

“Strengthening the links between European marine fisheries science and fisheries management”

MariFish WP6

Report on the analysis of special research topics and regional sea areas that warrant special programme coordination.

D6.1, D6.2 & D6.3

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Executive Summary

The main objectives of Work Package 6 in the MariFish Era-Net project was to identify emerging problems facing fisheries management at the regional and European scale and identify jointly funded MariFish research topics, based on the partners management and science strategies.

The research topics identified are based on analysis of previous Work Packages and data from the MariFish National Research Program Database. The database contains list of available information on MariFish partners (Funders) (n=20) representing 15 countries, collaborations (n=3), research programs (n=23), organizations (n=12), research fields (n=17), sea areas (n=17) and funding mechanisms (n=2).

The diagrams of current versus future research fields enabled the identification of future research fields that have limited representation in the current research funding programs. However limited representation does not necessarily mean that research in the field needs to be increased.

At the 3rd meeting of the MariFish Work Package Management Group in Athens, February, 2008 a workshop was held where Participants ranked the future research fields by importance for each of the three main geographic areas: North Atlantic, South Atlantic and Mediterranean.

As a result, most of the future research fields are presently covered by the current research fields. Those that are not covered include “geographic boundaries for ecosystem objectives”, “Increase availability of data”, and “dissemination, and collaboration regarding large scale questions”. Of those that are covered by current research fields, some are only covered by a single field, like the interaction between scientist and stakeholders while others are covered by up to 4 or 5 current fields.

Ranking of research topics varied between areas. All partners agreed on highest importance for two topics; **climate aspects** (stock assessments, multiple species models) and **ecosystems and trophic levels**. Partners from northern regions gave high ranking to all topics in the categories “By-catch and discards” and “Ecosystem management” while southern regions emphasized topics within categories “Trade-off’s”, “Habitat mapping” and “Governance and political economy” as well as “ecosystem management”

The overall results of the ranking were used to identify four common research fields to be jointly funded by MariFish in WP7. These were:

- Reduction of by-catch and discards from commercial fisheries
- Influence of climate on fish biology and population dynamics
- Managing fisheries within an ecosystem
- Habitat mapping

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1. Introduction

The main objectives of Work Package 6 is to identify emerging problems facing fisheries management at the regional and European scale and identify jointly funded MariFish research topics, based on the partners management and science strategies.

The research topics identified are based on analysis of previous Work Packages, mainly WP3 and WP5 and data from the MariFish National Research Programmes Database. The work of the previous Work Packages regarding fisheries management and research policy was based on the management and science strategies of the MariFish Partners and the “Blue Book” of the European Union on an Integrated Maritime Policy for the European Union and the previous analysis of MariFish partners (An Integrated Maritime Policy for the European Union (COM(2007) 574 final). The Blue Book. 10th October 2007).

The main objectives of WP1 was to observe what fishery managers consider the key issues involved in developing strategies for sustainable fisheries. They were able to identify some groups of countries that have similar responses. Overall there were no major surprises emerging from this analysis. The relative importance of the different factors encompasses a wide spectrum of opinion and there were no universal truths. (D1.4a. Drivers for Fisheries Management Report).

The main objectives of WP2 was to analyse information from the 17 MariFish partners on marine fisheries research program management in order to seek out best practice for European Research Area Member States in the domain of Marine Fisheries Research Programmes. (D2.1. Pre-Analysis Report comparing methods of research programme identification, commissioning and management within the MariFish Partnership, identifying particular strengths and weaknesses of the different national structures).

The main objective of WP3 was to identify existing international, European and regional collaborative links. A drawback of the analysis was that not all major funders from MariFish countries are members of MariFish. Against the background that the ecosystem approach to fisheries management calls for a broad collaboration, a recommendation was to include other ministries in MariFish, e.g. Ministries of Environment, Ministries of Fisheries, etc. In conclusion, combined efforts to organize the joint funding of marine fisheries research bear a real potential to tackle priority areas, which require community-based solutions. (D3.3 (3.1 & 3.2) Strengths and Deficiencies of International, European and Regional Collaboration and Coordination of MariFish Partner Countries).

Objective of WP4 was to summarize priorities in the field of socio-economic and other research related to fisheries. Report on the current status of socio-economic research in the field of fisheries, including type of research, institutes involved etc. (D4.4 Report of workshop and summary of priorities).

The objective of WP5 was to analyze the national funded research programmes and identify where there are areas of common interest, gaps and possible duplications. The general aim of the MariFish National Research Programmes Database was to provide an overview of the existing national research programmes of MariFish partners in the field of marine fisheries research. It provides detailed information of the national funding structures. Relevant organizations in the fisheries sector on international, European and regional scale which reflect ongoing collaboration. National research programmes are listed to provide a general view of funding mechanisms, durations, research fields and

geographical coverage. It helps Identifying areas of common interests, gaps and possible duplications which is a prerequisite in order to develop a common research programme with joint funding. It helps understanding the differences in the organization of research programmes between MariFish partner countries that enables adjustments in the funding of marine fisheries research to achieve common calls that address complex research problems. (D5.2 Criteria Matrix for the Evaluation of National Research Programmes).

The objective of WP8 was to identify strategic research areas required to support the development of fisheries management in Europe over the next ten years in context of broader marine environment. Key short term and strategic priorities for future research will be considered for MariFish funded collaborative projects. (D8.1 Future Demands for Fisheries Research).

The “Blue Book” recognizes the importance to focus more strongly on research on the Seas, to improve ecosystem based sustainable fisheries were the precursory management approach is considered and that measures need to be taken to strengthen the links between the fishing industry, scientists and the policy makers. (An Integrated Maritime Policy for the European Union (COM(2007) 574 final). The Blue Book. 10th October 2007).

2. Methods

The basis for this report is the data from the National Research Program Database, accessible at the projects homepage (<http://www.MariFish.net/>). The database contains list of available information on MariFish partners (Funders) (n=20) representing 15 countries, collaborations (n=3), research programmes (n=23), organizations (n=12), research fields (n=17), sea areas (n=17) and funding mechanisms (n=2).

2.1 Data gathering

Starting from the sea areas interface, first the research programmes behind each area were identified and then the research fields behind each research programme. Taking the Arctic Ocean as an example, there are two research programs that offer funding for research in that area. Each of these research programmes offers funding in 10 of the 17 defined research fields and together a total of 15 of the 17 defined research fields are covered in the Arctic Ocean.

