Fishermen's risk perception in four european countries

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Abstract This paper focuses on risk perception amongst fishermen in four countries: the Faroe Islands, Greece, Iceland and the UK. The main question addressed is whether fishermen in the four countries perceive risk in a similar or diverse manner. In particular, risks associated with policy, management and control, fish stock health, economic factors and climate change are analysed. Data on risk perceptions were collected through a series of unstructured interviews based on an adapted version of the mental modelling methodology. The output of the interviews was analysed qualitatively and by using simple descriptive statistics. The key findings of this paper are that risks relating to policy, management and control are of most concern to fishermen, followed by economic factors and the impact of fishing on the environment. It was also apparent from these results that most of the risks cited by fishermen tend to be controlled by agents outside the fishing industry. This study contributes to the emerging theory of risk within the fishing sector and highlights the areas that need to be addressed by fisheries managers to improve resource management. However, further analysis and research is required to fully comprehend risk perception among fishermen and other stakeholders in the marine environment.

Introduction

Risk issues are complex, dynamic and characterised by uncertainty and conflict. This complexity is due partly to their multidimensional nature, with technical, economic, social, political, ethical, health and other factors involved in most instances. In a paper by Macgill and Siu (2005:1108), who state that 'it is impossible to identify a risk issue that nobody knows anything about', risks are characterised as being multidimensional and 'exist only by the virtue of the knowledge people have of them'. In most cases, risk involves both physical and social dimensions, so we share the definition given by Macgill and Siu (2005:1110) that risk is 'the union of the dynamically evolving risk knowledge of the physical and social worlds'.

Risks associated with the fisheries sector can take many forms; for example, the risks of stock collapse, safety-at-sea, management failure, or exchange rate fluctuations. It is important to elicit the fisheries sector risk perceptions from a variety of viewpoints instead of merely relying on those provided using formal quantitative methods as carried out by scientists, for example when determining the likelihood of stock collapse or recovery that may result from various policy options. Fishermen are obviously central to the fishing activity and they in turn base their decisions on information (and associated risk perceptions) from a number of sources including management regulations, economic conditions, and operational factors. In writing about perceptions of risk by scientists and the general public, Slovic (1987:285) wrote that:

> Perhaps the most important message from this research is that there is wisdom as well as error in public attitudes and perceptions. Lay people sometimes lack certain information about hazards. However, their basic conceptualisation of risk is much richer than that of experts and reflects legitimate concerns that are typically omitted from expert risk assessments.

A failure to consider risk perceptions held by stakeholders in the fisheries sector can undermine government actions aimed at managing or accommodating risks to the sector. In particular, risks related to the sustainability of natural resources and the fishing community need to be better understood to ensure management measures adequately protect fisheries and the fishing industry. It is argued in this paper that risk perception of European fishermen is shaped by various social, political and economic forces. In order to increase communication between stakeholders in the fishing industry, and better manage natural resources, it is vital to understand how fishermen comprehend risks in their industry.

The research and results presented in this paper seek to elicit risk perception amongst fishermen in four countries. The four countries chosen for analysis are the Faroe Islands, Greece, Iceland and the UK. The basis of this selection is the contrasting scales and nature of the fisheries found in each country and the differing management structures and social contexts. The paper employs the Grounded Theory approach (Glaser and Strauss 1967), in order to develop concepts and patterns directly from data, and does so to identify the key elements of risk perceptions among European fishermen. The main objectives

for the research presented in this paper are: 1) to identify the risk perceptions of fishermen in each country; 2) present these risks by simple statistical and cluster analysis; and finally; 3) develop hypotheses from the emerging patterns of risk perceptions.

The research adopted a social science approach to the identification of risks by assuming that people differ in their perception and evaluation processes (de Camprieu, Desbiens and Feixue 2007). Data were collated through a series of unstructured interviews based around an adapted version of the mental modelling methodology put forward by Bostrom (2003). Results are analysed qualitatively and by using simple descriptive statistics.

This research was conducted under the European Union-funded research project PRONE.[1] This paper deals only with risk perception among fishermen. For analysis of risk perception among other groups of stakeholders in the fishing industry of the four countries selected see Tingley *et al.* (2008).

This is one of the first known attempts to collect and analyse data on risk perception of fishermen operating in different countries and to adopt a social sciences approach. Our research is unique due to the comparative aspects of fishermen operating in four European countries with different fisheries management systems.

The next section reviews the theory relating to risk perception research. Section three outlines the research methodology employed. Results are presented in section four and the paper ends with a discussion of the results in respect of the overarching research objectives where some conclusions are presented.

Literature Review and Theory

General Theories of Risk

The basic assumption of the social sciences is that a risk event or hazard can mean different things to different people and that these perceptions are also context and culturally dependent (Taylor-Gooby and Zinn 2006). In most cases risk involves both social and physical dimensions. The physical dimensions include factors such as ecological threats, transport accidents, and stigmatisation of local areas, whereas social dimensions refer to determinants of people's judgement about risk acceptability (Macgill and Siu 2005).

