

Tools for Assessment and Planning of Aquaculture Sustainability



SHORT TITLE:	TAPAS
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1 SUMMARY

On 15th January 2020, TAPAS project partners and stakeholders attended the TAPAS project closing conference at Scotland House in Brussels.

This document is Deliverable 9.7, the proceedings for the final TAPAS conference, hosted as part of the EU H2020 TAPAS (Tools for Assessment and Planning of Aquaculture Sustainability) project. The conference was held to give partners the opportunity to present the work that carried out during the project, some of the technologies that were developed, and the applications of these to European aquaculture. The Aquaculture toolbox was also explained and demonstrated.

The document includes an introduction to the conference, details of the venue and programme and summaries of the presentations that were given at the conference. It also features pictures of some of the presenting partners. The conference presentations were given by: Laurent Barille (UN), Stefano Ciavatta (PML), Trine Dale (NIVA), Lynne Falconer (UOS), Pierre Gernez (UN), Hanne Kaas (DHI), Arnaldo Marin (UM), Pauline O'Donohoe (MI), Nikos Papandroulakis (HCMR), Andreu Rico (IMDEA), Stefan Simis (PML), Trevor Telfer (UOS) and Manolis Tsapakis (HCMR). Malcolm Beveridge and Paul Tett from the TAPAS project Advisory Board gave a key note talk presentation and moderated open discussions, respectively.

Contents

1	Summary	3
2	Introduction	5
2.1	Introduction to the Conference	5
2.2	Venue, participants	5
2.3	Program	5
3	Aquaculture Toolbox	6
3.1	Theory and reasoning behind the Aquaculture Toolbox	6
3.2	The Aquaculture Toolbox	10
3.3	Application of models to shellfish production	10
3.4	Satellite data and use in European aquaculture monitoring	11
3.5	Does aquaculture provide ecosystem services?	12
3.6	Effective use of models for chemical regulation	12
3.7	Real-time monitoring and data collection for Aquaculture	13
4	Implementing TAPAS recommendations and tools	13
5	References	14
6	Final conference agenda	Error! Bookmark not defined.
7	Presentations	17
7.1	TAPAS Introduction	17
7.2	Aquatic Food Production and the Blue Economy	21
7.3	Bottlenecks, Policy Recommendations and Informing EU Policy	26
7.4	The Sustainability Toolbox	28
7.5	Application of models to shellfish production	30
7.6	Satellite observation capabilities in European Aquaculture monitoring	34
7.7	Does aquaculture provide ecosystem services?	37
7.8	Effective use of models for chemical regulation	39
7.9	New in situ observation technology	44
7.10	Implementing TAPAS recommendations and tools	47

2 Introduction

2.1 Introduction to the Conference

TAPAS is a four-year EU Horizon 2020 collaborative research project, which began in March 2016. The TAPAS consortium is made up of 15 partner organisations including research institutions, SMEs and regulators from across Europe. The project aims to promote and consolidate the environmental sustainability of the European aquaculture.

Aquaculture is the fastest growing food production sector in the world. However, the EU self-sufficiency in terms of seafood is low, with nearly 70% of the seafood consumed being imported. To turn this situation, EU member states prepared national strategies for an ambitious 25% growth by 2020. The TAPAS project will provide scientific research data about aquaculture sectors in both marine and freshwater environments to sustainably support this action.

The outcomes include the development of the Aquaculture Toolbox, a web-based tool to help decrease the licensing time for new and existing developments, enhance the public image of aquaculture and to gain a better understanding of the sustainability of aquaculture in the EU.

The sustainability of aquaculture must be ensured by applying a holistic view in developments as well as in the management of existing facilities. This method is described in the aspects of the ecosystem approach to aquaculture (EAA) saying that aquaculture activities should always be within the carrying capacity of the ecosystem. The Toolbox includes modelling and monitoring tools to investigate carrying capacity categories of freshwater and marine aquaculture in terms of recent regulation, policies, and indicators of sustainability while remaining focused on the most relevant problems of the aquaculture industry.

On 15th January 2020, project partners and stakeholders attended the TAPAS project closing conference at Scotland House in Brussels. Here, the Aquaculture Toolbox was explained and demonstrated, and partners presented the work they had completed using the tools identified in the toolbox.

2.2 Venue, participants

The final TAPAS conference was held at Scotland House in Brussels, Belgium. The final conference was held for stakeholders and partners. At the conference, partners were able to present the work they had completed during the TAPAS project.

A total of 39 participants attended the final conference. The participant list consisted of partners and stakeholders from research institutions, academia, SMEs, and aquaculture industry.

2.3 Program

The opening session set TAPAS in the context of wider European Aquaculture. This session was followed by a session all about the Toolbox, including a demonstration and an opportunity for attendees to try it out. In the afternoon session partners exhibited the results of their studies

and technological and model development. The session wrapped up in the late afternoon with a presentation about the future implementation of the TAPAS project and a discussion.

3 Aquaculture Toolbox

3.1 Theory and reasoning behind the Aquaculture Toolbox

Trevor Telfer of the University of Stirling opened the conference with a welcome and introduction to the TAPAS project, providing context of aquaculture in Europe and some of the licensing and regulations in Scotland and Norway. The presentation went on to explain how current fragmented approaches to licensing create additional challenges for the future of enhancing the environmental sustainability of aquaculture, and how the aims and objectives of the TAPAS project will help contribute to the sustainable growth of the European aquaculture sector. In a brief breakdown of work packages, participants were also introduced to the case studies and models used across Europe during the project.



Consultant, Malcolm Beveridge explained the need for aquaculture production to increase as part of blue growth, in order to help meet the planet's increasing demand for protein and nutrition. His presentation also stressed the need for this growth to be managed so that it can be done sustainably. Some of the key areas highlighted by Malcolm were alternative sources for aquafeeds, implementing of the UN code of conduct for responsible fisheries and adoption of new model technologies, such as cellular aquaculture.



Per capita fish supplies have doubled over the past half century. Much of this can be ascribed to the recent, rapid expansion of aquaculture, which now accounts for half of all fish and shellfish consumed. Aquaculture has the potential not only to address supply-demand gaps but also many of the Sustainable Development Goals, including those on poverty, hunger, health, work, climate and the aquatic environment.

This presentation focuses on aquaculture and food and nutrition security. However, it also highlights that for aquaculture to fully realize its potential to meet the SDGs there must be a shift away from the current prevailing narrative of the sector's role in fish supplies.

The various sectors that comprise the Blue Economy have different associated costs and benefits. Countries must consult widely and adopt a strategic multi-sector approach in order to determine the role of the aquaculture sector within the Blue Economy. In some countries sectoral expansion may be limited because essential resources, such as space, are to be preferentially allocated to other sectors. Elsewhere, growth of aquaculture SMEs may be prioritised over that of multinationals in order to generate greater local economic impact. In yet other parts of the world growth of aquaculture may be guided to improving resilience to climate change or helping provide food-based solutions to poverty and hunger.

With nearly 90% of wild fish stocks fully or overfished, it is widely believed that future growth in supplies must come from aquaculture. However, new, disruptive 'clean fish' technologies are also under rapid development. Three-D printing of fish produces contaminant free products that require little land or water, no fishmeal or fish oil, pose no welfare issues and produce little in the way of greenhouse gases.



Pauline O'Donohoe from The Marine Institute in Ireland presented policy recommendations and the future of EU policy for aquaculture, based on bottlenecks that already exist in the application process.

Following three phases of consultation with industry, regulators and relevant stakeholders the bottlenecks facing the development and advancement of the European Aquaculture industry were identified through Work Package 2 of the TAPAS project.

These bottlenecks included:

- The time taken to determine a licence decision.
- Poor communication with, within and between decision makers.
- Negative perception of the industry.
- Lack of political will to support or expand the aquaculture industry.
- Costs involved in applying for a licence vary significantly across jurisdictions.
- National and EU - legislation and regulatory frameworks are complex, both on an EU and a national level.
- The number of licences varies between jurisdictions in terms of licences, permits, registrations, and other authorisations, which can be a significantly high number when totalled.
- The Term and Ownership of licence was found to be too short which makes planning, investing and operating a business difficult.
- Amending / Renewing licence - In many jurisdictions it is equivalent to a new application.
- Policy - The need to implement national policies fully was highlighted.
- Application Complexities - the number of licences required to operate is considered excessive. Simplification of the administrative process is needed.
- Incomplete Applications - incomplete applications and request for further information and surveys during the process leads to time delays and increases the duration of the process.
- Decision making - the process is complex, with Multiple agencies/Multi-level governance involved.

During consultation recommendations were drawn up to help alleviate these bottlenecks. As follows:

- Develop a modern electronic licensing system focused on the provision of:
 - Formal timelines with real-time tracking.
 - Accessible guidance and procedural information for all users.

- Enhanced communication.
- Flexibility to support new and emerging technologies.
- Provide clear guidance for quantifying impact and balancing risk, with accessible and understandable tools to assist in quantification and risk assessment.
- Develop and improve tools and environmental models, making them accessible to industry and planners, to assist with site identification, site optimisation and carrying capacity assessment.
- Carry out real time, inexpensive, risk focused monitoring to assess the environmental impacts and monitor for potential impacts.
- Level the playing field for costs of applying for, and fees applied to, aquaculture licences, particularly regarding environmental impact statement preparation.
- Streamline aquaculture legislation by condensing the number of licences required to operate (and synchronising validity periods); incorporating operational flexibility into the legal framework and appropriate licence terms to support industry investment and planning, facilitating research using trial licence models.
- Harmonise the implementation of EU regulations by reducing the variation in implementation including harmonising of procedure and requirements for EIS and EIA incorporating reference to the benefits and costs of aquaculture within regulation.
- Encourage the implementation of the National Plans and the amended EIA Directive across jurisdictions to help simplify processes and administration.
- Designate strategic national aquaculture zones as part of spatial plans where risk assessments, capacity and impact studies are carried out on an 'area' approach in advance of issuing licences, balancing considerations of economic growth and environmental protection with cumulative impacts of development.
- Develop local scale, producer lead, communication platforms to facilitate dispute resolution between resource users, enhancing cooperation and developing a forum to represent local producers on a broader regional scale to input into local planning.
- Develop public communication platforms to make monitoring information publically available, providing context, and to provide explanatory information about aquaculture to the media and general public.

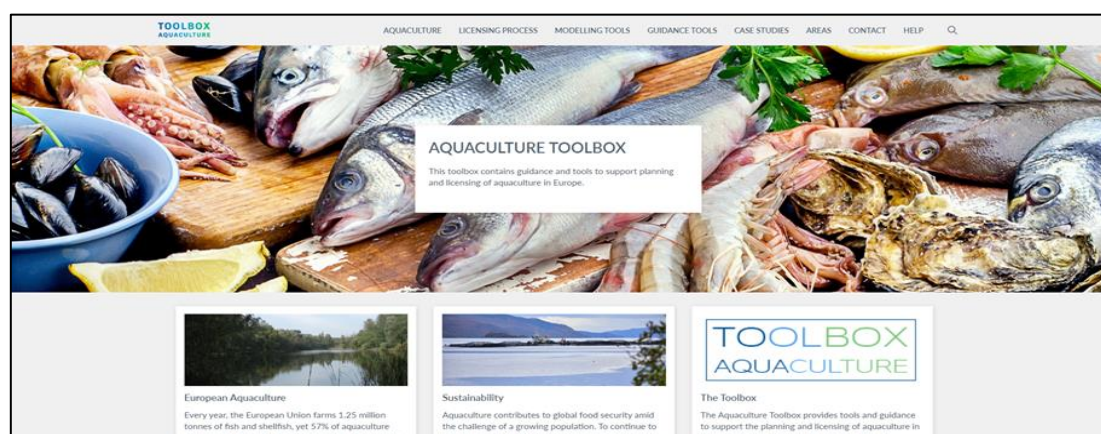
The Aquaculture Toolbox now contains relevant licensing and policy tools for applicants and regulators to aid in the licensing process taking into considerations these recommendations.

3.2 The Aquaculture Toolbox

Hanne Kaas from DHI AS in Denmark, introduced the reasoning behind the Aquaculture Toolbox. The toolbox is a major dissemination platform for TAPAS tools which will communicate the needs for licensing of European aquaculture now and in the future, give guidance on best practice in regulation and performance, provide one-stop access to model and guidance tools to support aquaculture planning and management, support the application by examples of use of model and guidance tools and support the “conversation” between all stakeholders. She demonstrated how stakeholder engagement throughout the TAPAS project has helped guide the content for the toolbox, with the most frequently demanded tools being models and those used for spatial planning.



A Toolbox walk-through and demonstration was carried out by Lynne Falconer of the University of Stirling.



3.3 Application of models to shellfish production

Laurent Barille of the University of Nante, France presented information about how models can be applied to shellfish production to map and model growth potential. GIS tools can be used for site selection taking into consideration the current potential and climate-robustness of offshore areas in order to map industry relevant indicators such as days until market weight, conflicts in use of space, food availability and bathymetry. There is increasing demand and limitations for

available space for shellfish cultivation, the models can be used to determine if offshore sites are suitable for bivalve production.

A range of models for shellfish production have been developed and applied as part of the Tools for Assessment and Planning of Aquaculture Sustainability (TAPAS) project (Falconer et al. 2016). They operate at both near-field (defined as the farm to regional water body scale) and far-field (national water body to global scale) levels, for the planning and management of sustainable aquaculture. All relevant models for European shellfish production integrate a spatial dimension and combine organismal energy budget and ecosystem modelling, earth observation and Geographic Information System (GIS). Their spatial resolutions vary from 20 m, for Sentinel 2 observations of the tidal variability over oyster-farming areas (Gernez et al. 2017), to 12 km, for pan-European approaches (Palmer et al. 2019a). Earth observation combined with Dynamic Energy Budget (DEB) models were used to map industry relevant indicators (Palmer et al. 2020). As the increase in and expansion of aquaculture and other human activities in the nearshore coastal environment has resulted in limited available space, extending shellfish production further offshore was considered for France, the UK, and Norway (Palmer et al. 2019b). Offshore shellfish production should be considered as a potential use via the implementation of the 2014 Marine Spatial Planning (MSP) EU directive. Site selection to ensure the feasibility and sustainability of aquaculture investments and activities was identified as a crucial step (Barillé et al. 2020, Falconer et al. 2019). Large-scale zoning has been demonstrated to highlight broad areas of interest, which can be targeted for more detailed or high-resolution investigation for farm-scale siting (Palmer et al. 2019 b). GIS-based Spatial Multi Criteria Evaluation (SMCE) showed that large areas are suitable for offshore shellfish aquaculture despite other existing uses of the offshore coastal area. SMCE tools should be transferred to stakeholders, and particularly to shellfish growers and representatives, to help them participate and self-advocate in the ongoing MSP debate and implementation.

