

**New Sustainable Aquaculture
Techniques in the Atlantic Area
(Andalucía Region)**

PROJECT IDENTIFICATION: EAPA_1059/2018 – ACCESS2SEA

www.access2sea.eu

NEW SUSTAINABLE AQUACULTURE TECHNIQUES IN THE ATLANTIC AREA REGION (ANDALUCÍA REGION)

As part of the programme of work including in Work Package Six of the Access2Sea project, Action Four involved Project Partners undertaking to research and analyse new aquaculture techniques being developed in their regions. This research is aimed at fostering a more sustainable industry by facilitating the dissemination of techniques which could be of value in addressing the needs of companies in other territories of the Atlantic Area Region.

The following three new sustainable aquaculture techniques were identified by the Andalucían Partners of the Access2Sea Project, FUNDACIÓN BAHÍA DE CÁDIZ PARA EL DESARROLLO ECONÓMICO & Fundación Centro Tecnológico Acuicultura de Andalucía:

1. Sustainable Wetlands Aquaculture
2. Integrated Multi-Trophic Aquaculture
3. Diversification towards Herbivorous / Omnivorous Culture Species (Emerging)

1) Sustainable Wetlands Aquaculture

Along the Atlantic coastline of southern Spain, it is common to find extensive aquaculture installations in wetlands where naturally-recruited shrimp and fish occur with production entirely supported by natural productivity. These enter the lagoons as larvae or juvenile passing through the sluice gates with the incoming estuarine water. Some of the lagoons have greater water exchange as they receive the water from semi-extensive seabass or seabream production that occurs in a row of culture ponds where fish are maintained at around 2-4 kg m⁻² and nutrition comes from both inflowing natural production and formulated feeds supplied by hand or automatic feeders. Also, oyster production is a relevant practise in this area, being the natural morphology of the wetlands ideal to place oyster cages for growing out as well as for seaweed production.

A good example of this sustainable aquaculture technique is an extensive / semi-intensive installation which is located within Doñana Natural Park. According to the technical report published in 2015 *Policy Guidance for Sustainable Wetlands Aquaculture* (Annex 1), the primary function of this wetland, and the economic justification for the investment in its construction and operation, is the provision of aquaculture products. Lagoons are harvested periodically every 3 to 5 years by lowering the water level to concentrate the fish which are then collected by netting. In addition, 100-120 fyke nets are deployed daily around the farm for the continuous harvest of shrimp, with mullet and other fish also regularly caught as by-catch. Semi-extensively cultured fish are harvested three years after stocking. The combination of semi-extensive (stocked and fed) and extensive (natural recruitment and no feeding) culture systems result in a mean annual production of 820 tonnes of which extensive production accounted for just over 25%. Bass (*Dicentrachus labrax*) is the main semi-extensively cultured species plus some gilthead seabream (*Sparus aurata*) harvested after a three year growout period.

This technical report shows that the development of sustainable aquaculture in saltmarshes located along the Atlantic coastline of Andalusia helps to keep their uses avoiding the abandonment of this areas, as well as it has a positive impact on some sustainable factors which are listed below:

- Nutrients absorption (N and P)
- Carbon sequestration
- Primary productivity
- Habitats for species
- Maintenance of biodiversity
- Assimilation of primary productivity by wetland birds and aquaculture species
- Cultural services, Ecotourism and Scientific knowledge

Objective: Sustainable use of wetlands within protected areas (or not) for extensive / semi intensive marine aquaculture activities and (but not necessarily) being compatible with other activities or uses of the area

Reference: Walton, Mark & Vilas, Cesar & Canavate, Jose Pedro & A., Prieto & Van Bergeijk, Stef & Medialdea, J.M. & M., Librero & N., Mazuelos & King, Jonathan & Oc, Lee & Le Vay, Lewis. (2015). *Policy Guidance for Sustainable Wetlands Aquaculture*. 10.13140/RG.2.1.4579.7203

