integrate

Layman's Report 2020

Integrate Aquaculture: an eco-innovative solution to foster sustainability in the Atlantic Area

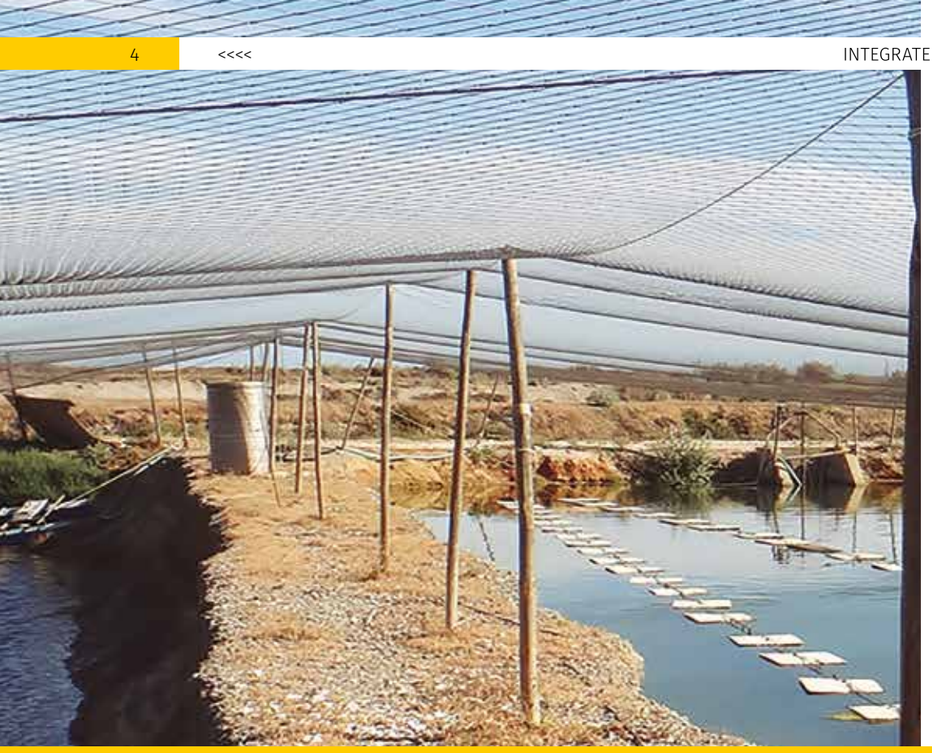
INTERREG Atlantic Area 2014-2020
Project EAPA_232/2016

Interreg Atlantic Area
European Regional Development Fund

EUROPEAN UNION

www.integrate-imta.eu

CONTENTS



Project facts

Project name:
INTEGRATE

Duration:
36 months. June 2017 - May 2020

Programme:
INTERREG ATLANTIC AREA

Total project budget:
2,012,372.08€, with an amount of ERDF co-funding of 1,509,279.06€.

1
Lead partner: Fundación Centro Tecnológico Acuicultura de Andalucía (CTAQUA, Spain)

8
Partners from Spain, Portugal, France, Ireland and United Kingdom

11
Associated partners

1 Introduction and project background

Integrated Multi-Trophic Aquaculture (IMTA) systems are a circular economy paradigm that contribute towards making aquaculture more sustainable and competitive, by finding sustainable ways to address an imbalance of resources. However, despite being encouraged by European Union (EU) policies such as the Blue Growth Strategy, the Atlantic Action Plan and RIS3, there are socio-economic, administrative and regulatory bottlenecks hampering the uptake of IMTA on an industrial scale.

To overcome these, eight organisations have partnered up to implement the INTEGRATE project (Integrate Aquaculture: an eco-innovative solution to foster sustainability in the Atlantic Area): The project started in June 2017 and was finalised in May 2020.

The project was conceived by a group of researchers and production experts from European Atlantic centres of excellence with proven experience in IMTA development from Spain, Portugal, France, Ireland and the UK. In addition, the partnership has counted with 11 associated partners from the five project partner countries.

INTEGRATE has been funded by the European Regional Development Fund (ERDF) through the INTERREG Atlantic Area 2014-2020 Programme (project grant number EAPA_232/2016).

The total project budget was 2,012,372.08€, with an amount of ERDF co-funding of 1,509,279.06€.

PARTNERS

- Fundación Centro Tecnológico Acuicultura de Andalucía - CTAQUA (Spain)
- Irish Seaweed Consultancy (Ireland)
- Institut National Supérieur des Sciences Agronomiques, Agroalimentaires, Horticoles et du Paysage (France)
- Scottish Association for Marine Science (United Kingdom)
- Instituto Portugês do Mar e Atmosfera, I.P. (Portugal)
- National University of Ireland Galway (Ireland)
- ALGAplus Produção e Comercialização de algas e seus derivados Lda. (Portugal)
- Centre d'Etude et de Valorisation des Algues (France)

1.1

About the Interreg Atlantic Area Programme

Interreg Atlantic Area
European Regional Development Fund
EUROPEAN UNION

The Interreg Atlantic Area is a European funding programme that promotes transnational cooperation among 36 Atlantic regions in five European countries. Via the European Regional Development Fund, the programme cofinances cooperation projects in the fields of Innovation & Competitiveness, Resource Efficiency, Territorial Risk Management, Biodiversity and Natural & Cultural Assets.