3.4 Satellite data and use in European aquaculture monitoring

Sites that are deemed suitable for aquaculture and where aquaculture is already taking place can be monitored using satellite observation. Stefan Simis (Plymouth Marine Lab, UK) and Stefano Ciavatta (Plymouth Marine Lab, UK) introduced the conference to the use of satellite data in European aquaculture monitoring. There are challenges associated with using satellite monitoring for aquatic environments because of the resolution required to resolve water colour from land/cloud and atmosphere. Medium (300m) and high (10-100m) resolution satellite images can be used to identify harmful algal blooms and provide early warning for fish farming and aquaculture to help prevent losses. Satellite images can also be used to identify cages and aquaculture farm structures and in conjunction with models in order to produce 3D products for aquaculture site selection, monitoring and forecasting.

This presentation covered the major challenges and opportunities associated with satellite observation in the near-coastal inland and inshore aquaculture domains. The advantages of high resolution (land) sensors and medium resolution (ocean colour) sensors were discussed. An overview of water quality remote sensing products (optical-biogeochemical water type zones, chlorophyll-a, turbidity and harmful algal bloom occurrence) is provided, as well as examples of data assimilation between remote sensing and biogeochemical modelling to reach

3D assessment capabilities. The presentation focusses on the use of optical satellite data for water quality retrieval, with additional examples of mapping aquaculture practises using radar (fish cages), and marine pollution (floating debris and vegetation).

3.5 Does aquaculture provide ecosystem services?



Trine Dale from NIVA, Norway, presented the ecosystem services provided by aquaculture in Europe. For extensive shellfish aquaculture these include coastal protection, nutrient removal, improving water clarity, and providing habitat and food. Her talk explained that the ecosystem services provided depend on the type of aquaculture and the

characteristics of the ecosystem where it is located. Sustainability of Aquaculture and the ecosystem services it provides can be improved by minimizing the negative tradeoffs. This can be achieved by good site selection, species diversification and improving farm management and operating practices.

3.6 Effective use of models for chemical regulation

Manolis Tsapakis (HCMR, Greece) discussed how Marine Antifoulant Models can be used to predict the behaviour of antifoulants and aquaculture emissions in the water column and sediment. These models have shown concentrations for both to be higher in the summer months. This is thought to be because there is an increase in antifoulant use in the summer. When compared to data from a Greek case study, the results of the model were validated.

This presentation gave a general overview on the use of veterinary medicines and other potentially toxic substances (heavy metals, antifoulant, disinfectants) in European aquaculture, and described the modelling tools available for assessing their environmental fate and ecological risks. Moreover, the models developed and tested in the three TAPAS case-studies were described. First, there was a general introduction to the hydrodynamic model developed by PML to assess the risks of emamectin benzoate and diflubenzuron in salmon cages located in Norwegian fjords. It is based on the Finite Volume Community Ocean Model (FVCOM) and calculates surface water and sediment concentrations over large areas, enabling impact assessments for several farms at the same time. Second, there was a general introduction to the Spanish case study, where the MAMPEC model was applied to calculate exposure of Cu leaching from antifouling paints in water and sediments from sea-bream and sea-bass farms. Moreover, several monitoring campaigns were used to assess the capacity of biofilms to act as indicators of farm pollution. Finally, the Greek case-study was presented. Similarly, to the Spanish one, the main objective of Greek case study was to validate the MAMPEC model for the chemical regulation of antifouling agents. The model was validated against in-situ data of Cu in the water column and sediment from an Allocated Zone for Aquaculture (AZA) in the Vourlias

Bay. The study shows that that during summer the predicted concentrations of total copper are higher than during winter for the water column and sediment due to the lower flow velocity. Thus, flow velocity is an important factor to reduce antifoulant wastes and their dispersion in the environment both in the water column and sediment. According to the results of this study, the model reproduces reasonably well the observed mean values and gradients for the dissolved copper for each season separately and for the copper in sediment. Thus, the model outputs could contribute to chemical risk assessment based on established threshold limits for water and sediment.

3.7 Real-time monitoring and data collection for Aquaculture

Marnix Laanen (Water Insight, Netherlands) and Nikos Papandroulakis (HCMR, Greece) presented examples of real-time monitoring and data collection technologies for aquaculture operators that were developed within the TAPAS project. These in situ tools can assist daily operations and long term modelling and reporting. Aquaculture Specific Profiler (ASP) are used for vertical profiles of the water from the surface to the bottom of the fish farm. It can provide data about the physical, ecological and chemical water quality with user configurable payload. Meanwhile Autonomous Underwater Vehicles can monitor the integrity of cage material by performing regular inspections of the cage material condition and transmitting alarms if problems (such as tears in the net) are detected.

An optical sensor based observation system with solar panels and 3G connection, called a WISPstation, can be used for ecological water quality measurements by recording radiance and irradiance. It performs continuous and autonomous high-quality spectrometer measurements for water quality which can be used by aquaculture farms and regulatory bodies to assist in decision making.

At the end of the TAPAS project, it has been concluded that the development of an effective AUV for aquaculture netting inspection is achievable and it has the potential to facilitate off-shore aquaculture installations. High-frequency automated water quality monitoring with the WISPstations can provide real time information to aquaculture farms and regulatory bodies to assist with decision making. And finally, today's technology advances can be effectively applied to the Aquaculture Industry, to enhance production and decrease operational costs.

4 Implementing TAPAS recommendations and tools

The implementation of TAPAS recommendations and tools was covered by Trevor Telfer (University of Stirling). The TAPAS project has several outcomes for exploitation including recommendations and guidance for changes to aquaculture policy in Europe; individual tools, models and methods for collecting data and information about aquaculture sites and the Toolbox for European aquaculture, which provides decision support for both producers and regulators. By utilizing these tools and recommendations, national level strategy and policies can be changed and/or developed, contributing to new or existing legislation and license processes,

administrative procedures can be simplified, and European aquaculture can benefit from growth through the coordination of spatial planning.



5 References

BARILLÉ L., LE BRIS A., GOULLETQUER P., THOMAS Y., GLIZE P., KANE F., FALCONER L., GUILLOTREAU P., TROUILLET B., PALMER S., GERNEZ P., 2020. Biological, socio-economic, and administrative opportunities and challenges to moving aquaculture off-shore for small French oyster-farming companies. *Aquaculture* 521, 735045

FALCONER, L., BARILLÉ, L., DABROWSKI, T., GARCIA-BUENO, N., GERNEZ, P., MARIN, A., MØHLENBERG, F., TORRES, R., TRIANTAPHYLOU, G., TSAPAKIS, M., TSIARAS, K., WALLHEAD, P. AND TELFER, T. 2016. Critical Evaluation and Suggestion of Models. EU H2020 TAPAS Deliverable 5.1. Report. 88pp.

FALCONER, L., MIDDELBOE, A-L., KAAS, H., ROSS, L.G., TELFER T.C., 2019. Use of geographic information systems for aquaculture and recommendations for development of spatial tools. *Reviews in Aquaculture* <https://doi.org/10.1111/raq.12345>

GERNEZ P., DOXARAN D., BARILLÉ L., 2017. Shellfish aquaculture from space: potential of Sentinel2 to monitor tide-driven changes in turbidity, chlorophyll concentration and oyster physiological response at the scale of an oyster farm. *Front. Mar. Sci.* 4:137. doi: 10.3389/fmars.2017.00137


PALMER S., GERNEZ P., THOMAS Y. CIAVATTA S., KAY S., BARILLÉ L., 2019a. Pan-european modelling of Pacific oyster (*Crassostrea gigas*) growth in the off-shore environment: indicators, regional comparison and climate change. *Aquaculture Europe 2019*, October 7-10, Berlin, Germany.

PALMER, S., BARILLÉ, L., GERNEZ, P., CIAVATTA, S., EVERS-KING, H., KAY, S., KUREKIN, A., LOVEDAY, B., MILLER, P.I., SIMIS, S., WILSON, R., TSIARAS, K., WALLHEAD, P., KRISTIANSEN, T., STAALSTRØM, A., DALE, T., BELLERBY R., 2019b. Earth Observation and model-derived aquaculture indicators report. TAPAS project Deliverable 6.5 report. 65 pp.

PALMER CJ , GERNEZ P., THOMAS Y., SIMIS S., MILLER P., GLIZE P., BARILLÉ L., 2020. Remote sensing-driven Pacific oyster (*Crassostrea gigas*) growth modelling to inform offshore aquaculture site selection. *Frontiers Marine Science* 6:802. doi: 10.3389/fmars.2019.00802

RICO, A., Vighi, M., VAN DAN BRINK, P.J., TER HORST, M., MACKEN, A., LILLICRAP, A., FALCONER, L. and TELFER, T.C., 2019. Use of models for the environmental risk assessment of veterinary medicines in European aquaculture: current situation and future perspectives. *Reviews in Aquaculture*, 11(4), pp.969-988.

6 Final conference agenda

	<p>Tools for Assessment and Planning of Aquaculture Sustainability : TAPAS (Grant No. 678396)</p> <p>FS-11B-2015. Consolidating the environmental sustainability of European aquaculture</p>
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FINAL TAPAS PROJECT CONFERENCE

[Scotland House](#), Rond-point Robert Schuman 6, 1040 Bruxelles, Belgium

Wednesday 15 January 2020

<i>Approximate time</i>	<i>Title</i>	<i>Presenters</i>
09.00	Arrive and registration	
09.30	Welcome and introduction to the project	Trevor Telfer (University of Stirling, UK)
10.00	Food production and blue growth – the needs	Malcolm Beveridge (Consultant)
10.30	Bottlenecks, policy recommendations and informing EU policy	Pauline O'Donohoe (Marine Institute, Ireland)
11.00	Coffee break	
Aquaculture Toolbox		
11.30	Theory and reasoning behind the Aquaculture Toolbox	Hanne Kaas (DHI AS, Denmark)
12.00	The Aquaculture Toolbox	Lynne Falconer (University of Stirling, UK)
12.30	Lunch – informal demonstration of the toolbox	
13.30	Application of models to shellfish production	Laurent Barille (University of Nante, France)
13.50	Satellite data and use in European aquaculture monitoring	Stefan Simis (Plymouth Marine Lab, UK) Stefano Ciavatta (Plymouth Marine Lab, UK)
14.10	Does aquaculture provide ecosystem services?	Trine Dale (NIVA, Norway)
14.30	Effective use of models for chemical regulation?	Andreu Rico (IMDEA, Spain) Arnaldo Marin (University of Murcia, Spain) Manolis Tsapakis (HCMR, Greece)
14.50	Real-time monitoring and data collection for aquaculture	Marnix Laanen (Water Insight, Netherlands) Nikos Papandroulakis (HCMR, Greece)
15.10	Coffee - networking	
Tie up session and discussion		
15.40	Implementing TAPAS recommendations and tools	Trevor Telfer (University of Stirling)
16.10	Discussion forum	Paul Tett – (SAMS, UK) moderator
17.00	Close	Trevor Telfer (University of Stirling, UK)

7 Presentations

7.1 TAPAS Introduction

TAPAS


This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 678396

'TAPAS'

Tools for Assessment and Planning of Aquaculture Sustainability

UNIVERSITY OF STIRLING, NIVA, PML, hcmr, Marine Institute, AC, ALTERNIA, i-dea, DHI, NACEE, KERRY VETERINARY UNIVERSITY

The TAPAS Project



- University of Stirling (UK) (coordinator)
- NIVA (Norway)
- DHI - DM/AS (Denmark)
- Water Insights BV (Netherlands)
- Altum-Ingeniørgruppen AS (Netherlands)
- Plymouth Marine Laboratory (UK)
- Universidad de Murcia (Spain)
- Université de Nantes (France)
- Hellenic Centre for Marine Research (Greece)
- Szent István University (Hungary)
- AquaBioTech Group Ltd (Malta)
- Marine Institute (Ireland)
- NACEE - Eastern European (Hungary)
- Aquaculture Stewardship Council (UK)
- Fundación Insular Aqua (Spain)

TAPAS

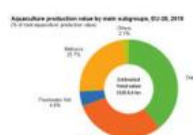
Aquaculture in Europe



TAPAS

Background – Aquaculture in Europe

- EU aquaculture produces 1.3 million tonnes worth € 4.4 billion
- EU aquaculture provides jobs for 39 000 people



Aquaculture production value by water sub-sectors, EU-28, 2018 (2018 total production value)

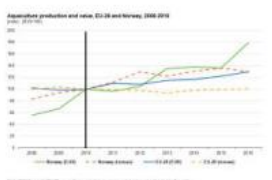
Sub-sector	Value (€ million)	Percentage (%)
Mariculture	1,100	25.0
Terrestrial finfish	1,100	25.0
Terrestrial shellfish	1,100	25.0
Other	1,100	25.0

Source: Eurostat, 2017

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Background – Aquaculture in Europe

- Trends overall: volume stable, but value slowly increasing?
- But compare this to the Norwegian aquaculture sector?
- Why?
- "Bottlenecks" to development
- Regulation, licensing and governance of aquaculture

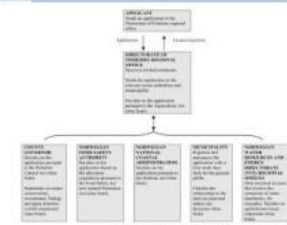


Aquaculture production and value, EU-28 and Norway, 2008-2018 (2018 total value)

TAPAS

Examples of licensing

- One-stop-shop system with a time limit of 22 weeks per application.
- MAB of 780 tonnes/licence within regions 1-9. Regions 10-13 have MAB of 945 tonnes/licence due to reduced growth.
- One licence can be used to operate up to 4 farm sites; farms exceeding MAB can utilise up to six licences within one given farm site.
- Availability dependent on existing production and disease impacts in a given area



Norwegian Ministry of Fisheries and Coastal Affairs, 2005.