Since there are two programs offering 10 fields each, this is calculated as 20 possible funding options for this area. Doing this for all the sea areas gave a total of 660 possible funding options that are registered in the National Research Programme Database (see figure 1).

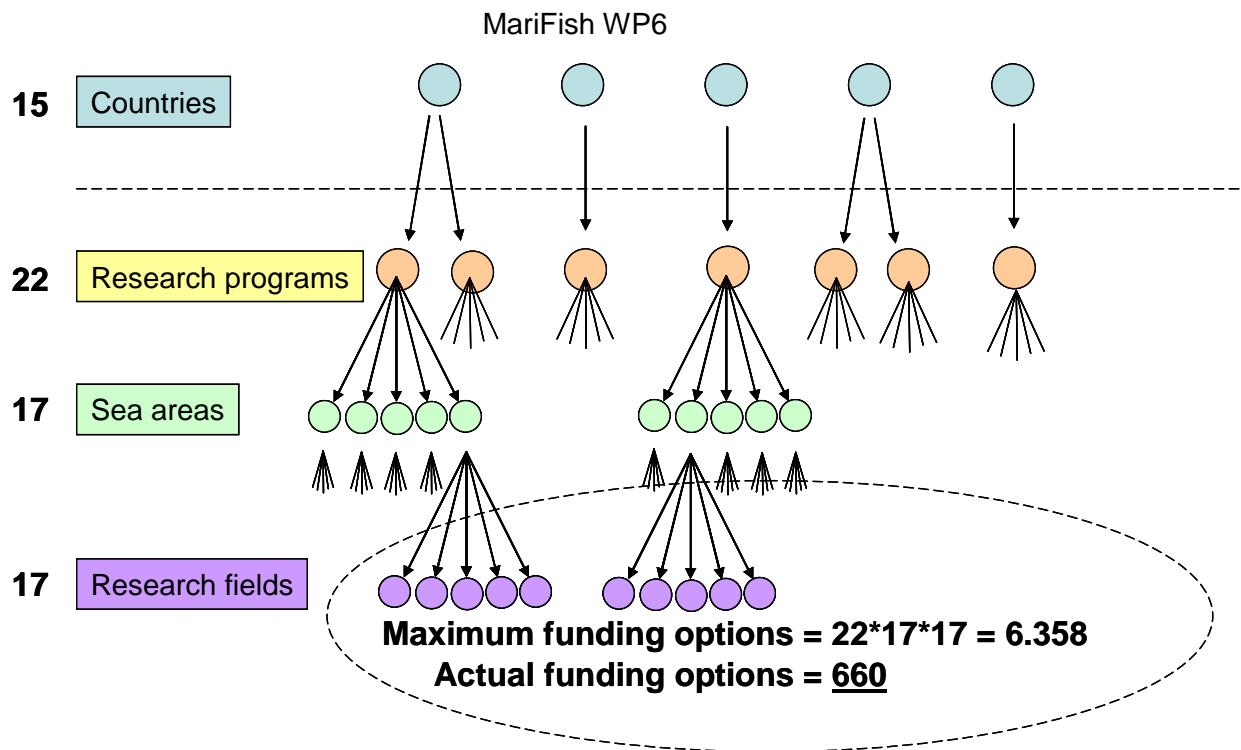


Figure 1. Funding options in the National Research Programme Database

2.2 Data processing

The data was analyzed in Microsoft Excel using pivot tables in order to be able to view the possible research/funding options from different angles (country, research field, sea area, etc.)

The countries were divided into three groups according to main region (see figure 2):

- **Nordic countries** – Iceland, Denmark, Norway and Sweden.
- **Central Europe** – Ireland, United Kingdom, Belgium, Netherlands, Germany and Poland.
- **Mediterranean** – France, Portugal, Spain, Greece and Cyprus.

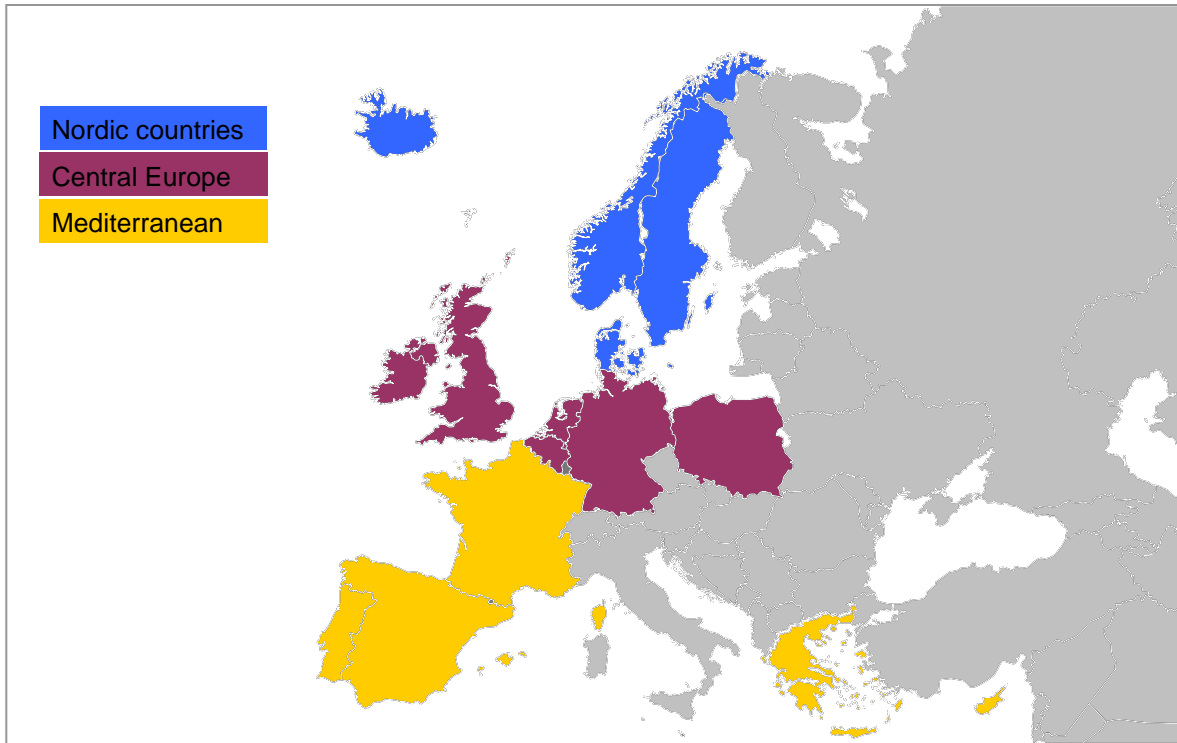


Figure 2. Grouping of the partner countries into Nordic countries, Central Europe and Mediterranean.

