2020

sustainable opportunity

STURGEON CONSERVATION FARM



Number of registration of Copyright under European legislation is:
3420-qHhBiwFDeE

Daniel Dorin Tăbăcaru

OLOOSON FACTORY ROMANIA

http://www.olooson.eu

daniel.tabacaru@olooson.eu

+40724593613

11/11/2020

Advocacy for the project

"INNOVATIVE REPRODUCTION STURGEON FARM & SUSTAINABLE HARVESTERS"

CONFIDENTIAL

Soon we will be 8 billion food consumers on this planet, which means that protein production technologies, without high efficiency, will be forced to "disappear" due to the overcrowded and especially finite available area of agricultural areas. The whole world will want every square meter of "generic farm" to have the highest possible feed conversion efficiency. This global trend will lead to an inevitable shift towards a drastic increase in the demand for meat in aquaculture, the only one that can provide a correct perspective. Therefore, research will be more than necessary in all areas related to aquaculture - from research into species with high food energy efficiency, to high-tech cropping systems, from genetics and nutrition,

At present, this global shift in interest in aquaculture is highly visible and is aimed at achieving efficiency benefits of aquaculture meat production, two to three times, per unit volume of water, for the same volume, amount of feed.

Unfortunately for us in Europe, these things happen in an extremely distant universe!

Our aquaculture systems, harmful mentality, conservatism, parade ecology, insufficient regulations, lack of innovative thinking patterns, as well as other factors, prevent the development of even a survival aquaculture. But the reality leaves us speechless ... We import high quantity fish and fish products into Europe for a long time, for an economic stability of Europe in the medium and long term!

We are even in free fall ... behind the whole world, in aquaculture technologies, because we finance systems that have proven inefficient and that are extremely harmful to the environment.

We consume the present, without building the future ...!

The "complacency" brought to the level of state policies (such as the one in Romania) ... "like, we don't need technology as long as we have so many water surfaces", said by the authorities in the field of fisheries and aquaculture, makes the chance for a modern aquaculture to decrease from year to year more and more. Those surfaces have been transformed into the strongholds of the day and are owned and exploited by a corrupt system with no prospect of the future!

If in countries like Bangladesh or India there are more jobs associated with the production of meat in aquaculture, compared to the production of chickens, in our countrys 70% of the workforce working in aquaculture is actually outside Europe.

What is certain is that in the medium term, 10 - 20 years, the results of technological research in the field of aquaculture will make certain species of fish, a meat cheaper than pork, or than chicken and this is called "pending evolution ", Because the contemporary gastronomic civilization has emancipated itself, wanting less cholesterol, less" crazy cow "less" bird flu ", less" swine fever "and if possible organisms raised without antibiotics.

Unfortunately, if aquaculture policy does not change, Europe will not be part of this evolution, but only of its expectation ...!

CONFIDENTIAL

And this is just cynical arguments about the economy and health of a continent.

In Romania, for example, my country, we consume less fish per capita than Mongolia, Ethiopia, Rwanda, Benin or Zimbabwe. This is while we have 3,450 lakes, with an area of 2,620 km², not to mention river courses or the proximity to the Danube rivers and Black Sea.

These facts and states left out of the political debate prove that politics can be an incomplete thing.

A rich but especially healthy Europe is the ultimate goal of any decent political and decision-making system in Romania, or in the European Parliament.

For most policy makers, "ecology" seems to be just a meaningless word, possibly politically conjugated, without any understanding of the real complexity of the interactions involved behind this term.

Europe is "doomed" to become a leader in biotechnology because it has great potential, to regain its position of respect in competition with the nations of the world and to prevent the massive job losses mentioned above through imports of aquaculture products.

Another aspect of the same direction is related to the internal ecological micro-systems associated with aquaculture, where relevant biological "games" deal with

the research of fungi, bacteria, fungi, algae and the complex interactions that the environment and aquaculture can create.

