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# The future of European aquaculture

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## The Vision and Strategic Research & Innovation Agenda of the European Aquaculture Technology and Innovation Platform

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12 April 2011

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# 14 Definitions

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## 15 ***Of a Technology Platform:***

16 Technology Platforms provide an open and transparent framework for  
17 stakeholders, led by industry, to define research and development  
18 priorities, involving a broad range of stakeholder interests and  
19 activities.

20 They are set to play a key role in ensuring an adequate focus of  
21 research funding on areas with a high degree of industrial relevance by  
22 covering the whole economic value chain and by mobilising public  
23 authorities at national and regional levels.

24 Technology Platforms address technological challenges that can  
25 potentially contribute to answering to a number of key policy objectives  
26 which are essential for Europe's future competitiveness.

27 Their key goals are to develop a strategic research agenda that responds to these challenges, providing an  
28 action plan so that the results of new research lead to real innovation in the field through effective  
29 dissemination and technology transfer mechanisms

30

31

## 32 ***Of Aquaculture:***

33 Aquaculture is the cultivation of fish, shellfish, crustaceans and algae  
34 which, in Europe, supplies 2.4 million tons of produce using cultivation  
35 methods and parameters across the entire aquatic environment, both  
36 marine and freshwater.

37 Throughout Europe, it generates jobs for an estimated 100,000 people  
38 in production, 60,000 in processing and 3,000 in the wider research  
39 community. It takes place in all EU and EEA Member States. In addition,  
40 service companies provide many additional jobs. Overall, the produce is  
41 valued at €6.2 billion.

42 Globally, aquaculture provided 43% of aquatic animal food for human consumption in 2007 (FAO).

43

*“European Technology Platforms are set to play a key role in supporting European industrial competitiveness and, ultimately, in improving significantly the daily lives of the European citizen in many areas.”* Commissioner Potočník (DG Research)

***“If aquaculture did not exist we would have to invent it”,***

***Commissioner Maria Damanaki (DG MARE) 2010***

44 **Table of Contents**

45

46 Foreword .....4

47 Key Messages and Summary: .....5

48 The Vision for European Aquaculture .....7

49 Strategic guidelines for aquaculture .....7

50 The Challenges for Europe and for Aquaculture.....7

51 The European Challenge for Aquaculture .....9

52 Opportunities .....9

53 The Future for Aquaculture: What will the sector look like in 20 years? ..... 11

54 The Strategic Research Agenda - "Achieving the Vision" ..... 12

55 The Visions and Key Goals of the Thematic Areas ..... 12

56 Conclusions ..... 17

57 The Action Plan ..... 18

58 Recommendations of the EATIP ..... 19

59

60

61 Disclaimer:

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## 63 Foreword

64

65 The impetus for creating European Technology Platforms<sup>i</sup> started in 2003, looking initially to strengthen the  
66 European Research Area. Facilitated by the European Commission, their scope and impetus is defined by  
67 the participating sectoral organisations but, above all, by the individuals concerned. Aquaculture  
68 stakeholders met in 2007 to debate the status of their sector and identify needs and gaps in knowledge,  
69 technology, skills and policy. The very diversity of aquaculture provided the initial challenges for a cohesive  
70 approach but 58 organisations agreed on the conditions to create the European Aquaculture Technology  
71 and Innovation Platform.

72 The financial crisis of 2008-9 further highlighted the need to address a range of structural challenges at the  
73 European and global levels, where the Europe 2020 Strategy<sup>ii</sup> identified the priorities of

- 74 ● **smart growth** – based on an economy founded on knowledge and innovation
- 75 ● **sustainable growth** – promoting a more resource efficient, greener and more competitive economy
- 76 ● **inclusive growth** – fostering a high employment economy, delivering social and territorial cohesion

77 These priorities are core principles within both the Vision and the Key Goals of the EATIP Strategic Research  
78 and Innovation Agenda, and are supplemented by the Grand Challenges identified in the European Council's  
79 review<sup>iii</sup> of the Sustainable Development Strategy.

80 In the development of the EATIP Vision Document and Strategic Research and Innovation Agenda, we have  
81 integrated the input of over 200 expert contributors from the Aquaculture Value Chain who have put these  
82 challenges and priorities to the front, identifying where aquaculture can make its contributions and the  
83 knowledge gaps that must be overcome for successful innovation and development.

84 This expertise comes from the personnel of commercial companies, research institutes, universities and  
85 representative organisations, consumer groups and other associated stakeholders, working across the  
86 Thematic Areas of EATIP. Their efforts have been considerable during the last year and the Board of  
87 Directors and I thank them for this.

88 Each Thematic Area has developed its own vision, strategic research requirements, accompanied by an  
89 Action Plan to realise these requirements. These are the guidelines upon which the contents of this paper  
90 have been developed and the complete documents can all be reviewed on the EATIP website –  
91 [www.eatip.eu](http://www.eatip.eu) – that includes facilities for on-line consultation.