The report “Future Demand for Fisheries Research” lists the results of a MariFish symposium organized by Work Package 8 and contains a number of recommendations, including a definition of 25 future research fields classified into 5 main categories. In order to see how these were covered by the 17 current research fields listed in the National Research Program Database, a number of frequency diagrams were constructed. In each diagram, a field in the future field domain could have connections to many fields in the current domain and vice-versa.

The diagrams provide a way to compare the current vs. future funding options (according to WP 8) and identify missing fields such as funding options for future research fields.

2.3 Ranking of future research fields identified in WP8.

The diagrams of current versus future research fields enabled the identification of future research fields that have limited representation in the current research funding programs. However limited representation does not necessarily mean that research in the field needs to be increased. In order to obtain this information the research fields from WP8 were ranked (from 1 to 10), however the upper and lower extremes were used sparingly in order to get a more pronounced weighing of the data. This ranking was performed during the MariFish meeting in Athens, 6th -7th February 2008. Based on the ranking it is possible to see if the most important future research fields have sufficient representation in the current

3. Results

The data in the National Research Program Database provided information on the available funding options. They do not include information on the number of projects funded under each funding option or the amount of financial support allocated to each research field or funding option. For this, a much more detailed data need to be collected.

This means that all the data and the corresponding results presented in this report are based on funding opportunities and do therefore not necessarily represent the view of the policy makers or the actual outcome of the activities performed within individual programmes.

Also, looking at the geographic distribution of the partner countries it is evident that the sea areas in question are not all represented equally. The Northeast and Northwest Atlantic areas (FAO 27) are quite well represented whereas the Mediterranean Sea (FAO 37) is less well represented. These facts need to be taken into consideration when interpreting the following results. (Figure 2).

3.1 Analysis of the currently available funding options

The data from the National Research Programme Database was analysed, based on the methodology described in chapter 2. The results for the currently available funding options are presented in tables 1 through 5.

Table 1. The percentage of all currently available funding options for each of the 17 research fields identified.

Field	Total	%
Anthropogenic Impacts on Fisheries & Aquaculture	47	7,1
Aquaculture	46	7,0
Economics & Socioeconomics	35	5,3
Effects of Climate Change on Fisheries	32	4,8
Fisheries (Gear) Technology	52	7,9
Fisheries Biology & Ecology	52	7,9
Fisheries Management	51	7,7
Fishing Impacts on Marine Ecosystems	52	7,9
Genetics and Biotechnology	33	5,0
Marine Biogeochemistry	11	1,7
Marine Ecosystem Studies	52	7,9
Marine Geosciences	20	3,0
Modeling and Data Analysis	42	6,4
Networking & Research Collaboration	20	3,0
Physical Oceanography	31	4,7
Seafood Quality & Processing	38	5,8
Stock Assessment and Monitoring	46	7,0
Grand Total	660	100

Lowest third

Middle third

Highest third

Table 1 summarizes the data on currently available funding options within each of the 17 defined research fields in the MariFish National Research Program Database and lists the percentage of all currently available research programmes for each of the 17 research fields identified. The different research fields varied considerably with respect to funding options or anywhere from 11 funding options for Marine biochemistry to 52 for fishing impact, gear technology and fisheries biology and ecology.

Table 2. Number of funding options by research field and country.

Research field \ Country	Belgium	Cyprus	Denmark	France	Germany	Greece	Iceland	Ireland	Netherlands	Norway	Poland	Portugal	Spain	Sweden	United Kingdom	Total	% of total
Anthropogenic Impacts on Fisheries&Aquaculture			5	1	6			2	4	5		2	12	3	7	47	7,1
Aquaculture	2	2	5	1	6	2	4	2	4	1		7	7	3		46	7,0
Economics & Socioeconomics			5	4	6				4	4	3			3	6	35	5,3
Effects of Climate Change on Fisheries			5		6			2					7	3	9	32	4,8
Fisheries (Gear) Technology			5	4	6	2	4		4	1	3	2	12		9	52	7,9
Fisheries Biology & Ecology			5		6		4	2		5	3	7	12	3	5	52	7,9
Fisheries Management	2		5	1	6	2	4			4	3	7	5	3	9	51	7,7
Fishing Impacts on Marine Ecosystems	2		5		6		4		4	4	3		12	3	9	52	7,9
Genetics and Biotechnology				1	6	2	4	2		1		2	7	3	5	33	5,0
Marine Biogeochemistry								2		4		2		3		11	1,7
Marine Ecosystem Studies			5	1	6	2	4		4	5		7	12	3	3	52	7,9
Marine Geosciences				1			4						12	3		20	3,0
Modeling and Data Analysis		2	5	4	6		4			4			5	3	9	42	6,4
Networking & Research Collaboration			5							4	3			3	5	20	3,0
Physical Oceanography				1			4	2		4		2	12	3	3	31	4,7
Seafood Quality & Processing	2		5		6		4	2		1	3	7	5	3		38	5,8
Stock Assessment and Monitoring	2	2	5	4	6		4	2			3	7	5		6	46	7,0
% of total	1,5	0,9	9,8	3,5	11,8	1,5	7,3	2,7	3,6	7,1	3,6	7,9	18,9	6,8	12,9	660	
Lowest third			Middle third			Highest third											

Table 2 summarizes the funding options by research field and country. It can be seen that Spain and The United Kingdom was well presented but the reason for this is that in Spain there are two Research programs and in The United Kingdom there are four. These Programmes sometimes offered an overlapping selection of research fields.

Table 3. Number of funding options by field and region.

Field / Region	Central Europe	Mediterranean, Spain, Portugal	Nordic countries	% of total
Anthropogenic Impacts on Fisheries&Aquaculture	19	15	13	7,1
Aquaculture	14	19	13	7,0
Economics & Socioeconomics	19	4	12	5,3
Effects of Climate Change on Fisheries	17	7	8	4,8
Fisheries (Gear) Technology	22	20	10	7,9
Fisheries Biology & Ecology	16	19	17	7,9
Fisheries Management	20	15	16	7,7
Fishing Impacts on Marine Ecosystems	24	12	16	7,9
Genetics and Biotechnology	13	12	8	5,0
Marine Biogeochemistry	2	2	7	1,7
Marine Ecosystem Studies	13	22	17	7,9
Marine Geosciences		13	7	3,0
Modeling and Data Analysis	15	11	16	6,4
Networking & Research Collaboration	8		12	3,0
Physical Oceanography	5	15	11	4,7
Seafood Quality & Processing	13	12	13	5,8
Stock Assessment and Monitoring	19	18	9	7,0
% of total	36,2	32,7	31,1	

Lowest third

Middle third

Highest third

The number of funding options by field and region varied extensively among regions with the highest number of options in the central Europe (North Sea, Northeast Atlantic) and the lowest number of options in the Nordic countries (Baltic, Greenland and Northeast Atlantic; Tables 3 and 4).

