



Fisheries- and Agro-Industrial Research

**ANALYSIS OF IMPACT VARIABLES
RESULTING FROM RESEARCH PROJECTS
IN THE FISHERIES AND AQUACULTURE DOMAIN
OF THE EUROPEAN COMMISSION'S FAIR
PROGRAMME
(1994-1998)**



Author: Gesche Pluem
Advisor: Jacques Fuchs

Period: Summer Stage 2003

DISCLAIMER

The views expressed in this report are purely those of its author and do not necessarily reflect the views or policies of the European Union (EU) or the governments it represents. They may not under any circumstances be regarded as stating an official position of the European Commission. The European Commission does not guarantee the source, originality, accuracy, completeness or reliability of any statement, information, data, finding, interpretation, advice, opinion or view presented.

The figures presented are by no means to be taken as guideline figures for future research projects. They solely represent the outcome of research projects funded under the FAIR programme.

CONTENTS

DISCLAIMER.....	2
1. INTRODUCTION.....	4
OBJECTIVE	5
2. APPROACH & METHODOLOGY	6
2.1. CLASSIFICATION.....	6
2.2. METHODOLOGY.....	8
<i>Step 1 - Updating Information</i>	8
<i>Step 2 - Compilation</i>	8
<i>Step 3 - Analysis</i>	9
<i>Most Frequently Encountered Discrepancies and Problems</i>	9
3. RESULTS	11
3.1. OVERVIEW	11
3.2. PUBLICATIONS IN PEER-REVIEWED JOURNALS	12
3.2.1. <i>Overview</i>	12
3.2.2. <i>Journals by Project Type</i>	14
3.2.3. <i>Journals by Scientific Area</i>	16
3.2.4. <i>Updates</i>	20
3.3. FAIR QUESTIONNAIRE.....	22
3.3.1. <i>Training</i>	22
3.3.2. <i>Protection of Intellectual Property Rights</i>	23
3.3.3. <i>Competitiveness, Support to Community Policies and Other Items</i>	23
4. CONCLUSIONS.....	25
DISCUSSION.....	27
ANNEX 1 – DOCUMENTS	30
FAIR QUESTIONNAIRE.....	30
EMAILS SENT TO EACH COORDINATOR.....	33
ANNEX 2 – ANALYSIS DETAILS.....	35
PROJECTS PENDING	35
PUBLICATIONS IN PEER-REVIEWED JOURNALS.....	39

1. INTRODUCTION

The potential of life science and biotechnology appears to be great in social and economic terms, being seemingly only preceded by information technology. Between 1994 and 1998, the European Union invested 11.879 M€ (excluding nuclear research, http://www.cordis.lu/en/src/f_002_en.htm) in research and technological development (RTD) activities to promote these sectors.

This report focuses on the FAIR programme, which was one of eighteen RTD programmes implemented in the period 1994 to 1998, also called the *Fourth Framework Programme* (FP4). The FAIR programme had an overall budget of 646,5 M€ (<http://europa.eu.int/comm/research/agro/agro3.html>). It was the continuation of the FP3 AIR, which stands for *Agro-Industrial Research*, with the inclusion of fisheries, hence the acronym FAIR. FAIR encompassed agriculture, horticulture, forestry, fisheries and aquaculture, rural development, agro-industry and food technologies. Its objective was to promote collaboration of research between the food and non-food sectors of these domains and link the rural activities with the processing industry and the end-users or consumers. The scope of the objective was broad and research activities were quite diverse. They were classified into six thematic areas or vertical activities (with indicative budgets):

Area 1: Integrated production and processing chains

(15% or EUR 97 M€);

Area 2: Scaling-up and processing methodologies

(7% or EUR 45 M€);

Area 3: Generic science and advanced technologies for nutritious foods

(16% or EUR 103 M€);

Area 4: Agriculture, forestry and rural development

(37% or EUR 239 M€);

Area 5: Fisheries and aquaculture

(17% or EUR 109 M€);

Area 6: Objectives addressed by concertation

(8% or EUR 52 M€).

This report evaluates impact criteria of projects from *FAIR Area 5* (Fisheries and aquaculture) and from *FAIR Area 3* (Generic science and advanced technologies for nutritious foods) pertaining to fisheries and aquaculture. Since impact measurements are ambiguous and no proper protocol had been established, the methodology with which these projects were evaluated is described below in detail.

The basis for this report were 134 research projects from *FAIR Area 5* and 24 from *Area 3*.

Objective

The main objective of this report was to assess output variables related to impact of the FAIR programmes' projects. The projects were classified by domains and data provided by each projects' coordinator was compiled and analyzed in order to determine the scope and range of impact on the scientific community, the Community level, legislation and advisory boards.

In addition, this analysis seeks to show one option for analyzing a completed programme. This may be of help in determining appropriate deliverables in future programmes as well as appropriate modes of analysis.

2. APPROACH & METHODOLOGY

2.1. Classification

This analysis focused on *FAIR Area 5*, fisheries and aquaculture, and selected projects from *FAIR Area 3*, generic science and advanced technologies for nutritious foods, pertaining to fisheries and aquaculture. *FAIR Area 5* can be further subdivided into five *scientific areas* listed below. The number of research projects funded are given in parentheses.

Sub-Area 5.1: Impact of environmental factors on aquatic resources (13);

5.1.1 Effects of environmental factors on fish and fisheries (11)

5.1.2 Multispecies interaction (2)

Sub-Area 5.2: Ecological impact of fisheries and aquaculture (26);

5.2.1 The effects of fisheries on the environment (16)

5.2.2 The effects of aquaculture on the environment (9)

5.2.3 Modelling (1)

Sub-Area 5.3: Biology of species for optimization of aquaculture (59);

5.3.1 Genetics (11)

5.3.2 Health of aquacultured species (26)

5.3.3 New species (7)

5.3.4 Reproduction (9)

5.3.5 Fish nutrition (6)

Sub-Area 5.4: Socioeconomic aspects of the fishing industry (14);

5.4.1 Behavior and strategies in the fishing sector (4)

5.4.2 Fishery management systems (9)

5.4.3 Integrated coastal area management (1)

Sub-Area 5.5: Improved methodology (22).

FAIR Area 3 can be subdivided in a similar manner. However, since only 24 research projects pertained to fisheries and aquaculture, they were pooled.

