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The Human Dimensions of the European Fisheries Governance: the North/South divide

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The Human Dimensions of the European Fisheries Governance: the North/South divide

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by

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Abstract

The Common Fisheries Policy (CFP) has been in existence since 1970 and has undergone two reforms. However, as a result of the CFP, European fisheries remain heavily subsidised and over-capitalised such that too many vessels chase too few fish. Consultation for the third reform of the CFP suggests that the cause of the failure of the CFP is institutional; if the right rules and governance structures had been put into place earlier, then natural resources would have been used wisely and conservation goals could have been met. At the same time, institutional success requires that all components (biological, socio-political and economic) of a fishery system are taken into account during policy-making. This thesis draws on the lessons that can be learnt from the historical legacy of the CFP. A multidisciplinary approach was adopted to identify how the Common Fisheries Policy's (CFP) governance structures and management system have influenced the European fisheries sector in economic and social terms, with specific reference to the European North/South divide. The CFP's conservation regulations were analysed to identify their spatial distribution and the biological and socio-political contexts which led to that distribution. The economic and structural changes that potentially arose as a result of some of these regulations were explored for selected European fishing fleets from the U.K., Denmark, Spain and Cyprus. Ports in these four countries were visited, and questionnaires were conducted to identify fishers' perceptions of the economic impact of regulatory measures using a conjoint analysis method which originated in the market research arena. These perceptions were compared to those of fisheries experts regarding the success of regulatory measures designed to sustain fisheries in order to identify any disparities between three potential management scenarios; the ideal scenario according to fishers, the ideal scenario according to fisheries experts and the status quo. Finally, social knowledge collected during field visits was used to fill in the information gaps which can lead to a robust and compliant fishery sector. As shown in Chapter 2 there is some degree of regionalization in the CFP, and the countries in the Northern European latitudes have to comply with a more burdensome management regime than those countries in the Southern latitudes. However, despite the CFP being a framework with a high degree of regulatory burden has not achieved its goals for sustaining the fisheries resources and as shown from Chapter 3, successes

or failures of measures can depend on the socio-political and ecological settings in which they have been applied. For example, the correct implementation of the *Buyers and Sellers* regulation in the UK increased fish prices and helped reduce black landings and thereby gained the industry's support. In Spain however, there is no indication that this regulation has been implemented effectively with landings and fish value data suggesting misreporting of landings. The findings in Chapter 4 and 5 supports the importance of industry participation in decision-making, as understanding of the function and the importance of measures imposed can increase acceptability of the regime. Chapter 6 demonstrated that there are localised differences in compliance and enforcement culture but also in factors such as isolation of the community, invasive species which can have a more pronounced impact on the fishery Social-Ecological System than any of the imposed measures. In conclusion, the CFP 2012 reform needs to focus on restructuring of its governance framework: a simplified regulatory framework with different methods of governance across different regions, allowing a greater involvement of stakeholders and a fast-track decision-making process.

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1 General Introduction

1.1 Introduction

With increasing awareness of the vulnerability of natural resources during the latter part of the 20th century, governments and intergovernmental organisations have introduced various measures aimed at improving the sustainability of our resource use. However, recently there has been an increase in the notion that the cause of resource degradation is institutional and that if the right rules and governance structures were put into place, natural resources would have been used wisely and conservation goals would have been met (Acheson, 2006). Fisheries resources are a common pool resource (CPR) which means that their use is not isolated from the surrounding society but is nested in the political, legal, and economic environment that both are a part of the CPR system and of the surrounding society (Rova, 2004). Thus, even though, introduced measures should ideally be based on the best available scientific understanding of the nature of these resources, in order for that regime to be a success interdisciplinarity is vital; thus cooperation of all relevant disciplines (biological, economics and social science) is needed (Charles, 1995; Daw & Gray, 2005; Symes, 2005; Buanes & Jentoft, 2009). There are a number of reviews on the importance of social science in fisheries management (Fricke, 1985; Clay & Goodwin, 1995; Wilson, 2001) and various theoretical frameworks have been created with which social scientists are attempting to make their discipline more 'acceptable' to conventional natural scientists.

Policy is an end rather than a cause; usually a result of social processes. Specifically, the regulatory framework of the European fisheries sector is the result of interactions amongst social, economic, biological, environmental and regulatory components, involving fishers and fishing communities, fishery capital, fish stocks, and economic and ecological environments (Charles, 1988; Mosse, 2004). This regulatory framework is known as the Common Fisheries Policy (CFP). However, when regimes are promoted as universal remedies, they tend to miss the complex details of the different systems and especially in the case of the CFP, rules and regulatory measures alone cannot guarantee successful outcomes (Folk and Berkes, 1995; Degnbol *et al.*, 2006). This is because regional differences in institutional structures, be they social, cultural, economic or biological need to be taken into account as different communities respond differently in institutional changes (Janssen *et al.*, 2007).

1.1.1 Governance in Fisheries

When effective management policies do not exist, there are two possible outcomes: a situation leading to the 'Tragedy of the Commons'; or alternatively, a situation where fishermen become self-regulating. Hardin in his famous 'Tragedy of the Commons' (1968) argued that common property resources due to their nature, will eventually be overexploited or degraded unless common property is converted into private property or top-down attempts are placed to control the 'freedom in the commons'. Global fisheries landings have been declining (Pauly *et al.*, 1998) as Hardin predicted, with a couple of examples being the collapse of the Atlantic cod in Canada in 1993 (Myers *et al.*, 1997) and the bluefin tuna in the Mediterranean and the northeast Atlantic (MacKenzie *et al.*, 2009). However, Hardin's pattern has not only been identified in the majority of unregulated fisheries around the world (Hilborn *et al.*, 2003) but also in fisheries regulated by top-down institutions (Berkes *et al*, 1989; Ostrom, 1999; Jentoft, 2010). Such top-down regulatory attempts followed recommendations based solely on biology and thus were unlikely to be suitable for the 'real world' in which fishers' behaviour (and therefore fishing mortality) is affected by economics and external societal issues as well as the personal experience, circumstances, traditions, perceptions, beliefs and preferences of individual fishers (Daw & Gray, 2005).

Fisheries management has now moved beyond Hardin's narrative (and hierarchical governance) and a number of different governance structures have been examined such as fishery property rights and co-management (Charles, 1994; Ostrom, 2001; Raakjær Nielsen *et al.*, 2004; Hentrich & Salomon, 2006; Gelcich *et al.*, 2009). Hilborn *et al* (2005) has identified three primary elements of governance (i) the way in which individuals are allowed to access fish resources (the issue of property rights (Schlager & Ostrom, 1992); (ii) the decision-making structure of the institutions; and (iii) the spatial scale of management. Regarding the issue of property rights the following regimes have been outlined by Berkes *et al.* (1989): (a) Open access (or absence of well-defined user rights), (b) private property (individuals or corporation has the right to exclude other from extracting the resource), (c) Communal property (property rights held by a community of users) and (d) The state (has the rights to a resource and can distribute it or not to its citizens). Regarding the decision-making structure of institutions which is also associated with spatial-scale of management, Symes (1998a), outlined that the responsibility of setting up the regulatory agenda can rely on: (i) the central government, (ii) a decentralised or regional authority, (iii) devolved to a delegated non-governmental organisation, (iv) an endogenous local system or (v) a combination of the above. In these set ups, the relationship between the regulators and the resource users, the division of responsibility and thus the level of co-management is also important (Jentoft *et al.*, 1998; Symes, 1998a; Kaplan & McCay, 2004).

Decisions regarding the appropriate management systems in fisheries should depend on the biological, social and economic specificities of each fishery system. However, for this to be possible economic, social but also fisher-participatory related research is important for the build up and improvement of the much needed information base on the human side of the fishery systems. Within this context, Charles (1995) suggests that research priorities are: (i) analysis of the management system at a strategic level and operational levels, (ii) identification (thus future predictions) of fisher behaviour particularly in response to regulations, (iii) the human (fleet and labour dynamics and capital and capacity expansion) dynamics in fishery systems, and (iv) the use of integrated systems modelling approaches. This thesis is an attempt to provide information which will help form an holistic picture of the human side of what has been described as a complex fishery system; the European fisheries sector.

1.2 The European Union's Fisheries sector

Even though the contribution of the fishing sector for the gross national product of Member States is generally less than 1%, it is still an important sector due to its significance as a source of employment in areas where there are often few alternatives (European Commission, 2007a). In 2008, the twenty seven Member States owned 86,587 fishing vessels collectively, with a total tonnage of 1,869,329 GT and a total engine power of 6,878,037 kW. The European Community, despite its enlargement from 15 to 27 Member States, was subject to a 31.3% decrease in the total annual catch for fisheries products of the fishing fleet[1] (from 7,492,173) and a 15.4% decrease in the number of fishing vessels between 1997 and 2007. It has been roughly estimated that 126,000 people[2] are employed full time in the European fisheries sector in 2007, 95% of which were employed in the old Member States (AER, 2009).

Table 1.1 presents data on the number of fishing vessels, total tonnage (GT), total engine power (kW) and employment in the fisheries catching sector for each Member State in 2007. The top three Member States for each indicator are in bold. Spain is Europe's leading fishing nation being in the top three Member States with regards to 'number of fishing vessels', 'total tonnage', 'total engine power' and 'employment'. Spain, France and Italy also appear to be among the EU's leading fisheries nations, owning the EU's biggest national fishing fleets in total engine power, and having the highest employment in the fisheries catching sector.

[1] From all oceans and internal waters of the world.
[2] Calculated from data provided by Member States using full-time equivalents (or total employed data if not available). These estimates did not include Malta or Portugal as data from these Member States were not provided.

Table 1.1: Structure of the European fishing sector as it was in 2008 for 'Number of fishing vessels', 'total tonnage' (GT), 'total engine power' (kW) and as it was in 2007 for 'employment number' per Member State and for all Member States together. The top three Member States for each indicator are in bold (Data from Eurostat and AER, 2009).

Country	Fishing vessels (No)	Total tonnage (GT)	Total engine power (kW)	Employment (FTE/ Total*)
EU (27 countries)	86587	1869329	6878037	146536
EU (25 countries)	83297	1858612	6801284	
EU (15 countries)	77934	1693800	6389640	
Belgium	100	19007	60620	501*
Bulgaria	2852	9047	70512	
Czech Republic	N/A	N/A	N/A	N/A
Denmark	2895	73040	263914	1943
Germany	1828	69135	161248	1617
Estonia	966	17808	45974	3421*
Ireland	2023	69867	193409	3838*
Greece	**17353**	88805	510993	24745*
Spain	**11420**	**461071**	**1029530**	**35274**
France	7941	**199269**	**1082260**	**13155**
Italy	**13683**	196313	**1149081**	**25426**
Cyprus	1169	5383	49023	747
Latvia	841	38228	61080	1632
Lithuania	221	50478	59794	744
Luxembourg	N/A	N/A	N/A	N/A
Hungary	N/A	N/A	N/A	N/A
Malta	1152	10961	86161	N/A
Netherlands	825	146925	344073	1966
Austria	N/A	N/A	N/A	N/A
Poland	833	40971	98958	2664
Portugal	8585	106516	383099	17021*
Romania	438	1670	6241	N/A
Slovenia	181	983	10653	116*
Slovakia	N/A	N/A	N/A	N/A
Finland	3240	16046	169707	1783 (2006)
Sweden	1486	41807	208913	1879
United Kingdom	6555	**206000**	832794	8064

1.2.1 The Common Fisheries Policy

During the treaty of Rome, national governments reasoned that the Community would be more able to defend its interests in international negotiations and manage its varied fish stocks through a single fisheries policy than via a series of national policies (Agiovlassiti, 1995). The formation of the Common Fisheries Policy (CFP) began in 1970, with the adoption of general principles and rules which were mainly aiming at the designation of fishing zones and access to coastal waters. The first common measures agreed equal access to fishing grounds for EU fishers (with the exception of the 12 nm coastal band reserved for local fishers and those who traditionally fished in those waters), a common market for fisheries products and a structural policy to coordinate the modernisation of fishing vessels. In this early stage however, there was a lack of means in the legislation to prevent the inherent rivalry which lead to over-harvesting of the resources (Jensen, 1999) and the conservation of the stocks was a vague and poorly defined concept. In 1977, Member States extended their rights to marine resources from 12 to 200 miles from the coast which meant that Member States were prevented from accessing catches within 200 nm of non-Member States and vice versa.

When the Common Fisheries Policy (CFP) was established in 1983 through the basic Regulation (EEC) No 170/83[3], it formed a framework of common rules for the EU Member States, covering all aspects and stages of the fishing industry from the sea to the consumer. This pan-European framework for fisheries management entails a two-dimensional process called Europeanization. A 'bottom-up' dimension refers to the evolution of European institutions as a set of new norms, rules and practices, whereas the 'top-down' dimension refers to the impact of these new institutions on political structures and processes of the Member States (Borzel, 2002). When in 1983-1991, the Member States of the Community agreed upon a system for the conservation and management of fish stocks in EU waters (with the exception of the Mediterranean), and this is when the concept of Total Allowable Catches (TACs) came into being. There was also a new approach for the regulation of the fishing fleet through

[3] Council Regulation (EEC) No. 170/83 establishing a Community system for the conservation and management of fishery resources.

harmonization of structural policies through the Multi-Annual Guidance Programs (MAGPs). The 1991 Review of the CFP was critical of the low level of attention paid to social parameters and highlighted the lack of an effective social policy to cope with the socio-economic implications of restructuring and thus fulfil the European Community's obligation of strengthening social and economic cohesion (European Commission, 1991).

The 2002 reform of the CFP had a greater focus on the sustainable exploitation of living aquatic resources based on sound scientific advice and on the precautionary approach to fisheries management (European Commission, 2004) and aimed for a move towards long-term perspective on fisheries management by introducing recovery and management plans. Public funds to support development of the sector became more selective and the structural policy gave more emphasis on the diversification of the coastal communities. However, 7 years on, the objectives of the reform have not been met, and still, 88% of the Community stocks are being fished beyond their maximum sustainable yield (MSY) (European Commission, 2009a). A new control system has been decided with better application of the rules since the current diversity of national control systems and sanctions for rule breakers, undermines the effectiveness of enforcement. Member States have been given authorisation to choose how they conduct the EU's policy on reducing fleet capacity. This new fleet policy was supposed to be simpler by putting responsibility for matching fishing capacity to fishing possibilities with the Member States, phasing out public aid for renewal and modernisation of fishing vessels. In addition, a new fishing effort regime set the number of days fishing vessels are allowed to conduct their fishing activities.

Currently, the CFP uses two types of instruments to conserve fish stocks within its jurisdiction: total allowable catches (TACs) which set upper limits for the total amount of fish which can be landed from particular areas; and technical measures including gear regulations, closed seasons, closed areas, and minimum allowable sizes for individual species. New management tools and targets like TACs and MSY created demand for advice on social and economic issues, causing a shift from biological issues being the only advice requested by managers (Degnbol *et al.*, 2006). In addition, there are policy attempts to limit fishing effort by controlling the capacity of fleets (structural measures) and limiting time spent at sea. The establishment of these measures is based on scientific assessment of the status of stocks. Working groups of scientists within the International Council for the Exploration of the Seas (ICES) coordinate and report on research, which is then discussed by the ICES Advisory Committee on Fishery Management (ACFM) and used to produce scientific advice for the European Commission. The commission then forms a proposal in light of this evidence and discussions with various relevant departments and committees, including the Scientific, Technical and Economic Committee on Fisheries (STECF) and the European Parliament Fisheries Committee. Proposals are sent in turn to the Council of Ministers, made up of national ministers from member states. The fact that the Council of Ministers has the final authority to negotiate and formulate fishery regulations means that the translation of scientific discovery into practical policies is often slow and incomplete, as many other political, social and economic factors come into play (Daw & Gray, 2005).

The subject of fisheries has frequently caused problems and complications in previous enlargements of the European Community. In a period of half a century and in five successive enlargements, the Member States increased from 6 to 27, and the populations from less than 200 million to a population close to 500 million people (Figure 1.1).

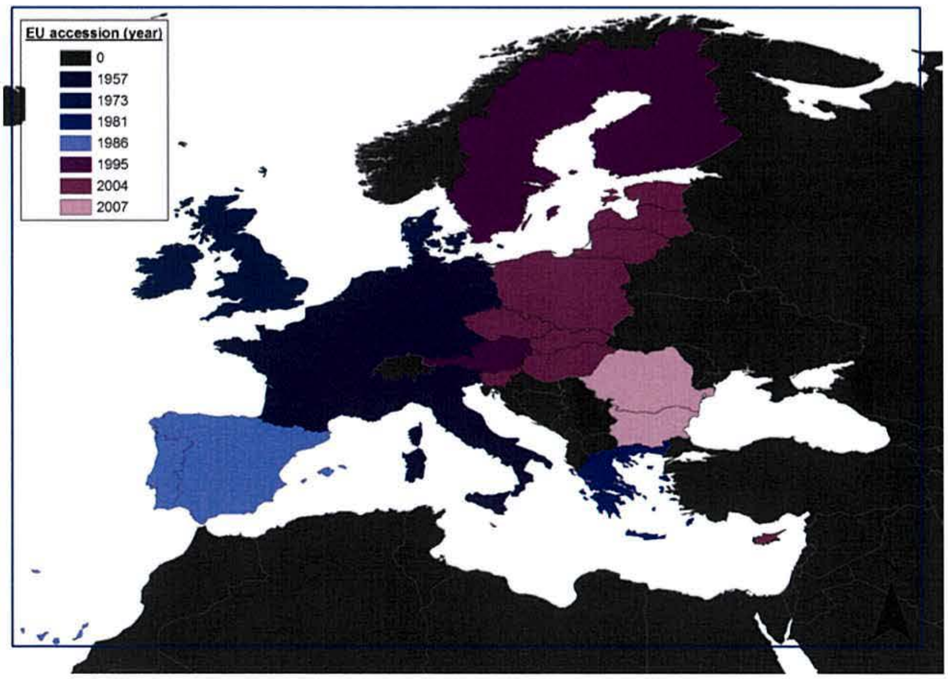

Figure 1.1: Timeline of the enlargement of the European Union (1957-2010).

After the last EU enlargement, all coastal states that have a share in the resources of the European Atlantic are part of the EU except Norway, Iceland and Russia. In the Mediterranean only 9 out of the 23 country-members of the General Fisheries Commission for the Mediterranean (GFCM) are members of the EU. Thus, in many cases, the EU has to call upon other Mediterranean/International legislative agreements in an attempt to protect Mediterranean stocks. The non-EU GFCM members known as the Mediterranean Partner Countries (MPCs)[4] accounted for 54% of fish caught in the Mediterranean in 2006, whereas the EU-27 accounted for 35%[5].

This EU enlargement meant that there was an even greater detachment between regulators and resource users. During the 2002 reform, the importance of regionalization was realised and steps were taken to adapt fisheries management more closely to the specificities of different seas and oceans, with one of the main innovations relating to the creation of Regional Advisory Councils (RACs). These councils enable dialogue among stakeholders, and provide mechanisms to reinforce stakeholder consultation by the Commission and the Member States. The new structure also reflects the need to adapt to the successive enlargements of the European Union and the increased diversity of Europe's fisheries regions (European Commission, 2002b). Today, 7 RACs are in existence, each of which was established at different years (in order of their operation starting from the oldest are: North-Sea RAC (November 2004), Pelagic stocks (August 2005), North-Western waters (September 2005), Baltic Sea (March 2006), Distant water fisheries (March 2007), South-western waters (April 2007), and the most recent being the Mediterranean Sea (September 2008)).

Besides problems that are related to the EU enlargement there are others which further complicate management. Such problems relate to natural heterogeneity in the environments in the area (Symes, 1999b), countries sharing parts of their 200-mile zones (EEZ) and the usually more industrialised/commercial forms of fishing. When it comes to the EEZs of Member States, the EU's joint EEZ is used for fisheries management (amounting to 25 million km^2) so vessels or nationals from one country

[4] The MPCs are Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, occupied Palestinian territory, Syria, Tunisia and Turkey.
[5] Eurostat: Statistics in focus. 88/2008

are allowed to fish in the EEZ of another Member State. In addition, due to the politicization of decision-making the advice of scientists is rarely adopted in full at the policy stage and technical and structural measures have often been stalled (Daw & Gray, 2005). Finally, the measures which are eventually adopted are poorly enforced (Daw & Gray, 2005).

1.2.2 Governance in Europe's Common Fisheries Policy

The CFP requires that EU fishermen have equal treatment and economic chances in Member State's waters. This has proven a particularly difficult task especially in an era when 'it is becoming increasingly important to ensure sustainable fishing as fish stocks dwindle, taking account of environmental, economic and social aspects in a balanced matter' (European Commission, 2004). The European fisheries sector implicates a number of different stakeholders and interests which means that a broad range of objectives need to be taken into account. Thus, fisheries management is characterised by multiple conflicting objectives and allocation issues which are politically sensitive and difficult (Charles, 1989; Buck, 1995; Daw & Gray, 2005; Wattage, 2005). Theoretically, biological management should ensure sustainability, however, what makes a good policy is not always what makes an implementable one (Andersen, 1983; Mosse, 2004). Thus, as stated in the EU Governance White Paper policymaking should be participatory, transparent, accountable, effective and coherent and where appropriate decentralised (European Commission, 2001).

The significance of environmental governance[6] within the EU goes beyond matters of legislation. It extends to (i) the manner in which the process of decision-making has become institutionalized[7]; (ii) how existing arrangements formulate, develop, and implement policy, and (iii) the set of rules, conventions, norms and practises within which organizational actors function (Weale *et al.*, 2003). The complex interactions amongst social, economic, biological, environmental and regulatory components in the EU led to the CFP being a complex set of rules (Charles, 1988). The CFPs'

[6] Defined in *Europa Glossary* as that which concerns all the rules, procedures and practices affecting how powers are exercised within the EU.

[7] The process in which environmental policy has been incorporated into a structured and highly formalised system (from Merriam-webster dictionary)

complexity has now been acknowledged and this has made the CFP simplification part of the European Commission's simplification programme which is part of the Commission's on-going policy domains. More specifically DG-MARE (the European Commission's Department on Fisheries and Maritime Affairs) adopted a multiannual sectoral plan to simplify it. As a matter of priority, the simplification would cover measures for the management and control of fishing activities.

In the light of the 2012 CFP reform, a Green Paper was published in 2009 to launch the consultation for this reform in which the Commission acknowledges that the 2012 reform could be the last chance to achieve the biological and economic sustainability goals of the European fisheries sector: '(the new CFP framework) needs to be a sea change cutting to the core reasons behind the vicious circle in which Europe's fisheries have been trapped in recent decades' (European Commission, 2009a). For the future reform to lead to successful measures, simplification of the CFP is crucial, as rules need to be more transparent, easier to understand and less burdensome to comply with (European Commission, 2009b). Additionally, a regional component is vital for stakeholder participation especially in a sector as culturally, economically and biologically diverse as that of European Fisheries. Thus, regionalization needs to go beyond the creation of the RACs during the last reform. A number of studies have criticized the CFP and identified where it has gone wrong (Daw & Gray, 2005; Khalilian et al., 2010; Markus, 2010). The Commission itself did a good job in pointing out the flaws of their own framework, by identifying its structural failings in the latest Green Paper something they failed to appreciate during the CFP's previous reviews in 1992 and 2002. During past reforms, the recommended changes did not involve suggestions of altering the basic approach whereas the intention in 2012 appears to be a fundamental reform tackling (i) problems of enforcement, and (ii) commitment to the legislative measures, and (iii) the problem of having a centralised governance system where Member States and the industry are rather disconnected from it (Symes, 2009). The identified structural failings are (European Commission, 2009a):

i) Deep-rooted problem of fleet overcapacity

ii) Imprecise policy objectives resulting in insufficient guidance for decisions and implementation

iii) Decision-making system that encourages a short-term focus

iv) Framework that does not give sufficient responsibility to the industry

v) Lack of political will to ensure compliance and poor compliance by the industry

The green paper on the CFP reform states that: 'Scientific knowledge and data are of vital importance to the CFP, because policy decisions must be based on robust and sound knowledge on the level of exploitation that stocks can sustain, of the effects of fishing on marine ecosystems and on the impacts of changes such as climate change' (European Commission, 2009a). However, there are a number of factors which make causes of economic successes and failures difficult to identify such as the complex socioeconomic context of the fisheries sector, the limited human and institutional resources available to provide advice and the numerous and complex questions needing to address (Kodithuwakku & Rosa, 2002; European Commission, 2009a).

1.3 Aims of the Thesis

This thesis aims to identify how the governance structures and management system of the Common Fisheries Policy (CFP) have influenced the European fisheries sector in economic and social terms, with specific reference to the European North/South divide. The term 'governance' is used according to the definition in the CFP's roadmap: 'the rules, processes and behaviour that affect the way in which powers are exercised, particularly as regards openness, participation, accountability, effectiveness and coherence' (European Commission, 2002b). The term 'management system' is the framework of processes and procedures used to ensure that objectives are fulfilled. Specific objectives are to (Figure 1.2):

- Identify the spatial distribution of the CFP's conservation, structural and technical regulatory measures.
- Identify how regulatory measures have acted as drivers of change for economic and structural indicators of the European fishing fleet with specific reference to case studies from the U.K., Denmark, Spain and Cyprus.
- Identify fishers' perceptions regarding which regulatory measures have the most and least impact on their income and to compare these between fishery sectors and country of origin.

- Compare fishers' perceptions in terms of the impact of regulatory measures on their income with fisheries experts' perceptions on the effectiveness of regulatory measures on achieving sustainability of marine resources and the status quo.
- Examine how social knowledge can improve resilience and compliance of fishery resource-dependent Social-Ecological Systems.

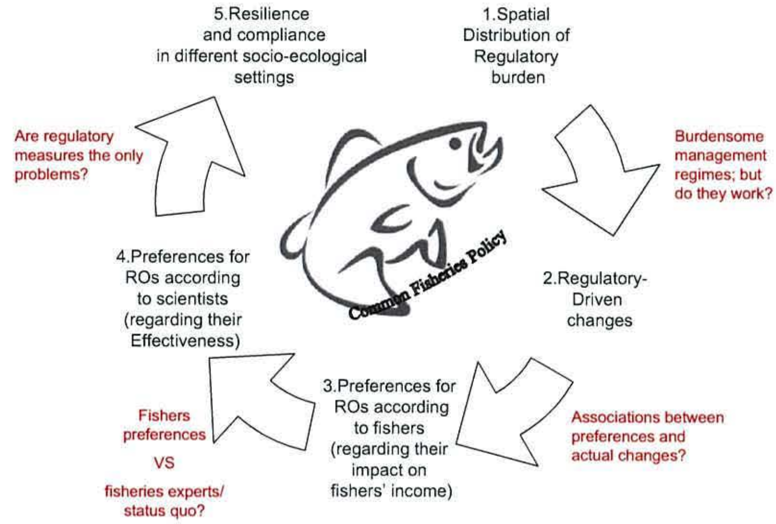

Figure 1.2: Flow-diagram of how the different objectives of this thesis were tackled.

The search for rules that improve the outcomes obtained in commons dilemmas is a complex task with an infinite combination of potential rules (Ostrom, 1999). Understanding institutional complexity and providing policy-relevant information to decision-makers needs to be an element included in fisheries management information base (Imperial & Yandle, 2005; Mead, 2005). Therefore, in order to provide decision makers with information needed to make informed choices about institutional design, it is more constructive that policy analysis reviews the common pitfalls of policy analysts' rather than highlight the deficiencies of particular studies or programs (Imperial & Yandle, 2005; Hill & Hupe, 2006). Unfortunately, analysts often fail to adequately consider the complexity and range of factors influencing institutional design and performance. Thus, in a way, this study undertook an institutional analysis of the European fisheries sector. The next section briefly describes how this study attempted to tackle each objective and why.

1.3.1 Overview

To assess impacts of regulations, it is important to first identify their spatial distribution. Thus, in the first data chapter 'Distribution of the burden of fisheries regulations in Europe: The north/south divide', a database including the EU fisheries legislation in force as of 1st January 2008 was created. The EU already has a search engine which allowing access to the EU's law, known as 'EUR-lex'. However, the use of such a search engine still requires for the researcher to go through all the results if one wishes to do a thorough search. Thus, a database which included the EU fisheries-related legislation was considered to be the most appropriate tool for the analysis of data such as legal measures for the following reasons: (i) Legislative measures are composed using complicated legal terms which do not allow non-lawyers to fully comprehend them. Thus, a database would be the ideal tool to store and retrieve information extracted from legislative measures using simple terminology for the different components; (ii) a well-thought database can allow for complicated information to be filtered by non-experts using simple wording, (iii) databases can be connected with other software i.e. ArcGIS which can allow for visual representation of information.

After identifying their geographic distribution, it was deemed important that regulatory successes or failures were identified. Since the study was looking into economic and social impacts of regulations, appropriate economic and social indicators were selected. The purpose of indicators is to enhance communication, transparency, effectiveness and accountability of management of a highly complex natural system (Garcia *et al.*, 2000). Linking changes in indicators to policies and outcomes, such indicators can start being used for more than simply to promote ad hoc policy responses (Rudd, 2004). During the Rio Summit in 1992, it was decided that a set of indicators was to be developed to assist national and international attempts to increase focus on sustainable development and assist decision-makers at all levels to adopt sound national sustainable development policies (United Nations, 1992). FAO also produced guidelines to support sustainability indicators in marine capture fisheries in order to provide decision- and policy- makers a handy tool to work towards sustainable development (Garcia *et al.*, 2000). Chosen indicators should describe the state of the system and be able to assess trends regarding the stated objectives. Taking into account the objectives of the CFP to "ensure exploitation of living aquatic resources that provides sustainable economic, environmental and social conditions"[8] appropriate indicators to identify successes or failures of the stated goals were identified. Economic indicators are rather straightforward as they tend to be indicators which allow analysis of economic performance such as profit, cashflow, value of landings etc. Social indicators are rather more difficult to identify. Thus, to identify social impacts of regulatory measures analysis of the fleet's structural indicators such as changes in employment levels, changes in fleet size etc were used.

In order to reduce bias originating from using economic and social indicator data from different sources, data from the 2009 Annual Economic Report on the EU fishing fleet were used. These data were collected in order to describe trends in the structure and economic performance for each Member State's fishing fleet. However, one must make assumptions on the nature of the data. For example, it was assumed that the data given by the Member States in the AER 2009 report were correct and comparable. Regarding data and information collected from fishers, as with all studies using social data, there is the assumption that the respondent is honest.

Chapter 4 uses a novel (for this field) conjoint analysis technique, the Adaptive Conjoint Analysis (ACA), an interactive computer survey, which by disaggregating the management process into key attributes with different potential levels, would allow fishers to rank their most and least preferred regulatory obligations in terms of their impact on their income. Are fishers' perceptions regarding regulatory measures and their impact on their income different than experts' opinions on which regulatory measures are most and least effective for ensuring sustainability? Chapter 5 goes further and compares the results from Chapter 4 with equivalent ones but of perceptions from fisheries experts. Thus potential similarities and/or disparities are explained and discussed in relation to fishers' participation, their relationship with science and their perception of risk. If one assumes that the regulatory measures least preferred by fishers are also the ones least preferred by fisheries experts then why are such measures still in force? On the other hand, if fishers least preferred measures are

[8] Council Regulation (EC) No 2371/2002 of 20 December 2002 on the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy.

those measures which the experts consider to be the most effective, proper communication between the two parties is vital; trust and risk are concepts embedded in social relationships, such relationships need to be understood in order to achieve a collaborative relationship needed for effective management (Chiles & McMackin, 1996). Loss of trust between science and industry stakeholders has been recognised as a major obstacle in fisheries management (Kerr *et al.*, 2006) due to the information they receive, how much of that information they understand and the time they have to make the decision; a notion known as 'bounded rationality' (Simon, 1978). However, in some cases, fishers can consciously understate or exaggerate a risk if they feel their identity is being threatened from regulatory interventions (Lidskog, 1996).

Fisheries management is only one of several challenges that fisheries communities are facing (Jentoft, 2010). Thus, the concepts of community resilience, vulnerability, and adaptation are increasingly important for the study of the human dimensions of global environmental change (Janssen & Ostrom, 2006a). Chapter 6 uses the framework proposed by Anderies *et al.* (2004) which focuses on the institutional response of specific case studies in relation to fisheries resources and allows exploring robustness of resource dependent communities. Interactions amongst the different agents are explored (resource, resource users, public infrastructure and public infrastructure providers) from problems which arose during surveys with fishers for three specific case studies; the Cypriot inshore fleet, the inshore fleet of an association in the north east Scotland (East Coast Licensed Small Boat Association) and of the fleet of a small Danish island in the Baltic. The majority of studies which used the proposed framework were in relation to institutional change and irrigation systems. Cifdaloz *et al.* (2010) used the framework to explore the robustness of small-scale agricultural systems facing water scarcities in Nepal whereas Shivakoti & Bastakoti (2006) explored the robustness of two irrigation systems in northern Thailand in the context of changing governance mechanisms and evolution of technological and market forces. Anderies (2006) applied the framework to an historical study of how the social structure of the Hohokam of the Phoenix Basin led to the creation of an irrigation system robust to short-term fluctuations in rainfall but an increased vulnerability to infrequent crises such as floods. Even though the framework can be adapted to allow examination of institutional changes in any resource management system, its application in fisheries is not known to have happened. Due to the biological, social and economic complexity of fishery systems the application of the framework requires to be attempted at a regional scale. Secondly, since levels of compliance are positively related to a system's resilience, this chapter will explore how different SESs react to institutional arrangements in a historical and cultural context.

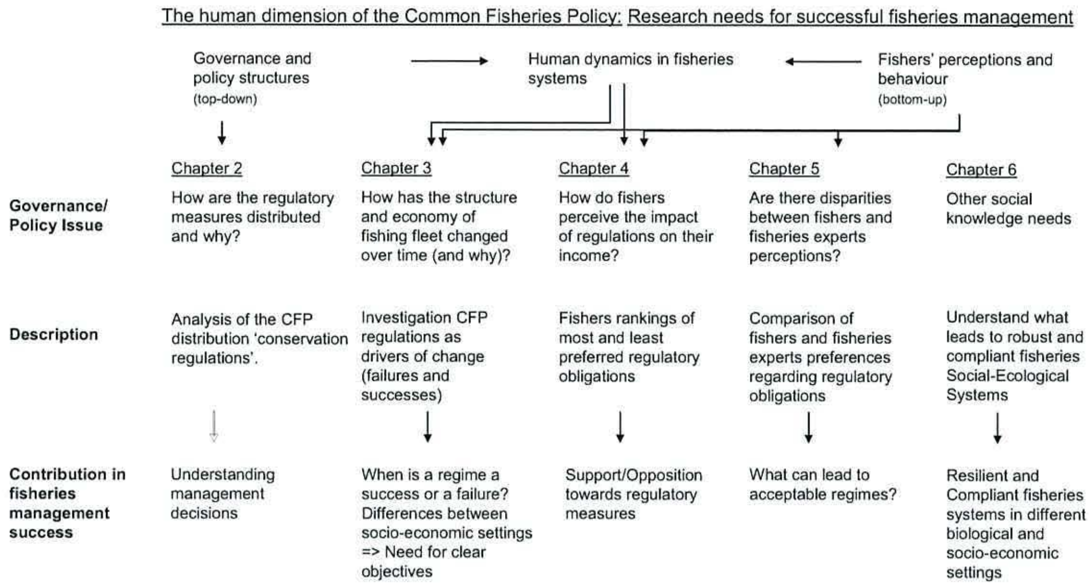

Figure 1.3: Links of the different approaches used in this study to collect information to satisfy some of the research needs for successful fisheries management in the European fisheries sector.

2 Spatial variation in the burden of Fisheries Regulations in the European Community

This chapter has been published in Hadjimichael, M., Edwards-Jones, G., & Kaiser, M.J., 2010. Spatial variation in the burden of Fisheries Regulations in the European Community. Marine Policy, 34:795-802

'It is not the prisoners who need reformation, it is the prisons', Oscar Wilde

2.0 ABSTRACT

The Common Fisheries Policy (CFP) is a priority area of the European Union's Better Regulation agenda. Understanding the spatial variation in the application of the policy and the reasons behind these differences would provide insights into policy making in different biological, socioeconomic and cultural settings that will assist in better regulation. The CFP *aqcuis* (the body of European Union law accumulated thus far) was analysed by creating a database composed of pre-defined elements from each obligation. Distinct differences are apparent in the 'burden' imposed by regulations in the Northern and Southern waters. However, a combination of a timeline of fish landings and the accumulation of the CFP regulations shows that despite the increase in the number of regulations this has not led to the anticipated reduction in landings. Historical, biological and geopolitical differences between the two major marine regions of the EU are discussed in terms of the impact they have had on the formation of the different fisheries management models in the different regions. Finally, the elements forming these models are discussed in terms of successes and failures in the context of the 2012 CFP reform.

2.1 Introduction

In human societies, some level of regulation is required in order to ensure that industry and individuals comply with societal desires. While trust, cooperation and goodwill are desirable attributes of social interactions, in the absence of regulations these attributes are insufficient to guarantee freedoms and rights for all citizens. The European Union (EU) has typically sought to use regulation to achieve its policy aims (European Commission, 2006). However, there is now an active debate about the potential economic benefits that may arise from reducing the regulatory 'burden' within the EU (particularly the administrative burden[1]) (DPI, 2007a). This debate is also acknowledged at a governmental level within member states (DPI, 2007b).

In the EU, the Commission has given a high priority to simplifying and improving the regulatory environment in Europe as part of the Better Regulation Agenda adopted in 2005. A joint objective, which can only be attained with cooperation between the Member States and European Institutions, is to achieve a 25% overall reduction in the administrative burden (European Commission, 2007a). However, while many governments of member states are under pressure to reduce the legislative burden upon their industries (Hontelez, 2004), some European policies and instruments such as the Common Agricultural Policy (CAP), and those focused on nature and landscape conservation in Europe, have for some decades been dominated by centralisation and standardisation. This has led to the neglect of contextual and place-related approaches and an unnecessarily high degree of over-simplification (Barnes & Barnes, 2001; Pinto-Correia *et al.*, 2006). Nevertheless, better regulation does not necessarily imply deregulation or withholding new European rules when they are needed. Rather, policy and regulatory proposals are now systematically assessed, and a wide range of options – both regulatory and non-regulatory - are examined for each initiative. In the context of the 2012 CFP reform, the European Commission and specifically DG-MARE (the European Commission's Department on Fisheries and

[1] Administrative burden, often referred to informally as 'red tape', imposes costs on businesses and not-for-profit organisations by requiring them to demonstrate compliance with government regulation and often takes forms such as record keeping, licence applications, annual reports and assisting with inspections by regulators.

Maritime Affairs) has adopted a multiannual sectoral plan to simplify the Common Fisheries Policy (CFP), whose simplification is also one of the Commission's on-going policy domains in its simplification programme. As a matter of priority, the simplification would cover measures for the management and control of fishing activities.

Within the EU, the significance of governance[2] in terms of the environment goes beyond matters of legislation. Such governance extends to the manner in which the process of decision-making on environmental policy has become institutionalized within Europe, along with the existence of arrangements that formulate, develop, and implement policy with policy principles and a set of rules, conventions, norms and practises within which organizational actors function (Weale *et al.*, 2004). In fisheries, the interactions amongst social, economic, biological, environmental and regulatory components, involving fishers and fishing communities, fishery capital, fish stocks, and economic and ecological environments has resulted in this sector being heavily regulated by a complex set of rules (Charles, 1988): the Common Fisheries Policy (CFP).

Over time, the European Commission has attempted to strengthen the dialogue with the fisheries sector and other interested parties. The first of these steps was the formation of the Advisory Committee on Fisheries and Aquaculture, composed of 21 members representing different interests including vessel owners, fishermen, fish farmers, the processing industry and NGOs. This committee is consulted by the Commission on measures related to the CFP and can issue opinions on its own initiative. During the reformed CFP (as of 1st January 2003) steps were taken to adapt fisheries management more closely to the specificities of the context of different marine regions. One of the main innovations to represent this geographic variation was the creation of Regional Advisory Councils (RACs). These councils were intended to enable a dialogue among stakeholders, and provide mechanisms to reinforce stakeholder consultation by the Commission and the Member States. This new structure also reflected the need to adapt to the successive enlargements of the

[2] Defined in *Europa Glossary* as that which concerns all the rules, procedures and practices affecting how powers are exercised within the EU.

European Union and the increased diversity of Europe's fisheries regions (European Commission, 2008).

The CFP is the EU legal framework for fisheries management and access with the first common measure dated back in 1970. The scope of the CFP encapsulates the management of resources, fleet issues, control and monitoring of fisheries activities, structural actions under the European Fisheries Fund, markets and international relations (European Commission, 2008). The policy requires that the catching, conservation and trading of fish caught within the 200-mile median line exclusive economic zones of member states should be organised at the European Union level (Wise, 1996) with the condition that in principle, EU fishermen should have 'equal treatment and economic chances in Member State's waters'. This has proven a particularly difficult task especially in an era when 'it is becoming increasingly important to ensure sustainable fishing as fish stocks dwindle, taking account of environmental, economic and social aspects in a balanced matter' (European Commission, 2004).

The aim of this study was to investigate whether the Common Fisheries Policy (CFP) has led to a homogeneous distribution of fisheries regulations or whether there is a geographic difference in the 'burden' of fisheries regulations. The focus was specifically on conservation-related regulations. This would have helped understand the development and drivers that have led to potential disparity in the spatial distribution of regulations. Thus, help gain deeper insights into how such legislation arose within a varied economic, ecological and cultural environment. In addition, such analyses may inform forthcoming initiatives related to the provision of 'better regulation', in terms of what works but more specifically what does not. Historical, biological and geopolitical differences which resulted in the variation of the regulatory burden between northern and southern regions of the EU are discussed in the context of the failure of the CFP.

2.1.1 The North/South Divide

For the purpose of this study, the EU is considered to have northern waters and southern waters: Northern waters were defined as the European part of the Atlantic which can be further divided into the NE Atlantic (Bay of Biscay, English Channel, North Sea and the Irish Sea) and the Baltic, while southern waters encompass the Mediterranean Sea[3]. There are a number of specific environmental characteristics in the Mediterranean that influence fisheries in the region. For example, the narrowness of the continental shelf leads to a situation in which a substantial part of the fishing activities are carried out close to the coast, coincident with the highest biodiversity of bottom fish (European Commission, 2002a). The constrained shelf area means that there is a high degree of competition for space among fishermen from different fleets and different sectors (professional and recreational).

In the Atlantic region there is distinct geographical asymmetry, which results in clear differences in fisheries opportunities and conflicts of interest among the different coastal states. Such differences relate to the variation in the physical characteristics in marine waters adjacent to the relevant states, a constriction of some nations' 200-mile EEZ and a propensity for more industrialised/commercial forms of fishing to occur. For example, the North Sea (ICES Areas IV a-c) is a comparatively shallow part of the Northern waters region, and a distinctive sub-system which also has distinct north/south variations in its physical and biological characteristics. The North Sea has high levels of primary and secondary production, yielding around 2.5 million tonnes of fish and shellfish annually (Symes, 1999a). Accordingly, the North Sea is generally accepted to be the most intensively fished part of the North Atlantic if not the entire world ocean (Symes, 1998b). The Baltic is isolated and distinct from the North Sea and NE Atlantic Ocean due to its physical environment with a shallow, constricted opening to the North Sea (sill depth 18 m, total opening less than 20 km wide) and a strong salinity gradient (from 34 to 0 psu) and winter ice coverage in the freshwater and low salinity region. Due to this physical isolation, fish stocks within the Baltic Sea are more susceptible to the effects of pollution and eutrophication that have reached high levels due to discharges from the surrounding land-masses.

[3] These maritime divisions are maintained for the subsequent chapters of the thesis.

Significantly different models for fisheries management have developed in the northern and southern waters, and these are related to the different fishing conditions[4], biological and physical characteristics (Symes, 1999b). On one hand, the NE Atlantic is considered to be the most productive region of the second most productive world fishing region in the world (North Atlantic). In contrast, the Mediterranean basin, even though not as productive, is one of the most diverse and stable Large Marine Ecosystem (LMEs) in terms of species groupings and their share of the total catch of the region[5]. These different management approaches which resulted in a dichotomy in the number of regulations that 'burden' each region were sought to understand.

[4] Fishing conditions refer to the different type of fisheries in the two regions (i.e. *métiers*, fleet), but also to the different political structures, economic development and cultural associations (Symes, 1999b).

[5] http://www.eoearth.org/article/Mediterranean_Sea_large_marine_ecosystem

2.2 Spatial distribution of the CFP's acquis communautaire [6]

2.2.1 Methods

EU legislations that related to fisheries that were in force as of 1st January 2008, were identified using the latest Directory of the Community's currently applied legislation. Key elements of each regulation were extracted and entered into a database. Regulations that simply amended existing regulations without adding new components were not analysed (including regulations altering Total Allowable Catches (TACs) set in previous years). Financial/subsidies related regulations also were not analysed, nor were those related to non-EU countries/sea areas or EU overseas territories. Given the focus of this study, the database was filtered to select only the conservation-related regulations which include those obligations of all conservation, structural and technical measures. These were then divided further into six categories: i) Fishing effort[7], ii) Gear prohibitions, iii) Minimum landing size, iv) Spatial and Seasonal Prohibitions, v) Vessel Characteristics and vi) Sanctioning/Compliance (Figure 2.1).

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[6] The term (EU) *acquis* is used in the European Union law to refer to the total body of EU law accumulated thus far. The term *acquis* is French for "that which has been acquired", and communautaire for "of the community". For the purposes of this study, the term *acquis* will be used to describe solely the total body of EU fisheries-related law unless otherwise stated.

[7] Measures controlling 'Fishing effort' are defined in this study other than in the standard definition of the European Commission. TACs/Quotas are in this study included in the 'Fishing effort' group and 'Days at Sea' measures in the 'Spatial and Seasonal Prohibitions'. The normal distinction for these measures is as input or output controls with 'Fishing effort' belonging to the input controls and TACs to output controls.

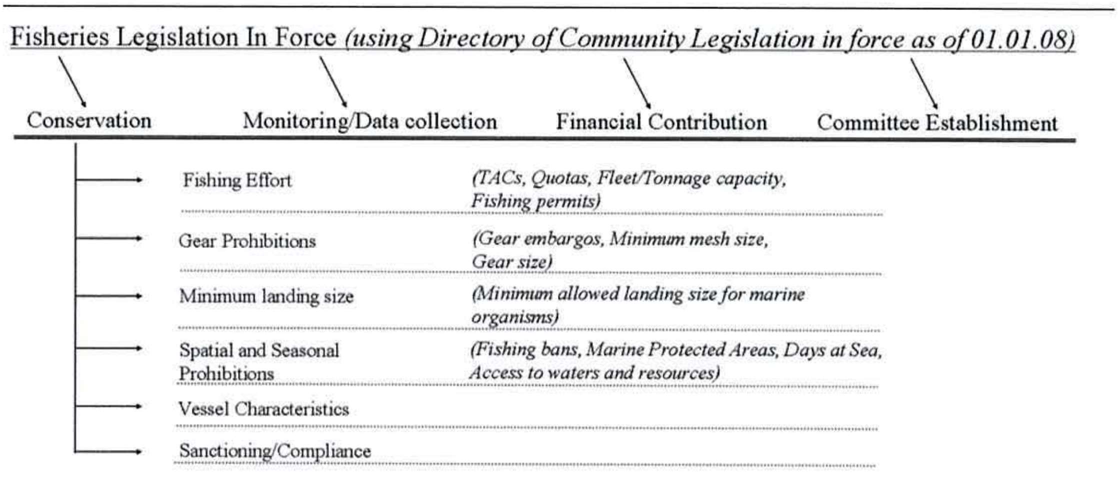

Figure 2.1: Schematic diagram of the plan used for the groupings of the CFP regulations.

Each regulation was assigned to the relevant spatial area to which it applied. Often each regulation affected more than one spatial area. Spatial distribution was organised into the FAO Major Fishing Areas for Statistical Purposes as in the Coordinating Working Party (CWP) Handbook of Fishery Statistical Standards. The maritime areas of the NE Atlantic and the Baltic are divided in the ICES rectangles, while the Mediterranean is sub-divided according to the FAO Major Fishing Area 37(GFCM divisions 1-4)[8]. Digitised maps of the marine waters were created with ArcGIS software and were spatially linked to the database of different regulations.

The *a priori* null hypothesis was that the number of regulations for each regulatory category was not significantly different among the three maritime areas (north east Atlantic, Baltic and the Mediterranean Sea). Differences in the composition of regulations within each of the maritime areas were tested using an ANOSIM randomised permutation test together with a similarities percentage (SIMPER) analysis in the PRIMER statistical software package (Clarke & Gorley, 2006) to investigate which regulatory groups accounted most for differences or similarities among and within the three maritime regions (Clarke, 1993). The three categories of

[8] Digitised maps of ICES (International Council for the Exploration of the Seas) rectangles and FAO (Food and Agriculture Organization of the United Nations) Major Fishing Areas (GFCM (General Fisheries Commission for the Mediterranean) divisions) were reproduced with the kind permission of ICES and FAO respectively.

regulations that contributed most to the dissimilarity between the regions were tested for significance using t-tests (Minitab® Statistical Software[9,10]).

9 www.minitab.com

10 2-sample t-test for normal data and approximately equal variances; Mann-Whitney test for normal data but not equal variances; and a Moods Median test for not normal data and not equal variances.

2.2.2 Results

There was a distinct difference between the number of regulations in operation in the EU's Northern and Southern seas, with the former being more heavily burdened than the latter (Figure 2.2). There was also an indication that there is a difference in the number of regulations even between the north east Atlantic and the Baltic. A multidimensional scaling ordination plot (Figure 2.3) showed that the ICES/GFCM areas were clearly clustered within distinct regions. The ANOSIM test revealed that there was a significant difference in the number of regulations that impact upon the three regions (NE Atlantic-Mediterranean: $R=1$, $p<0.01$; NE Atlantic-Baltic: $R=0.611$, $p<0.01$; Baltic-Mediterranean: $R=1$, $p<0.01$). Accordingly, this analysis suggests that the Common Fisheries Policy imposes a bigger regulatory 'burden' on fishers that fish in Northern seas compared with those that fish in the Southern seas of the European Union (Table 2.1). It is important to note however that this analysis is relatively simple as it only took account of the number of regulations and not their individual complexity.

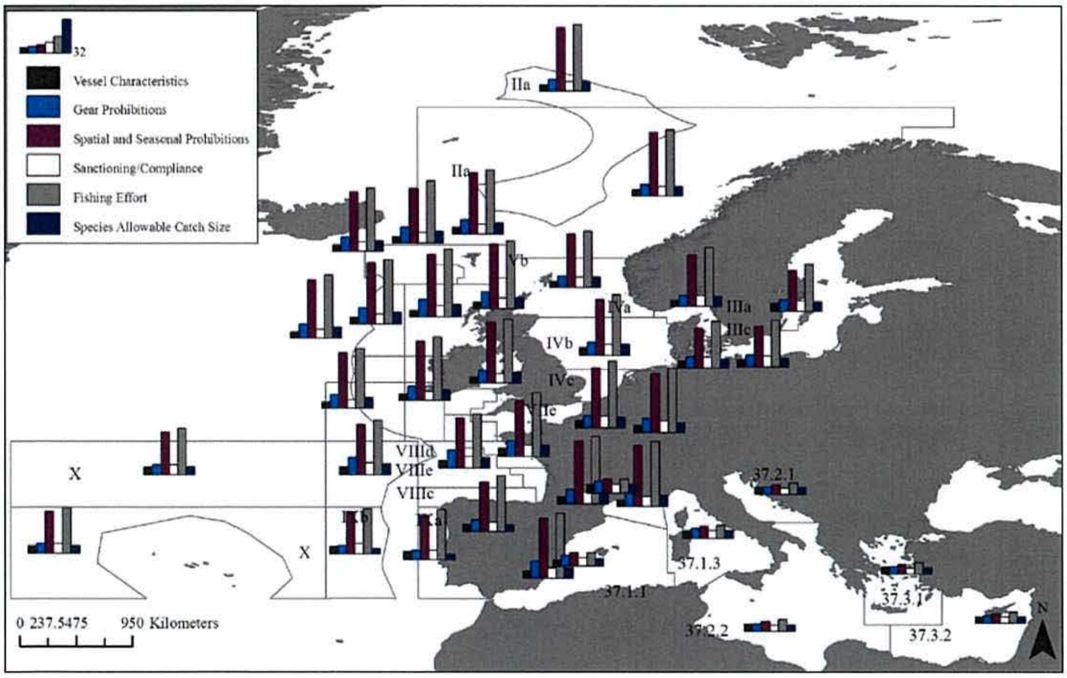

Figure 2.2: Number of regulations for each maritime sub-division in the NE Atlantic, Baltic and the Mediterranean in groupings of regulatory information. Number 32 in the legend represents the attribute value for a chart symbol of that size on the map (i.e. the size of the equivalent coloured bar on legend equals 32 data units on the map).

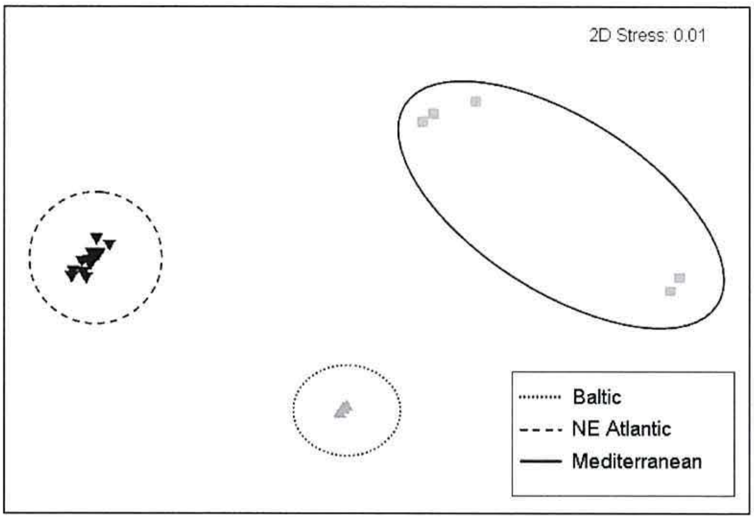

Figure 2.3: MDS (Multi-Dimensional Plot) of Bray-Curtis similarities from non-transformed data including the number of active fisheries conservation regulations in all the ICES/FAO areas grouped in the three maritime regions.

