

FISH DRY AGEING

A few helpful tips on how to dry age fish using **INOX BIM** climatic cabinets

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What's Dry-Ageing

Definition

We aim to answer to the question “*what’s dry-ageing?*” in the easiest way as possible:

a process in which the enzymes within the meat relax the tissues, thus softening their consistency. The proteins of the muscles, in extreme synthesis, are degraded and broken down into molecules that give the fish different types of flavour, now "concentrated" due to the loss of liquids.



Two 700lts Climatic Cabinets at "Vecchio Mulino Lab", Peschiera del Garda, Italy

In short, the same process of beef dry aging. Truth to be told, the distinction between fish and meat is merely gastronomic, and certainly not scientific (whether they are of water or land, they are still animals!).

As **Josh Niland**, the “father” of fish dry-ageing (at least the *modern* one¹), has specified many times, the dry-aged fish is not dried: it maintains the fundamental characteristics of the fresh product, with a consistency just a little denser; and in which the flavour is simply concentrated, not modified ².

Perks

Starred Chef **Lele Usai** provides a clear and concise explanation as to what the greatest benefit in terms of taste is: «*There are enzymes in the fibres that are activated after the death of the fish and that, after just one day, begin to relax the tissues, breaking down the connective ones. This makes the meat softer. At the same time, the fish also goes through a drying phase, deprived of liquids, combining the process of softening the fibres with that of concentrating the consistency*».³

The enzymatic processes that take place during dry-ageing bring a spectrum of new flavours ranging from sweet to the so-called *umami*. This name, which in Japanese means “tasty”, indicates a pleasant salty flavour, mainly given by glutamate, plus other types of amino acids. The taste of umami is subtle and blends well with other flavours to expand and complement those; it is regarded as one of the five basic tastes⁴.

Therefore, tastier meat in terms of flavour intensity, as well as a greater release of juices, although the product may seem drier on the surface⁵.

The Dry-Ageing Process

¹ Fish dry-ageing is an ancient practice, already in use by the ancient Egyptians in the third millennium BC.

² *Il pesce? È migliore se NON è fresco. Rivoluzionarie tecniche di maturazione*. Identità golose Web (identitagolose.it). C.Mangio. 2020

³ *Frollatura del pesce, cos'è e a cosa serve*. Cibovagare (cibovagare.it). A.Febo. 2021

⁴ *Science of umami taste: adaptation to gastronomic culture*. K.Ninomiya. 2015

⁵ Ferdinando Giannone in *Oltre la frollatura*, J.Ticchi. 2021

What kind of fish is suitable for dry-ageing?

It would be better to dry-age adult or large sized fish, because these must allow to perform a certain cut⁶. **Josh Niland** recommends a minimum weight of 800 grams⁷. One of the essential prerequisites is that the fish is fresh⁸, not frozen beforehand, and as pristine as possible, i.e. treated with sanitized tools⁹.

There is not an universally valid "recipe" for dry-ageing, nor one that is valid for a type of fish or for a given size¹⁰.

Some fish, so to speak, perform better than others due to their high fat composition, such as tuna¹¹, mackerel or swordfish¹². Salmon is suitable for dry-ageing up to 22 days¹³.

Other types of fish, more *meaty*, are also particularly recommended for dry-ageing, such as, for example: red snapper, sea bass and amberjack. After about a week of aging, their tendons begin to soften and leave a creamy, melting texture in the mouth¹⁴. Also a sole, a fish with shorter fibres and white and delicate pulp, becomes creamier¹⁵.

The red snapper reaches an intense and pleasant taste after 5 days of dry-ageing, due to the abundant presence of connective tissue, which softens during the dry-ageing process¹⁶. The Chef **Jacopo Ticchi** (Trattoria da Lucio, Rimini) lets it dry-age for up to 14 days and then serve it raw or quickly seared¹⁷.

