Deliverable No. 2.1

Project acronym:

AquaVitae

Project title:

New species, processes and products contributing to increased production and improved sustainability in emerging low trophic, and existing low and high trophic aquaculture value chains in the Atlantic

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[1] Document will be a draft until it is approved by the coordinator
[2] PU: Public, PP: Restricted to other programme participants (including the Commission Services), RE: Restricted to a group specified by the consortium (including the Commission Services), CO: Confidential, only for members of the consortium (including the Commission Services)
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Deliverable D2.1

Description of the scope, plans and initial stakeholder feedback for case studies (CS) that report to Work Package 2 (WP2)

21/04/2021

Executive Summary

Work package 2 (WP2) coordinates the AquaVitae case studies (CS) that will produce data related to post-hatchery to harvest technology development; however, this work package will also include post-harvest aquaculture products/processes that are circulated back into aquaculture to improve the aquaculture production of low trophic species. As such, all eleven case studies (CS1 - CS11) and both cross-cutting case studies (CS12 and CS13) will report part of their progress to WP2. This work also covers all five value chains, including: VC1 Macroalgae culture; VC2 Integrated multitrophic aquaculture (IMTA); VC3 Echinoderm culture; VC4 Shellfish culture; and VC5 Finfish culture. Overall, the work package shall place emphasis on environmental and economic sustainability of the technologies, including: (a) farming lower trophic levels; (b) reducing the environmental impact of the higher trophic species by including low trophic species as production inputs (e.g. feed-ingredient/feed-source) for higher trophic species; and (c) there will also be a focus on the recovery of waste-resources from aquaculture that can either be developed into products in their own right, or cycled back into aquaculture and thus reducing its overall environmental impact further.

The cross-cutting nature of much of the research that reports to WP2, sees numerous CS contributing to the completion of a single task. In such instances part of the results of a single task will be reported in one case study and some of the results will report to another; no results will be duplicated. A survey of the initial work-plans (completed by respective CS leaders in M4) found some duplication, and this is being rectified. In other instances, it was found that seemingly similar tasks carried out in different CS, were not exactly the same; and in those cases, the differences in those tasks have been highlighted. **Detailed work plans of each CS are included in Annex 3 of D1.1 and this Annex should be read in conjunction with this Deliverable (they have not been replicated here in the interest of brevity).**

Since WP2 shares many of the stakeholders with WP1 and WP3, the leaders of these three work packages have developed a common stakeholder survey system. This was done to improve reporting and data collection efficiency and to avoid partner and stakeholder fatigue. **Again, the detail of the reporting and survey system are included in WP1 Deliverable 1.1 and have not been duplicated here.**

The purpose of the stakeholder survey was to ensure that the CS tasks were well-aligned with the needs and expectations of the aquaculture industry and other stakeholders that stand to benefit from this project. It was not possible to reveal the identity of participants in the survey, primarily due to proprietary information and competition between business partners (from within and outside of the AquaVitae consortium), and this placed limitations on the depth of information that could be shared and it placed limitations on the depth of information that could be included in the conclusions that were could be drawn from the survey. However, the survey fulfilled its designed purpose and demonstrated alignment between the CS work plans (**see Annex 3, D1.1**) that were being developed at the time of the survey and these plans subsequently took cognisance of the survey and expected outcomes and with needs and expectations of industry stake holders. This is not surprising since the AquaVitae tasks and CS work plans were developed based on calls from the stakeholder group that was largely interviewed here. The pool of stakeholders that are surveyed will be expanded further in future stakeholder surveys.

