



FOSTERING EXPERTISE IN SUSTAINABLE AQUACULTURE



New tools to foster Europe's aquaculture industry

The five-year EcoAqua project (2014–2019) is undertaking innovative research into improving the sustainability of coastal aquaculture in outlying EU regions and balancing the demands of the different users of this sensitive maritime environment

Aquaculture is a major component of the EU's Blue Growth strategy, and sustainable growth in this sector will help to achieve the EU's Europe 2020 environment and job creation goals. At present, 25 per cent of EU seafood consumption is supplied from its own fisheries, 10 per cent from its aquaculture industry, and the remainder from imports.

These figures represent a significant market opportunity for increased aquaculture production in the region. The EcoAqua project is one response and is aimed at building a centre of excellence and a networking hub for research into sustainable aquaculture, for application in the EU's outermost regions (ORs) and overseas countries and territories (OCTs). ORs and OCTs comprise 34 states scattered around the globe. Most are island nations with significant marine resources. Macaronesia, which comprises the Azores, Madeira and the Canary Islands, has a vast 2,000,000 square kilometre marine sector.

The ORs and OCTs have a shared interest in developing their marine areas in order to grow their economies, whilst balancing the competing interests of biodiversity conservation, tourism, shipping, recreational fishing and aquaculture. By further developing the impressive aquaculture and marine research facilities and expertise at the University of Las Palmas de Gran Canaria (ULPGC) in the Canary Islands, the EcoAqua project aims to provide the tools these far-flung island nations need to meet their maritime challenges.

AQUACULTURE NETWORK

The first step was to consolidate facilities and resources in a newly formed institute, the University Research Institute in Sustainable Aquaculture and Marine Ecosystems (IU-ECOQUA), led by Marisol Izquierdo. The EcoAqua project is coordinated by Ricardo Haroun while the

ERA Chair Sachi Kaushik, president of the European Aquaculture Society, together with researchers from Croatia, Korea, France, Spain and Portugal has enhanced the research capability of IU-ECOQUA. The EcoAqua project's main research areas focus on spatial mapping, nutrition, genetics, environmental impacts and multi-trophic aquaculture. The extensive testing tanks and laboratories have been further upgraded to enable state-of-the-art research.

The second step was to create a platform through which to communicate, disseminate and discuss the maritime needs and issues of the ORs and OCTs. This has been achieved through two dedicated summer courses, a number of workshops, meetings and conferences. The face-to-face events provided the catalyst for discussions and collaboration, whilst the Technological Platform has enabled ongoing networking between the geographically disparate groups of stakeholders. Most ORs and OCTs are actively involved, including regions as diverse as New Caledonia, Aruba, Madeira, the Azores and Guadeloupe.

MARITIME SPATIAL PLANNING

Maritime spatial planning is a necessary tool for managing coastal waters and enables the development of tools and guidelines for managing competing activities, including shipping, tourism, coastal construction, fishing and aquaculture, within a framework aimed at also minimising environmental impacts and cost. EcoAqua is using open-source software and its own data collection and analytical expertise, with the goal of building a spatial map architecture for the Canary Islands that can be used by stakeholders and the administration to better manage its maritime environment.

Detailed spatial maps incorporating multiple geographic information system (GIS) layers help identify opportunities for sharing infrastructure, enable informed

policy decision-making, optimise marine traffic routes, and provide better outcomes for the economy and the environment. The expertise developed in EcoAqua can be utilised by other ORs and OCTs to build their own coastal waters' management frameworks. The idea behind this research line is that 'maritime spatial planning will result in the development of pertinent and robust monitoring methods for the marine environment that will reflect . . . different marine activities'.

MULTI-TROPHIC AQUACULTURE

A key research theme is investigating the advantages and feasibility of integrated multi-trophic aquaculture (IMTA). In the EcoAqua context, IMTA involves using biofiltration to purify aquaculture effluent and thereby produce a high protein source of algal biomass for feeding to the farmed seafood species. Research is focused on determining the nutritional properties of seaweeds produced in IMTA units, developing vegetable-based compound diets including seaweed meals, and optimising existing techniques and harvesting systems. An ongoing study is assessing the effect of algal diets on the growth of abalone in an IMTA unit.

