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**NATIONAL STRATEGIC PLAN FOR THE DEVELOPMENT OF AQUACULTURE IN
THE REPUBLIC OF SLOVENIA FOR THE 2014–2020 PERIOD**

LJUBLJANA, JANUARY 2014

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1 INTRODUCTION

The National Strategic Plan for the Development of Aquaculture in the Republic of Slovenia for the 2014–2020 Period (hereinafter: the »Plan«) lays down the priorities for the development of aquaculture as an economic activity in the Republic of Slovenia in the 2014–2020 period. The basis for the preparation and adoption of the Plan is Regulation (EU) No 1380/2013 of the European Parliament and of the Council on the Common Fisheries Policy of 11 December 2013 (hereinafter: "Regulation 1380/2013/EC") and the Strategic Guidelines for the sustainable development of EU aquaculture of the European Commission No 229/2013 of 29 April 2013. The Plan aims to provide the fundamental orientations that will promote the development of sustainable, competitive and knowledge-based aquaculture in the Republic of Slovenia.

The Plan is designed to contribute to the delivery of the objectives of the Europe 2020 strategy that highlights three priority elements that are mutually reinforcing:

- smart growth: development of a knowledge and innovation-based economy;
- sustainable growth: promotion of an economy that is more competitive, resource-efficient and greener,
- inclusive growth: fostering a high-employment economy delivering social and territorial cohesion.

The Plan further observes the guidelines prepared by the European Union for the development or sustainable future of aquaculture in the European Union. The guidelines were adopted in 2002 and supplemented by the Commission Communication to the European Parliament and the Council in 2009. In accordance with the above guidelines, the development of aquaculture must be based on environmentally acceptable, economically viable, and socially and demographically stable aquaculture, whereby innovation and lessons are taken into account while observing good farming conditions, all of which in turn enables sustainable aquaculture.

Fish as food, which includes all aquatic organisms and their products from catch and aquaculture, is one of the main sources of healthy proteins and fats in the human diet. This is why both the World Health Organization and the Food and Agriculture Organization of the United Nations (FAO) recommend more extensive consumption of fish. Consumption of fish per capita in Slovenia was around 10 kg/capita/year in 2009 according to the FAO methodology. This ranks Slovenia at the lower end of the European countries where an average of 25 kg of fish and fishery products per capita is consumed annually. Taking into account the fact that the catch of aquatic organisms has been decreasing on the global scale in recent years, this shortfall could be made up by aquaculture products.

Owing to the decrease of the fishing area where Slovenian commercial fishermen fish, commercial sea catch has decreased more than tenfold over the last 20 years. We could make up for a part of the shortfall in sea catch and thus ensure the maximum possible consumption of fish from self-sufficient supply, which can only be achieved with aquaculture products. Aquaculture should be based on the establishment of sustainable forms of aquaculture in accordance with environmental requirements and available water resources. This will only be possible with a clear strategy and

cooperation between the state, the profession, capital and workers in the aquaculture industry. The introduction of environmentally-friendly aquaculture will also allow for social consensus to be reached based on environmental acceptability and economic viability. Another requirement is greater consumer trust as to the quality of aquaculture products, the achievement of which will only be possible through the assurance of high quality, healthy and fresh products (primarily from domestic production), the assurance of traceability and control that is carried out from the farming location to the consumer's plate.

The term aquaculture is frequently mistaken for the term "fish farming", which is a narrower term and only involves the farming of fish, while aquaculture is an industry involving all forms of farming of aquatic organisms ranging from algae to vertebrates. The Slovenian aquaculture sector comprises the rearing of freshwater and marine organisms. Only fish are currently farmed as part of freshwater aquaculture, while marine aquaculture also involves the farming of molluscs. Aquaculture may be compared to primary agriculture and classic or intensive livestock rearing, which we perform on land, while a prerequisite for aquaculture is water. Slovenia possesses numerous natural features that are conducive for various forms of aquaculture. Inland waters, primarily those in the Alpine foothills and Karst areas, allow for the pursuit of various forms of coldwater aquaculture, while conditions suitable for warmwater aquaculture are found in the Pannonian part of the country. This part of Slovenia as well as the areas along the Spodnja Sava River is rich in groundwater. The Slovenian part of the sea features areas envisaged for mariculture within the inshore belt where the pressure on this part of the marine environment is extensive as it originates from other uses of the sea as well. This is why the possibilities for mariculture development here have nearly been exhausted.

In terms of the environment we, therefore, distinguish between freshwater aquaculture and marine aquaculture (mariculture). Freshwater aquaculture is further divided depending on the water temperature and the species of fish into coldwater and warmwater aquaculture, and depending on the intensity into intensive, semi-intensive and extensive. Water from a natural source is generally required for the pursuit of the aquaculture activity, whereby water consumption can be significantly lower in semi-closed and closed recycling systems where the water already used can be reused several times with the aid of pumps, filters and aeration systems. This also reduces the loading of watercourses with waste matter as well as the threat of introducing non-indigenous aquatic organisms that can have a material impact on natural habitats. Extensive aquaculture and some types of intensive aquaculture (such as recirculating aquaculture systems – RAS) generally have a small impact on the environment. Environmental impact in the case of RAS is increased indirectly because of the elevated consumption of electricity.

The field of aquaculture is a relatively new one and is the fastest growing food production industry that is continuously being supplemented by new types and practices. General knowledge about aquaculture is highly deficient, which is why the importance of aquaculture is frequently misunderstood and only assessed to a limited degree. This applies to operators, users and those who are competent for different levels of decision-making and assessment. This can give rise to incorrect decisions and unexploited possibilities.

Just like agriculture that has been receiving recognition in recent years for its secondary importance, some forms of aquaculture are not only important for the

production of food, but are also gaining in importance in terms of the preservation of cultivated landscape and the settlement of rural areas in addition to the special benefits that are characteristic of this industry.

Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy (the Water Framework Directive), the Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive) and Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC (Bathing Water Directive) have been transposed to Slovenian law by way of the Waters Act (Official Gazette of the Republic of Slovenia, No. 67/02, 110/02-ZGO-1, 2/04-ZZdl-A, 41/04-ZVO-1, 57/08 and 57/12) and implementing regulations. These serve as the framework for the comprehensive management of waters and the aquatic environment as well as ensure the sustainability of water management. The Water Framework Directive, among other things, aims to prevent the deterioration of the status of waters as well as protect and improve the status of water, whereby the main objective is to achieve at least a good status of all European surface waters and groundwater by 2015. The Marine Strategy Framework Directive serves as the environmental pillar of the maritime policy that aims to achieve a good status of the marine environment by 2020. This is also setting up the framework and should be taken into account when considering the possibilities of using water for aquaculture purposes, the type of aquaculture and the spatial limitations. Provided these conditions are observed, we estimate that there will be no transboundary impacts, especially on marine biological resources and marine ecosystems in neighbouring countries.

In the areas designated as areas of special importance pursuant to Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) and Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (Birds Directive in the NATURA 2000 areas), stricter environmental requirements have been imposed which could diminish the economic viability of aquaculture activities. Stricter environmental requirements provide for the preservation of wild fauna and flora, the biotic diversity of ecosystems, landscape impacts, recreation and the preservation of water quality. This ensures ecosystem services that on the other hand either indirectly or directly contribute to the improved economic efficiency of aquaculture activities, for example through the assurance of the quality of the aquatic environment and water. Frequently, however, the benefits are not recognised or utilised because of the lack of familiarity with the field.

In terms of administration, aquaculture falls within the competence of the Ministry of Agriculture and the Environment, more specifically the Agriculture Directorate (the Livestock-Breeding Act), Forestry, Hunting and Fisheries Directorate, Hunting and Fisheries Division (Freshwater Fishery Act) that also regulates the area of the Common Fisheries Policy and the implementation of the European Maritime and Fisheries Fund, and finally the Administration of the Republic of Slovenia for Food Safety, Veterinary and Plant Protection (hereinafter: AFSVPP) (registrations of aquaculture installations and put and take ponds, aquaculture production approvals, health care and welfare of aquaculture animals, health status and the assurance of safe food, etc.). Water permits are issued by the Water Use Division of the Slovenian Environment Agency.

The Plan was prepared by the working group appointed by the Minister of Agriculture and the Environment. The working group is comprised of members from the Hunting and Fisheries Division, the Waters Division, the Nature Preservation Division, the Administration of the Republic of Slovenia for Food Safety, Veterinary and Plant Protection, the Slovenian Environment Agency, public institutions working in the field of fisheries (Department of Zoo Technology of the Faculty of Biotechnology, the Fisheries Research Institute of Slovenia, the Institute of the Republic of Slovenia for Nature Conservation and the Institute for Water of the Republic of Slovenia), economic and social partners (the Chamber of Agriculture and Forestry of Slovenia, the Society of Aquatic Animal Farmers of Slovenia) and the representatives of individual types of aquaculture (freshwater fish farming, sea fish farming and shellfish farmers). The Plan is, therefore, the result of discussions that took place at workshops organised by the Ministry of Agriculture and the Environment. The study on the status and possibilities for aquaculture in Slovenia that was carried out for the purpose of preparing the National Strategic Plan for the Development of Aquaculture (hereinafter: the "Study") served as expert groundwork for the elaboration of the Plan.

2 ASSESSMENT AND ANALYSIS OF AQUACULTURE IN SLOVENIA

2.1 Natural Features

Water and space are the two natural features that are important for aquaculture.

Water

A water source of suitable quality is of key importance for aquaculture. It is particularly in the rearing of coldwater species of fish that the water source must be available in sufficient quantities throughout the farming cycle. The hydrological balance and the quality of the water source are important for the planning of aquaculture. It is only in the RAS closed systems that it is not necessary to continuously supply fresh water when farming certain species of aquatic organisms or such water supply requirements are very low.

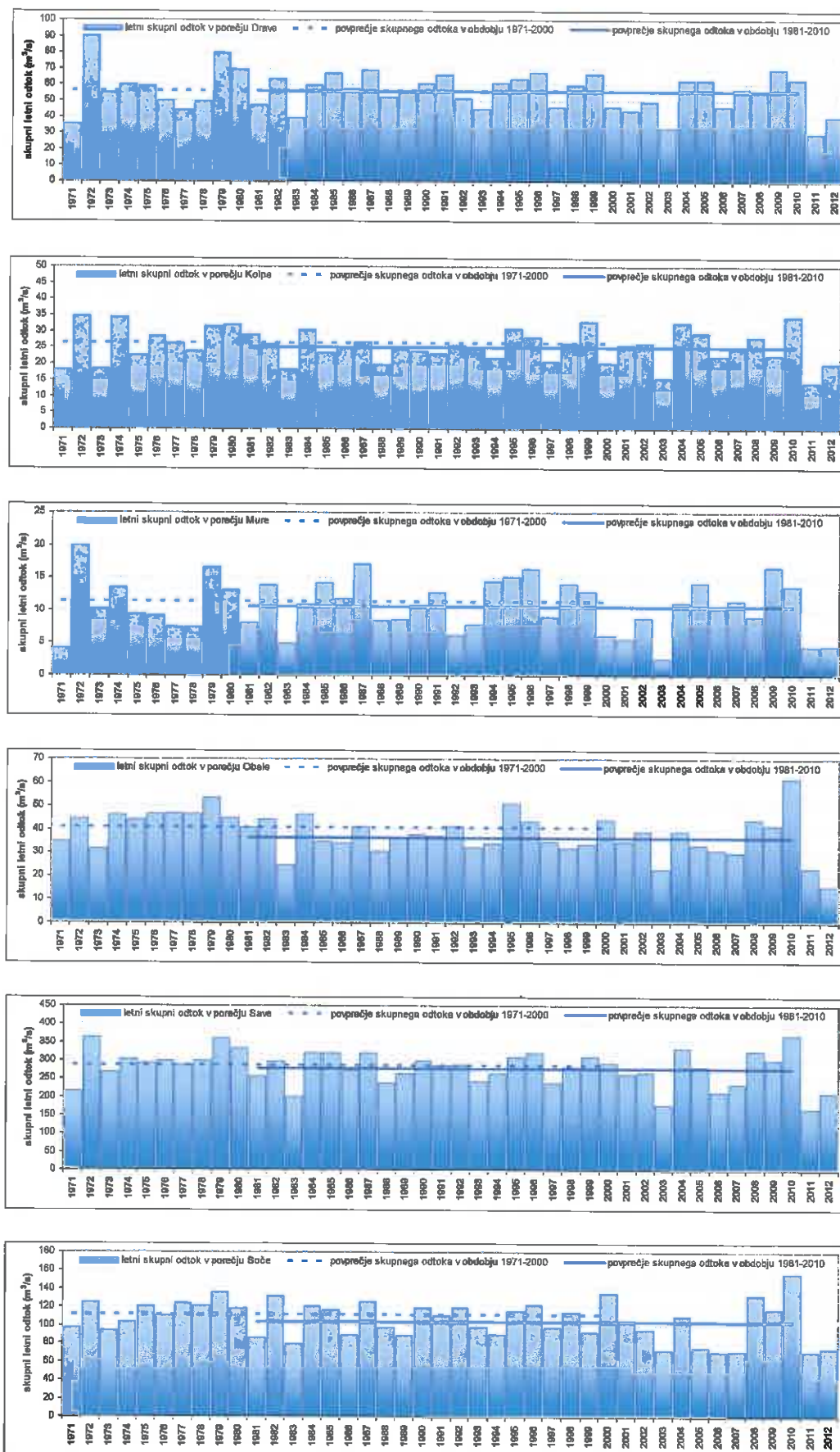
Water Balance

Data on the annual water balance for the area of the entire country shows that the specific total runoff of Slovenia is 25 l/s/km², which makes it a water-rich country when compared to Europe and its specific total runoff of 9.6 l/s/km² (Arnell et al., 1993; EEA, 1995). In addition to the high water stages with an average total discharge of 506.7 m³/s in the 1981–2010 period, Slovenia is also characterised by extensive spatial and temporal variability of all water balance elements. These extensive differences in the amount of precipitation and evapotranspiration are reflected in the variability of the quantity of surface and groundwater runoff. The total runoff for the 1981–2010 period estimated using the GROWA-SI regional water balance model is highest in the western part of the country where the river basin of the Soča River attains runoffs in the order of 46 l/s/km². The coefficient of variability of total annual runoff in the 1981–2010 period is highest in the eastern part of the country (34.5%). Model-based comparisons of the total runoff in the 1971–2000 period and the 1981–2010 period indicate an average 4.5% decrease in the area of the entire country, whereby the decrease is greatest in the river basin of Adriatic Sea rivers (10%) (Table 1). Data on the water balance in Slovenia shows that the country is a water-abundant country when compared to the water balance of Europe according to *Schendel*.

