Programme: FP7 Cooperation
Theme 2 Food, Agriculture, Fisheries and Biotechnologies

Deliverable N° 40

Plans of Action from Consultation Workshops

Project Acronym :	AQUAINNOVA
Project title :	Supporting governance and multi-stakeholder participation in aquaculture research and innovation
Grant agreement number :	245238 – FP7-KBBE-2009-3
Project coordinator :	European Aquaculture Technology & Innovation Platform

I. Introduction

This deliverable concerns the preparation of Action Plans decided **in each Workshop**, **specifically a recommended plan of action for the Thematic Area and the Technology Platform itself.**

In the 'Aquainnova' Description of Work, it was put forward that the workshops would achieve the following tasks (on Day 2 – following introductory objectives on Day 1.)

From the DOW, the following workshop agenda was foreseen;

A) Finalising recommendations for Research – leading to Strategic Research Agendas
- including participatory "gap analysis" and prioritisation using a ranking exercise

B) Recommendations for other Actions – contributing to Vision Documents – challenge identification (supported by Benchmark documents)
- Governance Challenges, including
  - Policy framework
  - Decision-making processes
  - Interpretation of European policy at national level
  - Interaction with stakeholders
- Business Challenges
  - Markets (influence of Thematic Area) & competition
  - Competition
  - Investment
  - Technology transfer
- Coordination Challenges (for development)
  - Bottlenecks and barriers
  - RTD Capacity and infrastructure issues
  - Networking & communication
- Knowledge Transfer Requirements
  - Targeted dissemination
  - Training
  - Long-term support measures

C) Identification of Research Areas/Topics that will be financed by:
- Private funding
- National funding mechanisms
- European funding mechanisms

Effectively, point C represents the concept of the Action Plan – Howe to deliver the research identified.

Each stakeholder consultation workshop will provide 3 important deliverables;

- a specific report, detailing the conclusions relative to issues affecting the Vision document and Strategic Research Agenda
- **a recommended plan of action for the Thematic Area and the Technology Platform itself. These will be prepared immediately following each workshop.**
- an evaluation of the funding mechanisms envisaged for RTD achievement

In fact, the structure of the workshops changed (following the 1st on Freshwater Aquaculture) and had to be adapted to accommodate the experience of the participants and account for additional factors (including fatigue due to many working in English rather than their mother tongue.)

The original workshop plan was too ambitious and, following the 1st one (on freshwater aquaculture), the workshop format was modified to become less onerous on participants, since it was also realised that virtually no participant read fully the documents provided prior to the workshop itself.

Consequently, following the preparation of the draft documents by each Thematic Working Group, the workshops were structured to have the following main debates.

- Welcome & workshop explanation
- Introduction to the Aquainnova process & Vision
- Review of the 2030 Vision and reasoning
- 3 Sessions on Thematic Proposals (grouped by Thematic Area) – mainly on Goals/Sub-goals – round-table debates on these (in preparation of prioritisation exercise).
- Progress review (end of Day 1)
- Debate on core issues identified
- Prioritisation of goals
- How to get there ***(relates to Plan of Action)***
- Conclusions and recommendations

Nonetheless, the following sections contain the information relative to the original deliverable

II. Example: Freshwater Aquaculture – Action Plan

A. COMMENTS on 'Aquainnova' ACTION PLANS

1. TA 1 – CONSUMER PERCEPTIONS (GOAL 4)

Measures needed (scientific information or actions for improvement);

Overall, sector needs to better understand the [consumer] perception of its production

1. **Potential Support Action on Consumer perceptions of [freshwater?] aquaculture products:**
    a. Compile existing information/data on this topic from EU and National Projects
    b. Analysis
        i. Questions asked/who did the study?
        ii. Regional differences in perception; do these change over time?
        iii. Taste/appearance and other differences in products (species) from different regions
2. **Potential RTD action**
    a. Design/objectives of perception study/studies, covering

i. Products/activities

ii. Knowledge about fish

iii. Importance (ranking) of different issues (including those covered by legal requirements) including

1. Price & presentation (whole, frozen, fillets etc)
2. Easiness to cook
3. Origin
4. Freshness
5. Taste
6. Bone presence
7. Home consumption/HORECA influences
8. Name/Latin name
9. Ω-3 levels
10. Sustainable production

iv. Professional help (e.g. IPSOS)

v. Frequency of follow-up?

2. TA 2 – Technology & Systems

Measures needed (scientific information or actions for improvement), with a focus on environmental sustainability:

1. **Support RTD activities aimed at the development of alternative technologies for traditional pond aquaculture**
    a. Partitioned aquaculture systems (PAS)
    b. Intensive/Extensive aquaculture systems (CIE)

Apply the IMTA concept to freshwater aquaculture – new realities and challenges

2. **Relative to Technology transfer, develop mechanisms for:**
    a. Science to industry
    b. Industry to industry
3. **Relative to Demonstration activities**
    a. Use RTD/IAG to communicate to Society & Policy-makers

3. TA 3 – Biological Lifecycle

Measures needed (scientific information or actions for improvement):

1. **Allochtone species**
    a. How to evaluate the risk for the environment?

Impact: Need RTDi/knowledge transfer so as to help choose the [right] species according to the rearing system and [appropriate actions] for stimulating consumption

2. **Need benefit/risk assessment techniques for autochtone/allochtone species with a multidisciplinary approach**
    a. market/consumer demand; ecological impact; technology for processing; related knowledge on biology

Impact: propose/develop tools for the decision-making process

3. **Generic approach for fish domestication;**
    a. How to transfer knowledge from one species to another (model species)

Impact: rapid development of diversified aquaculture

4. TA 6 – Knowledge management

Measures needed (scientific information or actions for improvement):

1. Tailored communication strategies or tools
    a. To provide knowledge (existing) to specific end-users
2. Facilitating access to information/knowledge, already available or newly generated
    a. A central access point (of delivery)
3. Facilitating SMEs with regard to IP issues
4. Create stronger links (for mutual benefit) between RTD players and the industry

5. TA 7 – Fish Health & Welfare

Measures needed (scientific information or actions for improvement):

1. Host-Pathogen interactions
2. Vaccine developments
3. Immunomodulation

Example given for Freshwater: Koi Herpes Virus – affecting carp

- Need to improve diagnostic test
- Knowledge of the immune response
- Strain variations

This could be considered as requirements for a project

III. Conclusion

As can be seen in the report on the proposals of the Freshwater workshop above, it was extremely difficult to obtain precise information or recommendations that suited the templates developed for the Plan of Action for each Thematic Area.

In addition, it was also realised that the participants have differing points of view and experience; few farmers can forecast neither a research budget nor how long a project would take while relatively few scientists are up to date on policies and legislative actions.

Given the short time span of the workshops, it was agreed within Aquainnova that it was more efficient to develop the Plans of Action based on feedback from the workshops, using the expertise within the Thematic Working Groups for their development.

Consequently, the individual workshop reports/comments were fed back to the Thematic Working Groups so as to develop the Plans of Action for each Thematic Area – based on consolidated feedback from **all of the workshops**, rather than individual workshop Action Plans.

Evidently, such Plans are documents that represent ideas developed within Aquainnova but which are fluid and will develop with time. EATiP is committed to reviewing these documents on an annual basis so as to monitor progress or to bring in new ideas/proposals.

1. Action Plan Format

The Plans of Action were designed to cover the following issues, by Thematic Area and to respond to the agreed Goals (of each Thematic Area). In effect, these follow on from the Impacts identified for the Technical Leaflets (allowing comparison)

1) **Activity (designation),** divided into
   - RTD (Research)
   - Technology Transfer
   - Policy Action
2) **Description of the Activity**
3) **Timeline of realisation (start and finish dates),** referring to
   a. 2012
   b. 2015
   c. 2020
   d. 2030

   This allowed the identification of whether the activity is short-medium-long term, using the inputs to identify when an activity would start and finish

4) Where possible, a **budget estimate** for the activity was provided (expertise from Thematic Working Groups)
5) A short descriptor of the **Results anticipated**, what the outputs would be and the expected impact
6) Where possible, an identification of **how the activity could be funded** and location of funds.

IV. Plans of Action (January 2013)

The following pages contain the plans developed for each Thematic Area, based on

- The Goals and sub-Goals agreed for each Thematic Area, based on the inputs of
  - The work of the Thematic Working Groups (see Deliverables 29-30)
  - The feedback obtained from the Workshops (see Deliverable 39)
  - Re-examination by the Thematic Working Groups
- The Activities identified thus provides solution proposed to respond to the sub-goals identified (see the Vision-SRIA document)

Not all TWGs were able to complete the funding components for each proposal identified; in part this is due to a lack of time in the project for identification or a lack of knowledge/experience of funding opportunities.

It is also noted that this component was finalised during the bridge time between the end of FP7 and Horizon 2020 and the exact nature of European funding regimes applicable to aquaculture and related topics for the future is not fully clear at this time.

TA1: PRODUCT QUALITY, CONSUMER SAFETY AND HEALTH

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012 2015 2020 2025 2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
1		***Ma ximise the health benefits of aquaculture products***					
	1.1	Identify relevant bioactive compounds present in aquaculture products	*RTD*	Characterisation of bioactive properties of aquaculture products and evaluation of their post harvest stability.	Short to medium timeline, Medium cost	Identifying and documenting health promoting components in aquaculture product, in addition to the already knonw ones, will increase the image of darmed products as a healthy food.	
	1.2	Better understand the mechanisms and synergies underlying the health benefits of bioactive components from aquaculture products in the promotion of human health	RTD	Human, in vivo and in vitro studies assessing bioavailability, bioactivity and mechanisms of action of health promoting components.	Short (in vitro) to long (human), Large cost	Will contribute to further unravel cellular and molecular mechanisms of targeted health promoting bioactive components in aquaculture products.	
	1.3	Investigate the specific effects of aquaculture products in sub-groups of the population with specific dietary needs	RTD	Human clinical trials and epidemiological studies assessing benefits of consumption in subgroups, e.g. children and the elderly. It also includes evidence-based risk-benefit analysis for all consumer groups including people with special dietary needs.	Medium to long timeline, Large cost	Increased knowledge how consumption of aquaculture products benefit sub groups which may serve as a scientific basis for dietary advice	
	1.4	Explore the differences in terms of health benefit between species and production methods including feed composition	RTD	Characterisation of nutritional profiles and bioactivities in aquaculture species	Short to medium timeline, Medium cost	Can contribute to product differentiation based of health benefits between species and production methods	
2		***Ensure the continuing safety of aquaculture products***					
	2.1	Identify, manage and eliminate existing and potential physical, chemical and biological new hazards and emerging risks; including virus, bacteria, toxins, persistent organic pollutants (POPs), toxic substances, etc	RTD	Keep updated databases of known and emerging risks (biological, chemical and physical, and including nanomaterials). Have a surveillance program to target novel emerging risks as soon as possible. Keep updated procedures to control the entrance of the hazards in the production chain. Establish protocols to inform the authorities as soon as possible of potential new hazards. Establish procedures to inform all the links in the chain of new hazards and measurements to control and/or eliminate them. Inform the health authorities of emerging risks for the fast implementation of new controls.	Short timeline, Medium - Large cost	Maintain the safety of aquaculture products. Predict and avoid potential incidents. Increase consumer confidence.	
			TT		Short timeline, Medium - Large cost		
			Policy		Short timeline, Medium - Large cost		
	2.2	Make available to producers of aquaculture products user-friendly methods to monitor and control the safety of the production, targeting known and emerging hazards	RTD	Develop and validate rapid and low-cost surveillance methods and procedures to identify the presence of hazards in the production chain	Short timeline, Medium - Large cost	Implementation of surveillance routines and fast analyses to identify the potential entrance of undesirable agents in the production chain (if that were the case) and to verify the safety of the products. The implementation of these procedures and analyses might divide the production into broad categories of safe, potentially unsafe and contaminated, before the batch left the production premises.	
	2.3	Ensure the manufacture of authentic aquaculture products, regarding the species, quality, processing, use of additives, production method and geographic origin	Policy	Develop and validate rapid and low-cost surveillance methods and procedures to authenticate product information such as species, quality, processing additives, production method and geographic origin.	Short - medium timeline, Medium cost	High quality authentic aquaculture products. Make it possible the application of "Denomination of Origin" and similar protected labels to aquaculture products (already exists at least one for oysters).	
			RTD		Short - medium timeline, Medium cost		
	2.4	Better understand the mechanisms and synergies underlying the health risks of undesirable compounds potentially present in aquaculture products for risk management purposes	Policy	Development and application of models to achieve suitable risk assessment on undesirable substances	Short - medium timeline, Medium - Large cost	Maintain the safety of aquaculture products. Predict and avoid potential incidents. Increase consumer confidence.	
			TT		Short - medium timeline, Medium - Large cost		
			RTD		Short - medium timeline, Medium - Large cost		
			RTD	Studies assessing bioaccessibility and bioavailability of undesirable susbtances in aquaculture products	Short time medium costs (in vitro studies) to long time large costs (human models)	Will contribute to further unravel cellular and molecular mechanisms of contaminants and to a more realistic evaluation of their effects on human health.	
3		***To deliver high quality European aquaculture products fully meeting consumer expectations including appearance, taste, texture, nutrition and provenance claims***					
	3.1	Define and standardize quality parameters of aquaculture products	Policy	To define the parameters that consumers use to differentiate quality when purchasing and / or consuming aquaculture products. Develop standards for each parameter to determine a quality scoring system.	Medium timeline, Small cost	Definitions of quality using organoleptic assessment combined with chemical and/or physical measurements	
			RTD		Medium timeline, Small cost		
	3.2	Develop and validate practical tools and fast methods for processors to measure aquaculture product quality, including physical/chemical parameters such as texture, colour, fat content and to mimic organoleptic parameters such as juiciness	TT	Taking the parameters defined in sub-goal 1 and developing/validating testing methods to determine the quality scores. This will include standardised sample preparation for raw and cooked assessment.	Medium timeline, Medium cost	To produce cost effective and rapid assessment tests that do not require laboratory facilities or laboratory technician expertise.	
			RTD		Medium timeline, Medium cost		