For one, projects were analyzed vertically within these 5 sub-areas and *FAIR Area 3*. This type of analysis and categorization will subsequently be referred to as *scientific area*.

Furthermore, projects had been categorized by their mode of implementation. This report will also analyze them horizontally by this categorization type, which will subsequently be referred to as *project type*. Solely three types of pure research projects were considered in this analysis:

SC: Shared-cost RTD Project
CA: Concerted Action
COOP: Cooperative Research Project

Shared-cost demonstration projects and exploratory awards were disregarded.

A Shared-cost RTD Project was defined as knowledge-producing, basic and developmental research and having an exploratory approach. An SC project could receive funding of up to 50% of total costs.

A Concerted Action project could be financed in full (100%). All of the resources were used in networking and coordination, that is creating links between research teams from different Member States and Associated Countries, pooling data and harmonizing practices.

Cooperative research projects were targeted at small or medium-sized enterprises (SMEs) which had common technological problems. Like an SC project, a COOP project could also receive support of up to 50% of total costs, but the results were owned by the SMEs and the researchers (RTD performers) were contracted out to solve the problems.

2.2. Methodology

Step 1 - Updating Information

A major factor related to impact are publications and dissemination activities. Two of the documents submitted to the European Commission, in addition to the final report at the end of each project, were the Executive Summary Report (ESR) and the FAIR questionnaire (see Annex 1). Details about dissemination activities were listed in the **ESRs** and the quantity of publications and other information were broken down in categories in the **FAIR questionnaire**. Based on a previous report, it was, however, realized that the majority of these two documents were outdated, if present at all. Therefore, the documents were updated by using information present in the Fisheries Directorate-General (DG FISH) archive (i.e. progress reports, final reports, annexes, Technological Implementation Plans (TIPs)). The two preliminarily updated documents were then sent as email attachments to each project's coordinator (see Annex 1) with the request to update dissemination activities. In the case of no response, the coordinator was reminded once more at a later point in time. Since the coordinator himself often had difficulty contacting or getting replies from project partners, the numbers of activities listed in the documents, and thus in this report, should be considered as the minimum numbers.

Step 2 - Compilation

The updated information was then compiled and the results are reported in this report. The number of publications and the corresponding journals were solely based on the dissemination information listed in the ESRs. The number of publications listed in the FAIR questionnaires (Section 1: Scientific and Technical Publications, see Annex 1) was disregarded if it did not match the details given in the ESRs. To verify accuracy of the information provided, a

few random samples were compared to official information listed online by the corresponding publishing companies' web sites.

The number of projects was not necessarily the same for the journal analysis when compared to the other parts of the evaluation based on the FAIR questionnaire, because for a few projects only the ESR or only the FAIR questionnaire was provided. Also, not all sections of the FAIR questionnaire were filled out in every project. The total number of projects considered may thus vary with the section being analyzed.

Step 3 - Analysis

- Analysis of Journal Publications

The analysis of journals was based solely on publication of results in peer-reviewed/refereed journals. Papers already published, accepted and in press were eligible in this category and only those with complete information (i.e. authors, title, journal name, issue number) were considered. Thus, information given in the first section of FAIR questionnaires was disregarded.

- Analysis of FAIR Questionnaires

Data in the fields "Training – Ph.D. students", "Protection of intellectual property rights" and "Competitiveness, support to Community policies and other items" were evaluated. Fields left blank or marked "not applicable" were interpreted as 0 or "no".

Most Frequently Encountered Discrepancies and Problems

1. Publications listed in the ESR did not match with the quantity of publications listed in the FAIR questionnaire.
2. No ESR, FAIR questionnaire and/or TIP submitted.

3. Coordinator's email was outdated.
⇒ The email was sent to the partners as sequentially listed until a valid email address was encountered.
4. Partner only knew of his/her publication (partial updates).
5. No response.
6. Coordinator forwarded emails to all partners, who replied to DG FISH.
⇒ Many partially overlapping updates arrived for the same project.
7. Partial updates, for example, coordinator only updated ESR.

3. RESULTS

3.1. Overview

Overall, 158 projects in the fields of fisheries and aquaculture were considered for this report. Each projects' coordinator was contacted resulting in 82 out of 134 projects being updated in *Area 5* (61%) and 12 out of 24 projects in *Area 3* (50%). Thus, the accuracy of this analysis is fairly high, even though not all partners were reached by the coordinators and the number of publications should therefore be regarded as the minimum number.

Table 1. Summary of the number of projects in each *scientific area* and by *project type* including projects that have not ended (see pages 6-7 for *scientific area* and *project type* description, see Annex 2 for projects that have not ended).

AREA	PROJECT TYPE			UPDATE			TOTAL
	COOP	CA	SC	Complete	Pending		
3	5	1	18	12	50%	12	24
5.1	0	1	12	7	54%	6	13
5.2	2	8	16	19	73%	7	26
5.3	11	6	42	40	68%	19	59
5.4	0	4	10	8	57%	6	14
5.5	0	5	17	8	36%	14	22
TOTAL	18	25	115	94	59%	64	158

3.2. Publications in Peer-reviewed Journals

3.2.1. Overview

In *Area 5*, a total of 711 publications were printed in 219 peer-reviewed journals by the participants of 82 recently updated projects. The *Journal of Fish Biology* ranked number one with 67 publications followed by *Aquaculture* with 36 publications (Table 2, see Annex 2, Table 1 for extended list).

Table 2. Top 5 journals of updated projects in *Area 5*.

Area 5: Fisheries and Aquaculture	Publications	Avg. No. of Publications/Project
Journal of Fish Biology	67	0,8
Aquaculture	36	0,4
Fisheries Research	29	0,4
Journal of Applied Ichthyology	26	0,3
ICES Journal of Marine Science	24	0,3
SUM (all publications)	711	8,7

Updated projects: 82/134 (61%)

In *Area 3*, all publications from updated projects occurred in the *SC project type*. Twelve updated projects published a total of 108 articles in 47 peer-reviewed journals (Table 3; see Annex 2, Table 2 for extended list). Most articles were published in the *Journal of the Science of Food and Agriculture*, followed by the tying *International Journal of Food Microbiology* and *Journal of Agricultural and Food Chemistry*.