92 It is therefore a privilege and a pleasure to present this document for public review and comment and I  
93 trust that this will provide a solid base for the future of European aquaculture.

94 *Signature*

95 Gustavo Larrazábal  
96 Chairman of EATIP

97 **Key Messages and Summary:**

98 Aquaculture's core function is to provide safe food of the highest nutritional benefit and quality, supplying a  
99 broad range of products adapted to consumer preferences and lifestyles.

100 European aquaculture is an extraordinarily diverse sector, predominantly  
101 devoted to fish and shellfish production, which is present, in different forms  
102 and scale, throughout the continent. While climate and location influence the  
103 choice of species and production technology, changing consumer preferences  
104 and market demands continue to provide new challenges and opportunities for  
105 product development and diversification.

106 Highly skilled personnel are active within each component of the value chain  
107 that, aside from professional producers, includes equipment and feed  
108 suppliers, veterinary and health services, and processors.

109 European technological advances, obtained through institutional, academic and industrial research efforts,  
110 have allowed new species to be produced, using high performance feeds, in innovative farming facilities.  
111 The farming of existing species has also been revolutionised through advancements in, amongst other  
112 inputs, diet, veterinary treatments, stock selection, farming technologies and the consequent  
113 improvements in husbandry. In many cases, European technology has also provided the stimulus for the  
114 growth of aquaculture elsewhere, whether this has been by the supply of equipment or by know-how and  
115 technology transfer. This led to 7-fold production growth in 40 years.

116 On the other hand, European aquaculture has always faced competition from fisheries and imports to  
117 establish its place in the market. While fisheries are restructuring to answer to the needs for improved  
118 natural stock management, competition from imports is ever rising within the conditions of a global market.  
119 In 1994, European resources (fisheries and aquaculture) provided 60% of Europe's needs for seafood;  
120 currently, this position has reversed and close to 70% of the supplies is imported.

121 Changing consumer and market demands have stimulated the provision of new added-value and  
122 convenience preparations and aquaculture continues to develop new products and strategies to adapt to  
123 these developments, supporting lifestyle changes and preferences.

124 Strategically, aquaculture has been linked traditionally to fisheries, within the scope of the Common  
125 Fisheries Policy and related instruments, mainly because its markets are similar to those for the wild  
126 products. The intrinsic differences in aquaculture processes and sectoral structure have been, however,  
127 difficult to reconcile within this European framework.

128 In focusing on the improved use of natural resources and the environmental, economic and social  
129 components of sustainable development, European aquaculture must now respond to a range of issues to  
130 consolidate its position and to develop.

131

*Seafood is a key component of the diet of many European citizens and supports societal health and a high quality of life*

132 Aquaculture is also seen as an integral component of Europe's bioeconomy - fundamentally based on  
133 excellence in science, technology and industry - and there is increasing recognition of the need to develop  
134 this concept, building on Europe's strengths and supporting sustainable development. The bioeconomy has  
135 to develop by responding to the Grand Societal Challenges, towards which aquaculture can make significant  
136 contributions.

137 In making responses to these challenges, we have taken the following guiding principles for the role of  
138 European aquaculture:

- 139 • Providing the European consumer with desirable products of the highest quality and at  
140 an affordable price
- 141 • Assuring that aquaculture's impact on the environment is minimal
- 142 • Respecting the conditions of optimal livestock health and welfare
- 143 • Developing and integrating new technologies within the entire value chain
- 144 • Improving economic performance at each level of the value chain
- 145 • Guaranteeing the training and skill development of those working in the sector
- 146 • Providing clear contributions and benefits to society

147 In identifying the potential contributions that European aquaculture can provide, specific opportunities  
148 have been identified so as to respond to the demands of the market, concerns for product quality and  
149 safety and how these can be assured. The sector's contributions to social cohesion have been noted, given  
150 its position in coastal and rural economies and the quality of the workforce. A wide range of technological,  
151 social and policy needs have been highlighted where Europe's RTDi sector is well positioned and qualified to  
152 provide solutions and impact on strategic research needs.

153 The EATIP Thematic Areas, which are described fully in the following sections, have contributed  
154 comprehensive Vision statements, identifying Key Goals and preparing Actions Plans that respond to these  
155 principles.

156 Furthermore, a full assessment has been made of how realisation of these proposals will contribute  
157 positively to the objectives of Europe 2020 and the Grand Challenges facing society.

158 To achieve these, European aquaculture needs dynamic European research and innovation that links to a  
159 responsible and competitive aquaculture value-chain, which is fully accountable to society. Successful  
160 innovation will also require extensive public/private cooperation, creating an innovation-friendly  
161 environment for the sustainable development of the sector.

162 In respecting the requirements for transparency and good governance, these positions provide an  
163 overarching picture of how European aquaculture – incorporating the complete value-chain and the  
164 research sector – will be able to develop, sustainably and competitively.

165 Achieving the goals of European Aquaculture requires moving from ideas and concepts to realisation, from  
166 research to measurable impact, from questions to acceptance. Implementing the EATIP Action Plan will  
167 provide the base for the sustainable development of European aquaculture.

