

ANALYSIS OF THE AQUACULTURE SECTOR AT THE LEVEL OF GIURGIU COUNTY

Simona SPÂNU¹, Marin FLOREA²

¹“Lucian Blaga” University of Sibiu, Faculty of Agricultural Sciences, Food Industry and Environment Protection, 7-9 Ion Rațiu, Sibiu, Romania, Phone: 00 40 748 675 375; Email: simona_spanu@yahoo.com

²“Lucian Blaga” University of Sibiu, Faculty of Engineering, 4 Emil Cioran, Sibiu, Romania, Phone: 00 40 771 589 170; Email: floreasb@yahoo.com

Corresponding author: simona_spanu@yahoo.com

Abstract

The paper presents the existing situation of aquaculture sector at the level of Giurgiu County, based on some data on fish consumption and a price analyse. Based the legal framework for organic fishing, sustainable fishing in studied in relation to environmental protection, and the main measures taken by the state are the goal to encourage and develop sustainable and lasting fisheries. Last but not least, it includes assessments of ecological aquaculture, the eco-label and measures that Romania takes to protect biodiversity, focusing on the balanced exploitation of the fishery resource. The paper employed a quantitative and a qualitative analysis using the data regarding from the tempo on line data base and the analysis is also based on interviews with the consumers. The results reveal that applying eco-friendly fishery methods, the environment can be kept cleaner, and the beauty of the fish and terrestrial wildlife around the rivers will be able to enjoy, along with fishermen, the rural community and tourists who come to the area.

Key words: aquaculture, fisheries sector, environment protection, sustainability

INTRODUCTION

Given that Giurgiu County is particularly rich in environmental heritage elements through avifaunistic protection sites, a number of restrictions have been imposed on the activities to be carried out within these protected areas. Interest in fish products is very high and demand exceeds the current production capacity. Although it is still a fairly small market, Romania has real growth potential in this sector. With European funding to finance the fisheries sector, in the coming years it will reach at least half of the average EU fish consumption, meaning 10 kilograms per capita. At present, Romania ensures from its own production only 25% - 30% of total fish consumption, which amounts to 90,000 tons.

Romania is one of the top eight European countries according to the annual consumption of fish and could export certain species that do not have a search on the local market but are wanted by other states. The

problem is that the European Union could ban the delivery of fish from Romania to the Member States of the Union if it does not meet certain conditions. For example, if the fish contain a high level of certain chemicals, above the level accepted by the EU, steps will be taken to stop the movement, in order to protect the European consumer. Over the past 18 years, fish exports from the Romanian market have declined considerably, at which time the trade balance is negative. The main cause: the range of products on the market. A major handicap for indigenous producers, which start fishing in the country and try to enter the Western markets, is the production conditions, which do not amount to the level of technology of the EU competitors.

According to the Register of Aquaculture Units (RUA) managed by the National Agency for Fisheries and Aquaculture, 41 fish farms are registered in Giurgiu County, of which 5 nurseries and 36 farms. Below is a list of fishing facilities (Source: RUA, 31.12.2017)

At the level of the county, 60 professionals have been identified who have specific fishing and aquaculture activities covering the exploitation of marine and freshwater resources for the purpose of capturing or collecting fish, crustaceans, molluscs and other creatures as well as other marine products for example: aquatic plants, pearls, sponges, etc. They are included in Division 03 Fisheries and aquaculture and activities that are normally integrated in the making of their own production (e.g. sowing oysters for pearl production).

At the level of the county there are 8 retail units of fish/fish products, sanitary-veterinary registration. Six fish/fish shops with prohibited activity were identified, out of which 4 were based in Giurgiu and 2 were based in Bolintin Vale. From the sanitary-veterinary point of view, only 4 direct fish sales units are registered at the county level [1]. At the level of Giurgiu County, according to the information presented by the Sanitary Veterinary and Food Safety Department Giurgiu, there are not registered as sanitary-veterinary: collection centres for batrachians, gastropods, crustaceans; aquaculture farms; fishing boats.

MATERIALS AND METHODS

In this paper, time series have been used with regard to the total catches of commercial fishing in Giurgiu County in 2017, total capture from aquaculture in Giurgiu County in 2017 and total catches (tonnes) reported by economic operators authorized to fish commercially in flowing waters under Romanian jurisdiction over 2008-2015. Also, statistical data on fish consumption were used including a questionnaires addressed to fishermen and aquaculture units in Giurgiu County [5].