TA1: PRODUCT QUALITY, CONSUMER SAFETY AND HEALTH

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012 2015 2020 2025 2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
	3.3	Develop and/or implement new technologies and materials in the seafood processing industry which enhance quality, including that of products to be sold alive	RTD	To determine the impacts on finished product quality from A) farming processes such as water quality, feed formulation, handling and slaughter and B) Post mortem processingand/ or C) harvesting and transport for organisms to be traded alive	Short time/cost for species already sucessful to Medium timeline/cost for more recently introduced species with less standardized production quality	To guide farmers and processors on optimising product quality to achieve the maximum scores defined under sub-goals 1 and 2.	
	3.4	Describe the parameters that can be manipulated to create differentiated products targeted at particular markets and consumer groups.	TT	Determine the farming parameters that can be manipulated to develop bespoke aquaculture products of differentiated quality and provenance. Specify traceability requirements. Set standards to determine required quality standards.	Medium timeline, Medium cost	Providing the aquaculture industry with sets of characteristics for each targeted product/consumer population combination that will aid in the increased efficience for further development of new products and new markets	
			RTD		Medium timeline, Medium cost		
	3.5	Develop and establish the foundations for the successful commercial implementation of a robust product certification and a consumer-friendly labelling system for European aquaculture products, based on provenance and quality.	TT	1) Identify the relevant parameters that define the characteristics of the certified products and develop and implement analytical methods and working protoocls to ensure the veracity of the label claims. 2) Identify the consumer´s demands and preferences on the product properties and their perception of the information from the labels, including both the type of information and how it is presented to them	Medium timeline, Medium cost	Increase consumer preference and trust in aquaculture products adn producers.	
			RTD		Medium timeline, Medium cost		
4		***Understand the dynamics of seafood markets***					
	4.1	Issue clear recommendations and guidelines for informed policy making on recommended consumption levels	Policy	Transfer the information obtained in the previous activities to policy makers and assist them by means of recommendations and guidelines	Short timeline, Medium cost	May contribute to increase fish consumption in general and aquaculture products in particular by means of effective communication strategies focussed specially in relevant opinion leaders. It will also provide the industry with information to better target various market segments and to implement strategies, and to promote an increase in the consumption of aquaculture products	
	4.2	Identify and close harmful gaps in consumers´ perception about aquaculture products and the current scientific knowledge	RTD	Obtain knowledge of the image that aquaculture products have in the consumer mind and identify the main motives and barriers that influence their consumption or rejection. Consumer studies: Collect, map and analyze data on the consumers´ perception of aquaculture products and their production and its effect on consumere preferences and purchasing behaviour.	Medium timeline, medium cost	It will provide the industry with knowledge and understanding of the consuemrs to improve their ow communicaiton and product development market strategies. Will contribute to overturn some of the prejudices that the industry is currently facing	
	4.3	Understand the dynamics of European seafood trade	RTD	Mapping of the conditions regarding the customers´ demands relating to sustainability, environment and ethics. Mapping consequences of processors and retail consolidation on aquaculture products´trade.	Medium timeline, medium cost	It will provide the industry with clear understanding of developments in the value chains of seafood includingindustrial purchasing behaviour, supply chain strategies and necessarys trategic moves.	

TA2: Technology and Systems

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012 2015 2020 2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
1		***Ensure an environmental sustainable industry by the application of new knowledge and technology innovations***					
	1.1	Development of technology preventing escapes of fish and eggs from production system	RTD	Preventing escape of fish and fish eggs by developing standards and protocols for technical equipment for marine environment.	3-7 Yrs €1,000,000	Reducing environmental impact by preventing escape and as well as improving production efficiency.	e.g. FP7 TARGETFISH project 2012-2016 The maiN objective being to reduce the impact fish diseases are having on European Aquaculture Industry through the development of targeted vaccination strategies. Other examples - Arriana,
			RTD	Development of new net cage materials and structures.	3-7 Yrs €1,000,000	Reducing environmental impact by preventing escape and as well as improving production efficiency.	
	1.2	Development of renewable energy sources for aquaculture production facilities	RTD	Development of renewable energy sources specially designed for offshore fish farming operations.	3-7 Yrs €200,000	Minimise environmental impact from energy generation of offshore fish farms	
			TT	Utilise existing technology for energy generation of offshore farms.	1-3 Yrs €100,000	Minimise environmental impact from energy generation of offshore fish farms	
	1.3	To effectively manage waste nutrients cycling in production systems in order to increase its retention in aquaculture products (polyculture, IMTA, integrated aquaculture)	RTD	1.Introduction of novel production techniques providing increased nutrient retention in aquaculture products.	3-7 Yrs €1,000,000	New production technologies for ecologically and economically efficient production of traditional and new products of pond aquaculture	e.g. FP7 TARGETFISH project 2012-2016 The maiN objective being to reduce the impact fish diseases are having on European Aquaculture Industry through the development of targeted vaccination strategies. Other examples - Arriana,
			TT	2.Transfer of existing knowledge from trial basis to commercial scale for integrating shellfish, fin fish and seaweed aquaculture.	1-3 Yrs €100,000	Improved use of the space resource and improved profitability	
			RTD	3.Study of environmental services provided by shellfish farms.	1-3 Yrs €100,000	Improved use of the space resource and improved profitability	
			Policy Action	4.Ensure that policy will allow close coupling of different aquaculture systems.	<1 Yr	Improved use of the space resource and improved profitability	
			RTD	5.A research project to avoid feed spillage, increase feed efficiency, water stability and improve composition of the waste (solid and dissolved) for commercial RAS farm conditions.	7+ Yrs €500,000	Improved water quality, increased feed efficiency, lower ecological footprint. Benefiting: farmers, society, water treatment system suppliers.	
			RTD	6.A research project optimizing the mineral absorption and retention in RAS by fish.	3-7 Yrs €500,000	Improved water quality, increased feed efficiency, lower ecological footprint. Benefiting: farmers, society, water treatment system suppliers.	
			RTD	7.A research project optimizing solids removal and evaluating cost effectiveness of solids removal (per species?) of RAS systems.	3-7 Yrs €500,000	Improved water quality, increased feed efficiency, lower ecological footprint. Benefiting: farmers, society, water treatment system suppliers.	
			TT	8.Determine the current or potential water treatment efficiency of treatment units and evaluate the cost effectiveness of RAS systems.	<1 Yr €50,000	Knowledge translation. Benefiting: aquaculture system suppliers, farmers.	
			RTD	Improve and evaluate treatment efficiency of end of the pipe treatment technologies (e.g. Dephosphatation, IMTA, geotubes) in RAS systems.	3-7 Yrs €500,000	Guidelines for best practices for end of the pipe treatments.	
			TT	Evaluate available techniques and the cost effectiveness of end of pipe treatment technologies in RAS when applied under aquaculture conditions.	<1 Yr €50,000	Knowledge translation. Benefits: aquaculture system suppliers, farmers.	
	1.4	Reduce waste release from aquaculture production	RTD	Develop knowledge on localisation and configuration of aquaculture installations to reduce benthic impact.	1-3 Yrs €200,000	Minimise environmental impact by optimised localisations of installations	
			TT	Adoption of Integrated Multi-Trophic Aquaculture (IMTA) techniques.	1-3 Yrs €100,000	Reduced nutrient loading on the environment and enhanced profitability on the farm level	
			RTD	Develop flow models suitable for use at farm and bay scales.	1-3 Yrs €100,000	Optimum design of farm layouts	
			Policy Action	Change of policy to enable adoption of Integrated Multi-Trophic Aquaculture (IMTA) techniques.	<1 Yr	Adoption of IMTA techniques	
	1.5	Development and upgrade of existing technologies for more efficient use of freshwater resources	Policy Action	Policy: impose taxes on the amount of waste being discharged and on amount of freshwater being consumed; Policy: stimulate use of RAS and re-use of water for aquaculture;	3-7 Yrs €5,000,000	reduced water use of freshwater to <50L/kg of fish produced; beneficiaries are farmers (lower costs of production), nature, society	
			RTD	RTD project on reduction of water use by closing cycle in RAS with strong focus on dephosphatation, nitrogen removal, solid sludge removal	3-7 Yrs €5,000,000	reduced water use of freshwater to <50L/kg of fish produced; beneficiaries are farmers (lower costs of production), nature, society	
	1.6	Develop T&S for the mass production of aquatic organisms (e.g. plankton, seaweed) for industrial use	RTD	RTD project on seaweed and algae production in seafarms, fundamental and a RTD-SME project to get it embedded			