## 168 **The Vision for European Aquaculture**

### 169 **Strategic guidelines for aquaculture**

170 Europe's recent strategic policies have identified many challenges that the technology platforms need to  
171 address; these may be considered as generic to Europe or as specific and relevant to the aquaculture  
172 industry. The guiding priorities are focused on smart and sustainable growth that will contribute to an  
173 inclusive high-employment economy. These need the generation of new knowledge that leads to  
174 innovation and competitiveness, supported by resource-efficient activities.

175 From the Europe 2020 Strategy, the 'Innovation Union' has to ensure  
176 that turning the results of research and innovation is successfully  
177 transferred into application so that the resulting products and services  
178 create growth and employment. The 'Resource efficient Europe'  
179 promotes the shift towards a low carbon economy while an 'Industrial  
180 policy for the globalisation era' is for the development of a strong and  
181 sustainable industrial base, notably for SMEs, so as to be able to  
182 compete globally. These priorities affect directly the frameworks  
183 affecting aquaculture and innovation, notably the Common Fisheries  
184 Policy and Europe's research and innovation programme.

*"The strongest growth is expected in the consumption of farmed fish and chicken, by convenience these also seem to be the animal protein sources with the smallest carbon footprint" - Jacques Diouf – Director General, Food and Agriculture Organisation*

### 185 **The Challenges for Europe and for Aquaculture**

186  
187 Europe, in common with the rest of the world, must respond to major environmental, economic and social  
188 challenges to assure that future generations can enjoy a safe, prosperous and healthy life.

189  
190 Specifically, six overarching "Grand Challenges" will guide the development and formulation of policy and  
191 influence how different societal components respond and develop in the current and future policies.

#### 192 **I. Sustainable management of natural resources**

193 Which for aquaculture means:-

- 194 • Ensuring responsible stewardship of the aquatic resource, feed components - particularly  
195 ingredients gained through forage fisheries - and the wider environmental impacts on the  
196 ecosystem, habitats and biodiversity
- 197 • Addressing spatial planning both in terms of river basin management and integrated marine and  
198 coastal resources, ensuring access to sufficient and appropriate sites while assuring an ecosystem  
199 approach to exploitation

200

201 **II. Sustainable production**

202 Which for aquaculture means:-

- 203 ● Assuring the sustainability of the entire aquaculture value chain, including
  - 204 ○ Optimising the role of aquaculture with regard to food security and the global food system
  - 205 ○ Maximising efficiency within the supply chain
  - 206 ○ Improving animal husbandry, achieving optimal conditions for fish health and welfare
  - 207 ○ Efficient stewardship of raw materials and inputs
  - 208 ○ Increasing productivity
  - 209 ○ Minimising our environmental foot print and avoiding unnecessary waste
- 210 ● Sustainable production has to be achieved within the confines of rising costs, market competition
  - 211 within the global economy, which demands
    - 212 ○ Efficiency with regard to energy and resource use
    - 213 ○ Satisfying market-led demand to deliver long term profitability
    - 214 ○ Ensuring investment in new technologies, research and innovation

215

216 As identified in the Commission's reviewed Aquaculture Strategy<sup>iv</sup>, EU production has developed in a  
217 piecemeal and haphazard manner, lacking focus and direction. Improved strategic direction within the  
218 Member States and at the European level is required for the industry to develop in a meaningful way.

219 **III. Improving public health**

220 Which for aquaculture means:-

- 221 ● Ensuring the safety and quality of feeds and the final product, accompanied by transparent
  - 222 traceability measures
- 223 ● Guaranteeing that production takes place in a clean and safe environment
- 224 ● Increasing consumption and promoting the benefits of aquaculture products across Europe
- 225 ● Integrating the positive health benefits of consumption into public health and education policies

226 **IV. Mitigating Climate Change**

227 Which for aquaculture means:-

- 228 ● Climate change will have significant effects on European aquaculture through changes to water
  - 229 temperature, ocean currents, weather patterns, frequency of extreme weather; this imposes the
  - 230 need to facilitate new working conditions (e.g. robust equipment), and production environments
  - 231 (e.g. dealing with new diseases and infections, non-native species, water availability)
- 232 ● Work must continue to minimise carbon footprint wherever possible and throughout the value
  - 233 chain, - in terms of resources, feed preparation and use, packaging, processing, distribution and
  - 234 storage, noting that
    - 235 ○ Shellfish cultivation provides a significant carbon sink
    - 236 ○ Fish farming has a very low carbon footprint compared to alternative sources of food
    - 237 protein

238 The sustainable intensification of aquaculture (*improving productivity and efficiency while minimising*  
239 *waste*) must be achieved in terms of minimising carbon impact.