With the exception of marine or ocean aquaculture and systems with massive volumes of water (lakes, drains and river ponds, etc.), most modern aquaculture systems, including all recirculating aquaculture systems, depend on microbiological ecology, capacity to treat, detoxify and recycle waste, even from aquaculture. This complex ecology contains thousands of species of bacteria, fungi, algae, protozoa, zooplankton, pathogens, etc., whose complexity and dynamics to our shame, are almost out of place, or very poorly understood.

Today in world aquaculture from Chile to China, "probiotic" and "prebiotic" formulations are being used on the agenda and are being used more and more widely. In our country, with a few small exceptions, not even the teachers from the profile university education units talk about these things. Distinguished professors from major European universities talk about the fact that the intimate mechanisms of biofiltration systems are still misunderstood and require a very high qualification, but forget that these systems have been working for billions of years in nature, which they seem to ignore. In every eye of water, puddle or evil on our planet we find in miniature an ideal model of biofiltration, without which our planet we know, could have been just an ammonia soup.

CONFIDENTIAL

In the natural world, we know that the structure and composition of many "aquatic microbiological ecologies" depends on the entire ecology of the natural environment. And that these "microbiological ecologies" can determine which bacterium, for example, will be dominant and whether it is a toxic bacterium, or one that does not produce toxins.

If you can understand these “microbiological ecologies” in recirculating aquaculture systems, you can control the quality and chemistry of the water, the energy flows and the performance of the target species. To control these systems, basic research is needed to define the components of these systems down to the DNA / RNA level, as well as all their specific interactions.

The reward of this effort is not only a fish of sufficient quality and quantity, but also means naturally filtered clean water systems, which unfortunately we can hardly talk about in many of the most economically developed countries in Europe.

It is gratifying that modern biological technologies are now on the exponential curve of declining costs, specialists comparing this decrease in costs with that achieved for example in the 90s in the field of microelectronics.

Aquaculture is an area in which Europe could be a major player, and the fruits of research in this area could be used to turn us into a top aquaculture producer, if we manage to escape the immobility of European conservatism.

As you well know, in Europe today we practice approximately the same aquaculture as 800 years ago and we have not changed anything but the tools with which we do this. We have new generation synthetic fiber nets and carbon fiber fishing rods. Otherwise, we failed to advance in terms of understanding the sustainability and balancing capacity of the systems, remaining dependent on an outdated mentality.

Our traditional fish farms pollute more like factories or agriculture and are not even at 20% of their efficiency potential!

Virtually all modern recirculating aquaculture systems are "polyculture" systems in which thousands of species of microscopic organisms interact.

For example, in conventional pond aquaculture where fish are fed by the farmer, nutrients from protein metabolism and especially nitrogen and phosphorus are recycled into the ecology of heterotrophic / nitrifying bacteria and then into algae, maintaining up to an equilibrium limit. water quality in the system.

CONFIDENTIAL

If you want to get extra biological mass and feed more, you will get an excess algae production (eutrophication) which is not a good thing, but if this vegetable surplus is used to feed a species of aquatic organisms, such as phytophagous fish, organic mass production can be increased without increased use of resources, but only by changing the model of sustainability.

At what scientific and economic parameters can such a system be outlined, it results only through applied research. And I chose an extremely easy example, to be better understood.

To create sustainability in an environment made unsustainable by our scientific indifference, due to anthropogenic influences, a true understanding of general ecology becomes critical.

Research in this direction is closely linked to the fundamental research of natural microbiological systems, biotechnology and the rapidly evolving area of bioinformatics.

To achieve this, it is necessary to support fundamental research, along with supporting applied practical research and increasing interdisciplinarity.

The aquaculture of the future will be, fully scientifically, intrinsically coupled with biotechnology, or it will not be at all!

Accordingly, I suggest that the efforts of future operational programs be focused on research and not on subsidizing the construction of inefficient but larger farms, which do nothing but perpetuate proven dysfunctional models in direct competition with deteriorating environmental quality, but on a much larger scale.

The treatment of solid waste from aquaculture due to undigested food and unmetabolised feed is today a well-known operational problem for aquaculturists. The accumulation of solids in aquaculture units reduces the quality of the growing environment and can be a major ecological footprint.

