

Comparison of Six Environmental Impact Assessment Reports for Greek Aquaculture Operations

Final report for Rauch Foundation. Region of A7 (Western Saronikos) of Corinth and Argolida

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Abbreviations and Acronyms

ADA	Aquaculture Development Area
AIW	Artificial Water Bodies
APC	Advanced Planning – Consulting Business Advisors S.A.
DE	Municipality
EEI	Ecological Evaluation Index
EI	Environmental Indicator
EIA	Environmental Impact Assessment
EU	European Union
ELSTAT	Hellenic Statistical Authority
EPXSAA	Spatial Planning and Sustainable Development Framework for Aquaculture
g	Gram(s)
HACCP	Hazard Analysis and Critical Control Points
HPHSAAY	Special Spatial Planning and Sustainable Development Framework for Aquaculture
ITYS	Heavily Modified Water Bodies
kg	Kilogram(s)
km	Kilometre(s)
km²	Square kilometre(s)
LOA	Length Overall
m	Metre(s)
PASM	Areas of Informal Concentration of Units
PAY	Aquaculture Development Area
PE	Regional Units
PEKA	Environment & Climate Change
POAY	Area of Organized Development of Aquaculture
RES	Renewable Energy Sources

SCI	Sites of Community Interest
SEIA	Strategic Environmental Impact Assessment
SEIS	Strategic Environmental Impact Assessment
Stremma	1 stremma = 1000 square metres, plural = stremmata
SMPF	Spatial Management Plan Framework
SPA	Special Protection Areas
STP	Sewage Treatment Plants
m	Metre(s)
TRIX	Trophic Index
WTU	Waste Treatment Unit
WWTP	Waste Water Treatment Plants
XADA	Area of uncontrolled waste disposal
XYTA	Sanitary landfill of waste
YMEPERAA	Transport Infrastructure, Environment and Sustainable Development

Disclaimer

This report is prepared from the original source reports in Greek. Every effort has been made to accurately provide English translations of the text from which these reviews are based. However, there may be some variations in the spelling of local names and differences in the acronyms and abbreviations used. Every effort has been made to standardise these throughout the reports.

Explanatory Notes

EIA report: The descriptions under the heading EIA report refer to the reported topic as described in the EIA report.

EIA analysis: The commentary described under the EIA analysis: section are MEP's independent assessment of the reported section's quality and likely impact.

Assessment criteria

The following assessment categories have been used when considering various aspects of the EIA.

Critical weakness: A critical weakness refers to a significant flaw or deficiency in the EIA report that has the potential to substantially undermine the accuracy, comprehensiveness, or credibility of the assessment. This could include fundamental errors or omissions in data collection or analysis, failure to consider key environmental impacts, or lack of compliance with regulatory requirements. Critical weaknesses typically require urgent attention and correction to ensure the integrity of the assessment process and the validity of its conclusions.

Major weakness: A major weakness denotes a notable deficiency in the EIA report that, while not as severe as a critical weakness, still has a significant impact on the overall quality and reliability of the assessment. This may include inadequate documentation of methodologies, incomplete analysis of potential impacts, or insufficient consideration of alternative measures or mitigation strategies. Major weaknesses require substantial remediation to address deficiencies and improve the overall robustness of the assessment.

Weakness: A weakness refers to a less significant flaw or limitation in the EIA report that may detract from its effectiveness or thoroughness but does not severely compromise its overall validity or utility. This could include minor inconsistencies in data presentation, gaps in information, or shortcomings in the assessment of certain environmental factors. While weaknesses may not necessarily invalidate the assessment, they still warrant attention and corrective action to enhance the credibility and reliability of the findings.

Minor weakness: A minor weakness indicates a relatively minor or incidental flaw in the EIA report that has minimal impact on the overall quality or integrity of the assessment. This might include inconsistencies or minor omissions in documentation. While minor weaknesses may not significantly affect the substance of the assessment, they should still be addressed to ensure clarity, accuracy, and professionalism in the report.

Executive Summary

The Strategic Environmental Impact Study (SEIS) covers the Area of Organized Aquaculture Development (POAY) in Aquaculture Development Area (PAY) A7 (Western Saronikos), of Regional Units of Corinth and Argolida. The study was undertaken in 2021 by APC and was based on data collected and analysed in 2015.

The study adequately describes the existing laws, regulations, and governmental framework for aquaculture development and theoretical potential environmental impacts. A detailed review of the Environmental and Socio-economic impacts, described below, demonstrates multiple insufficiencies ranging from major to minor weaknesses and one critical weakness.

Environmental impacts

The report effectively describes the project's location and the proposed zones for fish farming, highlighting a significant increase in production capacity in terms of total annual capacity and leased area. However, the intensification of production, particularly in Zones A, B, and F, raises concerns regarding potential environmental implications, warranting further analysis in these areas. This is a major weakness.

While the report acknowledges the need for substantial shore base support facilities, it lacks specific details about their size, location, and required services, hindering a comprehensive understanding of their impact on local infrastructure and services. Additionally, the evaluation of alternative options for determining zones is mentioned but lacks transparency, necessitating a clearer summary of alternatives and the reasons for their rejection to enhance stakeholder understanding. This is a major weakness.

The importance of additional space within the zones for future adjustments and smooth operation of floating units is recognised, but specific plans for effective management and utilisation of this space are absent. The report acknowledges potential local and cumulative impacts from multiple fish cage farms in the same water body but lacks quantification of nutrient output and comprehensive assessment. Further studies and modelling are needed, including depositional modelling of nutrients and nutrient mass balance box models, to address these impacts adequately. This is a minor weakness.

Regarding pollution prevention and mitigation, while the report acknowledges the need, it lacks specific measures and technologies to achieve effective results. Quantification and additional plans for wastewater treatment and waste management should be included to address pollution challenges adequately. The report emphasises the importance of environmental monitoring but lacks specifics on the frequency, scope, and methodology, requiring a well-defined monitoring program with clear parameters and sampling methods. This is a major weakness.

The absence of a specific regulatory act addressing environmental impacts in the POAY zones is highlighted, but a clear plan to address this gap is missing. Developing comprehensive regulations specific to the POAY zones and aquaculture activities is crucial for effective environmental management. Lastly, while the methodology focuses on immediate environmental impacts, it lacks emphasis on long-term sustainability, necessitating consideration of factors like resource use efficiency, disease management, and adaptability to changing conditions for a sustainable aquaculture future. This is a minor weakness.

Socio-economic impacts

The report does not fully cover what would be expected in a Socio-economic Impact assessment study at the site level. The study is **insufficient** in:

- Quantifying planned new facilities (land and sea) and their requirement for infrastructure (roads, fresh water, sewage treatment), labour and the use of inputs (feed and fingerlings).— This is a major weakness.
- Proposing environmental and social mitigation measures to reduce impact. This is a major weakness.
- Quantification on the use of resources and how these will be addressed (road traffic, marine traffic, additional electricity supply, additional freshwater supply, etc.). This is a major weakness.
- Quantification, solutions and impact from the project outputs such as wastewater treatment, solid waste disposal, and organic waste disposal. This is a major weakness.
- The study shows no evidence of stakeholder consultation and effort to find mutually agreed mitigation measures to reduce social impacts. This is a critical weakness.
- Marine tourism (yachts, pleasure vessels) could be impacted by the floating cage collars as well as the boating activity during the farm operation. This is a minor weakness.

1. Introduction

1.1 Background

The purpose of this Strategic Environmental Impact Study (SEIS) is to identify, describe and assess the environmental impacts of the establishment of an Organised Aquaculture Development Area (POAY in Greek) in the PAY A7 (Western Saronikos), of Regional Units of Corinth and Argolida, as well as the definition of actions and measures to reduce and mitigate the impacts.

The "Western Saronikos" study area is a PAY category A, while parts of it are considered PASM, as Zones of the POAY study, which was prepared with funding from EPAL (2005) and therefore they are also a transitional state of institutionalisation of POAY.

It is additionally stated that within POAY categories A and B, the establishment of new units was prohibited from the Spatial Planning and Sustainable Development Framework for Aquaculture (EPXSAA) until establishment of the POAY within them.

This ban is a negative factor in the development of maritime fish farming in the current phase given that POAY categories A and B constitute 91% of all POAY (41 out of 45). This means that in 91% of all the POAYs, new fish farms can not be established.

The main purpose of examining the environmental impacts, examined by the SEIA, is the spatial development of aquaculture activity in the coastal zone (marine and terrestrial). The study will also determine actions to limit and mitigate the effects of the establishment of the POAY and consider existing assessment methods and the organisation of the proposed POAY.

Marine fish cage culture has become an increasingly important industry in Greece, contributing to both the economy and the food security of the country. However, the industry has also been associated with several beneficial and detrimental environmental impacts.

Environmental Impacts

The addition of nutrients into the marine environment, often referred to as "nutrient enrichment" or "pellet rain," involves the input of nutrients from uneaten fish feed and fish waste. These nutrients can stimulate the growth of natural prey organisms, such as plankton and benthic organisms, which are important in the marine food web. However, marine fish cage culture significantly impacts marine ecosystems. Nutrient-rich waste from fish, including nitrogen (N) and phosphorus (P), leads to eutrophication, causing excessive algae growth, reduced water clarity, and decreased oxygen levels, which can harm aquatic life.

Particulate waste like faeces and uneaten food increases organic sediment, affecting benthic organisms and seagrass beds, which are essential for ecosystem health. Chemicals used in fish cages can contaminate the environment, impacting benthic health. Additionally, fish cages can spread diseases and parasites to wild fish, with high fish densities accelerating pathogen transmission. Escaped farmed fish may also genetically dilute wild populations. These farms can disrupt natural habitats, predator-prey dynamics, and create noise pollution, further stressing marine environments.

Socio-economic Impacts

The marine fish cage farming industry plays a significant role in the economy and food security, offering substantial socio-economic benefits at both national and local levels. Nationally, it provides considerable job opportunities, contributes to foreign exchange earnings through exports, and supports economic diversification, especially in coastal regions where traditional fishing is

declining. Locally, it generates employment in various sectors, aids in economic diversification, and contributes to community development through revenue that can be reinvested in projects like education and healthcare. Additionally, it supports local businesses by providing a reliable fish supply and stimulates skill development among workers.

However, the industry also presents socio-economic challenges. Environmentally, it contributes to pollution, disease spread, and habitat destruction. Socially, it often leads to tensions between fish farmers, traditional fishers, and local communities due to resource competition, lack of transparency in decision-making, and uneven distribution of benefits. Locally, the visual impact of fish cages can affect coastal aesthetics, potentially deterring tourism, while increasing local marine and road traffic, straining freshwater resources, and impacting housing markets due to worker demand. Balancing these benefits and drawbacks depends on careful management and interaction with local communities, highlighting the complexity of assessing the overall impact of the fish cage farming industry in Greece.

1.2 Study objective

A series of feasibility studies and Environmental Impact Assessments (EIAs) have been prepared for the designated POAYs. The focus of this review is the Strategic Environmental Impact Study (SEIS) prepared by APC and resubmitted in July 2021 with field research carried out in collaboration with the Hellenic Centre for Marine Research and the Environmental & Marine Research Company of Greece in 2015.

The establishment of POAY is carried out in the framework of the guidelines of the HPHSAAY and application of the provisions of article 10 of Law 2742/1999, as amended and in force (Paragraph 7, Article 30, Law 3889/2010) and the Decision No. 17239/2002 of the Ministry of Environment and Natural Resources "Determination of supporting documents, procedure and conditions for the establishment of Areas of Organised Development of Aquaculture".

The area under study for the creation of the POAY belongs administratively to two Regional Units (Corinth and Argolida). It includes one PAY (Category A), as defined in Decision No. 31722/4.11.2011 "Approval of the Special Spatial Planning and Sustainable Development Framework for Aquaculture and its Strategic Environmental Impact Study" (Government Gazette 2505/B/04.11.2011). This defines the marine areas that meet the specific characteristics for the spatial development of aquaculture in Greece. The area of study is PAY A7 Western Saronikos.

- Zone A (Platia Island, Corinth)
- Zone B (Obrios Island, Corinth)
- Zone C (Kakia Rachi, Corinthia)
- Zone D (North of Kakuri Bay of Corinth)
- Zone E (South of Kiourkati Bay to Cape Treli Corinthia)
- Zone F (Agios Petros Corinthia Island)
- Zone Z (North of Selonda Bay to South of Akrotiri Trachili Corinthia)

The proposed POAY Corinthia – North East Argolida consists of seven (7) Zones A, B, C, D, E, F, Z for fish farming with a total area of 19,180,023 stremmata¹ (productive area of 1,190 stremmata) and a total annual capacity of 23,338 tonnes (t) of fish.

¹ A unit of land area mainly used in Greece and Cyprus, equivalent to 1 km²

2. APC Advanced Planning - Consulting Consultants S.A. (APC S.A.)

The contractor of the study for the preparation of the project "Establishment of an Area of Organised Development of Aquaculture (POAY), in the PAY A7 (Western Saronikos) in the Regional units of Corinth and Argolida is the consultancy company APC Advanced Planning - Consulting Consultants S.A. (APC S.A.), which is engaged in the provision of services for development and spatial planning, environmental issues and the preparation of investment studies and programmes, the planning, management and evaluation of National and Community programmes.

For the preparation of the report, APC S.A. collaborated with the Hellenic Centre for Marine Research and the Environmental & Marine Research Company of Greece.

APC Advanced Planning – Consulting Business Advisors S.A., based in Athens, Greece, has expertise in the field of aquaculture, specifically in conducting EIAs for marine fish cages. The company specialises in various sectors, including fisheries and aquaculture, rural and regional development, and the marine environment.

APC has undertaken the coordination of the project titled "Monitoring and assessment of the conservation status of Community interest fish fauna species in Greece". This project was assigned by the Greek Ministry of Environment, Energy and Climate Change and involved collaboration with research institutions.

APC's international certifications include ISO 9001:2015 and ISO 27001:2013.

Experience:

- APC has experience in environmental studies and consulting suggesting capabilities in this area.
- Their portfolio showcases a wide range of environmental projects, including studies for renewable energy, infrastructure development, and waste management, demonstrating their familiarity with complex environmental assessments.
- This experience, coupled with their understanding of Greek regulatory frameworks, indicates their potential to navigate the specific requirements of marine fish cage EIAs.

Expertise:

- APC has a team of professionals with expertise in environmental engineering, biology, ecology, and related fields.
- Their website describes expertise in water quality modelling, marine ecology assessments, and environmental impact assessment methodologies, all of which are components of marine fish cage EIAs.

3. Analysis of Saronikos SEIS

3.1 Scope of SEIS

The EIA report states: This study area belongs administratively to the Regional Units of Corinth and Argolida of the Peloponnese Region and includes part of the coastal area of Solygeia and Saronikos of the Municipality of Corinthia (PE Corinthia) and Epidavros of the Municipality of Epidavros (P.E. Argolida). Below is a chart detailing each Zone and its current operations.

