

DIRECTORATE-GENERAL FOR INTERNAL POLICIES

POLICY DEPARTMENT
STRUCTURAL AND COHESION POLICIES **B**



Agriculture and Rural Development



Culture and Education



Fisheries



Regional Development



Transport and Tourism





DIRECTORATE GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES

FISHERIES

**EVALUATION OF THE IMPACT OF
«A STRATEGY FOR THE SUSTAINABLE
DEVELOPMENT OF EUROPEAN
AQUACULTURE»
COM (2002) 511 FINAL**

STUDY

This document was requested by the European Parliament's Committee on Fisheries.

AUTHORS

Mr. Alistair Lane, European Aquaculture Society (EAS)
Mr. Courtney Hough, Federation of European Aquaculture Producers (FEAP)
Mr. John Bostock, University of Stirling Institute of Aquaculture (UoS).

RESPONSIBLE ADMINISTRATOR

Mr Jesús Iborra Martín
Policy Department Structural and Cohesion Policies
European Parliament
B-1047 Brussels
E-mail: poldep-cohesion@europarl.europa.eu

LINGUISTIC VERSIONS

Original: EN
Translation: DE, ES, FR, IT.
Executive Summary: DE, EL, EN, ES, FR, IT, PL, PT.

ABOUT THE EDITOR

To contact the Policy Department or to subscribe to its monthly newsletter please write to:
poldep-cohesion@europarl.europa.eu

Manuscript completed in October 2009.
Brussels, © European Parliament, 2009.

This document is available on the Internet at:
<http://www.europarl.europa.eu/studies>

DISCLAIMER

The opinions expressed in this document are the sole responsibility of the author and do not necessarily represent the official position of the European Parliament.

Reproduction and translation for non-commercial purposes are authorized, provided the source is acknowledged and the publisher is given prior notice and sent a copy.



DIRECTORATE GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES

FISHERIES

**EVALUATION OF THE IMPACT OF
«A STRATEGY FOR THE SUSTAINABLE
DEVELOPMENT OF EUROPEAN
AQUACULTURE»
COM (2002) 511 FINAL**

STUDY

Abstract:

The 2002 strategy COM(2002) 511 FINAL was a landmark for European aquaculture and looked to build on the excellent growth seen in the sector during the 1990s. This study compares the impact of the 2002 Communication as perceived by various stakeholders across Europe, measured against recent statistics, facts, outcomes of economic, legislative and research processes.

While the core objectives of consumer health and safety and environmental issues were perceived to have been partially successful, the growth and development objective was not. In the period examined, Community aquaculture production has stagnated and even declined in some species sectors.

Aquaculture development since 2002 was perceived to have been held back by access to coastal and rural space, including competition from other resource users. The administrative burdens placed on (new) aquaculture operations was also considered to be important.

Reasons for the gap between the perceived impact and "documented" implementation success of the 2002 strategy are suggested. Some of the less successful actions have also been recognised by the Commission in its COM(2009) 162 aquaculture strategy.

CONTENTS

LIST OF ABBREVIATIONS	5
LIST OF FIGURES	7
LIST OF TABLES	7
LIST OF BOXES	8
EXECUTIVE SUMMARY	9
BACKGROUND	15
1. STAKEHOLDER PERCEPTION OF THE IMPACT OF THE 2002 AQUACULTURE STRATEGY	21
1.1. Stakeholder participation.	21
1.2. Perception of success in the Core Objectives	23
1.3. Perception of most successful actions.	28
1.4. Perception of least successful actions.	30
1.5. Actions where stakeholders had no perception	36
2. GAP ANALYSIS OF PERCEIVED IMPACT AGAINST DOCUMENTED ACTIONS	39
2.1. Overview of the gaps in the CORE OBJECTIVES and their supporting ACTIONS	40
2.2. Highest gaps in the CORE OBJECTIVES of the strategy	44
2.3. Highest gaps in the ACTIONS proposed in the strategy	50
3. RECOMMENDATIONS TO THE COMMITTEE ON FISHERIES	69
3.1. Promoting Competitiveness of Eu Aquaculture Production	70
3.2. Establishing Conditions for Sustainable Growth of Aquaculture	73
3.3. Improving the Sector's Image and Governance	74
3.4. Actions NOT addressed in the 2009 strategy	75
3.5. Summary of the recommendations	77
REFERENCES	81
ANNEX I. RESPONDENTS	83
ANNEX II. SECTOR SURVEY RESULTS	85

LIST OF ABBREVIATIONS

ACFA	Advisory Committee on Fisheries and Aquaculture
APR	Annual Percentage Rate
ASC	Aquaculture Stewardship Council
BEUC	Bureau Européen des Unions de Consommateurs
B2B	Business to Business
CCRF	(FAO) Code of Conduct for Responsible Fisheries
CITES	Convention on International Trade in Endangered Species
CFP	Common Fisheries Policy
CMO	Common Market Organisation
COFI-AQ	(FAO) Committee on Fisheries sub-committee on Aquaculture
EAS	European Aquaculture Society
EATIP	European Aquaculture Technology and Innovation Platform
EFF	European Fisheries Fund
EIA	Environmental Impact Assessment
EMAS	Eco-Management and Audit Scheme
FAO	Food and Agriculture Organisation of the United Nations
FEAP	Federation of European Aquaculture Producers
FIFG	Financial Instrument for Fisheries Guidance (now the EFF)
FP6	6 th Framework Programme of Community Research
GMO	Genetically Modified Organism
HABs	Harmful Algal Blooms

HACCP Hazard Analysis and Critical Control Point

HORECA The Hotel, Restaurant and Catering sector

ICCAT International Commission for the Conservation of Atlantic Tunas

ICZM Integrated Coastal Zone Management

IUCN International Union for Conservation of Nature

KBBE (European) Knowledge Based Bio-Economy

MRS Multiple Retail Stores (Super/Hypermarkets)

MSC Marine Stewardship Council

MSP Maritime Spatial Planning

NGO Non Governmental Organisation

OATP Offshore Aquaculture Technology Platform

PDO Protected Designation of Origin

PGI Protected Geographical Indication

RAS Recirculating Aquaculture System

RTD Research and Technological Development

SEPA Scottish Environment Protection Agency

SME Small and Medium sized Enterprise

TSG Traditional Speciality Guaranteed

UoS University of Stirling (Institute of Aquaculture)

LIST OF FIGURES

Figure 1: Stakeholder participation in the study	22
Figure 2. Respondent countries	23
Figure 3. EU finfish aquaculture production 2001 to 2008.	46
Figure 4. European finfish aquaculture production 2001 to 2008.	49
Figure 5. Total European finfish aquaculture production 2001 to 2008.	49
Figure 6. Global aquaculture growth 2000 to 2007.	50

LIST OF TABLES

Table 1: Stakeholder Groups contacted for the EP175 online survey.	19
Table 2: Assessment of CORE OBJECTIVE 1.	24
Table 3: Assessment of CORE OBJECTIVE 2.	26
Table 4: Assessment of CORE OBJECTIVE 3.	27
Table 5: Stakeholders perceived MOST successful actions.	28
Table 6. Stakeholders perceived LEAST successful actions.	31
Table 7 Actions where stakeholders were UNABLE to provide a perception.	36
Table 8: Gap analysis of Core Objective 1 and its sub-objectives and supporting actions	41
Table 9: Gap analysis of Core Objective 2 and its sub-objectives and supporting actions	42
Table 10: Gap analysis of Core Objective 3 and its sub-objectives and supporting actions	43
Table 11 Highest gaps in CORE OBJECTIVES.	44
Table 12 FEAP data on aquaculture production from 2001 to 2008	48
Table 10 Highest gaps in ACTIONS.	50
Table 11 SWOT for food-fish grow-out in Recirculating Aquaculture Systems (RAS)	54

LIST OF BOXES

Box 1. The European Aquaculture Technology and Innovation Platform (EATIP) . 30

Box 2. The Offshore Aquaculture Technology Platform 36

Box 3. The 2001/2002 sea bream sea bass price crisis 45

Box 4. The case of salmon..... 46

EXECUTIVE SUMMARY

The 2002 strategy for the sustainable development of European Aquaculture provided the first specific objectives for the aquaculture sector at a European level, focussing principally on the ambitions of creating long-term secure employment, in particular in fishing-dependent areas; assuring the availability to consumers of products that are healthy, safe and of good quality, as well as promoting high animal health and welfare standards; and ensuring an environmentally sound industry. The strategy was welcomed by the European aquaculture sector, and the Communication was subsequently adopted by the European Parliament and the Council. The following table summarises the core objectives and sub-objectives of the strategy.

Core Objectives of the 2002 Strategy COM (2002) 152	Sub-Objectives
Increasing employment in aquaculture by between 8,000 and 10,000 full-time job equivalents over the period 2003-2008.	Increasing the Union's aquaculture production growth rate to 4% per year.
	Solving the conflicts for space that hinder development in some areas.
	Promoting market development.
	Improving governance in the aquaculture sector.
Assuring the availability to consumers of products that are healthy, safe and of good quality, as well as promoting high animal health and welfare standards.	Offering the maximum level of consumer protection in terms of product safety and quality.
	Reduction of the incidence of farmed animal diseases.
	Prevention in transmission of diseases to and from wild stocks.
	Actions regarding the welfare of farmed fish, and the risks associated with harmful algal blooms.
Ensuring an environmentally sound industry.	Actions to reduce the negative environmental impacts of aquaculture.
	Developments on norms and/or voluntary agreements which prevent environment degradation.
	Public financial incentives for use in aquaculture developments with positive contributions to the environment.
	Actions for enhancing the knowledge base of the industry.
	Public financing and promotion of private initiatives in research and technological development.

This study has sought stakeholder perceptions of the success of the 2002 strategy. During which time the European Commission has also made its own stakeholder consultation and published a new Communication laying out a revised strategy for European aquaculture with a particular focus on ensuring development and defining the role of public authorities in its enactment.

After a period of growth during the 1990s, EU aquaculture has subsequently stagnated. To achieve the 4% growth targeted by the strategy would mean that, since 2002, when production was some 615 thousand tons, European fish farming should have reached 780 thousand tons by 2008. The Federation of European Aquaculture Producers (FEAP) Member Associations reported EU finfish production of 642 thousand tons (representing an APR of 0.5%). Evidently, the growth rate foreseen in strategy has not been achieved.

Furthermore, from the figures between 2001 and 2008, a decreasing trend has been seen for carps (-2.9% APR), eels (-5%), salmon (-2.7%) and trout (-2.1%); with the exception of eels, the total for carp-salmon-trout equalled 80% of European fish farming in 2001. Growth has been seen for minor species such as catfish (8.7%), turbot (19%), while the main major species increases were seen for seabass (8.7%) and seabream (9.7%). Consequently, with the exceptions of Greece (+9.4% APR (seabass/seabream)) and Spain (+4.1% APR (seabass/seabream/turbot)) **most European Member States actually saw their fish farming activities diminish between 2001 and 2008.**

Accompanying its growth in production, the seabass and seabream sector has also seen two price crises. The fundamental cause of these crises was an imbalance between supply and demand caused by rapidly rising production, especially in Greece and Turkey. The situation was exacerbated by the intrinsic seasonality of bass and bream production, which resulted in the largest volumes being harvested in the autumn when demand falls. Overproduction therefore appears to have been a major factor and the impact of the crisis was to reduce profitability and in many cases cause financial losses. Substantial corporate consolidation in the sector followed each of these crises.

Section 1 of this study reports the findings of a stakeholder survey, in which 112 stakeholders (a return rate of 57%) provided their perceptions on the success of implementation of the core objectives and supporting actions of the 2002 strategy. 47% of the respondents to the survey are from the aquaculture production sector; the remainder representing suppliers, consumer organisations, conservation and development organisations, the scientific community and national governments. The consensus was that **while the core objectives of consumer health and safety and environmental issues were generally perceived to have been partially successful, the growth and development objective was not.**

The following table presents the perceived success of the supporting actions of the strategy, shown as the 'top5' actions in each category. Reasons are suggested as to why the perception of the supporting actions was positive or negative and why the majority of stakeholders were unable to provide a perception for some of the actions.

MOST successful actions	LEAST successful actions	NO perception provided
Developments on stakeholder participation	Create specific common definitions and norms for “environment friendly” aquaculture	Modification of the veterinary pharmaceutical legislation
Development of Community legislation on food hygiene	Improve the image of the industry	Recognise the role of women
Promote research on alternative protein sources for fish feed	Create specific common definitions and norms for organic aquaculture	Development of instruments to tackle the impact of alien species
Extension of the opportunities for financing research and technological development	Incorporate future aquaculture developments in Integrated Zone Strategies and Management Plans	Research on solutions for the predation from protected wild species
Identification of research priorities	Develop offshore fish cage technology	Re-focus priorities for public aid through the FIG (now EFF)
		Further develop farmers’ partnerships

Section 2 of the report is a gap analyses performed by the study authors and analyses the achievements made against the objectives and actions proposed, in terms of the results of research, legislative developments and other information sources. This aimed to provide a realistic assessment of success or failure based on real impact.

The highest performance gaps are shown below, based on both stakeholders’ and authors’ perceptions. The report explains the current status of knowledge, suggesting reasons for the majority stakeholder perception, and the comparison with that of the authors.

Under Core Objective 1, the key supporting actions critical to the success of the objective are related to market development, marketing and information, as well as to competition for space. There are no major gaps for Core Objective 2 and the key supporting actions under Core Objective 3 relate to the development of specific guidelines for Aquaculture Impact Assessments, as well as the management of wild fish stocks for ongrowing, measures to strengthen the positive impacts of extensive culture and (re)stocking (part of the image of the sector) and solutions for predation from protected wild species (e.g. birds).

Core Objective 1. Increasing employment in aquaculture by between 8,000 and 10,000 full-time job equivalents over the period 2003-2008	Majority stakeholder perception	Authors' perception
Sub-objectives		
Increasing the Union's aquaculture production growth rate to 4 % per year	Partially successful	Highly unsuccessful
Promoting market development	Partially successful	Partially/Highly unsuccessful
Supporting Actions		
Competition for space		
Develop closed water recirculating systems	Partially successful	Partially unsuccessful
Market development, marketing and information		
Increase the use of official quality marks	Partially successful	Partially unsuccessful
Develop promotional campaigns	Neutral	Partially unsuccessful
Develop new tools to gather statistical information on production and markets	No perception	Highly unsuccessful
Core Objective 2. Assuring the availability to consumers of products that are healthy, safe and of good quality, as well as promoting high animal health and welfare standards	Majority stakeholder perception	Authors' perception
Sub-objectives	No major gaps	
Supporting Actions	No major gaps	
Core Objective 3. Ensuring an environmentally sound industry	Majority stakeholder perception	Authors' perception
Sub-objectives	No major gaps	
Supporting Actions		
Environmental aspects		
Management of the demand for wild fish for on-growing	No perception	Partially unsuccessful
Development of specific criteria and guidelines for aquaculture Environmental Impact Assessments	Partially successful	Partially unsuccessful
Measures to strengthen the positive impact of extensive culture and re-stocking	No perception	Partially unsuccessful
Research on solutions for the predation from protected wild species	No perception	Highly unsuccessful

Finally, section 3 provides recommendations to the Committee on Fisheries arising from the stakeholder survey and subsequent gap analysis. The recommendations are based on the components of the 2002 strategy that were considered by stakeholders as being unsuccessfully implemented, combined with the unsuccessful actions identified by the authors in the gap analysis and review. Recommendations are made in the light of those actions that have been addressed in this new Communication, as well as those actions that were considered but not included in the Communication and which figure in the Commission's Impact Assessment for the 2009 strategy.

A total of 24 recommendations under 9 themes are presented.

Equal competitor in terms of space

- Special workshops on marine and freshwater aquaculture (for example, as part of the series proposed within its Roadmap for Maritime Spatial Planning) – should be convened with the aim of providing clear information on the attributes of European aquaculture as a food production sector and as a tool for conservation of aquatic

species or restocking of fish for recreational activities. These workshops should seek to provide clear guidance and recommendations for implementation purposes – notably on siting criteria.

Environmentally friendly aquaculture

- A certification scheme for “environment friendly” aquaculture is urgently required. This document could later be debated in wider consultation with stakeholders with a special effort to ensure adequate, fair and balanced participation of all relevant interested parties concerned. Clear rules must be set for accreditation and certification in order to make the system credible and transparent.
- Public authorities (European and Member States) should encourage and make institutional information campaigns to promote consumer acceptance of products bearing eco-labels. They should also consider introducing a framework for economic and fiscal incentives for the implementation of Eco-labels.
- Eco-label criteria should be included in calls for tender in green public procurement.
- Mechanisms for achieving trans-national promotion schemes, within the European Union, should be developed for inclusion within the financing possibilities of the EFF.

Environmental Impact Assessment

- As a matter of urgency, specific criteria and guidelines for the aquaculture sector on the interpretation and implementation of EU Directives related to Environmental Impact Assessments are required.
- Improvement of IT tools for the achievement of EIAs is necessary.
- Facilitation of the licensing procedures that would encourage access to new sites and facilitate long-term access to existing sites is required. This will encourage re-investment and medium-long term planning, while facilitating the entry of new players – particularly in those sectors where SME/family businesses operate.
- A conference bringing together the public authorities from Member States should be convened to present these guidelines and discuss case studies that show effective and rapid implementation of EU and national legislation.

Develop new technologies to decrease effluents and their impacts

- A sector analysis is required to determine current production levels and development priorities for land-based Recirculating Aquaculture Systems. Cost/benefit and life cycle analysis and the development of adequate incentives must be integral to such an approach.
- Support for the development and promotion of technical performance standards for comparing recirculated aquaculture systems is needed.

Improving the image of the aquaculture sector

- A plan of action to improve and sustain the image of the aquaculture industry and its products, developed within a forum composed of the EP Fisheries Commission, the European Commission and stakeholders from the whole value chain, should be instigated as soon as possible. Concrete actions require to be planned and executed, avoiding overlap and conflicting messages.
- A measurement of the impact of restocking for conservation of endangered species and for sport angling is needed – for example in partnership with the Environmental

ministries, Producer Associations, European Anglers Alliance, or other similar National bodies for the latter.

- Quantification of the benefits of the environmental services provided by extensive pond aquaculture farms in Central and Eastern Europe, based on case studies on representative operations is required. This should be carried out in partnership with government departments involved in the implementation of the Water Framework Directive, Natura 2000 and the Habitats Directives.
- The environmental benefits of some (new and traditional) aquaculture practices in coastal zones, especially where these help to mitigate the impacts of other activities including intensive aquaculture, also needs to be documented, and including how these benefits may be considered in an eco-labelling scheme.

Ensuring adequate monitoring of the sector

- The development of an observatory to report on production for all components of the aquaculture sector is a priority for assurance of this aspect. This will provide a strong support to the active participation proposed by the Commission in developing harmonised (global) indicators on performance and will be essential for future policy development.
- Detailed measures on how to establish a price monitoring system for fisheries and aquaculture products throughout the value chain are required and could be an integral component of this observatory..

Development of offshore fish cage technology

- Examination of scenarios for successful implementation are urgently needed and would include operational considerations such as financing, insurance, synergies, training...
- An assessment of current technical advances allowing operational farming systems that optimise stock production in harsh marine conditions around the year while minimising risk to infrastructure and human operators should be made.
- Guidelines for the establishment, location and husbandry of offshore finfish and shellfish farms that can be used by farmers to develop appropriate codes of practice for their operations should be developed and integrated with the spatial planning mechanisms foreseen.

Management of the demand for wild fish for on-growing

- Regular assessment of the effectiveness of the Eel Management Plan is required.
- Clarification of the contributions and position of the tuna fattening/farming activity should be provided.

Solutions for the predation from protected wild species

- European guidelines are required for Member State adoption on the legal interpretation of the Wild Birds and Habitats Directives (in particular as regards the operative words “no satisfactory alternative”, “not detrimental” and “serious damage”) – and as recommended in the parallel study report of EP 177.
- The recommendations of the European Parliament regarding development of a coordinated population management plan and development of guidelines on good practice for prevention and mitigation of conflicts for bird predation should be adopted.

BACKGROUND

Aquaculture of fish and molluscs in the European Union expanded from nearly 690,000 tonnes in 1981 to over 1,293,000 tonnes in 2001. By 2001, aquaculture was contributing over 17% of the volume and 27% of the value of fishery production in the European Union. This growth confirmed European aquaculture as a significant complement to fisheries in providing seafood to the consumer.

The majority of European aquaculture production comes from freshwater fish farming (trout and carp in particular) and marine mollusc farming (mussels, oysters and clams). Both sectors can be described as 'traditional' and mostly comprise SMEs of less than 10 persons or family businesses. In 2001, the Newly Associated States brought a contribution of close to 100.000 tonnes to freshwater aquaculture production, with carp being the dominant species.

The rapid growth of European aquaculture during the 90s was largely represented by marine fish farming – primarily of salmon, sea bass and sea bream. The production of 'new' aquaculture species –such as turbot, cod, sole and halibut – has had varied success. Research has been made into the suitability of fast-growing high value species, such as cobia and tuna, also saw further developments.

