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THE OYSTER MARKET FACED WITH THE OPPORTUNITY TO COMBINE THE ENHANCEMENT OF MADE IN ITALY AND ENVIRONMENTAL DEFENSE

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Index

INTRODUCTION

This paper aims to demonstrate the importance of oysters for sea conservation and the potential of the oyster farming market for Italy, from both economic and environmental perspectives.

It is estimated that by 2100, due to global warming, most of Italy's coastline will be submerged by sea level. The latter could rise even more than 1 meter. Obviously, rising water levels bring subsequent coastal erosion, and the likelihood of flooding becomes even more tangible. ENEA studies estimate that by 2100 the Mediterranean Sea could rise up to 1 meter and reach a peak of even 1.4 meters in the upper Adriatic Sea.

The modern industrial agribusiness model, which has emerged over the past 50 years, may have led to increased productivity in the immediate term, but the environmental impact has been devastating: pollution, soil erosion, damage to the landscape, reduced energy resources, and an overall loss of diversity, both biological and cultural. Under this model, agricultural production has taken on the characteristics of industry, changing form and becoming an agribusiness industry. The hallmarks of this system, namely the increasing use of petroleum derivatives (fertilizers and pesticides, fuel for farm equipment), the spread of monocultures, especially to ensure animal feed, have caused serious consequences for the environment and compromised the economic survival of small producers. According to this model, natural resources are regarded as mere raw materials to be consumed and processed on a large scale with indiscriminate exploitation of resources such as water, land, soil and forests. This approach carries heavy consequences, with alarming prospects for the future and health of our environment. With the world population expected to increase from 6 billion to 10 billion by 2050, competition for the use of natural resources will become increasingly fierce, putting further pressure on our planet. The current global food system will have to be radically overhauled if its impact on the environment is to be significantly reduced.

In this paper we will go in the first chapter to show the importance of aquaculture in this revisiting of the food market by moving from a global to an Italian national view. Also, regarding aquaculture, we will go into detail trying to demonstrate the potential of oysters as a sustainable future food and market opportunity for Italy.

Then after an analysis of the national market for the product we will go on to propose a sustainable methodological approach to Italian oyster farming through an operational structure first, and afterwards focusing on innovative technologies to support this sector. Also important is the role of product branding by means of Made in Italy. All this in line with the new United Nations directives and the needs of our territory.

1. The challenge of the aquaculture sector for future environmental protection

1.1 Bioeconomy between natural resources, agriculture and the environment

In the European debate, the bioeconomy covers all sectors and systems that rely on biological resources, i.e., animals, plants, microorganisms, biomass, waste, and organic waste. In particular, it includes and connects terrestrial and marine ecosystems and the services they provide; primary production sectors that use and produce biological resources (agriculture, fisheries, and aquaculture); and all economic and industrial sectors that use biological resources to produce food, feed, bio-based products, energy, and services. The bioeconomy is a real driver of the European economy and a strategic sector in several countries on the Continent, with a total turnover of 2.3 trillion euros and employing 8.2 percent of the EU workforce. Three-quarters of that employment and two-thirds of the turnover are due to agri-food systems. To contribute substantially to the well-being of citizens and the economy, the European bioeconomy must be based on the principles of sustainability and circularity. In doing so, it will help modernize the primary sector and related industries, safeguard the environment, and preserve biodiversity. Realizing the potential of the bioeconomy will only be possible through heavy investment in research and innovation in all the sectors involved, seeking to translate innovation within new products and services. A development in sustainable terms of the bioeconomy could bring the creation by 2030 of one million jobs and provide an essential contribution to building a decarbonized future, grasping the targets of the 2030 Agenda and the objectives of the Paris Climate Agreement. In Italy, the bioeconomy sectors produce a total turnover of 328 billion euros and employ more than two million people, with the agri-food sector accounting for 60 percent and 67 percent, respectively. Over the past decade, the sector, at the global, European and national levels, has faced numerous challenges that have resulted in strong pressures from both production and environmental perspectives. Moreover, economic inequality is also producing problems of malnutrition and food shortages in our country. Moreover, there are countries where much food is wasted and with a high number of overweight or obese people, and countries with a significant proportion of poor people who suffer from food shortages and are at risk of malnutrition. The development of food production given current production patterns poses major environmental issues related to livestock activities and intensive production systems (e.g., loss of biodiversity, CO2 emissions, etc.) that need to be addressed by promoting a new model of agribusiness development. A model supported by adequate training and the adoption of technological innovations that enable sustainable production intensification while ensuring food safety and limiting the impact on natural resources. The food sector is called upon to adapt cultivation, management techniques to new issues and in a circular economy perspective, ensuring economic, social and environmental sustainability and implementing policy tools that also enhance the social and environmental role of the companies and entities involved. The food sector must contribute to safeguarding public health through the promotion of healthier and more sustainable lifestyles in order to encourage circular and sustainable resource management with consequent positive effects on climate and biodiversity. Also important are business governance and management models capable of promoting innovation, healthier and more sustainable lifestyles and products, and the resilience of agrifood systems.

The blue economy, for example, plays a crucial role in Italy, thanks to its 8,000 km of coastline and a strategic position in the Mediterranean. Its enhancement is a function of adequate knowledge of the structure and function of natural systems. Knowledge, in fact, will allow on the one hand the planning of environmental management and conservation policies by redesigning the economic activities that insist directly or indirectly on the marine environment, and on the other hand the implementation of an ecosystem approach to the management of marine resources.

European agribusiness is a real driver of the economy and a strategic sector in several European countries. In 2018, the agrifood sector contributed about 3.7 percent to European GDP, employing 44 million people. In Italy, agribusiness with a total value of 219.5 billion euros, or 14 percent of total GDP, and 1.4 million people employed is one of the most prominent sectors. In terms of enterprises (Federalimentare, 2019 Report), according to ISTAT data for 2016, the food industry is second in number of enterprises - 56,750, of which 53,360 are in food and 3,390 in beverages - only to the metal products manufacturing sector and followed, with a wide gap, by the machinery and equipment repair, maintenance and installation sector. The size distribution of Italian food and beverage firms according to the current identification criteria sees a clear dominance of micro and small firms, which together accounted for more than 98 percent of the total in 2016, and with a trend that between 2012 and 2016 saw a growth of about 3 percent for small firms and an equal decrease (-3 percent) for micro firms. This is followed by medium-sized enterprises, which accounted for about 1.3 percent of enterprises in 2017, and which, among the various classes, grew the most, by 13 percent, between 2012 and 2016; and then by large enterprises, with a low incidence on the total number of enterprises in the two macro-compartments: only 0.2 percent in 2016, with a 2012-2016 change of 11 percent. In summary, while the presence of very small firms is still entirely prevalent, a fair increase in average size can be observed in recent years, thanks to a relative increase in the number of relatively larger firms. According to ISTAT data, those employed in the food and beverage industry are in 2016 (latest available data) about 360 thousand. According to Federalimentare projections, they have further increased to about 385,000 in 2018, with an overall growth, considering the entire 2012-2016 period, of +5.05 percent.

The Italian bioeconomy encompasses all the main sectors of primary production, such as agriculture, forestry, fisheries, and aquaculture, the biological resource processing sectors, such as the food and beverage industry, the wood, pulp and paper processing industry, biorefineries, and some of the chemical, cosmetic biotechnology, and energy industries, as well as the marine and maritime industries. The Italian bioeconomy currently generates about 328 billion euros in annual turnover with 2 million jobs. The "Italian Bioeconomy Strategy" (BIT) aims to achieve a 15 percent increase in the current performance of the Italian bioeconomy by 2030. These estimates include all sectors of primary production on land and at sea, the sectors of biomass processing and products derived from it, including bioenergy, plus the treatment and valorisation of wastewater (12.1 billion euros) and the organic fraction of municipal waste (6.8 billion euros). For the blue economy part, data at the European level also represent relevant values a, with a turnover of EUR 750 billion and 5 million employees in 2018 (+11.6 percent from the previous year), the EU blue economy can also be described as being in a good state of health.

Although sectors such as coastal and marine tourism, fisheries and aquaculture have been severely affected by the coronavirus pandemic, the blue economy has enormous potential to contribute to green recovery.

1.2 The contributions of shellfish aquaculture to global food security

Food security is central to the vocalization of the United Nations 2030 Development Agenda, which, adopted in 2015, outlines 17 Sustainable Development Goals (SDGs).

The fastest growing sector of food production is aquaculture, which also carries with it the characteristic of being a sustainable option for achieving food security. Food as a basic necessity for human survival is always a topical issue. Therefore, because of the unique role of aquaculture, the demand for aquatic products (especially seafood) is expected to continue to increase due to population growth. Another fascinating feature of fish products is that they are among the world's best protein sources by containing micronutrients and essential fatty acids that are difficult to find in terrestrial protein sources. Apparently, shellfish aquaculture in the coming decades will have to be intensified to fill the gap between supply and demand in a cost-effective way. Only recently have debates emerged regarding the future of food and nutrition, with the world population projected to

reach 10 billion by 2050. While there is no uniform approach to meeting projected food needs, short-term recommendations have been made to ensure more sustainable food production for current and future consumption, one among them being aquaculture. The 3.1 percent growth rate of this sector is faster than the world population growth of 1.6 percent and the growth rate of animal-based farming which is at 2.1 percent per year. This could be because the aquaculture sector creates more economic value through production, marketing and trade. In addition to their high nutritional content, a key theme of the project, shellfish (and thus oyster) cultures are ecologically highly beneficial systems for the environment because they do not require energy-intensive processes.

