

Tools for Assessment and Planning of Aquaculture Sustainability



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DELIVERABLE 8.4

Aquaculture Sustainability Decision Support Tool

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SUMMARY

This report provides an overview of Aquaculture Toolbox developed in the EU H2020 TAPAS (Tools for Assessment and Planning of Aquaculture Sustainability) project. The toolbox has been developed with a focus on the end-user experience and it should be intuitive and easy to use.

It aims to help in communicating the needs for licensing of European aquaculture now and in the future, and to inform the “conversation” between all stakeholders for implementing an improved approach to aquaculture governance in line with potential future EU policy.

There are a number of different elements within the toolbox which is structured around an eight-stage licensing process. This has been established based on the knowledge gained within the TAPAS project and consultation with stakeholders and potential end-users. The toolbox is designed for both aquaculture producers and decision-making authorities such as regulators.

The Aquaculture Toolbox is available here: <https://toolbox-tapas.s1.umbraco.io/>

TABLE OF CONTENTS

Contents

1. Introduction	4
2. Aquaculture toolbox	5
2.1. Home page	5
2.2. Aquaculture page	5
2.2. Licensing process	7
2.3. Modelling tools	10
2.3. Guidance tools	12
2.4. Case studies	14
3. References	16



1. Introduction

The Tools for Assessment and Planning of Aquaculture Sustainability (TAPAS) project aims to investigate the bottlenecks to aquaculture licensing and suggest improved approaches to support more transparent and efficient licensing, supported by cost-effective management tools. The Aquaculture Toolbox is one of the key outcomes from the project, it is a decision support system that can be used to help regulatory authorities establish a more streamlined approach to licensing.

It aims to help in communicating the needs for licensing of European aquaculture now and in the future, and to inform the “conversation” between all stakeholders for implementing an improved approach to aquaculture governance in line with potential future EU policy.

The toolbox has undergone testing with a range of stakeholders and has been updated and revised based on their feedback and comments. The backend of the toolbox is described in TAPAS Deliverable 8.2 (Kaas and Middelboe, 2019). The toolbox includes input from WPs 2, 3, 4, 5, 6, 7 in the form of the modelling tools, guidance tools and case studies. The regulatory review and stakeholder consultation in WP2 has led to a number of important recommendations (Kane et al., 2017; O’Donohoe et al., 2019) which have been used within the toolbox. Furthermore, the knowledge and information gained in all work packages throughout the project has helped shape the toolbox so it focusses on the needs of the end users.

This document describes the Aquaculture toolbox and the main sections that are included. Some of these sections link together and can be accessed from a number of different routes. The Aquaculture Toolbox can be expanded and populated with additional tools and additional knowledge when available.

2. Aquaculture toolbox

2.1. Home page

The home page has been designed to show the main component of the toolbox which is the licensing process, but also show why the toolbox is useful for developing European aquaculture sustainably (Figure 1). From here, the users can go straight into the licensing process or can access pages from the individual links on the top of the page.

The screenshot displays the home page of the Aquaculture Toolbox. At the top, a navigation menu includes links for AQUACULTURE, LICENSING PROCESS, MODELLING TOOLS, GUIDANCE TOOLS, CASE STUDIES, MAPS, CONTACT, and HELP. The main content area features a large image of fish and shellfish. A central text box reads: "AQUACULTURE TOOLBOX. This toolbox contains guidance and tools to support planning and licensing of aquaculture in Europe." Below this are three columns: "European Aquaculture" (with a lake image and text about EU production), "Sustainability" (with a coastal image and text about food security and environmental challenges), and "The Toolbox" (with a logo and text about the toolbox's purpose). A "STAGES OF THE LICENSING PROCESS" section follows, showing an 8-step flowchart: 1. Location, 2. Licences, 3. Pre-application, 4. Application, 5. EIA, 6. Consultation, 7. Decision, 8. Compliance. A "Get started" button is positioned below the flowchart. The footer contains "TOOLBOX AQUACULTURE" branding, contact information, a description of the TAPAS project, and the European Union flag.