2) Integrated Multi-Trophic Aquaculture (IMTA)

An IMTA system is an integrated culture of organisms of various species belonging to different trophical levels in the same water body (but not necessarily at the same time), thereby guaranteeing a functional relation between the levels, i.e. an exchange of matter and/or energy among them. At the basis are the carnivores, usually fish that receive feed. Nutrients coming from fish excretions and feed rests will stimulate microalgae growth that serves as feed for bivalves (filter feeders), which will also feed on the feed rests directly. Finally, the nutrients from excretions from both fish and bivalves serve as a food source for seaweed cultures.

As part of the Atlantic Area Interreg Project, *INTEGRATE*, CTAQUA has designed, operated and evaluated IMTA culture in earthen ponds in an existing and operational oyster farm. The pilot experiment aims to demonstrate that cultivation of different marine species based on the principles of the IMTA-concept is viable in the earthen pond system. Furthermore, on a more scientific level, the pilot experiment aims to trace the nutrient flows in the system and to show how and where these are interconnected.

The pilot action is carried out in the *Salina de Belén de Poniente y de Levante*. This site, like many others in the area, is made of former salt evaporation ponds. Later, these were converted in fish cultivation ponds and the site has been in use for several years for the intensive cultivation of fish, mainly sea bass and sea bream. This activity ceased a few years ago, when intensive fish cultivation more and more took place indoor in recirculating aquaculture systems. In recent years, exploitation was taken over by Estero Natural, and activities are now mainly dedicated to oyster growing and extensive fish cultivation. Hydrologically it is connected to the inner zone of the Bay of Cádiz. Water exchange is driven by tides.

The IMTA consists of three trophical levels: fed fish (gilt-headed sea bream, *Sparus aurata*, dorada in Spanish), filter feeders (Japanese oysters, *Magallena gigas*, formerly known as *Crassostrea gigas*) and primary producers (seaweeds *Ulva ohnoi* and *Gracilaria gracilis*). Foliose *Ulva* species are being commercialised under the name sea lettuce (lechuga de mar in Spanish), whereas *Gracilaria* is sold under its Japanese name ogonori.

The INTEGRATE partnership consists of eight core partners and eleven associated partners from the five Atlantic Area Members States (Portugal, Spain, France, Ireland and United Kingdom), led by the Spanish aquaculture research organisation CTAQUA.

Objective: Maximize the input nutrient retention into harvestable products by making the most of the functional relations between different trophic levels

From: <http://integrate-imta.eu/> and
<http://integrate-imta.eu/category/training-materials/> and
<http://integrate-imta.eu/category/downloads/>

3) Diversification towards Herbivorous / Omnivorous Culture Species (Emerging)

Nutrition and feeding plays an essential role in the sustained development of marine aquaculture. Protein from marine resources is still necessary in fish feed formulations and then, the diversification towards herbivorous / omnivorous cultured species could be an option to address the issue of high protein % use in fish nutrition. Overall, marine and freshwater carnivorous species require 40-55 % dietary protein, while most freshwater omnivorous and herbivorous species require 30-40 % of their dry diet to be made up of protein. In the Atlantic Area of Andalusia there are some studies about the culture of Flat-head grey mullet (*Mugil cephalus*), omnivorous species with interesting future prospects in marine aquaculture production.

The project DIVERSIFY (<https://www.diversifyfish.eu/about-diversify.html>) has identified a number of new/emerging finfish species, with a great potential for the expansion of the EU aquaculture industry. Although the emphasis is on Mediterranean cage-culture, fish species suitable for cold-water, pond/extensive and fresh water aquaculture have been included as well. These new/emerging species are fast growing and/or large finfishes marketed at a large size and can be processed into a range of products to provide the consumer with both a greater diversity of fish species and new value-added products. The fish species to be studied include meagre (*Argyrosomus regius*) and greater amberjack (*Seriola dumerili*) for warm-water marine cage culture, wreckfish (*Polyprion americanus*) for warm- and cool-water marine cage culture, Atlantic halibut (*Hippoglossus hippoglossus*) for marine cold-water culture, grey mullet (*Mugil cephalus*) a euryhaline herbivore for pond/extensive culture, and pikeperch (*Sander lucioperca*) for freshwater intensive culture using recirculating systems. These species were selected based both on their biological and economical potential, and to cover the entire European geographic area and to stimulate different aquaculture types.