When planning and implementing aquaculture activities, the fact should be taken into account that Slovenia has a high share of torrential and Karst water bodies, where the difference between high and low discharges can be very extensive. Strategic planning of a stable development of aquaculture in Slovenia must be based on a detailed analysis of low discharges during drought periods or the groundwater discharges that recharge the river network during periods when there is no precipitation. Groundwater runoff or the groundwater recharge change substantially because of varying climatic conditions, geological composition, type of soil, land use, morphology and hydrogeology (ARSO, 2013), whereby periodic variability is also extensive. The variability coefficient that indicates the size of the periodic deviation from the average ranges from 15.5% in the area of the Kamniško-Savinjske Alps to 41.5% in Goričko. Based on the extensive deviations of the annual recharge of aquifer systems from the multi-annual mean, we can infer the relative quantitative sensitivity of individual aquifer systems or the quantitative stability of water resources required for aquaculture activities. The substantial annual variability of groundwater recharge quantities and the associated extensive quantitative sensitivity of water resources are reflected primarily

in the eastern sub-Pannonian parts of the country and the western part of the Primorska region with Slovenian Istria (Uhan and Andjelov, 2012).

Table 1: Total runoff by individual years and a comparison of the averages from the 1971–2000 period and the 1981–2010 period by individual river basins of Slovenia (GROWA-SI model)



Skupni letni odtok v porečju Drave - Total annual runoff in the river basin of the Drava River

Povprečje skupnega odтока v obdobju 1971–2000 – Average total runoff in the 1971–2000 period

Povprečje skupnega odтока v obdobju 1981–2010 – Average total runoff in the 1981–2010 period

Skupni letni odtok (m^3/s) – Total annual runoff (m^3/s)

Skupni letni odtok v porečju Kolpe - Total annual runoff in the river basin of the Kolpa River

Povprečje skupnega odтока v obdobju 1971–2000 – Average total runoff in the 1971–2000 period

Povprečje skupnega odтока v obdobju 1981–2010 – Average total runoff in the 1981–2010 period

Skupni letni odtok (m^3/s) – Total annual runoff (m^3/s)

Skupni letni odtok v porečju Mure - Total annual runoff in the river basin of the Mura River

Povprečje skupnega odтока v obdobju 1971–2000 – Average total runoff in the 1971–2000 period

Povprečje skupnega odтока v obdobju 1981–2010 – Average total runoff in the 1981–2010 period

Skupni letni odtok (m^3/s) – Total annual runoff (m^3/s)

Skupni letni odtok v porečju Obale - Total annual runoff in the river basin of the Obala (littoral) region

Povprečje skupnega odтока v obdobju 1971–2000 – Average total runoff in the 1971–2000 period

Povprečje skupnega odтока v obdobju 1981–2010 – Average total runoff in the 1981–2010 period

Skupni letni odtok (m^3/s) – Total annual runoff (m^3/s)

Skupni letni odtok v porečju Sava - Total annual runoff in the river basin of the Sava River

Povprečje skupnega odтока v obdobju 1971–2000 – Average total runoff in the 1971–2000 period

Povprečje skupnega odтока v obdobju 1981–2010 – Average total runoff in the 1981–2010 period

Skupni letni odtok (m^3/s) – Total annual runoff (m^3/s)

Skupni letni odtok v porečju Soča - Total annual runoff in the river basin of the Soča River

Povprečje skupnega odтока v obdobju 1971–2000 – Average total runoff in the 1971–2000 period

Povprečje skupnega odтока v obdobju 1981–2010 – Average total runoff in the 1981–2010 period

Skupni letni odtok (m^3/s) – Total annual runoff (m^3/s)

Water Quality

In accordance with the requirements of the Directive of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Directive 2000/60/EC), the status of surface waters is defined by the chemical and ecological status of surface waters. In accordance with the Marine Strategy Framework Directive, the environmental status is defined by 11 descriptors, i.e. biological diversity, non-indigenous species, fish stocks (populations of all commercially exploited fish), elements of marine food webs, eutrophication, sea-floor integrity, hydrographical conditions, environmental pollution, contaminants in fish and other seafood for human consumption, underwater noise and marine litter.

Chemical Status of Surface Waters

The loading of Slovenian waters with hazardous or priority list substances is low considering that as many as 147 surface water bodies (94%) have a good chemical status. The bad chemical status was declared because of the Mercury content for the Sava water body at Vrhovo–Boštanj, while the Krka water body at Soteska–Otočec and all water bodies at sea have a bad chemical status because of the excess content of tributyltin compounds (TBT). The possible source of sea pollution is the use of TBT in the anti-fouling coatings for the protection of ships in recent years as well as international maritime transport, though the use of TBT for ship coatings has been prohibited in the European Union since 2003 (source: www.arso.gov.si).

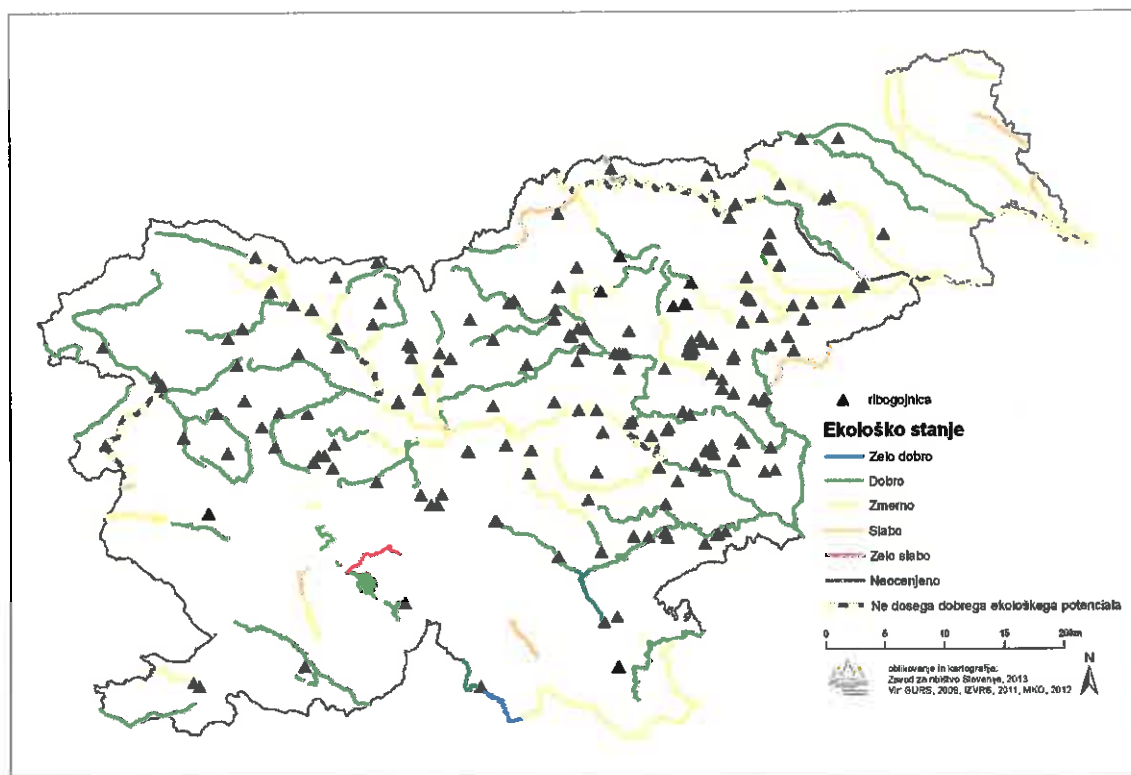
Chemical Status of Groundwaters

Groundwaters are under the most strain in the north-eastern part of Slovenia and in the surroundings of Celje. The biggest pressure is pollution with nitrates and pesticides. Bad chemical status was determined with a high confidence level for the Savinjska, Dravska and Murska basins and with a low confidence level for the eastern part of Slovenske gorice. The chemical status of other water bodies was determined as good, either with a low or high confidence level. The content of nitrates is not decreasing significantly and the results are not indicating positive impacts as resulting from the decrease of the introduction of nitrogen into the soil or aquifer. The content of atrazine is decreasing which demonstrates the positive impact of the prohibition of its use (source: www.arso.gov.si).

Ecological Status of Surface Waters

The ecological status of surface waters is determined based on the biological and supporting physico-chemical and hydromorphological elements of quality as well as special pollutants. Existing biological systems for the assessment of the ecological status of waters in Slovenia are based on the sampling of phytobenthos and macrophytes as well as benthic invertebrates, while phytoplankton is sampled in lakes. Methods based on fish sampling have recently been developed for the assessment of the ecological status of rivers. Surface water bodies are classified into five classes based on the assessment using biological and supporting physico-chemical elements of quality and special pollutants: high, good, moderate, bad or very bad ecological status. Classification into the high ecological status class is also verified in terms of the hydromorphological elements of the ecological status. The targets of Directive 60/2006/EC are not being achieved by as many as 59 assessed bodies of water (38%), two of which (1%) are classified into the very bad status class, seven (5%) are

classified into the bad status class and 50 (32%) into the moderate ecological status class or the moderate ecological potential class.



Aquaculture farm

Ecological status

High

Good

Moderate

Bad

Very bad

Not assessed

Does not achieve good ecological potential

Design and mapping

Fisheries Research Institute of Slovenia

Source: Surveying and Mapping Authority of the Republic of Slovenia 2009, IZVRS, 2011, MKO, 2012

Figure 1: Presentation of the ecological status of water bodies in Slovenia for the purpose of the Water Management Plan for the 2009–2015 Period, source: The Slovenian Environment Agency and the Fisheries Research Institute of Slovenia

Data on the chemical and ecological status of waters can only serve as an orientation point for the eventual assessment of the possibilities for the pursuit of aquaculture and the planning of its development. Actual planning also requires special analyses to be carried out of the other physical and chemical parameters of water resources that can decisively affect the success of aquaculture.

Assessment of the Environmental Status of the Sea

The first assessments of the environmental status of the sea have been performed for the purpose of preparing the marine environment management plan. Each of the eleven descriptors comprised several criteria, and the criteria in turn comprised several indicators. Environmental status is evaluated according to the precision indicator. For almost a half of the indicators, the status cannot be evaluated at this time because of a lack of data. Despite this, however, the first assessments of the environmental status show that 35% of all indicators have been assessed as good, while almost 13% of the indicators exhibit a bad status. The latter include distribution, size and status of demersal habitats, the extent of the fishing effort, the distribution of certain key trophic groups, physical damage to the sea floor and the concentration of pollutants.

Space

Space – just like water – is a precondition for the pursuit of aquaculture and is increasingly dependent on different interests. Site selection for aquaculture is becoming increasingly difficult. There have been certain general findings in this regard relating to permitted construction, the right of disposal of land and water, requirements for the comprehensive assessment of environmental impacts, etc., all of which impose stricter limitations on aquaculture than on other activities involving food production. In comparison with other countries, some of the Slovenian regulations governing this area that are presented in point 2.2 are stricter, while the conditions and procedures for the acquisition of water and land use permits last longer in some cases than in certain other EU countries.