In salmonid culture, the waste situation has improved in the last decade, due to stricter guidelines, better feed quality and the emergence of efficient technologies for waste disposal and processing.

At a feed conversion ratio of 1.0 (kg of feed / kg of feed), the solid dry matter to be removed by mechanical filtration from the feed water is approximately 100 - 300 g / kg of used feed or fish produced.

Today's salmon farms are extremely large and produce many millions of fish each year. The biomass produced annually in most of these farms is between 100 - 1,000 tons. In addition, production from terrestrial recirculating farms (RAS) and floating cages represents biomass 5-10 times higher, ie up to 10,000 tons per year per farm. These systems are suitable for removing solids, while systems in cage systems in the waters of lakes, seas and oceans cannot do so.

CONFIDENTIAL

Raising rainbow trout to the optimal commercial size on freshwater farms also represents, in some countries, a substantial amount of biomass and the corresponding percentage of sludge production. Such farms mostly load freshwater streams, lakes and rivers with sludge, and waste disposal from these farms should be properly treated before re-entering the watercourse. In freshwater, phosphorus removal is vital in terms of eutrophication, hence the need for well-designed and properly managed effluent treatment systems to effectively retain and neutralize phosphorus. Most of the phosphorus lost from fish farms is usually incorporated into particles that could be filtered with simple mechanical filters.

Danish trout farmers, for example, are subject to strict regulations by environmental authorities to protect freshwater bodies. Why only them? Solid or semi-solid waste storage takes place in artificial lagoons isolated with impermeable membranes to remove nutrients from plants.

Dehydrated waste from trout farms contains good levels of nitrogen and phosphorus, the main nutrients for plant production, but are extremely low in potassium. Sludge from aquaculture farms, if stabilized with added lime, is considered a real fertilizer for any arable land. Analysis of heavy metals, such as

chromium, chromium and lead, indicates extremely low levels and are really harmless to the environment. Several reports indicate that stimulated plant growth is very good, but in most cases the delivery of sludge to agriculture means additional operating costs for fish producers.

Other more advanced methods of using sludge are about to become widely used. These include sludge as a source of biogas production. The research center, Bioforsk (Norway), estimated a yield of more than 500 liters per methane per kg of dry sludge.

Biogas is a real source of fuel, for example, to make cars more environmentally friendly. Sludge from aquaculture farms is also an important source of direct energy and contains about 20 MJoules per kg of dry matter.

Combustion of dry aquaculture sludge in special combustion systems is a potential application and has been evaluated as an alternative, an extremely sustainable source of fuel in cement plants compared to the current use of fossil fuels which represent a serious local air pollution. .

Unfortunately, today only a small part of about 1.5% of the total sludge produced on salmon and trout farms in Europe is removed and processed. What is really serious is the fact that the predominant production of aquaculture products takes place in "Cage" systems, floating cages, unsuitable for waste collection and handling, coastal areas being "scorched" by the destructive effects of fish feed waste. .

CONFIDENTIAL

This area of wastewater use in aquaculture systems remains the biggest prize, being a double reward on the one hand by capitalizing on a new line of salable product from aquaculture farms and on the other hand by protecting the environment.

An ideal farm or aquaculture system capitalizes on every element of its composition and has a nearly zero nitrogen and carbon footprint.

European and even global research in this area are still at the beginning of the road and the only way to get things in the right direction is more restrictive environmental protection legislation combined with smart waste research programs. from aquaculture.

Can aquaponics help restore the aquaculture industry?

We have been watching the slow decline of the global fishing industry for years. I mainly took care to consult sources of excellence in the field of science. I began to see an important phenomenon in American industry, because aquaponic systems, in addition to being invented by American specialists, received special attention

while NASA was looking for sustainable solutions for distant galactic travel and colonization of other planets.

I would not want to be considered to treat with less respect the specialists in our research, who wrote a doctorate growing two lettuce in an aquarium populated with 3 Guppy fish ...

And in this seemingly hopeless environment, one has to realize that the direction is wrong and change the switch on the go.

