

The Philips logo is displayed in a white box with a blue border, set against a background of fresh fish on ice.

White paper



# The optimum lighting for fresh fish

## The importance of the fresh department

Despite the continuing boom in online shopping, one area of retail establishments continues to draw shoppers into physical stores. Fresh. Whether it is meat or cheese, bakery or deli, fruit & veg, fish or seafood, fresh is the growth engine of stores. Top retailers can generate as much as 43% of their sales from perishable items.<sup>1</sup>

It is not altogether surprising. Consumers are increasingly concerned with health and authenticity. This is leading to a return to tactile, experiential shopping, in which consumers like to look, touch, feel and smell their purchases – and in some cases taste samples – in order to confirm product freshness.

The optimal lighting of fresh produce is vital to drive customer engagement in the fresh department of supermarkets. The fresher the food looks, the more attention it gains. The correct lighting brings out the colors and textures of fresh food, enticing customers to stop and buy. Lighting can enhance the overall store experience. Research also shows the positive effect of lighting on sales of fresh produce.<sup>2</sup>

An infographic featuring a teal fish silhouette with a white circle containing '65%' above it. A line connects the circle to the fish. To the right, text states 'of EU consumers buy fish at least once a month'.

65%

of EU consumers  
buy fish at least  
once a month



## The health benefits of fish are driving consumption

Fish and aquaculture products continue to climb in consumers' perceptions of a healthy and natural source of protein and unsaturated fatty acids. This is translating into an overall increase in consumption.<sup>3,4</sup> The European Union is the world's largest market for fish, spending twice the amount of money on fish per capita as US consumers. Two-thirds of European consumers purchase fish at least once a month (Fig. 1). The supermarket or grocery store is where most fish and seafood are purchased in the EU, although 40% of consumers prefer the local fishmonger (Fig. 2).

Research also clearly indicates<sup>5</sup> that consumers say the main reason for buying or eating fish is that they are healthy (74%) and tasty (59%) (Fig. 3). The products purchased are fresh or frozen; nearly 60% of shoppers avoid breaded fish products or ready meals. The appearance, cost and origin are considered the most important aspects when buying fish (Fig. 4).

### Two thirds of respondents buy fish at least once a month

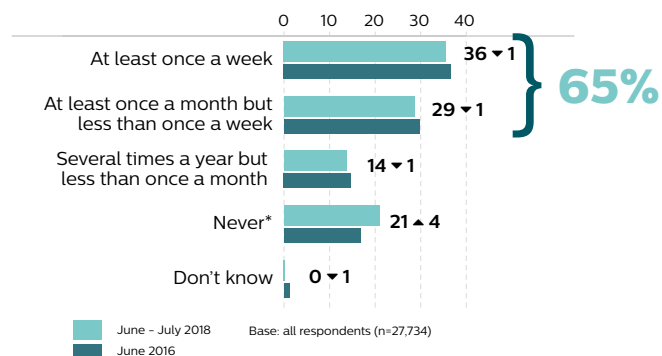


Fig 1. Consumption of fish among EU consumers.

### Most of those who buy fish do so at the grocery store, supermarket or hypermarket (77%)

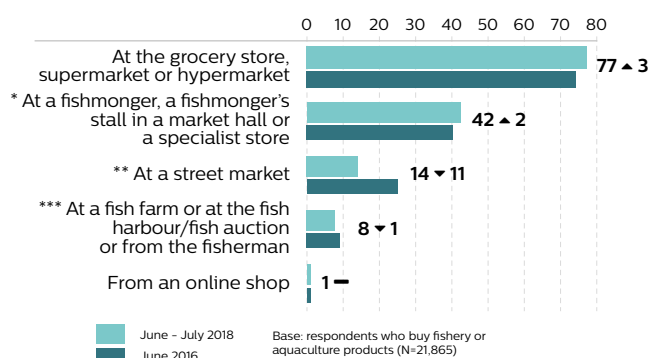


Fig 2. Where fish are purchased in the EU.

### Consumers say the main reasons for buying or eating fish are that they are healthy (74%) and they taste good (59%)

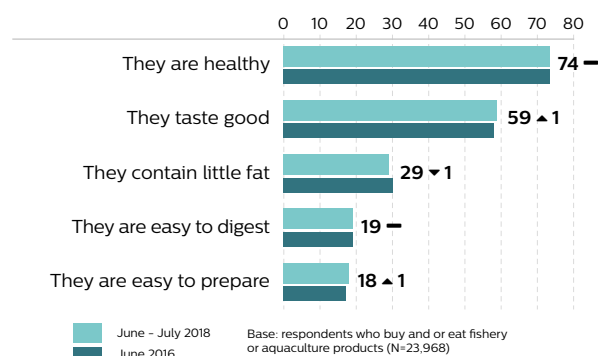


Fig 3. Reasons for purchasing or eating fish in the EU.