1.2

Rationale (the why)

Aquaculture in the European Atlantic Area (AA) is a leading maritime activity that shares common challenges in each country, such as effective environmental management, north-south divide, regulatory barriers, long licensing processes, lack of knowledge and social acceptability (social license) and space conflict with other maritime users. Therefore, through strong transnational cooperation, these challenges can be overcome, increasing competiveness and more sustainable development of aquaculture. Therefore, the INTEGRATE project was conceived based on the assumption that there is a need for environmentally sustainable approaches to diversification of the aquaculture sector as a growing industry in the bioeconomy; there is a need to overcome remaining hurdles, for example IMTA in the Atlantic Area is limited by socio-economic, administrative and regulatory challenges, although encouraged by major policies: EU Blue Growth Strategy, Atlantic Action Plan,

Aquaculture in the European Atlantic Area (AA) is a leading maritime activity

Regional Innovation Strategies; and the need for an industry relevant definition of IMTA in the European Atlantic Area.

As such, the project is focused on Priority Axis 2 and specific objective 2.2 of the Interreg Atlantic Area Programme and is built on specific opportunities of the regions involved through smart specialization strategies (RIS3): blue growth and green growth. It is also aligned with the reform of the Common Fisheries Policy and the Atlantic Action Plan in which improvement of green growth, productivity, competitiveness and environmental sustainability play a major role.

1.3

Aims and Objectives

By embracing and communicating the principles and benefits of eco-innovation and eco-efficiency on which the concept of IMTA is based, the INTEGRATE project aimed to strengthen transnational and collaborative networking among research, business-industry groups and civil society surrounding eco-efficient aquaculture techniques through a territorially based cooperation approach. Furthermore, the project facilitated the achievement of strategic regional goals as the industry transitions towards resource-efficient technologies (aquaculture is a sector highlighted in EU Blue Growth Strategy). This approach also supports the development of market consolidation in the EU sustainable seafood (Farmed in the EU), the promotion of green and blue growth among traditional businesses (Roadmap to a Resource Efficient Europe, Water Framework Directive) and awareness raising of IMTA's holistic approach. The **specific objectives** set at the start of the project were the following:

1
To strengthen collaborative networking around eco-efficient aquaculture techniques

2
To communicate the principles and benefits of IMTA (eco-innovation and eco-efficiency) and raise awareness of IMTA's holistic approach

3
To achieve market consolidation of EU sustainable seafood

4
To fulfil Atlantic Area & EU regional goals as the industry transitions to resource-efficient technologies: promotion of green and blue growth in aquaculture

The INTEGRATE project aimed to strengthen transnational and collaborative networking among research, business-industry groups and civil society







2 Defining a framework for IMTA development:

ACTION PLANS FOR THE ATLANTIC AREA. By studying the IMTA sector throughout the Atlantic Area we have been able to obtain an overview and propose recommendations to create a favourable context for the development of IMTA. SWOT matrix analyses were conducted at a national level for each of the following topics: Technical, Social, Environmental, Economic and Regulatory.

/// STRENGTHS

- Good mastery of the different aquaculture species in monoculture and numerous tests to integrate them into IMTA systems
- Improvement of the total productivity of the system under certain conditions, for several IMTA systems
- General positive perception of IMTA
- Proven environmental benefits (pond systems) - nutrient emissions
- Opportunity to diversify with increased resilience
- Access to new markets (depends on the scale of the production, maybe only local consumption for small producers)
- Strong regulatory sector and no regulations prohibiting the cultivation of multiple species in the same area.

/// WEAKNESSES

- High environmental constraints in open-sea or loch-like systems
- Concerns about salmon diseases hosted by bivalves
- Current IMTA models do not suit national aquaculture specificities. There is a need for designing new IMTA systems. Thought and discussion must be pursued on how to convert current aquaculture systems into IMTA systems
- Limited public knowledge about IMTA and aquaculture in general
- Difficulty to communicate about such a varied concept, and often ‘academic’ = "multi-trophic". There is no single IMTA model
- Variability of environmental benefits (open-sea systems) - difficulties to monitor these effects
- Investment - issues to convert existing systems to IMTA systems, need to find solutions to overcome these constraints
- Complexity of licensing which puts off current license holders from applying for diversification or for new concessions. Need to speed up licensing time, as in Ireland where the Blue licensing programme has been implemented to solve these issues
- Lack of visibility about IMTA impacts for the regulators. Difficulties in processing the files since there is no robust model

/// OPPORTUNITIES

- Increasing interest in IMTA and technical improvements
- Development of new markets (sea cucumbers, seaweeds) will help IMTA
- Support from the administration and research organisations for the promotion of sustainable aquaculture
- Job creation, upskilling, diversification, importance of aquaculture in sustainable territorial development
- Modelling improvements would lead to better monitoring and new proofs of IMTA benefits.
- Polluter-pays principle or valuation of ecosystem services
- Higher market value with or without Eco certification, marketing strategy to be developed

