



H2020

## TOOL FACTSHEET



### **Tool name**

ArcGIS Visibility Analysis

### **Tool type**

Seascape Visibility Analysis (also referred to as Zones of Theoretical Visibility)

### **Short description of the tool**

The analysis of visibility of features enables the determination of the extent of surface locations (e.g. aquaculture developments) visible to one, or a set of observers. It can be based upon the analysis of individual fish cages, individual aquaculture sites, or across multiple aquaculture sites.

The outputs are reported as:

- i) maps of visibility of features, and estimates of the number of features visible from any given point in a pre-selected viewing distance (e.g. number of fish cages or aquaculture sites visible from any specified location);
- ii) estimates of the extent of the area from which such features are visible.

It is used in three ways:

- i) calculation of a 'visibility census' for an area of interest (i.e. the relative visibility of one place compared to another across a specified area of interest) (Miller and Law, 1997);
- ii) calculation of the geographic extent of views of individual or multiple fish cages, at the level of the individual cages or aquaculture site as a whole;
- iii) calculation of proportions of views occupied by individual aquaculture sites, from specific sites of importance (e.g. designated viewpoints, visitor attractions, sites of significant cultural heritage).

Cumulative assessments of visibility of fish cages or multiple aquaculture sites, for both options ii and iii above. This is to enable the interpretation of the potential significance on the landscape of expanding, or reducing, the extent of aquaculture. Such cumulative assessments are based upon: (i) visual exposure to multiple developments from the one location, considering both the number of sites visible, and the horizontal extent of the view occupied; and, (ii) serial exposure experienced when the observer is moving through the landscape (e.g. on a road, a ferry crossing).

Such regional analysis enables the interpretation of visibility of aquaculture developments with respect to other spatially represented data, such as: designated areas, landscape character, visual receptors (i.e. viewpoints, transport routes, settlements, and prominent topographic features).

Its use is in the formal assessment of the potential environment impact of an aquaculture development, and in public consultations and engagement at which the concept or specific proposal is introduced to public audiences.

Visibility analysis is often used in conjunction with landscape assessments using photomontage and visualisation techniques (Scottish Natural Heritage, 2011).



H2020

## TOOL FACTSHEET



### Source (where/ link)

[www.esri.com/software/arcgis/extensions/3danalyst](http://www.esri.com/software/arcgis/extensions/3danalyst)

[ArcGIS Visibility Analysis](#)

### Licence cost or other type of costs (e.g. maintenance)

Licences are user and country dependent. For use in the Argyll and Bute case study (UK), software was used under an academic licence, c.£1,250 per annum for 50 users (c. 95% discount on commercial licence). For details contact national representatives.

### General requirements (technical and input data)

Input data:

Terrain - Digital Terrain Model of the area of interest, extending to an appropriate distance surrounding the area, equating to the maximum viewing distance used.

Features of interest – Locations of features, such as individual fish cages in an aquaculture development, and vertical dimensions of these features.

Note: The output scale of the analysis will inform the spatial resolution of the input terrain data and parameters (e.g. viewing distance, features and observer heights).

### Management dimension for which the tool could be used

- Policy / Management
- Environmental
- Economic / Market
- Other sectors

### Main functionality

- |   |   |
|---|---|
| <input checked="" type="checkbox"/> Site identification | <input checked="" type="checkbox"/> Modelling                     |
| <input checked="" type="checkbox"/> Mapping             | <input checked="" type="checkbox"/> Stakeholder engagement        |
| <input type="checkbox"/> Economic analysis              | <input checked="" type="checkbox"/> Ecosystem services assessment |
| <input checked="" type="checkbox"/> Scenario analysis   | <input checked="" type="checkbox"/> Other: (Please specify)       |

Environmental Impact Assessment (Landscape and Visual Impact Impacts)



H2020

## TOOL FACTSHEET



### **Fields of application (i.e. issue to be solved)**

Environmental Impact Assessment (Landscape and Visual Impact Assessment) of proposed aquaculture development, which is to assess the potential impacts of aquaculture development on the visual landscape. This is to comply with regulations under the EC Environmental Impact Assessment Directive (85/337/EEC, amended [2014/52/EU](#); European Union, 2014), as implemented in national or regional legislation.

