

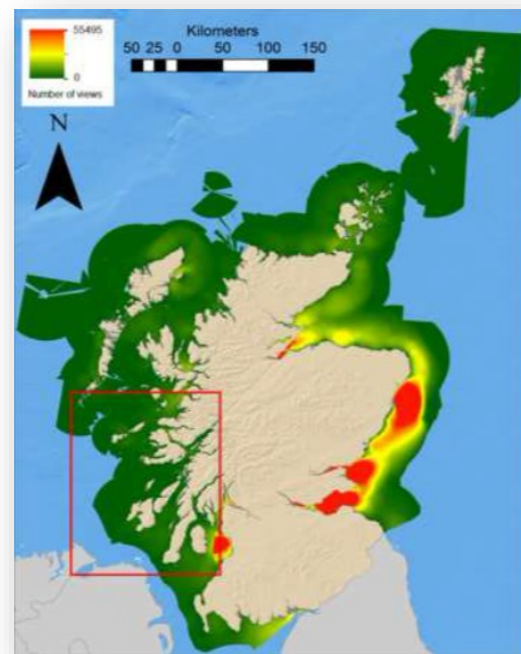
## Publications

### Visual amenity mapping for marine spatial planning and aquaculture (In Press)

O'Higgins. T, Black. K, Dunne. D (2016)

Ecosystem-based management considering social economic and environmental objectives and incorporating ecosystem services is emerging as the preferred basis for the management of the marine environment. Yet incorporation of ecosystem services into national scale planning has been limited. Growing global demand for fish protein has led to the rapid development of the marine aquaculture industry. Within the European Union, in order to manage and facilitate economic growth, whilst safeguarding environmental objectives in the marine environment, new legislation mandating the development of Maritime Spatial Planning (MSP) has been introduced. Using viewshed analysis a map of the visual amenity of Scottish national coastal waters was developed and a novel system for dynamic web display of the data was created. The visibility and distance from shore characteristics of aquaculture sites in Scotland were analysed to explore the potential for further aquaculture development based on visual amenity. The results suggest that, based on visual characteristics, the majority of coastal locations in eight of eleven marine regions are suitable for aquaculture development and the largest areas for potential development of aquaculture are located on the West coast. The advantages, potential and limitations of the methodology are considered.

The figure below illustrates the results of the viewshed analysis showing the overall national picture.



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#### What is SISAQUA?

The SISAQUA application aims to contribute to the decision framework for planning of aquaculture operations in Normandy.

This is a prototype of a system for aiding the decision based on the use of GIS technology (Geographic Information Systems) and Web.

SISAQUA based on three main modules:

- Management & visualization of spatial data (measurements in situ, satellite, digital models...).
- Combined analysis of these data (creating indicators).
- Dynamic user interface.

To date, SISAQUA manages data layers produced by Ifremer and has concentrated on shellfish farming, which represents the major aquaculture activity in the area.

#### SISAQUA in AquaSpace

Normandy is one of the workshops sites AQUASPACE project. During the three years of the project, the objectives are to contribute to a reflection on a European scale and to establish a process of consultation with local stakeholders to improve and refine aspects of the SISAQUA application. For example, the extension of SISAQUA to marine fish farming may be considered. Finally, the issue of transfer of SISAQUA will also be addressed.



### 1st Annual AquaSpace Meeting Held in Venice

A two-day AquaSpace project workshop focusing on an assessment of policy-management issues was held in San Servolo, Venice, Italy, from 18–19 February 2016. The 44 workshop participants from a wide range of sectors, including government, industry, trade, insurance and research, discussed key findings from a United Nations Food and Agriculture Organization (FAO) questionnaire survey. The FAO, a partner in the project, drew out the main conclusions for spatial planning and management of aquaculture for policy-makers and advocates specific key steps and approaches in the spatial planning process for aquaculture such as zoning, site selection and area management. Their questionnaire focused on these aspects coupled with discrete sections on the law and policy framework for aquaculture; steps and processes; technology; and public perception. Workshop participants were organised into working groups on zoning, site selection and area management and tasked with identifying the main issues, gaps and barriers to proper spatial planning and how these could be prioritised. The groups focused on methods used for spatial planning and public perception of aquaculture.