Social scientists have shown differences in risk perceptions among technical experts, the general public, ethnic and other social groups, and between individual and group preferences (Slovic and Weber 2002). Sjöberg (2002) notes, for instance, that experts tend to assign lower estimates to risks which fall within their own area of expertise and responsibility, in comparison to the public, suggesting that the level of responsibility felt by experts about a risk is the driving factor for these differences, as compared to the level of knowledge. Pidgeon *et al* (1992) conclude that experts are often overconfident in the exactness of their estimates. Activities are perceived as being more risky if the people or agencies managing them are perceived as untrustworthy. Also, information from trusted sources is given more weight than that from untrusted sources. Taylor-Goodby

and Zinn (2006) point out that if the 'non-expert' perception of the strength of uncertainty, or threat caused by a risk differs from that of the objective scientific or 'expert' community, this is neither irrational nor uninformed.

Many external factors have been shown to affect how people sense risks. For instance, Slovic, Fischhoff & Lichtenstein (1979) came to the conclusion that cognitive limitations cause uncertainty to be denied and risks to be distorted, and that risk is influenced by the imaginability and memorability of the hazard. Expert risk perceptions corresponded closely to statistical frequencies of death, while three factors were found to be particularly important in influencing lay people's acceptance of risk: factors known as uncommon risks, risks that are unknown, and the number of people potentially affected. People have been found to overestimate risks which score highly in terms of these properties and underestimate those they are more familiar with. Risk characteristics have also been found, for example, a 'dread risk' (Slovic, Fischhoff & Lichtenstein 1979) is seen to be linked with characteristics relating to degree of control of the risk by the individual. Dread risks are also potentially catastrophic or have fatal consequences, are irreversible, are involuntary and are inequitably distributed. 'Unknown risks' (Slovic, Fischhoff & Lichtenstein 1979) have been linked to the characteristics of not being known at all, including to science. Similarly, Otway and von Winterfeldt (1982) listed a series of eleven general negative attributes which were found to influence perception and acceptance of risks: involuntary exposure of risk and lack of control over outcomes means that people have negative attitudes to risk, and the same goes for uncertainty about likelihood and lack of experience with risk (that is, the fear of the unknown). The authors also list threat to future generations; infrequent but catastrophic accidents; benefits not highly visible; benefits go to others (inequality); difficulty in imagining exposure to the risk; effects of exposure in delayed time; and accidents caused by human failure rather than natural causes.

Relative power also appears to be an important dimension of context that influences perceptions of risk. Tierney (1999) finds that political and economic power determines the ability to impose risks on others, shape public discourse about risks, sponsor and conduct research that presents risk in particular ways and lobby for particular positions on the acceptability of risk. She also highlights the sociological view that risk is a dynamic concept and so human activity and social change constantly act to modify individual, group and society levels of risk vulnerability.

Based on the above discussion, we therefore hypothesize that perception of risk tends to increase when fishermen do not have control over a risk factor and when the risk is involuntary, unknown, human-based, and relates to untrusted agents. Moreover, fishermen's relative political and economic power will change their sense of risk.

Research Related to Risk in Fishing

In this section we present research that focuses on fishing related risks. Two main research streams were identified: risk and fisheries management systems and dangers relating to the fishers' occupation. At the end of the section we con-

nect this work on risk in fisheries with the general findings on risk presented in the previous section as a basis to assess the potential risk perceptions to emerge among European fishermen.

Previous research has shown that fisheries management systems affect the organisation of the fishing industry in various ways. First, we note the impact of fisheries management systems on the behaviour of fishermen. Especially pertinent to our case studies are Individual Transferable Quota (ITQs) and input restriction systems. Individual Transferable Quotas (ITQs) are generally thought to encourage fishermen to better match existing capacity and effort levels with current and future ITQ holdings in an economically rational manner. Thus they are encouraged to adjust their activities, by engendering a sense of responsibility towards ensuring long-run sustainability, rather than sacrificing long run yields for short run economic profits. However, ITQs have also been criticized for a variety of reasons such as initial allocation problems and windfall gains, consolidation and employment issues affecting vulnerable communities, increased propensity to discard, loss of smaller boats, and high quota prices (Minnegal and Dwyer 2008; Copes 1986).

Input restriction systems tend to be prone to overexploitation as a function of their lack of well defined property rights over the fishery resource. As each individual fisher is unable to prevent other fishers from taking their share of the catch the incentive is to take as much of the catch as possible (Charles 2001). As a consequence, fishermen tend to compensate for restricted inputs by increasing landings (Campell 1991) and to invest in more productive fishing technology often referred to as 'technological creep' (Marchal *et al*. 2007).

The complexity of fisheries management systems is the second aspect in relation to fishing, creating uncertainty and ambiguity in the industry that undermines the management of such systems. Accordingly, Garcia and Charles (2008) identify many features of the fisheries system which contribute to its unique complexity, such as the fundamentally limited and complex nature of renewable resources; exceptionally high levels of unobservability due to our inability to view fish in the sea; high levels of complexity due to multiple-species and fishing sectors, and strong political and economic drive due to high societal interest in ocean systems and high volumes of international fish trade. This complexity can cause losses in understanding, predictability, and management of the system, and the authors suggest changes to adapt new emerging relations between science, policy-making and society within complex fishery systems. In a similar manner, Degnbol and McCay (2006) discuss how a failure to understand linkages in the fisheries system can lead to management strategies that fail to achieve their objectives. They stress the need to recognise links between institutions involved in the production and evaluation of knowledge, on the one hand, and institutions which make management decisions, as well as being involved in fisheries implementation framework and adaptation, on the other. Finally, Pontecorvo and Schrank (2006) focus on the poor record of fisheries management. They argue that in a competitive industry like fisheries, the main objective is to maximize profits, or harvest, within a very short time frame. Consequently, catch limitations are seen as a threat to income. Unless the Total Allowable Catches (TACs) are based

on convincing scientific advice, the stakeholders in the industry will take any step they can to increase them. When these steps are successful, overfishing results. Pontecorvo and Schrank claim that overfishing is a structural problem involving knowledge limitations of fisheries science and the organisation of the fishing industry. In order to save the existing wild marine fisheries, they propose a more conservationist fisheries policy based on small scale fishing.