1.3 The role of the sea for Italy

The sea represents a source of well-being and opportunities: it mitigates the climate, represents a source of food, fossil and mineral resources, retains a significant part of anthropogenic CO2, absorbs a significant part of global warming, supports a global communication network, and is a strategic economic resource linked to many other sectors (tourism, pharmaceutical, nutraceutical, shipbuilding, etc.). For Italy, with its 8,000 kilometers of coastline and central position in the Mediterranean, the sea has always been a major player in the social and economic development and general welfare of its citizens in all the above sectors. Suffice it to say that, as of December 31, 2018, the sea economy had about 200,000 businesses (3.3% of total businesses in the country) with 885.2 thousand employees (3.5% of total employment in the country), and an added value of 46.7 billion euros (3.0% of the Italian economy) (source: UNIONCAMERE, 2018). Sectors such as tourism (30.9% of the national value added produced) make Italy a global leader. The seafood supply chain is internationally competitive registering in 2018 about 706 million euros export (8th Sea Economy Report, 2018). Despite the centrality of the blue economy for the national system, there continues to be a long-term vision that tends to consider the sea as a mere resource to be exploited and not a source of goods and services to be protected for society. Such a view leads to uncontrolled exploitation that could alter marine ecosystems that, as a result, may cease to provide goods and services to humanity. Anthropogenic activities, whether marine or terrestrial, produce impacts on marine ecosystems and biodiversity. The EU population living in coastal cities has more than doubled in the past 50 years, and commercial activities have also increased. In addition to the direct impacts of coastal activities, the river system brings chemical, physical, and biological wastes from agricultural, civil, and industrial activities from inland to the sea. Maritime transport contributes significantly to environmental pollution due to, for example, the use of outdated technologies, often inadequate regulations, and environmentally unfriendly behavior. The risk of accidents due to the use of poorly maintained vessels, coupled with poor ballast water management, illegal discharge of bilge water, and tank washing at sea, have serious consequences on marine environments and their habitats, compromising their biodiversity. These are just a few examples of the negative effects generated by the economic activities of the blue economy that risk irreversibly compromising biodiversity and the proper functioning of ecosystems essential for the physical, social and economic well-being of humans, and the entire planet.

While in Italy the sea is an asset that has yet to be fully exploited, the need for environmental protection-which all economic sectors must respond to-implies the need to adopt sustainable production models for the blue economy as well. The sector's economic potential and the need to preserve natural resources provide the basis on which to focus research and innovation activities to embrace an ecosystem-based and sustainable approach to the management of blue economy economic activities.

The European Commission's New Green Deal proposes a new model of the organization of our production and consumption systems, which will have to be based on respect for the environment-society-economy hierarchy, and consequently, the National Research Plan (NRP) will have sustainability as a cross-cutting theme. Sustainability-environmental, social and economic-requires improving and consolidating knowledge of the sea and its relationship with land-based activities.

Knowledge development will not be able to ignore, in addition to established traditional approaches, the use of digital and satellite technologies and the exploitation of the potential related to the use of artificial intelligence, machine learning and aquaculture 4.0. Thus, all lines of research in the coming years will have to take into account not only the need to develop sustainable initiatives, but also include research initiatives aimed at restoring sustainable conditions where these have been seriously undermined. The sustainability model adopted in the NRP (National Research Program) requires that the proposed priority lines of research take into account the interaction between the spheres:

1. Environmental (which includes ecosystems, society and the economy);
2. Social (which contains all the interactions between humans that make up various societies, and the economy);
3. Economic (which contains interactions involving the production and consumption of goods and services directly related to human activities).

Marine sustainability implies that all activities produce well-being, economic development, and social equity without having significant impacts on biodiversity and the functioning of marine and coastal ecosystems.

1.4 Oysters as a potential future food and sustainable Made in Italy product

The food of the future was described by Parodi as a food whose production capacity is developing rapidly due to technological advances, offering the potential to increase the level of production. These capabilities also include the ability to reduce production costs and environmental concerns.

In this vein, especially for Italy regarding emerging economic opportunity, is oyster farming.

Identifying suitable oysters as a future food and opportunity for the Italian market requires information from a multitude of sources, including research articles, patents, strategic reports from international organizations, and notes from think-tank support groups.

Indicators to be met to qualify as a potential future food. This section identifies four key indicators for earning this label (three of which are related to the production stage):

1. Response and tolerance to biotic and abiotic stressors: although many marine mollusk species are more versatile than others in terms of thermal tolerance, there are shortcomings in their consideration as future primary food sources. One of these is their low survival rate in captivity. Consequently, this is an important priority area that requires immediate research attention to improve shellfish survival through improved breeding technologies (i.e., genetic improvement) and optimization of environmental conditions during culture. Enhancing the survival and production characteristics of shellfish in the presence of rapidly changing biotic and abiotic stressors caused by efforts to maintain or increase production efficiency is also an essential area of research to be considered.
2. Availability of biological and technical knowledge: The many successes in aquaculture operations to date can be attributed to a sufficient understanding of the biological and technical aspects of the species being farmed. Therefore, it is necessary for the future of the industry to seek information on their biological and culture techniques to achieve sustainable mass production. To date, sufficient biological and technical knowledge is available for oysters, which partially justifies their candidacy as the food of the future.
3. Life cycle and maturity period of spawners: It is important to note that the short life cycle of a cultured species will be translated into the production of fast food. Therefore, to generate enough future food from seawater, species with relatively shorter life cycles must be considered. Most marine mollusks fall into this category compared to the relative life cycles of marine fish species. This includes their embryonic development to market size. The short life cycle of oysters justifies the great potential as a future food.

4. Nutritional value and health benefits: Oysters have immense beneficial properties that are inferred from their nutritional ones. Suffice it to say that they possess zinc, calcium, sodium, potassium, phosphorus and iron and multiple Group B vitamins. Typically for 100 grams of oysters as reported on Humanitas, the intake is as follows: 10.2 g protein; 0.9 fat; 5.4 g carbohydrates; 69 Kcal. The presence of calcium and phosphorus are essential for bones and teeth: they help give strength and energy to our muscular system. The presence of iron is a boon for our connective tissue and for the production of specific hormones, an indispensable component of hemoglobin. Omega 3 is known to all for its beneficial properties. Zinc, on the other hand, helps to strengthen our immune defenses, protecting us from bacterial attacks.

The role of shellfish in combating CO2 emissions. oyster farming could play a crucial role in environmental protection against climate change and rising seas. As with the capture of carbon dioxide in the air by forests, oyster shells are formed through the biomineralization of carbon, taken from the atmosphere where it is present in the form of carbon dioxide. This biological sequestration in the sea occurs through a complex mechanism of photosynthesis by phytoplankton, used as food by mollusks and then fixed in the calcareous shells of bivalves. This is a completely natural and minimally wasteful process. We are talking about a mechanism that goes by the name of biosequestering: carbon dioxide is taken out of the water and transformed into calcium carbonate, a key element in the construction of the shells of all mollusks. The carbon footprint emissions associated with their production are a fraction of those associated with the production of terrestrial meat or even farmed salmon. When one also considers that feed and antibiotics are not required for their cultivation, it can be said that the environmental impact of aquaculture oyster production is significantly less than all other sources of industrially produced animal meat. Meat produces between 19 and 37 kg of carbon dioxide per kilogram of product, while oysters, could produce thanks to technological innovations only 0.6 CO2/Kg of product.

2. Analysis of the Oyster Market in Italy

2.1 Market Overview

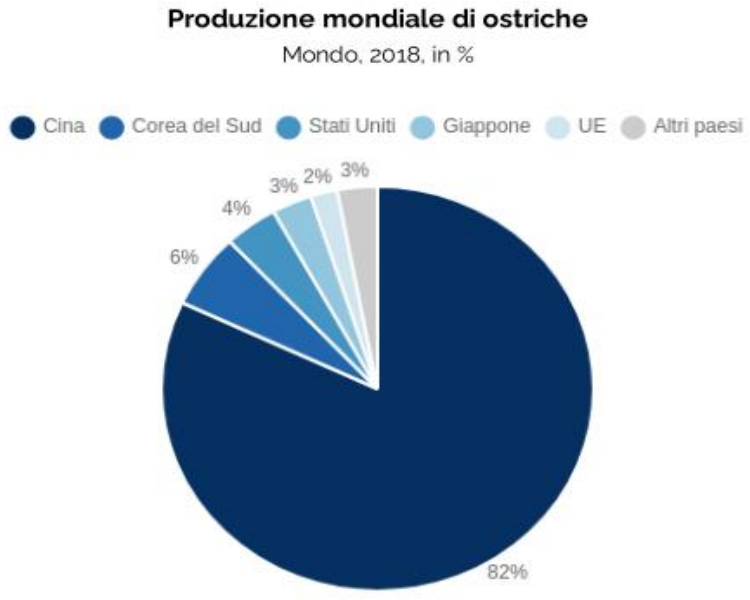
After addressing the importance of aquaculture in general and shellfish in particular for future nutrition and environmental protection we find ourselves analyzing the market with the most room for growth and least developed among shellfish in Italy, that of oysters.

Among edible bivalve marine mollusks we find the oyster family. Their consumption, which occurs especially outside the production period, is mainly from September to April, but in recent years we can find them available throughout the entire year. Oysters are traditionally related to being eaten raw, but they can also be eaten cooked and have great commercial value. Heinrich Schliemann discovered how they have been part of the diet of the Mediterranean basin since prehistoric times and have always been present on much of the Greek coast, as well as on the Italian and French coasts. The oyster market fits into the macro sector of the seafood market.

In 2018, the global oyster market was estimated at $7.46 billion. Although growth in 2020 was negative it is expected that for the five-year period 2021-2026 this market will increase at a CAGR of 5 percent.

