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PRIORITY TASKS AND MARINE AQUACULTURE DEVELOPMENT STRATEGY

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Abstract. Aquaculture (artificial cultivation, processing and sale of aquatic biological resources: fish and seafood) plays the role of a powerful locomotive for the development of the food sector of the 21st century and can become one of the catalysts for the deep economic, social and environmental changes in food systems around the world. COVID - 19 significantly halted globalization processes, strengthening social autonomy, closing many markets, which affected the volume of trade in fish and seafood and its subsequent processing for the catering industry. Global expectations imply further closure of borders and localization of the business, reduction in the number of employees and distance from large urbanization sites, which suggests the need for a new model for the development of the fish resource business in the context of sustainable development, environmental and social significance of the safest food. The current state of the functioning of the aquaculture and seafood market is investigated and proposals for the development of the industry are formulated. An analysis of international approaches revealed the need for structural transformation of the industry in accordance with the global concept of sustainable development of the agro-food complex and food security. The application of the proposed measures will lead to the achievement of performance indicators in line with international standards, improve the livelihoods of the adjacent urbanization areas and the overall economic progress of the country, and strengthen the system of organization, control and management of the aquatic biological resources sector.

Keywords: *aquaculture, marine ecosystem-based management, offshore fish farming, food demand, production growth, structural transformations, environmental benefits, innovative fish farming, integration, food security, modernization, fish market, sustainable development, resource conservation, environmental friendliness, organic products, global threats to intensive fish farming, level of biologic sustainability.*

1 INTRODUCTION

In terms of population consumption of fish, countries of the European Union are significantly ahead of countries with low income and food shortages. Fish and seafood as a key element are included in the diet of most coastal states, including Japan, France, Spain, Norway, Denmark, and Southeast Asian countries. Significant volumes of fish products are consumed in the United States of America and the People's Republic of China. According to the results of many studies, seafood in the next 10-50 years will tend to be more expensive and increase in demand than its competitors in the production of animal protein in a balanced healthy diet. Growing or fishing in the ocean or on the high seas requires the use of special expensive equipment, as well as hiring experienced fishermen and personnel, and there is also the problem of reducing its population in the ocean. Therefore, the design of underwater farms for breeding sea fish and aquatic organisms without harm to its population is relevant today. To quickly get a large number of marine fish, it can be grown directly at sea artificially - in large aquariums or at specialized fish farms. In order not to spoil the useful and tasteful qualities of marine products, it is necessary to keep fish in a natural reservoir. Therefore, we consider the development of a strategy for breeding marine fish directly in the open sea (ocean) relevant. Solving our priority tasks will give investors good competitive advantages in this business, the world community will be provided with marine food, and aquatic resources will receive prospects for their development in accordance with humanitarian and environmental standards to prevent the massive depletion of limited natural resources.

2 LITERATURE REVIEW

Around the globe, increasing human activities in coastal and offshore waters have created complex conflicts between different sectors competing for space and between the use and conservation of ocean resources. Like other users, aquaculture proponents evaluate potential offshore sites based primarily on their biological suitability, technical feasibility, and cost considerations. Recently, Marine Spatial Planning (MSP) has been promoted as an approach for achieving more ecosystem-based marine management, with a focus on balancing multiple management objectives in a holistic way. Both industry-specific and multiple-use planners all rely heavily on spatially-referenced data, Geographic Information System (GIS)-based analytical tools, and Decision Support Systems (DSS) to explore a range of options and assess their costs and benefits. Although ecological factors can currently be assessed fairly comprehensively, better tools are needed to evaluate and incorporate the economic and social considerations that will also be critical to identifying potential sites and achieving successful marine plans (Bela H. Buck, Richard Langan, 2017).

Chen J. *et al.* (2008) pointed out that "developing offshore cage farming is a new way to provide employment for people switching from fishing to aquaculture. From 2003 to 2010, an estimated 300 000 fishers are expected to leave their boats and look for other jobs. Offshore cage farming creates an opportunity for them. The Chinese government and relevant authorities strongly support the development of offshore cage farming, both in policy and financing. Since the beginning of the twenty-first century, six types of offshore cages have been developed and extended in coastal provinces. They are the HDPE circle cage, the metal frame cage, the floating rope cage, the dish-formed submersible cage, the PDW submersible cage and the SLW rotatable and submersible cage. Developing offshore cage farming can create significant socio-economic impacts. The short term target of offshore cage culture is that marine fish farming will become a major sector in China's aquaculture industry. The projected output of cultured marine fishes is around 500 000 tones by 2010".