Zone	Operating Units	Current Leased Area (stremmata)	Proposed Leased Area (stremmata)	Current Annual Capacity (t)	Projected Annual Capacity (t)
A	2	74	100	732	2,650
B	1	90	100	950	2,650
C	1	20	40	150	700
D	1	10	40	150	700
E	5	111.86	360	1,360	5,800
F	1	46.25	100	510	2,650
Z	10	244	450	4,545.5	8,188
Total	21	596.1	1,190	8,397.5	23,338

EIA analysis: The Saronikos coast is already heavily developed with fish cage farms with some farms closer than 500 metres (m) between each other. The POAY is recommending an increase in production area from 596.1 to 1,190 stremmata (100% increase) and production volume from 8,397.5 to 23,338 t (176% increase). This proposed increase requires careful analysis to ensure that the local environment is not overwhelmed and that the local infrastructure and services can cope with the proposed increase.

3.2 Framework and objectives of the study

The EIA report states: The report covers the International, European community and national environmental protection objectives relevant to the project.

3.2.1 EU policies and regulations:

The EIA report states: The report lists and briefly describes the strategies and directives for coastal and inland water management.

- **The European and National coastal and island policy** is guided by the Directive on Integrated Coastal Zone Management (COM (2000) 547/27-9-2000), which sets the strategy for coastal area interventions. This directive emphasises the importance of collaborative coastal zone planning, the harmonisation of EU and national frameworks, and the implementation of integrated solutions at local and regional levels. A specific framework, which is yet to be established, will include the definition of coastal zones and management guidelines, especially for the critical zone located 100 m from the coastline.
- **Directive 2000/60/EC**, known as the Water Framework Directive, aims to integrate the management of water resources at the river basin scale. It encompasses all water types

and redefines the concept of a river basin. Greek legislation has been harmonised with this directive, focusing on water protection and management.

- **River basin flood risk management plans** have been implemented under European Directive 2007/60/EC and incorporated into Greek law. These plans outline objectives for flood risk management, including necessary measures, priorities, and the assessment of potentially high flood hazard zones.
- **The bathing water quality monitoring program** has been systematically monitoring since 1988, in line with EU directives. It targets areas that attract significant numbers of bathers or are under environmental pressure, involving sampling, laboratory analysis, and macroscopic monitoring of the water and coastline.
- **The Bathing Water Directive (2006/7/EC)** register describes beach characteristics, identifies potential pollution sources, and assesses their impacts. Beaches included in the Monitoring Program are those that attract a large number of bathers or have other significant interests.
- **The identity register and "Blue Flags" program** are integral to coastal management. The Bathing Water Identification Register officially designates national bathing waters. The "Blue Flags" program, managed by the Hellenic Society for the Protection of Nature, leverages the results from the monitoring program to facilitate participation in coastal management.
- **Directive 2008/56/EC**, known as the Marine Strategy Framework Directive, aims to achieve or maintain good environmental status of the marine environment by 2020. Its focus is on protecting and preserving the marine environment, preventing and reducing pollution, and safeguarding marine biodiversity and ecosystems. This directive has been harmonised into Greek law by Law 3983/2011.
- **The Blue Growth Strategy** supports the sustainable development of maritime and shipping sectors, recognising seas and oceans as key economic drivers with potential for innovation and growth. It includes measures for marine knowledge, maritime spatial planning, and integrated maritime surveillance.
- **Directive 2014/89/EU, the Marine Spatial Planning Directive**, facilitates effective and sustainable planning of human activities at sea. It aims to reduce conflicts between sectors, encourage investment, and protect the environment. This directive has been incorporated into Greek legislation by Law 4546/2018.
- **The Communication on Sustainable Development of Aquaculture** in the EU (COM/2013/229) addresses administrative procedures, spatial planning coordination, competitiveness, and a level playing field. It encourages Member States to simplify administrative processes, coordinate spatial planning, and strengthen the competitiveness of EU aquaculture.
- **The National Strategy for Biodiversity 2014-2029** aims to halt biodiversity loss and ecosystem function degradation in Greece by 2026. It focuses on the conservation, management, and restoration of biodiversity outside protected areas and includes a 15-year strategy with a five-year action plan.
- **The Common Fisheries Policy (Regulation EU 1380/2013)** covers the conservation of marine resources, management of fisheries, market measures, and economic support. Its principles include good governance, an ecosystem approach, a precautionary approach, and regional cooperation. The policy aims for sustainable, environmentally friendly fishing activities and the development of sustainable aquaculture.
- **The Operational Programme for Fisheries 2007-2013** envisions the sustainable development of the fisheries sector. Its strategic objectives include achieving a sustainable balance between fishery resources and fishing activities, developing sustainable

aquaculture, and improving the sector's framework. This program funded actions for spatial planning and support for POAYs.

- **The Operational Programme for Fisheries & Sea 2014 – 2020.** The Operational Programme for Fisheries & Sea 2014-2020 focuses on sustainable, innovative, and competitive aquaculture. Key objectives include technological advancement, enhancing enterprise sustainability, protecting aquatic biodiversity, and promoting high environmental and health standards. The program supports investments in aquaculture, quality improvement of products, diversification of enterprise income, and ecological management practices. It aligns with the broader strategic plan for Greek aquaculture, emphasising administrative efficiency, resource access, sustainability, and industry-research synergies.

EIA analysis: The report adequately lists and briefly describes the international and EU directives and strategies covering sustainable aquaculture development and management of the marine environment, focusing on environmental protection, economic growth, and social well-being.

3.2.2 Greek policies and regulations.

The EIA report states: The report lists and briefly describes the Greek policies and regulations.

- **Marine Spatial Planning, under Law 4546/2018**, incorporates Directive 2014/89/EU. This planning includes national and regional strategies, with aquaculture as a key component.
- **National Biodiversity Strategy for the years 2014-2029** and a five-year Action Plan" (Government Gazette 2383 B/ 08-09-2014. This details the plans or programs for the conservation and sustainable use of biological diversity.
- **The General Framework for Spatial Planning and Sustainable Development** aims to create a sustainable spatial development model with a strong emphasis on biodiversity conservation. It focuses on the sustainable development of fishing areas, coastal fisheries, and aquaculture, and encourages the modernisation of aquaculture units, the adoption of environmentally friendly methods, and the development of POAYs.
- **The Special Spatial Planning Framework for Aquaculture** defines PAYs based on their suitability for aquaculture. These areas are classified into five categories (A-E) according to their development level and environmental sensitivity. The study area specifically includes zones in Arcadia, Argolida, and the Islands.
- **Organised Aquaculture Development Areas (POAY)** are created within the PAYs of categories A-D. These areas include zones designated for future leasing and water catchment. The study area features several proposed ODAs, each with varying capacities and conditions.
- **The Specific Framework for Aquaculture** establishes compatibility criteria for aquaculture units. These criteria focus on ensuring compatibility with tourism units, residential developments, port facilities, and other relevant factors.
- **The Special Spatial Planning Framework for Tourism**, which was initially approved and later annulled due to procedural issues, is currently awaiting a new framework. Until then, tourism development is being guided by existing Regional Spatial Plans.
- **The Special Spatial Planning Framework for Industry** provides guidelines for industrial development. This includes considerations for spatial planning and sustainable development, ensuring that industrial growth aligns with broader environmental and social goals.

Development compatibility with local Spatial Planning guidelines

- **Marine Spatial Planning, under Law 4546/2018**, incorporates Directive 2014/89/EU. This planning includes national and regional strategies, with aquaculture as a key component.
- **The General Framework for Spatial Planning and Sustainable Development** aims to create a sustainable spatial development model with a strong emphasis on biodiversity conservation. It focuses on the sustainable development of fishing areas, coastal fisheries, and aquaculture, and encourages the modernisation of aquaculture units, the adoption of environmentally friendly methods, and the development of POAYs.
- **The Special Spatial Planning Framework for Aquaculture** defines Aquaculture Development Areas (PAYs) based on their suitability for aquaculture. These areas are classified into five categories (A-E) according to their development level and environmental sensitivity.
- **Organised Aquaculture Development Areas (POAY)**: Created within the PAY of categories A-D of the Spatial Framework. Consist of one or more zones, including areas for future aquaculture leasing and water recreation.
- **Special Framework for Aquaculture**: Establishes compatibility criteria for aquaculture units, especially concerning tourism, residential developments, and port facilities.

EIA analysis: The report adequately lists and briefly describes the Greek directives and strategies covering sustainable aquaculture development and management of the marine environment, focusing on spatial planning.

The report also covers spatial planning for Saronikos and identifies the need for balancing industrial development with tourism and environmental sustainability. Aquaculture development must consider local service needs, environmental impacts, and compatibility with other activities, especially tourism.

3.2.3 Regional and Local Policies.

The EIA report states: The report lists and briefly describes the regional and local policies.

- **Management Plans for the River Basins of the Water Divisions of Attica, Eastern Central Greece, Northern Peloponnese, Eastern Peloponnese and Western Peloponnese**. This has the aim of specific actions for both underground and surface waters.
- **Watershed Flood Risk Management Plans**. This details Flood Risks of River Basins of the Northern Peloponnese Water Division.
- **Special spatial planning and sustainable development framework for tourism**: Initially approved in 2009, amended in 2013, and later annulled due to procedural issues. Until a new Framework is approved, tourist activity development is guided by existing Regional Spatial Frameworks.
- **Special spatial planning & sustainable development framework for industry**: P.E. Corinthia is categorised as a low to medium-priority area for industrial spatial policy. Emphasises the need for environmental measures and suggests potential expansion south of Corinth.
- **Special spatial planning and sustainable development framework for renewable energy sources (RES)**: The study area lacks comparative advantages for wind farms and is not prioritised for such developments.
- **Special spatial planning and sustainable development framework for coastal areas and islands**: Still under approval as of the last update. Recommends avoiding new aquaculture

units in developed touristic areas, allowing them in discrete non-touristic parts. Emphasises high-quality environmental maintenance for combined development with tourism.

- **Maritime Spatial Planning:** Includes preparation of national and regional marine spatial plans. Aquaculture is a key component and must comply with planning deadlines to avoid negative impacts.
- **Regional Framework for spatial planning & sustainable development of the Peloponnese region:** Currently under revision. Highlights a dualism between North and South, with the northern part depending on Attica. Suggests controlled exploitation of coastal area development of fishing shelters and integrated fishing actions. Recommends modernisation and relocation of aquaculture units after special zoning studies.
- **Environmental and geographical considerations:** Coastal zones in the region face risks like flooding, salinisation, and erosion. P.E. Corinthia shows population growth, benefiting from access to national road axes and a developed primary sector. Development axes are defined by residential centres and main land transportation hubs.

EIA analysis: The report adequately describes the Regional and Local policies and regulations. It covers the local policies that affect the local communities but does not relate (or quantify) the impacts of the expansion of cage culture to the regional and local objectives.

3.2.4 The proposed POAY.

The EIA report states: The report covers the POAY regulations and Implementation.

Law 4269/2014 and Aquaculture Management

Law 4269/2014 addresses the procedural and management aspects of aquaculture in Marine Protected Areas, highlighting the need for effective management, regulatory compliance, and environmental monitoring to ensure sustainable aquaculture development.

Amendment of Law 2742/1999: Law 4269/2014 amends Law 2742/1999, mainly in terminology and spatial planning levels, indicating a need for substantive amendment of Article 10 of Law 2742/1999.

- **Institutionalisation Procedure:** Entities interested in aquaculture submit a comprehensive application to the Spatial Planning Directorate, including feasibility studies, maps, environmental assessments, and producer consent. The Directorate reviews the application, consults with relevant departments, and puts the Spatial Management Plan Framework (SMPF) to public consultation. Following proposal approval, a decree is issued defining the POAY's location, boundaries, cultivation forms, species, and total capacity.
- **Management of POAY:** Management is assigned to a relevant entity by the Secretary General of the Decentralised Administration. The managing body can involve various legal forms, including private and public sector participants. The operator provides opinions on new unit establishments, manages the host, monitors environmental quality, and ensures compliance with established terms.
- **Regulation and Operation:** The POAY regulation includes installation conditions, rights and obligations, management of common facilities, and financial aspects. These include managing water break areas, restoring spaces post-closure, and waste management.
- **Current Status and Challenges:** As of June 2021, only four POAYs have been established in specific marine areas. The current framework has disadvantages, particularly for POAYs

established before the Specific Framework's implementation. The success of aquaculture establishments depends on monitoring and guidance from competent authorities.

- **Role of Management Entity:** The entity monitors the implementation of operational terms and legislation, aiding the work of State Audit Authorities. It works with local authorities and does not replace State Audit Authorities.

Role of POAY:

The lack of a spatial plan for aquaculture led to negative public perception and competition with other activities. The Special Framework established later defined PAYs and set criteria for compatibility with other uses.

The establishment of POAY, in regions like Corinth and Argolida, is expected to boost marketing dynamics, improve public trust, and enhance the negotiating power of production units. The Management Entity will play a key role in mediating and implementing necessary strategies for the effective marketing and promotion of aquaculture products. It leads to improved implementation of hygiene standards. This is achieved through organised management systems that facilitate better adherence to hygiene rules. The sustainable operation of these plants plays a significant role in maintaining the hygiene of the products. An essential part of this process is the development of the necessary infrastructure, such as hatcheries, nurseries and packing, which are constructed and operated under hygiene regulations. Furthermore, the time from product elimination to market placement is reduced, enhancing the overall quality of the products.

Advantages of aquaculture development

Strengthening Sectoral Employment: The aquaculture sector boosts employment, particularly in disadvantaged and island regions. It employs a significant number of qualified personnel in management, organisation, production, and skilled labour roles. Personnel are increasingly specialised due to technological advancements and automation. According to this report, direct employment in aquaculture ranges from 4,000-5,000, with indirect employment around 5,000-6,000. Manpower requirements depend on factors like capacity, distance from shore, infrastructure, and cage size. For example, a 300 t/year unit typically requires 7 people.

Contributing to market structure Improvement: The aquaculture market structure is similar across the territory, with products marketed through various channels like retail, commercial departments, and marketing companies. A significant portion of production, sometimes up to 80%, is exported, mainly to Europe. However, farms located on remote islands face transport costs and delays. Retail products must carry specific information as per national and EU legislation. Two producer organisations are operating that follow EU regulations. There's a recognised need for better promotion in domestic and foreign markets. The Government have implemented initiatives with substantial budgets for promoting Mediterranean aquaculture species.

The emphasis on informing consumers about the nutritional value and safety of aquaculture products is crucial due to prevalent misinformation. By educating consumers and exploring new markets, demand can be significantly increased.