240



241 **V. Integrating and balancing social developments**

242 Which for aquaculture means:-

- 243 • Fulfilling our potential in further developing an industry based already within rural and coastal
- 244 economies/communities
- 245 • Providing dynamic and flexible career opportunities
- 246 • Addressing skills and knowledge gaps within a fast developing industry
- 247 • Addressing the very wide disparity within the aquaculture industry across different regions and
- 248 cultures within the EU
- 249 • Improving communication of the benefits and risks of aquaculture to ensure our place in society

250 **VI. Global Sustainable development**

251 Which for aquaculture means:-

- 252 • Optimising our position closely within the global food system
- 253 • Aquaculture already provides nearly half of the world's seafood supply for human consumption<sup>v</sup>.
- 254 European aquaculture will assist in further increasing the percentage of fish and shellfish that is
- 255 farmed for human consumption, both through cultivation in Europe and also by the export of
- 256 technology and skills, knowledge and expertise
- 257 • Many of the challenges described affect the developing world more than Europe and aquaculture
- 258 should aim to contribute to global sustainable development
- 259

260 **The European Challenge for Aquaculture**

261 The Council of the European Union observed that the EU strategy for sustainable aquaculture of 2002<sup>vi</sup> led  
262 to significant progress in ensuring the environmental sustainability, safety and quality of EU aquaculture  
263 production but the need exists to ensure a sustainable and more competitive European aquaculture sector  
264 that meets consumer demands<sup>vii</sup>. Specific reports and recommendations that support this position have also  
265 been provided by the European Parliament<sup>viii</sup>.

266 The very diversity of European aquaculture provides clear advantages and disadvantages, providing a wide  
267 variety of high quality products from differing systems and operating conditions. Its impressive growth was  
268 halted for a variety of reasons, principally due to reduced competitiveness within a changing European  
269 marketplace which led to recent stagnation in production. This position was compounded by the sector's  
270 geographic dispersion, on coastal and rural communities, and a scattered socio-economic structure –  
271 composed of family firms, SMEs and multinational companies.

272 For aquaculture to fully exploit its potential within the priorities of European development, it has to take  
273 full advantage of its opportunities, while responding to the challenges identified.

274 **Opportunities**

275 **The Market**

- 276 - There is a growing market demand for our products
- 277 - Europe has a well developed and integrated aquaculture value chain
- 278 - There is an increasingly sophisticated and demanding market, both within the EU27 and increasingly in
- 279 third countries, that shows a growing interest in alternative diets and sources of protein for which
- 280 aquaculture is particularly suited.
- 281

282 **Product Quality and Safety**

- 283 - The wide-ranging recognised health benefits of fish and shellfish  
284 - The quality and safety of products of European aquaculture is assured by strong legislation and a  
285 responsible value chain, demonstrating full traceability.  
286 - An established regulatory framework exists for statutory, independent or industry-led product  
287 certification, accreditation and inspection  
288

289 **RTDi**

- 290 - Europe has a historic advantage in pioneering aquaculture research and development, forged by skilled  
291 and innovative scientists and engineers  
292 - The research infrastructure provides top class facilities for both basic and applied research tasks  
293 - Strong links subsist between research and industry through established networks  
294

295 **Social**

- 296 - A highly educated workforce with multi-disciplinary skills  
297 - Long term economic contributions and employment in coastal and rural areas  
298 - An affluent consumer society that is life-style oriented, appreciative of fish and shellfish, and increasing  
299 aware of issues concerning sustainability  
300 - Effective consultative representation, at National and European levels, which allows for good strategic  
301 planning and targeted actions within both the commercial and research communities  
302  
303

304 These opportunities provide a strong base for driving the sustainable growth of the sector but which  
305 require reinforcing and higher levels of integration so as to combine the multiple efforts anticipated within  
306 the EATIP Strategic Research and Innovation Agenda and Action Plan.

307 The EATIP has examined the challenges, opportunities and needs across 8 thematic areas, each of which in  
308 turn has considered their own vision for the future, what key steps are required to achieve that vision, and  
309 thus providing their own strategic research agenda.  
310

311 The 8 thematic areas in the EATIP cover:

- 312  
313 1. Product Quality, Consumer Safety and Health  
314 2. Technology and Systems  
315 3. Managing the biological life cycle  
316 4. Sustainable feed production  
317 5. Integration with the environment  
318 6. Knowledge Management  
319 7. Aquatic animal health and welfare  
320 8. Socio-economics and management  
321

322 *More than 200 experts, drawn from different sectoral industries, the RTDi and representative sectors, have*  
323 *contributed to the following Vision, Strategic Research and Innovation Agenda and Action Plan.*

## 324 **The Future for Aquaculture: What will the sector look like in 20 years?**

325

326 Few could claim to have accurately predicted 20 years ago where aquaculture would be today. Advances in  
327 technology and communication have revolutionised business, research and education. Further technical  
328 and commercial advances are made on a daily basis. Global society continues to undergo massive socio-  
329 economic changes, impacting on everything from economics to diet.

330

331 Rather than make generic observations or predictions of the future, the EATIP Thematic Areas have each  
332 considered their own vision for the future, what key steps are required to achieve that vision, and thus  
333 provided their own strategic research and innovation agenda.