In 2017, aquaculture production in the EU reached a 10-year high of 1,37 million tones with a value of EUR 5,06 billion. This represented a 5% and 67.172-tonne increase over 2016 production, and a significant 15% or EUR 662 million increase over 2016 value. Compared with 10 years ago, its value almost doubled, while its volume increased 11%, growing to 136.760 tones. The increasing value of aquaculture over the past decade is due to increased production of high value species (such as salmon, seabass and bluefin tuna), combined with the strong price increase of some major species (salmon, seabass, gilthead seabream, oyster and clam). Price increases can be related to the increase in demand, but there were also other factors such as the higher quality of products (including organic) as well as the decrease of supplies due to high mortalities (e.g. of oysters). Production of bivalves and other mollusks and aquatic invertebrates reached an 8-year high, mainly due to the increased production of mussel in Spain and oyster in France from 2016 to 2017 (EUMORA, 2019).

China's experiments in seafood production have provided a large-scale learning opportunity on the outcomes of intense exploitation and cultivation aimed at increasing volume of seafood produced. China has indicated that their future plans for seafood production will depart from business as usual and focus more on quality, rather than just quantity. (Szuwalski C., 2020).

The combined pressures of increasing sea temperatures, acidification, stratification, changes in ocean currents and the hydrological cycle, eutrophication from coastal run-off and other forms of pollution, overfishing and habitat destruction will define how productive and efficient the future ocean will be. Overexploitation means harvesting species from the wild at rates faster than natural populations can recover. Overfishing and overhunting are both types of overexploitation. (OECD, 2016)

Meanwhile, aquaculture production has been increasing for virtually all major species in recent years, although demand is outpacing supply for many bivalve products and harvest reductions are on the horizon for shrimp, seabass and seabream. Indicators measuring the health of the global economy point to slowing trade growth in 2019 and buyer hesitancy amidst a general atmosphere of political uncertainty. The effects of these broader trends are evident in seafood trade estimates for 2019, with flat or minimal expansion in the total export value expected for the year as a whole, contrasting with strong increases in the last two years. The tariffs introduced on a range of commodities by both China and the United States of

America have inevitably had a visible impact on seafood trade flows between these two major trading partners, while the reluctance of firms to take on too much risk when the situation can change so quickly is another less direct but more widespread consequence of the trade war. (FAO, 2019). Jeffrey B. Kaiser and Michael D. Chambers (2017) pointed, that as the fastest growing sector of world food production, aquaculture is increasingly playing a major role and currently accounts for nearly half of the total aquatic production worldwide. Marine cage culture in particular provides an opportunity to utilize vast amounts of the world's surface area to produce fish, shellfish, and plants, while avoiding land-use conflicts in crowded coastal regions. Currently in the US, very small volumes of marine fish are produced and very large volumes are imported. This trend shows no signs of slowing down with an ever increasing annual seafood trade deficit. In an effort to initiate more domestic production, private companies, research institutions, and government agencies have all been involved in various types of aquaculture production. Aquaculture can be generally categorized as land-based, near shore, or offshore. Offshore marine fish culture utilizing cages has been conducted on both the east and west coast of the US as well as in the Gulf of Mexico. Sea cage farming in India was initiated by CMFRI with support from Ministry of Agriculture, Govt. of India and National Fisheries Development Board (NFDB) and is gaining momentum as a commercial seafood production system. Several R&D programmes in cage culture, demonstrations and participatory mode of cage farming have led to the emergence of an economically viable farming method which resulted in popularization of the technology. The necessity of seed for farming has led to the development of hatchery technology for high valued finfish like Cobia, Pompano and Grouper. Consequently, seeds of these species also were made available for cage farming along with the already available seeds of Asian Seabass. As a result, cage farming of Cobia, Pompano, Asian Seabass and Grouper became popular among fishermen-groups and entrepreneurs along the Indian coast (National Fisheries Development Board 2019).