Food Safety and Hygiene: The safety and hygiene of aquaculture products are governed by a robust regulatory framework established by EU and national regulations. Operators in the sector actively control and monitor the quality of feed and the environment in which aquaculture is practised. The entire process, from the elimination of products to their packaging, is meticulously managed to ensure they are suitable for consumption. The Hazard Analysis and Control

Principles (HACCP) system is a critical component of this process, ensuring food safety. In shellfish farming, specific regulations are in place, including restrictions on farming near sewer outflows and in contaminated areas. Additionally, compliance with Directive 2006/113/EC is mandatory to maintain the required water quality for shellfish aquaculture.

Infrastructure Creation for Aquaculture Development.

The creation of infrastructure is a pivotal aspect of integrated sustainable management in aquaculture development areas. An overview of fish farming units reveals a variety of necessary components. Floating installations and equipment encompass floating fish cages, dicots, antifouling and bottom-set nets, mooring facilities, beacons, work exercises, waterborne transport, and production management equipment such as fish sorters, feeding systems, cranes, and other essentials like lighting, generators, and net cleaning machines. Accompanying facilities, as detailed in Section 3.1 of the SEIS, are also integral to these units.

Fish hatcheries, categorised as supporting facilities, require a range of infrastructure for phytoplankton production, live food production, genitor management, hatching, weaning, development, and fattening of juveniles. This also includes necessary offices, laboratories, and systems for water circulation, oxygen, and heat supply. Additionally, fresh fish packing plants are essential for packaging, gutting or filleting, grading, boxing, freezing, and ice production of seafood fish.

Infrastructure projects are comprehensive and include components such as access roads, boat docking areas, waste disposal and destruction sites, wastewater treatment, and energy supply networks. The establishment of a POAY brings significant benefits, particularly in facilitating the provision of land-based infrastructure and opening financing opportunities. A notable advantage of establishing a POAY is the potential for sharing land-based facilities among different units, optimising resource utilisation and efficiency.

EIA analysis: The report adequately covers the POAY regulations, scope and role of the POAY in planning and managing aquaculture development.

3.3 Project description

The EIA report states: The area being studied for the creation of the POAY belongs administratively to the Regional Units of Corinth and Argolida of the Peloponnese Region and includes part of the coastal area of Solygeia and Saronikos of the Municipality of Corinthia (P.E. of Corinth) and Epidavros Unit of the Municipality of Epidavros (P.E. Argolida).

POAY Corinthia – North East Argolida, as mentioned above consists of seven (7) Zones A, B, C, D, E, F, Z for fish farming

- **Zone A (Corinthian Square Island).** It has a total area of 2,284,694 stremmata, within which there is developed fish farming, units of intensive form, total annual capacity of 732 t. The proposed total annual capacity is set at 2,650 t of fish, in a productive area of 100 stremmata.
- **Zone B (Obrios Island of Corinth).** It has a total area of 3,281,718 stremmata within which there is developed fish farming, units of intensive form, with a total annual capacity of 950 t. The proposed total annual capacity is set at 2,650 t of fish, in a production area of 100 stremmata.

- **Zone C (Kakia Rachi of Corinth).** It has a total area of 792,182 stremmata within which there is developed fish farming, intensive units, total annual capacity of 150 t. The proposed total annual capacity is set at 700 t of fish, in a productive area of 40 stremmata.
- **Zone D (North of Kakuri Bay of Corinth).** It has a total area of 199,154 stremmata within which there is developed fish farming, units of intensive form, with a total annual capacity of 150 t. The proposed total annual capacity is set at 700 t of fish, in a production area of 40 stremmata.
- **Zone E (South of Kiourkati Bay to Cape Treli Corinthia).** It has a total area of 5,360,901 stremmata within which there is developed fish farming, units of intensive form, total annual capacity of 1,360 t. The proposed total annual capacity is set at 5,800 t of fish, in a production area of 360 stremmata.
- **Zone F (Agios Petros Corinthia Island).** It has a total area of 1,454,592 stremmata within which there is developed fish farming, units of intensive form, with a total annual capacity of 510 t. The proposed total annual capacity is set at 2,650 t of fish, in a production area of 100 stremmata.
- **Zone Z (North of Selonda Bay to South of Akrotiri Trachili Corinthia and Argolida).** It has a total area of 5,807,023 stremmata within which there is developed fish farming, units of intensive form, with a total annual capacity of 4,545.5 t. The proposed total annual capacity is set at 8,188 t of fish, in a production area of 450 stremmata.

EIA review: These zones have a total production area of 596.1 stremmata and a current annual capacity of 8,397.5 t and it is proposed to increase the production area to 1,190 stremmata and total annual capacity to 23,338 t of fish.

Table summarising the current state and planned expansion for each zone:

Zone	Current Total Area (stremmata)	Current Total Annual Capacity (t)	Current Production area (stremmata)	Proposed Annual Capacity (t)	Proposed Production Area (stremmata)
Zone A	2,284,694	732	74	2,650	100
Zone B	3,281,718	950	90	2,650	100
Zone C	792,182	150	20	700	40
Zone D	199,154	150	10	700	40
Zone E	5,360,901	1,360	111.86	5,800	360
Zone F	1,454,592	510	46.25	2,650	100
Zone Z	5,807,023	4,545.5	244	8,188	450

The report explains the following;

The expansion plans across the zones generally involve increasing both the annual capacity and the leased area. The expansions are achieved through a combination of enlarging existing units and establishing new ones. Environmental considerations, such as maintaining distances between units and respecting coastal distances, are emphasised.

The use of floating cage systems is consistent across zones. Land-based ancillary facilities are planned to support the aquaculture units, adhering to urban planning and environmental laws.

Other infrastructure and equipment will be provided by the Management Entity, which includes office equipment and the establishment of a communication network with POAY units.

EIA analysis: The report adequately describes present aquaculture production for each zone in terms of the number of farms, leased area and production and the proposed increase.

Zone	Total Area (stremmata)	Total Annual Capacity (t)	Production area (stremmata)	Proposed Annual Capacity (t)	Production Area (stremmata)
Total	21	596.1	1,190.0	8,397.5	23,338.0
Increase			593.89		14,940.5
% increase			100%		178%

However, it does not map the location of the shore base facilities on the maps. This does not allow the analysis of how farm development impacts local infrastructure and services.

3.3.1 Zone A (Platia Island, Corinth).

The EIA report states: Zone A has a total area of 2,284,694 stremmata, within which there is developed fish farming, units of intensive form, total annual capacity of 732 t. The proposed total annual capacity is set at 2,650 t of fish, in a productive area of 100 stremmata.

Currently, two aquaculture units are operating in Zone A, both breeding Sea Mediterranean Fish, with a combined total annual capacity of 732 t and a leased area of 74 stremmata.

Table 1 summarises the details of the fish farming units within Zone A, including their locations, marine area in stremmata, and annual production capacity. The first unit has a leased area of 25 stremmata and an annual capacity of 270 t, while the second unit has a leased area of 49 stremmata and an annual capacity of 462 t.

There are plans to unify the licensing for these two units into a single floating unit covering 74 stremmata. However, no new units can be established in this zone due to the required minimum distance of 500 m between units. Instead, development is expected to come through the extension of the existing unit, with a maximum limit of 100 stremmata and installation at depths of around 60-100 m. The proposed floating unit consists of three marine parks with specific areas.

The total leased (productive) area within Zone A will be 100 stremmata, and the maximum annual production capacity will be 2,650 t. Additionally, there is one designated water rest area covering 400 stremmata in this zone to address the relocation needs of units for environmental reasons. Water rest areas are used to restore environmental conditions in cases where specific inhibiting conditions affect the operation of aquaculture units and impact reversal processes, mainly due to poor unit operation and ecological characteristics of the area.

EIA analysis: There is a large, planned increase in production (262% increase) with a small increase in production area (35.1%). This means that more fish are being produced per unit area (intensity of production – tonne of fish produced per stremmata) from 9.9 to 26.5 t per stremmata.

Zone A	Total Area (stremmata)	Total Annual Capacity (t)	Production area	Intensity t/stremmata.
Present	2,284,694	732	74	9.9
Planned		2,650	100	26.5
Increase %		262.0%	35.1%	168%

This increased intensity of production will be related to a similar increase in environmental impact from nutrients on the water quality and sediment quality. This environmental impact needs to be quantified and confirmed so that it will not overpower the local environment.

3.3.2 Zone B (Obrios Island of Corinth).

The EIA report states: Zone B has a total area of 3,281,718 stremmata within which there is developed fish farming, units of intensive form, with a total annual capacity of 950 t. The proposed total annual capacity is set at 2,650 t of fish, in a production area of 100 stremmata.

Currently, there is one aquaculture unit operating in Zone B, out of a total of 21 in the POAY. This unit is involved in breeding Marine Mediterranean Fish, with a total annual production capacity of 950 t and a leased area of 90 stremmata.

No new units can be established in this zone due to the failure to observe the required minimum distance of 500 m between units. Therefore, the growth in aquaculture capacity is expected to come through the expansion of the existing unit, up to a maximum limit of 100 stremmata. The increase in total annual capacity, from 950 t to 2,650 t, is planned to be covered by this extension of the existing unit with installations at depths of around 60-80 m. The proposed floating unit consists of three marine parks with specific areas.

The total leased (productive) area within Zone B will be 100 stremmata, and the maximum annual production capacity will be 2,650 t. Additionally, one water rest area covering 400 stremmata is defined within Zone B to address the relocation needs of units for environmental reasons. Water rest areas are used to restore environmental conditions when specific inhibiting conditions affect the operation of aquaculture units.

EIA analysis: There is a large, planned increase in production (178.9% increase) with a small increase in production area (11.1%). This means that more fish are being produced per unit area (intensity of production – tonne of fish produced per km²) from 10.6 to 26.5 t per stremmata.

Zone B	Total Area (stremmata)	Total Annual Capacity (t)	Production area (stremmata)	Intensity t/stremmata
Present	3,281,718	950	90	10.6
Planned		2,650	100	26.5
Increase %		178.9%	11.1%	151%

3.3.3 Zone C (Kakia Rachi, Corinth).

The EIA report states: Zone Ct has a total area of 792,182 stremmata within which there is developed fish farming, intensive units, total annual capacity of 150 t. The proposed total annual capacity is set at 700 t of fish, in a productive area of 40 stremmata .

Zone C has 1 fish farm with a marine area of 20 stremmata and an annual production capacity of 150 t.

In Zone C, development can occur either through expanding the existing unit or creating a new one up to a maximum limit of 40 stremmata . The total annual capacity for the zone is expected to reach 700 t, compared to the current 150 t. The proposed floating unit consists of two parks, each covering 20 stremmata .

EIA analysis: There is a large, planned increase in production (366.7% increase) with a smaller increase in production area (100%). This means that more fish are being produced per unit area (intensity of production – tonne of fish produced per stremmata) from 7.5 to 17.5 t per stremmata .

Zone C	Total Area (stremmata)	Total Annual Capacity (t)	Production area (stremmata)	Intensity t/stremmata
Present	792,182	150	20	7.5

Planned		700	40	17.5
Increase %		366.7%	100.0%	133%

3.3.4 Zone D (North of Kakuri Bay of Corinth).

The EIA report states: Zone D has a total area of 199,154 stremmata within which there is developed fish farming, units of intensive form, with a total annual capacity of 150 t. The proposed total annual capacity is set at 700 t of fish, in a production area of 40 m.

Zone D extends from a designated line at a distance of at least 50 meters from the coast to the sea, with the sea distance ranging from 350-430 m. Similar to Zone C, there is currently one operating aquaculture unit in Zone D, out of a total of 21 in the P.A.Y. This unit is involved in breeding Sea Mediterranean Fish, with an annual production capacity of 150 t and a leased area of 10 stremmata .

There is one fish farm with a marine area of 10 stremmata and an annual production capacity of 150 t.

In this zone, development can occur through expanding the existing unit up to the maximum limit of 40 stremmata . The total annual capacity for Zone D is expected to increase to 700 t from the current 150 t.

EIA analysis: There is a large, planned increase in production (366.7% increase) with a large increase in production area (300%). This means that more fish are being produced per unit area (intensity of production – tonne of fish produced per stremmata) from 15 to 17.5 t per stremmata .

Zone D	Total Area (stremmata)	Total Annual Capacity (t)	Production area (stremmata)	Intensity t/stremmata
Present	199,154	150	10	15.0
Planned		700	40	17.5
Increase %		366.7%	300.0%	17%

3.3.5 Zone E (South of Kiourkati Bay to Cape Treli Corinthia).

The EIA report states: Zone E has a total area of 5,360,901 stremmata within which there is developed fish farming, units of intensive form, total annual capacity of 1,360 t. The proposed total annual capacity is set at 5,800 t of fish, in a production area of 360 stremmata .

There are currently 5 aquaculture units operating within Zone E, out of a total of 21 in the POAY. These units specialise in breeding Marine Mediterranean Fish, with a combined total annual capacity of 1,360 t. The leased areas for these units range from 10 to 40 stremmata .

Zone E offers several possibilities for growth and development:

- Expanding existing farming units with leased areas of less than 40 stremmata up to the maximum limit per unit, with a maximum annual capacity of 700 t per unit, provided that minimum distances between units are maintained.
- Extending the 40-acre floating unit operating within Limii Bay to 100 stremmata , with a maximum annual capacity of 1,600 t. This expansion plan is illustrated in the attached maps, which depict the proposed floating unit consisting of 3 marine parks.

- Expanding the 20-acre floating unit operating South of Akrotiri Stiri to 60 stremmata, with a maximum annual capacity of 1,000 t. The attached maps show the proposed configuration of this floating unit, consisting of 3 marine parks.
- Creating two new units with areas up to the maximum limit of 40 stremmata each, each with an annual capacity of up to 550 t, provided that minimum distances between units are maintained.

As a result of these development plans, the total annual capacity for Zone E is expected to increase to 5,800 t from the current 1,360 t, while the total productive area will expand to 360 stremmata from the current 111.86 stremmata.

Within Zone E, two water rest areas with areas of 328 and 372.7 stremmata are designated, located between Ormos Koli and Akrotiri Stiri and west of Akrotiri Treli, respectively. These areas are intended to accommodate the relocation needs of units for environmental reasons.

EIA analysis: There is a very large, planned increase in production (326.5% increase) with a large increase in production area (221.8%). This means that more fish are being produced per unit area (intensity of production – tonne of fish produced per stremmata) from 12.2 to 16.1 t per stremmata.

Zone E	Total Area (stremmata)	Total Annual Capacity (t)	Production area (stremmata)	Intensity t/stremmata
Present	5,360,901	1360	111.86	12.2
Planned		5,800	360	16.1
Increase %		326.5%	221.8%	33%

3.3.6 Zone F (Agios Petros Corinthia Island).

The EIA report states: Zone F has a total area of 1,454,592 stremmata within which there is developed fish farming, units of intensive form, with a total annual capacity of 510 t. The proposed total annual capacity is set at 2,650 t of fish, in a production area of 100 stremmata.