A more detailed examination of the distribution of the grouped regulations suggests that the major differences occur in the number of regulations concerning Fishing Effort and Spatial and Seasonal Prohibitions (Figure 2.4), which are regulations whose number increases by the number of maritime divisions in each area.

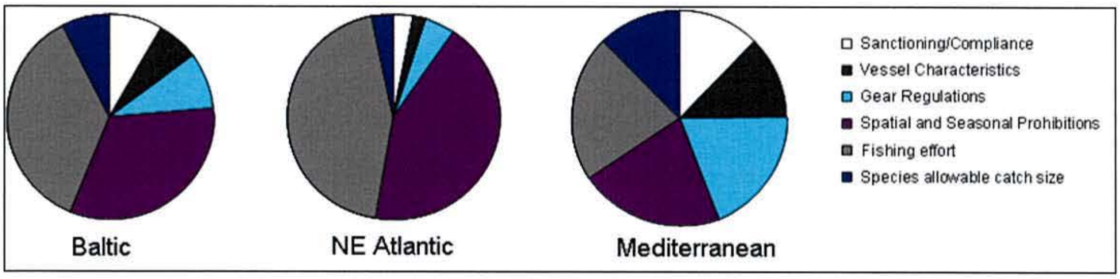

Figure 2.4: Distribution of the Conservation fisheries regulations in the three different maritime areas.

Both the NE Atlantic and the Baltic have a heterogeneous distribution of regulations between the different categories of regulation, unlike the Mediterranean which seems to have a more homogenous distribution of regulations among the different categories. The number of regulations that apply to the categories 'Sanctioning/Compliance', 'Vessel characteristics', 'Gear regulations' and 'Minimum landing size' were similar among all marine areas. However, the categories that related to 'Spatial and seasonal prohibitions' and 'Fishing effort' differed significantly among the three marine areas with respect to the number of regulations in each category (Table 1). The categories 'Spatial and seasonal prohibitions' and 'Fishing effort' contributed most to the dissimilarity between the Mediterranean and both the north east Atlantic and the Baltic, with the number of regulations in each category in each region differing significantly (Table 2.1).

Table 2.1: SIMPER analysis on the non-transformed data (number of regulations) for all the ICES/CECAF areas grouped in the three maritime regions (NE Atlantic, Baltic and Mediterranean). The three regulatory groups contributing most to the dissimilarity between the regions are shown. Av.Score = Average Score of the number of regulations in the group, Contrib. % = Percentage contribution and P-value = result of a t-test statistical analysis.

Average dissimilarity = 12.55

Regulatory Group	Av.Score Atlantic (+/- St.Deviation)	Av.Score Baltic (+/- St.Deviation)	Contrib.%	P-value
Spatial/Seasonal Prohibitions	52.32 (+/- 6.09)	37.67 (+/- 0.58)	43.15	**p=0.07
Fishing Effort	56.88 (+/- 5.92)	44.00 (+/- 0.00)	38.64	**p=0.14
Species Allowable Catch Size	12.68 (+/- 1.70)	10.67 (+/- 0.58)	5.51	**p<0.05

Average dissimilarity = 49.57

Regulatory Group	Av.Score Atlantic (+/- St.Deviation)	Av.Score Mediterranean (+/- St.Deviation)	Contrib.%	P-value
Fishing Effort	56.88 (+/- 5.92)	11.57 (+/- 1.13)	46.14	*p<0.05
Spatial/Seasonal Prohibitions	52.32 (+/- 6.09)	10.43 (+/- 1.9)	42.64	*p<0.05
Gear Regulations	12.68 (+/- 2.30)	8.29 (+/- 1.70)	4.60	*p<0.05

Average dissimilarity = 40.46

Regulatory Group	Av.Score Baltic (+/- St.Deviation)	Av.Score Mediterranean (+/- St.Deviation)	Contrib.%	P-value
Fishing Effort	44.00 (+/- 0.00)	11.57 (+/- 1.13)	47.71	**p<0.05
Spatial/Seasonal Prohibitions	37.67 (+/- 6.09)	10.43 (+/- 1.9)	40.11	**p<0.05
Sanctioning/Compliance	10.00 (+/-0.00)	6.71 (+/- 0.95)	4.87	**p<0.05

*Mann-whitney test

**Mood's median test

The categories of regulations that accounted for the increased numbers of obligations in the NE Atlantic and the Baltic ('Spatial and seasonal prohibitions' and 'Fishing effort') are those that are legislated to operate at a finer resolution in terms of space[11] (such as TACs, Days at Sea and areas with special protection measures such as the Shetland box) with more countries in those two maritime areas competing for resources in the same rectangles. Countries competing for resources in the ICES areas of the European Atlantic are usually EU Member States whereas countries competing for resources in the Mediterranean are mostly non-EU States. Furthermore, additional regulations are needed in order to set out access rules to waters and resources of vessels with traditional/historical fishing rights in the waters of a foreign country[12] (Van den Bossche, 2005).

[11] ICES divisions with which TACs/Days at Sea are set are spatially smaller than the GFCM divisions.
[12] Article 6§2 in the 1972 Act of Accession required that the historical fishing activities in the extended 12 mile bands were to be pursued in accordance with arrangements as to in which geographical zone of a different Member State each Member State is allowed to pursue fishing activities and the species concerned.

2.3 Which came first: changes in catches or changes in regulations?

The conservation aim of the CFP has been to "ensure that the fishing pressure is not higher than the stocks can sustain" by introducing various rules for total allowable catches, limitation of fishing effort, technical measures plus obligations on reporting catches and landings. In an over-simplification of such matters, one can hypothesize that if these measures worked, a relevant timeline of events would reveal a decline in stocks, followed by an increase in regulatory burden, followed by a rebound in stock numbers. The Scientific, Technical and Economic Committee for Fisheries (STEFC) uses two indicators of sustainability to provide scientific advice[13] based on the proportion of fish stocks capacity that are i) at full reproductive capacity and ii) being harvested sustainably. The latest information on European fish stocks was presented during "The State of European Fish Stocks in 2010" seminar (STECF, 2010). According to ICES results, in the European Atlantic regions/ICES areas (NE Atlantic and Baltic) the proportion of stocks being fished at a biologically safe level has increased over the past decade from about 10-15% to 50%. However, with regards to the proportion of stocks that are at full reproductive capacity no change has been detected. In 2009, 80.19% of the benthic stocks in the European Atlantic area, 47.72% of the demersal stocks and 76.32% of the pelagic stocks were within their Safe Biological Limits (SBL). In the Mediterranean however, from 34 stock assessments (23 demersal and 11 pelagic), it was calculated that 91% of the stocks assessed are overexploited or fully exploited. Additionally, most of the demersal fisheries in the Mediterranean are based on juvenile fish which means that most recruits never reach the age of 1st reproduction (STECF, 2010). Thus, from these data it appears that the introduction of various measures has been more successful in the European Atlantic than the Mediterranean.

In order to identify the potential impact of the measures on fishers' income, landings data were used and compared against the increasing number of regulatory measures. The assumption was that if regulations were truly burdensome and impacted the

[13] With the collaboration of research institutes/bodies such as ICES, GFCM, Sub-group for the Mediterranean Sea (SGMED) and other sub-regional bodies such as COPEMEDII, MEDSUDMED etc.

economic activity of fishers, then increase in regulatory measures could potentially lead to reduced catches (and a potential reduction in revenues)[14]. In 1995 catches were relatively high, while the number of active regulations was low (Figure 2.5). This trend of high catches and a low number of regulations continued until 2002 when there was a pronounced increase in the number of regulations in all three maritime areas. This was due to the major 2002 reform of the CFP during which new regulatory measures were introduced. These new measures such as days at sea, strengthening of the control and enforcement of fisheries regulations, stakeholder involvement and new rules on access to waters and resources aimed for better management of fishing effort. These measures and initiatives were followed by a reduction in landings.

[14] Nevertheless a reduction in catches could also lead to an increase in fishers' revenues as a decrease in fish supply in the markets can lead to increase in fish prices.

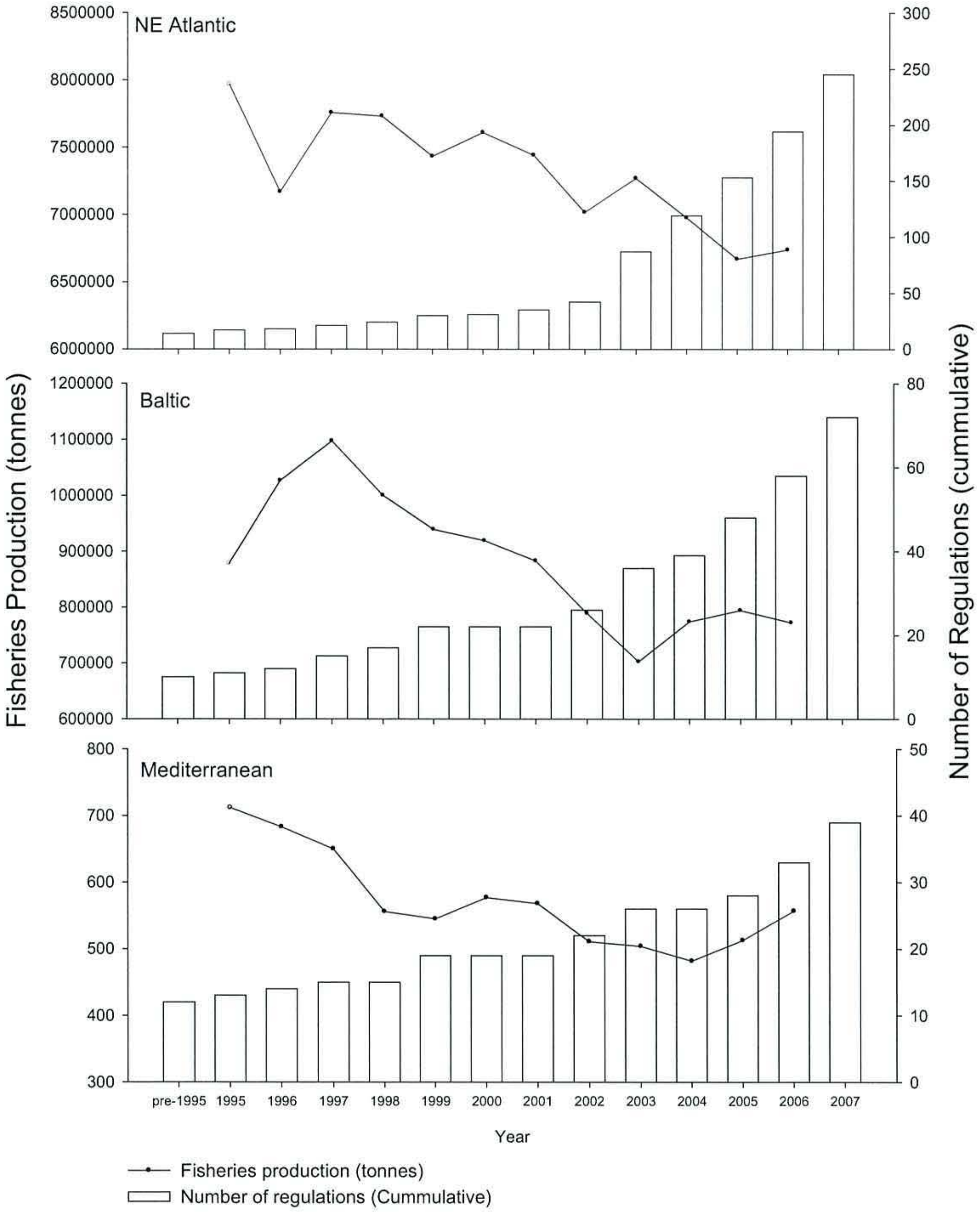

Figure 2.5: Relationship between the cumulative number of regulations and fisheries catches (tonnes) from pre-1995 till the present (Fisheries catches data available from EUROSTAT) – Note that scales in x and y axis differ.

Due to the technical regulatory measures dealing with TACs, changes in mesh sizes and/or changes in the size and number of gears, and spatial and seasonal closures, the landings in the Atlantic decreased immediately following the 2002 CFP reform. However, even though technical measures were designed to reduce catches and the tonnage of the fleet, new vessel technologies and more efficient vessels are thought to have counteracted the newly created conservation initiatives (European Commission, 2007b). The Mediterranean, despite the similar trend in terms of number of regulations, even with its different fisheries management plan, follows a different pattern in term of catches. Factors which may have influenced this trend are: 1) catch statistics that include EU vessel catches only (i.e. that do not include the catches of non-EU countries), 2) misreporting of the EU catches (especially of the catches from the inshore fleet), 3) non-reporting of IUU catches (controls in the Mediterranean are not as strict and frequent as in the northern waters especially outside the 12 nm limits). Generally though, there are many other factors that may contribute to these trends that would also need to be taken into account such as biological fluctuations in stocks, climate change impacts, fleet tonnage etc.

2.4 Discussion

Analysis of the current regulations illustrated the difference in the number of active regulations in the Northern (Baltic and NE Atlantic) and Southern (Mediterranean) waters of the European Union. It is important to note however, that the directory of current relevant Community legislation that provided the basis of this study is incomplete, as some obligatory measures were found to be missing[15]. Fishers in countries at higher latitudes of the EU (Northern Waters) have to cope with more regulations than fishers from lower latitudes (Southern Waters). This difference can be explained by i) the regulatory groups that account for the highest percentage of the difference in the number of regulations among the three maritime areas; this is related to the different management models in the regions and the factors contributing to these models, and ii) the history of the science and policy in the Atlantic and the Mediterranean; effective policy is evidence-based with the option for risk assessment, but this is only possible with adequate data that do not exist for many Mediterranean areas.

The first regulation for the conservation and management of fishery resources in the Mediterranean at EU level was Council Regulation (EC) No 1626/94 'laying down certain technical measures for the conservation of fishery resources in the Mediterranean' (reinforced and amended by Council Regulation No 1448/1999 'introducing transitional measures for the management of certain Mediterranean fisheries and amending Regulation No 1626/94'). The first Mediterranean-wide regulation was introduced after the first 10 years of the CFP. The main reason for this delay was the particular (mainly political) circumstances in the region. Thus, application of rules that have been implemented in the Atlantic and North Sea since 1983 were not able to be implemented in the Mediterranean at that time. Nevertheless, up until 1998, vessel licensing systems, Exclusive Economic Zones (EEZs), Total Allowable Catches (TACs) and quotas were not evident in the Mediterranean (Symes, 1999b). With the provision of Council Regulation No 1967/2006 'concerning management measures for the sustainable exploitation of fishery resources in the

[15]As confirmed by Giorgio Galizzioli of the Policy Development and coordination team in DG-MARE in November 2008.

Mediterranean Sea', new regulations are being adopted that aim to implement particular aspects of that main regulation[16]. In the future, many new Mediterranean regulations will be transposed to more specific regulations and thereby will increase the number of regulations in the Mediterranean.

Northern waters are not as diverse as the Mediterranean in terms of their political structure and economic development. Especially after the last EU enlargement, all coastal states that have a share in the resources of the European Atlantic are part of the EU except Norway, Iceland and Russia. However, there are other problems that further complicate management. Such problems relate to natural heterogeneity in the environments in the area (presented in section 2.1.1), countries sharing parts of their 200-mile EEZ and the usually more industrialised / commercial forms of fishing. When it comes to the EEZs of Member States, the EU's joint EEZ is used for fisheries management (amounting to 25 million km^2) so vessels or nationals from one country are allowed to fish in the EEZ of another Member State. Thus, whilst the offshore Scottish fishermen have shown their aversion to fishermen of other Member States fishing in 'their waters', the offshore Danish fishermen are content with the existence of an EU-wide EEZ since otherwise they would not be able to conduct their large-scale industrial fisheries in the North Sea[17]. This joint EEZ for fisheries management and the more industrialized (offshore) form of fishing, in combination with the biological characteristics (fish stocks present) of the productive region of the NE Atlantic/Baltic has led to the introduction of fishing effort measures such as TACs and Days at Sea, not present in the fisheries management model of the Mediterranean (except for bluefin tuna).

In the Mediterranean however, the diversity of its political structures, economic development and cultural associations can sometimes outweigh the naturally occurring elements of similarity (Symes, 1999b). A key factor is that only 9 out of the 23 country-members of the General Fisheries Commission for the Mediterranean (GFCM) are members of the EU. Thus, in many cases, the EU has to call upon other Mediterranean/International legislative agreements in an attempt to protect

[16] Personal communication with Poul Degnbol of Policy Development and coordination team in DG-MARE in July 2008.
[17] Results from Chapter 4 and 6.

Mediterranean stocks. These non-EU GFCM members are known as the Mediterranean Partner Countries (MPCs)[18] and in 2006 they accounted for 54% of fish caught in the Mediterranean, whereas the EU-27 accounted for 35%[19]. Between 1990 and 2006, the total catches by Mediterranean Partner Countries in the Mediterranean increased by 47%, with Egypt, Lebanon and Syria showing the greatest relative increase of 105%, 148% and 113%, respectively.

Regulations that were designed to monitor and thus restrain fishers' activities have accumulated over the years. As shown in section 2.3, the increasing regulatory measures appear to have led to a decrease in landings. However, even though this would suggest a decrease in fishers' income, data from the Annual Economic Report show a 21.4% increase in overall fish prices since 2002 (AER, 2009). The Directory of Community legislation in force as of 1st of March 2009 included 795 acts, which is a disproportionately large number for a sector like fisheries with limited economic activity and a restricted number of operators (European Commission, 2009b). The significant number of specific legal acts needed for the transposition of Regional Fisheries Organizations recommendations into EU law, and the number of obsolete acts currently in the active *acquis* form part of the problem. The Commission also suggests the streamlining of data collection of fishing activities and avoidance of duplication in an attempt to reduce 'red tape' (European Commission, 2003). One of the steps towards this goal is the current CFP simplification strategy with the objectives of i) simplifying the *acquis*, ii) consolidating the *acquis* and its maintenance as an up-to-date document, iii) codification, iv) reviewing the organization and presentation of the *acquis* (one of the actions is to identify the *acquis* in force), v) ensuring transparency and effective monitoring at political and technical level; vi) establishing an effective implementation strategy (European Commission, 2003).

A debate on the CFP 2002 reform showed that the CFP could only succeed if its main objectives are environmental, economic and social sustainability, and good governance principles such as openness, participation, accountability, effectiveness

[18] The MPCs are Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, occupied Palestinian territory, Syria, Tunisia and Turkey.
[19] Eurostat: Statistics in focus. 88/2008

and coherence are put into practice (European Commission, 2002b). But with the last reform proving to be a failure, officials need to first work out the reasons that a highly regulated sector is still suffering from resource decline and collapsing stocks[20]. The consultation on the CFP reform was launched in April 2009 with the presentation of a green paper and it is important that past mistakes are taken into account and not repeated. Throughout 2009 the debate on the resource conservation and fleet policy of the CFP continues in broad-based consultations with the fisheries sector, other stakeholders and the wider public. The consultations will end in 2010 and the Commission will aim to table reform proposals which will come into force on the 1st of January 2013 (European Commission, 2009a).

[20] As reported in the 2009 Green Paper on the reform of the CFP 88% of Community stocks are being fished beyond their Maximum Sustainable Yield, of which 30% are outside safe biological limits thus they may not be able to replenish.

2.5 Conclusion

Despite the contrast in the number of active regulations that apply to the Mediterranean and the North Atlantic, the majority of marine resources in both areas continue to decline. The upcoming CFP reform could be the last chance for Europe to break away from 'the current reality of overfishing, fleet overcapacity, heavy subsidies, low economic resilience and decline in the volume of fish caught by European fishermen' (European Commission, 2009a). It is now time to reassert science over politics in the fisheries management process. Differences within regions should not be overlooked, especially in the Mediterranean where contrasts of political structures, economic developments and cultural associations outweigh the similarities in the hydrography and the biological resources (Symes, 1999b). Considering all the regional differences when proposing a management model, both elements, the Instrument of Management and its mode of implementation, should be taken into account (Iglesias-Malvido *et al.*, 2002).

A 'one size fits all' CFP cannot deal with structural and conservation issues in areas of shared stocks that predominate in Europe's fisheries. A simplified regulatory framework with different methods of governance allowing a greater involvement of stakeholders and a fast-track decision-making process are essential in a rapidly evolving sector such as fisheries. It is accepted by all relevant stakeholders that the CFP has not as yet bring about the desired outcomes and has not achieved its stated aim of 'ensuring sustainable exploitation of living aquatic resources'. Even though the CFP framework did consider the differences between the northern and the southern waters of the EU through the adoption of two different management models, this was not sufficient to ensure success. Thus, more factors need to be integrated in the governance of the new framework of the CFP that consider all relevant social, economic and biological characteristics of each region whilst allowing for regional flexibility.

3. European Regulations as drivers of economic and structural change in the European fishing fleet

'Who so neglects learning in his youth, loses the past and is dead for the future', Euripides

3.0 Abstract

Regulations can act as direct or indirect 'drivers of change' for both ecosystem processes and the dynamics of resource dependent socio-ecological systems. This chapter explores changes (regulatory or not) in economic and structural indicators of specific European *métiers* (that is a homogeneity in fishing gear, target species and fishing geographic zone) in the U.K., Denmark, Spain and Cyprus and how these changes differ depending on the socio-political and economic contexts in which they were applied in. To achieve this, data on *métiers'* performance were obtained from the 2009 Annual Economic Report (AER) on the European Union fishing fleet. Changes in economic and structural indicators of the *métiers* explored varied. In the Mediterranean, smaller fishing vessels are prevalent as the region is less resource rich than its northern European counterpart. However, even though Mediterranean vessels are less efficient in terms of tonnes landed per unit time than northern European vessels, they have lower running costs, and are more efficient in terms of value per tonne of fish landed. With regards to specific national *métiers*, Cyprus' accession in the EU led to economic benefits in the form of subsidies and an increase in fish prices. In Denmark, the shift to the Individual Transferable Quotas (ITQ) system led to a more efficient fleet with fewer but bigger vessels. In the U.K.'s demersal trawl and seiner fleet, the introduction of the buyers and sellers registration regulation shows that correct implementation of a regulation can have a positive impact on the fleet by increasing the price of each fish unit. There are cases where the industry's political power is what drives change (or what does not allow change to happen): such as in the case of the Spanish Mediterranean Pelagic fleet (of which the main target is the endangered blue fin tuna), where the industry's political power has been the cause of 'regulatory stagnation'. Over the history of fisheries management different technical fixes, from controls concerning access to fisheries to controls concerning fishing effort, have been attempted and their success or failure depends on regional biological but also socio-economic and / or political variability. It is important that reasons behind the failures and successes of past policies are understood in order to reach ecological and economic sustainability in any complicated sector. It is clear that in the European fisheries sector no regime can be promoted as a pan-European remedy due to the complex variability between the different *métiers*.

3.1 Introduction

According to the Millennium Ecosystem Assessment a driver is 'any natural or human-induced factor that directly or indirectly causes a change in an ecosystem' (Nelson *et al.*, 2005). Direct drivers directly influence ecosystem processes, such as climate and invasive species whereas an indirect driver is one that acts upon direct drivers (Nelson *et al.*, 2005; Nelson *et al.*, 2006). Indirect drivers can be demographic, economic, scientific and technological in nature, but also cultural and religious. In the context of the fishing industry, two main types of driver effect change (i) those arising from the industry itself (i.e. increasing fishing effort, increased technological efficiency etc) and (ii) those arising from the governing bodies (in the form of regulations). These 'drivers of change' can have an economic, political and social context. Thus, by understanding the relationship between the resource, the resource users and the institutions, the possible advantages of a 'political economy[1]' can be related to a policy (Stubbs & Zrinscak, 2006).

Resource production is not only important for the resource user as it provides the user's income, but it is also important for national economies, in both an economic and a political context. The more profitable an industry is, the more it adds to the national economy in terms of revenues (Cox & Harvie, 2008). Thus, in the long term, it is in the national interest to ensure that the relevant industry operates within the sustainable limits of the resource. Hence, if management is necessary to obtain long-term economic gains in fisheries, in a perfect economy, the correct form of management should convert an unsustainable short-term profit making industry, to a longer-term more sustainable one (Andersen, 1983). Thus, in theory, biological management should ensure sustainability of the resource while economic management would promote economic efficiency of fishing (Andersen *et al.*, 2009). This has always been problematic as fisheries management historically has been compromised by a clash between considerations of human welfare, ecosystem health and economic cost (Farber, 2000). Thus, a good understanding of how different fishing fleets 'react' under various ecological, economic and socio-political contexts is important before deciding which management regime to implement in any given location.

[1] The term is used for studying production, buying and selling , and their relations with law, custom and government

In the European fisheries sector, the interactions amongst social, economic, biological, environmental and regulatory components, involving fishers and fishing communities, fishery capital, fish stocks, and economic and ecological environments has resulted in this sector being heavily regulated by a complex set of rules (Charles, 1988); the Common Fisheries Policy (CFP). The CFP uses two types of instruments to conserve fish stocks within its jurisdiction: total allowable catches (TACs) that define the upper limits for the total amount of fish which can be landed to port from particular areas[2]; and technical measures that include gear regulations, closed seasons, closed areas, and minimum allowable sizes for individual species. In addition, the policy attempts to limit fishing effort by controlling the capacity of fleets (structural measures) and limiting the time spent at sea. These instruments have acted as drivers of change for the European fishing fleet, either in economic or structural terms.

TACs and technical measures in general are drivers of direct economic change as they alter the total amount of resource extracted/produced. Structural measures, such as decommissioning schemes have been put in place to control the size of the fleet, and hence the number of resource users. However, they have failed to limit measures of effort in terms of engine capacity, therefore although boat numbers have decreased, the capacity to catch fish is arguably unchanged. Hence, these measures act as indirect economic drivers, as a reduction in the number of resource users will share a greater proportion of the limited resource and hence generate higher potential economic returns. When exploiting a common property resource which is free but scarce (i) the production function of the firm (vessel) is dependent upon the aggregate effort applied to the fishery, and (ii) the average productivity (capital and labour) is an inverse linear function of the aggregate effort applied to the fishery (Bell, 1972). Hence, in order to ensure economic efficiency, and also that the resource is not exploited over the maximum sustainable yield, the optimum management strategy would be to permit effort to expand to the point where the marginal cost of the resources (capital and labour) needed to produce a kilogramme (Kg) of fish is equal to the price consumers are willing to pay for that last Kg of fish produced.

[2] Note that TACs can have a negative effect on the amount of fish killed at sea through the practice of discarding (Karagiannakos, 1996; Villasante *et al.*, 2010)

As fisheries are a Common Property Resource (CPR) every person with access to the resource has the incentive to exploit it to the limits of profitability, or beyond in the presence of external financial subsidies (Sweeney *et al.*, 1974; Gordon, 1991; Turner *et al.*, 1997). This phenomenon has been described by Hardin (1968) as *the tragedy of the commons*. Due to this, it is easy for the total fishing effort to exceed the sustainable limit, increasing the risk of overfishing (BenDor *et al.*, 2009). When a fisher in a specific area catches another tonne of fish[3], two costs are incurred; (i) by catching another tonne of fish the fish stock is reduced and the next tonne becomes more expensive to catch for all fishers, (ii) the future reproduction potential for these fish is lost to all fishers (Hohnen et al., 2008). These extra costs are spread across all fishers as the state of the fish stock is an unpriced input to the production process and individual fishers bear only a fraction of the total cost of their action (Hohnen et al., 2008).

Market institutions (coordinated by price mechanisms) are as important as the hierarchical institutions (coordinated by mechanisms of authority through regulatory measures) in controlling economic behaviour (Loucks, 2007). As regulated open access fisheries are rationalised, rent dissipation and distortions on the marketing side of the ledger can be as important as distortions on the production side. This is because higher exvessel[4] prices in the market can sometimes be the first indicators of noticeable increases or decreases in costs (Homans & Wilen, 2005). The development of fisheries is correlated with the economic value of the resources, suggesting that the industry is profit-driven, and therefore what drives fishers to specific fishing areas and stocks relates to their potential costs and revenues (Sethi *et al.*, 2010).

Despite the increasing number of top-down controls, externalities arising in the fisheries sector can sometimes act as drivers of change acting towards the opposite direction to the stated sustainability goals, preventing the desirable shift to a sustainable fisheries industry. The following fisheries sector externalities have been recognised in the European fisheries: (i) Skippers of bigger vessels become compelled to seek better fishing opportunities in order to make their vessel more profitable by

[3] Excluding the traditional and fishing input costs of fuel, labour and capital.
[4] Exvessel value is the amount paid to fishers for their raw catch.

investing in new technology which will improve the vessel's fishing capabilities. Thus, when economic efficiency is not achieved, technological externalities produce a rising-cost industry (Bell, 1972). (ii) Quota regulations can act to sustain the stocks to a sustainable level but can also act to drive the trade underground so that reported import quantities become decoupled from actual trade volumes (Clarke *et al.*, 2007). (iii) The market transfer effect is an unintended consequence of environmental regulations which occurs when regulations controlling externalities in one market leads to increased market production and environmental damage in another market (Rausser et al., 2009). (iv) Finally, subsidies/financial aid to the sector is the externality which has been criticized the most for its negative impact on the resource (Frost & Andersen, 2006; Schmid, 2007; Markus, 2010). The over-subsidization of the European fishing sector by the European Fisheries Fund (EFF)[5] and its predecessor, the Financial Instrument for Fisheries Guidance (FIFG), has come under scrutiny for having a negative impact on the marine resources as it reduces fishing costs thus leading to catches occurring at an inefficient and unsustainable level (Markus, 2010). These types of subsidies have been characterised by Khan *et al.* (2006) as 'Bad Subsidies'.

Thus, following on from the previous chapter which examined the spatial distribution and evolution of the CFP in the different maritime regions of the EU, this chapter attempts to examine the kind of changes that these regulatory drivers have brought upon different European fishing fleets.

In this chapter the relationships created between the structure of the European fishing fleet and its economic activity that occurred after the implementation of specific fishing rules and market regulations are explored. To achieve this:

- Fleets of special interest were identified as stated in the EU's Annual Economic Report (2009) for Cyprus, Spain, Denmark and the United Kingdom.
- For each of the selected fleets, changes in structural and economic indicators were explored and associated with regulatory and / or market changes.

[5] EFF is the EU's body for granting financial support in order to meet CFP's economic, environmental and social goals

- Finally, close examination in the context of the relevant regulatory and market environment provided a perspective on 'what is driving that change'.

3.2 Methods

3.2.1 Origin of Data

The structural and economic performance indicators used in this section were obtained from the 2009 Annual Economic Report (AER) on the European Union fishing fleet (Anderson & Guillen, 2009). This report provides a comprehensive overview of the latest information available on the structure and economic performance of the EU Member States' fishing fleets including (i) an economic and structural overview of the EU fishing fleet, (ii) a detailed economic and structural overview of the fishing fleets from each Member State (up until 2007), (iii) qualitative economic performance predictions for 2008 and 2009 for each Member States fishing fleet, (iv) detailed economic and structural analyses of selected fleet segments for most Member States, (v) the latest information on EU fish prices and price trends, and (vi) a summary tables of the data submitted by each Member States at fleet segment level. The report was produced by fisheries economists from the Joint Research Centre (JRC) and a working group of economic experts (Sub-group of Economic Affairs (SGECA) 09-01) under the Scientific, Technical and Economic Committee for Fisheries (STECF), which convened 9th-13th of March 2009 in Ispra, Italy.

3.2.2 Nature of Data

The data used to compile all the various analyses contained within the AER were collected under the framework of the Data Collection Regulation (DCR)[6]. The data were extracted from Appendix 3: DCR Economic tables of the AER 2009. Data on the number of regulations in each region were calculated and presented in Chapter 2. Visual representations were created for the differences in the value of landings, effort days and number of regulations for all Member States combined for the three maritime regions (North east Atlantic, Baltic and the Mediterranean). The groupings of Member States in the three regions are shown in Table 3.1. Because the number of registered vessels were expressed in the form of the number of vessels per Member

[6] Council Regulation: European Commission (EC) No 1543/2000 of 29 June 2000.

State, and not expressed as the number of vessels per maritime region, additional calculations were undertaken for the Member States whose vessels conduct fishing activities in more than one European maritime region (e.g. for Spain which has both an Atlantic and Mediterranean coastline). For these Member States, it was assumed that the number of vessels that fished in each region is analogous to the value of landings[7] and that each vessel only fishes in one region. Thus, an approximation was made of the number of vessels fishing in each maritime region. For the Danish fleet, value of landings for the Baltic[8] and North Sea / NE Atlantic were taken from the Danish Ministry of Food, Agriculture and Fisheries website[9] and were converted from Danish Krones to Euros.

Table 3.1: Groupings of the Member States into the three maritime regions.

Baltic	**NE Atlantic**	**Mediterranean**
Denmark*	Belgium	Cyprus
Estonia	Denmark*	France*
Finland	France*	Greece
Germany*	Germany*	Italy
Latvia	Ireland	Malta
Lithuania	Netherlands	Slovenia
Poland	Portugal	Spain*
Sweden	Spain*	
	United Kingdom	

*Countries that have a fleet in more than one region

For the four case-study countries used in this study, economic and structural variables of their 'two fleets of special interest' were used to examine any potential changes which occurred over time (United Kingdom, Denmark, Spain and Cyprus - see section 3.2.3: Case study countries). Changes identified were then considered alongside changes in the regulatory or market environment.

The economic and structural indicators used from the AER 2009 are presented and defined in Table 3.2. It is important to note, that the different Member States sometimes use different methods for collecting these data. The indicators used were

[7] Except for Spain where the weight of landings was used instead.
[8] Including Skagerrak and Kattegat
[9] http://webfd.fd.dk/stat/Faste%20tabeller/Landinger-10aar/tab73x_eng.html

calculated by the JRC working groups using the data provided by the Member States. However, data from the Spanish national chapter in the AER (Table 3.18.6) were used rather than the relevant data in appendix 3 for the study of the Spanish 'Pelagic trawl and seine over-40m' fleet. This was after the advice from the chair of the JRC expert group, John Anderson according to whom the large fluctuations in the total employment in Appendix 3 of AER 2009 are most likely errors attributable to the Spanish authorities.

A number of structural and economic indicators were studied to identify trends or changes with time linked to the introduction of new regulations and/or changes in the markets etc. If such a link with a regulatory measure or market change was identified, the original objectives of that measure were ascertained to judge its success or failure. Indicators such as effort days, weight of landings, fleet capacity (kW engine power), number of vessels and total employment were selected to identify potential changes in the structure of each fleet segment. Economic indicators were selected to identify potential economic impacts of policy changes. Total income was selected as the reference point of the gross revenue fishers receive. The latter included not just the value of landings but also the income generated from other non-fishing activities and direct subsidies. Both, cash-flow and total cost were selected to identify the fishers' actual income after all the costs were removed (the only difference between cash-flow and total cost is that cash-flow includes the capital cost in its calculation). These two indicators were selected in preference to the profit / loss indicator as only Denmark provided data of sufficient detail to calculate profit / loss.

Table 3.2: Glossary of economic and structural indicators used as defined in the Annual Economic Report 2009 (AER, 2009).

Indicator	Definition	
Effort days (Days at sea)	Any continuous period of 24 hours (or part thereof) during which a vessel is present within an area and absent from port.	
Cash-flow	Refers to the Gross Cash-Flow, as defined in the Concerted Action. Income minus all operational costs, excluding capital costs: income – (fuel costs + crew costs + repair costs +variable costs +fixed costs)	
Value of landings	Value of landed fish calculated on the basis of the first hand price of fish to the fisherman.	
Total Income	Total income including value of landings, subsidies, tourism etc.	
	Income minus all operational costs: income – (fuel costs + crew costs + repair costs +variable costs +fixed costs + capital costs)	
	Fuel costs	Cost of fuel
	Crew costs	Crew cost including social security, health insurance, retirements and other related taxes
	Repair costs	Cost of repair and maintenance of vessel and fishing gear
	Variable costs	Operational costs – sum of all costs (other than fuel and crew costs) which are related to fishing activities
	Fixed costs	Sum of all costs that are not related to fishing effort (other than repair and capital costs)
	Capital costs	Total costs related to the total invested capital (i.e. depreciation and interest). National interest rates and depreciation times have been applied
Cost	Total Cost = Fuel costs + Crew costs + Variable costs + Fixed costs + Capital costs	
Weight of landings	Weight declared on landings fish or shellfish	
Fleet (kW)	Maximum continuous engine power	
Number of vessels	Number of individual fishing vessels	
Employment (Total)	Number of persons employed. For Denmark and Spain FTE (Full Time Equivalent) was used as Total Employment was not available. FTE for Denmark was calculated using the national threshold rate.	

Additional national data for the national case studies were obtained from:

— The Danish fisheries ministry website,

— The U.K. Sea Fisheries Statistics 2008 report available in the Marine and Fisheries Agency website and,

— The Annual Report 2008 on the Cypriot fleet by the Department of Fisheries and Marine Research (DFMR, 2008).

3.2.3 Case study selection

Four countries were originally selected for a detailed analysis of changes in the economic and structural indicators of their fleets of special interest; United Kingdom, Denmark, Spain and Cyprus. The individual country case studies were chosen to include nations for which fishing is economically, historically and culturally important. The four countries were chosen in part because they belong to different maritime regions; The United Kingdom and Denmark represent the Northern European fishing nations with the former conducting its fishing activities mainly in the Atlantic and the latter in both the Atlantic and the Baltic. Spain is a fishing nation that conducts its activities in two different maritime regions that are distinct in terms of their biology and management: the Atlantic and the Mediterranean. Finally Cyprus was chosen as it is representative of the smaller European fishing nations that only recently accessed the EU. In addition, Cyprus conducts its fishing activities solely in the Mediterranean with the majority of its fishing activities occurring within the 12 nautical mile limit. Even though it can be argued that in some cases different case studies could have been selected, the choice of case studies took into account a number of obstacles considered when choosing the case study countries in which to conduct the questionnaires for Chapter 4 (section '4.2.2 Case study selection') (for example language barriers and national contacts with good links with fishermen).

The choice of the 'fleets of special interest' for each country were chosen for the AER 2009 from each country's national experts based on the importance of each fleet for the economy of their country.

3.2.4 Data Issues

As already shown by the errors identified in the Spanish data (see Spanish case in section 3.2.2 Nature of data), using data from a report where the data were collected and compiled by people in 20 different countries is a challenge in itself. A significant number of Member States have submitted incomplete datasets (a list of Member States which did not submit is presented in Appendix 1), thus a truly accurate and comprehensive European overview that includes all active and inactive sectors of the EU fleet was not possible. The DCR has reported that: 'more or less severe delays or even failures in data submission, incomplete submission and unclear discrepancies between the number of vessels on the national fleet register and the submitted number of vessels in the latest data call'. In addition, the AER does not cover the total national fleet for all Member States but rather presents data on larger commercial fisheries, where earnings may be (substantially) higher than in small-scale coastal fishing.

The accession of new Member States to the EU after 2004 and thus the inclusion of their fisheries data in the AER added an extra complication when attempting to construct capacity and economic time series indicators at an EU level. At each EU enlargement, new Member States obtain access to the EU fishing zone. Until May 2004, the EU was composed of 15 Member States, 13 of which had access to fisheries in the open sea. By 2007, 20 countries had access to marine fisheries (22 if you take into account Bulgaria and Romania which are directly connected to the Black Sea). This makes the EU one of the largest and most complex 'fisheries nations' in the world.

3.3 Results

3.3.1 The European Union's fishing fleet

In this section, the three regions (NE Atlatnic, Baltic and Mediterranean) are compared in terms of fleet size, effort days, amount of fish landed and its value.

Fishers in the northern regions landed fish of higher value in fewer fishing days than fishers in the Southern regions (Figure 3.1). The value of landings per effort day in 2007 was higher in the northern regions than in the Mediterranean; 3.4 times higher in the NE Atlantic and 3.7 times higher in the Baltic (Table 3.3). The value of landings in € per unit fish landed (tonnes) on the other hand was highest in the Mediterranean; 2.6 times higher than the Atlantic and 4.9 times higher than the Baltic[10]. Thus, even though the Mediterranean is not as resource rich as the northern regions, value per resource unit was higher. In the Mediterranean the majority of the fleet are smaller vessels, which even though are less efficient (since they require a lot more days to catch the amount of fish caught in the Atlantic), attract higher prices for their fish (AER, 2009). Fish are often sold in the local markets, where consumers are willing to pay higher costs for fresh local fish. The Baltic fleet on the other hand, lands mainly pelagic fish which have a lower value. This counteracts the fleet's efficiency in terms of fish landed per day.

Table 3.3: Value of landings per unit fish (€/tonne) and value of landings per effort day (€/day) in the NE Atlantic, Baltic and Mediterranean for 2007.

Region	Value of landings/Weight of landings (€/tonne)	Value of landings/Effort day (€/day)
NE Atlantic	970	957
Baltic	520	1,034
Mediterranean	2,560	279

[10] However the data can be biased as Greek data have been scrutinized for a potential overestimation of revenues due to data collected using a random sampling strategy (the income of the Greek fleet seems to have increased by 71% since 2004).

Although under the umbrella of the Common Fisheries Policy, the Mediterranean fleet, is affected by fewer regulations than the NE Atlantic and Baltic fleet (NE Atlantic: 245; Baltic: 72; Mediterranean: 39), the ratio of landings / number of regulations for the two northern regions is almost four times higher in the Mediterranean than in the NE Atlantic and almost seven times higher than in the Baltic (Value of landings / number of regulations: NE Atlantic: 9.48 m€ / regulation; Baltic: 5.98 m€ / regulation; Mediterranean 38.21 m€ / regulation). The Mediterranean fleet is not subjected to 'days at sea' and quota regulations (except for bluefin tuna) thus explaining the high number of effort days. Nevertheless, the low value of landings in the Mediterranean indicates that more effort days are required for the fleet to sustain itself.

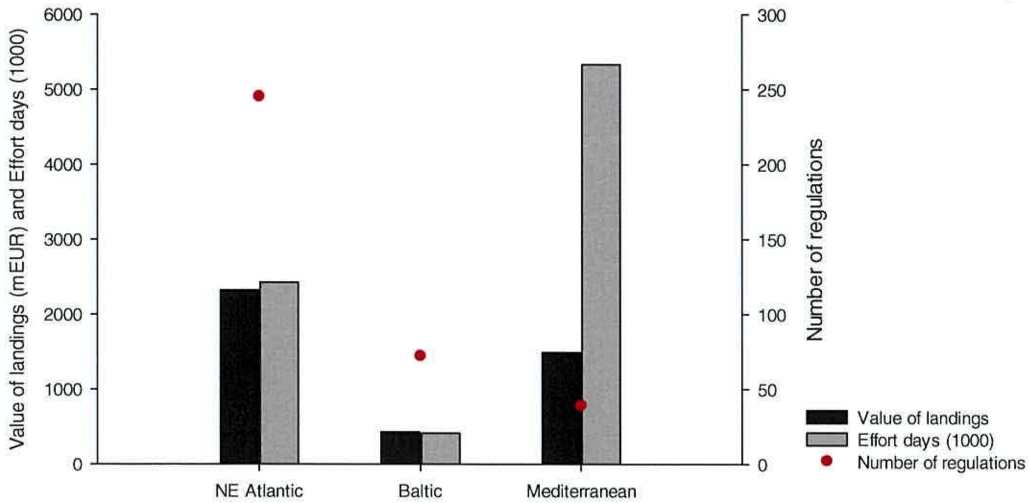

Figure 3.1: Total value of landings, total number of effort days and total number of conservation regulations for each European maritime region (data from Spanish fleet are missing) (AER, 2009).

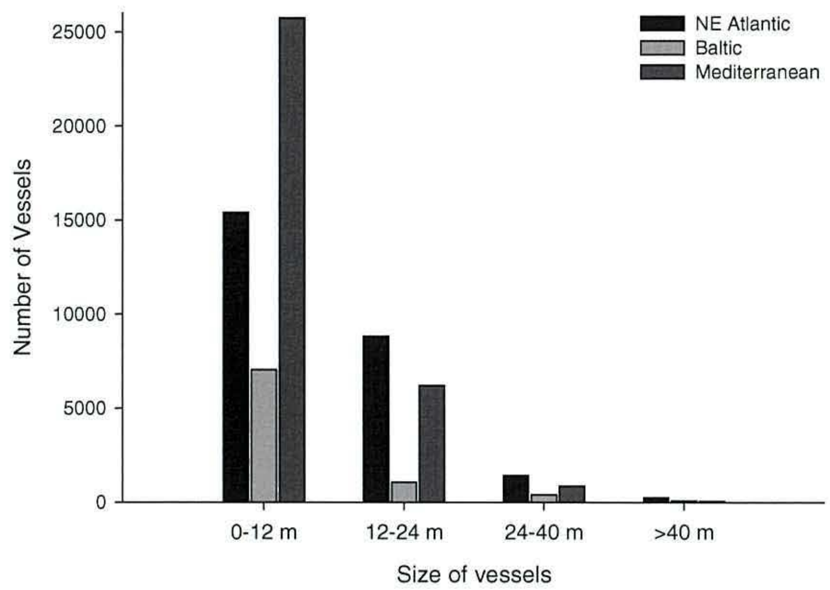

Figure 3.2: Number of vessels in each size category (0-12m, 12-24m, 24-40m and >40m) for each European maritime region (NE Atlantic, Baltic and Mediterranean) (AER, 2009).

In all three regions, the greatest number of vessels occurred in the smallest vessel category (0-12 m). The Mediterranean however had the most 0-12 m vessels. In addition, the Mediterranean did not have any registered vessels over 40 m. For all three regions there was a negative relationship between the number of vessels and the vessel's length category (Figure 3.2). In the more resource rich regions such as the Atlantic, larger and more powerful vessels can catch larger amounts of fish in less time and with less effort. Thus, depending on the region, a vessel's size can determine its efficiency. Generally, smaller fishing vessels have lower running costs, and even though they are less efficient (in terms of tonnes landed per unit time), in the less resource rich regions, where resources are closer to the coast they are more efficient in terms of value per tonne of fish landed.

3.3.1.1 Conclusion

In each of the NE Atlantic, Baltic and Mediterranean region, the fleet (its structure and its characteristics) reflect the productivity of that region, the type of resources (seasonal) and their location (inshore / offshore). The Mediterranean region has the largest number of small inshore vessels. These vessels conduct their fishing operations inshore and their catches are seasonal in nature. Thus, due to the less resource rich, but also seasonal nature of the resources, more effort days are needed for the fleet's profitable operation. In the NE Atlantic and the Baltic vessels land more fish in fewer days, but these are of less value per tonne. The larger size fleet of the Northern regions also have a higher operational cost (such as fuel cost and wages). Thus, the Mediterranean, despite its poor resource status, comprises mainly of smaller vessels, which despite landing less fish receive a higher price and have lower running costs. The lower value per unit resource in the northern regions compared to the Mediterranean could be associated with this difference in the supply and demand of fish but also to the (cultural) demand of Mediterranean consumers for local fresh fish. The lower supply of local fresh fish in the Mediterranean boosts its value in the region.

3.3.2 National Fleets of Special Interest

This section discusses changes in economic and structural indicators in relation to regulatory changes for the two fleets of special interest for the four case study countries; Cyprus, Spain, Denmark and the U.K.

3.3.2.1 Cyprus: The impact of a country's EU accession on the country's fishing fleet

According to Cypriot Fisheries Law, the country's fishing fleet is divided into three fleet segments: the small-scale inshore vessels (with a length overall of 6-12 m), the polyvalent (or longliners) (with a length overall of 12-24 m) and the bottom trawlers (with a length overall of 21-27 m). These vessels are categorised depending on their type of licence: those fishing in the territorial waters of Cyprus, and those that fish in international waters (eastern and central Mediterranean). There are a number of management measures drafted in the form of either National or Community legislation which include:

- Restrictive access to the fisheries by limiting the number of licences issued for each fleet segment
- Effort control by restrictions on the use of fishing gears (quantities, soaking time, depth of deployment and distance offshore) and by regulating fishing capacity (using scrappage schemes, engine power restrictions, capping the fleet vessel register).
- Market restriction measures that define a set of minimum landing sizes.
- Technical conservation measures by setting minimum mesh sizes.
- Seasonal and area closures.

3.3.2.1.1 Passive gear 0-12 m vessels

This category consists of the majority of the Cypriot fleet in terms of the number of vessels. The number of effort days for this fleet is seasonal and weather dependent. Depending on the time of the year, these small vessels target different species.

Landings are mainly composed of *Spicara* spp. (mostly *Spicara smaris*), *Boops boops*, *Mullus barbatus*, *Mullus surmuletus*, *Pagellus erythrinus* and cephalopods (*Octopus vulgaris*, *Eledone moschata*, *Loligo vulgaris* and *Sepia officinalis*). The fleet also lands relatively large quanitites of *Diplodus* spp, *Sparisoma cretense* and *Siganus* spp. In 2007, the 492 active vessels of this category formed 93% of the Cypriot fleet. These vessels engaged in seasonal fishing and were authorised to use trammel nets, anchored gillnets, set longlines, pots and traps. Despite this category forming 93% of the fleet in terms of numbers of vessels, it corresponds to just under half (2,420 GT) and 74% (28,290 kW) of the tonnage and engine power respectively (according to 2007 figures) (AER, 2009). In terms of employment 77% of the Cypriot fishermen work in this sector. This sector produces approximately 44% of the weight of landings that comprise 58% of the value of total Cypriot fishery landings. Fishermen in this sector use 95.6% of the total recorded fishing days.

The Cypriot Inshore Fishery's Production Rate (mtonnes / effort day) decreased after 1974[11], most possibly due to the political situation (the partitioning of the island) at the time which caused a general standstill in most activities in the country (Figure 3.3). The production rate picked up towards the end of the 1970s peaking in the mid-1980, but has been in decline ever since.

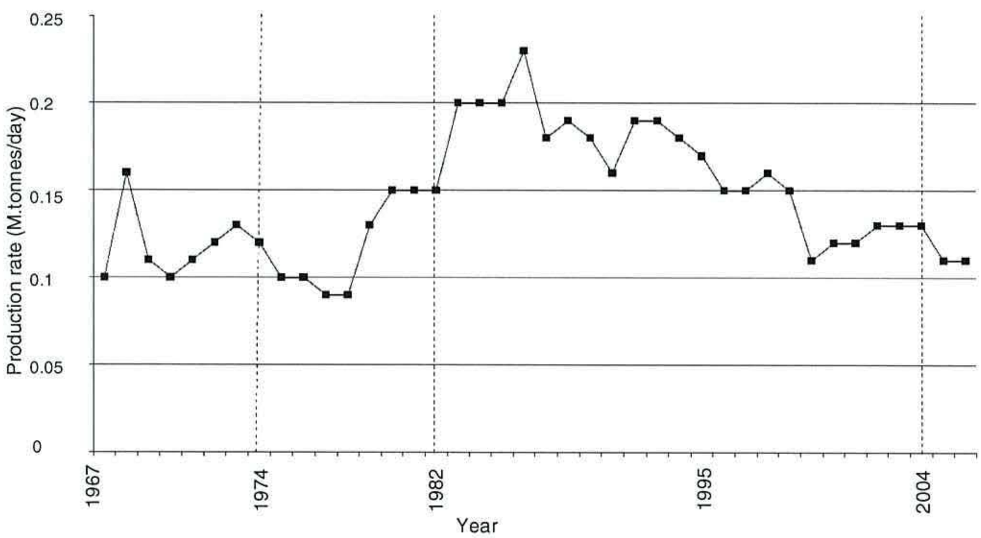

Figure 3.3: Cypriot Inshore Fishery Production Rate (mtonnes/day) from 1967-2006. Reference years are indicated with vertical lines; 1974 (Turkish Invasion), 1982 (prohibition of trawling in October) and 2004 (Cyprus accession in the EU) (Figure adapted from DFMR, 2007).

[11] 1974 is the year of the Turkish Invasion during which almost half the country was divided and is still under Turkish occupation today.

The following section discusses the fluctuation of the various indicators between 2005 and 2007. The short availability of the data for the different variables is due the recent accession of Cyprus to the EU. Thus, only assumptions can be made for what the potential drivers of that change could have been on any changes identified in the economic and structural indicators.

Between 2005 and 2007, there were small fluctuations in the number of vessels in the fleet and the total fleet power (kW) (Figure 3.4). The former fluctuates around the 500 licenses limit which is the number of licences issued by the DFMR for the sector. However, there has been a drop of 22.3% in the total number of people employed in this sector.

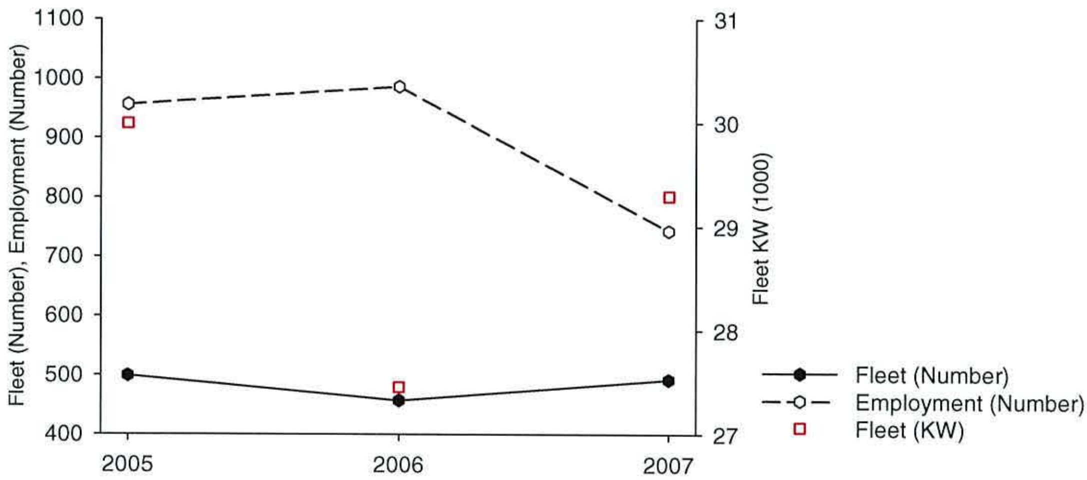

Figure 3.4: Fluctuations in structural indicators (Number of vessels, Employment and Fleet capacity in kW) of the Cypriot passive fleet 6-12 m between 2005-2007 (AER, 2009).