The FAO Code of Conduct for Responsible Fisheries (CCRF), adopted in 1995, provided principles, goals and elements for action towards sustainability of the fisheries and aquaculture sectors. In 1998, participants from 28 countries came together to produce the "Holmenkollen Guidelines for Sustainable Aquaculture" and these produced specific recommendations for states; producers and industry; the scientific and technological community and finally, for inter-governmental organisations and development agencies. The Federation of European Aquaculture Producers (FEAP) developed its own Code of Conduct to promote the responsible development and management of the fish farming in Europe. In addition, the Conference on Aquaculture in the Third Millennium decided on the Bangkok Declaration and Strategy concerning Aquaculture Development beyond 2000 and stated that "aquaculture policies and regulations should promote practical and economically viable farming and management practices that are environmentally responsible and socially acceptable."

In 2001, the FAO created a sub-committee on aquaculture of its Committee on Fisheries (COFI-AQ). COFI-AQ provides a forum for consultation and discussion on aquaculture and advises COFI on technical and policy matters related to aquaculture. In particular, COFI-AQ serves to identify and discuss major issues and trends in global aquaculture development; to determine those issues and trends of international importance requiring action to increase the sustainable contribution of aquaculture to food security, economic development and poverty alleviation and to recommend international action to address aquaculture development needs.

The 2002 EU strategy for the sustainable development of European Aquaculture provided the first specific regional objectives for the aquaculture sector, principally focussing on the ambitions of:

- Creating long-term secure employment, in particular in fishing-dependent areas;
- Assuring the availability to consumers of products that are healthy, safe and of good quality, as well as promoting high animal health and welfare standards;
- Ensuring an environmentally sound industry.

This initiative was welcomed by the European aquaculture sector as a whole, and was subsequently adopted by the European Parliament and the Council.

Aquaculture's position in the Common Fisheries Policy is considered to be underestimated. While European fisheries has continuously declined, the growth of and relative importance of aquaculture was largely ignored for many years. Parallel to this, the CMO (Common Market Organisation) was originally designed for fisheries interests where the specificities of aquaculture were recognized but largely put to one side. While sharing the same or similar products, aquaculture has the characteristics of a wide range of species/products which are produced on sites that are geographically dispersed. While fisheries remains the only hunter-gatherer activity in Europe, aquaculture is a process - with different inputs - that is, for the most part, controlled. If the products are similar, hence the inclusion of aquaculture in the CFP and the CMO, these differences explain the significant variations in approach. While fisheries is subject to TACs and Quotas and a range of control measures, aquaculture has to be achieved within a gamut of legislative measures concerning the environment, health, disease and welfare. The skills and knowledge required to be successful in aquaculture are this very different to those of fisheries.

The aquaculture profession sees its activities as being an important and substantial pillar of the Common Fisheries Policy and needs recognition of its contributions of:

- Safe, high quality food products for the European consumer
- Eco-friendly activities, and as
- An important knowledge-based contributor to the European bio-economy

As an economic activity, aquaculture is relatively new and many of its components are the fruition of successful European RTD that has been transferred to the professional arena. Nonetheless, the changes in the European market place - ranging from how fish & shellfish are sold to changing consumer preferences - mean that the reviews on the CMO and the CFP are extremely important for the sustainability of the sector. An example is the legislation concerning Producer Organisations where the sector believes that a new 'toolbox' of facilities are required to enable especially small/medium -size producers to group and be better organized to face competitively the modern European marketplace.

The positions of the profession in respect of the CFP and the CMO are under review at the present and will be completed in December 2009.

The 2002 strategy 'at a glance'

The 2002 strategy contained three headline objectives, 13 sub-objectives and 28 supporting actions under 9 different themes. Assessing the impact of these was the basis for this study.

CORE OBJECTIVE 1. Increasing employment in aquaculture by between 8,000 and 10,000 full-time job equivalents over the period 2003-2008

SUB-OBJECTIVES

- Increasing the Union's aquaculture production growth rate to 4 % per year
- Solving the conflicts for space that hinder development in some areas
- Promoting market development
- Improving governance in the aquaculture sector

SUPPORTING ACTIONS

Re-focus priorities for public aid through the FIGG
 Promote research on new species and strains
 Promote research on alternative protein sources for fish feed.
 Create specific common definitions and norms for organic aquaculture
 Create specific common definitions and norms for "environment friendly" aquaculture
 Develop closed water recirculating systems
 Develop offshore fish cage technology
 Develop offshore mollusc rafts and/or long lines
 Incorporate future aquaculture developments in Integrated Zone Strategies and Management Plans
 Increase the use of official quality marks
 Improve the image of the industry
 Develop promotional campaigns
 Develop new tools to gather statistical information on production and markets
 Further develop farmers' partnerships
 Increase the use of official quality marks
 Developments on stakeholder participation
 Use of self-regulation and voluntary agreements by the industry
 Adapt training programmes to aquaculture needs
 Recognise the role of women
 Recognise aquaculture in rural development and reversing the decline in coastal communities
 Extension of the opportunities for financing research and technological development
 Identification of research priorities

Core Objective 2. Assuring the availability to consumers of products that are healthy, safe and of good quality, as well as promoting high animal health and welfare standards

SUB-OBJECTIVES

- Offering the maximum level of consumer protection in terms of product safety and quality
- Reduction of the incidence of farmed animal diseases
- Prevention in transmission of diseases to and from wild stocks
- Actions regarding the welfare of farmed fish, and the risks associated with harmful algal blooms

SUPPORTING ACTIONS

Development of Community legislation on food hygiene
 Provisions for dioxin residues
 Provisions for antibiotic residues

More research on and control of toxic algal blooms
More research on aquatic animal diseases
Regular updating and simplifying of aquatic animal health legislation
Modification of the veterinary pharmaceutical legislation
Improve farmed fish welfare

Core Objective 3. Ensuring an environmentally sound industry

SUB-OBJECTIVES

- Actions to reduce the negative environmental impacts of aquaculture
- Developments on norms and/or voluntary agreements which prevent environment degradation
- Public financial incentives for use in aquaculture developments with positive contributions to the environment
- Actions for enhancing the knowledge base of the industry
- Public financing and promotion of private initiatives in research and technological development

Mitigation of the impact of wastes
Management of the demand for wild fish for on-growing
Development of instruments to tackle the impact of escapees
Development of instruments to tackle the impact of alien species
Development of instruments to tackle the impact of GMOs
Development of integrated pollution prevention and control methods
Development of specific criteria and guidelines for aquaculture Environmental Impact Assessments
Measures to strengthen the positive impact of extensive culture and re-stocking
Research on solutions for the predation from protected wild species

Aim of study

The aim of the present study is to provide an assessment of the impact of this first ground-breaking strategy for European aquaculture, at a time when aquaculture production in the Member States has stagnated and even declined for certain species, and when the European Commission has made its own stakeholder consultation and has published a new Communication that lays out a revised strategy to give impetus to the development of European aquaculture with a particular focus on defining the role of public authorities in its enactment.

This study:

- Provides an assessment of the **perceived impact** of the 2002 strategy from stakeholders representing the interests of finfish producers, shellfish producers, feed suppliers, consumer organisations, conservation and development organisations, the scientific community and other stakeholders.
- Provides an objective-based assessment of the **real impact** of the 2002 Strategy, by bringing together data, summaries of the status of initiatives and projects that supported the development of the actions stated in the Strategy in the period 2003-2008 and overviews of the status of legislative development during the same period.
- Analyses the achievements made against the objectives and actions proposed, by **performing a gap analysis between perceived and real impact**.
- Provides clear findings, including **explanations for failures**, where evidence for these is forthcoming and recommendations for policy makers.

Stakeholder Survey

The methodology used comprised an online survey that assessed the perceived impact of the 3 objectives and 13 sub-objectives of the 2002 Strategy, and then focused on the “success rating” of the implementation of the 9 action areas and 28 actions of that same document.

Table 1: Stakeholder Groups contacted for the EP175 online survey.

General Grouping	Sub-group	No. of panellists	% of total panel
INDUSTRY		94	48%
of which	European and National Finfish Producer Associations (FEAP members)	25	
	European and National Shellfish Producer Associations (EMPA members)	7	
	Aquaculture supplier companies	17	
	Members of the Board of Directors of the European Aquaculture Technology and Innovation Platform (EATIP)	12	
	Chairs and rapporteurs of the Thematic Groups of EATIP	14	
	Processors or Inter-professional organisations	10	
	Independent organisations providing aquaculture certification	9	
SCIENCE		63	32%
of which	Universities and research institutes	36	
	EAS Board of Directors	6	
	EU aquaculture sustainability project coordinators	21	
CONSUMERS	Consumer Organisations (BEUC members)	16	8%
GOVERNMENT	National government departments and agencies responsible for aquaculture development	15	8%
ENVIRONMENT NGOs	International and national environmental organisations	7	4%
TOTAL PANEL		195	100%

Responses to the survey questions used a 5-point scale that varied from point 1 - Highly Unsuccessful (i.e. lowest impact/implementation/success...) through a neutral midpoint (3) to point 5 – Highly Successful (i.e. highest impact/implementation/success...). A further point (6) was included for stakeholders that were unable to provide a perception for that particular action of the strategy. The web-based survey allowed easy compilation of responses and export to Excel and other formats for generation of graphical results. The

survey also allowed free comments that generated more qualitative responses and looked to highlight suggested reasons for failure (through the explanation of low-impact/success responses) and were in several cases followed up by telephone and/or face-to-face interviews for further detail.

Table 1 shows the stakeholders that were contacted to take part in the survey. Almost half of the invited stakeholders were from the industry sector and from several levels in the production/value chain. The next biggest group of contacts were from the scientific community, including the coordinators of 'flagship' EC-funded projects that had a specific focus on sustainable aquaculture development. The remaining stakeholders contacted were from European consumer organisations, environmental, conservation and development NGOs and representatives of national governments.

This structure provided, therefore, a panel of expert and non-expert stakeholders – considered of to be of high importance when judging the *perception* of success.

1. STAKEHOLDER PERCEPTION OF THE IMPACT OF THE 2002 AQUACULTURE STRATEGY

KEY FINDINGS

- 112 of the 195 panellists solicited provided their perception of the impact of the 2002 strategy, representing a **response rate of 57%**.
- Of these respondents, **47% are in the aquaculture industry** sector, 32% from the scientific community and the remainder split between consumer organisations, NGOs and representatives of national governments.
- Stakeholders generally agree that the Commission **strategy has been partially successful** in achieving its core objectives on assuring the availability to consumers of products that are **healthy, safe and of good quality** and also on ensuring an **environmentally sound** industry.
- Stakeholder responses are more split on the achievement of its core development objective in the sector, notably agreeing that the **strategy has been partially unsuccessful in solving the conflicts for space** that hinder development in some areas.
- A general stakeholder comment was that the **core development objective was not communicated clearly enough to Member States as a key EU policy**.
- The **most successful supporting actions** were identified by stakeholders as being developments on stakeholder participation; development of Community legislation on food hygiene; promotion of research on alternative protein sources for fish feed; extension of the opportunities for financing research and technological development and identification of research priorities.
- The **least successful supporting actions** were identified by stakeholders as being the creation of specific common definitions and norms for “environment friendly” aquaculture; improvement of the image of the industry; the creation of specific common definitions and norms for organic aquaculture; the incorporation of future aquaculture developments in Integrated Zone Strategies and Management Plans and the development of offshore fish cage technology.
- **Stakeholders generally had no perception** of the successful implementation of actions related to the modification of the veterinary pharmaceutical legislation; recognition of the role of women; the development of instruments to tackle the impact of alien species; research on solutions for the predation from protected wild specie; the re-focussing of priorities for public aid through the FIFG (now EFF) and the further development of farmers’ partnerships

1.1. Stakeholder participation.

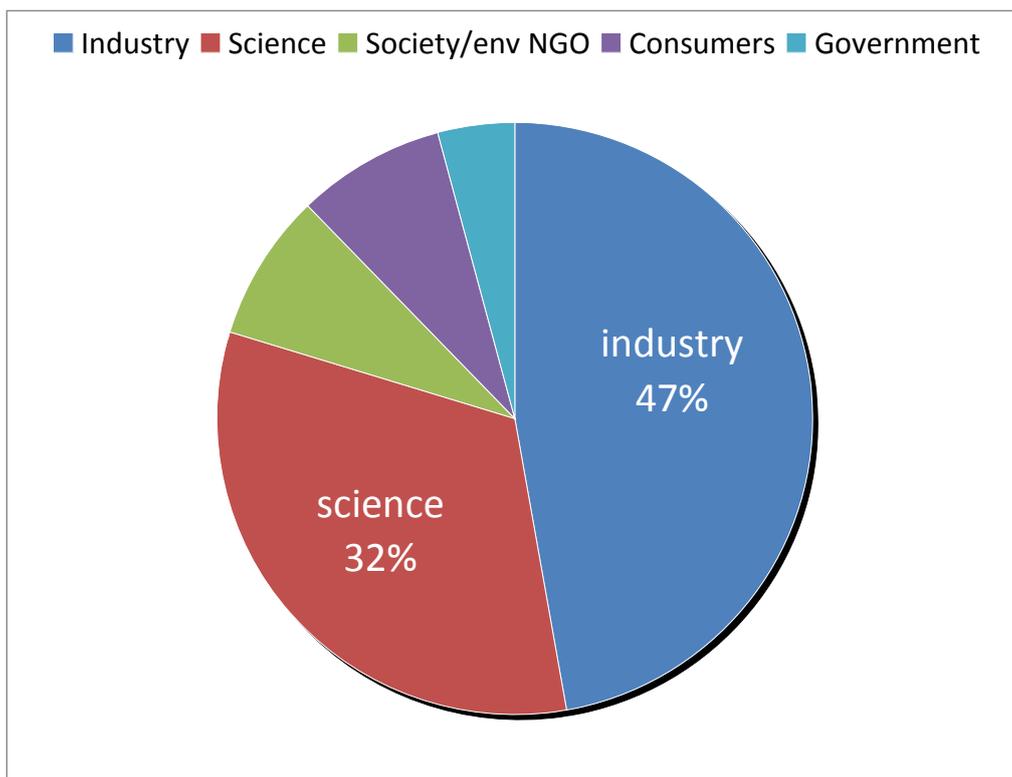
The use of an automated online web survey tool¹ allowed the creation of customised invitations and reminders that were programmed for sending to the panellists. A final reminder was sent to individual non-respondents directly by email from the study coordinator.

¹ CheckMarket, Belgium www.checkmarket.com

Of the total panel of 195 stakeholders, 75 replied using the automated survey system and a further 37 replied upon direct contact from the study coordinator. **This lead to an overall response of 112, representing a return rate of 57%**. This can be considered as exceptionally high for such a survey and provides an indication of the willingness of stakeholders to contribute to this study, thus increasing its value for the Committee on Fisheries.

The respondents (shown in Figure 1 and listed in Annex 1) followed closely the proportions of the target panel, indicating that responses were very well split over the target groups.

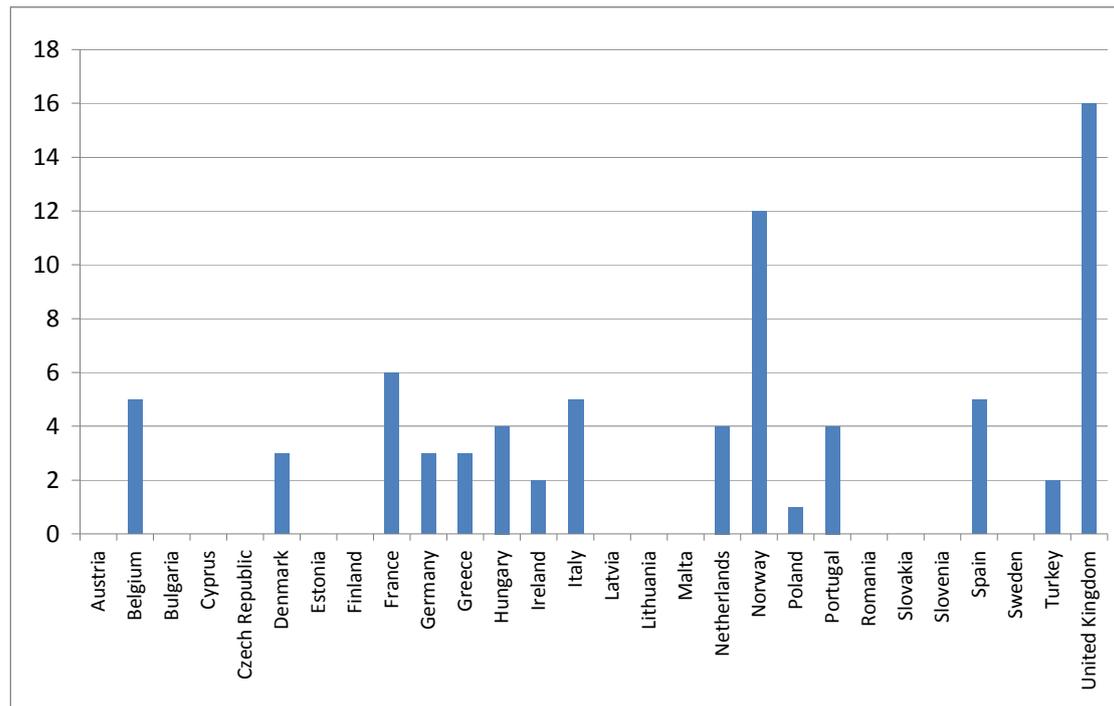
Figure 1: Stakeholder participation in the study



Source: Author

This is also important in providing the balance in responses that was originally planned. In terms of country representation (shown in Figure 2), the majority of respondents were from UK, Norway and France, these three countries representing 45% of the respondents. Those Members States where aquaculture production is currently limited (such as Estonia, Lithuania, Latvia, Slovenia, Slovakia...) were not represented in the survey, despite contacts with stakeholders in those countries.

It should also be noted that the respondent country could only be determined from the 75 respondents using the automated panel system. The identity and origin of the remaining 37 could not be determined, as they used a general link to the survey.

Figure 2. Respondent countries

The web survey was online for a period of one month (February to March 2009) and the average completion time was 19 minutes 45 seconds; this is a long time for a web survey and demonstrates stakeholder commitment to the study.

A total of 48 comments were received on the achievement of core objective one (increasing employment); 37 comments on core objective two (consumer health and safety) and 31 comments on core objective three (environmental soundness).

The following section discusses perceptions and provides comments on the core objectives.

1.2. Perception of success in the Core Objectives

In laying out its vision for the future, the Commission foresaw in its 2002 strategy the potential for growth.

“In the next ten years aquaculture must reach the status of a stable industry which guarantees long term secure employment and development in rural and coastal areas, providing alternatives to the fishing industry, both in terms of products and employment.....

..... Private investors are, and have to remain, the leading force to put progress in practice, while a key role of the public powers will be to guarantee that the economic viability be parallel to the respect of the environment and the good quality of the products.”

Source: COM(2002) 511 final

This section provides a summary of the stakeholders' feedback and where possible from the survey data, a summary of common comments that were made.

1.2.1. *Creating long term secure employment, in particular in fisheries dependent areas*

The first, ambitious objective was to increase employment in aquaculture by between 8,000 and 10,000 full-time job equivalents over the period 2003-2008. This was foreseen to be obtained mainly in fisheries-dependent areas by developing marine mollusc and cage farming, and was thought to be an opportunity for workers who might lose their jobs in the catching sector.

Four sub-objectives were proposed - increasing aquaculture production, solving the conflicts for space, promoting market development and improving governance in the sector.

Table 2: Assessment of CORE OBJECTIVE 1.

CORE OBJECTIVE 1. Increasing employment in aquaculture by between 8,000 and 10,000 full-time job equivalents over the period 2003-2008	Majority stakeholder perception
Increasing the Union's aquaculture production growth rate to 4 % per year	Partially Successful (27%)
Solving the conflicts for space that hinder development in some areas	Partially Unsuccessful (32%)
Promoting market development	Partially Successful (28%)
Improving governance in the aquaculture sector	Partially Successful (36%)

The majority of stakeholders hold the perception that the strategy was partially successful in fulfilling three of these sub-objectives, but that solving the conflicts for space that hinder development was partially unsuccessful, noting that Integrated Coastal Zone Management (ICZM) schemes have been put forward as a means for resolving this type of problem. The general opinion was that growth in production has been achieved for some species, but it had little to do with incentives or recommendations of the 2002 Strategy. This is evidenced by the marked lack of progress in the 3 sub-objectives of conflicts for space; market development and improving governance. Conflicts for space were perceived as becoming more important, especially in the light of EU regulations and policy (notably the Water Framework Directive and the Integrated Maritime Policy).

The promotion of market development for aquaculture products was also generally perceived as not being linked to the strategy, where the Commission preferred to put a focus on developing organic/eco aquaculture. No budget was available for market development support at a European level, due to the conditions of subsidiarity (i.e. allocations per Member State) applied to financial assistance from FIFG for achieving promotional actions.

Finally, the consensus was that governance in the sector had been improved.

A selection of respondents' comments reveals insights into the situation in various countries and regions. For example:

- **Sea bass and sea bream in Greece and Turkey.**

“Concerning the conflicts for space that hinder development in some areas: There are still some problems between the aquaculture sector and the tourism industry that could not be solved in some areas such as the Aegean Sea or the Mediterranean. Aquaculture and tourism in these regions share the same environment and both the fish and tourists like clean water and environment”.

“Marine production increase in Greece is within the goals set. However, the conflicts in space still remain. For having improvements in this area the policies of the local governments are quite important. Market has further developed, however the success on this aspect depends quite a lot on how the local producers collaborate to get the best outcome for their products. This has not been successful at least in Greece with marine fish prices not covering even the production costs”.

