Aquamed Draft report WP8

Deliverable 13

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Report summarizing chosen indicators and the framework they fit

A. Indicators of aquaculture sustainability in the Mediterranean

Generally it is accepted that sustainability requires an understanding of issues concerning natural resources, governmental and economic output and society welfare, and the exchanges between them. Sustainable aquaculture adopts productive, competitive and efficient production practices, while at the same time protecting and improving the environment and the global ecosystem, as well as the socio-economic conditions of local communities, in line with the principles related to human dignity. An important practical view to emerge is that indicators, providing various measured values describing characteristics of a specific activity, may be an effective means of describing paths of development. This way, policy approaches and directions for development could be built up "from the ground" using a suitably validated system of indicators. The indicators should be multidisciplinary and wide-reaching, covering ecosystem and biophysical, social and economic, as well as legal and institutional aspects of aquaculture.

Effective indicators have some characteristics in common: they are relevant, easy to understand, reliable, and based on accessible data.

Sets of indicators of aquaculture sustainability were already identified through research projects:

1. EVAD (Assessment of the sustainability of the aquaculture production systems. Elaboration of a method and implementation in different contexts of tropical and temperate areas.): project within the framework of the Agriculture and Sustainable Development federating program of the National Agency for Research (2005-2008) that published a practical guide as an output of research study carried out in several regions in Cameroon, Cyprus, Indonesia, France and the Philippines aiming the co-construction of sustainable development indicators in aquaculture. They have developed 13 principles from which 82 indicators were developed.

2. InDAM (Indicators for Sustainable Development of Aquaculture and Guidelines for their use in the Mediterranean): project of GFSM-CAQ WGSA specifically focuses on Mediterranean finfish species, with the aim of developing practical indicators and relative reference points and standards for direct and concrete use by the various stakeholders (farmers, users of the coastal zone, decision-makers, NGOs, etc.) within a shared definition and framework of the sustainable development of Mediterranean aquaculture. To reach such objective, InDAM used the participatory methodology suggested by EVAD, involving relevant stakeholders in the process of screening and selecting the indicators. The identified indicators in governance (34), economic (55), social (18) and environmental dimension (53).

3. MediterraneOn: a project defining sustainability indicators for Mediterranean aquaculture, developed by Spanish Aquaculture Observatory Foundation (FOESA), co-funded by the Biodiversity Foundation and with the collaboration of the International Union for the Conservation of Nature (IUCN) and the Spanish Association of Marine Fish Farmers (APROMAR) that designed indicators, which enable an analysis of the state of aquaculture in the region to be made with the aim of moving the various countries that make up the region towards an even more sustainable aquaculture development. This tool aims to be of used by all the stakeholders involved in the sector; administrations, production, scientific communities, non-governmental organizations and other sectors and stakeholders, in order to obtain an initial assessment of Mediterranean aquaculture from a

sustainability point of view. The elaborated indicators based on principle-criteria-indicators system:
a) indicators of sustainability at the farm/ company level: 9;
b) indicators of sustainability at the National level: 9;
c) indicators of sustainability at the Mediterranean level: 3;
d) other potential indicators: 7.

4. CONSENSUS (financed under the 6th Framework Programme, 5th Thematic Priority "Food Quality and Safety", contract FOOD-CT-2005-513998 – "CONSENSUS – A Multi-Stakeholder Platform for Sustainable Aquaculture in Europe"): platform for sustainable aquaculture in Europe with a strategic objective to provide and demonstrate to consumers the benefits of high quality, safe and nutritious farmed fish and shellfish grown in sustainable conditions. Plenary sessions were organized to provided key information as well as the group work, where participants discussed and agreed on the desired trends and associated indicators. The indicators were classified under the three poles of sustainability – economic, environmental and social – and suggestions on various aspects of their implementation were made. A matrix system was devised to sort and classify indicators, identify overlap and inconsistencies and judge completeness. The analysis lead to the production of a compilation of 78 indicators for sustainable aquaculture in Europe, organized by theme and for each multiple factors have been identified:
1. Definition of a criterion (Where we want aquaculture to be? For example we would like low fish mortality);
2. Indicator name and rank of importance at environ./ business/ social level (E.g. Fish mortality, rank 1 - most relevant);
3. Rational and context (Why fish mortality is relevant benchmark? How it contributes in achieving sustainability?);
4. Ease of measure (How easy, how often, who is responsible for?);
5. Effect/ overlap/ compromise with other SI (Showing cumulative + effects or trade-offs);
6. Trend (Which way we want the indicator to go? Where in 5 years?);
7. Implementation (How easy in sector? Legislation? Any research? Costs?).