I look forward to funding this project so that we can continue to innovate and optimize RAS systems as well as elite aquaponics production, while working for the industry within it on a larger scale. This will also allow us to provide the best technology for any farm in the future and hopefully leave a legacy of great success.

Therefore, what I propose through this project is the first large-scale farm in Europe that produces brood for mass repopulation and for sturgeon farming, as an antidote to combat poaching and the extinction of noble and extremely important species for the European economy. . In addition, we will happily produce organic vegetables and herbs using the latest generation aquaponic technology.

CONFIDENTIAL

This project can become a universal model, possible to multiply and this is determined by:

1. The challenge of climate and environmental conditions is accompanied by the false belief that only certain locations in Europe are suitable for year-round production, due to solar efficiency and the possibility of having a permanent product and not a seasonal one. I say false, because it is not the climatic and environmental conditions that have made the Netherlands the largest supplier of vegetables grown in greenhouses in hydroponic systems that are very similar to aquaponics.
2. Hand in hand with the climatological and environmental conditions recreated in smart greenhouse systems, comes the environmental surveillance and regulation legislation which, in some states, is considered too restrictive for a traditionalist approach, leaving room for innovative systems.
3. Finally, compliance with food safety rules and regulations in Europe proposes activities whose costs cannot be borne by the traditional business model, as the “organic or organic” attribute would greatly increase production costs.

There are many other European nations, including Romania, which can capitalize much better than they do, social, economic and environmental resources and thus

offer high quality products, constantly available at an affordable price while preserving environment.

Imagine that we have an opportunity to "produce the best quality sturgeon, a gastronomic and nutritious legend and fresh, raw and clean plants with the same resources"

And it is no longer a laboratory experiment, large aquaponics farms in other parts of the world today obtain 40% of revenues from vegetable production.

But, it's not the money from this business that is the big gain ... but the fact that we now have a prototype and models that already work ... and that's what happens today when we have the chance to build the future.

"Yes, aquaponic systems can really help relaunch the aquaculture industry!"

Most of them are on the "hobby / back yard farm" scale and are owned by a new generation of aquaculturists up to the age of 40 compared to traditional farms owned by older people.

Therefore, we have empirical evidence that aquaponics production may help restore the aquaculture industry, and only research in this area can give us a chance to be in the first tier.

CONFIDENTIAL

I have recently noticed an undisguised interest in Europe in the field of PhD students and research teams in this field, but I am not at all happy about the way in which this research is used in industry.

It is time to give a real chance to interdisciplinary research in the field and not to delight in the ease and superficiality of the ease with which we bring in apparent symbiosis aquatic organisms in general fish with plant organisms.

I say this because there are extraordinary interrelations between the two types of organisms that take place in the space of subtle bacterial biochemical exchanges.

So let's stop for a moment in this part of the universe.

If we are to put in the same (closed) system heterotrophic bacteria, nitrifying bacteria, fish or other aquatic organisms, plus plant organisms it is good to have from the beginning a detailed picture of the level and type of nutrients that each of them needs.

All food production systems tend to mature over time in order to improve efficiency and achieve better control and safety in operation. Aquaculture systems have been intensifying since the production explosion that began in the 1990s. The most intense systems ever imagined are closed ones, called recirculating systems (RAS).

Intensive systems rely on bacteria to oxidize ammonium excreted by aquaculture organisms. It is dependent on temperature, pH and salinity of water, with the non-ionized form ammonia which is extremely toxic and, if not oxidized, can increase to concentrations that are harmful to aquatic organisms causing their death.

Ammonium is oxidized in a complex two-stage process, initially from ammonium to nitrite, which is also a toxic medium, then finally to nitrate, which is almost non-toxic at values up to 200 mg / L. The mechanisms of ammonium oxidation are almost identical to those in the nitrogen circuit in the soil, when farmers use animal manure (urea) to fertilize crops.

The usual bacteria perform this process in two stages. However, the question is whether in the closed system we provide the necessary nutrients to these bacteria? Can I simply survive on nitrogen and oxygen alone? Unfortunately, both in the literature and in general culture, the typical perception is that bacteria need a source of nitrogen and oxygen to perform its oxidation, when, in fact, they have relatively complex nutritional needs.