Figure 1: Home page of the Aquaculture Toolbox.

2.2. Aquaculture page

One of the aims of the Aquaculture Toolbox is to increase transparency and improve public perception of aquaculture. Therefore, an aquaculture information page has been included (Figure 2), which can be accessed from the toolbar at the top of the site. The page provides information on why European aquaculture is important and the sustainability challenges. It also highlights how the Aquaculture Toolbox can support planning and management of the industry.

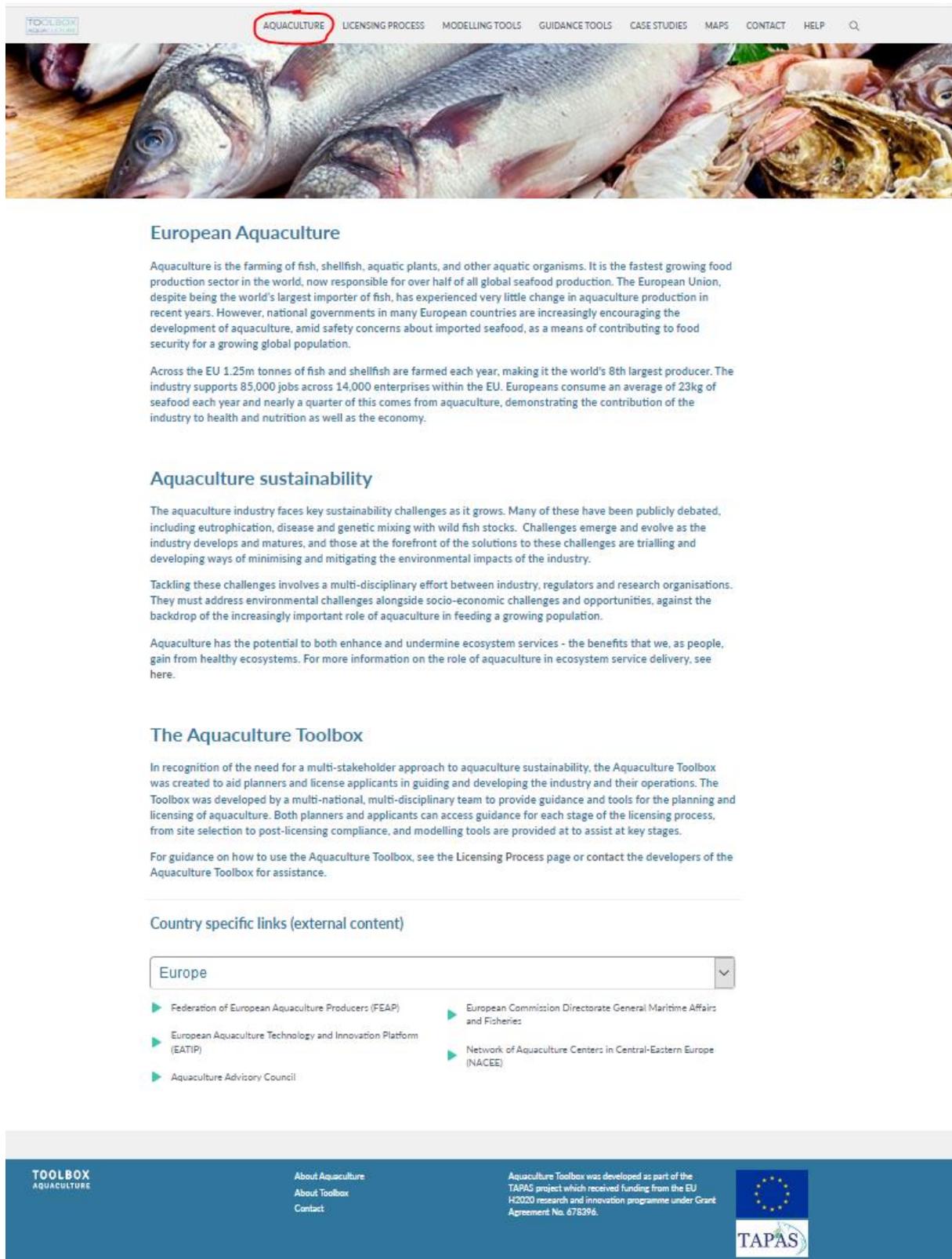


Figure 2: Aquaculture page within the toolbox

At the end of the page there is a section which is called country specific links (Figure 3). Here, users can select a country of interest and then find relevant links (producer organisations, statistic pages and aquaculture information websites). Europe is also included and people can find information on

European organisations and websites that may be of interest. Other parts of the toolbox have similar sections, where users can select a country and find links to relevant information.