/// THREATS

- Poor understanding of species interactions - possibility of disease spread raising concerns
- Concerns about global warming consequences which are already perceivable
- Increased development of aquaculture could be perceived as a negative event, unless an effective public consultation and participatory process is implemented
- Threats of using IMTA for greenwashing by certain companies due to the lack of definitions
- Current commercial difficulties in the aquaculture industry (collapse of salmon industry in Scotland, commercial difficulties in Spain, lack of interest in Portugal)
- Risk of disappointment for the public and regulators if IMTA is just a brand without real environmental benefits (greenwashing)
- Higher market value with or without Eco certification, marketing strategy to be developed

Many of these recommendations are not specific to IMTA, but are general to all aquaculture production activities. This result underscores the fact that the potential environmental interest attributed to these practices does not always facilitate the development of these systems and the creation of projects. Other technical, social and economic obstacles need to be removed to establish a context that favours the development of aquaculture and, therefore, of IMTA.

3

The need for a definition of IMTA

3.1 The Integrate approach

Two major challenges faced by aquaculture in the Atlantic Area are to provide a sustainable seafood supply that reduces EU dependency on wild stocks, catering to the market demand at local and transnational level; and to become a competitive supplier within the EU seafood market.

In order to achieve market consolidation of EU sustainable seafood, the INTEGRATE approach included a series of expert roundtables focused on one specific aspect of IMTA implementation each, including technical, economic, environmental, social and regulatory, in order to discuss the main challenges from each of these points of view.

Gathering key players from the respective sectors, including industry, academia, environmental organisations, and public administration, we were able to identify the advantages and disadvantages of IMTA implementation in each of these categories in each country, as well as the necessary steps to be taken in order to support industrial transition towards IMTA implementation.

The INTEGRATE approach to defining IMTA

ROUNDTABLES 20

- 5 economic roundtables
- 5 technical roundtables
- 5 social and regulatory roundtables
- 5 environmental roundtables

Each COUNTRY hosted 4 roundtables:

- France
- Ireland
- Portugal
- Spain
- United Kingdom

PARTICIPANTS 350

At the 20 workshops more than 350 participants were involved, representing academia, industry and state institutions

QUESTIONNAIRE 52

 # NUMBER OF CONTRIBUTORS 52

OBJECTIVE

Developed to understand areas of consensus, and lack thereof, with regards to understanding 'what is IMTA'.

TARGET AUDIENCE

Experts with direct knowledge or experience of IMTA, both academics and producers.

- International representation (FAO)
- Worldwide: Australia, Brazil, Canada, Chile, Israel, Mexico, South Africa, USA.
- Europe outside AA: Denmark, Italy, Netherlands, Norway
- Atlantic Area: France, Ireland, Portugal, Spain, UK

DEFINITION EVENT 40

Porto (Portugal) Event: MAY 9, 2019

To discuss the points identified from the questionnaire where there was lack of consensus about what constituted IMTA.

11 countries

- AA: France, Ireland, Portugal, Spain, UK
- Europe: Norway; Italy; Hungary; Belgium
- Worldwide: Israel, China

40 experts

- Academia (22)
- Industry (7)
- State/regulatory bodies (7)
- NGOs (3)

2 WORKING GROUPS:

- A land-based systems
- B sea-based systems

4 THEMED DISCUSSION SESSIONS:

- Fundamental terms of IMTA
- Environmental, social and economic benefits of IMTA
- Integration; scale, connectivity and ownership
- IMTA regulatory framework

DEFINITION OF IMTA:

Enhanced production of aquatic organisms (with or without terrestrial organisms) of two or more functional groups, that are trophically connected by demonstrated nutrient flows and whose biomass is fully or partially removed by harvesting to facilitate ecological balance.

Following the steps depicted in the infographic above, we reached a general consensus that there is indeed a need for a definition. There should be one global definition with sub-definitions to accommodate the diversity of systems that constitute IMTA. The global definition should be simple, aimed at legislators and policy makers and accompanied by a technical standard, which can be exacting and layered. It could be possible to define different levels of IMTA accreditation depending on the system used.

The technical standard allows assessment of the relative sustainability of multitrophic aquaculture operations according to the conservation ethic of INTEGRATE partners and experts. It includes background and rationale text explaining how the assumptions and values are reflected within the calculations and scoring options.

The technical standard should be used for all IMTA assessments in the Atlantic Area, and consists of the following:

- Defined guiding principles
- Science-based performance criteria that are regularly revised based on the input from IMTA experts
- A robust and objective scoring methodology resulting in a transparent assessment of an IMTA operation against the performance criteria

4 IMTA best practice in the Atlantic Area

The INTEGRATE project has developed and implemented 3 models of IMTA in the 5 European Atlantic countries, including Spain, Portugal, France, Ireland and the United Kingdom, in order to harmonise sustainable best-practice approaches throughout the Atlantic Region.