- **Carp in CEE countries.**

“There were no visible changes in Polish aquaculture under the angle of 2002 Strategy. Although the aquaculture production volume was slightly better, its value is not so impressive due to much lower prices. Considerable efforts have been made to promote fish to consumers, but as yet this is not shown by an increase in per capita consumption”.

“The human consumption of fish increased only 10 % in the last five years in Hungary. The number of employees is stagnant or less, compared to five years ago. The yield is stagnant in the inland aquaculture sector”.

- **Shellfish (in France)**

“With regard to shellfish aquaculture the strategy has not been very effective if detectable at all”.

“As far as shellfish farming is concerned, the production is stable. There is no increase in employment. In France, the number of concessionaires on the maritime public domain tends to decline”.

A general comment that caught the authors' attention was that *“This objective was not communicated clearly enough to member state governments as being a key EU policy”.*

The distinction in understanding the difference between a Strategy and an official policy is difficult.

1.2.2. Assuring the availability to consumers of products that are healthy, safe and of good quality, as well as promoting high animal health and welfare standards

The second core objective was based on health and safety, on the basis that consumers must continue to benefit from the positive health effects derived from consumption of fish and shellfish. It was deemed essential to offer the maximum level of consumer protection in terms of product safety and quality, and to reduce the incidence of farmed animal diseases and prevent transmission of diseases to and from wild stocks.

Other issues addressed under this objective were the welfare of farmed fish and the risks associated with harmful algal blooms.

Table 3: Assessment of CORE OBJECTIVE 2.

CORE OBJECTIVE 2. Assuring the availability to consumers of products that are healthy, safe and of good quality, as well as promoting high animal health and welfare standards	Majority stakeholder perception
Offering the maximum level of consumer protection in terms of product safety and quality	Partially Successful (40%)
Reduction of the incidence of farmed animal diseases	Partially Successful (37%)
Prevention in transmission of diseases to and from wild stocks	Partially Successful (33%)
Actions regarding the welfare of farmed fish, and the risks associated with harmful algal blooms	Partially Successful (41%)

The majority of stakeholders perceived the sub-objectives as having been partially successful, but commented on the difficulty to appraise actions regarding welfare together with those related to harmful algal blooms – questioning why these were joined together in the strategy.

Two representative comments from stakeholders sum up well the general perception:

“It is difficult to separate industry-led improvements from any effect that might have related to the EU strategy. However, EU food safety legislation has been very effective across all food sectors in improving the quality and safety of food for human consumption. There has been a reduced incidence of farmed animal diseases but mainly due to improved industry practices. The bureaucracy and high cost of the EU medicines regulations has acted as a barrier to the introduction of new fish medicines (a small industry sector) and lack of new medicines is now of major industry concern. Industry-led developments have produced very significant improvements in biosecurity and the welfare of farmed fish”.

“The Commission has been active in promoting product quality and safety and has had clear impact with respect to imports and probably some practices on EU farms. But, in some respects it has been left behind by private standards driven the multiple retailers - although also involving groups such as the UK RSPCA. Practices to prevent disease transmission are improving but uncertain to what extent this is due to any action by EC. I do not think that the development of new vaccines and therapeutants, although needed, has been substantially boosted”.

1.2.3. Ensuring an environmentally sound industry

The last of the three core objectives focussed on the environmental impacts of aquaculture, looking to develop a set of norms and/or voluntary agreements to prevent environment degradation, while also seeking to recognise and encourage (including use of public financial incentives) the positive contribution of certain aquaculture developments to the environment.

Table 4: Assessment of CORE OBJECTIVE 3.

CORE OBJECTIVE 3. Ensuring an environmentally sound industry	Majority stakeholder perception
Actions to reduce the negative environmental impacts of aquaculture	Partially Successful (48%)
Developments on norms and/or voluntary agreements which prevent environment degradation	Partially Successful (46%)
Public financial incentives for use in aquaculture developments with positive contributions to the environment	Partially Successful (30%)
Actions for enhancing the knowledge base of the industry	Partially Successful (44%)
Public financing and promotion of private initiatives in research and technological development	Partially Successful (43%)

As shown, the majority of stakeholders perceived the sub-objectives as having been partially successful.

Actions to reduce impact were commented on as being at a regulatory level, but also through better husbandry on the farm – often as a result of research – and on the development of voluntary standards and quality assurance schemes. On the legislative side, comments focussed on the (great) variability within national legislation, as well as the fact that European producers have a generally higher legislative requirement than those in countries that export to the EU.

In only one case (the public financial incentives) was the perception somewhat more divided – while 30% agreed that it was partially successful, 25% thought that it was neutral (i.e. no direct affect) and 20% were not able to provide a perception.

Finally, two comments sum up the respondents' views on aquaculture practices that have little environmental impact:

- From Poland: *“The inland aquaculture has positive impact on environment. The Water Framework Directive has negative impact for the producers. The big question is who will pay for making better the environment?”*

- From France: *“Shellfish farming has no impact on the environment and furthermore it provides ecosystem services. It helps regulating eutrophication (carbon and nitrogen sink). Industry knowledge and expertise should be better taken into account and professionals more associated to the definition of research priorities”.*

1.3. Perception of most successful actions.

The 2002 strategy proposed a total of 28 actions, grouped into 9 action areas – increasing production; competition for space; market development, marketing and information; training, governance; safety of aquaculture products; initiatives to improve farmed fish welfare; environmental actions and research.

The following sections present the ‘top five’ perceptions for most successful, least successful and actions where stakeholders were unable to provide a perception.

Table 5: Stakeholders perceived MOST successful actions.

Stakeholders perceived MOST successful actions	%	Core Objective
<i>combined % of highly/partially successful ratings</i>		
Developments on stakeholder participation	68%	1
Development of Community legislation on food hygiene	63%	2
Promote research on alternative protein sources for fish feed	63%	1
Extension of the opportunities for financing research and technological development	59%	1
Identification of research priorities	59%	1

With respect to the high success accorded to **developments on stakeholder participation**, this may be split into two basic areas:

- Ongoing, “structured” stakeholder consultation, such as through ACFA (Advisory Committee on Fisheries and Aquaculture)
- “Ad hoc” consultations or actions, which are increasingly widespread at the National level as well.

ACFA is the body through which the professional aquaculture sector, NGOs, Consumer Groups and other members of the aquaculture ‘value chain’ are able to be consulted and participate in debate. Over the last decade, FEAP, EMPA and COGECA have provided representatives to participate actively in the different working groups and activities of this Committee and this is probably why stakeholders have a positive perception of this action.

Two aquaculture Hearings (in October 2007 and March 2008) were also organised for the Committee on Fisheries, to inform Committee members on aquaculture developments. Furthermore, European Coordination Actions – such as CONSENSUS, PROFET and PROFET POLICY (the CONSENSUS² initiative was frequently cited by respondents) - funded under the 6th Framework Programme (FP6) have also reached out to stakeholders to have their inputs and the Commission organised a wide stakeholder consultation during 2007 to assess the impact of the 2002 strategy and to pave the way for its successor.

This was closely followed by the **development of Community legislation on food hygiene** and the promotion of **research on alternative protein sources for fish feed**.

Community legislation covers all stages of the production, processing, distribution and placing on the market of food intended for human consumption. 'Placing on the market' means the holding of food for the purpose of sale, including offering for sale, or any other form of transfer, whether free of charge or not, and the sale, distribution and other forms of transfer themselves.

The new hygiene rules³ [the hygiene 'package'] (adopted in April 2004 and applicable on 1 January 2006), with (amongst others) primary responsibility for food safety borne by the food business operator, registration or approval for certain food establishments and general implementation of procedures based on the HACCP principles are considered positively by stakeholders in the survey. Key acts include specific hygiene rules, import conditions, verification and compliance documents. Apart from hygiene conditions, extension to include further legal components on animal health and welfare have been included.

The replacement of fish meal and fish oil in aquaculture feeds was highlighted as an important research requirement and several FP6 projects looked at this issue. These were conducted in parallel with own initiatives by the major feed producing companies to reduce their reliance on these commodities. One FP6 initiative is noteworthy here.

The AQUAMAX Integrated Project⁴ started in March 2006 and runs for four years. It starts from the premise that fish play a unique role in human nutrition and wellbeing, that aquaculture has thus far managed to make up the fisheries deficit, but that its growth is becoming increasingly constrained by the limited industrial supply of fish on which aquaculture feeds are so heavily dependent. The strategic goal of the AQUAMAX project is to replace as much as possible of the fish meal and fish oil currently used in fish feeds with sustainable, alternative feed resources. The project involves 32 partners from throughout Europe with partners also from China and India. To date, AQUAMAX has made significant headway in 'tailoring' aquaculture feeds to produce high-quality fish with significantly reduced use of fishmeal and fish oil.

Finally, in terms of its objective to **extend the opportunities for financing research** and technological development and the **identification of research priorities**, the Commission expanded research possibilities within the EFF and achieved good participation within FP6 on industry-oriented research, through its SME measures (e.g. CRAFT) and the Collective Research tools.

² CONSENSUS - Multi Stakeholder Platform for Sustainable Aquaculture in Europe. Funded under contract FOOD CT 2005 513998, with EAS coordinating 21 partners from 10 countries. www.euraquaculture.info

³ Food hygiene legislation review: see http://ec.europa.eu/fisheries/legislation/other/food_hygiene_en.htm

⁴ AQUAMAX: Sustainable Aquafeeds to Maximise the Health Benefits of Farmed Fish for Consumers. www.aquamaxip.eu

The Commission also funded several initiatives to prioritise and obtain commitment to research. These included the highly successful PROFET⁵ and PROFET Policy⁶ initiatives – respectively focussing on identifying industry priorities for aquaculture research and the bringing together of research results under policy areas and specifically targeted towards policy makers.

More recently, the identification of research priorities has been taken up with the formation of the **European Aquaculture Technology and Innovation Platform**, EATIP⁷, and bringing together industry with other stakeholders to provide vision documents and a strategic research agenda for European aquaculture.

Box 1. The European Aquaculture Technology and Innovation Platform (EATIP)

The European Aquaculture Technology and Innovation Platform



EATIP www.eatip.eu is one of Europe's Technology Platforms and dedicated to providing an industry platform to develop a Vision for European aquaculture and to back up this vision with a Strategic Research Agenda for the sector.

The principal objectives of EATIP are to establish a strong relationship between aquaculture and the consumer (including issues relating to human health, product quality, traceability...); to assure a sustainable aquaculture industry, covering social, environmental and economic issues and to consolidate the role of aquaculture in society, by developing knowledge management, skill development, communications and networking.

EATIP is registered as a Non-Profit Association in Belgium and is open to the membership of companies, associations and federations, public authorities, institutions and universities, financial institutions, of European or international origin, that each has a declared and professional interest in the sustainable development of European aquaculture.

It has no political character.

1.4. Perception of least successful actions.

The table below shows the least successfully implemented actions of the strategy as perceived by the stakeholders and ranked so that the highest percentage is the least successful. The % figures are the combined partially or highly unsuccessful responses from the survey results. All actions are within Core Objective 1.

⁵ PROFET: 5 Trans-national workshops on the research needs of the European fish farming sector. www.feap.info/news/RTD/profet_en.asp

⁶ PROFET Policy: 9 International workshops on Fisheries and Aquaculture, communicating the results of European RTD projects to all stakeholders through an international dissemination platform. www.profetpolicy.info

⁷ www.eatip.eu

Table 6. Stakeholders perceived LEAST successful actions.

Stakeholders perceived LEAST successful actions	%	Core Objective
<i>combined % of highly/partially unsuccessful ratings</i>		
Create specific common definitions and norms for “environment friendly” aquaculture	37%	1
Improve the image of the industry	33%	1
Create specific common definitions and norms for organic aquaculture	31%	1
Incorporate future aquaculture developments in Integrated Zone Strategies and Management Plans	30%	1
Develop offshore fish cage technology	29%	1

1.4.1. Create specific common definitions and norms for “environment friendly” aquaculture

There is a general understanding among stakeholders of the meaning of the concept behind “environment friendly” aquaculture, as being aquaculture systems and practices in which the fish farmer reaches the goal of producing adequate yields and profits, while minimizing any negative short-and long-term side effects on the environment and on the well-being of the community. The major goals of this approach are thus to develop economically viable aquatic production systems, which retain or enhance the quality, resilience and productivity of the environment and its ecosystems.

Nevertheless, definition efforts have mainly drifted towards the “sustainable aquaculture” concept. “Environment friendly” aquaculture has remained as a more fuzzy concept with obviously less success in obtaining a clear grasp of the meaning.

The application of norms for “environment friendly” aquaculture should ideally lead towards protection of environmental quality without substantial sacrifice of yields or profits, and should allow aquaculture producers to remain competitive in the global fishery products market. The application of environment friendly measures at farm level mean long term sustainability but may involve higher productions costs in the short term. In this context eco-labels could be considered for produce from environmentally friendly systems, to encourage consumers to be aware of that hidden added value, make positive choices and confer market advantages, including premium price options.

The eco-label concept is in effect a scaled down and more easily applicable version of a “sustainable aquaculture” certification system, whose definition and measurement, based on environmental, social and economic criteria, is far more complex.

Certification schemes to improve environmental performance such as ISO 14.000, or to a lesser degree EMAS, are common in European aquaculture companies. Some sustainability

certification schemes initially designed for capture fisheries are also beginning to cover aquaculture production, such as “Friends of the Sea”, and similar to the concept of the Marine Stewardship Council, the Aquaculture Stewardship Council (ASC). ISO is also working on this concept⁸ (ISO TC 234) although completion is not foreseen in the immediate future.

However the multitude of private certifications schemes and of different labels relating to the environment (“organic”, “eco”, “sustainable”...) now existing in the marketplace are very confusing for both European consumers and aquaculture stakeholders.

Stakeholders in general agree on the importance of having a unique and common eco-label for the European Union. Nevertheless, no clear norm for “environment friendly” aquaculture or eco-label has yet been produced in the European Union.

The European Commission began working on an eco-label scheme for the fisheries sector in 2005, but through debates in ACFA it soon came clear that separate schemes would need to be developed for capture fisheries and for aquaculture. A proposal for a Regulation of the European Parliament and of the Council on a Community Ecolabel scheme (COM(2008)401-final) was developed to encourage the sustainable production and consumption of products by setting benchmarks for the good environmental performance of products based on the top performers in the market. By guiding consumers towards them, the eco-label logo should promote those products and services that have met these benchmarks compared to others in the same category.

Thus, it was put forward that capture fisheries and aquaculture products should be included in the proposed scope of a revised European Ecolabel Scheme. However, since further study has been requested on the feasibility and added-value for food and feed, this will be delayed.

The revised “Strategy for the Sustainable Development of European Aquaculture” (COM(2009)162-final), the creation of this eco-label for aquaculture appears to be supported by the policy-makers and the sector alike

1.4.2. Improve the image of the industry

Improving the image of the industry was put forward as an important component of the strategy as an integral component of the market development issue. Foreseen for generic actions, providing access to FIFG, information campaigns do not seem to have had any major impact. Many consumers were unaware (prior to labelling of origin in the MRS) that seabass or turbot might come from aquaculture. In addition, since major suppliers of aquaculture products within the EU are from 3rd countries (e.g. Norway, Turkey, Chile) or are destined for Intra-EU trade (e.g. from Greece to Italy/Spain (seabream/seabass) or from Denmark/France/Spain to Germany (trout)) or from Scotland/Ireland to France (salmon), the incentives to develop transnational/European marketing have been eliminated through the allocations of FIFG on the basis of subsidiarity. In considering the concept of the Common Market, this aspect requires reflection.

When combined with aggressive accusations about aquaculture’s activities, the publication of negative views on the activity have outweighed the positive ones, specifically on issues

⁸ See http://www.iso.org/iso/iso_technical_committee?commid=541071.

such as environmental effects (including the potential effect of escapes), the use of feeds (fishmeal and oil use, potential for contamination) have contributed to a range of negative perceptions.

The fact that the Multiple Retail Sector (MRS) provides little or no promotional information, combined with the consolidation of the sector (more large companies which do their own branding promotion) means that the Associative structures achieve less and less direct promotional actions at the generic level.

1.4.3. Create specific common definitions and norms for organic aquaculture

The fact that 31% of stakeholders rate this action as being partially or highly unsuccessful demonstrates that **widespread confusion that still today surrounds the organic aquaculture concept and its principles**. The Strategy for the Sustainable Development of European Aquaculture (COM (2002) 511 final) expected organic aquaculture production to thrive and contribute to expand the aquaculture industry in general, but this has not happened. Organic aquaculture services a niche market and its related production figures are marginal when compared to the global European aquaculture figures.

Organic production of agricultural products (not including aquaculture), and indications referring thereto on agricultural products and foodstuffs, were established through Council Regulation (EEC) No 2092/91 of 24th of June 1991. This legislation was repealed by Council Regulation (EC) No 834/2007 of 28th June 2007 on organic production and labelling of organic products. This new Regulation does indeed cover aquaculture products. Article 2 of this Regulation establishes common definitions for organic production including aquaculture.

Commission Regulation (EC) No 889/2008 of 5th of September 2008 laid down detailed rules for implementation with regard to organic production, labelling and control. But, at that time, the Commission believed that more time and discussion was needed for the elaboration of detailed production rules on organic aquaculture and so these would be elaborated in a subsequent procedure. For this reason, rules for aquaculture organic products were excluded from the scope of this Regulation.

A new Commission Regulation⁹ amends this and provides detailed rules on organic aquaculture.

Since it is only recently that the definitions have been made publicly known, this is probably the main reason for such a high rate of perceived unsuccessfulness.

Generally, it appears that – independently of European legislation - the combination of the prevalence of private labels for organic aquaculture with the dominance of MRS in terms of retail means that organic production will be split into local niche markets for small producers and a drift towards organic production for larger producers, if profitability is assured. Consumer organisations indicate, in the light of the financial crisis, that price remains a dominant consideration of the consumer for fish and shellfish consumption. The professional shellfish sector believes that its existing production practices are organic.

⁹ Commission Regulation (EC) No 710/2009 amending Regulation (EC) No 889/2008 laying down detailed rules for the implementation of Council Regulation (EC) No 834/2007, as regards laying down detailed rules on organic aquaculture animal and seaweed production.

1.4.4. Incorporate future aquaculture developments in Integrated Zone Strategies and Management Plans

While a combined 30% of stakeholders rated this action as being partially or highly unsuccessful, 29% were unable to provide a perception and 19% rated this as neutral (i.e. the strategy having no direct impact). A very mixed reaction, therefore.

Some of the free comments expressed by stakeholders illustrate the issues:

- *"Space is (still) a problem and conflicts with other marine users will not be resolved until a system of marine spatial planning can be successfully implemented".*
- *"This objective was not communicated clearly enough to Member State governments as a key EU policy".*
- *"The Member States have not felt encouraged enough to give aquaculture the strategic importance, so as to have a clear path of development through a clear definition on how to solve conflicts for space".*
- *"There is still a significant problem with the spatial deployment of coastal aquaculture, a complex national legislation framework that does not follow EU objectives".*

Following the publication of a European Integrated Maritime Policy, the Communication (COM (2008) 0791 final) from the Commission - a "Roadmap for Maritime Spatial Planning: Achieving Common Principles in the EU" - changed the emphasis from Integrated Coastal Zone Management (ICZM) to Maritime Spatial Planning".

While it was recognised that MSP should be based on the specificities of individual marine regions or sub-regions, and that implementation of MSP is the responsibility of the Member States (subsidiarity) it was felt that action at EU level could provide significant added value. Its application is nonetheless a local issue, and it would appear that stakeholders have very mixed perceptions of the actions foreseen at a European level that were proposed in the Communication.

The limited mention of aquaculture in the Integrated Maritime Policy was also most probably a factor leading to comments that the EU did not communicate the strategic importance that many in the sector believe it should have.

Since this aspect incorporates a range of different issues (competition for space, access to licences, site management plans....), much more clarity of how this will be implemented in practice – to assist aquaculture development and growth – is required.

1.4.5. Develop offshore fish cage technology

Although the consensus of stakeholders showed that this action had not been successfully implemented, a wide variation in responses was observed.

A number of initiatives were instigated after 2002; these included the creation of the Offshore Aquaculture Technology Platform (see box) and EU research initiatives were made in FP6 to develop specific technology for rearing infrastructure (cages).

In parallel, specific international fora were created to address technological and policy issues; offshore actions were enshrined in policy to develop the aquaculture sector in

Ireland. In the sector, offshore farms became operational in Spain, Ireland and Malta for sea bream, salmon and tuna.

The 2002 strategy identified offshore aquaculture as being one of the solutions to the competition for space. It also recognised that it would apply to only a few species and that technology required further development.

While no specific offshore technology research was funded in the EU, one notable initiative is the Norwegian-funded CREATE¹⁰ project. CREATE was one of 14 special cooperative programmes selected by the Research Council of Norway in 2006 to be a Centre of Research-Based Innovation. This designation means the centre is given a steady flow of basic funding of NOK 10 million (approximately 1.2 million euro) per year over 8 years, an amount that is matched and supplemented by participating industrial partners. CREATE's objective is to supply the Norwegian aquaculture industry with new technology and knowledge that can be used both at home and abroad. The goal is also to enable Norwegian aquaculture equipment manufacturers to continue supplying global markets over the long term. An additional focus is to develop knowledge for building new technologies that help young fish grow to maturity.