TAPAS

Examples licensing

- Five authorities have to be independently contacted as part of the application procedure.
- Processing time takes approx. 112 weeks.
- Rent is paid to the Crown Estate for a seabed lease.
- Currently under review

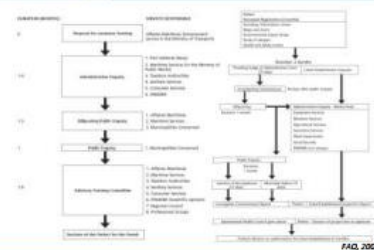


Gordon, 2018



Examples of licensing

- Mainly shellfish. Fish key for expansion
- Different concessions (private or state owned land/sea area)
- Large number of consultees at each stage
- Only one new licence granted in last 25 years

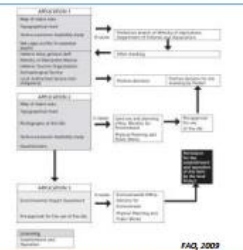


FAQ, 2009



Examples of licensing

- Large number of organisations involved
- Different regulatory and social economic factors taken into account
- Different ministry responsible for each factor, e.g. often 5 or more permits required

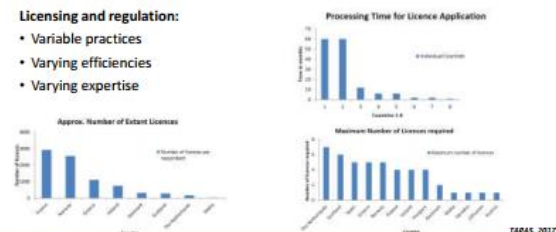


FAQ, 2009



Bottlenecks in licensing and regulation?

- Licensing and regulation:
- Variable practices
- Varying efficiencies
- Varying expertise



TAPAS, 2017



The Challenges for Aquaculture?

- Fragmented approaches to aquaculture licensing and regulation, together with limited availability of suitable areas, are a major barrier to future development and expansion of the aquaculture sector.
- There is a need to support member states to establish more efficient regulatory frameworks and to reduce cost and time of licensing aquaculture farms.
- There is a need to ensure there are appropriate tools, models and approaches available to predict and monitor environmental impacts and also quantify ecosystem services provided by aquaculture.
- There is a need to strengthen environmental sustainability of aquaculture and enhance its image.



Aims and objectives - TAPAS

- Identify sustainability requirements and licensing approaches, and identify bottlenecks hampering cost-efficient licensing and regulatory practices.
- Identify the gap between the availability of and needs for models, modelling and decision frameworks, and critically analyse and refine existing tools and technologies, developing new approaches if needed.
- Assess the environmental services provided by European aquaculture
- Strengthen management practices and develop an Aquaculture Sustainability Toolbox for timely and cost-efficient environmental assessment and regulation



What does the TAPAS offer?

- Improved regulatory frameworks for adoption by Member states
- Improved tools for quantification of environmental services
- Improved spatial planning linked to carrying capacity and sustainability indicators
- Improved, more efficient tools for licensing and aquaculture development
- Improved, more efficient tools for monitoring and prediction of environmental impacts
- Significantly enhanced real time in-situ monitoring linked to early warning and sustainability



The TAPAS Project

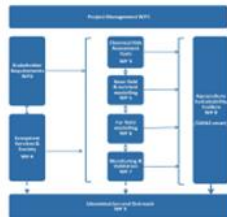
In addition:



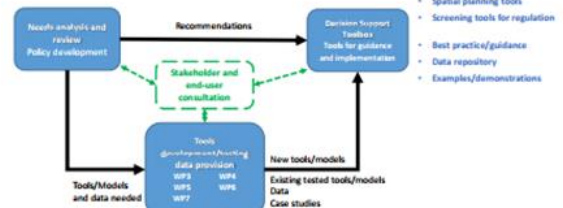
The TAPAS Project

Who is leading what?

- WP1 - Project management (UOS)
- WP2 - Requirements Analysis and Stakeholder Integration (IM)
- WP3 - Environmental Risk Assessment of potentially toxic substances (AL7)
- WP4 - Ecosystem Services and Societal models (MVA)
- WP5 - Near Field Models for regulation and site selection (UOS)
- WP6 - Far Field Models (PMS)
- WP7 - Monitoring and Validation (IM)
- WP8 - Aquaculture Sustainability Toolbox (TAPAS-amor) (DNE)
- WP9 - Dissemination, Outreach and Exploitation (AB7)



The TAPAS project



Case Studies

Production systems throughout Europe:

- Coastal shellfish (France, UK)
- Marine cages (Ireland, Norway, Malta, Greece, Spain)
- Freshwater cages (UK)
- Freshwater ponds (Hungary)
- Recirculating systems (Denmark)
- Marine integrated multi-trophic aquaculture (IMTA) (Ireland, Malta)
- Feed into the WPs for data and validation



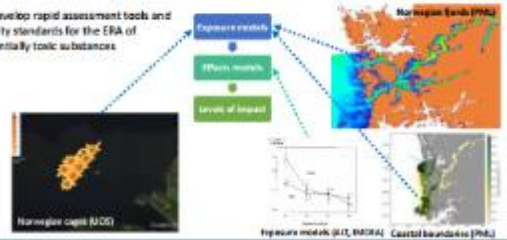
The workpackages, data and tools

Stakeholder consultation process



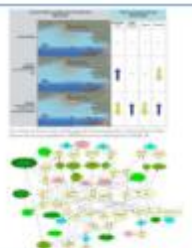
Environmental Risk Assessment

To develop rapid assessment tools and quality standards for the ERA of potentially toxic substances



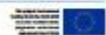
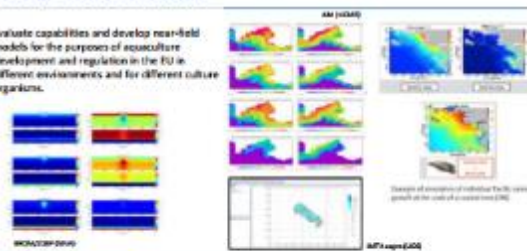
Ecosystem Services

- To build an analytical framework for the assessment of ecosystem services (ES) and benefits provided from European aquaculture
- To identify what trade-offs and possible synergies that exists between aquaculture producing services and other ecosystem services
- To assess how negative trade-offs can be minimised and sustainability improved
- selection of appropriate WPs
- species identification/traits
- adaptation to the farm, operating practices
- To analyse how the knowledge gained from assessment of ES and ES trade-offs can be incorporated into current planning and licensing



Near-field models

Evaluate capabilities and develop near-field models for the purposes of aquaculture development and regulation in the EU in different environments and for different culture organisms.

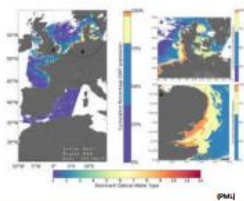


Far-field models

Improve existing approaches to combine Earth Observation and modelling

Develop additional indicators for operational use

Provide relevant far-field models and EO data to the other models and the toolbox



TAPAS

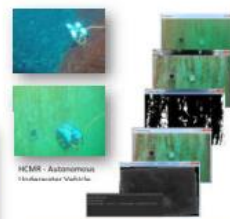
The project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 678396

Monitoring and validation

Establish methods for quality control of the large data streams produced by the automated measurement stations

Develop methods to detect emerging problems with water and sediment quality

Develop methods for using the upcoming Copernicus Sentinel-2 MSI



TAPAS

The project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 678396



Aquaculture Sustainability Toolbox

Aquaculture Sustainability



TAPAS

The project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 678396

TAPAS

The project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 678396



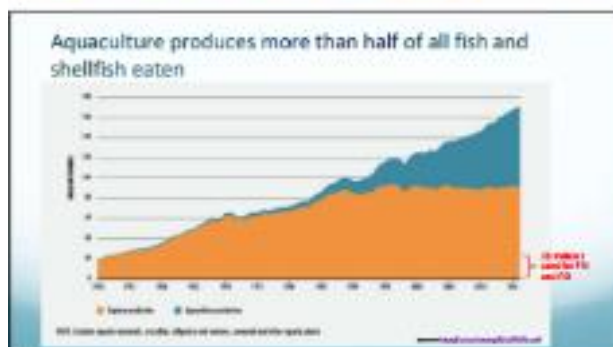
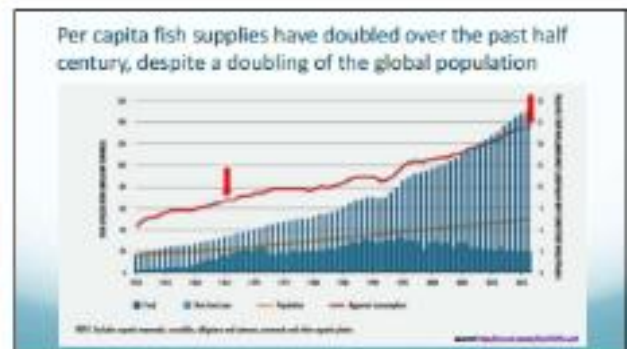
<http://tapas-h2020.eu/>

@tapas_h2020

tapas.h2020EU/



7.2 Aquatic Food Production and the Blue Economy



... will aquaculture be part of the solution ... or a barrier?

Scope of talk

- How important is fish to food and nutrition security?
- Is aquaculture a sustainable way to produce food?
- Aquaculture and food and nutrition security
- Can sector growth meet growing demand and needs?
- Aquaculture and the Blue Economy
- Conclusions ... and some ways forward

... but first, a closer look at fish, fisheries and aquaculture

Fish and shellfish, fisheries and aquaculture



Policy or program description	Study result (NNT) for children
Antenatal (30-40 mg) combined with vitamin	1:120 mg
Vitamin B12 200 milligram per prenatal vitamin tablet	1:100 mg B12
Iron 60 milligram per prenatal tablet	1:60 mg (or 1:100 milligram/oz)
Iron/B12 combined tablet of iron and 10 milligram per prenatal tablet	1:100 mg
Iron 100 milligram tablet (not per prenatal)	1:100 mg (or similar iron supplement)

modified from Langley et al. [2010]

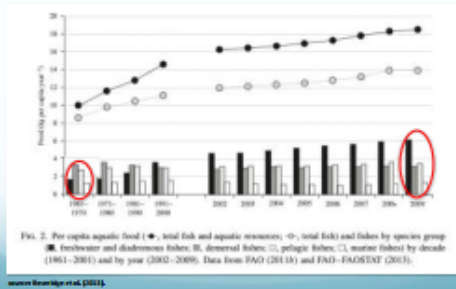
The diagram illustrates the production of 1 kg of feed from various agricultural products. The products and their contributions are as follows:

- Barley grain: 30 kg
- Soy protein: 10 kg
- Alfalfa hay: 10 kg
- Alfalfa standard: 10 kg
- Alfalfa 1: 10 kg
- Alfalfa 2: 10 kg
- Alfalfa 3: 10 kg
- Alfalfa 4: 10 kg
- Alfalfa 5: 10 kg
- Alfalfa 6: 10 kg
- Alfalfa 7: 10 kg
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- Alfalfa 100: 10 kg

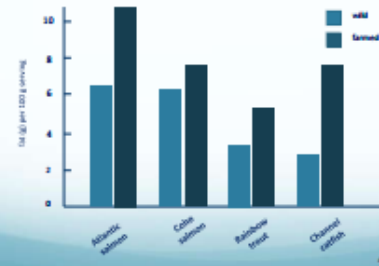
Country	0-14	15-64	65+
USA	~100	~250	~100
Canada	~50	~150	~50
Mexico	~30	~100	~30



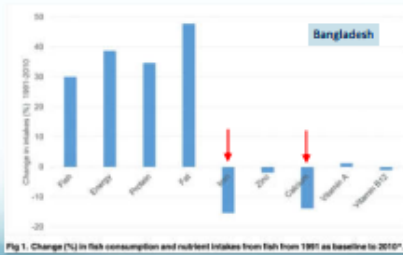
Aquaculture is changing the types of fish we eat



Farmed fish is fatter than wild counterparts

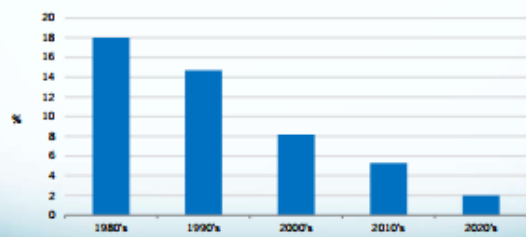


Eating more farmed fish may increase energy, protein and fat intake ... but reduce micro-nutrient intake

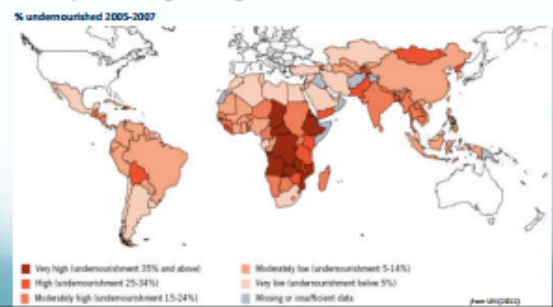


Will aquaculture be able to meet future demand?

Aquaculture growth is slowing ...