RESULTS AND DISCUSSIONS

For the Danube sector of Giurgiu County, the total allowable catch was 89 tonnes in 2015 and increased to 112 tonnes in 2016 and 2017. The increases were for native Cyprinids from 68 tonnes in 2015 to 75 tonnes in 2016 and

2017, at raptors species ranging from 12 tonnes in 2015 to 16 tonnes in 2016 and 2017, are mackerel from 5 tonnes in 2015 to 6 tonnes in 2016 and 7 tonnes in 2017, and in other species there have been reductions in quotas from 5 tonnes in 2015 and 2016, to 3 tonnes in 2017.

The total allowable catch for rapacious species (asp, catfish, zander and pike) recorded oscillations in 2015 – 2017 periods. Thus, a total allowable quantity of 131 tonnes was set in 2015 and 174 tonnes for 2016 and 2017 tonnes.

An increase in the total allowable catch for all four raptors (catfish, chicken and pike) is noted with approx. 35% in 2016 compared to 2015, which remained the same in 2017 as compared to 2016, even though it varied on the Danube sectors. The total catch for the asp was set at 16.2 tonnes in 2015 and 20.1 in 2016 and 2017. For catfish, was set a total allowable quantity of 53.3 tonnes in 2015 and 74.9 tonnes in 2016 and 2017. For the zander, the quantity increased from 41.8 tonnes in 2015 to 54.4 tonnes in 2016 and 2017 and at pikes 19.7 tonnes in 2015 and 24.6 tonnes in 2016 and 2017.

In Giurgiu County, the total allowable quantity decreased from 5 tons in 2015, half in 2016 and 2017 (2.5 tons), while the other abundant species was allowed to increase.

Regarding to the total allowable catch on cyprinids, the situation for the 2015-2017 period shows an increase for 2016 and 2017, as compared to 2015, of approx. 20%, the largest being carp grown (28.5%).

At the Prussian Carp, the total allowable quantity was 241.5 tonnes in 2015 and increased to 255.6 tonnes in 2016 and 2017; for Bream, an allowable quantity of 129.3 tonnes in 2015 and 152.1 tonnes in 2016 and 2017. The allowable quantity for the Vimba was 50.2 tonnes in 2015 and 60.1 tonnes in 2016 and 2017 and for Barbell was 56.2 tonnes in 2015 and 66.3 tonnes in 2016 and 2017. For the Roach an allowable quantity of 30.4 tonnes for 2015 and 43.1 tonnes for 2016 and 2017 was set. Finally, an allowable quantity of 23.7 tonnes in 2015 was set for the White Bream, which increased to 36.8 tonnes for 2016 and 2017.

On the Danube sector of Giurgiu County, the total allowable catch at native Cyprinids was 67 tonnes in 2015 and 75 tonnes in 2016 and 2017. The 2008-2015 data provided by Eurostat on total catches reported by economic operators authorized to fish commercially in flowing waters under Romanian jurisdiction show a decrease.

Based on Eurostat data, we graphically chart the evolution of the total catch reported by economic operators authorized to fish commercially in the Romanian waters under the jurisdiction of Romania for the period 2008-2015.

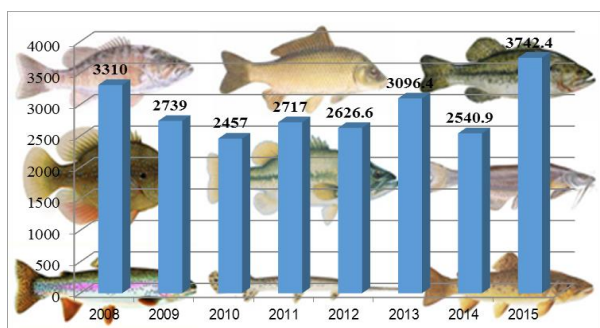


Fig.1. Total catches (tonnes) reported by economic operators authorized to fish commercially in flowing waters under Romanian jurisdiction over 2008-2015

Statistical data on fish consumption

There is a steady decrease for the period 2008 - 2011, an increase for the period 2012-2013, followed by a sharp fall in 2014 to a value below 2012 and a spectacular increase for 2015, when the largest amount catches resulting from commercial fishing, reported for the period considered.