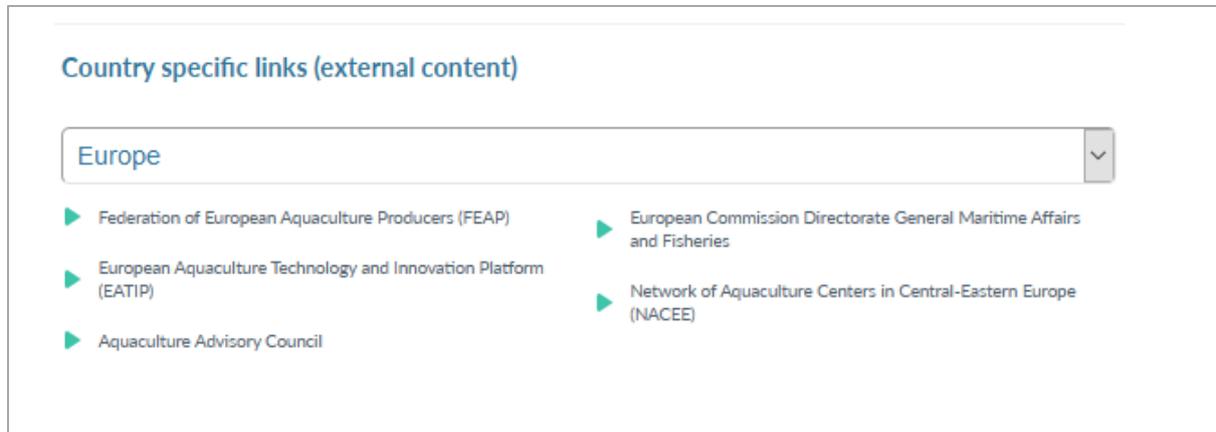


Figure 3: Country specific links within the Aquaculture page of toolbox

2.2. Licensing process

The main focus of the toolbox is the licensing process and this forms a core part of the structure (Figure 4). The steps within the licensing process have been established following a series of stakeholder consultations as part of WP2 and discussions with experts as part of WP8 to establish a process that support more efficient and cost-effective licensing if implemented and supported by relevant member states. Within TAPAS, the toolbox is proof-of-concept and provides more of a general approach to indicate how it could be established and applied. It could be taken further by the EU (e.g. DG MARE) or individual member states and further tailored to their needs. The licensing process is divided into eight steps:

- Location
- Licences
- Pre-application
- Application
- EIA
- Consultation
- Decision
- Compliance

