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Drivers for compliance with fisheries rules

A systematic literature review

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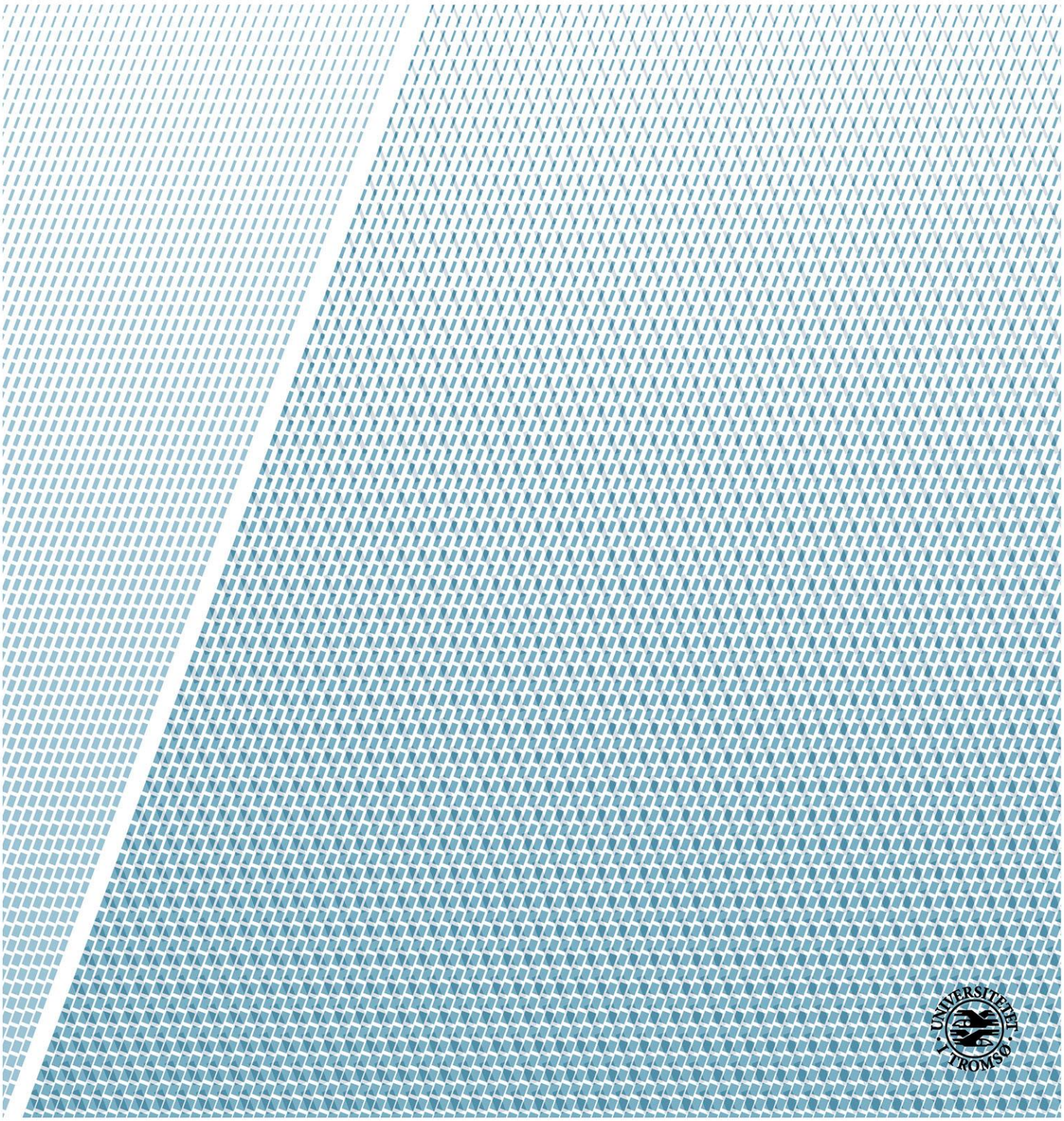
Master thesis in International Fisheries Management – November 2016



Abstract

Many diverse conflicts are commonly found in a complex and dynamic system such as a fishery. Usual sources of conflicts are property rights conflicts, space utilization conflicts (e.g. fishers versus aquaculture), enforcement conflicts and conflicts that occur between the fishers and the government. The latter two may lead to issues with fisher's compliance with state laws. This thesis examines scientific literature on compliance with fisheries rules, as investigated by researchers affiliated with institutions located in the European Union / European Economic Area (EU/EEA). The main objectives of this thesis are: to explore research trends in EU/EEA when it comes to drivers for fishers' compliance with rules; and to identify the main drivers for compliance with fisheries rules as studied by the EU/EEA researchers. The central methodology used in this study is a Systematic Literature Review. Search terms identified 22 scientific articles relevant for answering these research questions. After a thorough analysis of these articles, several trends in the EU/EEA research on fishers' compliance with rules have been identified (e.g. time trends, geographical trends, fisheries related trends). The results of this study are expected to provide researchers and fishery managers with more information about fishers' behavior. This is of relevance in, for instance, the formulation of new fisheries rules and in the improvement of governance processes in general. In addition, if a similar study would be performed on articles authored by researchers affiliated with institutions in a different region (e.g. North America, Asia), this study would provide a basis for comparison of different research approaches and traditions.

Keywords

Compliance; Drivers; European Union; Fishers behaviour; Non-compliance; Rules; Systematic Literature Review.

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1. Introduction

1.1. Background

Many diverse conflicts are commonly found in a complex and dynamic system such as a fishery. Usual sources of conflicts are property rights conflicts, fishers versus aquaculture conflicts, user-group conflicts, enforcement conflicts and conflicts that occur between the fishers and the government. The latter two may lead to issues with fisher's compliance (Charles, 2001). Compliance in the present settings means willingness to follow courses of operation or behavior prescribed by official rules, be them issued by supra-national, national or local authorities.