2.2 Permits for the Pursuit of the Aquaculture Activity

Water rights must be obtained for the purpose of using water in order to rear aquatic organisms in the Republic of Slovenia, which are issued pursuant to the Waters Act (Official Gazette of the Republic of Slovenia, No. 67/02, No. 110/02-ZGO-1, No. 2/04-ZZdl-A, No. 41/04-ZVO-1, No. 57/08, No. 57/12, No. 67/02, No. 41/04, No. 57/08 and No. 57/12) by the Slovenian Environment Agency. Procedures for the issue of permits to users were took a relatively long time until now and involved an environmental impact assessment as well as the determination of the environmentally acceptable rate of flow derived from the so-termed Water Framework Directive (2000/60/ES). Pursuant to the Freshwater Fishery Act (Official Gazette of the Republic of Slovenia, No. 61/06), the opinion of the Fisheries Research Institute of Slovenia must be obtained prior to the issue of the water permit. The procedure for the granting of water rights for the purpose of rearing aquatic organisms in areas protected pursuant to environmental protection regulations must take into account the opinion of the Institute of the Republic of Slovenia for Nature Conservation. Acquisition of water rights for the purpose of rearing non-indigenous species of aquatic organisms also includes the acquisition of a permit for such rearing. Other legislative acts to be observed are Council Regulation (EC) No 708/2007 concerning the use of alien and locally absent species in aquaculture and the Nature Conservation Act (Official Gazette of the Republic of Slovenia, No. 96/04 with all subsequent amendments), while in certain cases the procedure for the assessment of the risk posed to nature must also be carried out. Pursuant to the latest amendment of the Waters Act that changes certain types of water rights for the rearing of aquatic organisms from concessions to water permits, we can expect some of the procedures to become shorter in duration. At this time, it is necessary to acquire a water permit for the direct use of water for the farming of aquatic organisms irrespective of the type and

size of the farming surface areas. The Waters Division of the Ministry of Agriculture and the Environment is competent for the protection, use and regulation of waters as well as the tasks associated with the provision of public services of environmental protection (drinking water supply and the discharge and treatment of municipal waste water and stormwater). The Agriculture Division and the Hunting and Fisheries Division within the Ministry are competent for the management of fish and aquaculture. Supervision over the implementation of legislation is carried out by the environmental and agriculture inspection services of the Inspectorate of the Republic of Slovenia for Agriculture and the Environment. Cooperation, integration and the search for solutions were all poorer in the past. In order to efficiently implement the strategic plan and ensure sustainable, professionally supported and successful aquaculture ventures in Slovenia, cooperation between all of the relevant sectors must be strengthened.

Reasons for the lengthy procedures for the acquisition of a permit, or for not being able to acquire one, may perhaps lie in the lack of suitable knowledge and awareness of aquaculture methods as well as the lack of data on the environmental impact of aquaculture (especially coldwater and warmwater aquaculture farms). Examples of good practice in some other EU Member States are not well known in our country, which is why the most frequently used water management approach is the so-called precautionary approach (i.e. better to prohibit than limit), which does not allow uniform development of this industry. Permit acquisition procedures in Slovenia can last in excess of 5 years, especially if they involve the amendment of municipal spatial plans, but are usually not shorter than 2 years. European Commission guidelines stipulate that Member States should foresee procedures for the reduction of the time required to acquire permits, which should not be longer than 20 months.

Health care for aquaculture animals falls within the competence of the AFSVPP, which is a body affiliated to the Ministry of Agriculture and the Environment. AFSVPP drafts legislation, programmes for monitoring, supervision and eradication, regulates health statuses, etc.

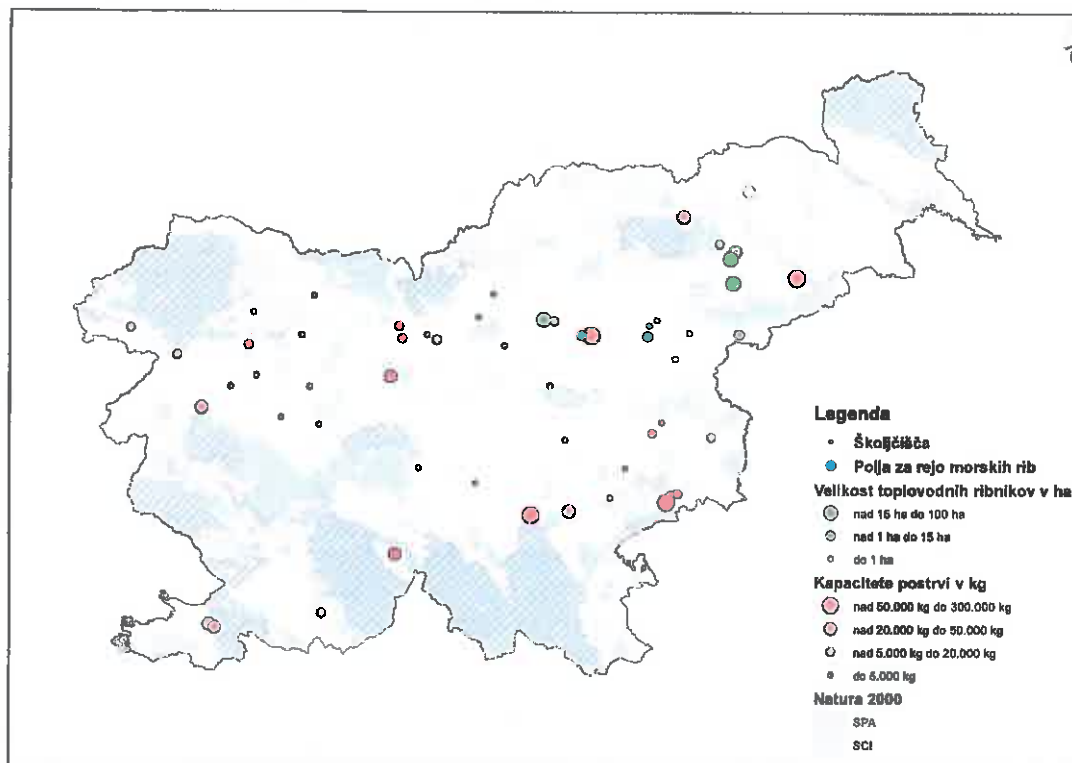
All aquaculture installations and put and take ponds must be registered in the Central Register of Aquaculture Installations and Put and Take Ponds (hereinafter: "CRA"), which users can access with an assigned password. Data collected in the CRA includes data about installations, activity providers, species of fish, and the stocks and annual production. The CRA is kept by the AFSVPP, Division for Identification, Registration and Information Systems (hereinafter: "SIRIS").

Each aquaculture production business must be approved by the regional AFSVPP office, save for the exceptions that only need to register in the Central Register, i.e.: aquaculture production businesses that farm animals not intended for the market, put and take ponds, and aquaculture production businesses which place smaller quantities of aquaculture animals on the market exclusively for the human diet (up to 3,000 kg) and sell them directly to the final consumer. The AFSVPP assigns each aquaculture production business a unique number and registers it in the INSTALLATIONS (OBRATI) register, which is kept at the AFSVPP.

In order to farm fish intended for the purpose of open-water ranching, an enterprise must obtain a special permit issued by the minister responsible for agriculture and the environment.

2.3 Aquaculture – General

Despite its small size, Slovenia is a geographically highly diverse country, which is a characteristic it shares with aquaculture. In the mountainous north-western, central and south-eastern parts, aquaculture farms are set up for the farming of coldwater fish, while warmwater farms prevail in the north-western Pannonian part. The coastal area, on the other hand, specialises in mariculture.



Legend:

Mussel farms

Saltwater fish farming fields

Size of warmwater aquaculture farms in ha

more than 16 ha and up to 100 ha

more than 1 ha and up to 15 ha

up to 1 ha

Trout capacity in kg

more than 50,000 kg and up to 300,000 kg

more than 20,000 kg and up to 50,000 kg

more than 5,000 kg and up to 20,000 kg

up to 5,000 kg

Natura 2000

SPA

SCI

Figure 2: Locations and capacities or sizes of aquaculture farms that are important for the farming of fish for consumption. Source: Study, 2012 and updated with the new NATURA 2000 areas

Coldwater species of fish farmed for consumption in the Republic of Slovenia include trout, whereby the most farmed species is the rainbow trout (*Oncorhynchus mykiss*), while brown trout (*Salmo trutta m. fario*) and brook trout (*Salvelinus fontinalis*) account for a slightly smaller share of the trout bred for consumption. The common carp (*Cyprinus carpio*) is the prevailing species of warmwater fish farmed for consumption, while the so-called supplementary species occasionally appear on the market, which are farmed together with the common trout in polyculture systems. European sea bass (*Dicentrarchus labrax*), the Mediterranean mussel (*Mytilus galloprovincialis*) as well as recently also the Warty venus (*Venus verrucosa*) are farmed in the sea. Traditional forms of aquaculture are employed the most, whereby coldwater aquaculture farms have flow-through systems in place, while warmwater aquaculture farms have semi-intensive farming systems in man-made ponds and line arrays for the farming of Mediterranean mussels and floating pens for the European bass. Various species are farmed that are not intended for consumption but rather for the repopulation of both salmonid and cyprinid species of fish. The importance of enthusiast and “technical” rearing is practically negligible both in economic terms and in terms of the number of jobs it creates. We do not yet have a RAS system in Slovenia, and only have two small-capacity warmwater aquaculture farms that operate as part of official certified organic aquaculture.

Organisation of the Sector

The Slovenian aquaculture sector is characterised by being extremely dispersed over the entire territory of the Republic of Slovenia and featuring smaller aquaculture farms. The majority of the products are sold on the domestic market. There has never been any extension or deepening of cooperation or integration between farmers. The most probable causes for this are the fragmentation of the sector, dispersion of production, small quantities, apparent self-sufficiency and the local market orientation as well as insufficient benefits of mergers that are associated with the market. At the state level, there is only the Society of Aquatic Animal Farmers (Društvo rejcev vodnih živali) that occasionally organises professional lectures and excursions. There are currently individual cases of cooperation between individual operators. There is certainly a lack of a greater number of joint activities of farmers, such as for example in the form of farmer associations, professional lectures and workshops, professional excursions, a professional journal, presentations of innovations, training programmes in the fields of production, processing, basic knowledge about diseases, environmentally-friendly aquaculture, etc.

In terms of the type of gainful activity, micro and small-sized companies prevail in Slovenia; these are mostly self-employed persons or private limited companies. This indicates that it is mostly smaller units that operate in the freshwater aquaculture sector, which are geared towards sales at the aquaculture farm and rearing for own consumption.

According to the data of the Statistical Office of the Republic of Slovenia, there were a total of 210 workers employed in the aquaculture sector in 2012, 171 of whom worked at freshwater fish farming operations and 39 in mariculture enterprises. There were 53 employees who worked full-time and 118 who worked part-time in the freshwater aquaculture sector, while 28 worked full-time and 11 of the workers were employed on a part-time basis in the mariculture sector. Upon the transition of part-time workers (4 hours) to full-time employment in 2012, 112 workers were employed full-time in

freshwater aquaculture in 2012 and 33 worked full-time in the mariculture sector, which brought the total number of full-time workers in aquaculture to 145.

Research and Professional Activities

Research in the area of aquaculture is carried out by the Chair for Cattle, Horses, Small Ruminants and Poultry Farming, Aquaculture, Ethology and Sustainable Agriculture of the Faculty of Biotechnology and by the Veterinary Faculty of the University of Ljubljana. Professional and practical support is provided to the aquaculture sector in the field by the Chamber of Agriculture and Forestry of Slovenia. Support is primarily provided in the form of consulting during the adoption of business decisions and the preparation of market analyses.

Expert associates at the National Veterinary Institute (hereinafter: "NVI") carry out the monitoring in accordance with the Order on the systematic monitoring of animal diseases and vaccination that is issued by the minister responsible for veterinary science each year. They also practice veterinary medicine and provide consulting with regard to good hygiene practices and biological safety measures as well as produce a risk assessment for each aquaculture facility in accordance with the rules governing the field of aquaculture. Based on the assessment, official veterinarians of AFSVPP regional offices carry out official supervision of aquaculture installations.

The Fisheries Research Institute of Slovenia performs the public service activity in the field of freshwater and marine fishery, market activities in sports and recreational fishery and fish farming as well as various research and professional tasks in the field of fish biology. The collection of environmental and partly biological data is carried out by the Marine Biology Station in Piran.

The Institute of the Republic of Slovenia for Nature Conservation takes part in procedures relating to nature protection.

The Slovenian Environment Agency carries out procedures relating to water management. The Institute for Water of the Republic of Slovenia participates in procedures for the drafting of expert opinions preceding the issue of water rights and procedures for the determination of the environmentally acceptable rate of flow. They also provide expert groundwork for the Water Management Plan.