4.1
Testing new eco-friendly technologies and high value seaweeds applied to IMTA

4.2
Near-shore eco-friendly IMTA developments

4.3
Testing and developing an eco-friendly IMTA standard model for land-based semi-extensive aquaculture

4.1

Testing new eco-friendly technologies and high value seaweeds applied to IMTA

Pilot action 1

About this pilot action

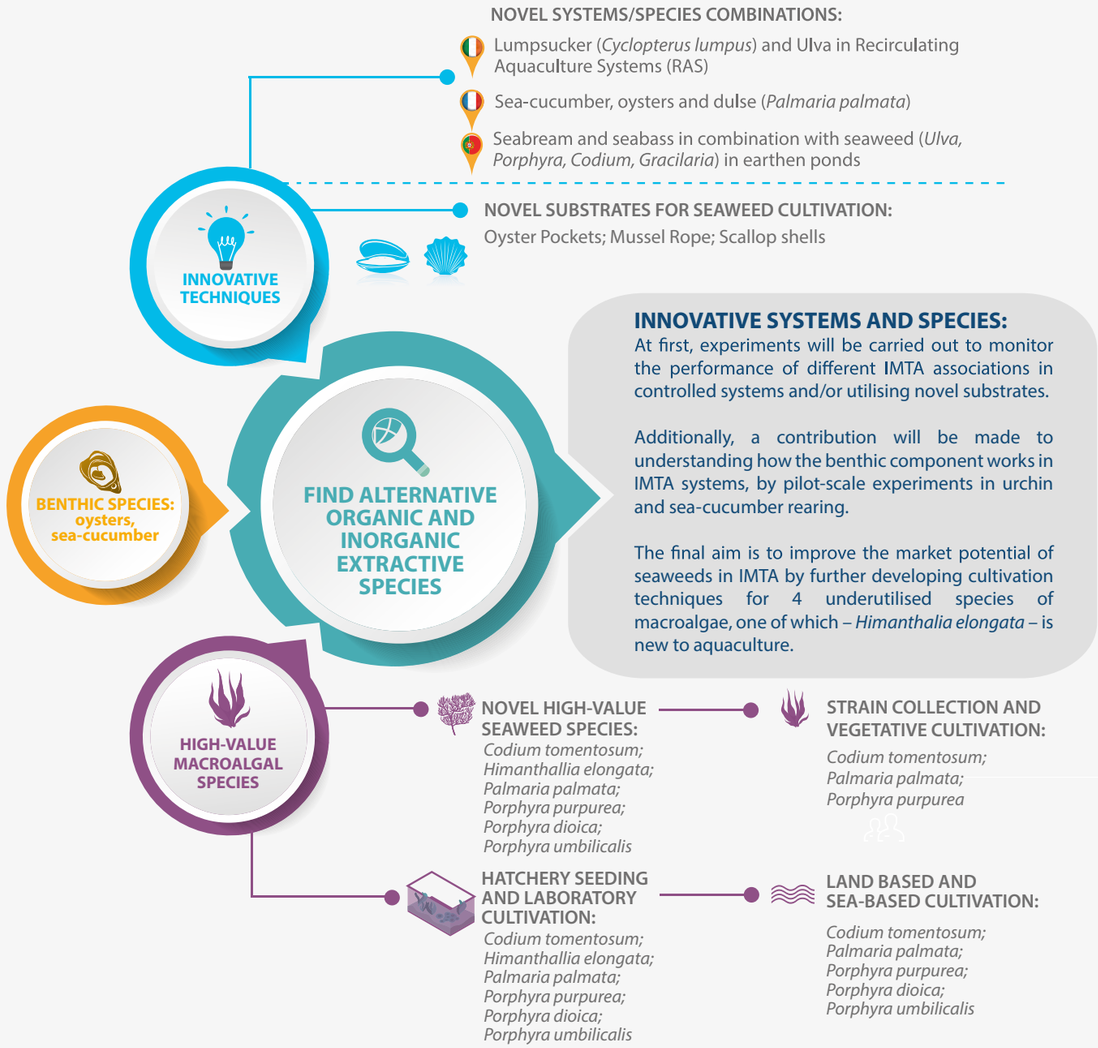
-

Partners:

France (Agrocampus Ouest & Ceva) - Ireland (NUIG & ISC) - Scotland (SAMS) - Portugal (ALGAplus).

The aim of this pilot action was to study innovative IMTA systems and to find alternatives to organic and inorganic extractive components for IMTA in the European Atlantic Area. Throughout the EU there is a lack of potential species to use in IMTA – hatchery techniques for many potential species are missing, and the commercial production of marketable species needs to be developed. Experiments have been carried out to monitor the performance of different IMTA associations in controlled systems.