Fishermen tend to respond to the constraints of fisheries management systems by diversification according to Minnegal and Dwyer (2008). In their study of locally-based commercial fishers in Victoria, Australia, they found that fishers utilise diversification, such as multiple targets as manifested in a variety of fishing areas, vessels and markets. Such techniques help them manage risks in the biological and economic environments they experience. These measures have contributed to the numerical stability of the local fleet, at a time when most fishing fleets are in decline in the surrounding areas. This has even counteracted the main purpose of most fisheries management systems, which is to decrease the numbers of vessels. An implication of these findings is that the ways fishers manage risk offer lessons for fisheries managers as to why their policies fail and how they could be more successful.

Fishing is statistically a dangerous occupation. Pollnac, Poggie, and Cabral (1998) argue that the literature supports the proposition that fishers manifest the characteristics of an active, adventurous, aggressive, and courageous personality. Individuals with these characteristics would tend to minimize the perception of danger. Furthermore, they belong to a subculture that values bravery and fearlessness, which may also influence their perception of risk and danger. In a study of the New England fishery Pollnac *et al*. (1998) found that all fishers show great concern with grave danger such as falling overboard, explosions, and collisions at sea. However, the more experienced fishermen, and those fishing further offshore, did not express the same severity in perceptions of these risks.

Roberts (1992) noted that fishermen operate in a unique and dangerous situation and have to deal with weather-related hazards combined with economic pressures; the industry can be unreceptive to the introduction of safety measures. Poor (or equally high) prices can encourage fishers to take risks to maximise trip value. These risks can involve risky behaviour (for example fishing in dangerous conditions), but can also involve risky strategies (for example landing black market fish). Personal safety appears not to be a priority for fishermen (Törner and Eklöf 2000) who tend to see safety protection as costly.

Based on the above discussion we therefore hypothesize that complex fisheries management systems will impose various risks on fishermen, such as restricting access to fishing, or enabling other fishermen to snatch their share. This tends to give rise to economic concerns. Knowledge limitations of fisheries science combined with our inability to view the fish in the sea can also pose some risks, as the unknown tends to increase risks, and as imperfect scientific knowledge tends to escalate conflicts between the fishing industry and regulators over catch size and restrictions on fishing. This can mean that activities are seen as more risky because they are managed by untrustworthy agents. Fishermen

tend to manage such risks by fighting fisheries restrictions, by diversifying, and by neglecting the risks associated to with their dangerous occupation.

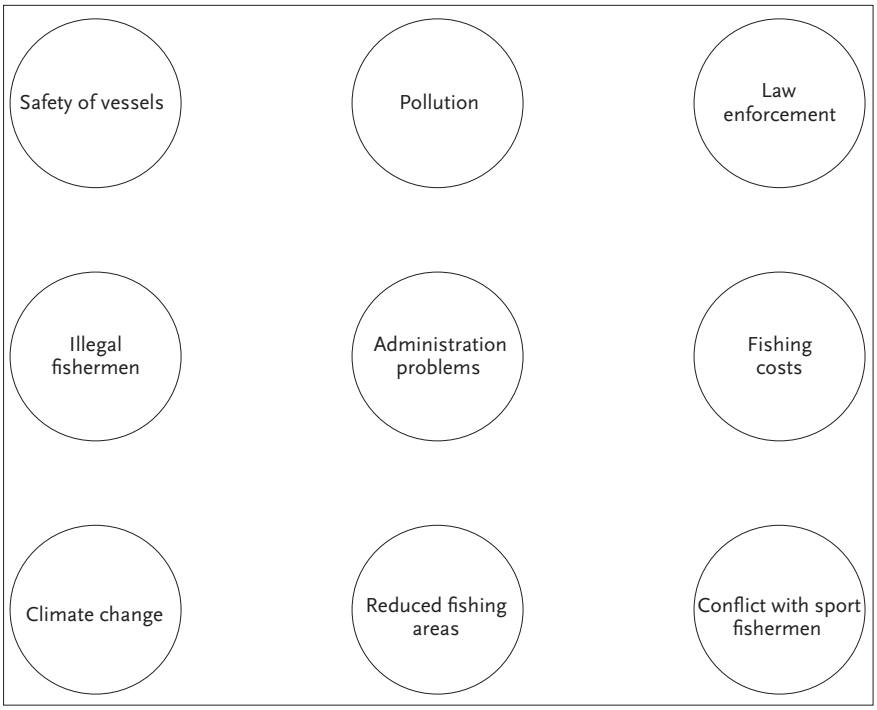
Methodology

This research was based on a series of qualitative, unstructured interviews and utilised an adapted version of the 'mental modelling' approach. Mental Modelling is a qualitative analysis technique used by social scientists, cognitive psychologists and decision-making theorists. It is used to explain an individual's thought process in relation to how something works in the real world and seeks to examine how people construct accounts of reality (Taylor-Gooby and Zinn 2006; Johnson-Laird 2004; Vasquez, Regens and Gunter 2006). The Mental Modelling interview process was developed to elicit interviewee perceptions of risk and the strength of these risk perceptions in relation to the fisheries sector. The methodology was also designed to capture explanatory information in relation to perceived linkages between risk factors, for example ranking, weighting and direction of linkages.