A range of fora have been organised to debate and provide focus for offshore aquaculture development. Actions include the International Council of Offshore Aquaculture Development (www.icoad.ie) and the Offshore Mariculture¹¹ conference, created by the Society for Underwater Technology and the Greenwich Forum. The principal conclusions are that governments need to support the development of an offshore mariculture industry with enabling legislation (particularly to minimise the time and cost of the permissions process) and by providing suitable funding and support for continuing research and development into sustainable production and on-going measures to analyse and underwrite socio-economic considerations for local communities.

Future advances that are needed include

- Technical advances that allow fully integrated operational farming systems that measure and optimise stock production in harsh sea conditions around the year while minimising risk to human operators
- Cost-effective technologies for harvesting, transfer and processing of stock to market
- Financing and insurance mechanisms that would allow participation in such ventures (e.g. cooperative or collective actions)
- Transfer and adaptation of technologies from other offshore sectors where appropriate
- Exploitation of potential synergies for co-development (e.g. with offshore wind farms...)
- Policies/Legislation for integration within Marine Protected Areas
- Model guidelines for the establishment, location and husbandry of an offshore finfish farm that can be used by farmers to develop appropriate codes of practice for their operations.

How to develop and grow the offshore fish farming business is the current focus. The research needs outlined in the OATP document (see below) were discussed and endorsed by 150 international delegates at Offshore Mariculture 2008. Various technologies for floating and submersible cage systems were featured, showing the competition by USA and

¹⁰ CREATE <http://www.sintef.no/Projectweb/CREATE/>

¹¹ www.offshoremariculture.com

European suppliers to the sector. It is generally believed that the technology for the growing systems is ready for the market while the technology for harvesting and other husbandry-related factors remains unfulfilled.

Box 2. The Offshore Aquaculture Technology Platform

The OFFSHORE AQUACULTURE TECHNOLOGY PLATFORM

The Offshore Aquaculture Technology Platform (OATP) www.offshoreaqua.net was financed through FP6 (Scientific Support to Policy) and brought together 16 partners from 7 countries, lead by the Marine Institute in Ireland.

Through workshops and consultations, it published its final report in January 2009, setting out its vision, strengths and gaps and recommendations on ethical issues, potential species, regulation and planning, safety, environmental considerations and technology.

The offshore platform is integrated into the European Aquaculture Technology and Innovation Platform (**EATIP**).

Given these initiatives, it would appear that stakeholder **perception is split between the development of technologies** and the professional implementation or **uptake** of those technologies by the sector, leading to the overall low level of perception by the stakeholders in the survey. **While the technology remains under development, the actual percentage of production in offshore (high-energy) systems remains low.**

The FEAP estimates that, in 2008, offshore production remains minimal within total European marine production. While technology remains an issue, the principal factors that are slowing down further development are related to high investment and operating costs, unknown logistics for daily management tasks and harvesting, and difficulties on insurance (site and stock).

1.5. Actions where stakeholders had no perception

The last of the “top 5” tables addresses those actions where the majority of stakeholders were unable to provide a perception of success.

Table 7 Actions where stakeholders were UNABLE to provide a perception.

Actions where stakeholders were UNABLE to provide a perception	%	Core Objective
Modification of the veterinary pharmaceutical legislation	39%	2
Recognise the role of women	37%	1
Development of instruments to tackle the impact of alien species	37%	3
Research on solutions for the predation from protected wild species	37%	3
Re-focus priorities for public aid through the FIFG (now EFF)	36%	1
Further develop farmers' partnerships	36%	1

1.5.1. Modification of the veterinary pharmaceutical legislation.

Most operators and related stakeholders are aware of the problems caused because of the low availability of authorised veterinary medicines in aquaculture (small/decreasing number of legal vaccines, antibiotics, anaesthetics, etc.). However, accurate knowledge on veterinary pharmaceutical legislation and the conditions of obtaining authorisations/licenses is restricted to a very small group of stakeholders (e.g. pharmaceutical companies, specialised veterinarians). For this reason, detailed perceptions on this issue, and on the role and impacts of European initiatives, are rare.

1.5.2. Recognise the role of women.

In the European aquaculture industry, women play a significant role and their participation is in much more equal terms with men than in the capture fisheries industry where the presence of women is anecdotal. For this reason, the majority of stakeholders take the importance of women within the sector for granted and do not see that this question is an issue. Women have a notable role in specific sub-sectors, notably hatcheries, processing and RTD institutes.

1.5.3. Development of instruments to tackle the impact of alien species.

The risks that alien species pose for aquaculture appears to be underestimated by most stakeholders and there is some confusion on the interpretation of the issue. This may partly be understood because some of the most important aquaculture species in the EU are not originally European (rainbow trout, oyster, etc.). Alien species for on-growing are seen by many as opportunities rather than as risks and for which instruments need to be developed. On the other hand, the import of alien species (such as ornamental fish) that may be vectors of disease is of concern. Equally, the impact of alien organisms that may have secondary effects (e.g. through the discharge of ballast water) is of wide concern.

Probably for these reasons, opinions are not common on this topic.

Nonetheless, the potential for genetic selection (for improved strains that have, for example, disease resistance or better growth performance) also provides a level of confusion in this area – specifically with the issue of escapes and their potential effects on biodiversity.

1.5.4. Research on solutions for the predation from protected wild species.

Protected wild species, such as cormorants or seals, pose a problem for aquaculture in many areas of Europe because of the increase in their populations and the rising and important losses of stocks that they cause. The solutions can only come through better data that will lead to legislative changes and effective management/control plans or procedures for the control of their populations. There is no evident explanation for the low proportion of stakeholders providing a perception on this issue. The absence of clear and constructive actions at both European and National levels is of clear frustration to the fish farming profession, specifically the pond farmers in Central Europe.

1.5.5. Re-focus priorities for public aid through the FIG (now EFF).

Most stakeholders are unaware of the possibility of re-focusing the priorities of FIG.

1.5.6. Further develop farmers' partnerships.

Farmers' partnerships have long been seen as a means for giving improved stability for the farmers in the face of the shift of buying/selling power to the MRS, which have concentrated the economics of the food markets within the EU.

The creation of cooperative structures for sales has been made in several parts of Europe (e.g. in UK, France...) but geographic dispersion creates a severe logistical problem – particularly if the cooperative is to engage in processing. Where farms are concentrated, actions have tended to be more successful.

The use of the structure of producer organisations, which were developed originally for fisheries, has not been successful. An important reason for this is that the rules of operation were developed in line with the characteristics of fisheries (e.g. vessels making landings at ports) as opposed to aquaculture (dispersed companies). It is anticipated that the current review of the Common Market Organisation for fisheries and aquaculture will provide a better insight to potential changes in the legislation.

2. GAP ANALYSIS OF PERCEIVED IMPACT AGAINST DOCUMENTED ACTIONS

KEY FINDINGS

- A gap analysis was made to objectively **analyse the achievements** made against the objectives and actions proposed in the strategy and to assess those **against the majority stakeholder perception** of those achievements.
- Of the core objectives (and sub-objectives) **high gaps were evident** in the success of the strategy **in promoting market development** and in **increasing the Union's aquaculture production growth rate to 4 % per year**.
- High gaps were also evident in **9 of the 28 specific actions**, 4 of which were within the theme **'environmental actions'** and related to Core Objective 3; 3 within **'market development'**, related to Core Objective 1 and 2 within **'competition for space'**, also related to Core Objective 1.
- By various objective measures, **these 9 actions** - to develop closed water recirculating systems; increase the use of official quality marks; develop promotional campaigns; develop new tools to gather statistical information on production and markets; manage the demand for wild fish for on-growing; develop specific criteria and guidelines for aquaculture Environmental Impact Assessments; strengthen the positive impact of extensive culture and re-stocking and research solutions for the predation from protected wild species - **were generally less successful than the stakeholder perception** (including where stakeholders had no perception).

The raw data from the survey formed the basis for the performance of a gap analysis, designed to analyse real achievements made against the objectives and actions proposed in the strategy and to assess those against the majority stakeholder perception of those achievements.

The authors also completed the survey independently and consequently held several discussions to agree an objective-based consensus position. Several sources of knowledge were used in this process and included data on the sector (production, value, employment etc in the period 2002 to 2008), outcomes from the Advisory Committee on Fisheries and Aquaculture and its working groups; developments in Community legislation on aquaculture, FEAP position papers and internal documents; IUCN Good Practice guidelines for the sustainable development of Mediterranean aquaculture; European- funded research and the proceedings of EU conferences and outcomes of other events such as the EAS "Aquaculture Europe" conferences.

2.1. Overview of the gaps in the CORE OBJECTIVES and their SUPPORTING ACTIONS

This short section provides an overview of the gaps in each of the three Core Objectives and are provided in tabular form over the next three pages.

For each Core Objective, the Sub-Objectives are listed, as well as the Supporting Actions proposed.

The differences between the majority stakeholder perception and the objective consensus position defined the gap and this is summarised in the tables.

- The highest gaps are shown in **red** and these represent **gaps of one or more 'point'** in the 5-point scale used in the survey and when there was a clear majority of stakeholder perception.
- The gaps shown in **orange** represent **gaps of one point**, but often when there was no clear majority stakeholder perception.
- The gaps shown in **green** show **no difference** between stakeholder perception and the author's consensus, and when a clear majority of stakeholders were unable to provide a perception.

The subsequent sections explain in more detail the principal gaps.

Table 8: Gap analysis of Core Objective 1 and its sub-objectives and supporting actions

Core Objective 1. Increasing employment in aquaculture by between 8,000 and 10,000 full-time job equivalents over the period 2003-2008			
	Majority stakeholder perception	Authors' perception	GAP
Sub-objectives			
Increasing the Union's aquaculture production growth rate to 4 % per year	Partially successful	Highly unsuccessful	
Solving the conflicts for space that hinder development in some areas	Partially unsuccessful	Partially unsuccessful	
Promoting market development	Partially successful	Partially/Highly unsuccessful	
Improving governance in the aquaculture sector	Partially successful	Partially successful	
Supporting Actions			
Increasing production			
Re-focus priorities for public aid through the FIGG	No perception	Partially successful	
Promote research on new species and strains	Partially successful	Partially successful	
Promote research on alternative protein sources for fish feed.	Partially successful	Highly successful	
Create specific common definitions and norms for organic aquaculture	Partially successful	Partially successful	
Create specific common definitions and norms for "environment friendly" aquaculture	Partially successful	Partially unsuccessful	
Competition for space			
Develop closed water recirculating systems	Partially successful	Partially unsuccessful	
Develop offshore fish cage technology	Partially successful	Neutral	
Develop offshore mollusc rafts and/or long lines	No perception	Neutral	
Incorporate future aquaculture developments in Integrated Zone Strategies and Management Plans	Partially unsuccessful	Highly unsuccessful	
Market development, marketing and information			
Increase the use of official quality marks	Partially successful	Partially unsuccessful	
Improve the image of the industry	Partially successful	Neutral	
Develop promotional campaigns	Neutral	Partially unsuccessful	
Develop new tools to gather statistical information on production and markets	No perception	Highly unsuccessful	
Further develop farmers' partnerships	No perception	Partially unsuccessful	
Increase the use of official quality marks	Partially successful	Partially unsuccessful	
Governance			
Developments on stakeholder participation	Partially successful	Highly successful	
Use of self-regulation and voluntary agreements by the industry	Partially successful	Highly successful	
Training			
Adapt training programmes to aquaculture needs	No perception	Partially successful	
Recognise the role of women	No perception	Partially successful	
Recognise aquaculture in rural development and reversing the decline in coastal communities	No perception	Partially successful	
Research			
Extension of the opportunities for financing research and technological development	Partially successful	Highly successful	
Identification of research priorities	Partially successful	Partially successful	

Table 9: Gap analysis of Core Objective 2 and its sub-objectives and supporting actions

Core Objective 2. Assuring the availability to consumers of products that are healthy, safe and of good quality, as well as promoting high animal health and welfare standards			
	Majority stakeholder perception	Authors' perception	GAP
Sub-objectives			
Offering the maximum level of consumer protection in terms of product safety and quality	Partially successful	Partially/Highly successful	
Reduction of the incidence of farmed animal diseases	Partially successful	Partially successful	
Prevention in transmission of diseases to and from wild stocks	Partially successful	Partially successful	
Actions regarding the welfare of farmed fish, and the risks associated with harmful algal blooms	Partially successful	Partially successful	
Supporting Actions			
Safety of aquaculture products			
Development of Community legislation on food hygiene	Partially successful	Partially successful	
Provisions for dioxin residues	No perception	Highly successful	
Provisions for antibiotic residues	No perception	Partially successful	
More research on and control of toxic algal blooms	No perception	Partially unsuccessful	
More research on aquatic animal diseases	Partially successful	Partially successful	
Regular updating and simplifying of aquatic animal health legislation	No perception	Partially successful	
Modification of the veterinary pharmaceutical legislation	No perception	Partially unsuccessful	
Initiatives to improve farmed fish welfare			
Improve farmed fish welfare	Partially successful	Partially successful	

Table 10: Gap analysis of Core Objective 3 and its sub-objectives and supporting actions

Core Objective 3. Ensuring an environmentally sound industry	Majority stakeholder perception	Authors' perception	GAP
Sub-objectives			
Actions to reduce the negative environmental impacts of aquaculture	Partially successful	Partially successful	
Developments on norms and/or voluntary agreements which prevent environment degradation	Partially successful	Partially successful	
Public financial incentives for use in aquaculture developments with positive contributions to the environment	Partially successful	Partially successful	
Actions for enhancing the knowledge base of the industry	Partially successful	Partially successful	
Public financing and promotion of private initiatives in research and technological development	Partially successful	Partially successful	
Supporting Actions			
Environmental aspects			
Mitigation of the impact of wastes	Partially successful	Partially successful	
Management of the demand for wild fish for on-growing	No perception	Partially unsuccessful	
Development of instruments to tackle the impact of escapees	No perception	Neutral	
Development of instruments to tackle the impact of alien species	No perception	Neutral	
Development of instruments to tackle the impact of GMOs	No perception	Neutral	
Development of integrated pollution prevention and control methods	Partially successful	Neutral	
Development of specific criteria and guidelines for aquaculture Environmental Impact Assessments	Partially successful	Partially unsuccessful	
Measures to strengthen the positive impact of extensive culture and re-stocking	No perception	Partially unsuccessful	
Research on solutions for the predation from protected wild species	No perception	Highly unsuccessful	

2.2. Highest gaps in the CORE OBJECTIVES of the strategy

As shown in Section 1.2, significant gaps were identified in sub-objectives of the first core objective of the strategy, which was to increase employment in aquaculture by between 8,000 and 10,000 full-time job equivalents over the period 2003-2008. The sub-objectives were to promote market development and to increase the Union’s production growth rate to 4% per year.

Data on the employment in the European aquaculture sector are not easily available. Two study report commissioned by the Commission provide some compiled data:

- MacAllister, Elliot and Partners (1999) estimated that in 1997, there were 54.029 full time equivalent jobs in the 15 Member States. They predicted that this would rise to 67.000 in 2005.
- Framian (2009a) estimates that in 2006, 16.561 companies in the 27 Member States employed 63.700 full time equivalents.

So if the employment data from those countries that were not Member States in 1997 is added to the 1997 MS figure, it becomes clear that the first core objective of the 2002 strategy to increase employment by 8.000 to 10.000 over the period 2003 to 2008 was not achieved.

For each of the sub-objectives, a short summary table is provided that shows the gap.

Table 11 Highest gaps in CORE OBJECTIVES.

CORE OBJECTIVES
Promoting market development
Increasing the Union’s aquaculture production growth rate to 4 % per year

2.2.1. Promoting market development

	Success in implementing objective					
	Highly Unsuccessful	Partially Unsuccessful	Neutral	Partially Successful	Highly Successful	Unable to provide perception
Stakeholders						
Objective review						

Promoting market development for the products of European aquaculture is an enormous challenge to the production sector. There are evident structural differences (often species-dependent) that have developed. Salmon production has consolidated leading to the existence of multinational and large companies, often vertically integrated. The use of salmon in processing and ready-to-eat/cook preparations has been successful. On the other hand, trout and carp producers are smaller in scale and have had difficulty in responding to these changes in consumer preferences. Seabass and seabream products have so far been rarely used in added-value preparations. Consequently, while diversification for market

development has been successful for salmon, it has proved much more problematic for trout, carp, seabass and seabream – the other major species produced in European fish farming. Shellfish, which are mainly sold fresh, are less subject to these developments, though vacuum packed mussels and clams are becoming important products.

Alongside this position, the shift of imported fish and seafood from 40% of supplies to over 60% reflects a growing market for fisheries & aquaculture products, but with a strong tendency towards cheaper products. This situation has provided severe price competition for European producers. Consequently, recent years have seen a decline in trout and carp production (freshwater) and two major upheavals (2001/2 and 2007-9) in the seabass/seabream sector, where (lower) pricing has been the only mechanism used to promote market development.

BOX 3: The 2001/2002 sea bream sea bass price crisis

The 2001/2002 Price Crises

“After a period of relatively stable pricing during the late 1990s and 2000, over the period January 2001 to March 2002, prices for bass and bream (300-450g, Greek fish in Italy) fell from €5.75 and €5/kg to around €3.75 and €2.75/kg respectively, and this fall was reflected for other fish in other countries.

The fundamental cause of the price crisis was an imbalance between supply and demand caused by rapidly rising production especially in Greece without proper planning, market support or promotion. The situation was exacerbated by the intrinsic seasonality of bass and bream production, which naturally tends to result in the largest volumes being harvested in the autumn when demand is falling. Over production appears to have been a major factor, especially of bream in Greece and Spain.

The impact of the crisis was to reduce profitability and in many cases cause losses. Many smaller farmers were either taken over or subsequently went out of business, and larger companies have assumed greater prominence in the selling of fish.”

University of Stirling Report to the European Commission, 2004.

As the consumer increasingly turns to fillets and added-value ready-to-eat/cook options, using the MRS as the prime source of purchase, the traditional (trout, carp, shellfish) and newer (seabass, seabream) sectors have yet to succeed significantly in responding to these changes.

Geographically and structurally different, the smaller farms are either focusing on local micro-markets or are looking to consolidate sales with other players. In some cases, the options appear limited by the characteristics of the species reared, where the consumer does not know how to prepare the fish or it is too small in size for processing (cf. salmon).

Further developments will be needed (e.g. fish biological profile, automation of processing) for these options to be progressed, in a competitive manner (cf. import pricing), so as to allow better development of the markets for European aquaculture products.

BOX 4: The case of salmon

Salmon market development

Salmon – available as fillets from larger fish (e.g. >3-4 kg individual size) – can be presented raw, slightly or fully smoked, boiled etc. in the MRS. It is also used in multiple added-value preparations. Marks & Spencer have more than 120 products which use salmon as an ingredient (including salads, sandwiches, ready-to-eat/cook preparations) which, when compared to other aquaculture products (mussels, seabass, trout, carp), demonstrates the adaptability of this product. A similar observation can be made for the HORECA (hotel, restaurant and catering) sector, where salmon is the most regular component of the fish menu throughout Europe.

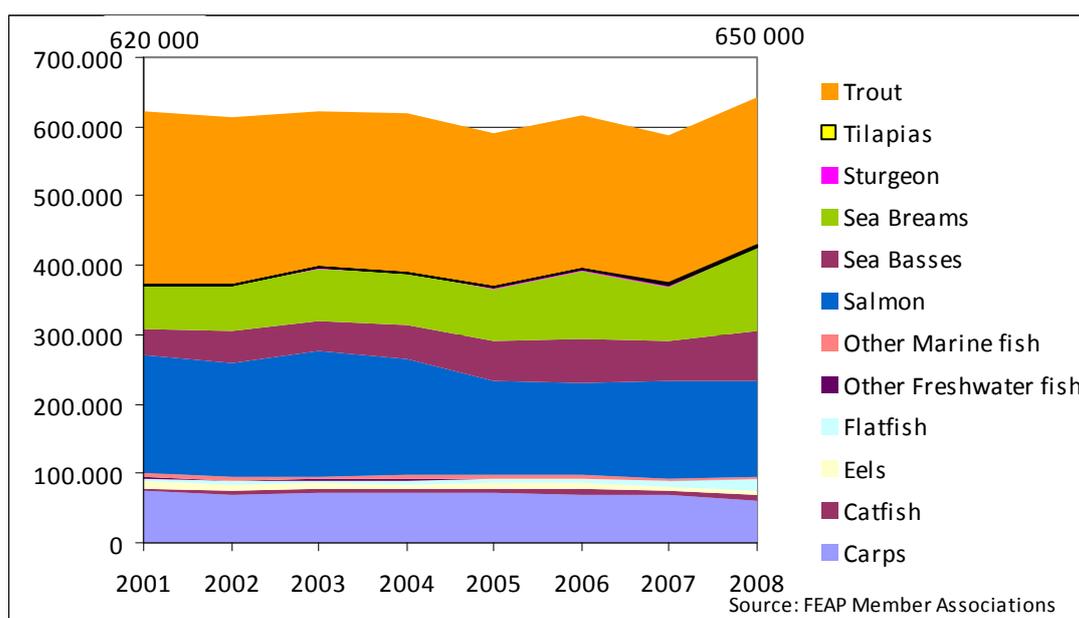
2.2.2. Increasing the Union’s aquaculture production growth rate to 4 % per year

	Success in implementing objective					
	Highly Unsuccessful	Partially Unsuccessful	Neutral	Partially Successful	Highly Successful	Unable to provide perception
Stakeholders						
Objective review						

Despite the fact that aquaculture is *perceived* by the stakeholder respondents to have grown since 2002, the facts show that it has not.