New techniques for cultivating new high-value and summer-season seaweed species, to be incorporated as the inorganic extractive components, have been developed in order to improve the economic value of seaweeds in IMTA systems in the Atlantic Area



4.2

Near-shore eco-friendly IMTA developments

Pilot action 2

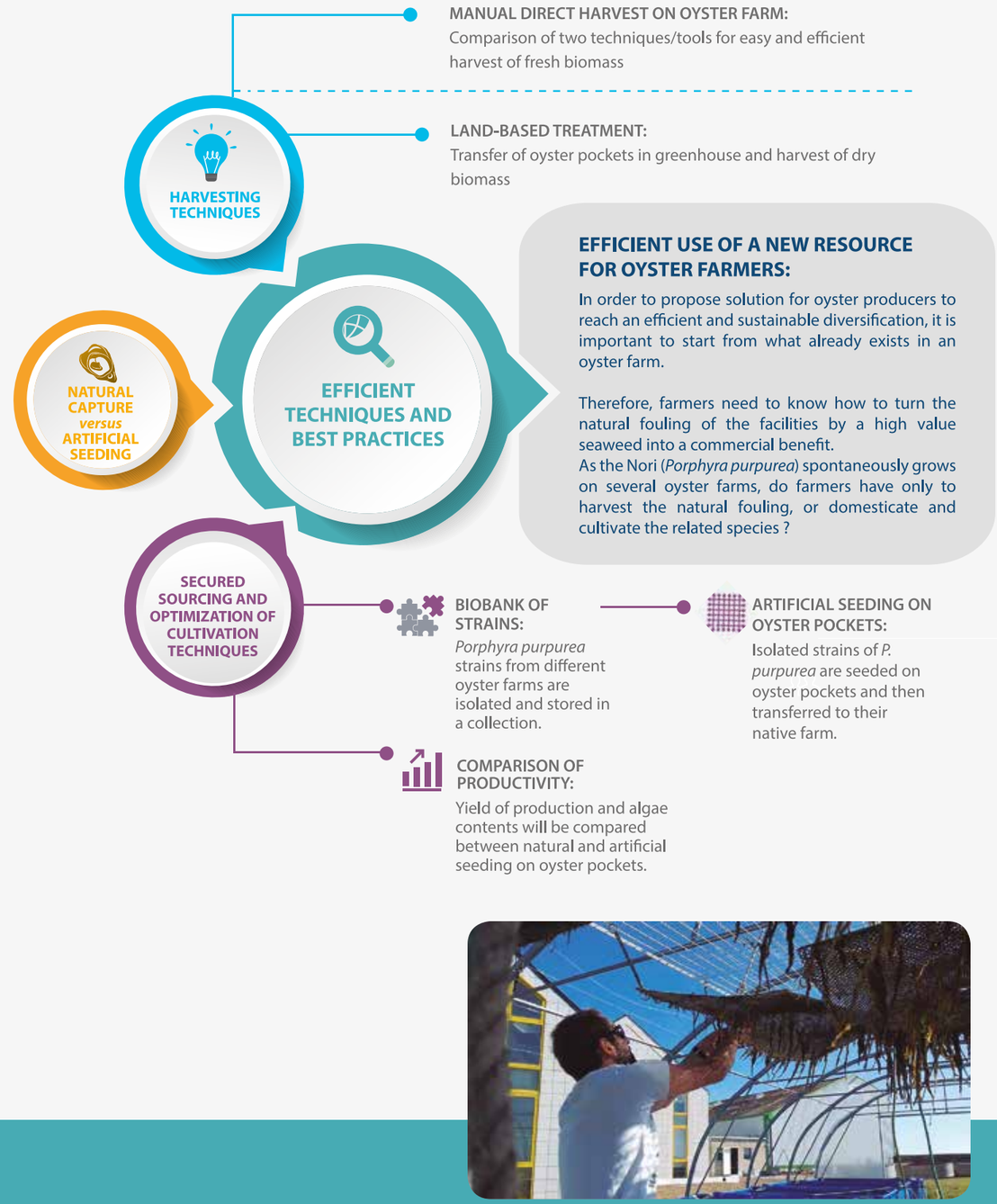
About this pilot action

-

Partners:
France (Agrocampus Ouest & Ceva) - Portugal (ALGAplus).

Oyster farming is a prominent activity on the shorelines of several European countries where a common problem for oyster farmers is the fouling of the oyster pockets with seaweed. The aim of this pilot action was to capitalise on this “problem” by intentional cultivation of a valuable species, thereby creating a second crop for the oyster farmers.

This action looked at the efficient management of the *Porphyra* resources in an integrated cultivation system with oysters. The wild collection and hatchery production of *Porphyra* was studied in order to provide oyster farmers with a cultivation technique that offers new economic perspectives to oyster farming, new supplies for the seaweed industry and new hatchery techniques.



4.3

Testing and developing an eco-friendly IMTA standard model for land-based semi-extensive aquaculture

Pilot action 3

In southern Spain and Portugal, converting decommissioned salt industry facilities into productive units for marine aquaculture has emerged as an inexpensive and easy process with lower environmental impacts that is able to take advantage of the existing nutrient-rich waters.