Official rules have many different formats, including recommendations, laws, directives, regulations, municipal laws and administrative procedures. All these have the potential to affect the way fishers operate or behave. Principles of good governance suggest that laws should e.g. be available and made known to all interested stakeholders, that members of the public concerned are given an adequate opportunity to express their views and participate at an early stage in the decision-making process, and that implementation and enforcement of laws and decisions are perceived to be fair, open, transparent and equitable (United Nations Environment Programme (UNEP), 2011). Given that these conditions are met, all members of the interested public have the opportunity and the responsibility to conduct a responsible form of fishing, i.e. to be compliant.

Low rates of compliance may negatively affect the environment and the fishery sustainability as a whole (Kuperan & Sutinen, 1998). Hence, it is important to take into consideration the reasons for compliance among the fishers. There are several types of incentives to non-compliance, including economic and social causes, and the negative effect of poor law-making processes and fisheries governance cannot be ruled out.

Fisheries that have received a good deal of attention with regard to compliance are those situated in the Northeast Atlantic, including the Barents Sea, and that are under the jurisdiction and competence of the European Union (EU), the member States, and other neighboring States, like Norway (which is part of the European Economic Agreement (EEA)) and Russia. These keep tight relations with regard to fisheries, and often similar regulatory

frameworks with the European Union. The European Union is a politico-economic union of 28 member states that maintains a common policy on fisheries, the Common Fisheries Policy (CFP). The European Economic Area (EEA) brings together the EU member states and the three EEA EFTA countries (Iceland, Norway and Lichtenstein) to European Single Market providing the free movement of persons, goods, services and capital within its area. Even though the EU Common Fisheries Policy is not part of the EEA Agreement, the EU and the EEA countries work in close cooperation (EFTA, 2016). It is clear that the EU nations have their own cultures and may have different approaches to compliance with official rules. Hence, the compliance rates may differ from country to country, or from region to region. The success of the CFP policy depends upon the EU countries ensuring that its rules are followed in practice (Eur-Lex., 2003), a principle that can be applied in any fishery in the world when it comes to any fisheries policy or rules. Significantly, the non-compliance with rules in the EU fisheries has been long a severe management problem, and fisheries managers consider ways to improve fishers' compliance with regulations. The important step in preventing non-compliance, in an EU context or worldwide, is to examine and understand possible incentives for illegal actions (Aarset, 2004).

Ground-breaking analyses of fisher non-compliance with the official regulations, particularly in the EU countries, have been already made by, for example, G. Hønneland, S. Jentoft and R. Nielsen (Hønneland, 2000; Jagers, Berlin, & Jentoft, 2012; Raakjær Nielsen, 2003). Characteristic for many studies is that they made long listings of observed or potential causes (drivers) for non-compliance. These analyses are based on case-studies and follow a narrative approach. Although informative, these listings are unstructured and lack descriptions of causal relationships. Thus, illustration of the relationships among the different drivers is lacking, nor is the strength of these linkages indicated. For instance, un-critical utilization of these lists would maybe suggest that two different drivers are just as important, while in reality one may be more important than the other, or one be a necessary condition and the other a sufficient condition in other contexts. Other hidden "assumption" is that the effects of these drivers are linear and cumulative, where many negative and positive inter-dependencies are most likely to occur. Unfortunately, the strength and interaction of the drivers of fishers behavior are not easy to extract in secondary studies, just because the primary studies often neglect those aspects. One aspect is, however, possible to

extract from literature, and that is whether or not relationships are symmetric: is the set of drivers for compliance the exact negative image of the set of drivers for non-compliance? This analysis would give some hints at the qualitative influence of some causal relationships.

In the present study I am going to consider the drivers for compliance and non-compliance with fisheries rules, as investigated by researchers affiliated with institutions located in EU/EEA. The main goal of the work is to reveal the reasons that put the fishers on the track of following or not following the rules. The main methodology that I employ is a Systematic Literature Review (SLR) of published research articles concerning fishers' compliance with official rules that are authored by researchers affiliated with institutions in EU/EEA. The results of this study are expected to provide researchers and fishery managers with more information about fishers' behavior. This is of relevance in, for instance, the formulation of new fisheries rules and in the improvement of governance processes in general. In addition, if a similar study would be performed on articles authored by researchers affiliated with institutions in a different region (e.g. North America, Asia), this study would provide a basis for comparison of different research approaches and traditions.

1.2. Research questions

This study aims to identify and analyze motives and incentives for fisher's compliance with state rules, as explored by researchers affiliated with an EU/EEA institution. This study investigates trends in fishers' behavior, their perception and understanding of rules; factors that may influence on compliance rates, fishers reasoning to comply or not comply with rules; it presents a general overview of the situation regarding drivers for compliance among fishers. Hence, this study attempts to answering the following research questions:

1) *What are the research trends in EU/EEA when it comes to drivers for fishers' compliance with rules?*
2) *What scientific journals are more concerned with fishers' compliance with rules?*
3) *What is the time trend in EU/EEA based research about fishers' compliance with rules?*
4) *What kind of fisheries and species are better sampled in EU/EEA research about fishers' compliance with rules?*
5) *What are the drivers for compliance with fisheries rules identified by EU/EEA researchers?*

1.3. Structure of the thesis

This thesis has the following structure:

Section 1 gives a general overview of the study including background information, research questions and the thesis structure.

Section 2 presents a theoretical framework that gives definitions of the main ideas and concepts that are used in this study, such as rules, compliance, enforcement.

Section 3 deals with the methodology of this study. It describes the process of performing a Systematic Literature Review in general and the actual application of this method to the case study.