The Ministry of Agriculture and the Environment in cooperation with the Slovenian Research Agency issues calls for tenders each year for the selection of providers of so-called targeted research projects, which it does so as to improve water management. Interest in research in the aquaculture sector could be observed over recent years, primarily as regards the discovery of causes for the appearance/disappearance of certain fish species in certain watercourses. There are research capabilities available in Slovenia, however, the level of interest in mutual cooperation is low. The majority of institutions for the financing of research rely on public funds provided either by the state or the EU.

Production in Aquaculture

Slovenia has a century-long tradition of farming trout and carp, however, production was negligible until the nineteen seventies when larger aquaculture farms began to be built for the farming of fish for consumption. Production peaked at the end of the 1990's

when trout production reached around 1000 tons and carp production was 250 tons. Since then, production has stayed at the same level (with some oscillations) or has even been decreasing over recent years. Mariculture production began in the 1970's with pilot projects and is slowly picking up pace. In 2007, a regulation was enacted that designated areas for farming mussels, snails and fish in the sea and prescribed regular monitoring of the suitability of mussels and snails, which is a precondition for their sale and consumption.

Table 2: Aquaculture production in Slovenia

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
	<i>in 1000 kg</i>										
Aquaculture total	1,288	1,354	1,574	1,347	1,367	1,354	1,319	1,307	778	1,397	1,154
<i>Freshwater rearing total</i>	1,168	1,148	1,297	1,120	1,174	1,038	1,044	931	659	902	791
<i>Coldwater</i>	891	861	1,000	805	894	799	775	664	456	611	635
<i>Warmwater</i>	208	201	198	263	204	195	166	177	160	188	156
<i>Mariculture total</i>	120	206	277	227	193	316	274	377	119	495	363
<i>Mussels</i>	83	135	164	201	163	301	224	312	78	439	311
<i>Fish</i>	25	55	78	25	30	15	50	65	42	56	52

Source: MKO, 2013

The multi-annual mean shows that the rearing of freshwater fish has been on the same level for several years and that fluctuations occur on an annual basis, while a positive trend is discernible in the production of marine organisms, primarily mussels, where regular production is being established slowly on nearly all of the available plots. Taking into account the water balance, production in freshwater aquaculture in Slovenia is a third smaller than in the European Union per unit of available flow (discharge). Water quantities fluctuate significantly over the course of a year, which should be taken account of when selecting sites for aquaculture farms. New aquaculture farms should not be sited where there is not enough water available during the year, or alternatively fish should be farmed in closed systems there.

With the exception of several larger aquaculture farms, Slovenian aquaculture farms are characterised by their relatively small annual production, which meets the needs of the local or surrounding market. These enterprises are mostly family-owned companies, sole traders, forms of subsidiary occupation at a farm, or fishing societies that rear fish primarily for open-water ranching.

According to the research performed within the scope of the study (Pohar, 2012), equipment at aquaculture farms is still rather obsolete when compared to the technologies used in aquaculture elsewhere in the world. The currently available capacity of freshwater is questionable, especially during longer-lasting drought periods and particularly if we take into account the ecologically acceptable rates of flow. The majority of the existing coldwater aquaculture farms do not even use oxygen enrichment devices. Only a small portion use simple aerators, while three aquaculture

farms use an oxygen enrichment system and two have a computer system for the monitoring of the oxygen content and temperature of the water. Most aquaculture farms also do not have systems in place for the purification of discharge water (effluent) nor any sedimentation pools. This will have to be arranged in the future so as to reduce the negative impacts on waters and aquatic ecosystems. A study will have to be carried out of the options for organic farming or transition to such a farming method, especially within the scope of small aquaculture farms, which would facilitate the creation of added value of products. When it comes to organic farming, it is important to create conditions that are as similar to the natural living conditions of a particular species of aquatic organisms as possible. The maximum stocking density has been determined; the use of genetically modified food has been prohibited as was the use of certain medicinal products, chemicals and technical measures such as water aeration and oxygen injection. The pressures exerted on the environment are thus smaller than in the case of classical farming, which is why the share of such farming should be increased.

Because of the increasing difficulties in ensuring sufficient quantities of water and owing to effluent-related problems, the priority of promotion programmes should be placed on the construction of RAS systems or technologically more advanced aquaculture methods. This would allow for the decrease of the loading of watercourses with nutrients, non-indigenous species and diseases. In Denmark where they have slow-running lowland watercourses that are heavily polluted by agricultural activities, they have developed RAS systems for the farming of trout. These systems are able to recycle up to 90% of the water, while 10% of the water required still needs to be supplied as fresh water from the water source. This technology is starting to be introduced in Slovenia, however, further options should be studied and the introduction of this technology promoted.

Considering that we barely have 50% self-sufficiency in traditionally farmed fish such as trout and carp combined with the fact that these are high quality and healthy fish, the consumption of which should be increased, it would be sensible to continue the support for the construction of classic coldwater aquaculture farms with sedimentation pools or other effluent treatment systems and warmwater fish ponds. Support should further be provided for the renovation or updating of aquaculture farms, which entails investments into existing installations that feature effluent treatment systems.

The Health of Aquaculture Animals

The health status in freshwater aquaculture can be assessed as satisfactory. Council Directive 2006/88/EC of 24 October 2006 on animal health requirements for aquaculture animals and products thereof, and on the prevention and control of certain diseases in aquatic animals stipulates that aquaculture farms can be classified into one of five categories in terms of the health status with respect to particular diseases (category I — disease-free status, category II — surveillance programme, category III — undetermined status, category IV — eradication programme and category V — infected aquaculture farm).

There are currently 8 aquaculture farms in the Republic of Slovenia that have the disease-free status for viral haemorrhagic septicaemia (VHS) and infectious haematopoietic necrosis (IHN). Five of these rear rainbow trout and three farms rear other salmonid species (brown trout and marble trout). One aquaculture farm is still in the phase of acquiring the health status.

41 trout-farming (8 with VHS and 33 with IHN) and 14 carp-farming aquaculture farms (Koi herpes virus (KHV) disease)) are infected. It should be emphasised at this point that most of these are not active infections, however, the farmers have still not completed the remediation programme or have not decided on implementing one (primarily in the case of KHV, for which remediation is difficult to carry out).

Other aquaculture farms have an unknown health status because the farmers do not wish to join the programme for the acquisition of the “disease-free” health status or do not have conditions in place for doing so.

Based on the Order on the systematic monitoring of animal diseases and vaccination, all farming schools of trout and graylings must be tested for VHS and IHN (30 of these were envisaged for testing in 2013) as must aquaculture farms that trade in live fish and eggs (36 of these were envisaged for testing in 2013).

Economy of Production

The data available for public records that are presented in the table below show that 37 economic operators operated in the field of aquaculture in Slovenia in 2011. These were organised as either public limited companies or sole traders. It is possible to obtain data for these, based on which we are able to assess their operations. Data on aquaculture activities pursued as a subsidiary occupation on agricultural holdings cannot be obtained. The data from societies, associations and public institutions are also not shown in the table. The table below shows that the total income of economic operators saw a more than twofold increase from 2008 to 2011 and exceeded EUR 10 million. Mariculture contributed almost entirely to the increase in total income as it overtook freshwater aquaculture in terms of total income for the first time in 2011. Economic operators that pursue mariculture also increased their assets, while the assets of operators pursuing freshwater aquaculture have remained almost unchanged for several years. It is also evident from the table below that the number of employed persons increased only slightly in the 2008–2011 period, whereby the number of employees in freshwater aquaculture decreased somewhat and the number of those working in mariculture increased. There were 37 economic operators in the field of aquaculture in 2011; 30 of these were involved in freshwater aquaculture and 7 pursued mariculture.

Table 3: Certain economic indicators for aquaculture activities in Slovenia (in EUR)

	No. of companies	Year	No. of employees	Assets	Capital	Total income	Profit or loss
Plc total	13	2008	34	3,503,882	946,967	3,791,739	-44,742
		2009	34	3,850,760	1,079,135	3,790,884	171,666
		2010	32	3,872,930	1,145,381	3,658,001	66,200
		2011	30	7,257,451	1,216,854	7,398,529	67,812
Plc mariculture	4	2008	8	567,798	25,817	1,064,391	7,218
		2009	8	620,030	27,173	1,173,036	1,356
		2010	9	769,147	78,991	1,220,810	51,819
		2011	9	3,929,933	142,843	4,316,261	48,851
Plc Freshwater aquaculture	9	2008	26	2,936,084	921,150	2,727,348	-51,960
		2009	26	3,230,730	1,051,962	2,617,848	170,310
		2010	23	3,103,783	1,066,390	2,437,191	14,381
		2011	21	3,327,518	1,074,011	3,082,268	18,961
Sole traders total	24	2008	10	1,593,863		1,078,991	60,313
		2009	25	3,704,963		2,298,332	70,227
		2010	24	5,098,550		2,570,379	14,578
		2011	22	5,650,926		2,824,774	125,270
Sole traders mariculture	3	2008	2	94,480		93,075	10,407
		2009	17	2,150,302		1,329,363	32,936
		2010	16	3,625,524		1,659,207	30,430
		2011	14	4,158,296		1,774,787	88,130
Sole traders freshwater aquaculture	21	2008	8	1,499,383		985,916	49,906
		2009	8	1,554,661		968,969	37,291
		2010	8	1,473,026		911,172	-15,852
		2011	8	1,492,630		1,049,987	37,40
Mariculture total	7	2008	10	662,278	25,817	1,157,466	17,625
		2009	25	2,770,332	27,173	2,502,399	34,292
		2010	25	4,394,671	78,991	2,880,017	82,249
		2011	23	8,088,229	142,843	5,691,063	136,931
Freshwater aquaculture total	30	2008	34	4,435,467	921,150	3,713,264	-2,054
		2009	34	4,785,391	1,051,962	3,586,817	207,601
		2010	31	4,576,809	1,066,390	3,348,363	-1,471
		2011	29	4,820,148	1,074,011	4,132,255	56,101
Total aquaculture	37	2008	44	5,097,745	946,967	4,870,730	15,571
		2009	59	7,555,723	1,079,135	6,089,216	241,893
		2010	56	8,971,480	1,145,381	6,228,380	80,778
		2011	52	12,908,377	1,216,854	10,223,303	193,082

Source: FI-PO

Please note: The data total does not take into account registered legal entities that did not operate in the period in question.

There is a so-called "innovation deficit" present in the field of aquaculture in Europe. A rough estimate shows that added value (AV) per employee in fishery and aquaculture was approximately 25% lower than the average added value. The difference between the average added value per employee for Slovenia (EUR 31,531 in 2007) and the AV per employee in fishery and aquaculture (EUR 12,491 in 2007) is EUR 19,040, which is approximately 60%. The value shown combines the AV per employee in fishery and aquaculture, which is why it is not possible to determine whether there is a difference between the two activities. However, data for countries that do not have the sea or fishery activity (e.g. Austria, the Czech Republic) and which could be presumed to

have had their added value calculated exclusively per employee in the aquaculture activity show the same picture. (Table 4)

Table 4: Added value per employee in 2007 by EU countries

Country	Average gross added value/employee	Gross added value/employee in the sector	Difference	Difference from the total in %
Germany	52,831	48,000	4,831	9.14%
France	66,033	54,250	11,783	17.84%
Belgium	68,169	105,714	-37,545	-55.08%
Denmark	498,771	502,112	-3,341	-0.67%
Finland	57,784	48,000	9,784	16.93%
Spain	45,756	32,822	12,934	28.27%
The Netherlands	58,596	63,425	-4,829	-8.24%
Greece	42,495	30,672	11,823	27.82%
Hungary	5,577,912	1,494,030	4,083,882	73.22%
Ireland	79,701	36,241	43,460	54.53%
Italy	54,902	26,573	28,329	51.60%
Great Britain	39,528	32,860	6,668	16.87%
Sweden	604,463	456,667	147,797	24.45%
Portugal	25,956	22,111	3,845	14.81%
Poland	67,842	25,143	42,699	62.94%
Slovakia	25,487	35,388	-9,901	-38.85%
Slovenia	31,531	12,491	19,040	60.38%
Austria	59,148	23,339	35,810	60.54%
The Czech Republic	608,367	343,798	264,569	43.49%
Estonia	325,770	148,779	176,991	54.33%
EU				25.72%
Iceland	6,181,526	10,463,881	-4,282,355	-69.28%
Norway	793,436	854,214	-60,779	-7.66%

Source: STAN database of the OECD (values in national currencies)

2.3.1 Coldwater Aquaculture

Most of the water resources that could be used for coldwater aquaculture have small capacity. Existing installations are dispersed almost throughout the country and not only in the north-eastern Pannonian part. More than 50% of farming installations are located in the Krka River basin. According to the data from the Central Register of Aquaculture Installations and Put and Take Ponds (hereinafter: "CRA"), it is exclusively trout species that are being reared, whereby the rainbow trout accounts for more than

90% of production, brown trout accounts for 5% while the remaining production includes brook trout, the huchen or Danube trout (*Hucho hucho*), grayling (*Thymallus Thymallus*) and lately also marble trout (*Salmo marmoratus*).