Table 4. Currently available funding options by sea area.

Sea area \ Region	Central Europe	Mediterranean, Spain, Portugal	Nordic countries	% of total
Antarctic Ocean	13			2,0
Arctic Sea		10	10	3,0
Baltic Sea	21		28	7,4
Barents Sea			10	1,5
Greenland Sea	13		25	5,8
Iceland and Faeroes Grounds			12	1,8
Mediterranean – Central		8		1,2
Mediterranean – Eastern		8		1,2
Mediterranean – Western		25		3,8
North Sea	49	31	23	15,6
Northeast Atlantic	26	27	25	11,8
Northwest Atlantic	21	38	12	10,8
Norwegian Sea			17	2,6
Other Sea areas	6	31	15	7,9
Rockall, Northwest Coast of Scotland and North Ireland	21			3,2
Skagerrak and Kattegat	13		28	6,2
Subarea VII	56	38		14,2
% of total	36,2	32,7	31,1	

Lowest third

Middle third

Highest third

Table 5. Number of funding options by field and sea area WP6.

Research field \ Sea area	Sea Area																	% of total
	Antarctic Ocean	Arctic Sea	Baltic Sea	Barents Sea	Greenland Sea	Iceland and Faeroes Grounds	Mediterranean - Central	Mediterranean - Eastern	Mediterranean - Western	North Sea	Northeast Atlantic	Northwest Atlantic	Norwegian Sea	Other Sea areas	Rockall, NW Scotl. and N Irel.	Skagerrak and Kattegat	Subarea VII	
Anthropogenic Impacts on Fisheries & Aquaculture	1	2	3	1	2			2	8	5	4	2	4	2	3	8	7,1	
Aquaculture	1	1	3		3	1	2	2	6	6	5	1	4	1	3	6	7,0	
Economics & Socioeconomics	1	1	4	1	2			1	8	3	2	1	3		3	5	5,3	
Effects of Climate Change on Fisheries	1	1	3		2			1	6	3	2		2	2	3	6	4,8	
Fisheries (Gear) Technology	1	1	3		3	1	1	1	9	7	6	1	4	1	2	8	7,9	
Fisheries Biology & Ecology	1	2	4	1	3	1		2	7	7	7	2	4	2	3	6	7,9	
Fisheries Management	1	1	4	1	3	1	1	1	9	6	6	1	3	1	3	8	7,7	
Fishing Impacts on Marine Ecosystems	1	2	4	1	3	1		2	10	6	5	1	4	1	3	8	7,9	
Genetics and Biotechnology	1	1	2		2	1	1	1	3	4	4	1	2	2	2	5	5,0	
Marine Biogeochemistry		1	1	1					1	1	1	1	1	1	1	1	1,7	
Marine Ecosystem Studies	1	2	3	1	3	1	1	1	7	7	6	2	5	1	3	6	7,9	
Marine Geosciences		1	1		1	1		2	2	2	3		3		1	3	3,0	
Modeling and Data Analysis	1	1	3	1	3	1	1	1	8	3	3	1	3	1	3	6	6,4	
Networking & Research Collaboration		1	3	1	1				3	3	1	1	1	1	2	2	3,0	
Physical Oceanography		2	1	1	1	1		2	3	4	4	1	3	2	1	5	4,7	
Seafood Quality & Processing	1		4		3	1		1	5	5	6	1	3	1	3	4	5,8	
Stock Assessment and Monitoring	1		3		3	1	1	1	8	6	6		3	2	2	7	7,0	
% of total	2,0	3,0	7,4	1,5	5,8	1,8	1,2	1,2	3,8	15,6	11,8	10,8	2,6	7,9	3,2	6,2	14,2	

Lowest third

Middle third

Highest third

It is evident that programmes offered in the North Sea, Northeast and Northwest Atlantic provided the highest number of funding opportunities as well as the best coverage of all or most research fields (Tables 4 and 5). These were mostly due to high number of funding options in UK, Spain and Germany (Table 2).

3.2 Mapping of current research fields to future research fields

One of the outcome from the WP8 work group meeting conducted in Denmark in summer 2007, was a definition of 25 research field that were considered important for future fishery research. These were classified into 5 categories:

Bycatch and discard (Table 6):

- Gear Technology
- Acceptable levels of discard
- Incentives for fishermen
- Real time closures

Habitat maps (Table 9):

- Methods for developing maps
- Impact assessments

Trade-offs (Table 10):

- Multiple species – effects
- Sociological analysis of decision making process.
- Climate aspects (stock assessments, multiple species models).
- Contaminants (effects on fish populations, food webs and climate interaction).
- Behavioural responses of fishermen.
- Impact assessments and footprint analysis.
- Interdisciplinary research (socio-economic and institutional analysis) to understand the drivers behind fishers' behaviour.

Governance and political economy (Table 8):

- Explaining the process, purpose, long term plan of the different stakeholders to understand why advices are not followed and to take stakeholder's concerns into account for setting up new objectives and a new management system.
- Solve trans-boundary issues for cooperation and data exchanges.
- Find new market developments for fisheries.
- Achieve more integrated and multidisciplinary research (to achieve scientific purposes but also to attract scientists into the fishery management field).
- Consumer to ocean/ocean to plate.
- Ecolabelling and certification.
- Spatial planning and carbon footprints.

Ecosystem management would require research (Table 7):

- To find out an acceptable impact level of fisheries and other activities on the ecosystems and compare them with “footprints” (allowing trade-off).
- To understand stock diversity, fish behaviour and genetics.
- To understand spatial processes of stock structure and diversity (impact of climate change).
- To determine what is the best space size or geographical boundaries for ecosystem objectives.
- Ecosystems and tropical levels (food webs and predator-prey interactions) are important new areas and could influence policies on MSY.