Section 4 gives an overview of obtained results.

Section 5 highlights major findings from the results chapter and gives their interpretation.

Section 6 summarizes the overall conclusion and explains the importance of the obtained findings.

2. Theoretical framework

2.1 Fishery rules

According to Cambridge Dictionary, the term “rule” means an accepted principle or instruction that stays the way things are or should be done, and tells you what are you allowed or are not allowed to do (Cambridge Dictionary, 2016d).

The same source defines the term “law” as a rule, usually made by a government that is used to order the way in which society behaves(Cambridge Dictionary, 2016b).

This thesis refers to compliance with rules, and uses the terms “rules”, “laws”, “official rules”, “legislation” and “state rules” as synonyms.

2.2 Compliance

The definition of a term “compliance” is the act of obeying an order, rule or request (Cambridge Dictionary, 2016a). Conversely, non-compliance means the act of disobeying an order, rule or request.

According to Collins English Dictionary, “driver” is something that creates and fuels activity, or gives a force or impetus (Collins Dictionary, 2016a). In this context, this thesis aims to identify what fuels or gives force to the activity of complying/non-complying with rules.

The two terms, “compliance” and “non-compliance” are tightly connected, and studying the drivers for one implies shading light on the drivers for the other.

According to Rayfuse (2005), the terms “compliance” and “enforcement” are often used interchangeably, depending on what they refer to in terms of actions and actors. The definition of the term “compliance”, according to Oxford English and Black’s Law dictionaries, is an “action in accordance with recommendation, request, or command” or as “submission, obedience or conformance”. The definition of the term enforcement is “the act of compelling observance of a law”, or “the act of putting something such as law into effect; the execution of a law; the carrying out of a mandate or command” (Rayfuse, 2005).

According to The New South Wales Government webpage, “compliance rate” means the state of conformity with fisheries laws (Unit, 2011) .

2.3 Enforcement

According to Charles, fishery enforcement is important part of the management system. Its rationale is based on understanding that illegal fishing (i.e. fishing non-compliant with rules) may occur as a response to a regulatory framework built to restrict fishing activities and having in mind economic motives that make such illegal fishing profitable in case of absence of potential penalties (Charles, 2001).

There is an observation, especially in poor developing countries, that a lack of policy attention to or (financial capability for) the enforcement of that legislation may prevent achieving the good purposes inherent in fishery legislation. One can give an example that there should be the will and the resources available to make both national and foreign fishing vessels that operate within a nation’s territorial waters, comply with national laws. If the capacity-limiting regulations were not designed cooperatively with fishers, it also may lead to non-compliance with rules (Charles, 2001).

It is apparent that this enforcement problem exists in fisheries throughout the world (Charles, 2001). According to Charles, “there are strategic, tactical and operational aspects of fishery enforcement”:

- At the strategic level, the main goal is to create an effective framework that would link management and enforcement in order to demotivate fishers for illegal fishing as far as it is possible, and to maximize fishers’ motivation for self-regulation. Also at this level, there is a key question of “how much resources to spend on enforcement”.
- At the tactical level, the goal of enforcement is to find the most efficient mechanisms, for example, set of monitoring, control and surveillance provisions.

3. Methodology

3.1 Systematic Literature Review – a general introduction

3.1.1 Definition of Systematic Literature Review

Systematic Literature Review (SLR) is a scientific study in itself, which is based on pre-planned methods and an assembly of original studies as their "subjects"(Cook, Mulrow, & Haynes, 1997). It is a summary of scientific literature that uses explicit and reproducible methods to systematically search, critically evaluate, and synthesize the results of investigations addressing a specific problem. Systematic Literature Review uses strategies that help to reduce bias and random errors (Cook et al., 1997).

According to Kitchenham,

"A Systematic Literature Review (often referred to as a systematic review) is a means of identifying, evaluating and interpreting all available research relevant to a particular research question, or a topic area, or phenomenon of interest" (Kitchenham & Charters, 2007).

Systematic reviews are able to produce a relatively objective baseline against which future research and evidence on certain interventions or aspects can be assessed (Mallett, Hagen-Zanker, Slater, & Duvendack, 2012).

3.1.2 The process of Systematic Literature Review

There are three major stages in systematic literature review (Kitchenham & Charters, 2007):

- Planning the review (making a protocol)
- Conducting the review
- Reporting the review

These stages are described and explained in the sections below.

3.1.3 Planning the Systematic Literature Review

Prior to undertaking a SLR one should confirm the need for such a review on a particular topic. It is important to identify and review any existing systematic reviews of chosen study

that may answer the proposed research question (Kitchenham & Charters, 2007). A Systematic Literature Review should start with a protocol that specifies the objectives, methods, and outcomes of primary interest of the SLR. Furthermore, it promotes transparency of methods (Health, 2016) and helps to avoid the possible bias in a study. According to Kitchenham, the protocol has all the pre-plans for the SLR such as (Kitchenham & Charters, 2007):

- The research questions are to be established
- The rationale for the systematic literature review is to be explained
- A database(s) is to be chosen from which sources of data are to be obtained
- Study selection criteria are to be defined
- Inclusion and exclusion criteria details are to be defined
- Development of quality assessment checklists and procedures are to be defined
- A strategy for data extraction is to be defined
- A coding scheme is to be defined
- A timetable is to be prepared for the different stages of the SLR
- A review of the protocol by experts is to be performed

3.1.4 Conducting the Systematic Literature review

Once the protocol has been agreed, one starts with the implementation of systematic literature review. This implementation can be performed in a fixed and rigid fashion, or in a more flexible approach by continuing to comply with the core principles of systematic review methodology (rigour, transparency and replicability) (Mallett et al., 2012).