Currently, within Zone F, there is one operating aquaculture unit out of a total of 21 in the POAY. This unit specialises in breeding Mediterranean Sea Fish and has an annual capacity of 510 t. The leased area for this unit covers 46.25 stremmata.

In Zone F, the potential for development is limited to expanding the existing aquaculture unit, as establishing a new unit is not feasible due to the inability to meet the required minimum distance of 500 m.

The expansion can be carried out up to the maximum limit of 100 stremmata, with a resulting maximum annual capacity of 2,650 t, compared to the current capacity of 510 t. The proposed area consists of 2 marine parks, each covering an area of 50 stremmata, designated for productive purposes.

EAI analysis: There is a very large, planned increase in production (419.6% increase) with a smaller increase in production area (116.2%). This means that more fish are being produced per unit area (intensity of production – tonne of fish produced per stremmata) from 11 to 26.5 t per stremmata.

Zone F	Total Area (stremmata)	Total Annual Capacity (t)	Production area (stremmata)	Intensity t/stremmata
Present	1,454,592	510	46.25	11.0
Planned		2,650	100	26.5

Increase %		419.6%	116.2%	140%
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3.3.7 Zone Z (North of Selonda Bay to South of Akrotiri Trachili Corinthia and Argolida).

The EIA report states: Zone Z has a total area of 5,807,023 stremmata within which there are developed fish farming, units of intensive form, with a total annual capacity of 4,545.5 t. The proposed total annual capacity is set at 8,188 t of fish, in a production area of 450 stremmata .

Currently, Zone Z houses 10 aquaculture units out of a total of 21 in the POAY., where Marine Mediterranean Fish are cultivated. The collective annual capacity of these units amounts to 4,545.5 t, with individual capacities ranging from 150 to 1,328 t per year. The leased area for these units spans 244 stremmata , with individual areas varying from 10 to 50 stremmata .

The potential for growth in Zone Z includes:

- Expanding existing units with smaller leased areas, up to the limit of 40 stremmata, and achieving a maximum annual capacity of 700 t per unit while maintaining the minimum distances between units. Some existing units already maintain an area of 50 stremmata .
- For floating breeding units that have previously received approvals exceeding the mentioned maximum annual capacity, they can either conform to the above-mentioned guidelines or expand up to the limit of 60 stremmata to maintain their approved capacity.

As a result of these growth opportunities, the total annual capacity of Zone Z is expected to increase to 8,188 t from the current 4,545.5 t. The total leased area designated for productive use will also rise to 450 stremmata from the current 244. It's important to note that some proposed floating units consist of more than one marine park.

EIA analysis: There is a large, planned increase in production (80.1% increase) with an increase in production area (84.4%). This means that less fish are being produced per unit area (intensity of production – tonne of fish produced per stremmata) from 18.6 to 18.2 t per stremmata.

Zone Z	Total Area (stremmata)	Total Annual Capacity (t)	Production area (stremmata)	Intensity t/stremmata
Present	5,807,023	4,545.5	244	18.6
Planned		8,188	450	18.2
Increase/decrease %		80.1%	84.4%	-2%

Intensity of production in leased area

The proposed intensity of production (t/leased area) in the zones is as follows;

Zone	Present intensity (t/s)	Proposed intensity (t/s)
Zone A	9.9	26.5
Zone B	10.6	26.5
Zone C	7.5	17.5
Zone D	15.0	17.5
Zone E	12.2	16.1
Zone F	11.0	26.5
Zone Z	18.6	18.2

Average	12.1	21.3
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The average proposed intensity of production (21.3 t/s) would increase beyond the highest intensity presently being produced (18.8 t/s) with 3 zones (Zones A, B and F) reaching 26.5 t/s.

Further analysis of the potential environmental impact should be undertaken for zones A, B and F.

Intensity of production in the whole area

The proposed intensity of production (t/whole area) in the zones is as follows;

Zone	Present intensity (t/s)	Proposed intensity (t/s)
Zone A		1.16
Zone B	0.29	0.81
Zone C	0.19	0.88
Zone D	0.75	3.51
Zone E	0.25	1.08
Zone F	0.35	1.82
Zone Z	0.78	1.41
Average	0.42	1.53

The average proposed intensity of production (1.53 t/s) would increase beyond the highest intensity presently being produced (0.78 t/s). All zones would be higher with Zone D reaching 3.51 t/s. Further analysis of the potential environmental impact should be undertaken for zone D.

3.4 Associated facilities

The units in all zones will be supported by land facilities, which may already exist or be created, following local spatial plans. These land facilities will adhere to urban planning provisions and environmental regulations. It's noteworthy that these land facilities can potentially be shared by multiple floating breeding units for added efficiency.

Infrastructure

- Mentioned land infrastructures include piers, seawater pumping and drainage systems, feed routing systems, warehouses, outposts, net storage areas, incinerators, staff accommodations, access roads, vehicle traffic areas, and shell transhipment infrastructure.
- These facilities can be located within the coast.

The current status of these accompanying land facilities is deemed unsatisfactory, either due to insufficiency or non-compliance with applicable law. It is suggested that existing facilities, especially piers, should be settled as a priority, followed by completion in a second phase. The Management Body will plan this project, prioritising facilities and setting an implementation schedule.

To meet the needs of POAY, the following land-based accompanying infrastructures are estimated to be required:

- 15 docking facilities (wharves), including both existing and new ones, distributed among various zones.
- 9 positions with existing other land-based accompanying infrastructures.
- 10 positions with proposed other land-based accompanying infrastructures.

Support Facilities:

- This category includes land support facilities for units that are not an integral part of them, such as broodstock and hatchery facilities, fish fattening facilities, packing plants, shellfish processing and sanitation centres, and chill and cold stores.
- The support facilities for the floating units, particularly the packaging plants, are relatively adequate for the needs of existing units.
- There is a need for new packaging units, either within the breeding units or as independent business units, to facilitate the circulation of aquaculture products.

Other Infrastructure and equipment:

- The Management Body will secure office space, office equipment, and a communication network with POAY units.
- It will also ensure the use of floating means and equipment to protect units from pollution emergencies.
- To monitor water environment parameters, the Management Body may procure necessary equipment or contract with specialised laboratories.

Organisation of individual uses in the sea and land area:

- The Management Body will list units that need to be relocated to comply with current legislation, indicating suitable areas and any restrictions.
- Requests from businesses for unit movement will be supported.
- The Management Body will design the framework for the further development of aquaculture activity in each zone, subject to conditions and limitations specified by the Pr. Decree establishing POAY.
- A similar organisational process will apply to the land area, including assessing existing facilities for compliance with current legislation.
- There will be a hierarchy among accompanying facilities based on their necessity for unit operation and employee service.
- Special emphasis will be given to providing living quarters for workers, addressing identified deficiencies in this area.

EIA review: The report acknowledges that there is a requirement for significant shore base support facilities. It attempts to quantify this in terms of the number of units but, it does not identify the size, location and services that would be required to support this. This does not allow any assessment of the level of road use, electricity and water demand, water treatment and waste disposal that will be required.

3.5 Mandatory assessment of alternatives and choice.

The EIA report states: The Proposed POAY and selection criteria:

- The proposed POAY is a significant endeavour involving the creation of seven distinct zones within the study area. These zones are designated by letters (A – Z), and each has a specific geographic location and size.
- One of the primary selection criteria for these zones was the state of the environment, with a focus on ecological quality and suitability. The assessment considered whether the study area was suitable for the sustainable development of aquaculture activity.
- Existing aquaculture units played a crucial role in determining the proposed zones. The presence of these units and their successful operation over many years influenced the selection of the zones. This approach aimed to include all the existing floating units within the POAY.
- Compatibility with other uses, both existing and potential, was another key factor. The proposed zones needed to align with the broader regional context and not interfere with other activities or uses of the area.

Alternative possibilities considered:

- In the process of selecting the zones, various alternative scenarios were examined to assess their viability and implications.

Zero solution:

- The "zero solution," which involves not establishing POAY in the study area, was considered but ultimately rejected. The main reason for rejecting this option is that it goes against the objectives outlined in the Special Framework for aquaculture. This framework envisions the creation of POAY within specific categories for the organised spatial development of aquaculture in the region.
- POAY is seen as an essential component for integrating environmental considerations into the development of aquaculture. It allows for responsible monitoring of the environment's condition while contributing positively to the local economy and promoting sustainable aquaculture practices.

Alternative options for determining zones:

Various alternatives were explored in terms of the number of zones, their locations, sizes, capacities, and the positioning of water rest areas. Each alternative was carefully evaluated and ultimately rejected based on several factors:

- **Environmental impact:** Alternative scenarios that could have had adverse effects on the environment or disrupted natural conditions were not chosen.
- **Suitability:** The chosen zones needed to match specific criteria defined in the Special Framework and meet technical and environmental prerequisites.
- **Compatibility:** Changes to the zones' boundaries or locations were discarded if they conflicted with other existing uses of the area, such as residential developments or tourist facilities.
- **Navigational considerations:** The proposed zones had to allow for safe navigation in the region, and alternatives that obstructed navigation were not favoured.

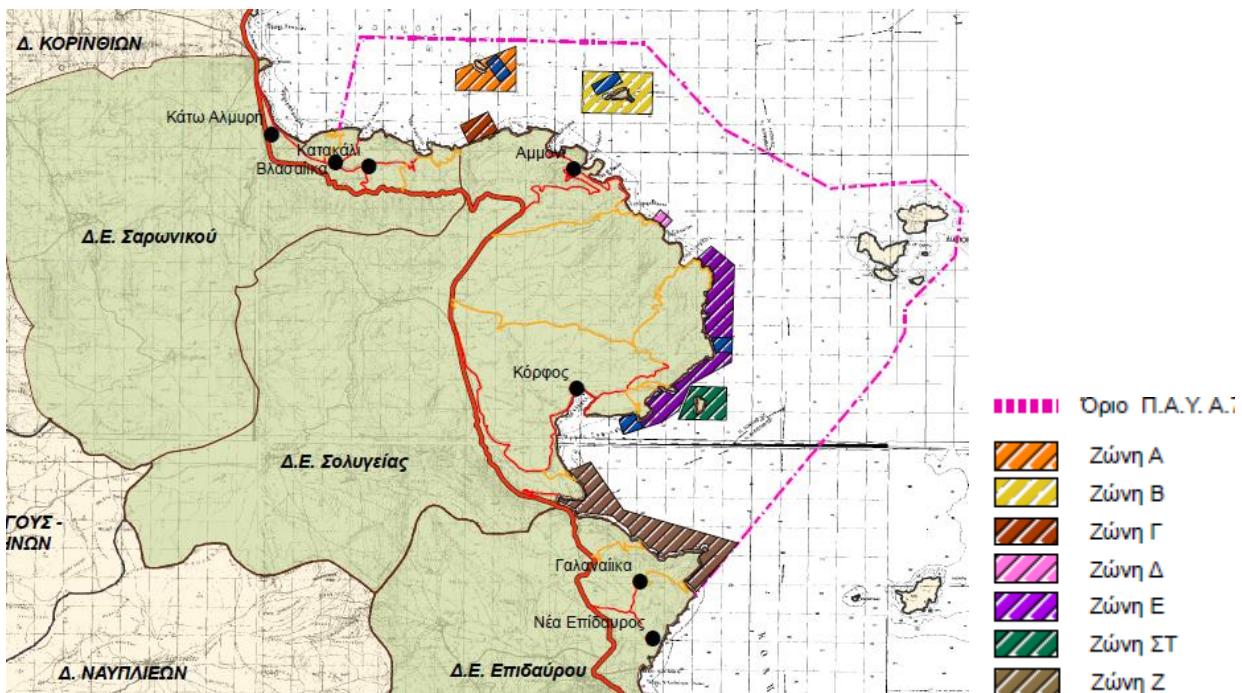
It was also emphasised that the additional space within the zones, beyond the productive area, was considered vital for future adjustments and the smooth operation of floating units. This extra space would accommodate changes in the orientation and positioning of units based on evolving data and conditions.

EIA analysis: The rejection of the "zero solution" without a more extensive exploration of its environmental and economic implications may limit the holistic evaluation of options. While the Special Framework for aquaculture outlines specific objectives for POAY, a more robust analysis of the environmental and economic trade-offs, and the local impacts on infrastructure and services between establishment and non-establishment should have been undertaken.

The report mentions the evaluation of alternative options for determining zones but does not provide specific details on these alternatives or the reasons for their rejection. To enhance transparency and have stakeholder understanding, a summary of these alternatives should have been included and the key factors leading to their rejection explained.

The emphasis on navigational considerations is important, but it should be accompanied by a detailed analysis of how potential navigational challenges and impact on marine tourism will be addressed within the proposed POAY.

The report mentions the importance of additional space within the zones for future adjustments and the smooth operation of floating units. The report should have provided specific plans for how this extra space will be managed and utilised to accommodate evolving data and conditions effectively.



The report considers variations on the proposed development plan but does not quantify the additional nutrient output from the expansion and the potential impact on the environment. The report also does not take into consideration the cumulative impact of many farms in a common water body.

4. Existing environmental situation

The EIA report states: presents the results of field research conducted in June 2015 by the Hellenic Centre for Marine Research for the study titled "Assessment of the ecological quality of the marine environment for the establishment of POAY. in areas of Corinth and NE. Argolida." The research included water and sediment sampling at 7 stations using the oceanographic vessel "FILIA.". A total of 7 sampling stations were selected, with 4 located near operational floating breeding units. The sampling depth ranged from 42 to 118 m. The assessment of ecological quality followed a methodology based on the Community Directive (WFD) (2000/60/EC) and involved hydro-morphological, physicochemical, and biological parameter measurements.

- **Bottom Type:** The coastline mainly consists of rocky areas with some small sandy beaches. The underwater environment is rocky with a steep slope towards the open sea.
- **Geochemical Analysis:** Sediment samples were collected and analysed for organic carbon, N, P, granulometric composition, and heavy metals. The sediment was generally characterised by high sand content, especially near aquaculture units.
- **Metal Concentrations:** Concentrations of heavy metals like Zn, Ni, Pb, Cu, and Cr were generally comparable to other coastal regions of Greece. No significant heavy metal pollution from aquaculture operations was observed.
- **Benthic Organisms:** The macrofauna, which is sensitive to organic enrichment, was collected and assessed using the BQI family index. Overall, most stations exhibited good environmental conditions, with station A1 being an exception.
- **Phytobenthos:** Phytobenthos, plant organisms living on the seabed, were not assessed at great depths due to the study's focus on rocky areas. Phytobenthos quality assessment considered data from the upper sub-coastal zone.
- **Phytoplankton:** These tiny plants forming the base of the marine food chain were examined for their abundance and composition. Diatoms and dinoflagellates were the primary groups, with nanoflagellates also present. Overall, the phytoplankton communities exhibited expected patterns for the season and region.
- **Zooplankton:** Copepods, a key group in zooplankton, dominated the communities, contributing significantly to the transfer of energy in the pelagic food chain. Biomass and abundance of mesozooplankton were generally high, indicating a stable and healthy biosphere. Variations in species composition were observed across stations, but diversity index values remained consistent.
- **Ecological Assessment Index:** An Ecological Evaluation Index (EEI) was used to evaluate the ecological quality based on macroalgae species. Two ecological status groups were identified, and the stations were classified accordingly.