⁶ Ferdinando Giannone in *Oltre la frollatura*, J.Ticchi. 2021

⁷ *The Whole Fish Cookbook*. Josh Niland. 2019

⁸ *The Whole Fish Cookbook*. Josh Niland. 2019

⁹ Interview to the Chef Michael Nelson (GW Fins, New Orleans) in *Dry-Aged Fish Comes to Austin, But What Actually Is It?* Austin Eater Website (austin.eater.com). S. Engstrand. 2021

¹⁰ Ferdinando Giannone in *Oltre la frollatura*, J.Ticchi. 2021

¹¹ «as rigor mortis slowly subsides, Adenosine Triphosphate (ATP) and Adenosine Diphosphate (ADP) start to breakdown into inosinic acid. It is this inosinic acid that improves the flavour of the fish when undergoing ageing/maturation for up to a week. This is because, inosinic acid is the building block for many kinds of salts such as dipotassium inosinate and calcium inosinate that give food its so called savoury umami flavour ». *Introduction to the science of ageing fish*. La petit Noisette (lapetitnoisette.com). 2021

¹² *The Whole Fish Cookbook*. Josh Niland. 2019

¹³ According to the Chef Jay Huang (Lucky Robot, Austin, USA), between 14 and 22 days. *Dry-Aged Fish Comes to Austin, But What Actually Is It?* Austin Eater Website (austin.eater.com). S. Engstrand. 2021

¹⁴ Interview to the Chef Ben Steigers (PABU, Boston) in *How to Age Fish at Home (and Why You Should Try It)*. The Manual (themanual.com). A.Gabriele. 2019

¹⁵ *Basta de pescado sin vender: el madurado ya muerde el anzuelo*. Vinomanos (vinomanos.es). L.Litvin. 2021

¹⁶ *Introduction to the science of ageing fish*. La petit Noisette (lapetitnoisette.com). 2021

¹⁷ *Oltre la frollatura*, J.Ticchi. 2021

To those mentioned above, other types of fish could be added such as grouper, sea bream, mullet, sea bass or skate. But it goes without saying that the marine world is so diverse that it would be impossible to make a list.

We recommend *experimenting*, initially by monitoring colour and texture once / twice a day.



Two 1400 lts. Climatic Cabinets at Trattoria Da Lucio di Rimini

The preparation

Once the fish is out of the water, it no longer must come into contact with it. The water, and the oxygen contained in it, is in fact where the potential bacteria that can lead to

rotting of the flesh reside¹⁸. Removing, as far as possible, the space where the bacterial load can proliferate is a first step, as simple as it is fundamental¹⁹.

The most difficult part of the whole ageing process is preparing the fish for it. This, in fact, must be carefully scaled and gutted, taking care not to damage the skin or to break the internal tissues.²⁰ For doing so, it's recommended the Japanese technique called *Sukibiki*²¹.



Cleaning the fish using the "Sukibiki" technique. (Jacopo Ticchi at "Da Lucio", Rimini, Italy)

¹⁸ Interview to the Chef Lele Usai (Il Tino, Roma) in *Frollatura del pesce, cos'è e a cosa serve*. Cibovagare (cibovagare.it). A.Febo. 2021

¹⁹ *The Whole Fish Cookbook*. Josh Niland. 2019

²⁰ *The Whole Fish Cookbook*. Josh Niland. 2019

²¹ *Dry-Aged Fish Comes to Austin, But What Actually Is It?* Austin Eater Website (austin.eater.com). S. Engstrand. 2021

The skin is important: first because it "defends" the meat from the cold and dry air ²², as well as from the oxidation (increased by the ozone generation). Besides that, it is also in the skin, and not only in the pulp, that the aromatic characteristics will be accentuated²³.

Scaling the fish is essential to reduce surface humidity, thus obtaining a drier skin, that will turn eventually, after cooking, more crunchy²⁴. Absorbent paper is needed to clean the animal without using water.

Bleeding the fish is also strongly recommended²⁵.

Once prepared, it is advisable to hang the fish upside down, in order to allow excess liquids to slide off²⁶.

However, according to Chef **Moreno Cedroni**, the fish can also be dry-aged in slices. In this case, the part in contact with the air will remain drier, but if the bone that protects it remains, the problem can be solved or minimized²⁷.