The first generation of salmon harvested at SalMar ASA's Ocean Farm 1 and the preliminary results seen from the offshore facility's second generation have confirmed that technologies which allow significant volumes to be produced in large, open-ocean locations around Norway and other regions are a genuine opportunity for the industry, SalMar CFO and COO Trine Sæther Romuld said. Romuld said at the North Atlantic Seafood Forum (NASF) 2020 that the Freya, Norway-headquartered SalMar – the fourth-largest Atlantic salmon farming company and the world's largest producer of organic salmon – has "a very strong belief" in the potential to produce fish out in open-ocean currents. With a net height of 70 meters, a diameter of 180 meters, and the capacity to host three million smolts, the Smart Fish Farm is twice the size of Ocean Farm 1. SalMar is currently working with Norwegian authorities to find a suitable location to test the concept, and while the current focus is to use this system in the open ocean off Norway, inquiries have begun pouring in from other regions, including Asia, Europe, and North America, pointed Jason Holland (2020). The economic benefits of improved access to information for offshore aquaculture developments are difficult to quantify. Sea cage designs that are optimised for deployment at the specific location of the farm should significantly reduce maintenance and replacement costs; reduced uncertainty in the temperature and salinity of the water should help to predict, and hence ensure, the closing of life cycles; historical, real-time and predicted meteorological events will help to prevent fish from escaping. In Ireland, the Irish Sea Fisheries Board has estimated that their "deep-sea fish farming project"1, when in full production, should generate: direct employment for approximately 350 people; a further 150 jobs indirectly through provision of netting, fish feed, transportation and other services; and an annual wage flow of €14.5 million, much of which will find its way into the local economy.

3 METHODOLOGY

As mentioned earlier, this study was aimed at development of a methodology for determining the priorities for the development of marine aquaculture using the PMter - Offshore fish farming, Spain project as an example. This study capitalized on secondary sources of information, primarily peer-reviewed journals and books from notable scholars and experts on the topic. Online journals and articles were also utilized as well, but only after careful evaluation of the accuracy of the work done, along with the credibility, not just of the authors, but of the online platforms as well. The data collected was carefully analyzed, beginning with text analysis for the data collected from secondary sources, all the way to statistical analysis for the case study approach adopted as well. With these analysis techniques, the study was able to identify patterns and pointers, all of which allowed for the easier and more effective drawing of conclusions on the topic. The investigated dynamically growing segment, taking into account the peculiarities of the biological and socio-economic nature and the establishment of the priority of well-being in the general system of macroeconomic organization of the national economy (natural and climatic resources, ecology, food market, labor resources, the process of production, processing and consumption of food, recreational sphere) can bring the most important result - a decrease in value and an increase in utility for man and nature.

4 DISCUSSION

The capacity of the fish and seafood market is still very far from saturation and increases in proportion to population growth and is predicted as one of the most dynamically growing among all food products by its useful properties. The volume of the seafood and seafood market is about 3 thousand tons per year. Currently, from several dozen commercial species of algae, only a few species are harvested in small volumes, and from 50 species of bivalve mollusks, no more than 6-8 species are harvested. The existing Aqua culture of fishing and other marine bioresources is far from ideal. The constant imbalance of fishing, along with other negative human impacts on flora and fauna, leads to interference in the existing natural balance of the aquatic ecosystem. Currently, for the development of aquatic culture, it is necessary to consider territories that have favorable climatic conditions for breeding and growing in coastal waters not only fish, but also scallops, mussels, rapans, shrimps, oysters, trepang, kelp, algae and some other valuable species of hydrobionts, possessing valuable pharmacological properties (hemolytic, cytotoxic, antifungal and immunomodulating activity, plan their artificial reproduction and pasture cultivation while preserving the ecosystem. The technology of cultivating mussels with collectors located in the water column opens up prospects for the development of this direction of mariculture. The estimated yield of mussels is estimated at approximately 30 tons from 0.8 hectares of the water surface, while there are reserves to increase productivity to 120 tons from the same area. Payback of this species is possible within 3 years with the prospect of reducing this period to 1.5 years. can be found in the natural habitat, while minimizing the risks and costs that occur when breeding in artificial ponds or catching by fishing vessels. Directly through the metal mesh, water is refreshed and marine plankton passes, which feeds the fish, and you can also organize high-quality nutrition. As a result, sea fish are in their natural habitat, but they feed on a good farm, which allows you to plan and get a high-quality product at minimal cost in the projected volumes and terms. Now more and more investors are looking at aquaculture as a potential market for investment. The production volumes of artificially grown marketable fish and other aquatic organisms on a global scale annually grow by an average of 6-8%, in contrast to natural production, which remains at approximately the same level. By 2030, the volume of caught and grown products will increase to 201 million tons, which is 18% more than the current level, which is estimated at 171 million tons. In the future, productivity growth should be determined by both technological and environmental factors that prevent water pollution. and the air environment, the destruction of coastal aquatic ecosystems due to large-scale construction in the water areas and the coast, the maximum use of the potential capabilities of coastal water areas to optimize the distribution of mariculture farms, the creation of natural and artificial (artificial spawning grounds and reefs) reproduction of valuable aquatic biological resources. In the past few years, catches in coastal waters have been steadily declining, and now the market is increasingly turning its eyes to marine farms. Science for Environment Policy (2015) Sustainable Aquaculture write that environmental concerns are already recognised by the aquaculture industry, which has made great progress in improving its environmental record in recent years.