Increasing the growth rate of European fish farming at 4%/year would mean that, since 2002, when production was some 615 thousand tonnes, European fish farming should have reached 780 thousand tonnes by 2008. The FEAP Member Associations reported production of 642 thousand tons (representing an APR of 0.5%). Evidently, the growth rate foreseen in strategy has not been achieved.

Figure 3. EU finfish aquaculture production 2001 to 2008.



Furthermore, from the figures between 2001 and 2008, a decreasing trend has been seen for carps (-2.9% APR), eels (-5%), salmon (-2.7%) and trout (-2.1%); with the exception of eels, the total for carp-salmon-trout equalled 80% of European fish farming in 2001. Growth has been seen for catfish (8.7%), turbot (19%), seabass (8.7%) and seabream (9.7%).

Consequently, with the exceptions of Greece (+9.4% APR(seabass/seabream)) and Spain (+4.1% APR (seabass/seabream/turbot)) **most European Member States actually saw their fish farming activities diminish between 2001 and 2008** as opposed to experiencing growth.

This is shown in the following table.

Table 12: FEAP data on aquaculture production from 2001 to 2008

PRODUCTION (tons)	YEAR								
GROUP	2001	2002	2003	2004	2005	2006	2007	2008	APR
Carps	74.371	70.522	71.078	70.854	71.158	70.516	67.891	60.684	-2,9%
Catfish	4.071	3.756	5.458	5.512	6.436	6.857	7.788	7.285	8,7%
Eels	10.082	8.993	8.679	8.268	8.805	7.790	5.320	7.030	-5,0%
Flatfish	4.829	5.630	5.107	6.046	5.860	7.274	7.493	16.407	19,1%
Other Freshwater fish	420	496	528	481	539	350	514	551	4,0%
Other Marine fish	6.988	4.895	3.737	8.103	6.231	6.315	2.770	2.888	-11,9%
Salmon	169.212	165.224	180.544	164.774	135.740	130.137	142.770	139.585	-2,7%
Sea Basses	39.046	44.951	45.230	50.029	56.706	65.736	55.625	69.939	8,7%
Sea Breams	63.124	67.386	75.640	74.172	75.172	95.999	79.897	120.566	9,7%
Sturgeon	595	600	630	675	2.142	2.597	2.077	2.227	20,7%
Tilapias	150	150	450	450	700	750	1.150	1.150	33,8%
Trout	248.001	241.859	224.733	229.315	220.837	222.485	214.183	214.067	-2,1%
Grand Total	620.889	614.462	621.814	618.678	590.326	616.805	587.477	642.378	0,5%

PRODUCTION (tons)	YEAR								
COUNTRY	2001	2002	2003	2004	2005	2006	2007	2008	APR
AUSTRIA	2.308	2.229	2.148	2.410	2.543	2.632	2.632	2.632	1,9%
BELG.-LUXBG.	1.520	1.200	1.200	1.200	1.200	1.200	1.200	1.200	-3,3%
CYPRUS	1.790	1.861	2.090	3.515	3.598	3.582	3.425	4.000	12,2%
CZECH REPUBLIK	18.660	17.946	18.337	18.798	19.892	18.870	19.803	19.621	0,7%
DENMARK	40.100	39.800	35.550	36.000	36.610	37.760	37.870	36.870	-1,2%
FINLAND	15.492	14.894	12.201	12.335	13.693	14.000	11.000	12.000	-3,6%
FRANCE	59.155	55.300	49.470	51.010	48.770	50.655	49.194	40.776	-5,2%
GERMANY	36.150	36.000	36.000	34.750	35.106	35.106	35.106	35.106	-0,4%
GREECE	66.550	73.500	78.500	79.500	83.600	100.000	72.000	125.000	9,4%
HUNGARY	17.733	18.408	17.735	17.735	17.837	17.697	15.114	15.114	-2,3%
IRELAND	24.213	24.173	19.340	15.421	13.220	11.607	13.060	12.020	-9,5%
ITALY	62.900	60.100	56.900	59.100	59.845	60.705	59.700	62.475	-0,1%
MALTA	1.235	1.116	1.000	913	931	931	931	931	-4,0%
NETHERLANDS	6.700	6.400	8.275	8.475	9.650	9.300	8.640	8.640	3,7%
POLAND	34.310	30.750	33.760	33.431	33.241	38.831	37.451	36.451	0,9%
PORTUGAL	4.940	5.040	6.040	6.040	6.040	5.040	5.040	5.040	0,3%
SPAIN	54.620	57.200	57.514	62.668	56.835	66.154	61.959	72.226	4,1%
SWEDEN	7.254	6.084	6.506	6.828	6.922	6.922	6.922	6.922	-0,7%
UTD. KINGDOM	165.259	162.461	179.248	168.550	140.793	135.814	146.431	145.355	-1,8%
Grand Total	620.889	614.462	621.814	618.678	590.326	616.805	587.477	642.378	0,5%

When compared to the rest of Europe, the stagnation in growth becomes much more apparent, as shown by the following two figures.

Figure 4. European finfish aquaculture production 2001 to 2008.

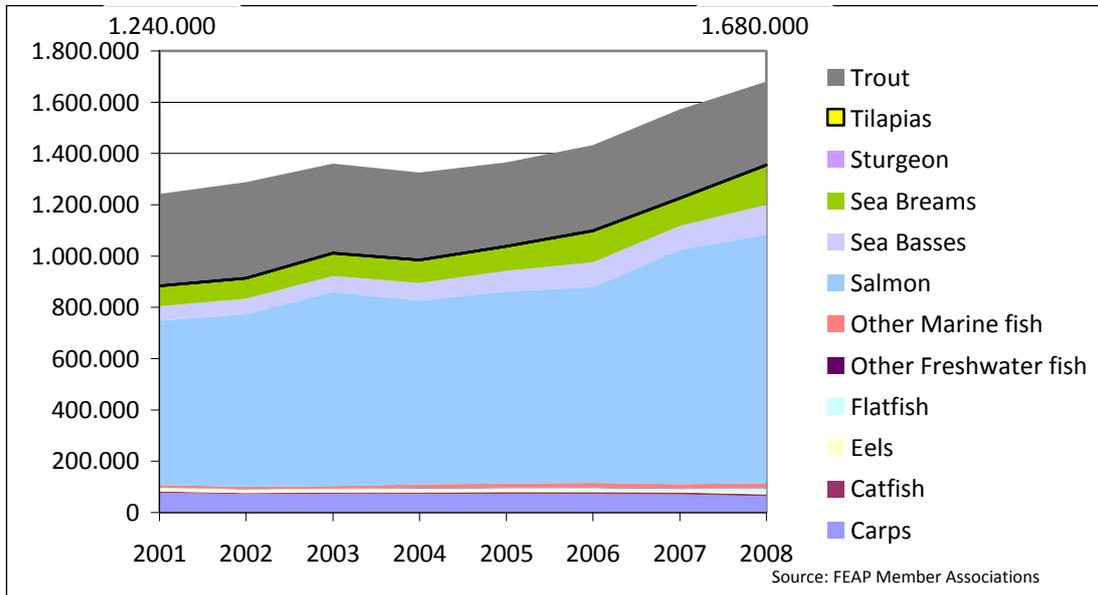
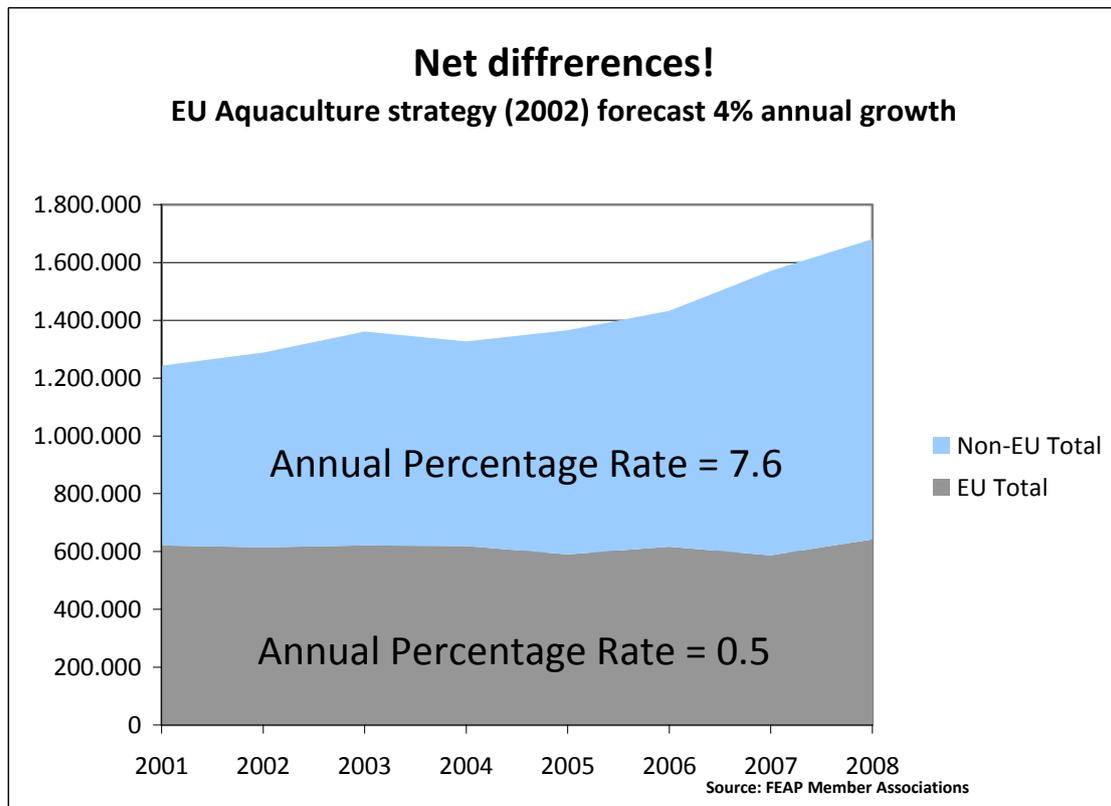
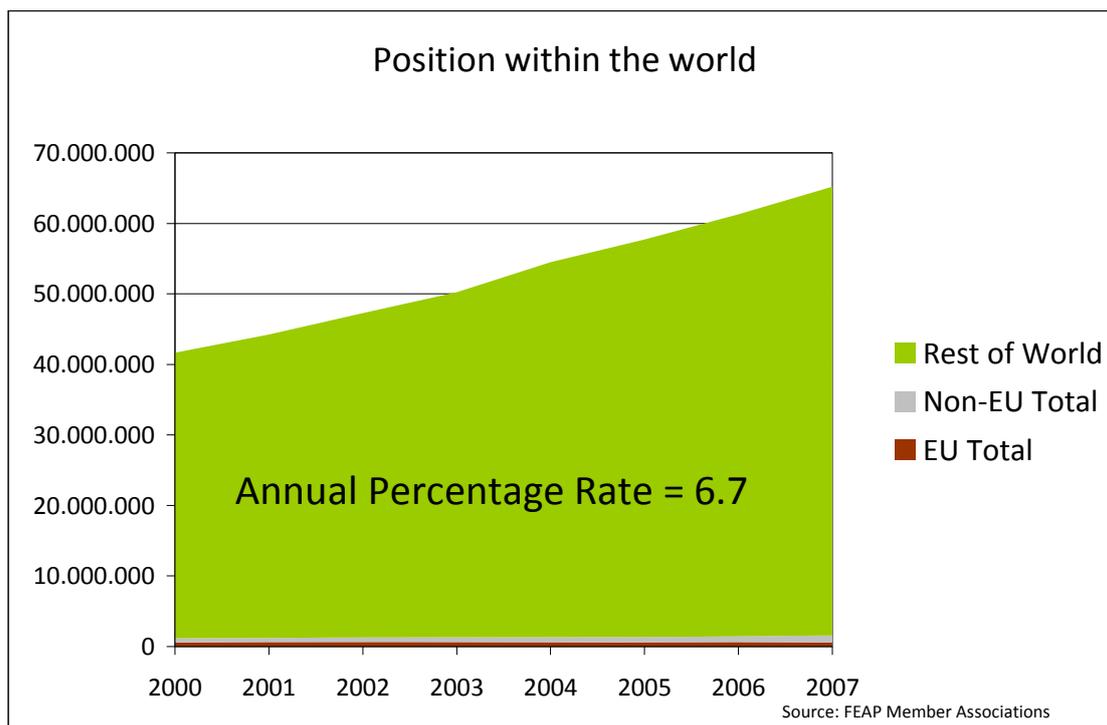


Figure 5. Total European finfish aquaculture production 2001 to 2008.



And finally, when compared to the global growth of the sector during that period. EU and European aquaculture remains practically insignificant.

Figure 6. Global aquaculture growth 2000 to 2007.



2.3. Highest gaps in the ACTIONS proposed in the strategy

The objective of this section is to show the basis of the objective assessment of the success of implementation of the actions (through legislative actions, research initiatives, ACFA outputs, outcomes of conferences/meetings/workshops...) and to suggest why there is a gap in perception between this assessment and the majority stakeholder perception.

This section therefore highlights and looks to explain the most significant gaps - these being the “red gaps” as shown in Table 9 and repeated here in this table.

Table 13 Highest gaps in ACTIONS.

Core Objective	ACTIONS
1	Develop closed water recirculating systems
1	Increase the use of official quality marks
1	Develop promotional campaigns
1	Develop new tools to gather statistical information on production and markets
3	Management of the demand for wild fish for on-growing
3	Development of specific criteria and guidelines for aquaculture Environmental Impact Assessments
3	Measures to strengthen the positive impact of extensive culture and re-stocking
3	Research on solutions for the predation from protected wild species

2.3.1. Develop closed water recirculating aquaculture systems (RAS)

	Success in implementing action					
	Highly Unsuccessful	Partially Unsuccessful	Neutral	Partially Successful	Highly Successful	Unable to provide perception
Stakeholders						
Objective review						

RAS covers a whole host of aquaculture production systems, in which water may be recirculated and treated to varying levels. There are four broad categories of RAS¹²:

Hatchery/ juveniles for food-fish production:

- Increasing use in salmonid hatcheries/smolt units for accelerated and/ or off-season smolt production - (remains a small proportion of production)
- Increased use in sea bass, seabream, cod and turbot hatcheries for fingerling production due to potentially better biosecurity and environmental and growth control
- Use for warm water species (e.g. tilapia, catfish, barramundi, shrimp)

Hatchery/ juvenile systems represent much lower proportion of overall costs than grow-out recirculating aquaculture systems and therefore offer greater economic scope for robust 'over-engineering'. Approximately 400 million juveniles were produced from European recirculated aquaculture systems in 2005 (Sturrock et al, 2008).

Food fish grow-out:

- Trout is the largest grow-out application, driven by stricter environmental regulations and freshwater resource constraints; Market concentration is driving greater standardisation e.g. in Denmark. Partial recirculation systems for trout are more common in other countries with fewer environmental restrictions.
- Most eel, African catfish, much turbot, sturgeon and all tilapia in Europe is produced in RAS
- 1 or 2 projects on European sea bass in recirculated systems (still in early commercial phase)
- Small-scale RAS for other niche warm-water species: barramundi, shrimp, tilapia, as well as temperate species e.g. Arctic charr (See Little et al, 2008).

Integrated systems:

- Aquaponics – integrating recirculated aquaculture with hydroponic plant culture to remove nutrients (Divers, 2006)
- Integrated multi-trophic systems using recirculated water with a fed-fish unit and two or more secondary species such as bivalves and seaweeds for waste and nutrient removal (Ridler et al, 2007, Brzeski & Newkirk, 1997)
- Integrated aquaculture and industrial processes – mainly for energy conservation

¹² See Sturrock et al, 2008 for further description and analysis

Ornamental production

- High value species, low density, small scale operation corresponds with simpler design requirements and lower capital costs.
- Standardised products due to large size of the hobby market

Of these four system types, in spite of their potential merits, integrated recirculation systems that have proved most difficult to develop and operate commercially. This is mainly due to differing production cycles for each component, differing production quantities and complexities of marketing and technical issues in ensuring reliable production.

Food fish grow-out has also proved highly challenging, mainly due to higher investment and operating costs than comparable cage or pond culture systems. This can also be compounded by the higher technology and management risk inherent in novel systems. The economics improve for high value species, or those that can be cultured at very high densities (such as African catfish) giving greater output per unit of production capacity. In Lifecycle Assessment studies, RAS compared favourably to flow-through for trout farming, with much reduced environmental impact, but higher energy requirements (D'Orbcastel, 2009). This confirmed earlier work by Aubin et al (2006) which found impacts associated with energy consumption to be most significant for turbot culture in RAS.

The estimated total food-fish production from European recirculated aquaculture systems in 2005 was under 20,000 tonnes (Sturrock et al, 2008) and includes barramundi (Asian seabass) and (Mediterranean) sea bass production in UK; tilapia production in Belgium and shrimp production in the Netherlands.

Probably the single biggest issue related to RAS production of food fish is the value of product versus the costs of production (investment and operating). It would appear from the figure above that private investors are not yet fully convinced to move towards RAS. Recent examples of RAS companies going into receivership do not improve the view on this activity within the current investment climate.

Community research (FP6) had a limited content of projects concerning RAS development, although RAS was an important component of several important EU actions previously mentioned in this report and including the development of sustainability indicators (CONSENSUS); the development of welfare indicators (WEALTH¹³); the identification of research priorities (PROFET and PROFET Policy).

Five FP6 projects that directly impact RAS are:

- SUSTAINAQ: Sustainable aquaculture production through the use of recirculation systems
- AQUAETREAT: Improvement and innovation of aquaculture effluent treatment Technology
- INTELFISHTANK: Development of an intelligent fish tank for cost effective aquaculture through control of water quality in each different fish tank.
- FISHTANKRECIRC: Development of electro-coagulation technique for optimal cleaning efficiency and maximum reuse of water in land based fish farming

¹³ Welfare and health in sustainable aquaculture. <http://wealth.imr.no/>

- GRRAS: Towards Elimination of Growth Retardation in Marine Recirculating Aquaculture Systems for Turbot

The SUSTAINAQ project www.sustainaqua.org aims to ensure that aquaculture products are environmentally sound, sustainable and, above all, safe for human consumption and is nearing completion.

Its focus is on RAS and, more specifically, to make the European freshwater aquaculture sector industry more competitive by helping farmers diversify their production, increase product quality, and improve production methods. The project revolves around five different case studies made in Denmark, Hungary, the Netherlands, Poland and Switzerland. In these studies, the project consortium develops and researches different options for diversifying the product range next to the fish production.

While this and the other research projects cited before should provide useful results and case studies that can be applied directly to the sector, it only addresses some of the many aspects of RAS. The table overleaf gives a summary SWOT analysis of the RAS sector in Europe.

The gap between the stakeholder perception (partially successful) of the implementation, of the 2002 action and author perception (partially unsuccessful) may be explained by:

- Framing of the survey question: phrasing aggregated juvenile production in RAS and grow-out RAS – yet the former have proved much more robust due to quick stock turnover, demand and higher product price.
- Minimal funded and published peer reviewed research on the broader sectoral performance of RAS or advanced technology development. Instead new projects/companies are typically reported as good news stories in the media/ trade-press with no equivalent exposure of high and recurrent failure levels.
- Despite high profile investments, which may have influenced stakeholder perceptions, production from RAS remains a very minor proportion of European aquaculture production
- RAS supply sector is still highly fragmented with little reliable performance data to guide new and potential users of the technology.

Table 14 SWOT for food-fish grow-out in Recirculating Aquaculture Systems (RAS)

Strengths	Weaknesses	Opportunities	Threats
Green traits (compared to flow-through systems) exploitable in marketing mix e.g. ability to produce concentrated wastes, potential for re-use of low-grade waste heat energy, low water consumption, enhanced biosecurity...	In most cases higher capital and operation cost (due to the need for oxygen, water pumping, temperature control etc) compared with cage or flow-through systems, making these systems very price sensitive.	Strategic location away from traditional concentrations in restricted coastal areas and near target markets/ processing centres, in environmentally sensitive areas or where energy costs are low.	Higher unit production costs - sector particularly vulnerable to fluctuations in feed and energy costs and general market volatility.
Potential to diversify into novel warm-water (alien) species	Despite biosecurity benefits - overall, insurance risk for recirculated systems is higher; associated with risk of mechanical failure.	Economics likely to become more compelling as local supplies of fresh fish become scarcer.	Consumer acceptance not well tested, systems generally not accepted for organic production, mainly due to level of intensification (some exceptions for juvenile production systems).
Potential for strategic location associated with lower water requirements and small physical footprint for intensive systems	Off-flavours taints – probably THE key quality issue associated with RAS grow-out.	Some evidence of consolidation - exploiting more sustainable scale-economies and possibly indicative of greater emerging confidence in the technology.	
	As yet relatively small and fragmented EU RAS sector resulting in low standardisation of RAS systems and high capital costs underpinning profitability.	Potential to offer a ‘smorgasbord’ of higher value species targeting smaller niche markets.	
		Highly standardised grow-out environments increase potential for profitable development of breeding lines.	