Table 3. Top 5 journals of updated projects in Area 3.

Area 3: Food Technologies	Publications	Avg. No. of Publications/Project
Journal of the Science of Food and Agriculture	11	0,9
International Journal of Food Microbiology	10	0,8
Journal of Agricultural and Food Chemistry	10	0,8
Journal of Food Science	7	0,6
Applied Environmental Microbiology	6	0,5
SUM (all publications)	108	9,0

Updated projects: 12/24 (50%)

The range of the number of publications per project was 0 to 55 in Area 5 and 0 to 21 in Area 3.

3.2.2. Journals by Project Type

In *Area 5*, there is a distinct difference in the number of publications and the journals chosen for publication between COOP projects and CA/SC projects. COOP projects originated from SMEs, whereas CA and SC projects originated from universities or research institutes. It could be expected that SMEs invested in research activities that improved commercial and economic parameters. Universities and research institutes could be expected to have a broader range of research interests including knowledge-generating and fundamental research. Furthermore, it could be expected that results owned by SMEs were not as readily published so not to aid the competition.

In *Area 5*, all publications resulting from COOP projects occurred in sub-area 5.3, biology of species for optimization of aquaculture, despite the fact that two projects got funded in sub-area 5.2. Therefore, COOP projects in sub-area 5.3 were compared to SC projects in the same sub-area (Table 4 and 5).

Table 4. Top 5 journals of updated Shared-cost RTD Projects in sub-area 5.3.

<i>Sub-area 5.3 SC</i>	<i>Publications</i>	<i>Avg. No. of Publications/Project</i>
Aquaculture	29	0,9
Journal of Fish Biology	21	0,7
Diseases of Aquatic Organisms	11	0,3
Fish and Shellfish Immunology	10	0,3
Fish Physiology and Biochemistry	10	0,3
SUM (all publications)	327	10,2

Updated projects: 32/42 (76%)

Table 5. Top 5 journals of updated Cooperative Research Projects in sub-area 5.3.

Sub-area 5.3 COOP	Publications	Avg. No. of Publications/Project
Aquaculture	4	0,8
Aquaculture International	2	0,4
Aquatic Living Resources	1	0,2
Lipids	1	0,2
Proc. Soc. Nutr. Physiol.	1	0,2
SUM (all publications)	9	1,8

Updated projects: 5/11 (45%)

An obvious difference between the two project types is the number of publications per project. On average, SC projects produced many more publications (10,2 publications per project) when compared to COOP projects (1,8 publications per project). The journal most preferred for publishing did not differ. Due to the nature of the task, biology of species for optimization of aquaculture, *Aquaculture* was the most popular journal to publish in (globally 2nd). Whereas the top publication journals in COOP projects were related to aquaculture and nutrition, SC projects also featured fisheries journals.

Publications resulting from the twelve updated projects in *Area 3* occurred in the SC project type. Therefore, it was not possible to compare differences within this area.

3.2.3. Journals by Scientific Area

In *Area 5*, an average of 8,7 peer-reviewed publications originated per updated project (Figure 1) with sub-area 5.1, impact of environmental factors on aquatic resources, being the most productive in regard to publications.

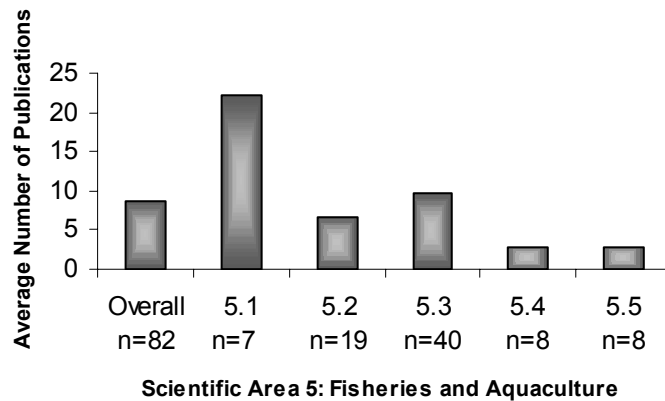


Figure 1. Average number of publications per updated project in *Area 5*.

3.2.3.1. SUB-AREA 5.1, IMPACT OF ENVIRONMENTAL FACTORS ON AQUATIC RESOURCES

Overall and in sub-area 5.1, the *Journal of Fish Biology* ranked first in terms of total number of publications (Table 6). *ICES Journal of Marine Science* is also among the top 5 journals overall. The objective of sub-area 5.1 was to generate a better understanding of the ecosystem.

Table 6. Top 5 updated journals in sub-area 5.1, impact of environmental factors on aquatic resources.

Sub-area 5.1	Publications	Avg. No. of Publications/Project
Journal of Fish Biology	36	5,1
ICES Journal of Marine Science	13	1,9
Marine Ecology Progress Series	10	1,4
Canadian Journal of Fisheries and Aquatic Sciences	9	1,3
Freshwater Biology	7	1,0
SUM (all publications)	155	22,1

Updated projects: 7/13 (54%)

3.2.3.2. SUB-AREA 5.2, ECOLOGICAL IMPACT OF FISHERIES AND AQUACULTURE

For sub-area 5.2, ecological impact of fisheries and aquaculture, the *Journal of Applied Ichthyology* ranked first (Table 7). Only *the Canadian Journal of Fisheries and Aquatic Sciences* did not make it among the top 5 journals overall. The objective of this sub-area was to reach a better understanding of the effects of fisheries and aquaculture on the ecosystem, and in particular to limit their impact on the aquatic environment.

Table 7. Top 5 updated journals in sub-area 5.2, ecological impact of fisheries and aquaculture.

Sub-area 5.2	Publications	Avg. No. of Publications/Project
Journal of Applied Ichthyology	22	1,2
Fisheries Research	20	1,1
Journal of Fish Biology	7	0,4
Canadian Journal of Fisheries and Aquatic Sciences	6	0,3
ICES Journal of Marine Science	6	0,3
SUM (all publications)	124	6,5

Updated projects: 19/26 (73%)

3.2.3.3. SUB-AREA 5.3, BIOLOGY OF SPECIES FOR OPTIMIZATION OF AQUACULTURE

Regarding sub-area 5.3, *Aquaculture* ranked first (Table 8). Due to the nature of the task, biology of species for optimization of aquaculture, this was to be expected. The objective of this sub-area was to gain better knowledge of the biology of aquatic species and to promote the development of an economically profitable industry.