Research has shown that some environmental pressures can been mitigated in absolute terms, as seen with the dramatic reductions in escapees and antibiotics use in Norwegian salmon farms. As the sector expands further, it must consider how to continually improve its environmental sustainability: this is essential to the long-term economic sustainability of aquaculture as well as to our food security. Scientific evidence must continue to play a central role in this industry, informing best practice. Ongoing applied scientific research is needed to develop practical solutions to environmental problems. It is also clear that research into the very ‘basics’ of marine/aquatic ecology and processes is needed, from which better practical solutions can be developed. Consumer demand and policy developments are also central in shaping the future of aquaculture. For instance, the MSP Directive is expected to improve the sustainability of aquaculture by considering when and where various human activities take place at sea. Member States will be required to carefully plan the co-location of marine activities, such as aquaculture, shipping and offshore energy, with the help of improved spatial data. This should ensure that all activities can benefit from synergies and that any negative environmental impacts can be minimised through their early identification. The most important feature of modern aquaculture, we consider the development strategy of integrated technologies for the simultaneous cultivation of several groups of cultivated organisms. The aim of this strategy should be to protect marine natural resources and ensure regular supplies of fish and hydrobionts farmed.

However, farming concepts might differ in their mechanism to avoid or mitigate any escaping events. It is worth to highlight that at the moment and due to limited experience with offshore fish farming, there are several relationships between these dynamic process not quantified, i.e. not an explicit equation, and several behaviours and influencing parameters are still unknown for offshore farming applications. Therefore, it is the time to conceptualise a valid profitability model for offshore fish farming and determine which influencing factors and impact relationships shall be studied and measured. Then, it might be possible to develop an integrated simulation model with valid and reliable outcomes (El-Thalji, 2019).

Business Background. It is widely recognised that Oceans have been over fished and that the world's fish stocks need to be additionally supplied from aquaculture. The fall in world natural fish stocks has been mirrored by an increase in demand for fish for health reasons as well the growing affluence of the developing world. Market demand for seafood far exceeds the ocean's ability to restock and the crisis is deepening. Worldwide, most natural ocean marine fisheries are either fully exploited or in sharp decline and many fishery experts are hopeful that aquaculture, or fish farming, can fill the gap. However, conventional aquaculture has also suffered problems. These are frequently due to over exploitation of the resource and inadequate recognition of the environmental and health issues associated with intensive fish farming. For example, expected ecosystem service value losses along the central Portuguese coast increase from approximately €30 million per year in 2028 to over €45 million per year by 2058 – a decrease in coastal ecosystem service values of almost 25%. Over 95% of these ecosystem service losses are attributed to the erosion of open spaced vegetation ecosystems (including beaches, dunes and sand plains), which provide important water supply, disturbance regulation and cultural ecosystem services (Alves, Roebling, Pinto & Batista, (2009)).

The service provided PMter includes the design, supply and installation supervision of the infrastructure. It also includes the initial & long-term management which supports the business infrastructure including packaging, cooling, storage, shipping, training, marketing and maintenance. Each project is custom-designed.

Spain eats a lot of fish. It is also ideally located to service the needs of France, another major fish market. The opportunity is to develop a new form of fish farm that can supply fresh fish into these two markets. Spain has also been a strong supporter of Aquaculture projects over the past few years. Catalonia is ideally placed to service the two markets of Spain and France. Facility locations and local partners have been identified associated with the choice of Catalonia as the best location for the fish farm.