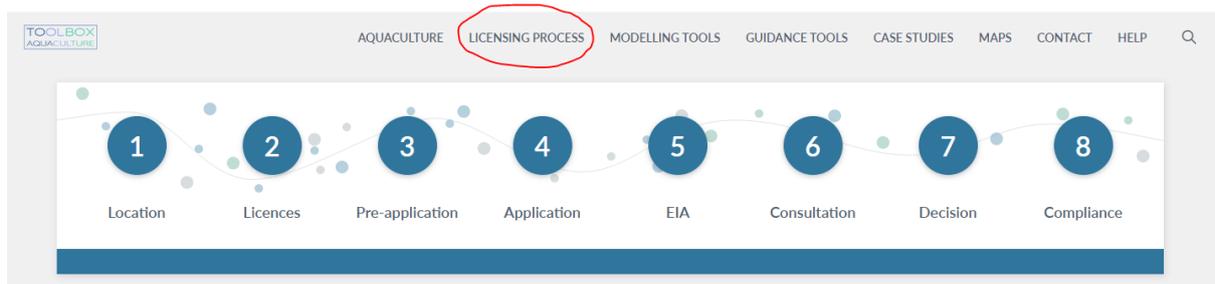


Figure 4: The licensing process which is used within the Aquaculture toolbox

A similar structure is used for each section and recommendations for decision making authorities and aquaculture producers. Information relevant for decision making authorities is given on a grey background and information for aquaculture producers is on a blue background (Figure 5). Figure 6 shows an example for one of the stages of the licensing process, 'Licences; which considers the number and type of licences that must be obtained as part of the planning process. When testing with potential end-users, they expressed a desire for concise pages which were not full of text and were easy to navigate. Therefore, the text is limited to the essential information and if more detail is required then links to more comprehensive documents or pages are provided.

DECISION MAKING AUTHORITIES

Text and recommendations with a dark grey background are aimed at regulators and licensing authorities. This can be used by regulators and licensing authorities to set-up or revise a licensing process. Some sections will be more relevant than others depending on experience and the status and maturity of the aquaculture sector in a given country.

To facilitate the process, we recommend regulatory authorities appoint an Aquaculture Liaison Officer who would provide guidance and be the primary contact throughout the licensing process.



APPLICANTS (AQUACULTURE PRODUCERS)

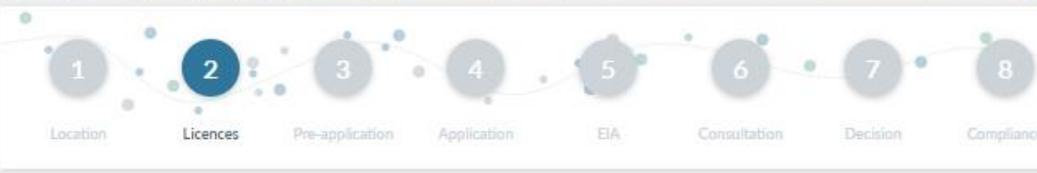


Text and recommendations with a blue background are aimed at the prospective applicant (producers, consultants and industry representatives). Producers must follow the licensing process that has been established for a particular jurisdiction, but the process here provides a general guide about effort and resources required, as well as some of the issues that may be encountered. Some sections will be more relevant than others depending on experience and the status and maturity of the aquaculture sector in a given country.

To facilitate the process, we recommend prospective applicants, or their representative, contacts the regulatory authority in advance of an application to ensure all requirements are met.

Figure 5: Within the toolbox, information relevant for decision making authorities is given on a grey background and information for aquaculture producers is on a blue background





Licences

In most countries, a number of licenses or permits are required before an aquaculture system can be established in a specific location. The number and type of licenses will vary depending on the species, system and area.

The Licensing process described here refers to the planning process and the general steps required to obtain planning permission and a permit to establish an aquaculture farm. The names and terminology may be different depending on the jurisdiction but content is relevant throughout Europe and can be adapted and applied to specific cases. It is important to remember that other permits or licences may also be required once a farm has been established.

RECOMMENDATIONS FOR DECISION MAKING AUTHORITIES

Some countries may not have a licensing system for aquaculture or may wish to revise their process. The first step should be a review of existing legislation to identify where licence applications are delayed at present and what the bottlenecks are. This will allow authorities to identify bottlenecks and consider how the process may be streamlined.