Statistical data on the quantity of fish caught and fish species are provided by the National Agency for Fisheries and Aquaculture.

Table 1. Total catches of commercial fishing in Giurgiu County in 2017

Fish species	Total capture (kg)	Fish species	Total capture (kg)
Red eye	535	Catfish	1,705
Batter fish	640	Luce	230
Crucian	8,973	Avat fish	109
Carp	6,363	Cornel	7,603
Fishmonger	1,718	Mackerel	125
Flat-fish	3,500	Other fish species	1,130
Zander	1,012		

Source: Address NAFA SR Muntenia no. 960/24.04.2018

The quantities of fish and species captured in Giurgiu County in the year 2017 show high aquaculture fishery values (897,785 kg) compared to commercial fishing (33,654 kg). Aquaculture production recorded in 2017 important values for the following fish species: carp, bighead, crash, chalice, blood, sleep.

Table 2. Total capture from aquaculture in Giurgiu County in 2017

Fish species	Total capture (kg)	Fish species	Total capture (kg)
Carp	623,988	Novac	64,112
Crucian	41,885	Fish cowboy	1,700
Other fish species	26,700	Zander	18,175
Cornel	110,254	Catfish	10,971

Source: Address NAFA SR Muntenia no. 960/24.04.2018

Price analysis

Romanians consume twice less fish as during communism and are the last in the EU in this chapter. The high food price, given that almost 90% of the fish sold in Romania is imported, is the main reason why the food is not the most sold product.

The price, the type of fish and its look in the display are the most important purchase criteria.

Table 3. Fish purchase prices from fishermen / aquaculture units

Species	Average purchase price from fishermen (RON)	Average shelf sales (RON)
Carp	14-18	18
Phytophagus	8	10-12
Silver Carp	8	10-12
Prussian Carp	6	8-10
Pike	15	19
Bleak	5	7
Chub	8	10-12
Bighead Carp	8	10-12
Perch	8	10-12
Bream	7	9.5-10
Rudd	7	9.5-10
Catfish	14	19
Asian Carp	8	10-12
Asp	8	12
Zander	14	19

Source: questionnaires addressed to fishermen / aquaculture units in Giurgiu County

The analysis of fish prices was made by comparing the existing offers on the Romanian market, from the moment of purchase from the fishermen to the consumers, and at the prices displayed on the shelves in the shops, depending on the type of fish most consumed.

The above table shows the average prices found on the market, but due to the legislative instability, the exchange rate increase, changes in the value added tax rate, as well as price increases due to wage increases, price changes often occur. There are also price differences between fish species from aquaculture and fish species in the Danube.

Ecological fishing capacity

The Common Fisheries Policy (CFP) aims to ensure that fisheries and aquaculture are environmentally, economically and socially sustainable and provide healthy food for EU citizens. It also aims to support a dynamic fishing sector and ensure a decent living for fishermen. Although it is important to maximize catches, there must be limits. We need to ensure that fishing practices do not affect the reproductive capacity of fish populations. The current policy sets out to establish sustainable catch limits in the period 2015-2020 to ensure the continuity of long-term fish stocks [3].

The CFP adopts a prudent approach that recognizes the impact of human activities on all ecosystem components. It aims to convince fishing fleets to be more selective with the species fished and to gradually eliminate the practice of discarding unwanted catches.

In Romania, a series of measures have been adopted for the protection of fish species of economic and / or ecological value. In 2005, the Order on the establishment of protective measures for some fish species of economic and / or ecological value was adopted, prohibiting commercial fishing and recreational / hop fishing for five years, of species with ecological value.

Ecological fish species forbidden to fish for commercial purposes for commercial purposes and for recreational / sport fishing were: huchen (*Hucho hucho*), grayling (*Thymallus thymallus*), river lamprey (*Eudontomyzon danfordi*, *Eudontomyzon*

mariae), ide (*Leuciscus idus*), striped zander (*Stizostedion volgense*), bleak (*Chalcalburnus chalcoides mentho*), striped chub (*Leuciscus agassizi*), *Romanichthys valsanicola*, small chub (*Leuciscus leuciscus*), common chub (*Petroleuciscus celestis*), pond chub (*Petroleuciscus borysthenicus*), common zingel (*Zingel Zingel*), streber (*Zingel streber*) and Nera subspecies (*Zingel streberi nerensis*); *Umbra krameri*; loach (*Misgurnus fossilis*); racer goby (*Bentophylloides brauneri*), *Cobitis eleongata*, pond cobitis (*Cobitis megaspila*, *Cobitis tanaytica*), golden loach (*Sabanejewia radnensis*), Danube golden loach (*Sabanejewia bulgarica*), three-spined stickleback (*Gasterosteus aculeatus*), Techirghiol three-spined stickleback (*Gasterosteus crenobiontus*), Ukrainian stickleback (*Pungitius platygaster*), roach (*Rutilus pigus*), thermal rudd (*Scardinius racovitza*).