3.1.5 Literature review strategy

One of the first steps of a SLR is to develop a search strategy. If the person performing the SLR is not an expert in the field, the search strategy should be established in consultation with librarians or experts in the field. The search strategy should include a preliminary search that identifies existing Systematic Literature Reviews and assesses an amount of potentially appropriate studies (Kitchenham & Charters, 2007). The search has to be based on report characteristics used as criteria for eligibility, such as years considered, language, publication status (Moher D, Liberati A, Tetzlaff J, 2009a). It is necessary to find at least one available

database that provides appropriate sources for the Systematic Literature Review (Kitchenham & Charters, 2007). All of the information sources have to be described. Doing the review one may use both database searches and snowballing technique. The review should report all the results in order to minimize the likelihood of publication bias. If the research process is not well-documented, this could weaken confidence in obtained results and conclusions (Centre for Reviews and Dissemination, 2009).

3.1.6 Study selection

It is necessary to assess the obtained documents for their actual relevance. This is a multistage process. First, the eligibility criteria should be interpreted liberally, so that a study identified by the searching machine can be clearly excluded based on the title and abstract. Following that, the inclusion and exclusion criteria based on practical issues should be applied (Kitchenham & Charters, 2007). Once all of the documents that are not relevant to a research question are excluded, one can start with analysis.

3.1.7 Study quality assessment

It is necessary to assess not only the results that were obtained based on inclusion and exclusion criteria but also their “quality”. One should take into consideration that there is no agreed definition of study “quality”. According to Centre for Reviews and Dissemination guidelines, the quality is generally based on bias, internal and external validity (Centre for Reviews and Dissemination, 2009).

3.1.8 Data extraction

Once the data selection is complete, there is a need to describe a method of data extraction from documents and any procedures for obtaining and supporting data from investigators (using, for example, the PRISMA checklist (Moher D, Liberati A, Tetzlaff J, 2009a)). Data from sources should be collected based on the coding scheme and stored in defined extraction forms such as Word tables, Excel spreadsheets, NVivo or other suitable software (Ridley, 2012). One should avoid duplicates during the data extraction. The data extraction includes two stages: preliminary analysis and secondary analysis.

3.1.9 Preliminary analysis

One considers a preliminary analysis as an early filtering stage of the obtained search results. The aim of the search is to identify research papers that could be relevant to the proposed research question. Studying the article abstract gives a clearer insight into a value of the article to a proposed research question. Following on from the abstract analysis, one can make a decision on the further reading of the article. It is necessary to select articles that would provide necessary knowledge and answers for the research question.

3.1.10 Secondary analysis

In a secondary analysis it is required to examine the text of the entire research paper. The aim of such analysis is to find text in the paper that gives proof and answers for the proposed question. One needs to highlight and analyze selected text more deeply.

3.1.11 Coding scheme

The main point of coding is the process of ordering your data into different groups that organize it and make it meaningful from that standpoint of one or more frameworks or sets of ideas (i.e. the research questions). The coding scheme gives an idea of what the data are all about. One codes data into groups in order to make sense in terms of the relevant interests (Lofland, 1995).

3.1.12 Data synthesis

According to Kitcheham, data synthesis “involves collating and summarizing the results of obtained primary studies”(Kitchenham & Charters, 2007). Extracted data should be synthesized in order to provide the results from the primary studies analysis. Synthesized data provides an actual answer to the proposed research question(s). One can present data from the studies narratively and/or statistically (a meta-analysis). There is no need for a meta-analysis if the studies are very heterogeneous; it this case, it may be most appropriate to summarize the data narratively (The University of Edinburgh, 2013).

3.2 Systematic literature review – application in this study

In order to conduct this Systematic Literature Review, the following steps were combined and adapted from the Kitchenham and Charters guidelines (Kitchenham & Charters, 2007) and the SLR guide offered by Ridley (Ridley, 2012):

1. I prepared the protocol
    - I proposed title, aim and rationale for the review (see Section 1.1)
    - I formulated the research questions (see Section 1.2)
    - I decided how records will be stored
    - I formulated the inclusion criteria (see Section 3.2.2)
    - I defined a search strategy (see Section 3.2.2)
    - I chose the digital libraries and other sources of materials (see Section 3.2.2)
    - I formulated the analysis procedure, including building the pre-defined part of the coding scheme i.e. what categories will be used for extracting data from the articles (articles meta-data: authors, affiliation, year of publication etc.; data about the content of the articles: species, type of fishery etc.) (see Section 3.2.9)
2. I conducted the actual search
    - I performed the search
    - I removed duplicates
    - I applied inclusion criteria
    - I excluded articles
3. I extracted data
    - I further developed the coding scheme to include driver for compliance/non-compliance (see Section 3.2.9)
    - I reviewed the articles
    - I extracted information from the articles based on the coding scheme
4. I performed the study quality assessment
5. I analyzed the results (see Section 4)
6. I developed conclusions (see Section 5)
7. I reported the study (this thesis)

More details about these steps are provided below.

3.2.1 Planning the review

I identified this study as a Systematic Literature Review. The background section (Section 1.1) is provided as a rationale for this review. The protocol is also provided including study objectives, research questions, inclusion criteria, and analysis procedures (see below). I decided to use Excel (Microsoft Office Professional Plus 2013) as the main software for data collation and analysis.

3.2.2 Search strategy and inclusion criteria

In order to identify if there is enough literature which is relevant to the study, I performed a preliminary search in Spring 2016. The Scopus database was used. The reason for using this database is that it is the largest abstract and citation database of peer-reviewed literature (Elsevier, 2016b).