A series of unstructured face-to-face interviews were carried out in 2007 in Faroe Islands, Greece, Iceland and the UK with a variety of fisheries sector stakeholder groups relevant to the case study fisheries. Interviewees were initially presented with a sheet of paper with empty bubbles (referred to here as Mental Model 1: Blank model). They were then asked to fill in as many of the bubbles as appropriate with a separate risk issue in each bubble that they felt was of relevance to the fisheries sector. The interviewer did not influence the interviewee or make any suggestions as to what people may perceive as a risk in the fisheries sector. Interviewees were also asked to rank their risks numerically (for example from 1 to *n* depending on number of risks identified) and to assign a weight to each risk, using the scale 0.1 to 1.0, with 1.0 being the highest possible weight representing the most serious risk. By definition, a weight of 0.3 represents three times more risk than 0.1. The interviewer recorded the reasons why the interviewees ranked risks in the way they did and also noted any linkages between risks by drawing lines and arrows between bubbles. Weights and arrow heads could also be assigned to the lines to show the strength of these linkages and their respective direction.

Following the completion of the Blank model, interviewees were shown what the authors term the 'Comprehensive model' (Mental Model 2). The comprehensive model was based on the results of pilot surveys undertaken in each Case Study Country in 2006. Whilst the range of perceived risks for fishermen was expected to vary between countries, it was thought appropriate to construct one 'Comprehensive model', for use in all countries, to allow for cross-country comparison. The variables in the comprehensive model were not linked or ranked, so as not to influence the interviewee's response in any way. A Comprehensive model was created for each stakeholder group in the original research, that is inshore and offshore fishermen, fishing industry representatives, governments and regulators, consumers, NGOs and scientists (only findings related to the fishermen are presented in this paper). See Figure 1 for an example of a Comprehensive model for inshore fishermen.

Figure 1: Mental Model 2: Comprehensive model. Example of inshore fishermen



After being shown the Comprehensive model, interviewees were asked if they wished to revise the model they constructed previously, termed Mental Model 1: Blank model. The interviewees were asked why they chose to add (or to omit) risks that had been included in the Comprehensive model.

To recapitulate: The interview process was unstructured. The interviewees were presented with only background information of the PRONE project and the aim of the interviews. They were then shown the blank Mental Model-sheet and asked to identify risks, their severity (on the scale 0.1-1.0) and how they interrelated. The only role of the interviewer was to facilitate the mental modelling process outlined above.

In total, interviews were carried out with seventy-two fishermen (ten in the Faroes, thirteen in Iceland, twenty-five in the UK, and twentyfour in Greece). Relatively few fishermen were interviewed in some cases; therefore any generalisation of results should be treated with caution. The depth and qualitative nature of the interviews, however, yielded a rich data-set and the small samples should be viewed in the context of a much larger number of country-specific interviews which took place with a range of other fishing sector stakeholders, the results of which are reported in full in (Tingley *et al.* 2008).

In all countries, a mixture of prior fishing sector knowledge, key contacts and established networks was used to pre-select interviewees and the snow-

balling technique (Churchill 2002) was employed to identify subsequent interview candidates. All fishermen interviewed were male.

Results

Key risks identified

In this section the key risks identified by fishermen in the Faroes, Greece, Iceland and the UK are presented in descriptive and tabular format. The number of risks identified varied between groups and between countries. Table 1 summarises the individual risks reported by the fishermen interviewed. A total of thirty-seven different risks were identified by respondents in all countries. Faroese, Icelandic and Greek fishermen identified fifteen distinct risks while UK fishermen identified fourteen. Among those risks, high fishing cost and the availability of experienced crew are common for all countries. Finally, eight risks are shared by at least two countries. The table indicates that the fishermen in the four European countries have divergent risk perceptions, and there is little agreement regarding the severity of risks identified. It should be noted also that in-group variations tend to be quite high.

Faroese Fishermen

The Faroese fishermen's perception of risks is mainly focused on four categories of risks: poor management of the fishery by the state; stock declines, fishing costs and climate change. All the interviewed fishermen mentioned poor government management and administration as a risk and ranked it highly. The main concern identified in the interviews was not regarding the effort-based system or the effect the system has on the stocks, but rather state management of the effort-based system. In other words, concerns regarding the poor use of fisheries management tools. The fishermen were concerned on the one hand with the politicians allowing too much fishing effort (too many days at sea) and, on the other hand, politicians not being able to reduce illegal fishing activity and illegal by-catch by the pelagic trawlers, which in the fishermen's opinion has devastating consequences for the stocks of cod, haddock and saithe.[2]

Stock decline was considered to be caused by illegal by-catch, overfishing, disruptions to the food chain resulting in a shortage of food for fish, illegal fisheries and effort restrictions set too low. The increased cost of fishing due to high oil and increasing gear prices was also identified by Faroese fishermen, and trawler fishermen in particular, because of its severe impact on profitability. Some of the fishermen also showed concern for the problem of obtaining appropriate fishing crew. In addition, Faroese fishermen referred to pollution, environmental legislation and lobby groups and climate change as risks, although the severity of these risks was considered much lower than the risks listed above. It is of interest that Faroese fishermen did not mention the state of scientific knowledge regarding stock size, stock reduction and other biological parameters as a risk.