Based on this large quantity of indicators, that in some cases were tested in the farm and country level, an Aquamed list of indicators was compiled. It comprised only indicators that (1) were highly acceptable, with a weighed mean score > 66th percentile and (2) are widely used at the Mediterranean level. List of original indicators is in Annex 1. The list includes the principle, criteria and its belonging indicator, as well the origin from where they were taken. Governance dimension included 6 indicators, economic 15, societal 14 and environmental 15 indicators (in total 51). Together with indicators list, a table identifying the source where the indicators could be found out (at national or regional level), the range of sustainability scoring (1= unsustainable; 2= far from sustainable; 3= approaching sustainable; 4= nearly sustainable; 5= sustainable) and the calculation of the indicator with known reference values (Annex 2) was sent to each partner country for assessment and scoring. Partners had to chose among 51 indicator, the 5 most useful ones. Based on this partner ranking, a second list of indicators was developed, which included only the indicators that have been chosen by 62.5% of partners.

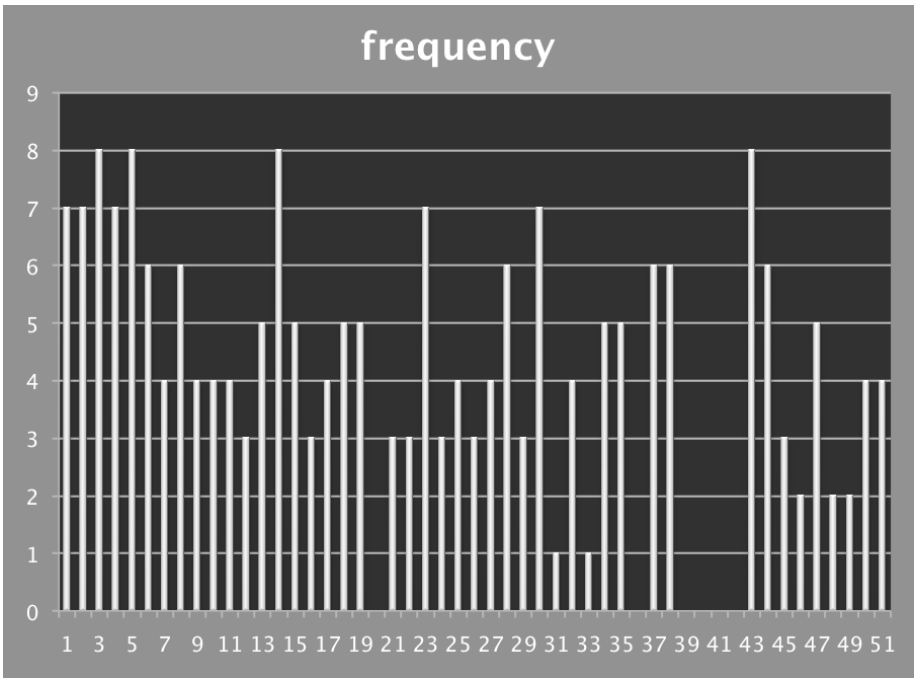
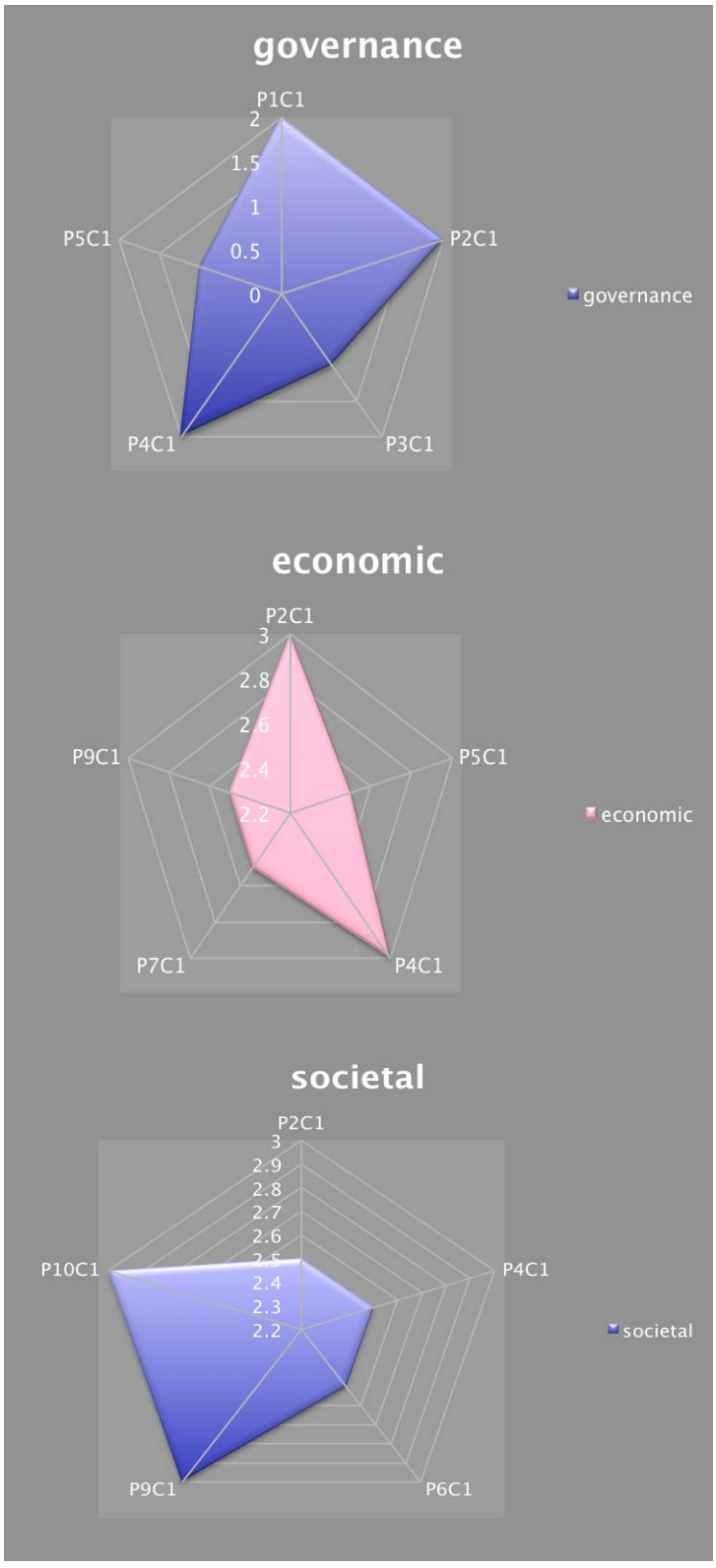


Table 1: The frequency of 51 indicators chosen by each of partners.