Table 8. Top 5 updated journals in sub-area 5.3, biology of species for optimization of aquaculture.

Area 5.3	Publications	Avg. No. of Publications/Project
Aquaculture	34	0,9
Journal of Fish Biology	22	0,6
Aquaculture Research	13	0,3
Diseases of Aquatic Organisms	11	0,3
Fish and Shellfish Immunology	11	0,3
SUM (all publications)	387	9,7

Updated projects: 40/59 (68%)

3.2.3.4. SUB-AREA 5.4, SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY AND 5.5 - IMPROVED METHODOLOGY

The fewest publications per project occurred in sub-areas 5.4 and 5.5 (Tables 9 and 10). Management, policy and economic journals were the preferred choice for participants of projects in sub-area 5.4, socioeconomic aspects of the fishing industry (Table 9). This correlates with the overall objective of generating a better understanding of the operation and management of the fishing industry.

Table 9. All updated journals in sub-area 5.4, socioeconomic aspects of the fishing industry.

<i>Sub-area 5.4</i>	<i>Publications</i>	<i>Avg. No. of Publications/Project</i>
Ocean and Coastal Management	12	1,5
Marine Policy	4	0,5
Marine Resource Economics	3	0,4
Cuadernos de Información Económica	1	0,1
Empirical Economics	1	0,1
Sociologia Ruralis	1	0,1
SUM (all publications)	22	2,8

Updated projects: 8/14 (57%)

Table 10. Top 4 journals in sub-area 5.5, improved methodology (the remaining eight journals feature one publication each).

<i>Sub-area 5.5</i>	<i>Publications</i>	<i>Avg. No. of Publications/Project</i>
Marine Ecology Progress Series	5	0,6
Fisheries Research	4	0,5
ICES Journal of Marine Science	4	0,5
Journal of Fish Biology	2	0,3
SUM (all publications)	23	2,9

Updated projects: 8/22 (36%)

3.2.4. Updates

Area 5

A total of 134 research projects were funded in *Area 5*. The analysis above only considered updated projects, that is 82 projects. Considering all 120 projects from *Area 5* for which dissemination information existed (updated and non-updated ones), then the 120 projects' participants (90%) published 956 articles in peer-reviewed journals resulting in an average of 8 publications per project. Comparing this to the overall analysis of *Area 5* of the updated projects only (Table 2), the top 3 journals remained in order with *Journal of Fish Biology* featuring 88, *Aquaculture* 55, and *Fisheries Research* 37 publications. *ICES Journal of Marine Science* (34) and *Journal of Applied Ichthyology* (26) were in reverse order when compared to the analysis of updated projects. Thus, including the non-updated journals decreases the average number of publications per journal from 8,7 to 8.

The 38 non-updated projects for which publication information existed cumulatively published 245 articles or 6,4 articles/project. Comparing the latter average number to the one of the 82 updated projects, there is a difference of 2,3 publications/project in favor of the updated projects.

Area 3

Considering all projects (updated and non-updated ones) in *Area 3* for which some kind of dissemination information was available, then 153 articles were published by 20 projects' participants. The top 5 journals listed for the updated projects were also the top five journals for all projects for which information existed, just in a different order.

The eight non-updated projects cumulatively published 45 articles or 5,6 articles/project. On average, the twelve updated projects published 9,0 articles/project. Comparing the eight non-updated to the twelve updated

projects, then there is a difference of 3,4 articles/project in favor to the updated ones.

3.3. FAIR Questionnaire

Information was provided by coordinators of 109 projects in *Area 5* and 17 projects in *Area 3*.

3.3.1. Training

The number of scientists that were involved in each project at least 10% of their time did not differ substantially between *Area 5* and *Area 3*. On average, there were 12 scientists per project in *Area 3* and 13 in *Area 5*. This number includes permanent staff, post-doctoral fellows, and post graduate students (Table 11).

Table 11. FAIR questionnaire “Training” domain synthesis.

Scientific Area	Area 5		Area 3	
	103*		17	
Number of Projects	Total	Average	Total	Average
Scientists	1389	13	204	12
Students	380	4	72	4
Exchanges	417	4	47	3
Technicians trained	280	3	114	7
Percentage of women	34%		43,4%	
Jobs created	43	0,4	2	0,1

*although 109 FAIR questionnaires were provided, section 2 was left blank in 6 of these

Similar between the two areas was also the number of students (Ph.D., Master,...) that were working on a project for a minimum of 6 months. On average, 4 exchanges of researchers between partners for at least one week during the project’s period took place. More than two times as many technicians were trained in *Area 3* projects when compared to *Area 5* projects. However, the number of jobs created approached zero for both areas. The weighted average percentage of women involved in the projects was 34 percent for *Area 5* and 43,4 percent for *Area 3*. Due to lacking information for the weighted average percentage calculation, only 99 projects could be considered in *Area 5*, but all 17 projects were considered in *Area 3*.

3.3.2. Protection of Intellectual Property Rights

Patents under exploitation and applications were negligible and only 5 patents were granted in *Area 5*. The nature of the sector, fisheries and aquaculture, is generally not considered suitable for patents. In *Area 3*, generic science and advanced technologies for nutritious foods, a few more patents were issued (0.1 patents/project or a total of 2 patents versus 4 patents in *Area 5*), but even in this sector the amount was negligible.

3.3.3. Competitiveness, Support to Community Policies and Other Items

145 proposals for further research were submitted as spin-offs from the 109 projects in *Area 5* and 31 proposals originated from 17 *Area 3* projects.

An estimated 161 industrial enterprises, 103 regulatory authorities and 119 advisory bodies benefited from the 109 research projects in *Area 5*. In *Area 3*, 95 industrial enterprises, 36 regulatory authorities, and 4 advisory bodies benefited from the 17 projects.

Fisheries and aquaculture research is usually not directly associated with increasing sales and obtaining new customers; this is reflected in the figures given by the project coordinators. In *Area 5*, 12% of the projects' participants believed to have increased their sales through their research and 13% attracted new customers. This information is worth differentiating into SC/CA versus COOP *project types*: half of the COOP project coordinators believed to have increased their sales and 40% got new customers. In contrast, only 8% of SC/CA coordinators monitored an increase in sales and 10% got new customers. In *Area 3*, no increase in sales was recorded and 6% of the projects increased their customer base.