TA2: Technology and Systems

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012 2015 2020 2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
2		***Meet the demand for aquaculture products in EU by the development of efficient technologies to support continued growth***					
	2.1	Development of farming equipment and operational procedures for off-shore sites	RTD	Development of floating fish farm systems for more exposed and new locations	3-7 Yrs €3,000,000	Increased production by increased access to space. Exploit the growth areas that are not available today, and not in conflict with other societal interests.	
			RTD	Research is required of fish welfare and behaviour with the purpose of developing improved equipment and systems for fish farming.	7+ Yrs €2,000,000	Improved fish welfare and production due to better equipment, systems and operations.	
			RTD	Stress analysis of equipment used in offshore conditions.	1-3 Yrs €100,000	Will provide guidance for the design and specification of offshore equipment. Benefit to industry.	
			TT	Study of existing offshore farming techniques and analysis of performance of pioneer projects.	1-3 Yrs €500,000	Input to further design of new equipment by summarizing past experients. Useful to develop design specification and future improvement of offshore equipment. Benefit to industry.	
			RTD	Develop trial operations for mussels farm at or near commercial scale	1-3 Yrs €500,000	Increased access to exposed areas. Greater production. Benefit to industry and consumer health.	
	2.2	Develop technology and systems for best site selection	RTD	Protocols for optimum feeding strategies for different species and identification of needed input parameters for automatic control of feeding	1-3 Yrs €1,000,000	Improved use of feed, which will be a limiting factor for further growth of the industry.	
			RTD	Develop feeding systems for offshore and remote locations	3-7 Yrs €1,000,000	A necessity for further expansion into more exposed and offshore locations. Improved use of feed, which will be a limiting factor for further growth of the industry.	
			RTD	Screening and analysis of potential sites	1-3 Yrs €100,000	Will identify priority development sites. This will benefit planners, regulators and industry.	
			TT	Conduct study to characterise the properties required of an ideal site	1-3 Yrs €200,000	Will provide short list of candidate sites	
			RTD	Develop a tool for site selection.	1-3 Yrs €1,000,000	Will provide a tool for better selection and identification of optimal site for farming production of specific species.	
	2.3	Maximize efficiency of Recirculation Aquaculture Systems (RAS) and reduce accumulation of persistent compounds		RTD1: research project optimizing solids removal and evaluating mitigation actions for accummulation of persistent compounds RTD2:Improve and evaluate treatment efficiency of end of the pipe treatment technologies (e.g. Dephosphatation, IMTA, geotubes); RTD3: the dynamics and control possibilities of accumulating substances originating from feed, fish and bacteria are determined at different recycling regimes	7 Yrs €10,000,000	Expected results: improved water quality, increased feed efficiency, lower ecological footprint, guidelines for design and management of RAS to avoid persistent compounds. Benefitting: farmers, society, water treatment system suppliers	
	2.4	Develop marine and freshwater integrated aquaculture systems (e.g. polyculture, IMTA) for production of present and new species and Environmental services	RTD	RTD: research on integrated aquaculture systems (freshwater or marine) to trap carbon (mitigate global warming), control pH, extract phosphorous and rare micro-nutrients, and providing bio-active compounds culturing novel species (sponges, holoturians, etc.)	4-5 Yrs €3-5 Million	New concepts to combine ecosystem services (food, organic fertilizers, novel bio-compounds) while mitigating atmosheric carbon and ocean acifidication.	
	2.5	Develop of production systems for new aquaculture products (new species, premium class and/or certified products) for changing markets	RTD	Development of technology for production of new species in pond-type farms.	3-7 Yrs €500,000	Description of technical and technological solutions for production alternative fish species	
			TT	Implementation of techniques and procedures allowing for production of fish fulfiling criteria of different certification protocols.	1-3 Yrs €50,000	The results of the activity will allow pond farmers diversify the supply with fish for growing market of bio- or eco labeled food products	
	2.6	Reduce the incidence of diseases by developing T&S	RTD	Research on early warning and detection of potential fish welfare or production problems.	3-7 Yrs €500,000	Be able to detect welfare and production problems before it becomes a major economical and/or welfare issue.	
			TT	Systems for remote (integrated) operation of fish farms.	1-3 Yrs €100,000	More efficient operation. Possible to operate in more exposed locations.	
			RTD	Develop disease resistant strains of shellfish	7+ €500,000	Decreased incidence of diseases. Increased production and more stable business. Benefit to industry.	
			Policy Action	Develop and enforce best practice protocols for control of movement of all diseased shellfish, even where disease vector has not been identified.	<1 Yr	Reduction of spread of disease outbreaks. Increased production. Benefit to industry.	
	2.7	Develop T&S for improved utilisation of existing sites	TT	Review of current best practices in management and production technologies and spread the knowledge through workshops and conferences.	1-3 Yrs €100,000	Adoption of best practices in management and production technologies, resulting in improved utilisation of existing sites. Benefits industry and society.	
	2.8	Development of technology to support production of new fish feeds (formulated, live feed)	RTD	RTD1: research on using/valorizing live organisms such as methane bacteria, worms and insects grown on waste streams or low value ingredients for fish feeds. RTD2: Research on process technology to concentrate nutrients (Proteins, fat) in novel low density ingredients such as leaves from crops, seaweed, algae etc and to destroy antinutritional factors in the same. RTD3: research on improved technologies (copied from human food industry) to increase physical stability pellets and reduce energy and water requirements by including water-rich ingredients	7 Yrs €10,000,000	New technologies which can be applied by the feed manufacturing industry enabling the making of novel feeds from novel ingredients with a lower energy and water foot print and lower resource use on ingredients which could also be used for human food	

TA2: Technology and Systems

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012 2015 2020 2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
3		***Ensure the profitability of the aquaculture industry by developing improved management systems and technology***					
	3.1	Development of automation for all stages of production (hatcheries, on growing, processing) for all present and future production system	RTD	Development of machinery, detection and sensing system for sorting, inspection, mass estimation and classification of fish.	3-7 Yrs €500,000	Improve efficiency, security and fish quality through out the whole production line.	
	3.2	Improve or develop novel systems to control biofouling of aquaculture equipment	RTD	Prevention and control of bio-fouling by research on more efficient methods of handling, new net materials and coatings, as well as on operating methods and strategies to minimize fouling.	7 + Yrs €2,000,000	Reduce the bio-fouling to minimum operations and improve water flow and oxygen exchange. Improved efficiency and profitability.	
			RTD	Methods and systems to treat large amounts of fish for parasites and systems to handle acute large amount of dead fish.		Reduce the risk of spreading disease. Improved operations and reduced handling of fish.	
	3.3	Develop technologies for improved quality of seed for all present and future production system	RTD	Development of technology for production of high quality seed material of different fish species to reduce mortality at early life stages.	7+ Yrs €2,000,000	Technology and breeding programs for hatcheries offering seed.	
			RTD	Development of tools for on-farm use for selection of fish for reproduction	3-7 Yr €500,000	Gene marker tools for selection of individuals for reproduction assuring improved quality (e.g. Disease resistance) of offspring.	
	3.4	Developing technologies for total utilisation of farmed products	RTD	Develop system for better preservation. Cost effective preservation processes have to be developed where the refining is extremely volume dependent. Rest raw materials have to be processed to a stage accepted as ingredients /consumer product.	1-3 Yrs €100,000	Value adding and total utilisation of rest raw materials from the fish processing/farming industry. Economical and environmental sustainability. Food security. Increased reputation.	
			TT	Develop effective logistic/transport system. There is a need for developing both equipment and transport solutions.	<1 Yr €50,000	Value adding and total utilisation of rest raw materials from the fish processing/farming industry. Economical and environmental sustainability. Food security. Increased reputation.	
			RTD	Development of new processing technologies. Aiming at the full valorisation of all the undervalued rest raw materials, several new processes have to be developed, process adapted from other industries and promising existing processes.	1-3 Yrs €100,000	Value adding and total utilisation of rest raw materials from the fish processing/farming industry. Economical and environmental sustainability. Food security. Increased reputation.	
			RTD	Develop technologies and processes for utilization of the omega-3 fatty acids in marine rest raw materials/by products in cut-offs from farmed fish as food supplement, food.	1-3 Yrs €100,000	Value adding and total utilisation of rest raw materials from the fish processing/farming industry. Economical and environmental sustainability. Food security. Beneficial to society /people´s health. Increased reputation.	

TA2: Technology and Systems

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012 2015 2020 2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
4		***Ensure technology for ethical and healthy production of high quality aquatic products***					
	4.1	Integration of technology management and biology for improving welfare and the prevention of disease outbreaks	RTD	Develop real time, in-vitro methods and technology for early detection of disease outbreaks in fish farms.	7+ Yrs €1,000,000	Methodology and equipment for the early detection of disease outbreaks in fish farms which will benefit the farmer (economy), the fish (welfare) and society (ethics).	
	4.2	To improve technology for transfer, handling and slaughtering of aquaculture products with respect to welfare and ethics	TT	Adaptation existing procedures of critical control point approach for monitoring and reporting of fish welfare status in the production chain.	1-3 Yrs €300,000	Improve production efficiency and fish welfare in fish processing plants. Fulfil ethical requirements concerning fish handling and slaugther.	
	4.3	Develop standardised detection and quantification methods for pathogens affecting humans	RTD	A research project in which the performance (growth, health and behaviour) of fish is determined for a range of recycling percentages (ion concentrations) in varying values of pH, CO2 and O2. TAN, NO2-N and NO3-N???			
	4.4	Develop technology and procedures for monitoring of welfare status of fish during all production stages	RTD	To improve technology for transfer and handling of farmed fish.	3-7 Yrs €500,000	Fish welfare will be improved. Promotes the montioring of fish welfare to comply with future legislation	
	4.5	Develop technology and procedures for monitoring of welfare status of fish during all production stages	TT	Decrease the level of human pathogens in shellfish by the adoption of tertiary treatment of any waste water outfalls which impact shellfish harvesting	7 Yrs	Reduced level of enteric illness in consumers leading to an improvement of comsumer confidence in shellfish products leading to increased sales, higher production and expansion of the industry	
			TT	Decrease the background levels of human pathogens in the environment by the adoption of tertiary treatment of waste water outfalls at known hotspots such as hospitals and residential homes	7 Yrs	Reduced level of enteric illness in consumers leading to an improvement of comsumer confidence in shellfish products leading to increased sales, higher production and expansion of the industry	
			TT	Widespread adoption of systems that give real time warning to shellfish harvesters of when pollution events occur in shellfish harvesting waters.	7 Yrs	Reduced level of enteric illness in consumers leading to an improvement of comsumer confidence in shellfish products leading to increased sales, higher production and expansion of the industry	
	4.6	Develop technology and procedures for monitoring of welfare status of fish during all production stages	TT	Adaptation of existing knowledge on traceability, quality assurance and critical control point to pond aquaculture products.	1-3 Yrs €100,000	Implemented procedures and equipment (e.g. IT) improving of food safety assurance during production and distribution chain. A consistent IT tool to monitor fish origin and distribution path.	

TA3: Managing the Biological Lifecycle

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012 2015 2020 2025 2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
1		***Establish predictability and improve output at every production stage of the lifecycle***					
	1.1	Develop indicators and tools to estimate/measure predictability and establishing the current variation level in farms	RTD	A review of key performance indicators (KPI) e.g., deformities, feed management and conversion, growth, etc., and their ability to estimate predictability	<1 Yr	Baseline for future RTD and a summary for producers	
			RTD	A research project to identify, develop, and test the KPI that can be used for predicting performance, and develop effective tools that can measure the most effective performance indicators	3-7 Yrs	New knowledge that needs to be implemented by producers in order to have sustainable intensification and good animal welfare	
			TT	Develop a tool for benchmarking and datamining of production data	1-3 Yrs	A tool for continuous optimisation of production, documentation regarding certification, identify possible bottlenecks in production	
			RTD	A research project to test new or existing technology for better evaluation of production parameters	3-7 Yrs		
	1.2	Improve animal performance at all stages, including egg and larval quality and its effects on performance during grow-out and/or ameliorate technological performance (protocols standardization / amended technology)	RTD	A research project to look at the relationships between broodstock rearing, season and off season spawning, egg incubation on larval quality, define and develop good indicators of larval quality, and the effect on later performance. This will be species specific knowledge but with possible synergies of cross-species tools of study	3-7 Yrs	Year round availability of high quality fertilised eggs and larvae with ability for good performance during grow out. A benefit for the European hatcheries and the on-growing sector	
			RTD	A research project to test effects of nutrition and rearing environment from start feeding on juvenile and grow out quality and performance. This will be species specific knowledge but with possible synergies of cross-species tools of study	3-7 Yrs	Reduced losses, improved growth and quality of fish, better fish welfare, and improved economy. A benefit for the European hatcheries and the on-growing sector	
	1.3	Improve sanitary control by better understanding the microbial environment (biotic & abiotic)	Policy	Harmonise EU legislation and regulatory framework on therapeutics and disinfection materials and protocols	1-3 Yrs	Equal terms of competition within EU	
			RTD	A research project improving hygiene during the hathery phase regarding i.e. improved water quality, tank cleaning, automation, and feeding strategies both in fresh and sea water hatcheries, flow-through and RAS	1-3 Yrs	Improved survival, growth and quality of fish and shellfish. Improved predictability and economy for European hatcheries	
			RTD	A research project to look at how to improve sanitary control in live feed rearing, both batch production, semi- and continuous rearing	1-3 Yrs	Improved survival, growth and quality of fish and shellfish. Improved predictability and economy for European hatcheries	
			RTD	A research project for developing and testing new and existing disinfectants, both for live fish and shellfish, and for technical equipment	3-7 Yrs	More types of disinfectants reduce possible development of resistance. Improved predictability and economy for European hatcheries	