From a quality point of view, Italy is one of the best nations in the world with regard to oyster production along with Normandy, which however still boasts the title of World Leader, but we are certainly very competitive in terms of price. Among the regions of the boot, the largest farms can be found in Liguria, Puglia, Veneto, Sicily and Sardinia: Oyster production in Italy amounts to a maximum of 170 tons per year. Fedagripesca-Concfcooperatives, with substantial investments, have been carrying out the goal of growth and reaching the French market of the Italian market for about 10 years.

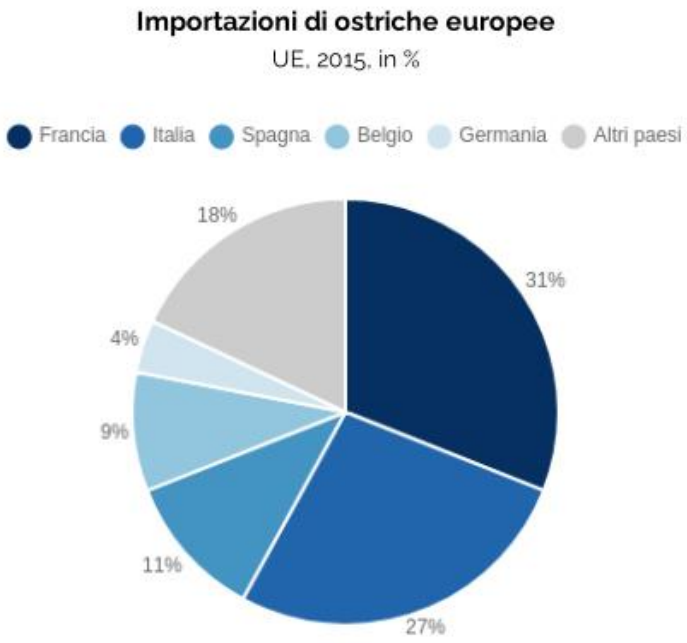
As for **world oyster production** (combining all species), it reached **6 million tons** in 2018 and China is the World Leader.



Fonte: EUMOFA

Chinese production is the only one increasing world production.

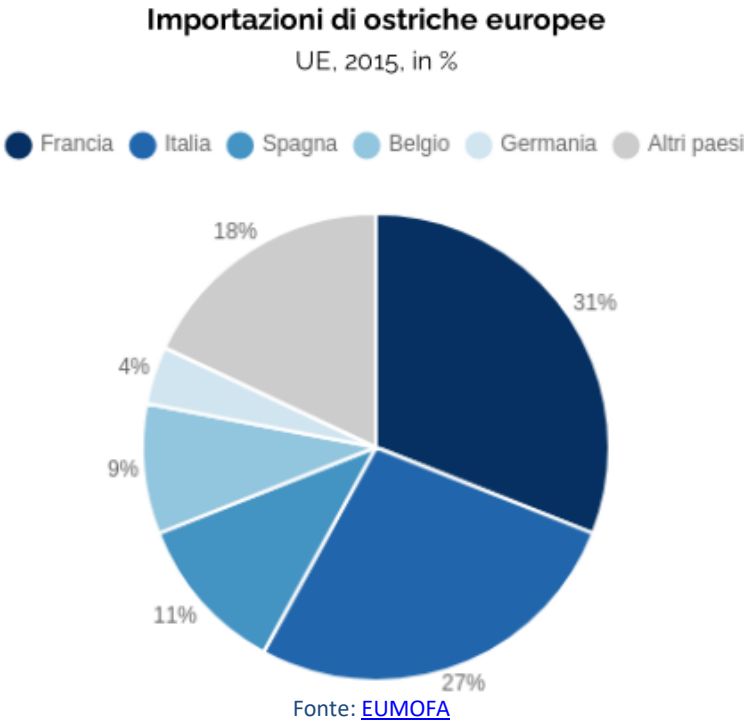
If we look at the European market, the last decade shows a negative trend of -32%. Among European producers (2% compared to world production) we have this breakdown:



Fonte: EUMOFA

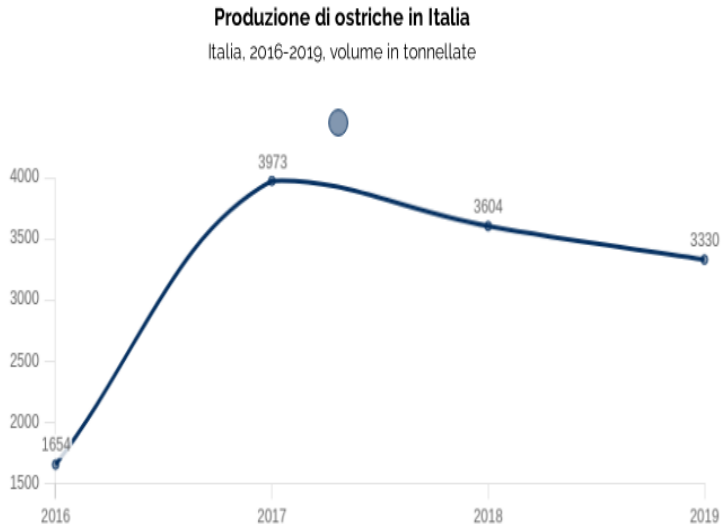
In 2015, European production was 108,910 tons.

Italy has been increasing its production only in recent years, never being among the top producers and still remaining a very small entity (only 0.3 percent of European production). But, a very relevant statistic, it is the second largest European importer of oysters:



Fonte: EUMOFA

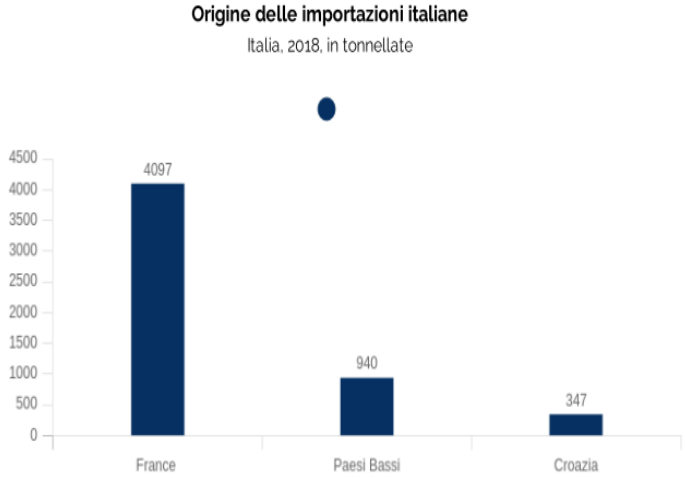
The domestic oyster market, as just mentioned, is still very small in detail:



Fonte: ISTAT

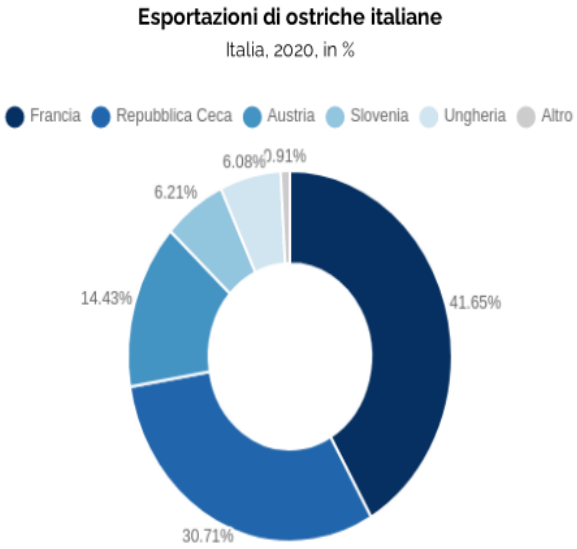
Despite the small numbers, as we will also see in the next chapter in more detail, the development of innovative technologies stimulates interest in production in new areas and allows us to think about the future of Italian oyster farming with optimism.

As mentioned earlier, import for this product has always been very strong:



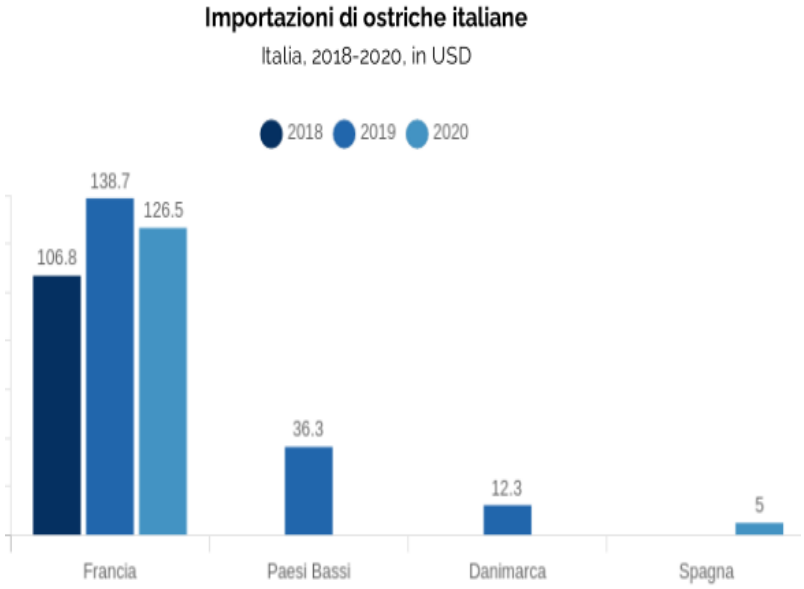
Fonte: EUMOFA

Another interesting fact is that despite being weak producers, Italy, thanks to high as well as particular quality, has a significant export network:



Fonte: Comtrade

Those who import our oysters are mainly:



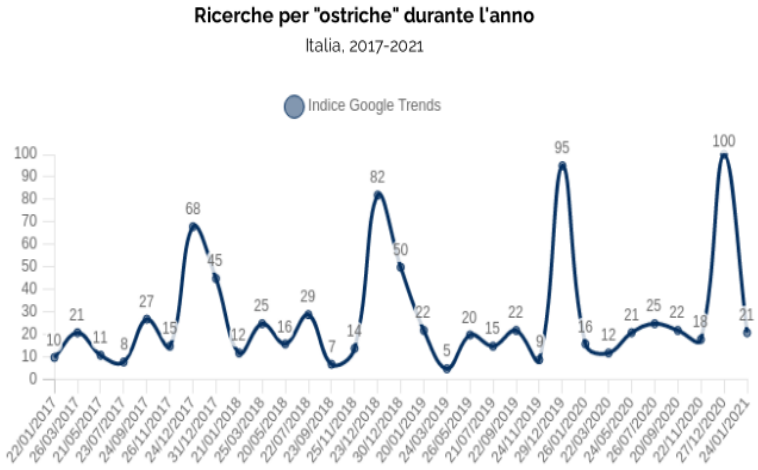
Fonte: Comtrade

Thanks to the data published by Comtrade we therefore understand that imports of Italian oysters occur mainly in France, which is noted to be the only country present in all years, while the others are present only in 2019.
It is good to specify that oysters are only one macrosector of the Italian fish wholesale and therefore also represent only a small part of its exports.
To conclude the market overview, it is only fair to mention **the impact of the Covid-19 crisis on the seafood market**. The oyster market, unlike other world markets, has shown excellent resilience regarding the health crisis.
During the interview with Giuseppe Prioli President of AMA (Mediterranean Aquaculture

Association), the body that established in 2002, promotes the representation, assistance, development and coordination of member companies, in order to promote, enhance and protect all activities along the aquaculture production chain, with particular attention to the shellfish sector, he also answered some questions regarding the response of the fish and oyster market to this period.
The president points out that in 2020, the year of total closure, there was a -25% contraction compared to 2019. However, from September 2020 onward there was a strong recovery. In fact, in 2021 the recovery even exceeded the 2019 figures, with a +10% increase.

2.2 Demand Analysis

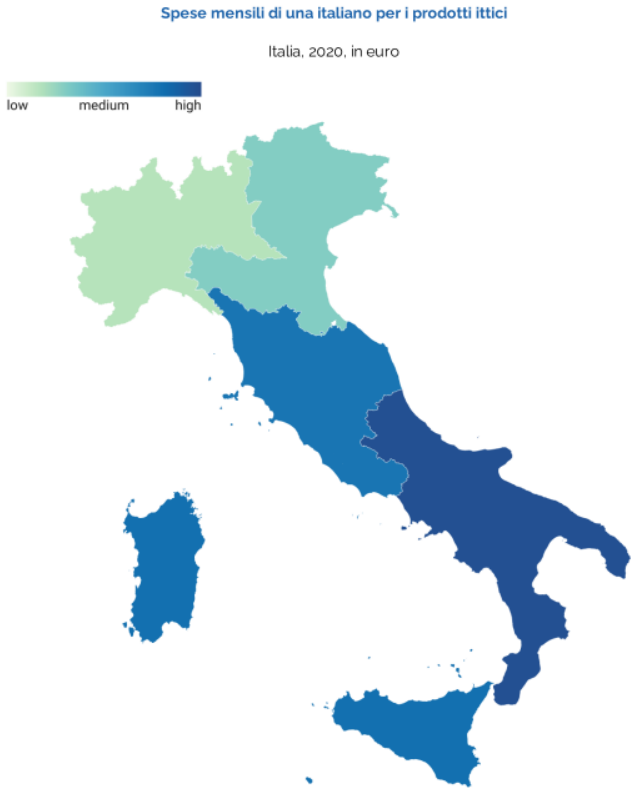
Although oysters are a product available throughout the year, demand is highly dependent on the season.
The search presented in the graph below results from the amount of searches for the word "oysters" in the year.



Fonte: Google Trends

The graph above represents the proportion of searches for a given chiavé word in a region and for a specific time period, compared to when the rate of use of that chiavé word was highest (a value of 100). Thus, a value of 50 means that the keyword was used less often in the given region, and a value of 0 means that there is not enough data for that keyword.
Between Christmas and New Year, on average, there is a +20% increase in demand for oysters in Italy.
While analyzing the demand, it is necessary to make a preamble about the environmental issues that are also increasingly discussed in this market. Recently (2021) studies conducted by several universities (e.g., Ca' Foscari University) and laboratories (e.g., Blue carbon Sink in La spezia) have researched and tested new ways of oyster production with the ultimate goal of fostering competitiveness and market development and ensuring economic sustainability (area growth, new company births, stabilizing price policies), environmental (ensuring control over resource use, low environmental impact) and social (improving the quality of working life of workers in the industry) for the entire industry. Other studies are increasingly concerned with the contamination of seafood, particularly its natural environment, seawater, which is increasingly polluted. Increasing consumer awareness could have an impact on the long-term demand for oysters. Therefore, new forms of oyster production that are increasingly environmentally conscious and responsible are being sought and tried.
Regarding the **segment of the population** that consumes the most oysters, it can be said that the 50+ category definitely ranks first, peaking at age 65. This figure is also relevant for new marketing initiatives towards a younger segment to tell the story of the product by highlighting the potential sustainable side to which the new generations are increasingly attached

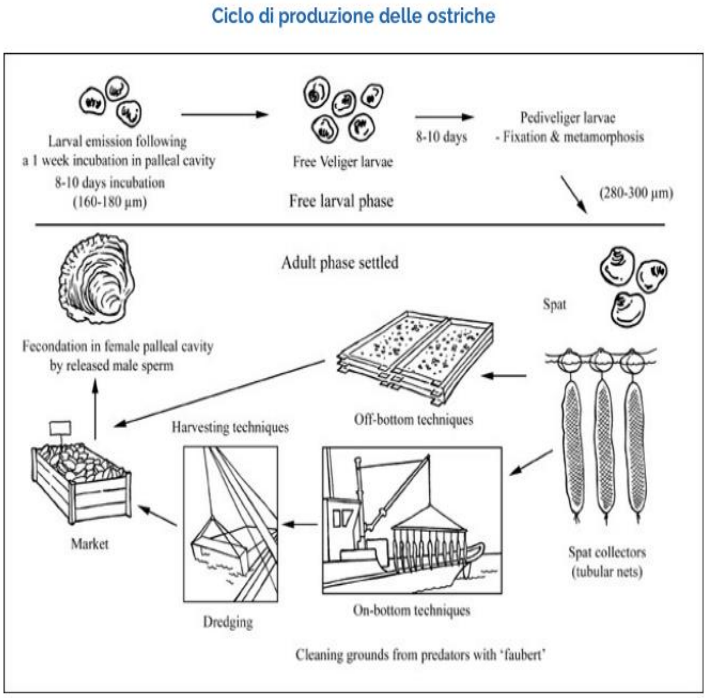
In the following graph we find a **territorial division of consumers**:



Fonte: ISTAT

2.3 Market distribution

The oyster production cycle does not consider a high time.



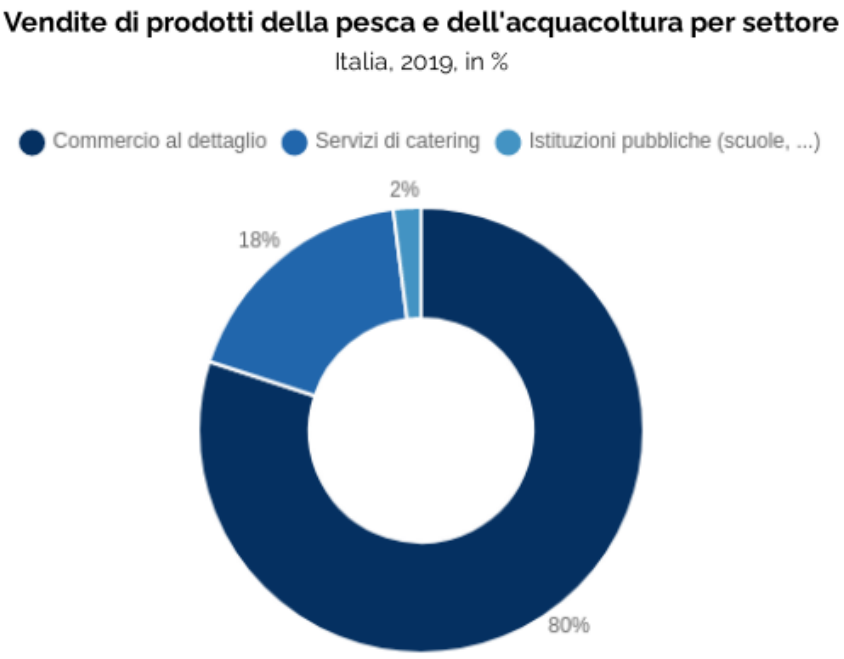
Fonte: FAO

In fact, in a few weeks the final product is obtained. The production cycle is divided into four parts thus:

- Seed production
- Pre-fattening
- Fattening
- Finishing

The journey of an oyster to the table requires good care by oystermen over a period of 3 to 7 years. The main production technique is known as in suspension, also known as the *longline* system. This system is characterized by a basic element consisting of a rope of variable length (cable or beam), anchored to the bottom by means of dead bodies and maintained at a variable depth depending on the characteristics of the production site, for example. Floating structures are installed along the beam that contain the oysters (of average length, usually about 5 cm) in suspension. This system will allow proper supply of nutrients through water circulation.