Subsequent discussion discussed methods used for spatial planning, associated issues and solutions with respect to zones, sites and areas. Identified barriers and obstacles included a lack of efficient implementation of existing policies on aquaculture, lack of a clear distribution of power and responsibilities, poor social acceptability, low technical knowledge and understanding of spatial planning concepts and lack of meaningful communication between relevant stakeholders including how stakeholders are involved in any planning processes. The groups made a number of recommendations including a pragmatic approach to planning; common guidelines and standardised procedures; monitoring; and capacity-building.

Workshop results showed that perceptions of aquaculture activities differ by category but are globally related to the same issues: food safety and environmental impacts. Those participants from the retailer, consumer and market category attributed negative public perception to concerns about food safety and nutritional aspects as well as ecological impacts. In contrast participants from civil society organisations felt socio-economic impacts needed to be prioritised before food safety, while tourist and coastal home owners were primarily concerned with pollution. Established tourist activities were viewed as potentially under threat from pollution incidents whereas coastal home owners were more concerned about the visual impacts of aquaculture farms.



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The project aims to provide increased space of high water quality for aquaculture by adopting the Ecosystem Approach to Aquaculture (EAA) using Marine Spatial Planning (MSP) to deliver food security and increased employment opportunities.



# Conflicts highlighted through AquaSpace case study stakeholder consultations

AquaSpace has 16 case study sites from various locations around the world. AquaSpace engages local stakeholders at each site through consultations. By collecting information at local level, cross comparisons can then be made across regions. Outcomes from the case studies will lead to a set of evaluated tools for facilitating the aquaculture planning process by overcoming present constraints

## Scotland—Argyll Case Study



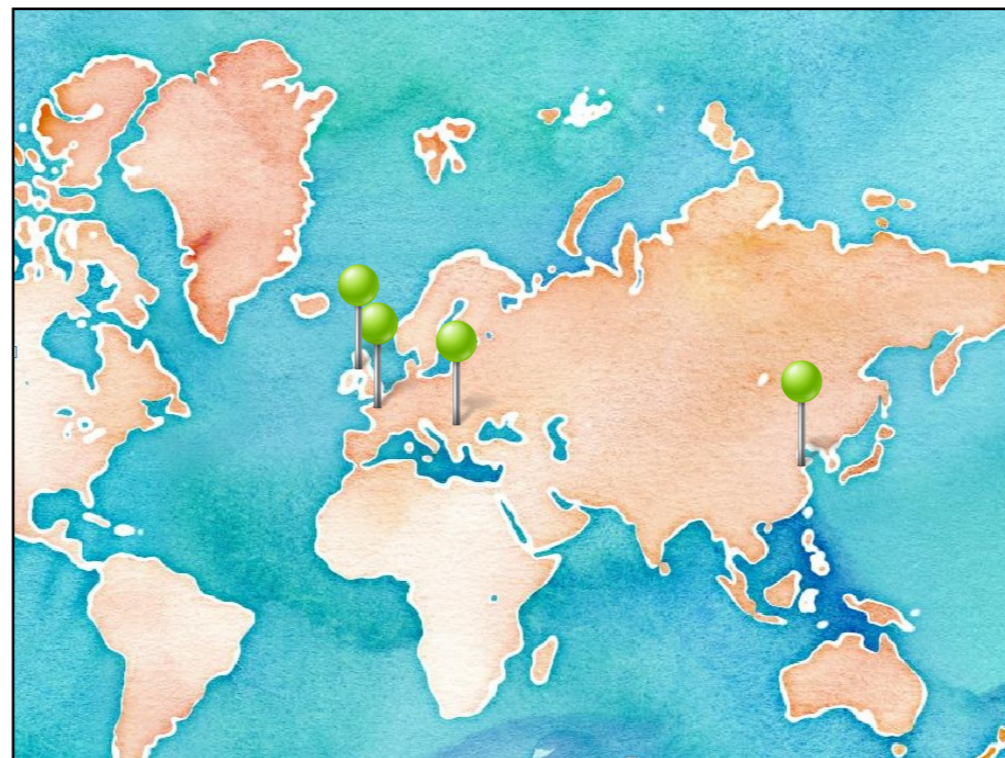
Argyll has the second largest area (8,055 km<sup>2</sup>, 10%) of the 37 counties of Scotland. Argyll has relatively high levels of employment in agriculture, fishing and aquaculture.