Even though capacity was reduced by 30% in tonnage and 9% in power between 2005 and 2007, it was expected to increase in 2008 following the addition of the new Category C licence. Due to this controversial regulation small fishing vessels used by recreational fishermen had a change of status from recreational to professional[12]. As a result, preliminary Eurostat data[13] are suggesting an increase of the Cypriot fishing fleet from 867 vessels in 2007 to 1169 in 2008.

[12] Regulation N.132(I)/2007 found on: http://www.moa.gov.cy/moa/dfmr/dfmr.nsf/All/3F0D80521A3533E7C225733F003E0011/$file/N.%20132(I)-2007.pdf?OpenElement

[13] http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/

The increasing trend in effort days was accompanied by an increase in catches (weight of landings) thus the total weight of landings per day remained stable (Figure 3.5).

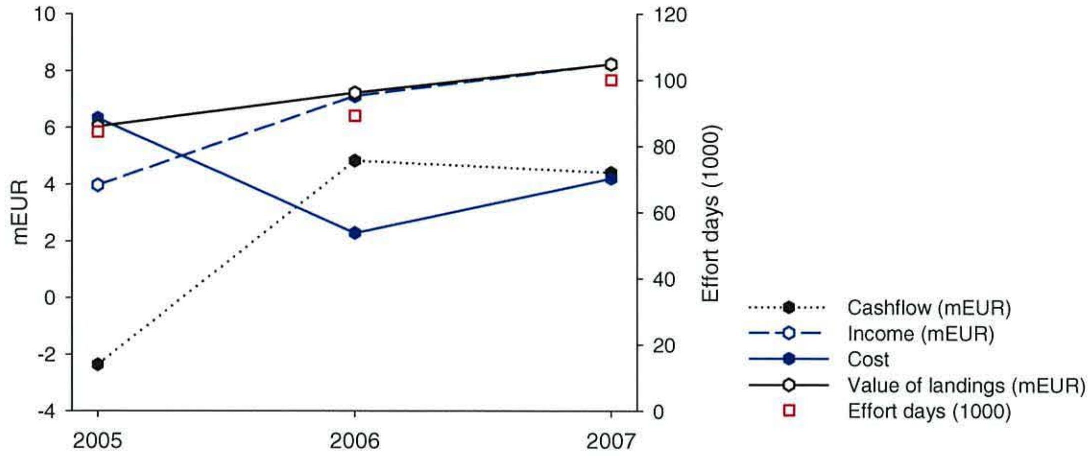

Figure 3.5: Fluctuations in economic indicators (Cash-flow, Income, Cost, Value of landings) and effort days of the Cypriot passive fleet 6-12 m between 2005-2007 (AER, 2009).

According to the economic indicators given in the AER, the Cypriot passive gear fleet (0-12 m) evolved from a non-profitable fleet (cost > income) in 2005 to a profitable one in 2006 and 2007. This could be associated with the loss of employees shown in Figure 3.4 as the number of employees per vessel reduced from 1.91 in 2005 to 1.51 in 2007 (cost reduction). Similarly, cash-flow per vessel increased from a negative figure (-4,700€ in 2005) to a positive (profitable) one (9,000€ in 2007). The slight decrease in cash-flow in 2007 can be partly related to the increase in fuel prices (operational cost). This decrease was not related to market price changes as in 2007 the value of landings was higher than the weight of landings (Figure 3.6). On the contrary, there was an increase of 9.5% (7.02 to 7.76) in the value per unit of fish between 2005 and 2007 (standardised by effort days).

On the whole there has been a decrease in the number of people employed in the sector since the country's entry to the EU, an increase in effort days, weight and the value of landings, despite the change in the yearly catch per vessel during 2006-2007 being slightly negative (-2.7%). 2007 saw an increase in the price of important species like bogue (*Boops boops*), red mullet (*Mullus barbatus*), octopuses and of the common cuttlefish from 5.14 to 5.24 € / Kg, 12.61 to 13.35 €/Kg, 4.53 to 5.22 € / Kg and 8.19 to 8.99 € / Kg respectively. Increases in fish prices led to an increase in the

Value of landings/Catch of landings ratio of 624 € / tonne. It could be of importance that this mix of demersal species targeted by the inshore fishery is not shared with other Mediterranean countries[14].

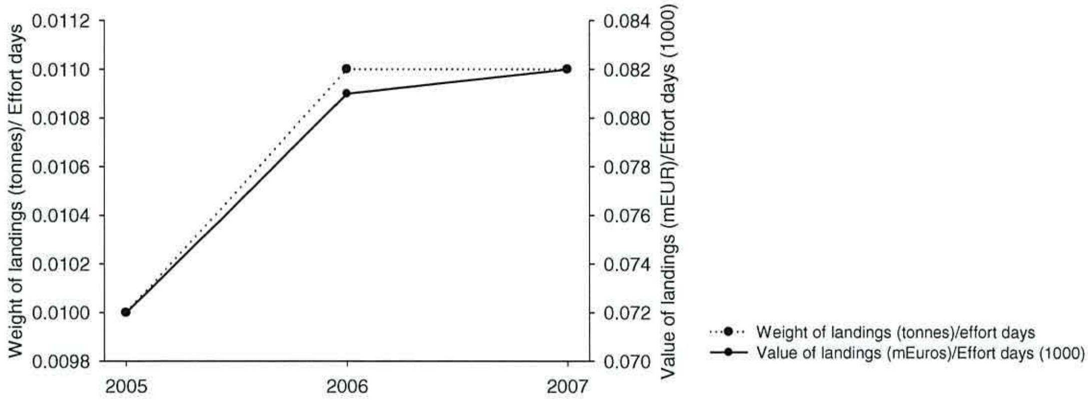

Figure 3.6: Changes in the value of landings (m€) per effort day (1000) and Weight of landings (tonnes) per effort day of the Cypriot passive fleet 0-12 m during 2005-2007 (AER, 2009).

3.3.2.1.2 Passive polyvalent gears 12-24 m vessels

The fleet is termed 'polyvalent' because these vessels are engaged in two fisheries. First, they engage mainly in the pelagic fishery for large fish species (targeting swordfish, bluefin tuna and albacore) using drifting longlines around Cypriot and the eastern Mediterranean waters. They also operate in the inshore demersal fishery using mostly bottom set nets and bottom longlines. In 2007, the polyvalent fleet comprised about 5% of the total Cypriot fishing fleet, and approximately 17% of the total tonnage and 14% of the total power. Only 15% of Cypriot fishermen are employed in this sector and use less than 2% of the total fishing days of the Cypriot fleet.

The number of vessels decreased during the period 2005-2007, as did kW and GT (Figure 3.7). The main reason for this change was that within the framework of European Structural Funds five of the most productive vessels in the fleet segment were decommissioned in 2006[15] (European Commission, 2007).

[14] The demersal inshore stock is however shared with the 4 remaining bottom trawlers of the Cypriot fishing fleet

[15] After entering the EU, the country was granted 3.42 m€ under FIFG (Financial Instrument for Fisheries Guidance) aid for the period 2004-2006 and of 20 m€ under the new European Fisheries Fund (EFF) for the period 2007-2013.

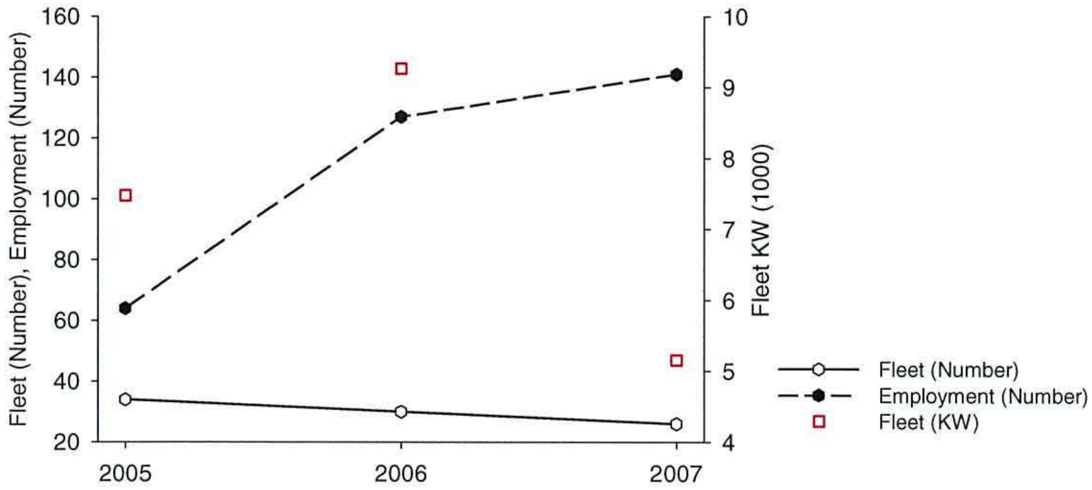

Figure 3.7: Fluctuations in structural indicators (Number of vessels, Employment and Fleet capacity in kW) of the Cypriot polyvalent fleet 12-24 m during 2005-2007 (AER, 2009).

According to figures from 2007, the polyvalent segment of the Cypriot fishing fleet accounted for only 2% of the total fishing days utilised by the entire fleet, but it landed approximately 32% (780 tonnes) of the total weight and 14% (1.99 m€) of the total value landed by the Cypriot fleet that year. There was a cost reduction in the fleet of 39% (from 2.25 to 1.37 m€) possibly associated with the decommissioning which took place in 2006 (Figure 3.8). Nevertheless, the fleet saw a 30.3% increase in cashflow during that period. The value of landings per unit fish (standardised by effort days) caught by the polyvalent fleet saw a 24.1% decrease between 2005 and 2007 (3.36 to 2.55) (Figure 3.9).

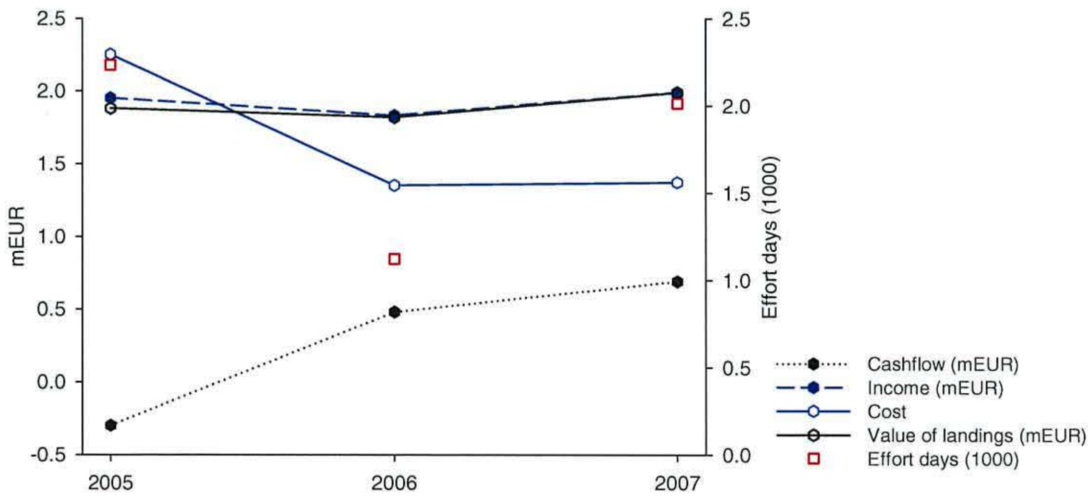

Figure 3.8: Fluctuations in economic indicators (Cash-flow, Income, Cost, Value of landings) and effort days of the Cypriot polyvalent fleet 12-24 m during 2005-2007 (AER, 2009).

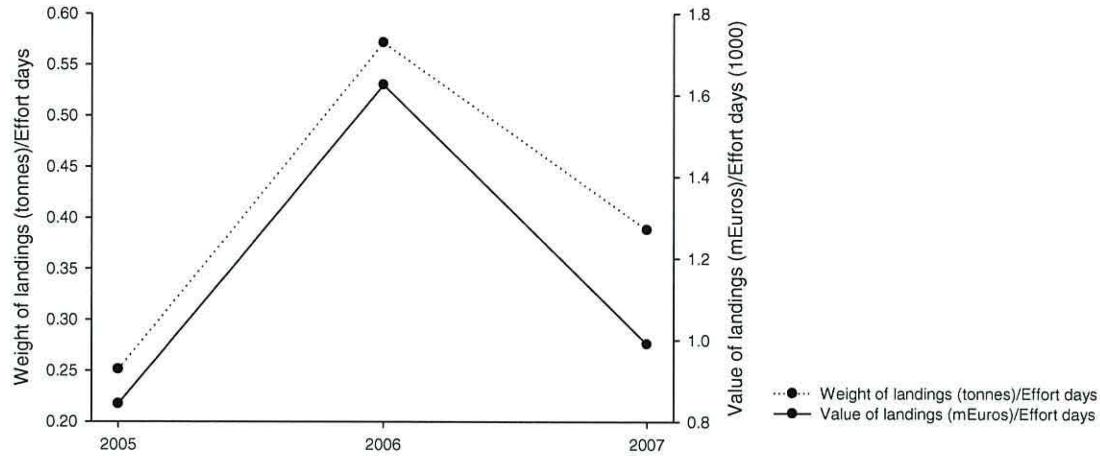

Figure 3.9: Changes in the value of landings (m€) per effort day (1000) and Weight of landings (tonnes) per effort day of the Cypriot polyvalent fleet 12-24 m during 2005-2007 (AER, 2009).

3.3.2.1.3 Conclusion

It is difficult to draw strong conclusions about the impacts of regulations and market controls as drivers of change due to wide variety of factors acting on the fishing industry. In Cyprus, a conclusion is even more difficult due to inadequate data. Nevertheless, accession to the EU seems to have (at least economically) benefited the Cypriot fleet. The smaller passive gear fleet saw a decrease in the average cash-flow between 2006 and 2007, despite an increase in average income. This can be related to the increase in fuel and fixed costs[16] during that period. The larger polyvalent fleet saw both an increase in the total income and cash-flow. Despite the increase in albacore landings, the large overseas market for the species drove its total value from 0.59 m€ in 2005, to 0.77 m€ in 2006 to 1.34 m€ in 2007. Thus, especially for the polyvalent fleet, membership of the common market resulted in the abolition of tariffs and a general reduction of trade costs and thus a better price for their fish.

[16] Sum of all costs not related to fishing effort other than repair and capital costs

3.3.2.2 Spain: politics and short-term profitability are prevailing over an endangered stock

3.3.2.2.1 Pelagic trawls and seiners over 40 m

The main catch for this fleet is the Atlantic bluefin tuna (*Thunnus Thynnus*) caught in the Mediterranean. Tuna has been the most valuable and sought-after species in the Mediterranean since the Mesolithic times (Coull, 1972). The size of the stock was estimated to have fallen by 80% since the early 1970s hence a recovery plan was put in place during ICCAT's (International Commission for the Conservation of Atlantic Tunas) annual meeting in 2006 to facilitate the species recovery (European Commission, 2010). This plan included reduced TACs, higher minimum landing sizes, stricter controls and enforcement. Nevertheless, the available structural and economic indicators for this fleet do not suggest any major changes in the fleet during the 2002-2007 period (Figures 3.10 and 3.11).

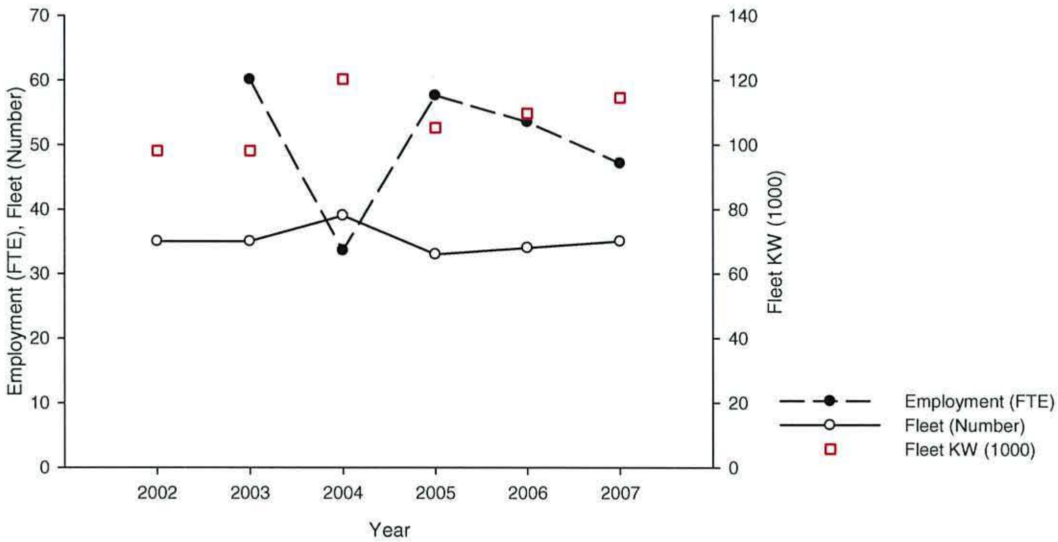

Figure 3.10: Fluctuations in structural indicators (Number of vessels, Employment and Fleet capacity in kW) of the Spanish pelagic trawl and seiner over 40 m during 2002-2007 (AER, 2009).

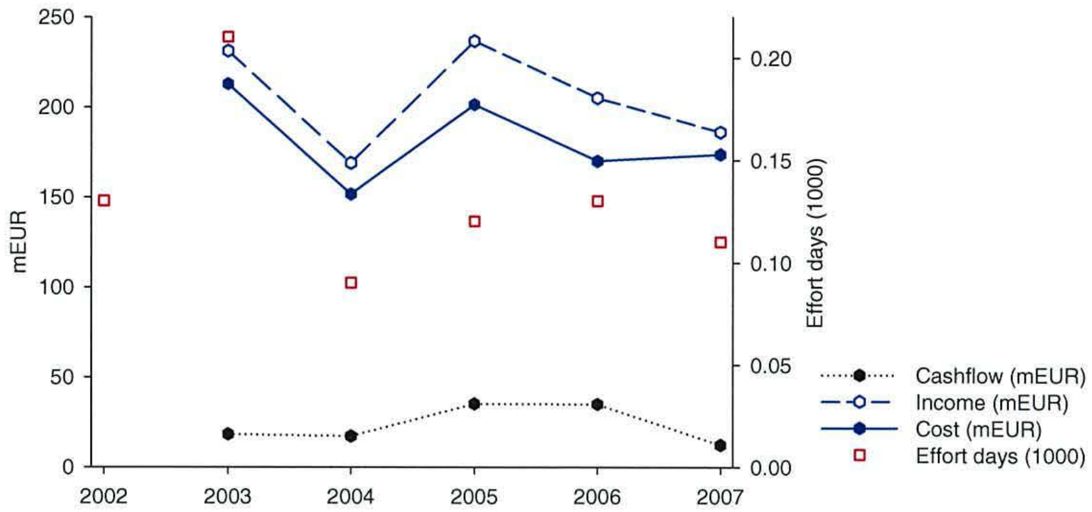

Figure 3.11: Fluctuations in economic indicators (Cash-flow, Income, Cost) and effort days of the Spanish pelagic trawl and seiner over 40 m during 2002-2007. [Cost excludes capital cost] (AER, 2009).

Data on capital costs are missing, thus profits could not be calculated. However, income and cash-flow remained positive albeit their fluctuation (probably due to changes in the weight of landings). Fluctuations in the weight of landings are presented in Table 3.4.

Table 3.4: Fluctuations in weight of landings for the Spanish pelagic trawl and seiner fleet segment between 2002-2007

	Year					
	2002	2003	2004	2005	2006	2007
Weight of landings (1000)	0.72	0.53	0.08	0.19	0.24	0.10

This suggest that the fleet remained profitable despite the state of its main target stock (cost<income, but with capital costs missing). The bluefin tuna is currently in the centre of a political campaign and despite its critically endangered status, a proposed fishing ban was rejected by the delegates at the Convention on International Trade in Endangered Species (CITES) (voted by a margin of 68 to 20 in March 2010) (Vasquez, 2010). The global fishing lobby is very strong, especially with the recent increase in price of tuna (mainly[17]) in the Japanese markets[18]. Due to the high prices,

[17] 80% of all the eastern Atlantic and Mediterranean bluefin tuna are eaten in Japan

[18] According to BBC's correspondent Roland Buerk, in January 2010, a 232 kg bluefin tuna was sold in Tokyo's fish market for a price of £109,000, the highest price in Japan for nine years.

national delegates for whom bluefin tuna landings are important for their country's economy fought against potential bans and measures that could potentially decrease that revenue.

3.3.2.2.2 Demersal trawls and seiners 24-40 m

This fleet is compared and discussed with its British equivalent in section 3.3.2.4.2.

3.3.2.2.3 Conclusion

The Spanish Pelagic case study supports the suggestion that there are cases where the driver of change (or in this case the lack of change) in a regime, is political power. Political power in itself is influenced by global trade, and in the bluefin tuna case, by future short-term revenues rather than the long-term protection of the stock (and thus potential long-term revenues). The bluefin tuna story has many analogies with the demise of the west coast US abalone fisheries in the 1970s and 80s in which ever increasing prices maintained the profitability of a severely depleted fishery that led to its total extirpation from local waters (Davies, 1989; Hilborn, 2005).

3.3.2.3 Denmark: *métier* shift under the introduction of Individual Transferable Quotas (ITQs)

3.3.2.3.1 Background on the North Atlantic Herring Fishery

The North Atlantic herring fishery is capital intensive and requires high quotas in order to be profitable. In 1995, an Individual Quota (IQ) system was introduced that allocated 90% of the Danish quota of herring to approximately 35 larger vessels, excluding a large portion of the Danish fleet from the herring fisheries (Christensen *et al.*, 2007). This was the first step toward implementing an Individual Transferable Quota (ITQ) system. Prior to that, Danish fishers were forbidden to increase the tonnage capacity of their vessels. After the 1980s fishers were allowed to merge capacity to build new vessels, but the investment was not profitable since they could not move the fish quota. A change in the regime in 2004 however meant that fishers no longer needed to keep their old vessels, but could transfer the quota and scrap the vessel. Thus, by having larger quotas the fishers could afford to invest in larger vessels but still use their old vessels to obtain the necessary tonnage as set by capacity restriction measures. This led to an overall decrease of the tonnage of the fleet thus a more efficient and profitable fleet as fewer but more powerful (in terms of tonnage) vessels were landing the same amount of fish. Nevertheless, due to the issue of technological creep it would be necessary to annually reduce the Danish fleet by at least 2% in tonnage just to maintain *status quo* in terms of fishing capacity (Hegland & Raakjaer, 2008).

The Danish system can be described as highly centralised and heavily influenced by a national tradition of involving user-groups and stakeholders in policy-making, through cooperative structures[19] (Hegland & Raakjaer, 2008). Thus, despite the introduction of the Fisheries Law of 1999[20] the reforms of the Danish fisheries policy were mainly due to changes in the political environment rather than the law itself (Hegland & Raakjaer, 2008). ITQs were strongly opposed by the majority of

[19] These corporative structures exist in the form of Producer Organizations.
[20] Folketinget 1999 is considered to be the Danish equivalent to the basic regulation of the CFP.

fishermen in other sectors[21] and the Danish Fishermen's Association (DFA) argued that it is unfair for a small group to have exclusive economic rights at the economic expense of other fishermen[22]. However, with the strong political platform of the Pelagic Fishermen's Producer Organisation (PFPO) and its support by the Danish Fish Processing Industries and Exporters, the Danish Parliament was convinced to introduce an ITQ system for herring fisheries in the North Sea and Skagerrak commencing in 2003. In 2005, the ITQ system evolved to include mackerel and non-human consumption species as well (Christensen *et al.*, 2007; Hegland & Raakjaer, 2008). In this new system quota rights are given for a number of years and could be traded (Hegland & Raakjaer, 2008).

The herring fishermen being a well organised and small, homogeneous group of fishermen, acted professionally through hiring educated staff from outside the fisheries to work strategically on their behalf (Christensen *et al.*, 2007). Additionally, these fishermen had the financial resources to promote their views. Thus, despite the DFA representing the majority of its members which opposed the introduction of ITQs, this elite group of well organised and wealthy fishermen managed to obtain exclusive rights to the main part of the herring quota (92.7% of the Danish quota and 13.9% of the global quotas in 2007). This shows that changes in institutions require individuals to act in a coordinated manner (Safarzynska *et al.*, 2010).

The Danish fleets of special interest are the country's '24-40m' and 'over-40m pelagic trawls and seiners' fleets. Pelagic fisheries are said to be one of the 'cleanest' fisheries as due to the way the gear works, there is minimal environmental impact on the seabed. Additionally, the quality of the catch is higher and as shoals of pelagic fish aggregate by size, few undersized fish are caught thus discards are kept to a minimum (Morizur *et al.*, 1996).

The Individual Transferable Quota (ITQ) system came into force in Denmark in 2003. Under this system, shares of the TAC are allocated among fishermen creating some

[21] Primarily by fishers with smaller vessels due to risk of ownership concentration and loss of local livelihoods.
[22] According to employment data, employment levels have dropped to a quarter of the 2002 levels in the smaller pelagic fleet (24-40 m)

degree of ownership by allowing fishers to buy, sell or lease quota shares among themselves (Degnbol *et al.*, 2006).

3.3.2.3.2 Structural and economic changes in the Danish pelagic fleets

Figure 3.12a,b and c suggest that this new system led to rapid structural adjustment; the number of 24-40 m vessels reduced by approximately 50% (134 to 61 vessels) between 2002-2007 whereas number of vessels for the over-40m vessels remained stable. There was a considerable reduction of the kW capacity of the 24-40m fleet (reduction of 42,190 kW which is equivalent to a more than 50% reduction). Approximately 50% of the adjusted fleet shifted to the over-40m fleet, the kW capacity of which increased by approximately 20,000 kW (47450 to 67110 kW).

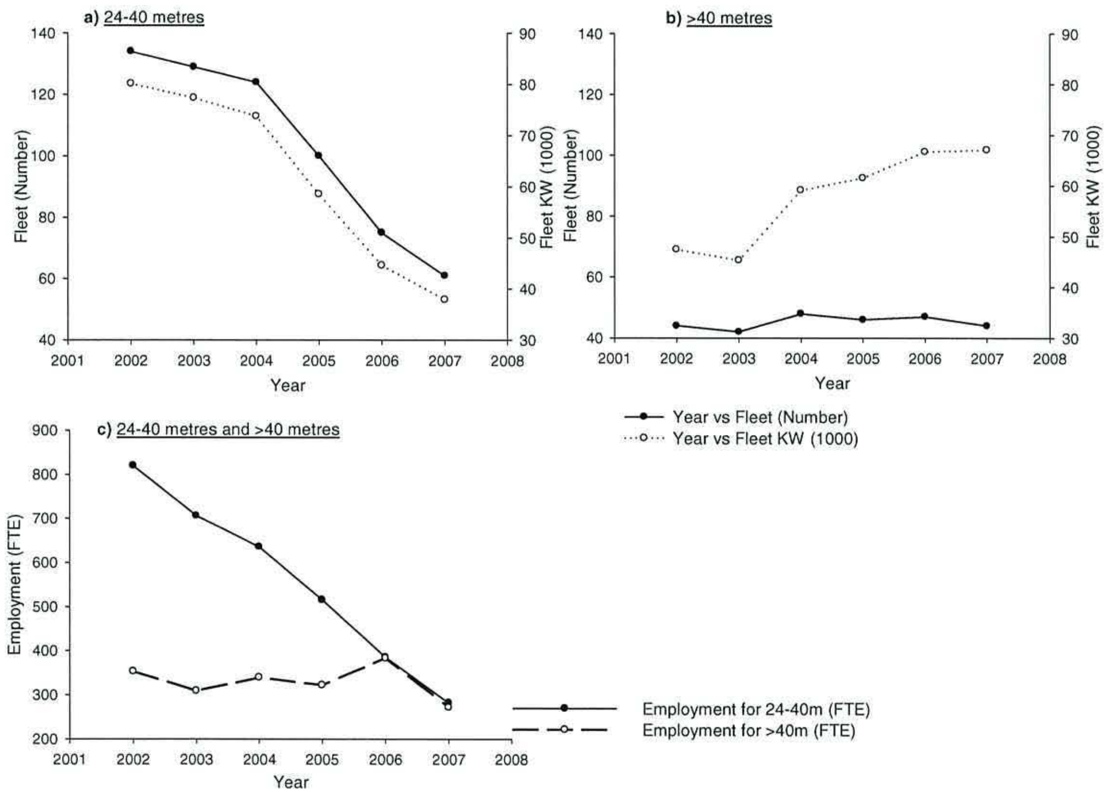

Figure 3.12: Fluctuations in structural indicators (Number of vessels, Employment and Fleet capacity in kW) of the Danish Pelagic trawls and seiners a) 24-40m fleet and b) over-40m fleet. 3.12c (AER, 2009).

Up until 2007, effort days for the 24-40m fleet decreased to a third of the days in 2002 (31370 to 11510), weight of landings to one sixth (1214150 to 220360 tonnes) and the value of landings saw a decrease of 57% (259.88 to 110.79 m€) (Figure 3.13a).

Similarly both income and cost decreased by approximately 50% (131.25 to 58.39 m€ and 126.63 to 61.75 m€ respectively) and cash-flow dropped to one third of the 2002 value (32.25 to 11.61 m€). The weight of landings decreased by approximately 1,000,000 tonnes. For the over-40m fleet (Figure 3.13b) there was a 10% increase in cashflow and 2% increase in income (39.70 to 43.68 m€ and 106.18 to 108.09 m€ respectively) between 2002-2007. There was also a 20% increase in cost (84.40 to 103.97 m€). Finally, there was a 3% in the value of landings (208.48 to 215.76 m€) despite the 42% decrease in effort days (10,560 to 7,460).

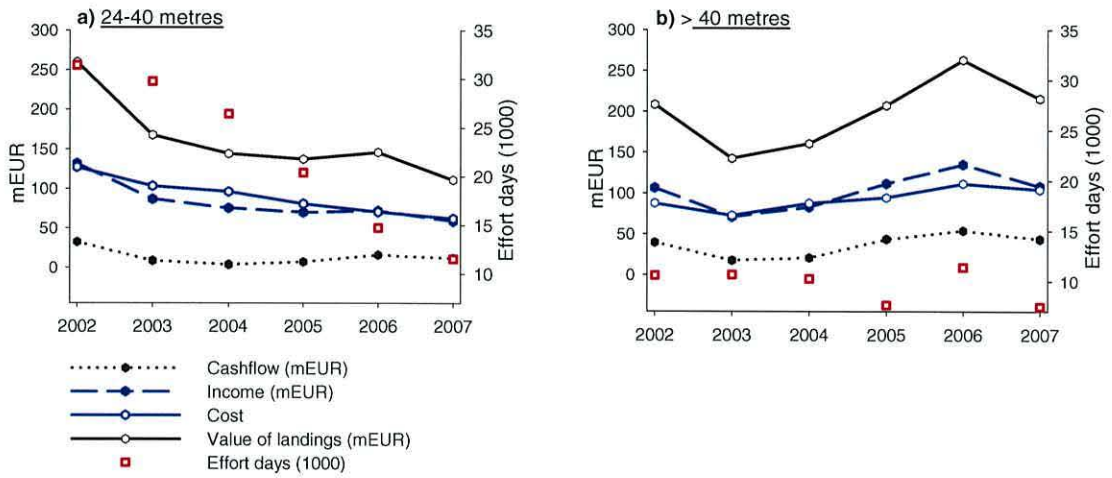

Figure 3.13: Fluctuations in their economic indicators (Cashflow, Income, Cost) and effort days a) 24-40m fleet and b) over-40m during 2002-2007. [Cost excludes capital cost] (AER, 2009).

The fleet's structural adjustments led to a more efficient pelagic fleet for both the 24-40m fleet and the over-40m (Figure 3.14a and Figure 3.14b). For the 24-40m fleet despite the weight of landings per unit effort decreasing by 49% (38.704 to 19.145 tonnes / day), the value of landings per unit effort increased by 16% (8.284 to 9.626 1000€ / tonne). For the over-40m fleet weight of landings per unit effort increased by 6% (90.886 to 96.306 tonnes / day) and the value of landings per unit effort increased by 46% (19.742 to 28.922 1000€ / day).

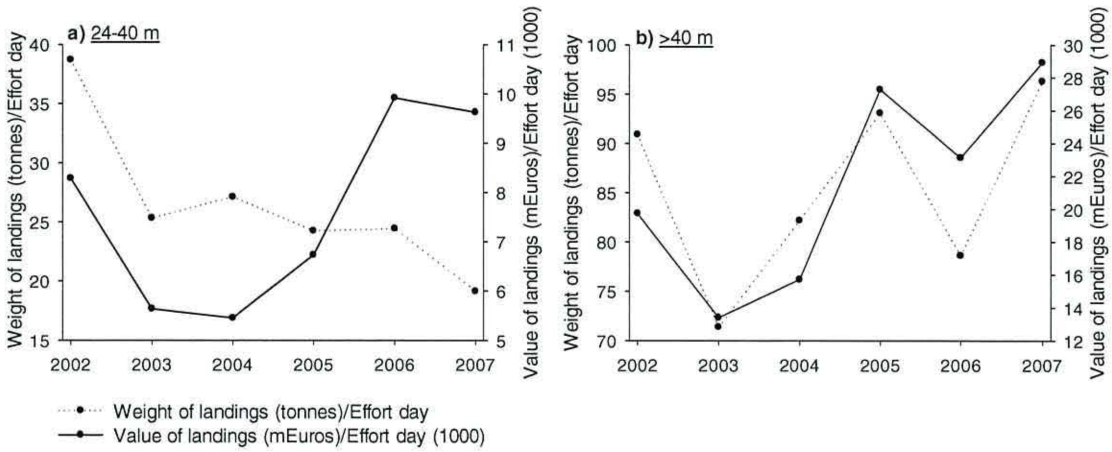

Figure 3.14: Changes in the weight and value of landings of the Danish pelagic fleet a) 24-40m and b) over-40m during 2002-2007 (AER, 2009).

3.3.2.3.3 Conclusion

The build up in the capacity of the Danish pelagic trawls and seiners sector between 1983-1987 was associated with factors such as (i) investment of profits into capital investments that avoided taxation (ii) good fishing possibilities where collective quarterly quotas encouraged fishers to increase their capacity in order to earn more than their colleagues, (iii) easy access to subsidies and (iv) a the lack of restrictions on vessels entering into the fleet (Raakjaer Nielsen, 1992). However, the industry subsequently realised that this strategy was ultimately unprofitable and generated support for scrapings and made this the focus in Denmark's structural policy over the next 20 years (Raakjaer Nielsen, 1992). Thus, the shift to the present Individual Transferable Quotas (ITQ) system, in which a vessel's activities are constrained by their quota allocations lead to a shift from an open and flexible system to one that is focused on security and segmentation in order to ensure long-term planning (Hegland & Raakjaer, 2008). However, this resulted in a trade-off between the fewer number of wealthier vessel owners and the majority of smaller fishers.

3.3.2.4 United Kingdom

In 2007, the demersal trawl and seiner sector generated more income than any other U.K. sector, at around 45% of the total U.K. fleet income, with 1,467 active vessels and 4,763 fishers employed full-time (AER, 2009). However, the fleet is considered to be heavily 'burdened' by regulatory obligations and has had to adjust to reduced quotas and restrictions on the number of days allocated for fishing in different areas[23]. Attaining the targets of quotas is complex due to the multispecies nature of demersal fisheries such that (DEFRA, 2008):

- The annual Total Allowable Catch for the North Sea cod (subarea IV, VIId and IIIa) has been reduced from 81,000 tonnes in 2000 to 28,798 tonnes for 2009 (even though the latest was an increase of almost 10,000 tonnes since 2007).
- The cod in the West of Scotland was assessed as heavily over-exploited and since a recovery plan was developed by ICES, the EU has cut TACs significantly, implemented two small closed areas, and in 2003 increased the net mesh size to 120 mm in line with the North Sea. TACs for 2009 were set to 202 tonnes, less than half of that in 2007.
- Celtic Sea cod has been assessed to be in a somewhat better condition and was excluded from EU's 2004 cod recovery plan. A management plan however is now under development as in 2008 the stock was assessed as at risk of suffering reduced reproductive capacity.
- The Irish Sea cod has been assessed as seriously depleted with landings falling rapidly during the 1980s and 1990s. After 2000, TACs were significantly reduced; the net mesh size was reduced to 100 mm and an area closure was implemented to coincide with cod spawning time.
- The haddock stock in the North Sea is managed under the EU-Norway long-term management plan and has been harvested sustainably from 2003-2008.
- The haddock stock in the West of Scotland however remains heavily exploited with respect to the rate that would lead to high long-term yields and has been assessed as at risk of suffering reduced reproductive capacity. TACs were almost halved in 2009 compared to the levels in 2007.

[23] Details on the burden of regulatory obligations on the fleet are discussed in Chapter 2.

3.3.2.4.1 Changes in Structural and Economic Indicators

By 2007, the fleet's kW power was reduced to a third in the 12-24m demersal fleet and almost halved in the 24-40m fleet (Figure 3.15a and Figure 3.15b). Prior to that, decommissioning exercises carried out by U.K. fisheries administrations in 2001 and 2003 led to a 45% effort reduction in the demersal trawl and seine segment since 2000 and a considerable reduction in the activity of the fleet (reduction in effort days) associated with the introduction of fishing effort controls in the form of days at sea regulations (DEFRA, 2008). During that period, vessels using demersal trawls that fished for whitefish were targeted so as to remove effort from the Cod Recovery Area which includes the North Sea, West of Scotland, Irish Sea and Eastern Channel fishing areas).

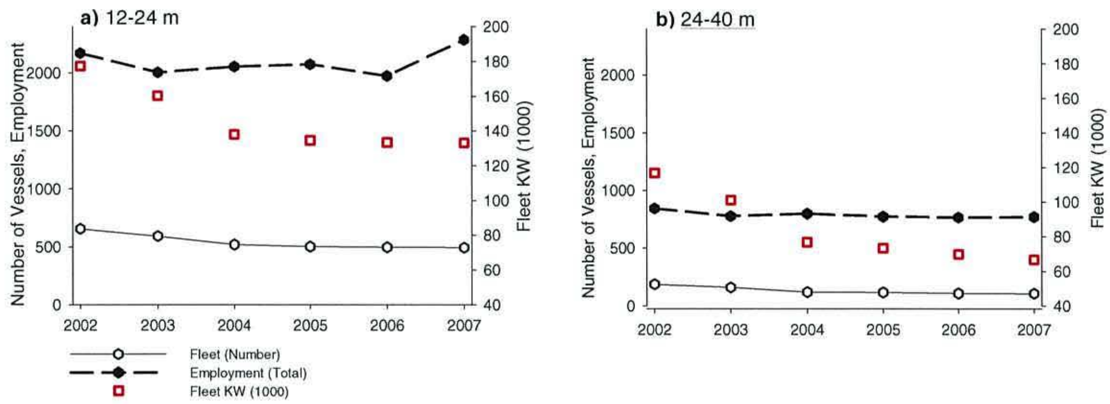

Figure 3.15: Fluctuations in structural indicators (Number of vessels, Employment and Fleet capacity in kW) of the U.K. demersal trawls and seiners a) 12-24m fleet and b) 24-40m fleet (AER, 2009).

The 12-24m fleet saw a 5% (from 2,168.90 to 2,285) increase in employment, but a 33% (177,100 to 132,950 kW) decrease in the fleet's overall capacity (kW) and 25% (from 654 to 492) decrease in the number of vessels (Figure 3.15a). Effort days saw a 19% reduction (from 110,400 to 81,260) and the weight of landings a 17% reduction (from 88,490 to 73,010 tonnes) (Figure 3.16a). This is associated with the reductions in TACs and Days at Sea allowances within the CFP framework. Despite this, there was a 19.1% increase in the value of landings (from 172.8 to 213.53 m€). In particular, there was a 58.3% increase in cash-flow (from -12.31 to 17.20) and of 21.1% increase in income (from 175.54 to 222.54) despite a 13.2% increase in cost (from 187.50 to 216.00 m€). Income increased for each vessel by 57.9% (from -

18,287€ to 13,293€). With regards to the 24-40m fleet segment, kW power decreased by 43% (116.5 to 66.5 kW) and the number of fishers employed in the fleet by 8.5% (from 841.6 to 770) (Figure 3.15b). Fishing days (effort days) decreased by 48.5% (from 42270 to 21890 days), the weight of landings by 32.2% (from 81290 to 55130 tonnes) and the value of landings by 10.9% (from 140.89 to 125.47 m€) (unlike in the 12-24m fleet where the value of landings increased substantially[24]) (Figure 3.16b). Cash-flow increased by 93.6% (from -1.21 to 17.57). There was even a 26.5% decrease in cost (from 161.03 to 118.34 m€) but also a 19.7% decrease in income (from 159.82 to 128.35 m€) (Figure 3.16b). Income increased for each vessel by 93.5% (from -6,540€ to 94,245€).

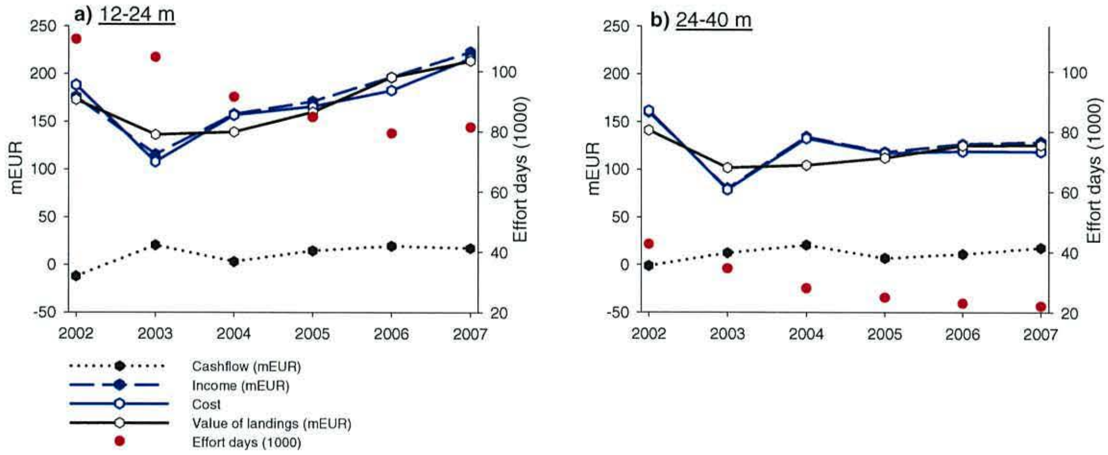

Figure 3.16: Fluctuations in the economic indicators (Cash-flow, Income, Cost) and effort days of the U.K. demersal trawl and seiners c)12-24 m fleet and d) 24-40 m during 2002-2007 (AER, 2009).

[24] Smaller vessels are thought to catch fish/shellfish of better quality which can be sold for a higher price (higher value per unit fish than the equivalent landed from larger vessels).

3.3.2.4.2 Enforcement of Registration of Buyers and Sellers regulation[25]

The buyers and sellers regulation is a Community measure[26] where: 'Auction centres or other bodies authorized by Member States, which are responsible for the first marketing of fishery products landed in a Member State shall submit, upon the first sale, a sales note, the accuracy of which shall be the responsibility of the said bodies, to the competent authorities of the Member State in whose territory the first marketing takes place'. Such a Community regulation is immediately compulsory and Member States are required to place rules working in practice. In the U.K. working rules were put into practise with the introduction of the Registration of Buyers and Seller regulation scheme in 2005 according to which: 'Buyers and sellers of first sale fish and shellfish landed into the U.K. now need to register with Fisheries Departments. Auction centres and fish markets at which such fish are sold also need to be registered[27]'. However, it was not possible to identify whether or not the Spanish authorities attempted to put working rules in place concerning the practical application of this Community regulation.

Both the British and the Spanish 'demersal 24-40m fleet' are included in the AER 2009 as a fleet of special interest for each country. The number of vessels for the two fleets saw a decrease of 43% (185 to 106 vessels) in the U.K. and only 3% (545 to 531 vessels) for Spain. The two fleets were compared for potential differences in the income and cost per vessel (Figure 3.17a). For standardization, changes in effort days were also compared (Figure 3.17b). Despite income and cost of each vessel both increasing, there is a higher increase in income than in cost. The income and cost for British vessels increased by 28.9% (159.82 to 128.35 m€) and 22.3% (161.03 to 118.34 m€) respectively whereas for Spanish vessels income and cost decreased by 10.1% (535.69 to 471.85 m€) and 9.3% (580.85 to 517.58 m€) respectively. The increase in income for British vessels occurred despite a 48.5% (42,470 to 21,890)

[25] Statutory Instrument 2005 No. 1605 (England). Scottish Statutory Instrument 2005 No. 286, Statutory Instrument 2006 No. 1495 (W.145), Statutory rule of Northern Ireland 2005 No. 419 (Northern Ireland)

[26] Article 9 in Council Regulation (EEC) No 2847/93 of 12 October 1993 establishing a control system applicable to the common fisheries policy, superseded by article 59 in Council Regulation (EC) No 1224/2009 establishing a Community control system for ensuring compliance with the rules of the common fisheries policy.

[27] http://www.seafish.org/b2b/subject.asp?p=53

decrease in effort days. For Spanish vessels there is a small decrease of 4.5% in effort days in the Atlantic (54940 to 52450) and a 24.2% (24,400 to 32,200) increase in the Mediterranean (effort days restrictions do not apply in the Mediterranean). There were large fluctuations in income and cost for the Spanish fleet and cost was higher than the vessel's income. Thus, the fleet has either been operating at a loss or part of the fleet's income has not been recorded. Supporting the latter, in May 2003, a retired Spanish skipper admitted to a U.K. court that his trawler repeatedly landed black fish and that the owners of Spanish vessels required their skippers to fish in the most economical way. His boat was investigated twice during which it was uncovered that he under-reported fish of up to £15,000 on the first occasion and of up to £41,000 the second (Anon, 2006a). In the light of this, Bertie Armstrong, chief executive of the Scottish Fishermen's Federation (SFF) said: 'When the biggest fishing nation in Europe is saying that there is institutionalised flouting of the rules; that is appalling.'

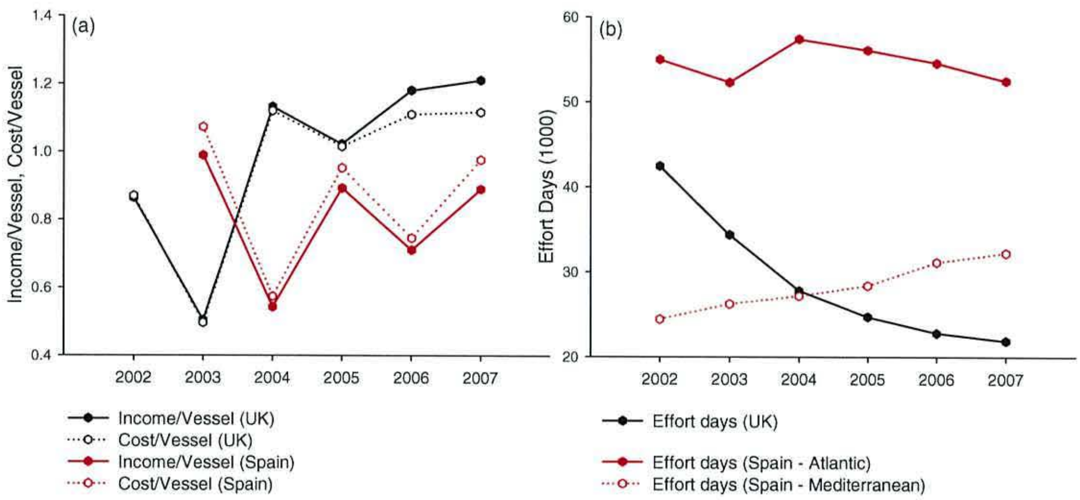

Figure 3.17: a) Comparison of income per vessel and cost per vessel for UK's and Spain's 24-40m demersal fleet; b) Comparison of effort days between the UK's and Spain's (Atlantic and Mediterranean) 24-40m demersal fleet.

Focusing on the U.K.'s demersal fleet, Figures 3.18a and b show the changes in the weight of landings in relation to changes in the value of landings between 2002 and 2007 for the 12-24m and 24-40m fleet respectively standardising with the number of effort days.

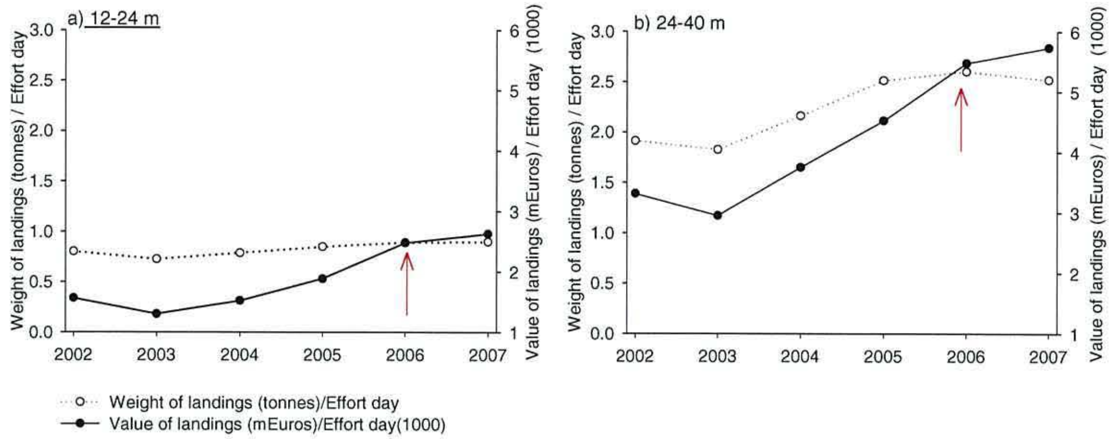

Figure 3.18: Changes in the weight of landings (tonnes)/Effort day and the value of landings (mEuros)/Effort days (1000) of the UK's demersal fleet a) 12-24m and b) 24-40m between 2002-2007.

For the 12-24 m fleet there was a 10.7% increase in the weight of landings per effort day and a 40.3% increase in the value of landings per effort day. Similarly, for the 24-40 m fleet, there was a 24% increase in the weight of landings per unit effort and a 58.6% increase in the value of landings per unit effort. Thus, after standardising for changes in the number of effort days, there is approximately a 30% difference between the increase in catches to the increase in the value of landings for both the U.K. demersal fleets.

Both trends support that the introduction of the Registration of Buyers and Sellers regulation increased the profit of the industry. For both UK fleets, the weight of landings continued decreasing after the introduction of the regulation and their value continued increasing. Thus, the value of each unit fish increased (Figure 3.18) as the price of a good is higher when sold in a normal market rather than in black market[28].

3.3.2.4.2.1 Attitudinal changes of the Industry

In most cases new measures, especially ones imposed from the top, tend to cause a chain of reactions. Reactions from the industry were identified by looking into the archives of Fishing News, the official newspaper of the industry and the results are presented in Table 3.5. The announcement of the proposal of the regulation received

[28] Due to the fact that black landings would tend to flood the market with fish thus driving the fish prices down.

a number of negative comments from the industry, with the biggest concern being that this new regulation will only intensify the Red Tape faced by the industry. There were also reactions by representatives of the smaller (under -10m fleet) suggesting that the new regulation would especially have a negative impact on the smaller fleet. These reactions (besides the ones from the under-10m fleet representatives) however shifted subsequently to the introduction of the regulation and in realization of its benefits on fishers' income.

A review undertaken by DEFRA in 2006 regarding registration of buyers and sellers of first sale scheme contacted 10% of the registered buyers and sellers and auction markets in England. According to this review, even though there were worries that there are still people not registered in the scheme, if the scheme had been brought in 20 years ago the fishing industry would be in better state (DEFRA, 2006).

Table 3.5: Articles on or relevant to the Buyers and Sellers regulation in the U.K., published in 'Fishing News'. Headlines in red are negative against the regulation and ones in blue are positive against the regulation

Fishing News Headline	Reactions
Black Fish Crackdown: All buyers and sellers to be registered in tough controls on fish sales 16 August 2002	— Catching and processing sector "an unwarranted interference in commercial freedom and would create a 'closed-shop' and pile yet more bureaucracy on businesses". — Hamish Morrison (SFF[29]): "they appear to undermine the free market in fish…the policy is inherently flawed" — Barrie Deas (NFFO[30]): "clearly a very significant development" — James Brown (Caley Fisheries and the Fish salesmen's Association (Scotland) Ltd: "another unnecessary layer of bureaucracy…an example of fiddling while Rome burns"
Regulation can only get worse 30 August 2002	— "…(the regulation) is foisted on fishermen with no democratic debate and with no right of appeal" — "The weight of the regulation now poses a very real threat to the viability of fishing as commercial activity for many fishermen…it is imposed by simple bureaucratic and political diktat. This is intolerable" — "…it never seems to occur to them (regulators) that the system may be so inherently and hopelessly flawed and complex that it can never work" — '…the intolerable weight of regulation can only get worse, because those who impose it have no other function in life but to regulate"
Registering buyers has a silver lining 30 August 2002; Letter to the editor (by David Gardner)	— "I believe that this (the regulation) is a valuable initiative in many ways" — "…as far as the inshore fishing sector is concerned the benefits of introducing traceability to the sale and purchase of fish and shellfish could be considerable"
Shellfish leader slams buyers/sellers rules: UK forced to comply with EU regulations 02 September 2005; on the regulation's impact on shellfishermen) (by Chris Venmore (SDCS[31]))	— "…the regulation could bring major financial losses and inconvenience to the UK shellfish industry, particularly to small boats…is really aimed at stamping out black fish, but crustacean species like crab and lobster have no quota, but shellfishermen will have to pay the price." — "…the political and legal pitfalls of a regulation aimed at a relatively small fleet of bigger boats will result in yet more bureaucracy, more loss of trust with DEFRA and even more work for an already overstretched inspectorate as it tries to interpret an incoherent piece of legislation."