334

335 **It is our collective vision that, by 2030, European aquaculture will have achieved the following position:**

336

- 337 ● Be a dynamic activity within coastal and rural economies, providing marine and freshwater food  
338 products in a variety of production systems, adapted to local conditions, that will
  - 339 ○ Produce more from less
  - 340 ○ Minimise waste and be waste neutral
  - 341 ○ Be as close to carbon neutral as possible
  - 342 ○ Adapt to the implications of climate change
- 343 ● Will have secured, maintained and enhanced the European aquaculture value chain.
  - 344 ○ Be an integral part of the food supply chain, contributing to health, nutrition and lifestyle
  - 345 ○ Cater for both mass and niche markets, with products tailored for demand
  - 346 ○ Possess a developed understanding of the implications of aquaculture processes and  
347 influencing factors
- 348 ● Will have a strong relationship with the consumer.
  - 349 ○ Assuring knowledge transfer to consumers
  - 350 ○ Established and understood in the consciousness of society at large.
  - 351 ○ Play a high role in the international food system
- 352 ● Will be recognised as a active sector, with viable & interesting equal-opportunity career options,  
353 encouraging
  - 354 ○ Skill development and lifelong learning
  - 355 ○ Adoption of new technology and operating conditions
- 356 ● Will be supported by an innovative European RTDi sector, well funded through public and private  
357 sources, engaging in
  - 358 ○ Effective and resourceful scientific and professional networks
  - 359 ○ Efficient technology transfer and innovation mechanisms
- 360 ● Will engage in the alignment of the sector's activities and development to
  - 361 ○ National and European strategic and policy priorities
  - 362 ○ Interrelated research agendas and funding precedence

363

364 **These all link to the 3 core values of the EATIP, which are to:**

- 365 - Establishing a stronger relationship between the aquaculture industry and the consumer
- 366 - The assurance of a sustainable aquaculture sector
- 367 - Consolidation of the role and importance of aquaculture in society

368 This Vision assumes inherently that the individual components of European aquaculture will have adopted  
369 the technological innovations developed by the European research community in response to the  
370 challenges identified for society in general and specifically for aquaculture.

371

## 372 **The Strategic Research & Innovation Agenda - “Achieving the Vision”**

373

374 *Using collaborative efforts, the EATIP Thematic Areas have covered distinct and important components of*  
375 *European aquaculture. Each Thematic Area, composed of experts working under the guidance of Chairs and*  
376 *Facilitators, has identified strategic research aims and goals, themselves derived from individual vision*  
377 *statements. The research requirements relating to these goals have been carefully considered by each*  
378 *Thematic Area of the EATIP and are set out in detail at [www.eatip.eu](http://www.eatip.eu)*

### 379 **The Visions and Key Goals of the Thematic Areas**

#### 380 ***Product Quality, Consumer Safety and Health***

381

##### 382 ***Vision Statement:***

383

384 *“To build a sustainable, cost-effective competitive advantage through the production of high quality,*  
385 *healthy, nutritious and safe seafood, accompanied by scientific data documenting these facts and*  
386 *communicating these effectively to the relevant interests groups and consumers.”*

387 Public awareness of a healthy diet and a more sophisticated understanding of nutritional science will  
388 continue to increase. So too will the understanding of the role that aquaculture products have to play in a  
389 balanced diet, and the broader European health agenda. As aquaculture products become more firmly  
390 established in the consciousness of the population, so issues relating to product quality and consumer  
391 safety will continue to be a priority, providing assurance in the safety and value of greater consumer  
392 consumption. The further development of functional aquaculture food, promoting health benefits, is an  
393 underlying consideration. Four key goals have been identified in this area.

##### 394 ***Goals to achieve the Vision***

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1. To maximise the health benefits of aquaculture products
2. Ensure the continuing safety of aquaculture products
3. To deliver high quality aquaculture products to protect and grow the farmed fish market, fully meeting consumer expectations including appearance, taste, texture, nutrition and provenance
4. To better understand consumer perception and improve their attitude towards aquaculture products

## 404 *Technology and Systems*

### 405 **Vision Statement:**

406 *“To advance aquaculture industry technologies and systems so that Europe can become an*  
407 *environmentally and economically sustainable net supplier of seafood, characterised by a safe and*  
408 *attractive working environment.”*

409 As aquaculture moves from being a new industry to an evolving industry, it is crucial that  
410 technology and systems are used to maximum advantage to fully exploit the potential of the  
411 European aquaculture industry. Contributions to automation, monitoring and analysis are key to  
412 increasing operational efficiency. Maximising advances in processing technology, with specific regard to  
413 product storage and shelf life, will complement the considerations on product quality. Five key areas  
414 have been identified in this field:

### 415 **Goals to achieve the Vision**

- 416 1. Ensure an environmentally sustainable industry by the application of new knowledge and  
417 technology innovations
- 418 2. Ensure the continuing safety of aquaculture products
- 419 3. Ensure the profitability of the aquaculture industry by developing improved management  
420 systems and technology
- 421 4. Ensure ethical and healthy production of fish
- 422 5. Ensure the production of high quality aquaculture products that are safe for consumption

## 423 *Managing the biological lifecycle*

### 424 **Vision Statement:**

425 *“European aquaculture in 2030 will produce larger volumes and contribute to a decrease of imports through*  
426 *a significant improvement of its competitiveness. It will also focus on being a commercial stakeholder in*  
427 *aquaculture worldwide. For the biological inputs, this competitiveness will be obtained from: product*  
428 *specificity, targeted production environments, a high level of professionalism & skills and clear political &*  
429 *societal support.”*

430 Competitiveness and efficiency within the European aquaculture value chain will be essential if the  
431 sector is to remain at the forefront of an increasingly competitive global aquaculture industry,  
432 where the EU is arguably already at a disadvantage. Further advances in aquatic species husbandry  
433 and the optimisation of bio-technology will assist in the delivery of four key goals:

- 434 1. To establish greater predictability and improve output at every production stage of the  
435 lifecycle
- 436 2. Genetic improvement of productive, health and welfare traits in aquatic animals
- 437 3. Improve broodstock management methods and control reproduction in captivity
- 438 4. Manage the lifecycle of one (or a few) new species of high economic value

439

## 440 *Sustainable feed production*

### 441 **Vision Statement:**

442 *“Sustainable fish feeds, [whose manufacture will be] based on solid scientific knowledge and*  
443 *reliable raw materials, will contribute to making aquaculture one of the most efficient producers of*  
444 *high value food for humans, and one that respects environment and fish welfare.”*

445

446 Fish feeds continue, at the present time, to provide one of the most contentious issues in  
447 discussions surrounding aquaculture. It is essential, if the sector is to develop further and for  
448 society to fully embrace the solutions that aquaculture can offer, that science-based objective  
449 methodologies are applied to the sustainable feed debate. Nonetheless, the basic efficiency of  
450 nutrient conversion and assimilation gives the opportunity for aquaculture to be the most efficient  
451 provider of high quality, nutritious food.

452 Five key goals have been identified for this topic:

453

- 454 1. To base fish feed formulas of the future on evidence-based knowledge of fish nutritional  
455 requirements, and expand the number of well characterised and sustainable raw materials  
456 that can be used.
- 457 2. To advance novel feed manufacturing technologies, reduce energy costs and improve feed  
458 quality.
- 459 3. To understand and minimise the negative effects of alternative diets on fish health and  
460 welfare.
- 461 4. To adapt and use advanced methods to understand and model nutritional responses.
- 462 5. To resolve strategic research problems in fish nutritional research.

463

## 464 *Integration with the Environment*

### 465 **Vision Statement:**

466 *“Aquaculture in 2030 will produce nutritious food with less environmental footprints than any other type of*  
467 *food production for humans, and this production will, to a greater extent, be based on feed resources taken*  
468 *from outside the human food chain”.*

469 When addressing the interaction between food production and the environment it is necessary to take a  
470 holistic approach. The isolation of a specific environmental factor can be unhelpful, particularly where the  
471 greater total impact of a given sector, such as aquaculture, may negate the impact of that factor in the  
472 production cycle or the wider value chain.

473

474 It is necessary to raise the level of understanding of the relationship between aquaculture and the  
475 environment through:

- 476 1. Creating fundamental scientific knowledge on the assimilation capacity of biogenic wastes  
477 from aquaculture in benthic and pelagic ecosystems (*Biogenic waste assimilation in*  
478 *ecosystems*)
- 479 2. Establishing technology to minimise emission of biogenic matter from aquaculture and to  
480 minimize the potential impacts of the actual emissions by means of management tools and  
481 integrated multi-trophic cultures (*Technology to minimise biogenic impacts*)
- 482 3. Understanding better the fate and cumulative effects of persistent agents used in  
483 aquaculture and minimizing their impact in ecosystems and on the environment
- 484 4. Advancing fundamental knowledge so as to reduce the negative interactions between  
485 farmed and wild stocks, including wildlife
- 486 5. Developing or adapting tools and measures in support of appropriate environmental  
487 governance for aquaculture
- 488 6. Communicating unbiased scientific knowledge on the environmental interactions of  
489 aquaculture in order to improve its public perception

## 490 **Knowledge management**

### 491 **Vision Statement:**

492 *“In 2030, the European aquaculture industry will be widely regarded as an environmental,*  
493 *economic and socially sustainable activity. This respect will be grounded in evidence-based*  
494 *scientific knowledge, industrial strength and consumer confidence. Knowledge and innovation will*  
495 *be competitive advantages for the European aquaculture industry. European scientists will be*  
496 *major contributors to the international scientific community, providing relevant input to all stages*  
497 *of the aquaculture value chain. The aquaculture sector will be attractive to a wide range of highly*  
498 *educated people, with positive growth and employment opportunities. The industry will be*  
499 *characterised by its ability to fast-track progress from knowledge development and intellectual*  
500 *protection through to innovation, industrial application and product development. European*  
501 *aquaculture will adopt cutting edge knowledge management practices to support state-of-the art*  
502 *technological development. This will be the key factor that allows the aquaculture industry to meet*  
503 *the imminent market demand for fish & shellfish production, due to limited natural resources*  
504 *coupled with a growing world population.”*