### The appearance, the cost and the origin are considered as the most important aspects when buying fish

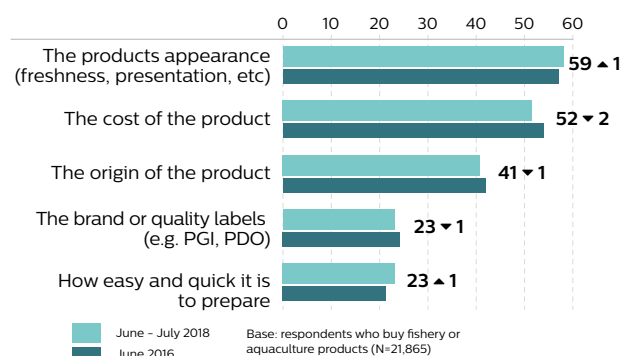


Fig 4. Aspects affecting fish purchase in the EU.





## Increasing the lure of the fish and seafood section

Food that is well presented and optimally illuminated looks good, will most likely taste good, and is more likely to be purchased. Fresh departments such as cheese, meat, fruit and vegetables have known this for some years. Given that fish is becoming more important for consumers (a trend that is clearly reflected in the graphs above), supermarkets are responding by making the fresh fish department more relevant and interesting to them.

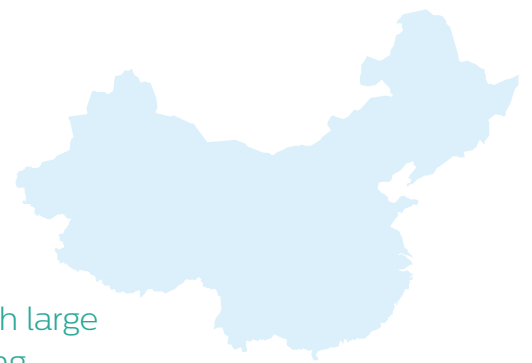
Temperature control is crucial for fish in order to preserve their nutritional value, freshness, flavor and vitamin content. A simple rule of thumb is that for every hour that a fish is not cooled after the catch, it loses a whole day's shelf life.<sup>6</sup>

Chilled fresh fish need to be displayed at or near 0°C, the melting point of ice, which makes ice the preferred

coolant in the fish industry. A bed of ice should be laid beneath the fish and a further sprinkling of pieces on and around the fish will keep it cool more efficiently. Moreover, the use of the correct type of ice – namely transparent ice shards – allows customers to see even small details in the fish. The fish should be laid out in thin layers; fish is a poor conductor of heat and deep piles of fish will not be effectively cooled.<sup>7</sup>

Temperature control and ice are thus needed to preserve the shelf life of fish after the catch. In parallel, good lighting is key to enhancing the appearance of the fish with the optimal illumination, brightness and color. This will increase the lure of the fish and seafood section in supermarkets, and help turn a routine shopping trip into an aesthetically pleasing experience.

# Signify's research in China



Retail in China has changed dramatically in recent years, with large numbers of supermarkets described as “new retail” appearing.

This change is led by the so-called O2O (online to offline) transformation, driven by the “Internet Plus” initiative from the Chinese government and fueled by many of the Chinese tech giants. Compared to conventional retail, new retail places greater emphasis on consumer experience. Integrating the offline channels together with online, consumers can now make their purchases through mobile devices online, anywhere, and at any time.

But at the same time they can enjoy the offline experience. This transformation of the retail sector in China is leading to new demands for optimized lighting in retail establishments – and especially in the fresh fish and seafood section.

Chinese consumers place great importance on the freshness of the fish and seafood they purchase. For this reason, many retailers present their fish still alive in glass tanks. Supermarkets are therefore looking to optimize the lighting of seafood that is kept alive in aquaria prior to being purchased by consumers.

Signify took up this challenge and conducted its own research in China. It focused specifically on lighting solutions for living seafood in aquaria, and how lighting can improve the customer's experience of selecting and buying fish in the fresh fish department.

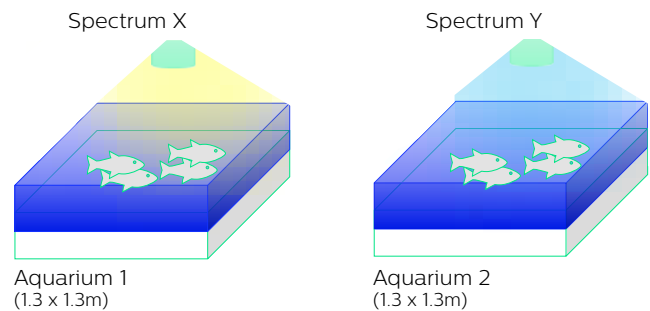


Fig 5. Live seafood in aquaria evaluation mockups

Evaluations involved the preparation of mockups (Fig. 5) so that the appearance of both silver-grey fish and red crustaceans such as crabs and lobsters could be observed and recorded.

Varying lighting setups were established in which the following parameters were changed:

- Correlated Color Temperature (CCT)
- Distance from the Black Body Line (BBL) was changed incrementally
- Color Rendering Index (CRI)
- Degree of saturation as measured by the Gamut Area (GA).