Based on the WP8 report from the meeting in Denmark 2007 and a certain emphasis made in the “Blue book”, additional four research fields or conducts were also included:

- Interaction between scientists, stakeholders and policy makers (Table 8)
- Increased availability of data / databases (Table 8)
- Collaboration regarding large scale questions (Table 10)
- Increased dissemination and incorporation into management of research data (Table 8)

As a result, a total of 29 future research fields have been identified.

The total coverage of the future research fields by the current research field are demonstrated for each of the 5 categories in Tables 6 to10.

As a result, most of the future research fields are presently covered by the current research fields. Those that are not covered include “geographic boundaries for ecosystem objectives”, “Increase availability of data”, and “dissemination, and collaboration regarding large scale questions”. Of those that are covered by current research fields, some are only covered by a single field, like the interaction between scientist and stakeholders while others are covered by up to 4 or 5 current fields (Tables 6 to10).

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Table 6. Mapping of WP8 research fields in “By catch and discard” to current research fields.

<p>Current (WP6) → Future (WP8) ↓</p>	Anthropogenic Impacts on Fisheries & Aquaculture	Economics & Socioeconomics	Fisheries (Gear) Technology	Fisheries Management
Acceptable levels of discard				
Gear Technology				
Incentives for fishermen				
Real time closures				

Table 7. Mapping of WP8 research fields in “Ecosystem management” to current research fields.

<p>→ Current (WP6) Future (WP8) ↓</p>	Economics & Socioeconomics	Effects of Climate Change on Fisheries	Fisheries Biology & Ecology	Fisheries Management	Fishing Impacts on Marine Ecosystems	Genetics and Biotechnology	Marine Ecosystem Studies	Marine Geosciences
Ecosystems and trophic levels (food webs and predator-prey interactions)								
Geographical boundaries for ecosystem objectives.								
Impact level of fisheries and other activities on the ecosystems and compare with “footprints” (allowing trade-off).								
Diversity and spatial processes of stock structure (impact of climate change).								
Stock diversity, fish behaviour and genetics.								

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Table 8. Mapping of WP8 research fields in “Governance and political economy” to current research fields.

Current (WP6) → Future (WP8) ↓	Anthropogenic Impacts on Fisheries & Aquaculture	Aquaculture	Economics & Socioeconomics	Effects of Climate Change on Fisheries	Fisheries Management	Fishing Impacts on Marine Ecosystems	Genetics and Biotechnology	Marine Geosciences	Networking & Research Collaboration	No current research field	Seafood Quality & Processing
Achieve more integrated and multidisciplinary research (to achieve scientific purposes but also to attract											
Consumer to ocean/ocean to plate.											
Ecolabelling and certification.											
Explaining the process, purpose, long term plan of the different stakeholders to understand why advices are not											
Find new market developments for fisheries.											
Increase availability of data / databases											
Increase dissemination and incorporation into management of research data											
Solve transboundary issues for cooperation and data exchanges											
Interacion between scientists, stakeholders and policy makers											
Spatial planning and carbon footprints.											

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Table 9. Mapping of WP8 research fields in “Habitat maps” to current research fields.

<p>Current (WP6) → Future (WP8) ↓</p>	Effects of Climate Change on Fisheries	Fisheries Biology & Ecology	Fishing Impacts on Marine Ecosystems	Marine Ecosystem Studies	Marine Geosciences	Modeling and Data Analysis
Impact assessments	■	■	■	■	□	■
Methods for developing maps	□	□	□	■	■	■

Table 10. Mapping of WP8 research fields in “Trade-offs” to current research fields.

<p>Current (WP6) → Future (WP8) ↓</p>	Anthropogenic Impacts on Fisheries & Aquaculture	Aquaculture	Economics & Socioeconomics	Effects of Climate Change on Fisheries	Fisheries (Gear) Technology	Fisheries Biology & Ecology	Fisheries Management	Fishing Impacts on Marine Ecosystems	Marine Biogeochemistry	Marine Ecosystem Studies	Marine Geosciences	Modeling and Data Analysis	Networking & Research Collaboration	Physical Oceanography	Seafood Quality & Processing	Stock Assessment and Monitoring
Behavioural responses of fishermen.	█		█													
Climate aspects (stock assessments, multiple species models).				█							█		█		█	
Collaboration regarding large scale questions																
Contaminants (effects on fish populations, food webs and climate interaction).								█						█		
Impact assessments and footprint analysis.		█			█		█	█								
Interdisciplinary research (socio-economic and institutional analysis) to understand the drivers behind fishers’ behaviour.	█		█									█				
Multiple species – effects				█		█				█		█				
Sociological analysis of decision making process.	█		█				█									

3.3 Future research fields by current research programmes

At the 3rd meeting of the MariFish Work Package Management Group in Athens in February, 2008 a workshop was held where Participants ranked the future research fields by importance. Three geographic areas were considered. These were:

- North Atlantic
- South Atlantic
- Mediterranean

The group working with the North Atlantic ranked the fields from 1-10 (Table 11) and made changes to the research fields by combining fields under broader headings. The four topics under bycatch and discard were merged into a single topic named “Reducing bycatch and discard”. This topic was given a top priority, grade 10. The two topics under Habitat maps and spatial planning and carbon footprints (listed under Governance and political economy) were merged under a single heading, “spatial management”. This topic was given a medium priority, grade 5, however at the same time this topic was also included in Ecosystem management which received a top priority (see below). The different topics listed under “Trade-offs” were pooled into two groups. The first was renamed “The effect of climate on fish biology and stock dynamics including multispecies interactions” and given top priority, grade 10. The second topic was renamed “General trade-offs (what happens in respond to management?)” and given medium priority, grade 5. The topics listed under Governance and political economy as well as the new additions were considered to be of a local interest and therefore the responsibility of national resources. As a result, they received a medium ranking, grade 4-7. Finally, the topics listed under Ecosystem management (renamed as Ecosystem and spatial management) were all rated highly and received top priority, grade 10.

To compare with the ranking in other areas grades 0-3 are **C**, 4-7 are **B** and 8-10 are **A**.