Table 1: Detailed list of fisheries sector risks identified by professional fishermen in Faroes, Iceland, Greece and UK

	Faroes			**Iceland**			**Greece**			**UK**		
	No of citations	*Mean scalar*	*Standard deviation*	*No of citations*	*Mean scalar*	*Standard deviation*	*No of citations*	*Mean scalar*	*Standard deviation*	*No of citations*	*Mean scalar*	*Standard deviation*
Poor political management	5	0.370	± 0.127				13	0.800	± 0.235			
Illegal by-catch	3	0.440	± 0.153									
Illegal fisheries	5	0.280	± 0.113				8	0.227	± 0.228			
Stock reduction	4	0.370	± 0.042				21	0.586	± 0.045			
Climate change & weather	3	0.300	± 0.476	12	0.363	± 0.164						
Poor political administration	5	0.180	± 0.000				20	0.452	± 0.241	3	0.130	± 0.190
Overfishing	2	0.250	± 0.071									
Shortage of food for fish	2	0.240	± 0.000									
High fishing effort	1	0.180	± 0.000									
Reduction of stocks	1	0.160	± 0.000									
Fishing cost	5	0.400	± 0.356	8	0.455	± 0.035	24	0.894	± 0.042	20	0.435	± 0.106
Availability of fishing crew	4	0.300	± 0.250	6	0.550	± 0.229	13	0.762	± 0.224	12	0.360	± 0.141
Endagered species	1	0.200	± 0.000									
Pollution	2	0.180	± 0.212				6	0.264	± 0.274			
Environmental legislation and lobbying	2	0.180	± 0.350							9	0.220	± 0.085
Conflict with sport fishermen							10	0.764	± 0.295			
Poor law enforcement							23	0.589	± 0.266			
Safety at sea				4	0.430	± 0.200	8	0.318	± 0.249	9	0.195	± 0.021
Inappropriate legislation							18	0.406	± 0.187	10	0.430	± 0.410

Table 1 (continued)

	Faroes			Iceland			Greece			UK		
	No of citations	*Mean scalar*	*Standard deviation*	*No of citations*	*Mean scalar*	*Standard deviation*	*No of citations*	*Mean scalar*	*Standard deviation*	*No of citations*	*Mean scalar*	*Standard deviation*
Conflicts with aquaculture							6	0.227	± 0.232			
Conflicts among professional fishermen							13	0.523	± 0.192			
Limited fisheries infrastructure							10	0.431	± 0.296			
Reduction of fishing grounds							8	0.346	± 0.300	11	0.400	± 0.071
Reduction of quota				9	0.580	± 0.141				17	0.790	± 0.220
Politics				4	0.520	± 0.207						
Currency exchange rates				3	0.400	± 0.230						
State of scientific knowledge				9	0.555	± 0.219				8	0.270	± 0.057
Poor fisheries management				2	0.380	± 0.071				7	0.600	± 0.33
No renewal-closed system				1	0.180	± 0.000						
Fishing gears				2	0.140	± 0.071						
Whaling				4	0.400	± 0.224						
Market & Prices				4	0.340	± 0.346				4	0.150	± 0.290
Working conditions				3	0.330	± 0.224						
Pressure from vessel owner				3	0.330	± 0.224						
Habitat deterioration										2	0.160	± 0.310
Reduction of fishing effort										9	0.490	± 0.480
Rigid political management										6	0.220	± 0.360

Greek Fishermen

The risks identified by Greek fishermen can be grouped into four main categories: Economic factors, conflict with other sectors, stock reductions, and legislative and political factors. The Greek fishermen ranked fishing cost as their number one risk. Conflict with sport fishing and aquaculture was mentioned as a risk by inshore fishermen, while offshore fishermen identified conflicts between professional fishermen. This relates to disagreements among coastal, trawler, purse seiner and shore seiner fishermen on issues like illegal fisheries and the operation of industrial vessels close to the coast and within the fishing grounds of coastal fishermen.

Many Greek fishermen expressed significant concern about the fisheries management system in general. Most interviewees mentioned issues relating to the application of legislation, too much paperwork, problems with the Ministry of Agriculture Development and Food and managers not being fully aware of the problems faced by the fisheries sector.

Most of the fishermen in Greece indicated apprehension about the reduction of stocks, and some mentioned pollution. Some also noted safety at sea and the problem of finding experienced seamen. The latter is related to the high proportion of foreign workers, and the high labour turnover among domestic workers. As with the Faroese fishermen, it is noteworthy that Greek fishermen do not see the state of scientific knowledge as a major risk.