505 In this regard, this Thematic Area has identified the following key goals:

- 506 1. To manage knowledge effectively within the European aquaculture sector
- 507 2. To guarantee the availability and efficient use of necessary state-of-the-art aquaculture  
508 research infrastructures across national, stakeholder and disciplinary boundaries
- 509 3. To ensure that the European aquaculture sector has an excellent reputation through  
510 successfully communicating the role it plays in society
- 511 4. To foster and build the human capital of the European aquaculture sector

512

513 ***Aquatic animal health and welfare***

514 **Vision Statement:**

515 *“By 2030, further improvement in aquatic animal health and welfare in European aquaculture will produce*  
516 *high quality, robust animals - resulting in increased productivity that builds on environmental and welfare*  
517 *standards.”*

518 The extremely high standards of fish health and welfare observed in European aquaculture are a credit to  
519 the different production sectors and indicative of the investment made in fish health and welfare research  
520 and sectoral education. This competitive advantage can be maintained in fish health and welfare  
521 knowledge, improving productivity and the output from the entire production cycle, by addressing four key  
522 goals:

- 523 1. Improving understanding of host-pathogen interactions together with the application of  
524 novel instruments - such as diagnostic tools, vaccines and immunomodulators.  
525 2. Minimising the spreading of existing, emerging and exotic diseases through epidemiology,  
526 health monitoring and surveillance.  
527 3. Minimising treatment when possible - ensuring prudent effective application that avoids  
528 the build-up of resistance.  
529 4. Measuring welfare and understanding its consequences if compromised in order to  
530 incorporate welfare as a core component of production management systems.

531 ***Socio-economics & Management***

532 **Vision Statement:**

533 *“Create the economic, social, management, political and governance framework conditions that enable*  
534 *innovative development of sustainable aquaculture and future food and nutrition security, viable companies*  
535 *and livelihoods within Europe's coastlines and freshwater aquatic resources.”*

536 European aquaculture operates within a commercial globally-influenced market. As world economic trends  
537 move from state intervention, subsidies and centralised planning towards deregulated free trade, it is vital  
538 that aquaculture is not disadvantaged through legislation, regulation or arbitrary intervention and  
539 interference. As such, the EATIP will aim to resolve these key goals for the European aquaculture sector:

- 540 1. Ensuring effective governance– having a ‘level playing field’ within and outside Europe  
541 2. Establishing an enabling environment for innovation and productivity growth that allows a  
542 balanced trade-off between risk and return  
543 3. By 2030 there will be an increased acceptance of the products of genetically-enhanced  
544 plants and microbes. The manner of engagement with the opportunities afforded through  
545 biotechnology and genomics will have been resolved.  
546 4. Recognition of property rights, collateral and access to and protection of sites  
547 5. Realising economies of scale, knowledge development, effective horizontal measures and  
548 adequate research funding, efficient supply chains; the structure of the industry will adapt  
549 to changes in trade and markets  
550 6. Assuring sectoral dependence, resilience, adaptability and distribution  
551 7. Advocating image and consumer acceptance



552

## 553 **Conclusions**

554 While the Visions of the EATIP Thematic Areas show overlapping concerns and needs, these confirm the  
555 need to further develop an innovative multi-disciplinary approach to challenges and issues, integrating  
556 specific needs within broader strategies and frameworks.

557 Consensus appears for a range of important factors identified for success in achieving the Vision for  
558 European aquaculture in 2030.

## 559 **Dynamic European Research and Innovation**

- 560 • Resolving applied and fundamental research challenges, relating to sectoral and societal needs,  
561 with access to 'state of the art' facilities
- 562 • Applying multi-disciplinary approaches
- 563 • Answering needs for effective knowledge management and technology transfer
- 564 • Developing curricula and competence-building relative to the needs of the aquaculture value chain  
565

## 566 **Responsible Aquaculture Value-Chain**

- 567 • Assuring recognised stewardship of natural resources for a sustainable activity
- 568 • Producing high quality, safe and nutritious food, ethically and efficiently
- 569 • Incorporating innovative technology and management systems, producing more from less with  
570 minimal waste
- 571 • Providing a wide range of career opportunities within a safe, stable working environment
- 572 • Supplying the consumer with the products required, with the associate assurance of information

## 573 **Accountable to Society**

- 574 • Building specialised and efficient networks to ensure successful technology transfer and innovation  
575 implementation
- 576 • Participating in multi-disciplinary and multi-stakeholder governance, assuring the requirements of  
577 transparency and responsibility
- 578 • Communicating with society on all aspects of the aquaculture value chain

579 These factors highlight the need for the best coordination across the Thematic Areas and the integration of  
580 this approach at National and European levels, highlighting the following requirements.