An analysis of the survey carried out in preparation of this deliverable, includes the following recommendations for future surveys:

- It needs to be streamlined to limit data directly needed for the innovation work packages only;
- The survey needs to include greater emphasis on experimental approach that will better align the CS work plans with the needs of industry;
- It needs to be modified (or a second survey developed) for non-industry stakeholders;
- In future surveys, greater importance needs to be placed on the method of interview, particularly for stakeholders who are not AquaVitae partners and who are not familiar with the project and who might need to be given direction to answer the question so that the answer remains relevant to the project (which is easily done if the interview is carried out in-person or over the telephone; but less easily done if the responded completes the interview by email, for example);
- The responded needs greater context to complete the interview (primarily new AquaVitae stakeholders and those that are not AquaVitae partners) and this could be done by expanding on the task description provided by the CS leader in the survey, providing more contextual documentation to the responded ahead of the interview, or just inviting them to view the AquaVitae kick-off meeting videos ahead of the interview;
- Greater importance needs to be given in relation to respondent anonymity, making them aware how the survey data will be used, the level at which their own data will be distributed/or not and the audience to which it will be distributed.

Contents

1. Introduction

Synopsis AquaVitae

Work Package 2 (WP2) is the second of nine work packages that make up the AquaVitae (AV) research and innovation project. While the development and innovation processes in the project will generate a series of new species, technological processes and products in various aquaculture value chains (and these developments will report to WP1, 2 and 3), the AquaVitae project will also evaluate, test and have these innovations validated by stakeholders and this validation will be reported in other work packages in this project (i.e. WP4 to WP9). The contextual detail of the project has already been introduced in the AV's first deliverable of WP1 (D1.1) and the deliverable here shall include an abbreviated introduction only, to reduce replication. However, it will include sufficient information to allow for this deliverable to be interpreted independently of D1.1 and D3.1.

AquaVitae is funded by the EU's Horizon 2020 programme, and includes a project consortium of 36 partners, from 16 countries and four continents. In addition to numerous countries in Europe, project participants are located in South Africa, Namibia, Brazil and North America. The overall aim of AV is to introduce and develop technology for the aquaculture low trophic species, products and processes in aquaculture value chains, and that are applicable to stakeholder across the Atlantic Ocean.

Scope and motivation of Deliverable 2.1 (D2.1)

The aims of AV's second work package are to develop new production technologies and to improve existing production technologies to facilitate the requirements of stakeholders that have an interest in the following aquaculture value chains (VC):

- VC1 Macroalgae culture
- VC2 Integrated multitrophic aquaculture (IMTA)
- VC3 Echinoderm culture
- VC4 Shellfish culture
- VC5 Finfish culture

This work package, in line with the other work packages in the AV project, shall place emphasis on environmental and economic sustainability of the technologies that are investigated and developed as part of this project. This will include: (a) focusing on farming lower trophic levels (i.e. including low trophic species as the primary aquaculture product); (b) including low trophic species as production inputs (e.g. feed-ingredient/feed-source) for higher trophic species and thus reducing the environmental impact of the higher trophic species; and (c) the recovery of waste-resources from aquaculture that can either be developed into products in their own right, or cycled back into aquaculture and thus reducing its overall environmental impact further.

This deliverable (D2.1) shall focus on aligning the needs and expectations of the stakeholders with interest in these five value chains, with (a) the proposed work-plans (Annex 3, D1.1) and (b) the expected outcomes of the research that will report to WP2.

2. Scope of Work Package 2 (WP2)

The differentiation of tasks that report to WP1 and WP2 are quite clear since all activities related to hatchery and seed-development technologies report to WP1 and all aquaculture production-related tasks that take place post-hatchery to harvest report to WP2. However, the line between WP2 and

WP3 is less clear. Some products of aquaculture that would seemingly have reported to post-harvest technology of WP3, cycled back into aquaculture to improve production and thus report to WP2. So, it was not always clear if the process/technology should report to WP2 or WP3. Therefore, the scope of WP2 and WP3 required clarification, and this has been summarised as follows (Figure 1):

- All post-hatchery to harvest technologies report to WP2. However, this work package will ALSO include post-harvest aquaculture products/processes that are circulated back into aquaculture to improve the aquaculture production of LOW TROPHIC SPECIES;
- All other post-harvest technologies will report to WP3; taking particular note that products that circulate back into aquaculture to improve HIGH TROPHIC SPECIES shall report to WP3 (and, repeated in this bullet for the sake of clarity, those that circulate back into aquaculture to improve low trophic species shall report to WP2). It should also be noted that post-harvest products for human consumption shall NOT report to WP3 since they are already accounted for in WP7.