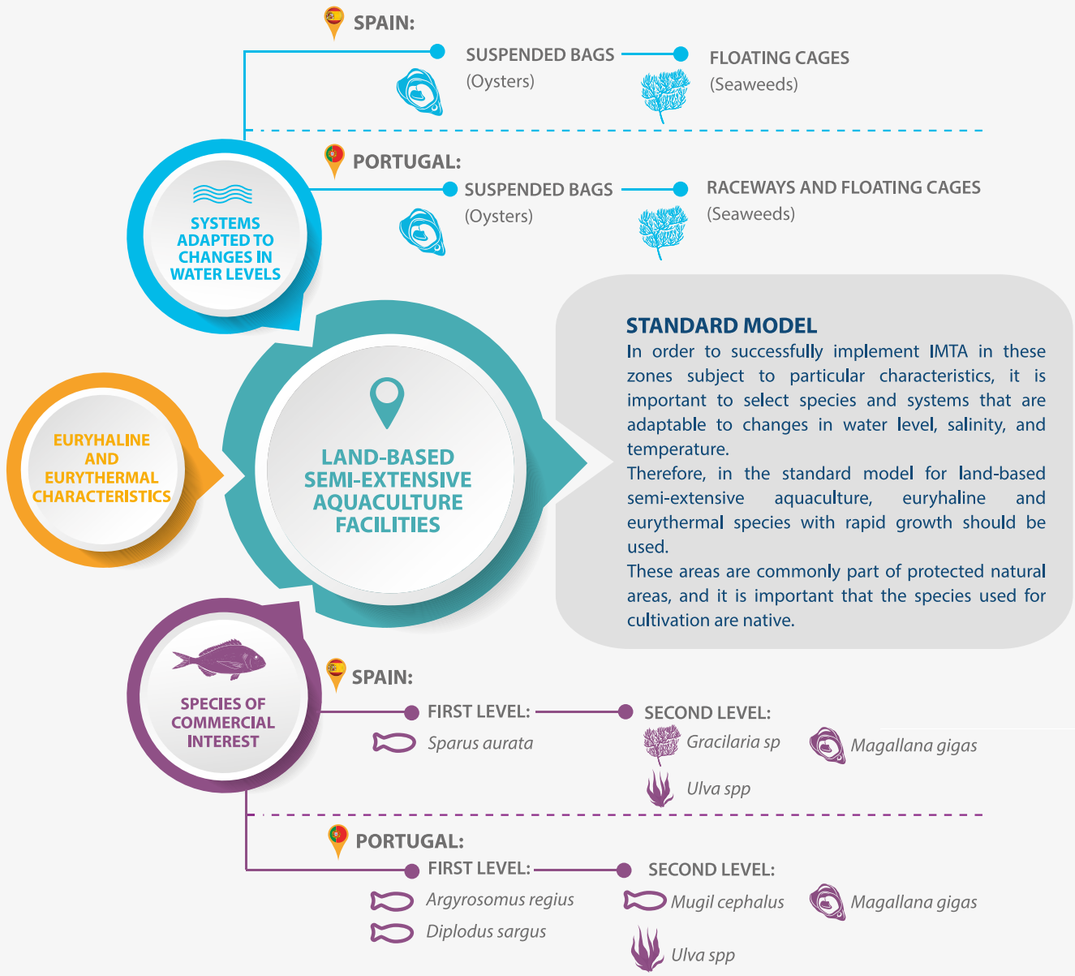
About this pilot action

-

Partners:
Spain (CTAQUA) -
Portugal (IPMA).

These facilities are located in the coastal zone in tidal and onshore areas directly influenced by the tides and close to the Atlantic Ocean for water inflow. Land-based production systems are ideal candidates for IMTA development due to the possibility of controlling the diversion of water through the different inputting and extracting compartments that comprise IMTA systems before final discharge. For this reason, these spaces offer excellent opportunities for the implementation of Integrated Multi-Trophic Aquaculture systems.

The work carried out in this pilot action enabled further development and standardisation of a land-based standard IMTA model, with the ultimate aim of industrial upscaling of the systems tested.



5 IMTA Environmental impact

5.1 The challenge of quantifying how much IMTA impacts the environment

Over the past few decades, there has been increasing concern about the sustainability of consumer products. As described previously, IMTA promotes a new circular economy model since it is based on an efficient reuse of resources, including waste, in traditional aquaculture facilities. Farmers combine fed species with other organisms that capture their sustenance from the farming environment in an integrated waste-recycling marine polyculture system (see Figure 1 below).

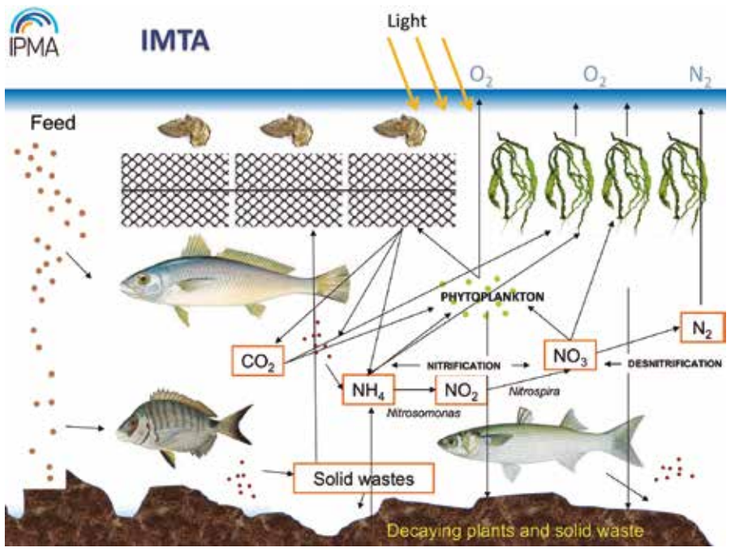


Figure 1: Schematic explanation of IMTA. Excess nutrients from fish farming can be used to cultivate other species of high commercial value