Icelandic Fishermen

Fishermen in Iceland identified four categories of risks: Quota reduction and fisheries management, cost of fishing, working conditions and climate change. Almost all fishermen mentioned the impact of political decisions within the fisheries management system on total allowable catch (TAC) as a strong risk to their industry. Just before the interview process began the Icelandic government had decided to cut cod quotas by thirty percent which may have been one of the reasons this particular risk ranked so high relative to others. Cost is also a significant factor, operational and financing cost in particular, and the exchange rate between the fluctuating Icelandic currency and foreign currencies was also singled out as a specific risk in itself, affecting the financial well-being of the fishermen.

Science or state of knowledge is also a significant risk factor, as the reduction in quotas is based on scientific advice. Fishermen gave scientific knowledge a fairly high priority as a risk factor. This relates both to disagreement within the research community, and the disparity between scientific knowledge and fishermen's experience as regards the sustainability of the fishing stocks.

The fishermen mentioned many aspects related to the working environment, such as safety at sea, harsh weather, and obtaining an appropriate crew. The difficulty in obtaining skilled seamen is a risk factor that is directly and indirectly linked to many other risks. The crew have to handle all aspects of life while out at sea and they must trust each other with their lives. Morale onboard is fundamental to the well-being of the fishermen. Finally, the fishermen tend to speak of oceanic change rather than climate change. They detect positive effects of ocean warming, but the uncertainty involved was often the risk cited.

UK Fishermen

The most important risks identified by British fishermen related to concerns about ineffective fisheries management, the potential threat of reduced fishing areas due to the expected creation of Marine Protected Areas, and increased costs of fishing. These attitudes are not unexpected given the state of the cod fisheries management system in 2007 (Tingley *et al.* 2008), the increasing level of (current and potential) encroachment on traditional fishing grounds as concerns from environmental organisations and the economic climate at the time, particularly high fuel prices.

Fishing for quota species is heavily controlled under the Common Fisheries Policy and there is widespread discontent with a number of features of the current quota management system, including the scientific and information process. It is not surprising, therefore, that the majority of interviewees mentioned risks relating to the catch quota management system – particularly quota shortages.

The potential for reduced fishing areas, as a result of current and potential wind farm development is also perceived to represent a risk. The UK's east coast already has a number of offshore wind farms and many more are currently being proposed in the area. There has also been a high profile public debate in the UK in recent years about securing future energy supplies with a particular emphasis on renewable sources. The east coast is also the site of much of the UK's marine aggregate dredging, so again it is not surprising that inshore fishermen in this area are highly aware of the perceived constraints and effects on their fishing activity from other industries and are concerned about potential future impacts.

Concerns about the risk from fishing costs were cited by the majority of interviewees – particularly in relation to fuel expenses – although some tempered their concerns noting that good market prices in 2007 were helping to ease the financial impact of the risk from increased costs. It is to be expected that economic factors such as expenditure and crew shortages feature prominently in a risk register of this type given the current economic climate. Operational factors such as safety at sea were only mentioned by few respondents and the severity of risk ranked low.

Cluster Analysis

In order to further analyse the data, and to increase the comparability of results, the research group classified the various risks identified by fishermen and other stakeholders into eight clusters of related risks. These are: 1) economic factors, such as cost of fishing, market price, oil price, exchange rate, *et cetera*; 2) prevailing environmental conditions, for example, climate change, bad weather, and effects of pollution on stocks; 3) conflicts with non-fisheries sector stakeholders using (or with interest in) marine resources, such as environmental organisations, reduced fishing areas and so on; 4) working environment and conditions, primarily safety at sea; 5) policy, management and control, consisting of ineffective fisheries management, lack of scientific knowledge, law enforcement, quota availability, illegal fisheries, *et cetera*; 6) conflict between political priorities; 7) conflicts within the fisheries sector and; 8) impact of fishing on natural environment and resources, that is, stock declines, overfishing, habitat damage, *et cetera*.

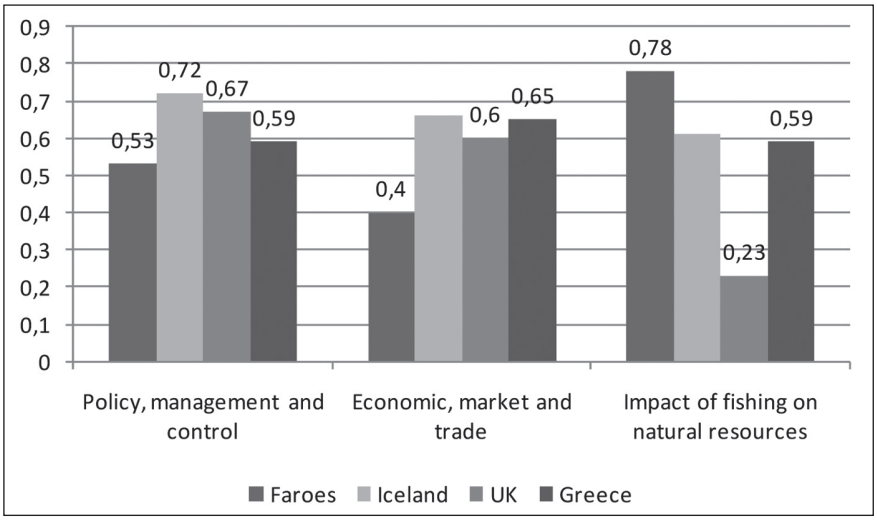
It is possible to categorise risk in a variety of ways, for example in terms of who has control over it (for example autonomous agent, dependent agent). However the categorisation method chosen in this analysis represents an attempt to partition risks with respect to the fisheries sector according to whether they are driven by, or arise as a result of, drivers from outside of the fisheries sector (and therefore generally outside of its control, for example, as represented by categories 1, 2, 3 and 4) or whether they arise from factors generally within the control of some part of the fisheries sector (for example, government/regulators [categories 5 and 6] or fishermen [7]). Finally category 8 represents the risk from the fishing activity itself on the natural environment and its resources which also should arguably come under the control or influence of both government/regulators and fishermen to some extent.