## The results of Signify's research in China

1. The Correlated Color Temperature (CCT) was found to have a strongly positive contribution on customers' purchasing preferences for fish. The appearance of silver-grey fish in particular was found to be more sensitive to changes in CCT; the fish in aquaria with higher CCTs were preferred by customers over the lower CCTs. This was not so clear for the red crustaceans; a lower CCT was disliked, but increasing the CCT did not significantly improve preference.
2. Optimizing the distance from the Black Body Line (BBL) increased the attractiveness of both the silver-grey fish and the red crustaceans. Lighting settings with a white point below the BBL were more preferred than those with a white point on or above the BBL.
3. By varying the distance from the BBL and the Gamut Area (GA) at a fixed CCT, the whiteness perception and color saturation changed.
4. Color saturation of white light had a positive contribution on the attractiveness of red crustaceans but had little influence on that of silver-grey fish. Changes in Gamut Area/color saturation had a significant effect on the appearance of the red crustaceans.
5. The research led to specifications of an optimal spectrum for illuminating fish in aquaria. The CCT, distance to the BBL and color saturation were the most critical parameters.

# Signify's research in Europe



The research results for aquaria in China were then tested by Signify in the European market to see if they also applied to fresh fish on ice. The testing was conducted in two ways: qualitative and quantitative, involving both face-to-face and online tests.

The tests in Europe covered different types of fish: with skin and without skin (filet), as well as different colors (white, grey, salmon pink, and red). Different spectra covering the same variations in parameters as in the China research were included: Correlated Color Temperature (CCT), distance from the Black Body Line (BBL), Color Rendering Index (CRI) and Gamut Area (GA).

In the first part of the test – the qualitative part – the spectra were first evaluated one by one. In the second part of the test, the spectra were compared and evaluated.

From the qualitative test it was concluded that the different parameters had a clear effect on the perception of colors. This was discovered through answers to questions such as: Does white look white? Do the reddish colors look nice? Are the different colors in one fish clearly visible? Moreover, the

parameters also had an impact on the visibility of structures (most notably the skin) and on the shininess/sparkle of the fish.

As with the research in China, it turned out that the spectra with a color point below the BBL and an increased color saturation (GA) were most preferred by the test panel.

The second, quantitative test was an online test, set-up as a paired comparison test in which photographs of fish were compared. These photos were taken under the same spectra as used in the qualitative test. A paired comparison is a test in which a combination is presented (see Fig. 6) and the people taking the test have to indicate which they prefer. They need to make a choice between left or right. In this test all combinations were offered to the participants, including all left/right, right/left combinations.



Fig 6. Example of selected type of fish illuminated by two different spectra.

The conclusion from the **quantitative test** was similar to that of the qualitative test.

Most of the test panel preferred the spectrum with a color point below the BBL and an increased color saturation (GA).

The overall conclusion of Signify's research in Europe is that the same lighting solution is valid for fish on ice as for living fish in aquaria.

This resulted in the development of a dedicated spectral tuned Fresh Food LED recipe. This spectral tuned recipe has a CCT of 5000K, a CRI of 90, a color point below the BBL and an increased color saturation. In Europe Signify is bringing this recipe to the market under the name Frost.



## Correlation with research into **memory color**

The results described above are in line with previous studies on memory color. For example, Signify commissioned a study with the University of Leuven, which investigated how customer preferences and color memory play a role in their perception of fresh foods. The study demonstrated that in terms of perception, the saturation of color is of key importance. Interestingly, people remember the colors of fresh foods as being more saturated, and the color they prefer is even more saturated still – effectively an enhanced version of their memory. The impact of these elements on fresh food thus has a significant effect on how customers experience the presentation of fresh food in supermarkets. This confirms the results of the research both in China and Europe.

Along these same lines, a study that was conducted in a supermarket by Signify and the Independent Retail Institute (EHI) based in Cologne, Germany, found that lighting can have a positive impact on sales in a supermarket's fresh produce department. Again, this aligns with the research described above.

Finally, research conducted on the impact of the color fidelity index and gamut area on consumer preference for white light sources in fresh food indicated the significant contribution of color saturation on the appreciation of a light source. This research further vindicates Signify's research in this area.



### Lighting design recommendation for **fish displays**

- 1.** To optimally light fish and aquaculture products, Signify recommends using products with the Philips fresh food LED lighting recipe Frost. This accent lighting recipe enhances presentation of fresh fish on ice.
- 2.** It is recommended to create an average light level ( $E_{ave}$ ) of around 750-1000 lux on display. This is important because the right amount of light is needed to create a pleasant atmosphere in the fresh fish area and to attract the attention of customers.
- 3.** Assuming a spacing of 1.8 meters between luminaires:
  - For mounting height  $\leq 3$  m use luminous flux  $\sim 1700$  lm
  - For mounting height  $\geq 3$  m use luminous flux  $\sim 2700$  lm
- 4.** Create evenly distributed light without harsh peak illuminances.
- 5.** Uniformity ( $E_{min}/E_{ave}$ )  $> 0.6$ . Therefore, use an oval or wide beam.



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