MACALISTER ELLIOTT & PARTNERS LTD

Comparative Assessment of two EIA Studies undertaken for Poros Island (POAY)

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Abbreviations and Acronyms

AMBIO	AMBIO S.A. Development Consultants
EIA	Environmental Impact Assessment
MEP	MacAlister Elliott and Partners Ltd.
MERAMOD	Predictive model for aquaculture (see https://cordis.europa.eu/article/id/81735-meramod-a-predictive-model-for-aquaculture)
POAY	Area of Organized Development of Aquaculture
SEIA	Strategic Environmental Impact Assessment

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.

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.

Executive Summary

A Strategic Environmental Impact Study (EIA) for aquaculture development within the administrative boundaries of the island of Poros was undertaken by Greek consultants AMBIO in 2015. This report was analysed by Macalister Elliott and Partners Ltd. (MEP) in 2024 and found a number of issues and concerns with the report. Specifically, over a dozen weaknesses and omissions were found, of which seven were major weakness and one was a critical weakness.

In 2021, AMBIO presented a new EIA to the Ministry for the approval of an Area of Organized Development of Aquaculture (POAY) on Poros. Using the software, Microsoft word review/compare function, MEP compared the 2015 document to the 2021 document. We have provided a document showing the mark-up between the two documents (the document 'comparison EN.doc' and the original in Greek is provided as well 'Comparison GR.pdf').

The comparison of the two Greek versions of the Poros POAY documents indicates that the texts are largely identical, with limited but notable modifications reflecting legislative updates, spatial adjustments, and minor technical refinements.

In summary, we found no substantial differences in the documents; specifically:

- The new report has the addition of Section 3.4.1, which integrates the provisions of the new Greek spatial planning framework established under Laws 4447/2016 and 4759/2020.
- The proposed change in production area is minimal: 2,689.83 to 2,702.15 stremmata, less than 0.5%.
- A new exclusion zone was added in Zone P2 (Bisti) due to identified underwater antiquities. The Bisti zone itself was reclassified from Zone P1 to P2.
- Two new aquaculture sites were added in Zone P1.
- There have been no changes to HCMR data collection or MERAMOD analyses or outputs despite the number of weaknesses from the 2015 report. No new analyses were conducted; no new models were run; no new input data was collected.
- The 2015 EIA demonstrates that Bisti is badly impacted but the EIA does not follow-up or make recommendations regarding this site.
- The changes to the monitoring requirement need to be checked in order to ensure that the proposed methodology and parameter thresholds comply with Directive 2000/60/.
- For calculation of the Shannon-Weiner biodiversity index, AMBIO uses the logarithm to the base of 2 for the formula. However, in the table of AMBIO thresholds are shown for the formula that uses the Natural Logarithm. The difference between the two means that the thresholds to the Logarithm to the base of 2 are 1.44 times higher than those of the natural logarithm. This now means that most of the AMBIO Shannon-Weiner calculations fall within the Low or Bad diversity thresholds rather than the Medium to Bad thresholds. This is a critical weakness.

Each of these items is discussed in detail in the Analysis section below.

The issues identified in the analysis of the 2015 AMBIO report were not addressed in the updated report and are listed below;

- **Describing present farm activities and facilities**: The study fails to detail the number and size of cages, fish production at sea, and the land-based facilities, vessels, and trucks involved. It also does not summarise regular environmental monitoring surveys, which are crucial for indicating the present level of impact and validating the MERMOD model predictions. This is a weakness.
- **Quantifying planned new facilities and outputs**: There is a lack of detailed quantification of planned new facilities, both land and sea-based, as well as the use of inputs (feed and fingerlings) and outputs (nutrients released to the water column). Such details are necessary to understand the potential changes that might occur with the expansion of production and the project area. This is a weakness.
- **Proposing environmental and social mitigation measures**: The study does not adequately propose environmental and social mitigation measures to reduce impacts. Identifying and recommending mitigation measures should be a core part of the study to minimize potential conflicts. This is an omission and a major weakness.
- **Resource use quantification and solutions**: There is insufficient quantification of the use of resources (road traffic, marine traffic, additional electricity supply, additional freshwater supply) and how these will be addressed given the level of infrastructure and services available on the island. This is a weakness.
- **Quantification and impact of project outputs**: The study lacks detail on the quantification, solutions, and impacts of project outputs such as wastewater treatment, solid waste disposal, and organic waste disposal. The increase in production will generate significant wastewater treatment requirements and other waste disposal needs, which must be quantified to predict scale and potential solutions. This is a weakness.
- **Misinterpretation of MERMOD model predictions**: The study misinterprets the MERMOD impact model predictions, particularly for the selected alternative 4, underestimating the environmental impacts. This misinterpretation minimises the perceived environmental impact of the expanded production on sediment quality under the cages. This is a major weakness.
- **Existing environmental impacts at Bisti Site**: The MERMOD model predicts significant environmental impacts already present at the Bisti site (Site 4), which the study does not adequately address. This is a major weakness.
- **Fragmented regulatory alignment.** Policies and regulations across international, European, national, and regional levels lack alignment, resulting in fragmented planning and management. Disjointed frameworks significantly hinder cohesive strategy implementation and effective governance. The lack of a unified enforcement body and limited resources for monitoring compliance weaken the entire framework. Environmental impact assessments may become bureaucratic exercises without proper follow-through. This is a major weakness.
- **Lack of stakeholder consultation**: The study shows no evidence of stakeholder consultation or efforts to find mutually agreed mitigation measures to reduce social impacts. This is a major weakness.