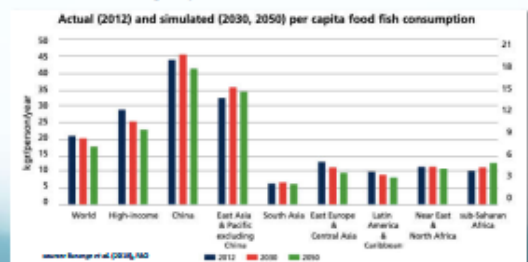
Poverty and hunger are greatest in Africa and South Asia



The world according to aquaculture ...but where's Africa?

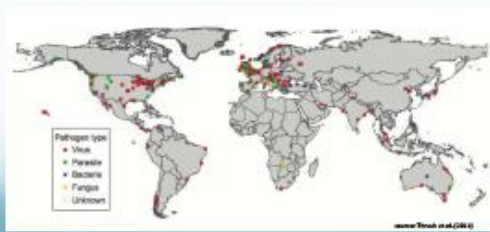


Fish consumption looks OK ... provided you're not poor and live in the right part of the world



Disease shocks could affect aquaculture growth

Incidence of emerging aquatic animal diseases, 2002-2010



Climate change will have geopolitical and economic repercussions, with consequences for food security



- “... population growth is likely to put pressure on fish markets, leading to higher prices...”
- “... higher prices may decrease per capita food fish consumption at world level...”
- although
- “... higher prices should stimulate increases in productivity and efficiency...”

aquaculture and the blue economy

The EU Blue Economy is diverse ... but growing slowly



- Coastal tourism; fishing; mineral, oil & gas extraction; ports, warehousing & water projects; shipbuilding & repair; maritime transport
- Gross operating profit €74.3 billion, 2% higher than in 2009
- Mainly UK, Spain, Germany, France and Italy
- 2% of employment is in the Blue Economy
- Five sectors targeted
 - Aquaculture
 - Coastal tourism
 - Marine biotechnology
 - Ocean energy
 - Seabed mining

Aquaculture's role in EU Blue Economy is small and constrained ...



- 1.5 million t; equivalent to 20% EU fish production
- Employs 85 k people, 20% women
- Key issues
 - lack of maritime space
 - competitiveness in global markets
 - licensing and administration
 - impacts on the environment, incl. wild fish
 - lack of capital

... contributing to a €25 billion European seafood trade deficit



... the Blue Economy is about more than just aquaculture



Ireland anticipates limited sectoral and seeks synergies with other sectors



Norway aims to facilitate development and uptake of new technologies to address key challenges



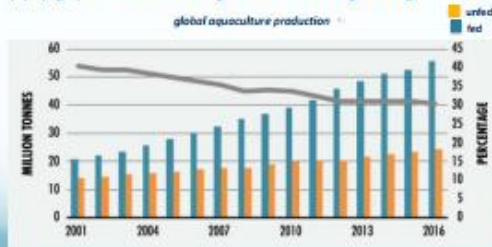
New technology development licenses and green licenses

- offshore systems and semi-closed and closed systems
- Territorial issues - space
- Sea lice and welfare
- Wastes, esp. chemical wastes
- Escapes

source: <https://www.bbc.com/news/health-51000000>

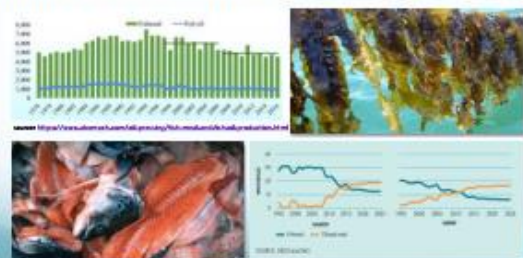
Conclusions – and ways forward

Aquaculture production may be able to fill the demand-supply gap ... but sector growth needs guiding



source: <https://www.fao.org/aquaculture/en/>

Fishmeal and fish oil supplies are declining ... aquafeeds must come from alternative sources



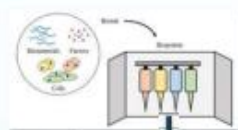
Countries must use incentives to secure the economic, social and environmental outcomes they want



Implementing the UN Code of Conduct for Responsible Fisheries with respect to aquaculture helps ensure sustainability



e.g. BlueNalu ... mission: global leader in cellular aquaculture



- Consistency of product supply
- Fewer external shocks (disease, climate, etc.)
- No blood vessels, no bones ...
- No mercury, no parasites or microplastics ...
- No animal welfare issues

Thank you

Bottlenecks, Policy Recommendations and Informing EU Policy

Pauline O'Donoghue, Marine Institute, Ireland

15.01.2020 Brussels

Bottlenecks

- Time** - The time taken to make a licence decision.
- Communication** - poor communication with, within and between decision makers.
- Public Perception** - negative perception of the industry.
- Political Will** - lack of political will to support or expand the aquaculture industry.
- Costs** - costs involved in submitting an application for a licence vary significantly across jurisdictions.
- Legislation** - National and EU - legislation and regulatory frameworks are complex, both on an EU and a national level.
- Number of Licences** - varies between jurisdictions in terms of licences, permits, registrations, and other authorisations, which can be a significantly high number when totalled.
- Term and Ownership of licence** - too short which makes planning, investing and operating a business difficult.
- Amending / Renewing licence** - in many jurisdictions it is equivalent to a new application.
- Policy** - The need to implement national policies fully was highlighted.
- Application Complexities** - the number of licences required to operate is considered excessive. Simplification of the administrative process is needed.
- Incomplete Applications** - incomplete applications and request for further information and surveys during the process leads to time delays and increases the duration of the process.
- Decision making** - the process is complex. Multiple agencies/multi-level governance.

Recommendations

- Develop a modern electronic licensing system focused on the provision of:
 - Formal timelines with real-time tracking.
 - Accessible guidance and procedural information for all users.
 - Enhanced communication.
 - Flexibility to support new and emerging technologies.
- Provide clear guidance for quantifying impact and balancing risk, with accessible and understandable tools to assist in quantification and risk assessment.
- Develop and improve tools and environmental models, making them accessible to industry and planners, to assist with site identification, site optimisation and carrying capacity assessment.
- Carry out real time, inexpensive, risk focused monitoring to assess the environmental impacts and monitor for potential impacts.

The Toolbox

- E-licensing
- One-stop-shop
- Guidance
- Review of Legislation
- The Aquaculture Licence
- Communication Platform
- Public Information Platform
- Decision Support

These tools are relevant to applicants, decision makers and regulators.

Consultation

- Phase 1 → Licensing Regulators
- Phase 2 → Stakeholders
- Phase 3 → Consultation process - continuous engagement with
 - Industry
 - Regulators
 - Stakeholders

Recommendations

- Designate strategic national aquaculture zones as part of spatial plans where risk assessments, capacity and impact studies are carried out on an 'area' approach in advance of issuing licences, balancing considerations of economic growth and environmental protection with cumulative impacts of development.
- Develop local scale, producer lead, communication platforms to facilitate dispute resolution between resource users, enhancing cooperation and developing a forum to represent local producers on a broader regional scale to input into local planning.
- Develop public communication platforms to make monitoring information publically available, providing context, and to provide explanatory factual information about aquaculture to the media and general public.

The TAPAS Toolbox

E-licensing

Each jurisdiction provide an electronic licensing application system.

The advantages would include:

- To view the progress of an application in real time.
- Reduce the likelihood of 'incomplete' applications, or missing information.
- A one-stop-shop access point to all guidelines and guidance materials.
- Data required by decision makers in one accessible area.
- The facilitation of concurrent consultation periods.
- A defined workflow and tracking system that demonstrates the progression of the application.
- Tools to assist with mapping and site identification.



The TAPAS Toolbox

One-Stop-Shop

To assist with the coordination between the applicant and decision-making authorities, as well as between decision-support agencies.

The important tasks are to:

- Provide the Aquaculture Licence application forms.
- Act as the sole responsible agency to coordinate all the actors in the regulatory process.
- Centralise all elements of the application and coordinate the decision-making process.
- Facilitate communication with the applicant, liaising on their behalf with other agencies/actors.
- Provide appropriate guidance to the applicants, to ensure the completeness of the submission.
- Ensure formal timelines are adhered to.
- Process application fees.



The TAPAS Toolbox

Guidance

Provisions that should be available to the prospective applicant should include:

- Detail of the steps involved in application process.
- Detail of the consents required, expected timelines, expected costings, the regulatory agencies involved, and contact information for assistance through the process.
- Detail of the decision-making process; the steps, milestones and expected timelines.
- Provision of all documents centrally available in a single online portal.
- Direct stakeholders to information such as:
 - Information on relevant regulation and legislation.
 - Regulatory assistance/guidance information and requirements.
 - Information on funding.
 - Information on careers and training opportunities.
 - Information on strategic projects and investments.
 - Industry reports and production statistics.
 - Contact details for aquaculture groups.



The TAPAS Toolbox

Review of Legislation

Member States should:

- Carry out a review of their aquaculture consenting process, with the aim to identify the changes needed that will:
 - Ensure consenting decisions happen in a timely manner.
 - Create clarity and transparency in the consenting process.
 - Ensure it takes on board best practice and experience from other jurisdictions.
- Ensure the review provides clear, specific and actionable recommendations to allow for rational, streamlined, transparent, efficient legislative framework and licensing system.
- Produce a specific and timed implementation plan for the recommendations from the review.



The TAPAS Toolbox

The Aquaculture Licence

The aquaculture licence should:

- Define the activity and methodology that is permitted.
- Define the location within which the activity is permitted.
- Define the period for which an aquaculture activity can be conducted.
- Define the review, amendment and ownership processes regarding the licence.
- Define the parameters within which an activity is permitted, and the necessary monitoring to ensure compliance.
- Detail production quantities.
- Define terms and conditions of activities.
- Detail fees relating to holding the licence.



The TAPAS Toolbox

Communication Platform - Conflict avoidance and resolution methods

An effective forum for communication at a local level, within and between producers, and with other resource users, should be facilitated and supported to allow for the development and progression of common management plans.

Providing a forum for communication between producers:

- Allows for effective resource planning and problem solving.
- Enhances local development in a structured way.
- Allows better management between users and better utilisation of shared space.
- Allows better exchange information on fish health and management practices between producers for better environmental management.
- Facilitates communication between aquaculture producers and other resource users locally.



The TAPAS Toolbox

Conflict avoidance and resolution methods (cont.)

- Provides for collective representation of the sector in broader scale planning and development.
- Provides an effective channel for financing and funding, assisting local industry and services.
- Facilitates a bottom-up and top-down communication with regulators, where the forum can act as an intermediary.
- Facilitates representation of aquaculture producers on an area and regional level.
- Allows for the effective dissemination of technology and information within local producers, from the research and the regulatory bodies.
- Informs the sectors on general issues.
- Provides engagement with other interested parties to discuss/encourage integration of associated activities, e.g. fisheries & fishing, tourism, leisure users, etc.



The TAPAS Toolbox

Public Information Platforms

As a minimum provision, an effective public information platform should provide:

- Clear, correct and reliable information and reference materials.
- Better the understanding of the processes of aquaculture and its contributors to food security and ecosystem services.
- Inform regarding the methods involved in aquaculture.
- Inform regarding the environmental footprint of the industry.
- Provide information on food safety, nutritional benefits, responsible sourcing and environmental effects.
- Address current questions or concerns regarding issues relating to the sector, providing the latest scientific thinking.
- Act as a focal point for stakeholders.
- Exchange information on fish health.
- Inform regarding organic production and origins of the food produced in the sector.
- Encourage and facilitate public aquaculture engagement.
- Provide guidance to industry on approaches to being open to public engagement.



The TAPAS Toolbox

Decision Support

The Regulator is the primary arbitrator when it comes deciding on the consent to allow the operation of an aquaculture facility.

To reduce administrative burden and improve decision-making capacity, jurisdictions should review their decision-making processes for:

- Have clearly defined timelines, laid out in the process, for reaching decisions.
- Enhance efficiency in facilitating timely decision making.
- Clearly define the actors involved in the decision making process, and their roles.
- Have a clearly defined frameworks detailing the processes and individual steps.
- Deliver a transparent approach.
- Ensure direct access to in-house technical expertise to facilitate informed scientific judgement.
- Integrate changes to alleviate the bottlenecks using best practice and technical expertise from other systems.
- Ensure decision making bodies are adequately resourced.
- Facilitate knowledge exchange with regulators, researchers and stakeholders.



Thank you to the stakeholders for your contribution to the TAPAS project



Country	Number	Country	Number
Norway	8	UK	16
France	6	Greece	12
Spain	9	Ireland	44
Italy	3	Poland	2
Netherlands	4	Denmark	6
Faroe Islands	1	The	7
Croatia	2	Hungary	15
Austria	1	Lithuania	5
Slovakia	1	Slovenia	1
Latvia	2	Belarus	2
Serbia	1	Ukraine	1
Russia	1	EU group	1
	Total		151

TAPAS

<http://tapas-h2020.eu/>



7.4 The Sustainability Toolbox

TAPAS

The Aquaculture Sustainability Toolbox

TAPAS Conference 15/01/2020



What do we want the toolbox to do?

Provide a platform supporting development of European Aquaculture and reaching all stakeholders

- Communicate the needs for licensing of European aquaculture now and in the future
- Give guidance on best practice in regulation and performance
- Provide one-stop access to model and guidance tools to support aquaculture planning and management
- Support the application by examples of use of model and guidance tools – case studies
- Support the "conversation" between all stakeholders




The toolbox is a major dissemination portal for TAPAS tools


more TAPAS products are presented on the TAPAS project website

The toolbox is more

- also including ex-TAPAS tools and knowledge




Design thinking approach



Clarify the framework and content → Define the concept

Inspiration	Define	Ideate	Prototype	Test
What: Observe, listen to and engage with users to obtain their knowledge of their needs	Define boundaries and problems to be solved	Brainstorm ideas for best development	Create physical representation of the tool	Identify opportunities
Why: Focus on how users work	Focus on the problem the tool shall solve	Think out of the box	Test and feedback from users	Spread tool and feedback from users
How: Workshops, interviews	Analysis of interviews, workshop	Work on ideas	Build and feedback from users	Working online prototype for share with end group

Programming the toolbox → Test toolbox

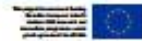
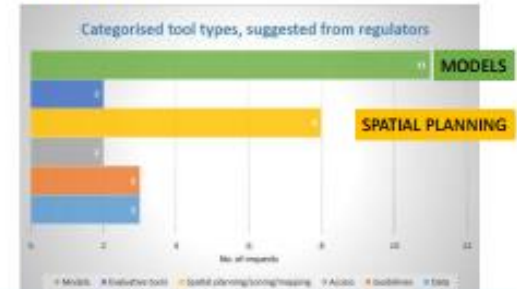


Framework, requirements, content

- Gather information about existing tools (ex-TAPAS tools)
- Gather information about tools developed by TAPAS
- Several consultations with different stakeholders to clarify
 - Bottlenecks for development of European aquaculture
 - Requirements for licensing
 - Tools asked for by regulators and industry



Tools asked for



Guidelines for development

- Make it web-based to allow access from a wide audience
 - Industry, Regulators, Public
- Focus on being intuitive and easy to use.
- Focus on licensing process - interactive tools (models) - guidance tool - examples by case studies



Toolbox home page



This is version 1!