To summarize the different IMTA systems implemented in the INTEGRATE project a conceptual compartment model was developed for land-based semi-extensive IMTA in ponds that accommodate five trophic compartments (carnivores – detritivores - filter feeders – phytoplankton – macroalgae) and displays their structural organization and functioning (see following Figure 2).

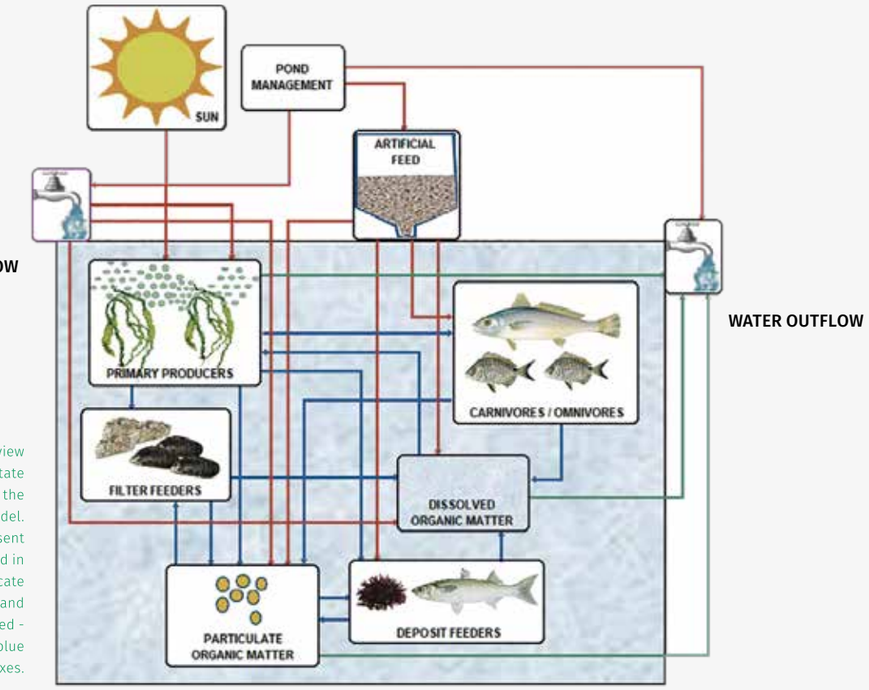


Figure 2: General overview of the biogeochemical state variables and fluxes within the conceptual pond IMTA model. Square boxes represent functional groups defined in the model. Arrows indicate fluxes of energy, carbon and inorganic nutrients: red - inputs; green – outputs; blue - internal fluxes.

This conceptual compartment model, developed using the Stella software, has allowed us to obtain a list of parameters and data, which were subsequently assessed in order to provide a prediction of the environmental performance of salt water pond IMTA through a Life Cycle Assessment (LCA), an important assessment methodology for measuring the environmental footprint of materials, products and services over their entire lifetime.

The aim of the LCA in the INTEGRATE project was to assess the potential environmental impact and benefits of marine pond IMTA developed by Portugal and Spain within the framework of the project. The specific objectives were to:

- estimate environmental impacts of semi-extensive and semi-intensive pond IMTA production systems developed within the framework of INTEGRATE
- identify their critical environmental impacts
- identify ways of addressing and minimising the impacts and maximising the sustainability of pond IMTA.

IMTA promotes a new circular economy model since it is based on an efficient reuse of resources, including waste

The LCA report describes the comparison of three IMTA systems of combined cultivation of fish, oysters, and seaweed (mainly Ulva) as a downstream production. Two of the IMTA systems are semi-intensive and the third semi-extensive.

☆ **The main conclusion from the study** was that Feed was the largest single contributor to all environmental impacts associated with IMTA production, followed by Rejects Fish, Direct Farm Activity, Water consumption and Equipment. These are important processes driving environmental impacts through their production and use. Semi-extensive IMTA practices lead to a better use of resources and can reduce the overall impact of the production. The only drawback of this system was Land Competition since it required more space to produce the same amount of edible product.

6 Main results and conclusions

MAIN RESULTS

INTEGRATE has found consensus on a definition of IMTA relevant for the industry and policy-makers in the Atlantic Area;

INTEGRATE has developed technical knowledge of macroalgal cultivation for species of high economic value and potential for novel and early-stage species (*Himanthalia elongata, Porphyra spp., Codium spp., Palmaria palmata*);

INTEGRATE has harmonised cultivation approaches and IMTA implementation techniques through production of freely available technical manuals and implementation guides;

INTEGRATE has further strengthened the international IMTA community, facilitating harmonised progress towards achieving important results in the short term, as is the case for the consensus reached on a definition of IMTA.