The keywords for the SLR were selected based the research topic: *fish** and *compliance*. As this study is exploring compliance in relation to fisheries rules the two keywords were linked with the connector "AND". The truncation symbol (*) was used after the word "fish" in order to get as many relevant records as possible (e.g. fish, fishery, fisheries, fisher, fisherman etc.). In order to focus the results on relevant domains of science, subject areas such as Mathematics, Medicine or Engineering were excluded. The SLR had to be adapted to the amount of time I had for analysis, therefore I have limited the search to the keywords registered for the articles included in the database. This search strategy is summarized in Table 1.

Furthermore, I have formulated criteria based on which to include or exclude sources, as indicated in Table 2.

Table 1. Database, keywords, and search strategy used to identify scientific articles to be included in the Systematic Literature Review of fishers' compliance with official rules, Spring 2016.

Database	Keywords	Where in the article	When	Subject area
Scopus	Fish* AND Compliance	Keywords	All times	Environmental Science; Agricultural and Biological sciences; Economics, Econometrics and Finance; Earth and Planetary Sciences; Decision Science.

Table 2. Inclusion criteria used to identify scientific articles to be included in the Systematic Literature Review of fishers' compliance with official rules, Spring 2016.

Inclusion criteria	Why this criterion?
Published in the English language	English is the most common language for scientific publication in this field.
Published as an article in a scientific journal	The scientific articles published in scientific journals are reliable source of data that have passed rigorous quality control.
Published by EU or EEA based researchers	This thesis investigates research trends in EU/EEA.
Refers to fishers' compliance with official rules	This thesis refers to fisher's compliance with official rules, and not other kinds of rules (e.g. social rules, religious rules).

3.2.5 Study selection

Based on the search strategy summarized in Table 1 and the inclusion criteria explained in Table 2, the search provided in total 37 hits. The keywords used in the database assigned to the obtained articles such as "compliance", "fishery management", "fishery policy", "fishery regulation" etc. indicated that the obtained literature was appropriate for the scope of the analysis.

After the screening phase (i.e. preliminary analysis), six articles were excluded due to their obvious irrelevance to the study.

After the articles were carefully read and assessed for eligibility, nine of them were excluded due to their irrelevance to the study. Therefore, 22 articles were retained for data extraction and analysis (Figure 1).

3.2.9 Coding scheme

The coding scheme I used in this study has two parts. The first part of this coding scheme is pre-defined (i.e. it was built before reading the selected sources). The following codes were included in the Excel spreadsheet:

1. **article meta-data:**
    a. author(s) of the article;
    b. affiliation of the first author;
    c. title of the article;
    d. journal of publication, subject area as identified by Scopus (e.g. Environmental Science, Social Sciences);
2. **general data about the respective study:**
    a. location of the fishery that the article is referring to (e.g. North Atlantic Ocean, including Mediterranean Sea and Black Sea; Arctic Ocean);
    b. species involved in the respective fishery (e.g. cod, herring);
    c. type of fishery (i.e. commercial other than small-scale, commercial small-scale, recreational, native (indigenous, aboriginal), based on classification by Charles (Charles, 2001)).
    d. type of study (e.g. empirical, theoretical or both). Theoretical articles refer to new or accepted abstract principles concerning a specific field or knowledge. These articles are peer reviewed and but do not usually include research or present experimental data (Rider University, 2016b). In the empirical articles, authors report on their own study. The data is collected by authors in order to answer the research question (Rider University, 2016a).