[29] Scottish Fishermen's Federation
[30] National Federation of Fishermen's Organizations
[31] South Devon and Channel Shellfishermen

Creating a level playing field 27 May 2005; Letter to the editor (by David Gardner)	— "With all the pressures on it from so many directions, the small scale, local inshore sector needs all the help it can get, and improvements in the traceability of fish and shellfish will be a major benefit."
Light in sight 09 December 2005; Signs that white fish fleet may have turned the corner	— "…the boats are beginning to be in a position to be able to buy the quota and days at sea, they need to fish legally, ending the stresses and strains of putting black fish ashore, and also boosting prices as the over quota trade declines." — "Experience already with the buyers and sellers legislation has indicated that one effect is a rise in prices, as over quota landings diminish and buyers have to pay the full, instead of the black, market price."
Tough Climate 28 April 2006; Comment on a Scottish pair trawl grossing a record £115,000	— "There is no doubt that white fish prices have firmed significantly in recent moths, helped considerably by the fact that black fish has been squeezed out of the market to a large extend by heavy regulation – including buyers and sellers registration – and tough enforcement."
Huge boost for Scrabster -as local seine netter hits £1m grossing in 2006	— Andrew Bremner (Skipper): "The black fish has been squeezed out following the buyers and sellers regulations, and prices have got back to a level we ought to be getting."
Negative publicity counterblast 12 January 2007; SEAFOOD Scotland attempts to put out a raft of information to counter the negative publicity surrounding the fishing industry	— SFPA[32] announced: "landings of illegal (black) fish into Scotland is now negligible and at its lowest ever level". — This is partly due to the introduction of the Registration of Buyers and Sellers legislation, but also reflects "commitment by industry towards accountability and ensuring that fisheries remain sustainable for the future"
Catch more real criminals 13 April 2007	— "Black fish has been all but squeezed out of the system. There have been a number of high profile court cases in recent times involving multiple charges against several owners and skippers that are the result of determined and some would say over zealous actions by the authorities." — "The introduction of buyers and sellers regulations has given a further twist to the screw, so much so that it is creating a quota shortage crisis in the inshore sector, where there is now no flexibility left for fishermen to squeeze a living out of pitifully inadequate quotas."
Unite to beat quota crisis 23 November 2007	— Dave Pessel (PTA[33]): "The issue of the buyers and sellers consultation in August 2004 was a time bomb for the under -10m fleet…whatever course is chosen, hundreds of small-boat fishermen will be driven out of the industry because the under10m fleet has traditionally caught far more than was evident in the casual and inaccurate estimates previously kept by DEFRA".

[32] Scottish Fishery Protection Agency
[33] Plymouth Trawler Agents

3.3.2.4.3 Conclusion

The demersal trawl and seiner fleet segment had to learn to adjust to an increasing number of controls from quotas and days at sea to capacity reduction schemes. The measures decreased the fleet's capacity (number of vessels and kW) and fishing effort (effort days and weight of landings). Nevertheless, the decrease in demersal landings led to an increase to the value of landings. Thus, a combination of a reduction in the supply of a resource (assuming demand is stable) and the anti-establishment of the black market can safeguard prices obtained by the producers. In the U.K. this was achieved by the correct implementation of the Community regulation regarding the establishment of a scheme for the registration of buyers and sellers in the U.K. Despite this measure being heavily criticised by the industry, its success led to a *volte-face*[34] of the industry's attitude, verifying that fishers in many cases tend to challenge new measures out of fear of the unknown. If the industry is involved and informed on new measures they are more likely to support the measures.

[34] A total change of position as in policy or opinion.

3.4 Discussion

The history of fisheries management is rich in examples of technical fixes which have gained importance among research and policy-making communities (Degnbol *et al.*, 2006). These fixes, be they market controls or fishing effort controls, have been an attempt to solve the fisheries foe, the *tragedy of the commons*. Such arrangements however, tend to steer changes in different directions, depending on the socio-economic and/or political context they are applied in. The quality of the data used for this chapter varies between Member States and any conclusions are made assuming that the data are correct. The comparison of analogous U.K. and Spanish fleets showed how the correct implementation of the conflicting *Buyers and Sellers* regulation in the U.K. increased fish prices and helped reduce black landings gaining the industry's support. In Spain however, there is no indication of working rules for this regulation to have been put into place with landing and fish value data suggest misreporting of landings. Cyprus's entry in the EU and its accession into the common market appears to have boosted fish prices, whilst the introduction of an ITQ regime for the Danish pelagic fleet led to a more efficient fleet with fewer but bigger vessels. Such changes in the economic and/or structural indicators in different *métiers* helped identify socioeconomic and political reasons which lead to successes or failures of regulations. Nevertheless, there are multiple factors impacting the economics and structure of fishing fleets, and regulations are but one potential drivers of change.

Profitability and efficiency of vessels depend on the *métier* and the management regime imposed on that *métier*. Profitability of the fishing sector depends on a variety of factors such as (i) fishers performance[35], (ii) enforcement levels between Member States (which allows for variations in short-term revenues), (iv) physical productivity of vessels, (v) the market price of fish and (vi) the cost of inputs (Whitmarsh *et al.*, 2000). Therefore, a vessel that produces the biggest annual landing or achieves the highest gross earning is not always the most profitable as sometimes a vessel of a smaller size and power can be economically more efficient than a larger vessel (Eddie, 1983). For example, big vessels in the Baltic land more fish with less effort but the

[35] For example family history i.e. knowledge passed down from previous generations, was found by Coglan & Pascoe (2007) to improve the efficiency of the trawl vessels.

fish are of lower value. In the Atlantic, again with less effort, larger vessels land fish of higher value than in the Baltic. Mediterranean vessels, despite requiring more than 3 times the effort to land less fish than vessels in the Baltic and the Atlantic, they obtain more than double the price for their fish. On the contrary, the smaller vessels (24-40 m) of the Danish pelagic fleet saw a decrease in both income and cash-flow, whereas the over 40 m fleet saw an increase in both indicators. The move of the Danish pelagic fleet to a transferable quota system led to possibilities for long-term planning which helped lower costs and / or maximise income by adjusting catches to the market situation to obtain the highest price (Hegland and Raakjaer, 2008). Thus, depending on the industry and the desired results of a regime, different quota organization systems can lead to different outcomes.

The introduction of fishing effort controls requires clear objectives; and debates over ITQ programs have primarily been between economic efficiency on one hand, and social equity and community impacts on the other (Hilborn, 2007). The change towards an ITQ system in Denmark led to a smaller, in terms of vessel numbers, but more efficient pelagic fleet. Thus, even though the majority of the quotas for this fleet are now owned by a small number of wealthy vessel owners, many boat owners sold their boats and quotas when Danish quotas were made transferable in 2007 in order to cash in on the rising quota value. Thus in this case, such a rights based measure gave the right incentives to the industry to self-adjust and the enhanced human capital could lead to longer term economic benefits as well as conservation ones (Coglan & Pascoe, 2007). In the case of New Zealand, ITQs aimed to reduce both capacity and fishing effort thus quotas were also bought by NGO's and the government[36] (Dewees, 1998). In general, with such a system it is the market that decides who buys out whom, and if the management objective includes protection of the fishing community then an ITQ system via a Community-Based Management (CBM) could be a better option (Copes & Charles, 2004).

TACs and quota regulations have come under a lot of criticism despite their widespread use (Karagiannakos, 1996; Khalilian, 2010). Their main criticism is that these controls simply reduce the number of fish landed rather than the number of fish

[36] The government in New Zealand used buyback and across-the-board cuts in order to adjust TACs.

actually removed from the sea and lead to a significant number of discarded fish (Turner, 1997). Quota regulations have also been blamed for a significant amount of fishermen turning to illegal activities, mainly by misreporting their catches and landing illegal fish, commonly known as black landings. Thus, quota restrictions acted as drivers of an underground trade where reported import quantities become decoupled from actual trade volumes (Clarke *et al.*, 2007). A Community regulation requiring the registration of Buyers and Sellers was introduced to tackle this problem. In the United Kingdom, this community measure was put into practice effectively (with the introduction of statutory instrument No. 1605 in 2005 regarding the establishment of buyers, sellers and the designation of fish auction sites) and led to the scrapping of black landings and boosting fish prices. Thus, despite the initial opposition from the industry, this legislation showed that the right measure with the correct enforcement can improve the industry's profits and achieve its sustainability objectives.

Being part of the Common market has an economic advantage for the various Member States. Accession in the EU and thus the internal market, means abolition of tariffs and a general decrease in trade costs related to a reduction in trade-related risk, mutual recognition of product standards and lower administration costs. These costs have been calculated to range up to 30%[37] compared to costs before accession (Nahuis, 2004). However, even though the internal market is meant to encourage conservation by reflecting the price of the resources in the price of 'goods'[38], in fisheries the 'goods' are CPRs and tend to act as public rather than private goods[39] (Opschoor & Turner, 1994). The 2004 enlargement expanded the internal market from 15 to 25 member states and added 75 million consumers or 20% to that of EU15 albeit with a lower per capita fish consumption of 10.4 kg / annum, compared to the EU's 23.9 kg (Symes, 2005). Market mechanisms in institutional frameworks for the EU fisheries sector are important for obtaining acceptable levels of profitability without relying on public aid (Suris-Regueiro *et al.*, 2002). Fish prices do form an important part of economic incentives driving fishermen decisions; along with other economic drivers such as subsidies and operational or fixed costs (Marchal *et al.*, 2007). There are

[37] However, this varies across different industries.
[38] A 'good' in economic terms is produced for the market to satisfy some desire or need.
[39] CPRs act as rivalrous (their consumption or extraction simultaneously prevents its consumption by someone else) but non-excludable goods (noone can be effectively excluded form using that good).

many ways in which regulations impact market prices. Quota regulations for example can cause a market transfer effect when a number of British whitefish trawlers switched to Nephrops as there are more available quotas and they generally get better price than for whitefish[40]. This led to an increasing amount of Nephrops in the market lowering their price. The market responds quickly to such changes in raw product quality, as output prices can jump almost immediately after rationalization[41], leaving significant market-side rent gains in the hands of quota owners (Homans & Wilen, 2005). Thus, lack of exclusive rights to fishers makes it harder to implement environmental protection measures in a market environment as there is not enough individual economic interest in sustainable use of fish stocks (Hentrich & Salomon, 2006); to overcome the inefficiency of the fishing sector, the prices need to be "correct" so that fishers feel they are getting the right price for their fish depending on the effort and cost of fishing (Manner & Gowdy, 2010).

Poor returns in fisheries, be they due to increased fishing effort controls or reduction in the resources result in increased pressure for subsidies aggravating the economic losses incurred in many fisheries (Anon, 2006). The rationale regarding subsidies is to increase net welfare in society even though quite often they can counteract positive changes achieved with regulatory measures and drive the change to the opposite than the desired direction (Schmid *et al.*, 2007). EU / National subsidies for example helped entrench both the over-exploitation of resources and the economic inefficiency of the fishing industry (Davis & Gartside, 2001). Thus, there is an important functional relationship between a subsidy, the induced behavioural change and its impact on the environment. For the period of 2007-2013 the European Fisheries Fund (EFF) has a budget of €4,305 million for and during this period the Commission proposes to allocate around €578 million[42] a year to all 26 Member States[43]. The amount is divided between the Member States based on the size of their fisheries sector, the number of people working in the sector and the adjustments considered

[40] During 2002-2007, the price of Nephrops was always at least 2-4 times higher than the price of cod in the EU (AER, 2009).
[41] Rationalization aims at increasing efficiency by better use of existing possibilities assisted by existing knowledge, technology etc., thus the industry uses market knowledge to decide which product will lead to higher profits.
[42] The Financial Instrument for Fisheries Guidance (FIFG) (predecessor of the EFF) budget for 2000-2006 period was around €1,253 million per year
[43] Luxembourg is excluded

necessary for the fishing industry, and for the continuity of its activities. Political power also has a big impact on subsidies as 'Vested interests and misguided politicians resist real change, and harmful subsidies continue to flow' (Knigge, 2009). However the unequal division of subsidies between the Member States can sometimes create distortion in competition within the EU[44] [45]. However, the aid given by the EU has now shifted towards helping fishers leave the sector rather than support their unprofitable stay in the sector.

Political power and influence is an important driver in policy-making in both national and European politics. Politics and power have always gone hand in hand with governments intervening to ensure that new policies are consistent with their political agenda (Mahoney, 2004). Since the beginning of the CFP negotiations some countries have had a stronger political support than others. In the 1970's for example, during the EEZ negotiations, the British and Irish governments lost the battle when fighting for bigger EEZs for each Member States as the majority of the then Member States had a stronger economic incentive to fight for the ability to fish in other Member State's EEZ (Jensen, 1999). Thus, in order to manoeuvre in the increasingly complex political environment, it is important for fishers to develop their organisational and institutional capabilities to penetrate the decision-making process (Christensen *et al.*, 2007). A more recent example is that of the bluefin Atlantic tuna where a politically strong and wealthy pro-fishing lobby group had the ability to slow down the negotiating procedures for the recovery of this endangered but high-priced stock. So, despite the status of the stock, its importance (especially as exports) for some national economies mean that their national delegates supported the pro-fishing group as exports can generate a stronger value of the domestic currency in both nominal and real terms (Davis & Girtside, 2000). At a more national level, the strong political platform of the elite well-organised minority of the Danish over-40m pelagic fleet allowed this small group to benefit from the ITQ system and institutionalize it by obtaining exclusive rights to the main part of the herring quota.

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[44] Spain will receive €1,132 million for the EFF period 2007-2013 with the next in line country being Poland with €734 million

[45] During 2007 for example, Denmark and Cyprus did not use public aid to reduce the capacity of their national fleet, unlike Spain who scrapped over 9,000 GT and 21,000 kW using public aid (European Commission, 2009c).

Governments responsible for managing marine fisheries need information on the current state of fisheries and the likely consequences of alternative management strategies (Whitmarsh *et al.*, 2000). Thus, before new initiatives are proposed by the European Commission, policy makers are required to develop an impact assessment analysing all the potential economic, social and environmental impacts of the proposed initiative. However, in order to be able to produce successful strategies for the future, we need to look into the past and identify the successes and failures of previous management regimes. So many resources in terms of both money and time, have continuously been put into a disorderly fisheries management regime and a positive change is yet to be achieved. Ultimately, sustainable management of marine resources depends on making sure that private users have the right incentives (Perrings, 2000). There are contrasting interests between the Member States and the different stakeholders involved in the CFP thus decision-making results in an imprecise and controversial fisheries policy. The same regime can be a success or failure depending on the socio-economic and political context is applied within. Thus, when regimes are promoted as universal remedies, they tend to miss the complex details of the different systems (Degnbol *et al.*, 2006). A *one size fits all* regime for a system as diverse as the European fisheries sector could never be a viable option.

4. Crossing boundaries: Which regulatory obligations are best and which are worst for fishers' income? Identifying fishers' perceptions using a marketing tool

'Men are disturbed not by the things that happen, but by their opinion of the things that happen', Epictetus

4.0 Abstract

Profit is an important driver of harvest for fishers. Thus, identifying fishers regulatory preferences in economic terms can assist in the creation of more acceptable, workable and sustainable policies. The Adaptive Conjoint Analysis (ACA) method was adopted from its original application as a marketing tool in order to identify fishers' best and least preferred regulatory obligations in terms of the impact these obligations have on their income. Significant differences were identified in fishers' preferences depending on the management strategy they were conformed to; thus depending on the *métiers* fishers belonged to (concerning homogeneity in fishing gear, target species and fishing geographic zone). Fishers from all *métiers* agreed that access to resources, i.e. how much access they have within a certain sea area was most important for their income; with 'no exclusion' from the area ranked being the most and 'exclusion' from the area as the least preferred regulatory obligation. However, there were differences in fishers' preferences with regards to the majority of regulatory measures; inshore fishers preferred to comply with restrictions in 'Days at Sea' rather than in 'Total Allowable Catches', whereas it was the other way round for offshore fishers. Ranks for 'Enforcement and Compliance' obligations had the most variability between the different *métiers* with the general trend being that fishers tend to prefer the measure with which they are most accustomed to. This chapter has enhanced the need for additional knowledge at a more localised level on fishers' regulatory perceptions. Such knowledge can fill in the knowledge gaps concerning what makes fishers' accept and hence comply with a regime, thus assist in the creation of effective fisheries management policies.

4.1 Introduction

Modern industrial fishing is a business enterprise and profit is an important driver of harvest for fishers (Sethi *et al.*, 2010). Acknowledging stakeholder preferences for management policies in economic terms is important for achieving fisheries socio-economic goals as it will assist in creating more acceptable, workable and sustainable policies (Wattage *et al*, 2005). In fisheries, a number of different stakeholders and interests co-exist, which is the main reason why fisheries management is characterised by multiple conflicting objectives (Charles, 1989; Wattage *et al*, 2005). Fishing for a livelihood is in itself loaded with financial risks that are compounded by the accumulated regulatory measures that restrict the activities of fishers and add to their financial burden (Eggert & Lokina, 2007). The European fisheries regulatory framework, the Common Fisheries Policy (CFP) has failed to meet its stated economic and biological goals despite an ever increasing burden of regulations (Karagiannakos, 1996; Daw & Gray, 2005). Presently, with the 2012 CFP reform approaching, it is widely accepted that the various tools incorporated within the framework[1] have failed in both economic and biological respects and resulted not only in environmental damage but also in social losses and loss of income (Daw & Gray, 2005; Hentrich & Salomon, 2006). Thus, as the acceptability of measures could be an important part of its potential success or failure, it is important prior to the CFP reform, to identify how stakeholders perceive different measures in terms of their economic impact i.e. which measures are the most and least popular.

In the European Community, fishers feel that their identity is being threatened by outside interventions. Such feelings vary among fishers as the northern and southern regions are controlled by very different models of fisheries management[2] (Symes, 1999). Differences in management regimes mostly exist between sectors and regions (Atlantic vs Mediterranean) rather than between Member States. For example, inshore fishers and those operating in the Mediterranean have to follow less complex regimes than offshore fishers operating in the Atlantic (as shown in Chapter 2). Fishers' perceptions can be affected by cultural differences, regional perceptions

[1] Especially that of Total Allowable Catches (TACs) which failed to achieve the goal of maximising fishers' profits whilst they extracted less resources
[2] Chapter 2 illustrates and explains these different management models.

regarding the EU, its policies and its institutions that are related to differences in the complexity of the regimes and fishers' familiarity with the regimes. In addition, fishers' reactions and acceptance of regimes that have been introduced by EU institutions depend upon whether or not the regimes conform to the historical and sometimes even cultural priorities of their Member State[3] (McLean & Gray, 2009).

In order to identify stakeholder regulatory preferences in a complex setting such as that of the European fisheries sector, the ideal approach would take into account the fact that (i) management regimes come in bundles of different regulatory obligations and (ii) that each fisher has a different level of preference for each regulatory obligation comprising that management regime. Conjoint analysis and related choice modelling methods have been used for many years in marketing research to evaluate consumer behaviour and preferences for a number of products with different attributes (Green & Srinivasan, 1978). This statistical market research technique allows for the quantification of an individual's perceived values with respect to a given product (Orme, 2006). By visualising that a management regime (existing or potential) is a commercial product and that the product's different attributes are the different regulatory obligations, conjoint analysis has been used by researchers in different fields from health care (Bridges et al., 2008) to designing policies to encourage on farm conservation (Smale *et al.*, 2004) to fisheries to evaluate stakeholders perceptions on management objectives (Wattage *et al.*, 2005; Dorow *et al.*, 2009).

The number of applications of conjoint analysis increased in the natural and environmental sciences in the late 1980s, when the importance of examining resource users' perceptions regarding management regimes was appreciated as a useful tool to assess the effectiveness of management policies (Johnson, 1987). The conjoint analysis method selected for this study, Adaptive Conjoint Analysis (hereafter ACA) has mostly been used in marketing experiments to explore consumer perceptions of new products and to help to understand consumers' marketing behaviour. It is the conjoint analysis method least used in environmental sciences (Alriksson & Öberg, 2008): however, in the environmental sciences ACA often has been used to evaluate

[3] McLean & Gray (2005) for example suggested that the reason British fishers are more anti-CFP than German fishers is due to the fact that the fishing sector has historically been more important for Britain than for Germany and environmentalism has always been more important for Germany compared to Britain.

farmers' perceptions of issues regarding the methods for controlling, preventing and mitigating animal diseases but also to compare farmers' preferences with those of experts' (van Schaik, *et al.*, 1998; Valeeva *et al.* 2005; Cross *et al.*, 2008; Leach *et al.*, 2010). It has also been used in environmental pollution studies to identify the ideal scenario for dealing with, preventing, implementing and enforcing regulations (Althoff, 1974). No papers were found reporting the use of ACA in fisheries, even though there are other conjoint analysis techniques such as choice experiments which have been used in a fisheries context (Wattage *et al.*, 2005; Dorow *et al.*, 2009). The main reason ACA was selected for this study is the fact that it would tolerate smaller sample sizes, thus it enabled comparisons across nations that otherwise were not possible due to financial and time restrictions.

This chapter aimed to identify fishers' opinions with respect to their most and least preferred regulatory obligations in terms of their impact on fishers' income. This was achieved by disaggregating the management process into key attributes with different potential levels.

The specific objectives were to:

- Identify the important attributes (different themes) of the CFP's conservation regulations and their levels (specific regulatory obligations),
- Conduct ACA surveys with fishers in the U.K., Denmark, Spain and Cyprus in order to quantify and rank fishers' preferences regarding the economic impact of regulatory obligations and compare findings among the different *métiers*[4].

[4] Homogenous subdivision of a fishery by fishing gear, target species and fishing geographic zone combined.

4.2 Methodology

4.2.1 The Adaptive Conjoint Analysis approach

Conjoint analysis assumes that products can be broken down into separate attributes with different levels. For example, imagine the assessed product is a surfboard and the attributes are (i) shape (levels: shortboard, longboard, fish), (ii) length (1.8 m, 2m, 2.3m) (iii) colour (white, blue, yellow), (iv) material (levels: foam, glass, carbon fibre, wood). Respondents are shown hypothetical product concepts that differ systematically in their attributes, and are asked for their overall reactions to each concept. A value is inferred for each attribute from the respondents' responses. If product preferences can be accounted for in terms of the known values of their attributes, then preferences can be predicted for new products consisting of different combinations of the same attributes. Conjoint Analysis has four assumptions (Johnson, 1987):

1. Each attribute level has a particular value for a respondent, affecting how much the respondent 'likes' a product. These values are called 'utilities' or 'part-worths'.
2. Part-worths of a product equal the sum of the utilities of its attributes.
3. The above process can also be reversed; instead of adding utilities and predicting the preferred product for a respondent, utility values can be calculated by asking respondents' preferences over a conceptual product.
4. The products are considered as 'bundles of attributes', each with specified levels, i.e. if the study is looking into cars and the one of the attributes is colour, the different levels can be red, blue, green etc. The equivalent of the terms as used in this study with regards to fisheries management are illustrated in Table 4.1.

Table 4.1: Glossary of the Conjoint Analysis terms as their equivalent in Fisheries management.

In ACA/Marketing	In Fisheries Management
Product	Management regime
Attribute	Purpose of Regulatory Obligation (e.g. Spatial-related)
Level	Regulatory Obligation (RO) (e.g. No access areas)

Three methods have been the most popular for conjoint analyses; the 'full-profile' method (which has been used by most analyses), the 'trade-off matrices' method and the 'ACA' method (Huber, 1993). For the 'full-profile' method a set of concepts or 'profiles' are composed and every concept is fully specified. The respondent is shown concepts which are like real products in the sense that they are described by all the relevant attributes. The respondent is then asked to rank the concept from best-liked to least-liked. Thus, even though the task is very natural, in the case of a large number of attributes most respondents tend to simplify the task by choosing a few attributes as the most important and attend to only those. The use of 'trade-off matrices' attempted to solve this problem. This method asks a respondent to consider a pair of attributes combining all levels for those attributes and the respondent is required to write a '1' in the cell corresponding to his first choice, a '2' for his second choice, etc. Even though this method can handle a large number of attributes it feels artificial and many respondents can't even understand what is required of them (Sawtooth Software, 2007). In addition, the task can become tedious with a large number of attributes and respondents can end up simplifying the task by mechanically filling in numbers across rows or down columns after too many matrices.

The ACA method is a conjoint analysis method which tries to retain some of the strengths of both the full-profile and trade-off matrix approaches and was thus chosen for this study. ACA's design usually has good statistical efficiency, even with smaller sample sizes[5]. Statistical efficiency is increased as more attributes are used in each concept, and it is also possible to produce concepts more nearly equal in attractiveness when there are more attributes with which to work. However, using larger numbers of attributes has the unfortunate consequence of making the questions more complicated, and respondents can become more easily confused (Sawtooth Software, 2007). Its main advantage is that it adapts the interview for each respondent, thus reducing the time needed for each interview which is important for maintaining respondents' attention.

4.2.1.1 Choosing attributes and levels

The attributes and levels used for the survey were selected using the groups created for the analysis of the CFP regulations in Chapter 2. A total of four attributes were used for this study with a total of 20 levels between them. The attributes were selected taking into account the regulatory groupings which depend on what the regulations control. The levels for each attribute were chosen according to the specific regulatory obligations (ROs) used within the CFP framework (according to the methodology in Chapter 2 these are under the 'purpose of the regulatory measure'). As fishers belonged to different *métiers*, some levels have broad categories so that they can apply to all fishers (Table 4.2 presents each attribute with the different levels and details on what each level included). If a specific RO did not apply to them, fishers were advised to reply to the question hypothetically.

[5] Increased statistical efficiency of the method is due to (i) the use of priors allows for more attributes to be explored in the least possible time, and (ii) the utilities for each level/attribute are calculated using the Hierarchical Bayes method (section 4.2.1.4)

Table 4.2: Attributes and levels chosen for the Adaptive Conjoint Analysis and explanations for the regulatory obligations incorporated in each level.

Attributes	Levels (Regulatory obligations)	Detail
Spatial related regulations	Complete exclusion/No Access Areas	Areas where fishing is not allowed
	No exclusion/Open Access Areas	Areas where fishing is allowed
	Real time closures	Inshore fisheries: Temporary/seasonal closures Offshore fisheries: Voluntary scheme arrangements (not subjected to enforcement action), where areas of fishing grounds are closed if sampling has identified high stock abundance-the area remains closed for a period of three weeks.
	Property rights/ Resource ownership	Inshore fishers: Resource ownership by a group for a geographical area. Offshore fishers: Member States in charge of their 200 nm EEZ.
Gear related regulations	Minimum mesh size	
	Gear embargos	Prohibition for use of trawl/gill nets, long-lines, dredges, seines
	Size limits of relevant gear	Length of long-lines, trawl nets or nets in general used by your vessel, Size of pots
	Prohibition of explosive or similar substances	
	Prohibition of electric shock generators etc.	
Ways of controlling fishing effort[6]	Total Allowable Catches/Quotas	Total catch allowed to be taken in a specified period
	General gear prohibitions	
	Days at Sea	Hours/days in year a vessel is allowed to be out in the sea
	Minimum landing size	The lowest individual size of a species allowed in landings or markets
	Fishing permits	The obligation to acquire a permit in order to fish
Ways of achieving compliance	Increase in Fines	
	VMS (Vessel Satellite Systems)	Vessel tracking system (usually satellite-based): provides accurate information on fishing vessels position, course and speed at time intervals.
	Controls at Ports	
	On-board observers	
	Random vessel checks at sea	
	Voluntary agreements between fishers	Fishers and/or their organisation agree on committing to responsible fishing by following certain restrictions (not subjected to enforcement action).

[6] Measures controlling 'Fishing effort' are defined in this study other than the standards definition of the European Commission. TACs/Quotas are in this study included in the 'Fishing effort' group and 'Days at Sea' measures in the 'Spatial and Seasonal Prohibitions'. The normal distintion for these measures is as input or output controls with 'Fishing effort' belonging to the input controls and TACs to output controls.

4.2.1.2 The ACA methodological procedure

The survey started by collecting the socio-demographic and fleet information of each respondent: (i) nationality, (ii) country of employment, (iii) port in which the majority of fish is landed, (iv) year of birth, (v) gender, (vi) sector (offshore/inshore), (vii) fleet, (viii) targeted species, (ix) vessel size, (x) crew number, (xi) maritime region and (xii) ICES/GFCM area in which they operate (The socio-demographic section of the questionnaire is presented in Appendix 2).

The first two parts of the questionnaire are termed the 'Priors': ranking and importance questions. During the ranking questions, respondents were asked to rate how each regulatory obligation impacts or could impact their income on a 5-point likert scale for each attribute (total of four questions) (Figure 4.1).

How **do** *or* **would** the following ***"Spatial-related regulations"*** impact your income					
	Greatly Decrease	Somewhat Decrease	No change	Somewhat Increase	Greatly Increase
Complete exclusion/ No Access Areas	•	•	•	•	•
No exclusion/ Open Access Areas	•	•	•	•	•
Real time closures	•	•	•	•	•
Ownership right	•	•	•	•	•

Figure 4.1: Example of an 'ACA Prior' question as it is on-screen.

The 'importance' question reiterates the respondent's best and worst levels for each attribute. Fishers were asked to what extent the best level of that attribute c.f. the worst is important for their income (based on the answers they gave during the ranking questions) (Sawtooth Software, 2007) (Figure 4.2).

If two sets of regulatory obligations were identical in *all other ways*, how important would the presence/absence of either of these regulatory obligations make to your income?							
	Not Important	–	Somewhat Important	–	Very Important	–	Extremely Important
Complete exclusion/ No Access Areas *--Instead of--* Ownership rights	•	•	•	•	•	•	•

Figure 4.2: Example of an 'ACA Importance' question as it is on-screen.

The 'Priors' are the basis from which the software ranks the relative importance of each attribute, and thereby lead to a focus on the most important attributes for the next section of the questionnaires, the 'Pairs'. Depending the responses during the 'Priors', questions are adapted to reflect each respondent's priorities, hence minimise the time needed to extract utility scores. This results in broader scope, since more attributes can be tested. More importantly, the data are often of higher quality, since respondents are more interested and involved in the task (Sawtooth Software, 2007). During the 'Pairs' questions, the software makes up two alternative regulatory combinations from which the respondent is asked to chose between depending which combination is better for their income (Figure 4.3). The respondent has to make a choice (trade-off) between 20 concepts. For the first ten pairs, each concept is comprised of two attribute levels and the next ten pairs are comprised of three attribute levels each. Both anecdotal and experimental evidence has shown that it is usually best to start with only two attributes per concept and, after a few pairs, to increase the number of attributes to three. Beyond three attributes, gains in efficiency are usually offset by respondent confusion due to task difficulty (Johnson, 1987).

<table>
<tr><td colspan="5">If these two sets of regulatory obligations were identical in <u>all other ways</u> which would be better for your income?</td></tr>
<tr><td colspan="2">Increase in Fines
Minimum mesh size</td><td>or</td><td colspan="2">Random vessel checks on Sea
Gear embargos</td></tr>
<tr><td>•
Left would be much better for my income</td><td>•
Left would be somewhat better for my income</td><td>•
None will make a difference</td><td>•
Right would be somewhat better for my income</td><td>•
Right would be much better for my income</td></tr>
</table>

Figure 4.3: Example of an 'ACA Pair' question as it is on-screen.

Following each response the software updates its estimates of the respondent's utilities, and uses this new information to compare the next regulatory combination (Johnson, 1987). The final part of the questionnaire is the 'calibration task'. Four custom-designed concepts are constructed by the software based on the respondents' previous responses and the respondent is required to choose a number from zero to 100 to state the desirability of the combination depending on its impact on his income (Figure 4.4).

Please type a number between 0 and 100 where:
0 = the set of regulatory obligations the respondent WOULD definitely NOT be in favour for due to their impact on his income *and* 100 = the set of regulatory obligations the respondent WOULD definitely be in favour for due to their impact on his income
Minimum mesh size Increase in Fines Total Allowable Catches/Quotas Complete exclusion/No Access Areas

Figure 4.4: Example of an 'ACA Calibration' question as it is on-screen.

4.2.1.3 Limitations / Setbacks of the ACA (and of the particular survey)

Despite the advantages that ACA encompasses, it also has some limitations. The ACA technique has been designed to identify consumer preferences so to there is the uncertainty that comes when applying a technique to fisheries management which originated in a different discipline. Additionally, during the course of conducting surveys in different countries and among different sectors, some limitations which did not come up during the pilot studies arose (due to the geographical range of the study, a pilot study with all metiers included was not possible). In addition, when a similar study was completed with fisheries professionals (data for which are analysed and discussed in Chapter 5), similar and/or additional comments arose:

- In order to make the questionnaire relevant to all *métiers*, the different ROs were found to be in some cases too vague and not relevant to all respondents. This was sometimes irritating for respondents.
- The survey consisted of 42 computer screens in total; seven screens of demographic/fleet information data, 32 screens of ACA-related questions (but with only one question each) and three additional questions (not discussed in the ACA chapters). However, each survey was conducted face to face thus administered in the form of a discussion which made it less tedious for the respondent.
- During the conjoint pair task, only two or three attributes are shown each time and the respondent must remember that 'all else is equal'.
- The survey took place in four different countries. The original survey was written in English with Sawtooth Software© and was backwardly translated in Spanish,

Greek and Danish. A Spanish version was also created with Sawtooth Software©. However, Greek and Danish versions of the survey were available only on paper for the fishers in Cyprus and Denmark respectively (the survey still took place on the laptop but the questions, attributes and levels were all available in the respondent's native language). Before calculating the utilities / part-worths of the different attribute levels, the two surveys had to be merged into one using the 'Accumulate CAPI data files' function.

4.2.1.4 Calculating utilities

The conjoint utilities for each individual respondent were calculated with the ACA / HB software (which uses the Hierarchical Bayes (HB) method) for each level of each attribute and for each individual respondent. These utilities were then imported into the Sawtooth Software Market Research Tools (SMRT) program which allowed the segmentation of the utilities into different groups, *métiers*. Thus, utilities were calculated and compared for the different countries, maritime regions, sectors, fleets etc. The relative importance of each attribute is then determined for each individual by obtaining the difference between the utilities of the most preferred and least preferred attribute option, and expressed as a percentage.

There are two ways to calculate part-worth utilities; using the Ordinary Least Squares (OLS) or the Hierarchical Bayes (HB) method. Even though OLS has been successfully used in ACA calculations for over a decade now, the Hierarchical Bayes estimation (HB) technique provides 'a more theoretically satisfying way of combining information from priors and pairs' (Sawtooth Software, 2006). HB is now considered as the 'gold standard' for ACA part-worth utility estimation as it exceeds the quality of the OLS estimations and it has the following benefits (SSI Web, 2007):

1. Greater precision of estimates for each individual.
2. It relaxes the assumption of equidistant part-worths in the Priors for a priori ordered attributes.
3. It improves accuracy of part-worths for predicting holdout concepts.
4. It provides a theoretically more defensible approach for combining self-explicated and conjoint data.

The basic idea behind the use of HB is to recognize that each individual is a member of a group of more or less similar individuals, and that knowledge of the entire distribution of individuals' part-worths can enhance estimation for each individual. Individuals are assumed to be distributed multi-normally, and HB estimates the mean vector and covariance matrix for that distribution. It uses that distribution as a 'prior' in the Bayesian sense, to enhance the estimation of each individual's part-worths. The HB model is a 'hierarchical one' because it has two levels: (i) the higher level assumes that individuals' parameters (part-worths / utilities) are described by a multivariate normal distribution. Such a distribution is characterised by a vector of means and a matrix of covariances. (ii) The lower level assumes that given an individuals' part-worth, his / her probabilities of responding in a particular way are governed by a multinormal distribution[7]. The advantages of using a hierarchical Bayes algorithm to estimate individual part-worths provides two benefits: (i) it improves the stability of each individual's estimates by 'borrowing' information from other individuals, and (ii) it also provides an improved way of combining data from the self-explicated and conjoint sections of the interview. In Bayesian statistical analysis there is the assumption that the data are described by a particular model and a computation attempts to establish whether or not the data are consistent with those assumption.

The parameters are estimated by an iterative process which is quite robust and its results do not depend on starting values. So as to help the process converge as quickly as possible, the start estimates are reasonably close to the final values. During each iteration a new estimate for the individual was constructed by adding a small random perturbation to each element. Each part-worth is the product of the predicted probabilities of all choices made by the respondent given that estimate and the ratio of the new part-worth and the old part worth is computed. Therefore, over the first several thousand iteration (for ACA 5000 iterations are enough to assume convergence), each estimate gradually converges to a set of estimates that fit the data while also conforming to a multi-normal distribution (Johnson, 2000). HB has the

[7] Multi-normal or multivariate normal distribution is the generalisation of the one dimensional (univariate) normal distribution to higher dimensions. A random vector is said to be multivariate normally distributed if every linear combination of its combination of its components has a univariate normal distribution.

ability to produce reasonable estimates for each respondent even when the data are poorly fitted and inadequate for individual analysis by "borrowing" information by the population distribution.

4.2.1.5 Interpreting results and statistics

Figure 4.5 illustrates a simplified diagram of the data collection and analysis procedure.

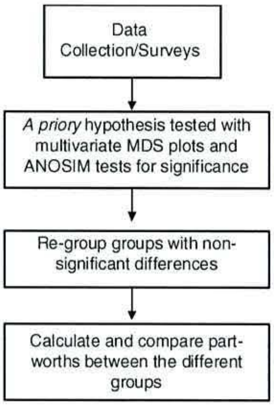

Figure 4.5: Flow-diagram of the data analysis.

4.2.1.5.1 Statistical analysis

The *a priori* null hypothesis was that the responses given by fishers among different Member States and sectors did not differ. This hypothesis was tested using PRIMER, a multivariate statistical software package (Clarke & Gorley, 2006) which allows the exploration of similarities among samples with the same number of variables. PRIMER not only allows the samples to be grouped according to how similar they are, but it also allows the use of factors to explain differences that may occur among these groupings in a statistical robust manner (for example maritime region, fleet, sector etc). The software is more normally used for biological community analysis in which the variables would be considered to be the species contained within a sample.

The conjoint utilities as calculated in ACA / HB are presented as interval data (individual respondents utilities have positive and negative values but the values add up to zero), thus the values are required to be transposed into ordinal data. This was done by converting the conjoint utilities into ranks from the most to least preferred regulatory obligation for each individual respondent (for each attribute). A similarity matrix is created and used to form a Multi-Dimensional Scaling (MDS) plot where the samples are organised in a two-dimensional plot, in an attempt to satisfy all the conditions imposed by the rank similarity matrix. MDS uses an iterative algorithm that takes the multidimensional data of a similarity matrix and presents it in minimal dimensional space (in this case two dimensions were used) to visualise group differences. The result of MDS ordination is a map where the position of each sample is determined by its distance from all other points in the analysis. Since MDS ordination is an iterative algorithm that involves a 'goodness of fit' estimate, an important component of an MDS plot is a measure of the goodness of fit of the final plot. In the case of an MDS ordination, the latter is termed the 'stress' of the plot; (i) stress value > 0.2 indicates that the plot is close to random, (ii) stress < 0.2 indicates a useful two-dimensional picture and (iii) stress < 0.1 indicates an ideal ordination plot (Clarke, 1993). For example if fisher 1 has more similar responses to fisher 2 than with fisher 3, then fisher 1 will be placed closer to fisher 2 on the plot than to fisher 3. The factors used to identify important groupings were the country of operation, the maritime region and sector (inshore, offshore or both).

4.2.1.5.2 Interpreting conjoint results

In this chapter two types of data which result from the ACA output are discussed; conjoint importances and conjoint utilities (part-worths).

Conjoint importances are ratio data which means that values can be added, multiplied, divided etc just like height and weight values. Just like when comparing weight values, the difference between 20 and 30 kilograms is the same as the difference between 30 and 40 kilograms, and 40 kilograms is twice as heavy as 20 kilograms. When comparing conjoint importances it is important to keep in mind what is known as 'Number of levels effect'; where an attribute importance appears to depend on the number of levels and the more levels an attribute has, the more it tends to capture the importance (Wittink, 1992). However, this effect is much reduced in ACA than in other conjoint analysis methods as ACA forces individuals to pay attention to every attribute, whether important or not[8] (Orme, 1997).

Unlike conjoint importances, conjoint utilities are interval data. Thus, the levels within each attribute are ranked from the level with the highest value to that with the lowest value (with 1 being the most preferred level). The utilities are scaled to sum to 0 within each attribute. Therefore, even though these values allow for simple operations like adding and subtracting, the values cannot be directly compared (the difference between different levels in each attribute however can). For example, if when choosing a surfboard according to its shape: 'longboard' and 'shortboard' both scored 20 utiles but cannot be compared as being equally preferred, nor that they are twice as preferred as the 'eggshaped' which scored 10 utiles. However, if the difference of preference between a carbon fibre board and a foam board is also 10 utiles it suggests that the preference between a longboard and an eggshaped board equals the preference of having a carbon fibre board to a foam board.

It is important to keep in mind when interpreting interval data that a negative value does not suggest that the specific level is unattractive but rather that is not as attractive as other levels in that attribute. Dummy coding arbitrarily sets the part-worth of one level within each attribute to zero and the remaining levels are estimated as contrasts with respect to zero.

[8] In other conjoint methods respondents tend to use simplification strategies to answer difficult tasks, thus they tend to consider only the few most important attributes which in turn results in exaggerated differences in importance between the most and least important factors.

4.2.2 Case study selection

Four countries were selected as the case studies to conduct the ACA questionnaires; United Kingdom, Denmark, Spain and Cyprus (Figure 4.6).

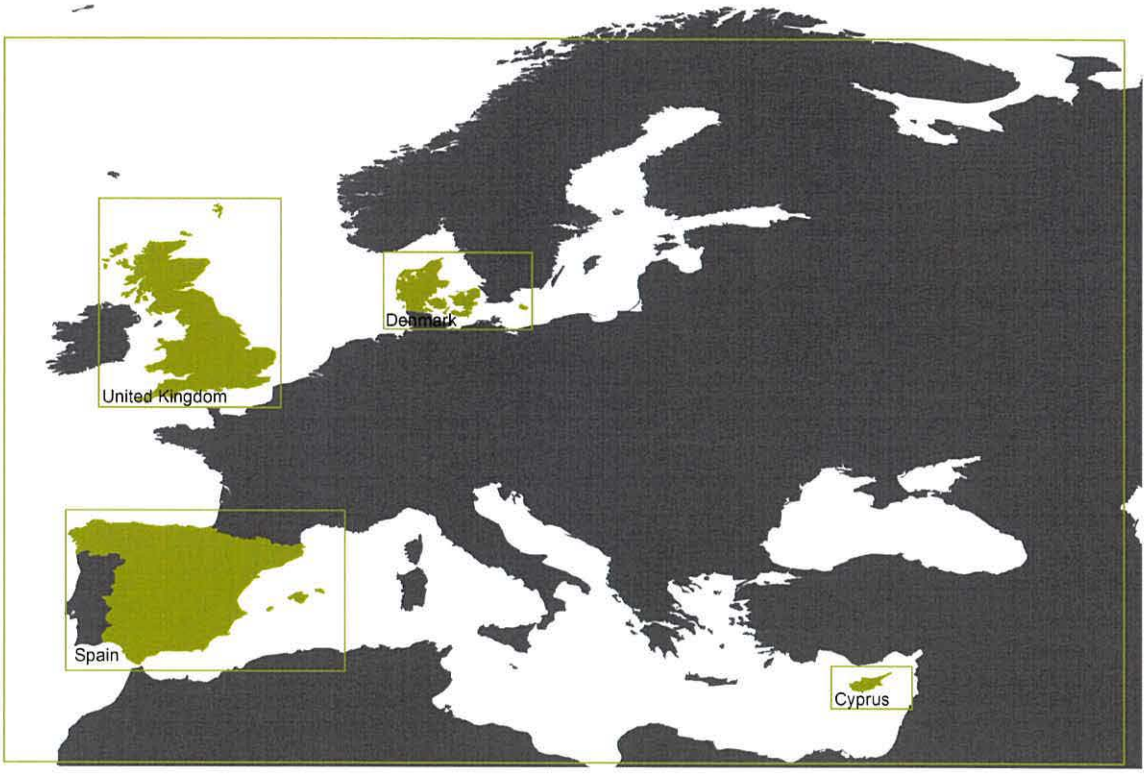

Figure 4.6: Map of Europe with highlighted the selected European Member States used as case studies; United Kingdom, Denmark, Spain and Cyprus.

These case studies were chosen to include nations for which fishing is an important activity, either in economic or social terms. The four countries represent combinations of countries belonging in different maritime regions; United Kingdom and Denmark represent the Northern European fishing nations with the former conducting its fishing activities mainly in the Atlantic and the latter in both the Atlantic and the Baltic. Spain has by far the largest fishing capacity out of all Member States (461 000 GT in 2008) (DEFRA, 2009) and more importantly it allows for an intra-national comparison between fishers preferences in the Mediterranean and the Atlantic. Cyprus represents the smaller European fishing nations, which only recently accessed the EU. In addition, Cyprus conducts its fishing activities solely in the Mediterranean and the majority of its fisheries occur within the 12 nautical mile limit. Even though it can be argued that other case studies could have been selected, the choice of these case studies took into account a number of obstacles:

- The complexity of a questionnaire using the ACA method and the fact that the survey was computerised meant that the chances of convincing fishers to participate increased if fishers were informed of the study before hand and / or a trustee of the fishers showed support of the study. Thus, when choosing a country, support from Producer Organisations (P.O.s), fishers' unions and scientists were taken into account. This was particularly important when deciding on case studies for specific ports / areas.
- Logistics did not allow for a translator thus, the researchers language skills had to be taken into account. For example, Spain was chosen over France for the intra-country Mediterranean and Atlantic coast comparison due to the researcher having knowledge of the Spanish language.

4.2.2.1 Port / Area Selection

4.2.2.1.1 United Kingdom

Four areas of the U.K. were chosen in order to incorporate fleets operating in as many fishing areas (ICES areas) as possible (Figure 4.7). Thus, even though in many cases some of the ports visited were not amongst the top in the U.K. in terms of number of vessels and / or landings, they were good representatives of a fishing area. In total, two Scottish regions were included and two English regions with no regions selected in Wales and Northern Ireland. In 2008, the Scottish ports of Peterhead, Lerwick and Fraserburgh accounted for 51% by quantity and 38% by value of all landings by U.K. vessels into the U.K. (Sea Fish stats, 2008). In addition, even though England has the largest number of vessels of the total U.K. fleet (49% against 34% for Scotland); Scotland has the highest share of capacity (GT) and power (kW) (61% and 50% respectively against 29% and 37% for England). Fishing communities in Scotland are thought to have been hit hard by the reduction in whitefish catches in 2002 which led to these fishing communities having undergone dramatic demographic, economic and social changes (Stead, 2005). For example, whereas historically households in these communities organised their lives around fishing, boat preparation and various other fishing-related activities, now at least one member relies on wage work in towns, factories or oil rights (Stead, 2005).

Figure 4.7: Map of the ports visited in the United Kingdom.

The North East coast of Scotland is an important case study example as it includes three of the most important fishing ports in the U.K., Aberdeen, Fraserburgh and Peterhead. The latter is the U.K.'s largest whitefish port and is a base for the largest whitefish market in Europe (Stead, 2005) and thus it was visited to survey offshore fishers. Peterhead is renowned and accredited as the U.K.'s largest whitefish port (with its whitefish landings coming to £52,353,000 in 2006) but it is also at the top with other important European ports. Since the quota cuts and enforced decommissioning of fishing vessels which were a consequence of the CFP reform in 2002, the port has successfully diversified to handle larger volumes of pelagic fish and shellfish (mainly *Nephrops norvegicus* commonly known as langoustines / Nephrops). In 2006, the total value of fresh fish handled through Peterhead was a record of over £100 million, half of which were pelagic species (mainly herring and mackerel), with the rest being whitefish (cod, haddock, coley and monkfish) and also shellfish. The region also supports a number of smaller fishing ports. A meeting with the East Coast Licensed Small Boat Association (ECLSBA) in Fraserburgh was arranged and after a discussion with the whole group, the ACA survey was conducted with inshore fishers individually.

Surveys in the West coast of Scotland were conducted in the ports of Ullapool and Kinlochbervie. These two ports were amongst the UK ports hit the hardest by the reduction in whitefish catches in 2002 (along with Peterhead) (Stead, 2005).

Representing some of the British fleet operating in the North Sea, North Shields and adjacent ports (mostly for inshore fishers) were visited. Unlike in Peterhead, the town's economic base is increasingly diverse mainly because the local fishing fleet is old and contracting and has suffered from both decommissioning and quota cuts (Brookfield *et al.*, 2005). Due to a reduction in whitefish quotas many vessels of the small local fleet have shifted to catch Nephrops making North Shields the most important Nephrops port in England and Wales (Brookfield *et al.*, 2005).

Newlyn includes vessels ranging in size from small single-handed cove boats to over 30 m long beam trawlers, using diverse techniques including trawling, beam trawling, crab/lobster potting, gill-netting, longlining, drift-netting, scallop dredging, ring-netting and handlining (CFPO, 2008). Newlyn is the top port in the UK in terms of number of registered fishing vessels and fishing capacity (kW) and second in terms of tonnage capacity (GT) after Grimsby. Despite a number of fishing ports in England and Wales feeling abandoned by the UK government and the EU, the rights of Newlyn's fishers are fought through one of the largest producer organisations in England, Wales and Northern Ireland, the Cornish Fisheries Producer Organisation Ltd (CFPO). The importance of fishing for the town is also proven by the appointment of £2.3 million in grants out of £5.25 million appointed to the English fishing industry from the European Fisheries Fund in 2010, for a new fish market in Newlyn (Newlyn Fish Industry Forum, 2010).

4.2.2.1.2 Denmark

Questionnaires in Denmark were restricted to offshore fishers mainly due to time restrictions and language barriers[9]. Questionnaires were conducted in (i) Thyborøn and (ii) Hirtshals and (iii) Hanstholm, in the Jutland region, in the North Sea coast of Denmark, (iv) Skagen, the northernmost tip of the Jutland peninsula in Northern Denmark (it is considered the boundary between the Skagerrak and the Kattegat), and (v) Bornholm, a Danish island located in the Baltic, east of the rest of Denmark (Figure 4.8).

Figure 4.8: Map of the ports visited in Denmark.

The fleet of Thyborøn, Hirtshals, Hanstholm and Skagen are North Sea fleets and mainly target Sandeel and Norway pout and sprat (Mardle et al., 2002; Raakjær Nielsen & Mathiesen, 2006). Thyborøn, Hanstholm and Skagen but also Bornholm are all communities highly dependent on non-human consumption fisheries and economic development as they are located in remote rural areas (Mardle *et al.*, 2002; Raakjær Nielsen & Mathiesen, 2006; Raakjær Nielsen & Christensen, 2006). Unlike in the North Sea, the catch of the Bornholm fleet is comprised of a different and more limited species composition influenced to some extent from the low salinity of the Baltic, mainly cod, herring, sprat and salmon (Bager, 2007; Delaney, 2007). All

[9] It was extremely difficult to find inshore fishers who felt comfortable enough to communicate in English (even though the questionnaire was available in Danish as well).

interviews in Denmark were arranged through the local fishers associations (Danmarsk Fiskeriforening).

4.2.2.1.3 Spain

The four regions visited in Spain were Galicia and the Basque country on the Atlantic side of Spain and Catalunia and Mallorca on the Mediterranean side (Figure 4.9).

Figure 4.9: Map of the various ports/areas visited in the Spain.

The best way to approach inshore fishers in Spain was via their cofradias (the Fishers Guild in Spain). Cofradias are formal public organisations assigned exclusive territorial areas for their activities. Cofradias represent the interests of the entire fisheries sector and act as formal consultative and collaborative bodies of the State administration. In Galicia, the cofradia de Pescadores Martiño in Bueu was visited and questionnaires were conducted with inshore fishers. Bueu is a small town and its fleet is comprised of artisanal vessels whose length varies between five and 12 meters. Depending on the season, fishers fish for octopus, razor clams, barnacles and other crustacean with some fishers fishing for blue fish (tuna, swordfish etc.). In the Basque country, the town of Ondarroa was visited and questionnaires were this time conducted with offshore fishers. The port of Ondarroa is the most important deep-sea fishing port (bottom otter trawls and pair trawls) of the Basque country and the Cantabrian coast (Anon, 2010). Vessels from this port will usually travel to the fishing regions of the West of Scotland and in the Bay of Biscay for their fishing activities. The Mediterranean coast of Spain has no typical type of fishing but rather, its characteristic is its great variability (Sarda, 2009). In Catalunia, the Cofradia de Pescadores de Palamos was one Mediterranean case study. The second Mediterranean case study was the Balearic Island of Mallorca where a few different ports were visited; Palma, Port d'Andratx, Colonia de san Jordi and Cala ratjada. Fishermen were either approached via the cofradias or with the help of researchers of the island's oceanographic institute (Centro Oceanografico de Baleares).