Ecological aquaculture is a healthy alternative that produces fresh and local food. The quality of fish meat is a thing of the kind, providing the human body with Proteins, but also an important source of vitamins and nutrients. It is obvious that overfishing is endangering world fish stocks. Rational exploitation of fish or aquaculture can help mitigate this pressure on fish and the environment, even in the face of a growing demand for fish, both in the EU and globally. Fish-farming, one of the most spectacular food industries on the world produces about half of the fish consumed each year, with figures rising. Without aquaculture, there is not enough fish to meet demand, and excessive fishing could jeopardize the long-term viability of wild fish stocks [2].

Fish produced in fish farms provide good quality protein for human diet, and local aquaculture products contribute to the economic development of the area, for the benefit of the community. More than 80 000 people work directly in European aquaculture and their number increasing as EU farmers provide more and more aquaculture products. Through policy reforms and specific financial support, the European Union is constantly supporting the economic growth of this sector, the creation of jobs and the high quality of

farmed fish produced in Europe, because aquaculture products are healthy and ensure development sustainable area. The reform of the Common Fisheries Policy aims at fully harnessing the potential of EU aquaculture in line with the Europe 2020 objectives: sustainability, food security, growth and employment.

As in organic farming, priority in aquaculture and ecological farming is the production of healthy food for consumers, the protection of the aquatic environment and for fish species. Farmers rely on clean water and sanitation. There are many situations where fish find food in the environment, but where it is insufficient; farmers provide additional food to ensure healthy, balanced nutrition in full compliance with strict environmental and consumer protection standards.

Since 2010, as a result of strict EU rules, organic fish production has grown in European countries, with the growing interest of consumers in organic products and the possibility of using the eco-label to identify and describe these products, accounting for almost 4% of total EU aquaculture production, around 50,000 tones in 2015 [4]. Ireland is the first to fish in UE organic aquaculture, with over 44% of European production. It is followed by Italy (17%), Great Britain (7%) and France (6%).

The main species of freshwater aquaculture grown according to ecological standards are salmon, carp, trout and bass.

Economic performance in aquaculture varies across EU Member States due to constraints limiting its development.

In Romania, organic fish farming started in 2010 with support from the European Fisheries Fund (EFF), 2007-2013. The conversion process focused on common carp, since the differences between traditional farming practice and ecological practices were not significant [1].

Fish farming in Romanian ponds and fish farms is managed mainly by extensive and semi-intensive technologies, which are based on the natural productivity of ponds with additional local cereals (corn, wheat, sunflower).

Ecological fish production in Romania was 2042 tonnes (in 2014), generally based on carp growth, by 29 certified companies, covering 14,840 ha of certified ponds.

Carp is one of the most widespread fish species in European fisheries, especially in Eastern Europe. Total carp production reached 83400 tonnes in 2015.

According to Eurostat data, the main EU organic carp breeders are Hungary (over 3,000 tonnes in 2015), Romania (2,700 tonnes) and Lithuania (1,200 tonnes). Smaller quantities are produced in Austria, Germany, Poland and Latvia.

The cost of growing carp in an ecological system is considerably higher than the cost of traditional carp (from 0.65 euro / kg in Germany to 0.89 euro / kg in Poland, which means an additional cost of 30% in Germany and 46% in Poland). The main costs that make up the difference are those for sapling and those for fish food, which are doubled under the conditions of organic farming.

In organic fish farming it is necessary to use additional sapling because of the low survival rate of the sapling in the additional year of growth. In Germany and Poland, a double quantity of saplings is required for traditional breeding and in Romania the cost is higher because the Romanian farms buy older broilers (compared to organic farmers in Poland and Germany that produce their own brood) and the additional needs of brood is estimated at 50%.