Likewise, 100% of partners have chosen the following indicators: 3. number of fish-farmers taking part in consultative bodies; 5. existence of a public plan to support aquaculture development; 14. investment in R&D&I in aquaculture, and 43. existence of a well-defined environmental policy, program and/or strategy for aquaculture.
87.5% of partners have chosen: 1. existence of ICZM plan for coastal areas, including aquaculture under head state authority, taking account future evolution of industry; 2. number of workers (direct and indirect); 4. existence of bodies in support to aquaculture training; 23. annual production, and 30. existence of national aquaculture strategy.
75% of partners have chosen: 6. existence of extension and dissemination services; 8. feed cost/kg fish produced (and % of total cost/kg); 28. number and quality of jobs; 37. depth (m); 38. food conversion ratio (kg food/kg fish), and 44. existence of common site selection criteria.
62.5% of partners have chosen: 13. change in total aquaculture production value; 15. legal security of tenure; 18. existence of market tools; 19. prices, range of products, consumption; 34. composition of the workforce (age, education and gender); 35. education/training, and 47. existence of native and low-trophic-level species.
The rest of indicators that have been chosen by less of 62.5% of partners were not included in further analyses.
The exercise also included the scoring for 5 chosen indicators in each of the 4 dimensions and the visualization of scores by kite diagrams for each country. In the example of Croatia the scoring diagrams are shown below:


governance
P1C1
2
1.5
1
0.5
0
P2C1
P3C1
P4C1
P5C1
governance
economic
P2C1
3
2.8
2.6
2.4
2.2
P5C1
P4C1
P7C1
P9C1
economic
societal
P2C1
3
2.9
2.8
2.7
2.6
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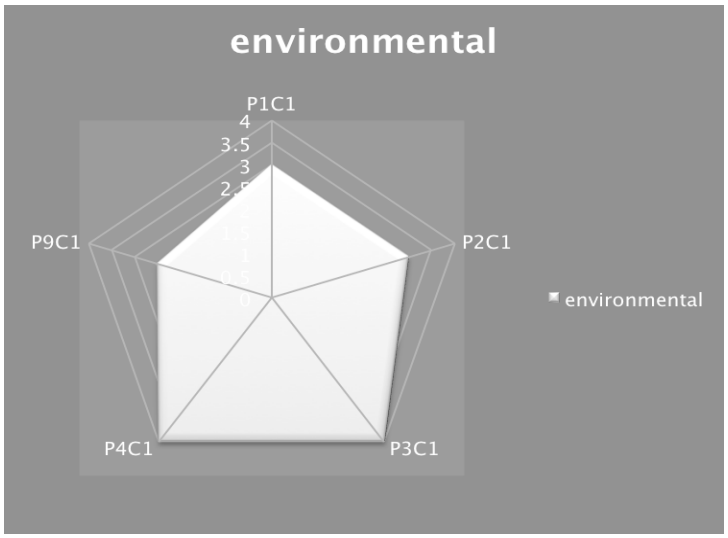
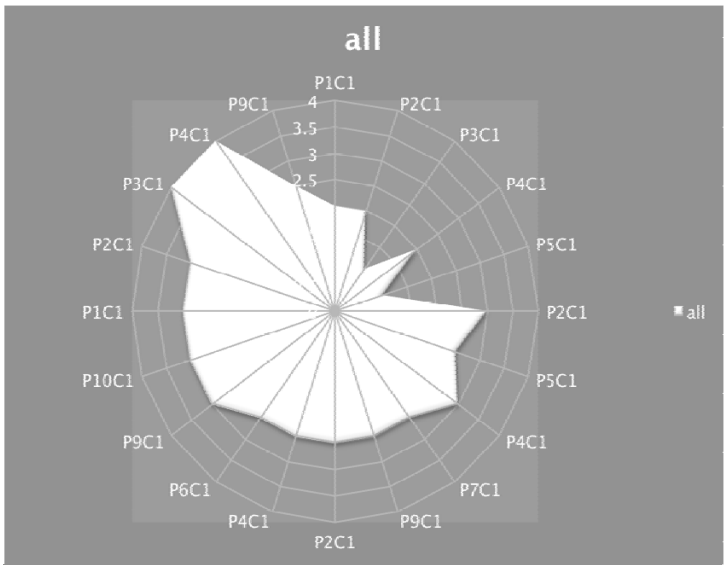
societal



Summing up all scores from 4 dimensions, a total kite diagram was obtained:



Based on the partner comments, the final list of ranked indicators was sent to all partners for evaluation and the validated indicators were used as a base to develop a software (Annex 3).