Points related to social assessment and impact

- **Social impact.** While the study considers demographics, employment, unemployment, human health, material assets, cultural and archaeological heritage and landscape, the study does not provide quantification of permanent jobs that would be created by the proposed aquaculture facilities or make recommendations on monitoring proposals made for social mitigation measures to reduce impact. This is a major weakness.
- **Ineffective stakeholder engagement.** While the policy emphasizes stakeholder engagement the SEIA report showed no evidence of stakeholder consultation and effort to find mutually agreed mitigation measures to reduce social impacts. This is a critical weakness.
- **Infrastructure challenges**. While the infrastructure of the greater region is discussed there is no information presented on the quantification of the waste likely to be produced by the aquaculture facilities in Poros. The quantity of drinking water available on the Poros has not been determined and it is noted that the presence of tourism in summer may aggravate the availability of drinking water. No information is presented on the requirements for freshwater in the aquaculture facilities and whether supplies can meet demand. This is a major weakness.
- **Interaction with tourism.** Marine tourism (yachts, pleasure vessels) could be impacted by the floating cage collars as well as small fisheries activity during the farm operation. This is a minor weakness.

Analysis

Comparison of the two Poros versions

The 2 Greek versions of the AMBIO EIA reports were compared and the differences identified with markup (see attachment; document ‘comparison EN.doc’).

The versions are almost identical except for:

1. **Section 3.4.1 which was inserted.**

The new Greek spatial planning Laws (4447/2016 and 4759/2020) were introduced in 2016 and 2020. This law organises planning at national, regional, and local levels. Strategic planning includes national and regional frameworks, while regulatory planning covers local and urban plans. The 2020 law was passed to simplify and speed up the process and clarified how the different levels interact.

The National Spatial Strategy sets broad, non-binding goals for land and sea use. Special Spatial Frameworks guide national priorities such as settlement structure, infrastructure, productive sectors, and protection of cultural and natural areas.

Regional Spatial Frameworks apply these directions locally, organizing development, transport, and environmental protection within each region. They must follow and expand on the national frameworks and can only modify them when allowed.

The new Laws 4447/2016 and 4759/2020 replaced an older, more fragmented planning system established mainly under Laws 2508/1997 and 2742/1999. The new laws attempt to streamline the process, unify spatial planning levels, integrate land and marine areas, and align Greece's system with EU sustainability and spatial governance standards.

The English translation of the inserted section is as follows;

At the regional level, the directions of the Regional Framework for Spatial Planning and Sustainable Development of the Region of Central Greece are given.

Spatial Planning - Sustainable Development

Law 4447/2016 "Spatial Planning - Sustainable Development and other provisions" structures the spatial planning system at national, regional and local level and distinguishes, depending on its character, into strategic or regulatory:

a. *The category of strategic spatial planning includes the Special Spatial Planning Frameworks and the Regional Spatial Planning Frameworks.*
b. *The category of regulatory spatial planning includes urban plans which are prepared on a local scale and which are divided into two design levels. The first level of regulatory spatial planning includes:*
    - *The Local Spatial Plans, which regulate the sustainable spatial development and organization of the territorial region of a Local Authority.*
    - *The Special Spatial Plans, which are the recipients of plans, projects and programmes regardless of administrative boundaries.*

The second level of regulatory spatial planning includes the Urban Implementation Plans, which are the specialization and implementation of the plans of the first level.