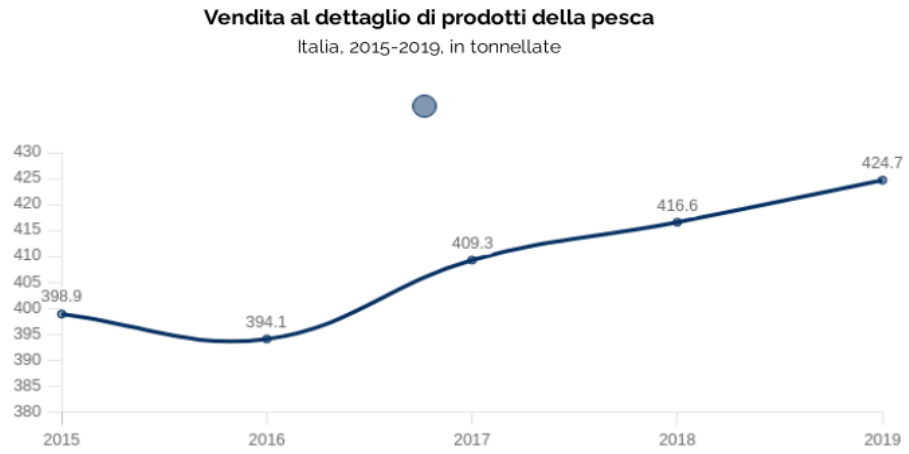
The distribution of oysters goes through the sale of the product in the market. Oysters are part of the world fish market, thus fisheries-related products.



Fonte: EUMOFA

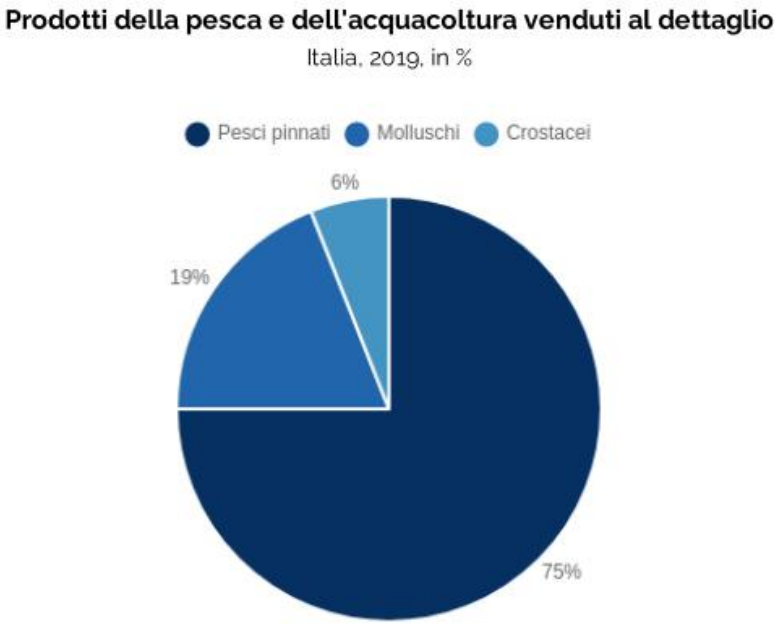
Retail is the main sales channel for unprocessed fishery and aquaculture products. The Olbia Mollusc Farmers Consortium distributes more than half of its production to 600 restaurants where it is a supplier. The other half then is distributed among Liguria, Tuscany, Veneto and Lombardy.

Italy is the only European country to have managed to increase retail sales of the product from 2014 to 2019, with a slight increase of +2 percent.



Fonte: EUMOFA

Of the 424.7 tons of catch sold at retail in Italy, the breakdown of products is as follows:

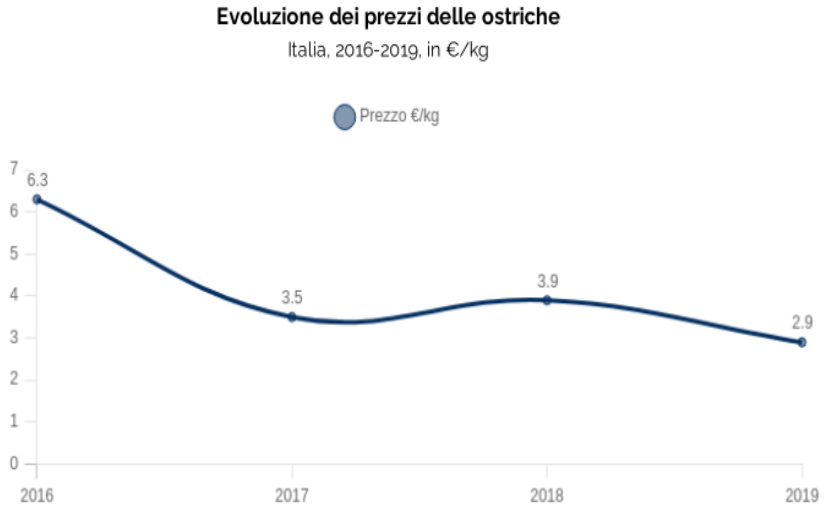


Fonte: EUMOFA

The retail sale of shellfish, and thus oysters, in Italy is very small compared to finfish, but still quite significant in the total, accounting for **90.7 tons**.

2.4 Supply analysis

To analyze supply, we need to start with the price, per kilogram, of oysters, which, as we can see in the following graph, have decreased in recent years:



Fonte: ISTAT

From 2016 to 2017 we notice a very important reduction, while in subsequent years they have experienced small variations.

The oyster market consists of a very large number of different products, distinguished by three species, various areas of origin, numerous brands and gauges. It is, therefore, quite difficult to make an economic assessment of this market. National fish markets at distribution detect the indicative price of conch oysters with reference to a product of medium quality and caliber (gauges 1-2).

Unioncamere's analysis notes what was said earlier that there are three species of oysters produced or consumed in Italy:

Specie	Descrizione
Ostrica piatta europea (Ostrea edulis)	è l'ostrica da sempre pescata e allevata in Europa. Ha una forma tondeggiante e abbastanza regolare, con un diametro che va indicativamente dagli 8 ai 12 centimetri e con una taglia minima di 6 cm.
Ostrica concava detta anche Ostrica giapponese o del Pacifico (Crassostrea gigas)	Ha una forma più allungata e sia la valva inferiore che quella superiore risultano concave, è la specie più allevata al mondo.
Ostrica americana (Crassostrea virginica)	La si trova nei bassi fondali, la raccolta di questo tipo viene fatta maggioritariamente allo stato selvatico. Per questo motivo la sua produzione è in calo

Fonte: Unioncamere

Oysters live in shallow waters up to several meters deep, so near the coast, or preferably in river estuaries. They live an adult life and are usually anchored to rocks or debris but are usually found on sandy or clayey bottoms. They are very resistant to changes in temperature and salinity and also require a water temperature is above 10°C to begin the reproductive phase, while embryonic development requires temperatures above 20°C. Like several species of animals, oysters are hermaphrodites and precursors: the same animal, once sexually mature, is in the first male stage; in the next stage of its existence, it becomes a female, usually laying eggs three times a year. If they lived in more nutrient-rich waters, females would outnumber males. As we will see later, the

technological innovation made available to oyster farming will be crucial to accurate data collection in the growth process for production optimization.

2.5 Regulations

Domestic regulations:
In Italy, the current regulation regarding oysters put in place by the Ministry of Agriculture Food and Forestry follows *Legislative Decree 4/2012*.
In December 2021, the Budget Law was discussed, and the reduction of VAT on oysters has been much debated, creating some discord between parties.
In fact, currently in Italy the Vat on oysters is 22 percent, so it is considered as a luxury product, especially compared with other countries where the Vat is lower (for example, in France the Vat for oysters is 6 percent).
During discussions, some parties called for a reduction in VAT from 22% to 10%. There was no further discussion of this amendment, though, and the Vat on oysters remained at 22%.

European regulation
Regulation No. 708/2007-use of exotic and locally absent species in aquaculture-regulates European standards regarding oysters.

The regulation applies to:

- Movements of exotic species (introductions) or locally absent species (translocations) used in aquaculture in the EU.
- All types of aquaculture farms. However, special provisions are made for closed aquaculture facilities. Translocations of non-native or locally absent species that are to be kept in closed aquaculture facilities may be exempt from requiring a permit, provided that these species are transported under conditions that prevent their spread into the environment. Member states must establish a list of closed aquaculture facilities and update it regularly.

It does not apply to:

- Translocations of organisms within member states, unless there is a risk to the environment.
- Pet stores, garden centers or aquariums where there is no contact with EU waters.
- To Annex IV species subject to certain cases.

It covers all aquatic species and includes all parts capable of survival and reproduction.

2.6 Positioning of actors

Regarding positioning inevitable is a segmentation of the market into three macro areas.

	Nome	Fatturato
Import-Export Prodotti Ittici	GIÓ MARE S.P.A.	16.95 milioni € (2019)
Commercializzazione e Produzione Molluschi e Crostacei	Finittica	12.5 milioni € (2019)
	Del Mar	9.9 milioni € (2019)
Produttori Specializzati	Oyster Oasis	5.3 milioni € (2019)

The second area deserves special mention with Finittica proving to be a leading Italian company in the marketing of shellfish and crustaceans. This one is also involved in the production and in the processing of these sea products. It is based in the municipality of Goro in the province of Ferrara and is therefore contiguous to major Italian shellfish and crustacean farming sites.

The sector of specialized producers is also growing strongly, especially in the regions of Emilia-Romagna, Puglia, Liguria and the two islands. Still few, however, have a sustainable vision of production and distribution as the centrality of their business.