- By using a content management approach (CMS) we are supporting easy updating/addition
 - more information and tools may easily included in the future
 - and the Toolbox can be adapted to specific owners [countries] / stakeholders

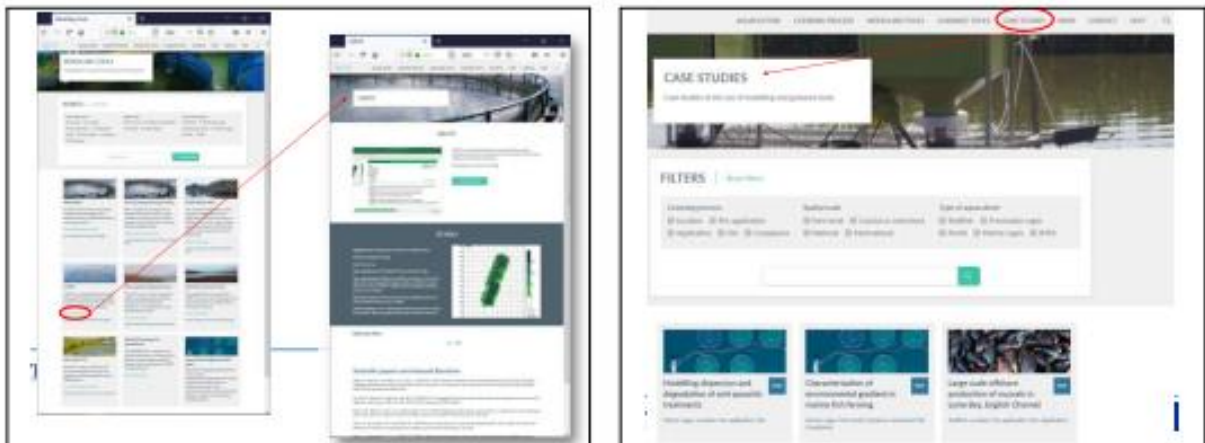


The process developing a website



The licensing process is the core skeleton





7.5 Application of models to shellfish production

Application of models to shellfish production












www.univ-nantes.fr

Laurent Barillé, Stephanie Palmer, Pierre Gernez, Susan Kay, Stefano Ciavatta, Kathrin Poser, Stefan Simis, Andrey Kurekin, Riccardo Torres, Phil Wallhead, Frank Kane, Lynne Falconer

Background



Limited near-shore space & increasing demand: new sites are needed for shellfish aquaculture

Impacts of climate change on shellfish aquaculture: current sites may become unsuitable, and/or new sites may become viable in the future

Challenging spatialized modelling for a wide range of spatial scales from near-field (WP 5) to far-field (WP 6): spatial resolution from 20 m to 12 km

```

graph TD
    Food([Food availability  
(chlo. phyto)]) --> Ingestion[INGESTION]
    Temp1([Temperature]) --> Ingestion
    Ingestion --> Assimilation[ASSIMILATION]
    Assimilation --> Shell[SHELL]
    Assimilation --> Soma[SOMA]
    Assimilation --> Reserves[RESERVES  
GONAD]
    Respiration[RESPIRATION] -- "Germotogenesis" --> Soma
    Respiration -- "Oxidative  
germotogenesis" --> Reserves
    Temp2([Temperature]) --> Respiration
    
```

The diagram illustrates the SFG model (SCOPE FOR GROWTH model) for shellfish growth. It shows a flow from Food availability (chlo. phyto) to INGESTION, which is also influenced by Temperature. INGESTION leads to ASSIMILATION. ASSIMILATION then branches into three components: SHELL, SOMA, and RESERVES GONAD. RESERVES GONAD is further influenced by RESPIRATION, which is also influenced by Temperature. RESPIRATION has feedback loops to SOMA (Germotogenesis) and RESERVES GONAD (Oxidative germotogenesis).

Ecosystem model: POLCOMS - ERSEM

The diagram illustrates the Ecosystem model: POLCOMS - ERSEM, showing the integration of physical and biogeochemical processes.

POLCOMS (Physical Ocean Model):

- Meteoric forcings (DMS):** Includes radiation, cloud cover, and atmospheric pressure.
- River inputs (dissolved silicate):** Represented by a river icon.
- Boundary GLORYS reanalysis:** Represented by a grid of blue and white squares.
- Domain:** North East Atlantic, covering -12° to 60° latitude and 40° to 10° longitude.

ERSEM (Ecosystem Model):

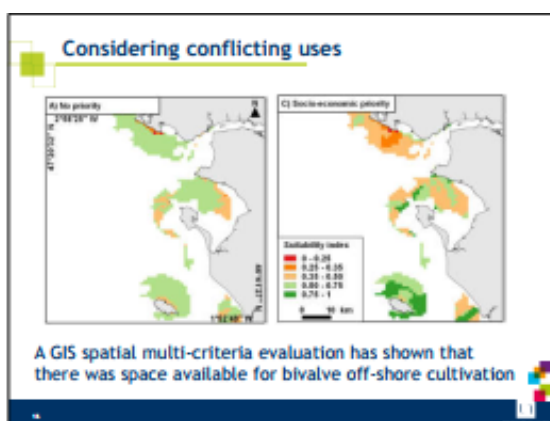
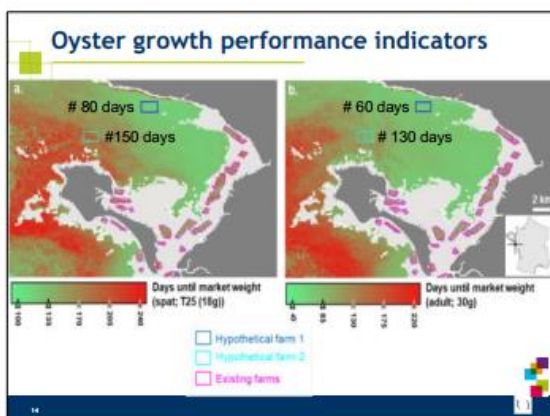
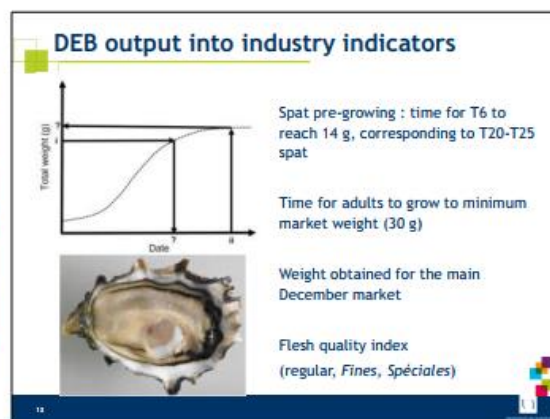
- Atmosphere:** Includes processes like radiation, cloud cover, and atmospheric pressure.
- Pelagic:** Includes Phytoplankton and Zooplankton.
- Benthic:** Includes Benthos and Detritus.
- Ecosystems:** Includes Phytoplankton, Zooplankton, Benthos, and Detritus.

European Regional Seas Ecosystem model (ERSEM)

Nearshore potential for shellfish aquaculture

Coupling Earth Observation data with
ecophysiological model

MERIS full resolution (300 m) & Pacific
oyster DEB model



Affordable for small companies TAPAS

Manuscript Details

Manuscript number: AQUA_2019_1898


Title: BIOLOGICAL, SOCIO-ECONOMIC, AND ADMINISTRATIVE OPPORTUNITIES AND CHALLENGES TO MOVING AQUACULTURE OFFSHORE FOR SMALL FRENCH OYSTER-FARMING COMPANIES

Article type: Research Paper



Laurent Barillé, Anthony Le Bris, Philippe Goulletquer, Yoann Thomas, Philippe Oliva, Frank Rame, Lyne Fokemer, Fabrice Goulletquer, Elise Trépolet, Stephane Parnis, Pierre Genest

Pacific oyster off-shore growth indicators (daily time steps, spatial resolution 0.1°)



Spat pre-growing : time for T6 spat (0.5 g in April) to reach 18 g, corresponding to T25 spat

Main restrictions:

- food ($>1 \mu\text{g Chl a L}^{-1}$)
- bathymetry ($<200 \text{ m}$)

Hotspots: UK, the southwestern North Sea, and western Africa

Conclusions TAPAS

Significant potential for off-shore shellfish aquaculture that can be exploited by large companies (Arctic, western sahara, South England) as well as smaller ones in near-shore conditions

Added value of spatialized data: spatial variability of growth performances at all spatial scale

Earth Observation time-series can have a significant contribution for aquaculture (ESA SENTINEL 2 & 3)



Remote Sensing for Aquaculture

Frontiers

Philippe Genest, Yoann Thomas, Fabrice Goulletquer, Elise Trépolet, Stephane Parnis, Pierre Genest

Deliverables in open-access repository TAPAS



zenodo

Earth Observation and model-derived aquaculture indicators report

OpenAIRE

Exploitation of TAPAS program TAPAS

Transfert of a Spatial Multi-Criteria Evaluation tool for bivalve off-shore aquaculture in the Région Pays de la Loire (France)



PAYS DE LA LOIRE



Comité Régional de la CONCHYLICULTURE des Pays de la Loire

Shellfish farmers representatives

Strategic coastline documents for the Marine Spatial Planning of the French Atlantic coast to be ready in 2021

Thank you for your attention TAPAS



7.6 Satellite observation capabilities in European Aquaculture monitoring

TAPAS

Satellite observation capabilities in European aquaculture monitoring

Stefan Simis [PML]
and many others

STIRLING NIVA PML HIRSH MARELLE JRC ECHOES

Requirements and technical challenges

Most aquaculture take place in inland and inshore environments

- Medium resolution sensors (300m) most accurately resolve water colour (from nearby land/cloud and atmosphere)
- High resolution sensors (10-100m) needed to resolve bays, fjords, rivers but don't offer same diagnostic features
- Atmospheric correction near land is a major technical issue introducing ambiguity into interpretation of the satellite observation
- Highly variable water constituent composition; there are no 'global' algorithms for non-ocean waters

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Satellite observation capability: opportunities

We have entered the age of operational earth observation from satellites, providing guaranteed global coverage of water temperature, water colour and sea state for the coming decades.

Rapid development of observation capabilities in four domains

- Monitoring water quality, early warning**
- Habitat mapping, site selection, long-term variability and trends**
- Monitoring of aquaculture practises**
- Model-observation data assimilation (trends and forecasts)**

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Medium vs high resolution products
Sentinel-2 MSI (launch 2016) vs Sentinel-3 OLCI (launch 2017)

monitoring water quality

9 Aug 2018, Baltic Sea, UK, Turbidity (PMU)

TAPAS ECHOES Credit: Mark Warren, Stefan Simis (PML)

Medium vs high resolution products
Sentinel-2 MSI 100m capabilities developed during TAPAS

monitoring water quality

Gulf of Gdansk, 2018 median annual Turbidity (PMU)
Bays, estuaries and small lakes resolvable at 100 m
(noting that the sensor resolution is 20-60m)

TAPAS ECHOES Credit: Mark Warren, Stefan Simis (PML)