Details



RECOMMENDATIONS FOR APPLICANTS (AQUACULTURE PRODUCERS)



Aquaculture producers should identify all licences they will require to establish their site. This includes planning permission and discharge consents as well as any other licences that may be specified by the regulators. It is recommended that producers contact the Aquaculture Liason Officer at the earliest opportunity to establish what the licences are, the approximate cost and a timeframe for setting up a site.

Relevant guidance documents

 <p>Aquaculture Licences and Permits PDF</p> <p>Location, Pre-application, Application, Compliance, EIA, Farm level, Coastal or catchment, National, Shellfish, Freshwater cages, Ponds, Marine cages, IMTA</p>	 <p>E-Licensing PDF</p> <p>Application, Farm level, Shellfish, Freshwater cages, Ponds, Marine cages, IMTA</p>	 <p>Review of Licensing and Regulatory Processes PDF</p> <p>Application, Compliance, EIA, Pre-application, Location, Farm level, Coastal or catchment, National, International, Shellfish, Freshwater cages, Ponds, Marine cages, IMTA</p>
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Figure 6: The 'Licences' page within the licensing process of the Aquaculture Toolbox

2.3. Modelling tools

A section on modelling tools which can be used to support the planning and licensing process can be accessed from the toolbar or from relevant sections within the licensing process. The Modelling tools page (Figure 7) contains a number of relevant tools for the different types of aquaculture found in Europe. The search box can be used to restrict tools to those of relevance to the end-user by selecting the criteria they are interested in. Users can look through the thumbnails which provide brief information on the modelling tool. By clicking on the link they can get more information in a dedicated page which follows the same structure for each tool (e.g. Figure 8). There is a short overview and then more specific details which support decision on whether or not the tool is appropriate for the user's needs. Some tools are available to download directly within the toolbox, others have a link where they can be downloaded free or for a fee from the developer.