B. Indicators of sustainability of aquaculture research in the Mediterranean

Very few studies presented the development of indicators used to evaluate the sustainability of a particular research activity. If any, they are hardly applied to aquaculture research. The reasons recognized as bottlenecks in developing research sustainability indicators arethat (1) they are hardly measurable because of the difficulty of ascribing to research as such a direct impact on a complex phenomenon; (2) they are hardly referenced because of the unpredictability of research results and of the length of the research and innovation cycle, and (3) they are not many because there is no linearity of the innovation process. For all of these reasons, it is believed that the construction of indicators to measure the direct impact of R&D on the 4 dimensions is extremely difficult. An additional difficulty is to produce global

indicators to evaluate a program, from the evaluation of several independent and relatively small projects composing it.
In order to collect indicators (of the 4 dimensions), that may assess an impact on research , existing sources have been used (Annex 1):

1. InDAM: a small number of indicators are relevant to assess a potential impact on research (7 in total);

2. Aquamed: from WP4 of the project, gathered data related to the research were reformulated in indicators (5 in total).

3. Vision RD4SD: (VISION Research and Development for Sustainable Development) is a Coordination and support action (2011-2013) project financially supported by the European Commission 7th Framework Program, coordinated by the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas) (http://www.visionrd4sd.eu). It aims to ensure that Europe is able to contribute to a sustainable development of the world, by formulating policies and decisions based on robust, up-to-date knowledge. This will be done by developing a shared vision between science funding bodies and national science policy institutions in the European Member States on how best to harness research and development for sustainable development. Indicators from this project do not follow the principle-criteria-indicator system and are global for research in general. The project however recommends the study of the process rather than the measurement of the impact, which is another difference from the system that was used for aquaculture sustainability indicators (20 in total).

The list of selected indicators (32 in total) was evaluated among the project partners but the approach was not satisfying (you have to explain why it was not…). It was therefore decided to create a specific set of indicators on research sustainability using directly the results obtained in the WPs of Aquamed:

WP4: coordinated by the Moroccan partner INRH, was aimed at making an inventory of all existing research teams, tools, projects, networks through Mediterranean and to carry out a first analysis of the lacks and overlapping at the country level. One of the tasks was to map all the existing types of research expertise and training, physical infrastructures, available funds (origin attribution process and use) and existing initiatives, national and international projects. It enabled the collection, identification and description at the country level of the research means in the sector of aquaculture (infrastructures, management and funds), projects and communication tools, capacity of development (training and expertise in aquaculture, recruiting of the sector), which was further fed in the database of Aquamed (WP5, Spanish partner IEO), and served as well for development of the typology in Mediterranean aquaculture (WP6, French partner CRNS LAMETA);

WP6: coordinated by French partner CRNS LAMETA, was aimed at performing data analysis and identification of several types of situations where countries are confronted with similar constraints, among which one aspect is the research capacity at the country and regional levels. From this approach, two deliverables that had the potential to offer adequate research indicators were: the common database construction characterizing the aquaculture systems and research means, elaborated through the country level inventories and the key variables identification and country typology realization in order to identify groups of country confronted to similar situations. Indicators (total 32) extrapolated from WP6 are listed in Table 2.

Capacity of research (Production (tons)/researcher manpower (researchers, technicians, training positions))
Number of researchers working on aquaculture
Number of technicians working on aquaculture
Percentage of institutions projects on System-environment
Percentage of institutions projects on Biology
Percentage of institutions projects on Society
Percentage of institutions projects on Shellfish
Diversity of institutions research facilities
Percentage of diversity of institution research facilities
Standard deviation of facilities diversity (more important is the figure more it exist specialization per country, e.g. Spain research institutions work on a diversity of topics but they are specialized in histology, physiology and nutrition)
Percentage of development projects (comparing to research projects).
Number of projects started in 2005
Number of projects started in 2006
Number of projects started in 2007
Number of projects started in 2008
Number of projects started in2009
Number of projects started in2010
Percentage of projects with international collaboration
Percentage of research projects involving stakeholders
Number of projects involving fish and shellfish farmers
Number of projects involving government bodies
Percentage of projects which have produced protocol
Percentage of projects which have produced Handbook
Percentage of projects which have produced Review
Percentage of projects which have produced Case study
Percentage of projects which have produced Prototype
Percentage of projects which have produced Products
Percentage of projects which have produced Standards
Percentage of projects which have produced Guidelines
Percentage of projects which have produced Learning material
Percentage of projects which have produced Database or directories
Percentage of projects which have produced Software

Table 2: List of 32 indicator of sustainability of research of aquaculture in the Mediterranean extrapolated from WP6.