Medium vs high resolution products
Calibrating algorithms for the Sentinel-2 MSI (10-60m) sensor

monitoring water quality

Low tide
High tide

TAPAS Credit: Gomes et al. PUMAS 2017

Medium vs high resolution products
Aligning land and ocean colour sensor chlorophyll-a retrieval

monitoring water quality

Initial comparison MSI vs OLCI
Calibrated response

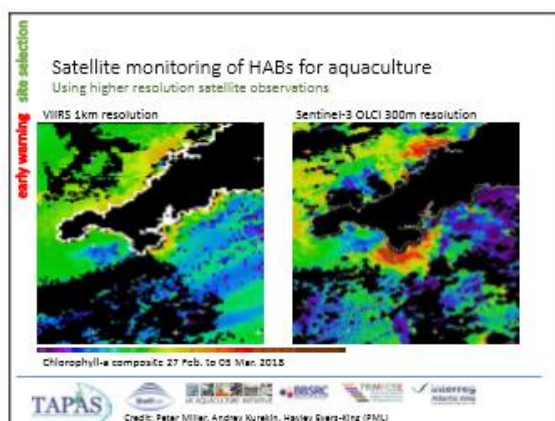
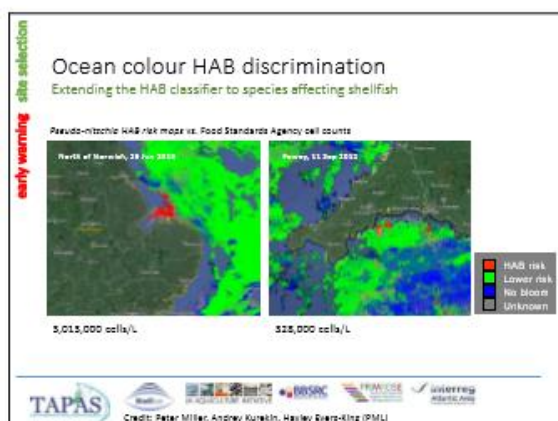
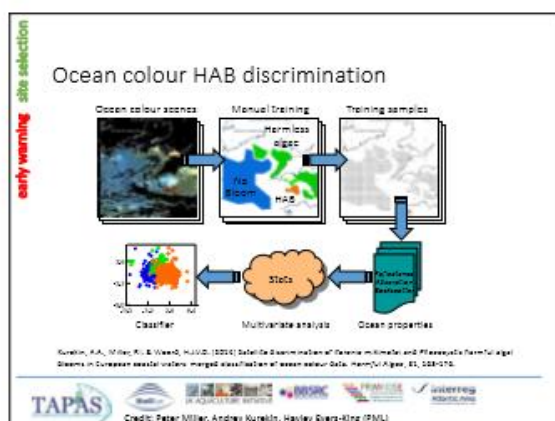
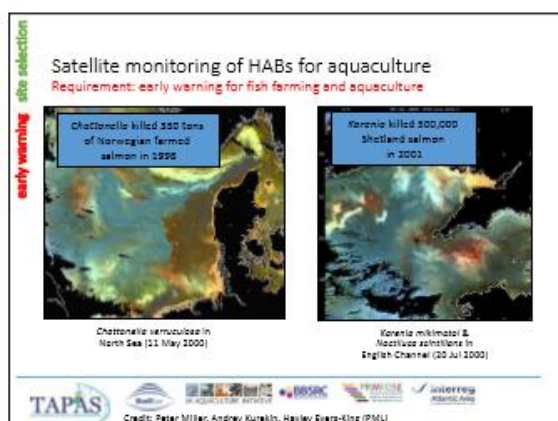
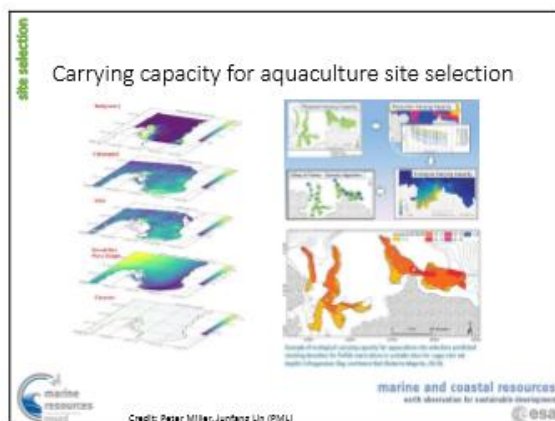
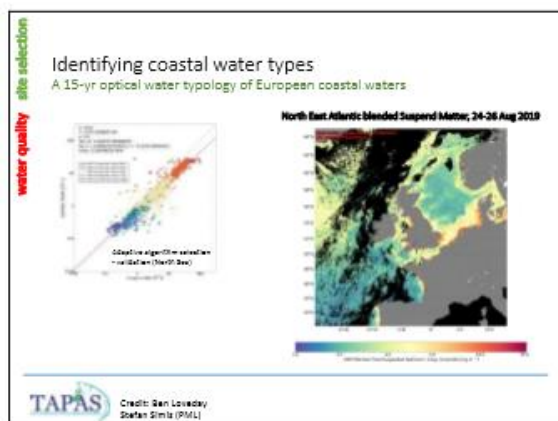
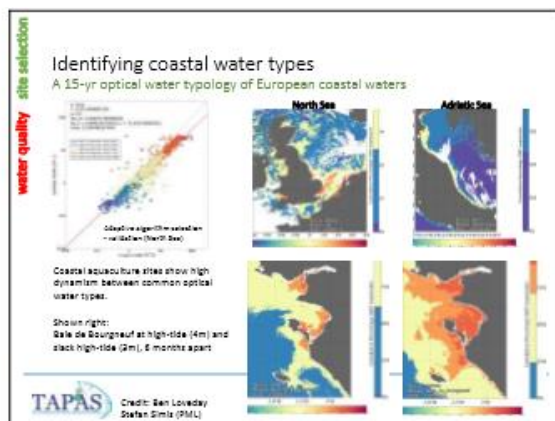
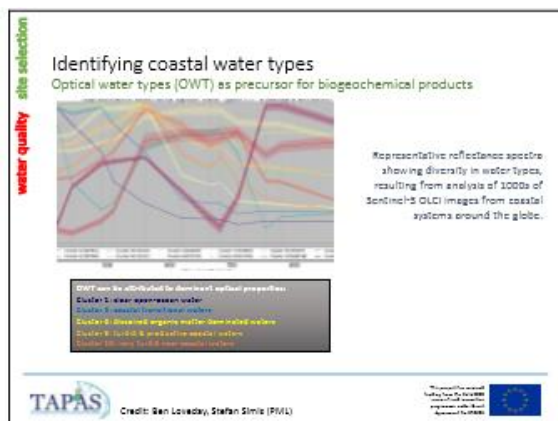
TAPAS ECHOES Credit: Mark Warren, Stefan Simis (PML)

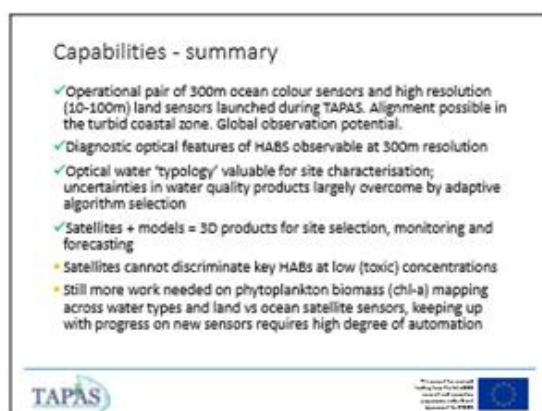
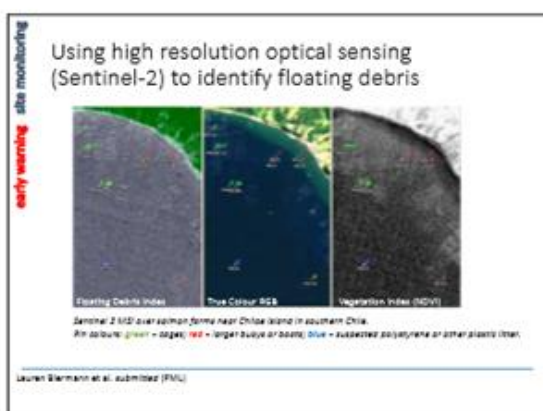
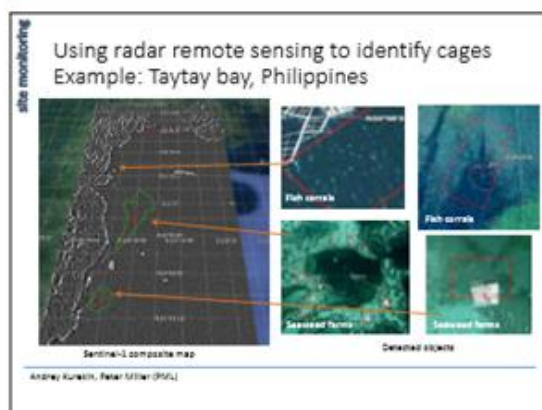
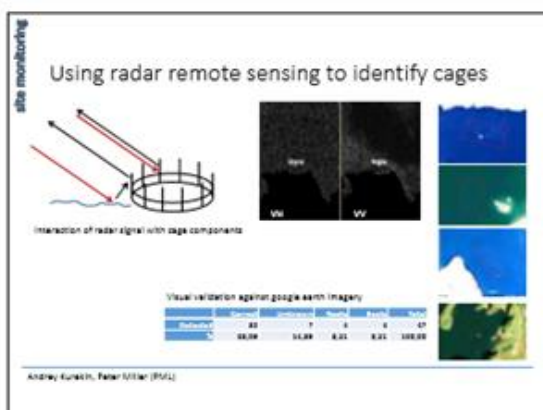
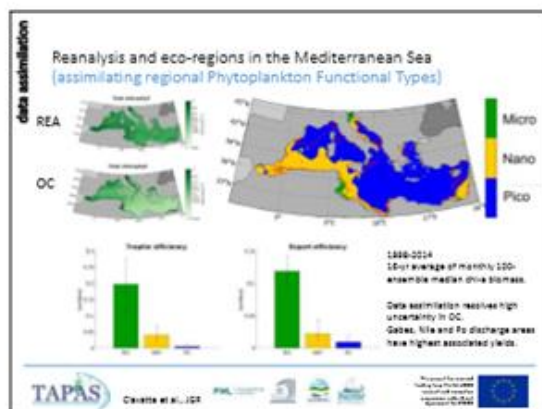
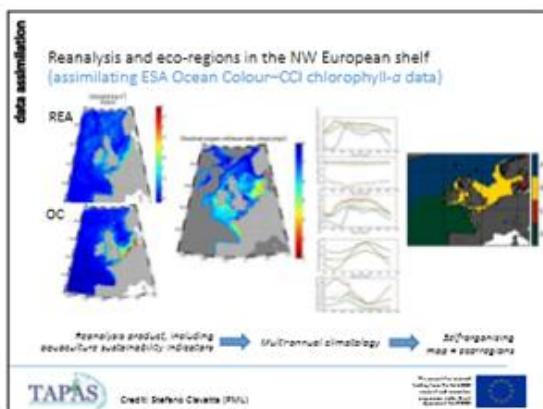
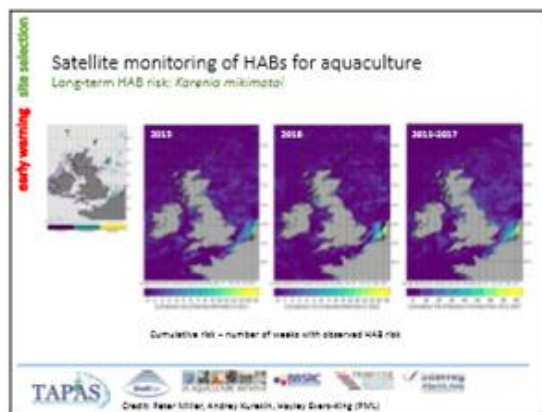
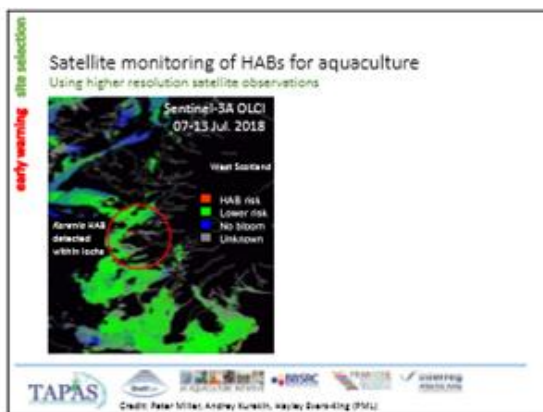
Identifying coastal water types
Optical water types (OWT) as precursor for biogeochemical products

water quality

- High-level detection of water types, e.g. clear / turbid / productive
- Facilitate algorithm selection and fuzzy classification, addressing the issue that no single biogeochemical retrieval algorithm is globally valid
- Offer accessible framework to identify and map issues with remote sensing retrieval accuracy

TAPAS Credit: Ben Lovelady, Stefan Simis (PML)





7.7 Does aquaculture provide ecosystem services?

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Does aquaculture provide ecosystems services ?

Final TAPAS Project Conference
Brussels 15 th January 2020
Presented by Trine Dale, NIVA

UNIVERSITY OF STIRLING NIVA PML hcmw Bluewin NACEE

idea DHI

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 678396

Yes !

To some extent

Yes, but.....

Outline:

- The ecosystems services approach
- Ecosystems services and aquaculture
- Some small «food for thoughts»

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What is aquaculture in Europe ?

Space in natural environment

Intensive to extensive

Different trophic level on farmed organism

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What are ecosystems services ?

.....many people have an intuitive idea about the concept:

- it has something to do with the goods that our ecosystems can provide
- the services can somehow be valued

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Ecosystems Services (ES) and ES approach

Ecosystems
-capacity to provide services

Socio-economic systems
-human welfare-economic value

Biophysical processes
-biological, chemical, physical

Ecosystems services
-e.g. food, fiber, fuel, raw materials, recreation, regulation, cultural

Benefits
-e.g. economic, social, health, well-being, environmental

Value
-e.g. economic, social, health, well-being, environmental

Land resources (e.g., policy, management, legislation)

Ecosystems (e.g., structure, and use, climate change)

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Ecosystems services classification

PROVISIONING SERVICES	REGULATING SERVICES	CULTURAL SERVICES
Products obtained from ecosystems	Benefits obtained from the regulation of ecosystem processes	Non-material benefits obtained from ecosystems
<ul style="list-style-type: none"> Energy Food Biomaterial Transportation National defense 	<ul style="list-style-type: none"> Flood prevention Climate regulation Erosion control Control of pests and pathogens 	<ul style="list-style-type: none"> Educational Recreational Heritage Spiritual

SUPPORTING SERVICES
Services necessary for the production of all other ecosystem services

- Biological diversity maintenance
- Nutrient recycling
- Primary productivity

source: Final Recommendations of the Intergovernmental Panel on Ecosystem Services, 2010

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Extractive (not fed) aquaculture

Regulating services
Carbon sequestration
Nutrient removal
Improve water clarity
Coastal protection (wave attenuation)

Supporting services
Provide habitats

Provisioning services
Food
Biomaterials

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Fed aquaculture

Supporting services
Provide habitat

Provisioning services
Food
Augmentation of wild fisheries

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Food of thought. What about cultural ecosystems services ? Are there any provided by aquaculture ?

Fruitflaming in Hardangerfjorden is central to cultural heritage, important for tourism

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Yes, but....