Company philosophy will be:

➢ The use of **new ideas** to grow the fish in a more economical way by changing the traditional growing procedures, and:

➢ The use of **proprietary technology** which will ensure that the environmental concerns will be minimised and that the fish will be healthier.

The core of the business will be **Grow-out** of fish (plate sized) in net cages in Arenys de Mar + other sites in Spain at a later date.

➢ Ocean sourced fish have declined due to overfishing and environmental damage

➢ Production of popular ocean caught fish has fallen by up to 90%

➢ Onshore fish farming provides some solution to this problem but suffers from environmental difficulties

➢ Offshore fish farming (in open ocean) offers **major environmental benefits**

➢ PMter has an **established marketing strategy** with proven European outlets

➢ PMter will provide specialty high value fish for European markets

➢ PMter has proven the business model in other locations with a typical IRR of 30+%

➢ The projected return for this project is **31%,** Annual revenue will reach **€ 20m** by year 7 with a projected gross margin of 50+%, Funding of **€ 11.5m** is required including cover for interest charges.

The Facilities and Locations. PMter have access to a marine farm for grow-out at Arenys de Mar. The rights to the **Grow-out site** at Arenys de Mar are held by the Spanish partners Cultimar - one of the best locations in Catalonia. Cultimar has signed an agreement to lease its production rights to PMter.
Grow-out site assets:

➢ This concession is currently authorized to grow 2,000 tons pa in 24 marine cages.

➢ Permission to increase production to over 3,000 tons pa is available.

Pre-fattening

➢ Its unique port is defined "fishermen use" and has free access to heavy trucks with easy to access the high way AP-7.

➢ There are two other available grow-out sites near the chosen site of Arenys for later expansion.

➢ Cultimar own a 9-meter catamaran along with leases to offices, storage place, warehouse, packaging rooms, docks for large vessels, operational space on the pier. All these will be made available for PMter's operation.

To run the operation at Arenys de Mar, the old cages will be removed and new moorings and net cages will be installed. PMter will purchase additional workboats and marine equipment. The site is well exposed to open sea waters; however, it still offers low waves and no tides. The site is referred to as open sea aquaculture and meets all relevant regulations for sustainable aquaculture.

Products Offered.

Plate Sized Fish species: PMter will offer Seabass, Seabream, Meagre Plus others.

Traditional Aquaculture	**Offshore, Ecological fish farming**
Located inside sheltered bays	Located at an exposed off-shore location
Presents possible conflict with tourism	Distance from seashore does not compete with other interests of beach users
Operation in closed, sheltered bays introduces ecology concerns due to the fish droppings	Currents and waves dilute the droppings; the farm fertilizes the sea with no overload or concentration of droppings
Many countries impose regulations and restrictions on any aquaculture that does not comply with environment care and fish welfare	The technology and strategy meet the ecological criteria and regulatory standards of the EU. All the locations for this project are approved
In a bay, the fish are grown in their own sea water with restricted renewal – the environment is not healthy for the fish	Currents and waves introduce better oxygenation and constant fresh water to the fish – large mesh sizes are beneficial to this
Traditional fish farming does not comply with environment requirements or fish welfare	Offshore fish farming using large mesh & twine is safer for the farmer and for the growth of the fish

The fish market defines the optimum species for PMter's plan. The major distributor in Catalonia that specialises in the supply of fresh fish to local and export markets is guiding the plan:

Seabass: also known as Bar (France), Bass, Lubina (Spain) and Labrak is the most important fish in the market. It sells fresh in various size from 350 grams up to more than one kilo. It also has large markets for filets and is sold frozen.

Seabream: also known as Chipura (Cyprus), Dorada and Deniz (Turkey) is the second most important fish and mainly purchased as a plate fish (eaten whole).

Meagre: is a common fish in fisheries but new to Aquaculture. This species is a fast growing fish and can **reach market size in less than 14 months**, offering the advantage of a short life

cycle.
New fish species: having a land based, pre-fattening site offers a **special advantage** over other fish producers in the market. Whilst other producers are tied to the more common fish species as stated above, PMter will benefit from **growing high valued fish** new to aquaculture with very high demand.
For example: The species of Red mullet, Surmullet or Mullus-Barbatus. This is a very high value fish, selling for €15-20/kg which it is possible to grow at PMter's site. In order to present a conservative investment proposal, the sale of these fish is not used in the business plan.