WP7: coordinated by Italian partner ISPRA, was aimed at identifying the research needs and formulating recommendations in order to improve the efficiency of the research sector at the group of countries and Mediterranean levels. From one of its deliverables - Collective synthesis of research needs necessary to overcome the constraints identified per group of countries and at Mediterranean regional level, principles-criteria-indicators were extrapolated. In this WP, more then 150 stakeholders originating from research, industry, policy bodies and NGOs have compiled 2 on-line surveys where they elucidated the information and consensus on

future trends, identified knowledge gaps and challenges and prioritized the research needs in fish and shellfish, as well as marine and freshwater sector of aquaculture. After an extensive data analysis, ISPRA generated 10 top goals and 10 top subgoals, that were used as bases for the development of research indicators.

The top (sub)goals were translated in indicators as shown below:

Thematic area #8: TA8-SocioEconomics & Governance includes a goal “To develop policy for national aquaculture” (scored very high, e.g. 74.88). It can be included in the governance dimension, answer to the principle: P1. To develop research focused on policy for national aquaculture; criteria: C1. Level of development of policy for national aquaculture, and indicator: 1. Percentage of policies existing for national aquaculture in relation to the whole agriculture sector.

Another example related to Thematic area #1: TA1-Product Quality & Consumer includes a goal “To guarantee products with high quality standards and maximize human health benefits” (scored 74.24), was included in economic dimension, answering to the principle principle: P1. To guarantee products with high quality standards and maximize human health benefits; criteria: C1. Level of high quality standards for aquaculture products that maximize, and indicator: 6. Number of projects assessing nutritive aspects of aquaculture products in 5-years period.

In total 52 indicator were extrapolated using this research from WP7 (Annex 4).

Further, the 2 lists composed of 32 indicator generated from WP6 and 52 from WP7 were distributed to all partner for evaluation and ranking. In some cases very similar indicators were developed from both WPs.

The same approach of indicators selection as for aquaculture sustainability was then used: after analyzing the frequency at which each partner has chosen a set of 5 indicators in 4 dimensions for the sustainability of the research, indicators that were chosen with less than 62.5% of partner were discarded. For example, 100% partners have chosen these indicators:

1. Percentage of policies existing for national aquaculture in relation to the whole agriculture sector
2. Percentage of projects involving aquaculture science, social science and other coastal users in relation to total number of aquaculture-related research.
3. Percentage of projects aiming aquaculture impact on the environment including different stakeholders in relation to total number of aquaculture-related research...
4. Number of projects assessing integration of aquaculture activities and aquaculture management policies at national level in 5-years period.
6. Number of projects assessing nutritive aspects of aquaculture products in 5-years period.
7. Number of organized training courses or workshops on aquaculture sustainability in 5-years period.
16. Number of projects aiming at the safety recommendations for aquaculture products at national level.
17. Number of projects aiming the safety of aquaculture products in 5 years.

The framework used for selected aquaculture/ research sustainability in the Mediterranean

For the organization of sustainability indicators, some common methods or frameworks exist. The simplest framework is the category or issue list based on the main focus of each indicator, which shows whether all aspects of the aquaculture (environmental, social, governance, economy) are represented. A goal-indicator matrix can show how each indicator relates to many issues or a set of aquaculture goals. Driving force-State-Response (DSR) table balance measures of causes or driving forces, of results and of programs or other human activities designed to alter driving forces with the goal of improving the state.
In Aquamed, the approach developed and described from the EVAD project was used. For this purpose, principles and criteria were prioritized for each set of indicators, which was done during previous projects. Each principle could comprise many criteria, and each criteria could be monitored by many indicators.
Because the most useful indicators from previous projects were used and disseminated to the partners for ranking, in the final Aquamed list of indicators (used further to develop the software), mostly one principle comprised only one criteria, described by only one indicators. As the consensus was that the Aquamed indicators list and the software will comprise only 5 indicators for 4 dimensions in order to remain robust but simple and versatile tool for stakeholders, inevitably the concept of describing the principle with more than one criteria was lost.