Ecosystems services trade-offs

Current Conditions and Alternative Future Scenarios (Member Inputs)	Change in Ecosystem Services (Member Outputs)			
	Provisioning Services	Regulating Services	Cultural Services	Biodiversity
Scenario 1: Current conditions	High	High	High	High
Scenario 2: Increased aquaculture	High	Low	Low	Low
Scenario 3: Reduced aquaculture	Low	High	High	High

Source: Silvestri, S., Kershner, P. (eds.), 2010. Framing the Flow: Innovative Approaches to Understand, Protect and Value Ecosystem Services across Linked Habitats. UNEP World Conservation Monitoring Centre, Cambridge, UK.

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Summing up

- Yes, aquaculture provide ecosystems services
- To what extent and what type of services is depending on range of factors both related to the type of aquaculture and the characteristic of the ecosystem where aquaculture is located
- Investigate further **how negative trade-offs can be minimized** and sustainability improved through management and planning approaches (e.g. selection of adequate sites, species diversification and IMTA) and through adaptations in the farm operating practices

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"Be happy and not sad, it's better to be sad than to be happy"

Thanks

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Ecosystems services valuation

There is a range of different methods and approaches economists use to perform ecosystems services valuation

Valuation Method	Strengths	Weaknesses
Market-based valuation	Highly accurate	Only captures a small portion of total value
Replacement cost method	Easy to understand	Does not capture non-use values
Stated preference method	Can capture non-use values	Subject to bias and error
Implied preference method	Can capture non-use values	Subject to bias and error

Source: UN Food and Agriculture Organization, "What are Ecosystem Services?" (FAO, "Ecosystem Services in the World: A Global Overview")

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Overall objectives of WP 4

1. To assess the **combined environmental and social impacts of aquaculture**, and identify management tools that could provide incentives to reduce negative impacts of aquaculture (Task 4.4) (D.4.5)-Submitted
2. To **build an analytical framework** for the assessment of ecosystem services (ES) and benefits provided from European aquaculture based on the general concept of Ecosystem services cascades. (Task 4.1)(D.4.2)-Submitted
3. To identify what **trade-offs and possible synergies** that exists between aquaculture provisioning services and other ecosystem services and to be able to quantify these. (Task 4.2 & 4.3)(D.4.3)-Submitted
4. To assess how **negative trade-offs can be minimized** and sustainability improved through management and planning approaches (e.g. selection of adequate sites, species diversification and IMTA) and through adaptations in the farm operating practices. (Task 4.3)(D.4.4)-Submitted
5. To analyse how the knowledge gained from assessment of ES and ES trade-offs can be **incorporated into current planning and licensing** (Task 4.5)(D.4.6) pending

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Task 4.5 Ecosystem Services approach as a practical DSS tool (NIVA, MI, ABT)

Objective:

To understand the **potential and limitations of incorporating an ES approach** into regulatory frameworks – **particularly planning and licensing processes**.

Approach:

Exploratory exercise to analyse the potential use of an ES approach to assessing sustainability and how such an approach can be integrated into current planning and licensing practices

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Ecosystems services trade-offs and synergies

Current Conditions and Alternative Future Scenarios (Member Inputs)	Provisioning Services	Regulating Services	Cultural Services	Biodiversity
Scenario 1: Current conditions	High	High	High	High
Scenario 2: Increased aquaculture	High	Low	Low	Low
Scenario 3: Reduced aquaculture	Low	High	High	High

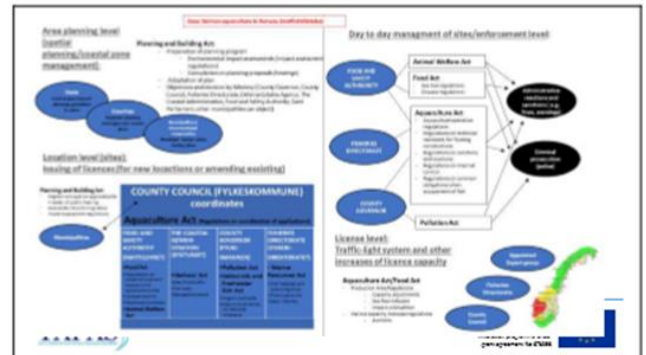
Source: Silvestri, S., Kershner, P. (eds.), 2010. Framing the Flow: Innovative Approaches to Understand, Protect and Value Ecosystem Services across Linked Habitats. UNEP World Conservation Monitoring Centre, Cambridge, UK.

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Background and methods

- Planning for aquaculture and granting licences to aquaculture can be seen as «optimization game» How to **balance diverse requirements from society**?
- The ecosystem services (ES) concept can be useful for addressing this type of challenge, as it is a broad and inclusive and stimulate the reflection **on the multifunctionality** of nature.
- Examples where ES inform real-world decisions are still rare.
- Case study from Norway;
- In-depth interviews** conducted:
 - Area planners** from different regions, and with experience from different levels of coastal zone planning,
 - Case officer** processing license applications
 - Researcher** (professor in economy) working on valuation of non-market goods and services related to coastal zones and the marine environment



Results

- To some extent is already included in the coastal zone planning and processing of licenses phase, but also that there is potential for more use of it in both these phases and other management areas.
- The main challenge for wider uptake
 - Concept of **ecosystem-services** (and valuation methods of non-market goods more generally) is **not clearly defined**, or standardized
 - Approach is on a **theoretical level** and therefore generally **not well aligned with practical realities**
 - Already existing complexity** and challenges in the management system – do we need more?
 - Procedural/material rules in regulatory frameworks and terminology.
 - Lack of knowledge** and uncertainties related to the **ecosystem itself** and the **impact** of aquaculture activities on the ecosystems



Contributions to the Aquaculture Sustainability Toolbox



Welcome to the Aquaculture Toolbox Licensing Process

The Aquaculture Toolbox Licensing Process is a tool for assessing the sustainability of aquaculture activities. It is designed to help license holders and license applicants to understand the requirements for sustainable aquaculture and to ensure that their activities are in line with the requirements. The process is based on the Aquaculture Act and the Aquaculture Regulations. The process is designed to be a continuous process, where the license holder and the license applicant are involved in the process from the start to the end. The process is designed to be a continuous process, where the license holder and the license applicant are involved in the process from the start to the end.

Guidance documents:

1. Framework for the assessment of ecosystem services
2. Bayesian network model, Bioeconomic model
3. Economic incentives for sustainable aquaculture



7.8 Effective use of models for chemical regulation

Effective use of models for chemical regulation

UNIVERSITY OF STIRLING, NIM, PML, DHI, NACE, U, etc.

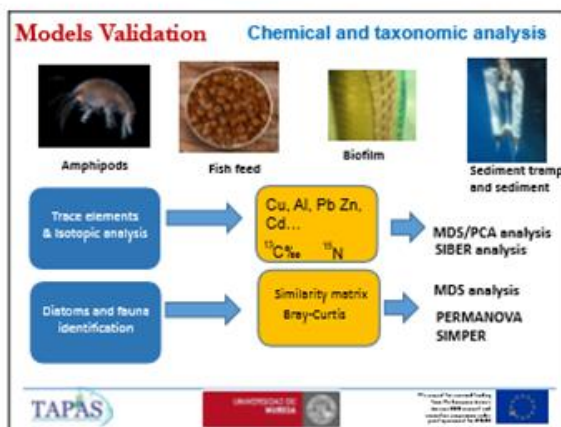
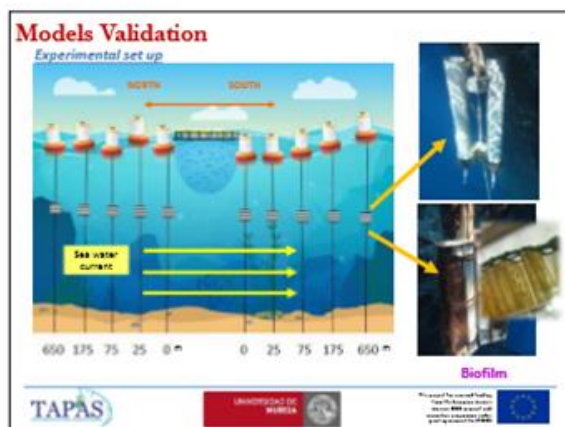
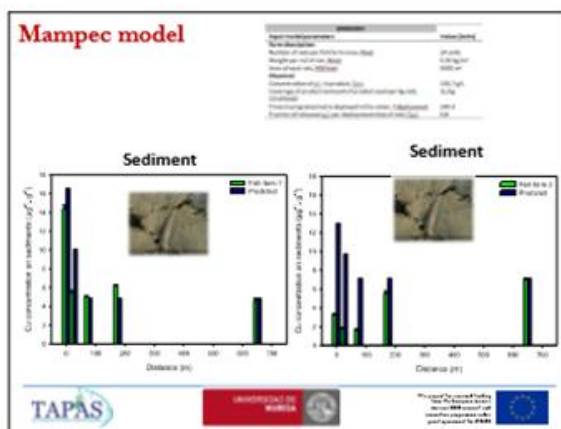
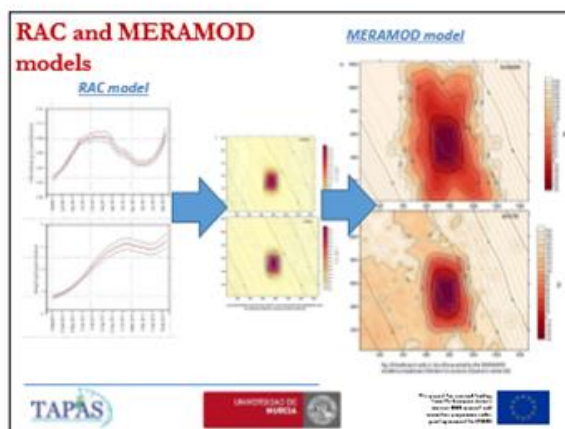
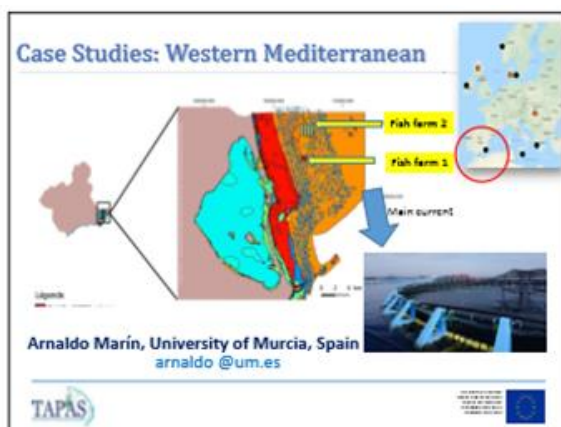
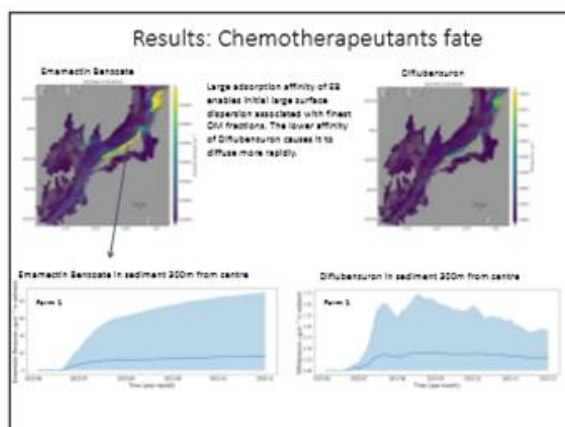
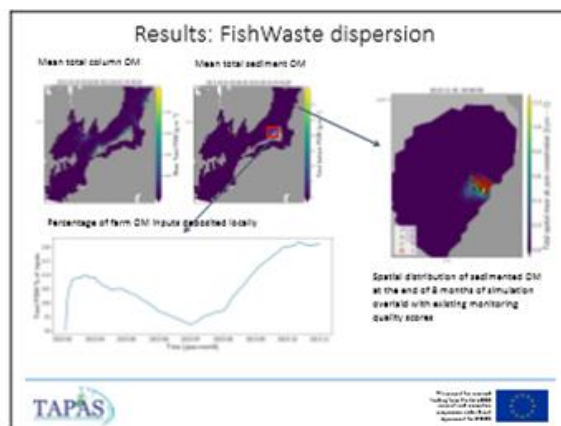
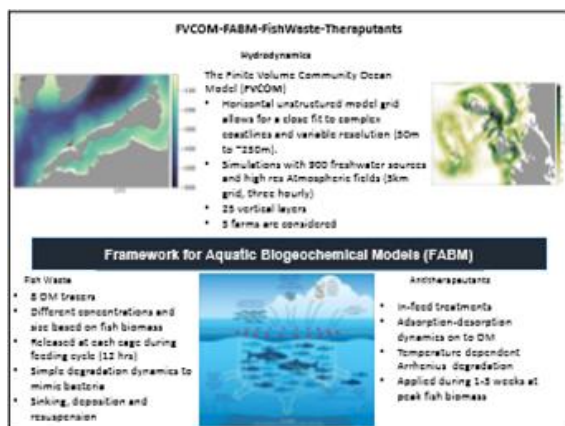
Potentially toxic substances in aquaculture

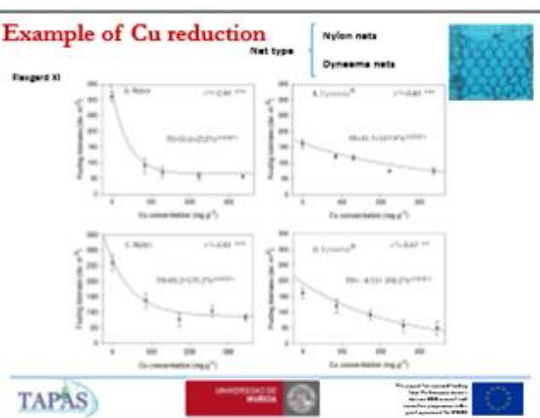
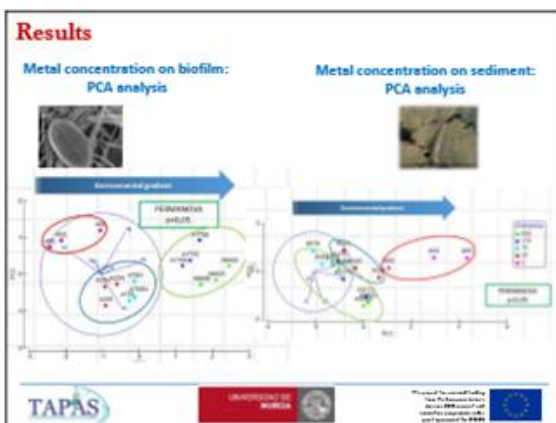
Veterinary medicines and other **potentially toxic substances** (e.g. antifouling paints, disinfection products) may affect biodiversity