4.2.2.1.4 Cyprus

The Cypriot fishing fleet is mainly composed of small fishing vessels (<12 m) using seasonal passive gear. Considering the size of the island and the size of the fleet there is a considerable number of harbours (or fishing shelters according to DFMR[10]) (Table 4.2). However, that also means that fishers are scattered along the coast (Figure 4.10). Thus, instead of following the technique of four regions as in the other case studies, a number of ports were visited during a one month period (Table 4.3). In some cases however, local researchers, fish merchants and fishers' representatives assisted by introducing the researcher to fishers.

[10] Department of Fisheries and Marine Research

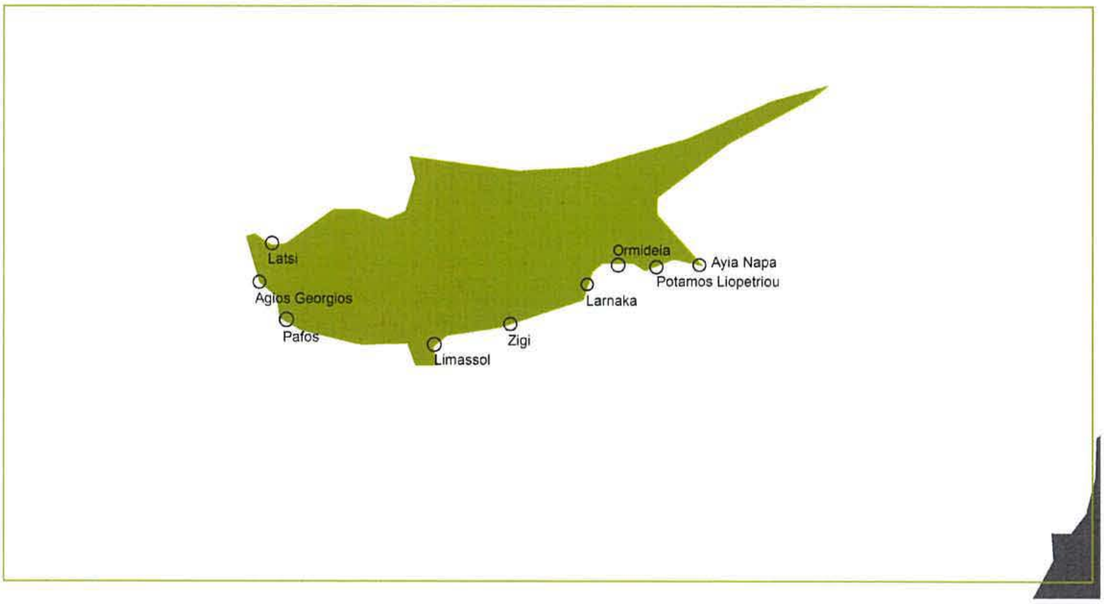

Figure 4.10: Map of the ports visited in Cyprus.

Table 4.3: Fishing shelters in each district in Cyprus and the number of registered vessels for each (Category A: full time fishers and Category B: part-time fishers).

District	Fishing Shelter	No. of registered vessels	Visited
Famagusta	Ayia Napa	99	X
	Paralimni	56	
	Ayia Triada	25	
	Potamos Liopetriou	66	X
	Xilofagou	16	
Larnaka	Dekelia	3	
	Ormidia	28	X
	Larnaka	129	X
	Zigi		X
Limassol	Limassol		X
Pafos	Pafos		X
	Pomos	12	
	Pirgos	17	
	Agios Georgios (Pegias)	15	X
	Pissouri		
	Latsi		X

4.2.2.2 Port Visits

Port visits were spread out across an approximate period of one year (May 2009-March 2010) and depending on fishers' organisational structure, different methods of contacting fishers were followed (Table 4.4). In the U.K. and Spain, visits at each port lasted one week and fishers who were around the port were approached either solely by the researcher or with the assistance of a point of contact who fishers knew well. In the U.K. the point of contact could be fisher's association representative, harbour master, Sea Fisheries Committee staff etc. In Spain, representatives of relevant cofradias would usually assist with contacting inshore fishers and fisheries scientists with offshore fishers. In Cyprus, due to the small size of the island and of each port / harbour, different ports were visited each day. Sometimes fishers were informed about the survey prior to the visit from a researcher with whom they had a working relationship with (AP Marine Environmental Consultancy Ltd) or a fishers' representative. In Denmark, the IFM institute (Innovative Fisheries Management) assisted with contacting the selected local fishers' associations with whom meetings with offshore fishers were arranged.

Table 4.4: Methods used to approach fishers at each Country/port

Port/ Visited	Approach
United Kingdom	
East coast of Scotland 18-23rd May, 2009	• Offshore fishers: approached in the port/ survey conducted onboard vessels, in the port's café, fishermen's mission • Inshore fishers: prearranged meeting
West coast of Scotland 25-27th May 2009; 8-10th March, 2010	• Fishers approached in the port/ surveys conducted onboard the vessel, in the port's café, fishermen's mission
Northumbria 15-20th February, 2010	• Fishers approached in the port/ surveys conducted onboard vessels, in the port's café, fishermen's mission
Newlyn 1-5th March, 2010	• Fishers approached in the offices of the Cornish Fish Producers Association (CFPO)
Cyprus 1-30th June, 2009	• Fishers approached at port/fishmongers; first contact sometimes via president of fishers' association
Denmark 1-27th September, 2009	• Fishers approached at port/surveys conducted onboard the vessel • Prearranged meetings at Fishers' Producer Organisations
Spain	
Galicia 6-9th July, 2009	• Prearranged meetings at the local Fishers' Producer Organisation (cofradia)
Basque country 13-17th July, 2009	• Prearranged meetings with fishers organized by research institute (AZTI – El centro technologico del Mar y los Alimentos)
Catalunia 20-25th July, 2009	• Prearranged meetings at the local Fishers' Producer Organisation (cofradia)/ICM-CSIC (Institute of Marine Sciences, Barcelona)
Mallorca 27-31st July, 2009	• Prearranged meetings at the local Fishers' Producer Organisation (cofradia)/ (Centro oceanografico de Baleares – IEO) • Fishers approached in the port

4.3 Results

4.3.1 Preliminary multivariate data analysis

The number of respondents is presented in Table 4.5 according to the country, sector and maritime region.

Table 4.5: Number of respondents per country / sector (Total number of respondents = 188)

Sector	Country				
	United Kingdom	Denmark	Spain		Cyprus
			NE Atlantic	Mediterranean	
Inshore	23	1	9	17	47
Offshore	32	23	9	2	1
Both	13	2	1	5	3

In order to identify similarities in fishers' responses, Multidimensional Scaling Plots (MDS) were created for all respondents (Figure 4.11) and for each country (Figure 4.12).

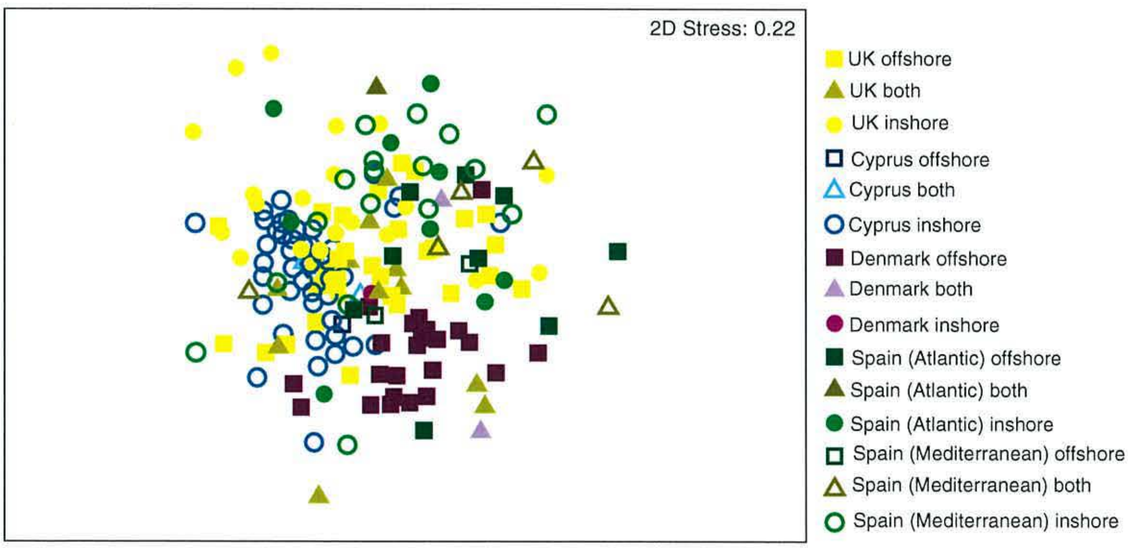

Figure 4.11: MDS (Multi-Dimensional Plot) of Bray-Curtis similarities from non-transformed data conjoint utilities for all fishers.

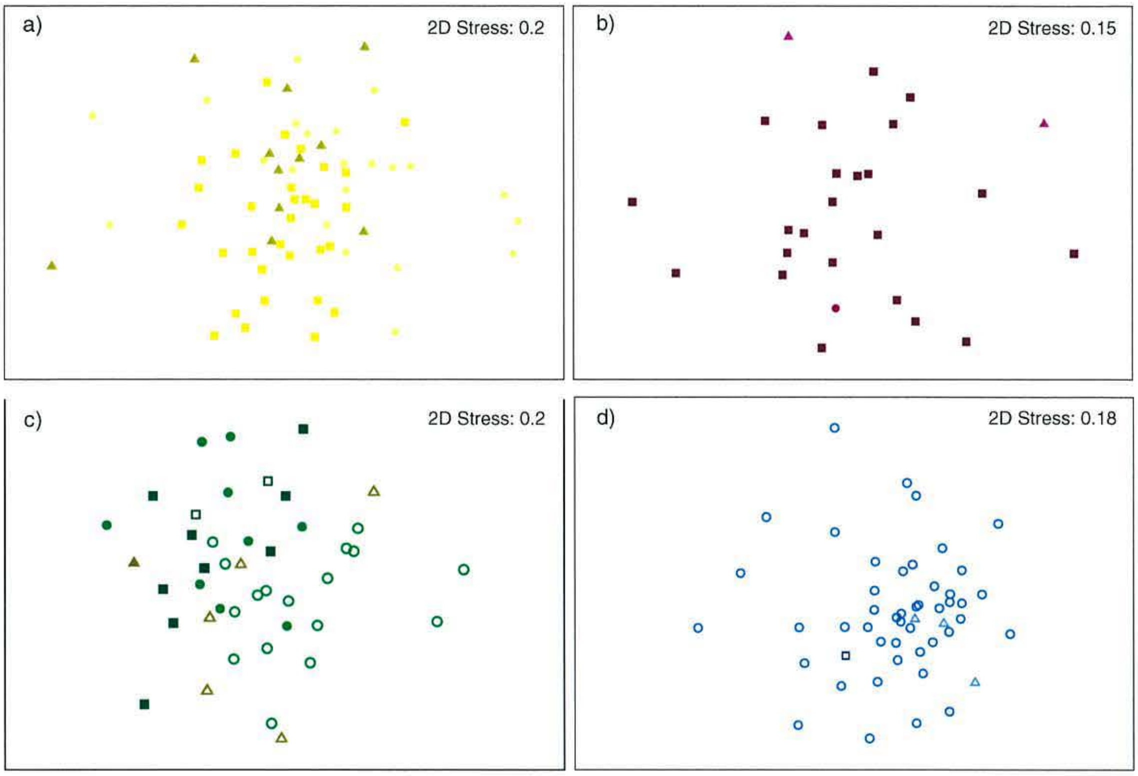

Figure 4.12: MDS (Multi-Dimensional Plot) of Bray-Curtis similarities from non-transformed data conjoint utilities for a) U.K. fishers, b) Danish fishers, c) Spanish fishers and d) Cypriots fishers.

The MDS plot for all respondents shows distinct clustering of most *métiers* but especially for the 'Cypriot inshore' and the 'Danish offshore' group. The 'Spanish inshore' are also clustered together. There also seems to be segmentation between inshore and offshore fishers. The U.K. fishers are clustered together in the middle of the other national clusters, whereas the 'Spanish' is the most spread-out group. The spread of the 'Spanish offshore Atlantic' group suggests that fishers in that group have the least similar responses between them unlike respondents in the other *métiers*.

In order to identify whether or not the differences between groups identified from the MDS plot were significant, ANOSIM tests were run. The ANOSIM results are presented in Table 4.6 by country and sector and in Table 4.7 by sector for each country individually.

Table 4.6: ANOSIM results for fishers' utility ranks for different regulatory obligations as calculated using the Adaptive Conjoint Analysis (ACA) method: Country, maritime region and sector comparisons.

Factor	Global R	P-value	Pairwise tests	
			R-value	P-value
North/South	0.057	<0.05	—	—
Sector	0.151	<0.05	—	—
Inshore/Offshore	—	—	0.167	<0.05
Inshore/Both	—	—	0.136	<0.05
Offshore/Both	—	—	0.126	<0.05
Country	0.249	<0.05		
Cyprus/UK	—	—	0.141	<0.05
Cyprus/Denmark	—	—	0.599	<0.05
Cyprus/Spain	—	—	0.349	<0.05
UK/Denmark	—	—	0.263	<0.05
UK/Spain	—	—	0.157	<0.05
Denmark/Spain	—	—	0.22	<0.05

There was a significant difference between ranking of regulatory measures between fishers in the Atlantic (North) and the Mediterranean (South) ($R=0.057$, $p<0.05$). Similarly, the differences of the responses between different sectors and countries were also significant (Sector: $R=0.151$, $p<0.05$; Country: $R=0.249$, $p<0.05$). In these two cases, were there were more than two groups in each factor, pairwise comparisons between the groups also showed significant differences among all groups. Basically no nationality or sector has the same response.

For differences in responses within countries, ANOSIM gave significant differences between sectors for all countries (UK: $R=0.167$, $p<0.05$; Denmark: $R=0.314$, $p=0.06$; Spain: $R= 0.121$, $p=0.052$). In those cases where the number of respondents in specific groups was not adequate for reliable comparisons, the abbreviation N / A (Not Available) was put in the appropriate box in the table.

Table 4.7: ANOSIM results for fishers' utility ranks for different regulatory obligations as calculated using the Adaptive Conjoint Analysis (ACA) method: Intra-country sector comparisons.

Factor	**R-value**	**P-value**	**Pairwise tests**	
			R-value	**P-value**
UK	0.167	<0.05		
Inshore/Offshore	—	—	0.215	<0.05
Inshore/Both	—	—	0.057	0.21
Offshore/Both	—	—	0.13	0.08
Denmark	0.314	0.066		
Inshore/Offshore	—	—	N/A	N/A
Inshore/Both	—	—	N/A	N/A
Offshore/Both	—	—	0.458	0.037
Spain	0.121	0.052		
Inshore/Offshore	—	—	0.145	<0.05
Inshore/Both	—	—	0.094	0.21
Offshore/Both	—	—	0.145	<0.05
Inshore(N) /Inshore(S)	—	—	0.22	<0.05
Offshore(N)/ Offshore(S)	—	—	N/A	N/A
Both(N)/ Both(S)	—	—	N/A	N/A
Cyprus	N/A	N/A		
Inshore/Offshore	—	—	N/A	N/A
Inshore/Both	—	—	N/A	N/A
Offshore/Both	—	—	N/A	N/A

Given the results from the PRIMER analysis, respondents for each sector and each maritime region were grouped together as shown in Figure 4.13 (hereafter termed *métiers*).

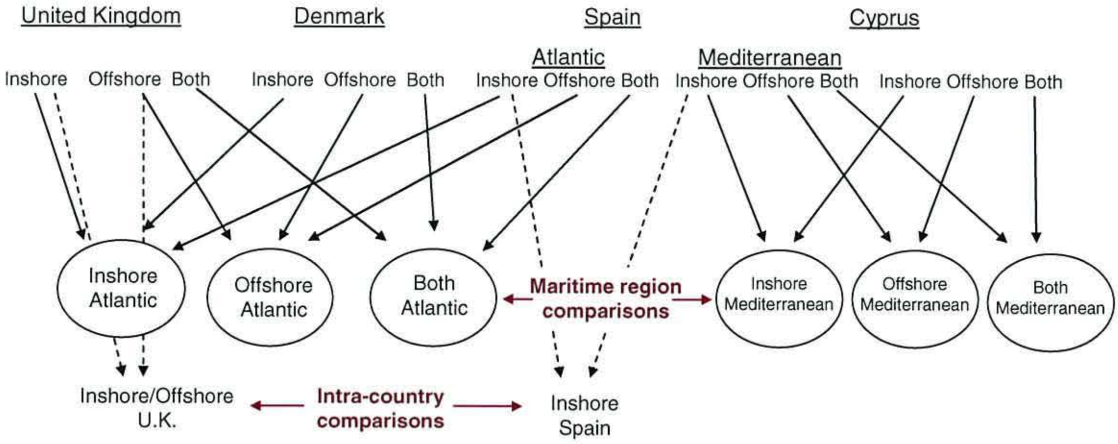

Figure 4.13: Final groupings of all the respondents as resulted from the PRIMER analysis (filled lines represent groupings for sector/region comparisons and lines represent groupings for national comparisons).

4.3.2 Adaptive Conjoint Analysis

4.3.2.1 North VS South (all respondents)

Respondents' individual conjoint utilities were calculated within the ACA / HB. From the individual utilities, the conjoint utilities and importances were calculated for the all six *métiers*. Figure 4.14 presents the conjoint importance (%) for each attribute for each sector for the Atlantic and the Mediterranean.

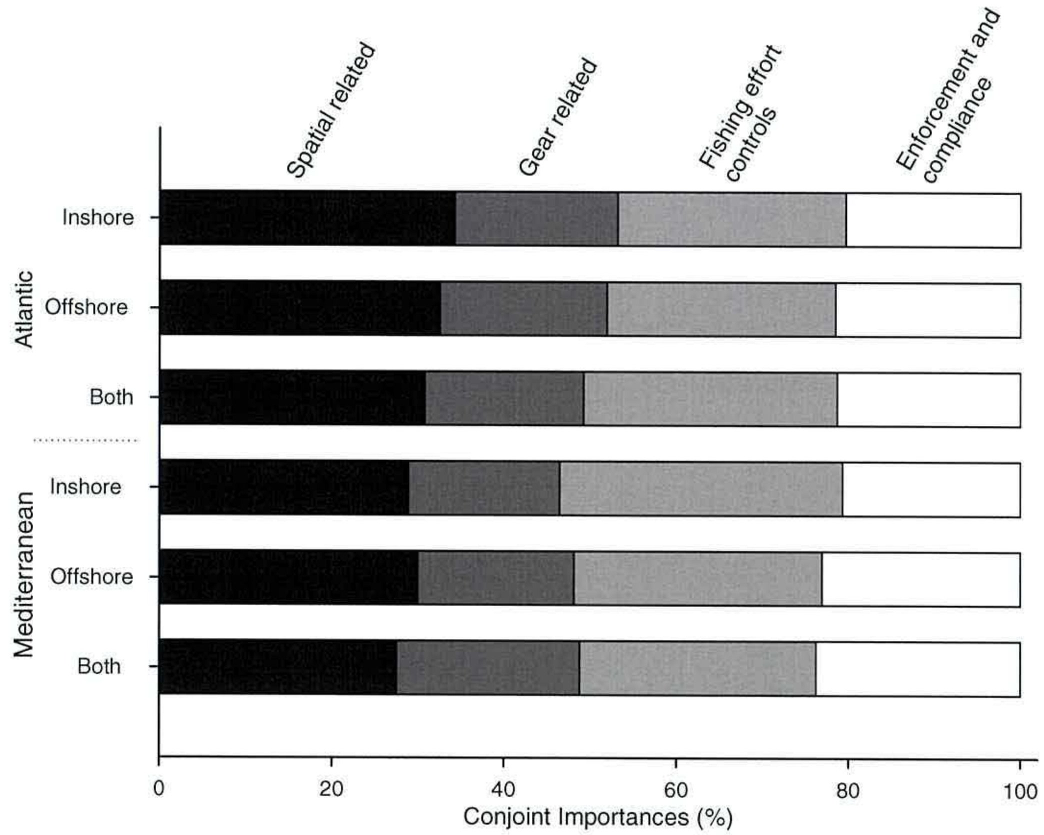

Figure 4.14: Relative importance (%) for each attribute for the three sectors (Inshore, Offshore and Both) in the Atlantic and the Mediterranean.

The relative importance of each attribute in terms of its impact on fishers' income did not differ greatly between the different *métiers*. Changes in 'Spatial–related regulations', thus access to resources, was perceived by fishers as the attribute which has the biggest (positive or negative) impact on their income. However, the 'Mediterranean inshore' group perceive measures for 'Fishing effort controls' (such as addition of 'Days at Sea', 'TACs' etc) to be more important than access to resources. For all other groups changes in 'Fishing effort controls' is ranked as second. For 'Atlantic inshore' fishers, 'Spatial-related regulations' are almost twice as important as the 'Gear-related regulations' (conjoint importance: 34.24% and 18.96% respectively). On the contrary, for the 'Mediterranean inshore' fishers, 'Fishing effort control regulations' are almost twice as important as the 'Gear-related regulations' (conjoint importance: 32.88% and 17.60% respectively). The relative utilities for each RO and for all *metiers* are presented in Table 4.8.

Table 4.8: Relative utilities (and ranks with 1 being the most preferred level) for each attribute level for NE Atlantic (including the Baltic) and the Mediterranean as calculated with the Sawtooth Market Research Tool (the number next to each sector is the number of respondents in each category).

		NE Atlantic			Mediterranean		
	Attribute levels	**Inshore (33)**	**Offshore (64)**	**Both (16)**	**Inshore (64)**	**Offshore (3)**	**Both (8)**
Spatial-related regulations	1.Complete exclusion	-64.74 (4)	-48.88 (4)	-37.99 (4)	-41.84 (4)	-45.82 (4)	-42.56 (4)
	2.No exclusion	47.31 (1)	65.51 (1)	44.81 (1)	52.37 (1)	70.33 (1)	41.64 (1)
	3.Real time closures	-14.87 (3)	-3.35 (2)	-3.88 (3)	-6.03 (3)	-15.39 (3)	-5.70 (3)
	4.Ownership areas	32.30 (2)	-13.28 (3)	-2.94 (2)	-4.50 (2)	-9.12 (2)	6.62 (2)
Gear-related regulations	1.Minimum mesh size	-13.38 (4)	6.92 (3)	3.53 (3)	-20.19 (4)	4.44 (3)	-3.63 (3)
	2.Gear embargos	-24.44 (5)	-27.50 (5)	-41.20 (5)	-21.68 (5)	-26.52 (4)	-31.54 (5)
	3. Size limits	-1.43 (3)	-26.66 (4)	3.42 (4)	-7.89 (3)	-35.26 (5)	-21.68 (4)
	4.Prohibition of explosive or other substances	24.22 (1)	27.85 (1)	18.42 (1)	32.39 (1)	35.33 (1)	32.59 (1)
	5.Prohibition of electric shock generators etc	15.05 (2)	19.39 (2)	15.85 (2)	17.37 (2)	22.01 (2)	24.26 (2)
Fishing effort control regulations	1.Total Allowable Catches/Quotas	-40.88 (5)	-28.57 (4)	-40.49 (5)	-52.13 (5)	-62.99 (5)	-19.93 (4)
	2.General gear prohibitions	11.94 (3)	-6.09 (3)	1.88 (3)	18.34 (3)	-7.69 (3)	-0.19 (3)
	3.Days at Sea	-19.55 (4)	-30.96 (5)	-22.88 (4)	-50.29 (4)	-17.31 (4)	-31.30 (5)
	4.Minimum landing size	18.29 (2)	29.95 (2)	25.49 (2)	23.89 (2)	49.94 (1)	14.83 (2)
	5.Fishing Permits	30.20 (1)	35.67 (1)	36.00 (1)	60.18 (1)	38.05 (2)	36.59 (1)
Enforcement and Compliance regulations	1.Increase in Fines	-27.41 (5)	-37.52 (6)	-14.99 (6)	-9.46 (5)	-35.60 (6)	-37.85 (6)
	2.VMS (Vessel Satellite System)	3.29 (3)	17.30 (1)	15.39 (2)	5.63 (3)	25.29 (2)	15.50 (2)
	3.Controls at Ports	19.18 (1)	13.46 (2)	24.74 (1)	18.37 (1)	25.72 (1)	19.11 (1)
	4.On-board Observers	-10.30 (4)	-3.10 (5)	-14.33 (5)	-4.16 (4)	12.98 (3)	-7.81 (5)
	5.Random vessel checks on sea	11.95 (2)	5.00 (3)	-12.14 (4)	17.09 (2)	-12.75 (4)	9.09 (3)
	6.Voluntary agreements between fishers	3.29 (3)	4.86 (4)	1.33 (3)	-27.47 (6)	-15.63 (5)	1.96 (4)

4.3.2.1.1 Spatial-related regulations

Fishers perceived that not being excluded from fishing in an area to be best for their income and their complete exclusion from an area is perceived to be the worst. Between 'Ownership areas' and 'RTCs' only the 'Offshore Atlantic' group rated 'RTC's' above 'Ownership areas'. 'Ownership areas' was termed as i) having complete jurisdiction within the 12 nm limit (rights based management for inshore fishers) and ii) the national authorities having complete jurisdiction within the 200 Exclusive Economic Zone (EEZ) (rather than the EU having the jurisdiction). All groups except that of the 'Offshore Atlantic' operate within their national waters. The 'Offshore Atlantic' fishers however, base their income in being able to operate in ICES areas of the EU's Northern waters in which they own quota. Thus, they need to have the ability to operate in waters other than their national waters.

4.3.2.1.2 Gear-related regulations

For 'Gear-related regulations', it is not surprising that the two catastrophic practises of 'using explosive or toxic substances' and 'electric shock generators, percussive instruments etc' were ranked as first and second respectively by all fishers. Thus, fishers understand the importance of prohibiting such practises in terms of sustaining the future of the resource they base their income upon. 'Atlantic inshore' and Mediterranean inshore' fishers' third choice is 'size limits' allowed, followed by 'minimum mesh size' and 'gear embargos'. Inshore *métiers* are influenced as to the amount of gear they can take out to sea due to the size of their boat. Inshore fishers tend to own small boats and thus they cannot carry all the allowable gear. Thus, a decrease in the size of nets or the number of pots would not affect them. However, an increase in the 'mesh size of their nets' can significantly decrease their catch. The remaining groups rank 'minimum mesh size' as being better for their income than 'limits in size / number of gear', for the exact opposite reasons the inshore fishers rank them the other way round.

4.3.2.1.3 Fishing effort control regulations

The requirement for 'Fishing Permits / licences' is ranked as the most important regulatory obligation for the majority of fishers as it helps to keep the number of people fishing in an area down, thus it reduces competition (both in terms of resource and markets). 'Minimum Landing Size' is ranked second. 'Minimum Landing Size' and 'general gear prohibitions'[11] have been used as management tool for longer than 'Days at Sea'[12]. However, even though gear restriction measures were introduced at the same period as TACs, the former are measures which are rather easy to follow as they tend to be done once via gear change. It came to no surprise that the two most debated tools, 'TACs' and 'Days at Sea', are the two measures which the fishers feel are having the most negative impact on their income. For all groups except the 'Offshore Atlantic' and the 'Both Mediterranean' fishers, there is a preference for 'Days at Sea' rather than TACs/Quotas. For the former in particular, the preference for TACs/Quotas can be for the following reasons:

- TACs/Quotas were introduced before 'Days at Sea'. Thus, for the majority 'Days at Sea' has always been an additional measure which added to the restrictions.
- Fishers have found ways to make the most out of their set TACs. During a fishing trip for example, high-grading[13] can be used, in order to choose the fish that would get them the best price during different hauls.
- With 'Days at Sea', fishers can waste days without catching enough fish to cover their costs.

Both inshore *métiers* showed a preference towards 'Days at Sea' rather than TACs/Quotas. There are two main differences between the inshore and the offshore groups which could have led to these differences: (i) inshore fishers have significantly fewer quotas than the offshore fishers and they feel that the lack of quotas is

[11] This is also shown by gear-related regulations being of lowest importance for fishers' income in the attribute level.
[12] Gear restriction measures were introduced in 1983 and so did Total Allowable Catches. Days at sea limitation were not introduced until the 2002 reform of the CFP.
[13] High-grading is used to describe the act of selecting the harvested goods which would give the best price and ignore the rest.

significantly affecting their income[14], (ii) the size difference in the boats of inshore and offshore fishers mean that the offshore fishers can go out to sea considerably more days, independent of weather (if they have the necessary 'Days at Sea' allowance).

4.3.2.1.4 Enforcement and Compliance regulations

This attribute is the most diverse in terms of level ranks for each group. 'Controls at ports' is a measure that all groups ranked as being most preferable for their income, along with 'VMS' and 'Random checks at Sea'. For all attributes, the preferable measures are generally the ones which have been in use the longest. The only group favouring 'VMS' from 'Controls at Ports' was the 'Offshore Atlantic' group. The vessels in this group all have a 'VMS' and fishers are accustomed to it. The 'Inshore Atlantic' group rated 'Voluntary agreements between fishers' in the middle of the scale, whereas it was at the bottom of the ranks for the 'Mediterranean inshore' group. 'Increase in fines' was ranked last for all other groups.

[14] This is the case in the Atlantic as there is no TAC/Quota restrictions in the Mediterranean.

4.3.2.2 ACA analysis for same country *métiers*

Fishers' regulatory preferences also varied between different maritime regions and sectors of the same county. This section deals with the differences in the two regions and the inshore / offshore sector without the country bias; (i) differences between the Spanish inshore fleet operating in the Mediterranean and the Atlantic, and (ii) between the British inshore and offshore fleet.

4.3.2.2.1 Spanish Inshore: Atlantic vs Mediterranean

The major difference in conjoint importances between the two groups relates to 'fishing effort control regulations' group (20.81% for the Atlantic group against 33.83% for the Mediterranean group) (Figure 4.15). Thus, even though there is not a notable difference in the rankings of the conjoint utilities of the different regulatory obligations in that attribute, there is a big difference in the amount each level is preferred over another. 'Fishing permits' is the regulatory obligation most preferred in this attribute. 'General gear prohibitions' is rated second for the Atlantic fishers and 'Minimum Landing Size' for the Mediterranean.

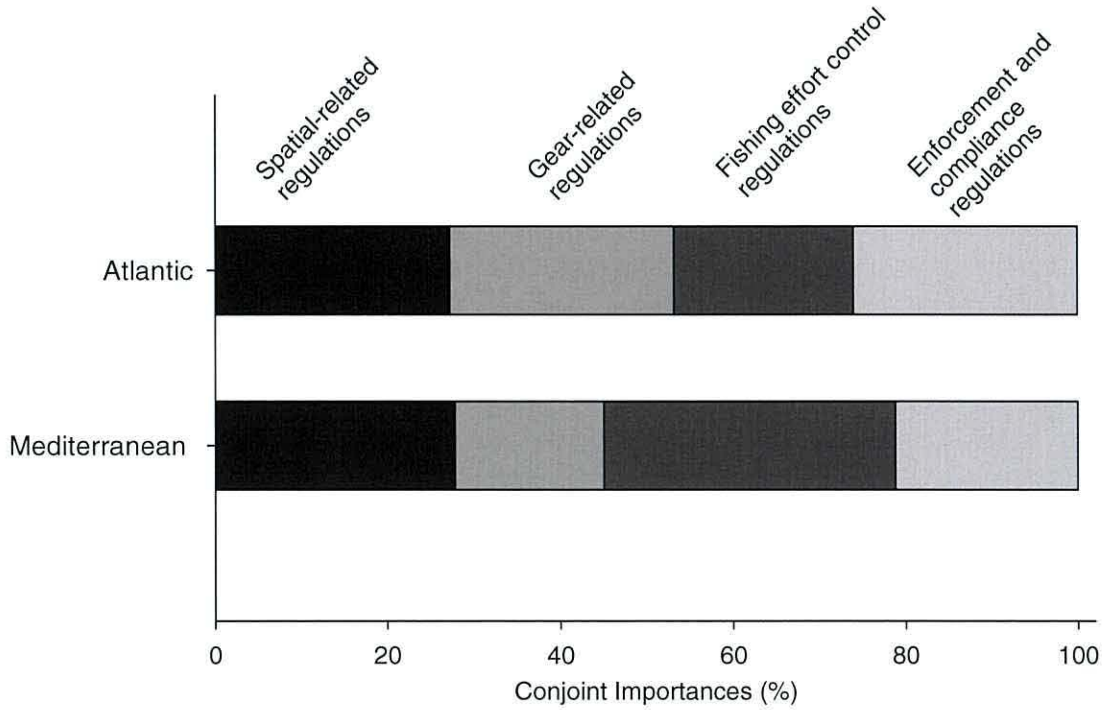

Figure 4.15: Relative importance (%) for each attribute for the Spanish Inshore fishers in the Atlantic and the Mediterranean.

With regards to 'Spatial-related regulations', the order of preference for each level is the same between the two groups (Table 4.9). Again, there is a difference in the magnitude of preference. Atlantic fishers feel that 'No exclusion' is better for their income than the rest of the options with 43 utiles difference from 'Ownership areas' which was ranked second. On the other hand, for the Mediterranean fishers the difference between the second and third regulatory obligation ('Ownership areas' and 'temporary closures' respectively) is five utiles and 15 utiles difference respectively with the preferred level. Within the 'Enforcement and Compliance regulations' attribute, the difference between 'Voluntary agreements between fishers' and 'Increase in fines' is almost double (35.09 utiles for the Mediterranean and 64.91 for the Atlantic fishers) even though in terms of ranks they are separated by four regulatory obligations.

Table 4.9: Relative utilities (and ranks with 1 being the most preferred level) for each attribute level for the Spanish Inshore fishers in the NE Atlantic and the Mediterranean as calculated in the (SMRT) Sawtooth Market Research Tool (the number next to each sector is the number of respondents in each category).

	Attribute levels	Atlantic – Bueu (9)	Mediterranean – Palamos/Mallorca (17)
Spatial-related regulations	1.Complete exclusion	-53.45 (4)	-37.38 (4)
	2.No exclusion	46.82 (1)	19.61 (1)
	3.Real time closures	2.87 (3)	4.03 (3)
	4.Ownership areas	3.76 (2)	13.74 (2)
Gear-related regulations	1.Minimum mesh size	-28.58 (5)	-9.00 (3)
	2.Gear embargos	-20.00 (3)	-27.95 (5)
	3. Size limits	-23.49 (4)	-14.09 (4)
	4.Prohibition of explosive or other substances	45.31 (1)	33.18 (1)
	5.Prohibition of electric shock generators etc	26.77 (2)	17.86 (2)
Fishing effort control regulations	1.Total Allowable Catches/ Quotas	-20.03 (5)	-44.06 (4)
	2.General gear prohibitions	4.70 (2)	14.66 (3)
	3.Days at Sea	-12.51 (4)	-48.72 (5)
	4.Minimum landing size	1.96 (3)	18.52 (2)
	5.Fishing Permits	25.88 (1)	59.59 (1)
Enforcement and Compliance regulations	1.Increase in Fines	-49.90 (6)	-14.92 (5)
	2.VMS (Vessel Satellite System)	-2.19 (5)	-9.69 (4)
	3.Controls at Ports	14.94 (3)	17.93 (2)
	4.On-board Observers	3.32 (4)	-23.75 (6)
	5.Random vessel checks on sea	18.81 (1)	10.26 (3)
	6.Voluntary agreements between fishers	15.01 (2)	20.17 (1)

4.3.2.2.2 UK fleet: Inshore vs Offshore

U.K.'s inshore fishers rate access to resources as the factor with greatest potential to impact on their income (37.16%). U.K.'s offshore fishers have the same first preference (30.64%) even though their second preference, fishing effort control regulations, is a very close second (30.18%) (Figure 4.16).

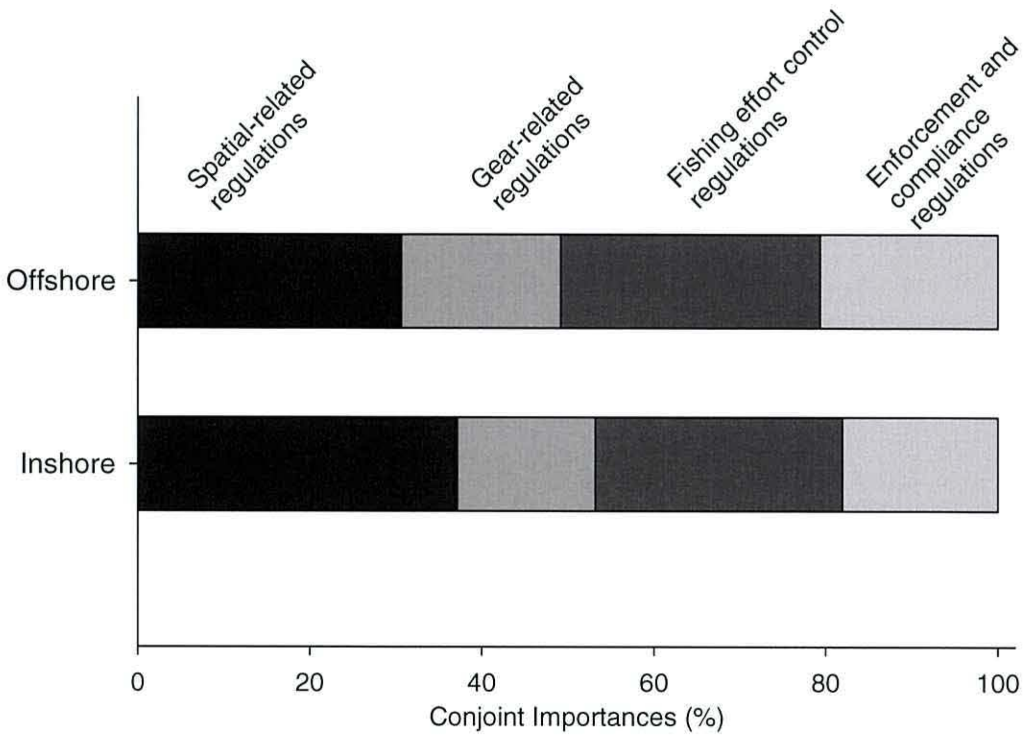

Figure 4.16: Relative importance (%) for each attribute for the U.K.'s Inshore and Offshore fishers.

Rankings for the 'spatial-related regulation' are identical for the two groups. There are approximately 48 utiles between the offshore fishers' first and second option ('No exclusion' and 'Ownership areas' respectively) whereas only three utiles for the inshore fishers. It is important to remember that there is a different definition for ownership areas for inshore fishers than for the offshore fishers (Table 4.10). Thus, 'Ownership areas' would give more rights to inshore fishers whereas offshore fishers would potentially have more restriction when fishing in waters of other EU Member States. Regarding 'fishing effort control regulations', the different levels have the same rankings for the two groups. 'Days at Sea' and 'TACs' are the least preferred options.

Table 4.10: Relative utilities (and ranks with 1 being the most preferred level) for each attribute level for the British Inshore and Offshore fishers as calculated in the (SMRT) Sawtooth Market Research Tool (the number next to each sector is the number of respondents in each category).

	Attribute levels	Inshore	Offshore
Spatial-related regulations	1.Complete exclusion	-69.32 (4)	-58.89 (4)
	2.No exclusion	46.89 (1)	58.41 (1)
	3.Real time closures	-21.42 (3)	-9.98 (3)
	4.Ownership areas	43.85 (2)	10.46 (2)
Gear-related regulations	1.Minimum mesh size	-8.01 (4)	7.63 (3)
	2.Gear embargos	-27.13 (5)	-25.20 (5)
	3. Size limits	9.75 (2)	-23.00 (4)
	4.Prohibition of explosive or other substances	15.70 (1)	24.47 (1)
	5.Prohibition of electric shock generators etc	9.69 (3)	16.10 (2)
Fishing effort control regulations	1.Total Allowable Catches/Quotas	-51.41 (5)	-53.94 (5)
	2.General gear prohibitions	16.33 (3)	8.74 (3)
	3.Days at Sea	-20.69 (4)	-35.77 (4)
	4.Minimum landing size	24.51 (2)	40.32 (2)
	5.Fishing Permits	31.26 (1)	40.66 (1)
Enforcement and Compliance regulations	1.Increase in Fines	-17.44 (6)	-29.22 (6)
	2.VMS (Vessel Satellite System)	4.95 (3)	10.84 (2)
	3.Controls at Ports	20.59 (1)	11.99 (1)
	4.On-board Observers	-16.36 (5)	-9.08 (5)
	5.Random vessel checks on sea	8.52 (2)	8.84 (3)
	6.Voluntary agreements between fishers	-0.26 (4)	6.63 (4)

4.4 Discussion

Ascertaining the attitudes and functions of individuals and groups towards 'their resources' and their perceptions against measures controlling their activities can help identify and resolve conservation problems (Daoutopoulos & Pirovetsi, 1990). The study helped to quantify, but mainly rank fishers' preferences for different regulatory obligations with regards to the perceived impact on their income. Risk perceptions are context and culturally dependent (Tingley *et al.*, 2010) and as shown in this study, fishers opinions varied depending the maritime region, country and sector. In general, fishers were hesitant and suspicious towards new regulatory measures as outcomes of unknown situations tend to be worrisome. Hence, the preferred measures were in most cases the ones which fishers are most accustomed to. The calculated utilities of the ROs differed significantly between the different regions, countries, and sectors. Thus, for an industry with the diversity of the European fisheries there were hardly any general trends with regards to fishers' regulatory preferences.

With regards to the technique used, there are no reasons to dismiss the use of ACA as a tool to identify fishers' preferences and perceptions vis-à-vis the economic impact of different regulatory measures. The technique was used to rank fishers' most and least preferred regulatory obligations in terms of their impact on their income and it did so successfully. Even though fisheries management is comprised of different levels and elements of governance[15], this chapter simply aimed at exploring fishers' preferences for the elements of governance fishers' feel the direct impact of[16]. Subsequently, social, economic and political issues were identified in order to acknowledge and identify the potential underlying rationales behind these preferences.

Inevitably, logistics and time restrictions limited the power of the study as a bigger sample size would have offered higher confidence in predicting fishers' preferences. Nevertheless, the trade-off between a bigger sample size against a greater number of

[15] As discussed in Chapter 1, Hilborn *et al* (2005) identified the issue of property rights, the decision-making structure of the institutions and the spatial scale of management as the three primary elements of governance .

[16] Fishers do not feel that participating in decision-making has an impact in their income, whereas they do feel that the decisions taken i.e. quota limitations have.

case studies allowed the study to cover a wide range of *metiers* representing different regions and sectors. Moreover, the method's statistical efficiency with small sample sizes was an important reason for its selection as also shown by a number of studies which have used ACA in order to accommodate for small but more selective sample sizes (Valeeva *et al.*, 2005; Cross *et al.*, 2008; Morgan-Davies, 2009).

Access to resources is perceived to be vital for fishers despite the impact of the 'Number of levels effect' where attributes with more ROs tend to capture the importance thus reducing it for those attributes with fewer levels. The 'spatial-related regulations' attribute captured most of the importance despite having the least number of levels. Restricting access to fisheries was the regulatory response to overcoming Hardin's (1968) *Tragedy of Commons.* However, convincing fishers of the economic advantages of potential closures is challenging, especially if such a restriction is a new measure for them thus perceived as potentially catastrophic for their income, a concept known as 'status-quo bias' (Samuelson & Zeckhauser, 1988). Whether fishers prefer open access against temporary closures or some type of area ownership[17] can depend on their perceptions and experiences with a certain regime. Fishers are averse to income variation, but are more averse to income loss and thus for them closures which spatially reduce their fishing opportunities can lead to a reduction in their fishing revenues (Holland, 2008). Therefore, even though fishers understand the importance and potential benefit that could result from area closures, the uncertainty of its potential impacts makes them assume that such closures will have a negative impact on their income (especially in the short-term) (Dimech *et al.*, 2009; Mangi & Austen, 2008). A review by Carter (2003) on the socioeconomics of Marine Protected Areas (MPAs) suggests that, MPAs could potentially improve social welfare as even though consumptive users (fishers) are worse off (at least in the short-term), their losses can be offset by the gains in non consumptive values. However, fishers who have already been affected by the establishment of marine protected areas and have experienced positive changes in their income, verify that such measures not only enhance the natural environment but also that in the longer-term, fishers' income is enhanced. The inshore fishers of La Colonia Sant Jordi in Mallorca, conduct their

[17] For offshore fisher "Ownership" of an area meant that their country had national jurisdiction up to the 200 nm EEZ; for inshore fishers, "Ownership" meant that their local co-operative had jurisdiction of their 12 nm limit.

fishing activities within or adjacent to the marine and terrestrial reserve of the Cabrera Archipelago (*Parque Nacional del Archipiélago de Cabrera)* which was established in 1991. These fishers are very proud of the status of their marine resources and according to them, fish from their calleta is in high demand and they get the highest price in Mallorca. In addition, the status of such areas can improve their attractiveness to visitors, thus helping fishers diversify their activities either by using their boats for wildlife/diving cruises or in general tourist-related activities (Russ *et al.*, 2004; Dimech *et al.*, 2009).

The existence of local fishers' co-operatives tends to lead to well-organised and controlled practises (Daoutopoulos & Pirovetsi, 1990; Hilborn *et al*, 2005; Gelcich *et al.*, 2009). Offshore fishers in the Atlantic have come to learn that being part of a P.O. and / or a fisheries association can provide them with political and thus decision-making power. In relation to inshore fishers, those belonging to powerful and well-organised co-operatives were more likely to accept the potential advantages of some restrictions if their co-operative was backing up that measure. In a limited access system within a co-operative, fishers agree on how to share the fish: they no longer just compete against each other for resources thus individuals can concentrate on reducing costs and seek improved marketing conditions (Hilborn *et al.*, 2005). Especially for inshore fishers, co-operatives increase trust among fishers, which can lead to a reduction of regulatory burden through voluntary agreements between fishers within a co-operative or between co-operatives[18].

Comparison of British inshore and offshore fishers, illustrated that even though fishers gave almost identical ranks to regulatory obligations, there were major disparities in the degree of preference of one RO over another. In general, offshore fishers tended to have more of a marked preference for some obligations over others. Regulatory obligations controlling access were those with highest utile difference, with inshore fishers have a small (three utile) difference between the two highest ranked obligations (open access and ownership rights) whereas for offshore fishers this difference was approximately 40 utiles. Thus, even within a country, the human

[18] In Chapter 5, table 5.7, a comparison of inshore Mediterranean fishers in Cyprus and Spain proves that the existence of cofradias in Spain gives fishers the confidence that (i) ownership of the territory of their cofradia could be beneficial for them, and (ii) Voluntary agreements amongst them can work better than any other enforcement regulation

component in fisheries varies depending on the organisational structure of the fishery, fishers' level of dependence and to other external factors impacting the fishery[19] (Daoutopoulos & Pirovetsi, 1990).

Underlying considerations that became apparent from fishers' responses were due to concerns over the practicalities of implementing regulatory measures. This was especially true for some 'Enforcement and Compliance' obligations. For example, appointing 'on-board observers' was thought to be impractical as having an extra person on-board would imply some difficulties, for both small-scale fishers (who would have space issues) and offshore fishers. The cost of the potential introduction of such a measure was also of concern due to the high number of observers which would be needed. ROs such as 'minimum mesh size' which would require fishers to spend money were also deemed to be impractical, so as the inclusion of VMS devices. In general, even though fishers were not against such measures, they were not keen on having to spend money for the relevant equipment.

Tight legislation and strict enforcement can assist in improving fishers' behaviour against measures they oppose (Haapasaari *et al.*, 2007). 'Enforcement and Compliance' ROs had the most diverse rankings between the different groups. Thus it is important to ascertain differences into the perceptions and opinions of enforcement and compliance regulations[20]. Understanding fishers' relative preferences with regards to existing and proposed management strategies is important for improving compliance and for succeeding the goal of a regime. The current main enforcement instrument ('Controls at Ports') was the most preferred one amongst all groups. Not surprisingly, an 'Increase in Fines' was the least preferred. The low preference for this measure depended on the level of enforcement in each country; (i) some fishers (mainly in Denmark and in the U.K.) considered fines to be high enough. Especially in Denmark, fishers said that in many cases they would receive high fines for 'easily made mistakes'[21]; (ii) some fishers (mainly in the Mediterranean) felt that such a measure is pointless as it is not enforced properly.

[19] Chapter 6 illustrates how external factors, other than regulatory measures can impact on fishers' social and economic resilience.
[20] Chapter 6, section illustrates the existence of different perceptions regarding enforcement and compliance among the various Member States.
[21] For example, when forgetting to ring the relevant port two hours prior their expected arrival.

Uncertainty preceding the introduction of new ROs is regarded by fishers as a risk due to potential impacts and the level of risk has a regional variability. Thus, how fishers perceive and react to risks has to be understood as phenomena largely influenced by their contexts, as created by complex and local circumstances (Lidskog, 1996). One must remember that the stated ACA question asked fishers to state preferences regarding the impact a regulatory obligation has or could have on their income. The question itself urged fishers to reply in a profit-related context. In some cases, fishers replied *"In the short-term or in the long-term?"* This shows that there is already a shift in fishers' understanding regarding the difference between short-term profits and the more sustainable long-term ones. Being aware of how fishers perceive a regime or a specific measure is essential for designing management strategies which can achieve the stated goals. Such knowledge can decrease existing knowledge gaps regarding what makes fishers' accept and thus comply with a regime; what makes fishers persist over their preferred measures and against new ones (which could potentially have a positive impact on their income) and what can be done to get their support for such new measures.

5. When perceptions and opinions collide: Linking risk and trust between fishers and experts in the European fisheries sector

'Status quo, you know, that is Latin for 'the mess we're in", Ronald Reagan

5.0 Abstract

High levels of uncertainty and thus high levels of risk are inherent in fisheries management due to biological, ecological, meteorological, oceanographic and economic variations. For fishers, changes in regulatory and policy systems are considered to be of the highest risk. Thus, when new regulatory measures are to be introduced, fishers tend to oppose them because the disadvantages of change seem to be larger than the advantages. This chapter uses a statistical market research technique, the Adaptive Conjoint Analysis (ACA), to quantify an individual's perceived values with respect to a given management regime assuming that a management regime is a product composed of different attributes. The technique was used to identify differences between (i) fishers' preferred Regulatory Obligations in terms of the impact the regulations have on their income (using data collected fro Chapter 4) and (ii) fisheries experts' preferred Regulatory Obligations in terms of their effectiveness in protecting the fisheries stocks. Additionally, policy simulations were generated to calculate fishers' 'purchase likelihood' for different management scenarios; fishers' ideal scenario, fisheries experts' ideal scenario and the status quo. The comparisons were carried out for fishers and fisheries experts' of the 'offshore Atlantic demersal' métier and the 'Mediterranean inshore' metier and perceptions differed for each *métier*. 'Offshore Atlantic demersal' fishers gave a higher 'purchase likelihood' for the fisheries experts' scenario than the 'Mediterranean inshore' fishers. The results suggest that people's perception of and reactions to risks are phenomena influenced by their contexts, as they are formed by a complex combination of general and specifically local circumstances such as fishers' experience in participation in decision-making, trust and relationship between stakeholders and the status quo.

5.1 Introduction

High levels of uncertainty are inherent in fisheries management due to biological, ecological, meteorological, oceanographic and economic variations (Charles, 1998; Pontecorvo, 2003; Tingley *et al.*, 2010). High levels of uncertainty are accompanied with high levels of risk, a term which has appeared in fisheries management documents since the early 1990s (Francis & Shotton, 1997) and which can be defined as 'a multidimensional and subjective concept with a particular risk or risk event' (Tingley *et al.*, 2010). A study from Tingley *et al.* (2010) suggests that according to fishers' perceptions, risks relating to fisheries management and policy issues are of highest importance (even from risks related to environmental conditions, political conflict and conflict with the sector). Thus, it is important to be aware of stakeholders' risk perceptions regarding management regimes if we are to address any disagreements between the different stakeholders (industry, the scientists and the regulators) in order to increase trust among them and help resolve management and conservation problems (Daoutopoulos & Pirovetsi, 1990; Luhmann, 2000).

The relationship of trust between the scientific community and the public has been weakened by scientific mistakes and is frequently one of scepticism and mistrust (Wynne, 1996; Leiss, 1995; U.K. Government, 2010). Since trust and risk are concepts embedded in social relationships, such relationships need to be understood in order to achieve a collaborative relationship needed for effective management (Chiles & McMackin, 1996). Even though some healthy criticism or 'critical trust' is constructive in policy debates, policy debates in fisheries management have rather suffered from 'distrust' (low level of trust and low scepticism) (Poortinga & Pidgeon, 2003). This loss of trust between the science and industry stakeholders has been recognised as a major obstacle in fisheries management with stakeholders not trusting the science, even if the evidence is strong (Kerr *et al.*, 2006). Thus, psychology and knowledge of human behaviour can contribute to the understanding of what influences perception. In decision making, individuals' rationality is limited by the information they have, the cognitive limitations of their minds (thus how much of the information received they understand) and the time they have to make the decision; a notion known as 'bounded rationality' (Simon, 1978). For example, on one hand mistrust of a regime can be confused with lack of familiarity (Luhmann, 2000). On the other, fishers can develop subjective immunity[1] and consciously understate or exaggerate a risk when they feel that their identity is being threatened from regulatory interventions (Lidskog, 1996).

Economic and environmental sustainability are the two conflicting objectives in fisheries management which have been causing major disputes and disagreements between the relevant stakeholders. During the latest Common Fisheries Policy[2] (CFP) reform in 2002 this issue was acknowledged regarding the importance for improved stakeholder participation. This led to the creation of the multi-stakeholder discussion groups known as the Regional Advisory Councils (RACs). Discussions in the RACs brought to the surface that perceptions regarding the state of the stock and opinions regarding the various management tools vary among the different stakeholder groups (Verweij *et al.*, 2010). Such disputes are expected as fishers' harvest decisions tend to be profit-led whereas decisions made by scientists are informed by experimental data and modelling (Francis & Shotton, 1997; Sethi *et al.*, 2010; Oreskes, 2004). However, differences of opinion are sometimes simply rooted in alternative perspectives, 'both entirely understandable and valid within their[3] windows of perception' (Mackinson & van der Kooij, 2006). Are fishers' perceptions regarding regulatory measures different than experts' opinions? This chapter attempts to explain any potential differences in relation to fishers' participation in decision-making, their relationship with science and their perception of risk.