CONCLUSIONS

INTEGRATE pilot actions have further demonstrated that IMTA is a feasible option for the future of Atlantic Area aquaculture and have added a number of species to the IMTA proof-of-concept;

INTEGRATE life cycle assessments show that semi-extensive IMTA has an overall lower environmental impact compared to semi-intensive IMTA and semi-intensive fish monoculture;

INTEGRATE life cycle assessments show that semi-intensive IMTA is much less eutrophic and water dependent than semi-intensive fish monoculture;

INTEGRATE life cycle assessments show that semi-extensive IMTA is economically profitable, especially in large protected areas;

INTEGRATE national policy briefings will facilitate progress towards development of regulations to strengthen the consolidation of IMTA at European level.

7. Project Strategies

HOW TO DEVELOP IMTA IN EUROPE?

From DIAGNOSIS to STRATEGIC PLAN

1. DATA COLLECTION

HOW?

INTERVIEWS: producers/ stakeholders

ROUNDTABLES: producers/ academia/ administration/ consumers

REGULATORY environment:

LITERATURE: technical/ environmental/ economic social/ regulatory

WHAT?

- CURRENT STATE
- BARRIERS
- LEVERS
- PRACTICES

2. ANALYSIS

TECHNICAL
ENVIRONMENTAL
ECONOMIC
SOCIAL
REGULATORY

Strengths — S
Weaknesses — W
Opportunities — O
Threats — t

REGULATORY ANALYSIS OF IMTA IN THE AA.
Common challenges

DIAGNOSIS

3. INTEGRATE STRATEGIES

Training courses
IMTA training courses in higher education
Project objective:

Online community & organisation of events
Growth of international IMTA community
Project objective:

Definition and policy briefings
Disseminate definition among policy-makers
Project objective:

Life Cycle Assessments
Use LCA to obtain comprehensive review of findings
Project objective:

IMTA technical implementation manuals/ guidelines
Promote project materials & resources
Project objective:

Project objective 1.
To strengthen collaborative networking around eco-efficient aquaculture techniques

Project objective 2.
To communicate the principles and benefits of IMTA (eco-innovation and eco-efficiency) and raise awareness of IMTA's holistic approach

Project objective 3.
To achieve market consolidation of EU sustainable seafood

Project objective 4.
To fulfil Atlantic Area & EU regional goals as the industry transitions to resource-efficient technologies: promotion of green and blue growth in aquaculture

8 Dissemination and Communication

The INTEGRATE project has developed training material and resources, which are all freely available on the INTEGRATE project website.

8.1 Capitalisation

The aim of the capitalisation activities was to transfer IMTA experience and best practice into a series of events and learning materials in order to take the project knowledge and disseminate it to interested stakeholders, including students, industry partners, academia and public administration. Training and capacity building are important to obtain INTEGRATE capitalisation.

Training material

The project has developed fit for purpose training material and resources, which are all freely available on the INTEGRATE project website, including open materials for students about eco-efficient aquaculture systems.

Technical visits

In order to bridge the gap between research, industry and society to facilitate the implementation of greener aquaculture systems in general according to circular economy principles, we developed and implemented a series of measures so that aquaculture industry professionals and future professionals could experience first-hand how to develop IMTA activities in their own facilities. For example, through technical visits to the pilot action sites, we were able to show the challenges and limitations to IMTA implementation, as well as some solutions to overcome these.

www.integrate-imta.eu

Policy brief documents

In order to develop a supportive regulatory framework for IMTA in the Atlantic Area, using the information collected during the process of defining a framework for IMTA development, we produced an IMTA policy brief document for each partner country, with the aim of holding face to face meetings with key government and regulators to discuss the project findings and ultimately anchor IMTA in EU legislation.

8.2 Communication material

- A suite of promotional material has been developed to help inform different stakeholders and members of the public about a range of aspects of eco-efficient practices in aquaculture to demonstrate that Integrated Multi-Trophic Aquaculture (IMTA) represents a key tool for greening the Atlantic aquaculture industry, by producing safe and healthy food products and creating economically sustainable jobs.
- We have developed a portfolio in which we present an overview of the material developed. In addition, all these materials are freely available for download as pdf from the multimedia section of the INTEGRATE project website at www.integrate-imta.eu.

8.3 Networking

As a direct result of the dissemination activities of the project results, numerous interested stakeholders, including industry, academia, among others, have contacted the project partners for information and support for development of their own IMTA implementation.

"Our objectives support resource efficiency with the aim of fostering green growth opportunities within the aquaculture sector, priorities which have been established by the Europe 2020 strategy towards a smart, sustainable and inclusive growth"

Layman's Report 2020

Integrate Aquaculture: an eco-innovative solution to foster sustainability in the Atlantic Area

INTERREG Atlantic Area 2014-2020
Project EAPA_232/2016

Interreg Atlantic Area
European Regional Development Fund
EUROPEAN UNION