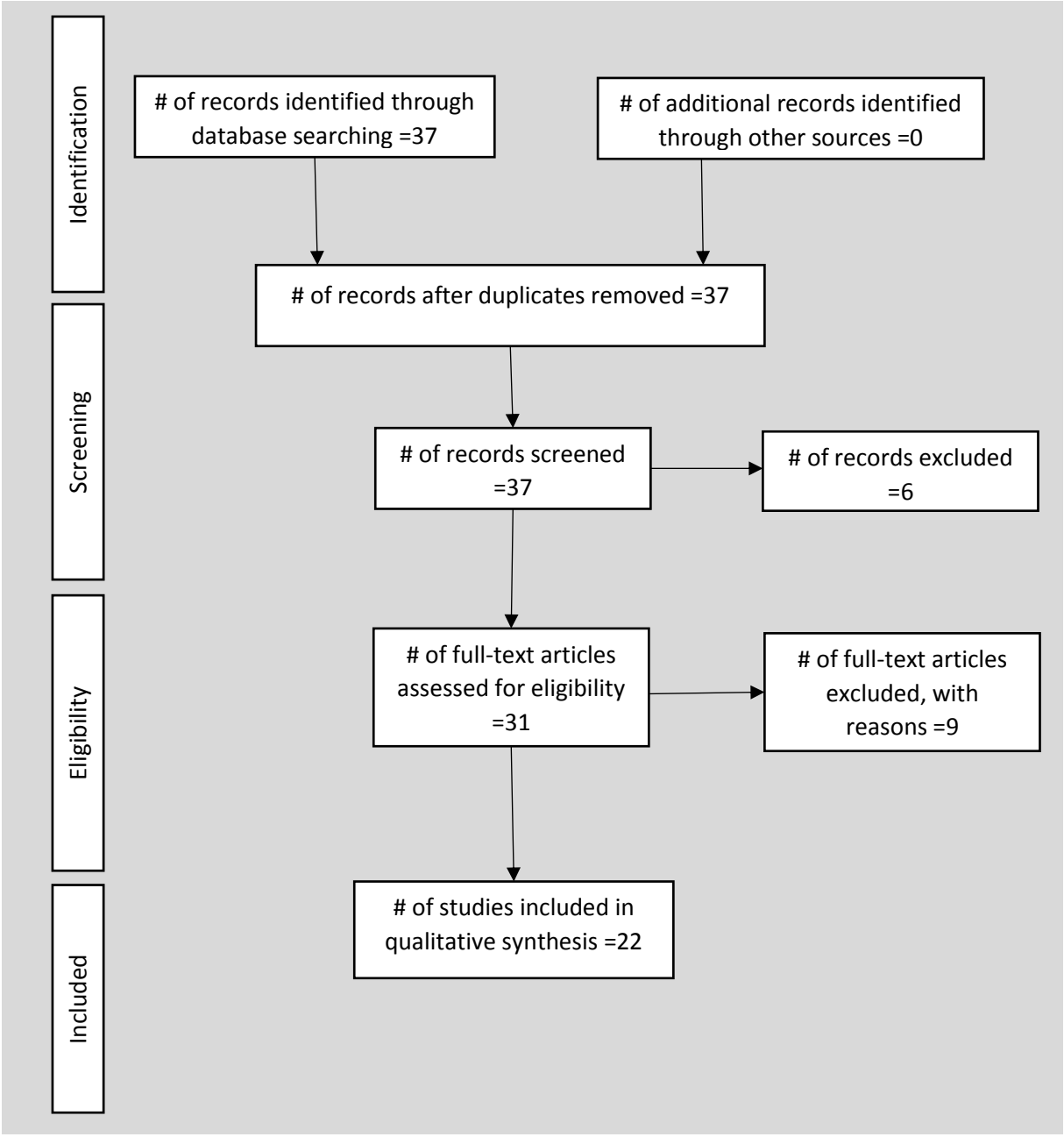

Figure 1. Flow of information through the different phases of this systematic literature review (adapted from PRISMA flow diagram (Moher D, Liberati A, Tetzlaff J, 2009b) .

The second part of the coding scheme refers to drivers for compliance/non-compliance, and it was constructed on-spot while I extracted data, i.e. I have copied and included in the coding scheme the drivers for compliance/non-compliance that I have found while reading the articles included in analysis; afterwards I have recorded which articles were referring to a driver already included in this scheme.

4. Results

4.1 Pre-defined coding scheme

4.1.1 Articles meta-data

Most of the articles included in this Systematic Literature Review were published from year 2009 to year 2016, in the academic journal Marine Policy (Figure 2 and Table 3). Journals as Ocean Development and international Law, ICES Journal of Marine Science, Fishery Management and Ecology also published articles that were included in this study, but significantly fewer.

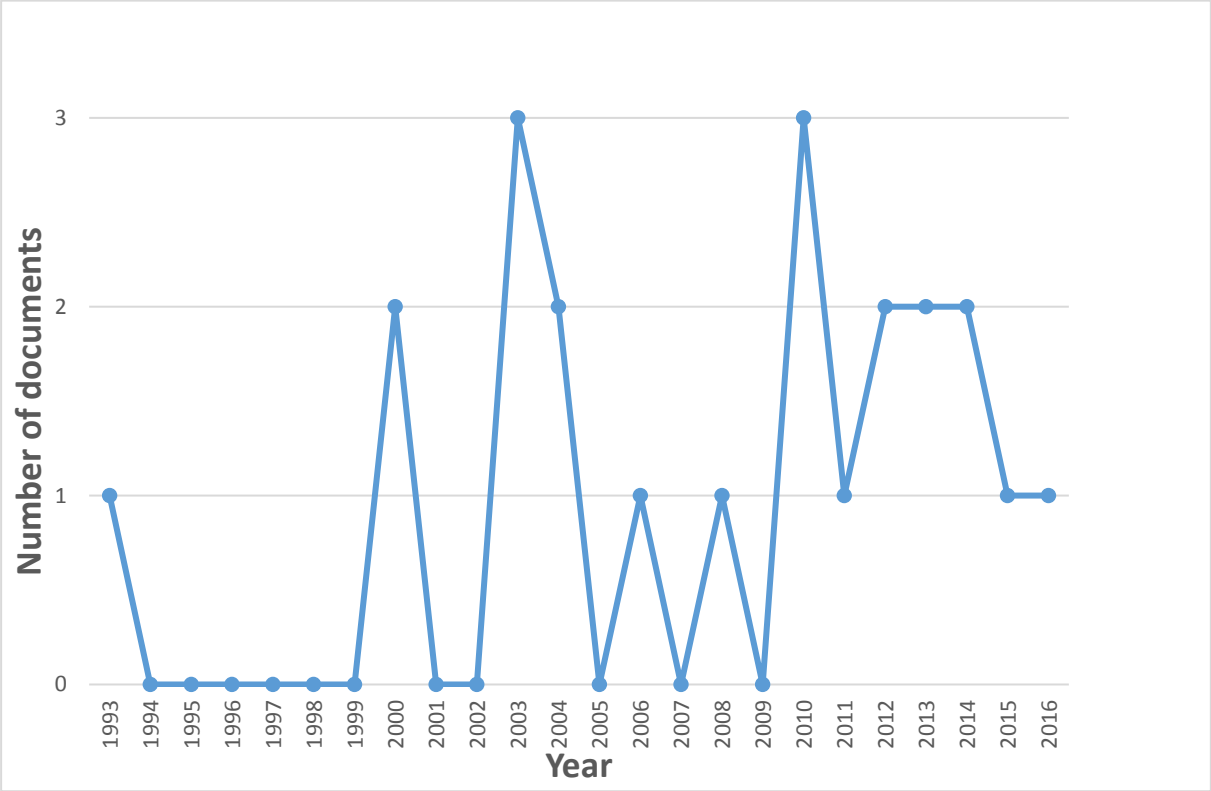

Figure 2. Number of articles about fishers' compliance with rules by year (N=22).

Table 3. Journals that published the articles included in the Systematic Literature review of fishers' compliance with rules (N=22).