The nutritional needs of the two groups of basic bacteria required for the functioning of biofiltration and oxidation of N nitrogen in RAS, Nitrosomonas and Nitrobacter systems, compared to the nutritional and mineral requirements of fish. Many of the nutrients needed for pure bacterial culture are imposed on fish by supplementation in the diet, but most are not. Quantitatively, molybdenum, cobalt and chromium have not been clearly identified as necessary nutrients for fish, although they are considered essential nutrients for other animals. Based on this simple comparison, we might suspect that the diet of fish is inadequate for the sustainable growth of oxidizing nitrogen bacteria.

CONFIDENTIAL

As we worked on this topic a few years ago, we included a quick analysis of several fish species raised in RAS systems in the Research Laboratory of the Romanian Association for Innovation in Aquaculture and Fisheries (ARIAP).

Following the analysis the results of chemical analyzes from the existing RAS system, operated at different temperatures and containing two different species. Sturgeons, which were bred at temperatures between 4 ° C and - 22 ° C and trout at temperatures between 4 ° C and 16 ° C. Each species of fish was fed a specific commercial diet from the major producer of food, which in principle should have satisfied the nutritional needs of the fish. All systems have been in operation for 9 months. The basic macro minerals (Ca, P, Mg, Na, K and S) were measured daily at least once and at most three times. Instead all micro minerals (Mo, Zn, Cr, Bo, Co, Se, Ni, V) were below the detectable limits (BDL) of the instrument used, a DR 3900 from Hach & Lange despite the fact that at least theoretically these minerals were added in the daily system (through fish feed). The conclusion I drew

was that the bacteria on the biofiltration system took up these micro-minerals from the water at a faster rate than they were added to the system through the food administered. The question that needs to be asked and clarified through research is whether in our systems that the authorities blaspheme by saying that "they have bad economic indicators", we provide an adequate nutritional spectrum for bacterial colonies.

The value of these micro-minerals depends on the certainty of their existence in the food administered in the values declared by the producers, of the oxidative processes in contact with the digestive system of the fish, on the presence of these micro-minerals in the granulation of feces, which the mechanical filtration systems culture and not in the end of the water solubility of these nutrients?

On the other hand, what we call water quality plays an important role in feeding bacteria. The honest answers to these questions are that we still don't know exactly how things are.

The data from the study included 18 minerals that interact with a target organism fish, bacteria or plants in an aquaponic system, all influenced by water quality parameters (pH, alkalinity, hardness, dissolved oxygen, carbon dioxide) that can change drastically these interactions.

CONFIDENTIAL

An experienced aquaculturist may notice nutritional deficiencies in fish, which are quite rare these days, and will more accurately observe the more common mineral deficiencies in plant species used in aquaponics.

However, it will not be able to easily detect nutritional deficiencies in bacterial colonies until ammonia or nitrite increases to hazardous concentrations. These systems are complex, poorly understood and there are no adequate models and solutions to allow aquaculturists to have a high degree of certainty, if all organisms have sufficient nutrients and what is the health of the colony system.

Research and development of practical models and tools for monitoring the optimal functioning of biological filtration systems in this context is becoming a necessity.

It will not be possible to develop intensive recirculating systems if we do not develop these tools, all the more so as each system benefits from a body of water with parameters specific to the location and geology of the groundwater.

And consequently without high-performance RAS systems we will not have any sustainable growth of aquaculture.

An educational recapitulation (for beginners) would be:

- Nitrogen is found in proteins, nucleic acids and amino acids; in the basic components of enzymes.
- Phosphorus is an essential component of DNA structures, RNA and phospholipids, which play an important role in cell membranes and also a major role in the energy system of plants.
- Potassium plays a major role in plant metabolism and is involved in photosynthesis, drought tolerance, improving resistance to low temperatures and protein synthesis.