Regulatory systems depend on scientific evidence to support policy decisions; a need that has been increasing over the years (Funtowicz *et al.*, 2000; Kerr *et al.*, 2006; Griffin, 2009). However, science is one of many inputs in the policy process and scientific contribution is not the decisive factors in decision-making (Funtowicz *et al.*, 2000). Particularly, political externalities arising from the interests of the more politically powerful stakeholders often result in the science being compromised. 'Scientific truth' is rarely convenient for everyone and (especially in environmental policy) it sometimes generates incentives for manipulation and misrepresentation of

[1] Subjective immunity: people can choose to doubt certainty as a result of their beliefs and experiences.
[2] Council Regulation (EC) No 2371/2002 of 20 December 2002 on the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy.
[3] The different stakeholders.

information (Oreskes, 2004). The various stakeholders, be they industry or NGOs, have recognised this and they now have more sophisticated representatives which allows them to be more involved in decision-making and question scientific claims (Funtowicz *et al.*, 2000; Griffin, 2009). There are discrepancies between management-strategy evaluations (MSE) which are peer-reviewed (academic science) with ones carried out on request from fisheries managers or stakeholders (regulatory science) (Kraak *et al.*, 2010). This is partly because regulatory science is required by the political process and by legal requirements to predict certainty (even if certainty is not quantifiable) (Kraak *et al.*, 2010). Such discrepancies can lead to disputes among fisheries experts which intensify fishers' defiance of regulatory measures (Funtowicz *et al*, 2000; Oreskes, 2004) as in such cases regulatory science is suspected to have lost its *raison d'être*[4], to have become politicized and thus restrained from giving its value-free and open-minded judgement (Miller, 2001; Kraak *et al.*, 2010).

This chapter aims to identify the differences and the similarities between (i) fishers' preferred Regulatory Obligations (hereafter: ROs) in terms of the impact of regulations on fishers income and (ii) fisheries experts' preferred ROs in terms of their effectiveness in protecting the fish stocks.

To achieve this, the present study aimed to:

- Identify the important attributes (different themes) of conservation regulations within the Common Fisheries Policy and the specific ROs for those attributes.
- Identify the opinion of fisheries experts in Europe regarding which ROs are most effective for sustainable fisheries.
- Calculate fishers' part-worth utilities (likeness) for each attribute level and thus rank them in order of preference (from data collected for Chapter 4).
- Compare fisheries experts' utilities with fishers' utilities calculated in Chapter 4 for two *métiers*[5]: (i) Atlantic offshore demersal and (i) Mediterranean inshore fishers.

[4] Reason for existence

[5] Homogenous subdivision of a fishery by fishing gear, target species and fishing geographic zone combined.

- Ascertain market simulations (what-if scenarios) in order to compare fishers' purchase likelihoods of the status quo, the fisheries experts preferred and the fishers preferred scenario.

5.2 Methods

This chapter is comprised of two sets of data: (i) data obtained from surveys conducted with inshore and offshore fishers in the Northern and Southern European maritime regions, and (ii) data obtained from surveys conducted with fisheries experts in Europe. For fishers, perceived values for ROs are calculated in relation to the RO's impact on fishers' income. The details on the methodology used and results obtained from the surveys conducted with fishers are discussed in Chapter 4. For fisheries experts, perceived values for ROs are calculated in relation to which RO experts perceive to be best for sustaining resources. The technique used to ascertain fishers and fisheries experts' opinions is a conjoint analysis technique known as Adaptive Conjoint Analysis (hereafter: ACA).

5.2.1 Adaptive Conjoint Analysis

This statistical market research technique basically allows for quantification of an individual's perceived values with respect to a given product by assuming that products are decomposable into separate attributes with different levels (Orme, 2006). Thus, respondents are shown hypothetical product concepts that differ systematically in their attributes, and are asked for their overall reactions to each concept. For this study, fishers and fisheries experts are asked to visualise that a management regime (existing or potential) is a commercial product and that the product's different attributes are the different ROs. The equivalent terms for fisheries management as used for this chapter are illustrated in Table 5.4.1. More technical details about ACA were included in Chapter 4.2.

Table 5.1: Glossary of the Conjoint Analysis terms as their equivalent in Fisheries management

In ACA/Marketing	In Fisheries Management
Product	Management regime
Attribute	Purpose of Regulatory Obligation
Level	Regulatory Obligation (RO)

5.2.1.1 Selection of fisheries experts

The survey was sent to 68 fisheries experts from across EU member states. The initial list of experts was comprised of natural scientists, social scientists (political and scientists and economists), Industry and Non-Governmental Organisation (NGO) representatives from both the Atlantic and the Mediterranean. Fisheries experts were selected due to their attendance in high-level stakeholder meeting proceedings on European fisheries (especially meetings organised by DG-MARE) over the past two years (2007-2009). The main proceedings scanned were from RAC meetings, Advisory Committee for Fisheries and Aquaculture (ACFA), General Fisheries Commission for the Mediterranean (GFCM), European Economic and Social Committee (EESC) and the Committee of the Regions. Additionally, a number of CFP relevant reports were scanned and a number of websites of various relevant authorities/organisations (i.e. International Council for the Exploration of the Sea (ICES), European Commission, national fisheries authorities, think tanks and NGOs with an interest in fisheries). All fisheries experts were contacted by email. The email requested the experts' participation and contained information on the study, its purpose and explained the method used and a link to the survey. A second email was sent as a reminder two weeks after the original email was sent. The survey was left online for two months as some experts expressed their interest to complete it at a later date due to lack of time. The data from the completed surveys were downloaded for analysis. Figure 5.1 is a simplified diagram of the data collection and analysis procedure.

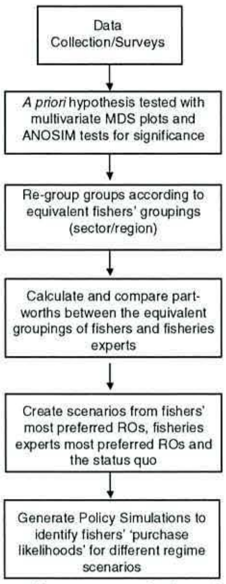

Figure 5.1: Flow-diagram of the data analysis.

5.2.1.2 Data Collection and Analysis for fisheries experts

The fisheries experts were requested to give demographic information (age, gender, nationality, country of employment) and background information regarding their profession such as their discipline and their employer. The fisheries experts were requested to select for which maritime region (North / Atlantic region or South / Mediterranean region) they would like to give their opinion about and for which fleet of that region (inshore or offshore [6]) (The socio-demographic section of the questionnaire is presented in Appendix 3).

The first two parts of the questionnaire are termed the 'Priors': ranking and importance questions. During the ranking questions, the respondents were asked to rate whether they believe a RO is effective in developing sustainable fisheries or not on a 5-point likert scale for each attribute (total of four questions) (Figure 5.2):

[6] Inshore fleet was defined as the fleet which operates within the 12 nm limit, whereas offshore fleet was defined as the fleet which operates beyond the 12 nm limit.

Please rate the following ***"Spatial-related regulations"*** in terms of how effective they are in developing sustainable fisheries in your chosen region(s)					
	Not effective	—	Somewhat effective	—	Very effective
Complete exclusion/ No Access Areas	●	●	●	●	●
No exclusion/ Open Access Areas	●	●	●	●	●
Real time closures	●	●	●	●	●
Ownership right	●	●	●	●	●

Figure 5.2: Example of an 'ACA Prior' question as it is on-screen.

The 'importance' question reiterates the respondent's best and worst levels of each attribute, and they were asked to what extent it is important to achieve the best level of that attribute c.f. the worst (Figure 5.3).

Imagine that the regulatory environment in your chosen region was the same in *all other ways*, apart from the existence of the ROs noted below – In order to develop a sustainable fishery how important would it be to implement the first option instead of the second option?							
	Not Important	—	Somewhat Important	—	Very Important	—	Extremely Important
Complete exclusion/ No Access Areas *--Instead of--* Ownership rights	●	●	●	●	●	●	●

Figure 5.3: Example of an 'ACA Importance' question as it is on-screen.

The 'Priors' are the basis of which the software ranks the relative importance of each attribute, and thereby leads to a focus on the most important attributes for the next section of the questionnaire ('pair section'). It also helps to formulate preliminary estimates of the respondents' utilities. During the 'Pairs' questions, the software makes up two alternative regulatory combinations (with either two levels or three levels in each) from which the respondent is asked to chose the option that would be the most effective in developing a sustainable fishery (Figure 5.4). The respondent has to make a choice (trade-off) between 20 concepts. For the first ten pairs, each concept is comprised of two attribute levels and the next ten pairs are comprised of three attribute levels each. Both anecdotal and experimental evidence has shown that it is usually best to start with only two attributes per concept and, after a few pairs, to increase the number of attributes to three. Beyond three attributes, gains in efficiency are usually offset by respondent confusion due to task difficulty.

Imagine that the regulatory environment in your chosen region was the same in _all other ways_ apart from the existence of the ROs below - which of the two sets of ROs below would be most effective in developing a sustainable fishery?				
Increase in Fines Minimum mesh size		*or*	Random vessel checks on Sea Gear embargos	
• Left would be much better for my income	• Left would be somewhat better for my income	• None will make a difference	• Right would be somewhat better for my income	• Right would be much better for my income

Figure 5.4: Example of an 'ACA Pair' question as it is on-screen.

Following each response the computer updates its estimates of respondents' utilities, and uses this new information to compare the next regulatory combination (Johnson, 1987). The final part of the questionnaire is the 'calibration task'. Four custom-designed concepts are constructed by the software based on respondents' previous responses and the respondent is required to choose a number from zero to 100 to state the desirability of the combination depending on its effectiveness in developing a sustainable fishery (Figure 5.5).

Please consider the four ROs as a set of regulations. Then type a number between 0 and 100 where: 0 = the group below WOULD definitely NOT be effective in developing sustainable fisheries in your chosen region(s) *and* 100 = the group below WOULD definitely be effective in developing sustainable fisheries in your chosen region(s)
Minimum mesh size Increase in Fines Total Allowable Catches/Quotas Complete exclusion/No Access Areas

Figure 5.5: Example of an ACA Prior question as it is on-screen.

5.2.1.3 Utility calculation and Interpretation of results

The conjoint utilities for each individual respondent were calculated with the ACA/HB software (which uses the Hierarchical Bayes (HB) method described in Chapter 4.2.1.4) for each level of each attribute and for each individual respondent. These utilities were then imported into the Sawtooth Software Market Research Tools (SMRT) program which allowed the segmentation of the utilities from fisheries experts utilities into different groups depending on their discipline and the maritime region/sector they have chosen to give their opinion on. Then, the multivariate statistical software PRIMER (Clarke & Gorley, 2006) was used to test the null hypothesis that the responses given by fisheries experts of different disciplines and maritime regions/sectors did not differ. PRIMER allows the exploration of similarities among samples with a number of variables and allows the samples to be grouped according to how similar they are. It also allows the use of factors to explain these groupings (for example maritime region, fleet, sector etc).

The conjoint utilities calculated in ACA / HB and are presented as interval data (individual respondents utilities have positive and negative values but the values add up to 0), thus the values are required to be transposed into ordinal data. This was done by converting the conjoint utilities into ranks from the most to least preferred regulatory obligation for each individual respondent (for each attribute). A similarity matrix is created and used to form a Multi-Dimensional Scaling (MDS) plot where the samples are organised in a two-dimensional scale, in an attempt to satisfy all the conditions imposed by the rank similarity matrix. For example if fisher 1 has more similar responses to fisher 2 than with fisher 3, then fisher 1 will be placed closer to fisher 2 on the plot than to fisher 3. Thus, the respondents are clustered according to how similar their responses were. The factors used to identify important groupings were the country of operation, the maritime region and sector (inshore, offshore or both).

In this chapter two types of data which result from the ACA output are discussed; conjoint importances and conjoint utilities (part-worths).

Conjoint importances are ratio data which means their values can be added, multiplied, divided etc just like height and weight values. Just like when comparing weight values, the difference between 20 and 30 kilograms is the same as the difference between 30 and 40 kilograms, and 40 kilograms is twice as heavy as 20 kilograms. When comparing conjoint importances is important to keep in mind what is known as 'Number of levels effect'; where an attribute importance appears to depend on the number of levels and the more levels an attribute has, the more it tends to capture the importance (Wittink *et al*, 1992). However, this effect is much reduced in ACA than in other conjoint analysis methods as ACA forces individuals to pay attention to every attribute, whether important or not[7] (Orme, 1997).

Unlike conjoint importances, conjoint utilities are interval data. Thus, the levels within each attribute are ranked from the level with the highest value to that with the lowest value (with 1 being the most preferred level). The utilities are scaled to sum to zero within each attribute. Therefore, even though these values allow for simple operations like adding and subtracting, the values cannot be directly compared (the difference between different levels in each attribute however can). It is important to keep in mind when interpreting interval data is that a negative value does not suggest that the specific level is unattractive but rather that is not as attractive as other levels in that attribute. Dummy coding arbitrarily sets the part-worth of one level within each attribute to zero and the remaining levels are estimated as contrasts with respect to zero.

5.2.1.4 Limitations / Challenges

The scientists completed the survey online. This important detail is a limitation in itself as fishers completed the survey face to face. Thus, the latter group of respondents had the technique explained to them as they were completing the survey. The combination of experts' being contacted by email, the online nature of the survey and the novelty (hence difficulty) of the technique is associated with the low response rate; less than 50%, 28 out of the 60 scientists contacted completed the survey. Other limitations identified include:

- The different levels (ROs) were found to be in some cases too vague and not relevant to all respondents (in an attempt to make the same survey relevant to all *métiers*.
- The ROs/levels were not well defined; Fisheries experts who completed the survey could not clarify any doubts once they started completing the survey.

[7] In other conjoint methods respondents tend to use simplification strategies to answer difficult tasks, thus they tend to consider only the few most important attributes which in turn results in exaggerated differences in importance between the most and least important factors.

- The web-based nature of the survey did not allow for collection of qualitative data to justify reasons behind the respondents' choices/preferences.

5.2.1 Policy Simulations

The ACA questionnaire assessed (i) fishers' most and least preferred ROs with regards to their income and (ii) fisheries experts' most and least preferred ROs with regards to achieving the sustainability goals of the CFP. Sawtooth software's SMRT has a function which uses simulations to transform the calculated preferences into a useful model of projective 'market choices' for different products. The function basically uses the calculated respondents' preferences to estimate their likely preference for hypothetical policy scenarios or profiles (Sawtooth Software, 2007). The Market Simulator lets the researcher model a hypothetical 'market' by specifying each product's level on each attribute. The file of respondent utility values is read, and a computation is made of each respondent's relative utility for each hypothetical product. Thus, SMRT allowed the use of the calculated 'part worths', to calculate fishers' overall utilities for different management scenarios; (i) the status quo regime, (ii) that which would be the most effective for sustainability according to the fisheries experts and (iii) that which would be economically the most profitable according to fishers.

The ACA Market Simulator was utilised for two case studies; the Atlantic demersal fleet and the Mediterranean Inshore fleet. For each case study different products/management scenarios were created; (i) the status quo, (ii) the scenario the fisheries experts rated as best out of the choices given and (iii) scenarios fishers rated best out of the choices given. Although the market simulator was run using the individual utilities of fishers from each relevant case study, individual scenarios were created for each national sub-group. The market simulator model is then interpreted as an index of 'relative desirability' presented as a 'purchase likelihood'. 'Purchase likelihoods' are not to be interpreted literally but rather as a gauge or "barometer" of which scenario is closer to that which fishers' perceive to be best for their income.

5.3 Results

5.3.1 Preliminary data analysis from surveys with fisheries experts

Out of the 60 fisheries experts contacted, 28 completed the survey. Eight of them gave their opinion on management regimes in the Southern region and twenty of them in the Northern region. Table 5.2 illustrates the number of fisheries experts and their discipline who gave their opinion for the Mediterranean region and table 5.3 the number who gave their opinion for the Atlantic region.

Table 5.2: Number of fisheries experts who completed the survey for Europe's Southern Region and their related discipline.

Scientists Total: 8	
Maritime region	**Discipline**
Mediterranean (Inshore) (6)	Natural Scientist (4) Social Scientists (1) Interdisciplinary Scientist (1) Industry expert (0)
Mediterranean (Offshore) (2)	Natural Scientist (2) Social Scientists (0) Interdisciplinary Scientist (0) Industry expert (0)

Table 5.3: Number of fisheries experts who completed the survey for Europe's Northern Region and their related discipline.

Scientists Total: 20	
Maritime region	**Discipline**
NE Atlantic (Inshore) (2)	Natural Scientist (1) Social Scientists (0) Interdisciplinary Scientist (1) Industry expert (0)
NE Atlantic (Offshore) (12)	Natural Scientist (5) Social Scientists (3) Interdisciplinary Scientist (3) Industry expert (1)
Baltic (Inshore) (1)	Natural Scientist (0) Social Scientists (0) Interdisciplinary Scientist (1) Industry expert (0)
Baltic (Offshore) (1)	Natural Scientist (1) Social Scientists (0) Interdisciplinary Scientist (0) Industry expert (0)
NE Atlantic & Baltic (Inshore) (0)	Natural Scientist (0) Social Scientists (0) Interdisciplinary Scientist (0) Industry expert (0)
NE Atlantic & Baltic (Offshore) (4)	Natural Scientist (2) Social Scientists (0) Interdisciplinary Scientist (2) Industry expert (0)

To identify whether fisheries experts cluster according to their policy preferences MDS plots were created. Clustering was detected as shown in Figure 5.6a which displays fisheries experts according to maritime regions/sector but not in Figure 5.6b which displays fisheries experts according to their discipline. The most distinct clustering in Figure 5.6a appears to be for the inshore and offshore group.

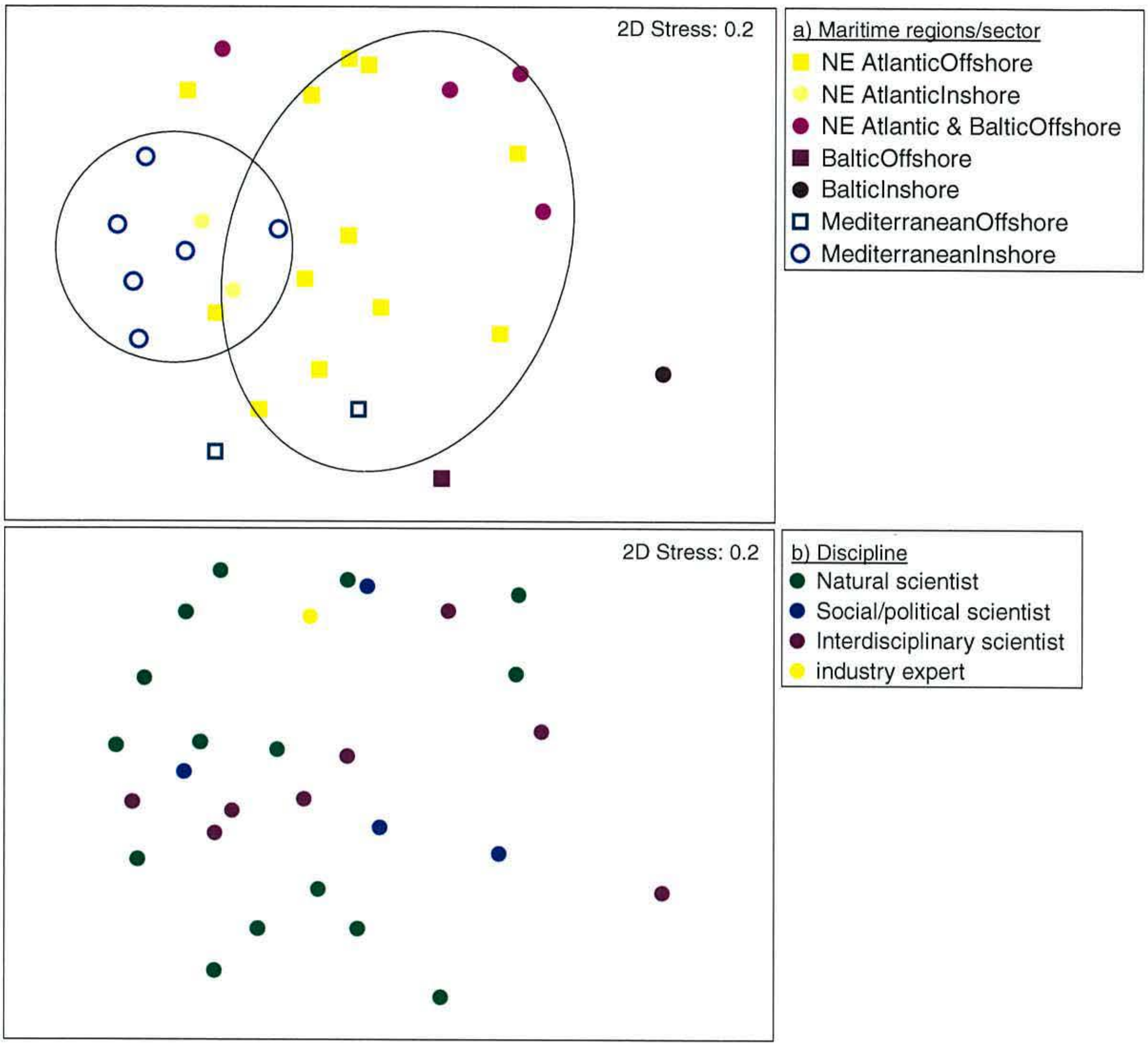

Figure 5.6: MDS (Multi-Dimensional Scaling) plot of Bray-Curtis similarities from non-transformed data conjoint utilities for fisheries experts of different disciplines (Figure b) giving their opinion for different European maritime regions and sectors (Figure a). Circles in Figure 6a are indicative of the clustering in that group.

The ANOSIM analysis did not show any significant differences between the regulatory preferences of scientists for different maritime regions/sector and of different disciplines. There was no significant difference between ranking of ROs between fisheries experts in the Atlantic (North) and the Mediterranean (South) (R=0.091, p=0.16). Similarly, there were no significant differences of the rankings of ROs between different sectors and disciplines (Sector: R=0.08, p=0.15; Discipline: R=-0.159, p=0.99). This was particularly interesting as with the same procedure, fishers' responses showed not only distinct clustering in their national groups and sectors but there were also significant differences among those groupings (Chapter 4, section 3.1).

5.3.2 Adaptive Conjoint Analysis from surveys with fisheries experts

Even though the multivariate analysis did not suggest any significant differences in fisheries experts' opinions regarding the most and least effective ROs, in order to be consistent with the fishers' groupings, the fisheries experts were clustered in four groups according to the maritime region and the sector on which they gave their opinion. Figure 5.7 and Table 5.4 present the conjoint importances and conjoint utilities of the four groups (Offshore and Inshore Mediterranean and Offshore and Inshore Atlantic).

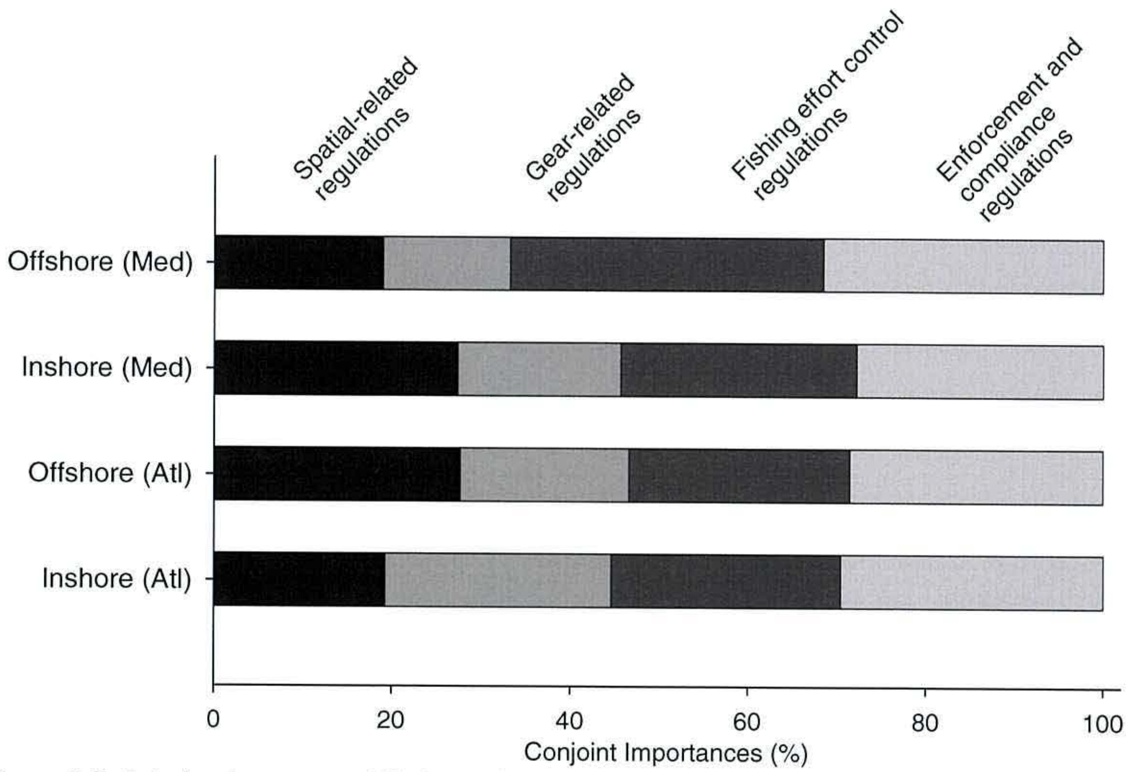

Figure 5.7: Relative importance (%) for each attribute for fisheries experts' preferences with regards to which are the most important attributes for sustaining the fisheries resources in inshore and offshore Mediterranean and Atlantic regions.

Due to the small sample size of fisheries experts giving their opinion on Inshore Atlantic (n= 3) and Offshore Mediterranean (n=1), these two groups will not be analysed or discussed further. In the next section, the utilities of the fisheries experts giving their opinion on the Offshore Atlantic and the Inshore Mediterranean fleet are compared with the opinion of the corresponding fishers.

Table 5.4: Relative utilities (and ranks with 1 being the most preferred level) for each attribute level for the fisheries experts in the Atlantic and the Mediterranean for both sectors, inshore and offshore, as calculated in the (SMRT) Sawtooth Market Research Tool (the number next to each sector is the number of respondents in each category).

	Attribute levels	Offshore		Inshore	
		Atlantic (17)	Mediterranean (1)	Atlantic (3)	Mediterranean (7)
Spatial-related regulations	1.Complete exclusion	-17.59 (3)	15.01 (2)	-13.79 (3)	34.97 (1)
	2.No exclusion	-40.13 (4)	-52.22 (4)	-21.15 (4)	-57.39 (4)
	3.Real time closures	23.92 (2)	13.27 (3)	39.37 (1)	21.39 (2)
	4.Ownership areas	33.80 (1)	23.95 (1)	-4.43 (2)	1.03 (3)
Gear-related regulations	1.Minimum mesh size	-8.38 (3)	14.03 (2)	-21.08 (5)	-33.19 (5)
	2.Gear embargos	-9.55 (4)	31.37 (1)	-0.29 (3)	8.36 (3)
	3. Size limits	-22.13 (5)	-14.72 (4)	-2.17 (4)	-14.01 (4)
	4.Prohibition of explosive/toxic or other similar substances	29.88 (1)	-25.48 (5)	19.28 (1)	28.72 (1)
	5.Prohibition of electric shock generators/percussive instruments etc	10.18 (2)	-5.20 (3)	4.26 (2)	10.11 (2)
Fishing effort control regulations	1.Total Allowable Catches/Quotas	15.97 (2)	-61.00 (5)	-24.92 (5)	-43.16 (5)
	2.General gear prohibitions	-13.13 (4)	-11.44 (3)	-20.39 (4)	14.05 (3)
	3.Days at Sea	13.67 (3)	79.93 (1)	36.12 (1)	42.29 (1)
	4.Minimum landing size	-32.55 (5)	-31.37 (4)	3.92 (3)	-33.08 (4)
	5.Fishing Permits	16.04 (1)	23.88 (2)	5.28 (2)	19.90 (2)
Enforcement and Compliance regulations	1.Increase in Fines	-11.90 (5)	41.88 (2)	-6.54 (4)	-27.72 (6)
	2.VMS (Vessel Satellite System)	5.84 (3)	15.17 (3)	24.88 (2)	36.11 (1)
	3.Controls at Ports	-11.46 (4)	-22.46 (4)	-35.71 (6)	-10.11 (3)
	4.On-board Observers	30.86 (1)	-33.05 (5)	9.41 (3)	-11.35 (4)
	5.Random vessel checks on sea	-24.70 (6)	-63.79 (6)	-34.60 (5)	-17.18 (5)
	6.Voluntary agreements between fishers	11.36 (2)	62.25 (1)	42.55 (1)	30.25 (2)

5.3.3 Comparison of Utilities of Fishers and Fisheries Experts

5.3.3.1 Atlantic Offshore Demersal fleet

Fisheries experts consider enforcement of regulatory measures to be of highest importance for achieving sustainability goals. Comparison of conjoint importances between fishers and fisheries experts is that the 'Enforcement and Compliance regulations attribute' is given the most weight by the professionals (28.52%) whereas it is rated as 3rd and 4th for fishers (British: 19.22%, Danish: 22.96%, Spanish: 21.08%) (Figure 5.8). Access to resources is the most important attribute for the demersal Atlantic fleets. The importance of fishing effort controls attribute was the main (and the only major) difference in the preferences between the three demersal fleets being highest for the U.K. fleet (29.71% in contrast with 22.59% for the Spanish fleet and 22.26% for the Danish fleet).

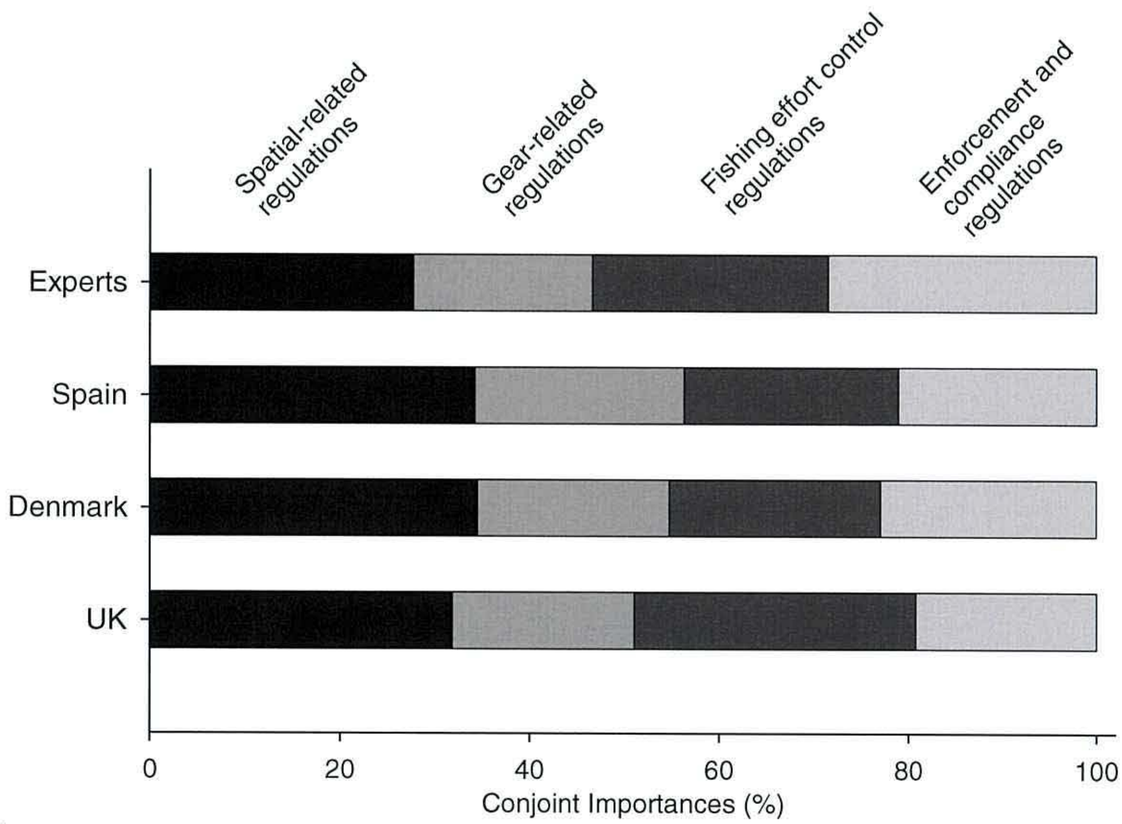

Figure 5.8: Relative importance (%) for each attribute for the offshore fishers in the Atlantic for Spain, Denmark and the U.K.

Table 5.5 portrays the relative utilities and rank order of each level for fishers and fisheries experts. Rankings of the different ROs differed not only between fishers and fisheries experts but also between fishers of different nationalities.

Table 5.5: Relative utilities (and ranks with 1 being the most preferred level) for each attribute level for the Atlantic offshore demersal fishers divided my country (U.K., Denmark and Spain) as calculated in the (SMRT) Sawtooth Market Research Tool (the number next to each sector is the number of respondents in each category).

	Attribute levels	U.K.	Denmark	Spain	Professionals
Spatial-related regulations	1.Complete exclusion	-61.39 (4)	-32.09 (3)	-49.75 (4)	-17.59 (3)
	2.No exclusion	62.91 (1)	73.30 (1)	62.03 (1)	-40.13 (4)
	3.Real time closures	-10.57 (3)	1.48 (2)	11.18 (2)	23.92 (2)
	4.Ownership areas	9.05 (2)	-42.69 (4)	-23.45 (3)	33.80 (1)
Gear-related regulations	1.Minimum mesh size	3.87 (3)	15.24 (3)	-18.28 (3)	-8.38 (3)
	2.Gear embargos	-28.06 (5)	-33.15 (5)	-28.81 (5)	-9.55 (4)
	3. Size limits	-20.55 (4)	-29.59 (4)	-26.94 (4)	-22.13 (5)
	4.Prohibition of explosive/toxic or other similar substances	25.40 (1)	28.94 (1)	38.19 (1)	29.88 (1)
	5.Prohibition of electric shock generators/percussive instruments etc	19.34 (2)	18.55 (2)	35.83 (2)	10.18 (2)
Fishing effort control regulations	1.Total Allowable Catches/Quotas	-48.81 (5)	1.43 (3)	-13.46 (4)	15.97 (2)
	2.General gear prohibitions	8.14 (3)	-22.23 (4)	-22.59 (5)	-13.13 (4)
	3.Days at Sea	-41.24 (4)	-30.16 (5)	-2.19 (3)	13.67 (3)
	4.Minimum landing size	40.03 (2)	24.98 (2)	3.14 (2)	-32.55 (5)
	5.Fishing Permits	41.88 (1)	25.99 (1)	35.10 (1)	16.04 (1)
Enforcement and Compliance regulations	1.Increase in Fines	-29.65 (6)	-45.77 (6)	-40.25 (6)	-11.90 (5)
	2.VMS (Vessel Satellite System)	12.72 (1)	26.15 (1)	12.08 (2)	5.84 (3)
	3.Controls at Ports	12.41 (2)	15.75 (2)	10.84 (3)	-11.46 (4)
	4.On-board Observers	-10.88 (5)	0.14 (4)	9.68 (4)	30.86 (1)
	5.Random vessel checks on sea	8.34 (3)	9.84 (3)	-16.21 (5)	-24.70 (6)
	6.Voluntary agreements between fishers	7.06 (4)	-6.12 (5)	23.87 (1)	11.36 (2)

Capacity control was regarded from both fishers and fisheries experts as the most important measure among the 'fishing effort control regulations'. TACs / Quotas remain a strong preference for fisheries experts who believe they are effective if properly applied and enforced. Fishers ranked TACs / Quotas as one of their least preferred management tools. The national differences in rank demonstrate that the ITQ system in Denmark has positively shifted fishers' attitudes towards this management measure. Conversely, fishers in the U.K. ranked 'TACs' as their least preferred measure and would prefer to be controlled solely by 'Days at Sea'. On a national level, the ranks of the three least preferred ROs for the 'fishing effort control regulations' attribute differed between the three fleets. The Spanish ranked general gear prohibitions as their least preferred regulations (3rd: 'Days at Sea' and 4th: 'TACs / Quotas'). The Danish ranked 'Days at Sea' as their least preferred RO (3rd: 'TACs / Quotas' and 4th: 'gear prohibitions'). The Danish have a smaller fleet thus each vessel obtains a higher percentage of the quotas than vessels in Spain and the U.K. and thus Danish fishers were happier with their TAC allocations. For British fishers 'Days at Sea' (4th) and 'TACs/Quotas' (5th) were their least preferred ROs with a difference of more than 30 utiles from general gear prohibitions (ranked 3rd).

No exclusion was the most preferred RO by fishers from the 'spatial-related regulations'. However, it was rated last by fisheries experts who rated fishers having some kind of ownership to the resources as the most effective measure. For the U.K. fleet 'Ownership areas' was ranked 2nd, 3rd for the Spanish and 4th for the Danish (less preferred than having no access areas). The U.K. fleet preferred to fish within and to have control of their 200 EEZ whereas the Danish preferred to fish in the EEZs of their fellow Member States. RTCs are ranked second from the Danish and Spanish fishers but third from the U.K. fishers. This can be related to the fact that the U.K. fishers were already affected by RTCs at the time of the interview whereas the other two fleets were not.

There was an agreement in ranks of 'gear-related regulations' between fishers and fisheries experts. The sole difference is that fishers ranked gear embargos as the least favourite obligations whereas fisheries experts' ranked size limits. This is probably not because limiting the size of nets is not effective but rather because according to fisheries experts other methods would be more effective.

With regards to 'enforcement and compliance regulations', both fishers and fisheries experts rated 'increases in fines' as their least preferred option. Fishers were happy with the controls which were currently in place ('VMS' and 'Controls at Ports'). However, introduction of on-board observers was ranked low (5^{th} for the U.K. and 4^{th} for Denmark and Spain) whereas fisheries experts ranked on-board observers as 1^{st}.

5.3.3.1.1 Policy Simulation

The ROs ranked as most preferred for each attribute (Table 5) were selected for each group; (i) for the 'gear related' attribute, the first two obligations (prohibitions of explosives/prohibition of electric shock generators) were ignored as they have the same ranks for all groups and because all respondents tended to select them as they thought it was the right thing to do[8], (ii) for 'fishing effort controls', the choice was between TACs and Days at Sea as they are the two important effort controls for the offshore demersal fleet (Table 5.6). Since the simulation is done using utilities calculated from fishers' responses, fishers' scenarios had the highest 'purchase likelihood' percentage with the Danish fishers having the highest 'purchase likelihood' (75.34%), followed by the scenario of the British fishers (73.96%) and that of the Spanish ones (67.33%). The Fishers' 'purchase likelihood' for the status quo scenario was approximately 30% lower than their preferred scenarios. However, the preferred scenario as proposed by the fisheries experts received the lowest 'purchase likelihood' score (33.46%).

[8] This became apparent during the interviews: most fishers (especially those in the NE Atlantic) did not even understand why those two levels were included in the choices.

Table 5.6: The different policy scenarios and their 'purchase likelihood' (Standard Error) percentage by the Atlantic Offshore demersal fishers (RTC=Real Time Closures; TACs=Total Allowable Catches; VMS=Vessel Monitoring Systems).

Policy Scenario	Attributes				
	Spatial-related	**Gear-related**	**Fishing effort controls**	**Enforcement & Compliance**	**'Purchase likelihood' (%) (S.E.)**
A: Status Quo	RTC	Minimum mesh size	TACs	Controls at Ports	44.83 (3.86)
B: Fisheries experts	Ownership areas	Minimum mesh size	TACs	On-board Observers	33.46 (3.08)
C: Fishers (U.K.)	No exclusion	Minimum mesh size	Days at Sea	VMS	73.96 (3.50)
D: Fishers (Spain)	No exclusion	Minimum mesh size	Days at Sea	Voluntary agreements	67.33 (3.38)
E: Fishers (Denmark)	No exclusion	Minimum mesh size	TACs	VMS	75.34 (3.04)

5.3.3.2 Mediterranean Inshore Fleet

'Enforcement and compliance regulations' was given the most weight by the fisheries experts (27.79%) whereas it was rated as 3rd for fishers (20.53% for Cyprus and 21.58% for Spain) (Figure 5.9). Inshore fishers perceived 'fishing effort control regulations' (32.58% for Cyprus and 33.83% for Spain) and 'spatial-related regulations' (29.21% for Cyprus and 27.80% for Spain) as the measure which could have had the most impact on their income.

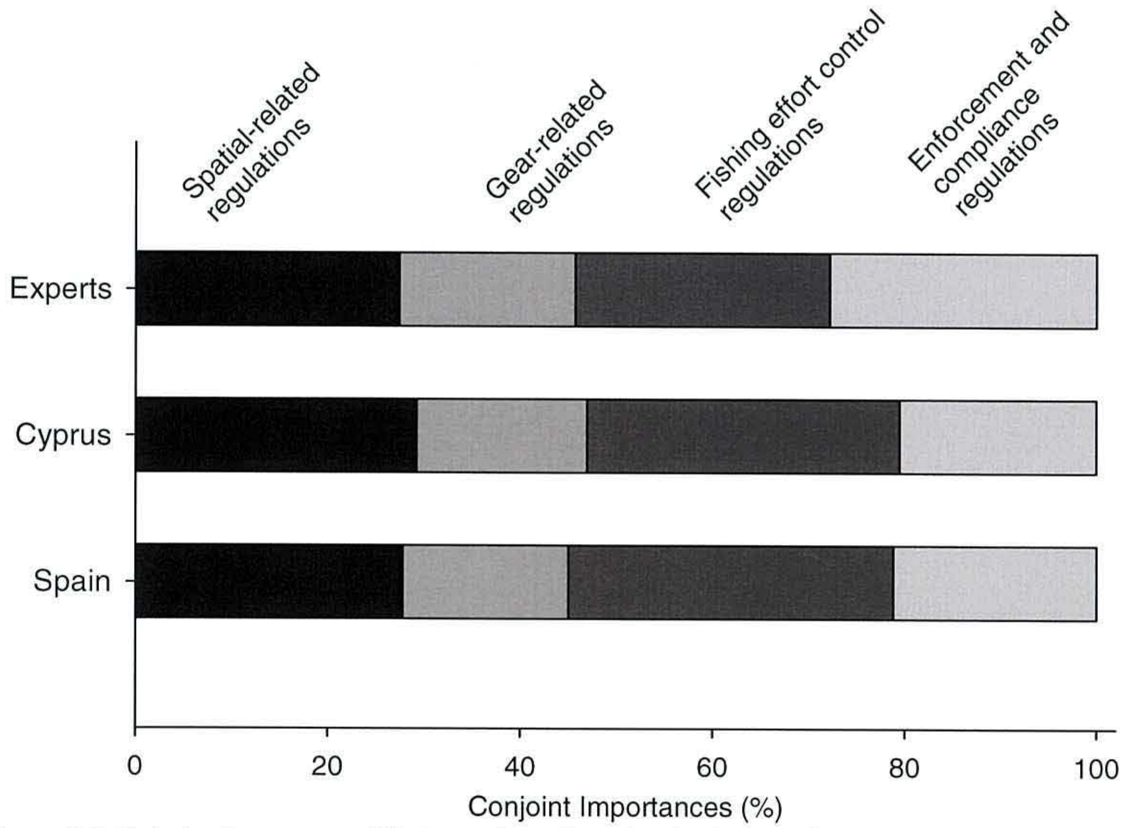

Figure 5.9: Relative importance (%) for each attribute for the inshore fishers in the Spanish Mediterranean and Cyprus.

Analysis of the relative utilities and how they were ranked among inshore fishers in the Spanish Mediterranean and Cyprus have shown national differences among Spanish and Cypriot fishers as well as differences amongst fishers and fisheries experts (Table 5.7).

Table 5.7: Relative utilities (and ranks with 1 being the most preferred level) for each attribute level for the Inshore fishers operating in the Mediterranean divided my country (Cyprus and Spain) and fisheries experts as calculated in the (SMRT) Sawtooth Market Research Tool (the number next to each sector is the number of respondents in each category).

	Attribute levels	Cyprus	Spain	Professionals
Spatial-related regulations	1.Complete exclusion	-43.38 (4)	-37.38 (4)	34.97 (1)
	2.No exclusion	64.38 (1)	19.61 (1)	-57.39 (4)
	3.Real time closures	-9.94 (2)	4.03 (3)	21.39 (2)
	4.Ownership areas	-11.36 (3)	13.74 (2)	1.03 (3)
Gear-related regulations	1.Minimum mesh size	-22.44 (5)	-9.00 (3)	-33.19 (5)
	2.Gear embargos	-19.98 (4)	-27.95 (5)	8.36 (3)
	3. Size limits	-6.79 (3)	-14.09 (4)	-14.01 (4)
	4.Prohibition of explosive/toxic or other similar substances	31.84 (1)	33.18 (1)	28.72 (1)
	5.Prohibition of electric shock generators/percussive instruments etc	17.37 (2)	17.86 (2)	10.11 (2)
Fishing effort control regulations	1.Total Allowable Catches/Quotas	-55.96 (5)	-44.06 (4)	-43.16 (5)
	2.General gear prohibitions	19.58 (3)	14.66 (3)	14.05 (3)
	3.Days at Sea	-50.65 (4)	-48.72 (5)	42.29 (1)
	4.Minimum landing size	26.20 (2)	18.52 (2)	-33.08 (4)
	5.Fishing Permits	60.83 (1)	59.59 (1)	19.90 (2)
Enforcement and Compliance regulations	1.Increase in Fines	-8.82 (5)	-14.92 (5)	-27.72 (6)
	2.VMS (Vessel Satellite System)	12.21 (3)	-9.69 (4)	36.11 (1)
	3.Controls at Ports	19.12 (1)	17.93 (2)	-10.11 (3)
	4.On-board Observers	3.76 (4)	-23.75 (6)	-11.35 (4)
	5.Random vessel checks on sea	18.95 (2)	10.26 (3)	-17.18 (5)
	6.Voluntary agreements between fishers	-45.23 (6)	20.17 (1)	30.25 (2)

For the 'spatial-related regulations', 'no exclusion' was the most preferred RO by fishers and least preferred by fisheries experts. The latter group rated permanent closures (such as MPAs) first and temporary closures (such as seasonal bans) as second. Cypriot fishers preferred 'temporary closures' rather than 'ownership areas' whereas Spanish fishers preferred 'ownership areas' to 'temporary closures'. Spanish fishers were already part of well organized regional organisations (called caletas) and believed that having ownership of their caleta can be economically beneficial for them.

'Gear-related regulations', 'prohibition of dangerous substances' and 'electric shock generators' were ranked as most important for all groups. Gear embargos were ranked 4th for Cypriot and 5th for Spanish fishers whereas fisheries experts ranked it as 3rd. 'Minimum mesh size' were ranked 3rd from Cypriot fishers but 5th from Spanish ones and fisheries experts.

From the 'fishing effort control regulations', 'TACs / Quotas' was the RO least preferred by both fishers and fisheries experts. However, even though fisheries experts' rated 'Days at Sea' as the best way to control fishing effort, fishers gave it a low rating and most preferred capacity control.

The ranks of the 'enforcement and compliance regulations' were the most inconsistent among the three groups. Fisheries experts rated the introduction of 'VMS' on the inshore vessels as their most preferred RO for controlling compliance. Cypriot fishers ranked 'controls at ports' and 'random vessel checks at sea' as most preferred as these two measures would also mean better controls on their biggest competitors: the recreational and illegal fishers[9]. Spanish fishers rated 'voluntary agreements amongst fishers' as the best compliance measure whereas Cypriot fishers rated this measure as last. Again, the organisation of the Spanish fishers in caletas gave a higher sense of trust among fishers whereas Cypriot fishers tend to be very suspicious of each other and would like more control from the relevant authorities.

5.3.3.2.1 Policy Simulation

The ROs ranked as most preferred for each attribute (Table 5.5) were selected for each group. For the 'gear-related regulations' attribute, the first two obligations ('prohibitions of explosives' / 'prohibition of electric shock generators') were ignored as they have the same ranks for all groups and in many cases respondents tended to

[9] Chapter 6 discusses the how the biggest problems faced by inshore fishers in the Mediterranean is the big numbers of recreational and illegal fishers who can operate without many controls.

select them as they thought it was the right thing to do[10] due to the catastrophic potential of the use of such substances/instruments (Table 5.8).

Table 5.8: The different policy scenarios and their 'purchase likelihood' (Standard Error) percentage by the Mediterranean inshore fishers (VMS=Vessel Satellite System).

	Attribute				
Policy Scenario	**Spatial-related**	**Gear-related**	**Fishing effort controls**	**Enforcement & Compliance**	**'Purchase Likelihood' (%) (S.E.)**
A: Status Quo	Temporary closures	Minimum mesh size	Fishing Permits	Controls at Ports	74.24 (1.83)
B: Fisheries experts	Complete exclusion	Gear embargos	Days at Sea	VMS	9.06 (0.86)
C: Fishers (Cyprus)	No exclusion	Size limits	Fishing Permits	Controls at Ports	91.84 (1.50)
D: Fishers (Spain)	No exclusion	Minimum mesh size	Fishing Permits	Voluntary agreements	78.77 (1.66)

Again, similar to the simulation results for the Atlantic Offshore demersal fleet, fishers' scenarios received the highest simulation results with the Cypriot fishers' scenario receiving the highest score (91.84%). The status quo scenario also received a relatively high score (74.24%) unlike the score given to the scenario proposed by the fisheries experts which was only given a score of 9.06%.

[10] This became apparent during the interviews: most fishers (especially those in the NE Atlantic) did not even understand why those two levels were included in the choices.

5.4 Discussion

Fishers' behaviour is affected by their perceptions of risk (Smith & Wilen, 2005). Thus, changes in regulatory systems which are perceived by fishers to be of highest risks tend to be received with hostility and suspicion (Tingley *et al.*, 2010). This study was designed to identify how fishers' perceive the different ROs in terms of the impact ROs have on fishers' income. The risk was also quantified for each RO relative to the ROs in the same regulatory group. More importantly, the study allowed for a comparison between fishers' and fisheries experts' ideal management scenario and the status quo. Fishers and fisheries experts' perceptions differed for the *métiers* explored. The two groups were in effect not asked to rate the ROs with the same measures but taking into account their occupational driver (profit for fishers, sustainability for fisheries experts). It is important to acknowledge the fact that fishers and fisheries experts were asked to state their preferences on regulatory measures against different parameters (income and resource sustainability respectively). Ideally, both fishers and fisheries experts, would have been asked to rank their regulatory preferences under the same parameters. However, this would have meant that each respondent would have to conduct two surveys. This was not possible due to time, logistics and respondents' attention span limitations. Thus, instead of using either the income or resource sustainability parameter, it was deemed more valuable that the occupational driver for each group was used as the parameter. This allowed for the creation of ideal policy scenarios for each group with the relevant parameters. Consequently, the SMRT allowed for the calculation of fishers' 'purchase likelihood' for each scenario. Thus, allowed to identify similarities / variations in fishers opinions with fisheries experts so as to essentially identify some of the underlying reasons for this.

Regulatory measures do restrict fishers' activities and thus have an impact on their income. However, their presence is vital for the conservation of the fisheries resources. Essentially this study detected fishers' apprehension towards potential risks that can arise from new regulatory measures. Additionally, it seems that, unlike fishers in Chapter 4, there is no distinct clustering among (and at least no significant differences) fisheries experts. Partly, this can relate to the smaller sample size.

However, it may also be associated with a general agreement regarding the most effective tools to be used in fisheries management.

The perception of, and reactions to, risks has to be understood as phenomena influenced largely by their contexts, as they are formed by a complex combination of general and local circumstances (Lidskog, 1996) i.e. experience in participation, relationships between stakeholders and the status quo. The latest is known as 'status quo bias', a phenomenon where individuals have a strong tendency to remain at the status quo because the disadvantages of change, seem to be larger than the advantages (Kahneman *et al.*, 1991). In such cases, changes that can make things worse appear to be more plausible than those that can bring gains due to the differential weighting between the advantages and disadvantages of potential changes. Thus, as in prospect theory, the different agents, especially resource users, tend to be loss averse, meaning that they prefer to avoid losses rather than acquire gains (Kahneman & Tversky, 1984).

There were differences in the comparison between fishers' preferences against the status quo and the fisheries experts' opinion in the 'Atlantic offshore' and the 'Mediterranean inshore' group. The 'purchase likelihood' of Atlantic offshore fishers towards the status quo was 44% and towards the fisheries experts' ideal scenario was 33%. In contrast, although the status quo scenario for the Mediterranean inshore fishers had a 'purchase likelihood' almost as high as that of the fishers' ideal scenarios (74%), the purchase likelihood for the fisheries experts ideal scenario was very low (9%). In order to consider the cause of this variability, two factors should be kept in mind: (i) the two regions are already under different fisheries management models (the north/south divide as discussed in Chapter 2), and (ii) different management models apply for inshore and offshore fisheries (inshore fisheries are under national responsibility rather and Offshore under an EU one). Such heterogeneity in behavioural responses to financial risk and other aspects of the economic environment sometimes reflects differences in knowledge and information given by the regulators to fishers rather than differences in behavioural rules (Smith & Wilen, 2005). The creation of management models in the Atlantic has been partly developed following scientific consultation with the industry (especially after the creation of Regional Advisory Councils). However, for the Mediterranean inshore sector, since inshore fisheries management models are formed at a national (and sometime more local) scale, conclusions can be derived on a case by case basis.