The major finfish species produced in

Argyll is Atlantic salmon. Scotland's Marine trout sector is entirely based in Argyll and this production comprises about 28% of total Scottish trout production. There is a small production of Halibut (~ 100 tonnes) in Argyll.

Shellfish statistics are reported for Strathclyde, the vast majority of which is in Argyll so these are used here. The major shellfish species produced in Argyll is the blue mussel.

Key findings from the case study consultation workshop indicate that there is a **mis-match** between national policy, local decision-making and industry needs. **Competition** for space is an issue that could be addressed through **co-existence** but this may have to be progressed by regulatory authorities. There is a need to develop **accountability** within the sector, across all actors, to as to improve **public perceptions** of aquaculture.



## Case Study Sites Initial Issues Identified

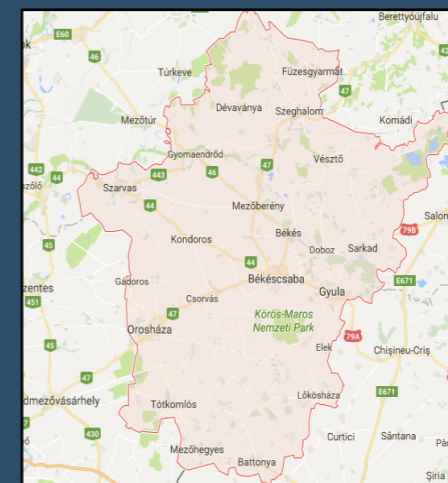
Case Study Location	Policy / Management Issues	Spatial Conflict	Environmental Issues	Economic Issues
Emilia-Romagna, Adriatic Sea, Italy	Issue	No Issue	Issue	Issue
Algarve Coast, Portugal	Issue	No Issue	Issue	Issue
Basque Country, Spain	Issue	No Issue	Issue	Issue
Békés County, Hungary	Issue	No Issue	Issue	Issue
Carlingford Lough, U.K/Ireland	Issue	No Issue	Issue	Issue
Great Bay, Piscataqua, USA	Issue	No Issue	Issue	Issue
Houtman Abrolhos Islands, Australia	Issue	No Issue	Issue	Issue
Long Island Sound, USA	Issue	No Issue	Issue	Issue
Mediterranean Sea Multinational	Outcome Pending			
Normandy/Cancale, France	Issue	No Issue	Issue	Issue
North Sea, Germany	Issue	No Issue	Issue	Issue
Norwegian Coast, Norway	Issue	No Issue	Issue	Issue
Nova Scotia Bays, Canada	Issue	No Issue	Issue	Issue
Sanggou Bay, China	Issue	No Issue	Issue	Issue
Argyll, Scotland	Issue	No Issue	Issue	Issue
Zhangzidao Island, China	Issue	No Issue	Issue	Issue

Topics raised are indicative of stakeholder consultation and will provide a basis for further study.