In *Area 3*, almost double the number of project coordinators estimated that their research results helped to improve ethical issues when compared to *Area 5* (Figure 2). 72% of the projects in *Area 5* and almost half of the projects

in Area 3 believed that their projects helped to improve environmental issues. The situation was further positive in both areas with project results aiding in improving sustainability issues. Roughly 50% of the projects had results, which have been used for scientific advice for implementation of Community policies and have also contributed to legislation at national, international or Community level.

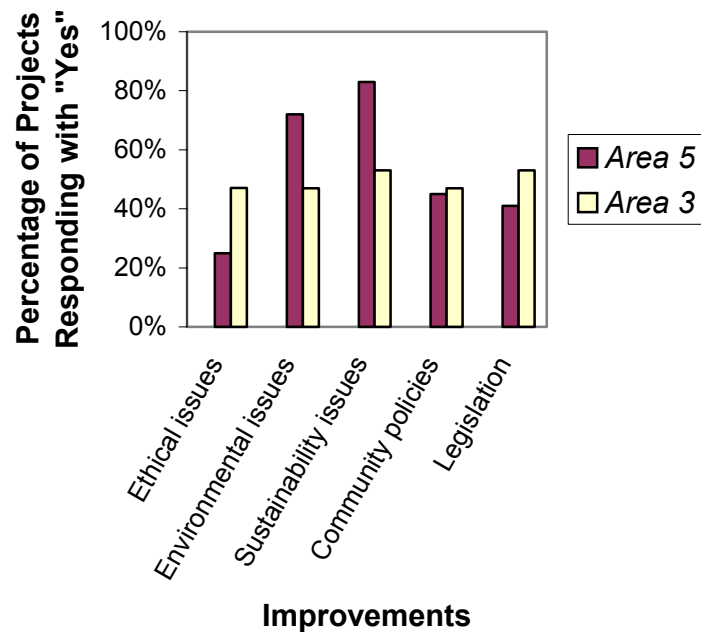


Figure 2. Synthesis of FAIR questionnaires' "Competitiveness, support to Community policies and other items" domain (see text for explanation of categories).

4. CONCLUSIONS

This analysis of output variables from research projects in the Fisheries and Aquaculture domain provides information on the impact these projects have on the scientific community, the Community level, legislation and advisory boards. This report gives a picture of the integration of Community funded projects on collaboration between research in the food and non-food sectors linking rural activities, processing industry and end-user needs.

The great amount of publications is an indicator of the fisheries and aquaculture sector being an active area of research, and the FAIR programme contributed in expanding the knowledge base in this field. The most important journals in which European researchers published in were *the Journal of Fish Biology*, *Aquaculture* and *Fisheries Research* with a total of 134 articles in these. Overall, a minimum of 1109 articles were published in peer-reviewed journals. A total of 2439 people were involved in the 120 projects for which this information was provided with 1593 being scientists and 452 being students (Ph.D., M.Sc.). On average, 13.3 scientists and 3.8 students were involved in each project. 35,5% of all people involved in the 120 projects were women.

The analysis of 126 FAIR questionnaires showed that the projects' results contributed to better understand environmental (68%) and sustainability issues (79%). Thus, the conducted research was beneficial to the end users, to the Community level. About forty-two percent of the projects' coordinators expressed the view that their projects contributed to legislation. Nearly all projects disseminated their results to one advisory board (123) and one regulatory authority (139). 256 industrial enterprises benefited from the research. Through these types of dissemination the FAIR programme is also expected to have impact, and in particular harmonize research in this area.

The funded projects elicited further research interests and questions as is suggested by the number of spin-off proposals. In *Area 5*, 145 proposals

originated from 109 projects and in *Area 3*, 31 proposals originated from 17 projects.

The fact that COOP projects have fewer publications compared to SC and CA projects is consistent with their mode of implementation: private companies, SMEs, are usually not keen to disseminate their novel discoveries, whereas it is prestigious for research institutes and universities. Only six patents got granted; patents are obviously not frequently sought in the fisheries and aquaculture sector.

The basis for project funding were research alliances among laboratories, universities and private enterprises in European Union Member States and beyond. This basis, together with the great output in terms of scientists involved, publications, legislation and the like, showed that the FAIR programme reached many of the goals it strived for.

This analysis is evidence of the tremendous research EU funding stimulated; scientists got employed and trained, many high quality articles got published and follow-up proposals illustrate further significance in the subject matter. Considering that the updates necessary to determine the success of the FAIR research programme were on a voluntary basis, cooperation was quite high with 59% of the projects being updated.

Discussion

Summarizing the non-updated projects, the same trend as with the updated ones could be seen in regard to journals. The top 5 journals were the same when summarizing updated versus non-updated projects; the order in which they appeared differed. Regarding the number of publications, there is a definite increase with time: publishing results continued to take place long after projects were formally finished. Hence, the number of publications resulting from a project at the time the project ends is likely to be an underestimate.

Regarding the FAIR questionnaire, no major updates were made besides the first section. Most variables such as the number of patent applications did not change or changed only slightly after the projects had ended. A few questions were vague. The “Percentage of Women involved in the project” was one of those questions impossible to analyze correctly later on. When calculating the weighted average percentage, assumptions needed to be made as to the total number of people involved in the project (scientists, students, technicians) and one will quickly find that different coordinators used different totals.

Nevertheless, the number of publications is the most biased factor when analyzing non-updated projects, projects for which information was provided right after their formal ending. The number of publications is one important variable in determining impact on the Community level. However, updating all variables long after the projects have finished is time-consuming, error-prone and dependent on the goodwill of the projects’ participants. Usually not only one updated list of journals is submitted, but several overlapping ones are submitted for one project. This is due to all participants updating their own activities at different points in time. If one determines this variable, the number of publications, as crucial and therefore projects need to be updated after having ended, then an automated system should be established. This entails electronic FAIR questionnaires that upload directly into a database. In

addition, an incentive should be given to the projects' coordinators and/or participants to motivate them to follow up to this measure.