In fisheries the various stakeholders have to choose between alternatives with uncertain outcomes, thus choice is not rational as such but based on well-defined preferences influenced by a wide range of behavioural, psychological, cultural and sociological factors (Samuelson & Zeckhauser, 1988; Tingley *et al.*, 2010). Fishers' decisions depend upon familiarity with different measures (especially with the status quo), but also with their relationship with scientists and decision-makers. In contrast, scientists' decisions are impacted by scientific information and regulators/managers would be impacted not only by the scientific information provided to them, but also the trust they have in that information and (sometimes more importantly) the political influence that encroaches upon them. Hence, in many cases a reform is not straightforward as gains and losses of management strategies are non-neutrally distributed and the status quo benefits the politically strong ones, and therefore a reform becomes difficult to adopt (Fernandez & Rodrik, 1991). Additionally, the way political control is exercised, creates a sense of mistrust and lack of faith in the effectiveness and legitimacy of fisheries management strategies (Lowery *et al.*, 1983).

This chapter revisits the importance of participation in governance. Additionally, it acknowledges that stakeholder preferences regarding the participatory process can depend on stakeholders' experience with public participation, their motives for participating and the group's identity (Tuler & Webler, 2010). As a rule of thumb, more industrial fishers are part of wealthier and more organised associations, whereas more small-scale fishers are part of smaller associations with less wealth and political power. However, there are also national differences in fishers' organisational structures which can form fishers' perceptions. For Spanish fishers (inshore and offshore), 'voluntary agreements' was perceived as an important and feasible instrument to achieve compliance. Fishers from both groups were part of strong fishers associations and felt that they could have their voice heard via their association. Inshore fishers of the Cypriot fleet however, for which being part of a fishers association which channels concerns and ideas from the bottom-up is a rather new concept, 'voluntary agreements' is a rather incomprehensible concept. Nevertheless, being part of a relatively influential association is not always associated with trust among fishers. The Danish and British offshore fishers, even though part of strong fishers' associations have rated 'voluntary agreements' at the lower end of the scale. These two groups are often represented at high-level participatory meetings by knowledgeable experts (in science and politics) who the fishers trust to make the best decisions for them. In addition, transposition of and abiding by EU decisions is culturally embedded in the nation's politics, thus they are cognisant of following regulations.

Even though it is now time to reassert science over politics in the fisheries management process not only is it not morally and politically correct to simply impose rules on the industry but an increasing number of studies are now justifying a more active stakeholder involvement for successful management strategies (Pomeroy & Berkes, 1997; Charles, 1998; Jentof, 2005). Stakeholder participation in decision-making is important as it improves stakeholder's understanding of the problem and the risks, thus can lead to more positive attitudes towards scientists and their suggestions (Durant *et al.*, 1989; Lidskog, 1996; Miller, 2001). For years, the fisheries industry 'enjoyed' an authoritarian bargaining with the authorities, by which they relinquished some of their rights for economic security (Desai *et al.*, 2009). Such a regime where Hardin's *commons* are left out of the policy process creates an 'us versus them' attitude, which leaves fishers no other role other than to catch as much fish as possible and ignore the rules (Charles, 1998). This created a paternalistic industry and an authority with hierarchical and bureaucratic tendencies where policy risks are acceptable as long as institutions have protocols for dealing with them (Tingley *et al.*, 2010). Failure of the management strategies to protect the industry led to the loss of trust between the two groups leading to a social amplification of risk which spawns behavioural responses which in turn will result in impacts such as stigmatization of risk managers (regulators) but also in political and social pressure (Kasperson *et al.*, 1988).

In conclusion, a risk event can mean different things to different people and these risk perceptions are context and culturally dependent (Tingley *et al.*, 2010). This close relation of fishers' perceptions with the status quo re-enforces the concept that fishers are not solely profit-led individuals. The strong desire to maintain the status quo has been developed by fishers mainly due to uncertainty over a future regime's potential effectiveness and this enhances the need for change in the way information is communicated between stakeholders; the status-quo should be stated as a reference point during communication between resource users and fisheries experts (Kahneman *et al.*, 1991). Via proper communication, fishers can be shown how a reformed strategy will work and in what ways it will be better for them contrary to the status quo. It is rather how each instrument is applied and enforced according to the specificities of each region which will eventually lead to the biological and economic success of a regime. The loss of trust between stakeholders needs to be reinstated if the collaborative relationship which is essential for effective management in fisheries to be achieved. Acceptability of the newly reformed CFP by the industry could be the gelling agent for its success. However, acceptance can only come with understanding which in turn can only come with participation. The way to achieve this is by scaling-down the decision making process.

6. Importance of social knowledge for robust and compliant Socio-Ecological Systems

6.0 Abstract

Even though natural resource management requires rigorous scientific knowledge, social science research can provide data such as information on fishers' social and economic situations. This chapter focuses not only on how social science data can help identify factors behind robust and non-robust social-ecological systems (hereafter: SESs or systems) but also what influences compliance in different institutional arrangements. A framework proposed by Anderies *et al* (2004) was adapted and used to explore the resilience of three different fisheries SESs in the EU; the Mediterranean inshore fleet, the Danish island of Bornholm and the East coast licensed small boat association on the East coast of Scotland. The three case studies illustrated that the complex interactions among different agents in SESs force them to adapt to different conditions showing that internal reactions to external disturbances vary amongst different fishing communities. The Mediterranean small-scale fishers do not seem to have been particularly affected by the CFP regulations but a major problem has been their inability to compete (spatially but also in terms of markets) with the illegal fishers and/or the politically strong recreational fishers. The biggest problem for Cypriot inshore fishers has been the invasion of the rabbit fish population. The equivalent inshore fleet on the East coast of Scotland seems to believe that their interests are not sufficiently protected as the interests of their offshore counterpart. Bornholm's biggest problem appears to be arising due o its isolation for example the less competitive market prices of fish. Additionally, variation in law enforcement and inspections shows that each country adjusts European rules to its own culture and way of life. The success of fisheries control is uneven with many fishing activities being efficiently controlled and other activities not controlled at all or having a level of control that is clearly insufficient. The variability in what influences the robustness of different SESs in the EU along with variability in national perceptions and levels of compliance illustrates that social knowledge data are vital for decision making. More importantly, such data can only fulfil their potential if collected at the appropriate scale. With the rise of multi-disciplinarity in fisheries management, tt is important that economists have a better understanding of the ecology and ecologists become less naïve of economic, political and social realities

6.1 Introduction

Sound natural resource management requires rigorous scientific knowledge to underpin what is ought to be done for fisheries sustainability, but this is not sufficient on its own (Schusler *et al.*, 2010). Social science research can provide data beyond the relationship between the resource and the resource user such as information on fishers' social and economic circumstances or status. Lack of socio-economic data means that localised social conditions are not taken into account during policy-making and this can lead to conflict among the different stakeholders, low regulatory compliance, significant delays and overly complicated management measures (Fricke, 1985; Kaplan & McCay, 2004; Marshall, 2007). This chapter focuses on (i) how social science data can help identify factors that would underpin robust and non-robust social-ecological systems (hereafter: SESs or systems) and (ii) what influences compliance in different institutional arrangements. Such social knowledge is important but needs to be understood at the appropriate scale (be that national, coastal etc) due to the demographic, biological and cultural differences which can affect robustness and compliance.

Fisheries management in the European Union has had to adapt to the bio-physical specificities of different seas and oceans, as well as their political, economic and cultural differences of the adjacent Member States and non-EU states. The interactions that occur amongst social, economic, biological, environmental and regulatory components, involving fishers and fishing communities, fishery capital, fish stocks, and economic and ecological environments have resulted in this sector being heavily regulated by a complex set of rules, that are embodied within the Common Fisheries Policy (CFP) (Charles, 1988). Upon entering the EU, Member States give decision-making power give to a democratic European Council which decides on institutional solutions to resource problems. However, fishing communities absorb different levels of external shocks depending on their socio-economic environment and attempts to improve their performance from outside can undermine their ability to cope with change, maintain their structure and function (Janssen *et al.*, 2007). The cultural variations in the EU can influence any imbalances regarding the operation (i.e. enforcement) and outcomes of policy processes (Yearley *et al.*, 1994). Additionally, due to internal European political bargaining processes regarding decision-making, policies may favour those countries with the strongest political platform (Yearley *et al.*, 1994). This chapter uses social knowledge to explore two different concepts; (i) the links between institutional arrangements and ecological dynamics in fisheries Socio-Ecological Systems and (ii) the differences on levels of enforcement and compliance across the EU, but also regarding the perceptions of authorities.

6.1.1 Resilience of Social-Ecological Systems

A common explanation for the collapse of SESs throughout the centuries has been their "failure to adapt" to environmental, institutional and other changes (Janssen *et al.*, 2003; Folke *et al.*, 2005). Robustness is a concept which 'emphasizes the cost-benefit trade-offs associated with systems designed to cope with uncertainty' (Anderies *et al.*, 2004) and is related with resilience; which is the amount of change required to transform a system to one with a different set of processes and structures (Holling, 1973). Robustness, and thus resilience, of many resource-dependent SESs depend on ecological resilience (the sustainability of natural resources), which is the foundation of their social and economic vitality (Anderies *et al.*, 2004; Janssen *et al.*, 2007; Robards & Greenberg, 2007). Thus, with resources facing a decline and controls in resource extraction becoming stricter[1], such resource-dependent systems face socio-demographic disadvantages (Pauly *et al.*, 1998; Robards & Greenberg, 2007).

SESs integrate a number of important dimensions of social structure that are ruled by stability dynamics that emerge from three complementary attributes: resilience, adaptability, and transformability (Walker, et al., 2004). A resilient system has the capacity to absorb disturbance and reorganise while undergoing change, so as to still retain essentially the same function, structure, identity, and feedbacks (Walker *et al.*, 2004, Janssen & Ostrom, 2006a). An adaptable system has the capacity to influence resilience without changing the dynamics of a system (Walker *et al.*, 2004; Walker *et al.*, 2006). However, if a system is highly adapted to a range of variability through

[1] Management inherently affects dynamics and emergent structures of the entire SES.

specialised institutions it can be more vulnerable to new unknown changes (Nelson *et al.*, 2007). In order to sustain such systems, it is important to understand these dynamics as they not only face predictable and well-understood variations but also unpredictable temporal and spatial variations in social and natural variables (Folke *et al.*, 2005; Janssen *et al.*, 2007; Robards & Greenberg, 2007). Such key interactions are particularly important with regards to robustness but often are overlooked (Anderies *et al.*, 2004).

It is thought that stable systems are able to return to equilibrium faster and with less fluctuation following external change, and that introducing an external undesirable change can decrease resilience, increase vulnerability, increasing the risk of the whole system flipping from one state to another (Holling, 1973; Folke and Berkes, 1995; Nelson *et al.*, 2007). Such complex systems are able to organize around continuous change (Janssen *et al.*, 2007; Robards and Greenberg, 2007) and in the event of a change, a system can either be resilient, or it can adapt or transform itself.

The catching sector of the fishing industry is continuously developing ways to remain profitable by adapting to changes such as fluctuations of the resource biomass, changes in operating costs and regulatory changes. Adaptive strategies include:

- Transformability, where fishers shift to a different metier when ecological, economic, or social (including political) conditions make the existing system untenable (Walker *et al.*, 2006).
- Diversification, which involves the broadening of alternatives, both within fishing and between fishing alternative livelihoods (McCay, 1978).
- Intensification, which refers to an increased commitment to an investment in one or another mode of resource procurement (McCay, 1978).

There are a few examples where EU solutions have transformed social-ecological systems rather than help them adapt to the current situation (Folke, 2006). For example, decommissioning schemes and Individual Transferable Quotas (ITQs) in Denmark have caused a shift in the capacity of fishing fleets (see Danish Pelagic fleet shift, section 3.2.3 in Chapter 3). In contrast, subsidies on the other hand have been used to help communities adapt to new regulatory measures by acting as shock absorbers[2]. However, the excessive use of subsidies by the EU, distorts the economic landscape of fisheries without addressing the underlying issues such as the overcapacity of the sector (Robards & Greenberg, 2007) and sometimes encourages people to stay in a non-viable fishery.

A system's resilience encompasses the following crucial aspects and is influenced by individuals or groups: (i) Latitude: the maximum amount a system can be changed before losing its ability to recover; (ii) Resistance: the ease or difficulty of changing the system – how resistant the system is to being changed; (iii) Precariousness: how close the current state of the system is to a limit or "threshold"; (iv) Panarchy: cross-scale interactions such as politics, ecological changes, market changes etc which trigger unpredictable events and thus the resilience of a system depends on different agents interacting (Walker *et al.*, 2006). This chapter was focused on the last point, the aspect of resilience known as panarchy[3].

6.1.2 Compliance

Robustness of a social system is an important component of fisheries management and it depends on the following factors which allow a regime to adapt to the system's ecological, economic and political situation: (i) the acceptance of the regime by stakeholders (how they perceive and respond to management), and (ii) the regime's capacity for institutional learning (the process by which institutions change in reaction to internal pressures or external changes in the ecosystem or socio-economic contexts) (Christensen *et al.*, 2009).

A system's resilience (thus robustness) is positively related to compliance. Rules that are understood and deemed legitimate and functional by fishery stakeholders have the potential to lead towards robust and effective management of fishery resources (Cinti *et al.*, 2010). However, compliance does not just depend on the ability of fishers to endure change. It also depends on factors such as historical compliance culture,

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[2] For example, fuel subsidies to fishers aim to assist fishers in times when fuel prices are too high.
[3] A model of linked, hierarchically arranged adaptive cycles that represent the cross-scale dynamic interactions among the levels of a system and consider the interplay between change and persistence (http://www.resalliance.org).

users' perceptions on governmental institutions and the institutional arrangements all of which differ among the different areas of the EU. To understand compliance, existing linkages between diverging factors that influence environmental harm between issues of social and environmental justice need to be examined in an historical context (Hauck, 2008). If fishers respect the institution, they may feel a moral obligation to comply with the rules imposed by the institution and may also influence their peers to comply (social influence) (Sutinen & Kuperan, 1999). Even if in theory a regulation can result in sustainable resource extraction, if it is not aligned with the local cultures and traditions, then it will most likely fail. Thus, just as it is important to understand the inter-relationships and complexities leading to resilient systems, those leading to non-compliance also need to be understood.

6.1.3 Aim and Objectives

The aim of this chapter is twofold. Firstly, to understand how the different agents in the resilience framework interact (resource, resource users, public infrastructure and public infrastructure providers) in three different fisheries SESs in the EU. Thus, the systems' resilience is explored in terms of institutional arrangement and ecological dynamics. Secondly, since levels of compliance are positively related to a system's resilience, this chapter will explore how different SESs react to institutional arrangements in a historical and cultural context. Specific objectives are to:

- Analyze the robustness of Social-Ecological Systems from an institutional perspective in three different SESs using the framework designed by Anderies *et al.* (2004) incorporating primary field data and other relevant literature. The SESs examined are the Mediterranean inshore fleet, the Danish island of Bornholm and the East Coast Licensed Small Boat association on the Scottish East coast.
- Examine levels of compliance in the different Member States by analysing enforcement and compliance data given to the EU by the Member States.
- Identify regional perceptions regarding enforcement and compliance but also regional perceptions on institutional arrangements from primary and secondary data.

6.2 Analysis of different Social-Ecological Systems in the European Union

This section goes beyond the one-dimensional view of resource users' harvesting decisions, or of decision-makers' regulatory-choices, and attempts to explore the resilience of three different fisheries SESs in the EU using a modified version of the framework proposed by Anderies *et al.* (2004) (hereafter: framework). The framework was designed to be used by researchers with diverse disciplines as a method to analyse internal dynamics among four components of a SES; two human components: resource users and public infrastructure providers: the resource and public infrastructure. By studying the resilience of a resource-dependent SES, one can explore how the resource-users interact with the other three components of the system and how they react to a change that be an environmental problem i.e. stock collapse, change in the biology of the natural system, or a change in the management regime etc.

6.2.1 Methods - The Analytical Framework

The framework consists of a set of definitions and a list of attributes that are of key importance to understanding the robustness of a SES. Specifically, it looks at how institutional arrangements affect the robustness of SESs and for this study in particular whether regional differences in such arrangements lead to different levels of robustness. To achieve this, disturbances which occurred over time were isolated, the processes triggered and problems caused were described along with the reactions in response to these problems (Ternström, 2004). Thus, the links between the different entities/elements of the system in the framework were identified and examined thoroughly (Figure 6.1). In the framework proposed by Anderies *et al.* (2004), the resource is a form of natural capital transformed for use by resource users. The public infrastructure providers intervene to control its use through regulatory measures (public infrastructure). The resource users and the public infrastructure providers are two actors with 'different specialized tasks' leading to more complex SES (Janssen & Ostrom, 2006a).

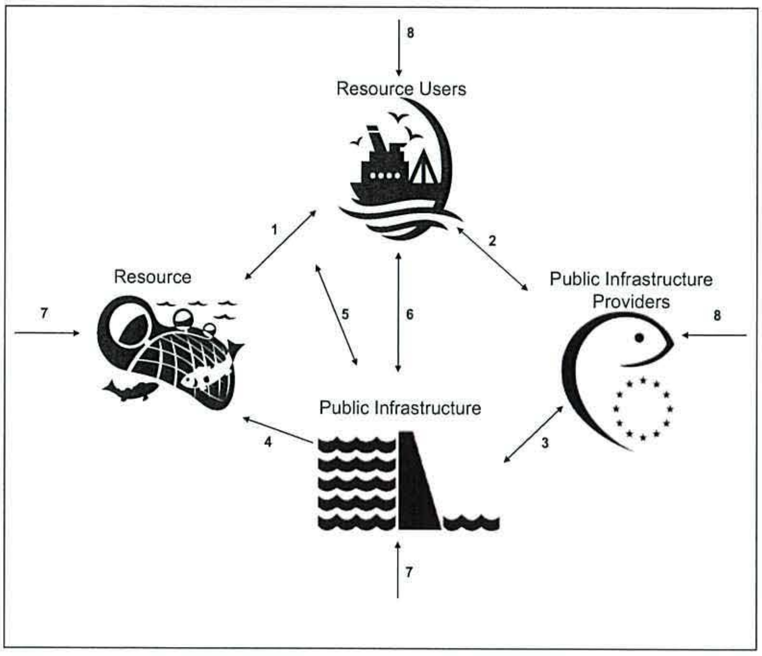

Figure 6.1: A conceptual model of a social-ecological system with the numbered links involved between the four agents (the numbered links are described in Table 1) (adapted from Anderies *et al.*, 2004).

For this study some of the entities of the framework interact in a different manner. The term public infrastructure depends upon the SES context and can represent either physical or social capital, where physical capital includes engineered works such as dams and social capital represent the rules used by those governing, managing, and using the system (Janssen, 2006). Public infrastructure providers are national or EU wide policy/decision makers. According to the framework, links between entities were identified and numbered and are presented (Table 6.1).

Table 6.1: Links involved in social-ecological systems (adapted from Anderies *et al.*, 2004).

Number	Link
(*)	Between different users
(1)	Between resource and resource users
(2)	Between users and public infrastructure providers
(3)	Between public infrastructure providers and public infrastructure
(4)	Between public infrastructure and resource
(5)	Between public infrastructure and resource dynamics
(6)	Between resource users and public infrastructure
(7)	External forces on resource and infrastructure (biophysical disruptions)
(8)	External forces on social actors (socioeconomic changes)

6.2.1.1 Nature of Data

Empirical data for this chapter were derived from the surveys conducted for the data collection for Chapter 4. Problems and challenges faced by fishers which repeatedly came up during conversation were further explored using secondary data such as past research literature, national reports, relevant national and European regulations and follow-up discussions with governmental fisheries experts. Thus, using the adapted framework, key interactions (links) were analysed for three SESs (see section 2.2).

6.2.2 Case Studies

The three case studies to which the framework was applied were (i) the Cypriot Inshore fleet (with references to the equivalent one in the Spanish Mediterranean) (ii) the East Coast Licensed Small Boat Association on the Scottish East coast and (iii) the fleet of Bornholm island, Denmark (Figure 6.2). The main entities identified for each SES are presented in Table 6.2.

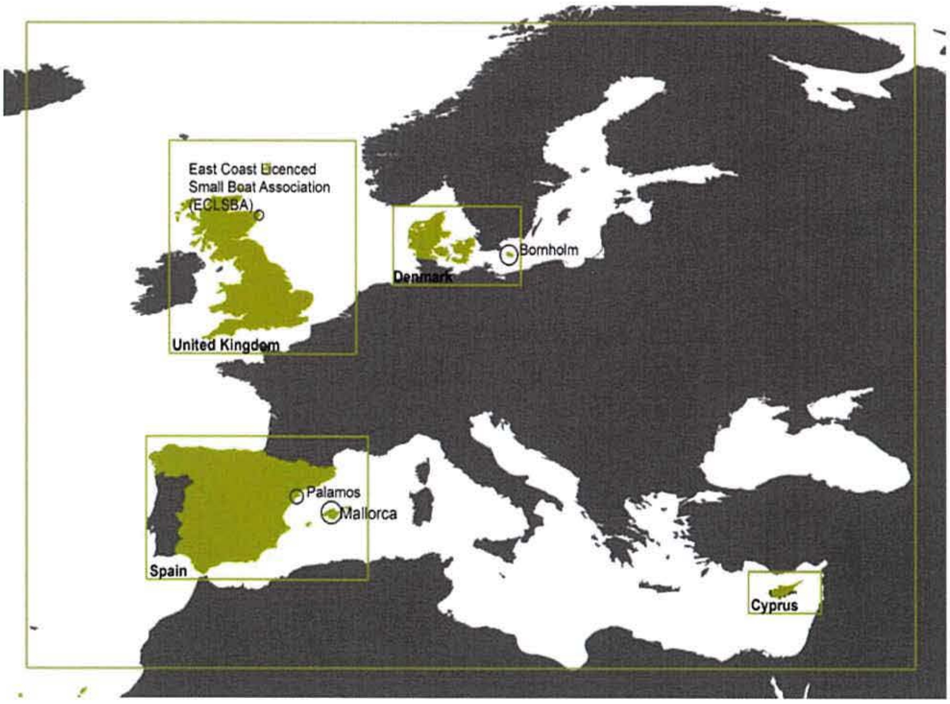

Figure 6.2: Map of Europe with the selected European Member States visited; United Kingdom, Denmark, Spain and Cyprus, and the areas for which Anderies' framework was applied to pointed out; (i) Cyprus/Palamos/Mallorca, (ii) ECLSBA) and (iii) Bornholm.

Table 6.2: The different entities involved in the three EU fisheries Social-Ecological Systems (adapted from the framework proposed by Anderies *et al.* (2004)).

Entities	**Social-Ecological System**			**Potential Problems**
	Inshore Fleet, Cyprus	East Coast Licensed Boat Association, U.K.	Bornholm island, Denmark	
Resource	-Fishery	-Fishery	-Fishery	Complexity, Uncertainty
Resource Users	Professional Fishers; passive fleet, polyvalent fleet, trawlers Recreational fishers	Professional Fishers; Inshore: ECLSBA, Offshore: Scottish, Spanish, French	Professional Fishers; Bornholm, Danish, Polish, Latvian, German, Russian Recreational fishers	Overharvesting
Public Infrastructure providers	Local and national representatives, Department of Fisheries and Marine Research, national decision-makers, EU	Inshore Fisheries Groups (IFGs), Scottish fisheries protection agency (beyond 12 miles), National POs, National decision-makers, EU	Danish fishers' Association, National decision-makers, EU	Internal conflict, indecision about which policies to adopt Information lost
Public Infrastructure	National Fisheries Act, CFP, Aswan dam, Suez canal	National Fisheries Act, CFP	National Fisheries Act, CFP	Failure to reach goal, Uncompliance

6.2.2.1 Case study I: Cypriot inshore fleet (with references from the Spanish Mediterranean)

Empirical data for this case study were primarily collected in the majority of ports along the Southern coast of Cyprus[4] during June 2009. Data from ports in Palamos and the island of Mallorca (Spanish Mediterranean) were also collected in July 2009 but were limited due to time restrictions and language barriers. Fishers were approached and the purpose of the study was explained to them and they were asked to participate. In Cyprus, individuals from the Department of Fisheries and Marine Research (hereafter: DFMR) were interviewed to get an alternative view to that of the fishers. The Cypriot inshore fleet is mainly composed of small fishing vessels (>12 m) that use passive gear that is deployed seasonally (see Chapter 3 section 3.2.1.1 for more information on the fleet). This fleet is the most important in terms of vessel numbers (93% of the overall active fleet), but also in terms of employment (74% of the total employment of the Cypriot fleet). The fleet is also the most significant in terms of its contribution to national fleet production representing 44% of the total national volume of landings and 58% of the total value of landings with value of around €1.1 million in 2007 (AER, 2009). Cyprus belongs to the Eastern Mediterranean GFCM Division 3.2 (Levant Sea), an area characterised by a narrow continental shelf, high depth and alow level of biological productivity due to the low nutrient composition of the water (Papaconstantinou & Farrugio, 2000). The Spanish Mediterranean belongs to GFCM Division 1.1/the Balearic area. This is an area of relatively high productivity, where purse-seiners and trawlers predominate and the small-scale inshore fishery is also well developed (Papaconstantinou & Farrugio, 2000).

<u>Link 1 - Between resource and resource users</u>: Despite the region's low productivity status the fisheries in the Mediterranean have demonstrated a surprising resilience to fishing compared with some areas of the Atlantic (Lleonart, 2005). Nevertheless, commercial fisheries in the Mediterranean are already in serious danger from the dual affect of environmental pollution and overfishing (Lleonart, 2005). With the

[4] Visits along the North coast was not visited due the political situation in Cyprus: the island was partitioned in 1974 during the Turkish Invasion and the Northern part of the island has been under Turkish occupation since.

increasing pressure of the main fisheries habitats due to the increase of coastal population the threat is even greater especially since the narrowness of the continental shelf means that a substantial part of the fishing activities are carried out close to the coast (Symes, 1999b; Turley, 1999). There is also a great diversity in the bio-production in various areas, and differences in the capacity among Mediterranean countries leading to an uneven catch among the coastal states (Zei, 1978).

Link 2 - Between resource users and public infrastructure providers: The rather dysfunctional relationship between fishers and the Cypriot authorities makes attempts at a collaborative relationship between the industry and the authorities rather challenging. There is a general lack of trust and confidence in the authorities which originates in a rather cynical view that in Cyprus having the right personal contacts overrules any regulatory measures. During discussions with Cypriot fishers their mistrust of the Cypriot authorities and the decision-makers in particular was apparent. The Cypriot Department of Fisheries and Marine Research (DFMR) has the difficult task of being the 'middle man' between the decision-makers and the resource users and it is sometimes also mistrusted by resource-users. Thus the majority of the fishers were optimistic that the country's accession to the EU would have a positive impact on their profession.

A recent example which widened the gap between resource users and decision-makers was the introduction of the legislation measure in 2007 which gave recreational fishers professional status (Category C status). According to this new regulation (Number 132(I) of 2007) Category C holders are allowed to use nets of restricted mesh and of maximum 600 metres but only during weekends. This legislation was introduced after the introduction of EC Regulation 1967/06[5] which prohibited recreational fishers from using fishing nets and thus catching large amounts and species of fish. For many, the introduction of Category C status was a mechanism used by decision-makers (members of parliament) to benefit influential and rich recreational fishers prior to elections. According to the president of the Association of Professional Fishermen, Andreas Adamou, in Cyprus mail[6] 'instead of the Cyprus

[5] Council Regulation (EC) No 1967/2006 of 21 December 2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea.
[6] http://www.cyprus-mail.com/cyprus/parliament-accused-passing-fishing-laws-attract-votes

Parliament approving the regulation (EC No 1967/2006) so that it can become law, after pressure from the masses of amateurs and in an attempt to attract votes, not only did it not approve it, but instead bypassed it and with a special legal amendment created a category C of fishermen.'

To make matters worse, according to professional fishers, Category C holders were sometimes upgraded by the DFMR to a Category A or B status[7] (and sometimes Category A or B fishers were downgraded to Category C). Apart from the time allowed for fishing and the gear used, the different categories are also associated with allocation of subsidies; Category A fishers receive more than those in Category B, whereas those in Category C are not eligible for subsidy payments. Nevertheless, disputes regarding the licensing system appear to be a matter of status rather than a financial one. Fishers derive considerable satisfaction from their work and they are extremely proud of their identity as fishers, even if they fish only part time (or recreationally) (van Ginkel, 2001).

Despite the fact that the accession of Cyprus to the EU led to an increase in regulatory obligations for its fishers, it is perceived as a positive step, for two main reasons: (i) fishers feel they can make objections against the national decision-makers to the EU, and (ii) the European Fisheries Fund (EFF) mean an easier escape from the industry, better fishing shelters[8] etc. A veteran fisher in Ayia Napa harbour commented: "the EU regulations are the best we have had. The job (fishing) has been destroyed by those who have jobs other than fishing but they are still fighting to have the same rights as the full time fishermen. The new measures on early retirement[9] has benefited this place. There are fewer boats and thus the resources are increasing". However, subsidies also have been a source of disputes between the DFMR and the fishers, as fishers do not always trust the DFMR to use these subsidies to the advantage of fishers. During a visit to Zigi harbour, I was shown a mug on which was inscribed: 'Strategic Fisheries Development Plan 2004-2006, Financial allocation for

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[7] Category A and B are for professional fishers for whom fishing is their main (Category A) or part-time (Category B) occupation.
[8] Fishing shelters are small harbours.
[9] Under axis 1 of the European Fisheries Fund (EFF) aid can be given for fishers looking for an early retirement.

fisheries sector € 7,7 million' to which the fishers commented '€ 7,7 million and all we got is this mug'!

Link 4/5/6 - Between public infrastructure and resource and their dynamics/ between resource users and public infrastructure: The opening of the Suez Canal in 1869 and the construction of the Aswan High Dam in 1964 were two important events which impacted upon the ecology of the Levantine Basin (El-Sayed & van Dijken, 1995):

(i) The opening of the Suez Canal triggered the biggest problem currently faced by the Cypriot fishers; the invasion of a species referred to by the locals as lagocephalos (rabbit fish), or commonly known as silverstripe blassop (*Lagocephalus scleratus*). The silverstripe blassop is widespread in the Indo-Pacific and migrated from the Red Sea into the Mediterranean through the Suez Canal and is thus a "lessepsian migrant[10]" (DFMR, 2009). According to DFMR, *Lagocephalos* was first reported in Cyprus in 2000, although it has become more common in catches since 2004. Measuring up to 100 cm in length and 7 kg in weight, *Lagocephalos* can cause serious damage to the catch and fishing gear of fishermen, using its powerful jaws. Additionally, it has no commercial value due to the presence of tetrodotoxin in its tissues[11].

(ii) The Eastern Mediterranean ecosystem has always been relatively stable with the annual flood of the Nile River being the most important event regulating the fertility of the region (El-Sayed & van Dijken, 1995) providing seasonal inflows of sediment and nutrients into Eastern Mediterranean GFCM Division 3.2 (Papaconstantinou & Farrugio, 2000). The construction of the Aswan High dam led to the dramatic reduction of this inflow of sediment and nutrients with immediate impacts on the small pelagic fish resources (Papaconstantinou & Farrugio, 2000). El-Sayed & van Dijken (1995) proposed that the reduction of the fish catches (pelagic and demersal species) off the Egyptian coast has grown back to levels comparable to those prior the construction of the dam but that this is the result of the discharge of human sewage and agricultural drainage replacing the nutrient subsidy once provided by the Nile (Nixon, 2003). The damming of the Nile, has thus thought to have influenced the

[10] Also known as the Erythrean invasion: the ongoing migration of marine species across the Suez Canal, usually from the Red Sea to the Mediterranean Sea, or more rarely in the opposite direction.
[11] A neurotoxin that can be a source of poisoning with high fatality risk.

productivity, biogeochemistry and food web structure of the Eastern Mediterranean but also the hydrological functioning and structure of the whole Mediterranean (Turley, 1999).

Link 7 - External forces on resource/ SES Link * - Between Resource Users: The Cypriot inshore fleet has two main competitors; (i) the inshore trawling fleet and (ii) the recreational fishers.

(i) In general, the low productivity of the region does not allow the development of "industrial fishing" in the conventional meaning of the words as in other marine regions of the world such as the Atlantic (Farrugio et al., 1993). However, a small inshore trawling fleet operates in Cypriot waters which small-scale fishers perceive to be destroying the inshore fishing grounds by damaging the seabed with the bottom trawl gear but also to be destroying their passive gear deployed in the same fishing grounds. The narrow continental shelf of Cyprus[12], limits the inshore trawling fleet's fishing grounds to a minimum. Picarel (mainly *Spicara maris*) which is the trawlers' main catch, is mainly caught within the 50 m isobath. With Council Regulation (EC) No. 1967/2006 forbidding trawling within 3 miles from the coast (or on bottoms less than 50 metres deep), it means that this inshore trawling fleet cannot no longer operate in the inshore fishing grounds.

(ii) The large number of recreational fishermen in the Mediterranean, as well as the type of fishing gears used, justifies the wish of small-scale fishermen to include this sector within fisheries management for conservation purposes and to ensure fairer application of management rules (European Commission, 2002a; European Commission, 2003). The issue of recreational fisheries was raised on many occasions during conversations with small-scale fishermen not only from Cyprus, but also from ports of the Spanish Mediterranean. On many occasions, the small-scale fishermen complained about the activities of the recreational fishermen in their areas and suggested that in many ways they are their biggest threat. The main reason for this concern is that recreational and small-scale fishermen in the Mediterranean compete for the same resources: (i) boats are of same size and power (sometimes the

[12] The Cypriot continental shelf has an area of 2,960 km^2 (Earthtrends, 2003)

rich recreational fishers own boats that are more powerful than the small-scale fishers), (ii) there is a lack of control in the catches and activity of the recreational fishers, (iii) recreational fishers sometimes illegally sell their catch to restaurants[13] for a lower price than that of professional fishers. Since the creation of Category C licence owners they are perceived as an even bigger threat to the professional fishers as they are allowed by law to commercialize their catch. The lack of control on the activities of recreational fishers is mainly due to the fact that they fish during out of office hours and the absence of a VMS on their vessel[14] (if they are using one). In Latsi harbour in Cyprus, fishers' claim that they observe recreational fishers fishing most days (rather than just during weekends) using longlines, in areas where professional fishermen are not allowed to fish. Fishers around that area have been affected by increasing numbers of recreational users since the Turkish invasion as it is the richest fishing area in the South of Cyprus.

Recreational fishing has economic, social and cultural roles in the Mediterranean. Commercial fishing is largely dominated by small-scale concerns operating in coastal areas thus both recreational and commercial fisheries exploit the same resources in the same areas (Morales-Nin *et al.*, 2005). In Cyprus about 2000 individuals are licensed sport fishermen, while many others fish with rod and line and spear gun for pleasure, without a licence. Categories of sport fishing that need a licence are boats with nets and long lines, scuba divers, divers with lights and spear-guns and fishing with nets-without boats. The sport fishery captures about 15% of the total Cypriot catch but this is not yet reflected in the Fishery Statistics, as the attention of the DFMR has only recently focused on this fishery (DFMR, 2008). In Mallorca, 37,265 people, 5.14% of the island's population, are involved in recreational fishing, making it one of the main leisure activities (Morales-Nin *et al.*, 2005). Thus, not only is this activity socio-economically important, it also has the potential to exert considerable ecological impact on the coastal marine ecosystem. According to the same study, the number of recreational fishers is two orders of magnitude greater than the number of commercial fishers. However, existing management programmes in the Mediterranean based on effort regulation, do not apply to recreational fishing. Thus, if the goal for fisheries

[13] This accusation was also made by small-scale fishers in the UK
[14] Cypriot professional fishers are obliged to have a VMS system on board regardless the size of the vessel

management is to sustain viable populations and ecosystems, both recreational and commercial fisheries require effective regulation (Morales-Nin *et al.*, 2005).

6.2.2.1.1 Conclusion

The Mediterranean small-scale fishers do not seem to have been particularly affected by the CFP regulations. The reason for this is twofold: (i) There are not many legally binding EU legislations for inshore waters (< 12 nm from the coast), and (ii) the authorities are adjusting the EU regulations to the needs of their national fleet (this was found particularly true in the Cypriot case study). For both national fleets, a big problem has been their inability to compete (spatially but also in terms of markets) with the illegal fishers and/or the politically strong recreational fishers. In Cyprus, this has amplified commercial fishers' mistrust for the national authorities. The biggest problem in Cyprus however, has been the invasion of the rabbit fish population; a result of the creation of the Suez Canal assisted by an increase in sea temperatures. Fishers suggested that the impacts caused by the rabbit fish invasion far outweigh any impacts derived from national or CFP regulations.

Plate 1: Cypriot inshore fisherman Andreas Leonti sorting his catch at Larnaca harbour.

6.2.2.2 Case study II: East coast licensed small boat association, Scotland, U.K

The East Coast Licensed Small Boat Association (hereafter: ECLSBA) is a small self-organised fishers' association including small-scale fishers operating from various harbours along the East coast of Scotland. These harbours include Peterhead and Fraserburgh, but also smaller ones such as Banff, Macduff, Sandhaven and Portsoy. Fishers in ECLSBA are owners of boats smaller than 10 m and operate with handlines and pots/creels due to the seasonal nature of their activities. Handlines are used during the summer months to catch mackerel (*Scomber scombrus*). However, potting for species such as Norway lobster, or *Nephrops norvegicus* but also brown crabs and lobsters is essential (especially for full time fishers) due to the small quota allowance inshore fishers have for mackerel. The empirical data were collected during a pre-arranged meeting with the president of the association and seven other members of the association during May 2009 in Fraserburgh.

Link */1 - Between Resource Users/Between resource and resource users: Despite being part of the EU, legislation relating to sea fisheries and fishing rights are exclusive to the UK for the sea that is between the coastline and the 6 nautical mile limit. The only non-UK vessels allowed to fish within 6-12 nautical miles are those with historic rights relating to specific fisheries and specific countries. However, quota restrictions and the way they are handed out have left inshore fishers with, in their own words, the crumbs of the quota cake, as larger boats being part of politically stronger fishers' associations' acquire the majority of the quotas.

Link 2 - Between resource users and public infrastructure providers: The emphasis of inshore fisheries management in Scotland is more recent compared to England and Wales, with the latter having a system for inshore management for well over a century (Phillipson & Symes, 2001). Scotland on the other hand, assigned inshore management responsibility for inshore fisheries centrally to the Scottish Parliament until recently, with the creation of Inshore Fisheries Groups that have increased the level of co-management. The members of ECLSBA, were particularly eager to make their voice heard, even to a researcher rather than a government official. The group complained about the lack of advice and information received from the relevant authorities regarding new and existing regulatory measures, changes in the regulations and regimes, and even the lack of clarification on the different measures applied on their activity. The particular group of inshore fishers feel that due to their size and the relatively small economic input to the national economy, there is no interest from above regarding their welfare. There is no statutory requirements for vessels under 10 m to declare their catches and thus it is difficult to separate landing data within the 6 (or 12) mile zone, thus a measure of the economic significance of the inshore sector has to rely on informed guesswork (Phillipson & Symes, 2001).

Despite their frustration with the national authorities, this group of inshore fishers, in common with the majority of fishers visited in Scotland, are critical of the EU for all the regulatory measures inflicted upon them, something supported by other studies in the area which suggest that fishers attribute the contemporary crisis in the fishing industry to the CFP. (Nuttall, 2000; Rossiter & Stead, 2003) The Total Allowable Catches (TAC) measure is regarded as the one of highest impact on fishers' income (Chapter 4). According to this measure, each Member State is allocated a percentage share of catch (for certain species in certain areas) according to an established allocation mechanism which gives each Member State a fixed percentage share each year. From then on, it is up to individual Member States how the quotas will be allocated to individual fishers. In Scotland, the quotas are shared out in a way which relates to a vessels' previous fishing activity or "track record". This allows fish Producers Organisations (POs) to manage their allocations of fish quota according to the needs of their members (vessels) and take appropriate action to ensure that quotas are not overfished.

'The quota allocation for the under-10 m vessels fishing for mackerel by handline in Area IVa will be subject to a minimum allocation of 300 tonnes. This allocation may be caught only in Area IVa and not in Areas IIIa, IVb or IVc. Fisheries administrations will endeavour to acquire sufficient quota to allow for the opening of an under-10 m handline mackerel fishery in area IVbc in accordance with seasonality'[15]

Link 8 - External forces on social actors: Establishment of voluntary standards, labels and codes of conduct such as the Marine Stewardship Council (MSC) accreditation

[15] http://www.defra.gov.uk/foodfarm/fisheries/documents/fisheries/rules.pdf

scheme are intended to reward sustainable use of marine natural resources and also producers from unjust trade relations. The move towards seafood products that are certified as sustainable is being driven by environmentally sensitive consumers that are concerned about how a product is produced and prefers those derived from sustainably managed resources (Egestad, 2001). It is thus a market based rather than a regulation-based mechanism aiming to promote sustainable fishing by encouraging consumers to choose to buy a sustainable fished resource rather than an unsustainable one.

The MSC accreditation scheme has been criticised for a number of reasons including (Ponte, 2008; Jacquet *et al.*, 2010):

- Having been driven by the largest commercial player in the industry (or at least at the beginning)
- Not having consulted with fishers at the stage of the development of the standard
- Having a centralized and corporate structure
- Being biased in favour of industrial fisheries
- High costs of compliance and certification
- Not ensuring sustainability.

In the Mediterranean, small-scale fishermen are the majority with a highest contribution to the national economy, thus regulatory measures tend to be introduced taking the fleet's specificities into account. In the Northern Waters countries however, the industrialised/offshore fleet is the most economically important, thus minorities like the inshore fleet, often feel marginalised and that their opinions are not considered during decision-making. According to the Scottish government "…the allocations against vessels in this group (10 m and under fleet) are decided upon by Fisheries Administrations in consultation with relevant industry interests". To resolve this problem, the Scottish Government has decided upon the formation of Inshore Fisheries Groups (IFGs) which "aim to improve the management of Scotland's inshore fisheries and to give commercial inshore fishermen a strong voice in wider marine management developments". The stakeholders of the groups are content with this initiative, even though more time is needed before their success can be evaluated. There is a different attitude in the Spanish Atlantic however, where the small-scale fishermen of Bueu, seemed more satisfied with the way their cofradia[16] is handling their resources and feel more involved in the management of their coasts.

6.2.2.2.1 Conclusion

Unlike the Mediterranean fishers, the inshore fishers in East Scotland are affected by EU regulations, particularly by the TAC controls which due to the small amount of quota allocated to them, such that the pursuit of the relevant fisheries (especially mackerel) is not worthwhile. Such inshore fleets have not got as much power as their offshore counterparts due to their contribution to the economy. Their small-scale nature has also affected their lack of ability to enter into the MSC accreditation process which reduces their ability to compete with other products. However, since the meeting with the association, the ECLSBA have become members of the Moray Firth Inshore Fisheries Group (IFG) which is part of an initiative of the Scottish Government to 'offer an innovative, partnership-led and locally specific approach to fisheries management' (The Scottish Government, 2010). However, even though the association received 'a warm welcome' from the IFG it remains too early days to know how their new-found partners would improve their position (Baden Gibson, pers.comm.).

[16] In Spain, fishermen associations in each port are called cofradias de pescadores; Cofradia = Spanish for guild or association

6.2.2.3 Case study III: Bornholm, Denmark

Bornholm is a small Danish island located south of Sweden, north of Poland and east of Denmark of which it is a part. The island's structure is indicative of a fisheries dependent region with high levels of activity in the primary sectors (agriculture, fisheries and food processing); while service industries (i.e. manufacturing) are under-represented, except for tourism related industries (Joergensen, 2004). The remoteness of the island and its geography means that economic diversification is difficult as new economic developments are either difficult to get going or unsuitable (Delaney, 2007). Regarding the fisheries sector, even though the island's dependency on fisheries is not as high compared to dependent regions in other parts of Europe, the development of the sector is, linked to the overall development of Bornholm. In addition, the fisheries sector is relatively more important for the island than on the mainland (Denmark) on average (Delaney, 2007). Capture fisheries have been an important activity for the island since ancient times, in terms of subsistence and commerce/export of processed products (Delaney, 2007).

<u>Link * - Between Resource Users</u>: Local regions, and Bornholm in particular, are often sensitive to outside fishers' activities in their local fishing territories (Joergensen, 2004). In Bornholm, local fishers have to compete for resources with fishers from Poland, Germany, and Sweden and from mainland Denmark. This has led to remarkable changes in local resources and severe down turns in local fleet income (Joergensen, 2004). An increase in foreign vessels operating around Bornholm has a negative impact as not only does it increase competition for resources with larger foreign vessels, but it increases fish supply in the local markets thereby lowering prices. In addition, the illegal activities of foreign vessels (especially Polish vessels) have fuelled negative publicity regarding fleets fishing for Eastern Baltic Cod, regardless of whether they are operating within their legal limits (discussed in SES Link (8)). However, the island itself has profited from landings by outside (non-local) vessels, through the local processing industry and the companies that service the fishing fleet (Delaney, 2007; Joergensen, 2004). There has been a decrease in landings from foreign vessels in the last decade, which also led to a decrease in vessels requiring the island's service facilities, both factors resulting in the decline of

one of the island's main industries. This decline was due to new regulatory measures such as:

- Requirement to notify foreign landings in an EU member state in advance,
- Stricter enforcement of hygiene regulations, and
- Stricter control regulations than elsewhere in the area.

Link 1 - Between resource and resource users: The fisheries sector of Bornholm has traditionally been dependent on a relatively limited number of species, namely cod, herring, sprat and salmon (Delaney, 2007). Cod is the most important species thus the sector is particularly sensitive to the development of the catch and landings of cod.

Link 2 - Between resource users and public infrastructure providers: Danish fisheries are managed under the EU's CFP framework and total allowable catch (TAC) is the main regulatory instrument. The Danish government determines its own fisheries policy stated in 'The Fisheries Act' which is within the CFP framework. Since January 2007, Danish vessels have operated under an FKA system (Fartøjs Kvote Andele = vessel quota shares) where each vessel is allocated a quota based on historical rights. The fishermen's organisation of Bornholm opposed the FKA system as they feared that the ability to transfer and join quotas through vessel mechanisms[17] would lead to quota concentration (Delaney, 2007). The present management package for the Baltic cod fishery was seen as too complex and inconsistent and a number of setbacks were stated by fishers during the interviews. Problems which were highlighted as a result of the remoteness of the island include:

- The difficulty of securing a bank loan from the local banks in order to buy a bigger share of the quotas. This issue was either due to the inexperience of the local banks in dealing with such issues or due to the banks' limited funds.
- Vessel owners from Northern Jutland had previous experience of the FKA and ITQ system (on herring and mackerel) and thus foresaw the opportunities and bought cod quotas earlier than local fishers. Mainland fishers also had more funds and/or easier access to loans.

[17] With enough money, vessels can be bought (along with the quotas that come with the vessel), the vessel can then be decommissioned and the quotas transferred and concentrated on one vessel.

- Fish prices are low as a result of the island's distance from the mainland but also due to factors such as the impact of green groups on the consumers (discussed in SES link 8). Low fish prices appeared to be the biggest problem impacting the fishers of Bornholm.
- High transport costs; the island has an advantage in terms of the place close to the surrounding fishing grounds, so fishers have lower transport costs in supplying at the local processing industry. But the processing industry has higher costs in transporting the finished products to customers on the mainland.
- The decrease in landings from the Baltic increased the importance of the costs of transport of substitute imported fish (this is particularly important for consumers).

Link 7 - External forces on resources: Even though the Baltic was a nutrient poor sea with low biological production in the 1940s, the area provided food and shelter and also spawning and nursery grounds for many fish species (Jansson & Dahlberg, 1999). The region has been affected by eutrophication and toxic substances deriving from industry, urban settlements and agriculture which degrade the salmon habitats and can even have direct impacts on species mortality and behaviour (Jansson & Dahlberg, 1999). These environmental concerns caused increased levels of dioxins and PCB's (polychlorinated biphenyls) which led the closure of the salmon fishery by the Ministry of Food, Agriculture and Fisheries in 2004 (Joergensen, 2004). In 2006, the relevant legislation concerning salmon from the Baltic Sea was amended and until today salmon between 2 to 5,5 kg can only be place in the market only if it is trimmed for the fat and salmon over 5,5 kg cannot enter the market18.

Link 8 - External forces on social actors: In 2006, Greenpeace launched a campaign against the illegal fishing of the eastern Baltic Cod. During that campaign, a number of articles were written (a number of articles are included in Appendix 4) and awareness raising stunts, which led to consumer mobilization and lobbying of the product. During this campaign, the lobbying group lobbied big companies such as McDonalds and the food manufacturer BirdsEye, part of Unilever, to stop buying and thus supporting any illegal fishing of the eastern Baltic cod. Bornholm fishers tended

[18] Regulation Number 526, 24/06/2005: https://www.retsinformation.dk/Forms/R0710.aspx?id=123406

to sell a large amount of their fish to such big companies. The boycott of illegally caught fish led to the legally caught cod being boycotted too. The situation has now improved and Bornholm's fishers can now sell their fish more easily as: (i) there has been an increase in the spawning stock biomass since 2005, and (ii) Poland's entry in the EU and the country's new government aspiring to be a compliant Member State means there is a country-level effort to stop illegal fishing in the eastern Baltic. According to fishers however, due to Greenpeace's campaign, the eastern Baltic cod is still out of bounds for 'conscientious' consumers thus product demand and prices are low.

6.2.2.3.1 Conclusion

The fishing industry of this isolated island has suffered due to a range of factors. Firstly, the island's isolation means that the cost of exports from the island to the mainland are high, thus its products are more expensive and less competitive. Fishers also have to compete with other national and non-national fleets for space and resources. Until recently, the non-Danish fleets in particular had less stringent regulations with which to comply that led to campaigns against buying Eastern Baltic cod. Finally, the enclosed environment of the Baltic suffered from increased pollutants levels due to runoff from the surrounding area that have led to bio-accumulation in fish that led to fishery closures.

Plate 2: Bornholm fisherman Thomas Thomsen preparing his nets before going out to sea.

6.3 Variation in levels of Enforcement and Compliance in the EU fisheries sector

6.3.1 Methods

This section utilises empirical primary data (qualitative and field observations) and secondary data to identify (i) levels of compliance and enforcement across the European Member States, (ii) regional differences in perceptions and culture regarding enforcement and compliance, and (iii) differences in regional perception on institutional arrangements. Primary data were collected from fishers as part of conducting the surveys discussed in Chapter 4. The areas visited were; the U.K. (East and West of Scotland, North Shields, Newlyn), Denmark, Spain (Galicia: Bueu, Basque Country: Ondarroa, Catalonia; Palamos, Mallorca) and Cyprus (see Chapter 4 section 2.2 for relevant maps and information on the case studies). The survey included the following question the results of which were utilised for this study: 'What should, in your opinion, be the minimum fine for non-compliance on the following: (i) Illegal entry, (ii) Using prohibited gear, (iii) Fishing without a permit, (iv) Landing marine organisms below the minimum size, (V) Landing marine organisms which are protected.'

Secondary data were extracted from reports produced by the European Commission which amalgamate enforcement and compliance data given to the Commission by Member States. Data and information were used mainly from the following reports:

- COM(2002)/ 0181 final*. Communication from the Commission on the reform of the Common Fisheries Policy ("Roadmap").
- COM(2003)344 final. Communication from the Commission on Compliance with the rules of the Common Fisheries Policy; Compliance work plan and scoreboard.
- COM(2008) 670: Communication from the Commission to the Council and the European Parliament on reports from Member States on behaviours which seriously infringed the rules of the Common Fisheries Policy in 2006.
- COM(2009)163 final Green Paper: Reform of the Common Fisheries Policy.

Secondary data were also extracted from papers which looked into differences in compliance and enforcement among the different Member States.

6.3.2 Enforcement and Compliance in the EU

Poor enforcement of fisheries regulations throughout the EU was recognised as a major shortfall in governance (European Commission, 2002b), and as stated in the green paper 'Fisheries control has generally been weak, penalties are not dissuasive and inspections not frequent enough to encourage compliance' (European Commission, 2009a). The level of enforcement varies between EU countries thus one of the main challenges set during the 2002 CFP reform was to establish a more level-playing field across the Community (European Commission, 2002b). Communication with fishers suggested that fishers themselves are also calling for a level-playing field. The reasons behind this are different for the different EU regions; in the NE Atlantic and the Baltic, fishers are asking for the same level of enforcement in all Member States. In the Mediterranean on the other hand, inshore fishers appealed for stricter controls on recreational fishers. The number of serious infringements per vessel, as reported by Member States for vessels exclusively flying their flag did not suggest any pronounced difference between the number of infringements detected per vessel between states in the north and the south of the EU[19]. However, Member States in the European Southern regions have a higher ratio of infringements per vessel despite their greater fleet size (Figure 6.3).

The low number of detected breaches may be an indication of a high degree of compliance or low detection rates. Indeed the number of breaches detected, when compared to the size of the fleet, rather highlights the poor performance in the control activities or lack of in certain Member States. This is explained by a phenomenon called 'Unrevealed compliance' meaning that the commission only gets to know about an infringement if a) the national authorities detect it (dependent on them actively enforcing the regulation) and report it, b) independent citizens/companies/NGO's

[19] Data for the creation of the graph taken from COM(2008) 670: Communication from the Commission to the Council and the European Parliament on reports from Member States on behaviours which seriously infringed the rules of the Common Fisheries Policy in 2006.

detect the infringement and report it. A recent report suggests that there is no real improvement in level of compliance with CFP rules', as it states 'the inadequate level of the sanctions imposed in most of the cases detected together with the low probability of being caught and pursued by the control authorities may convince the fisherman that the economic benefits that he can derive from breaching the rules outweigh the risk' (European Commission, 2008b).