RAS addresses several key environmental policy issues such as low food-miles, minimal water consumption and reduced nutrient waste discharge. However, further Life Cycle Analysis is required to provide the best and most equitable comparison with other production methods. Sustainability analysis (e.g. LCA) may still show it to be better to import from tropical countries; nonetheless additional issues (including carbon footprint, CO₂ emissions/kg meat produced) may have an increasing effect on this aspect.

Political and ethical issues may also require further examination, with respect to its potential for improving domestic (European) food (fish) security; for reducing pressure on wild fish stocks and with regard to fish health and welfare. There are also ethical questions to be raised about importing food fish from countries that have (growing) domestic food poverty.

There is considerable scope for standardisation and efficient combination of existing technology as an immediate route to sectoral advancement. This can be best achieved through empirical comparative studies between existing systems and/ or action research with individual producers. The basis for a standard to enable performance comparisons between biofiltration systems has been proposed (Drennanii et al, 2006).

2.3.2. Increase the use of official quality marks

	Success in implementing action					
	Highly Unsuccessful	Partially Unsuccessful	Neutral	Partially Successful	Highly Successful	Unable to provide perception
Stakeholders						
Objective review						

The 2002 Strategy for the Sustainable Development of European Aquaculture (COM (2002) 511 final) had proposed to increase the use of official quality marks as tools for market development, marketing and consumers information on aquaculture products. Consumer confidence in products is to a large extent dependent on both perceived product quality and available information about the product. In this respect, appropriate and well-designed labelling is generally accepted to be an important tool. The 2002 Strategy recommended European aquaculture producers to take advantage of the possibilities offered by the EU schemes for product marketing and use the official quality marks available. Furthermore, FIFG covered the possibility to finance the cost of quality certification.

In 1992 the European Union had introduced a system of official certified labels to guarantee to consumers that certain products met a certain quality standard. Its objectives were to encourage diverse agricultural production and to help consumers by giving them information concerning the specific character of the products. At present there are over 700 products available, although not many in capture fishery products and very few in aquaculture, which carry at least one of the four EU official quality labels: Protected Designation of Origin, Protected Geographical Indication, Traditional Specialty Guaranteed, and Organic. These schemes were the cornerstones of European food quality policy.



It should be reminded that when the EU certifies a certain product to a quality standard, it does not mean that it tastes better, is more healthful, or lives up to a certain culinary expectation. It means that it has fulfilled the requirements of authenticity, that is, the product came from where it says it came from, was produced in the traditional method, or complied with organic production methods.

Protected Designation of Origin (PDO).

The most stringent of the labels, the PDO label is used on a product that is certified as having taken place in a specific geographical area. The product must be exclusive to the

region that is designated and the raw materials used to create the product must also be from the defined area. An example of PDO is “Mexillón de Galicia”, which covers aquaculture mussels produced in the Spanish region of Galicia.

Protected Geographical Indication (PGI).

Some products are also associated strongly to a geographic area, but not all the ingredients may come from that region. These products may carry the less stringent label of PGI. An example of a PGI in the fishery sector is “Arbroath Smokies”, Scottish whole haddock smoked at high temperature, the heads and innards of which are removed in Arbroath according to an ancient method.

TSG - Traditional Speciality Guaranteed.

The least stringent of the three and not used in fishery products, TSG labels certify that the product has been made with a long standing traditional method but is not linked to any specific geography.

Organic production.

Organic production represents an overall system of farm management and food production that combines best environmental practices, a high level of biodiversity, the preservation of natural resources, the application of high animal welfare standards and a production method in line with the preference of certain consumers for products produced using natural substances and processes. Its regulation on aquaculture products at an EU level is very recent.

While no stand-alone European quality mark for aquaculture has been implemented to date, organic production is unquestionably the widest used label in aquaculture. Nonetheless, this is not in itself a quality mark, since it reflects a philosophy and a production process. Neither PDOs, PGIs nor TSGs are especially suitable for aquaculture products because geographical differences in this industry do not render such product differences as management practices can do. Besides this, another reason for the very low success of official quality marks in aquaculture is the wide range of quality certification schemes already operating in the EU, in a number that continues to increase: retailer schemes, B2B (business to business) schemes, private quality schemes and NGO eco-labels, etc.

The review suggests that the implementation of the official quality marks has been partially unsuccessful rather than partially successful, as stakeholders see them. The reason for this gap is the large degree of confusion around certification schemes and quality marks. It is quite reasonable to assume that stakeholders are unaware of the differences between official quality marks and private or NGO quality marks, which could explain this difference.

The 2009 Strategy places almost no emphasis on the use of official quality marks. However, it does consider that EU producers should position their products on the market as high value products based on their environmental performance, high health standards and traceability. The Commission recommends voluntary labelling and certification schemes that could strengthen consumer confidence and improve the position of aquaculture products that meet rigorous quality standards. One should also remember that it is not easy to label fresh fish, packing being required for an information label.

Organic certification

EU regulation of organic agricultural production has been in existence for some time, and was specifically addressed to aquaculture in 2007¹⁴. In 2008, the Commission adopted detailed rules to implement the 2007 legislation and considered that further elaboration of detailed rules on organic aquaculture should be made, the details of which were provided in August 2009.

This also explains the 'partially unsuccessful' rating concluded by the review, where it has taken seven years to bring this issue to fruition.

While private schemes exist and organic farmed fish are produced and sold, there is a general consensus by European producers that organic aquaculture is not expected to develop to a higher level than covering niche markets.

Ecolabels

In April 2009, the European Parliament passed a resolution of the proposal for a regulation of the Parliament and the Council on a Community Ecolabel scheme. It covered exploration of the feasibility of establishing reliable criteria covering environmental performance during the whole life cycle of such products, including the products of fishing and aquaculture and paying special attention to the impact of any ecolabel criteria on food and feed products, as well as unprocessed agricultural products (lying within the scope of Regulation (EC) No 834/2007).

A European ecolabel for aquaculture could be an efficient instrument to assure consumers about the responsible practices of European aquaculture producers. European authorities are deeply involved in improving the environmental and energy performance of products sold within the EU, adopting a life-cycle approach in production, promoting the emergence of 'green' pricing and better informing consumers. They also acknowledge that sustainable production and consumption are among the drivers for achieving the objectives under both the Sustainable Development Strategy of the EU and the Lisbon Strategy.

Changing unsustainable consumption and production patterns is fundamental in moving towards more sustainable development and consumers need appropriate information to help them understand the environmental impact of consumption and become familiar with eco-design, eco-production and eco-consumption solutions, which will enable them to make better informed choices.

However, a **European ecolabel should not compete with organic certification schemes, as they have different principles and objectives** and care would be needed to prevent consumer's confusion with terminology and names. The distinction of definitions - between 'organic', 'ecological' and 'environmental' - within the different languages of the European Union is unclear and contributes to such confusion.

¹⁴ Council Regulation (EC) No 834/2007 on organic production and labelling of organic products.

2.3.3. Develop promotional campaigns

	Success in implementing action					
	Highly Unsuccessful	Partially Unsuccessful	Neutral	Partially Successful	Highly Successful	Unable to provide perception
Stakeholders						
Objective review						

Non-corporate promotional campaigns have generally been for the provision of generic information on the sector’s products or to promote quality schemes (e.g. ‘Crianza del Mar’ in Spain). However, when the spend on such promotional actions was made by the Associative or Representative structures, the projection of a National image (e.g. French aquaculture) or a generic product (e.g. trout) would be the objective. Evidently, the achievement of a campaign depends on the will and financial capacity of the representative structures to achieve such actions.

A major change has emerged with the profile of the professional sector. For example, the European salmon (UK/Ireland) and seabass/seabream (Greece/Spain) sectors contain more large and/or multinational companies. Their prime interest is to promote their own [branded] products.

Furthermore, the decreasing profitability of other sectors (carp, trout) has meant that less sectoral money is available for co-financing. With the move towards MRS as the main outlet for retail sales, options as to the benefit of a promotion campaign vs. direct marketing actions (e.g. discount pricing) have to be assessed, as have the benefits of such campaigns more generally, with an analysis (increased sales, profitability etc.) on the results of such investments. Such is the market power of the MRS that benefits to producer investment may be very uncertain, though the argument also needs to be considered that sector performance could be more negative without such promotions.

Nonetheless, the restriction of marketing activities to national issues ignores the extensive intra-EU trade of much of European aquaculture. Major target markets include France, Italy, Spain and Germany (albeit for different products) yet promotional activities (outside of trade fairs) of EU producers in these markets are rare, if not inexistent.

This position is due partly to the absence of a European budget for European actions, given that both the FIFG and EFF have been designed for full subsidiarity, in line with National action plans for development and expenditure. Trans-national promotion within Europe has not been a priority for market development by Member States, nor by the structuring for expenditure foreseen for the EFF. Mechanisms to overcome what is seen by the profession as an urgent requirement (i.e trans-national promotion) require close examination.

2.3.4. *Develop new tools to gather statistical information on production and markets*

	Success in implementing action					
	Highly Unsuccessful	Partially Unsuccessful	Neutral	Partially Successful	Highly Successful	Unable to provide perception
Stakeholders						
Objective review						

One of the strange absences in the information age has been this topic; in other words. the development of tools for access to real-time data on production and markets. Aside from some private initiatives (access to auction information or the Norwegian Kontali market reports), there is little availability or access to such information. In part, this also reflects the consolidation of buyers and the dominance of the MRS in the retail sector (where buying prices are not published).

In 2008, the European Commission published a report on the CFP, reporting aquaculture production data for 2005 and 2006, noting that the FEAP provides informal data on production, prices and forecasts within the current year. Market information (on trade) can be obtained through Eurostat and Intrastat, but very few SMEs (if any) use these tools.

In addition, while recognising that such information is important, there has been a reluctance to pay for such information. Consequently, in Europe, no new tools have been developed to provide up-to-date information on production and markets.

In July 2008, Regulation (EC) No 762/2008 on aquaculture statistics was adopted by the European Parliament and the Council. It requires Member States to collect and submit data on annual production (volume and value), annual input to capture-based aquaculture, annual production of hatcheries and nurseries and data on the structure of the aquaculture sector. This Regulation (which repeals and replaces the former Regulation (EC) No 788/96) not only significantly extends the scope of data to be monitored, compared to the previous regulation, it also potentially provides additional guarantees regarding data quality.

Following the adoption in February 2008 of a Regulation establishing an EU framework for the collection, management and use of data in the fisheries sector and support for scientific advice regarding the CFP (Regulation (EC) No 2008/199), this new regulation was extended to cover additional data concerning the marine aquaculture industry. The Commission implementing Regulation ((EC) No 665/2008) was adopted in July 2008 and provides for the collection of the following economic variables: income, personnel costs, energy costs, raw material costs, investment, employment and number of enterprises.

Regular reports/studies and analyses of both production and markets are needed by all components of the European aquaculture sector, since this would assist planning and decision-making at all levels (producer, processors, decision-makers, policy-makers...). To this end, two additional initiatives have been undertaken:

- A study report (Framian, 2009) carried out for the Commission to identify the data required to assess the economic trends and performance of the EU-27 aquaculture sector and the best mechanisms for collecting this data. The main recommendations arising from the Framian report can be summarised as being:
 - That maximum efficiency and effectiveness of an on-going data collection scheme can be only achieved if the future intended data use is well defined,

which will also allow a precise formulation of the objectives of the scheme as well as prioritization of the indicators to be collected or estimated.

- A significant level of heterogeneity still exists within the defined segments of aquaculture firms (based on species and on-growing technology), caused by differences in size and by the level of vertical integration, e.g. own production or acquisition of juveniles. Therefore it is recommended to define the 'field of observation', including suitable thresholds and focus the on-going data collection on it. Additional criteria could be also applied, e.g. with focus on species or size. Data on segments which fall outside the field of observation can be collected in ad hoc surveys to be carried out according to specific needs less frequently. Average segment data should be based on at least five firms, none of which should represent more than a specified percentage of the total production value.
- In addition to the definition of the field of observation it is recommended to prioritize the indicators to be collected. Data on high priority indicators (turnover, personnel costs, total operational costs, employment) should be collected annually. Data on lower priority indicators (details on composition to operational costs and capital costs) could be collected only once in several years in ad hoc surveys, whilst estimation procedures should be developed to generate this data information whenever needed.
- Co-operation of the aquaculture industry is indispensable for several reasons: a/ to obtain access to the data, b/ to justify the additional administrative costs which the data collection will imply for the surveyed firms and c/ to promote the legitimacy of analysis based on that data, so that the results are not disputed or discredited as being based on biased information. Therefore the objective of the data collection scheme as well as certain details of the implementation (prioritization of indicators) should be developed in dialogue with the industry.
- As the number of firms in new areas of aquaculture in individual countries is very low, it is recommended to pool the data of the anonymous individual companies from several Member States to calculate averages at EU level. This approach is likely to produce a lower relative standard error and data confidentiality will be easier to guarantee.
- Collection of the aquaculture data should be executed by organizations already involved in compilation of statistical data scientific analysis in comparable areas, such as agriculture or fishing. This approach will have several important advantages: a/ proximity of data collection and analysis allows a better interpretation of the quantitative results due to precise knowledge of strengths and weaknesses of the data, b/ the link between analysis and data collection will be beneficial for prioritization and implementation of ad hoc studies on specific new aquaculture activities and/or detailed indicators as proposed above, including various estimation procedures.
- The concept of developing a [professional] observatory to achieve these tasks has also been put forward and has been supported by the sector. The second initiative is a current (August 2009) DG MARE tender (MARE/2009/06) for the development of just such an observatory. The objectives of the observatory will be to collect, harmonize, analyse and disseminate economic data on the European market for fisheries and aquaculture products. The observatory will then help public policy decision makers, industry actors from first sale to retail level and research bodies to

improve their knowledge of the markets and it will become part of the Common Organisation of the Market (COM). This is seen as a pilot initiative at present and is due to run for a 4 year initial period.

The combination of the above-mentioned Regulations and these two initiatives should provide a very strong base for the sector to plan production related to market conditions and to provide a benchmark for performance.

Although the review rated this action of the 2002 strategy as being highly unsuccessful, it now appears that strong moves are being made to rectify this position.

2.3.5. Management of the demand for wild fish for on-growing

	Success in implementing action					
	Highly Unsuccessful	Partially Unsuccessful	Neutral	Partially Successful	Highly Successful	Unable to provide perception
Stakeholders						
Objective review						

The wild fish species that are used in European aquaculture are primarily eels and tuna. Since both of these are fished, controls are enacted under the rules of the Common Fisheries Policy.

Eels

There are 2 slightly different concepts to be considered since the European eel arrive as juveniles (glass eels) which are considered to be a highly-prized delicacy by some (e.g. Spain, France, Portugal) and are fished as such. On the other hand, migrating adults, which leave freshwater for the sea, are fished at river exits. For eel aquaculture, it is the low availability and hence high price of glass eels that is the main issue, particularly since a significant part of the catch is now exported live to China for on-growing – then re-imported as frozen eel for the EU market. The European eel population is considered to be in danger and in September 2007, the Council of the European Union adopted in 2007 the Council Regulation (EC) No. 1100/2007 of 18 September 2007 establishing measures for the recovery of the stock of European eel, where EU Member States were to deliver national eel management plans before the end of 2008.

The principal objective of each MS Eel Management Plan is to reduce anthropogenic mortalities to permit, with high probability, the escape to the sea of at least 40 % of the silver eel biomass relative to the best estimate of escapement that would have existed without anthropogenic impacts. Member States that had not submitted plans by 31 December 2008 would require either to reduce fishing effort by at least 50 % relative to the average effort deployed from 2004 to 2006 or reduce fishing effort to ensure a reduction in eel catches by at least 50 % relative to the average catch from 2004 to 2006, either by shortening the fishing season for eel or by other means.

In the Netherlands, 40% escapement implies 4,000-6,000 tonnes of silver eel and the current annual escapement level is about 400 tonnes. The Dutch plan (NLV, 2008) proposes:

- Reduction of eel mortality at pumping stations and other water works
- Reduction of eel mortality at hydro-electric stations

- Establishment of fishery-free zones in areas that are important for eel migration
- Release of eel caught at sea and at inland waters by anglers
- Ban on recreational fishery in coastal areas using professional gear
- Closed season for all professional eel fishery from 1 September-31 October
- Stop the issue of licences for eel snigglers by the minister of LNV
- Restocking of glass eel and pre-grown eel from aquaculture
- Research into the artificial propagation of eel.

Similar constraints on mortality, on fishing and restocking from aquaculture are likely to be the principal measures proposed by other Member States.

Tuna

The European Commission has applied strict catch regulations on blue-fin tuna due to overfishing activities. A portion of the European catch, as juvenile tuna, may be ongrown to market size in farms – almost exclusively for the export market to Japan. Strict quotas on catches and (especially) control mechanisms on movements may well reduce the farming activity in the foreseeable future.

In February 2009, the Commission made various proposals for a multi-annual recovery plan for bluefin tuna in the Eastern Atlantic and Mediterranean¹⁵, including detailed requirements for fishing plans, fishing capacity and technical measures and farming and fattening capacity measures. Concerning the latter, the capacity of a Member State would be limited to the ICCAT record of farming facilities or authorised and declared to ICCAT as of 1 July 2008 and each farming or fattening Member State would establish a management plan of farming and fattening capacity over 2010-2013 for submission to the Commission by 15 August 2009. However, in September, 2009, Member States did not give their support to a Commission proposal to temporarily ban international trade of Atlantic bluefin tuna under the Convention on International Trade in Endangered Species (CITES) at their convention meeting in Recife, Brazil in November.

The FP7 research project SELFDOTT¹⁶ proposes to implement knowledge already obtained on the artificial control of reproduction of the Atlantic bluefin tuna (BFT), *Thunnus thynnus*, to obtain viable eggs, and study embryonic and larval development for the production of juveniles. The project is also developing suitable and environmentally performing feeds for the growout of BFT, thus reducing or eliminating the practice of raw fish importation and feeding by the fattening industry. In July, 2009, SELFDOTT partners in Spain successfully spawned more than 200 million BFT eggs, and hatcheries based in France, Spain, Malta, Crete and Israel are all now concentrating on the developing larvae. The excess eggs were released into the sea off the Spanish coast and this is the first time that living tuna eggs have been returned to the sea from breeding fish in captivity.

Evidently, the plans for both species will require long term efforts and support for development if they are to succeed,

¹⁵ COM(2009)93. Proposal for a Council Regulation concerning a multi-annual recovery plan for bluefin tuna in the Eastern Atlantic and Mediterranean

¹⁶ SELFDOTT. From capture based to self-sustained aquaculture and domestication of bluefin tuna, *Thunnus thynnus*. Summary at http://cordis.europa.eu/fetch?CALLER=FP7_PROJ_EN&ACTION=D&RCN=88440

2.3.6. Development of specific criteria and guidelines for aquaculture Environmental Impact Assessments

	Success in implementing action					
	Highly Unsuccessful	Partially Unsuccessful	Neutral	Partially Successful	Highly Successful	Unable to provide perception
Stakeholders						
Objective review						

The main environmental impact legislation from the EU is EC Directive 97/11/EC (amending 87/337/EEC) published on 3 March 1997 (EU, 1997)¹⁷. This applies generally to all activities that may impact upon the environment and is considered appropriate for application of an Environmental Impact Assessment. Here aquaculture is designated an “Article 4” activity which is subject to environmental criteria within Annex III of the amended Directive.

These criteria are based on project characteristics, project location, and potential impacts of the project. Within each of these features specific issues should be addressed. For example the ‘potential impacts’ feature should take into consideration - the extent, the transfrontier nature, the magnitude and complexity, probability of effect, and duration and frequency of the impacts caused by the development.

This legislation forms the basis for the information contained in Environmental Impact Assessment as implemented in local and national legislation for European countries.

Bates (2001) of the EC Directorate General XIV Fisheries, highlighted that there was “no single master plan for aquaculture...at EU level”. He also commented on the local rather than EU level implementation of EIA legislation for aquaculture.

The EU Strategy for the Sustainable Development of Aquaculture (2002), mentions the need for EIA in terms of quality of receiving waters but states that only the feasibility of developing specific criteria and guidelines to undertake EIAs for aquaculture, will be addressed (page 20, paragraph 1 of the strategy), but makes no specific mention of the EC EIA Directives.

Over the past 12 years the requirements for an EIA, on the basis of the EC 97/11/EC, have been incorporated into individual country or local legislation through normal implementation plans. This varies between countries and even between localities within a country, i.e. in Spain, the different Autonomous Regions have requirements which match or may supersede federal legislation. Therefore, the EIA requirements may vary with locality.

Further environmental legislative requirements may also be imposed upon activity developers. Thus, in the UK, or more specifically Scotland, the EC legislation is implemented as part of the Planning Legislation (Planning Permission and permit) under the auspices of the Local Planning Authority. Here, an EIA is required as part of the planning application. However, fish farmers are also required obtain a discharge consent from the Scottish Environment Protection Agency (SEPA), which is independent of the Local Planning Authority. While using information gathered during production of the EIA, granting

¹⁷ EU (1997) Council Directive 97/11/EC of 3 March 1997 amending Directive 85/337/EEC on the assessment of certain public and private project on the environment. Official Journal No. L 073, 14/03/1997 P. 0005.

discharge consent also requires an independent assessment based on different environmental requirements for baseline survey and monitoring.

These factors may in part explain the perceived differences between the stakeholders and the review in the effectiveness of the EIA part of EU Strategy, as highlighted in the table. Implementation of these Directives in national legislation may have given stakeholders the perception that such implementation was the result of the EU Strategy.