From: <https://www.diversifyfish.eu/summary.html>



Lead Partner



Centro Europeo de
Empresas e Innovación

CEEI Bahía de Cádiz

C/ Manantial, 13. Edificio CEEI
Polígono Ind. Las Salinas de San Jose Bajo
11500 El Puerto de Santa María (Cádiz) - Spain
Tlf: (+34) 956 860 654 / Fax: (+34) 956 860 028
E-mail: asuarez@ceeicadiz.com
Web: www.ceeicadiz.com



Partners



CENTRO TECNOLÓGICO
DE LA ACUICULTURA

Centro Tecnológico de
Acuicultura de Andalucía
Muelle Comercial S/N
11500 El Puerto de Santa María (Cádiz) - Spain
Tlf: (+34) 956 56 93 63
E-mail: mm.agraso@ctaqua.es
Web: www.ctaqua.es



Swansea University
Centre for Sustainable Aquatic Research
Wallace Stores, Singleton Park
SA2 8PP - Swansea
Tlf: +44(0) 1792 29 53 83
E-mail: p.n.howes@swansea.ac.uk
web: www.swansea.ac.uk



Údarás na Gaeltachta

Údarás na Gaeltachta
Na Forbacha, Co. Dublin, Galway
Tel: 091-503100
Fax: 091-503101
E-mail: foh@udaras.ie
web: www.udaras.ie



Innovation & Management Centre
CLG T/A WESTBIC
11 Galway Technology Centre, Wellpark Road
Galway, H91 E2W5 - (Ireland)
Tlf: (+353) 86 2574978
E-mail: smccormack@westbic.ie
web: www.westbic.ie



Technopole
Quimper-Cornouaille

Technopole Quimper Cornouaille
2 rue François Briant de Laubriere
29000 Quimper - Francia
Tlf: +33(0)298 100 200
E-mail: rachel.sellin@tech-quimper.fr
web: www.tech-quimper.fr



CIIMAR

Centro Interdisciplinar
de Investigação
Marinha e Ambiental

CIIMAR | Interdisciplinary Centre of Marine and
Environmental Research of the University of Porto
Novo Edifício do Terminal de Cruzeiros do Porto de Leixões
Avenida General Norton de Matos, S/N
4450-208 Matosinhos | Portugal |
Tlf: (+351) 223 401 852
E-mail: rodrigo.ozorio@ciimar.up.pt
web: www.ciimar.up.pt



UALg

UNIVERSIDADE DO ALGARVE

University of Algarve
CRIA - Pavilhão B1
8005-139 Faro (Portugal)
Tlf: +351 289 800 097
E-mail: ajmarq@ualg.pt
web: www.ualg.pt



INVESTIR EN
FINISTÈRE

Investir en Finistère
46, quai de la Douane
CS 63825 29238, Brest cedex 2
Tlf: +351 (0)298 339 773
E-mail: a.coppens@investir29.fr
web: www.investir29.fr



Associated Partners

✓ Technopole Brest Iroise
www.tech-brest-iroise.fr

✓ Cuideachta Feamainn Turtar Gorm Teo (TSC – Bleu Turtle)
www.theseaweedcompany.com

✓ Association of Aquaculture Marine
Businesses of Andalusia (ASEMA)
www.asemaonline.com

✓ Union Chamber of Algae and Marine Vegetables (CSAVM)
www.chambre-syndicale-algues.org



www.access2sea.eu