Merrior – The Good Flavors of Oysters

*By Michael A. Rice**

It has been known for eons by ostreophiles (lovers of oysters) that oysters of the same species will taste very differently depending upon where they are grown and the season of the year.

Figure 1. A green-gilled *Crassostrea gigas* oyster grown in the Marennes Oléron Bay Region and finished in claires for greening of the gills with marennine algal pigment. Photo courtesy of Cagette Canteen and Deli, Bangkok, Thailand.

This variation in taste in oysters parallels very closely a similar phenomenon that occurs with varietal wine grapes. In varietal wines, *terroir* is the concept that their flavors are derived from a sense of place. The vineyard's soil characteristics, terrain and drainage, sunlight, water quality, microclimate, etc. all contribute to a unique flavor that encapsulates a particular place and time. Those who market wines are well-accustomed to the value of terrior, as wines from particular vineyards and chateau wineries can command very premium prices due to their reputations, which have built up over time as a result of the terrior of their grapes.

In French, the word *mer* means sea, so the portmanteau term *merroir* was coined to describe a sense of *terroir* for oysters, and the term has become popular around oyster bars, particularly in North America.Each oyster is intimately impacted by the body of water it comes from, the algae it feeds on, the strength of currents and tides, the mineral content of the seafloor, rainfall, temperature, season and more. Although oysters can be the same species and grown in a similar manner, just a difference of a few hundred meters in location can have a big effect on their flavor.

The flavors of oysters are most often described as having three phases: an initial first impression stage involving saltiness, a second stage involving body and sweetness, and a final third stage, often described in terms like floral, fruity, or metallic aftertastes or finishes. But what are the factors that affect the flavors of oysters and how? Of course the species of an oyster has a great influence upon its taste. For instance, various popular oysters such as the Eastern oyster, *Crassostrea virginica*, the Pacific oyster *Magallana (Crassostrea) gigas*, the Olympia oyster, *Ostrea lurida* and the European flat oyster, *Ostrea edulis*, all have distinctive flavors that are characteristic to the species. Pacific oysters have what is described as a robust full bodied flavor, whereas Eastern oysters are often described as having a salty taste of the sea and a more delicate, sweeter flavor. The Olympia and European oysters are frequently described as having a full-bodied flavor but with a slight metallic finish.

The merrior of an oyster is most prominently experienced when eating oysters of the same species, but harvested at different times of the year or harvested from different water bodies. One of the largest differences in taste of oysters at different times of year has to do with how ripe the gonads of the oysters might be during a particular season. During the spring season in the northern hemisphere for example, oysters emerge from inactivity during the cold winter and are met by lengthening days and warming waters. These conditions are favorable for spring phytoplankton blooms and intense filter feeding by the oysters. During this period of abundant food and relatively cool waters, oysters undergo rapid gonad maturation and build-up of an energy storage molecule called glycogen that is a complex carbohydrate consisting of a string of glucose (sugar) molecules in a chain.

Oysters are the fattest just prior to their late spring or early summer spawning period, with ripe gonads, displaying a creamy-colored appear-

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Figure 2. Oyster claires near the village of La Cayenne, in the Marennes-Oléron region of France.

Figure 3. Matunuck Oyster Farm, South Kingstown, Rhode Island USA. Photo by M.A. Rice.

ance to the soft tissues that fill up the shell cavity of the oyster. This is the time when oysters have their sweetest flavor and pleasing texture. Later in the summer, when the oysters have spawned out, their meat is thinner and glycogen is expended, so their taste becomes more bland.

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Oysters in the temperate zone will typically regain some stored glycogen, and thus some their flavor, as the result of autumn phytoplankton blooms and building up glycogen stores to fuel their next overwinter period of low temperature inactivity.

The salinity of growing waters also has a profound influence on the flavors of oysters. Oysters, like many marine invertebrates, physiologically adapt to higher or lower water salinities by adjusting the concentration of dissolved substances in their cells to match the salinity or osmotic concentration of their aquatic environment. This physiological process of maintaining relatively constant cell volume by oysters in variable salinity is referred to by physiologists as *osmoconforming*, or matching the osmotic pressure of fluids inside and outside of the cells. If the concentration of dissolved (osmotically active) molecules inside the cell is higher than the concentration of dissolved osmotically active ions in the seawater, then water will be drawn into the oyster cells from the seawater and the cells will swell, or even burst if the concentration difference is drastic. Conversely, if the concentration of dissolved osmotically active ions in seawater becomes higher than the osmotic concentration in the oyster cells, the cells will shrink in volume as water is drawn out of them.