Source	Articles (count and percentage of total)
Marine Policy	14 (63%)
Ocean Development and International Law	2 (9%)
Ocean and Coastal Management	1 (4%)
ICES Journal and International Law	1 (4%)
Human Ecology	1 (4%)
Fisheries management and Ecology	1 (4%)
Biological Conservation	1 (4%)
Ecological Economics	1 (4%)

As depicted in Figure 3, most of the authors of the articles included in this Systematic Literature review are affiliated with an institution from Northern Europe (69% of the articles are written by authors from Norway, Sweden, Finland and the United Kingdom). Significantly fewer authors were affiliated with institutions in Southern Europe (21% of the articles are written by authors from France, Portugal, Spain and Italy).

All the documents included in this Systematic Literature Review recorded in the database as belonging to the Environmental Science subject area. Most of these articles, but not all, were recorded in the database in the Social sciences subject area. Table 4 summarizes all the subject areas the articles included in this Systematic Literature Review were included in.

Figure 3. Map of countries the first authors of the articles included in the Systematic Literature review of fishers' compliance with rules are affiliated with (N=22; one author had double affiliation and was counted against both countries).

Table 4. The subject areas of articles included in the Systematic Literature review of fishers' compliance with rules (N=22).

Domain	Articles (number and percentage of total)
Environmental Science	22 (100%)
Agricultural and Biological sciences	19 (86%)
Economics, Econometrics and Finance	17 (77%)
Social Sciences	17 (77%)
Earth and Planetary Sciences	2 (9%)

4.1.2 General data about the respective study

Most of the articles included in this study refer to the North Atlantic Ocean, as indicated in Table 5.

Table 5. Locations of fisheries described in the from the articles included in the Systematic Literature review of fishers' compliance with rules (N=22).

Water region	Articles (number and percentage of total)
North Atlantic Ocean	11 (50%)
General	6 (27%)
Arctic Ocean	3 (14%)
Pacific Ocean	1 (4%)
South Atlantic and Indian Ocean	1 (4%)

Fisheries in general and commercial fisheries (other than small scale) are the main focus of 80% of the articles included in this study. Some of the articles report on recreational fisheries (9%) and small-scale commercial fisheries (9%) (Table 6).

Table 6. Type of fisheries described in the articles included in the Systematic Literature review of fishers' compliance with rules (N=22).

Type of fishery	Articles (number and percentage of total)
General	9 (40%)
Commercial	9 (40%)
Commercial small scale	2 (9%)
Recreational	2 (9%)

Articles that focus both on fisheries situated in the North Atlantic Ocean and on commercial activities concentrate on demersal (28%) and pelagic species (18%). There are three articles situated in this water region (28%) that report on fisheries in general. There is only one article that reports on shellfish harvesting.

All the three articles focusing on the Arctic Ocean refer to pelagic or demersal fisheries and to commercial fisheries.

There is only one article that is related to fisheries in the Pacific Ocean and it refers to fisheries in general, focusing on mixed fisheries. The same about the article focusing on fisheries situated in the South Atlantic and Indian Ocean.

There are six articles that do not mention the water region (thus, they were recorded as "general" in the coding scheme). Half of these refer to fisheries in general (i.e. they do not specify a certain species). Table 7 summarizes the number of articles per water region and per species harvested.

Among the analyzed articles, 13 were only empirical (59%), seven were only theoretical (31%). The rest (9%) were combined.

Table 7. Number of articles related to different water regions and different harvested species (N=22).

Water region (number of articles)	General	Demersal	Pelagic/Demersal	Pelagic	Mixed	Not mentioned	Shellfish
North Atlantic (11)	3	3	2	2	0	0	1
General (6)	3	0	0	0	1	2	0
Arctic (3)	0	1	2	0	0	0	0
Pacific Ocean (1)	0	0	0	0	1	0	0
South Atlantic/Indian Ocean (1)	0	0	0	0	1	0	0

4.2 On-spot coding scheme

From the 22 articles included in this SLR, 63% articles discus in depth drivers for compliance with fisheries rules. The rest over only mention motives for compliance/non-compliance.

Out of the 22 articles included in this SLR, 19 focus on fishers' non-compliance with state rules. I identified 19 drivers for non-compliance (40% of the total number of drivers). The same number of articles refer to fisher's compliance with state rules. I identified 29 drivers for compliance (60% of the total number of drivers) when analyzing these articles (Table 8). The most common non-compliance drivers with fisheries rules identified by this SLR are economic incentives and economic sanctions (Table 10). The most common compliance drivers with fisheries rules identified by this SLR are moral reasoning, social pressure, involvement in rule making and legitimacy of regulation (Table 10). All these drivers are listed in Table 8 (non-compliance) and Table 9 (compliance), with their definition/explanation, as identified in the respective article or external source (alphabetical order).

Table 8. Drivers for fishers' non-compliance with rules and their definition/explanation, as identified in the respective article or external source (alphabetical order).

Drivers	Definition/Explanation
Competition between fishers	In some areas there are not so many alternative income sources available. One loses his income since others continue fishing. The depletion of the inshore marine resources accelerates the race for fish (Boonstra & Bach Dang, 2010). "The heavy competition forces local fishers to use the most efficient fishing equipment in order to fish as much as possible, even if this means breaking the law" (Boonstra & Bach Dang, 2010). "Gaining competitive advantage through illegal means is generally regarded as unfair play" (Gezelius, 2006)(Gezelius, 2006).
Complexity and inconsistency of rules	It is difficult for fishermen to follow the rules due to their complexity and sometimes inconsistency. Also, lack of information about rules (My explanation). "Fishermen also draw attention to how the complexity of the management system makes compliance difficult—even to the point where rules are violated without fishermen being aware of it" (Jentoft & Mikalsen, 2004). There are some practical difficulties to comply with the regulations have major or medium impact on their compliance behavior (Raakjær Nielsen & Mathiesen, 2003).