Table 2 shows that policy, management and control risks were the most frequently cited risks amongst fishermen in all countries. Economic-related risks were joint second in Greece and Iceland, whereas the impact of fishing on the marine environment and fish resources came second in the Faroes and conflict with non-fisheries sector marine stakeholders was cited second in the UK.

Table 2: Risks identified by fishermen

	Faroes		**Iceland**		**Greece**		**UK**	
Academic risk duster grouping	*Number of citattions*	%	*Number of citattions*	%	*Number of citattions*	%	*Number of citattions*	%
Conflicts between political priorities	2	2.9	1	0.74	0	0.0	1	1.1
Conflicts with non-fisheries sector marine stakeholders	7	10.0	12	8.89	4	1.7	20	21.5
Conflicts within fisheries sector	2	2.9	1	0.74	13	5.4	1	1.1
Economic factors	13	18.6	37	27.41	46	19.1	19	20.4
Impact of fishing on natural environment and resources	14	20.0	9	6.67	32	13.3	11	11.8
Policy, management and control	22	31.4	40	29.63	94	39.0	32	34.4
Prevailing environment conditions	9	12.9	17	12.59	26	10.8	7	7.5
Working environment	1	1.4	18	13.33	26	10.8	2	2.2
	70	100.0	135	100.0	241	100.0	93	100.0

Figure 2: Major risk categories identified by fishermen based on the impact of the risk (scalar values raging from 0.1-1.0.[3]



When the major risk categories of Figure 2 are analysed according to the impact of the risk as given by the fishermen in scalar values, we notice some national differences. It can be seen that the impact of fishing on natural resources was given a high value in the Faroese (0.78), but only a low value (0.23) in the UK. Similarly, Faroese fishermen rank economic, market and trade risk as low (0.4) compared to other fishermen (0.6-0.66). Fishermen from all countries rate the risk related to policy, management and control above 0.5, with Icelandic fishermen rating it highest at 0.72.

An analysis of the nature of the risks mentioned above supports the theory that fishermen perceive risks to be primarily driven by actors outside the fishing sector. This is the case for economic and market factors, and to a large extent with regard to policy, management and control. The category of fishing impact on the environment is, on the other hand, under the control of both regulators and fishermen to some extent.

It is clear from these findings that many social, political and economic factors impose risk on the daily operations of European fishermen. Common factors are the fisheries management system affecting access to fishing grounds, economic struggles, and concerns about whether there are enough fish in the sea. Also, some national characteristics, such as type of fishing, fishing technology, natural conditions, and, most importantly, fisheries management systems, seem to have lasting impact on the perception of risk in the fishing industry. With regard to fisheries management systems, two countries in our case study – Iceland and the UK – have ITQ systems, while the Faroese use a fishing days system, and Greece has no limitation on the magnitude of fishing, except for tuna. Simply put, Iceland and the UK restrict the total catch each vessel can land per year, while the other two countries allow fishermen to catch what they land. This difference

seems to have an impact on the perception of risk as Icelandic and UK fishermen are more concerned about policy, management and control risks than fishermen from the other countries. Fishermen from the Faroe Islands and Greece are more concerned about the impact of fishing on natural resources. However, given the small sample size, and thus limited number of observations, the results of this study should be used with caution. However, this is one of the first attempts to apply such risk research to the fishing industry and consequently further research is required to validate the results presented here.

Discussion

This paper has focused on risk perception amongst fishermen in four countries: the Faroe Islands, Greece, Iceland and the UK. The main question addressed was whether fishermen in the four countries perceive risk in similar or divergent manner. We hypothesized, first, that perception of risk tends to increase when fishermen do not have control over the risk, the risk is involuntary, unknown, human-based, and/or relates to untrusted agents. Moreover, relative political and economic power of actors largely outside the fishery will influence risk for fishermen. Secondly, complex fisheries management systems will impose various risks on fishermen, who are inclined to manage such risks by fighting restrictions on fishing, diversifying their activities, and by tending to neglect the risks associated with their dangerous occupation.

The main findings of this paper are that 1) fishermen in the four countries have divergent risk perceptions and 2) where similar risks were identified between countries, the severity of these risks was often perceived quite differently. In line with this latter finding, the average score (from 0.1 to 1) given to each risk also varies between countries. The risks identified were, poor management by the state, the cost of fishing, stock declines, overfishing, illegal fishing, safety at sea, climate change, conflict with sport fishing, conflict with aquaculture, reduced quotas, exchange rates fluctuations, obtaining appropriate fishing crews, and the state of scientific knowledge. When these risks were grouped into clusters of related risks, policy, management and control risks were most frequently cited amongst fishermen in all countries. Economic-related risks, the impact of fishing on the marine environment and fish resources, and conflicts with other stakeholders were also often cited.