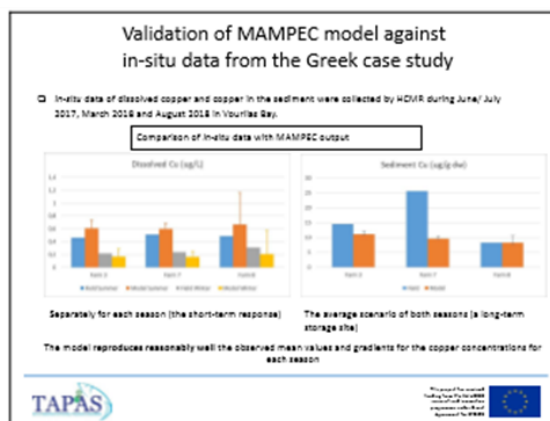
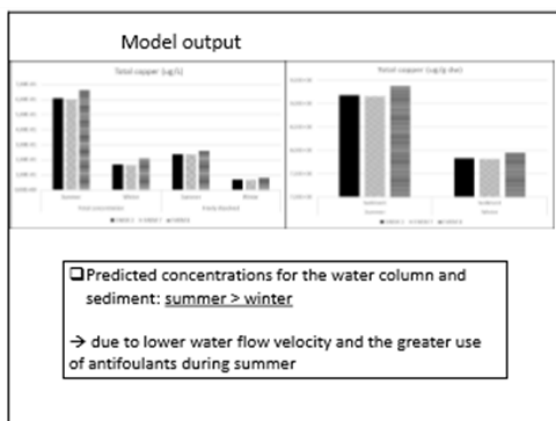
TAPAS logo



[illegible]



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7.9 New in situ observation technology

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New in situ observation technologies

[Subtitle]

UNIVERSITY OF STIRLING, NIVA, PML, DHI, NACEE, etc.

TAPAS

- Development of new in situ observation technologies of
 - physical, ecological and chemical water quality
 - novel biosensors and optical sensors
 - monitoring the integrity of the cage material

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- An Aquaculture Specific Profiler
 - for vertical profiles of the water from the surface to the bottom of the fish farm, with user configurable payload
- An Autonomous Underwater Vehicle
 - able to perform regular inspections of the cage material condition and transmits alarms in case of problems detection
- An optical sensors based observation system
 - for ecological water quality measurements by recording radiance and irradiance performing continuous and autonomous high-quality measurements for water quality

hcmr

Aquaculture Specific Profiler

M. Ntoumas, M. Pettas, G. Petinakis
HCMR

TAPAS

hcmr

An autonomous profiling system based on the operational principal of oceanographic Argo floats (Variable buoyancy system-VBS)

ASP Mission Concept

TAPAS

hcmr

ASP Operational test (1)

- At water depth of 60 m
- The objective
 - test the ability to efficiently collect data during a mission
- An Aanderaa Temperature/Conductivity 3919B sensor was configured in the ASP

	Measurement Range	Resolution	Accuracy	Supply voltage	Maximum Current Drain
3919B sensor	-5-40°C/0-7.55/m	0.01°C/0.00025/m	±0.05°C/±0.001 m	5 to 14VDC	100mA

TAPAS

hcmr

ASP Operational test

Temperature/velocity during ASP descent (10m)

At water depth of 60 m

The objective

- test the ability to efficiently collect data during a mission

"raw" data collection

TAPAS

hcmr

Future work

- The ASP, limited by the weight (< 2kg) and the energy requirements, can be equipped with more sensors
 - Dissolved Oxy,
 - Chl_a,
 - Turbidity etc
- Improve TRL level (presently at 5-6)

TAPAS

An AUTONOMOUS UNDERWATER VEHICLE for AUTOMATED INSPECTION of AQUACULTURE NET PEN CAGES

V. Chalkiadakis, G. Livenos, K. Moirgiorgou, M.
Zervakis, N. Papendroulakis
HCMR

TAPAS

Project funded by the European Union
under the Horizon 2020 research and innovation programme
grant agreement No 101019719

The problem

- Negative Consequences by fish-cage structural failures in aquaculture installations
 - fish escapes
 - decreased growth performance

Today's Practice

- Inspection by specialized professional divers
 - costly
 - less frequent
 - more difficult in off-shore installations
- Inspection using ROV
 - on-site personnel required

TAPAS

Project funded by the European Union
under the Horizon 2020 research and innovation programme
grant agreement No 101019719

TAPAS AUV approach

- Use of Autonomous Underwater Vehicles (AUV) for automatic inspection and reporting
 - lower operational cost
 - frequent inspections
 - early problem detection

An effective solution particularly for off-shore aquaculture

TAPAS

Project funded by the European Union
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Solution Overview

- AUV* equipped with
 - Lite On-board Navigation System based on computer vision
 - Docking Station for wireless battery charging and video uploading
 - Off-line automatic Net Inspection s/w

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Net inspection

- Based on image processing of video-frames annotated with time and AUV position
- Net hole identification concept
 - Regular Texture Image analysis
 - Template matching techniques
 - comparison of a source image with a template image
 - Edge Detection techniques
 - Retrieve damage location using annotation
 - Generate Alarms and Reports
- Hardware development for online analysis (CMR project)

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Field trials

- Test and trials conducted under different conditions
 - Stocking density may be an issue

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Future work

- Improve Autonomous Navigation
- Use the system as "platform" for additional tools (e.g. fish size measurement)
- Reduce the size of the vehicle, making it feasible to equip each net cage with one
- Improve TRL level (presently at 5-6)

TAPAS

Project funded by the European Union
under the Horizon 2020 research and innovation programme
grant agreement No 101019719

Autonomous above water radiometer system WISPstation

M.L. Laanen & S.W.M. Peters
Water Insight

TAPAS

Project funded by the European Union
under the Horizon 2020 research and innovation programme
grant agreement No 101019719

7.10 Implementing TAPAS recommendations and tools



TAPAS



The European Union has funded this project under the Erasmus+ programme

Implementing TAPAS recommendations and tools





UNIVERSITY OF STIRLING



NVA



PML



NOR



Mannix Business



ASC



UNIVERSITY OF APPLIED SCIENCES



UNIVERSITY OF BAYREUTH



GULF UNIVERSITY OF SCIENCE AND TECHNOLOGY



idea



DHI



U



NACEE



UNIVERSITY OF JYVÄSKYLÄ



UNIVERSITY OF TURKU

Strategy

- Vision for the future
- Promoting competitiveness
- Conditions for sustainable growth
- Improving the image and governance

"In the EU, the aquaculture sector has become a modern, dynamic industry that produces safe, high valuable and high quality products, and has also diversified the means to be environmentally sustainable. But this industry is also facing a number of challenges. This strategy should define the best possible growth potential for the EU aquaculture industry, setting clear actions both over time and by construction.

... guidance to both stakeholders and administrations to ensure consistency and clarity in developing the policies needed for the sustainable development of European aquaculture"

EN EN
EC, 2009)

TAPAS

The first TAPAS project was launched in 2007 and was supported by the European Union under the FP6 programme.

EUROPEAN UNION

Strategy

- Simplify administrative procedures
- Growth through coordinated spatial planning
- Enhance competitiveness of EU aquaculture
- New governance support:
 - National strategic plans
 - Complementarity with EMFF
 - Exchange of best practices
 - Aquaculture Advisory Council - dialogue




The image shows the front cover of the 'European Union Aquaculture Strategy 2013-2020'. The cover is white with a blue header containing the European Union flag and the text 'EUROPEAN COMMISSION'. Below this, the title 'EUROPEAN UNION AQUACULTURE STRATEGY 2013-2020' is printed in a large, bold, sans-serif font. Underneath the title, there is a smaller line of text: 'A strategy for the sustainable development of the aquaculture sector in the European Union'. At the bottom of the cover, the text 'EN' is visible on the left and right sides.


Exploitation

- Recommendations and guidance for change in aquaculture policy in Europe
- Individual tools, models, methodology and data/information
- Toolbox for European aquaculture – decision support for sustainable development

Required input	YES
improved regulatory framework for adoption by Member States	0
improved tools for quantification of environmental risks	0-4
improved open for planning linked to sampling capacity and sustainability indicators	0-4
improved, more efficient tools for learning aquaculture development	0-4
improved, more efficient tools for marketing and profitability of food environmental impact	0-4
improved options for investment in the sector through public aid of state or other national, regional, national, developer support	0
significant enhanced and strong for the marketing linked to early warning and sustainability	0-4
Enhanced image of European aquaculture	–
improved sustainability of the European aquaculture sector	–



 The project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101019719



Policy recommendations and guidance


The figure illustrates the process of policy recommendations and guidance, showing three sequential steps:

- Step 1: Bottlenecks and Requirement analysis/needs/needs integration**
 - Bottlenecks:** A list of challenges and a table of 'Requirement analysis/needs/needs integration'.
 - Requirement analysis/needs/needs integration:** A table with columns for 'Requirement analysis/needs/needs integration' and 'Requirement analysis/needs/needs integration'.
- Step 2: Recommendation Learning**
 - Recommendation Learning:** A line graph showing 'Recommendation Learning' over time.
 - Recommendation Learning:** A table with columns for 'Recommendation Learning' and 'Recommendation Learning'.
- Step 3: Recommendation Learning**
 - Recommendation Learning:** A line graph showing 'Recommendation Learning' over time.
 - Recommendation Learning:** A table with columns for 'Recommendation Learning' and 'Recommendation Learning'.

Arrows indicate the flow from the first step to the second, and then to the third step.

Technical outcomes


- Models
- Data/Information
- Guidance tools
- Methodology
- Technology developed
 - Sensors
 - Monitoring/sampling
- By productions from research



Technical outcomes from TAPAS project:

- Models
- Data/Information
- Guidance tools
- Methodology
- Technology developed
 - Sensors
 - Monitoring/sampling
- By productions from research

TAPAS

[illegible]

Aquaculture Toolbox

Suggested plan

Conceptual diagram of the interactions of users, providers and managers for a framework for exploitation of the Aquaculture Sustainability Toolbox after completion of the TAPAS project.

```
graph TD; BC[Booring Committee] --> EJM[EJM Project manager]; EJM --> UFP[User Forum  
Inquiries  
Proposals]; UFP -- "Suggestions  
Experience  
Rating of tools" --> EF((Evaluation  
Forum)); EF --> ATM[Aquaculture toolbox  
Manager  
Technical  
Management]; ATM --> TT[Toolbox development]; ATM --> TA[Toolbox admin]; ATM --> TRT[Toolbox training]; PRT[Providers  
Research Institutions  
Users  
EC...] -- "Interactive tool  
Cases  
Guidelines" --> ATM;
```

The diagram illustrates the interactions between various stakeholders and components of the Aquaculture Sustainability Toolbox framework. Key elements include:

- Booring Committee**: Interacts with the **EJM Project manager**.
- EJM Project manager**: Manages the **User Forum Inquiries Proposals**.
- User Forum Inquiries Proposals**: Provides input (Suggestions, Experience, Rating of tools) to the **Evaluation Forum**.
- Evaluation Forum**: Feeds back into the **Aquaculture toolbox Manager Technical Management**.
- Aquaculture toolbox Manager Technical Management**: Oversees **Toolbox development**, **Toolbox admin**, and **Toolbox training**.
- Providers Research Institutions Users EC...**: Utilizes the toolbox through **Interactive tool Cases Guidelines**.

TAPAS logo and European Union flag are present at the bottom left.



Markets and end-users

The exploitable results of the TAPAS project are relevant to:

- Authorities for aquaculture licensing and regulation
 - Guidance, Aquaculture Toolbox
- Aquaculture producers
 - Guidance, data & information, modelling tools,
- The public
 - Information on governance, compliance
- The consultants, scientific and research community
 - Methods, tools and data



Implementation – How?

EU policy driving but implementation at national level

National stakeholder meetings:

- Guidance in developing regulation/licensing for aquaculture
- Guidance to simplify administrative burden – One stop shop
- Tools for management of sustainable aquaculture
- On line licensing
- Reliable information for public.

Finis Lengyel - Hungary



National level implementation?

- Based on "Updated strategic guidelines for sustainable development of EU aquaculture"
- Use a staged approach to putting into practice?
- How can TAPAS help?



National level implementation?

- Economic benefits of aquaculture
- Social benefits of aquaculture
- Social license for aquaculture
- "Political will" to develop aquaculture
- Involvement of stakeholders
 - Regulators, NGOs, producers, others?
- Review existing national plan

TAPAS – policy recommendations, information WPs and guidelines – inform the debate



National level implementation?

- Will legislation need to be changed?
- What standards should be achieved?
 - Environmental standards
 - Welfare
 - Product Environment Footprint (PEF)
 - etc....
- Consider certification and "Beyond compliance"

TAPAS – policy recommendations and guidelines
TAPAS – data, results, methodology – provide detail



National level implementation?

- Involvement of all stakeholders
 - Regulators, NGOs, producers, conflicting users, others?
- Licensing authority?
 - Who is responsible?
- What aquaculture system and size?
 - Ponds, Cages, RAS etc?
- Implications of change?
 - Economic?
 - Environmental?
 - Trade-offs needed?

TAPAS – Aquaculture Sustainability Toolbox
TAPAS – monitoring provision and technology outcomes for data provision



National level implementation?

- Simplified licensing procedures (one-stop shop?)
- Decision support for:
 - Site selection and suitability for aquaculture
 - Application of environmental standards
 - Monitoring and Compliance
- TAPAS – Aquaculture Sustainability Toolbox