EIA analysis: The study area mainly consists of rocky coastlines with good water clarity. Ecological quality ranged from moderate to high, with no observed Posidonia meadows.

The field study of the area undertaken by the Hellenic Centre for Marine Research showed that present environmental conditions in the area were comparable to other coastal areas and bays in Greece, indicating no significant negative impact from present aquaculture activities in the area. However, the sample sites were not close to the existing farms so the local impacts of the farms within the leased area were not evaluated.

4.1 Water bodies

The quality of surface water bodies is determined by ecological status and chemical state. Ecological status is assessed based on biological quality elements, and chemical status considers priority substances. Ecological status is classified as high, good, moderate, poor, or bad, depending on alterations and disturbance. Chemical status is classified as good or less than good based on the presence of priority substances. Artificial Water Bodies (AIW) and Inland, Artificial, or Heavily Modified Water Bodies (ITYS) have different environmental objectives compared to natural water bodies.

River Water Bodies:

- In the Northern Peloponnese beach stream catchment, 64.7% of rivers are in good ecological condition, while 29.4% are in moderate ecological status.
- In Attica and the watershed of Lekanopedi, 14 rivers have varying ecological and chemical statuses, with some classified as good and others as moderate, incomplete, or unknown.

Lake Water Bodies:

- Two lakes are identified in the Northern Peloponnese catchment, with one having good ecological and chemical status, while the other has an unknown ecological condition with good chemical status.
- An Artificial Lake Asopos is also identified with unknown ecological and chemical conditions.
- In Attica, the artificial lake Marathon is in good ecological, chemical, and overall condition.

Transitional Water Bodies:

- In the Northern Peloponnese, the ecological and chemical status of all transitional water bodies is classified as unknown.

Coastal Water Bodies:

- In the Northern Peloponnese, three coastal water bodies are recognised, with all having good ecological, chemical, and overall statuses.
- In Attica, several coastal systems have varying ecological and chemical statuses, with some classified as good and others as moderate or unknown.

EIA review: The assessment of water bodies in the area reveals a mixed picture in terms of their ecological and chemical statuses. In the Northern Peloponnese, most rivers (64.7%) are in good ecological condition, while a significant portion (29.4%) falls into the moderate ecological status category. This indicates a relatively healthy state of river ecosystems in this region.

The assessment of coastal water bodies in the Northern Peloponnese shows that all three coastal water bodies have good ecological, chemical, and overall statuses. In Attica, the coastal systems exhibit variability in their ecological and chemical statuses, with some areas classified as good and others as moderate or unknown. This suggests the importance of assessing the impact of further aquaculture development on coastal water that already has only moderate quality and identifying measures to mitigate coastal water quality in farm locations.

4.2 Seawater quality analysis

The evaluation of various physicochemical parameters in both fresh and seawater in the context of aquaculture units. Here are the key points from each section:

Velocity of Sea Currents:

- Defines closed gulf, open sea gulf, highly exposed sea area, and fast current area based on sea current speeds.
- Indicates that no aquaculture unit operates in a closed bay in the study area, with most areas being highly exposed.

Physicochemical Parameters in the Water Column:

- Describes the methodology for measuring temperature, salinity, turbidity, dissolved oxygen, and suspended solids.
- Dissolved oxygen concentrations indicate good oxygenation at all stations.
- Seasonal temperature variation aligns with general patterns in the coastal marine environment of Greece.

Nutrient Salts and Chlorophyll-a:

- Details the methodology for measuring inorganic nutrients and chlorophyll-a.
- Nutrient concentrations are generally low and comparable to values reported in the coastal environment of Greece.
- Heavy metals (Cu, Zn) concentrations are within acceptable limits and comparable to clean areas in the Aegean Sea.

Heavy Metals in the Water Column:

- Discusses the presence of heavy metals in coastal marine environments, often from terrestrial inputs.
- Notes that concentrations of Cd, Ni, and Pb are below environmental quality standards defined by Directive 2008/105/EC.
- Reports variations in lead (Pb) concentrations.

Assessment of Ecological Quality (Eutrophication Indicators):

- Evaluate eutrophication using chlorophyll-a concentrations and TRIX and EI indices.
- Chlorophyll-a concentrations indicate good to high ecological status.
- TRIX and EI indices suggest oligotrophic conditions with occasional mesotrophic areas.

EIA analysis:

The report indicates that the area is suitable for sustainable aquaculture at the present level of production but does not quantify or estimate how further aquaculture development would impact the environment and biodiversity.

4.3 Natura 2000 network

The EIA report states:

The report delves into the various categories of protected areas and the ecological diversity present in the Prefecture of Corinthia. It starts by introducing the Natura 2000 Network, which is a critical part of European conservation efforts. This network includes Special Protection Areas

(SPAs) designated for the protection of wild birds and Sites of Community Importance (SCIs) designated for the conservation of natural habitats and species. Greece has actively participated in this network, designating several SPAs and SCIs across its territory. However, it is noted that the study area itself does not contain any regions that fall within the Natura 2000 Network.

Moving on to Wildlife Refuges, these are highlighted as important areas for the development of wild flora and habitats for various wildlife species, including those for feeding, breeding, and wintering. While the concept of Wildlife Refuges is explained, the report mentions that there are none designated within the study area.

Nature Protection Areas, which are vital for preserving areas of great ecological or biological value, are briefly touched upon. These areas ensure that the natural environment remains protected from activities that might alter its physical condition or composition. Despite their importance, no Nature Protection Areas are identified within the study area.

The report also introduces the concept of Preservable Monuments of Nature, encompassing individual trees or stands of trees with special ecological or cultural significance. These areas can also include regions of ecological, palaeontological, or geomorphological interest. However, the report notes that there are no designated protected natural monuments within the study area.

Finally, the report provides insights into the rich biodiversity of the Prefecture of Corinthia. It mentions the presence of diverse forest ecosystems, including pristine forests of Capellinian fir, virgin pine forests, pure black pine forests, and mixed evergreen-broadleaf forests. These forests are found across various mountainous and semi-mountainous regions within the prefecture.

Additionally, the report highlights the existence of river valleys, ravines, and wet areas that host species like plane trees, willows, and poplars. These regions are characterised by a variety of plant species and provide unique habitats for various wildlife.

The agricultural landscape of the prefecture is briefly discussed, with a focus on crops such as grains and vines, which thrive in areas with temperature fluctuations. Mushroom cultivation in greenhouses is also mentioned, indicating the diversity of agricultural activities in the region.

EIA analysis: The Natura 2000 network, encompassing Special Protection Areas (SPAs) and Sites of Community Importance (SCIs), plays an important role in conserving natural habitats and species habitats significant at the European level. In the context of aquaculture development and its potential impact on the Natura 2000 network, it's essential to consider the specific areas within the network that are relevant to the study area.

While the study area does not fall within the Natura 2000 network, surrounding areas do, and they host a range of protected habitats and species. The development of aquaculture in these regions requires careful consideration of these protected areas and species, particularly concerning *Posidonia oceanica* meadows and reef habitats. Proper management and adherence to environmental regulations are essential to ensure that aquaculture development does not adversely impact these valuable and sensitive ecosystems.

4.4 Sources of pollution

The EIA report states: The report discusses various sources of pollution affecting the environment of the study area, categorising pollutants into two main groups based on their origin and impact on aquatic ecosystems. The first category includes common pollutants like organic loads, nitrates (NO_3^-), phosphates (PO_4^{3-}), and suspended solids, primarily originating from urban

sewage and agricultural and livestock activities. The second category consists of toxic substances and pathogenic microorganisms, arising from industrial activities, uncontrolled waste disposal sites, pesticide use, and urban sewage.

Municipal sewage and waste represent a significant source of pollution in the broader area, stemming from settlements with cesspools or sewerage networks and central sewage treatment plants. However, it's worth noting that there is no wastewater treatment facility within the study area itself. Instead, sewage treatment plants serve neighbouring areas, such as Ancient Epidaurus, Corinth, and Loutraki, with some effluents used for irrigation. Additionally, there is a concern about potential contamination from a nearby area of uncontrolled waste disposal (XADA), as indicated by the Watershed Management Plan Y.D. of Northern Peloponnese.

Agricultural and livestock activities also contribute to pollution through organic pollution. In the wider region, agriculture is a significant sector, and pollutants from fertilisers, pesticides, and insecticides used in crop cultivation can leach into subsoil, surface and groundwater. The area of North Corinthia has been designated as vulnerable to nitrate pollution of agricultural origin.

Industrial activity, particularly in the Corinth and Isthmus areas, exerts pressure on the Saronic Sea and Gulf. In the immediate study area, food processing industries, slaughterhouses, and olive mills are prevalent, with olive mills producing industrial waste that can lead to environmental problems, especially if not adequately treated or disposed of.

The report also mentions the issue of groundwater salinisation in the coastal area of the study area, attributed to over-pumping and natural geological factors. The aquifer system's connection to the sea allows for both drainage and seawater intrusion, making it challenging to find high-quality water sources, particularly in the coastal region where water demand is high during the tourist season.

Despite these pollution sources, the overall water quality in the study area is assessed as good in terms of composition and quantity, according to the River Basin Management Plans of the Northern Directorate Peloponnese. The coastal waters of the study area, as evaluated in the Water Management Plan of Attica, have a moderate ecological condition in the Western Saronikos Gulf.

EIA analysis: The study area faces various sources of pollution, including municipal sewage, agricultural runoff, industrial discharges, and groundwater salinisation.

There are two main groups of pollutants based on their origin and impact on aquatic ecosystems:

Organic pollutants.

Organic pollutants include common substances such as organic loads, NO_3^- , PO_4^{3-} , and suspended solids, primarily originating from urban sewage and agricultural and livestock activities. Municipal sewage and waste represent a significant source of pollution. However, it's important to note that there is no wastewater treatment facility within the study area itself. Agricultural and livestock activities in the wider region contribute to pollution through organic pollution, with the use of fertilisers. The area of North Corinthia has been identified as vulnerable to nitrate pollution of agricultural origin.

Toxic pollutants

The second category of pollutants comprises toxic substances originating from industrial activities, uncontrolled waste disposal sites, pesticide use, etc. In the immediate study area, food processing industries, slaughterhouses, and olive mills are prevalent. Olive mills, in particular, produce industrial waste that can pose environmental problems if not adequately treated or disposed of.

While these pollutants pose environmental challenges and risks, they tend to be very localised and present aquaculture production is not greatly impacted by them.

4.5 Fishing and aquaculture

Fishing

The study area contributes significantly to Greece's fishing production, with the total annual catch reaching 7,530 tons in 2013. The total value of these catches in 2013 was approximately €28,170,740, representing around 12% of the total value of catches at the national level.

A total of 196 coastal fisheries work in the study area vessels with an average length of 6.8 m, a total tonnage of 478 GT and a total power of 3,626 KW. The class of boats with a length (LOA) of less than the nearest organised fish market, handling significant quantities of fishery products, including cod, sardines, and anchovies.

In conclusion, fishing plays a vital role in the study area, contributing to both local and national fishing production. Coastal and medium fishing vessels are prevalent, with various species being caught and marketed through ports and fish markets. Fisheries management and environmental considerations remain important factors in sustaining this significant economic activity in the region.

Aquaculture

In the Peloponnese region, aquaculture plays a prominent role with a total of 66 operating aquaculture units. These include 4 inland water units, 7 units situated in lagoons, and 7 units dedicated to tuna production. Importantly, there is a substantial demand for the establishment of new marine aquaculture units and the expansion of existing ones in this region. The economic viability is bolstered by the promising export opportunities in the aquaculture sector.

In the study area, within the PAY A7 (which, as mentioned, includes part of the P.E. of Corinthia and the P.E. of Argolis) a total of 21 marine fish farming units are active, with a total annual approved capacity of 8,397.5 t of sea fish and a leased area of 596.11 stremmata.

Outside the PAY A7 (Western Saronikos), one (1) unit is active for breeding Marine Mediterranean Fish, with a leased area of 40 acres and an approved capacity of 1,035 tons.

The fish cage farms are served by land supporting and accompanying facilities, which include fish hatcheries, packing houses, warehouses, staff buildings, etc.

In the study area, there are 3 fresh fish packing plants operating with a maximum annual capacity of 8,870 tons:

EIA review: The present level of aquaculture production is below the level of fisheries. However, the proposed increase in aquaculture production would be higher than that of fisheries. Although the leased area will increase, this will not significantly impact the area of traditional inshore fisheries. As the main aquaculture production is based on seabass and seabream and is focused on exports, aquaculture will also not greatly impact local fish market prices.

4.6 Theoretical environmental impact assessment

The EIA report states: The environmental impacts of aquaculture in Greece, particularly in relation to the spatial placement of aquaculture units, can be categorised into effects on the aquatic environment and effects on the terrestrial environment. These impacts stem from various aspects of aquaculture operations, including the installation and operation of floating marine aquaculture units, spawn production stations, packaging facilities, land-based infrastructure, and more.

Marine fish farming, being a significant component of Greek aquaculture, has drawn attention due to its visual impact on the coastal landscape. While the alteration of natural coastal scenery is noticeable, it is important to note that these aesthetic changes are typically reversible and temporary. Studies have indicated that essential environmental alterations are not extensively present.

Research conducted over the last decade has provided valuable insights into the interaction between fish farms and the environment. These studies have focused on factors like chemical parameters in the water column and parasite presence. Notably, the release of dissolved waste, such as ammonium (NH_4^+) and PO_4^{3-} , from fish farms has been found to have limited effects on nutrient concentrations and chlorophyll-a levels in the surrounding waters. Conversely, the impact of solid waste is more immediate, leading to changes in sediment characteristics, especially beneath the cages.

Effects on plankton, benthic fauna, and fish fauna have been explored. Plankton assemblages near fish farms have been observed to be similar to control areas in terms of abundance and diversity. Studies have shown that fish abundance and biomass can increase in areas with fish farms, particularly in oligotrophic regions like the Aegean. The impact on biodiversity varies, with the primary concern being the effect on *Posidonia oceanica* meadows, which are often chosen as fish farm sites.

The extent and intensity of negative effects depend on local hydrology, bathymetry, and topography. Most studies suggest that most impacts occur within a radius of 50-150 m around the cages. Fish farmers play a role in limiting environmental degradation, as they wish to maintain the quality of the rearing environment. Furthermore, practices that increase costs and reduce product quality are typically avoided due to competitive pressures.

One potential concern is the introduction of foreign species, mainly associated with oyster cultivation. Strict control and preventive measures are necessary to address these risks. It is essential to note that all farmed species in Greece are currently endemic.