Table 11. Ranking of future research fields for the North Atlantic

		Grade classes		
	Grade	C	B	A
		0-3	4-7	8-10
By-catch and discard				
Gear Technology	10			1
Acceptable levels of discard	10			1
Incentives for fishermen	10			1
Real time closures	10			1
Habitat maps including spatial management				
Methods for developing maps	5		1	
Impact assessments	5		1	
Trade-offs				
Multiple species – effects	0	1		
Sociological analysis of decision making process.	0	1		
The effect of climate on fish biology and stock dynamics including multispecies	10			1
Contaminants (effects on fish populations, food webs and climate interaction).	0	1		
Impact assessments and footprint analysis.	4		1	
Behavioural responses of fishermen.	5		1	
Interdisciplinary research (socio-economic and institutional analysis) to understand the drivers behind fishers' behaviour.	5		1	
Governance and political economy				
Explaining the process, purpose, long term plan of the different stakeholders to understand why advices are not followed and to take stakeholder's concerns into account for setting up new objectives and a new management system.	7		1	
Solve trans-boundary issues for cooperation and data exchanges.	4		1	
Find new market developments for fisheries.	4		1	
Achieve more integrated and multidisciplinary research (to achieve scientific purposes but also to attract scientists into the fishery management field).	4		1	
Consumer to ocean/ocean to plate.	4		1	
Ecolabelling and certification.	4		1	
Spatial planning and carbon footprints.	4		1	
Ecosystem management including spatial management ?????				
To find out an acceptable impact level of fisheries and other activities on the ecosystems and compare them with "footprints" (allowing trade-off).	10			1
To understand stock diversity, fish behaviour and genetics.	10			1
To understand spatial processes of stock structure and diversity (impact of climate change).	10			1
To determine what is the best space size or geographical boundaries for ecosystem objectives.	10			1
Ecosystems and trophic levels (food webs and predator-prey interactions) are important new areas and could influence policies on MSY.	10			1
New additions				
Interaction between scientists, stakeholders and policy makers	4		1	
Increased availability of data / databases	4		1	
Collaboration regarding large scale questions	4		1	
Increased dissemination and incorporation into management of research data	4		1	

The group working with the South Atlantic ranked the future research fields into three groups: A,B and C, with A being the most important and C the least. Three separate results were delivered for this area, one of which was mainly targeted at far south regions. These results are shown in tables 12 and 13. Those topics that received the highest ranking included: most of those listed in “bycatch and discards”, five of the topics listed under Trade-offs: Multispecies effects, sociological analysis of decision making, climate impact, contaminants and interdisciplinary research to understand drivers behind fishers’ behaviour. Two of the topics under Governance received high priority and three of the topics listed under ecosystem management: Stocks diversity, spatial diversity and stock structures and tropic level studies).

The group working on the Mediterranean region ranked from A to C and delivered four separate results (Table 14). Seven topics were ranked highly by all participants. These included: Habitat mapping, Climate aspects, Contaminants, drivers being fishers’ behaviour, cooperation and data exchange, integrated and multidisciplinary research, tropic level studies and availability of data and data bases.

Table 12. Ranking of future research fields for the South Atlantic

	Grades		Sum of...			Score
	France	Spain	A	B	C	
Bycatch and discard						
Gear Technology	A	B	1	1		B
Acceptable levels of discard	B	A	1	1		B
Incentives for fishermen	-	B		1		C
Real time closures	-	A	1			B
Habitat maps						
Methods for developing maps	A	A	2			A
Impact assessments	A		1			B
Trade-offs						
Multiple species – effects	A	A	2			A
Sociological analysis of decision making process.	B	A	1	1		B
Climate aspects (stock assessments, multiple species models).	A	A	2			A
Contaminants (effects on fish populations, food webs and climate interaction).	B	A	1	1		B
Impact assessments and footprint analysis.	-	-				C
Behavioural responses of fishermen.	-	B		1		C
Interdisciplinary research (socio-economic and institutional analysis) to understand the drivers behind fishers' behaviour.	A	B	1	1		B
Governance and political economy						
Explaining the process, purpose, long term plan of the different stakeholders to understand why advices are not followed and to take stakeholder's concerns into account for setting up new objectives and a new management system.	-	B		1		C
Solve trans-boundary issues for cooperation and data exchanges.	A	A	2			A
Find new market developments for fisheries.	-	B		1		C
Achieve more integrated and multidisciplinary research (to achieve scientific purposes but also to attract scientists into the fishery management field).	A	A	2			A
Consumer to ocean/ocean to plate.	-	C			1	C
Ecolabelling and certification.	-	C			1	C
Spatial planning and carbon footprints.	-	C			1	C
Ecosystem management						
To find out an acceptable impact level of fisheries and other activities on the ecosystems and compare them with "footprints" (allowing trade-off).	-	B		1		C
To understand stock diversity, fish behaviour and genetics.	A	A	2			A
To understand spatial processes of stock structure and diversity (impact of climate change).	A	A	2			A
To determine what is the best space size or geographical boundaries for ecosystem objectives.	-	B		1		C
Ecosystems and trophic levels (food webs and predator-prey interactions) are important new areas and could influence policies on MSY.	A	A	2			A
New additions						
Interaction between scientists, stakeholders and policy makers	-	B		1		C
Increased availability of data / databases	-	B		1		C
Collaboration regarding large scale questions	A	A	2			A
Increased dissemination and incorporation into management of research data	-	A		1		B

Table 13. Ranking of future research fields for the South Atlantic emphasis on the Antarctic

	Grade	Grade classes		
		C	B	A
Bycatch and discard	Germany	0-3	4-7	8-10
Gear Technology	2	1		
Acceptable levels of discard	8			1
Incentives for fishermen	4		1	
Real time closures	6		1	
Habitat maps				
Methods for developing maps	7		1	
Impact assessments	6		1	
Trade-offs				
Multiple species – effects	7		1	
Sociological analysis of decision making process.	8			1
Climate aspects (stock assessments, multiple species models).	10			1
Contaminants (effects on fish populations, food webs and climate interaction).	8			1
Impact assessments and footprint analysis.	7		1	
Behavioural responses of fishermen.	4		1	
Interdisciplinary research (socio-economic and institutional analysis) to understand the drivers behind fishers' behaviour.	8			1
Governance and political economy				
Explaining the process, purpose, long term plan of the different stakeholders to understand why advices are not followed and to take stakeholder's concerns into account for setting up new objectives and a new management system.	6		1	
Solve trans-boundary issues for cooperation and data exchanges.	2	1		
Find new market developments for fisheries.	5		1	
Achieve more integrated and multidisciplinary research (to achieve scientific purposes but also to attract scientists into the fishery management field).	4		1	
Consumer to ocean/ocean to plate.	8			1
Ecolabelling and certification.	6		1	
Spatial planning and carbon footprints.	6		1	
Ecosystem management				
To find out an acceptable impact level of fisheries and other activities on the ecosystems and compare them with "footprints" (allowing trade-off).	7		1	
To understand stock diversity, fish behaviour and genetics.	4		1	
To understand spatial processes of stock structure and diversity (impact of climate change).	6		1	
To determine what is the best space size or geographical boundaries for ecosystem objectives.	6		1	
Ecosystems and trophic levels (food webs and predator-prey interactions) are important new areas and could influence policies on MSY.	8			1
New additions				
Interaction between scientists, stakeholders and policy makers	5		1	
Increased availability of data / databases	0	1		
Collaboration regarding large scale questions	1	1		
Increased dissemination and incorporation into management of research data	0	1		