3. Sustainable methodological approach to oyster farming in Italy

The Green Deal calls for looking to the future of the economy by rethinking the concept of sustainability not as a constraint but as an opportunity to maximize the efficiency levels of the blue economy while preserving the natural resources fundamental to human well-being. To this end, a holistic and cross-sectoral approach capable of exploiting synergies to increase the effectiveness and enhance the impact of the actions to be taken is indispensable.

The project of sustainable oyster farming, through the "installation" in the seas of real oyster deposits that absorb carbon dioxide in the sea, is aimed at enhancing the value of national products by making Italy a model of production and marketing of a valuable commodity also for the future. This is part of the NRP (National Research Program) 2021-2027 plan, which has the following objectives with respect to the sea theme:

1. Produce energy with low CO2 and particulate impact.
2. Reduce the spread of non-recyclable materials.
3. Eliminate the use of contaminants that alter marine biota.
4. Manage fisheries and aquaculture sustainably.
5. Develop sustainable industrial practices.
6. Modernize the coastal infrastructure network.
7. Identify ecologically coherent spatial units of marine conservation and management.
8. Assess ecosystem goods and services, and introduce into planning processes the costs induced by their alterations.
9. Embrace the principles of social and economic ecological sustainability.
10. Develop and/or use intelligent digital systems for monitoring and safeguarding marine and coastal resources also in relation to the definition of policies and interventions for climate change mitigation and adaptation.
11. Promote knowledge of the relationships between biodiversity and marine ecosystem functioning to achieve sustainability goals.

Of these, for our purposes, the most relevant are: 1, 2, 4, 7, 9, 10

3.1 Potential operational structure

The project has two types of objectives.

General objectives

- To identify and build innovative business opportunities for the benefit of agribusiness enterprises.
- To raise awareness of innovation among enterprises and support them in developing their own innovation path.
- Strengthen innovation capabilities at the individual enterprise level.

Specific objectives

- Identification and characterization of suitable sites for oyster production.
- Development of a predictive model of accretion applicable in Italian coasts (especially in the South).
- Development of skills including through technology transfer for oyster spawning.
- Use of technologies aimed at giving centrality to the sustainability of the project.
- Enhancement of the *Made in Italy* product.

To give a practical idea of design, let us divide the operational structure of a new breeding site into working-packages:

Working package	Description	Task	Description
WP1Classification and mapping of coastal and marine systems suitable for oyster production	The objective of Wp1 is to identify potential suitable sites for oyster farming through a coordinated spatial planning approach.	1.1 Site mapping for an environmental suitability assessment (Water classification, historical ASL ARPAS data etc.)	The activity of task 1.1. involves the collection of all previous data in particular: chemical-physical parameters; bacteriological and biological parameters; ecological status, chemical status, environmental status and classification of waters for shellfish farming purposes. **Expected result:** overview of the biotic and abiotic characteristics of the lagoons, protection constraints and the activities that take place there.

		1.2 Integration of missing data for eligibility assessment	Data of specific parameters for the assessment of oyster accretion will be sought from universities, regional bodies and gray literature. **Expected result:** integration of data of "background" environmental conditions necessary for evaluation of potential suitable sites for oyster farming.
		1.3 Cataloguing data provided by institutions, organizing and mapping available data	Data provided by institutions will be analyzed and cataloged, and selected metadata will be organized in software for geospatial data management and visualization, Maps or layers (geographic information layers) of scenarios for sustainable aquaculture development planning will be produced. Expected result: cataloguing of all available homogeneous metadata into sharable data-base as a support tool for planning oyster farming in coastal environments.
			The task involves the involvement of stakeholders, such as regulators, with particular reference to

Wp2 Planning the oyster production system.	The goal of Wp2 is to Strengthen institutional capacity and simplify administrative procedures.	2.1 Identification of critical issues and conflicts of use in the production sites identified in the cluster	the Services of the relevant regional departments, managers, operators, and other users of the resource of lagoon and coastal ecosystems for analysis of the difficulty of reconciling different needs of an economic nature (anthropogenic pressure, civic uses, tourist activities) in conflict with the intended use aimed at primary production and environmental conservation. **Expected result:** promotion of the ecosystem approach for the sustainable development and management of aquaculture
		2.2 Assessment of the administrative suitability of sites (analysis cantierabilità timing and fulfillment)	For potentially suitable sites, the administrative status and real settlement potential linked to the authorization and permit regimes dependent on the various competent bodies will be assessed. **Expected result:** to arrive at a picture of the real feasibility of future production settlement proposals.
			Environmental variables, particularly trophic variables, with significant effects on the growth of filter-

Wp3 Assessment of the oyster production potential of the national (and regional) coastal system.	The objective of Wp3 is to acquire experimental data to assess the suitability of sites for oyster farming and production potential.	3.1 Characterization of production pilot sites (environmental and production parameters)	feeding mollusks will be investigated. Characterization of the state of the environment and trophic status will be carried out at pilot production sites. Continuous monitoring of chemical and physical variables of the water column will be carried out for a period of at least one year. In addition, production data from currently used farming systems and protocols will be monitored. **Expected result:** identification of the most useful indicators for improving the selection of suitable sites for oyster farming under different environmental conditions
		3.2 Assessment of impacts (application of circulation models)	The impact of farming on the benthic ecosystem will be investigated at a pilot site by sampling and analyzing sediment as a function of hydrodynamic conditions. **Expected result:** assessment of environmental changes due to pressures from oyster aquaculture in the coastal environment.

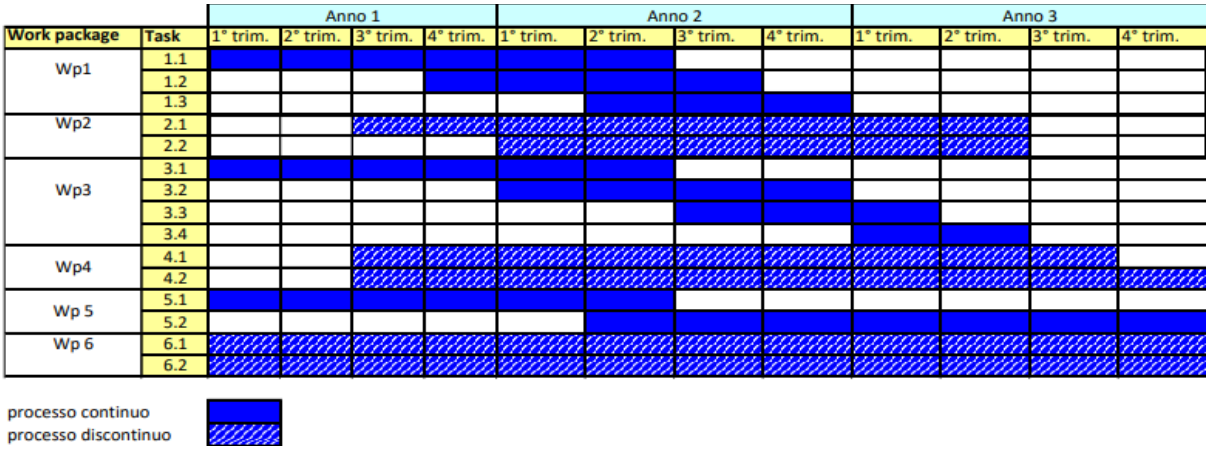
		3.3 Identification of oyster growth pattern applicable in national and regional coastal environment	The applicability of an accretion prediction model based on bioenergy principles will be evaluated. Validation of the model will be done using standardized measurement protocols with environmental and production data from pilot sites. **Expected result:** identification of a tool to help quantify the effects of environmental parameters on oyster growth applicable to the Italian coastline
		3.4 Assessment and mapping of the production potential of pilot sites	Application of the bioenergy model as a tool for screening initial suitability and approximate production capacity based on environmental characteristics. **Expected result:** analysis of oyster farming scenarios in pilot sites.
Wp4 Technology transfer.	The goal of Wp4 is to train the company's staff on the different breeding methods and production stages	4.1 Technology transfer to productive enterprises	Production company personnel and potentially interested operators will be trained through skills exchange and technology transfer by the universities and laboratories most trained in this area. **Expected result:** companies trained in oyster production

			techniques and sensitized to technological innovation.
		4.2 Experimentation with breeding techniques in relation to the environmental characteristics of different regional sites and different growth stages;	Breeding methodologies selected on the basis of morphological and environmental characteristics in suspension or floating systems will be tested at pilot sites. Growth parameters during the production cycle of the tested protocols will be measured to evaluate production performance in different rearing systems and at different stages of the production cycle. **Expected result:** to establish the functional relationship between environmental and methodological breeding characteristics
Wp 5 Plant design and Technology Transfer for hatchery.	The goal of Wp5 is to develop skills for laboratory reproduction of oysters, a key aspect for full sustainability	5.1 Design and implementation of experimental plant for oyster production	It would be consonant to build a hatchery for oyster spawning research activity. The facility would be designed to meet the experimental needs of independently testing individual environmental parameters and different diets. The design should be supported by universities and research institutions. **Expected result:** implementation of a

			laboratory-scale experimental oyster spawning facility
		5.2 Technology transfer and expertise for experimental oyster production	Knowledge of reproductive biology and technical skills for producing and rearing triploid oysters to pre-fattening stage in the laboratory will be acquired. Research personnel will be trained through skill exchange and technology transfer by proven researchers from the same universities and research institutions. **Expected result:** researchers trained on oyster reproduction.
Wp6 IMC	Overhead and coordination expenses	6.1 Coordination and administrative expenses	A project steering cabin and administrative management system for the project will be organized. **Expected Result:** Operational and administrative management of the project.
			To ensure the most effective dissemination of the final results, local seminars will be organized with interaction among project participants; these meetings will aim to learn from each other. Workshops will also be organized not only for stakeholders

		6.2 Dissemination	but also for different actors and relevant regulatory authorities. **Expected Result:** To foster integration among producers make visible the opportunities offered by the sector and disseminate the results of the project

Timeline:



3.2 Technological innovation in the service of sustainable aquaculture: Planetetek Italia's Rheticus model and satellite solution

Fish and shellfish farms, as mentioned earlier, must adapt their farming techniques to the environmental context in which they will operate. The temperature, chlorophyll and turbidity of marine waters significantly affect the growth rate and health of animals.
Climate change has led to changes in sea temperature and phytoplankton quantities, factors that influence animal growth and mortality rates and, therefore, farm productivity and product quality.
It is clear that a deeper understanding of these variables is critical to achieving optimized farm management.