²² *Todo lo que debes saber sobre la maduración del pescado*. Diario Sur (diariosur.es). E.Pelaez. 2021

²³ *Pesce fresco? No, ben frollato. I grandi Chef sfatano vecchi miti*. In Gambero Rosso, n.355, Agosto 2021. A. De Santis

²⁴ *The Whole Fish Cookbook*. Josh Niland. 2019

²⁵ According to the Chef Luigi Pomata: «the fish must be completely bled, and the intercostal blood must also be cleaned well». *Il metodo di frollatura del pesce spiegato da Luigi Pomata*. Identità golose Web (identitagolose.it). C.Mangio. 2020

²⁶ Intervista allo Chef Lele Usai (Il Tino, Roma) in *Frollatura del pesce, cos'è e a cosa serve*. Cibovagare (cibovagare.it). A.Febo. 2021

²⁷ *Pesce fresco? No, ben frollato. I grandi Chef sfatano vecchi miti*. In Gambero Rosso, n.355, Agosto 2021. A. De Santis

The *Rigor Mortis*

Immediately a few hours after being caught, the fish undergoes *rigor mortis*, which can last from about ten hours up to a day²⁸. The length of time within which rigor mortis occurs depends, among other things, on the difference between the sea temperature at the time of fishing and the temperature at which the fish is stored (or aged). The higher this difference, the sooner rigor mortis will arise²⁹.

Completion of rigor mortis (the time of which depends on several factors, including: breed, age of the animal, and, above all, storage temperature³⁰), as briefly mentioned above, proteolytic enzymes break down proteins into smaller molecules (such as amino acids), which give the meat flavor notes that would not otherwise be found in so-called fresh fish³¹. As you will have noticed by now, the processes that take place during the maturation of meat and that of fish are the same. However, the proteins are different, as those of fish are much more "delicate" to treat³². This means that the post-mortem transformation of fish is much faster and more unpredictable than that of beef, or meat in general³³.

²⁸ *Post-mortem Changes and Assessment of Fish Quality*. N. Alam. 2007

²⁹ Interview to Bruno Goussault in *Peut-on maturer le poisson?* In Yam Magazine, n.29, gennaio 2016. L.Gogois

³⁰ *Post-mortem Changes and Assessment of Fish Quality*. N. Alam. 2007

³¹ Ferdinando Giannone in *Oltre la frollatura*, J.Ticchi. 2021

³² *The Whole Fish Cookbook*. Josh Niland. 2019

³³ Interview to Bruno Goussault in *Peut-on maturer le poisson?* In Yam Magazine, n.29, gennaio 2016. L.Gogois

Dry-ageing parameters

The dry-ageing parameters that can be managed with the Inox Bim Climatic Cabinet are: *duration, temperature, relative humidity, ventilation* and, where the generator is included, *ozonation*.



The Chef Moreno Cedroni, interviewed by the Italian National News "Studio Aperto", in front of the Climatic Cabinet

The duration

As written in the previous paragraph, but in fact it is better to repeat it over and over again, there is no universally valid recipe for maturation. Indeed, different fish can have different reactions to the same conditions such as temperature and degree of relative humidity³⁴.

Therefore, even the duration may vary not only by the type of fish, but also by weight, age of the animal or even the type of dish to be served³⁵. In fact, dry-ageing modify the texture

³⁴ Interview to Chef Michael Nelson (GW Fins, New Orleans) in *Dry-Aged Fish Comes to Austin, But What Actually Is It?* Austin Eater Website (austin.eater.com). S. Engstrand. 2021

³⁵ For instance, Chef Giuseppe Iannotti (Krèsios, Teleso Terme, Italy) prefers a short dry-ageing (no longer than 6 days) in order to have only a liquid loss, avoiding any denaturation of fish's taste. *Pesce fresco? No, ben frollato. I grandi Chef sfatano vecchi miti*. In *Gambero Rosso*, n.355, Agosto 2021. A. De Santis

of the meat and it amplifies several otherwise barely perceptible flavours. Therefore, the dry-ageing program can also vary according to the type of recipe.

But, is there any *minimum* or *maximum* duration of a dry-ageing process?

As a minimum duration, the end of the rigor mortis process referred to in the previous paragraph can be established (approximately 24 hours).

There is a maximum duration, although this also depends on the type of fish being aged. It is the point beyond which enzymatic processes will not substantially change the flavor or texture. A stage of *maximal dry-ageing*³⁶, so to speak.

Although fish that has been aged for a long time can always be edible, it should also be remembered that prolonged ageing more than necessary can lead to flavours that are too strong and not appreciated by everyone³⁷.

Examples of duration

Specifically, how long the maturation process should last by type of fish is not a matter on which there is no common agreement. As expected, each Chef has his own "recipes" also with regard to dry-ageing.