A recent review by the Commission confirmed the considerable variation and also observed a number of issues in implementation amongst Member States (European Commission 2009c – COM(2009)378) which included the considerable variation in the extent to which Member States carried out EIAs; inconsistencies in the approach to and the quality of EIAs, including in the environmental standards applied, the consideration given to the results of consultations and the quality of information requested and gathered; and different approaches applied to screening (for example the mandatory requirement for certain types of project).

The Commission also noted that although all but one Member State had implemented Directive 2003/35/EC, aimed at increasing public participation in the EIA process, but that there is still no standard practice for this.

The **need for improved EIA procedures** is recognized in both the 2002 Strategy and the 2009 revised Strategy, which goes some way to suggesting areas that require attention, as well as recommendations on how to proceed. One such area is quality control. The COM(2009) 378 study concluded that EIA standards (which are not laid down in the Directives but set by individual countries within their regulatory framework), and the content and quality of the Environment Statements are highly variable between Member States. A recent study into the quality of Environmental Statements for marine fish farming in Scotland¹⁸ concluded that though they were generally of satisfactory standard they were variable in content and quality, due to the differential requirements from “screening” by statutory bodies and the EIA scoping process. The report concludes that a standard template-based EIA procedure should be adopted for marine fish farming in Scotland. Detailed suggested templates are given. This approach, while still under consideration and consultation in Scotland, may be considered more widely in a European context, taking any Council legislation into account. It would also both standardise and streamline the environmental impact assessment process.

A recurring theme within the overall licensing issue is the sheer number of licences and task requirements to obtain these in order to open and operate an aquaculture farm. While this is seen as a burden for many existing operators, it also acts to discourage new investors to enter the sector. The concept of a ‘one-stop shop’ for the licensing of aquaculture entities has been proposed previously by the profession as a means of simplifying this aspect.

¹⁸ RSP Group PLC (2007) Environmental Impact Assessment Practical Guidelines Toolkit for Marine Fish Farming. A report to the Scottish Aquaculture Research Forum. Report No. SARF024. 112 pp. Available at: <http://www.sarf.org.uk/downloads.html>.

2.3.7. Measures to strengthen the positive impact of extensive culture and re-stocking

	Success in implementing action					
	Highly Unsuccessful	Partially Unsuccessful	Neutral	Partially Successful	Highly Successful	Unable to provide perception
Stakeholders						
Objective review						

The majority of stakeholders were unable to provide a perception on the success of the 2002 strategy with regard to these issues. This can be interpreted simply as meaning that they have no knowledge on which to base or form an opinion.

Extensive aquaculture in freshwater (often referred to as 'Pond Aquaculture') is Europe's oldest form of aquaculture, going back to mediaeval times in central and eastern European countries. Traditional production of carp in these countries gave rise to harvests for festive periods (Easter and, predominantly, Christmas/New Year).

The 2002 strategy recognised that fact that **sustainable aquaculture can help to improve environmental protection and restoration in many ways and that extensive systems are also a very good way of exploiting the natural resources of the water bodies**. However, it also recognised the ensuing limit on productivity and hence the need for public financial support in its development.

The use of labels of origin and of organic labels (for example for carp produced in Hungary and the Czech Republic) has increased over recent years in an effort to add value to those species in the domestic market, but also for export (for example, to Germany).

Arguments concerning the ecosystem services of Pond aquaculture were presented to the Commission at its **European Aquaculture and its opportunities for development Conference**, held in Brussels in November 2007. This noted that pond farming is not just about producing fish and organisms but provides 8 services:

- Production – e.g. efficient production using natural food and solar energy, ideal for organic production
- Ecosystem – creation of habitats
- Environment – waste water treatment, grow plants for energy production
- Employment – creates employment especially in rural areas
- Recreational Fishing, Tourism – angling, hunting, etc
- Water Management – fish ponds retain water and serve as buffers during dry periods, they also improve soil and atmospheric moisture
- Shaping landscapes – and can attract tourists
- Preserves Tradition – sites can be used for education, promote artisanal craftsmanship.

The key question is who should pay for these services? The farmers? Society? It should be noted that many of the larger farms are close to or within Natura 2000 sites.

Pond aquaculture producers generally agree on the need to communicate the non-food contribution of pond aquaculture production, where the emphasis is not necessarily to increase production, but to provide a better contribution to rural livelihood.

The review of rated the achievement of actions to promote this form of aquaculture as being partially unsuccessful. This reflects the reduced production levels and the unresolved and rising impact of predators on fish stocks.

Since the publication of the original strategy, the CONSENSUS initiative produced a brochure for European consumers that communicated the benefits of extensive aquaculture and of restocking – notably of trout and of sturgeon, and underlining the strong potential conservation of endangered species through management of their biological reproductive cycle.

In 2007, the Commission funded the SEACASE project www.seacase.org (finishing in January 2010). This does not focus on freshwater extensive aquaculture, but on the coastal equivalents, addressing the development of effective tools for maintenance of competitiveness, productivity, profitability and thus sustainability of extensive and semi-intensive aquaculture production in Southern Europe. The project is based on case studies in Portugal, Spain, France, Italy and Greece where, apart from technological improvements to production, the contribution to the preservation of wetlands and coastal areas of particular ecological interest is also an important feature.

This potential for aquaculture to play a positive role in environmental management is gradually receiving more attention globally, mostly as a result of research into Integrated Multi-Trophic Aquaculture (IMTA) systems. IMTA has borne out of an attempt to negate some of the negative impacts of mono-culturing species, particularly fish species, which contribute significant nutrients to aquatic systems. The method ensures complimentary species are being grown together for the benefit of profitability, of environmental impact reduction and social acceptance.

IMTA systems can be described as culture systems that use species from different trophic levels grown in combination within the same water body or through some other water-based linkage (for land-based systems). Scale does not necessarily have to be large, provided the layout of the species being grown and the quantities being grown are compatible. In all cases water is the nutrient transport vector for dissolved and particulate wastes, the releases from one species acting as food for other species at a lower trophic level. The combination of species from different trophic groups creates a synergistic relationship which, in turn, acts as a bioremediation measure. In a perfect IMTA system the processing of biological and chemical wastes by other species would make the whole production cycle environmentally neutral.

There is potential to apply the concepts of IMTA more widely to include other activities within a water area that contribute or abstract nutrients and organic matter, such as the EC funded PAPUSSA project (<http://www.papussa.org/>) which examined aquatic peri-urban freshwater systems in Southeast Asia. There is also considerable interest in growing agricultural crops in freshwater aquaculture waste - aquaponics - for both economic advantage and environmental mitigation. This is still in a very early phase. In principle the environmental benefits of using an IMTA or aquaponics system should allow the resulting aquaculture produce to be eco-labelled for enhanced marketability.

2.3.8. Research on solutions for the predation from protected wild species

	Success in implementing action					
	Highly Unsuccessful	Partially Unsuccessful	Neutral	Partially Successful	Highly Successful	Unable to provide perception
Stakeholders						
Objective review						

The problems of protected wildlife predating on aquaculture species remains a serious issue for many producers.

For many aquaculture producers, predation by birds (notably cormorants and herons) is a major problem and can give rise to significant stock losses (consumption and/or damage to live stocks through wounding).

In looking for solutions to this issue, the original strategy indicated “Predation by protected species. The Commission considers that **the relevant public authorities should investigate methods to protect fish farms from wild predators**. Under Article 9 of Council Directive 79/409/EEC31 Member States can take measures to limit the impact of protected bird species in order to prevent serious damage to fisheries and water and for the protection of flora and fauna.”

Europe-wide – Cormorant predation in Pond aquaculture systems

The prime issue in this case is that of the Great Cormorant. The main issues arise from this bird being migratory and its voracity for fish in areas that it crosses. The losses to aquaculture and inland fisheries are enormous (estimated at over 80,000 tons/year), although there is considerable debate as to the exact numbers of the European population. 2 European projects have examined this issue (Intercafe¹⁹ and Redcafe [finished 2002]). The European Parliament made a Resolution (A6-0434/2008 / P6-TA-PROV(2008)0583) recommending the development of a Pan-European Management Plan but subsidiarity considerations indicate that this will be difficult to achieve. The Commission has since communicated that it does not consider a Pan-European Management Plan to be effective. For extensive pond farms, fisheries lakes and those farms that are affected by the migration routes, this issue remains as a very severe problem. The large ponds that are typical of this sector cannot be covered by protective netting and face extensive losses each year. In many cases, the situation is further complicated by the existence of Natura 2000 sites in close proximity.

Consequently, no practical progress has been made since the publication of the strategy in 2002 (apart from the realisation of the COST research action INTERCAFE). The profession has requested, as a matter of urgency, that this problem be reviewed and that an appropriate action plan be developed rapidly.

UK – Eider duck predation on mussel farms

The last published research found was based on work conducted between 1996 and 1999 by the University of Glasgow and funded by the UK Natural Environment Research Council. Losses were typically 10-30% of stock between 1992 and 1996. Since then some

¹⁹ “Interdisciplinary Initiative to Reduce pan-European Cormorant-Fisheries Conflicts” – A COST action – see <http://www.intercafeproject.net/>

companies have continued to test and develop at least partial solutions. Most effective have been net panels as a physical barrier to the ducks, supplemented with various scaring techniques. One of the most effective of these being to occasionally chase the birds by speedboat but more frequently to play recordings of engine noise as a scare mechanism (Ross & Furness, 2000). Recent trials with sacrificial diversion mussel beds have also proved quite successful and are welcomed as a positive measure for eider duck protection (Anon, 2005). However, shooting remains in use at some sites where other measures have failed and is subject to license.

In some areas, oyster catchers can be a more significant problem than eider ducks, whilst golden eye duck and herring gulls can also be responsible for some losses.

UK – Seal predation on salmon farms

Salmon farms have mainly been protected through a combination of scare mechanisms, physical barriers (anti-predator nets) and licensed shooting. A full survey of the status of seal populations in the UK in 2008 noted “Very little research has been directed specifically at the interaction between seals and fin fish farms. This has been recognised as a problem for some time in terms of the damage caused to cages and fish, but also in terms of secondary effects because of salmon escaping from cages and mixing with local wild populations.

More recently, however, the potential effects of methods used to control seals around fin fish farms, involving acoustic deterrent devices (ADDs) and/or shooting seals in the vicinity of farm cages, have been increasingly viewed as a concern. This is partly because of potential effects of ADDs on other marine mammals and partly because the decline of common seals has focussed attention on ways in which it may be possible to reduce unnecessary killing of seals by man.... Although there is a lot of experience within the fin fish farming industry of operating different methods to deter and control seals there has been no systematic assessment of (1) the relative scale of the problem in different fin fish farms in relation to geographical location or fish farm characteristics (cage design, rearing regime); or (2) mitigation methods used to control seals” (Special Committee on Seals, 2008).

Whilst Scottish salmon farms are accused of unnecessary shooting of seals by some conservation groups, the Scottish Government has confirmed that the decline in the common seal population is more likely related to competition with grey seals and predation by killer whales in the Northern Isles (Scottish Parliament, 2009). The re-location of seal colonies outside of the breeding season is the measure most supported by conservation groups (Seal Protection Action Group, 2009) although the success of this strategy has been questioned where it has been practiced in Tasmania (Kirkwood et al, 2006 & TheFishSite, 2008).

For most of the time, predation is a background issue for the aquaculture industry. Its impact is often site-specific and generally chronic rather than acute. Even in the case of protected predatory species where there is high conservation interest, the issue gains little publicity or research funding and hence many in the sector feel unable to provide an opinion on whether there has been any change in status due to policy measures. The review concludes that there has been no substantive progress on the issue and that the policy has therefore been unsuccessful.

3. RECOMMENDATIONS TO THE COMMITTEE ON FISHERIES

This report has highlighted the objectives, sub-objectives and supporting actions of the 2002 strategy that were considered as being unsuccessful – either by stakeholder perception, or by the authors' appraisal. Some of these actions have also been recognised by the Commission in its COM(2009) 162 aquaculture strategy and further actions have been proposed to give new impetus to the original strategy's objectives.

This section brings together the unsuccessful actions of the 2002 strategy and compares them to the new actions proposed by the Commission.

The table below shows those components of the 2002 strategy that were considered by stakeholders as being unsuccessfully implemented, combined with the unsuccessful actions identified by the authors in their gap analysis. To ease comparison, the section headings are consistent with those of the new Communication of the Commission.

For each action, recommendations are made in the light of those actions that have been addressed in this new Communication, as well as those actions that were considered but not included in the Communication, and which figure in Annex III of the Commission's Impact Assessment for the 2009 strategy (European Commission 2009a).

Most unsuccessful actions of the 2002 strategy (presented in order of the sections of the 2009 Communication COM(2009) 162)

PROMOTING COMPETITIVENESS OF EU AQUACULTURE PRODUCTION

Measures to strengthen the positive impact of extensive culture and re-stocking

Incorporate future aquaculture developments in Integrated Zone Strategies and Management Plans

Increase the use of official quality marks

Develop promotional campaigns

Create specific common definitions and norms for "environment friendly" aquaculture

Create specific common definitions and norms for organic aquaculture

ESTABLISHING CONDITIONS FOR SUSTAINABLE GROWTH OF AQUACULTURE

Develop closed water recirculating systems

IMPROVING THE SECTOR'S IMAGE AND GOVERNANCE

Improve the image of the industry

Develop new tools to gather statistical information on production and markets

Several actions considered to have been unsuccessfully implemented in the 2002 strategy are not included in the 2009 Communication. These include: develop offshore fish cage technology; management of the demand for wild fish for on-growing; development of specific criteria and guidelines for aquaculture Environmental Impact Assessments and research on solutions for the predation from protected wild species. Recommendations are also provided for some of these actions.

3.1. PROMOTING COMPETITIVENESS OF EU AQUACULTURE PRODUCTION

In Section 3 of the 2009 Communication, the Commission addresses 3 main issues, aquaculture being an equal competitor in terms of space, enabling professional aquaculture to cope with market demands and RTD for the development of the sector.

3.1.1. *Research and technological development*

2002 action: Measures to strengthen the positive impact of extensive culture and restocking.

2009 proposed action: The Commission invites Member States to recognise the importance of extensive and traditional forms of aquaculture and to consider possibilities of developing production in existing sites and facilities.

The most important elements for these issues – sited mainly in Central and Eastern Europe, but also in coastal areas – are seen as being:

- Protection from predation
- Recognition of the environmental contributions (water buffering/reserves)
- Contribution to maintenance of social traditions (cyprinid culture).

Restocking, for fisheries or for sport angling, remains an active component of much of freshwater aquaculture. More information is required on the efficiency of restocking proposals for endangered species (e.g. eel/tuna) and for increasing fisheries stocks (e.g. pikeperch). More work is required on realistic and economically productive diversification opportunities. Traditional aquaculture also plays an important role in many coastal areas and some practices, especially extensive systems and culture of bivalves and seaweeds are increasingly being appreciated at positive contributions to overall ecosystem health and environmental protection, as well as playing an important role in livelihoods. A better understanding of ecosystem processes should improve the quality of sustainable and integrated development in such areas.

RECOMMENDATIONS

- A measurement of the impact of restocking for conservation of endangered species and for sport angling is needed – for example in partnership with the Environmental ministries, Producer Associations, European Anglers Alliance, or other similar National bodies for the latter.
- Quantification of the benefits of the environmental services provided by extensive pond aquaculture farms in Central and Eastern Europe, based on case studies on representative operations is required. This should be carried out in partnership with government departments involved in the implementation of the Water Framework Directive, Natura 2000 and the Habitats Directives.
- The environmental benefits of some (new and traditional) aquaculture practices in coastal zones, especially where these help to mitigate the impacts of other activities including intensive aquaculture, also needs to be documented, and including how these benefits may be considered in an eco-labelling scheme.
- The issues concerning implementation of the Eel Management plan and its effectiveness need to be resolved
- The predation issues affecting extensive pond aquaculture need to be resolved

3.1.2. Equal competitor in terms of space

2002 action: Incorporate future aquaculture developments in Integrated Zone Strategies and Management Plans

2009 proposed actions:

The Commission

- Will continue its initiatives to promote the development of maritime spatial planning and Integrated Coastal Zone Management, as identified in the framework of the new EU Maritime Policy;
- Invites all Member States to develop marine spatial planning systems, in which they fully recognise the strategic importance of aquaculture. In this context, as part of the preparation of the next reform of the Common Fisheries Policy, the Commission will consider the possibility to strengthen the linkages between Community financial instruments and the issue of access to space for maritime activities, including aquaculture;
- Invites Member States to ensure that terrestrial land planning fully integrates the needs and values of freshwater aquaculture.

Maritime Spatial Planning has become an important component of the new European Maritime Policy and, by definition, will be included within ICZM. As referred to in many open consultations, the European marine aquaculture sector has requested its treatment as an equal rights user so as to be able to access sites for its continued operation and development. Fair treatment of aquaculture operators as an equal rights user needs to be assured.

Terrestrial land planning also needs to be followed, particularly in line with Environmental Impact Assessments, to assure that freshwater aquaculture is also treated on a fair basis – specifically in rural areas.

The licensing arrangements for freshwater aquaculture development are often criticised by the profession due to their number and the dispersion within different government/ministerial departments as well as those of local government (e.g. water discharge permits). This situation is seen as being extremely discouraging for new/young entrepreneurs who wish to enter the business. Section 3.4.3 addresses one aspect of this, notably Environmental Impact Assessment.

RECOMMENDATION

- Special workshops on marine and freshwater aquaculture (for example, as part of the series proposed within its Roadmap for Maritime Spatial Planning) – should be convened with the aim of providing clear information on the attributes of European aquaculture as a food production sector and as a tool for conservation of aquatic species or restocking of fish for recreational activities. These workshops should seek to provide clear guidance and recommendations for implementation purposes – notably on siting criteria.

3.1.3. Enabling the aquaculture business to cope with market demands

2002 actions:

- Increase the use of official quality marks
- Develop promotional campaigns
- Create specific common definitions and norms for “environment friendly” aquaculture
- Create specific common definitions and norms for organic aquaculture.

2009 proposed actions:

The Commission will review the market policy of fisheries and aquaculture products in 2009 and will

- Assess and address needs of the aquaculture sector, in particular regarding producer organisations, inter-professions, consumer information and marketing instruments such as labelling of aquatic food products, in the framework of the future reform of the market policy for fisheries and aquaculture products;
- Continue its work with Member States, the European Parliament and stakeholders to develop and promote standards (notably on organic aquaculture or on Eco-labelling Schemes);
- Continue its international cooperation on labelling and certification issues, notably with the FAO.

The availability of clearer and indisputable information on the nature of the products and their environmental performance is necessary to influence consumer demand and reduce consumers’ confusion on the proliferation of labels.

A unique and common aquaculture eco-label for the European Union is probably the best way forward, for both consumers and aquaculture producers, as well for all other stakeholders.

Traceability measures have been implemented throughout the production/processing chains but control at Member State level of the information available for distribution to the consumer (i.e. retail/catering sectors), so as to assure that such traceability/labelling efforts are respected, is paramount to the success of these efforts.

The promotion of “environment friendly” aquaculture, as for other activities, is essential for the protection of the climate, ecosystems and for human health, as well as for the preservation of natural resources. In order to develop such efforts, the European Union should provide itself with efficient and coherent instruments. A robust certification scheme must be supported by scientific evidence, using methods accepted widely across the scientific and technical community, and must be consistent with European legislation in order to provide a clear and uniform framework within the industry and provide a level playing field in which the European sector may operate.

RECOMMENDATIONS

- A certification scheme for “environment friendly” aquaculture is urgently required. This document could later be debated in wider consultation with stakeholders with a special effort to ensure adequate, fair and balanced participation of all relevant interested parties concerned. Clear rules must be set for accreditation and certification in order to make the system credible and transparent.
- Public authorities (European and Member States) should encourage and make institutional information campaigns to promote consumer acceptance of products bearing eco-labels. They should also consider introducing a framework for economic and fiscal incentives for the implementation of Eco-labels.
- Eco-label criteria should be included in calls for tender in green public procurement.
- Mechanisms for achieving trans-national promotion schemes, within the European Union, should be developed for inclusion within the financing possibilities of the EFF.

3.2. ESTABLISHING CONDITIONS FOR SUSTAINABLE GROWTH OF AQUACULTURE

In Section 4 of the 2009 Communication, the Commission addresses ensuring compatibility between aquaculture and the environment.

3.2.1. *Ensuring compatibility between aquaculture and the environment*

2002 action: Develop closed water recirculating systems

2009 proposed actions:

The Commission will

- Continue to emphasise the importance of environmentally sustainable development of aquaculture in its policies and actions;
- Continue to monitor developments in terms of escapees and if necessary, assess the added value of possible action at the EU level.

Comment: While not specifically addressing the further development of recirculating systems, the Commission puts the focus of the use of (existing) technologies for cleaning water by removing wastes and contaminants and the further development of new technologies to decrease effluents and their potential impact.

Nonetheless, the economic realities of closed water recirculating systems reflect higher investment and operating costs when compared to open systems and those used in 3rd countries providing competitive imports. This circumstance has severely inhibited development of such systems at the European and global levels.

RECOMMENDATIONS

- A sector analysis is required to determine current production levels and development priorities for land-based Recirculating Aquaculture Systems. Cost/benefit and life cycle analysis and the development of adequate incentives must be integral to such an approach.
- Support for the development and promotion of technical performance standards for comparing recirculated aquaculture systems is needed.