A long-standing objective of the EU is to reduce the quantity of marine-derived fish meal (FM) and fish oils (FOs) in food formulations fed to farmed fish species and to develop vegetable-based diets. It has been recognised that aquaculture can only reduce pressure on marine fisheries by minimising the need for farmed fish to be fed with krill, anchovies or other marine species. EcoAqua builds on other research projects funded within the EU, which have already resulted in food formulations with low FM and FO content. EcoAqua's work will determine if renewable vegetal sources can form a large part of the diet for farmed species without detriment to growth rates and nutritional qualities of the product. If so, IMTA using seaweed to filter aquaculture



The events organised by EcoAqua have fostered cooperation and multidirectional dialogue between regions

effluent, which is then used to feed farmed species, has great potential to reduce the global and regional environmental impacts of aquaculture.

NUTRITION AND GENETICS

A further study is developing genetic improvement programmes in marine species, including fish, crustaceans and molluscs, in order to optimise growth, performance and quality. By studying the effects of consanguinity and examining morphological traits, the team hopes to identify the genes associated with chosen parameters so as to provide fish breeders with tools to improve production.

A related research strand is examining the effect of different levels of nutrition over the full life cycle of seafood species in order to optimise growth rates, fertility, egg viability and larval quality. Data is being gathered on the effects of different diets on larvae and juvenile growth performance, body composition and quality.

UNDERWATER HABITAT CHARACTERISATION

Improved facilities at IU-ECOQUA are enabling comprehensive research into deepwater and subtidal seabed surface ecosystems, in order to determine their sensitivity to human activities (including aquaculture) and their role in regional maritime ecosystem health. Epibenthic species are poorly understood and may be

at risk from sewage outfalls or aquaculture and maritime uses. Researchers are using deep diving equipment and acoustic techniques to map the seabed and gather data on the flora and fauna present on seabed sediments.

Innovative research is focusing on the ancient and extensive red algae (rhodolith) beds around the Canary Islands. Rhodoliths resemble coral and support diverse benthic communities. Subtidal regions dominated by rhodoliths are thought to provide essential nurseries for invertebrates and various fish species as well as providing extensive carbon sinks. The EcoAqua research will characterise these ecosystems, assess and promote their value, and determine ways in which they may be better conserved.

While the term of the EcoAqua project is five years, the benefits will accrue for decades to come. The newly formed IU-ECOQUA will continue as a centre of excellence in maritime and aquaculture research and as a hub for the collection and dissemination of results and findings. Tools and guidelines developed in EcoAqua will enable the ORs and OCTs of the EU to better manage their maritime resources in order to both grow their economies and protect their unique marine environments.

Project Insights

FUNDING

European Union FP 7 European Research ERA Chair

COLLABORATING ENTITIES

Tri-Continental Atlantic Campus • Madeira Regional Secretariat of the Environment and Natural Resources/ Regional Directorate of Fisheries • Centre of Applied Economics Studies of the Atlantic • French Overseas Aquaculturists Union (UAOM) • New Caledonia Economic Development Agency (ADECAL)

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PROJECT COORDINATOR BIO

Professor Ricardo Haroun is a marine biologist whose research focuses on systematics, sustainable uses and conservation of marine biota. He obtained his PhD in Biological Sciences from La Laguna University, Spain. Haroun has been a Full Professor at ULPGC since 2014 and has more than 100 scientific publications related to biodiversity, ecological processes and sustainable use of marine resources, including a book about marine plants of the Canary Islands. He is a member of the Ecosystem Management Commission of the International Union for Conservation of Nature, a consultant for the Canarian Regional Government on island biodiversity, and a reviewer of various high impact scientific journals. Haroun is actively working on aquaculture and environment interactions, climate change and its effects on benthic communities, ecological services and the effects of marine alien species.