Nitrogen availability limits the productivity of most agricultural systems. It is a component of chlorophyll, so when nitrogen is insufficient, the leaves will have a yellow (chlorotic) appearance in the middle of the leaf. The growth of new shoots or leaves of plants will be reduced and pale or brown areas without chlorophyll may appear. Due to its essential role in the structure of amino acids and proteins, nitrogen-deficient plants and seeds will have a low protein content. Excess nitrogen results in extremely dark green leaves and promotes vegetative growth of plants. This growth, especially of seeds or fruit, may exceed the plant's ability to remain upright. Nitrogen is extremely mobile in both soil and plants,

CONFIDENTIAL

Phosphorus is another essential macro nutrient whose deficiency causes major effects in agricultural systems. It is an essential part of DNA and RNA components and is involved in the function and integrity of the cell membrane. It is also a component of the ATP system, the "energy currency" of plants and animals. Phosphorus deficiency is seen as violent or reddish discoloration of the leaves and is accompanied by reduced plant and root growth, reduced yield and early fruit fall as well as delayed ripening. Excess phosphorus can also cause problems, although it is not as common. Excess phosphorus can induce zinc deficiency through biochemical interactions. Phosphorus is generally immobile in the soil, which influences the application methods and is somewhat mobile in plants.

Potassium is the third and most common macro nutrient. It has important functions in plant metabolism, is part of the regulation of water loss and is necessary for adaptation to stress (such as drought and cold). Potassium-deficient plants may show a decrease in growth yield before any visible symptoms are observed. These symptoms include yellowing of the edges and veins and worsening or rolling of the leaves. An excess, over time, will reduce the presence of magnesium in plants due to chemical interactions.

In general, the nutrient needs of plants are small when the plants are small and grow rapidly through vegetative growth and then decrease again after the end of the period of development of the reproductive elements. The nutritional status of early seedlings will affect the development and overall yield of plants. Plants that

enter the reproductive stages have high nutrient requirements, but many of them are met by redistributing nutrients from the vegetative parts not involved in the reproductive process.

This project addresses a mix of experts such as academics, scientists and business professionals, the general public, current and potential farmers, to share information and ideas about the development of aquaponics.

Your long-awaited and desired involvement can be in any of the areas or topics relevant to aquaponics or the protection of the only valuable sturgeon species in Europe.

Anyone interested in aquaculture, aquaponics, including potential growers, researchers, professors, students or PhD students in fields related to aquaculture, can participate in this project. The project is also addressed to companies that produce and sell technology, products or services to the aquaculture industry.

Scientific specializations necessary for the success of this project

Specialization 1: Aquatic ecology

Ecology is the scientific study of how organisms interact with each other and with their environment. This includes relationships between individuals of the same species, between different species and between organisms and their physical and chemical environments. Aquatic ecology includes the study of these relationships in all aquatic environments, including oceans, estuaries, lakes, ponds, wetlands, rivers and streams. The boundaries of an aquatic ecosystem are somewhat arbitrary, but generally include a system in which inputs and outputs can be estimated. Ecosystem ecologists study how nutrients, energy and water flow through an ecosystem.

Specialization 2: Sustainable aquaculture

Aquaculture is and will continue to play an important role in increasing world fish production and meeting the growing demand for fishery products. Aquaculture is expected to be the main source of protein as demand from the global middle class increases and wild fishing approaches the collapse of sustainable capacity. Sustainable aquaculture is a dynamic concept, and the sustainability of an aquaculture system can vary depending on the species, location, social norms and the state of knowledge and technology.

Specialization 3: Aquatic diseases and immunity

Aquaculture is the fastest growing sector of animal protein production and now accounts for 47-50 percent of the world's supply of food from aquatic animals.

Aquaculture production helps to reduce the pressure on wild fishing caused by overfishing. Diseases have emerged as a significant problem due to the high storage density used in intensive aquaculture. These diseases can destroy farmed aquatic animals and spread to wild populations.