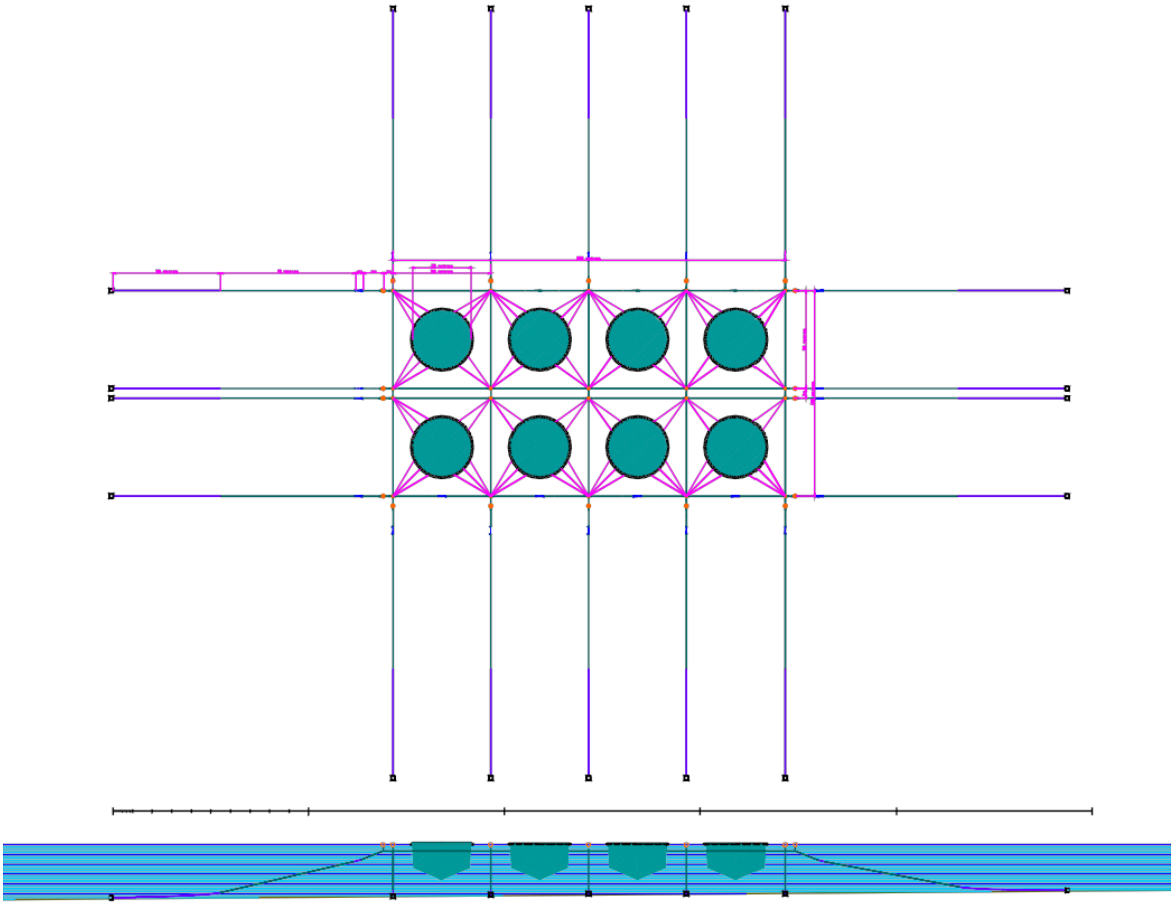
Technical Proposal.

PMter integrate the latest **patented** systems are superior to conventional **contaminants**. Being Offshore provides some net-cage technologies for offshore fish farming. These Near Shore cage farms because of **reduced bio-fresh and clean environment** for healthy fish growth.

The Offshore Approach

FISH CAGE MOORING DESIGN: 8 X 30M PLASTIC CIRCLES

Cage Grid Proposal:



Cage & Net Data

- The common design of cages in this region is of 25-meter diameter, 2 ring, plastic circle cages, which are used to grow out having a possible net depth of 12 meters, to the lowest horizontal bolt rope.
- Given that, such a site is more than likely to expand, the designed moorings of 8 x 30-meter diameter cages will cover the optional upscale.
- The cages designed for this project are 2 ring cages, with plastic stanchions. Circumference of the cages is ~ 95 meters, and the pipes are of 315mm diameter, with a wall thickness of 28mm. These cages will have continuous hand rails, which make the cages stiffer in the vertical plane, during large waves.
- The assumed nets (for design purposes) are of knotless Nylon with 15mm square or Hexagonal mesh sizes, which is standard for Sea Bass & Sea Bream. This information also affects the calculation of the Marine Growth, net weight and current drag.
- Nets installed in practice, will be of 25-30 mm mesh size assuming that fish will be installed at an average body weight of 50-100 gram respectively.
- With currents > 2knots, there should be significant net weighting on a 15 mm mesh size. This method is commonly used in the region for many years to prevent the net enclosures volume being reduced during strong currents. Given the size of these cages, maintaining net volume will be a priority to avoid fish stock losses. Total net weighting of around 2,000 kgs per cage is normally used to sustain the net volume.

- Given the net depth of 12 meters, plus possible 'sag' of the lower net bag(not always used in the region), the lowest point of the nets may be at 15 meters, leaving a seabed clearance of 6-7 meters, in still water.

Critical Advantages offered by PMter System

1. The PMter expertise with underwater cages has been developed from designing cages suitable for overcoming concerns about storms & heavy seas.
2. The PMter have proprietary technology that permits the by sinking of the Net-cage up to 35meter safe depth on a gale alert. In nature fish dive to this safe depth just as the Offshore System does.
3. In some locations, The PMter may choose its specially designed wave proof technology that offers advantage over other traditional systems.

The Project Schedule:

Year 1 - the first 9 cages will be rapidly installed offshore. By the end of Year 1, the second 9 cages will also be under installation. The number of cages will increase until Year 4 when the total of 36 cages will be installed. Two sizes of cages may be used. Depending upon the diameter of the cage and the depth of netting, from Year 3 the cages will have an annual production capacity of up to 90 tons each. During the first year of operation and starting initially with 15-20 grams' fingerlings, the biomass of the cages will be up to 8.1 Kg/m^3 and each cage will yield 60 ton/pa after 540 days (depending on species of fish).

From Year 3 onwards the biomass of the cages will be 12.23-18 Kg/m^3 and each cage will yield up to 90 tons/pa.

At a full production rate, from Year 5 onwards, the company will produce 3,240 tons of fish every year.

	year-1	**year-2**	**year-3**	**year-4**	**year-5**	**year-6**
Grow-out						
Number of cages	9	18	227	36	36	36
Annual production/cage	0	30	50	65	84	90
Tons sold per annum	0	126	1,193	1,746	2,813	3,240

The critical issue in the fish farming market is the management of the production. Normally, farms purchase their juvenile-fish (fingerlings) in a limited size (maximum of 15 gram) due to the logistical limitations of transportation. Moreover, due to the small size of the fingerlings in their sea inhabitation, transportation, production, handling and maintenance are more costly.

The Business Opportunity in Spain; the rights to operate a grow-out marine production facility at Arenys de Mar. At the next step of this business we intend purchasing a land based prefattening facility.

The Operational Advantage of this business; by using only well-known technologies in a more efficient management in order to achieve more profit from the fish production.

Major points of interest:

The strategy reduces production costs and reduces worries related to marine farming.

The use of large net mesh and twines improves oxygenation and reduces drag forces.

Using less labor and reducing fish mortality by unique and simple methods.

The project is well connected to fresh fish distribution channels within the EEC.

The advantage: Marine farm for grow out in Catalonia at Arenys de Mar.

The Opportunity: During 2020 new stocks of fish dropped by 30% due the world economic crisis. Selling prices are now in 2020 back to the level before the crisis, but production is still lower than required.

Technology: The technologies employed are our own propriety but fully proven. Growing small fish on-shore under better control ("no winter") saves money and reduces risk. Large fish grow in the marine cages with a life cycle at sea reduced by 50%.

Further point: Spain, Catalonia, is the better location for Aquaculture. In future there will be no new license available to acquire.

Whilst other locations in the Mediterranean offer no environment advantages over Catalonia, Catalonia offers a reduced distance to the main markets – this is the most significant factor.

In all countries, licensing procedures are difficult and time consuming, in some cases taking up to 5 years. Aquaculture is a relatively new industry, there is no legislation that deals specifically with it, and most jurisdictions take a cautious approach. Many different parties have to be consulted, and there is often conflict and competition with other users e.g. fisheries and tourism. In addition, there are increasingly strict environmental restrictions and the need in most cases for comprehensive environmental impact assessments (EIAs). Given that most licensing takes place at the local level, there are major issues with local authorities being influenced by fishermen, environmentalists, lobbyists for tourism and local politicians, all of whom generally prove to be more politically powerful than aqua culturists.