According to the latest CRA data, somewhat less than 200 installations are registered, which also includes smaller pools for keeping fish temporarily or for own use. Around 80 installations are registered as hatcheries or ponds for fingerlings. Owing to the special water quality requirements, they are located primarily in the areas that are near the sources of watercourses. More than half of the hatcheries and rearing installations are owned by fishing societies that rear fingerlings mostly for their release into nature, but these could also participate in commercial farming for consumption if restructured.

According to CRA data, Slovenia has one aquaculture farm with a capacity of 250 tons for the farming of trout and only four with a capacity of more than 50 tons. One of these is no longer in business. There are ten aquaculture farms with a capacity of between 20 and 50 tons and around 40 with a capacity of more than 5 tons.

In 2012, 25% of total production was sold to the end consumer directly at the aquaculture facility, whereby the fish sold were mostly fresh and cleaned fish and a smaller portion of the fish sold were in the form of fish fillets. Approximately 40% of production was sold directly to restaurants and fish shops, while 15% of the fish were sold for processing. The remaining trout production, i.e. 20% of the annual fish production, was sold as live fish to enthusiast aquaculture farms for their own consumption, put and take ponds and open water ranching.

The majority of aquaculture farms are outdated. None of them have systems for the filtration and recycling of water in place, and devices for water aeration during drought periods are used to a small extent, which is why farming capacities are poorly utilised. By updating existing aquaculture farms and introducing modern technologies there, the farms could increase production, while investments into water treatment technologies could reduce their negative impact on the state of waters.

Annual trout production over recent years has ranged between 600 and 700 tons even though it was more than 1000 tons a decade ago. The drop in production coincides with Slovenia's accession to the European Union when the Slovenian market was flooded by trout from other countries and domestic farmers were simply not prepared for taking advantage of the opportunities offered by the new European Union markets they got access to. Prior to Slovenia's accession to the European Union, trout imports were mostly non-existent, while current estimates show that around 500 tons of trout are supplied to the Slovenian market from other countries. Exports of trout from Slovenia to the common market could also be said to be non-existent. Small farming units, obsolete technology, the occurrence of diseases, disorganisation of the sector and the recent difficulties in obtaining water permits associated with the determination of the ecologically acceptable rate of flow do not enable farmers to compete with the prices of trout from traders from other countries. An economic analysis produced for this purpose has shown that production of 5000 kg of trout at the lowest possible costs would cover monthly labour costs of EUR 1,625 gross, which is the minimum value in our opinion that would still cover the costs of wages and all contributions for a worker, while production of 3000 kg of trout with the highest possible costs imputed provides less than EUR 200 of a contribution for the coverage of labour costs, which is why smaller aquaculture farms with production of up to 5 tons of trout where income from production does not achieve the economic threshold for sustaining a farmer can only

represent a fish farming profession performed as a subsidiary occupation. Most of these try to sell their products to the end buyer at the aquaculture facility or to the local market, while some also try to sell processed fish products. Other marketing approaches, i.e. online stores, mobile shops and sales at fairs, are seldom made use of by aquaculture farmers.

An example of good practice is the Libo company that gears its activities primarily towards the regions of Posočje and Goriška, and is gradually establishing its position on the entire Slovenian market by selling fingerlings. The aquaculture farm owned by the Libo company is located in the town of Gorenja Trebuša in the Tolmin municipality. It registered its freshwater fish farming activity in 2000. The company operates two separate installations, whereby the hatchery is located in freshwater, while pools for the farming of adult fish are supplied by the hatchery discharge water as well as from open water. They sell their products of freshly cleaned and filleted fish to end buyers at the facility itself as well as delivering them daily directly to fish shops, hospitality establishments and, by order, also to customers at their homes. Owing to the outstanding quality of the water, the company rears rainbow trout of excellent quality that is held in high esteem by customers far and wide. This aquaculture farm with annual production of 40 tons of rainbow trout for consumption is one of the largest in Slovenia. The company's local market share is estimated to be around 70% and 4% on the level of Slovenia. In addition to the sale of rainbow trout for consumption, they also see an opportunity in farming trout fingerlings for sale to other aquaculture farms in Slovenia. To this end and with the help of the European Fisheries Fund they carried out an investment into a new hatchery with modern equipment, plastic pools that can be completely emptied and which are made of smooth materials, as well as into fishery machinery that allows for the integration and simplification of work processes. The investment into the new hatchery also enables improvements and harmonisation with veterinary sanitary conditions. This aquaculture farm is one of the few in Slovenia that feature a sedimentation pool at the water discharge point, from which sediment is cleared regularly. The sediment is then transported in a tank to nearby meadows and fields and deposited as an organic fertiliser.

The farming of species that are high up in the food chain (carnivorous animals, to which trout species belong) increases the need for fish meal, which is similar to other livestock production (poultry and pig farming), and this in turn increases the pressure to utilise fishing resources. There have been great advances in recent years in the fields of knowledge and technology, which leads us to expect that the utilisation of these resources as feedingstuffs will decrease in the future.

The impact of coldwater aquaculture farms on the river ecosystem in the case of classical farming is exerted primarily on the hydrological regime, the saprobic index, the chemical properties of water and the phytobenthos community. In 2006, the Fisheries Research Institute of Slovenia produced a study of the impact of coldwater aquaculture farms on the river ecosystem. The study included several of our coldwater aquaculture farms and found a certain level of impact primarily on the stretch of the first 500 m from the point where the water is discharged from the aquaculture farm (e.g. the saprobic level deteriorates by half a degree), while after the first 500 m the status is similar or comparable to the status upstream from the sampling point. Coldwater farming, therefore, creates waste water (effluent) that can put pressure on the environment, however, the impact is largely dependent on the farming technology employed by the aquaculture farm in question as well as the feedingstuffs used. Feedingstuffs that are more difficult to digest pollute the environment more. If the right

technology is employed and highly digestible feedingstuffs are used, the environmental impact can be small as compared to other livestock production. In the case of classical production in flow-through pools, the production of one ton of fish releases around 40 kg of nitrogen on average into the water system. By investing in water treatment technology (sedimentation and filtration systems), the negative impact of aquaculture on the state of the water can be reduced.

The ecologically acceptable rate of flow (hereinafter: "Qes") was determined in 2009 when water permits started being issued. It is the rate of flow of the water resource, below which no further water abstraction is permitted. The flow rate is usually in the range of the mean low flow and can even occur several times a year in certain periods. A decrease of the Qes is envisaged for the holders of existing permits for the use of water for farming aquatic organisms by a maximum factor of 0.3. An exception is possible when issuing new permits, i.e. if – based on a study produced in accordance with Annex 3 of the Decree on criteria for determination and on the mode of monitoring and reporting of ecologically acceptable flow – the farmer justifies the claim that lower Qes values still ensure the attainment of a good chemical and ecological status of waters. Aquaculture activities need to be adapted to the available water sources, and the water for them also needs to be provided in the natural watercourse channel, however, unavailability of water lasting even a few hours a year means the end of aquaculture. This is why – when selecting sites for new aquaculture installations – special attention needs to be paid to the availability of the water source and the use of suitable technology that ensures economy of water use. Denmark¹, which is one of the leading EU countries in the field of trout farming, provides farmers with the minimum rate of flow throughout the year despite the introduction of RAS systems and irrespective of the water stage of the water source. When farming trout in these systems, it is still necessary to provide 10% of the required water from a natural source. The minimum ecologically acceptable rate of flow is determined in Denmark simply as 50% of the value of the median (not mean value) of the minimum daily discharge measured in a time series representing a period of 20 years. The aim of the so determined flow rate is to prevent the quality of water in the channel deteriorating in the summer when there is little water. It should also ensure the possibility for fish and other aquatic fauna to migrate in the water past the facility. This Qes determination system is suitable primarily for lowland watercourses, while it is less suitable for torrential watercourses. The majority of the Member States do not have the Qes determined by way of a national regulation, but rather only have guidelines, whereby Qes is determined on a case-by-case basis depending on the type of watercourse and the type of aquaculture.

¹ New methods in trout farming to reduce the farm effluents – Case study from Denmark. V SustainAqua - Integrated approach for a sustainable and healthy freshwater aquaculture - A handbook for sustainable aquaculture. 2009.

SWOT Analysis of Coldwater Aquaculture in Slovenia

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> • Tradition of production • Free-of-charge consulting services for the user • Broad “coverage” of Slovenia with installations • Favourable sales price on local markets • Controlled and contained health status • Availability of quality domestic eggs, fry and fingerlings • Water quality • High quality of the product • Variety of species suitable for farming 	<ul style="list-style-type: none"> • Low productivity • Poor installation utilisation rate • Low level of technological equipment • Water permits not functioning as they should in practice • Lengthy procedures of construction and reconstruction • Poor organisation of workers in aquaculture and lack of sector integration • Lagging behind global technological trends • Deficient research and training support
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> • Increase in productivity • Increase in the level of expertise of the farmers • Education and training (of the farmers, decision-makers, assessors, users, etc.) • Organic production orientedness • New sales methods and approaches • Product certification • Increased interest of consumers in domestically produced food • More efficient effluent handling • Introduction of new production technologies • Utilisation of EU funds • Fishing and eco-tourism • Improvement of the health status and the subsequent increase of the market 	<ul style="list-style-type: none"> • Deterioration of water resources • Environmental changes; longer drought periods, higher water temperatures • Increase in food prices • Occurrence of diseases • Drop in the purchasing power of the population • Continued economic crisis (inability to ensure own funds) • Loading of the environment with disinfectants for skin parasites and with antibiotics • Loading of the environment with nutrients, non-indigenous species and diseases • Hydromorphological strains and habitat changes

2.3.2 Warmwater Aquaculture

The tradition of warmwater aquaculture in Slovenia goes back to the 18th century; however, the activity never really took off. Two of the reasons are the lack of areas that would potentially be suitable for the construction of larger ponds for farming and the dietary habits of consumers. There are numerous standing water bodies primarily in the north-eastern lowland part of Slovenia, which, however, are not suitable for aquaculture and are mostly intended for recreational fishing and tourism. According to the data from the CRA and the fisheries cadastre, we have more than 400 ponds, gravel pits and retarding basins, however, only around 40 are used for rearing aquatic organisms. Of these, 11 are ponds managed by fishing societies that farm fish for release into nature, 10 are ponds for the farming of fingerlings and around 20 are

installations for the farming of warmwater fish for consumption. There are no larger areas in Slovenia that are primarily intended for warmwater farming. We only have 5 large water retarding basins with a total surface area of around 250 ha, in which aquaculture is pursued as an supplementary activity. Extensive or semi-extensive farming of carp in polyculture systems is performed at these sites and they have been achieving 400 kg of annual production per hectare in recent years. One of these retarding basins has silted up in recent years, which makes production nearly impossible. In Slovenia, 85% of warmwater fish species for consumption is produced in retarding basins. Slovenia only has one large and one small complete aquaculture farm with a hatchery and rearing installation for carp, however, the large one is no longer being fully used. Other ponds that are intended exclusively for the rearing of carp species are all smaller than 10 ha. These annual production data also show that we have a low installation utilisation rate as average annual production is mostly below 600 kg per ha. It is only at three installations, which are professionally managed, that production exceeds 3 t/ha per annum. Maximum capacities are determined with respect to the environmental objectives by way of the water rights. It would be reasonable for production to approximate the said capacity.

The impact of warmwater aquaculture on the environment can differ. In 2006, the Fisheries Research Institute of Slovenia produced a study entitled *The Impact of Fish Farming At Warmwater Aquaculture Farms and In Gravel Pits On the Aquatic Ecosystem*. The study has shown that even the construction of a standing water body itself has a certain impact on the aquatic ecosystem. Compared to the inlet point, water quality at the installation discharge point deteriorates by one quality grade, however, the study has specifically emphasised that it is difficult to distinguish between the impact of the impoundment and the impact of farming. The biggest impact that aquaculture can exert occurs during the filling or evacuation of ponds or retarding basins or when non-indigenous species of aquatic organisms are introduced into the pond where they can reproduce naturally and then spread into open waters upon evacuation. The introduction of fish into retarding basins and other warmwater aquaculture installations must be planned and controlled. It should be ensured that target species are suitable and do not represent a potential threat to the natural environment. In addition to the threat of target species, there is the threat of the introduction of non-target species. If these installations are not closed, target and non-target species can enter other water bodies (especially in the event of floods that are becoming increasingly more frequent), which negatively affects the local populations or species as well as the efforts to preserve biotic diversity. Intensive carp farming represents a closed ecosystem; if properly balanced and managed, no accumulation of organic matter occurs as such matter is transformed into fish growth in the nitrogen-algae-zooplankton-fish-nitrogen cycle.