In an experiment carried out by the biologist **Ferdinando Giannone**, it was shown that there is no increase in bacterial load in the maturation of fish ranging from 3kg (such as Red gurnard or monkfish) up to 20 kg (amberjack) in ageing up to 13 days, with a temperature of 4°C³⁸.

In any case, there are many and sometimes conflicting opinions. In this document we mention some of them to give a general idea:

According to **Dani Garcia**, tri-starred Spanish Chef, the general rule would be, the bigger the fish, the longer dry-ageing time should be³⁹. What is certain is that if after ten days no

³⁶ Ferdinando Giannone in *Oltre la frollatura*, J.Ticchi. 2021

³⁷ This according to the Chef Jay Huang (Lucky Robot, Austin) in *Dry-Aged Fish Comes to Austin, But What Actually Is It?* Austin Eater Website (austin.eater.com). S. Engstrand. 2021

³⁸ Ferdinando Giannone in *Oltre la frollatura*, J.Ticchi. 2021

³⁹ *Dani Garcia* (profile page). Madrid Fusion (edicionesanteriores.madridfusion.net). E.Bellver, 2021

further changes are noticed, it has reached the point of *maximal dry-age* as such we called it above⁴⁰.

The Chef **Lele Usai** states that «a medium-sized fish, after two or three days, can be considered as ready, and there's no need to go any further»⁴¹. The animals weighing around 1kg need 6/7 days⁴².

According to the Chef **Luigi Pomata**, generally a week or so for large bottom fish, and up to two weeks for groupers, and only 2/3 days for turbot ⁴³.

Josh Niland states 4/5 days of dry-ageing are enough for fish such as John Dory, bream or flounder⁴⁴.

The Chef **Matteo Compagnucci**, in his restaurant *Sintesi* (Rome, Italy), performs a dry-ageing that usually lasts 10 days as it comes to medium-sized fish (around 10 kgs)⁴⁵. The Croatian Chef **Saša Began** (Foša Restaurant, Zadar, Croatia) dry-age for the same amount of time (10 days) a smaller fish like the mackerel⁴⁶.

The Chef **Francesco Sodano** (Il Faro di Capo d'Orso, Maiori, Italy) put on the menu a bonito that has dry-aged for 8 up to 12 days⁴⁷.

15 days last the dry-ageing of the red mullet made by **Stefano Sforza** (Opera, Turin, Italy); **Marco Claroni** (Osteria dell'Orologio, Rome, Italy) uses the same amount of time for bigger fish, as amberjacks⁴⁸.

Jacopo Ticchi (Trattoria da Lucio, Rimini, Italy), on the other hand, seems to prefer ageing on average longer than those listed above: 18 days for monkfish, 16 days for snapper, 7 days for turbot and mullet⁴⁹.

⁴⁰ Dani Garcia (pagina profilo). Madrid Fusion (edicionesanteriores.madridfusion.net). E.Bellver, 2021

⁴¹ Frollatura del pesce, cos'è e a cosa serve. Cibovagare (cibovagare.it). A.Febo. 2021

⁴² Pesce fresco? No, ben frollato. I grandi Chef sfatano vecchi miti. In Gambero Rosso, n.355, Agosto 2021. A. De Santis

⁴³ Pesce fresco? No, ben frollato. I grandi Chef sfatano vecchi miti. In Gambero Rosso, n.355, Agosto 2021. A. De Santis

⁴⁴ The Whole Fish Cookbook. Josh Niland. 2019

⁴⁵ Pesce fresco? No, ben frollato. I grandi Chef sfatano vecchi miti. In Gambero Rosso, n.355, Agosto 2021. A. De Santis

⁴⁶ Odležavanje nije rezervirano za mesne odreske, Saša Began eksperimentira s ribom i to uspješno. Dobra Hrana (dobrahрана.hr). V.Babić, 2021

⁴⁷ Pesce fresco? No, ben frollato. I grandi Chef sfatano vecchi miti. In Gambero Rosso, n.355, Agosto 2021. A. De Santis

⁴⁸ Pesce fresco? No, ben frollato. I grandi Chef sfatano vecchi miti. In Gambero Rosso, n.355, Agosto 2021. A. De Santis

⁴⁹ Oltre la frollatura, J.Ticchi. 2021

Here we would like to advise, not to set a specific duration for the maturation program, at least at the beginning; and maybe to do some "tests" first, experimenting on the different types of fish that you intend to dry-age in the future.