Description of the tool for monitoring aquaculture/ research sustainability in the Mediterranean

The final list of aquaculture and research sustainability in the Mediterranean was developed and comprises in total 20 indicators (Annex 3). The last step of this WP was to wrap-up the selected indicators and their implementation into a tool (software) that will enable accurate measurement of sustainability at the national and at a regional levels. The tool enables identification of strengths and weaknesses in respect to sustainability, providing its items of evidence to the different stakeholders on one hand and the identification of putative intervention points for improvement, on the other. It also visualizes trends and developments over time, aiming to discern the pitfalls and bottlenecks at the appropriate moment, giving enough time for improvement. This tool is of key importance as it represents the basis for continuing the work and exchanges after the end of the project, through the feedback from the Stakeholder platform.

The software developed is named AMI (Aquaculture Mediterranean Indicators) and comprises a small introduction of the Aquamed project (aims and scopes) and the short explanation on how it is used for aquaculture and research indicators. When starting the analysis, the user (stakeholder) selects first its category (research, industry, policy body, NGO, other), its country of origin and the type of sustainability indicators that has to be calculated (aquaculture or research). Then, the user scores one by one each of five indicators in 4 dimensions, helped by short explanations on how the specific indicator can be calculated and the indicator score (from 0 to 5). Since all research sustainability indicators have been developed from Aquamed, their reference values can be found in the Aquamed database of research capacities, which is open for Aquamed MSHP users (this has been explained in the AMI introduction). After scoring all 20 indicators in specific area, AMI generates kite diagrams for 4 dimensions and the final kite diagram comprising all indicator scores. Also a visualization using "traffic lights" has been added. AMI output can be saved in pdf and printed out for filing over time. In addition for visualization of sustainability, AMI provides a very robust "diagnosis" of specific scored situations that serve as a bases for work on the improvement of the system.

The AMI software can be freely downloaded directly from http://byte-lab.com/download/ami/publish.htm or Aquamed website.

Technical details: AMI software was developed using Microsoft Visual Studio 2012 integrated development environment. Software is based on NET framework 4 Client Profile and is completely written in C# programming language. Data related to indicators are stored in external XML files to simplify modifications and localization.

System requirements and supported operating system: Windows 7, Windows 7 Service Pack 1, Windows Server 2003 Service Pack 2, Windows Server 2008, Windows Server 2008 R2, Windows Server 2008 R2 SP1, Windows Vista Service Pack 1, Windows XP Service Pack 3, Windows XP SP3, Windows Server 2003, SP2 Windows Vista SP1 or later, Windows Server 2008 (not supported on Server Core Role), Windows 7, Windows Server 2008 R2 (not supported on Server Core Role), Windows 7 SP1, Windows Server 2008 R2 SP1. Supported architectures: x86, x64.

Hardware Requirements (recommended minimum): Pentium 1 GHz or higher with 512 MB RAM or more, minimum disk space: x86 – 600 MB, x64 – 1.5 GB.

Prerequisites: Windows Installer 3.1 or later, Internet Explorer 5.01 or later.

AMI will be disseminated to the stakeholders during their next platform meeting for "in situ" validation, as well as to the Aquamed partners. The feedback on the usefulness of AMI has been secured in a way that after finishing the analysis and before the user is able to save/ print it, a pop-up box emerges with the field where the user needs to comment any aspect of the tool. The comment is automatically sent to defined e-mail address (feedback@aquamedproject.net), where it will be stored for further analysis. Feedback data from the stakeholders and national parties, will be collected after they have been uploaded through the project web site that will continue to be active after the end of the project (5 years).