The purpose of Law 4759/2020 "Modernization of Spatial and Urban Planning Legislation and other provisions", which amends Law 4447/2016, is to simplify and accelerate the process of drafting, reviewing and modifying spatial planning frameworks and urban plans at each level, as well as to clarify the relations between them.

Based on Law 4447/2016, as amended by Law 4759/2020, the Council of Ministers approves the National Spatial Strategy referring to land and sea space, which is a text of basic policy principles for the development and planning of space, as well as for the coordination of various policies with spatial consequences. The National Spatial Strategy includes indicative directions of spatial organisation, the main axes, as well as the medium and long-term spatial development objectives at the level of the General Government and its individual bodies and is not binding. It also incorporates the national maritime spatial strategy and proposes the subdivisions of the maritime space.

According to Article 5 of Law 4447/2016 (Government Gazette, Series I, No. 241), as replaced by Article 7 of Law 4759/2020, the Special Spatial Planning Frameworks are sets of texts and diagrams, which determine directions at national level and, where necessary, regulations, in particular, for:

a. *the spatial structure and structure of the residential network of the Country,*
b. *the spatial structure of sectors or sectors of productive activities and in general sectors of development of national importance,*
c. *the spatial structure of networks and services of technical and administrative infrastructure, d) the formation of a land policy,*
d. *the protection of the cultural and natural landscape,*
e. *the spatial development and organization of areas of the national space that are of particular importance from a spatial, environmental, developmental or social point of view, such as coastal, island, mountainous and problematic areas,*
f. *the promotion of plans, programmes or projects of spatial development of major importance or of transnational or interregional scope.*

According to Article 6 of Law 4447/2016 (Government Gazette, Series I, No. 241), as amended and shaped by Article 8 of Law 4759/2020, Regional Spatial Planning Frameworks are sets of texts, maps or diagrams, which provide directions for spatial development and organization at regional level and, where necessary, regulations, in particular, for:

a) *the assessment, promotion and utilization of the special developmental and generally spatial characteristics of each Region for its equal integration into the national, EU and international space,*
b) *the spatial structure of the main productive sectors and sectors,*
c) *the spatial structure of the regional transport networks and other technical infrastructure of regional interest,*
d) *the structure of the peripheral space (spatial organization model), as well as the spatial organization and structure of the residential network,*
e) *the residential development and reconstruction of the urban space,*
f) *the promotion, promotion and protection of the natural and cultural heritage, as well as the residential and architectural environment of each Region,*
g) *the identification of active interventions and programmes of a spatial and urban nature, such as in particular the Special Spatial Intervention Areas (PESP) and the Integrated Urban Intervention Plans (IDPs) of articles 11 and 12 of Law 2742/1999 (A' 207),*
h) *the protection of the cultural and natural environment and the landscape.*

The Regional Spatial Planning Frameworks are bound by the regulations and are harmonized with the directions of the Special Spatial Planning Frameworks, which they coordinate, specify and supplement at the level of the Region, as well as amend, only if this possibility is expressly provided by the Special Spatial Planning Framework.

2. The production area has expanded slightly from 2,689.83 to 2,702.15 stremmata.

3. There are changes in name from Καλάμι to Ormos Varniania and from Όρμος Βαρνιανιά to Pyrkalo.

4. There is one exclusion zone added due to the existence of underwater antiquities in the P2 (Bisti Zone)

EXCLUSION ZONE			
Exclusion zone due to underwater antiquities	P.2.9	454244,367	4156403,467
	P.2.10	454125,903	4156290,846
	P.2.11	454146,272	4156195,702
	P.2.12	454133,043	4156064,998
	P.2.13	454019,127	4156017,307
	P.2.24.b	454297,733	4155735,047
	P.2.25	454657,542	4156090,198

Source: 2021, AMBIO EIA

5. Bisti zone has been moved from P1 to Zone P2

6. Some of the map sources have been updated e.g. AMBIO S.A.2015 to AMBIO to 2021.

7. 2 new sites are included in Zone P1 rather than P2

		Scenario 3		Scenario 4	
		Stremma	Production tonnes	Stremma	Production tonnes
5	ESTABLISHMENT OF A NEW	20	862,50	40	1.462,50
6	ESTABLISHMENT OF A NEW			40	1.096,88

Source: 2021, AMBIO EIA

8. Change in farm area size Section 4.1.1

   Site Plaka P.1.5 has changed between 1,462.5 tonnes and 787.5 tonnes.