Policy, management and control risks affect the total amount of catch in most countries. Government decisions regarding total allowable catch or effort are based on scientific advice and the final decision is a political one in the hands of Ministers of Fisheries. It is, therefore, no surprise that fishermen consider such decisions, which have a great impact on their economic and social well-being, as high risks. The same goes for economic risks which considerably affect the net return of earnings and profit in the fishing industry. These findings further strengthen the argument of Garcia and Charles (2008) where they state that the unobservability of the fish in the sea, multiple-species interaction, and strong political and economic drive in ocean systems makes fisheries management

difficult to implement, to say the least. Our conclusions indicate that as a result of special circumstances in the fishing sector scientific findings in themselves come to be regarded as a risk for fishermen; hence, scientific advice tends to be met with scepticism and even as an untrusted source. This is in accordance with the findings of Pidegon *et al.* (1992).

Our findings are similar to the conclusions of Slovic and Weber (2002) and Otway and von Winterfeldt (1982) stating that involuntary exposure to risk and lack of control of outcomes tend to increase risk perception. A cluster analysis of the risks identified by fishermen in our study indicates that risks most prominent to fishermen are primarily driven by actors outside the fishing sector. This is also the case for economic and market factors, and to a large extent true of policy, management and control. The category fishing impact on environment is, on the other hand, under the control of both regulators and fishermen to some extent, and such risks were given low values. The same applies to working conditions, which are ranked low by the fishermen in the study. This is probably due to the fact that this risk is to a large extent under their own control, and they belong to a subculture that values bravery and fearlessness (Roberts 1992; Pollnac *et al.* 1998). Moreover, the ever more complex fishing management systems in most countries seem to impose more risks on fishermen relating to such factors as lack of control over the fishing grounds, involuntary risks, and lack of knowledge. Many fishermen in the study expressed their concern about ever diminishing access to fishing due to political decisions and green lobbying. They also complained about negative debate in the media. These points confirm the findings of Tierney (1999) on how political and economic power can give the ability to impose risks on others, shape public discourse about risks, sponsor and conduct research that presents risk in particular ways, and lobbies for particular positions on the acceptability of risk.

It is interesting to note that fishermen in Greece and the Faroe islands are more concerned about the impact of fishing on the environment and natural resources than fishermen in Iceland and the UK. The latter groups are, however, more concerned about the state of scientific knowledge and its input into policy formulation than fishermen in Greece and the Faroe Islands. This may well be an effect of the different fisheries management systems in these countries as suggested by Minnegal and Dwyer (2008) and Marchal *et al.* (2007).

Further analysis and research is needed to fully comprehend risk perception among fishermen. What is, for example, the impact of different fisheries management systems on risk perception and behaviour among fishermen? What role does trust have in the effective operation of different fisheries management systems? And finally, how can risk perception of fishermen be incorporated into the fisheries management system in order to improve risk communication and the operation of such systems?

One objective of this research is to develop hypotheses from the patterns of risk perceptions identified in the research process. The following hypotheses are put forward so that future research can improve our understanding of risk perception in fishing and further secure sustainable fishing.

H1: Fisheries management systems and political decision making processes have a great impact on risk perception among fishermen
H2: Economic matters have an impact on risk perception among fishermen.
H3: Fishermen operating under open access or total allowable effort management systems are more concerned about fishing impact on the marine environment than fishermen operation under other systems.
H4: Fishermen operating under fisheries management systems where scientific advice is the basis of total allowable catch decisions tend to view the state of knowledge of fishing species as a risk.

Conclusion

Our study contributes to the emerging theory of risk within the fishing industry. Our findings indicate, firstly, that fisheries management systems impose various kinds of risk on fishermen, such as 1) how often and how much the fishers can fish; 2) which groups can fish in which oceans, often causing conflict between various groups of fishermen (small and large scale, of different nationality *et cetera*); 3) the total allowable catch available in each country; and 4) the state of scientific knowledge that stock estimates are based on. Secondly, economic factors impose risk on fishermen, particularly: 1) exchange rate between countries; 2) oil price and fishing gear cost; 3) investments in fishing boats and quota; and 3) market prices. Thirdly, there seem to be a national differences in risks related to the impact of fishing on the natural environment. Here we notice that fishermen in open access fisheries or fisheries where input restrictions do not impose maximum catch limits, such as fishing day systems, are more concerned about risks related to stock reduction, overfishing and habitat damage, whereas fishermen in ITQ systems barely mention such risks. Fourthly, fishermen tend to underestimate risks related to safety at sea, although operations on the open sea are usually very dangerous. We hope that our findings will encourage others to explore the dynamics between national conditions and the risk perception of fishermen and stimulate dialogue among all parties with an interest in the marine environment.

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Notes

1 Precautionary risk methodology in fisheries.
2 All of which are important commercial species in the Faroe Islands.
3 The figure shows average scalar values. It has been noted that there was great inter-group variation in each country, and the number of observations is quite limited. The results should, therefore, be interpreted with caution.

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