed that 57% of consumers thought that chilled fish had a higher freshness quality than frozen fish. In comparison 12% thought the reverse was true. In fact freezing fish at sea soon after capture to lock in freshness is the best way to significantly slow spoilage, If stored correctly at around -30°C white fish is still acceptable after 12 months.

The same consumers considered frozen fish to have a mushy and softer texture. If done properly white fish can be frozen and defrosted several times without detriment to either flavour or texture. In general the soft texture comes from cell damage caused by slow freezing. Slow freezing allows the formation of large ice crystals that damage the cells of the fish on defrosting. Soaking, over glazing and seasonality can also cause softening. The same consumers state a strong unpleasant odour is a major reason for not buying or cooking fish. In fact fish with a high freshness quality generates very little odour.

Torry score

A Torry score of 6 (11 days on ice) is considered the cut off point for sale, as it is the point just before off flavours and odours are detected.

Figure 1. Quality changes in chilled fish



Maximising Quality

Either, the time from capture to consumption must be reduced or tighter temperature control can be applied. For every 5°C rise in fish storage temperature, the shelf life more than halves. Super chilling is sometimes used to slow the rate of spoilage, holding the fish at -2.2°C is reported to extend the shelf life of the fish to 26 days before off flavours are detected.

Once lost, freshness quality can not be regained. Periodically, industry is offered various chemical or physical treatments to extend shelf life. There is no quick fix to slow spoilage because of the way fish spoils. Bacteria inside the fish are protected by the muscle blocks, which neutralise the chemical or UV light. Some treatments may have a deodorising effect, temporarily masking poor quality, but Seafish trials have shown no significant long-term benefits.

Measuring fish quality.

Human sensory assessment still remains the fastest and most accurate way of assessing fish freshness. Non-human techniques exist but these can be problematic.

The Torry meter is an electrical device developed to determine fish freshness. However, it can give inaccurate readings under certain seasonal conditions or when the fish flesh is bruised or damaged.

Chemical analysis including total volatile bases (TVB) or (TMA) is also time consuming to get a result and can prove inaccurate until the fish is well past the point of acceptability. There are also questions over the lack of a standard method which limits the usefulness of chemical testing.

Figure 2. Fish quality assessment

Microbiological testing is also sometimes used to determine freshness quality. Total viable count (TVC) should not be used, as it is common for fish straight out of the sea to have a TVC of $1x10^5$-$1x10^6$. A better correlation is seen be measuring specific fish spoilage bacteria such as *Pseudomonas* or *Shewanella* species.

Human Sensory Assessment.

The human sensory assessment method widely used in the UK was developed by the now closed Torry Research Station in Aberdeen. A species specific score sheet is used, describing the appearance, odour and flavour of both raw and cooked samples. An example of the score sheet for cooked cod is given in Table 1. As a quality assurance tool, cooked Tory assessment is more meaningful than raw. Fish straight out of the sea would score 10, with badly spoiled fish being completely inedible at 3. A skilled assessor can determine the freshness quality of a sample very accurately. If necessary, the age of the fish in terms of days on ice can be calculated. The rule of thumb being two days from point of capture for the first Torry point, then one Torry point every three days thereafter. To use the Torry scheme effectively an assessor must undergo initial and periodic calibration. This involves tasting a range of fish of known age and freshness quality. Around 15 Torry scoring schemes exist for fish and shellfish. In more recent years a similar method called the quality index method (QIM) has made an appearance, but is not discussed here.

Table 1 Torry scoring sheet for cooked cod

Score	Odour	Flavour	Texture, Mouth Feel and Appearance	Score	Days on ice
10	Initially weak odour of sweet, boiled milk, starchy followed by strengthening of these odours	Watery, metallic, starchy. Initially no sweetness but meaty flavours with slight sweetness may develop.	Dry, crumbly with short tough fibres.	10	0
9	Shellfish, seaweed, boiled meat, raw green plant.	Sweet, meaty, creamy, green plant, characteristic.	Succulent, fibrous. Initially firm going softer with storage. Appearance originally white and opaque going yellowish and waxy on storage.	9	2
8	Loss of odour, neutral odour	Sweet and characteristic flavours but reduced in intensity.		8	5
7	Woodshavings, woodsap, vanillin.	Neutral		7	8
6	Condensed milk, caramel, toffee-like.	Insipid		6	11
5	Milk jug odours, boiled potato, boiled clothes like.	Slight sourness, trace of ‘off’ flavours.		5	14
4	Lactic acid, sour milk, ‘byre-like’.	Slight bitterness, sour ‘off’ flavours		4	17
3	Lower fatty acids (e.g. Acetic or butyric acids), composted grass, soapy, turnipy, tallowy.	Strong, bitter, rubber, slight sulphide.		3	20

Legal Matters

The Food Standards agency has issued guidance: CRITERIA FOR THE USE OF THE TERMS FRESH IN FOOD LABELLING.

Use of the term ‘fresh’ is acceptable to describe ‘fish that has been kept chilled on ice, but not stored deep frozen’.

It is possible to find fish that has been previously frozen and labelled as fresh, or has a low freshness quality. In this case the consumer is protected from being misled by the Consumer Protection from Unfair Trading Regulations 2008.

Information Sources

- **Quality and quality changes in fresh fish – FAO** www.fao.org/docrep/v7180e/V7180E00.htm
- **Seafish Chilled vs. Frozen Research** Contact Seafish Market Insight team
- **Torry Sensory Assessment Scoring schemes – Seafish** http://tiny.cc/HBA6P
- **Seafish Quality assessment training** http://www.seafish.org/land/training.asp?p=fe175
- **Chapter 27: Scombrotoxin (Histamine) Formation** http://seafood.ucdavis.edu/haccp/compendium/Chapt27.htm
- QIM – Eurofish www.qim-eurofish.com/

For further information contact:
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Fish Quality Myths

A recent Seafish survey showed that that the majority of consumers will throw out chilled fish if they have had it in the fridge for more than a couple of days, due to fear of food poisoning.

Clearly there is confusion over the safety of uncooked fish, raw bivalve shellfish and cooked ready to eat seafood products. Raw white fish is intrinsically safe after cooking; it is inedible long before it becomes harmful. However care should be taken with pelagic fish such as tuna, mackerel and herring held at higher temperatures, as a risk of scombrotoxin production is possible. This toxin is not destroyed by cooking. Histamine is produced by the action of some types of natural spoilage bacteria (on scromboid fish) which grow rapidly at higher temperatures between 20**°C** -30**°C.**