In case the trend of having the names of the top journals and an approximate number of publications are sufficient in addition to the other impact variables (other sections of the FAIR questionnaire), then the system as it is in place is operative. Nevertheless, it is advisable that the document regarding the number of publications and the document regarding the journals be created in an electronic format for the reasons mentioned above. Consequently, the main recommendation stemming from this analysis is that documents such as the FAIR questionnaire should always be handed in electronically. Setting up a database into which a type of FAIR questionnaire and the journals could be incorporated into would save time and prevent potential errors.

ACKNOWLEDGEMENTS

The author is grateful to the coordinators and participants of the research projects for providing updates; thank you for responding. The author would also like to thank the entire Research Unit of DG FISH and in particular Dr. Jacques Fuchs.

ANNEX 1 – DOCUMENTS

FAIR Questionnaire

<u>AIR/FAIR PROGRAMMES</u>	
<u>QUANTITATIVE OUTPUTS FROM THE PROJECTS</u>	
<input type="checkbox"/> AIR	<input checked="" type="checkbox"/> FAIR
Type of project	<input type="checkbox"/> RTD Project
	<input type="checkbox"/> Demonstration Project
Duration of the project	Total: <input type="text"/> months
For finished projects	<input type="text"/> Months since end of contract
Date of filling in this form	<input type="text"/> 1999
Project n° <input style="width: 150px;" type="text"/>	
	<input type="checkbox"/> Cooperative research
	<input type="checkbox"/> Concerted Action
	By now: <input type="text"/> months
Scientific and Technical Publications	
Papers published or accepted for publication in refereed journals	(n°)
Papers submitted for publication in refereed journals	(n°)
Articles accepted or submitted in non-refereed technical ('popular') journals	(n°)
Dissertation theses	(n°)
Books	(n°)
Published reports	(n°)
Courses and lectures	(n°)
Training materials	(n°)
Training – PhD students	
Scientists (permanent staff, post-doctoral fellows, post graduate students, ...) involved in the project at least 10 % of their time	(n°)
Students (PhD, Master's, graduate schools, ...) working in the project for at least 6 months	(n°)
Exchanges of researchers between partners (for a period of at least one week)	(n°)
Technicians trained in the project	(n°)
Percentage of women involved in the project	(n°)
Protection of intellectual property rights	
Patent applications	(n°)

Patents granted		(n°)	
Patents under exploitation		(n°)	
Others (Please specify, i.e. trademark, copyright, trade secret, plant variety...)		(n°)	
Processes/products/standards			
New prototypes/products	developed	(n°)	successfully implemented (n°)
New and modified processes	developed	(n°)	successfully implemented (n°)
New methods/tests	developed	(n°)	successfully implemented (n°)
Norms/standards	developed	(n°)	Successfully implemented (n°)
Software/codes	developed	(n°)	Successfully implemented (n°)
Dissemination to end-users			
Presentations (oral, poster) made		(n°)	
Participations in dissemination or technology transfer workshops		(n°)	
Press-releases		(n°)	
Web-sites		(n°)	
Technical manuals		(n°)	
Consumer-/User-friendly guides		(n°)	
Competitiveness, support to Community policies and other items			
Proposals for further research/demonstration projects submitted as spin-off of this project		(n°)	
Users benefiting from the research project (directly involved or having participated at least in a dissemination event):			
Industrial enterprises	(n°)	Regulatory authorities	(n°) Advisory bodies (n°)
Increase of sales, turnover or market-share?		(yes/no)	
New customers?		(yes/no)	
Jobs created		(n°)	
Has the project given results that help improving ethical issues?		(yes/no)	
Has the project given results that help improving environmental issues?		(yes/no)	
Has the project given results that help improving sustainability issues?		(yes/no)	
Has the project given results that have been used for scientific advice for the implementation of Community policies?		(yes/no)	

Has the project given results that contribute to legislation at national, international or Community level?	(yes/no)
Comments	

Could you please list, in your view as coordinator, the three major successes of this project?

1.

2.

3.

Emails sent to each coordinator

First Email:

Date: Brussels, day/month/2003
Subject: Follow-up of FAIR project n° x – Update of
Publication List
Attachments: FAIR questionnaire, List of Publications

Dear Mr./Ms./Dr. ...,

We are currently in the process of assessing the impact of the FAIR projects pertaining to fisheries and aquaculture. The analysis is based on the information given by you in the Executive Summary Report (ESR) and the FAIR questionnaire.

Since the time of our last correspondence, there may have been new developments in regard to publications of your project. May I kindly ask you to update your FAIR questionnaire and your list of publications which are attached to this message. Your help would render the final result more accurate and would be greatly appreciated. A copy of the analysis will be send to you in mid-summer of this year.

I would very much appreciate the return of the updated documents within 10 days. Please email these to Ms. Pluem (Gesche-Stefanie.Pluem@cec.eu.int). In case you are no longer responsible or involved in this project, please forward this message to the new person in charge.

Thank you very much for your cooperation.

Yours sincerely,

(signed)

W. Brugge

Head of Unit

Second, Follow-up Email:

Date: Brussels, day/month/2003
Subject: Request to update FAIR project n° x

Dear Mr./Ms./Dr. ...,

Some time ago you should have received a request to update the dissemination information of your FAIR project. I would like to finalize the analysis of the FAIR program pertaining to fisheries and aquaculture and would like you to respond with the updated documents within 10 days. After this final deadline your project cannot be considered in the analysis, despite its high quality and interesting results. I therefore hope to hear from you.

Best regards,

(signed)

Gesche Pluem

ANNEX 2 – ANALYSIS DETAILS

Projects pending

The following list consists of 10 FAIR projects that have not been finalized up to this date. All of them (except the two *Area 3* projects) were contacted, because, among other things, none had provided the ESR nor the FAIR questionnaire. They are listed in ascending order by scientific area, then by contract number.