Table 14. Ranking of future research fields for the Mediterranean

	Grades				Sum of ...			Score
	Greece	France	Spain	Cyprus	A	B	C	
Bycatch and discard								
Gear Technology	A	A	B		2	1		B
Acceptable levels of discard		-	A	A	2			B
Incentives for fishermen		-	C	A	1		1	C
Real time closures	A	-	A		2			B
Habitat maps								
Methods for developing maps	A	A	A	A	4			A
Impact assessments		A	A	B	2	1		B
Trade-offs								
Multiple species – effects	A	A	C	B	2	1	1	B
Sociological analysis of decision making process.		-	B	B			2	C
Climate aspects (stock assessments, multiple species models).	A	A	A	B	3	1		A
Contaminants (effects on fish populations, food webs and climate interaction).	B	A	A	A	3	1		A
Impact assessments and footprint analysis.		-	C	B		1	1	C
Behavioural responses of fishermen.		-	B	B		2		C
Interdisciplinary research (socio-economic and institutional analysis) to understand the drivers behind fishers' behaviour.	A	A	A	C	3		1	A
Governance and political economy								
Explaining the process, purpose, long term plan of the different stakeholders to understand why advices are not followed and to take stakeholder's concerns into account for setting up new objectives and a new management system.		-	B	B		2		C
Solve trans-boundary issues for cooperation and data exchanges.	A	A	A	B	3	1		A
Find new market developments for fisheries.		-	B	A	1	1		B
Achieve more integrated and multidisciplinary research (to achieve scientific purposes but also to attract scientists into the fishery management field).	A	A	A	B	3	1		A
Consumer to ocean/ocean to plate.		-	C				1	C
Ecolabelling and certification.		B	C	B		2	1	C
Spatial planning and carbon footprints.	B	-	C			1	1	C
Ecosystem management								
To find out an acceptable impact level of fisheries and other activities on the ecosystems and compare them with "footprints" (allowing trade-off).		-	A	A	2			B
To understand stock diversity, fish behaviour and genetics.	B	B	A	B	1	3		B
To understand spatial processes of stock structure and diversity (impact of climate change).		B	A	B	1	2		B
To determine what is the best space size or geographical boundaries for ecosystem objectives.		-	B	B		2		C
Ecosystems and trophic levels (food webs and predator-prey interactions) are important new areas and could influence policies on MSY.	A	A	A	A	4			A
New additions								
Interaction between scientists, stakeholders and policy makers	B	B	B	B		4		B
Increased availability of data / databases	A	A	A	B	3	1		A
Collaboration regarding large scale questions	B	B	A		1	2		B
Increased dissemination and incorporation into management of research data	B	B	A		1	2		B

In order to find common research interests all the results were combined into one table showing the relative rankings by each group (Table 15).

Table 15. Combined ranking results (colouring shows emphasis as described at the bottom of the table)

By-catch and discard

- Gear Technology
- Acceptable levels of discard
- Incentives for fishermen
- Real time closures

Habitat maps

- Methods for developing maps
- Impact assessments

Trade-offs

- Multiple species – effects
- Sociological analysis of decision making process.
- Climate aspects (stock assessments, multiple species models).
- Contaminants (effects on fish populations, food webs and climate interaction).
- Impact assessments and footprint analysis.
- Behavioural responses of fishermen.
- Interdisciplinary research (socio-economic and institutional analysis) to understand the drivers behind fishers' behaviour.

Governance and political economy

- Explaining the process, purpose, long term plan of the different stakeholders to understand why advices are not followed and to take stakeholder's concerns into account for setting up new objectives and a new management system.
- Solve trans-boundary issues for cooperation and data exchanges.
- Find new market developments for fisheries.
- Achieve more integrated and multidisciplinary research (to achieve scientific purposes but also to attract scientists into the fishery management field).
- Consumer to ocean/ocean to plate.
- Ecolabelling and certification.
- Spatial planning and carbon footprints.

Ecosystem management

- To find out an acceptable impact level of fisheries and other activities on the ecosystems and compare them with "footprints" (allowing trade-off).
- To understand stock diversity, fish behaviour and genetics.
- To understand spatial processes of stock structure and diversity (impact of climate change).
- To determine what is the best space size or geographical boundaries for ecosystem objectives.
- Ecosystems and trophic levels (food webs and predator-prey interactions) are important new areas and could influence policies on MSY.

New additions

- Interaction between scientists, stakeholders and policy makers
- Increased availability of data / databases
- Collaboration regarding large scale questions
- Increased dissemination and incorporation into management of research data

	South	Far south	Med	North
Gear Technology	B	C	B	A
Acceptable levels of discard	B	A	B	A
Incentives for fishermen	C	B	C	A
Real time closures	B	B	B	A
Methods for developing maps	A	B	A	B
Impact assessments	B	B	B	B
Multiple species – effects	A	B	B	C
Sociological analysis of decision making process.	B	A	C	C
Climate aspects (stock assessments, multiple species models).	A	A	A	A
Contaminants (effects on fish populations, food webs and climate interaction).	B	A	A	C
Impact assessments and footprint analysis.	C	B	C	B
Behavioural responses of fishermen.	C	B	C	B
Interdisciplinary research (socio-economic and institutional analysis) to understand the drivers behind fishers' behaviour.	B	A	A	B
Explaining the process, purpose, long term plan of the different stakeholders to understand why advices are not followed and to take stakeholder's concerns into account for setting up new objectives and a new management system.	C	B	C	B
Solve trans-boundary issues for cooperation and data exchanges.	A	C	A	B
Find new market developments for fisheries.	C	B	B	B
Achieve more integrated and multidisciplinary research (to achieve scientific purposes but also to attract scientists into the fishery management field).	A	B	A	B
Consumer to ocean/ocean to plate.	C	A	C	B
Ecolabelling and certification.	C	B	C	B
Spatial planning and carbon footprints.	C	B	C	B
To find out an acceptable impact level of fisheries and other activities on the ecosystems and compare them with "footprints" (allowing trade-off).	C	B	B	A
To understand stock diversity, fish behaviour and genetics.	A	B	B	A
To understand spatial processes of stock structure and diversity (impact of climate change).	A	B	B	A
To determine what is the best space size or geographical boundaries for ecosystem objectives.	C	B	C	A
Ecosystems and trophic levels (food webs and predator-prey interactions) are important new areas and could influence policies on MSY.	A	A	A	A
Interaction between scientists, stakeholders and policy makers	C	B	B	B
Increased availability of data / databases	C	C	A	B
Collaboration regarding large scale questions	A	C	B	B
Increased dissemination and incorporation into management of research data	B	C	B	B

2 rankings A B C 1 ranking 1 – 10 4 rankings A B C 1 ranking 1- 10

For the category “By catch and discards” the most important research field is “Acceptable levels of discard” (Table 15). This field overlaps with two of the current funding options; “Anthropogenic impacts on Fisheries and Aquaculture” and “Economics and Socioeconomics” (Table 6).