TA3: Managing the Biological Lifecycle

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012 2015 2020 2025 2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
2		***Genetic improvement of productive, health and animal welfare traits***					
	2.1	Selective breeding to target important traits e.g. adaptation to alternative feed sources, disease resistance, feed efficiency, fillet yield, flesh quality, nutritional profile and human health factors	RTD	Generate knowledge to incorporate feed intake, digestibility, metabolic efficiency, animal welfare and product quality for changed feed source composition into aquaculture selective breeding programs	2015	Selection methods for avoiding the negative impact of novel non-animal feed on efficiency, quality and potential genotype-by-diet interactions	
			RTD	Exploit genetic potential for improvements in production efficiency traits: growth rate, feed efficiency, nutrient retention	2015	Direct or indirect selection methods for improving life-long biological efficiency (feed efficiency, nutrient retention) by selective breeding	
			TT	Incorporate feed efficiency and nutrient retention traits into aquaculture selective breeding programs	2020	For industry and EU citizens: improved efficiency of production systems: producing more with less input	
			RTD	Rank production efficiency traits (growth rate, feed efficiency, nutrient retention, adaptation to alternative feeds, processing yield, sexual maturity and survival.) according to economical and global environmental impact	2015	For industry and EU citizens: optimised breeding goals according to their economical and global environmental impact	
			RTD	Develop methods to measure, define and incorporate product quality traits into aquaculture selective breeding programs	2015	For industry: new opportunities to increase genetic gains in quality traits through individual measurement on breeding candidates	
			RTD	Explore the genetic basis of product quality traits to incorporate them into aquaculture selective breeding programs	2020	For industry: all necessary genetic information to implement selection for quality traits. For consumer: an insurance of high and constant quality of aquacultured products	
			RTD	Exploitation of cross breeding for line breeding and protection of commercial breeding material	2020	For industry: knowledge about the possibilities of hybridisation or crossbreeding for protection of genetically improved strains	
	2.2	Develop efficient tools (genetic, molecular, genomics) or adapt genetic tools from other sectors to introduce disease resistance in breeding programs to get « robust » animals, resistant to disease, stress, changing environment	RTD	Define (at the phenotypic and genomic levels) robustness traits, that can be included in the breeding goals of breeding schemes, and to develop methods and breeding program designs that select for these	2020	For industry: available methods to select animals that have high fitness and are robust to variable environmental parameters, both between farm and within-farm environment) For industry and EU citizens: knowledge on the impact of genetically increased biological efficiency on animal health and reproduction, and solutions to reduce potential harmful effects	
			RTD	Develop integrative approach of the genetic variability of immunity and resistance to specific diseases	2020	Develop statistical genetic methodology to estimate genetic parameters for disease resistance traits and their correlation to production traits (including systems and locations) Evaluate genetic variability and predictors of innate immunity Map QTL for disease Develop a better understanding of the physiological and immunological basis of disease resistance using genomic	
			RTD	Increase genomic information for all European aquaculture species and develop methods to utilise this in breeding programs	2015 2030	For research and industry: potential for next generation breeding schemes	
			TT	Using results from Action 2.2., optimize the design of breeding programs for industry implementation of disease resistance in new or existing breeding schemes		Reduction of mortalities (benefit to industry) and chemical treatment (benefit to consumers) consecutive to use of efficient breeding schemes for disease resistance	
			Other	Assure cost effective large scale testing facilities or methods for evaluating specific diseases resistance for breeding purposes	2020	Effective implementation of breeding for disease resistance (benefit to industry and consumers) requires operational large scale testing methods and facilities	
	2.3	Identify and quantify genetic correlations between productive, disease resistance and welfare traits to enforce synergies between traits and avoid unwanted effects of selective breeding for productivity traits	RTD	Estimate phenotypic and genetic correlations between production, maturation, disease resistance, fillet quality, and welfare traits	2020	For consumers and industry: ability to breed healthy animals and respect the integrity of each individual, including cardiac capacity, bone development, survival, respiratory capacity, stress and behaviour	
	2.4	Increase industry and policy makers awareness and competence about potential gains and implementation of selective breeding programs	TT	Initiate a targeted joint education program at the level of EU member states on aquaculture genetics and breeding (e.g. EMJD program) including professional training course	2020 2030	For industry: benefit of well educated personnel to (i) evaluate the cost-benefit aspect og breeding programs, (ii) operate breeding programs, (iii) manage and prevent inbreeding For student: job opportunities through the creation of a world class educational program on aquaculture genetics and breeding	
			Policy	Set up European Standard Certification Procedures to assess distinctness between commercial strains		For industry: improve trust in origin and performance of selected lines	

TA3: Managing the Biological Lifecycle

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012–2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
3		***Improve broodstock management methods and control reproduction in captivity***					
	3.1	Identify reproduction related problems, and knowledge gaps for each major aquaculture species in Europe (finfish and molluscs)	*Other*	Cost Action network. A network to discuss approaches to address the various sub-goals ensuring the acquisition of the desired outputs, which will result in increasing both the competitiveness and production output of European aquaculture. The action, as well as the following RTD actions, will focus on all major aquacultured species in Europe, where it is considered necessary.	1-3 Yrs €1,000,000	Research lines would be scored and ranked to identify the most promising lines to obtain outputs that will have the impact of increasing both the competitiveness and production output of European aquaculture. The benefits will be first that the stakeholders and the scientific community direct research efforts to the necessary bottlenecks and the species that require research in each action, for example if an industry of a particular species has acceptable and predictable egg quality efforts would not be directed to improve the egg quality.	e.g. FP7 LIFECYCLE PROJECT 2010 - 2013 : Advances on current knowledge on mechanisms governing essential biological functions in fish. Understanding the maternal gene transfer during early development and the ontogeny of immune competence.
	3.2	Evaluate the impact of sexual maturation on growth the welfare and potential risk of disease susceptibility	RTD	Investigate the effects of sexual maturation on the immune system and welfare of each important aquaculture species, especially the ones that have a reported problem in this area.	1-3 Yrs €10,000,000	Definition of the effects of sexual maturation on the immune system and welfare. Commercial broodstock managers and fish pathologists/veterinarians will benefit from the information in devising methods to overcome the negative influences of maturation and reduce the risk of disease or reduce welfare at this important life stage.	e.g. FP7 TARGETFISH project 2012-2016 The maiN objective being to reduce the impact fish diseases are having on European Aquaculture Industry through the development of targeted vaccination strategies. Other examples - Arriana,
			RTD	Develop practices and/or pharmaceutical treatments that improve the immune system and welfare during sexual maturation of each important aquaculture species.	3-7 Yrs €10,000,000	Improved welfare and immune function, resulting in reduced disease incidence in association with sexual maturation in European aquaculture. The beneficiaries will be commercial broodstock operations, which will become more effective and efficient in producing eggs, thus increasing the competitiveness of the industry.	
	3.3	Understand the role of genetic, physiological, nutritional, behavioural and environmental factors on the spawning of gametes of high quality and the timing of spawning to facilitate year round supply	RTD	Perform a multivariate analysis using industry data to examine the relationship between nutrition, environment, husbandry and spawning therapies with egg quality, based on available data from research centres and the industry.	1-3 Yrs €5,000,000	Definition of the problem and identification of environmental and husbandry practices that effect gamete quality. Beneficiaries will be scientist working in the field, in order to plan further research activities.	
			RTD	Investigate the effects of husbandry, environment and nutrition on gamete quality.	7+ Yrs €10,000,000	Identification of optimal conditions (environment, husbandry and nutrition) for the production of high quality gametes. Description of the mechanisms involved in gamete quality, with the identification of molecular tools that can be used to predict gamete quality and identify causes of poor gamete quality. Improvement of gamete quality will increase production output and make the industry more competitive.	
			RTD	Define genetic influences on gamete quality including the role of maternal transcripts in embryo development.	7+ Yrs €10,000,000	Identify genes, or areas of the genome (QTLs) and maternal transcripts that are associated with good gamete quality. This will form the basis of breeding programs to produce individuals with good gamete quality. Improved and predictable gamete quality will increase production output and make the industry more competitive.	
			RTD	Improve the control of reproduction in important European species that present reproductive dysfunctions (endocrine and behavioural), limiting the productivity of in commercial aquaculture.	7+ Yrs €20,000,000	Increased understanding of the cause of reproductive dysfunctions. Improved methods and/or hormonal therapies to control endocrine and behavioural dysfunctions. Improved spawning of good and predictable gamete quality will increase production and make the industry more competitive.	
			RTD	Establish or improve methods for year-round gamete production where necessary, through out-of-season stimulation of reproductive function, using environmental and husbandry manipulations.	7+ Yrs €20,000,000	Description of optimal environmental manipulations and of the pathways involved in out-of-season spawning of good quality gametes with predictability of gamete quality. Identification of molecular tools that can be used to predict gamete quality and identify causes of poor gamete quality. The improvement or provision of out-of-season gametes with good and predictable quality will increase production and make the industry more competitive.	
			RTD	Establish indicators of gamete and egg quality.	7+ Yrs €20,000,000	Knowledge of what confers quality in gametes and eggs, and development of operational indicators that can be used by the aquaculture industry to evaluate the quality of the produced eggs and to predict their rearing success potential.	
			RTD	Develop reproduction induction methodologies to reproduce desired broodstock as needed for optimized breeding programmes.		Knowledge and practices that would allow to synchronise breeders and more specifically dams, to control the reproduction of specific individuals targeted in selective breeding program. The industry increases competitively.	
	3.4	Control puberty by understanding the role of genetic and physiological factors, including the effects of environment, husbandry practices and nutrition	RTD	Determine the underlying mechanisms (genetic, physiological, endocrine or nutritional) influencing the onset of puberty.	7+ Yrs €15,000,000	Improved understanding of the mechanisms that control puberty leading to novel approaches to induce or prevent puberty in important European aquaculture species. Improved systems to control puberty (both induce and inhibit) will increase production and make the industry more efficient and competitive.	
			RTD	Explore new methods and improve existing ones for the control of puberty using genetic selection, environmental manipulations (photoperiod and/or nutrient availability) and husbandry (grading, stocking density, temperature).	3-7 Yrs €10,000,000	Provide improved systems for the control of puberty. Improved systems to control puberty will increase production and make the industry more efficient and competitive.	
	3.5	Cryopreserve for biosecurity, predictability, distribution and bio-banking	RTD	Improve sperm cryopreservation technologies and provide protocols for the use of cryopreserved sperm on a commercial scale.	3-7 Yrs €10,000,000	Application of sperm cryopreservation technologies by the industry to increase biosecurity, predictability, distribution and bio-banking. Increased security and competitiveness of the industry.	
			RTD	Develop technologies for the cryopreservation of eggs or embryos.	7+ Yrs €20,000,000	Methods for the cryopreservation eggs or embryos, increasing biosecurity, predictability, distribution and bio-banking. Increased security and competitiveness of the industry.	
	3.6	Understand the basis sex determination and sex differentiation (genetic, environmental and physiological) to enable monosex production	RTD	Investigate the role of and interaction between genetics and environment on sex determination and differentiation, including the underlying mechanisms on the level of the genome, gene expression, endocrine systems and physiology	7+ Yrs €15,000,000	Understanding of the mechanisms of sexual differentiation for each important European species whose production efficiency may be improved by sex control. Genomic sex probes or markers to determine sex. Development of novel techniques for the control of sex. Increased growth rates and increased production efficiency, resulting in increases in competitiveness of the aquaculture industry.	
	3.7	Develop new sterilisation methods as an alternative to triploidy, and (when not possible) methods to allow production of triploids at an industrial scale for species usually propagated with mass spawning (cod, sea bass, sea bream,...)	RTD	Research the underlying mechanisms on levels of the genome, gene expression and physiology that initiate and control the early stages of sexual development in all important European aquaculture species.	7+ Yrs €10,000,000	New treatments that block maturation and induce sterility, promoting increased growth rates and increased production efficiency in cultured fishes. The industry increases competitively. Reduced concern about escapes and reproduction and the liberation of gametes from farm stocks. Reduced environmental impact of industry.	
			Other	Evaluation of the potential of existing sterilisation techniques such as ploidy for the important European aquaculture species.	<1 Yr €1,000,000	Selection of important European species for which existing sterilisation techniques such as ploidy offer a potential solution to produce sterility.	

TA3: Managing the Biological Lifecycle

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012 2015 2020 2025 2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
			RTD	Improve existing sterilisation techniques such as ploidy for the important European aquaculture species identified.	3-7 Yrs €10,000,000	Improved sterilisation techniques such as ploidy for the important European aquaculture species. Increased growth rates and increased production efficiency. The industry increases competitively. Reduced concern about escapes and reproduction and the liberation of gametes from farm stocks. Reduced environmental impact of industry.	
4		***Manage the life cycle of carefully selected "new" species that have high economic importance***					
	4.1	Develop efficient tools to identify best candidates for domestication	RTD	Produce desktop study of new candidates (including algae) for aquaculture, based on objective criteria, e.g.: indicators issued from market studies, biological specificity (e.g., reproduction in a different season than currently cultured fishes, better growth in some specific environmental conditions, lower trophic level, dependence on exclusively plant feeds, etc.), opening of new markets or new aquaculture sector for production (e.g. offshore for tuna, polyculture and/or integrated (multi-trophic) aquaculture or RAS)	2015	For industry and research program funding orgabnizations: an objective list of promisisng new soecies for different European territories with an identification of blocking points for their development	
			RTD	Develop innovative (e.g; generic) tools to domesticate more easily new species benefiting from the expertise acquired from already mastered species	2015	For industry: tools for identifying the possibility of new specie domestication with little adaptation of rearing technologies of already mastered species	
	4.2	Optimize the management of natural stocks	TT	Develop field management pratices (e.g. Best Gardening Practice) to develop and/or restore production of European species	2020	For industry: management pratices for maintenance and/or restoration of natural resources as an alternative to intensive monoculture	
	4.3	Promote adequate genetic management of new species	TT	Implement (on farm) genetic breeding programs adapted to industry size, and to biological capacity of species	2020	For industry: management of genetic resources, and thus (1) knowledge of genetic variation for economically important traits and optimum selection and mating designs according to breeding capacities, and (2) reduction of environmental impact in case of escapees thanks the control of reared stock genetic variability.	