An extraordinary source of information comes, today, from Earth observation satellites. Their data make it possible to carefully estimate multiple parameters such as sea temperature, chlorophyll concentration (a proxy for the presence of phytoplankton) and water turbidity (a proxy for water quality).

Over the past 25 years, Planetek Italia has gained a great deal of experience in this field thanks to several research programs of the European Space Agency (ESA) and the European Commission, such as "Integrated Coastal Water Management for MED (ICWM for MED)," "SAtellite Near Real Time Monitoring Network (SAIMON)," and "Marine-EO," to mention the latest projects.
As part of the European project "User uptake activities Copernicus Marine Environment Service (CMEMS) - Promoting demonstrations of CMEMS downstream services." coordinated by Mercator Ocean, Planetek also enhanced Copernicus CMEMS data and services by creating an innovative platform called Rheticus® that provides on-demand geoanalysis services specifically designed for environmental reporting, marine engineering, and fisheries and aquaculture activities.

All these experiences contributed to the development of the Rheticus® Aquaculture service, specifically designed for mussel site management. The service was developed by Planetek Italia in partnership with Bluefarm s.r.l. to provide mussel farmers with a weekly digital bulletin of up-to-date information on sea temperature and chlorophyll trends, shellfish growth rate, and growth trends compared to past trends. The service also provides an estimate of optimal harvest time and expected production volume.

Technical Specifications. Rheticus® Aquaculture is a geo-informative service that provides aquaculturists with up-to-date information on the growth rate of farmed shellfish, depending on the environmental conditions of the production site, including for the purpose of estimating the optimal harvest time and production volume.
The service also provides useful elements for early detection of critical issues that may raise the risk of production loss such as harmful algal blooms, presence of pollutants or adverse weather and sea conditions.

To activate the service, the farmer must provide the following information:

- Geographic coordinates of the production site or georeferenced vector file (ESRI shapefile, KML, georeferenced DWG/DXF).
- Date of planting.
- Average seed size.
- Number of rows at planting (optional).

During the production cycle, the breeder must also provide information on tamping in order to improve estimates of growth rates. Specifically, he should provide the following data:

- Dates of run-ups;
- Average size of the tampings;
- Stocking size (optional);
- Number of rows tamped (optional).

Usage. With the activation of the service, the system generates, for the duration of the subscription, a periodic bulletin that contains estimates of the level of animal growth in addition to data on risks. The bulletin is sent to the customer in PDF format to the e-mail address provided by the customer at the time of subscription

Fonte: Planetek

For shellfish farms, the environmental indicators and parameters provided in the bulletin are:

Indicators:

- Estimated total weight of the average individual;
- Weekly estimate of growth level of animals from the date of planting and/or run-up;
- Growth forecast over the next 7 days;
- Comparative analysis of growth trends from the previous year.

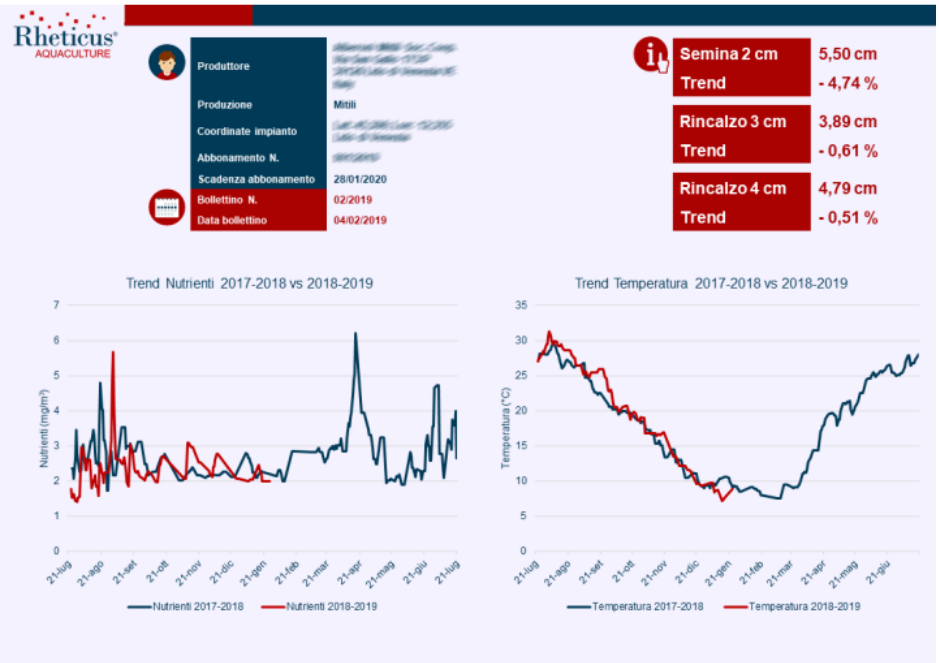
Environmental parameters:

- Temperature
- Concentration of nutrients.

Bulletin updates are made with all useful satellite images, and the service is available throughout the Mediterranean basin.

Benefits. The benefits that the service brings to farm production are essentially two:

- Continuous monitoring of the production site: support for plant management activities thanks to constantly updated data.
- Prevention of possible environmental stress and production losses: monitoring of key environmental and physiological parameters to detect in advance the onset of conditions unfavorable to good shellfish growth.



Fonte: Planetek

3.3 The importance of valorization and branding of a sustainable Made in Italy product

With its 0.3 percent of oysters produced on a European scale, Italy is last in Europe, in a picture where France excels, with 85 percent, although qualitatively the oyster made in Italy is of great quality. Those already produced have a strong attractiveness, due to their high quality, which, as we could see in the market analysis, mean that they already have a strong export demand. But being the second largest consumers in Europe, production should first and foremost meet domestic needs, which is seeing clichés, however, take over and shift demand to French oysters, synonymous with high quality.
We should present our product with the right importance both within our borders and externally, focusing, from a marketing point of view, on the one hand on the attractiveness of a made in Italy brand, and on the other on green marketing, which has been very effective in the last period.
Within our country, the installation of sustainable and innovative farms could develop an attractiveness that would also include other sectors such as tourism, becoming a model to visit.

This would be especially useful for Southern Italy, which is still poor in initiatives of this kind that could an all-round (healthy) development of the territory.
From seed to waters, from processing to marketing, the oyster should speak Italian. A real gem with great potential, Italy given the natural potential of the territory could produce oysters unique in Europe.

By creating small production poles in each navy along the 7 thousand kilometers of coastline, with about fifty quintals each Italy could compete with France. There is no shortage of signs of the vibrancy of our market. One issue to be resolved, however, as mentioned earlier, is the tax regime on which weighs a 22 percent VAT as for luxury products, while in Portugal it is 4 percent and in other European countries such as France it is below the 10 percent threshold.

Oysters are for the Italian consumer a product associated with luxury and with a consumption linked to an overall experience of taste and fascination that also derives from the recent territory of origin of this culinary tradition. This imagery is currently mostly linked to France, and the expanded promotion of the product would require a targeted and shared intervention among all, producers, traders and distributors, to spread a new perception of an Italian product.
It is necessary to initiate the spread among Italian (but also foreign) consumers of the curiosity to taste the Italian and local product, as well as among restaurant operators, encouraging the inclusion of the Italian national oyster on their menus, demonstrating how the market would recognize the value of the product itself and the tale of a territory associated with it.

In this regard, it is desirable to have an enhancement path based on an own brand of producer associations that is both a guarantee of the application of a low-impact production process and an opportunity to identify product, territory and oyster farmers.

3.4 Expert opinion: Interview with Giuseppe Prioli, President Associazione Mediterranea Acquacoltori

After a brief explanation to the host of the project and a presentation of her profile, here are questions relevant and useful to the topic of sustainable oyster farming and the potential in the Italian market:

1. Firstly, I wanted to ask what do you think with respect to the role of oysters against carbon emissions?

"On the topic of sustainability and carbon I would like to say one thing right away. I just sent an email to the group we are working with on the issue of carbon credits because a communication came to us who participate in the advisory council of the culture bank in Brussels regarding our request to introduce carbon credits in shellfish. But the response was to wait because there are still a number of issues to be resolved. And they are right in some aspects and that is what we are working on. So be careful about taking for granted some values that it is better to remain cautious with. Also in our opinion the issue of carbon dioxide sequestration is as you described but you always have to look into it. You still have to set standards to clarify a complex issue because you consider that an oyster from life to death (understood as the end of the valve) you have to be sure that it has a sustainable pathway so in this case when you make these arguments you have to have an overall view and where the knowledge is not there you have to go deeper. Now with a working group in Santa Teresa we are trying to define these standards to give more and more elements to those who point out the critical issues. Not all the standard-setting issues have been answered with certainty. We believe that this is all part of a context to be analyzed based on what you do not what you could do or what others would like to do so we would like to define standards that say how to behave from the beginning to the end of our process. You have to focus on your own path is not the whole process."