Fish Dry-Ageing at Il Tino, Fiumicino (Rome), Italy

Temperature

Fish dry-ageing needs the same parameters as its correct storage⁵⁰: we can assume that the temperature for a correct maturation falls within a range that goes from zero up to four degrees Celsius.

The low temperature lengthens the dry-ageing time, and, on the contrary, a high temperature favours bacterial proliferation⁵¹. By consequence, a successful dry-ageing must therefore find a balance.

In presence of an ozone generator, however, bacterial proliferation is effectively slowed down. A setpoint of two grades centigrades, a hysteresis of $\pm 2^{\circ}\text{C}$, in this case it may be a good solution.

Humidity

«*Humidity is the first enemy of the fish*», using the words of **Josh Niland**⁵². The Chef **Jay Huang** (Lucky Robot, Austin, USA) states that dehydration, by means of humidity control, is the most important factor⁵³.

An environment that is too humid is an ideal environment in which bacteria proliferate. This must be reduced first with manual operations (such as drying with absorbent paper during cleaning and evisceration), and then through controlled dehumidification. Doing so eliminates, or drastically reduces, the presence of blood and especially mucus, the main cause of the bad smell of fish⁵⁴.

It is also crucial to avoid a too low percentage of relative humidity, causing this dehydration of the skin, ruining eventually meat's texture⁵⁵. The main task of dry-ageing is to reduce internal humidity while intensifying the flavour⁵⁶, without spoiling the texture.

⁵⁰ *The Whole Fish Cookbook*. Josh Niland. 2019

⁵¹ Ferdinando Giannone in *Oltre la frollatura*, J.Ticchi. 2021

⁵² *Il pesce? È migliore se NON è fresco. Rivoluzionarie tecniche di maturazione*. Identità golose Web (identitagolose.it). C.Mangio. 2020

⁵³ *Dry-Aged Fish Comes to Austin, But What Actually Is It?* Austin Eater Website (austin.eater.com). S. Engstrand. 2021

⁵⁴ Interview to the Chef Liwei Liao (The Joint, Los Angeles), in *Everything You Need to Know About Dry-Aged Fish*. Food and Wine (foodandwine.com). A.Wang. 2019

⁵⁵ *Introduction to the science of ageing fish*. La petit Noisette (lapetitnoisette.com). 2021

⁵⁶ *The Whole Fish Cookbook*. Josh Niland. 2019

Relative humidity must therefore also be balanced, in order not to have too many bacteria, nor too much dryness of the muscle and skin⁵⁷.

What kind of level of relative humidity is suitable then?

A sort of “general rule” is given by **Lele Usai**: humidity is related to size. The larger the size, therefore, the higher the RH must be, otherwise drying will not take place homogeneously⁵⁸.

According to **Moreno Cedroni** (Madonnina del pescatore, Senigallia, Italy) relative humidity during dry-ageing must be set at 80%, as the skin must not dry out, otherwise there would be no osmosis with the outside⁵⁹.

Generally speaking and considering the temperature range suggested in the previous paragraph, a recommended Relative Humidity range would be 75%, with a differential of \pm 10%.

Ventilation

As mentioned in the previous paragraphs, for better ventilation it would be ideal to hang the fish whole (or if possible). Otherwise, an arrangement of the slices on the grill leaves enough space for the air to pass.

The Inox Bim Climatic Cabinet allows three options:

- *Ventilation off*: in this case the fans switch on only when the compressor is operating.
- *Ventilation always on*: fans are always operating.
- *Ventilation on at time intervals*.

⁵⁷ Ferdinando Giannone in *Oltre la frollatura*, J.Ticchi. 2021

⁵⁸ «At least, this is what I do» says the Chef. *Frollatura del pesce, cos'è e a cosa serve*. Cibovagare (cibovagare.it). A.Febo. 2021

⁵⁹ *Pesce fresco? No, ben frollato. I grandi Chef sfatano vecchi miti*. In *Gambero Rosso*, n.355, Agosto 2021. A. De Santis

Balancing the airflow is necessary to favour the set Relative Humidity rate and avoid the danger of the meat drying out⁶⁰.

Inox Bim recommends ventilation always on.

Ozone

To properly dry-age a fish, an adequate bacterial environment must be created. From there, it shouldn't be handled anymore, to prevent any unwanted bacterial contamination⁶¹.