TA4: Sustainable Feed Production

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012 2015 2020 2025 2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
1		***Base formulation of Future Fish Feeds on solid knowledge of fish nutritional requirements, and expand the number of well characterized and sustainable raw materials which can be used***					
	1.1	Improve knowledge on nutritional requirements of fish commonly farmed in Europe and for promising new species	RTD	Research projects, which will consolidate the knowledge base on nutrient requirements of major European fish species and fill the current gaps using novel methods	3-7 Yrs €1 Millon/Fish species	• Data on nutrient requirements and Energy allocation over the full life cycle: "from larvae to broodstock" • Feed (ingredient), fish, farming system interactions Beneficiaries include: Fish feed Companies through optimization of feed composition, lower environmental impact	EU, national projects, ARRAINA
	1.2		RTD	Research projects on specific nutritional requirements of potential new species	>7 Yrs, €1 Million /Fish species for extended research, less for specific problems	Improved performance of new species, diversification of aquaculture.	EU, national projects, Fish producers
	1.3		TT	Compile and produce a complete set of data for the nutritional requirements of fish and shellfish	3-7Yrs €100,000	Web-based database; regularly updated / updatable. Beneficiaries: Feed Companies	Feed Companies
	2.1	Provide a sufficient characterization of nutritional value of alternative raw materials, both in current use as well as of new promising or underutilized marine or terrestrial sources, considering their sustainability, to increase flexibility in formulating highly nutritious feeds, of low environmental impact and appropriate for different aquaculture systems.	RTD	Research projects studying nutritional value of emerging raw materials and underutilized nutritional sources taking into account antinutrients and integrative sustainability indices	1-3Yrs €0.2Million/Raw material	• Types and range of levels of ANFs and possible toxicants in different ingredients in relation to origin and treatment. Biological value of ingredients to fish. • Development of feedsof high assimilation and low environmental impact. Beneficiaries: Feed Companies, farmers	EU, national projects, Feed Companies, Raw materials producers
	2.2		RTD		1-3Yrs €0.05Million/Raw material	• Types and range of levels of ANFs and possible toxicants in different ingredients in relation to origin and treatment. Biological value of ingredients to fish. • Development of feedsof high assimilation and low environmental impact. Beneficiaries: Feed Companies, farmers	national projects, Feed Companies, Raw materials producers
	3.1	Clarify the potential of commonly used and novel microingredients to optimize efficiency of diet utilization by fish	RTD	Research projects, studying trace element requirements in major farmed species as well as identifying novel feed additives of nutritional or technological interest and their mechanism of action	1-3 Yrs €2 Million	• Sound estimations of trace element requirements in major farmed species at different life stages and practical farming conditions. • Identification of novel feed additives	EU, Feed Companies, Producers of additives, ARRAINA
	4.1	Evaluate the effects of using alternative feed ingredients to the content of key bioactive compounds of aquaculture products and understand how to optimize their nutritional value in order to tailor aquaculture products for maximizing the consumer health benefits.	RTD	Fish feeding trials with new ingredients. Analysis of nutritional profiles and dietary changes for optimization of composition	3-7 Yrs €2Million	Effects of diets on nutritional value of the product and diets for improved quality	EU, National projects, Feed Companies, Raw materials producers, Producers of additives
	4.2			Fish feeding trials with specific diets. Evaluation of the nutritional profiles and documentation of the health benefit of the product	3-7 Yrs €1 Million	Improved knowledge on how to design the feed and feeding regimes in order to create exceptional healthy products for niche markets	EU, National projects, Feed Companies, Raw materials producers, Producers of additives
	5.1	Adapt feeding procedures to ensure optimal feed utilization and minimize environmental impact		Fish feeding trials with focus on obtaining optimal utilisation of a given diets by feeding to different species, during different lifestages and using different farming conditions and technologies.	3-7 Yrs €1 Million/species	Improved knowledge on how to design the feed and feeding regimes in order to obtaind optimal utilisation of the feed and secure a minimal environmental impact under specified farming conditions.	EU, National projects, Feed Companies, Aquaculture units FEED & TREAT
	6.1	Provide necessary information to support/change regulatory measures	Policy	Provide objective evidence on the potential of using alternative ingredients in order to adapt current regulation	3-7 Yrs €100,000	Increase EU feed industry competitiveness and provide the best possible raw material for future growth in the aquaculture industry	Feed Companies, Raw materials producers, Producers of additives

TA4: Sustainable Feed Production

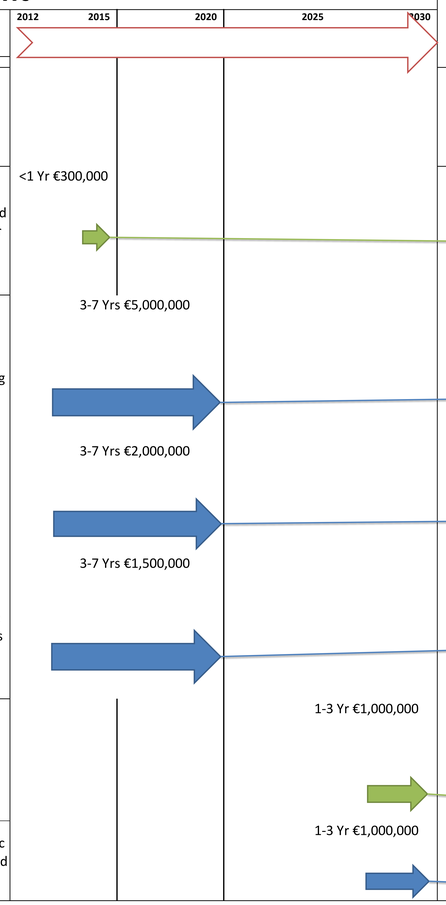
Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012–2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
2		***Advanced novel feed technologies to produce cost effective feed with improved quality***					
	1.1	Develop novel technology and improved processing routes for cost effective and sustainable fish feed production	RTD	Research projects exploring alternative ingredients and new cost effective processing routes in the feed manufacturing process	3-7 Yrs €600,000	Novel sustainable processing alternatives enabling reduced energy consumption in the feed manufacturing industry	National projects, Feed Companies, Raw materials producers
	1.2		TT	Up-skilling of feed manufacturers and fish producers on new processing technology	<1 Yr €100,000	Education platform and improved competence among industrial decision makers and process operators	EU, National projects, Feed Companies, Aquaculture units
	2.1	Novel and improved larval feed technology for better survival, larval growth performance and quality	RTD	Research projects to develop start feed for marine larvae	7+ Yrs €0.6 M	Remove the main bottle neck for a viable prodction of several species. The benefits will be reduced production cost and improved fish health	EU, National projects, Feed Companies ARRAINA
	2.2		TT	A literature review gathering information about alternative methods to produce larval feed and results	1-3 Yrs€100,000	Get an overview over methods to improve quality of live food, as well as technologies tested for production of weaner diets	EU, National projects, Feed Companies
	3.1	Improved understanding of the interactions between ingredient properties and processing conditions affecting physical feed quality and utilization of nutrients	RTD	Research projects adressing the fundamental mechanisms governing mash transformation in the feed manufacturing process and physical pellet properties	3-7 Yrs €800,000	Improved understanding and models explaining the fundamental mechanisms governing physical pellet quality in the feed manufacturing process	EU, National projects, Feed Companies
	3.2		RTD	Research projects investigating the impact of physical pellet quality on feed intake and the nutritional value of feed	3-7 Yrs €300,000	New physical feed quality specifications combining optimal nutritional and durability properties	EU, National projects, Feed Companies ARRAINA
	4.1	"Documentation on safe use of animal by-products"	Policy	Trials to investigate inactivation of known pathogens that limit use of animal by-products	7+ Yrs €1 Million	Improved sustainability of the aquaculture sector by use of ingredients not competing with human resources.	EU, National projects, Feed Companies
	4.2	"Environmental impact of aquaculture production"	Other	Improved communication between research, feed producers, fish producers and the final consumer of the fish product	7+ Yrs €1 Million	Improved knowledge about aquacultured production and environmental impact	EU, National projects: FEED & TREAT
3		***Understand and minimize non desired effects of alternative diets on fish health and welfare***					
	1.1	Response of alimentary system to alternative feeds and development of methods and markers for assessing dietary effects	*RTD*	Research on the effects of diet ingredients, feed additives, and physical characteristics of the feed on digestive functions and structure	3-7 Yrs €3,000,000	Basic knowledge on morphology and physiology of the GI tract and associated organs. Methods and markers of GI function and structure in relation to feed. Information on acceptable levels of raw materials and additives. Commensal microbiota in relation to diet and impact on GI structure and functions. Beneficiaries: Producers of feeds, additives, animal health professionals, farmers	EU, National projects, Feed Companies, Raw materials producers, Producers of additives
	2.1	Research on the effects of diet on the gastrointestinal and systemic immune system and subsequently on disease susceptibility	RTD	Clarification of the effects of diet on immune responses and disease susceptibility. Indices of fish health status. Information on acceptable levels of raw materials and additives. Identification of other stressors that may compromise fish health. Beneficiaries: Producers of feeds, additives, animal health professionals, farmers	3-7 Yrs €3,000,000	Clarification of the effects of diet on immune responses and disease susceptibility. Indices of fish health status. Information on acceptable levels of raw materials and additives. Identification of other stressors that may compromise fish health. Beneficiaries: Producers of feeds, additives, animal health professionals, farmers	EU, National projects, Feed Companies, Raw materials producers, Producers of additives
	3.1	Evaluation of the relation of dietary changes to the aetiology of production diseases	RTD	Research on the relation of diet to production diseases, which are are usually characterized by complex non-infectious, multifactorial aetiologies in which diet and nutrition can play central roles.	7+ Yrs €3 Million	Links between feeds, nutrition and production diseases. Development of methods and markers for their characterization. Beneficiaries: Producers of feeds, animal health professionals, farmers	EU, National projects
	4.1	Evaluation of diet involvement in stress, behavioural and feeding responses of fish and methods for remediating possible adverse effects and optimizing performance.	RTD	Research on the relation of diet and feeding on stress and behavioural responses	7+ Yrs €3 Million	Development of methods and markers for characterizing fish welfare as affected by feeding strategies, feeds, feed ingredients, feed additives, nutrition ad metabolism. Methods of stress and aggression remediation. Beneficiaries: Producers of feeds, animal health professionals, farmers, consumers	EU, National projects, Feed Companies, Raw materials producers, Producers of additives
		ALL SUBGOALS	TT	Knowledge transfer to feed producers and animal health professionals	7+ Yrs €100,000	Improved feed formulations for the Feed Industry, competitiveness of European Aquaculture	EU, National projects, Feed Companies
			POLICY	Improve legislation on fish feed ingredients, including feed additives	7+ Yrs €100,000	Support for Companies producing inovative products. Increased competitiveness of European Aquaculture	EU, National projects, Feed Companies, Raw materials producers, Producers of additives
			OTHER	Improve communication to consumers	7+ Yrs €100,000	Consumers, Aquaculture and related Industries	EU, National projects, Feed Companies, Raw materials producers, Producers of additives