It would be difficult to find an example of good practice in warmwater aquaculture in Slovenia, nevertheless the carp farmed here are of above-average quality and are mostly sold for ranching where requirements are stricter. Environmental services are often prescribed for the farmers that they cannot perform with the funds generated from production. Good practices in certain central European countries show that suitable aquaculture activities can contribute to the improvement of the state of the environment, i.e. through the treatment of effluent, a suitable feeding regime, selection of species and installation capacity. This requires the cooperation of all stakeholders and persons responsible for the management of built standing water bodies in terms of finance.

Great cormorants are a big problem for warmwater farming because they stay at ponds in the winter months and cause a lot of damage primarily to the carp fingerling populations. This is why the setting up of suitable preventative measures to protect against these birds is urgently required (nets and other non-invasive procedures for deterring birds and other predators). Deterrent measures can be successful on smaller ponds, while this is almost impossible to achieve on larger retarding basins. The damage incurred in some places is already threatening the profitability of production.

In some retarding basins, aquaculture was envisaged as a tertiary activity and could indirectly positively affect the thus transformed environment provided it is implemented correctly. The problem arises if farmers do not possess all of the required permits, especially the water permit, and are unable to draw funds from the European Maritime and Fisheries Fund. As regards the permits in the Republic of Slovenia, we can note that there has still not been any final resolution as to the water rights for the farming of aquatic organisms in certain water retarding basins that are older than ten years and where aquaculture was defined as one of the main activities in addition to the retention of high waters, water use for irrigation and other purposes. Farmers held all permits required for the activity; however, the permits were from the 1980's. Upon the amendment of legislation (adoption of the Waters Act), new water rights were not issued. Such aquaculture farms are located in the eastern part of the country. For the purpose of preserving the landscape and mitigating environmental change, it is certainly reasonable to preserve ponds where warmwater aquaculture is pursued because, on the one hand, extensive forms of aquaculture maintain the hydrological balance and, on the other, ensure the protection and renewal of aquatic biotic diversity and ecosystems. Within this framework, one of the opportunities is the potential possibility of developing extensive aquaculture in unused or abandoned ponds.

In 2012, warmwater aquaculture farms sold most of their production as live fish, i.e. nearly 75%. The fish were sold to enthusiast ponds, put and take ponds, for release in nature and for recreational fishing, while the remainder was sold in approximately equal parts to fish shops or for processing. The domestic market is not showing extensive interest in carp, which is why there are no large imports of these species from other countries. Interest in these species has increased only in recent years. These are the pike, pike perch and the European catfish which are mostly imported.

SWOT Analysis of Warmwater Aquaculture in Slovenia

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> • Tradition of production • Rearing of a large number of species • Sustainability-oriented production • Links between production and sports fishing or demand for ranching 	<ul style="list-style-type: none"> • Most of the rearing is performed in non-dedicated installations intended for the retention of high waters • Small installations • Water permits not functioning as they should in practice • Price-related uncompetitiveness • Unpopularity of warmwater fish with the general public • Poor technical equipment • Low level of specialisation • Lack of professional support • Lack of knowledge for the introduction of new technologies • Problem with successful remediation upon the occurrence of disease • Poor organisation of workers in aquaculture and lack of sector integration
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> • Designation of areas suitable for warmwater aquaculture with the observation of other functions and uses of water bodies • Improved utilisation of existing capacities, production innovations, processing and distribution • Organic production orientedness • Assurance of activities that are important for biotic diversity • Inclusion in environmental programmes • Supplementary activities; farm–rural tourism • Rearing of new species • Vertical and horizontal integration • Increase in the level of expertise of farmers • Education and training (of the farmers, decision-makers, assessors, users, etc.) 	<ul style="list-style-type: none"> • Price-related competition from neighbouring countries • Disputes between environmentalists and other interest groups • Silting up of larger retarding basins • Damage caused by fish-eating birds • Environmental changes – drought • Occurrence of diseases and difficulties in containing them in retarding basins • Continued economic crisis (inability to ensure own funds) • Loading of the environment with nutrients, organic matter, non-indigenous species and diseases • Hydromorphological strains and habitat changes • Loading of the environment with disinfectants for skin parasites and with antibiotics, biocides and fertilisers

2.3.3 Mariculture

Slovenia has 46 km of sea coastline and the sea is 20 metres deep on average. There are three larger towns located in this area as well as tourist complexes, the port of

Koper with terminals for container and bulk cargo, three fishing ports, several smaller ports and harbours, the navigable waterway to Koper and Trieste, two salt pans, etc. Despite this, mariculture was able to find its own place. Somewhat over three decades ago, individuals began trial farming of Mediterranean mussels, which yielded promising results and is still developing today. By way of the regulation enacted pursuant to the Waters Act, three areas were designated for the farming of mussels and one area for the farming of saltwater fish. The surface area of the zones intended for the farming of marine organisms is 1,180,000 m². The area intended for the farming of marine organisms in Sečovlje encompasses 866,000 m², 133,000 m² in Strunjan and 180,000 m² in Debeli rtič. Within the areas intended for the farming of marine organisms, water rights were conferred by way of concessions. There are 14 plots in Sečovlje that are intended for the farming of mussels (260,000 m²) and two plots for the farming of fish (80,000 m²). Water rights were conferred for 13 plots intended for the farming of mussels (240,000 m²) and one plot for the farming of fish (40,000 m²). Water rights were conferred in Strunjan for 6 mussel farms with a surface area of 99,000 m². Three concessions were granted in Debeli rtič for a surface area of 90,500 m².

The Mediterranean mussel is farmed at mussel farms today, while there have been trials in recent years for the farming of the Warty venus. Water permits have been issued for all available plots and farming equipment has been installed on all of the plots. Realistic expectations envisage that annual production of Mediterranean mussels could exceed 1000 tons considering the annual yield of 25 t/Ha, which would in turn exceed domestic consumption. The farming practice employed also preserves the status of the marine environment. All three mussel farming areas are located in the so-called zone B, meaning that all mussels arriving on the market from these mussel farms must be treated because of the excessive number of microorganisms. Mussels must pass through registered depuration (purification) centres where they are purified in pools of clean water for 24 hours. Plankton also occurs occasionally in all three of these areas. It contains biotoxins hazardous to human health, which is why mollusc trading is prohibited at those times. In 2010, mussel farms were not allowed to sell mussels for more than 10 months. Large schools of seabream have in recent years (in the period from June to the end of September) been coming to the Sečovlje mussel farming area, which is a fishing reserve, and feeding primarily on young mussels. In 2012, they ate almost the entire crop. It would be reasonable to devote attention to this problem in the future. Abroad (France, Spain and Italy), they began using special nets to prevent fish from accessing mussels and were thus able to successfully protect their crop from predators. Cages (pens) for the farming of saltwater fish are located exclusively in the Bay of Piran (Piranski zaliv) in Sečovlje. In Slovenia, we mostly farm the European seabass, as well as occasionally and in smaller quantities the seabream and sharpsnout sea bream.

The impacts of mariculture were treated in greater detail within the scope of the European project entitled *An Ecosystem Approach for Sustainable Aquaculture – ECASA*, which was implemented in Slovenia by the National Institute of Biology – Piran Marine Biology Station (2006). Project results indicate that mariculture affects the concentration of nutrients (such as phosphates, ammonium) and the biotic diversity of meiofauna (meiobenthos), phytoplankton biomass and the abundance of bacteria. The impact is significant in the vicinity of pens and decreases as the distance from the source of the pollution increases. As already mentioned in previous chapters, descriptors for the evaluation of the environmental status within the scope of the implementation of the framework marine strategy have not yet been fully developed. Despite this, however, the first assessments show that mariculture creates a share of

marine litter, which is one of the descriptors. On the other hand, a secondary hard bed is created underneath the mussel farms that will also be evaluated within the scope of the special seabed integrity descriptor.

All farming areas are located within NATURA 2000 areas, whereby the Strunjan and Debeli rtič areas were designated NATURA 2000 areas in 2013. No special nature protection measures have yet been laid down, however, the special characteristics and requirements of the sector should by all means be taken into account and compensations should be envisaged in the event of a loss of income or in the event of additional costs brought on by the eventual implementation of the NATURA 2000 nature protection measures.

Even though only one mariculture farm is currently in operation in Slovenia, we can take it as an example of good practice in mariculture.

The Fonda aquaculture farm is located in the Bay of Piran between Seča, Sečovlje and Kanegra. It was established a decade ago by the Fonda family-run company and is currently the only Slovenian marine aquaculture farm. Ribogojstvo Fonda is a family-run company that has set the goal for itself of using their knowledge and a respectful attitude towards nature as well as the links to the sea in order to rear the best possible farmed seabass that are as similar to the wild fish as possible. In addition to an unpolluted sea, a favourable marine current, work without chemicals and longer rearing times, mariculture requires high quality fingerlings and feedingstuffs. The quality of the seabass that they have been marketing for a number of years under the *Fonda brancin* (Fonda seabass) trademark has actually convinced a number of acclaimed chefs, restaurateurs and hotel owners as well as a growing number of private consumers.

More than six years ago, they designed an innovative sales strategy with an original visual identity and started introducing the "Fonda Piranski brancin" trademark with the business slogan "Health Is a Matter of Good Taste" (Zdravje je stvar dobrega okusa). Since then, the Fonda seabass have been furnished with a special designation stating the origin as well as the date of harvest. The Fonda seabass is thus distinguished from other fish at points of sale. This was the first such case of saltfish marking on the Slovenian market. Additionally, end consumers and private individuals can order the fish online or via telephone and have them delivered to their home in specially designed and recognisable packaging. Somewhat over a year ago, they completed a pilot EU project on the traceability of foodstuffs designated "RFID – From farm to fork (F2F)" that was supported with state-of-the-art radiofrequency identification technology that provides the consumer with a lot of useful information. Project deliverables have already been introduced into the business process. Each crate is furnished with a QR code and a chip holding a record of traceability of the entire production process from rearing, harvesting and to the final delivery to the consumer's address.

They ensure the recognisability of their trademark in several ways. The first thing is that they have opened the doors to their aquaculture farm widely for visitors who are presented with the "content" of the fish farm and the sustainable method of rearing the Piran seabass by the company's team. Within the scope of marketing and other public relations efforts, they use modern tools; websites, social networks (FB, TW) as well as direct communication with journalists and experts in the culinary field. They take part in presentations in Slovenia and abroad independently as well as together with partners from the fields of gastronomy and oenology.

They invest a lot of effort in selling most of their production as close to the farming location as possible, whereby the target is "0 kilometres". They currently sell over 70% of the Fonda seabass on the domestic market, around 20% in Italy (through an agent) and the rest in Austria where demand is on the rise.

Most of the investments into the fixed assets of the aquaculture farm and mussel farms were co-financed by the European Union and the Republic of Slovenia from the European Fisheries Fund. The investments were aimed at the sustainable development of fishery and were implemented through calls for tenders published by the Ministry of Agriculture and the Environment.

SWOT Analysis of Mariculture

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> • Recognised quality of produced marine organisms from this part of the sea • Modern equipment (mussels, fish) • Experience (fish, mussels) and mastery of the technology (fish, mussels) • Well-established strong trademark for the fish segment • High level of expertise (mussels, fish) • Good environmental conditions for farming (mussels) • Vicinity of the market with a tradition of eating mussels • Excellent taste of the mussels from all three farming areas 	<ul style="list-style-type: none"> • Suboptimal conditions for farming (fish) • Low productivity (fish) • Limited possibilities for expanding production surface areas in bays (fish, mussels) • Dependence on the procurement of fingerlings from abroad (fish) • Frequent algal blooms and occurrence of toxic algae • Problem of seabream in the Sečovlje farming area • Unarranged mussel unloading points and moorings for vessels • Low mussel consumption in Slovenia
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> • Increased demand for seafood and the associated increase in the consumption of food from the sea • Rearing of new species • The segment of very high purchasing power buyers is increasing • Establishment of traceability (mussels, fish) • Increased interest in the understanding of the principles of mariculture • Promotion of mussels that would affect the sale of mussels in Slovenia • Investments into processing • Possibility of a new market (Croatia) • Option of expanding farming areas for mussels from the shore • Inclusion into the organic aquaculture scheme 	<ul style="list-style-type: none"> • Price-related competition from abroad (mussels, fish) • Spreading of diseases (mussels, fish) • Difficulties in containing infections • Pressures exerted on the environment (mussels, fish) • Stricter environmental protection requirements (fish) • Propagation of algae and the occurrence of biotoxins in mussels as well as cases of poisoning (mussels) • Low mussel consumption in Slovenia • Increased competition brought on by the accession of Croatia to the EU • Occurrence of toxic substances in meat • Continued economic crisis (inability to ensure own funds) • Loading of the environment with non-indigenous species • Loading of the environment with

	<p>nutrients and suspended particles (fish)</p> <ul style="list-style-type: none">• Loading of the environment with organic matter excreted by farmed mussels and the creation of a secondary hard bed beneath the mussel farm• Possibility of marine plastic litter being created (plastic nets for the farming of mussels) because certain quantities of such litter end up in the marine environment
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3 POSSIBILITIES AND OBJECTIVES OF THE DEVELOPMENT OF AQUACULTURE WITHIN THE SCOPE OF THE EUROPEAN MARITIME AND FISHERIES FUND FOR THE 2014–2020 PERIOD

Slovenia possesses good natural potential for the development of aquaculture, i.e. both traditional forms and the forms associated with new technologies. In doing so, EU and domestic policy in the fields of environmental protection, water management and use as well as protection of the habitat, health and welfare of aquaculture animals should be observed.