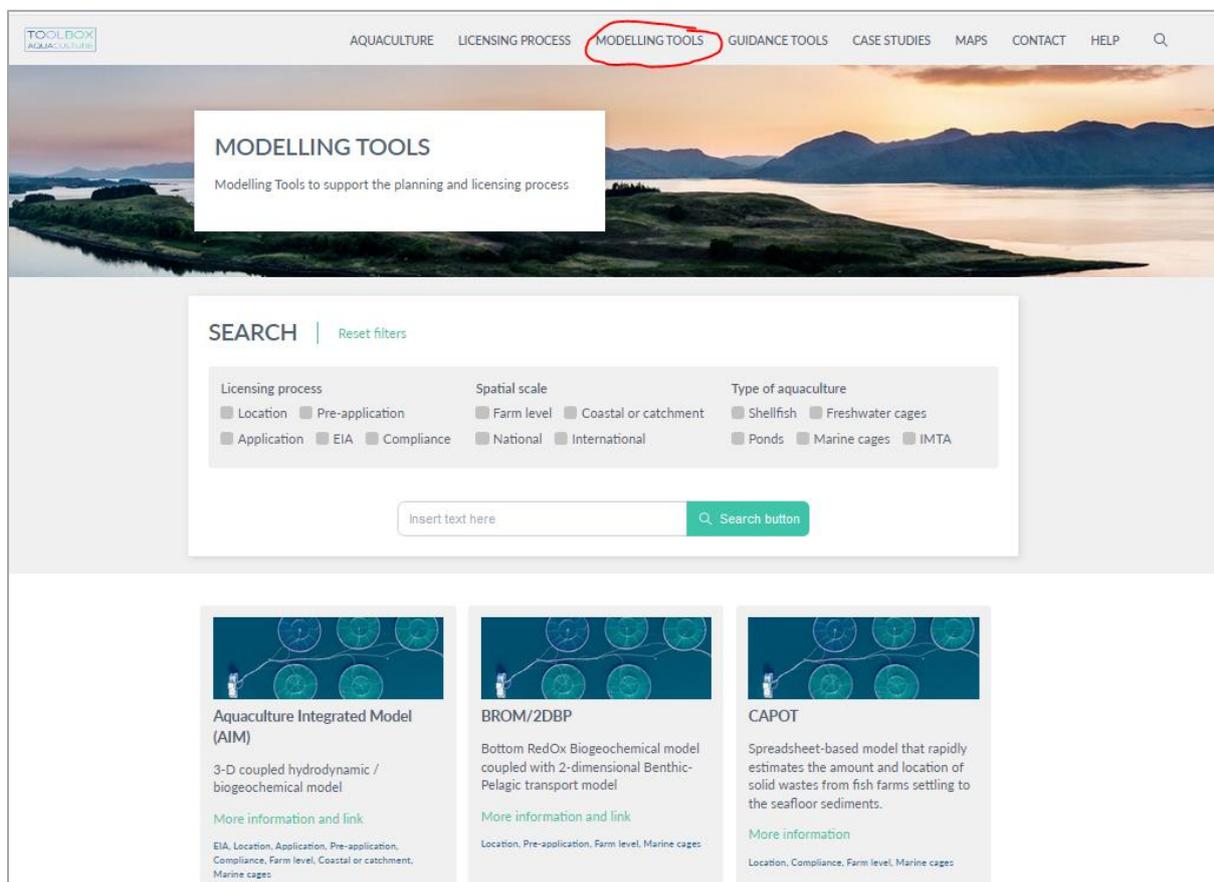


Figure 7: The Modelling Tools page within the Aquaculture Toolbox

Aquaculture Integrated Model (AIM)

The Aquaculture Integrated Model (AIM, Tsagaraki et al., 2011), developed at Hellenic Centre for Marine Research (HCMR), is based on a complex generic biogeochemical model, coupled to a 3-D hydrodynamic model and has been applied to study the effect from aquaculture waste in different areas of the Mediterranean Sea (Tsagaraki et al., 2011; Petihakis et al., 2012). A series of nested models is used to consistently downscale the hydrodynamics and biogeochemistry from the coarser resolution (~few kilometres) model of the wider area to the high resolution model (~few tens of meters) of the fish farm area. The amount of nutrients entering the environment from the fish cages is calculated using a mass balance approach. The model produces maps of near surface currents, Chl-a, dissolved inorganic nutrients (phosphate, nitrate, ammonium, silicate), plankton biomass and production that can be used to calculate different indicators describing the environmental status in the area, proving a tool for the sustainable management of the AAZ. This tool will offer significant assistance and know-how in decision making, giving the ability to objectively look at a series of parameters, make predictions about environmental impacts, designing reliable monitoring protocols and analyse scenarios in order to further good practices in management and development.

Developed by Hellenic Centre for Marine Research (HCMR).

OVERVIEW

Suggested users: Aquaculture producers, regulators, certifiers, spatial planners, researchers.

Format: Multiple modelling approaches, computer code, large computer model run on supercomputers

Cost: Not available for purchase but is available as a service (contact: George Triantafyllou, gt@hcmr.gr, Hellenic Centre for Marine Research)

Data requirements: Bathymetry data and initial fields for temperature, salinity and dissolved inorganic nutrients are required for the initial model setup. These are usually found from available sources (databases, model outputs etc) and customize for the specific application. Fish feed data from the existing farms are also obtained to compute the fishfarm wastes.

Additional inputs: (currents, inorganic nutrients, Chl-a) and remote sensing (SST, Chl-a) data are also used for model validation.

Time requirements: Months for initial model setup, customization, testing and validation, and days for model application

Required resources: Fortran programming language to compile the code and computer server to run the model.

Prior knowledge: Some technical (computer) and scientific expertise is needed in order to apply the tool (run model simulations) and interpret the model outputs.



Relevant links

▶ [Portal](#)

▶ [Example \(PDF\)](#)

Scientific papers and relevant literature

Petihakis, G., Tsiaras, K., Triantafyllou, G., Korres, Tsagaraki, T.M., Tsapakis, M., Vavillis, P., Pollani, A. and Frangoulis, C. 2012. Application of a complex ecosystem model to evaluate effects of finfish culture in Pagasitikos Gulf, Greece. *Journal of Marine Systems*, 94, 565-577.