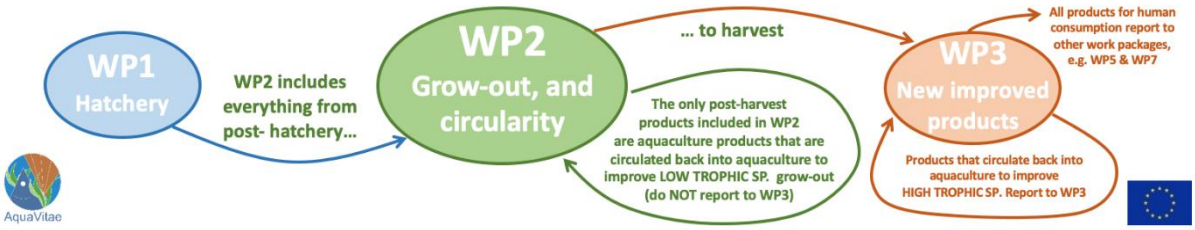

Figure 1 Clarification of how to determine which project tasks report to Work Packages 1, 2 and 3 (WP1, WP2 and WP3).

All of the AquaVitae case studies (CS) include tasks that will produce research outputs that will contribute towards stakeholder needs and expectations that are covered in WP2. The CS include:

- CS1: Macroalgae, new species production (CIIMAR)
- CS2: Offshore macroalgae cultivation (ORF)
- CS3: Land-based IMTA (FCPCT)
- CS4: Sea-based IMTA (RhU)
- CS5: Biofloc and pond based IMTA (UFSC)
- CS6: Sea urchin roe enhancement (Nofima)
- CS7: Sea cucumber species, site selection and key hatchery steps (AWI)
- CS8: Improving seed availability and grow-out of native and non-native oysters (IVL)
- CS9: Offshore production of blue mussels (DTU)
- CS10: Optimising freshwater fish production in Brazil (EmBraPa)
- CS11: Marine finfish farming (FURG)
- Cross cutting CS12: Adding value to aquaculture by products
- Cross cutting CS13: Low trophic level fish feeds

Case study 1 and the cross cutting CS12 and CS13 were not originally (i.e. according to the detail of the AV project application) going to include tasks that reported to WP2. However, as the case studies were developed and as the work packages and their boundaries evolved (i.e. the process that resulted in the detail presented in Figure 1), it became apparent that CS1, CS12 and CS13 included tasks that would contribute to WP2.

In the first four months, the work plans of all these case studies were developed and scoped to demonstrate how their research outputs would contribute to the different value chains, and how they will benefit the project's stakeholders. These work-plans have been updated and have been formally submitted by the case study leaders to the work package leaders and have been presented in Annex 3 of D1.1; however, they shall remain "working documents" and shall be subject to change over the duration of the first 36 months of the project, based on the outcomes of initial research and based on our understanding of the needs and expectations of our stakeholders. A broad summary of the tasks that will report to WP2, the value chain to which they report and the potential application of the research has been included here (Table 1).

Due to the cross-cutting nature of much of the research that is taking place in this project, numerous case studies might contribute to the completion of a single task. In such instances part of the results of a single task will be reported in one case study and some of the results will report to another. No results will be reported twice.