For the category “Habitat maps” the most important research field is “Methods for developing maps” which overlaps with “Marine ecosystem studies”, “Marine Geosciences” and “Modeling and Data Analysis” (Table 9).

For the category “Trade-offs” the most important research field is “Climate aspects (stock assessments, multiple species models)” which overlaps with “Effects of Climate Change on Fisheries”, “Marine Geosciences”, “Physical Oceanography” and “Stock Assessment and Monitoring” (Table 10).

For the category “Governance and political economy” the most important research fields are “Solve trans-boundary issues for cooperation and data exchanges” with no overlap in table 8 and thus no current funding options and “Achieve more integrated and multidisciplinary research (to achieve scientific purposes but also to attract scientists into the fishery management field)” which overlaps with “Networking & Research Collaboration” (Table 8).

For the category “Ecosystem management” the most important research field is “Ecosystems and tropic levels (food webs and predator-prey interactions) are important new areas and could influence policies on MSY” which overlaps with “Effects of Climate Change on Fisheries”, “Fisheries Biology & Ecology”, “Fishing Impacts on Marine Ecosystems”, “Marine Ecosystem Studies” and “Marine Geosciences”(Table 7).

For the category “New additions” the research fields “Increased availability of data / databases” and “Collaboration regarding large scale questions” were ranked high in some areas.

4. Discussion

The main objectives of Work Package 6 is to identify emerging problems facing fisheries management at the regional and European scale and identify jointly funded MariFish research topics, based on the partners management and science strategies.

A significant part of this work was conducted during the MariFish symposium organized by Work Package 8 conducted in Roskilde, Denmark in June 2007. During this symposium a number of recommendations, including a definition of 25 future research fields classified into 5 main categories, were defined. These future results fields address many of the emerging problems facing fisheries management in the next 10 years.

In WP 5, current research activities funded by the partners, were initially classified into 17 research fields and inserted into the National Research Program Database.

The different research fields varied with respect to funding options and the number of funding options varied between regions and sea areas (chapter 2). In

general, the highest number of options were available in central Europe (North Sea and Northeast Atlantic) and the lowest number of options in the Nordic countries. The main reason for this stems from the fact that central Europe has greater representation within the project (i.e. higher number of partners) than the Nordic. Additionally, in some of the countries (for example Iceland and Sweden) a substantial part of relevant research is funded by non partners (D2.1).

In order to see how the future research fields (WP 8) were covered by the 17 current research fields (WP 5), a mapping showing overlap between current and future research fields was designed (chapter 3). Most of the future research fields were found to be covered by current research fields. Some were covered by a single field but others by many. However, one of the main problem with this analysis, stems from the fact that the data contains no information on actual research activities. The National Research Programme Database contains only information on possible funding options, but no information on which options are presently being used or how much funds have been allocated to each research field.

It should be noted that the results from the mapping of the current vs. future research fields do not stipulate the relative importance of the different research fields, i.e. low coverage does not necessary call for an increase in funding activity. Therefore, during the meeting in Athens in February 2008, a workshop was conducted where all partners were asked to rank future research fields by importance.

Ranking of research topics varied between areas. All partners agreed on highest importance for two topics; **climate aspects** (stock assessments, multiple species models) and **ecosystems and tropic levels**. Partners from northern regions gave high ranking to all topics in the categories “By-catch and discards” and “Ecosystem management” while southern regions emphasized topics within categories “Trade-off’s”, “Habitat mapping” and “Governance and political economy” as well as “ecosystem management”

The overall results of the ranking were used to identify four common research fields to be jointly funded by MariFish in WP7. These were:

- Reduction of by-catch and discards from commercial fisheries
- Influence of climate on fish biology and population dynamics
- Managing fisheries within an ecosystem
- Habitat mapping

5. Conclusions

The research fields identified during the WP8 working group meeting in Denmark 2007, provide a comprehensive list of topics that cover most areas that are expected to be important for future fishery research. According to the work performed by WP6, most of these topics are potentially covered by current

research funding options although the extent of coverage varies between fields and areas.

The ranking of these topics, performed during the WP6 working group meeting in Athens, demonstrated extensive differences between geographical areas in terms of importance assigned to the different topics. Only two topics received top ranking by all participants. These were the Climate aspects and Ecosystem and topic levels studies. Both of these topics are relatively well covered by the current funding options (Tables 7 and 10). Two more topics received top ranking by 75% of the participants, i.e. acceptable levels of discard and multiple species effects in trade-offs. Both of these are also covered by current funding options (Tables 6 and 10). However, it should be reiterated that the statistics listing the number of funding options does not give information on the actual research activity involved within these fields.

A number of research fields received low ranking. These included: impact assessments associated with the Habitat maps, many of the Governance and political economy topics, i.e. as they were expected to be dealt with on a national basis, gear technology and real time closures within by-catch and discard and impact/footprints.

Finally, the outcome of the ranking exercise was used to identify common research fields to be jointly funded by MariFish WP7.

6. References

- An Integrated Maritime Policy for the European Union (COM(2007) 574 final). The Blue Book. 10. October 2007. 16pp.
- D1.4a Drivers for Fisheries Management Report.
- D2.1 Pre-Analysis Report comparing methods of research programme identification, commissioning and management within the MariFish Partnership, identifying particular strengths and weaknesses of the different national structures.
- D3.3 (3.1 & 3.2) Strengths and Deficiencies of International, European and Regional Collaboration and Coordination of MariFish Partner Countries.
- D4.4 Report of workshop and summary of priorities.
- D5.2 Criteria Matrix for the Evaluation of National Research Programs.
- D8.1 Future Demands for Fisheries Research.