Tsagaraki, T.M., Petihakis, G., Tsiaras, K., Triantafyllou, G., Tsapakis, M., Korres, G., Kakagiannis, G., Frangoulis, C. and Karakassis, 2011. Beyond the cage: ecosystem modelling for impact evaluation in aquaculture. *Ecological Modelling*, 222(14): 2512-2523.

Figure 8: Example of a tool page within the Aquaculture Toolbox

2.3. Guidance tools

A section on guidance tools and documents which can inform aquaculture producers and/or decision making authorities about different aspects of the planning and licensing process can be accessed from the toolbar or from relevant sections within other parts of the toolbox. The Guidance Tools page (Figure 9) contains downloadable pdf documents which cover a particular aspect and provide recommendations or guidance on that topic (e.g, Figure 10). The search box can be used to restrict tools to those of relevance to the end-user by selecting the criteria they are interested in. Users can look through the thumbnails which provide brief information on the guidance tool. There is a not a specific template for these documents as some topics require more in depth information than others. They are available as pdf downloads as the end users suggested this was most useful for them.

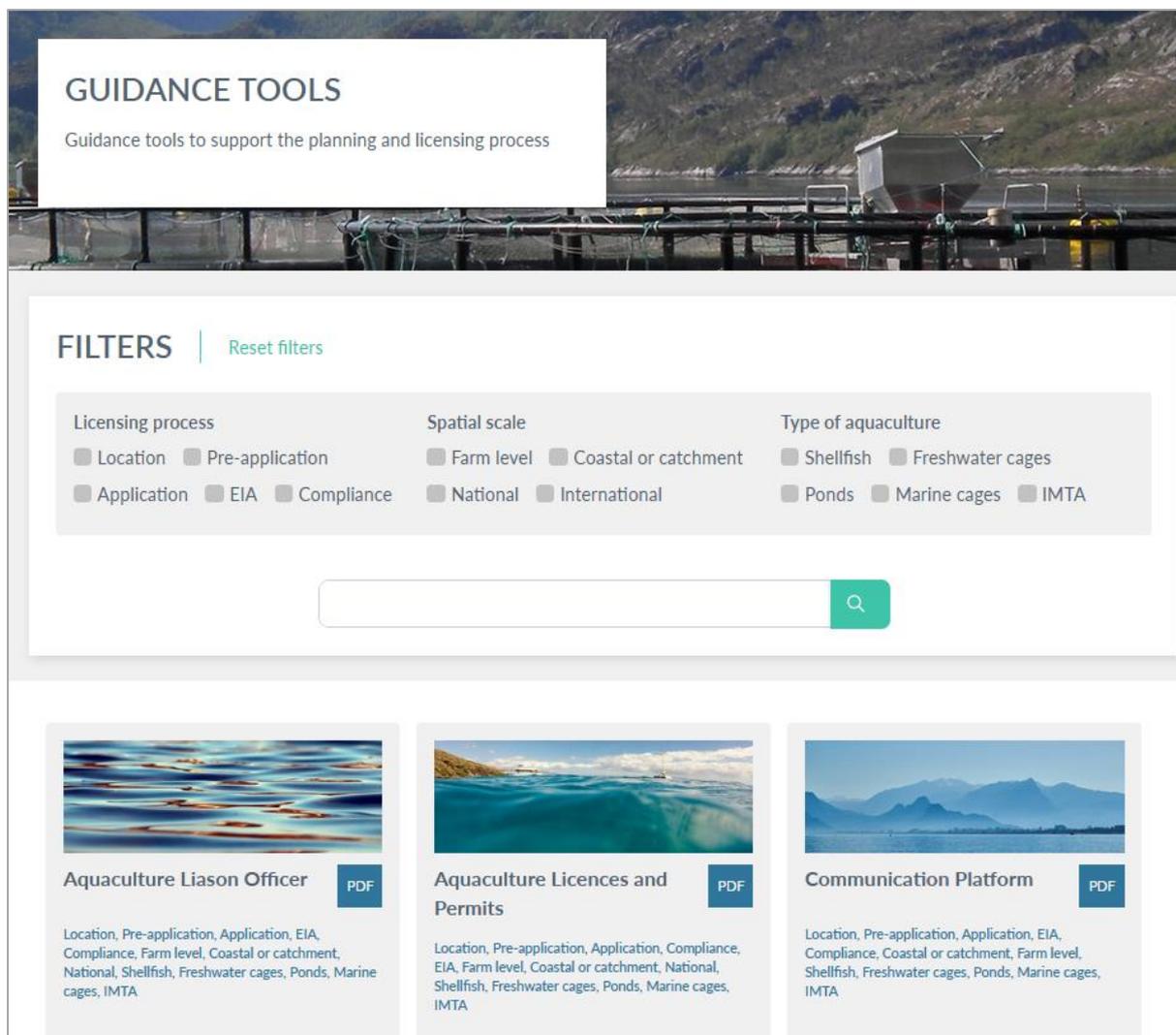


Figure 9: The Guidance Tools page within the Aquaculture Toolbox

2.4. Case studies

The case studies section demonstrates how modelling tools or guidance can be applied to support decision making within aquaculture. The case studies Page (Figure 11) can be accessed from the toolbar or other sections within the toolbox. The search box can be used to restrict case studies to those of relevance to the end-user by selecting the criteria they are interested in. Users can look through the thumbnails which provide brief information on each example. The case studies are provided as downloadable pdf documents which cover a topic (e.g, Figure 12). Unlike the guidance tools the case studies have a common template so they are easier for users to evaluate. Each example provides information on the approach, but also a SWOT analysis and a critical consideration of some of the limitations of the approach.