9. Table 6.37 has changed, specifically: Distribution of the employed population ELSTAT, Population Census, 2011.

10. The interpretation of the Shannon-Weiner equation in Section 713.

    The AMBIO EIAs use the following formulae:

Συγκεκριμένα ο δείκτης Shannon – Weiner υπολογίζεται από τον τύπο:

$$H = \sum_{i=1}^{S} p_i \log_2 p_i$$

Όπου: S ο αριθμός των ειδών

pi η πιθανότητα ένα άτομο επιλεγμένο τυχαία να ανήκει στο είδος i και υπολογίζεται από τον τύπο:

$$p_i = \frac{n_i}{N} = \frac{\text{αριθμός ατόμων είδους } i}{\text{συνολικός αριθμός ατόμων}}$$

Source: 2021, AMBIO EIA

Note that AMBIO uses the logarithm to the base of 2 for the formula.

However, in the table of AMBIO thresholds are shown for the formula that uses the Natural Logarithm

Πίνακας 7.8 Εύρος τιμών δείκτη Shannon – Weiner που αντιστοιχούν στα διαφορετικά καθεστώτα οικολογικής ποιότητας, όπως ορίζεται από την Οδηγία – Πλαίσιο περί υδάτων (Οδηγία 2000/60/ΕΚ).

Καθεστώς ποιότητας	**Δείκτης Shannon (*H'*)**
Υψηλό	$H' > 4$
Καλό	$3 < H' \leq 4$
Μέτριο	$2 < H' \leq 3$
Χαμηλό	$1 < H' \leq 2$
Κακό	$H' \leq 1$

Πηγή: Πανεπιστήμιο Κρήτης, 2007.

Source: 2015 and 2021 AMBIO EIA

Changing the log base rescales H but does not change rankings or evenness patterns.

However, the difference between the 2 Conversions is $H_2 = H_{\ln}/\ln\ 2 \approx 1.4427\ H_{\ln}$

Which means that the thresholds to the Logarithm to the base of 2 are 1.44 times higher than those of the natural logarithm.

Category	Base e (ln)	Base 2 (log_2)	Interpretation
High	> 4.0 nats	> 5.77 bits	Very diverse, highly stable community
Good	3 – 4	4.33 – 5.77	Well-balanced community
Medium	2 – 3	2.89 – 4.33	Moderate diversity
Low	1 – 2	1.44 – 2.89	Dominated by few species
Bad	< 1	< 1.44	Very low diversity, stressed community

Source: 2015 and 2021, AMBIO EIA

This now means that most of the AMBIO Shannon-Weiner calculations fall within the Low or Bad diversity thresholds rather than the Medium to Bad thresholds. This is a critical weakness.

11. Some changes to sections 7.4.1 on the monitoring system and frequency.

The proposed Environmental Management System of POAY includes the implementation indicators of the plan of the Table below:

PLAN IMPLEMENTATION INDICATORS	LEVEL
Quantity of cultivated species (per species t/y)	Sea zone
Number, area, capacity of aquaculture units, per year	Sea zone
Number, area, capacity of organic aquaculture units, per year	Sea zone
Number of environmental compliance inspections and violations found in compliance with environmental controls	Sea zone
Water column parameters monitored on a regular basis by the Management Body of the P.O.A.Y.	Sea zone
Sedimentological parameters monitored annually by the Management Body of the P.O.A.Y.	Sea zone

Number of certified environmental and ecological management systems	Sea zone
Number of certified good aquaculture practices and catch management systems	Sea zone

Source: 2021, AMBIO EIA

The environmental monitoring programme has been designed in such a way as to meet the requirements of the current legislation.

The monitoring includes the most widely used methods for detecting the impacts from aquaculture units, such as the measurement of physicochemical parameters in the water column and sediment, the analysis of benthic fauna and the determination of indicators for the assessment of ecological quality and needs to be checked that it is compatible with Directive 2000/60/EC and the provisions of the Water Resources Management Plan of the Water Body Attica District, as well as the Water Resources Management Plan of the Eastern Peloponnese Water District. In order to control the quality of farmed seawater and to prevent situations that may be dangerous for the operation of POAY, the biotic and abiotic parameters of the water will be monitored in accordance with the provisions of Table 3 of the Circular No. ΥΠΕΝ/DIPA/121634/7242/2019 for the determination of environmental monitoring parameters in marine aquaculture units. This table needs to be checked that the methodology and parameter thresholds comply with Directive 2000/60/EC.

The collection of samples must take place at the time when maximum effects are expected from the farm, *i.e.* at the end of a production cycle. However, it is recommended, depending on the nature of the parameter being measured, to repeat it over time in order to determine any temporal variation of the effects. The parameters selected, as well as the sampling frequency per parameter, are presented in the table below.