The scoping of the 11 case studies and two cross cutting CS work plans demonstrated what, at first glance, might appear to be duplication of tasks between case studies (Table 1); i.e. the same task is listed more than once in the list. All overlapping tasks have been highlighted and brought to the attention of CS leaders. In two instances (and both cases this included tasks the reported to cross-cutting case studies), the same task was reported in more than one case study, and these are being addressed with the case study leaders concerned and the work plans are being corrected to eliminate the overlap. In other instances, where a task appears more than once and might appear to be duplicated (Table 1), it was found that that this was not the case. For example, exactly the same procedure will be carried out on algae harvested in land based IMTA as algae harvested in sea-based IMTA; that is, exactly the same process, but carried out on two different products and reported in two different case studies. Again, this has been brought to the attention of the case study leaders and is currently being addressed by making the difference in the tasks very clear in the scope of the work that will be carried out in the case studies.

Table 1: Comprehensive overview of the tasks that report to WP2, the value chain to which the stakeholder is likely to apply the outcome of the task and case study (CS) to which the activity reports.

Activity that report to WP2	**Value Chain:**				
	IMTA	**Macroalgae**	**Shellfish**	**Echnioderm**	**Finfish**
Codium tomentosum grow out		CS1			
Commercial scale *Ulva* production		CS1			
Characterization of algal biomass		CS1			
Find suitable commercial-scale sites		CS2			
Test large scale reuse of equipment		CS2			
Inclusion of product in abalone diets		CS2 & CS13			
Abalone IMTA			CS3		
Co-culture of algae, abalone, sea cucumber	CS3 & CS7	CS3 & CS7	CS3 & CS7	CS3 & CS7	
Biosecure integration of algae, abalone	CS3 & CS13	CS3 & CS13	CS3 & CS13		
Biosecure integration of algae, abalone	CS4 & CS13	CS4 & CS13	CS4 & CS13		
Sea-based culture of macro-algae, mussels	CS4	CS4	CS4		
Alternative algal products into abalone feed	CS3 & CS13	CS3 & CS13	CS3 & CS13		
Co-culture of European lobster, Europe flat	CS4		CS4		
C & N in a fjord: mussel, seaweed, salmon	CS4	CS4	CS4		CS4
Long line Ulva for feeding abalone	CS4	CS4	CS4		
Ulva on cages for feeding abalone	CS4	CS4	CS4		
Scallop and oyster production	CS4		CS4		
Identification of new species	CS4	CS4	CS4	CS4	CS4
Shrimp production in biofloc	CS5		CS5		
Evaluation integration of shrimp, mullet, Ulva	CS5	CS5	CS5		CS5
Pond based shrimp, seaweed, oyster	CS5	CS5	CS5		
Strongylocentrotus droebachiensis roe				CS6	
Paracentrotus lividus roe production				CS6	
Species identification				CS7 & CS3	
Controlled feeding experiments				CS7 & CS3	
New/improved techniques native oysters			CS8 & CS12		
Improved anti-fouling in oyster culture			CS8		
Challenges high-energy mussel production			CS9		
Recycling $CaCO_3$ in mussel shells			CS9 & CS12		
Protocols to manage fouling on blue mussels			CS9		
Large-scale production of triploid tambaqui					CS10
Brazilian flounder growth in RAS					CS11
Feed development for juvenile flounder					CS11 & CS13
Carbon foot print of mussel culture			CS12		
Finfish fed by-products ($CaCO_3$; finfish waste)			CS12 & CS13		CS12 & CS13
Using macroalgae to improve feeding for LTS		CS13, CS2, CS3 & CS4	CS13, CS2, CS3 & CS4		CS13, CS2, CS3 & CS4
LTS to improve feeds for HTS			CS13 & CS12		CS13 & CS12

3. Plans and methodology

Since all of the CS shall be required to report their progress to more than just one of the innovation work packages (i.e. WP1, WP2 and WP3) and since their tasks (and in some cases a single task) might make contribution/s to the value chains at either hatchery or grow-out and product-stage of the value chain, almost all CS will be reporting to numerous work packages. For this reason, and to facilitate an efficient reporting, WP1, WP2 and WP3 have developed a common reporting structure, so the method that is presented here is largely common (and thus repeated in place so that each plan can be interpreted independently) in equivalent sections of WP1, WP2 and WP3:

As already mentioned in D1.1, to comply with the plans and methodology section, WP1-3 leaders have developed a CS report template (see Appendix 2 D1.1) that will be sent out to each CS leader to be completed by M6, M12, M18, M24, M30, M36, M42 and M48. By this means, both WP leaders as well as case study leaders are in possession of the information needed to supply the relevant industry with the case study developments. The document will also be used to keep track on the stakeholders involved and detail their interest and comments towards the potential applications resulting from each CS.