Title: **“The evaluation of a simple, cheap rapid method of non-protein nitrogen determination in fish products through the processing/merchandising chain.”**

Scientific Area: 3.3.3

Contract Number: FAIR-CT97-3253

Acronym: n/a

Project Type: Shared-cost RTD project (SC)

End (Ext. included): 31/12/2000

Contribution: EUR 1.1 Mio

Title: **“Development of multi-sensor techniques for monitoring the quality of fish.”**

Scientific Area: 3.3.3

Contract Number: FAIR-CT98-4076

Acronym: n/a

Project Type: Shared-cost RTD project (SC)

End (Ext. included): 13/04/2002

Contribution: EUR 0.7 Mio

Title: **“Environmental and fisheries influences on fish stock recruitment in the Baltic Sea.”**

Scientific Area: 5.1.1

Contract Number: FAIR-CT98-3959

Acronym: STORE

Project Type: Shared-cost RTD project (SC)

End (Ext. included): 30/06/2002

Contribution: EUR 1.0 Mio

Title: **“Selective whitefish grid system for demersal towed gear fisheries in the North Sea and adjacent waters.”**

Scientific Area: 5.2.1

Contract Number: FAIR-CT98-3536

Acronym: EUROGRID

Project Type: Shared-cost RTD project (SC)

End (Ext. included): 31/07/2002

Contribution: EUR 1.1 Mio

Title: **“Selectivity Database-2.”**

Scientific Area: 5.2.1

Contract Number: FAIR-CT98-4044

Acronym: n/a

Project Type: Concerted Action (CA)

End (Ext. included): 31/01/2003

Contribution: EUR 0.5 Mio

Title: **“A study to identify, quantify and ameliorate the impacts of static gear lost at sea.”**

Scientific Area: 5.2.1

Contract Number: FAIR-CT98-4338

Acronym: FANTARED2

Project Type: Shared-cost RTD project (SC)

End (Ext. included): 01/04/2002

Contribution: EUR 0.9 Mio

Title: **“A European database of Indicator Coastal Communities.”**

Scientific Area: 5.4.3

Contract Number: FAIR-CT98-4399

Acronym: INDICCO

Project Type: Concerted Action (CA)

End (Ext. included): 15/10/2002

Contribution: EUR 0.4 Mio

Title: **“Aggregation patterns of pelagic commercial fish species under different stock situations and their impact on exploitation and assessment.”**

Scientific Area: 5.5.1

Contract Number: FAIR-CT96-1799

Acronym: n/a

Project Type: Shared-cost RTD project (SC)

End (Ext. included): 29/02/2000

Contribution: EUR 0.7 Mio

Title: **“Fine genetic structure of swordfish (*Xiphias gladius*) in the Mediterranean and the Atlantic: Study by means of individual genetic tagging, using microsatellite DNA markers.”**

Scientific Area: 5.5.1

Contract Number: FAIR-CT98-3941

Acronym: n/a

Project Type: Shared-cost RTD project (SC)

End (Ext. included): 30/06/2003

Contribution: EUR 0.4 Mio

Title: **“Stock effects on recruitment relationships (An operational model of the effects of stock structure and spatio-temporal factors on recruitment).”***

Scientific Area: 5.5.1

Contract Number: FAIR-CT98-4122

Acronym: STEREO

Project Type: Shared-cost RTD project (SC)

End (Ext. included): 28/02/2002

Contribution: EUR 1.1 Mio

*project not finalized, but FAIR questionnaire and dissemination information present

Publications in Peer-Reviewed Journals

Table 1. Number of Publications in Peer-Reviewed Journals considering Updated Projects in Area 5.

<i>Area 5 - Name of Journal</i>	<i>Total</i>
Journal of Fish Biology	67
Aquaculture	36
Fisheries Research	29
Journal of Applied Ichthyology	26
ICES Journal of Marine Science	24
Canadian Journal of Fisheries and Aquatic Sciences	20
Marine Ecology Progress Series	18
Aquaculture Research	13
Diseases of Aquatic Organisms	12
Ocean and Coastal Management	12
Fish and Shellfish Immunology	11
Comparative Biochemistry and Physiology	10
Fish Physiology and Biochemistry	10
Gene	10
General and Comparative Endocrinology	9
Journal of Fish Diseases	9
Journal of the Marine Biological Association of the UK	9
Biochimica et Biophysica Acta	7
Fisheries Oceanography	7
Freshwater Biology	7
Journal of Animal Ecology	7
Parasitology	7
Aquaculture International	6
Bull. Eur. Ass. Fish Pathol.	6
Molecular Biology and Evolution	6
Virus Research	6
European Journal of Biochemistry	5
Functional Ecology	5
Immunogenetics	5
Journal of Experimental Marine Biology and Ecology	5
Marine Biotechnology	5
Recent Research Developments in Virology	5
Biology of Reproduction	4
Fish and Fisheries	4
Hydrobiologia	4
Journal of Biological Chemistry	4
Journal of Molecular Evolution	4
Journal of Shellfish Research	4
Journal of the World Aquaculture Society	4
Marine Biology	4

Area 5 - Name of Journal	Total
Marine Environmental Research	4
Marine Policy	4
Molecular Ecology	4
Molecular Reproduction and Development	4
Sarsia	4
Aquaculture Nutrition	3
Aquatic Genomics	3
Aquatic Living Resources	3
Aquatic Toxicology	3
Archives of Polish Fisheries	3
Development and Comparative Immunology	3
Estuarine, Coastal & Shelf Science	3
FEBS Letters	3
Genetics	3
Journal of Experimental Zoology	3
Journal of Plankton Research	3
Journal of Sea Research	3
Journal of Virology	3
Marine Resource Economics	3
Mechanisms of Development	3
Scientia Marina	3
The Science of the Total Environment	3
Veterinary Immunology and Immunopathology	3
Advances in Marine Biology	2
American Zoologist	2
American Journal of Physiology	2
Biol. Mar. Medit.	2
Biotech. Letters	2
Brain Behavior and Evolution	2
Cell Biochemistry and Function	2
Communications in Numerical Methods in Engineering	2
Ecological Modelling	2
Ecology	2
Environmental Biology of Fishes	2
Genetics and Molecular Biology	2
Genomics	2
Helgoland Marine Research	2
International Journal for Parasitology	2
Journal of Applied Ecology	2
Journal of Comparative Neurology	2
Journal of Controlled Release	2
Journal of Eukaryotic Microbiology	2
Journal of Experimental Biology	2
Journal of General Virology	2
Journal of Immunology	2
Journal of Marine Systems	2
Journal of Morphology	2
Journal of Northwest Atlantic Fishery Science	2
Journal of the Science of Food and Agriculture	2