TA4: Sustainable Feed Production

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012 2015 2020 2025 2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
4		***Adapt and utilize advanced methods to understand and model nutritional responses***					
	1.1	In vivo and in vitro models to examine physiological responses to nutrients	RTD	Cell culture models: Cell culture allows in vitro examination gene promoters, gene expression and directed response to nutritional components.	7+ Yrs €2 Million	Tools developed that will help inturpret geneomic responses to nutritional components and genes involved in metabolic pathways	EU, National projects
	1.2		RTD	fish models, eg zebrafish to examine whole animal and tissue responses & gene knock out / knock in.	7+ Yrs €1 Million	Tissue responses to nutritional changes and cross talk between metabolic pathways.	EU, National projects
	2.1	Integrative tools -omic tools:	RTD	Understand transcriptional and translational responses to nutritional challenges. This activity will be referred to as nutriogenomics	7+ Yrs €4 Million	Key molecular markers to inturpret nutional responses. Genomic responses, ontogeny related to early nutritional experiences. Use data to gene mapping related to nutrion.	EU, National projects ARRAINA
	2.2		RTD	Completed genomes for farmed fish - high resolution genomic linkage maps.	2020	Linkage maps, single nucleotide polymorphism (SNP) arrays developed for gene related to growth FCR and health interaction	EU, National projects
	2.3		TT	Knowledge transfer to industry regarding nutrigenomics	7+ Yrs	?	?
	3.1	Mathematical modeling of nutritional responses and possible contaminant accumulation in fish	RTD	Integrating data from both nutritional trial and genomic techniques to obtain maximun benefit from generated high throughput data.		Bioinformatic tools delevopled to allow interdisiplinary analysis of data generated related to nutrition, healtth growth and environment. This can then be fed to the industry & feed manufacturers.	EU, National projects
	3.2		POLICY	related to responses to toxicology and issues related to Genetic Modification.		Bioinformatic tools delevopled to allow interdisiplinary analysis of data generated related to nutrition, healtth growth and environment. This can then be fed to the industry & feed manufacturers.	
	3.3		OTHER	Vast data sets will be developed and bioinfomatic platforms will need to be developed. This will include mathematical modelling relating genomics to production and environmental change.		Bioinformatic tools delevopled to allow interdisiplinary analysis of data generated related to nutrition, healtth growth and environment. This can then be fed to the industry & feed manufacturers.	EU, National projects
5		***Resolve strategic research problems in fish nutrition***					
	1.1	Development of feeds to a) maximize protein accretion and minimize lipid deposition, b) achieve optimal product composition promoting human health.	RTD	A series of studies on metabolic and feed intake regulation, nutrient-hormone interactions, protein and lipid deposition and on their genetic basis	3-7 yrs €500,000	Practical tools (feeding, feeds ingredients, and non-lethal biomarkers) to control product quality and human health promoting factors in sea food products. Means of stimulating effective use of feed components including novel plant-based ingredients to deposit protein.	EU, National projects, Feed Companies ARRAINA
	1.2		RTD	Economical evaluation of the methods developed, demonstrating solidly their realistic commercial potential.	<1 Yr €80,000	Broodstock owners, breeding companies, feed companies and farmers benefit from more efficienct animal material, increasing industry profit. Consumers and environment benefit from human health promoting products and decreased nutrient load to environment, both factors increasing attractiveness of sea food products.	Feed Companies
	2.1	Development of selection tools for improving nutrient utilisation and protein/lipid deposition contributing to biological efficiency of aquaculture species via selective breeding and via choice of broodstock material (species, strain)	RTD	Development of feed intake recording methods, indirect ways of improving biological efficiency e.g. via body composition and waste reduction, biomarkers and physiological indicators reflecting efficiency. Estimation of genetic potential for E3selection, and development of genomic tools for selection of biological efficiency	3-7 yrs €3,000,000	Direct or indirect selection methods, including novel genomic tools, for improving life-long biological efficiency (feed intake, feed efficiency, nutrient retention as protein and fatty acids, yields) by selective breeding.	EU, National projects
	2.2		RTD	Economical evaluation of the methods developed, demonstrating solidly their realistic commercial potential.	<1 Yr €50,000	Breeding companies, feeding compnaies, processing industry, consumers, and environment benefit from adapted and more efficiency fishmaterial providing product output per unit of input and with less nutrient load to environment.	EU, National projects
	3.1	Formulation of targeted feed compounds, feeding and fish management practices that condition farmed species to novel feeds, increase adaptability, reduce stress, and increase biological efficiency.	RTD	To formulate targeted feed compounds, feeding and fish management practices that condition farmed species to novel feeds, increase adaptability, reduce stress, and increase biological efficiency.	3-7 yrs €3,000,000	Increased control of animal growth, feed intake, body composition, efficiency of utilizing plant-based diets through a nutritional conditioning at the broodstock and/or larval level. Increased disease resistance, stress tolerance, maturity age, and adaptation to a new environment after a transfer	EU, National projects, Feed Companies ARRAINA
	3.2		RTD	Economical evaluation of the methods developed, demonstrating solidly their realistic commercial potential.	<1 Yr €80,000	Broodstock owners, feed companies and farmers benefit from more efficienct, resistant and robust animal material, increasing industry profit.	EU, National projects
		Subgoals 1,2,3	TT	Scaling up of methods developed in subgoals 1, 2 and 3 to mass production and implementation by EU enterprices, confirming the final commercialization.	1-3 Yr €500,000	Confirmation/rejection that the methods can be commercially implemented. Benefiting parties: breeding and feed companies, broodstock owners, farmers, consumer and the environment.	EU, National projects, Aquaculture units
		All Subgoals	Other	Development and distribution of material to consumers in form of advertisements, promotion material, product placement, news paper and magazine articles, recipes.	1-3 Yr €500,000	Powers and promotes sales of aquaculture products, benefiting consumers (health benefits) and the whole aquaculture supply chain via increased demand.	EU, National projects, Aquaculture units

TA5: Integration with the environment

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
1		***To establish fundamental scientific knowledge on the assimilation capacity of biogenic wastes from aquaculture to determine acceptable emission rates for Benthic and Pelagic Ecosystems (Biogenic waste assimilations in Ecosystems***				
	1.1	To establish a scientific based concept for the management of biogenic waste emission to open waters with relevant indicators for assessing chemical and ecosystem state as a contribution for the implementation of the Water Framework Directive (WFD)	Other	Concerted action/Working Group to establish scientific concept and reliable EQS variables and ecosystem state assessment criteria for WFD implementation based on existing knowledge	Scientific concept that may replace the precautionary approach and introduce a scientific based management of pelagic ecosystems and form the basis for an integrated waste management	
	1.2	To determine assimilative capabilities and the environmentally acceptable critical loading rates of biogenic wastes per volume and per area of sea floor, including the contribution or ecological services of shellfish and macroalgae farmed in aquaculture locations	RTD	Marine open water - Research required to obtain the necessary fundamental knowledge on assimilation capacities of non-toxic biogenic wastes from aquaculture on pelagic ecosystems, including the potential contribution by farmed shellfish and macroalgae	Quantitative knowledge on the ecological services provided by marine pelagic ecosystems to assimilate biogenic wastes of aquaculture. This is a basis for determining production capacities per sea area and a main tool needed for coastal planning and optimal siting strategies, also needed for a proactive auaculture-environment dialog with the public	
			RTD	Marine benthic - Research required for determining assimilation capabilities per seafloor surface area, with a specific focus on sensitive habitats and on offshore locations	Better knowledge on abundance and assimilation capabilities of sensitive benthic habitats on- and offshore. This is a basis for determining production capacities per sea floor area and a main tool needed for coastal planning and optimal siting strategies, needed for a proactive auaculture-environment dialog with the public	
			RTD	Freshwater pelagic and benthic - Research required to determine assimilation capabilities of pelagic and benthic freshwater systems	Quantitative knowledge on the capabilities of freshwater ecosystems to assimilate biogenic wastes per volume and surface aea for freshwater types, needed for developing freshwater aquaculture in Europe and for public dialog	
	1.3	To establish integrated management tools for waste emission which consider assimilation capabilities, hydrodynamic energy and presence of sensitive habitats as a tool for siting, spatial planning and ecosystem based management of aquaculture	Other	Concerted action to integrate of R&D results for assimilation capabilities in benthic and pelagic ecosystems in different water types and hydrodynamic energy to establish a unified scientific basis for managing biogenic wastes from aquaculture	A science base for managing biogenic emission from aquaculture to marine and freshwater ecosystems	
			RTD	Implementation of new mamagement tools for integrated biogenic waste emission in the WFD; including EQS variables, EQS-values and ecosystem state criteria	The knowledge/science base for assimilation capabilities is implemented in European legislation of the WFD	



TA5: Integration with the environment

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012 2015 2020 2025 2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
2		***To establish technology to minimise emission of biogenic matter from aquaculture and to minimize the potential Environmantal influence of the actual emissions by means of Environmental management and integrated multi-trophic Aquaculture (Technology to minimise biogenic impacts)***					
	2.1	To improve feeding technology, feeding management and feed composition of Mediterranean aquaculture in order to minimise biogenic emission from aquaculture installations per unit fish produced	RTD	Research to study how biogenic waste emmision of Mediterranean fish farms of different scale can be reduced (feed conversion improved) by using automated camera assisted feeding systems and optimal feed composition (binders)	3-7 Yrs €6,000,000	Specifications of smaller scale feeding systems and feed binders/feed composition that may reduce waste emission and improve feed conversion efficiency for small Mediterranean fish farms. Lower waste losses is vital for the economy and lower emissions may in turn allow larger consessions	
	2.2	To learn how optimal siting and the best available technology for environmental management can minimise the potential environmental influence of emissions per unit fish produced	TT	Transfer knowledge on optimal siting criteria and environmental management (e.g., MOM) from salmon to other species	<1 Yr €150,000	Technology transfer from salmon may facilitate harmonisation of siting strategies and environmental management of aquaculture in Europe	
	2.3	To explore the potential environmental benefits of an expansion of marine aquaculture of fish, shellfish and macroalgae to exposed Atlantic and European marginal seas	TT	Feasibility study of the optional environmental benefits associated to aquaculture of fish, shellfish and macroalgae expanded to exposed sites	1-3 Yrs €300,000	Updated data base and state of knowledge on the possible adventages of expanding marine aquaculture to more exposed waters	
			OTHER				
	2.4	To explore potentials of utilising wastes from existing and new European cage fish farms in exposed waters for combined feeding and extractive aquaculture (IMTA), with a focus on co-farming of fish, macroalgae and vulnerable non-fed invertebrates	TT	Feasibility study of possibilitie and constraints of IMTA driven by cage aguaculture, a European perspective for protected and exposed (off-shore) locations	1-3 Yrs €200,000	Updated data base and state of knowledge on options and limitations of cage aquaculture driven IMTA in Europe in protected and exposed marine waters	
			Other				
			RTD	Study the theoretical and actual environmental and economic potentials of implementing IMTA driven by cage culture for exposed cage aquaculture.	3-7 Yrs €6,000,000	Better knowledge on the economic and environmental potentials of IMTA of macroalgae and invertebrates driven by cage fish farming in European waters	

TA5: Integration with the environment

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012–2015–2020–2025–2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
3		***To understand the fate and cumulative effects of Synthetic agents used in aquaculture and minimizing their impact on the environment (Fate of Synthetic agents in ecosystem)***					
	3.1	To better understanding mechanisms and risks for harmful ecosystem interactions of pharmaceuticals and chemical antifouling agents	RTD	Research to understand the feasibility and fundamental interactions of alternative agents to reduce biofouling and to combat specific disease	1-3 Yr €2,000,000	Better knowledge on the fundamental mechanisms of potentially harmful agents before they are introduced in aquaculture. Minimise environmental impact, increase consumption safety.	
	3.2	To study cumulative effects and fate of new antifouling and pharmaceutical agents that are beneficial for aquaculture , their ecosystem interaction in the near site and far-field environments	RTD	Research is required on fate and cumulative effects of persistent agents and their interaction in the near and far sites of farms with the environment.	3-7 Yr €2,000,000	An improved knowledge on components used in aquaculture that can be harmful to the environment and secondly to aquaculture	
	3.3	To improve access to field data with the possibility to build a transparent surveillance and reporting network of the fish infections and volumes and classes of pharmaceuticals used by fish farms to regulatory agencies in order to minimize their usage and their impact into the environment	Policy Action	Policy change of regulatory agencies to build a transparent surveillance and reporting network for the fish infections, volumes and classes of pharmaceuticals and agrochemicals used by fish farmers.	<1 Yr €150,000	Facilitates the sharing of knowledge on harmful chemical agents and contribute to transparency among aquaculture actors and management	
4		***To establish more fundamental knowledge to understand the interactions between farmed and wild stocks, including wildlife (Interactions of farmed and wild stocks)***					
	4.1	To better understand the potential positive and negative aquaculture interactions with fisheries and ecosystems, including wild life, predators and exotic species	RTD	Evaluation of the importance of different ecological interactions between aquaculture and the ecosystem and its key functional bgroups of organisms, with the ultimate goal of ranking impotance	3-7 Yrs €3,000,000	Basic research questions that will identify the most imerging problems and the positive interactions of aquaculture to the environment	
			Policy Action	Establish principles, methods and guidelines to support the implementation of an an ecosystem based management of aquaculture	3-7 Yrs €500,000	Established management tools to undertake ecosystem based management of aquaculture at local and global scales	
	4.2	To better understand diseases and parasite interactions between farmed and wild organisms	RTD	The ecological consequences of spreading of disease and parasites from farmed to wild fish and shellfish and vice versa	3-7 Yrs €2,000,000	Basic research questions addressed. Will provide knowledge to local and global managers of aquaculture	
	4.3	To better understand the genetic interactions between wild and farmed stocks	RTD	Understand better the genetic effects of escapes and survival in the wild, ability of successful spawning and reproduction of endemic and exotic species	3-7 Yrs €2,000,000	Basic research questions addressed. Will provide knowledge to local and global managers of aquaculture	