Industry will be presented with a synopsis of the research outputs that report to WP2 and the survey will be designed to:

a. get the industry's perspective on the developments and tailor the production system/methodology to the industry's requirements;
b. identify implementation of culture advancements; and
c. identify the production process that is industry ready.

The leaders of WP1-3 have prepared a common questionnaire to better understand the needs and expectations of the industry stakeholders (Appendix 1, D1.1) that will be used to align the expected outcomes of this project with the needs of society. The use of this questionnaire, the process of how it will be modified in relation to the spiral model (D1.1, Figure 1) and how it will be used to influence the CS work-plans and tasks and has been described in D1.1 and this process shall be applicable to WP2 (D2.1). The results of the stakeholder survey and the report system from the case study leaders is common to WP1, 2 and 3.

4. Initial stakeholder feedback

The purpose of the stakeholder feedback in WP2 is ultimately to ensure that the research approaches adopted by the case studies in AquaVitae are well-aligned with the needs and expectations of the industry and other stakeholders that might benefit and gain positive impact from this project. This deliverable (D2.1) includes: (a) feedback on the development of an appropriate stakeholder survey process. It also presents (b) the approach that has been developed, (c) how it should be modified going forward to better gather stakeholder-related data, and (c) it includes a summary of direct feedback from interviews from stakeholders (20 stake holder surveys where received and contributed to the analysis prepared for D1.1, D2.1 and D3.1), including stakeholders that are external to AquaVitae and those that are project partners. The content of this deliverable will be used to modify the content and approach in further WP1, 2 and 3 surveys and it will feed directly back to case study work plans.

Overall, the purpose of the AquaVitae project aligns well with the expectations of the industry stakeholders; their responses ranged and varied but, overall, there is alignment with what the project is offering and what the stakeholders are looking for. This is not surprising since, in many cases, the project was designed based on a call from industry for this research. For example, the development of macroalgae aquaculture was repeatedly raised as an industry stakeholder sustainability priority and the project is delivering to this end. However, this should be interpreted with the limitation of the survey-group in mind. That is, the respondents were not randomly selected from the aquaculture industry, but sent to a small selection of stakeholders with whom the case study leaders were familiar and, in many cases, the case study leaders would have known the stakeholder's interest in this project. Nonetheless, this survey confirms that the project is addressing issues that align with the expectations of industry stakeholders.

Going forward, and given that it has been established that a large portion of the stakeholders find the work that is being carried out highly relevant to their business, the survey might offer greater value to the AquaVitae project if it were modified to get feedback on how the research approach might be better modified to make even more relevant to the industry stakeholders.

It was noted that this survey was well designed for industry stakeholders, but parts were not well designed for stakeholders with other interests. For example, policy makers, research institutes that might support aspects of this research and non-government organisation (NGOs) with agenda's outside of industrial production might require a very different survey format.