Area 5 - Name of Journal	Total
Marine Pollution Bulletin	2
Nordic Journal of Freshwater Research	2
Oceanologica Acta	2
Physics and Chemistry of the Earth	2
Physiology and Behavior	2
Proc. Natl. Acad. Sci.	2
Russian Journal of Ichthyology	2
The Japanese Society of Fish Pathology	2
Transgenic Research	2
Vaccine	2
Acta Adriatica	1
Advances in Botanical Research	1
Aggressive Behavior	1
Ambio	1
Animal Behaviour	1
Animal Genetics	1
Annales Zoologici Fennici	1
Antarctic Science	1
Aquatic Invertebrate Cell Culture	1
Archive of Fishery and Marine Research	1
Behavioral Ecology	1
Biofouling	1
Biological Sciences	1
Biology of the Cell	1
BioMed Central Ecology	1
Boletín del Instituto Español de Oceanografía	1
Boreal Environmental Research	1
British Journal of Nutrition	1
Bulletin of the Sea Fisheries Institute	1
Cahiers de Biologie Marine	1
Cahiers d'Ethologie	1
Canadian Journal of Zoology	1
Cell Adhesion and Communication	1
Cell and Tissue Research	1
Cell Death and Differentiation	1
Cell Stress and Chaperones	1
Cellular Microbiology	1
Chemistry	1
CHIEAM journal, Options Méditerranéennes	1
Chromosoma	1
Chromosome Today	1
Coastal Zone Topics: Process, Ecology & Management	1
Comparative Hepatology	1
Cuadernos de Información Económica	1
Current Biology	1
Current Opinion in Cell Biology	1
Cybium	1
Cytogenetic and Genome Research	1
Dansk Veterinærtidsskrift	1

Area 5 - Name of Journal	Total
DNA and Cell Biology	1
Ecology Letters	1
Ecology of Freshwater Fish	1
Ecotoxicology and Environmental Safety	1
Empirical Economics	1
Endocrinology	1
Environmental Archaeology	1
Environmental Technology	1
Environmental Toxicology and Chemistry	1
Estuaries	1
Ethology	1
European Association of Fish Pathologists	1
Evolution	1
FASEB Journal	1
Freshwater Crayfish	1
Genetica	1
Genetics, Selection and Evolution	1
Genome	1
Genome Research	1
Heredity	1
Hormones and Behavior	1
Ichthyophysiological Acta	1
Immunology	1
International Journal in Numerical Methods in Engineering	1
International Journal of Osteoarchaeology	1
International Journal of Pharmaceutics	1
International Review of Cytology	1
Invertebrate Biology	1
Italian Journal of Biochemistry	1
Journal Molluscan Studies	1
Journal of Agricultural and Food Chemistry	1
Journal of Applied Mathematics	1
Journal of Cell Science	1
Journal of Chemical Neuroanatomy	1
Journal of Comparative Physiology	1
Journal of Endocrinology	1
Journal of Evolutionary Biology	1
Journal of Invertebrate Pathology	1
Journal of Invertebrate Reproduction	1
Journal of Natural Products (Lloydia)	1
Journal of Parasitology	1
Journal of Phycology	1
Journal of Steroid Biochemistry and Molecular Biology	1
Journal of the Textile Industry	1
Journal of Thermal Biology	1
Journal Repro. & Fertility	1
Limnology and Oceanography	1
Lipids	1
Malacologia	1

Area 5 - Name of Journal	Total
Mechanisms of Ageing and Development	1
Methods in Cell Science	1
Mol. Genet. Genomics	1
Mol. Mar. Biol. & Biotechnol.	1
Nat. Gen. Rev.	1
Nature	1
Nature Genetics	1
Nutrition Journal	1
Ocean Modelling	1
Plant Molecular Biology Reporter	1
Proc. Estonian Acad. Sci. Biol. Ecol.	1
Proc. Soc. Nutr. Physiol.	1
Proceedings of the Royal Society of London	1
Regulated Rivers	1
Regulatory Peptides	1
Reviews in Fish Biology and Fisheries	1
Sociologia Ruralis	1
Systematic Parasitology	1
Tellus	1
The Biological Bulletin	1
Theriogenology	1
Tissue and Cell	1
Transactions of the American Fisheries Society	1
Transplantation	1
Trends in Genetics	1
Veterinary Record	1
Virologie	1
Virus Genes	1
Water Research	1
Water Technology	1
Zoomorphology	1
SUM	711
Updated Projects n=	80

Table 2. Number of Publications in Peer-Reviewed Journals considering Updated Projects in Area 3.

Area 3 - Name of Journal	Total
J. Sci. Food Agric.	11
International Journal of Food Microbiology	10
J. Agric. Food Chem.	10
J. Food Sci.	7
Applied Environmental Microbiology	6
Aquaculture Research	5
Food Research International	4
Eur. J. Food Res. Tech	3
European Food Research and Technology	3
Food Chemistry	3
Journal of Food Protection	3
Z. Lebensm. Unters. Forsch.	3
Analytica Chimica Acta	2
Aquaculture	2
J. Biotechnol.	2
Journal of Molecular Catalysis	2
Veterinary Record	2
Anal. Bioanal. Chem.	1
Anal. Chem.	1
Applications in Food Industries	1
Applied Microbiology and Biotechnology	1
Archive für Lebensmittelhygiene	1
Biotechnol. Appl. Biochem.	1
Biotechnology and Bioengineering	1
Current Microbiol.	1
Fischereiforschung	1
Food Biotechnology	1
Food Hydrocolloids	1
Grasas y Aceites	1
Health Perspe.	1
Int. J. Food Sci. Technol.	1
J. Amer. Oil Chem. Soc.	1
J. Assoc. Off. Anal. Chem	1
J. Chromatogr.	1
J. Food Sci. Tech. Int	1
J. Mar. Biotechnol.	1
J. Microbiol. Methods	1
J. Virol. Meth.	1
Lebensmittelchemie	1
Lett. Appl. Microbiol.	1
Lipids	1
Mar. Biotech.	1
North American Journal of Aquaculture	1
Preparative Biochemistry and Biotechnology	1

<i>Area 3 - Name of Journal</i>	<i>Total</i>
Proc. Biochem.	1
Recent Research Developments in Microbiology	1
Toxicon	1
SUM	108
Updated Projects n=	12