## Next Steps

The case study sites represent a wide variety of environmental characteristics and locations. One of the main objectives of the stakeholder workshops was to determine the key conflicts within each case study site and to then utilise that information in other tasks in the project. Once all of the workshops have been conducted, the information collected will be synthesized into commonly occurring conflicts and issues relating to aquaculture development. These will then be mapped against a matrix developed to assess aquaculture and other sectoral issues occurring at national level so as to determine where there are gaps between policy and practice, issues relating to multiple spatial scales, direct competition for space and social aspects. In addition, relevant tools, that are appropriate to address the user-defined issues at the sites as well as the scale and character of the site, will be tested and assessed in the case study locations and their utility documented. This will occur in collaboration with the stakeholders at each site so that a real and practical evaluation of the strengths and weaknesses of the tools together with possible recommendations for improvements can be incorporated into later phases of development. Ultimately it is the aim of the project to make these tools available as part of the AquaSpace toolbox and other educational project outputs.

## Békés County—Hungary



Békés County is located in South-Eastern Hungary. The dominant aquaculture system both in the county and also in Hungary is pond aquaculture. The main pond system is situated in the surroundings of the village Biharugra, which with its 1927 ha, is the third largest fish pond system in Hungary.

A stakeholder consultation process was initiated in the frame of the AquaSpace project with a focus on pond fish farming and its interactions with surrounding environment, conflicts and synergies with other sectors. In a workshop, aquaculture producers, NGOs, authorities, decision makers and academics sat at the same table and discussed the **actual situation** and **future concerns** related to freshwater aquaculture. The main outcome was that all sectors had supporting attitudes towards **pond culture** and it was confirmed that the fish ponds are important elements of the rural landscape and economy. The main bottleneck of further growth in the sector are of **economic** and **market** nature, but there are also **legislative** and **social barriers**. These can be removed by **intensifying the discussion** between farmers, academics, environmentalists and other users of natural resources.

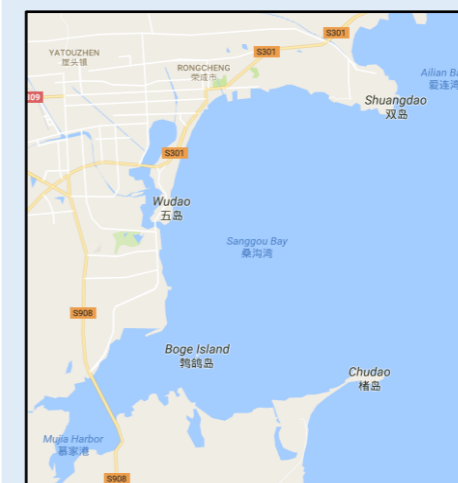
## Normandy/Cancale—France



This case study is located in the north-western part of France. The area does not include the Channel Islands, which are independent and have their own administration.

The Normandy/Cancale stakeholder workshop highlighted issues falling under all four categories of the matrix. Having a very decentralised **governance** system has raised issues relating to development of sites, transparency in the process and time taken to realise a project. There was also the opinion that aquaculture does not always have political support at local and global levels. This may also impact on **public perception** of aquaculture in the longer-term, in the view of workshop participants. **Economic issues** raised were linked to the time taken to start a new production facility coupled with uncertainty surrounding energy and feed costs. There was a strong aspiration for a tool that would facilitate **better planning** which could take into account emerging risks as well as up-to-date **physical and environmental data** directly relevant to aquaculture activities.

## Sanggou Bay—China



Shandong has a coastline of 3,345 km, which is 1/6 of the total of mainland China. The coastal sea provides ample space for marine aquaculture. Seafood production and total revenue exceeds any other province in China.

Sanggou Bay is a semi-enclosed bay located on the eastern tip of Shandong Peninsula, facing the Yellow Sea, with a surface area of 133.3km<sup>2</sup> and an average depth of 8m.

There are more than twenty aquaculture farms in the bay, with a diverse range of culture facilities including longlines for seaweed, lantern nets for scallop and abalone, and net cages for finfish etc. There are also shrimp ponds along part of the coastline of the bay.

A critical finding from the workshop was the impact high density longline culture was having on the **water exchange** rate in the bay and consequent impacts on seaweed aquaculture. This emphasises the need for more effective spatial planning. Reforms to the **regulatory system** have the potential to hinder expansion, hence accentuating the need for **co-existence** and greater **collaboration** between industry and regulators.