3.3. IMPROVING THE SECTOR'S IMAGE AND GOVERNANCE

In Section 5, the Commission addresses improving the image of the industry and ensuring an adequate monitoring of the aquaculture sector.

3.3.1. *Improve the image of the industry*

2002 action: Improve the image of the industry

2009 proposed actions:

The Commission

- Will assess the need to revise and to raise the profile of the aquaculture industry, and the possibilities to reinforce the role of aquaculture representatives;
- Will create a forum for dialogue between the European Aquaculture Technology and Innovation Platform, the Commission and Member States' research programme managers to facilitate the programming of research activities at Community and national level;
- Invites Member States to support pro-active public information initiatives from the aquaculture industry, in particular using the possibilities available in the European Fisheries Fund.

The authors support entirely the new actions proposed in the 2009 Communication with one major recommendation.

RECOMMENDATION

- A plan of action to improve and sustain the image of the aquaculture industry and its products, developed within a forum composed of the EP Fisheries Commission, the European Commission and stakeholders from the whole value chain, should be instigated as soon as possible. Concrete actions require to be planned and executed, avoiding overlap and conflicting messages.

3.3.2. *Ensuring an adequate monitoring of the aquaculture sector*

2002 action: Develop new tools to gather statistical information on production and markets

2009 proposed actions:

The Commission will

- Monitor the progress and evolution of this sector, in particular by way of the new statistics Regulation²⁰ and the new data collection framework;
- Actively participate internationally (most notably with the FAO) to further develop and collect global and harmonised indicators for this growing industry;
- Broaden its information-base regarding market prices. The Commission will put in place the necessary measures to establish a price monitoring system for fisheries and aquaculture products throughout the marketing chain.

²⁰ Regulation (EC)No 762/2008.

A regular report and analysis of both production and markets is needed by all components of the European aquaculture sector, since this would assist planning and decision-making at all levels (producer, processors, decision-makers, policy-makers...).

The Commission has itself commissioned a report (Framian 2009) on the usefulness of financial indicators for the aquaculture sector.

A proposal for the development of a pilot [professional] observatory to achieve these tasks has been made and is supported by the sector.

RECOMMENDATIONS

- The development of an observatory to report on production for all components of the aquaculture sector must be prioritised. This will provide a strong support to the active participation proposed by the Commission in developing harmonised (global) indicators on performance and will be essential for future policy development.
- Detailed measures to establish a price monitoring system for fisheries and aquaculture products throughout the value chain are required.

3.4. Actions NOT addressed in the 2009 strategy

While the 2009 strategy proposes other actions not directly linked to those of the original communication, the following actions of the 2002 strategy remain without be directly addressed:

- Development of offshore fish cage technology
- Management of the demand for wild fish for on-growing
- Development of specific criteria and guidelines for aquaculture Environmental Impact Assessments
- Research on solutions for the predation from protected wild species.

3.4.1. Development of offshore fish cage technology

RECOMMENDATIONS

- Examination of scenarios for successful implementation are urgently needed for the entry of different aquaculture players into offshore aquaculture production
 - These would include operational considerations such as financing, insurance, synergies, training....
 - Targeted study that assesses current technical advances allowing operational farming systems that optimise stock production in harsh marine conditions around the year while minimising risk to infrastructure and human operators should be made.
- Guidelines for the establishment, location (planning) and husbandry/logistics of offshore finfish and shellfish farms that can be used by farmers to develop appropriate codes of practice for their operations should be developed and integrated with the spatial planning mechanisms foreseen.

3.4.2. Management of the demand for wild fish for on-growing

RECOMMENDATIONS

- Assessment of the effectiveness of the Eel Management Plan should be made on a regular basis
- Clarification of the contributions and position of the tuna fattening/farming activity should be provided

3.4.3. Development of specific criteria and guidelines for aquaculture Environmental Impact Assessments

The 2009 strategy encourages “better implementation” of EU environmental legislation and proposes the development of guidance documents and workshops to facilitate implementation of its environmental policy. This review suggests that the principal objective of such an exercise should be to facilitate the obtaining or renewal of production licences and/or the facilitation of better area-based strategies, facilitating the strategic re-location of aquaculture sites to optimise use of environmental capacity, reduce any potentially negative interactions, and provide well founded options for further site access.

RECOMMENDATIONS

- As a matter of urgency, specific criteria and guidelines for the aquaculture sector on the interpretation and implementation of EU Directives related to Environmental Impact Assessments are required.
- Improvement of IT tools for the achievement of EIAs is necessary.
- Facilitation of the licensing procedures that would encourage access to new sites and facilitate long-term access to existing sites is required. This will encourage re-investment and medium-long term planning, while facilitating the entry of new players – particularly in those sectors where SME/family businesses operate.
- A conference bringing together the public authorities from Member States should be convened to present these guidelines and discuss case studies that show effective and rapid implementation of EU and national legislation.

3.4.4. Research on solutions for the predation from protected wild species

RECOMMENDATIONS

- European guidelines are required for Member State adoption on the legal interpretation of the Wild Birds and Habitats Directives (in particular as regards the operative words “no satisfactory alternative”, “not detrimental” and “serious damage”) – and as recommended in the parallel study report of EP 177 (Hedley and Huntingdon, 2009).
- The recommendations of the European Parliament regarding development of a coordinated population management plan and development of guidelines on good practice for prevention and mitigation of conflicts for bird predation should be promoted for adoption.

3.5. Summary of the recommendations

Equal competitor in terms of space

- Special workshops on marine and freshwater aquaculture (for example, as part of the series proposed within its Roadmap for Maritime Spatial Planning) – should be convened with the aim of providing clear information on the attributes of European aquaculture as a food production sector and as a tool for conservation of aquatic species or restocking of fish for recreational activities. These workshops should seek to provide clear guidance and recommendations for implementation purposes – notably on siting criteria.

Environmentally friendly aquaculture

- A certification scheme for “environment friendly” aquaculture is urgently required. This document could later be debated in wider consultation with stakeholders with a special effort to ensure adequate, fair and balanced participation of all relevant interested parties concerned. Clear rules must be set for accreditation and certification in order to make the system credible and transparent.
- Public authorities (European and Member States) should encourage and make institutional information campaigns to promote consumer acceptance of products bearing eco-labels. They should also consider introducing a framework for economic and fiscal incentives for the implementation of Eco-labels.
- Eco-label criteria should be included in calls for tender in green public procurement.
- Mechanisms for achieving trans-national promotion schemes, within the European Union, should be developed for inclusion within the financing possibilities of the EFF.

Environmental Impact Assessment

- As a matter of urgency, specific criteria and guidelines for the aquaculture sector on the interpretation and implementation of EU Directives related to Environmental Impact Assessments are required.
- Improvement of IT tools for the achievement of EIAs is necessary.
- Facilitation of the licensing procedures that would encourage access to new sites and facilitate long-term access to existing sites is required. This will encourage re-investment and medium-long term planning, while facilitating the entry of new players – particularly in those sectors where SME/family businesses operate.
- A conference bringing together the public authorities from Member States should be convened to present these guidelines and discuss case studies that show effective and rapid implementation of EU and national legislation.

Develop new technologies to decrease effluents and their impacts

- A sector analysis is required to determine current production levels and development priorities for land-based Recirculating Aquaculture Systems. Cost/benefit and life cycle analysis and the development of adequate incentives must be integral to such an approach.
- Support for the development and promotion of technical performance standards for comparing recirculated aquaculture systems is needed.

Improving the image of the aquaculture sector

- A plan of action to improve and sustain the image of the aquaculture industry and its products, developed within a forum composed of the EP Fisheries Commission, the European Commission and stakeholders from the whole value chain, should be instigated as soon as possible. Concrete actions require to be planned and executed, avoiding overlap and conflicting messages.
- A measurement of the impact of restocking for conservation of endangered species and for sport angling is needed – for example in partnership with the Environmental ministries, Producer Associations, European Anglers Alliance, or other similar National bodies for the latter.
- Quantification of the benefits of the environmental services provided by extensive pond aquaculture farms in Central and Eastern Europe, based on case studies on representative operations is required. This should be carried out in partnership with government departments involved in the implementation of the Water Framework Directive, Natura 2000 and the Habitats Directives.
- The environmental benefits of some (new and traditional) aquaculture practices in coastal zones, especially where these help to mitigate the impacts of other activities including intensive aquaculture, also needs to be documented, and including how these benefits may be considered in an eco-labelling scheme.

Ensuring adequate monitoring of the sector

- The development of an observatory to report on production for all components of the aquaculture sector is a priority for assurance of this aspect. This will provide a strong support to the active participation proposed by the Commission in developing harmonised (global) indicators on performance and will be essential for future policy development.
- Detailed measures on how to establish a price monitoring system for fisheries and aquaculture products throughout the value chain are required and could be an integral component of this observatory..

Development of offshore fish cage technology

- Examination of scenarios for successful implementation are urgently needed and would include operational considerations such as financing, insurance, synergies, training...
- An assessment of current technical advances allowing operational farming systems that optimise stock production in harsh marine conditions around the year while minimising risk to infrastructure and human operators should be made.
- Guidelines for the establishment, location and husbandry of offshore finfish and shellfish farms that can be used by farmers to develop appropriate codes of practice for their operations should be developed and integrated with the spatial planning mechanisms foreseen.

Management of the demand for wild fish for on-growing

- Regular assessment of the effectiveness of the Eel Management Plan is required.
- Clarification of the contributions and position of the tuna fattening/farming activity should be provided.

Solutions for the predation from protected wild species

- European guidelines are required for Member State adoption on the legal interpretation of the Wild Birds and Habitats Directives (in particular as regards the operative words “no satisfactory alternative”, “not detrimental” and “serious damage”) – and as recommended in the parallel study report of EP 177.
- The recommendations of the European Parliament regarding development of a coordinated population management plan and development of guidelines on good practice for prevention and mitigation of conflicts for bird predation should be adopted.

REFERENCES

- Aubin, J., Papatryphon, E., Vanderwerf, H., Petit, J., & Morvan, Y. (2006). Characterisation of the environmental impact of a turbot (*Scophthalmus maximus*) re-circulating production system using Life Cycle Assessment. *Aquaculture*, 261(4), 1259-1268.
- Bates, R (2001) EU requirements for aquaculture planning in the member states. CIHEAM - Options Mediterraneennes, pp 147-150.
- Brzeski, V., & Newkirk, G. (1997). Integrated coastal food production systems of current literature a review. *Ocean & Coastal Management*, 34(1), 55-71.
- Diver S (2006) Aquaponics – Integration of Hydroponics with Aquaculture. ATTRA, National Centre for Appropriate Technology, 28pp. <http://files.meetup.com/1031456/aquaponic.pdf>
- D'Orbcastel, E. R., Blancheton, J., & Aubin, J. (2009). Towards environmentally sustainable aquaculture: Comparison between two trout farming systems using Life Cycle Assessment. *Aquacultural Engineering*, 40(3), 113-119.
- Drennanii, D., Hosler, K., Francis, M., Weaver, D., Aneshansley, E., Beckman, G., et al. (2006). Standardized evaluation and rating of biofiltersII. Manufacturer's and user's perspective. *Aquacultural Engineering*, 34(3), 403-416.
- European Commission (2009), Communication from the Commission on Building a Sustainable Future for European Aquaculture – A New Impetus for the Strategy for the Sustainable Development of European Aquaculture, COM(2009) 162 final, Brussels.
- European Commission (2009a). Impact Assessment accompanying “Building a Sustainable Future for European Aquaculture – A New Impetus for the Strategy for the Sustainable Development of European Aquaculture”, SEC(2009) 453, Brussels.
- European Commission (2009b). Report of the Expert Meeting on Cormorants, 29 January 2009. Brussels. ec.europa.eu/fisheries/dialog/acfa_040309_annex2_en.pdf
- European Commission (2009c). Report from the Commission on the application and effectiveness of the EIA Directive (Directive 85/337/EEC, as amended by Directives 97/11/EC and 2003/35/EC). COM(2009) 378 final, Brussels, 23 July 2009
- European Commission (2009d). Report from the Commission on the application and effectiveness of the Directive on Strategic Environmental Assessment (Directive 2001/42/EC). COM(2009) 469 final, Brussels, 14 September 2009.
- European Commission (2008a). Communication from the Commission a “Roadmap for Maritime Spatial Planning: Achieving Common Principles in the EU”. COM (2008) 791 final, Brussels.
- European Commission (2008b). Communication from the Commission - Towards an EU strategy on invasive species. COM(2008) 789 final, Brussels.
- European Commission (2006). Communication from the Commission on a Community Action Plan on the Protection and Welfare of Animals 2006-2010, COM(2006) 13 final, Brussels.
- European Commission (2002). *Communication from the Commission on a Strategy for the Sustainable Development of European Aquaculture*, COM(2002) 511 final, Brussels.
- Framian (2009). DEFINITION OF DATA COLLECTION NEEDS FOR AQUACULTURE. Reference No. FISH/2006/15 - Lot 6. FINAL REPORT May 2009. Part 1. Review of the Aquaculture Sector and

results of the costs and earnings survey.

http://ec.europa.eu/fisheries/publications/studies/aquadata_part1_en.pdf

Gordon, J. & Northridge, S. (2002) Potential impacts of Acoustic Deterrent Devices on Scottish Marine Wildlife. Scottish Natural Heritage Commissioned Report F01AA404. <http://fp.ukecologic.free-online.co.uk/ecologicUK/SNHADDRReview.pdf>

Hedley, C and Huntingdon, T. (2009) Regulatory and Legal Constraints for European Aquaculture. European Parliament Study IP/B/PECH/IC/2008_177 (in press)

MacAllister, Elliot and Partners (1999). Forward Study of Community Aquaculture. European Commission Directorate General of Fisheries. <http://ec.europa.eu/fisheries/publications/studies/aquaculture.pdf>

Ministerie van Landbouw, Natuur en Voedselkwaliteit (2008). THE NETHERLANDS EEL MANAGEMENT PLAN. www.sportvisserijnederland.nl

Little, D., Murray, F., Azim, E., Leschen, W., Boyd, K., Watterson, A., et al. (2008). Options for producing a warm-water fish in the UK: limits to "Green Growth"? Trends in Food Science & Technology, 19(5), 255-264.

Quick NJ, Middlemas SJ & Armstrong JD (2004) A survey of antipredator controls at marine salmon farms in Scotland. Aquaculture 230, 169-180. http://www.seaturtle.org/PDF/Quick_2004_Aquaculture.pdf

Ridler, N., Wowchuk, M., Robinson, B., Barrington, K., Chopin, T., Robinson, S., et al. (2007). Integrated Multi - Trophic Aquaculture (IMTA): a Potential Strategic Choice for Farmers. Aquaculture Economics & Management, 11(1), 99-110.

Ross BP & Furness RW (2000) Minimising the impact of eider ducks on mussel farming. University of Glasgow. http://www.gla.ac.uk/media/media_19794_en.pdf

Special Committee on Seals (2008) Scientific Advice on Matters Related to the Management of Seal Populations: 2008. Natural Environmental Research Council. http://www.smru.st-andrews.ac.uk/documents/SCOS_2008_v1.pdf

Stirling University, Department of Marketing and the Institute of Aquaculture (2004). Study of the market for aquaculture produced seabass and seabream species. Report to the European Commission DG Fisheries. http://ec.europa.eu/fisheries/publications/studies/aquaculture_market_230404.pdf

Sturrock H, Newton R, Paffrath S, Bostock J, Muir J, Young J, Immink A & Dickson M. 2008 "Prospective Analysis of the Aquaculture Sector in the EU". Part 2: Characterisation of emerging aquaculture systems. EC Joint Research Centre, Institute for Prospective Technological Studies <http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=1740>

Tal, Y., Schreier, H., Sowers, K., Stubblefield, J., Place, A., Zohar, Y., et al. (2009). Environmentally sustainable land-based marine aquaculture. Aquaculture, 286(1-2), 28-35.

TheFishSite (2008) State to Pull Out of Seal Program. Internet article. <http://www.thefishsite.com/fishnews/6047/state-to-pull-out-of-seal-program>

Timmons MB, and Ebeling JE (2007) Recirculating Aquaculture. Cayuga Aqua Ventures, LLC (Ithaca, NY) 975pp.

Annex I. Respondents

Country	Organisation	Last name	First name
Belgium	Test-Achats	Remy	Robert
Belgium	Bureau Européen des Unions de Consommateurs	Veale	Ruth
Belgium	Federation of European Aquaculture Producers	Hough	Courtney
Belgium	European Aquaculture Society	Lane	Alistair
Belgium	INVE	Lavens	Patrick
Denmark	EUROFISH	Vandewalle	Gilles
Denmark	Biomar	Alsted	Niels
Denmark	Aquacircle	Heldbo	Jesper
France	French Government	Ferlin	Philippe
France	Comité National de Conchyliculture	Guillaumie	Bruno
France	IFREMER	Blancheton	Jean-Paul
France	INRA	Kaushik	Sadasivam
France	European Aquaculture Society	Harache	Yves
France	Comité National de Conchyliculture	Dinimant	Julie
Germany	AquaBiotech	Klein	Burkhard
Germany	TTZ Bremerhaven	Oberdieck	Alexandra
Germany	TNC Partners	Dallimore	John
Greece	Kepahlonian Fisheries	Barazi-Yeroulanos	Lara
Greece	PASTI	Chatziefstathiou	Michael
Greece	HCMR	Alexis	Maria
Hungary	National Association for Consumer Protection	Dömölki	Livia
Hungary	Ministry of Agriculture and Rural Development	Pinter	Karoly
Hungary	Fish Culture Research Institute (HAKI)	Varadi	Laszlo
Hungary	National Federation of Fish Breeders	Tölg	László
Ireland	Irish Farmers' Association	Flynn	Richie
Ireland	AquaTT	Murphy	David
Italy	University of Insubria	Saroglia	Marco
Italy	Agroittica	Pazzaglia	Matio
Italy	Friend of the Sea	Bray	Paolo
Italy	Istituto Sperimentale Italiano Lazzaro Spallanzani	Chavanne	Herve
Italy	University of Lecce	Zonno	Vincenzo
Netherlands	WUR	Van der MHEEN	Henk
Netherlands	Dutch Ministry of Agriculture, Nature and Food Quality	Rothuis	Arjo
Netherlands	European Fisheries and Aquaculture Research Organisations	van Hoof	Luc
Netherlands	WUR IMARES	Smaal	Aad C.
Norway	Skretting	Halseth	Viggo
Norway	NTNU	Neyts	Alexandra

Norway	AKVA Group	Molaug	Knut
Norway	Aqualine	RØNNINGEN	Noralf
Norway	SINTEF	Fredheim	Arne
Norway	Marine Harvevst	Lyngoy	Cato
Norway	Institute of Veterinary Science	Skjerdal	Taran
Norway	Institute of Marine Science	Oppedal	Frode
Norway	SINTEF	Reitan	Kjell Inge
Norway	University of Tromsø	Ellevoll	Edel
Norway	Institute of Marine Research	Svåsand	Terje
Norway	AquaOptima	Schei	Idar
Poland	Aller Aqua	Juchniewicz	Jacek
Portugal	University of the Algarve	Dinis	Maria Teresa
Portugal	University of the Algarve	Dias	Jorge
Portugal	DECO Portugues Consumer Association	Dias	Nuno
Portugal	IPIMAR	Nunes	Maria
Spain	AZTI	Mendiola	Diego
Spain	OCU Compra	Trigueros	Gemma
Spain	Grupo Tres Mares	Arregui	Luz
Spain	University of Madrid	Torrent	Fernando
Spain	APROMAR	Ojeda	Javier
Turkey	Turkish Federation of Aquaculture and Fisheries (SUFED)	Tosun	Beyhan
Turkey	Çanakkale Onsekiz Mart University	Murat	Yigit
UK	Food Certification Scotland	Gill	Martin
UK	International Fishmeal and Fish Oil Organisation	Jackson	Andrew
UK	Marine Conservation Society	Purchase	Dawn
UK	British Trout Association	Bassett	David
UK	Boris Nets Ltd	Fowler	Donald
UK	Scottish Association of Marine Sciences	Black	Kenny
UK	EWOS	Carr	Ian
UK	Seafood Choices Alliance	Siggs	Melanie
UK	European Aquaculture and Technology Innovation Platform	Ruscoe	Alison
UK	CEFAS	Hill	Barry
UK	Pharmaq	North	Ben
UK	Shellfish Association of Great Britain	Pickerell	Tom
UK	Scottish Salmon	Thomas	Phil
UK	GAA	Lee	Dan
UK	EWOS	MacDonald	Niall
UK	University of Stirling	Bostock	John

ANNEX II. Sector Survey Results

Annex II is available in electronic version on e-studies:

<http://www.europarl.europa.eu/studies>

DIRECTORATE-GENERAL FOR INTERNAL POLICIES

POLICY DEPARTMENT **B** STRUCTURAL AND COHESION POLICIES

Role

The Policy Departments are research units that provide specialised advice to committees, inter-parliamentary delegations and other parliamentary bodies.

Policy Areas

- Agriculture and Rural Development
- Culture and Education
- Fisheries
- Regional Development
- Transport and Tourism

Documents

Visit the European Parliament website: <http://www.europarl.europa.eu/studies>

PHOTO CREDIT: iStock International Inc., Photodisk, Phovoir