The future of coldwater aquaculture lies in the improved utilisation of certain existing production capacities through updating and the introduction of technological innovations; the selection, feeding practices and technical measures for the improvement of sanitary conditions for the rearing and improved health status of aquatic organisms; and the measures for reducing environmental strains. Because of the increasing difficulties in ensuring sufficient quantities of water and owing to effluent-related problems, we should promote the construction of RAS systems or technologically more advanced aquaculture methods. This would allow for the decrease of the loading of watercourses with nutrients, non-indigenous species and diseases. In addition to the mentioned extensive consumption of electricity, the deficiencies of RAS systems include poorer quality of products and the threat of a negative attitude of consumers towards such a production method. These systems also involve intensive production practices, which can negatively affect the health status of fish (parasites, bacteria and viral infections), and the effect on animal welfare is also negative.

There is potential for the construction of new installations provided sustainability and minimum environmental impact considerations are taken into account. The potential for future development also lies in smaller family-owned production installations associated with agricultural or other activities and the possibility of selling products to the end consumer. Such production should be geared towards organic rearing, especially because it means intensive production that enables higher quality of fish and the sale of fresh fish at the installation itself. Because aquaculture is usually a supplementary activity in these cases, it represents added value also from the socio-economic point of view. Small and medium-sized installations will also have to search for opportunities of selling directly to the end consumer by expanding their offer in the form of processed products, an additional offer of recreational fishing and new marketing approaches. These methods also provide an opportunity for organic aquaculture and subsequently the generation of added value. Large installations will have to keep selling their products also to large retail chains where foreign competition will exert pressures by lowering prices and raising standards, to which domestic farmers will have to adapt. Studies will have to be carried out to determine which watercourses will, depending on watercourse discharges, allow the construction of new aquaculture installations, whereby account will have to be taken of environmental acceptability within the scope of comprehensive spatial planning. In order to achieve sustainable and efficient aquaculture, suitable expert support will have to be provided.

Warmwater aquaculture should be preserved on account of the centennial tradition as well as its importance and its positive impact on the preservation of special riparian and aquatic habitats. The potential for expanding new aquatic areas in Slovenia is low. The function and use of standing water bodies will have to be defined in the future and bodies will have to be designated that are suitable for aquaculture by taking into

account other existing or envisaged uses. Sustainable and efficient aquaculture with professional management should then be established on standing water bodies designated for aquaculture purposes. Farming should be converted to organic rearing. It is especially the farming in large retarding basins that is already geared towards extensive production that should be converted to organic farming. Measures for the protection of aquatic birds should be included in the plans based on the examples of good practices from neighbouring countries. Farming in small ponds can be successful primarily as a supplementary activity integrated with agriculture and tourism. In order to secure quality reproduction material for further farming, the construction of a required hatchery for warmwater aquatic organism species should be supported. In order to achieve sustainable and efficient aquaculture, suitable expert support will have to be provided.

The possibilities for the development of mariculture are mostly limited in terms of space to the already designated areas where no expansion is currently envisaged. Existing areas, however, do provide possibilities for increasing sustainable production of both mussels and fish, i.e. by utilising all of the farming plots. There is also potential in the farming of other mussel species in existing fields as they are already doing so to a large extent abroad (e.g. oysters, etc.). There are also possibilities for farming the Warty venus in offshore areas, which, however, still needs to be investigated. The directive on comprehensive maritime spatial planning was adopted recently and cites mariculture as one of its important activities. It would be reasonable in the future to investigate the possibility of finding additional space for mariculture along the shore and offshore.

Other forms of aquaculture should also be developed, whereby primary focus should be on the RAS closed systems. The introduction of closed aquaculture systems reduces water consumption and strains on the environment. The future also lies in aquaponics which merges agriculture and aquaculture in a closed water cycle with almost no strains on the environment. The potential of closed systems lies primarily in the rearing of warmwater species and the introduction of new species with sound market potential, such as for example the African sharptooth catfish (*Clarias gariepinus*), tilapia (genus *Tilapia*) and certain crustacean species, etc. When doing so, the possibility of unintentional release of non-indigenous species into the natural environment and their effect on the environment should first be studied. Non-food aquaculture features possibilities of farming algae for use in cosmetics and alternative medicine, etc.

Groundwater remains completely unexploited as we do not have an installation based on the use of this water resource that is available in Slovenia considering the provision of Article 108 of the Waters Act (ZV-1) stating that the use of waters for drinking water supply (which is mostly supplied from groundwater in Slovenia) has priority over the use of water for other purposes.

When it comes to marketing, we should keep providing support to the measures for the improvement of the offer of aquaculture products for the local market, which should include support for the arrangement and construction of shops and small processing facilities for the sale and processing of aquaculture products coming from own farming within the scope of aquaculture installations as well as the arrangement of aquatic areas for the offer of fishing tourism.

The objective of the development of aquaculture in Slovenia by 2020 is an increase in production and self-supply with aquatic organism species, for which good natural conditions exist in Slovenia and which are acceptable in terms of the preservation of nature and the achievement of objectives from the Water Framework Directive and the Marine Strategy Framework Directive on the one hand, and the introduction of new technologies and species with sound market potential on the other. We should promote the rearing of domestic autochthonous species of fish and mussels that would provide additional variety in what the hospitality industry has to offer, whereby the potential impact of farmed forms of certain indigenous species on the genetic diversity of local populations should be taken into account.

Slovenia's objective is to increase the production of trout species from the current 635 tons to 1,000 tons per year, which would represent self-supply of 70% that should be combined with the promotion of market measures. This objective could be achieved primarily through an increase in production at existing, but technologically updated aquaculture farms, by 100 tons and by an additional 100 tons with the construction of installations featuring classic flow-through systems and sedimentation basins. Additional target production could take place in new recirculating facilities. At installations where production would not be increased, we should promote organic farming so as to produce 20 tons of organic trout.

Warmwater farming aims to maintain the current production scope or raise it to a level we had years ago, i.e. around 300 tons, and to increase the share of organically reared fish. This could be achieved by maintaining and legalising farming in multi-purpose retarding basins and the restoration of production in abandoned ponds where this is appropriate considering the environmental requirements.

The objective in mariculture is to increase production of Mediterranean mussels from 311 tons to 1000 tons, which would exceed self-supply needs, as well as to increase and ensure the regular production of the Warty venus. When it comes to saltwater fish, we could ensure that the water permit for the available marine plot is issued, which would allow for the increase in production from 52 tons to 120 tons, and that would in turn represent self-supply of 40% of our needs, whereby these objectives must be harmonised with the objectives for the preservation of a good environmental status.

One of the main objectives of aquaculture development is the introduction of closed aquaculture systems and other forms of aquaculture so as to achieve 500 tons of production by 2020, whereby these objectives must be harmonised with the objectives for the preservation of a good environmental status.

Up until now, the contribution of the aquaculture sector to the development of the countryside was not sufficiently known. Data on employment indicate that the size of the active working population and the number of employees in the sector is decreasing. The employment rate in the sector is very low when compared to other sectors. The rearing of fish probably serves as an additional source of income for most of them. The objectives would, therefore, be to preserve existing jobs; this could be achieved with support for the updating of existing aquaculture farms, integration with other sectors and joint projects geared at local development (e.g. establishing ties between aquaculture, tourism and sports, etc) and training of aquaculture activity operators as well as the provision of expert assistance.

It should be specifically highlighted that the following conditions will have to be ensured in order to achieve the objectives set out for aquaculture: suitable functioning of administrative services and participation of the profession, consulting services in aquaculture and the entire aquaculture sector; faster implementation of procedures for the issue of necessary permits for pursuing the aquaculture activity should also be ensured. In terms of the use of water for the farming of aquatic organisms, it should be verified whether it is possible to adapt the conditions or lay down exceptions in the determination of the ecologically acceptable rate of flow and, as appropriate, amend the Decree on criteria for determination and on the mode of monitoring and reporting of ecologically acceptable flow (Official Gazette of the Republic of Slovenia, No. 97/2009). It would be reasonable to introduce standards that apply to the introduction of organic matter, nutrients, disinfectants and antibiotics resulting from the rearing of other animal species and which reduce the impact on the environment.

Within the scope of the future development of Slovenian aquaculture, activities will be promoted that contribute to the EU2020 strategy for sustainable, smart and inclusive growth, i.e. by way of the following three priority tasks:

1) Fostering Sustainable Aquaculture

- Enhancement of ecosystems and fostering resource-efficient aquaculture
- Promotion of aquaculture with a high level of environmental protection and of animal health and welfare and of public health and safety.

SPECIAL OBJECTIVE:

FOSTERING SUSTAINABLE AQUACULTURE AND BIOTIC DIVERSITY

- ◊ *Fostering and financing new installations and new technologies with low-level environmental impact*
- ◊ *Fostering the restoration of and production at abandoned ponds where this is environmentally acceptable and economically viable*
- ◊ *Fostering organic aquaculture*
- ◊ *Fostering the rearing of indigenous fish species*
- ◊ *Fostering and financing measures for the reduction of negative impacts on the environment and the introduction of new technologies in the area of effluent management*
- ◊ *Training of the representatives of other interest groups and decision-makers in the field of environmental and nature protection on the impacts of individual cyprinid aquaculture practices on the environment and on nature*
- ◊ *Designation of the most suitable areas for aquaculture by observing environmental objectives*

Proposed measures within the scope of EMFF:

Increasing the potential of aquaculture installations
Transition to eco-management and audit schemes and organic aquaculture
Aquaculture providing environmental services
Public health measures:
Animal health and welfare

2) Fostering innovative, competitive and knowledge-based aquaculture

- support to the strengthening of technological development, innovation and knowledge transfer;
- enhancement of the competitiveness and viability of fisheries, in particular of the small scale coastal fleet, and improvement of safety or working conditions;
- development of new professional skills and lifelong learning;
- improved market organisation for aquaculture products.

SPECIAL OBJECTIVE:

◇ FOSTERING COMPETITIVE AQUACULTURE

- ◇ *Fostering and financing technologies aimed at increasing productivity and competitiveness*
- ◇ *Fostering and financing installations that represent a missing link in the production chain*
- ◇ *Implementation of measures to protect against loss of income*
- ◇ *Verification of potential new areas for the farming of marine organisms*
- ◇ *Activities that contribute to the creation of new jobs, primarily within the scope of micro and small-sized enterprises*
- ◇ *Incentives for the development of supplementary activities or for greater diversity of enterprises involved in aquaculture*
- ◇ *Fostering and financing measures to increase added value through processing or recreational fishing*
- ◇ *Provision of consultants-promoters and organisers for individual forms of aquaculture*
- ◇ *Assurance of efficient operation of consulting and support services: organisation of training, lectures, seminars and expert excursions for aquaculture employees for the fields of rearing technologies, processing and marketing*
- ◇ *Assurance and issue of a professional publication and establishment of a website for producers*
- ◇ *Inclusion of aquaculture for consumption purposes into environmental and agricultural programmes and the provision of public funds for the implementation of such programmes*
- ◇ *Fostering the financing of new forms of marketing for aquaculture products*
- ◇ *Promotion and design of a trademark for mussels and fish*

Proposed measures within the scope of EMFF:

Innovations

Productive investments in aquaculture

New forms of income and added value

Services for the management of aquaculture installations as well as relief and consulting

Fostering human capital and networking

Insurance of the aquaculture stock

Marketing measures

3) Increasing employment and territorial cohesion:

- Fostering economic growth, social inclusion, the creation of jobs and support for labour force mobility

SPECIAL OBJECTIVE:

INCREASING EMPLOYMENT AND TERRITORIAL COHESION

- ◊ *Creation of new jobs*
- ◊ *Incentives for the establishment of closer ties within the scope of sustainable local development in the countryside*
- ◊ *Incentivising producers to build stronger ties and closer cooperation in the field of rearing and marketing aquaculture products*

Over the future 2014–2020 financial period, there will be possibilities for incentivising freshwater aquaculture also within the scope of community-led local sustainable development that is defined in Regulation (EU) No 1303/2013 of the European Parliament and of the Council of 17 December 2013 laying down common provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund, the European Agricultural Fund for Rural Development and the European Maritime and Fisheries Fund and laying down general provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund and the European Maritime and Fisheries Fund. The key requirements of community-led sustainable development are that it is managed by individual local action groups that draft comprehensive multi-sectoral development strategies, based on which certain measures can be implemented. Strategies must be based on the needs of the local environment; they must observe local potentials, incorporate innovation in the local environment, networking and cooperation between local stakeholders. Local action groups must be tripartite: public sector at the local level, e.g. regional development agency; local communities; representatives of the private sector (e.g. freshwater aquaculture farms) and other sectors, whereby one group of representatives may not have more than 49% of voting rights. Significant emphasis is, therefore, placed on cooperation and the assurance of ties between various funds. For the field of freshwater aquaculture, such cooperation is envisaged between the European Agricultural Fund for Rural Development and the European Maritime and Fisheries Fund, whereby measures would be implemented according to the LEADER approach. We envisaged this form of cooperation in the following regions of Slovenia: Dolenjska and Bela Krajina, Lower Posavje, northern Primorska, part of Štajerska and the Kamnik and Lower Savinja River area. This means that the representatives of the freshwater aquaculture sector will be able to get involved in existing local action groups set up in the 2007–2013 programming period of the programme for rural development in the regions that were designated in advance. These regions must be limited in scope; they must be smaller than the units on the NUTS III level; they must be functionally linked in geographic, economic and social terms and must ensure a sufficient critical mass of human, financial and economic resources for the support of the feasible long-term local development strategy by observing the special features of the freshwater aquaculture sector. Local groups must have a representative number of representatives from the freshwater aquaculture sector.