Seawater, of course, is primarily made up of sodium and chloride ions, and to a lesser extent magnesium, sulfate, calcium and other ions and molecules as well that generally impart a salty taste. However, the primary osmotic solutes inside oyster cells, and the cells of many other delicious marine invertebrates, are free amino acids. These are uncombined amino acids that could, if assembled, become protein chains. For example, the free amino acids that are most abundant in high concentrations in Pacific oyster tissues are glycine, alanine, serine, aspartic acid, and glutamic acid, along with the non-protein amino acid, taurine [See: Rice and Stephens. 1987. Aquaculture 66:19-31]. These free amino acids impart a rich pleasant flavor to oysters, and other invertebrates, that the Japanese call the *umami* taste. Indeed, one free amino acid, glutamic acid, in its monosodium form (MSG) has been used for many decades as a food flavor enhancer. And *umami* taste receptors have been discovered on the human tongue, providing a neurophysiological basis for adding *umami* to the list of basic human tastes that have traditionally included sweet, sour, salty and bitter [See: Chaudhari, Landin, and Roper. 2000. Nature Neuroscience 3(2): 113-119].

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The overall concentration of free amino acids in oyster tissues has a profound influence on oyster taste. When oysters and other *osmoconforming* invertebrates adapt to low salinity water they lose free amino acids in their cells, and as a result, they assume a bland 'washed out' flavor. Conversely, when the same oysters are raised in higher salinity waters, there is a gain in free amino acids in their tissues and a rich *umami* taste comes through. It is for this reason that oysters grown in higher salinity waters are often sought after as having good merrior.

Salinity is not the sole criteria for good merrior. Different trace minerals, in combination with salinity, temperature, and time of year will determine the timing of various phytoplankton blooms that feed oysters. However, phytoplankton blooms occur in various patterns: as cycles, trends, fluctuations, unusual events and irregular pulses. And these can occur at various time scales: hourly or less, daily, seasonally, annually or over decades, and even chaotically, at varying frequencies (See: Smayda. 1998. ICES Journal of Marine Science 55: 562-573). Since different phytoplankton have differing nutritional value to oysters and can also impart different flavors, it is no wonder that locations prone to having blooms of favorable phytoplankton strains with greater frequency are the best for good merrior. There are known species of phytoplankton such as the chain-forming diatom *Skeletomema costatum* and boat-shaped diatoms of the genus *Navicula*, among others, that are known to impart good flavor to oysters, so oyster grounds in areas with frequent blooms of favored phytoplankton species would have the best merrior.

The oyster farmers likely to have the best understanding of the marketing value of merrior are those of the Marennes Oléron Bay Region (45.78N, 1.11E) in the Charente-Maritime Department of Southwestern France. This region has a long history of oyster farming dating back to well before the 17th century, and part of the traditional finishing process was to place market sized oysters into salt marshes for a month or more prior to sale so that the oysters fattened and developed a greenish color to their gills (Figure 1). King Louis XIV of France was reported to be fond of these green-gilled oysters, thus contributing to their enormous popularity, at least among the French aristocracy of the time. As time went on, the practice of finishing oysters prior to sale evolved into a process of placing them into shallow managed ponds called *claires* in which the pond water could be managed to at least partially control the blooms of various phytoplankton species (Figure 2).

It was eventually found that the greening of the oyster gills was caused by oysters eating a specific opportunistic diatom, *Haslea ostrearia*, that produces a water-soluble green pigment now known as marennine [See: Gastineau et al. 2014. Marine Drugs 12(6):3161-3189]. Management of the phytoplankton blooms in the *claires* has focused upon promotion of *Skeletonema costatum* and other diatoms for fattening and *H. ostrearia* for the "greening" of the oysters prior to sale [See: Soletchnik et al. 2000. Aquaculture 199:73-91]. Thus the oyster farmers of Marennes Oléron Bay truly show that assuring good merrior in oyster farming need not necessarily be a haphazard process of farm site selection, but it can also be a managed process that adds considerable value to the product.

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