I totally agree. You have to try to check the sustainability of the whole process of oyster farming life and production. It is admittedly true that looking for sustainability across the board is very difficult. What is important to me right now though is to relate the data, in the food macro sector, between oyster farms at sea and meat farms on land, the proportion changes disproportionately.

"Undoubtedly on this level there is no match. After that if I also become neutral or even negative all the better. Certainly, the production of a steak consumes much more."

What I want to bring with my work is to propose the *Made in Italy* oyster by differentiating the product from the mere luxury product as it is seen today. Too little is still eaten, too much is still imported. Italy is the second consumer but last producer. This data should be worked on, especially at a time like this of recovery and incentives from the European point of view.

2. Speaking of data, it was difficult to find data from the oyster farming sector in Italy post covid, how is the sector doing to date?

"The sector to date has recovered. I have to say that it had recovered quite a bit even after the winter of 2020, then clearly it had some surges however it has recovered quite a bit. The oyster sector has also grown a little bit since then. A little bit, in this case it becomes a lot, because talking about minimum values because even one more breeder increases the percentage. But we have good realities in different regions of the national territory. The most developed regions are Puglia, Sardinia, Liguria and Emilia-Romagna, although there is still a lot of potential to be exploited in these regions as well. A very important experience, among the first in our territory is the one that Scardovari has carried out with the Tarbouriech oyster. Tarbouriech is a large French producer who invented a very original system: since there are no tides, they hung the installations on movable poles that artificially create the effect of the tides. You mentioned something important earlier, which

is that the oyster is still seen as a luxury good. With respect to this issue we are leading a battle regarding VAT to raise it from 22 percent to 10 percent, so we are asking to raise it to the levels of other fish. Beyond what they want people to believe, it is an affordable good for everyone."

It is also based on this that another part of my argument develops because in my opinion it would be very important to present it well in fact in a marketing part of the work relevant part is the branding of the product. If I present the Made in Italy oyster, as an oyster that besides being good, with a certified quality and Km 0 is also an oyster that safeguards the environment it could be a more attractive product in the market. We young people are very attached to the issue of environmental protection, so we demand to know how it is produced and where it comes from.

"Of course, that is what we are focusing on, for mussels in general and for oysters in particular. It is a very important aspect. It's something that actually years ago this stimulus from the consumer was not so strong. Now we hope that this crisis will pass that will probably mitigate some of the behaviors that we have in that we feel the burden. But if, as we all hope, we return to the levels of a few months ago, certainly. Just look at the value that all organic products have reached and those that demonstrate a quality seen not are as organoleptic but understood as environmental and sustainable quality. Now we are all more inclined to move in that direction."

3. Of course, among these features required in this area, we can also avoid talking about traceability (although usually also much required) since oyster farms are not mobile but fixed. Is this a fair point?

"Don't forget one thing. Not always the one who produces is the same as the one who markets, there is a risk that the one who markets doesn't like to be traceable. Let me give you an example: here in Emilia-Romagna, I am working a lot to promote the Romagnola mussel. Why? A lot of imported product comes here because it is cheaper for the trader. But because the Romagnola mussel has intrinsic value by having more pulp it is used to cut other products. So, it doesn't suit the seller some times to declare all the talk related to traceability and provenance because then the difference between the best and the worst will be obvious. This is the issue, so in this market we have realized that the various quality labels have stopped at the moment when the one who markets in the next steps is not the producer. So the one who markets has to be either the producer through shipping centers who goes to the market with his own brand or he makes deals with those who do it in a serious way. If I give it to the trader and he is free to sell it differently and independently at that point it becomes a problem because he will have no interest in promoting only one feature."

4. I completely agree with that. One possible solution might be to decrease the supply chain. I link to this by posing another thought. We should shorten the supply chain both in post-production, but in my opinion even before that. In that as, as you well know, many times we import the oyster seed from France. One would need to understand the sustainability of this transportation. If you want a truly km 0 product you would also have to produce the seed in Italy. There are already small realities. Shortening the supply chain is also synonymous with reducing the cost of production and the price because of course each actor adds a percentage to it. By shortening the supply chain we could potentially offer a better product at a price if not lower, at least justifiable. Do you agree?

"Yes, absolutely. My advice to you, though, get the costs right with respect to the environment. Because the transportation of the seed that comes very small from the point of view of environmental costs remains very small. Don't underestimate though, for example the energy cost of a stand-alone hatchery that doesn't produce massively might have a higher energy cost than buying it elsewhere. Evaluate everything carefully. French seed that arrives when it is 3 mm might have a much lower cost per unit in environmental terms. The LCA has to be applied to the whole circuit that one has to

take into consideration including this. Envision something like: if you consume my oyster I will come and collect your valves."

5. Since there are different qualities of oysters what would be the best one to produce in Italy?

"To get ostrea edulis (the European one) is not easy and not all environments are good. In the sea it might do well but it has a very slow growth and is also more delicate. Ostrea gigas is more hardy, which is why it is the most common worldwide. I can tell you, however, that Croatia prohibits it. A breeder cannot breed it as it is not a native species. You might find yourself breeding this and have an environmentalist against you. If you really wanted to come up with a native Made in Italy oyster you would have to get the European one, then you would have to see though if this is present in some areas. Certainly it is much better. For example, in France the price of the European one is even double. It is the queen of oysters. They don't send it to us, it would cost too much. We are not enhancing ours, though. I am trying, now we will start with other projects. Nothing takes away from a good oyster gigas its value and quality."

From a production cost perspective, would raising European oysters be more expensive?

"Yes, unless you use natural shoal ones and then do the refinements. There are natural beds that are fished, there is the possibility of fishing them especially in the Marche region. These can be bought relatively cheaply, if afterwards it is kept 2 or 3 months in breeding only by giving it a place to stay it would have good potential. It has another flaw though, being natural, unlike the other one which being tetraploid does not reproduce, summer this one cannot be marketed because being in spawning it contains sperm which has an unpleasant taste so in summer you cannot eat them. Its best time is from late November to late April. So as you see there are many aspects that should be investigated. I want to reiterate though, as already mentioned that a good ostrea gigas bred well and treated well has a market that satisfies even the most prized palates, the only downside, that it is not a local species."

6. Carbon credit still nothing for this sector, but are there any European or Italian incentives for sustainable production yet?

"So far, no. But definitely in new FEANPA will go toward that direction, the financial instrument par excellence is this. Sustainability is the main item now. Those who work that way, with that kind of production will have an advantage especially if they are also associated with others during the supply chain. The problem that our farmers are all loose and individual, we would need a common force."

7. Last question. From a natural and geographical point of view, Italy has an enviable heterogeneity. So many different seas with different characteristics that all point to the Mediterranean. If we were to talk about the Italian market and decide on Living Labs where to launch this sustainable oyster farming project, it could be 3 good places: Puglia, Sardinia and Liguria? Or Sicily?

"Sicily rule it out. Without taking anything away from that beautiful area, but to grow bivalves you need a minimum of nourishment. So you have to take those places where there is food and high sea quality. By combining the two characteristics the 3 places you mentioned can be adequate."

Conclusion

It is quite clear from the above that there may be ample room for growth in Italy, both in consumption and production of oysters.
It does not help, however, that common sentiment associates oysters with relatively elite and expensive consumption. As far as oyster farming is concerned, the emergence of new farms is an important sign, and if these new experiences manage to take hold and develop, they will set the pace for those to come. In this regard, the difficulties brought about by climate change that are affecting Atlantic farms could create production gaps that could be filled by production from new farms and new technologies.

Environmental sustainability was assessed through life cycle analysis (LCA), with specific focus on carbon footprint calculation. In particular, it emerged how km 0 production, with seed produced in Italy and the reduction of boat trips, and consequently reduced fuel consumption, ensure a product with a very low environmental impact in terms of emissions of kilograms of CO2 equivalent.
This, not to mention the benefits for the marine ecosystem, resulting from a production that does not require any external input of feed, nor the administration of antibiotics or pesticides, typical of intensive fish farming.
In addition to being environmentally sustainable, economic analysis has shown that oyster farming represents a good opportunity for production diversification, with the potential to generate profits quickly, according to market estimates. Net of investments for the plant and boat, with a commitment of 110 days/year, a production of about 8.5 tons, and with an assumed selling price of 9 e/kg, the activity generates an average operating profit of between 10,000 and 18,000 euros, depending on production scenarios.

Oyster farming, therefore, certainly represents an opportunity for the area, having large margins to increase production relative to demand, but it is clear that the challenge for new employees is still all uphill, since in the face of future potential, risks and investments must be present. The main point of weakness to the spread of oyster production is therefore the current reluctance of entrepreneurs to undertake new production, in the face of a supply chain that today is structured only for the needs of local restaurants and needs all to be built and reorganized, starting with logistics and distribution.

The possibility of giving oneself cooperative management also becomes an advantage in terms of promoting the product, being able to access marketing channels that the individual producer would not be able to approach. Oysters, in fact, are for the Italian consumer a product associated with luxury and a consumption linked to an overall experience of taste and fascination that also derives from the recent territory of origin of this culinary tradition. This imagery is currently mostly linked to France, and for the expanded promotion of the product, a targeted and shared intervention among all, producers, traders and distributors, would be needed to spread a new perception of an Italian product.
In this regard, a path of valorisation based on an own brand is desirable that is both a guarantee of the application of a low-impact production process and an opportunity to identify product, territory and oyster farmers.

In conclusion, the project has made it possible, as expected, to provide the territory with the necessary elements to understand the potential of starting an innovative production, also in an advantageous perspective of diversification in a context of mono-economy based on the breeding of other mussels and has provided the tools to undertake the right path of commercial valorisation, integrated with an overall territorial promotion.

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