Visibility analysis is used in the assessment of the potential visual impacts of proposed developments. Such assessments are based upon the extent and location of theoretical views of developments with respect to selected viewpoints (as agreed with relevant authorities), and visual receptors (e.g. designated landscapes, recreation features, housing and transport).

### **Circumstances in which it can be implemented (strength and opportunities)**

The analysis of visibility of aquaculture sites is a requirement in best practice for assessing potential visual impacts on landscapes and seascapes in several countries (e.g. UK). The outputs are well-proven and widely accepted by planning authorities and relevant regulatory agencies when considering proposals for aquaculture development.

The tools are transferrable across geographic areas and jurisdictions. It is a desk-based task with no explicit expectation of field verification. The significance of the 'Theoretical Zone of Influence' is that the analysis assumes a 'bald' earth surface (i.e. excluding the vertical dimension of land use features (e.g. trees, buildings). Therefore, the absence of data on surface details is not a constraint on the use or validity of the tool.

The outputs can be used directly in cartographic products for communicating the results. These can be in paper or digital media, and combined with other spatial data of relevance to the planning process, including public consultations. In Aquaspace, this includes the incorporation of such data into visualisation tools (e.g. Google Earth, augmented reality tools).

### **Limitations**

Constraints on the analysis are:

1. Data - no Digital terrain Model available of a suitable quality (i.e. accuracy, horizontal and vertical resolution);
2. Audiences - requirement to explain a 'bald surface' for public audiences (i.e. why features that restrict views are excluded, leading to an overestimate of the spatial extent of estimates of visibility);
3. Data processing – a long processing time for the calculation of a visibility census, or visibility of a large number of features (e.g. fish cages within a large geographic region, or at different periods of time).

### **Technical skills needed to operate the tool**

Skills are required in the handling of spatial data, and knowledge of the use of the specific software tools and associated underlying assumptions. Skills in the use of the outputs (e.g. cartography, visualisation) are an advantage to enable their most effective use.



H2020

## TOOL FACTSHEET



### **Background knowledge needed to implement the tool**

Correct implementation of the tool requires knowledge of the spatial resolution and scale of the required outputs, and the significance of decisions about parameter settings for the input data. For example, understanding of the basis of the calculation of a 'visibility census' of the area of interest, requires understanding of the factors to be considered when selecting the viewing distance, the spatial intervals for the grid of viewing targets, and the practicalities of running processing over prolonged periods of time.

Skills in engagement with relevant stakeholders are required if there is a need for negotiating the selection of viewpoints of significance for calculations of the visual influence of aquaculture developments, and explaining the significance of findings to developers, planners and the public.

### **How can the tool contribute to the EAA**

Please select the EAA steps that the tool can contribute:

1.  Scoping
2.  The identification of issues and opportunities
3.  Prioritisation of issues
4.  Objectives
5.  Management actions
6.  Monitoring

### **How can the tool contribute to the MSP**

Please select the MSP steps that the tool can contribute:

1.  Define goals and objectives
2.  Gather data and define current conditions
3.  Identify issues, constraints, and future conditions
4.  Develop alternative management actions
5.  Evaluate alternative management actions
6.  Monitor and evaluate management actions
7.  Refine goals, objectives and management actions



H2020

## TOOL FACTSHEET



### AquaSpace case studies in which it has been implemented

**Case study name:**

Argyll and Bute, UK

**Reference and link to case studies report:**

Aquaspace D4.2 on [www.aquaspace-h2020.eu](http://www.aquaspace-h2020.eu) Library/Reports page

### Other bibliographic references

ESRI 2017. [ArcMap: An overview of the Visibility Toolset](#), ArcGIS for Desktop, ESRI.

European Union 2014. [Directive 2014/52/EU of The European Parliament and of The Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment](#), Official Journal of the European Union, L124/1, 25/4/2014.

Miller, D.R. and Law, A.N.R. 1997. [The mapping of terrain visibility](#). The Cartographic Journal, 34(2) 87-91.

Miller, D.R. and Morrice, J.G. 2001. [A Geographical Analysis of the Intervisibility of the Coastal Areas of Wales for Characterizing Seascapes](#). Final report for Maritime Ireland/Wales INTERREG 1994-1999. pp.55.

Scottish Natural Heritage 2011. [The siting and design of aquaculture in the landscape: visual and landscape considerations](#). Scottish Natural Heritage, pp 57.

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