The screenshot shows the 'CASE STUDIES' page within the Aquaculture Toolbox. The navigation bar at the top includes 'AQUACULTURE', 'LICENSING PROCESS', 'MODELLING TOOLS', 'GUIDANCE TOOLS', 'CASE STUDIES' (highlighted with a red circle), 'MAPS', 'CONTACT', and 'HELP'. The main content area features a header with the title 'CASE STUDIES' and the subtitle 'Case studies of the use of modelling and guidance tools'. Below this is a 'FILTERS' section with a 'Reset filters' link. The filters are organized into three columns: 'Licensing process' (Location, Pre-application, Application, EIA, Compliance), 'Spatial scale' (Farm level, Coastal or catchment, National, International), and 'Type of aquaculture' (Shellfish, Freshwater cages, Ponds, Marine cages, IMTA). A search bar is located below the filters. Three case study thumbnails are displayed below the filters, each with a title, a 'PDF' icon, and a list of applicable filters.

Case Study Title	Applicable Filters
Planning and management of Mediterranean fish farming	Pre-application, EIA, Compliance, Farm level, Marine cages
Predicting environmental concentrations of antifoulants released from fish farms	Marine cages, Farm level, EIA, Compliance
Simulating the impact of fish farm wastes on the environmental status in an Allocated Zone of Aquaculture	Marine cages, Coastal or catchment, Farm level, Location, Pre-application, Application, EIA

Figure 11: The Case study page within the Aquaculture Toolbox

3. References

Kaas, H, Middelboe, A.L. 2019. Documentation for Aquaculture Sustainability Toolbox. TAPAS Deliverable 8.2. 16pp.

Kane, F., Casserly, J., Jackson, D. 2017. D8.1 Existing regulatory and licensing frameworks and identification of bottlenecks. TAPAS Deliverable 8.1, pp151.

O'Donohoe, P. Casserly, J. Kane, F. McLoughlin, S. Jackson, D. 2019. Final stakeholder requirement input from WP2. TAPAS Deliverable 8.3. 37pp.

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