Food consists mainly of cereals. The nutritional value of organic cereals is equal to that of conventional cereals, but the price is double. Because of the problems rose during breeding (lower growth rate), an additional year of growth is needed, which generally leads to a 15% conversion rate of food. The additional year of growth required for organic carp also explains the additional labour costs. The studies show that the profitability is much lower for organic carp than for the one grown in the conventional system. The data clearly show that organic farming of carp is unsustainable without subsidies. In Romania, there is currently no difference between prices for organic aquaculture products and non-organic products. For example, the retail price

for carp is 14-16 lei / kg (3.11 - 3.55 euro / kg).

Fishing techniques and ecological tools (nature friendly)

In Romania, organic fish farming has begun to develop with the implementation of funding programs that encourage this type of fish farming, namely the European Fisheries Fund - EFF 2007-2013. The funding granted was limited to encouraging aquaculture and less to developing the ecological / sustainable segment at the commercial level, especially with applicability on the Danube River.

Concerning nature-friendly fishing at commercial level, the authorities have taken a number of measures to limit the ecological imbalances created by overfishing and poaching. Thus, to restrict the population of fish, it was decided to limit, in some cases even prohibit, fishing for certain periods of time, strict rules on commercial fishing, regulation of fishing gear by fishing category and last but not least commercial fishing monitoring actions were organized.

With regard to aquaculture, the conversion process has focused on common carp, since the differences between traditional farming practice and ecological practices have not been significant.

Although Romania has transposed into national legislation the European framework for organic farming, environmental certification, the legal framework to legislate on environmentally friendly fishing gear, fishing techniques, was not identified. In the current legal framework, certified organic operators are required to produce cleaner food, more suited to human metabolism, in full correlation with environmental conservation and development, to comply with the rules on eco-labeling. One of the main purposes of organic farming is the production of fresh and authentic agri-food products that respect natural and environmental factors. At the same time, they have the obligation to collaborate with inspection and certification bodies in order to check compliance with the provisions of the legislation on organic production.

Recreational fishing has identified a number of fishing techniques and tools that can be

considered nature friendly. It is also noted the emergence of ecological fishing tackle on the profile market, such as alternatives to fishing lead. Among these we mention:

Still fishing is the most practiced fishing method. This is a type of static fishing, praised in an area prepared by prior priming to group the fish once.

As an ecological alternative to classic fishing lead, the "Stonze" natural stones, produced in a wide range of weights, are used for most fishing styles.

Widespread use can have immediate beneficial effects by reducing lead pollution.

Sheffield fishing is an adaptation of stationary fishing. It is practiced with a reel and a telescopic or telescopic jaw, with telescopic rings. This offers some advantages:

- In a not too deep pond, whose bottom is on a slight slope, often more deep depths are found at 20 - 30 meters shore;

- Far off shore, the fish are less disturbed by the noise and fewer will hesitate to bite the bait.

- Large fish with relatively thin and elastic dwarf yarns can be caught (French producers write it with "anglaise", the Italians write it "affluent" and the English producers with "sinking"), then thanks to the reel brake, the thread also reserves the parabolic action of a good rope for Sheffield fishing.

Fly fishing is undoubtedly the most "green" fishing. This style of fishing has developed in the UK, Sheffield, but has spread to Europe and the world. It also represents a way of contributing to the preservation of species in the context of drowning fish in a drought-water course. Due to the absence of the hook, the fish will be released more quickly and will not keep track of the catch.

Lagoon fishing: trout fishermen often practice this fishing technique, but it can also be used for other fish species. As bait, insects, larvae and worms are found on the water's edge, which moves the hook in the water in the most natural way possible.

Itinerant fishing is a way for the fisherman to reconcile his passion for fishing and walking.

Surfcasting fishing: " Looking for fish in the waves", also known as "surfcasting", is

practiced from shore (sand, rocky shore) and especially from a sandy beach, with a vertically mounted pin on a stake and with a lace where the bait is attached. Wherever you fish, the material, tools and baits are basically the same. Surfcasting is based on the use of a lead rod with lead between 50 and 200 g, and then the fisherman only has to wait. If itinerary fishing can be practiced for catching small fish (eg, roach), surfcasting is generally practiced for catching fish from the edges of rivers, rivers and torrents. Often, amateur catfish fishermen use various natural or artificial baits in their search.