TA5: Integration with the environment

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012 2015 2020 2025 2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
5		***To develop or adapt tools and measures in support of appropriate environmental governance for aquaculture (Tools for environmental governance)***					
	5.1	To adapt existing and development of new planning tools used for site selection based on ecosystem assimilative capacity and spatial planning for further aquaculture developmen	RTD	Research for the development of water body scale modelling, site selection and zoning, environmental indicators, EQS based on sound scientific basis	3-7 yrs €500,000	Appropriate models for site selection, and ecosystem assimilative capacity for aquaculture to assist in responsible and sustainable planning of aquaculture development by Regulators.	
	5.2	To adapt existing and develop new management tools and measures used for environmental monitoring, production optimization and minimizing aquaculture impact	RTD	Research for the development and validation of Governmental measures (eg area management, monitoring, GIS based database, etc).	3-7 yrs €500,000	Appropriate governmental measures for responsible and sustainable development of aquaculture. Input aquaculture data into a database that can be accessed publically.	
	5.3	To harmonize environmental regulations and legislation, and implement regulations between European Countries	Policy Action	Comparative research on legislatives framework, in different important aquaculture producing countries to ensure that the European legislative framework includes the latest knowledge developments from the scientific research and ensure the level playing field in all aquaculture productions commercialized into the European market	1-3 Yrs €200,000	A harmonised, logical and facilitating legislative framework in European Countries. Operators will benefit from a more level playing field for the production of common products.	
	5.4	To develop techniques and procedures for quantification of environmental and ecological services provided by aquaculture farms and encourage farmer based voluntary contribution to environmental management	RTD	Research for the development and validation of farmer management measures for minimising aquaculture influence and to identify and quantify environmental and ecological services provided by aquaculture	1-3 Yrs €300,000	Better knowledge on the environmental services of aquaculture and harmonised Codes of conduct for the main aquaculture sectors. Producers will benefit from coordinated management of production in shared watershed/water bodies.	

TA6: Knowledge Management

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012 2015 2020 2025 2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
1		***To manage Knowledge effectively within the European Aquaculture sector***					
	1.1	To efficiently and effectively create knowledge that is focused on outcomes and impacts on industry and ensure that research efforts are not duplicated	RTD	Develop a research priority list that adheres to the requirements of the SRIA of TA1-5 and TA7 to ensure that research is industry focused	Ongoing process, medium urgency and significant cost	Funding of research that will directly affect the aquaculture sector and increase efficiency, productivity, economy or job creation. Research priorities can be reviwed as needs change and duplication avoided.	
	1.2	To efficiently and effectively manage and transfer knowledge including the dedicated transfer to identified users and translation of research results for stakeholder uptake	TT	Develop guidelines on effective transfer of results and engage knowledge management professionals to tailor make transfer media relevant for industry, policy and society.	Ongoing process, medium urgency and significant cost	Industry, Policy and Consumers will be aware of developments in the aquaculture sector will help to avoid duplication of research and research plans can be adapted as needs change	
	1.3	To encourage the protection of legal rights, management of IP, and adherence to ethical standards in a manner that ensures open innovation and the development of a sustainable sector	TT	Develop best practice guidelines on the management of knowledge and transparency of methods	Ongoing process, medium urgency and significant cost	Transparency of process will ensure that innovation in the sector will not be affected by IPR	
	1.4	To promote sustainable aquaculture practices through the transfer and application of knowledge and technology, including the challenges of food production, environmental protection, product safety and economic viability	TT	International cooperation at multiple levels (commercial, RTD, governance) in order to share best practice	Ongoing process, medium urgency and significant cost	A globally sustainable sector capable of addressing future global challenges	
2		***Ensure the availability and efficient use of aquaculture research infrastructures across all boundariesto benefit the Industry***					
	2.1	Ensure international and inter-regional cooperation to develop research infrastructures that can meet emerging needs	Other	Development of an aquaculture roadmap and strategic plan that expresses the need for new infrastructures of a European dimension. Involve industrial stakeholders in awareness- and fund-raising processes related to the establishment and upgrading of research infrastructures	Medium urgency, small cost	A strategic Plan for efficient development and use of European Research Infrastructure in line with industry requirements	
	2.2	Increase the awareness of existing research infrastructures (functionalities, scale, services and access) for all stakeholders	Other	Mapping of existing public and private research infrastructure (i.e. physical facilities, e-infrastructure, services, and related expertise) in aquaculture and other relevant research areas, to ensure transparency	Short term urgency, small cost	Avoid duplication and Gap Identification	
3		***To Collect and Collate Evidence to Inform communications on the benefits of the European Aquaculture sector for Society and the Environment***					
	3.1	To develop an evidence based knowledge resource to inform communications on the environmental and societal attributes provided by European aquaculture sectors	RTD	Collect, collate and analyse the latest global scientific evidence related to issues of concern about the aquaculture industry (including consumer perception, health benefits, environmental issues etc.).	Short term urgency, medium cost	New knowledge on how aquaculture is perceived will provide the evidence base for communication from the sector on these perceptions. Informed sector able to generate appropriate communication channels to carry out coordinated sectoral promotion to a range of targeted stakeholders and the wider public and engage in well informed and well planned public engagement. Informed competent authorities will also communicate messages to consumers, public etc.	
	3.2	To understand perceptions of aquaculture across Europe and identify stakeholder groups as advocates so that public communication campaigns are targeted and responsive	Other	Study on the perceptions of aquaculture across Europe (consumer perceptions, environmental perceptions etc.geographic spread, age, culture)	Short term urgency, small cost	New knowledge on how aquaculture is perceived so that communication can be targeted and directed correctly. A better informed society leading to improved governance of the aquaculture sector	

TA6: Knowledge Management

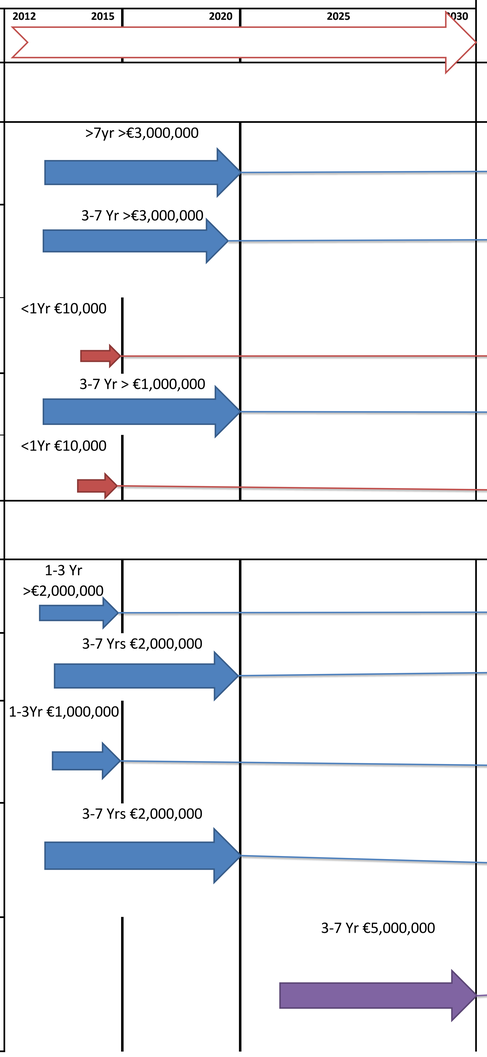
Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012 – 2015 – 2020 – 2025 – 2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
4		***To foster and build the human capital of the European aquaculture sector***					
	4.1	Promotion of formal and informal lifelong learning opportunities at all levels as a central strategy for ensuring knowledge transfer for a sustainable, innovative and competent workforce	RTD	Reference to wider trends in educational policy and practice - investigate mechanisms for the accreditation of non-formal learning and for delivering flexible life-long learning involving greater partnerships between academic, research and industry stakeholders and the role of communities of interest and individual learner efforts	1-3 Yrs €250,000	Improved knowledge of un-met needs and barriers to uptake of LL opportunities for use by policymakers, learning providers and industry. Improved transparency and status data for the current LL arena for use by policymakers, learning providers and industry. Improved access of participants to LL opportunities.	
			TT	Pilot courses and partnerships implementing the new models proposed under 3.1	7+ Yrs €500,000	All participants in the aquaculture sector will have improved awareness of and access to suitable learning resources, opportunities and support	
	4.2	Exploration of new models and partnerships for learning and its accreditation to encourage career development and innovation in the sector	RTD	Building on the research in 1.1 and the earlier WAVE and VALLA projects develop a more comprehensive framework for job, personnel and curriculum assessment	1-3 Yrs €750,000	Toolset useful in business, research and learning organisations for developing learning programmes and assessments	
			TT	Promoting the uptake of the toolsets in industry, research and learning organisations	3-7 Yrs €250,000	Employers will benefit from clearer assessment of staff competences. Employees will benefit from clearer definition of employer needs and competences provided through educational/training programmes or other lifelong learning	
	4.3	Attract and retain talented, enthusiastic and able individuals to work in the aquaculture sector and to foster entrepreneurship	RTD	Investigating the image of aquaculture for young people and messages that might be effective in improving it	3-7 Yrs €500,000	Improved understanding of young people's perceptions of the sector and how they may be positively stimulated	
			Other	Promoting the image of aquaculture to the public and highlighting the challenges and opportunities to young people	7+ Yrs High cost	Improved position of aquaculture in public perception and greater awareness and interest in the sector by young people	
			Other	Offer tax incentives to start up businesses or provide grants to entrepreneurs who can provide a solid business plan	Ongoing process, medium urgency and significant cost	Will allow for greater innovation in the sector and permit small businesses to grow	

TA6: Knowledge Management

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012 – 2015 – 2020 – 2025 – 2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
	4.4	Seek to maximise appropriate career pathways and job satisfaction.	RTD	Survey of career paths and job satisfaction within the European aquaculture sector to inform policy and strategy	1-3 Yrs €500,000	Report on status, aspirations, trends and likely future scenarios; toolset for company and self-evaluation	
			Other	Promotion of career development policies and supporting tool sets	3-7 Yrs €500,000	Improved career structures and progression linked with learning and competence development	
	4.5	Promote and enable peer-to-peer networking and collaboration as key components of an innovative European aquaculture sector	RTD	Study of how people in the aquaculture sector are motivated to engage in networking and mobility in order to help with design of subsequent programmes	<1 Yr €100,000	Report advising on further actions	
			Other	Promotion of mobility at all levels and between different sub-sectors and types of organisation to maximise learning opportunities and possibilities for innovation	3-7 Yrs €1,500,000	Individuals within the sector have better developed personal learning networks and duplication and overlap in trial and error research is reduced Sharing of experiences and transfer of best-practice methodology among the aquaculture sector	
			Other	Hosting of a large scale European-wide networking event	1-3 Yrs ? Cost	Increased personal and company networks Sharing of best-practices among institutions and organisation Increased visibility of the extent and diversity of the aquaculture sector Opportunity to promote and discuss the human capital of the European aquaculture sector	
	4.6	To create and sustain effective links between industry and research communities.	RTD	industry training for researchers and Academia-Industry mobility grants	Short term urgency , medium cost	A more informed and better trained researchers who understand the working organisation of the aquaculture industry	
			Other	Open up channels of communication between researchers and stakeholders	Short term urgency, minimal cost	A more informed research community which is aware and updated of issues facing industry	
			RTD	Industry developed trainning	Short term urgency, minimal cost	A more informed research community which is aware and updated of issues facing industry	