- 581 1. Research and innovation efforts on aquaculture must be increased, focused and supported,
- 582 2. Networks must be built and consolidated, within and between the research and industrial sectors,  
583 and including civil society and governmental representation,
- 584 3. Strengthened capacity for progress within the aquaculture value chain – including the legislative  
585 framework, RTDi and education, financing and market conditions.

586 Achieving these coordination requirements requires extensive public/private cooperation, stimulating the  
587 creation of an innovation-friendly environment for all players involved.

## 588 **The Action Plan**

589 The fundamental actions of EATIP are summarised in 3 interlinked stages.



590

591 The EATIP Thematic Areas have identified 39 key goals, several of which are interlinked and overlapping,  
592 and reflect their Vision for European aquaculture and the contributions of individual Thematic Areas.

593 Each Thematic Area has prepared an individual Action Plan that describes how its goals can be achieved.

594 The methodology used for this has been to identify and describe:

- 595 • Key Goals, their effects on the Vision and assessments of the impacts on sustainability, with a  
596 risk/opportunity analysis
- 597 • Sub-goals – classed as identified issues or plans – which enable achievement of the Key Goals –  
598 containing the following criteria:
  - 599 ○ Activity type (Research, Technology Transfer, Policy action, Other)
  - 600 ○ Description of the sub-goal
  - 601 ○ Methodology required for achievement
  - 602 ○ The expected results of achieving the sub-goal
  - 603 ○ The timeline and duration for achievement
  - 604 ○ Broad cost estimate
  - 605 ○ Identification of overlap with other Goals/sub-goals

606 The breadth and detail of these Action Plans cannot be summarised in this paper but these can be viewed  
607 within the Consultation component of [www.eatip.eu](http://www.eatip.eu).

608 The EATIP will be organising regional workshops during 2011-2012 to present and debate its Vision, SRIA  
609 and Action Plan so as to establish consensus on its proposals and prioritise actions. This transparent  
610 consultation will result in agreement on the actions to be pursued.

## 611 **Recommendations of the EATIP**

612

613 EATIP has identified its strategic aims, a detailed research and innovation agenda and has proposals for  
614 Action and Implementation. To realise these, we have certain recommendations that apply to the members  
615 of the EATIP, to policy makers at local, national and European levels, to industry, to consumers and all  
616 engaged in the aquaculture value chain.

617 The engagement and output of the EATIP members contributing to the positions presented in this paper  
618 have been phenomenal, and we are proud of the work achieved to date. However, we recognise an overlap  
619 of identified issues within the Thematic Areas, where it is necessary to identify areas of crossover,  
620 opportunities for cooperation and elimination of the duplication of effort.

621 In addition to the integration of vision statements and benchmarking of key goals, it is necessary to  
622 prioritise the actions foreseen. To this purpose, EATIP will organise consultation workshops for the regional  
623 components of European aquaculture to obtain consensus and finalise its Action Plan.

624 EATIP recommends improved dialogue with the policy makers to integrate agreed objectives to ensure a  
625 symbiotic relationship for the best governance of the European aquaculture sector. A significant  
626 component is to ensure that the research, technology and development priorities are reflected in the  
627 financing opportunities of national and European funding. New mechanisms for facilitating industrial  
628 financial contributions also require evaluation. Policy, industry and academic research must all operate to a  
629 common purpose so as to maximise opportunity and ensure the best use of resources.

630 High level consideration must be given to the long term strategic positioning of European aquaculture. As a  
631 complete sector, covering wide industrial and RTDi interests, it is able to operate and contribute at many  
632 levels across European society but the true place of European aquaculture - in the context of a global  
633 society - needs to be acknowledged and considered. Given the influence of a global food system, with its  
634 own commodity index, it is essential to consider how to best use the strengths of European aquaculture,  
635 ensuring smart positioning of the sector in terms of its products, knowledge, skills and expertise.

636 This appraisal, accompanied by our Vision and strategic research and innovation priorities, must also  
637 acknowledge the need for harmonised European development. Assuring the common purpose of the  
638 sustainable development of the sector has to be reinforced, placing European aquaculture as a major  
639 contributor to answering the Grand Challenges.

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## Inside Back Cover:

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### List of EATIP Board – Chairs/Facilitators

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The EATIP Board, Chairs and Facilitators have worked collectively in the development of the Vision Documents, Strategic Research Agendas and Action Plans.

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*The EATIP will continue to use the Thematic Areas in a dynamic way to allow for scenario planning, project formulation and funding circumstances, applying forecasting and futures techniques to address the uncertainties that face the EU aquaculture industry in the mid to longer term.*

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The EATIP is a non-profit association, registered in Belgium (N° 808.986.136)

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For further information please contact the EATIP secretariat at.... or see [www.eatip.eu](http://www.eatip.eu) for further information

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Reference documentation

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