Impact Objectives

- Foster research excellence in sustainable aquaculture under an ecosystem approach
- Develop and strengthen the research potential and capacities of the University of Las Palmas de Gran Canaria (ULPGC)

Fostering expertise in sustainable aquaculture

Researchers **Ricardo Haroun** and **Gercende Courtois de Viçose** together with the ERA Chair **Sachi Kaushik** describe how the **EcoAqua** project has helped to strengthen the **University of Las Palmas de Gran Canaria (ULPGC)** and develop a centre of excellence for networking and research into sustainable marine aquaculture in the EU's outermost regions



EcoAqua directing and management team. Ricardo Naroun (left), Gercende Courtois de Viçose (middle), Sachi Kaushik (right).

The EcoAqua project was launched in June 2014. What do you consider to be its major achievements in the past two years?

RH: EcoAqua is part of the ERA (European Research Area) Chairs initiative. Hiring a top international scientist as ERA Chair to guide and lead the development of the EcoAqua project objectives was the first action. Research lines in sustainable aquaculture and marine conservation topics have been reinforced with the arrival of five young scientists with expertise in different aspects of an ecosystem approach, such as integrated multi-trophic aquaculture, marine conservation, maritime spatial planning, genetic selection and fish nutrition. Another major achievement was to combine four different research groups of ULPGC into a more capable and efficient University Research Institute in Sustainable Aquaculture and Marine Ecosystems (IU-ECOQUA). This is a major milestone and forms a stable research centre within ULPGC, with increased international visibility and autonomous potential for undertaking research and seeking funding. IU-ECOQUA is developing a Strategic Plan of Sustainability with the advice of the ERA Chair in order to secure its future.

A stated aim of EcoAqua is to strengthen the research capability of ULPGC in the maritime aquaculture sector. What improvements to research facilities have been enabled?

RH: The main improvement achieved in the research facilities is the automation of data acquisition from aquaculture tanks. Another improvement is the acquisition of new underwater sampling equipment, including three re-breathers to allow deepwater sampling of biological material. The purchase of a current meter also enhances the existing capacity for oceanographic data acquisition. Another achievement has been the linkage and interoperability of the Geoportal of the ULPGC, providing data on marine species and habitats of the Canary Islands to major international and European environmental databases.

Have the ULPGC summer courses on sustainable aquaculture been well attended and received?

GCV: The first course was held in October 2015 and focused on an ecosystem-based approach to the sustainable development of aquaculture. It provided specific knowledge on marine spatial planning, ecosystem interactions and aquaculture development in coastal areas. The second was held in June 2016 and focused on understanding the basic and applied aspects of both micro- and macroalgae culture methods and uses, including different aspects related to the biology of cultivated algae, cultivation approaches, novel techniques and biotechnology.

Have any guidelines or tools on establishing sustainable coastal aquaculture enterprises been developed to date?

GCV: In order to establish guidelines for sustainable coastal management and aquaculture development in the EU's

outermost regions (ORs) and overseas countries and territories (OCTs), EcoAqua has organised various events to collect and compile information on thematic areas including economics, environment, society and technical innovation, and to identify common issues. The participants were representatives from OR and OCT regional authorities and administrations, together with aquaculture producers and scientists working in industry, environment, sustainability and marine spatial planning, plus other stakeholders concerned with aquaculture development.

Can you talk about the digital platform that has been developed for networking and sharing knowledge between ULPGC and researchers and industry in ORs and OCTs?

GCV: The events organised by EcoAqua have fostered cooperation and multidirectional dialogue between regions. Participants recognised the usefulness of the creation of the EcoAqua Technological Platform which has enabled ongoing communication, dissemination and discussion on technological advances; principal gaps, obstacles and challenges for the sustainable development of aquaculture; and potential synergies between research groups, the private sector, regional authorities and the community.