Attention also needs to be given to interview method, particularly for new AquaVitae stakeholders. It might be necessary to have slightly different surveys for new AquaVitae industry stakeholders, or to provide new AquaVitae stakeholders with more background/contextual information either during or ahead of the survey. Stakeholders that were familiar with the project seemed to have little problem in completing it (although even some of the AquaVitae-partner stakeholders had problems with some of the survey questions). Some of the stakeholders, with limited knowledge of AquaVitae, found it hard to complete the survey and this appeared to be based on it not providing sufficient background/contextual information on the purpose of AquaVitae. This could be addressed by either: (a) expanding on the section that describes the relevant task and providing greater context; and/or (b) providing the respondent access to more project documents ahead of the interview; and/or (c) providing web-links to some of the videos that introduce the project and its overall aims and objectives ahead of the interview. Furthermore, AquaVitae-partner stakeholders were able to complete the survey on their own by email, whereas those without knowledge of the project struggled, since they posed contextual-related questions for many of the questions and either did not answer them or noted that their answer might be inappropriate since they were unsure of the context of the question or how it related to the project. Limiting new AquaVitae participants to in-person or telephone interviews, where the respondent can interact with the interviewer who has knowledge of the project, will probably address this sufficiently well in the future.

Anonymity in the surveys and what was going to happen to the data collected in the survey was highlighted as a concern by some respondents. This concern was based on the feedback that some of the stakeholders are competitors and that hold valuable proprietary information, and that the disclosure of any information might compromise the security of information; not just if the data is placed in the public domain, but within AquaVitae too. There is competition among some of the AquaVitae stakeholders, and the transcribed stakeholder interviews contain personal/company data, so storing the detail on the internal SharePoint server does not address the concern of stakeholders. The survey did not cater sufficiently for this, and it was felt that:

(a) It needed to state, more clearly, the audience to which the outcome/results/detail of the survey was intended.
(b) What the information was going to be used for.
(c) There should have been a clear option to remain entirely anonymous in completing the survey.
(d) The survey should state clearly that a responded was not required to complete any part of the questionnaire that they do not wish to complete.

5. Conclusion

During the first five month of the project the leaders of WP1-3 have closely cooperated to prepare the methodology for scoping the case studies. The first set of products coming from the case studies were extracted from CS specific work-plans prepared by all CS leaders. A common template for regular, comprehensive CS reports and a common questionnaire to gather stakeholder feedback with regards to the products arising from the case studies were developed. Both are currently being tested by the CS leaders. The timeline for the use of these two tools (template and questionnaire) to develop and test new products from the aquaculture value chains were set.

The cross-cutting nature of much of the research that reports to WP2, sees numerous CS contributing to the completion of a single task, and this requires very close working relations between CS leaders and leaders of WP1, 2 and 3.

This deliverable also included the detailed CS work plans (CS1-CS13; Annex 3, D1,1), which include research plans, partners involved, location and timing of the research and a description of the expected key exploitable results. These will all contribute to the overall aims and outputs of this work package and those of WP1 and WP3.

The close alignment that the initial survey found between the CS work plans (see Annex 3, D1.1) and expected outcomes with needs and expectation of industry stake holders was not surprising since the AquaVitae tasks and CS work plans were developed based on calls from the stakeholder group that was largely interviewed here. However, an analysis of the survey used for the stakeholders of WP1, 2 and 3 has found that the survey process could be improved in future:

- It needs to be streamlined to limit data directly needed for the innovation work packages only;
- The survey identified the importance of aligning experimental approach of the CS work plans with the needs of industry;
- The survey needs to be modified (or a second survey developed) for non-industry stakeholders;
- In future surveys greater importance needs to be placed on the method of interview, particularly for new AquaVitae stakeholders who are not familiar with the project and who might need to be given direction to answer the question so that the answer remains relevant to the project (which is easily done if the interview is carried out in-person or over the telephone; but less easily done if the responded completes the interview by email, for example);
- The responded needs greater context to complete the interview (primarily new AquaVitae stakeholders or those that are not AquaVitae partners) and this could be done by expanding on the task description provided by the CS leader in the survey, providing more contextual documentation to the responded ahead of the interview, or just inviting them to view the AquaVitae kick-off meeting videos ahead of the interview;
- Greater importance needs to be given in relation to respondent anonymity, making them aware how the survey data will be used, the level at which their own data will be distributed and the audience to which it will be distributed.