TA7 AQUATIC ANIMAL HEALTH AND WELFARE

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
1		**Improve fish health by increasing the understanding of host parasite interactions and to have access to effective vaccines and immunomodulators**				
	1.1	Improving understanding of host pathogen understanding	RTD	Develop novel fish cell lines, develop antibody markers for cell types in fish, evaluate relationship between immune gene expression and protein expression	Increase understanding of disease process enable improved livestock management to prevent disease and reduce impact of same.	
	1.2	Development of new vaccines and improvement of existing vaccines and diagnostic tests, including their application to all stages of finfish life cycles	RTD	1.2.1 - Reducing side effects, embracing new vaccine technologies, efficacious oral vaccine development	Improved protection and welfare of farmed fish, reducing mortalities and environmental impact	
			Policy Action	1.2.2 - Assessement and decision on use of DNA vaccines in food fish	Permit use of DNA/sub unit vaccines	
	1.3	Research required on mode of action and use of mmunomodulators	RTD	1.3.1 - Evaluate dietary manipulation to stimulate resistenace to disease and the use of immunomodulators for fish	Clarification of value and use of immunomodulators in fish health	
			Policy Action	1.3.2 - Clarification of regulatory status of immunomodulators	Clarification of value and use of immunomodulators in fish health	
2		**Application of epidemiological principles to minimise the threat of existing, emerging and exotic diseases**				
	2.1	Improve understanding of transmission mechanisms, of all pathogens at all levels from farm, through country to Europe level.	RTD	This will include data collection through field sampling and analysis and modelling	Outputs will quantify disease risks from various sources informing prevention and control strategies.	
	2.2	Understand the industry structure (network) and its vunerabilities to endemic and epidemic diseases	RTD	Data compliation, analysis and modelling, providing a platform for testing scenarios and strategies	More effective disease prevention and control strategies.	
	2.3	Development of framework (model) for evaluating the relative importance of health and welfare threats, including bio-economic modelling and risk assessement and biosecurity	RTD	Tools to canvas stakeholder opinion and bio economic decision tools to prioritise areas of investment	Decision tools based on bioeconomic models to inform decision makers for all stakeholders groups	
	2.4	Improve strategic data availability through standardisation	RTD	Develop a common schema for data storage to allow more efficient data exchange and compliation	Reduction in reporting effort (especially SMEs) to legislators, quality schemes, retailers etc. Improved ability to address strategic questions across industry. Improved market opportunities through improved traceability.	
	2.5	Turn understanding into strategies through industry, goverment, acedemic participation in research and consultation	TT	Continue to develop research partnerships with end users and ensure that realistic pathways to uptake and impact are negogiated with end users. The process starts from identification of research priorities (2.3) through the research process, with adequate resources allocated for development of practical strategies from research outputs	Improved uptake and impact from research, resulting in greater return for European investment in research. Ongoing commitment not specific to this TA. Rather than large additional costs this would invlive changes in processes for funding and assessing research	



TA7 AQUATIC ANIMAL HEALTH AND WELFARE

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012–2015–2020–2025–2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
3		***Use and develop best practise to optimise efficacy of treatments and prevention methods***					
	3.1	Minimise treatment when possible by using best practice	Other	Codes of practice for use of existing products	1-3 Yr >€500,000	Code of Practise for all industry sectors.	
	3.2	Investigate Alternate remedies and methods such as probiotics and biological control	RTD	Development of alternative remedies, specifically alternatives to formalin, an effective antifungal agent	>7 Yrs €1,000,000	Alternative remedies for ectoparasitic and external fungal infections	
	3.3	Improve and streamline the medicine and Licensing system	Policy Action	Development of fast track licensing mechanisms e.g. Licensing of US formalin brands, licence for all finfish species, MUMS legislation optimisation oprimisation	1-3Yr €100,000	Increase access to remedies which will be effective and safe for controlling fish diseases	
	3.4	Improve application of management measures with emphasis on alternative control measures	RTD	Development of biological control measures, non-medical control measures, pre- and probiotics e.g. Wrasse for lice	3-7 Yrs >€3,000,000	Disease control and treatment using biological methods (not chemotherapy)	
	3.5	Develop methods for effective delivery of treatments in novel systems e.g. large off-shore cages, well boats etc	Other	Develop methods for effective delivery of treatments in novel systems e.g. large off-shore cages, well boats etc	>€100,000 Ongoing	Development of effective treatment methodologies in novel systems	Funded by Industry- Producers and Pharmacy (no requirements for EU funding)
4		**Measure welfare/Stress and understand its consequences if compromised in order to incorporate welfare as core component of production management**					
	4.1	Develop and Improve existing welfare/stress indices	RTD	Network action	1-3 Yr >€100,000	A welfare index based on a flexible model that allows continous updates and improvements.	
	4.2	Understand and quantify short and long term consequences of compromised welfare, such as reduced growth, reduced feed efficiency, health, treatment effects, product quality etc.	RTD	Integrate production output with welfare index measurements	3-7 Yrs >€3,000,000	Create a knowledge base allowing transfer of welfare issues to economic values.	
	4.3	Incorporate welfare/low stress management as a major factor in production and legislation decisions and in on-going risk, cost and Gap analysis.	RTD	Modelling based on biological data	1-3 Yr €1,000,000	Decision tool. Industry and legislators.	

TA8: SOCIO-ECONOMICS, MANAGEMENT AND GOVERNANCE

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012 2015 2020 2025 2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
1		***To promote effective governance - establishing a 'level playing field' for aquaculture within and outside Europe***					
	1.1	To standardise decision-making processes on aquaculture activities by employing good principles of governance (e.g. cohesiveness, openness, participation, effectiveness and accountability)	*RTD*	Research to understand existing governance structures (e.g. hierarchial, market or participant) and relationships between governance constraints and implementation of aquaculture related management and policy	1-5Yr €5,000,000	Communicate to policy-makers in government and non-governmental organisations the aquaculture governance constraints underpinning efficacy of government processes, management tools and policy	
	1.2	To ensure policies consider potential impacts of management measures on aquaculture from a vertical (local, national, regional and international) and horizontal (between sectors e.g. aquaculture and fisheries) perspective	RTD	Assemble a region-wide management toolbox on empirical evidence based case studies from different countries	1-3Yr €3,000,000	The efficacy (ability of a management tool to support aquaculture development) of management tools will be determined for improving future trajectory of growth in aquaculture sectors at all scales	
	1.3	To simplify legislation and reduce time from application to award of licence	Policy Action	Policy change of regulatory agencies to build a single network for simplifying application and processing of licences for aquaculture operations	1-3Yr €1,500,000	Comprehensive database underpinning user-friendly decision-making tool to facilitate sharing of knowledge from disparate sources for processing awards of operation licences	
	1.4	To ensure food produced with ingredients and processes outside Europe should comply with EC standards	Policy Action	Develop and validate methods and procedures to authenticate product information and ensure imports comply with EC standards	1-3Yr €2,000,000	Policy making advice on outlining procedures and resources required for ensuring imported aquaculture products comply with EC standards	
	1.5	To link social and economic dimensions of aquaculture with environmental considerations in a fair, legitimate and transparent manner	Policy Action	Build an ecosystem based approach to growing the aquaculture sector (including policy on implementation of equal consideration of social, economic and environmental impacts of aquaculture)	1-3Yr €1,800,000	Provide a GIS based management tool to visualise trade-offs between social, economic and environmental consideration of aquaculture using good principles of governance applicable at local, national and regional scales	
	1.6	To develop a European database to better inform the aquaculture industry of drivers underpinning local, national, regional and international markets.	RTD	Identify, define and standardise indicators for assessing risk of market drivers' impact on future trajectory for growth of the aquaculture sector	1-3Yr €1,600,000	Determine governance structures and management measures best suited for responding to changing market drivers via access to multi-faceted decision-making tool	
	1.7	To provide a transparent and user-friendly decision support system for effective aquaculture governance that can weigh potential benefits and costs of different management measures to all interested parties	RTD	Comparative research on impacts of different governance structures on efficacy of management measues under different future scenarios for a variety of species and production models	3-7Yr €4,300,000	Dynamic and adaptive aquaculture governance framework that includes latest scientific research findings and ensures decision-makers adopt a level playing field approach to managing aquaculture developments	

TA8: SOCIO-ECONOMICS, MANAGEMENT AND GOVERNANCE

Goal	Subgoal:	Subgoal Description	Activity	Activity Description	2012 2015 2020 2025 2030	EXPECTED RESULTS/OUTPUTS/IMPACT	FUNDING OPTIONS/PROJECTS IN PROCESS
2	***To establish an enabling environment for innovation and growth to allow aquaculture to realise its full potential***						
	2.1	To identify standard methods to measure trade-offs between risk and return on aquaculture projects in regulatory evaluations	RTD	Define indicators to evaluate different impacts regulations will have on aquaculture projects	3-7Yr €1,200,000	A user-friendly guide for producers, policy makers, managers, scientists and other interested parties for aiding decision-making using risk management techniques	
	2.2	To identify incentives to promote investment in aquaculture and ensure longetivity of sustainable production	RTD	Compartive desk based study on cases exhibiting best practice in applying different forms of investment (e.g., private, government, public) combined with empirical evidence to inform on constraints to future investment models	<1 Yr €95,000	Guide or decision-making technology (preferred format to be informed by end-users) developed or adapted that delivers robust advice on which investment model and type of incentives matches a particular situation	
	2.3	To establish policies that recognise property rights of aquaculture enterprises and offer methods on how to balance economic, social and environmental impacts of aquaculture on an area	Policy Action	Define and outline issues surrouning property rights and combine with outputs in sub-goal 1.5 to ehance management tool that suggests relevant actions for different scenarios	<1 Yr €80,000	Provide enhanced GIS based management tool based on outputs in sub-goal 1.5 to visualise how social, economic and environmental imapcts of aquaculture can be influenced by property rights	
	2.4	To facilitate open and inclusive dialogue in decision-making about growth of all aquaculture related activities	Other	Employ different survey methods (e.g. key informant interviews and focus groups) and effective communication strategies to explore a range of future scenarios for sustainable aquaculture development	1-3Yr €500,000	Contemporary knowledge on prioritisation of new and existing types of European aquaculture	
	2.5	To ensure communication on research and development between industry, scientists and policy makers is facilitated through joint development of effective communication strategies	Other	Identify constraints for effective communication between scientists, policy makers and industry and test innovative incentives to promote joint collaborations	1-3Yr €400,000	List of incentives and modes of communication that facilitate effective working relationships between scientists, policy makers and industry under different sceanrios	
3	***To better understand social and economic dimensions of aquaculture at different scales***						
	3.1	To develop aquaculture as an attractive and viable livelihood for achieving income generation and food security for all interested communities including coastal and rural areas	RTD	Undertake empirical based surveys and future scenario planning to ascertain barriers and opportunities for aquaculture to realise its full potential in creating income generation and food security across Europe	1-5Yr €3,000,000	Decision-making tool for governments to show pros and cons and associated risks of introducing or enhancing different aquaculture activities that can make an impact on peoples lives	
	3.2	To promote social and economic benefits associated with aquaculture through evidence based scientific information communicated using different media formats appropriate for different target audiences	RTD	Identify and test different methods and media formats on effective ways to aid understanding of social and economic benefits associated with aquaculture to both specailist and non-specialist audiences	1-3Yr €2,500,000	End-user led developments in technology that facilitate understanding of strengths and weaknesses of social and economic impacts of aquaculture on communities	
	3.3	To better understand what parameters explain social and economic impacts of aquaculture including spatio-temporal trends	RTD	Building on social and economic benefits defined in sub-goal 3.3, spatial and temporal parametrs will be defined	<1Yr €400,000	Outputs from sub-goal 3.3. will be enhanced to demonstrate how to mitigate against uncertainity in spatio-temporal trends	
	3.4	To improve understanding of methods and tools to apply social and economic data to decision-making	RTD	Critical appraisal and comparative study on social and economic values used in policy making on sustainable aquaculture developments	1-3 Yr €800,000	Demonstration of how different approaches to valuing social and economic impacts of aquaculture can influence viable industries and associated communities	
	3.5	To provide a transparent decision support system for linking relationships between social and economic factors with environmental considerations to inform what type of governance structure is needed to support sustainable development of the sector	RTD	Integrating outputs from sub goals 3.1, 3.2, 3.3 and 3.4 to test with policy makers and government officials an interactive governance decision-making software	3-7 Yr €2,900,000	Clear guidelines on impacts of different environmental management measures with social and economic parameters for various communities in different countries under a range of future scenarios	