In Spain, licensing procedures were relatively straightforward in the early days of the industry, but a process of decentralization to local communities has since made licensing more difficult, and increasing public awareness of aquaculture has resulted in further constraint. Areas still with scope for development include the southern.

Criteria of site selection

1. Access to the market, choosing a site for aquaculture should consider the time to market (the distance to the buyer).
2. Cost of operation; close distance site to port at suitable locations are preferred as this reflects directly on operational costs.
3. Aquaculture may introduce ecology concerns; a site where the water is well refreshed should be provided to meet regulations and restrictions protecting the environment.
4. The site selection should be away from industrial effluents or other contamination sources.
5. Land base facilities are important to support operation; the availability of access road, operation zone, warehouse, packing hall, ice supply, offices and technical suppliers.
6. Port facilities; aquaculture requires a port that allows fishermen's activity, deep enough for large vessels, and is not limited by pleasure yachting or international shipping routes.
7. Other conflicting interests for the use of the concession zone should be evaluated;

tourism, industry, navigation routes etc.

8. Know-how to grow species of high value fish using sustainable methods and technologies.

Marketing Strategy. Offshore production will provide with the ability to promote a more environmentally beneficial product. It is well established that Near Shore fish farms are susceptible to contamination and fish diseases. The offshore production can demonstrate that it is secure against these concerns. Marketing fish into high value markets will strongly utilise this as a marketing tool.

Promoters have been active in and investigating the international fish market over a number of years. Through their existing connections, they have established that the EU market is actively looking for new sources of organic fish and seafood.

- Design of Patent applied diving Netcage systems for marine fish-farming.
- Design and construction of water treatment devices;

(a) sewage separators for air-craft,

(b) fish-hatcheries micro filtration and

(c) commercial applications.

- Patent applied ozone generators and ozone applications for disinfection, bleaching and shelf life prolongation.
- Design and construction of specially made gentle washing machinery.

Financing. A projected Business Plan is confidential information. The business plan is based upon the key assumptions listed above. Also attached is a sensitivity assessment that allows for both less attractive and enhanced market conditions.

5 CONCLUSIONS

It is well known that foods that were grown in natural habitats always have a better taste and are more beneficial for humans. Therefore, the fish that was caught in the open sea will be much tastier and healthier than the one that was grown in artificial reservoirs. This paper focused on the main paradigm for the development of cultivation of any animal organisms should not be complete extermination, but the preservation of natural characteristics, restoration of rare and endangered species of animals and plants in their natural habitats (reintroduction), a planned and predicted increase in the number of wild populations, taking into account changes in climatic conditions, which should have conducted in parallel with the saturation of the consumer market with high-quality seafood. Humanity is obliged to correct the harm done to the natural ecological system. Man, plants and animals, used by him in the process of social production to satisfy material and cultural needs, are a functional whole, connected by a general exchange of matter and energy. In terms of population consumption of fish, countries of the European Union are significantly ahead of countries with low income and food shortages. Fish and seafood as a key element are included in the diet of most coastal states, including Japan, France, Spain, Norway, Denmark, Southeast Asia and the role of artificially cultivated aquatic organisms will increase significantly after 10 years. Significant volumes of fish products are consumed in the United States of America and the People's Republic of China. The productivity of mariculture farms of the oceans can reach 150 million tons when using 5% of the offshore areas of the ocean with depths of 20 to 50 meters. The relevance of intensifying the search for advanced aquaculture technologies is necessary to provide food to the growing population of the Earth. The development of aquaculture is a direct consequence of the progressive degradation of agricultural land areas and large coastal areas of the seas and oceans, which are potentially suitable for building farms and should be in demand for investment projects solely on the basis of the ecosystem approach. Another important feature of the development of modern aquaculture is the introduction of integrated technologies for the simultaneous cultivation of several groups of cultivated organisms (fish, mollusks, crustaceans, algae…). The ecosystem approach in offshore mariculture involves integrated business management on the basis of compliance with environmental and social principles in a separate geographical area to achieve sustainable use of resources, as well as their inclusion in national marine resource management policies and could enable increased seafood production while alleviating pressure on coastal ecosystems and wild fisheries.

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