Table 1. Measurements carried out during the operation of a POAY and/or an individual marine fish farming unit.

Sediment (granulometric composition, total organic carbon, total nitrogen, total phosphorus, Cu, Zn): At the bottom and at a distance of 50m from the boundaries of the leased area, at the shallowest point downstream of the direction of the main stream, the measurement time interval. In the case of more than one park per unit, the measurement refers to the park that has the capacity.
Dissolved Oxygen: At three levels (surface, middle, bottom) of the water column and at a distance of 50m from the boundaries of the leased space, at the shallowest point downstream of the direction of the main stream, the measurement interval. In case of more than one park per unit, the measurement refers to the park which has the greatest capacity.
Turbidity (with secchi disk): At three levels (surface, middle, bottom) of the water column and at a distance of 50m from the boundaries of the leased space, at the shallowest point downstream of the direction of the main stream, the measurement interval. In case of more than one park per unit, the measurement refers to the park which has the greatest capacity. Monthly at the same measurement point.
The measurements are carried out by a body or laboratory certified for this purpose or the scientific director of the unit. Water column (nitrates, nitrites, ammonia, total nitrogen, total phosphorus, total carbon) In three levels (surface, middle, bottom) of the water column and at a distance of 50m from the boundaries of the leased space, at the shallowest point downstream of the direction of the main stream during the measurement period.
In case of more than one park per unit, the measurement refers to the park which has the greatest capacity. Once a year at the same measurement point, in the period from June to September. The measurements are carried out, in accordance with the national coastal water assessment methodology of Directive 2000/60/EC, by a body or laboratory certified for this purpose.

* For POAYs, the measurement points are those selected for the measurements during the process of their establishment.

12. A section in 8.2 has been removed.

ONSHORE FACILITIES The location of activities in the terrestrial area, within the framework of the proposed POAY, concerns exclusively the necessary facilities (accompanying and supportive) for the smooth operation of aquaculture species breeding units in accordance with the Aquaculture Conservation Act (Government Gazette 2505/B/4-11-2011), namely: Accompanying facilities: Facilities referred to in par. 2a1 of article 4. The location of these units is carried out in accordance with the provisions of article 4, par. 2a1 of the EPXSAA for Aquaculture.

~~Supporting onshore facilities: this category includes facilities serving aquaculture units which, however, are not an integral part of the base installation and are located at a distance from it. These are: a) fry production stations (hatcheries of fish and other freshwater and marine species) b) fish hatcheries c) fish pre-fattening units (d) facilities for the packaging, preservation and production of unprocessed fishery products Categories a, b and c are located outside the seashore or bank and preferably near them, in order to facilitate the pumping of water to serve the needs of the facilities. The other facilities are located in accordance with the provisions of article 7, par. III (Government Gazette 2505/B/4-11-2011).~~

13. Changes in Section 8.4.3. Some text has been removed.

Relocation of the unit to a resting position. Suspension of capacity increase, if the proposed capacity of this plan has not been achieved by then. ~~Reduction of production capacity to the level defined by Circular 121570/1866/12-6-2009 of the Ministry of Environment and Rural Development and the Ministry of Rural Development and Rural Development (YPAAT), without taking into account the surcharge coefficients, if it is not possible to relocate to the levels before the unit in a standstill position of capacity increase. Suspension of operation of the unit, if it is not possible to relocate the unit to a resting position. Relocation of the unit to a resting position.~~

Conclusion

The proposed change in production area is minimal: 2,689.83 to 2,702.15 stremmata, less than 0.5%.

- There have been no changes to HCMR data collection or MERAMOD analyses or outputs despite the number of weaknesses from the 2015 report. No new analyses were conducted; no new models were run; no new input data was collected.
- The 2015 EIA demonstrates that Bisti is badly impacted but the EIA does not follow-up or make recommendations regarding this site.
- The changes to the monitoring requirement need needs to be checked that the proposed methodology and parameter thresholds comply with Directive 2000/60/EC.
- For calculation of the Shannon-Weiner biodiversity index, AMBIO uses the logarithm to the base of 2 for the formula. However, in the table of AMBIO thresholds are shown for the formula that uses the Natural Logarithm. The difference between the two means that the thresholds to the Logarithm to the base of 2 are 1.44 times higher than those of the natural logarithm. This now means that most of the AMBIO Shannon-Weiner calculations fall within the Low or Bad diversity thresholds rather than the Medium to Bad thresholds. This is a critical weakness.