Regarding land-based impacts, environmental legislation and regulations primarily address aesthetic alterations caused by infrastructure construction. Access to the coast and the presence of accompanying facilities can sometimes hinder beachgoers, but these facilities are usually of limited size and not permanent in nature. Additionally, aquaculture has positive environmental effects, as it helps meet the growing demand for seafood and reduces pressure on wild fish populations.

When considering the conservation of natural resources, aquaculture is generally regarded as a more environmentally friendly option compared to other coastal activities such as industry, intensive agriculture, mass tourism, recreational housing, and port works/marinas.

Contrary to the belief that aquaculture has substantial and incompatible environmental impacts, it has been proven otherwise. There have been no scientifically documented complaints regarding permanent negative environmental effects resulting from aquaculture operations in Greece.

Moreover, there are no recorded legal or administrative penalties due to adverse environmental impacts in aquaculture businesses.²

The prevailing negative perceptions about the aquaculture sector can be attributed to various factors, including the visual alteration of coastal landscapes, poor practices during the early stages of the industry's development, unsubstantiated objections, and a lack of systematic communication to educate consumers about aquaculture products.

While there may have been past cases of environmental burden due to poor practices, these effects were not irreversible or had medium-term consequences. Over the last 20 years, advancements in know-how, technology, and scientific knowledge have led to significant improvements in aquaculture practices, minimising environmental impacts. These improvements include better feed conversion rates, optimised fish feed, automated food distribution, genetic selection, water quality monitoring, and disease prevention.

The strict institutional framework in the European Union, along with national regulations, emphasises the protection of the environment in aquaculture. These regulations address various aspects, such as the use of therapeutic agents, permissible levels of substances in food, fish feed ingredients, and more, to ensure product quality and environmental sustainability.

The responsibility for minimising impacts falls on both aquaculture producers and competent supervisory and control mechanisms of the administration. Clear criteria for the establishment and operation of aquaculture units are essential, and administrative tools like Integrated Coastal Zone Management and Aquaculture Development aim to better organise and control production processes, reduce conflicts, and promote good practices for environmental protection and consumer safety.

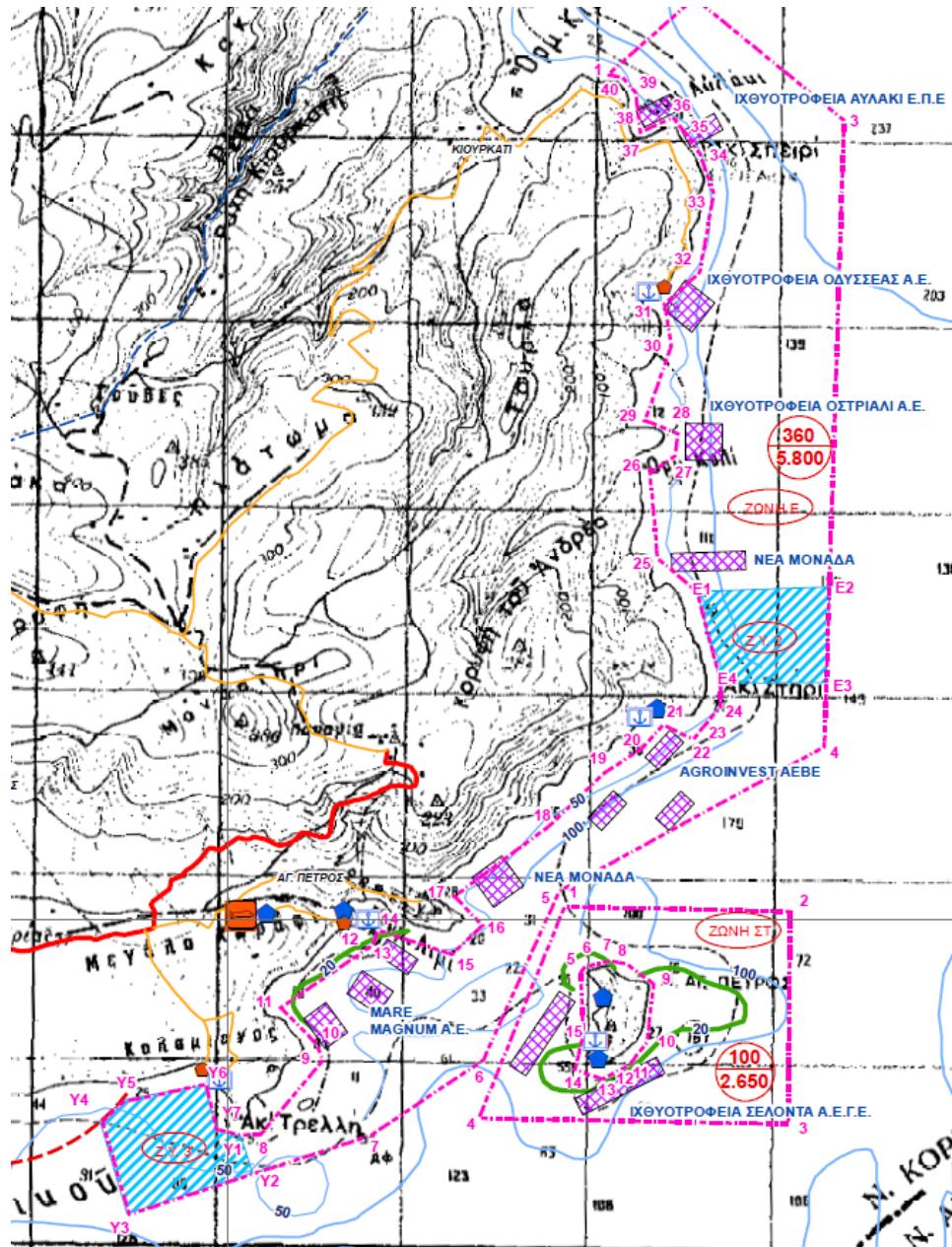
Mitigation strategies:

- **Local nutrient increase.** The localised increase in nutrients resulting from aquaculture is an inherent process, but it can be managed to minimise its effects. Therefore, the placement of aquaculture units in the proposed POAY zones will be conducted in areas with strong hydrodynamics. These areas should have a minimum depth of 18 m and be exposed to the open sea, allowing strong currents to disperse nutrients across a wider area, thus avoiding significant local impacts on food levels.
- **Visual landscape alteration.** The alteration of the visual landscape due to aquaculture facilities, which are often located along the coastline or close to it, is an impact that cannot be entirely avoided. However, it's worth noting that in the majority of the coastal areas proposed for POAY placement, there is limited existing development or conflicting land use activities.

The report claims that the placement of units within POAYs can have a positive impact on enhancing the overall landscape character.

EIA analysis: The report describes the potential impacts of aquaculture on the environment, local infrastructure and services but does not quantify the increased level of impact locally at each farm and cumulatively in common water bodies.

² Please note that this section comes directly from the EIA and reflects the opinion of the writers of the EIA not the evaluators.



Προτεινόμενη Περιοχή Οργανωμένης Ανάπτυξης Υδατοκαλλιεργειών (ΠΟ.Α.Υ.)

-  Όριο Π.Ο.Α.Υ.
-  Προτεινόμενες θέσεις υδρανάπαυσης
-  Προτεινόμενες θέσεις μονάδων
-  Οικοδομικός Συνεταιρισμός (ΦΕΚ 266/Δ'/2004)
-  Ζώνη απόστασης 1000μ από χρήσεις - δραστηριότητες Άρθρου 7 ΕΠΧΣΑΑΥ

The coast is already heavily developed for aquaculture and the further increase in production could cause further cumulative impact of multiple fish cage farms in the water body affecting the ecosystem, particularly concerning eutrophication, the spread of fish diseases and parasites.

- **Eutrophication:** Fish farms release nutrients such as N and P into the water through fish excrement and uneaten feed. These nutrients can accumulate due to limited water exchange. High nutrient levels can lead to eutrophication, characterised by increased algae levels in the water and, in extreme cases, can cause algal blooms. These blooms can deplete oxygen in the water (hypoxia), harm marine life, disrupt the ecological balance and sometimes cause fish kills.
- **Spread of fish diseases and parasites:** Cage farms that are close to each other can facilitate the rapid spread of diseases and parasites, such as sea lice and isopods. These pathogens can affect not only farmed fish but also wild populations if they escape or interact with wild fish.

These impacts can affect water quality, fish farm operations, and local coastal communities.

- **Impact on water quality:** The accumulation of dissolved nutrients from fish waste and uneaten feed can deteriorate water quality. This degradation can manifest as increased turbidity, reduced oxygen levels, and altered chemical composition of the water.
- **Fish farm operation:** The cumulative impacts of multiple farms can lead to a decline in the health and productivity of the fish stocks. Over time, farms may face increased costs due to the need for more disease treatments and potentially lower yields due to disease outbreaks or environmental stressors.
- **Effect on local coastal communities:** Local communities may experience both direct and indirect impacts. Directly, poor water quality can affect recreational activities, tourism, and the health of local fisheries. Indirectly, the community might face economic challenges if the sustainability of the aquaculture industry is compromised. Additionally, conflicts can arise between fish farmers and other stakeholders, such as local fishermen or conservation groups, over resource use and environmental concerns.

5. Proposed Monitoring and Mitigation Measures

5.1 Monitoring parameters

The EIA report states:

To safeguard the aquatic environment and ensure the satisfactory production of aquaculture units within the POAY, it is imperative to implement a water quality monitoring system. This monitoring aligns with the provisions of Law 3199/2003 and Pr. Decree 51/2007, which adheres to Directive 2008/56/EC (Framework Directive on Maritime Strategy) and require the monitoring of aquatic ecosystems.

Continuous monitoring of the aquatic environment is essential to collect data over several years and create a time series for evaluating and studying ecosystem processes. Without such data, it is impossible to formulate effective environmental management measures. The Circular DIPA/121634/7242/20.12.2019, issued by the Secretary General of Natural Environment and Waters, defines the parameters for environmental monitoring in marine aquaculture units and POAY zones.

These monitoring parameters are categorised into three groups:

1. Measurements required for the establishment, relocation, or expansion of floating marine fish farming units.
2. Measurements are necessary for POAY establishment.
3. Measurements are to be conducted during POAY operation, including individual marine fish farms.

To select measurement points, the principle of permissible mixing zones is considered, following EU guidelines. A detailed presentation of relevant results from a field survey conducted in June 2015 by the Hellenic Centre for Marine Research, titled "Assessment of the ecological quality of the marine environment for POAY establishment in Corinthia – North East Argolida," adequately covers the analysis requirements for POAY establishment.

Furthermore, the POAY body will adopt environmental monitoring parameters during the operational phase of POAY, as outlined in Table 3 of the Appendix of Circular No. YPEN/DIPA/121634/7242/20.12.2019.

Monitoring the Implementation of POAY

A monitoring system will be developed to assess the implementation of POAY objectives within the environmental sector. These objectives encompass various areas, including biodiversity, flora, fauna, and protected areas, as well as water, air, soil, and climate factors, among others.

The monitoring system aims to achieve the following:

- Minimise the impact of aquaculture on the environment.
- Protect marine species and habitats.
- Organise monitoring of marine environment quality.
- Establish provisions for waste management at sea and on land.

Additionally, it focuses on:

- Ensuring the hygiene and safety of fishery products.
- Creating job opportunities and improving living conditions in disadvantaged areas.

- Enhancing working conditions.
- Protecting and enhancing the aesthetics of the coastal landscape.

Overall, the monitoring system seeks to balance the growth of the aquaculture sector with the preservation and protection of the environment, biodiversity, and the well-being of local communities.

EIA analysis: The report provides a list of environmental and social criteria that should be monitored based on Government and POAY regulations but gives insufficient information on the sampling location, frequency, analysis and thresholds.

5.2 Proposed general mitigation measures

The EIA report states: The methodology outlined in the text aims to prevent and minimise the environmental impacts of aquaculture development in the selected POAY Zones in the Western Saronikos region of Greece (P.E. Corinthia and Argolis).

- **Minimising local nutrient increase:** To address the issue of local nutrient increase from aquaculture, the text proposes installing aquaculture units in areas with intense water currents, ensuring depths of at least 18 m and exposure to strong sea currents. This strategy aims to disperse nutrients over a broader area, minimising their localised impact and preventing adverse effects on local food chains.
- **Landscape alteration:** The text acknowledges that the alteration of the landscape due to aquaculture facilities near the seashore or in the coastal zone is unavoidable. However, it emphasises that this impact is generally limited, as there is limited development in the coastal region where the POAY Zones are proposed. It also highlights that the placement of units in organised receptors contributes positively to enhancing the landscape's character.
- **Environmental monitoring:** To protect the aquatic environment and ensure satisfactory aquaculture production, an environmental monitoring system is recommended. This monitoring system aligns with national laws and directives, including Directive 2008/56/EC (Framework Directive on Maritime Strategy). It emphasises continuous monitoring to collect long-term data, which is essential for evaluating ecosystem processes and facilitating effective environmental management measures.
- **Monitoring parameters:** The report specifies the parameters to be monitored in coastal and inland water aquaculture units, categorised into measurements required for licensing, measurements for establishing POAY, and measurements during POAY operation. The selection of measurement points considers permissible mixing zones, ensuring compliance with EU regulations.
- **Monitoring of implementation:** The methodology proposes a monitoring system to assess the degree of POAY implementation. This monitoring includes objectives related to biodiversity, marine species protection, waste management, and the reduction of environmental impact. Additionally, it addresses water, air, soil, and climate factors, emphasising the importance of minimising aquaculture's impact and mitigating waste production and emissions.
- **Regulatory framework:** The establishment of POAY is designed to integrate environmental considerations into aquaculture activities. The methodology mentions specific measures to

comply with existing environmental legislation and highlights the inclusion of monitoring parameters in environmental approval decisions at the unit level. It acknowledges the lack of a special regulatory act for addressing POAY environmental impacts and underscores the legal basis provided by current legislation.

EIA analysis: The reports cover the theoretical mitigation measures that are covered by regulations for the management of farms. However, the report does not sufficiently cover the following;

- **Pollution prevention.** While the report acknowledges the need to prevent and minimise environmental impacts, it provides limited detail on specific measures and technologies that will be employed to achieve these goals. It mentions installing aquaculture units in areas with high water currents to disperse nutrients, but it lacks specifics on wastewater treatment, waste management, or methods to reduce the release of pollutants into the marine environment. A more comprehensive and detailed pollution prevention plan is necessary to address the complex challenges of aquaculture-related pollution effectively.
- **Mitigation strategies.** The report mentions that landscape alteration due to aquaculture is unavoidable, but it does not provide any specific mitigation strategies to minimise the visual impact or negative aesthetic changes to the coastal areas. It would be beneficial to explore options and include community involvement in landscape planning to address this concern.
- **Environmental Monitoring.** While the report emphasises the importance of environmental monitoring, it lacks specifics on the frequency, scope, and methodology of monitoring activities. A well-designed monitoring program should include clear parameters, sampling methods, and data analysis procedures to effectively assess the environmental impact of aquaculture operations.
- **Regulatory Framework.** The report mentions the absence of a special regulatory act to address the environmental impacts of aquaculture in the POAY zones. This highlights a potential gap in the regulatory framework, and it does not provide a clear plan for addressing this weakness. Developing comprehensive regulations specific to the POAY zones and aquaculture activities is essential to ensure effective environmental management.
- **Long-term sustainability.** While the methodology focuses on minimising immediate environmental impacts, it lacks a clear emphasis on the long-term sustainability of aquaculture practices. Ensuring that aquaculture activities remain environmentally sustainable over time is crucial, considering factors such as resource use efficiency, disease management, and adaptation to changing environmental conditions.