So, not only a fresh product, but also, using the words of Chef Lele Usai: "almost sterile environments"⁶².

Sanitation in Inox Bim climatic cabinets is provided by ozone. There are in fact two types of generators that can be featured: the simple generator and the generator with detection probe. The latter is more accurate as it detects the amount of ozone present in the room. The first simply indicates the amount of ozone generated.

Ozone is generated with an electric discharge (corona effect): it can be harmful only if inhaled in large quantities (far greater than those that can be contained in the cabinet). It is particularly effective against the most common bacteria on the surface of the fish⁶³.

The downside could be an acceleration in the oxidation of meat, a danger that, however, is not run with a low concentration and constant ozonation over time.

In the presence of a simple ozone generator, Inox Bim recommends a program with 30 seconds of ozone generation every 10 minutes.

Inox Bim recommends, if the ozone generator with probe is featured, to maintain a level in the cell of 0.10 PPM. (This is the PPM value that the probe detects in the cell. The level of the ozone generated is higher though, as both the fat, and the fish carcass are excellent catalysts. The probe will detect, to put it simply, residual ozone).

⁶⁰ Ferdinando Giannone in *Oltre la frollatura*, J.Ticchi. 2021

⁶¹ *Il pesce? È migliore se NON è fresco. Rivoluzionarie tecniche di maturazione.* Identità golose Web (identitagolose.it). C.Mangio. 2020

⁶² *Frollatura del pesce, cos'è e a cosa serve.* Cibovagare (cibovagare.it). A.Febo. 2021

⁶³ As such: Vibrio, Aeromonas, Edwardsiella, Pseudomonas, Streptococcus, Flavobacterium. *Bacterial Flora Associated with Diseased Freshwater Ornamental Fish.* N.Walczak, K.Puk, L.Guz. 2017

Monitoring the Dry-Ageing process

If in the presence of a glass door, the product can be monitored during the process, at least from a visual point of view, without having to open the door.

The properly dry-aged fish will look pretty much like a fresh one⁶⁴, with the only differences of some darker nuances due to oxidation⁶⁵, and a slightly more dehydrated look.

In fact, due to the loss of liquids, there will be a weight loss which, depending on the duration of the maturation, will normally amount to more than 30%⁶⁶. In case the Climatic Cabinet features the “weight loss function”, we suggest you set the notification for every step of weight loss (check on YouTube: “*INOX BIM Digital Control. First steps - Setting notifications*”)⁶⁷.

Yet one more way to check if the dry-ageing process is going correctly is the smell. «*Every problem - starting with the bad odour that always accompanies a fish that is not fresh - derives from the incorrect temperature and the presence of water, in which bacteria develop*»⁶⁸. By carrying out the correct dry-ageing, given that this has parameters that are also ideal for conservation, it will increase the shelf-life of the product, thus eliminating those chemical compounds (first of all, trimethylamine) that cause bad smells..

Finally, the PH. When glycogen converts to lactic acid, the pH of the muscle tissue begins to drop from the initial physiological values of approximately 7.2 to the final post-mortem pH of between 5.5 and 6⁶⁹.

If you have an acidity meter, check that the pH of the meat is at the level mentioned above: this is essential for the success of the maturation⁷⁰.

⁶⁴ *Todo lo que debes saber sobre la maduración del pescado*. Diario Sur (diariosur.es). E.Pelaez. 2021

⁶⁵ We remind you that oxidation also occurs without the use of ozone, which at most accentuates it in a barely perceptible way, if kept at a level as recommended above. *Pesce fresco? No, ben frollato. I grandi Chef sfatano vecchi miti*. In Gambero Rosso, n.355, Agosto 2021. A. De Santis

⁶⁶ *Pesce fresco? No, ben frollato. I grandi Chef sfatano vecchi miti*. In Gambero Rosso, n.355, Agosto 2021. A. De Santis

⁶⁷ <https://youtu.be/W4q5YurEh-k>

⁶⁸ Josh Niland, quoted in *Il pesce? È migliore se NON è fresco. Rivoluzionarie tecniche di maturazione*. Identità golose Web (identitagolose.it). C.Mangio. 2020

⁶⁹ *Post-mortem Changes and Assessment of Fish Quality*. N. Alam. 2007

⁷⁰ Ferdinando Giannone in *Oltre la frollatura*, J.Ticchi. 2021