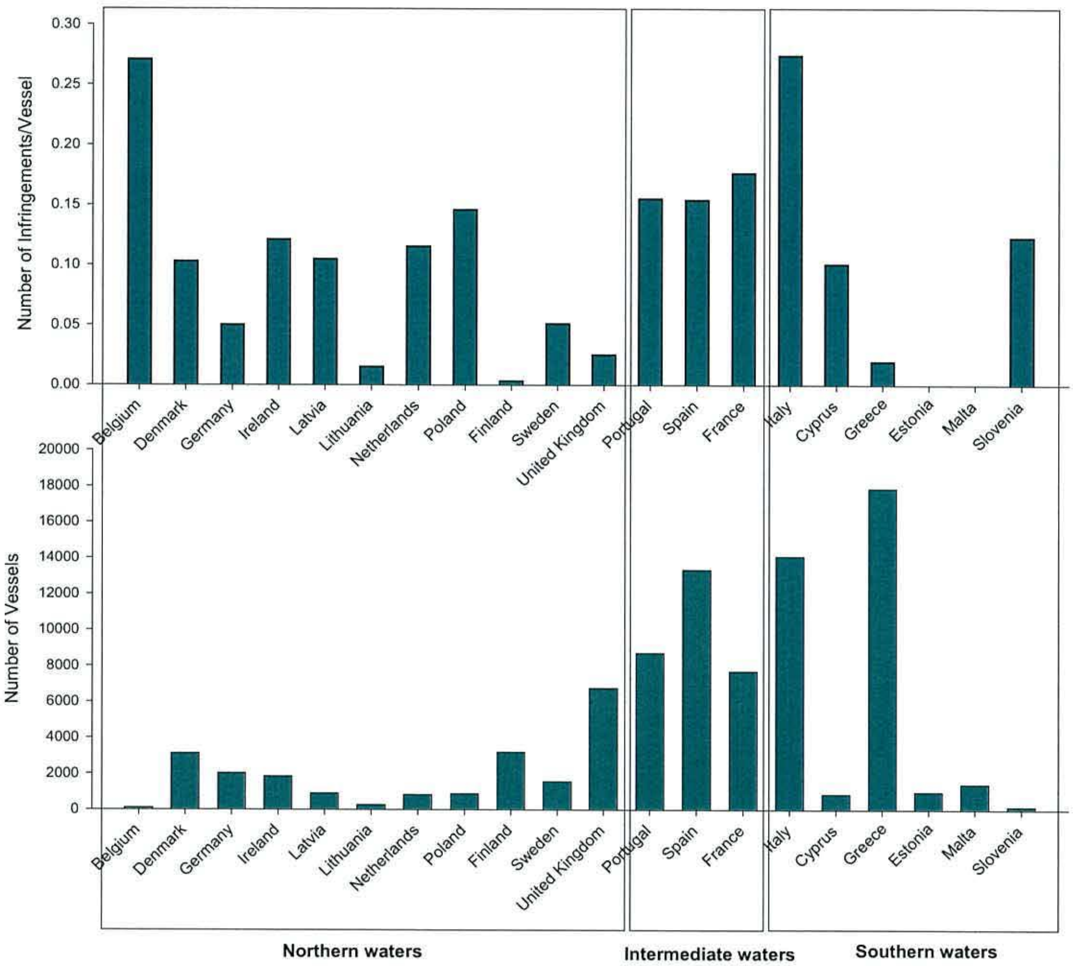


Figure 6.3: Number of serious infringements per vessel for each Member State of the EU from data given to the Commission from each Member State regarding vessels exclusively flying their flag

To achieve high levels of compliance sanctions need to be sufficient to deter violators. Maximum fines have been found to vary in Member States from 170€ up to 120 000€, and even for the same type of infringement average fine in 2005 varied from 170€ to

6070€ (European Commission, 2008b). However, sanctions vary among *métiers*[20] as their revenues vary. When fishers were asked to state their opinion on what the minimum fine should be for different offences, inshore fishers were less likely to reply. However, those that did indicated lower fines than the offshore fishers. This is understandable as the catches and revenues of inshore versus the offshore fishers are considerably different. The general consensus was that the fine should be appropriate to the fleet, the type of infringement and evidence of previous offenses. Many suggested that the best way to stop infringements is a temporary or permanent (depending on the type of infringement and/or the number of incidents of non-compliance) withdrawal of licence. The Commission also states in a report that "suspension of licences to fish or to carry out a professional activity is a very effective tool in enhancing compliance with CFP rules, because it can be quickly applied and it has an immediate effect" (European Commission, 2008b). However not all countries use this as a tool. 1082 licences were withdrawn in 2006 which is 10% of the infringement cases (compared to 1226 licences in 2004 which was 13% of the cases). In Greece licences were withdrawn in 71% of the cases of an infringement, 36% in Spain, less than 10% in Denmark and the Netherlands and less than 2% of the cases in the rest Member States.

6.3.3 Regional perceptions on enforcement and compliance

Fishers' understanding and perceptions varied, both on the importance of enforcement and compliance and on existing levels of enforcement. Both the UK and Denmark are reputed to abide with regulatory measures especially in relation to conservation issues of CFP. Similarly, the majority of British and Danish fishers seemed to understand and respect the importance of conserving the stocks. Fishers in the Northern region (especially British and Danish rather than Spanish fishers) were more likely to complain that the enforcement was too strict and regulations too complex. There was also the belief that their national politicians and delegates in decision-making were too eager to please the EU when introducing new regulatory measures without taking into account the interests of their own fishers. Regarding the simultaneous application

[20] Homogenous subdivision of a fishery by fishing gear, target species and fishing geographic zone combined.

of TAC and Days at Sea controls on them, offshore fishers find it frustrating and incomprehensible since for them one regulation counteracts the other and both of them enforced together makes their job inoperative. However, with regards to the simultaneous application of TAC and Days at Sea (something offshore fishers found frustrating and perplexing) British and Danish fishers views on the regulatory measures were stronger than those of Spanish fishers. This could be associated with differences in the application and enforcement of the rules between the countries[21] (see section 3.2.4.2: Enforcement of Buyers and Sellers regulation in Chapter 3).

Fishers in Southern regions, even though they complained about the lack of enforcement specifically on recreational and illegal fishers, enjoy the lenient application of minimum landing size regulations (MLS). The rather lenient enforcement of the MLS regulations allows Cypriot fishers to land all marketable fish (meaning the fish that consumers would buy and not that above the legal limit). However, it is important to note that fishers have come to an agreement with the DFMR, to increase their nets' mesh size from the CFP-set 16 mm to 18 mm.

The introduction of the Vessel Monitoring System (VMS) technology (in Community fishing vessels over 15 m) since the 2002 CFP reform has considerably enhanced the capacity of national authorities to monitor fishing activities. Some Member States went further to adopt comprehensive control systems maximising the probability for vessels to be inspected. In Cyprus for example, fishing vessels of all sizes have been supplied with a VMS device[22], by the department of fisheries and marine research (DFMR) in an attempt to facilitate control since the number of inspectors is limited. In the U.K. the Sea Fisheries Committee inspectors carry out not only random inspections, but also follow-up inspections on vessels which have already been caught acting illegally. However, controls in the Mediterranean are mainly for professional fishers, and there fishers were asking for out of office hours controls for recreational and illegal fishers (see section 2.2 for further information). At the moment, patrols are scarce and include inspectors visiting fishers in ports and harbours during the mornings to check who has gone out fishing. This is then cross-examined with fishers' receipts and VMS data. There are also some patrols using the DFMR's patrol

[21] Spanish authorities are considered to be more lenient.
[22] Vast majority of the fishing boats are less than 10 m in total length.

boats. However, the patrols are currently focused on professional fishers and there are no funds to cover out of office hours patrols to tackle the problem with recreational and illegal fishers.

Fishers in Denmark perceive some of the control measures used by the Danish authorities as excessive and onerous. For example, fishers are required to contact the harbour 2 hours before they are expected to land. Depending on the circumstances however, according to fishers they sometimes arrive early thus they have to delay landing their catch or pay a fine if they arrive at the port late. Differences were also identified during vessel inspection of offshore vessels, depending on the country having the jurisdiction and the nationality of a vessel. The offshore fishers of Ondarroa for example, (an important port of the Basque country province in Spain) suggested that treatment from the French inspectors (in ICES areas VIIIa, b/Bay of Biscay), is especially harsh in comparison to the treatment received in UK waters (they usually conduct their fishing activities in the West of Scotland). The French and Norwegian inspectors performed frequent, extensive and long (approximately three-hour) inspections on the vessel. There were similar views regarding the French inspectors from British and Danish skippers. The British, Swedish and Danish inspectors on the other hand were in general more understanding and tried not to interfere and irritate the fishers excessively.

6.3.4 Perceptions on institutional arrangements

Community requirements for the introduction of new regulations can be delayed either due to national authorities being slow to react, but due to the fishing industry not being supportive. Policy-making amongst the European Member States is top-down and national policy-makers can either compliment and reinforce community process or complicate and undermine it (Pridham, 1994). An overburdened or inefficient administration or national actors with strong ideological hostility against changes to their way of doing things also leads to non-compliance (Falkner, 2004). Southern countries are generally perceived to have higher levels of ineffectiveness, corruption, administrative lethargy and defective policy co-ordination (Pridham, 1994). This has profound implications in the way citizens of each country feel about respecting and complying with the rules set by their country. Thus, southern societies which have a certain distrust of their state institutions resort to the EU for assistance (Pridham & Cini, 1994). An example that stood out was in the introduction of the Category C fishing licence in Cyprus - the creation of a specific category of fishing licences from the parliament which went against the Commission rules, the DFMR advice and the benefit of the professional fishers (see section 6.2.2.1: SES Link (*)). Both the DFMR and fishers turned to the EU for resolving this matter. On the contrary, a Northern EU state like the UK does not tend to turn to the EU with complaints as often, not only due to its citizens having more trust to their national institutions but also due to the dislike of the EU institution itself. Thus, in the U.K. not much has happened to change the perception of Scottish fishers that 'European regulations place pressure on their way of life, restrict their activities, and as far as conserving fish stocks is concerned, are ultimately resulting in conditions for unsustainable practices' (Nuttal, 2000).

Thus, societal monitoring can be one of the most important sources of information and it may vary significantly between member states due to different degrees of social mobilization and respect for law (Borzel, 2001). Both Spain and Greece show a lower degree of societal activism than their northern counterparts of similar population size (Eder & Kousis, 2001), however they both have an unusually high share of complaints to the Commission (Spain compared to the other big four: Germany, France, U.K. and Italy; and Greece compared to the group of less populated states like the Netherlands and Denmark) (Borzel, 2001).

Social control is also important as in some communities' disobedience of rules which are there to protect the common good leads to a social stigma in the community. Sometimes however, breaking of the rules in order to ensure a necessary income is sometimes excused unlike breaking the rules on a large scale in order to maximise profit which can lead to social exclusion (Gezelius, 2003). The imprisonment of the Irish father and son Charles and Charlie McBride for example in 2009 raised concerns in the trawling community with trawlermen around the UK suggesting that even though landing of black fish should not be condoned, if this took place in a Southern country such as Italy or Greece, the situation would have passed with a slap on the wrist.

6.3.5 Conclusion

The variation in the law enforcement and inspections shows that each country adjusts European rules to its own culture and way of life. On the whole, most Member States increased the means of inspection and surveillance or have involved the industry itself more directly in the monitoring of fishing activities. Nonetheless, the success of fisheries control is still uneven with many fishing activities being efficiently controlled and other activities not controlled at all or having a level of control that is clearly insufficient. Low levels of compliance are due to a number of factors which differ among countries and even communities:

- Resource users cannot or are not willing to adapt to changes in the rules
- Resource users are not given the right incentives to comply with the rules
- Resource users do not believe in the effectiveness of the rules thus do not comply with them (sometimes because they were not consulted during the formulation of the rules or because the rules were not explained to them)
- Resource users do not trust the governing authority, that be the EU or the national authority
- There are cultural differences affecting the level of trust between national authorities and the resource users.

Correct enforcement of rules and thus compliance to management regimes is vital for the success of the regime. However, if those reliant on a resource are not resilient or cannot adapt to a new regime, they will be inclined to break these new rules. Depending on the region and the fleet, CFP rules are affecting the industry in different ways. Fishers from the NE Atlantic seem to have been negatively affected by the new fishing effort regulations of the CFP and blame the EU for many of their problems. Mediterranean fishers on the other hand, mainly blame the local authorities for the lack of proper controls (mainly on illegal and recreational fishing with which they have to compete). In terms of compliance, differences among Member States can be associated with the culture and traditions of each state on following rules. Cultural and traditional differences among Member States need to be understood and taken into account when objectives are set and decisions are formed in order for the new policies to be effective and the Member States compliant to them.

6.4 Discussion

The different forms of social knowledge presented in this chapter show the importance of social data for maintaining resilience of SESs. How fishers behave and perceive external disturbances is influenced by their dependence upon the marine resource and the economic and social structure in which they operate arranges this dependence into cultural forms (Löfgren, 1977). The three case studies presented in section 6.2 illustrated that the complex interactions among different agents in SESs force them to adapt to different conditions and thus internal reactions to external disturbances vary amongst different fishing communities. However, the nature of the data restricted the amount of information available thus (i) the framework could not have been applied for all of the case studies (visited and discussed in Chapter 4); and (ii) the framework for each of the case studies is potentially incomplete. However, the objective was not to characterize the robustness of each case study in much detail (as this would require a more in depth analysis with interviews and/or questionnaires specifically designed to identify different links). Rather, this section attempted to verify that there is regional variability in the links between the different entities in SESs, and that there are different factors which depend on regional socio-cultural and biological contexts that can influence resilience. Such a task is important as it is vital to acknowledge that there are various sources that can disturb a SES other than regulatory measures and are important to be understood.

Resilience and the SESs' ability to adapt is also associated with levels of enforcement but mostly compliance. The resource system itself can be disrupted by natural events, human induced impacts, and accidents (Janssen & Ostrom, 2006a) and this will in turn have an impact on the resource users. External threats such as regulatory measures, consumer pressure, and additional burden on the resource and fishing zones are some of the entities that can affect the various components and links within a SES. National differences in social norms and culture form another problem as the institution of norms and culture changes at a slower speed than simply a change from one formal rule to another (Rova, 2000).

Regulatory measures can drive fishers to adapt or leave the fleet. The Cypriot trawling fleet was not left with many alternatives by the regulations imposed by the DFMR and the EU. Limitations of fishing grounds and changes in the mesh size led most of the fishers to decommission their vessels. On the other hand, after the introduction of the ITQ (Individual Transferable Quota) regime, the Danish pelagic fleet transformed to into a bigger fleet by investing in bigger and more powerful vessels by merging the power of smaller boats (Chapter 3.3.2.3). On the other hand, smaller scale fishers tend to diversify their activities to various other fishing activities for example the inshore fishers on the Scottish East coast changed their main catch from mackerel, cod and other quota-species to species with high quotas such as Nephrops or non-quota species such as lobsters etc. In the more extreme cases, and usually in the Southern regions, fishers diversified into non-fishing activities mainly tourism. British trawler fishers also had to adapt their fishing activities and after the introduction TAC for whitefish they switched to Nephrops (langustines) as their main catch. Nephrops have higher TAC and the prices remain stable due to demand from non-UK markets (DEFRA, 2008).

According to small scale fishers, big trawlers are associated with human greed and are more to blame for the fisheries crisis than themselves (Gezelius, 2003). Excluding ecological factors, the resilience of industrial fleets is challenged mainly by regulatory measures, markets and competition amongst themselves. However, the inshore fleet albeit usually subjected to less regulatory measures, faces many other challenges. Inshore fishers face competition from large-scale offshore fishing and recreational fishers for both resources and markets (van Ginkel & Steins, 2001; Morales-Nin *et al.*, 2005). Recreational and illegal fishers put pressure on the resources and on access to fishing zones but more importantly, they distort the market for fishing products making it more difficult for legal fishers, who are themselves subjected to higher production costs due to taxation, social contributions and compliance with licensing and other regulations (Ifremer, 2007). In addition, technological innovation, the development of marine transport and the rise of tourism have all increased the level of human impact on coastal areas and resources along with long term developments such as demographic growth, urbanisation, expanding demand for food and natural resources, the integration of resources into markets interfering with inshore fisheries (van Ginkel & Steins, 2001).

Generally, small-scale fisheries provide employment with all its social benefits as it sometimes provides employment in rural/isolated areas where alternatives are scarce. In the EU there are roughly as many crew in vessels under-12m as in larger vessels (Ifremer, 2007) whereas for some countries this percentage increases. In Cyprus for example, 93% of the active fishing fleet is comprised of under-12m passive gear fleet. However, their participation in decision making is generally weak and almost non-existent, especially in areas where more industrialised fishing (for example in North east Scotland) is more prominent (Phillipson & Symes, 2001).

To compensate for capacity deficiencies in improving compliance the EU adopted a number of strategies among which was to promote fishers' diversification (by allocating a set of economic funds to ease and promote adjustments to EU policy) and make policies less ambiguous (by issuing interpretative guidelines for various policies in order to avoid non-compliance arising from rule uncertainty) (Tallberg, 2002). The EU funds were put in place to subsidize fuel, modernize or decommission vessels but also to help fishers with the great challenge of adapting and diversifying to alternative livelihoods which is critical to community resilience (Folke, 2006; Nelson *et al.*, 2007; Robards & Greenberg, 2007). Nevertheless, even though maintaining the capacity of SESs for self-organization is essential, it can be costly and difficult as the relationship between subsidies and investment in social, human, human-made and social capital need to be mutually sustaining (Anderies *et al.*, 2006b). Additionally, the politics behind subsidization could be one of the main reasons why SESs so often remain maladapted to current conditions and opportunities, even to the point of collapse (Anderies *et al.*, 2006b).

Non-compliance is dependent on (i) fishers relationship with the decision-making body and the authorities, that be the EU or their national authority but also (ii) fishers' trust in the information used to make the decisions (the information provided by scientists).

Fishers assess the risks of, and their ability to cope with, policies (thus their resilience) and the more confident fishers are about their future the more likely they are to try and adapt to new policies (thus comply with the policies) (Marshall &

Marshall, 2007; Marshall, 2007). In addition, if a management system is perceived as practical and necessary, stakeholders are more likely to accept it and thus be more compliant (Christensen *et al.*, 2009). Thus, the more involved stakeholders are in decision-making the more likely it is that policies are accepted and complied with. Involvement in decision-making and the cultural differences in compliance and enforcement among different states are the main factors leading to the variability in perception about the EU and its fisheries framework. When new policies are devised by external authorities, these policies are rarely tailored to the local ecology and culture, nor can they invest substantial resources in monitoring patterns of resource use and sanctioning those who do not follow the rules (Janssen & Ostrom, 2006b). Furthermore, it leads to the creation of a paternalistic culture which leads to the industry lacking accountability for its actions. This lack of accountability is an important factor in the institutional design of a management regime which can lead to the industry complying or not (Raakjær Nielsen, 2003). Traditional arrangements which promote a high degree of compliance are extremely important as they provide a repository of experience and knowledge from which many of the decision and policy makers could draw valuable lessons from (Gelcich *et al.*, 2006). Thus, it is important that when designing new policy interventions the importance and perceptions of local institutions among different SESs is appreciated.

The power of national lobbying groups varies between Member States, with environmental lobbying groups having more of an impact in Northern countries than in Southern countries (i.e. the Greenpeace campaign on Baltic cod). There are also cases where lobbying groups have the ability to convince their government to introduce rules which are against European frameworks or directives; for example the introduction of Category C licence in Cyprus. The situation in Cyprus has similarities with the Maltese government ignoring the EU's Wild Bird Directive and allowing spring hunting of turtle doves and quails since its accession in the EU in 2004. As in the case of Cyprus (where the government was lobbied by wealthy and politically powerful recreational fishers), the Maltese government has been under pressure by the powerful hunting lobby (BirdLife, 2010). This reflects a typical problem in small island states/communities where people are strongly influenced by personal and political agendas to a greater extend than in larger nations where the decision-making process is more distant.

Complex SESs in complex settings can rarely be prescribed with an optimal solution and those involved have to learn over time by experimenting with local ideas and past examples (Janssen & Ostrom, 2006a). Thus, recently decision makers have come to the realization that management of ecological resources requires the protection of well-functioning small-scale SESs, as by preserving institutional diversity a rich set of solutions for social systems can be achieved to adapt to ecological contexts (Folk & Berkes, 1995; Janssen et al., 2007). Fisheries management has been used many times as a tool to react to resource crises i.e. fishery closures after stock collapses or overcapitalised subsidies, rather than as a prevention tool; in an attempt to remove a disturbance rather than help the system adapt to it. This created systems which are static and inelastic meaning that they are not robust as they have not got the sufficient buffering capacity after a change (Rova, 2000). Just as specific biological data are required for each area and stock for decision-making, similarly specific social knowledge data should be collected for specific national fleets. It is important that economists have a better understanding of the ecology and ecologists realize the importance of taking into account the various economic, political and social realities during decision-making (Robards & Greenberg, 2007).

7. General Discussion

7.1 Summary of results

Throughout the thesis, different aspects of the European fisheries governance structures and management systems were examined by embracing cross-disciplinarity. Policy analysis allowed the creation and analysis of a database of the Common Fisheries Policy regulations and this was followed by exploration of changes in the performance of economic and structural indicators of the European fishing fleet. A conjoint method originating from the market research arena was then utilised to identify fishers' perceptions on economic impact of regulations. Finally, social knowledge was applied (i) on an adapted theoretical framework to identify micro-scale differences affecting the robustness of a fishery community and (ii) to identify differences in perception regarding enforcement and compliance. Specifically, governance structures and management systems of the European Atlantic and Mediterranean regions, the European north/south divide, were compared. The general discussion presented here encompasses a summary of the results obtained, a discussion of common findings and their importance for future policy reform. It will conclude with my personal reflection on the study, the important key findings and future research needs.

The Directory of Community legislation in force as of 1st of March 2009 examined in Chapter 2 was found to include 795 acts, a number disproportionately large for a sector like fisheries with limited economic activity and a restricted number of operators (European Commission, 2009b). Analysis of the Directory of Community legislation demonstrated the difference in the number of active regulations in the Northern (Baltic and NE Atlantic) and Southern (Mediterranean) waters of the European Union. Thus, fishers in countries at higher latitudes of the EU (Northern Waters) have to cope with more regulations than fishers from lower latitudes (Southern Waters). This is related to the different management models implemented in the two regions and the factors which contributed to the creation of these models; differences in the biology, the history of available scientific information and policy history in the Atlantic and the Mediterranean. It is also important to note that the directory of current relevant Community legislation that provided the basis of this study is incomplete, as some obligatory measures were found to be missing.

The accumulation of legislative measures over the years led to changes in fisheries landings, and thus potentially changes in fishers' revenues. However, at the end of its second reform, the CFP's objectives have still not been met and 88% of the Community stocks are being fished beyond their maximum sustainable yield (MSY) (European Commission, 2009a). Thus, Chapter 3 investigated the timeline of structural and economic indicators of different European *métiers* to identify their potential relationships with the implementation of specific fishing rules and/or market regulations. The study found that sometimes, such policy arrangements steer changes in different directions, depending on the socio-economic and/or political context such arrangements are applied in.

The socio-economic and political contexts in which a policy is applied are moulds in which the industry's perceptions are formed. Chapter 4 and 5 have evaluated which regulatory obligations (ROs) are most and least preferred by fishers and identified the rationale behind these preferences. Fishers and fisheries experts' perceptions differed for the *métiers* explored; are there any patterns behind the most and least preferred ROs? Essentially both chapters identified fishers' apprehension regarding the risks that can arise from new regulatory measures; this apprehension was socio-politically and culturally dependent, and arose from the fact that potential outcomes of unknown situations tend to be worrisome. Hence, the regulatory measures which fishers had a higher preference to were those which they were more familiar with.

However, one must remember that fisheries management is only one of several challenges that fisheries communities are facing (Jentoft, 2010). Chapter 6 set out to collate social information data to ascertain regional variability regarding the robustness and compliance of various fisheries Socio-Ecological Systems (SESs). The two concepts examined are interrelated, as robust SESs tend to have higher levels of compliance. This micro-scale analysis supports the assumption that fisheries management success depends on the existence of localised socio-economic information, which are to be taken into account during decision-making in order to decrease conflict among the different stakeholders, increase regulatory compliance and lead to more regional and simplified fisheries management regimes (Fricke, 1985; Kaplan & McCay, 2004; Marshall, 2007).

7.2 Discussion and Policy Implications

Throughout this thesis the successes and failures of management strategies of the Common Fisheries Policy (CFP) are portrayed by bringing together those disciplines which are relevant to fisheries such as biology, economics and sociology. Thus, the findings of the thesis advocate the need and importance for integration of the relevant disciplines if effective fisheries management is to be achieved. This school of thought has earned the support of a number of fisheries experts, and in many cases, experts from different disciplines came together to encourage the amalgamation of such expertise (Berkes & Folke, 1998; Degnbol *et al.*, 2005; GLOBEC, 2008). The variety of methodologies used gave important insights into why regulatory measures sometimes do and sometimes do not achieve their objective and why sometimes fishers do and sometimes do not support a regime. More importantly, this study illustrated that in order for such results to be useful for future management and policy suggestions, they must be drawn not solely at the European north/south scale, but rather at a more localised scale. This thesis is essentially advocating that a multidisciplinary approach to fisheries management must be the way forward if the third CFP reform attempt is to be successful. It is important to point out that the thesis is not an attempt to draw out the epitome of fisheries management for each region, but rather it shows the importance of venturing into regional multidisciplinary research on governance structures and management systems before decisions on policy reforms are taken.

In the EU, considering all the regional differences, when a management model is proposed, both elements, the Instrument of Management (regulatory measures) but also its mode of implementation, should be taken into account (Iglesias-Malvido *et al.*, 2002; Symes, 2009a). This study supports ideas put forward by scholars like Charles (1995), Symes (1997), Symes & Hoefnagel (2010), Raakjær Nielsen & Christensen (2004), Hilborn *et al.* (2005) that successful fisheries management requires effective governance structures and relevant policy instruments which are correctly implemented according to well founded research regarding past mistakes and successes on (i) property rights distribution, (ii) the way decision-making takes place and (iii) the spatial scale in which decision-making is exercised. This is particularly important in the light of the CFP's 2012 reform, as, even though the importance of putting into practise good governance principles such as openness, participation, accountability, effectiveness and coherence were identified prior to the CFP's 2002 reform (European Commission, 2002b), the reform was still a failure[1].

Wisdom and learning can only be derivative of trial and error, thus for fisheries management, identifying the uncertainties of the system and learning from them can prevent future failures (Hilborn, 1992). A number of measures introduced within the CFP framework have been criticised over the years; especially the quota system (Karagiannakos, 1996; Rossiter & Stead, 2005; Fernandez-Macho *et al.*, 2008) and the subsidization of the sector (Hatcher, 2000; Markus, 2010). However, in many cases it is not the measures that cause the failure but the way these measures are implemented and/or communicated (Daw & Gray, 2005) as shown by the introduction of ITQs in Denmark in Chapter 3. It is important that the implementing authorities attempt to convince the industry of the potential advantages of a new regime and increase the chances of the regime being accepted (with valid and factual information). This requires trust between the different stakeholders. As Chapter 4 and 5 illustrated, sometimes the underlying factor for mistrust is the lack of communication and participation of the industry. In Chapter 6 however, specific examples are presented where the industry has valid reasons to be suspicious of the authorities (i.e. the introduction of Category C in the Cypriot fishing vessel licensing system). Thus, the EC needs to ensure that it acts as a mediator when the gap between national authorities and the industry widens.

In a sector like fisheries where such conflicting objectives exist, success has a different meaning for different stakeholders (Hilborn, 2007). Altruistically speaking, the objective of conserving the resources should be the pillars for success in fisheries management, as the other objectives like economic, social and political ones cannot be achieved without it. Thus, scientific advice must be followed and the best available tools must be used (Schrank, 2007; Cardinale & Svedäng, 2008). It is also important that both this scientific advice and regulatory decisions are well-communicated with the industry. Evidence from Chapter 4 and 5 suggest that clashes

[1] As reported in the 2009 Green Paper on the reform of the CFP 88% of Community stocks are being fished beyond their Maximum Sustainable Yield, of which 30% are outside safe biological limits thus they may not be able to replenish.

between stakeholders regarding the implementation of different ROs are mainly attributable to lack of knowledge and understanding of the measures, which leads to high levels of uncertainty regarding regime outcomes. Establishment of closed areas in particular tended to receive much opposition by the industry. Fishers' attitudes have important implications for the establishment of fisheries management tools which are considered to have potential conservation benefits, for example the implementation of spatial closures. Thus successes of such measures require increased dialogue between the different stakeholders in order to improve understanding of the fisheries benefits of such measures. Again, the implementation of such measures requires a case by case evaluation and monitoring as unfulfilled expectations can lead to loss of credibility of what can be a valuable management tool (Hilborn *et al.*, 2004).

Nevertheless, there undoubtedly will be instances where industry and regulators will not agree, and a decision with which the industry is not in agreement with must be reached for the benefit of conservation (and thus the long-term benefit of the industry). Chapter 3 illustrates two examples where a regulation was imposed on the industry, and despite the industry's initial resistance, the success of the regime has brought about the desired changes. In the U.K. the introduction of the Buyers and Sellers registration regulation assisted in increased fish prices and helped reduce black landings. In Denmark, the introduction of an ITQ regime for the Danish pelagic fleet led to a more efficient fleet with fewer but bigger vessels and despite the initial hostility of smaller-scale pelagic fishers (those with vessels of <40 meters), the majority who ended up selling out their quotas have earned a respectable amount of money and happily left the industry. Thus, even though the potential of always reaching a consensus among stakeholders is not possible, it is important to get the incentives right and the only way to achieve that is to be case specific (Hilborn, 2007).

The one common finding from each of the chapters is that no matter which methodologies are used to examine governance structures and management systems, their study ought to be done at a regional scale. According to Symes (1997), 'the state has allowed itself to become too centrally involved in fisheries management and must therefore shoulder much of the responsibility for the failures. It has distanced itself too much from those it seeks to regulate and failed to gain acceptance for its policies'.

However, as the 'local' level of public action is needed as a condition of social acceptability, ecological effectiveness and practical adaptation of human change, it cannot become an argument to delegitimise societal orientations and political decisions at a global level (Charles, 1994; Steyaert et al., 2007).

When objectives are being formed in a top-down manner not only are they too broad to be effective, they also become 'diluted' on the way down. Community-level objectives are definitely needed but area-specific objectives can be much more efficient as they will tend to include local-specific decisions and guidance for their implementation. The need for a fundamental reform is acknowledged in the Green Paper on the 2012 CFP reform with the Commission recognizing the causes of poor implementation (Symes, 2009a) by identifying the five structural failings of the CFP. From these failings, four are related to governance: (i) imprecise policy objectives resulting in insufficient guidance for decisions and implementation, (ii) decision-making system that encourages a short-term focus, (iii) framework that does not give sufficient responsibility to the industry, (iv) lack of political will to ensure compliance and poor compliance by the industry (European Commission, 2009a). For these failures, regionalization can form part of the solution.

A more regionalised decision-making system can encourage a longer-term focus. Decisions taken closer to the source can capture the specific local views and ideas of those affected. Debates at a local level can result in an exchange of views which will be educational for all parties and potentially to agreements of a longer-term focus. Regional specific debates and decision will account for the different cultures of the various EU regions (and to complicate things even further, such regional differences, are in turn composed of different socio-political and organizational realities[2]). This needs to be respected if specific objectives are to be met and a different approach is required to engage different stakeholders. Regionalization can definitely make the industry admit to its part of the responsibility for the state of the resources. Particularly, if decisions are taken closer to the source[3], and the industry is more

[2] For example the differences in fishers' organizational structure in the Mediterranean case studies; the well organised cofradias in the Spanish Mediterranean against the not so well organised fishers in Cyprus.
[3] Closer to where the measures will be implemented

active during the decision-making, they are more likely to be compliant with the decisions as they can be held accountable for the decisions.

Finally, when decisions are taken away from the source, those further away from the source (the European Commission) are the first ones to be blamed by the industry but also by the national ministers. Thus, when EU decisions are against the 'dos' and 'wants' of the voters (industry and family), it is easy for the national ministers to wash their hands of the decisions and blame the Commission. In a similar manner, the main aim of the national ministers during the December fisheries council is usually to return to 'their fisher-voters' with good news of an increase in their quotas (and if not, then they can just tell them that the Commission did not allow them to)[4].

Specific policy implications which can lead to a transparent, fast-track decision-making system in fisheries include:

1. The council of ministers have too much influence for issues about which they do not have suitable knowledge. Thus, (i) politics should be taken out of the decision-making process and (ii) scientists, be they biologists, economists or sociologists need to be allowed to do their job.
2. The decision-making process, especially for specific micro-management issues needs to be moved closer to the source.
3. Increasing participation of the industry is vital. The creation of RACs has certainly been a positive step. However, in many cases such arrangements tend to mostly hear the opinions of the wealthier and more industrial fishers who tend to be better organised in their Producer Organizations. I propose that that each Member State employs social or multidisciplinary scientists in their fisheries team instead of simply employing a social or interdisciplinary researcher when a specific study is required. Thus there will be information exchange between grassroots fishers and the authorities (whether that is socio-economic concerns from fishers to the authorities or communication and rationalization of potential new proposals from the authorities to the fishers).
4. To minimise the socio-economic impacts of new measures, the EC has introduced 'Impact Assessments' according to which the EC is required to assess

[4] Interview with Ernesto Penas during December 2008

potential economic, social and environmental consequences of new initiatives before these initiatives are presented to the decision-makers (Council of Ministers). Impact assessments for new fisheries initiatives will take into account scientific advice derived from biological and economic analysis given by the Scientific, Technical and Economic Committee for Fisheries (STECF) and by consultation with the relevant stakeholders. I propose that the methods used in this study, especially the use of structural and economic indicators as in Chapter 3 are incorporated in the Impact Assessments so as to identify what has and what has not worked in the past. The use of such information should be supplemented with local social knowledge. This knowledge must originate from fishers themselves via their representatives, on-field researchers or via representatives set by the national authorities. The latter can assist in improving the relationship between fishers and their national authorities.

7.3 Reflection and Future research needs

This study embarked on a difficult task; to analyze the governance structures and management systems of the CFP. However, the spatial scale at which this analysis was attempted was too broad, thus there were many logistical and time related difficulties to be accounted for. Due to this, sample sizes for Chapter 4 and 5 (in terms of fishers interviewed and ports/countries visited) are only but a small percentage of the actual population size. Even though the initial study could have been attempted on a smaller scale (i.e. as a single country analysis or a single *metier*), I believe that as an initial attempt, such an endeavour on a pan-European level was needed, as long as its limitations are acknowledged. However, a widespread understanding of past European fisheries institutional failures and successes are required for the future reform, and this understanding is needed on specific *métier* by *métier* basis. Additionally, further research is needed to understand fishers' perceptions on (i) the ROs imposed on them and (ii) the authorities in charge (national and EU).

During this thesis there have been attempts to use methods which are either completely or relatively novel in fisheries management. Chapter 4 and 5 used a technique which originated in the marketing circles to explore consumer perceptions of new products and help understand their marketing behaviour known as the Adaptive Conjoint Analysis (ACA) (Alriksson & Öberg, 2008). This interactive computer survey disaggregated the management process into key attributes with different potential levels, and allowed for the quantification, but mainly the ranking of fishers' preferences for different ROs with regards to the perceived impact on their income. A theoretical framework known in the social sciences has also been successfully used in Chapter 6 which helped assess the multidimensionality of how resource, resource users, public infrastructure and public infrastructure providers are linked depending on regional socio-cultural and biological settings. In conclusion, when objectives are clearly set out, relevant methods established in other disciplines can be obtained and employed to achieve those objectives.

7.4 Conclusion

As shown in this study even though there is some degree of regionalization in the CFP (Chapter 2), different measures have succeeded or failed depending on their implementation strategies which are related to the different socio-political and ecological settings they have been applied in (Chapter 3). Additionally, participation of the industry is essential for the successful implementation of the management measures; participation not essentially in decision-making regarding which management measures are best to control the industry's activities, but rather in terms of improving the industry's understanding the function and the importance of measures imposed on them (Chapter 4 and 5). Thus, for institutional change to be successful, stakeholders need to realize the benefits of change before moving on to new institutional arrangements (Ostrom, 1990). The development of an effective policy also needs to rely on research which allows unanticipated impacts to be identified (Symes & Hoefnagel, 2010) the recognition of which can help in the development of fisheries micro-management needed for compliant and robust fisheries systems, and thus sustainable ones (Chapter 6).

It is important that the new reformed Common Fisheries Policy takes into account all the biological, political and cultural differences of the relevant member states, as it might be the last chance for salvaging Europe's over-exploited marine resources. A ‘one size fits all’ CFP cannot deal with the structural and conservation issues of European fisheries. What is needed is a simplified regulatory framework with different methods of governance across different regions, allowing a greater involvement of stakeholders and a fast-track decision-making process which are essential in a rapidly evolving sector such as fisheries. This study is not suggesting anything new in terms of what is ought to be done during the CFP reform. Rather, it has produced evidence to support the new policy and governance suggestions supported already; decentralization of decision-making and micromanagement of the resources taking into account biological, socio-economic and political specificities.

However, the importance of the ‘local’ level of public action as a condition of social acceptability, ecological effectiveness and practical adaptation of human change, does not mean delegitimizing societal orientations and political decisions at a higher European level (Charles, 1994; Steyaert *et al.*, 2007). Thus, despite this need for regionalization, the framework of the CFP is still required to remain an integrated Community policy. A Community environmental policy is important not solely from a pure environmental protection aspect but also from (i) an economic point of view; harmonisation of environmental regulations help avoid distortions of competition within the EU plus to preserve and increase competitiveness of Community products in the world market economy; and (ii) a political point of view; the increased public concern for environmental issues concerns the government for losing legitimacy in case no action is taken (Liberatore, 1991). Various obstacles discussed in this thesis, such as differences in enforcement and compliance culture along with the governance history of each area can indicate why regionalization can form an even more important part in the 2012 reform of the Common Fisheries Policy but also why complete responsibility to the Member States of their marine resources can be dangerous.

In conclusion, even though some degree of regionalization already exists due to the biological and physical characteristics of the EU waters, the CFP has not been successful in maintaining fisheries stocks in a healthy state. The variation in the cultural aspects within Member States suggests that through changes in governance, and by shifting some of the decision-making closer to the source the chances of the 2012 reform being a success will improve. When objectives and decisions are formed via a top-down approach, these objectives are generally too broad to be effective and cannot take into account fears or suggestions from the stakeholders, especially those stakeholders at the foundations of the industry. We must not forget however, that the resource is what sustains the industry, hence scientific advice must be prioritized over politics and even social concerns to ensure sustainability of a stock. Nevertheless, it has been shown that communication between the industry and the scientists can minimize conflicts. For the 2012 CFP reform to succeed, clear and localised objectives are vital, with transparent communication and knowledge exchange pathways between fishers, scientists, politicians and the EC.

'If a man does not know to what port he is sailing, no wind is favourable',
Seneca the Younger

Plate 3: Inshore fishing vessel near the Cypriot West coast.

8. Appendices

8.1 Appendix 1

Table 8.1: Summary of missing data for each key Data Collection Regulation parameter and economic indicator used

	2002	2003	2004	2005	2006	2007
TOTAL INCOME (mEUR)	Missing Portugal, Spain, Greece, Ireland	Missing Ireland, Madeira	Missing Madeira	Missing Madeira	Missing Azores, Madeira, Slovenia	Missing Portugal, Malta
TOTAL VALUE OF LANDINGS OF FISH/SHELLFSH (mEUR)	Missing Spain, Portugal, Ireland, Greece	Missing Spain, Portugal	Missing Spain	Missing Spain	Missing Spain	Missing Spain, Malta
CASH-FLOW (mEUR)	Missing Portugal, Spain, Greece, Ireland	Missing Portugal, Greece, Ireland	Missing Portugal	Missing Portugal	Missing Portugal, Slovenia	Missing Portugal, Malta
PROFIT (LOSS) (mEUR)	Missing Portugal, Spain, Greece, Ireland, Belgium, Italy, UK	Missing Portugal' Spain, Greece, Ireland, Italy	Missing Portugal, Spain, Italy	Missing Portugal, Spain, Cyprus, Malta, Latvia	Missing Portugal, Spain, Cyprus, Malta, Latvia	Missing Portugal, Spain, Slovenia, Malta, Latvia
EMPLOYMENT (TOTAL)	Missing France, Spain, Portugal, Denmark, Netherlands, Ireland	Missing France, Denmark, Netherlands, Madeira	Missing France, Denmark, Netherlands, Madeira	Missing France, Denmark, Netherlands, Madeira, Malta, Latvia	Missing France, Denmark, Netherlands, Madeira & Azores, Latvia	Missing France, Denmark, Netherlands, Portugal, Malta, Latvia
EMPLOYMENT (FTE)	Missing Finland, Spain, Belgium, Sweden, Portugal, Italy, Ireland, Greece	Missing Finland, Belgium, Portugal, Sweden, Italy, Ireland, Greece	Missing Finland, Belgium, Portugal, Sweden, Italy, Ireland, Greece	Missing Finland, Belgium, Portugal, Sweden, Italy, Ireland, Greece, Malta, Estonia	Missing Finland, Belgium, Portugal, Ireland, Greece, Malta, Estonia, Slovenia	Missing Finland, Belgium, Portugal, Malta, Ireland, Greece
EFFORT DAYS (1000)	Missing Portugal, Ireland					

WEIGHT OF LANDINGS OF FISH /SHELLFISH (1000t)	Missing Portugal, Ireland	
FLEET (number of vessels)	Missing Portugal, Ireland	Missing Azores
FLEET KW (1000)	Missing Portugal, Ireland	Missing Azores

8.2 Appendix 2:

Demographic Information for fishers

(i) Nationality:

(ii) In which country are you employed?

□Cyprus
□Spain
□Denmark
□United Kingdom

(iii) In which port do you land your fish?

(iv) Year of Birth (format: 19XX):

(v) Gender

□Male
□Female

(vi) Do you fish mainly inshore (within the 12 naultical miles) or offshore (beyond the 12 nautical miles)?

□within the 12 nautical mile limit
□beyond the 12 nautical mile limit
□Both

(vii) Which fleet do you belong to?

□Pelagic trawl
□Beam trawl
□Bottom otter trawl
□Bottom pair trawl
□Bottom trawl
□Pelagic Trawl
□Midwater trawl
□Midwater demersal otter trawl
□Multi Rig Otter Trawl
□Nephrops Trawls
□Pair Trawl
□Purse Seine
□Danish/Scottish seine
□Dredge gears
□Handlines
□Gill nets
□Long-line
□Trammel Nets
□Other (please specify)

(viii) Which species does your vessel target?

(ix) What is the length overall (L.O.A.) of your vessel?
□>/= 8 m
□9-10 m
□10-12 m
□13-15 m
□16- 18 m
□19-24 m
□> 24 m

(x) What is your status on the vessel?
□Owner
□Skipper
□Owner & Skipper

(xi) Apart from yourself, how many crew members are there on your vessel?

(xii) In which European marine region do you fish?

□Northern waters
□Southern waters
□Both

(xiii) In which area(s) do you usually fish in and what percentage (%) of your fishing time do you spend in each area?
If you fish in more than one area please make sure that the sum of the time you spend fishing in each area comes to 100

IIa
IIIa
IIIb
IIIc
IIId
IVa
IVb
IVc
Vb
VIa
VIb
VIIa
VIIb
VIIc
VIId
VIIe
VIIf
VIIg
VIIh
VIIj
VIIk
VIIIa
VIIIb
VIIIc
VIIId
VIIIe

IXa
IXb
X
37.1.1
37.1.2
37.1.3
37.2.1
37.2.2
37.3.1
37.3.2
37.4.1
37.4.2
37.4.3
Other
Total

8.3 Appendix 3:

Demographic Information for Scientists

(i) Age

(ii) Gender
☐Male
☐Female

(iii) Do you consider yourself to be
☐mainly a natural scientist
☐mainly a social/political scientist
☐an interdisciplinary scientist *(please only use this option if you cannot describe yourself as one of the above)*
☐Other

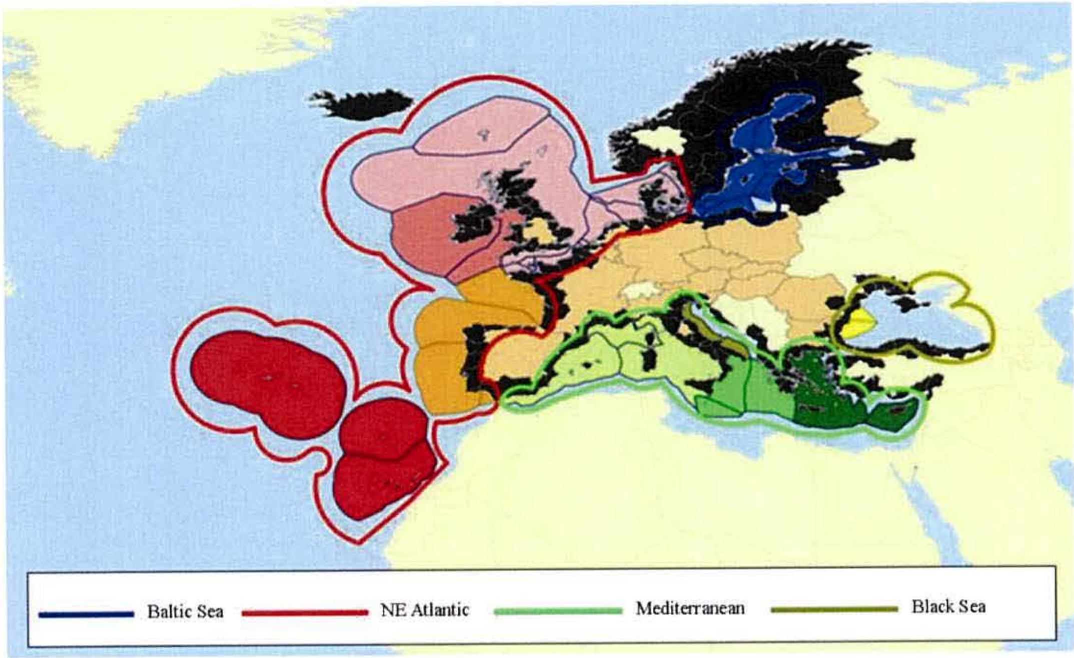
(iv) Who do you work for?
☐University
☐Government
☐Non-governmental organisation
☐Other

(v) Nationality

(vi) Country of employment

(vii) Which fleet would you rather talk about?
☐Inshore fleet (fishing activities take place within the 12 nautical mile limit)
☐Offshore fleet (fishing activities take place beyond the 12 nautical mile limit)

(viii) Which European region would you like to consider in this survey?(You can tick more than one region if you believe those regions should have the same (or very similar) fisheries management models)
☐Baltic Sea
☐NE Atlantic
☐Mediterranean
☐Black Sea


Baltic Sea
NE Atlantic
Mediterranean
Black Sea

8.4 Appendix 4:

Articles written to raise awareness for the illegal fishing of the eastern Baltic cod

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Article 1:
The Cod Fishery in the Baltic: unsustainable and illegal
Published: September 6, 2006

A 16-page report which summarises 'the disastrous situation, gives an overview of the Baltic cod fleet and markets, and describes the EU's political approach to managing Baltic cod fisheries, which may be viewed as a failure to this point in time'.

URL: http://www.greenpeace.org/international/Global/international/planet-2/report/2007/8/cod-fishery-baltic-sea.pdf

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Article 2:
30% of cod in the Baltic Sea is stolen by pirates
Published: September 6, 2006

MALMÖ, Sweden — At least a third of the cod caught and landed in the Baltic is stolen, and pirate fishing is making the recovery of certain populations impossible, according to a new report by Greenpeace.
In Poland last year the figure was even higher, with 45% of the Eastern Baltic Cod caught estimated to be illegal, unreported to authorities or in breach of regulations.

"A legitimate company would never dream of buying or selling a product where they knew a third of the parts where stolen goods. Still large distributors and manufacturers of fish products ignore that their raw material could be totally illegal, and look the other way while our seas are being destroyed", said Ida Udovic, Ocean Campaigner onboard Greenpeace ship Arctic Sunrise in the port of Malmö.

The illegal and legal catches are mixed in the ports and it is impossible to point out exactly where the illegal cod ends up. Poland, which is the centre for cod filleting across the region, last year supplied Western Europe with over 41 000 tons of cod filets. The bulk, 44%, went to the UK; Germany took 13%, Denmark 12% and Belgium 9%. Among the companies that buy cod from Baltic catches are Pickenpack and Frosta (Germany), Fjord Seafood (Netherlands), Västkustfilé (Sweden) and Royal Greenland (Denmark). Most of the Baltic cod is sold as fresh whole fish or fillets either to retailers or restaurants. The exception is the large Danish company Espersen A/S having a key role in processing and distributing frozen fillets for various brands.

"No company that sources fish from the eastern Baltic can guarantee that their products do not include fish that is caught by pirate fishing vessels", added Udovic.

Despite the large-scale illegal fishing on cod the Baltic Sea states routinely fail to take action. The maximum average fine recently imposed anywhere in the region has been a mere 538 euros.

The Arctic Sunrise is in the Baltic as part of the Defending Our Oceans campaign and will be highlighting the issue of pirate fishing throughout the region. Greenpeace is demanding a network of marine reserves to shut down the pirate trade and allow vital cod stocks to recover. Marine reserves make controls much easier than the current patchwork of regulations that have made control impossible. In addition all fishing vessels in the Baltic should have a device onboard enabling electronic surveillance, controls ashore and off shore should increase and a black list for all vessels caught cheating should be established. At the same time the Greenpeace ship, Esperanza is in the Pacific, also highlighting the issue of stolen fish.

URL: http://oceans.greenpeace.org/en/press-centre/press-releases/baltic-sea-pirates

Article 3:
Captain Birds Eye - Make piracy history,
Unilever should clean up its act before selling
Published: September 20, 2006

IGLO/Birds Eye Frozen Foods is the Number one frozen food player in Europe, operating mainly in the UK under the Birds Eye brand, and in Germany and Austria under the IGLO brand. Birds Eye proudly proclaims it makes, "enough fish sticks every year to stretch around the equator!" What they don't tell you is that over a third of their cod fish sticks could be stolen, the fish plundered illegally from the Baltic and Barents Seas.

Would you buy a used car if a third of the parts were stolen?
Recently Unilever sold Birds Eye and IGLO in Europe to Permira, an investment company. The sale isn't final until the end of the year. Unilever continually promises to ensure that all their fish came from sustainable sources.

Unfortunately, they have a serious problem with a lot of illegal fish in their supply chain, including cod. Danish company Espersen is one of their main suppliers of cod. Espersen sources directly and indirectly from the Baltic, and indirectly from the Barents. This hides Unilever behind a wall of others, but this does not remove their responsibility.

It also means Captain Birdseye cannot guarantee that the fish in your supermarket is not from illegal pirate fishing.

Before the sale to Permira is finalized, Unilever should live up to its promises and announce publicly its intention to ensure that Permira isn't buying an illegal cod-laundering operation.

What's so bad about cod?

Scientists are calling for a drastic reduction of quotas, and even a complete stop to cod fishing in the eastern Baltic Sea from 2007.

It's bad enough that the official Baltic cod quota is 49,000 tonnes - more than three times the quota recommended by scientists for 2006. To make matters worse, a huge amount of additional cod which is illegally caught is landed in harbours around the Baltic Sea bound for EU dinner plates - including your Birdseye or IGLO fishsticks. At that rate, cod may soon be off the menu for good.

Why target fish companies? What about governments?

Birds Eye and IGLO are of the world's biggest users of cod and have the power to influence the supply chain. Unlike many of their competitors, Unilever has made no public commitment on countering illegal cod in their products.

URL: http://www.greenpeace.org/international/en/news/features/captain-birdseye/

Article 4: Artic Sunrise crew seizes pirate's fishing nets
Published: September 15, 2006

Yesterday, the Arctic Sunrise crew found illegal nets set for cod in the eastern Baltic. But the pirate fishermen are in for a surprise when they return. Our crew has confiscated the nets, but helpfully left a note on a buoy with a phone number the pirates can call to get them back.
And we hope the pirates do call because they've got some explaining to do. As part of a fisheries management plan, the eastern Baltic is closed to cod fishing between June 15 and September 15. Obviously, someone thought they could get a head start.

The problem

In reality, pirate fishing is rampant in the Baltic Sea - where it is estimated that every third cod brought in is caught illegally. And the nets we found today were mostly full of small cod. None of the fish in them was old enough to spawn.

The eastern cod stock is severely threatened and scientists have recommended a complete halt to cod fishing in this area. Yet, the EU proposed quotas of 38,000 tons for 2007. Coupled with the rampant illegal fishing, unsustainable EU policies are paving the road to extinction for the Baltic cod.

Yeah right

Our activists also boarded two fishing boats in the area closed to cod fishing. Onboard we found hundreds of kilos of cod, and the nets where still wet. The fishermen claimed the cod was caught far away in the western area.

"Holding up fishing rods they said they only stopped in the area for recreational fishing. Even though I may not be able to prove it in court I'm convinced these guys where fishing pirates," said Ida Udovic, from on board the Arctic Sunrise.

Following the money

Onboard the same vessels Greenpeace also found several boxes from Europe's largest cod supplier, Espersen AS, Denmark. In 2001, Espersen was caught using cod fished illegally in the Baltic Sea. The company was fined 134,000 euros. In early 2006 they where caught again, this time receiving illegal cod from the Barents Sea. In the latter case, Espersen claimed to have been ignorant of the true origin of the cod, and was not charged.

How to save the cod fishery

A network of marine reserves - no take zones - would facilitate enforcement and give cod stocks a chance to recover. To go with this, all fishing vessels in the Baltic should have a device onboard enabling electronic surveillance.

Proper controls on and off shore should be set up, and a blacklist for all vessels caught cheating should be established.

URL: http://www.greenpeace.org/international/en/news/features/baltic-piracy-confronted/

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