5.3 Main additional studies and surveys required

The EIA report states: The report lists a series of additional studies and surveys that will need to be undertaken to support the establishment and operation of the POAY. These studies primarily focus on land-based facilities that accompany and support the floating aquaculture units, as well as infrastructure projects.

- The identification of the required land facilities, categorising them by type, number, and size, considering parameters like surface area, volume, and capacity during the initial phase for outlining the scope of the projects.
- Construction studies are to be conducted to determine the feasibility and cost of these land-based facilities. These studies should be carried out by competent bodies, likely involving

collaboration between local government and state agencies, under the responsibility of the POAY Management Body.

- Studies on infrastructure projects will also be required. These projects may include improvements to port facilities and enhancements to the road network serving the needs of the POAY. These infrastructure studies will be conducted on a case-by-case basis and will involve cooperation with relevant authorities.
- The development of a monitoring program for the aquatic environment. This program aims to collect data that will serve as the foundation for assessing water quality over time. The information gathered through this monitoring will be invaluable for potentially adjusting the design and operations of the POAY in the medium term to ensure environmental sustainability.

EIA analysis: Although the report recommends further studies for the improvement of infrastructure and services to support the expansion and increase in fish production, there should be further studies undertaken to quantify the additional nutrient output from the expansion of aquaculture activities and assess the impact on the local environmental and cumulative impact in the shared water body. This could be undertaken by:

- The use of depositional modelling of nutrients serves as a predictive tool to assess the potential impact of nutrient deposition on the seabed beneath marine fish cages. This is a modelling approach that helps estimate how nutrients, particularly organic matter and waste, may accumulate on the seabed over time. Researchers and environmental authorities can use these modelling outcomes to assess the ecological impact of nutrient deposition on the seabed. This includes evaluating whether nutrient accumulation may lead to adverse effects on benthic communities, water quality, and overall ecosystem health. If the modelling indicates potential environmental concerns, mitigation strategies can be devised to address nutrient accumulation, such as adjusting feeding practices, optimising cage positioning, or reducing aquaculture production.
- Nutrient mass balance box models can be used to predict the impact of nutrients on water quality around marine fish cages. These models employ a systematic approach to estimate the movement and fate of nutrients in the aquatic environment. The models consider various sources of nutrient input into the marine environment around fish cages, including fish excretion, uneaten feed, and other farm-related activities. These inputs are quantified based on factors such as fish biomass, feeding rates, and nutrient content in fish feed. The modelling process provides insights into the distribution and concentration of nutrients in the water surrounding the fish cages. It allows for the assessment of water quality parameters such as nutrient levels, oxygen concentrations, and the potential for nutrient-related issues like eutrophication. By analysing the modelled data, researchers and aquaculture managers can predict the potential impact of nutrient discharges from fish cages on the surrounding marine environment. Based on the model results, strategies can be developed to mitigate nutrient-related issues. These strategies may involve adjusting feeding practices, optimising cage positioning to minimise nutrient release or reduction in aquaculture production.

6. Socio-economic benefits and drawbacks of marine fish cage culture in Greece

The section below is an analysis of the EIA from a socio-economic perspective, providing an overview of the possible benefits and drawbacks associated with marine fish cage culture in Greece. This section is intended to highlight what the sector offers at the regional, country and local level and is an independent overview from the report authors.

6.1 Socio-economic benefits

6.1.1 Socio-economic benefits at the country level

- **Job creation.** Fish cage culture employs a significant number of people in Greece, from farm workers to fish farmers to technicians and managers. According to the Hellenic Aquaculture Producers Organisation (2021), the industry directly employs 3,871 people and it is estimated directly and indirectly employs about 12,000 people³.
- **Export earnings.** Greece is a major exporter of farmed fish, with exports of over €300 million per year. This contributes significantly to the country's foreign exchange earnings.
- **Economic diversification.** Fish cage culture provides an important source of income for coastal communities, particularly in areas where traditional fishing has declined. This helps to diversify the economy and reduce reliance on a single industry.

6.1.2 Socio-economic benefits at the local community level

- **Job creation.** Fish cage culture can create jobs in construction, operation, maintenance, and processing. This can be a major benefit for local communities, particularly in areas where employment opportunities are limited.
- **Economic diversification.** Fish cage culture can provide an additional source of income for local communities, which can help to diversify the economy and reduce dependence on a single industry.
- **Community development.** Fish cage culture can generate revenue that can be reinvested in community development projects, such as education, healthcare, and infrastructure.
- **Increased local demand for goods and services.** Fish cage culture can increase the demand for goods and services provided by local businesses, such as transportation, construction, maintenance, and supplies. This can stimulate economic activity and create jobs in the local community.
- **Fish supply for local businesses.** Fish cage culture can provide a reliable source of fresh fish for local businesses, such as restaurants, hotels, and fishmongers. This can help to reduce reliance on imported fish and support local food systems.
- **Skill development.** Fish farms can provide training and education to local workers in aquaculture, marine biology, and other relevant fields. This can enhance their skills and employability, making them more competitive in the job market.

6.1.3 Food security benefits at the country level

- **Increased fish production.** Fish cage culture has helped to increase the production of fish in Greece, making it a more self-sufficient country in terms of fish supplies.

³ https://fishfromgreece.com/wp-content/uploads/2023/10/HAPO_AR23_WEB-NEW.pdf

- **Supplementing wild fisheries.** Fish cage culture can help to supplement wild fisheries, which have been under pressure due to overfishing and environmental degradation.
- **Reducing reliance on imports.** Fish cage culture helps to reduce Greece's reliance on imported fish, which can be expensive and can contribute to food insecurity.

6.2 Socio-economic drawbacks

6.2.1 Drawbacks at the country level

- **Environmental impact.** Fish cage culture can have a negative impact on the environment, including pollution from fish waste, the spread of diseases and parasites, and habitat destruction.
- **Conflict with traditional fisheries.** Fish cage culture can conflict with traditional fishing practices, leading to competition for resources and disruption of fishing grounds.

6.2.2 Drawbacks at the country level

- **Social tensions.** Fish cage culture can lead to social tensions between fish farmers, traditional fishers, and local communities, as there may be concerns about the environmental impact and the distribution of benefits.
- **Competition for resources.** Fish farms compete with traditional fishers for resources, such as fishing grounds. This competition can disrupt traditional fishing practices and reduce the livelihood opportunities for traditional fishers.
- **Lack of transparency and participation.** The decision-making process for fish cage culture projects is often opaque, and traditional fishers and local communities may not have a say in the size of farms and where the farms are located. This lack of transparency can lead to resentment and distrust.
- **Lack of benefits sharing.** Traditionally, the profits from the fishing industry have been shared among the fishers and the local communities. With fish cage culture, the profits often flow to the fish farmers and the companies that own the farms, with little benefit to the local communities.

6.2.3 Drawbacks at the local level

- **Visual impacts on seascape.** The presence of fish cages can alter the natural beauty of coastal areas, affecting the aesthetics of the seascape. The large floating structures of fish cages and feeding barges can be visually unappealing, disrupting the natural views and creating an industrial feel to the shoreline. This can be particularly noticeable in areas with pristine coastlines or with significant tourism value.
- **Impacts on coastal tourism and yachting.** Fish cages can potentially deter tourists and yachters from visiting coastal areas, negatively impacting the local tourism industry. The sight of fish cages can diminish the perceived natural beauty of the coastal landscape, reducing the appeal for recreation and relaxation. This can be particularly detrimental for tourist destinations that rely on the pristine beauty of their coastlines.
- **Local marine traffic.** Fish cage culture operations can increase local marine traffic, as vessels are required to transport fish, feed, and supplies to the farms, and to collect and transport fish away from the farms. This increased traffic can disrupt the movement of other vessels, such as fishing boats and pleasure craft, and can also increase the risk of collisions and accidents.
- **Local road traffic.** The construction and operation of fish farms can also increase local road traffic, as trucks are needed to transport materials and supplies to the farms and to carry away

waste and byproducts. This increased traffic can put a strain on local infrastructure and can also contribute to air pollution.

- **Freshwater resources.** Fish cage culture operations can consume large amounts of freshwater, which is used for cleaning fish tanks, diluting waste, and maintaining optimal water quality. This can place stress on freshwater resources, particularly in areas where freshwater is already scarce.
- **Housing for workers.** The expansion of fish cage culture can lead to an increase in the demand for housing for workers, as fish farms need a steady supply of labour to operate efficiently. This can put pressure on local housing markets and can lead to higher housing costs such as rents.

6.3 Assessing the balance of benefits and drawbacks

The socio-economic impacts of marine fish cage culture in Greece are complex and there is no easy answer to whether the benefits outweigh the drawbacks. The industry has the potential to provide significant economic and food security benefits, however, it is important to manage the environmental and social impacts carefully.

The overall balance of benefits and drawbacks, as outlined in sections 6.1 and 6.2 depends on how the industry is managed and how it interacts with local communities.

7. Social analysis

7.1 Social assessment

EIA report of content: The study assessed the present (2015) social status, including:

- Demographics
- Employment and unemployment
- Tourism
- Infrastructure and services
- Economic conditions
- Land use
- Cultural heritage
- Protection of human and public health

7.1.1 Demographics

The EIA report states: The study area consists of 3 municipalities: Solygeia and Saronikos in the Regional Unit of Corinth and Epidavros in the Regional Unit of Epidavros. These municipalities have similar social, economic and population characteristics.

Census results (EL. STAT 1991-2011) show that the largest population lives in Saronikos (2011 - 5,227 persons) followed by Epidavros (2011 – 4,018 persons) and Solygeia (2011-2,701 persons).

Over the 10 years from 2001-2011, the population in Saronikos has been relatively stable (-1.3%) while that of Solygeia and Epidavros has declined by 11.4% and 10.1% respectively.

The educational level of all the country's residents is considered satisfactory, as more than 65% of the population of both the country and the study area are primary and secondary school graduates, with 12% of the population with a tertiary level of education.

EIA analysis: The EIA study considers that the creation of the POAY will strengthen the economy and the development of the local communities since new employment positions will be created.

However, the study does not consider the age distribution or the educational level of the population of these regions nor evaluate the potential number of jobs that can be created by the fish farms, their quality and whether this can be met by local recruitment. At the local level, the POAY will create new jobs while maintaining existing ones, thus retaining the local population, and increasing social cohesion.

7.1.2 Employment -Unemployment

The EIA report states: In 2011, the permanent population of the 3 municipalities in the study area was reported as 11,870 persons of which 26% (3,052) were employed, 6.1% were unemployed and 62.9% were economically inactive.

In 2011, in the whole of the study area, 62.6% of the economically active population was employed in the tertiary sector. In all the regions of the study the percent of the population working in the tertiary sector exceeds 60% Due to the coastal regions and easy access from Attica this region has a developed tourism activity with related services. The primary sector employed 12.8% of the population and 24.5% were employed in the secondary sector. It was noted that in Saronikos an

important part of the population is employed in the developing manufacturing activities of the wider Corinth area and West Attica.

EIA analysis: There are some discrepancies in the figures used for the population and employment-unemployment figures. Only 96% of the total population appears to have been accounted for in the analysis of the active population.

Without an evaluation of the potential total number of jobs in aquaculture that exist and would be created by the POAY, it is not possible to explore the potential disruption to traditional ways of life and community dynamics. Without analysis of the number of potential jobs in these diverse regions, it is impossible to analyse the strain the proposal will make on local infrastructure (roads, fresh water and sewage, healthcare and schools) due to population influx and the effect of increased economic activity.

7.1.3 Tourism

The EIA report states: The importance of the tertiary sector in Greece's economy is obvious given that 80.35% of the gross value added is generated by this productive sector and as a result, tourism development is prominent. The study notes that the Municipalities of Saronikos, Solygeia and Epidavros have a high percentage of workers in the tertiary sector.

Within the study area of the POAY, the regulations about the status of land use within the urban planning regulations are considered and areas for tourist development or restrictions on tourism are mentioned.

EIA analysis: No analytical study on the existing leisure and tourism activities within the study area has been carried out (i.e. available hotel accommodation, occupancy etc.). Further development of the tourist industry such as the rise of popularity of AIRBNB will most likely increase the number of tourists in the study area. Implications on the social aspects and cost of living due to any increase need to be investigated. Further prediction of the touristic development may impact the locals' openness to such a project.

Through the creation of seven spatial zones in the POAY the potential for negative spatial impacts is avoided, while at the same time, emphasis is placed on any planned new uses to avoid future conflicts due to competing uses (e.g. aquaculture and tourism). However, without an analysis of the tourism sector, it is not possible to fully evaluate the spatial organisation of the POAY with other competing sectors.

7.1.4 Infrastructure

The EIA report states: The existing infrastructure of the study area is described and summarised:

- **Port infrastructure** – In the area where the POAY is planned there is no developed port structure. There is a basic infrastructure for the mooring of fishing boats in Korfos. All other piers in the bay areas have arisen to expedite the existing aquaculture activities.
- **Road transport** – Road transport dominates the wider region. The roads that cross the study area include the National roads Isthmus – Eleni - N. Epidavros – Ancient Epidavros and Corinth-Nemea- Argos – Tripoli – Megalopolis - Kalamata
- **Rail transport:** This is non-existent in the study areas. The closest connection is the Proastiakos which passes through Corinth and connects to Athens.
- **Air transport:** The Regional Units of Corinth and Argolida do not have any airports. Kalamata and Tripoli airports serve the wider region and the main international airport is in Athens.

EIA analysis: A detailed analysis of how the current infrastructure will affect the development of the project, the way goods are transferred, boats stored and moored seems to be very weak. The understanding is that a lot of work would need to be carried out to have a truly functional road network and port that would cover the needs of such a project.

7.1.5 Freshwater supply and sewage

The EIA report states:

- Freshwater – In the regional Unit of Corinth a high percentage of the water supply comes from underground water and there are boreholes throughout the region. The quality of water from these sources is decreasing, as is the quantity due to over-pumping. In the Regional unit of Epidavros, the supply network covers all the settlements of the municipality and is of satisfactory quality. Water used in irrigation is extracted using inefficient methods and is one of the causes of over-pumping.
- Sewage - In the settlements of the study area, and as in most of the settlements in the Regional Unit of Corinth, there is no sewage network and the settlements are served by cesspits. Only the urban areas have a sewage network. There are no sewage treatment plants in the study area except in Corinth and Ancient Epidavros.