Bomb fishing is a relatively recent method. Biking allows you to fish far away from the shore, with light natural baits, to move the bait from a distance, and to thoroughly search for all water layers. It is an extremely effective method of catching trout from mountain chutes or lakes, but the technique is also currently interesting for the raptor catching fishermen such as catfish, pike or perch, and sometimes for the seashore fishermen. Experienced fishermen know the best fishing methods that do not have a negative impact on the environment. Given the emphasis on "green life" in today's society, it is important to ensure that each fisherman does everything he can to support fish stocks and protect wild habitats that make fishing a pleasure but also a pleasure. Here are some recommendations of good practice in the field of organic fisheries.

Lead has traditionally been used in fishing, but if the level of lead in a body of water increases, it can poison fish and other aquatic animals. It is therefore advisable to change the lead plates with environmentally friendly fishing gear that uses steel or tin and biodegradable fishing rods.

All fishermen should comply with the limits on the quantity and size of captured fish that are set at government level and assumed at local and regional level. This prevents overfishing of certain species of fish in a given area.

The fish once captured, can be used entirely in the household. What is generally thrown away can be mixed with leaves, tree bark or sawdust and used as fertilizer, because the

compost thus obtained is more prone to nutrients. It is also recommended to use a small amount of bait. Types of foreign bait can affect the local ecosystem if introduced into excess water without being used. It is preferable to use live bait rather than plastic, as unused living bait can be left in the river bed. If the fisherman does not need to keep the fish, he can try to catch it and then release it to allow the fish to live and reproduce, supporting the increase in the number of specimens. For this, the fisherman needs to know the best techniques of catching and releasing the fish.

Also in favour of environment-friendly fishing, the recommendation is to use traditional boats, rowing, or canoeing in favour of motorists. This reduces the carbon footprint by reducing emissions from engine boats. However, if a motorboat is used, the use of these must be done in accordance with local rules in different habitats and in certain sectors of the shore so that birds nesting in the vicinity are not disturbed.

The Triad "Reduce, Reuse, Recycle" also applies to fishing. Awareness of the impact that waste has on the environment should cause fishermen to pick up plastic scrap, worn off gear, household waste on the banks of the river (especially plastic boxes, aluminium cans, plastic bags and packs, canned cans), because all of these not only disturbs visual and olfactory but can become traps for the animals in the area.

By applying these simple rules, the environment can be kept cleaner, and the beauty of the fish and terrestrial wildlife around the rivers will be able to enjoy, along with fishermen, the rural community and tourists who come to the area.

CONCLUSIONS

The Fish Market is the best business environment on this market by providing major benefits to buyers / traders and fish suppliers (fishermen, fishermen associations) at least at the theoretical level, given that in reality the Romanian authorities have difficulties in implementing this type of entity.

The benefits of a fish market are:

- product traceability from manufacturer to buyer (via batches and identifiers used);
- increasing the transparency of transactions on the fish market;
- stimulate competitive behaviour on the market,
- real monitoring of the quantities of fish traded;
- price monitoring on the fish market;
- applying equal and non-discriminatory treatment to all trading partners;
- the possibility to communicate with fish suppliers and to manage the real problems in the territory;
- the possibility for buyers to participate in more transactions within a short period of time;
- buyers will benefit from products marketed under optimal hygiene and conservation conditions;
- concentrating all fish resources in one place;
- ensuring compliance with quality and control procedures, hygiene standards;
- maintaining a market balance between supply and demand;
- guaranteed payment to fish suppliers.

In recent years, several fish stocks have been established in Romania through the Operational Program for Fisheries 2007-2014. Most are inoperative or provide imported fish. The future of inland fishing depends on the protection of biodiversity, with a focus on the balanced exploitation of the fishery resource.

In principle, inland fishing is considered to be sustainable in relation to the environment if it fulfils two fundamental conditions:

- limit the adverse impact on the environment;
- ensure the conservation and preservation of biodiversity of biotopes as well as the natural restoration of exploitable fish resources;

In order to ensure the environmental sustainability for processing activities, the use of non-environmental processing technologies is required both for waste and wastewater management and for the higher exploitation of by-products, including energy.

Fishery areas benefit from exploitable fish resources as well as significant water areas that allow for various complementary

activities (tourism, recreational fishing). Cultural heritage is rich in areas such as fishing, fish farming, agriculture, animal husbandry, handicrafts.

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