A coastal fisheries community was organised in the coastal region already in the 2007–2013 financial period within the scope of the European Fisheries Fund and included the representatives of the mariculture sector. In the 2014–2020 financial period, this group will most probably continue the projects aimed at sustainable development of fisheries areas, however, not within the scope of community-led local development.

Proposed measures within the scope of USD:

Support to funds of the common strategic framework for local development

Proposed measures within the scope of EMFF:

<p>Preparatory support Implementation of local development strategies Cooperation activities Running costs and incentives</p>

4) Plan Objectives by 20202

		INDICATOR	ST AT E- OF - AF FAI RS 20 12	OBJECTIVE IN 2020
PRIORITY TASK	SPECIAL OBJECTIVE			
1) Promotion of sustainable aquaculture	PROMOTION OF SUSTAINABLE AQUACULTURE AND BIOTIC DIVERSITY	Number of existing installations where new technologies will be introduced for the treatment of waste water for the purpose of reducing the negative impacts on the environment and the improvement of efficiency	/	5 installations with a production capacity of more than 10 tons fish/year
		Number of closed systems and farming capacities	/	3 500 tons/year
		% of organic production with respect to the total production in aquaculture	0.1 %	5% 50 tons/year
		Designation of the most suitable areas for aquaculture by observing other environmental requirements	0	1 study
		Number of implemented special protection measures in the NATURA 2000 areas ³	0	2
2) Fostering innovative, competitive and knowledge- based aquaculture	FOSTERING COMPETITIVE AQUACULTURE	Number of all approved aquaculture installations producing food for consumption	35	10 new ones
		Number of enterprises involved in aquaculture	37 (for 20 11)	45
		Aquaculture activity as a	18	25

² Values for certain indicators are provided according to the current expectations that can differ in case of changed external factors or general factors that could affect the aquaculture activity.

³ Implementation of a measure is associated with the acquisition of water permits for warmwater aquaculture farms and the determination of nature protection measures for the NATURA 2000 areas that will have to be implemented by the farmers.

		supplementary activity on a farm		
		Production in coldwater aquaculture	635 tons	1000 tons
		Production in warmwater aquaculture	156 tons	300 tons
		Mussel farming production	311 tons	1000 tons
		Saltwater fish production	52 tons	120 tons
		GVA/employee	€19,500	€25,000
		Number of training courses implemented (seminars, workshops, excursions, etc.)	/	14
		Number of participants at training courses (seminars, workshops, excursions, etc.)	/	150
		Number of projects aiming to improve knowledge and innovation	0	3
3) <u>Increasing employment and territorial cohesion</u>	INCREASING EMPLOYMENT AND TERRITORIAL COHESION	Number of jobs (FTE)	145	180
		Number of operating local fishery or local action groups for the field of aquaculture	/	3

Within the scope of the development of the Slovenian aquaculture sector in the 2014–2020 period, activities will be performed for the establishment of successful and sustainably oriented aquaculture. Support will be provided for smart growth within the scope of measures aimed at ensuring an increase in production and greater self-supply with fish, for which Slovenia has good natural conditions and market potential. Further activities that will be supported are those for the acquisition of new professional knowledge, life-long learning, activities for the introduction of new technology, research, innovation and consulting services, activities promoting new market approaches for the pursuit of the economic activity and thus the increase added value of the products and improve working conditions. Within the scope of sustainable development efforts, activities will be supported that lead to the reduction of the impact of aquaculture on the environment, i.e. those that enable the protection and preservation of ecosystems and the assurance of high level environmental protection. Within the scope of the efforts to ensure inclusive growth, activities will be supported that contribute to the creation of new jobs – primarily within micro and small-sized

enterprises, that promote the development of supplementary activities or diversity, and which create closer ties within the scope of sustainable local development.

In order to ensure suitable harmonisation of the positions and opinions of authorities that are linked in administrative terms with the aquaculture sector (e.g. agriculture, veterinary science, the environment, safe food, waters, the research sphere, etc.), the analysis (Pohar, 2012) also recommended that a coordination authority be established that would comprise representatives of the mentioned authorities. In this way, we would ensure a coordinated and comprehensive approach to the aquaculture sector.

4 EXPLANATION OF SELECTED MEASURES OF THE EUROPEAN MARITIME AND FISHERIES FUND FOR THE 2014–2020 PERIOD TO SUPPORT AQUACULTURE

Below, we present in detail a set of measures that are currently envisaged in the Proposal for a Regulation of the European Parliament and of the Council for the European Maritime and Fisheries Fund which Slovenia has recognised as being key for the implementation of the 2014–2020 development strategy.

1. The “innovation” measure is envisaged for the development of technical innovations that especially reduce the impact on the environment and contribute to the welfare of animals, the rearing of new species and the design of new procedures for rearing and marketing.
2. The “Productive investments in aquaculture” measure. This measure is envisaged as a way to update and construct new aquaculture units. As envisaged, the measure aims primarily to update existing aquaculture installations so as to increase the diversity of production, improve working conditions and veterinary and hygiene conditions, reduce negative impacts and enhance the positive impacts on the environment as well as the quality of the aquaculture, which applies primarily to warmwater aquaculture, in particular the overhaul of ponds by removing mud and by implementing potential measures for the prevention of mud deposition.
3. The “New forms of income and added value” measure. This measure is envisaged for enterprises involved in aquaculture so that they can perform processing, marketing and direct sale of (primarily) their own aquaculture products. The measure further aims to increase the diversity of the said enterprises through the development of supplementary activities outside of aquaculture, which must, however, be associated with aquaculture. These include recreational fishing (angling), environmental aquaculture services or education activities in the field of aquaculture.
4. “Services for the management of aquaculture installations as well as a relief and consulting” measure.
5. The “Promoting human capital and networking” measure.
6. The “transition to eco-management and audit schemes and organic aquaculture” measure is intended primarily for the promotion of the conversion from classic to organic aquaculture.
7. According to the experience gathered to date about algal bloom that occurs nearly every year in our part of the sea and the biotoxins in mussels, the “public health” measure is urgently needed and was implemented already in the previous programming period.
8. The “animal health and welfare” measure is intended for refunding costs of surveillance and measures for the eradication of certain diseases in accordance with Council Decision 2009/470/EC on expenditure in the veterinary field, for the development of improved practices or codes regarding biological safety or needs, for the welfare of animals as well as studies aiming to increase the availability of

medicine in aquaculture, and finally for the implementation of pharmaceutical studies.

9. The “aquaculture providing environmental services” measure envisages the payment of refunds for stakeholders in aquaculture in NATURA 2000 areas who have lost income because of the implementation of nature protection measures or who have incurred additional costs and costs associated with participation in the preservation and breeding of aquatic animals within the scope of programmes to protect and restore biotic diversity, including genetic diversity.
10. The “insurance of aquaculture stock” measure is intended to protect the income of producers in the field of aquaculture by supporting the contribution to stock insurance in aquaculture in case of natural disasters, adverse climatic events, sudden water quality changes, for which the economic operator is not responsible, and diseases in aquaculture or the loss or destruction of production capacities, for which the economic operator is not responsible.
11. The “support to funds of the common strategic framework for local development” measure envisages the co-financing of preparatory costs, operations within the scope of the local development strategy, the preparation and implementation of activities for the participation of local action groups and running costs as well as the promotion of the local development strategy by up to 25% of the total public expenditures allocated within the scope of the local development strategy. Support can be awarded to activities for the provision of information on local development strategies and activities within the scope of project development.
12. The “preparatory support” measure can cover the costs of training or enhancing the expertise and networking with the aim of preparing and implementing local development strategies.
13. The “implementation of local development strategies” measure envisages co-financing of the following objectives: addition of value, job creation, promotion of innovation on all levels of aquaculture in the food chain, increasing diversity and creation of jobs in the fisheries industry, especially in other maritime sectors, enhancing and capitalising on the environmental assets of the fisheries and aquaculture areas including operations to mitigate climate change, promotion of social welfare and cultural heritage, which includes marine cultural heritage.
14. The “cooperation activities” measure envisages the co-financing of projects for the cooperation between regions at the state and international levels, preparatory technical assistance for cooperation projects under the condition that the group proves that it is also preparing their implementation.
15. The “running costs and incentives” measure envisages the co-financing of the management of implementation of local development strategies within the framework of local fisheries (action) groups.
16. The “marketing measures” measure envisages the implementation of state advertising campaigns for aquaculture products and other campaigns for the provision of information in order to raise public awareness about the aquaculture sector and the promotion of quality and added value of aquaculture products by simplifying procedures for the registration of a particular product in accordance with

the conditions laid down in Regulation (EC) No 510/2006 of 20 March 2006 on the protection of geographical indications and designations of origin for agricultural products and foodstuffs as well as the improvement of the possibilities for the placing on the market of aquaculture products produced using methods that have a low-level impact on the environment or products from organic aquaculture.

17. The “Raising the capacity of aquaculture installations” measure. In order to contribute to the development of aquaculture installations and infrastructure, the EMFF can support the identification and mapping of the most suitable areas for developing aquaculture, and where applicable, taking into account spatial planning processes.

5 LITERATURE AND SOURCES

Information on sectorial state strategies and the data on the scope of funds and activities at other ministries and services of the Government of the Republic of Slovenia were obtained based on electronic correspondence, telephone and personal conversations with the representatives of the said institutions as well as from publicly available documentary materials.

When compiling the document, we observed the following:

- European Union orientations,
- Strategy for the sustainable development of European aquaculture, Commission of the European Communities, Brussels, 19 September 2002, COM (2002) 511,
- Slovenia's Development Strategy 2013—2020,
- Commission of the European Communities, Brussels, 8 April 2009, COM(2009) 162 Final Communication from the Commission to the European Parliament and the Council; Building a sustainable future for aquaculture,
- Strategic Guidelines for the sustainable development of EU aquaculture of the European Commission No 229/2013 of 29 April 2013,
- Decree on the river basin management plan for the Danube Basin and the Adriatic Sea Basin (Official Gazette of the Republic of Slovenia, Nos. 61/11, 49/12),
- data from the Statistical Office of the Republic of Slovenia,
- data from the Central Register of Aquaculture Installations and Put and Take Ponds,
- data from the fisheries cadastre,
- Eurostat data,
- OECD data.

Literature used:— Dr. Jurij Pohar; Študija o stanju in možnostih aquaculture/akvakulture v Sloveniji za pripravo Nacionalnega strateškega načrta razvoja akvakulture Ljubljana 2012,— Institute of Hydrometeorology of the Republic of Slovenia, *Površinski vodotoki in vodna bilanca Slovenije, Ljubljana 1998*,— Ministry of Agriculture and the Environment, Osnutek Programa upravljanja rib za obdobje 2010 – 2021,— Fisheries Research Institute of Slovenia »Vpliv gojenja rib v toplovodnih ribogojnicah in gramoznicah na vodni ekosistem« Ljubljana 2006,— Fisheries Research Institute of Slovenia »Vpliv gojenja rib v hladnovodnih ribogojnicah in gramoznicah na vodni ekosistem« Ljubljana 2006.