EIA analysis: The EIA study does not quantify the freshwater requirement for the population or irrigation and what volume of water is being pumped from the underground sources. It is not clear whether additional boreholes will be required and can meet the requirement or any additional requirement of the new proposed facilities. There will be a requirement for the following:

- Worker drinking water
- Cleaning water (tanks, packing facility, etc.)
- Domestic toilet water
- Water for ice (harvesting, packing)

7.1.6 Telecommunications Infrastructures

The EIA report states: There are no specific problems with the telecommunication network of the region. The quality of communications regarding fixed voice and internet use is considered sufficient. In the municipalities, there are fibre optic networks.

EIA analysis: Without detailed information, it is not possible to assess whether the telecommunication infrastructure is capable of meeting modern demands.

7.1.7 Electricity supply

The EIA report states: The study area is supplied by the national electricity distribution network of energy that extends throughout the Peloponnese. It consists of a network of high, medium and low voltage. The distributed energy is produced by generation stations operating in the region. It is noted that the total energy requirements of the region are met with the existing production.

In addition, there are extensive locally Interconnected Transmission System Facilities in the area. The 150,000Volts transmission lines Methana- Corinth, Routh – Ladon and Koumoundourou-Megapolis pass through the area.

EIA analysis: The study does not consider the supply capacity or the requirement for electricity in the study area. The EIA does not quantify the electrical demands of the proposed new land-based facilities of the POAY.

7.2 Environmental impacts

EIA report:

1. Noise and light pollution
2. Landscape
3. Cultural heritage

The study concludes that there will not be any significant impacts.

7.2.1 Impacts of noise and light pollution

The EIA report states: The study does not consider the impact of any noise and light pollution from the facilities in the proposed areas of the POAY.

EIA analysis: The study does not consider the impact of any noise and light pollution from the facilities in the proposed areas of the POAY. Generally, perimeter mooring warning lights at night and land security lighting at night are used. It is prudent to have flashing warning lights at night at the perimeter of the sea cage sites together with radar reflectors to prevent collision of boats with the cages at night. The flashing lights can be designed to be shielded from the light penetrating the water and causing light pollution. Unshielded lights might affect sea turtle behaviour, esp. in terms of nesting. In addition, low-intensity lighting is used to protect the sea cage units, and to avoid stress to fish populations during storms.

The EIA does not consider the noise impact from fish hatchery production facilities.

The EIA does not consider the noise from reversing forklift vehicles around the packing stations which may impact nearby residential sites

7.2.2 Impacts on the landscape

The EIA report states: The EIA study recognises that in the regulations the coastal landscape and environment must be respected. Descriptions of the landscape and protected environments in the study area are described and areas of outstanding natural beauty are considered. The study considers that the visual alteration of the natural coastal landscape, by the installation of land and sea infrastructures, is a basis for criticism. However, it notes from the experience to date from the operation of fish farming units, significant impacts on the landscape and the view can create a nuisance for residents in some areas.

The location of the units in organised aquaculture development areas contributes positively to strengthening the character of the landscape.

EIA analysis: The study does not quantify the number or size of additional land-based facilities that are expected to be constructed or located. This is a major omission as it does not take into consideration the necessary land services and infrastructure requirements that are needed to support the expansion, road traffic increase, freshwater requirement, electricity requirement, housing requirement, sewage and water treatment, etc. Without quantification of these facilities and their locations, it is not possible to make an informed judgment on the impact on the landscape. The EIA does not take into consideration the visual seascape and impact on yachting in the area and the use of sheltered space and bays.

7.2.3 Impact on cultural heritage

The EIA report states: In the entire Regional Unit of Corinth and Argolida there are a multitude of notable cultural elements that are protected according to the provisions of Law 3028/2002 “for the protection of antiquities and in general of cultural heritage”. The study reports that there are no archaeological sites and monuments which should be taken into account in the study.

EIA analysis: The proposed aquaculture areas appear to be free of important historical cultural heritage and all relevant regulations would have to be followed before the construction of any facilities.

7.2.4 Identification of residential /spatial impacts

The EIA report states: The report considered in each of the aquaculture development zones the siting of the aquaculture units in relation to other users in the areas given that the zoning and the radius of influence would vary, according to activity, from 500 and 1000m from the aquaculture sites. The zones only have residential areas at much greater distances than 500 m and these are described and taken into account when the boundaries and possible growth expansion of the zones were considered for the proposed POAY. The study provides indicative locations of the land-based facilities on maps.

EIA analysis: The EIA study does not estimate the additional land-based facilities that will be required or provide the area required for the location of the facilities. The EIA does not attempt to quantify the amount and type of land use change. The maps providing indicative locations of the land-based facilities were not included in the report provided for this assessment.

The support facilities will include coastal installations such as jetties and net washing facilities including net washing effluents (organic and solid waste). Without quantification of such facilities, the impact cannot be assessed. The net washing process creates high nutrient effluent that needs treatment before being released back into the sea. Net washer effluent is small in volume but has high nutrient loading and inorganic particle loading (mussel shells). This requires a high level of treatment as well as sludge and solid waste disposal.

7.3 Impacts Related to Infrastructure

The EIA report states: The EIA notes that there are no sewage or waste management facilities in the allocated aquaculture areas.

The purpose of the creation of POAY is the concentration of aquaculture activity in areas where organised units already exist, and this will minimise any negative effects of the POAY in the spatial organisation of the wider region.

EIA analysis: Under infrastructure, the study does not state where a freshwater supply will come from. In addition, it does not mention any electrical supply requirements.

Both floating and land units require the existence of road infrastructure for the distribution of products.

The EIA study does not estimate the increase in road traffic. The expansion of production will cause significantly higher levels of road traffic on the existing road infrastructure. Road traffic might include:

- Feed deliveries to the feed store
- Deliveries of fry from hatcheries to the onshore nursery unit
- Harvested fish delivered to the packing facilities and from the packing facilities to the main markets
- It is estimated that there will be a need for an additional 300 workers and these workers will have to travel to the farms and back home daily.

The study does not estimate the increase in marine traffic. There will also be a significant increase in marine vessel traffic, e.g.,

- Changes of nets (nets taken to shore to be washed, nets taken out)
- Feed supply to each cage
- Fish harvesting
- Cage servicing
- Diver inspection of each cage
- Cage security at night.

7.4 Social impact

7.4.1 Population

EIA review: The EIA study expects the proposed POAY to enhance the employment intensity of the aquaculture sector in the study area, reducing unemployment and activating local potential, providing significant growth and employment opportunities.

Aquaculture farms are usually located in arid and/or remote areas. It is well known that in Greece such areas face problems, mainly due to the absence of development structures to retain the new population.

EIA analysis: The EIA study does not estimate the increase in workers and skilled personnel required for the proposed increase in production and without analysis it is difficult to assess the effect on the unemployment rate. Given the low employment rate in the Municipalities and the requirement to bring in workers and skilled personnel to the area the study does not detail any effect on developmental structures such as housing, schools, and healthcare, and no proposals are made as to how these can be addressed.

7.4.2 Human health

EIA review: The assembly operations of the fish cages are not expected to cause any risk of harm to human health, provided that all necessary measures for the safety of personnel as required by applicable legislation are taken.

EIA analysis: No mention is made of the use of chemicals, vaccines and anaesthetics used on farms.

7.4.3 Economic impact

The EIA report states: The EIA study states that the aquaculture sector currently employs directly and indirectly about 10,000 workers (their estimates differ from those reported by HAF on page 46 of this report), mainly in the periphery of the country. Many of these jobs are located in remote areas and the development of aquaculture has a positive impact on the economies of local communities. This is reinforced by the potential for developing alternative forms of tourism (fishing tourism, fish tourism, diving tourism) in combination with productive activities, boosting the income of producers, and diversifying and enriching the tourist product of a region.

EIA analysis: No stakeholder engagement has been made to determine current employment levels and gauge the potential employment levels required with proposed levels of production.

7.4.4 Solid waste disposal

The EIA report states: In the Regional Unit of Corinth there are 2 Sanitary landfill sites (XYTA) for waste in Xylokastro and Kiato. In the rest of the Peloponnese Region, there are no other XYTA. The municipality of Epidavros disposes of its waste in a landfill (XADA) in Lygourio. Similarly, the municipality of Saronikos disposes of its waste in the region of Athikia (Kritiko) and the municipality of Solygeia in "Lacca Ugrita" Sofikos.

According to the Regional Solid Waste Management Plan of the Peloponnese Region all waste from the Province of Corinthia, the Province of Argolida and the Municipalities of Tripoli and North & South Kynouria of N. Arkadias will be taken to a sanitary landfill site.

Under the environmental conditions of the region, the Ministry of the Environment and Climate Change (PEKA) provides for the creation of a Waste Treatment Unit (WTU), a Sanitary Landfill and two Waste Transfer Stations in the Regional Units of Corinth and Argolida. This project is being implemented with co-financing from the business plan YMEPERAA and is contracted from the 1st /2021 and is expected to be completed on the 11th /2023.

EIA analysis: The EIA report does not estimate the scale, or type of solid waste that will be generated or give any details on how and where the solid waste will be disposed of. The report does not mention the main sources of solid waste which include:

- Feed bags
- Discarded nets
- Fish mortalities
- Net washer sludge and shells

Other waste streams (such as lubricating oils, accumulators, batteries, waste electrical and electronic equipment including light bulbs, tyres, end-of-life vehicles) are not mentioned and should be collected and delivered to licensed collectors or approved alternative management systems.

7.4.5 Housing

The EIA report states: The EIA study does not mention the additional housing needs for the workers.

EIA analysis: There will be a need for additional housing for technicians and managers who will be brought in from outside the region. An increase of additional workers will put pressure on availability (and rental price) for year-round accommodation. This needs to be quantified.

7.5 Stakeholder consultation

The EIA report states: The study reports that one of the purposes of the company "POAY Corinthias SA" established and registered in 2016 is the preparation of studies related to the purposes of the company and the promotion of the conclusions to interested parties.

EIA analysis: No details of any stakeholder consultation are given in the report, and this should be a central element in the planning and operation of the POAY. If this is the case, then there is a serious omission in an EIA study. There is no mention of social responsibility measures for the local community.

8. Conclusions

8.1 Environmental

The EIA report for the proposed POAY in Corinth outlines the expansion plans across eleven zones, emphasising environmental considerations and the use of floating cage systems.

- **Project description.** The EIA effectively describes the project's location and the proposed zones for fish farming. It outlines the significant increase in production capacity, both in terms of total annual capacity and leased area.
- **Production intensity.** The intensity of production per leased area and whole area is significantly increased. It is therefore important to predict the potential environmental implications of such significant expansion, particularly in Zones A, B, and F, where intensity exceeds the highest present levels. Further analysis of the environmental impact, especially in these zones, should be undertaken to assess potential consequences adequately. This is a major weakness.
- **Shore base support facilities.** The report acknowledges the need for significant shore base support facilities but lacks specific details regarding their size, location, and required services. To better understand the potential impact on local infrastructure, road use, electricity and water demand, and waste disposal, more comprehensive information about these facilities is necessary. This is a major weakness.
- **Evaluation of alternative options.** While the report mentions the evaluation of alternative options for determining zones, it lacks specific details on these alternatives or the reasons for their rejection. Providing a transparent summary of these alternatives and the key factors leading to their rejection would enhance stakeholder understanding and the overall assessment process. This is a minor weakness.
- **Use of additional space.** The report mentions the importance of additional space within the zones for future adjustments and smooth operation of floating units but does not provide specific plans for how this extra space will be managed and utilised effectively. This is a minor weakness.
- **Local and cumulative impact.** The report acknowledges the potential for local impact and cumulative impact from multiple fish cage farms in the same water body but does not quantify the additional nutrient output from the expansion or the cumulative impact on the environment. Further studies and modelling, such as depositional modelling of nutrients and nutrient mass balance box models, should be conducted to assess these impacts comprehensively. This is a major weakness.
- **Pollution prevention and mitigation:** The report mentions the need to prevent and minimise environmental impacts, but it lacks specific measures and technologies to achieve these goals effectively. Quantification and additional plans should be undertaken for wastewater treatment, waste management should be included in the report to address pollution challenges adequately. This is a major weakness.
- **Environmental monitoring.** While the report emphasises the importance of environmental monitoring, it lacks specifics on the frequency, scope, and methodology of monitoring activities. A well-defined monitoring program with clear parameters and sampling methods is necessary to assess the environmental impact of aquaculture operations accurately. This is a minor weakness.
- **Long-term sustainability.** The methodology focuses on minimising immediate environmental impacts but does not emphasise the long-term sustainability of aquaculture practices. Ensuring sustainability over time, considering factors such as resource use efficiency, disease

management, and adaptation to changing conditions, should be a priority. This is a minor weakness.

8.2 Social

The report outlines several socio-economic benefits and drawbacks associated with the initiative. While there are potential advantages, several weaknesses and concerns can be identified in the analysis.

At the country level, the report states that the development is expected to create jobs and an indicative figure of 7 employed people for a 300 ton/year capacity unit is given but not extrapolated to the proposed POAY. It also contributes to Greece's export earnings, fostering economic diversification, and reducing reliance on a single industry. Additionally, it enhances food security by increasing fish production and supplementing wild fisheries.

There are concerns with conflicts with traditional fisheries, resulting from competition for resources, social tensions, resource competition, lack of transparency and participation, and uneven benefits sharing. Additionally, visual impacts on the seascape, disruption to coastal tourism and yachting, increased local marine and road traffic, freshwater resource stress, and housing demand for workers are issues at the local level.

The EIA analysis: reveals significant gaps in the assessment of infrastructure impacts. It fails to quantify the freshwater and electrical supply requirements or the increase in road and marine traffic that the project may entail. The lack of details regarding solid waste disposal and the potential impact on existing infrastructure raises concerns. Additionally, the report does not adequately address housing needs for incoming workers.

The EIA report mentions the establishment of a company for the promotion of study-related purposes and conclusions to interested parties. However, the report lacks details on stakeholder consultation, which is crucial for addressing community concerns and ensuring transparency and public participation.

The report is insufficient in assessing the use of chemicals, vaccines, and anaesthetics in aquaculture, which can have implications for human health and safety.

References

- Greece - National Aquaculture Legislation Overview. <https://www.fao.org/fishery/en/legalframework/gr/en?lang=en>
- Διαφάνεια 1 - Gov.il (Presentation on Greek Aquaculture Legislation). https://www.gov.il/en/departments/units/fishery_and_aquaculture
- Environmental impact of aquaculture in Greece. Practical experiences. <https://link.springer.com/article/10.1007/s41742-020-00289-8>