Specialization 4: Nutrition and consumables for aquaculture

Nutrition for aquaculture provides a global perspective on the nutrition of all aquatic animals grown. Fish is eaten as food by many species, including humans. It has been an important source of protein and other nutrients for humans throughout recorded history. Health experts have long argued for the nutritional benefits of fish: these sea creatures are on the list of the best sources of heart-healthy Omega-3 fatty acids, high-quality protein, metabolism-friendly selenium, vitamin B12 that stimulates energy and inflammation.Omega-3 are essential nutrients that help prevent heart disease, diabetes and inflammation that slows down the metabolism and are found mainly in fish.

Specialization 5: Genetics and biotechnology of aquaculture

Genetic purity analyzes have much to offer, especially in providing tools to identify valuable specimens unequivocally and assess the structure of the stock. Biotechnology provides powerful tools for the sustainable development of aquaculture, fisheries and the food industry. Increased public demand for seafood and declining natural marine habitats have encouraged scientists to study ways in which biotechnology can increase marine food production, turning aquaculture into a growing field of animal research. Biotechnology allows scientists to identify and combine traits in fish and shellfish to increase productivity and improve quality.

Session 6: Freshwater biology

Freshwater biology is the scientific biological study of freshwater ecosystems and is a branch of limnology. This "field of research" seeks to understand the relationships between living organisms in their physical environment. These physical environments may include rivers, lakes, streams, or wetlands. This discipline is also widely used in industrial processes to make use of biological processes such as wastewater treatment and water purification. Water flow is an essential aspect of species distribution and influence when and where species interact in freshwater environments.

Session 7: Aquaculture engineering and waste management

Aquaculture engineering is the branch of agricultural engineering that studies cultivated aquatic species and production systems used in their culture. The study, research and development in this field varies from low intensity artificial pond

systems to intensive recirculation aquaculture systems. The species grown in these systems range from carp to salmon and may also include crustaceans or algae.

Specialization 8: Micro biology and aquatic sciences

Aquatic biology deals with small organisms that live in water - bacteria, viruses and microbial communities. It focuses mainly on the interaction within microorganism communities. Most microorganisms can only be seen with a microscope. Aquatic science is the multidisciplinary study of aquatic ecosystems, both freshwater and marine. Scientific research varies in scale from the molecular level of contaminants to the stress on entire ecosystems.

Specialization 9: Fish and plant nutrition

Fish is eaten as food by many species, including humans. It has been an important source of protein and other nutrients for humans throughout history. The subject of the study is the anatomy and functions of the major organs and systems in fish, which affect nutrition. Sensory organs are important in fish nutrition because fish use these organs to locate and investigate the acceptability of any food or feed in the environment. The oral cavity is the area where food is first eaten by fish. The structures that help capture and retain food are the taste buds, teeth, gills and esophagus. Plants sublimely convert solar energy into chemical energy in the exchanges and reactions caused by plant growth.

Specialization 10: Fisheries science and research

The science of fishing is the academic discipline of managing and understanding fishing. It is a multidisciplinary science, based on the disciplines of limnology, oceanography, freshwater biology, marine biology, meteorology, conservation, ecology, population dynamics, economics, statistics, decision analysis, management and more, in an attempt to provide integrated integration. . In some cases, new disciplines have emerged, such as the bioeconomy and fisheries legislation. Because fishing science is such a comprehensive field, fisheries scientists often use methods from a wide range of academic disciplines.

Specialization 11: Physiology and biochemistry of fish

Fish physiology is the scientific study of how the component parts of fish work together in live fish. It can be contrasted with the anatomy of fish, which is the study of the shape or morphology of fish. In practice, the anatomy and physiology of fish complement each other, the former treating the structure of a fish, its organs or component parts and how they are put together, as could be seen on the dissection table or under a microscope, and later dealing with how these components work together in live fish.

Specialization 12: Market analysis

The aquaculture market is expected to grow from $ 30.1 billion in 2018 to $ 42.6 billion by 2023, with a CAGR of 7.2% over the forecast period. This is attributed to the increasing consumption of fish for its nutritional value. In addition, the upward trend in smart fishing and the growing trade in seafood are also driving the demand for aquaculture products we have never seen before.

Daniel Tabacaru

President Asociation for Innovation in Aquaculture

+40724593613

CONFIDENTIAL