Decoupled management from the available resources	Overcapacity may be a sign of the decoupled management: “First persisting overcapacity suggests fleet management decoupled from the resources available, creating economic incentives for underreporting. Second, TACs being decoupled from the biological reality has created incentives for misreporting of species composition in this mixed species fishery” (Hentati-Sundberg, Hjelm, & Osterblom, 2014).
Economic gain vs. economic sanctions	When the fishermen decide to comply or not, they calculate their economic benefits (yield, profit) and costs (severity of sanctions, chance of getting caught) (Boonstra & Bach Dang, 2010). “The decision on compliance versus non-compliance behavior is based on a calculation of the economic gain to be obtained from bypassing the regulation compared to the likelihood of detection and the severity of the sanction”(Raakjær Nielsen, 2003)
Economic incentive	“Something, often money or a prize, offered to make someone behave in a particular way” (Cambridge Dictionaries Online). Yield or profit.
Failure of understanding regulations	“Uncertainty or simply missing a knowledge of all existing recreational fishing regulations are common phenomenon in the Azores” (Diogo, Gil Pereira, & Schmiing, 2016).
Justification	Compliance is determined by the degree to which regulations are considered justifiable among the fishers (Jagers et al., 2012).
Lack of information about rules	Fishermen also draw attention to how the complexity of the management system makes compliance difficult—even to the

	point where rules are violated without fishermen being aware of it (Jentoft & Mikalsen, 2004).
Lack of moral constraints	"Lack of perceived moral restrictions increases fishers' propensity not to comply with regulations" (Jagers et al., 2012).
Lack of political will	The lack of political will to deal with the problem contributes to the morality erosion and hereby encourages non-compliance behavior (Raakjær Nielsen & Mathiesen, 2003).
Low fines	The overall impression of Swedish monitoring and enforcement of fisheries is that it suffers from too long handling periods, that convictions result in very low fines, that gear and catches often may be kept by the fishers despite convicted crimes and finally, that in Sweden, so far, there is no possibility of withdrawing fishing licenses for a limited period in case of violation (Eggert & Ellegård, 2003)
Low level of environmental awareness	Fisher's understanding of fragility of the exploited resources and the importance of their protection (My explanation).
Management void	Some developing countries are not able to monitor the access and use of marine resources. "However, de facto the Vietnamese central state was not able to control and monitor the access and use of marine resources. It meant that in practice there were no functioning management institutions in place" (Boonstra & Bach Dang, 2010).
Managers lack knowledge of the conditions and factors that influence rule compliance and legitimacy of fishery management	"Such knowledge is essential to improve voluntary compliance behavior among the fishermen" (Raakjær Nielsen, 2003).
Non-compliance behavior of fellow fishers	"In case of bypassing quota regulation, fishers' attitude (norm) is found to a large degree to be influenced by the

	consequences of non-compliance behavior of fellow fishers" (Raakjær Nielsen & Mathiesen, 2003).
Non-monetary incentives	"Practical knowledge, social pressure and moral have an impact on fisher's behavior" (Raakjær Nielsen, 2003).
Poor landings control system	"It has induced inequality among fishermen which has further reduced incentives for their rule compliance" ((Suuronen, Jounela, & Tschernij, 2010).
Stock condition (scarce resources)	A bad condition of the stock accelerates race for fish (Boonstra & Bach Dang, 2010). This race may influence on the compliance rate.
Weak external control	The authorities are not able to provide appropriate control (my understanding)

Table 9. Drivers for fishers' compliance with rules and their definition/explanation, as identified in the respective article or external source (alphabetical order).

Drivers	**Definition/Explanation**
Chance of getting caught	Fishermen may get caught by doing something illegal or shortly hereafter (my explanation).
Compliant behavior follows as the most desirable choice of action independently of management and enforcement measures	When quotas are high and fish is ample, there is no incentive to fish with illegal mesh size or enter closed areas(Hønneland, 2000).
Degree of enforcement	"A certain degree of enforcement is necessary in an ocean "fishery. The exact amount of surveillance (e.g. in the form of inspection frequency) and severity of sanctions are, however, not the (or at least not the only) decisive factor in "fishermen's decisions on compliance vs. non-compliance" (Hønneland, 2000).
Distinction between commercial and "food fisheries"	Fishing for food is generally

	considered morally acceptable and consequently not connected with extensive secrecy (Gezelius, 2004).
Distributive fairness	In the instrumental approach, it is important that the regulations and the distribution of fishing rights are perceived as legitimate. Especially in situations where there is a large overcapacity in the fleet, as it is generally the case in most fisheries, the distributive fairness is important (Raakjær Nielsen, 2003).
Efficacy of imposed regulations	An essential incentive for compliance is that the imposed regulations are perceived as meaningful. Fishers will not comply with regulations that are not believed to conserve the stocks (Raakjær Nielsen & Mathiesen, 2003).
Fines	According to Collins English Dictionary, a fine is a certain amount of money exacted as a penalty (Collins Dictionary, 2016b)
Good condition of the stock	“When quotas are high and "fish is ample, there is no incentive to "fish with illegal mesh size or enter closed areas” (Hønneland, 2000).
High level of environmental awareness	High level of fishermen environmental awareness influences on the compliance rate in a positive way (my explanation).
High quotas	“When quotas are high and "fish is ample, there is no incentive to "fish with illegal mesh size or enter closed areas” (Hønneland, 2000).
Involvement in rulemaking	The compliance rate is dependent on whether or not fishermen participate in construction of the regulations (Boonstra & Bach Dang, 2010)
Legitimacy in the regulations	Together with generally legitimate regulations, authorities and procedures, these constitute a framework which renders a largely compliant behavior the more salient option for most of the

	fishermen most of the time (Hønneland, 2000).
Legitimate enforcement	Somewhat more surprising, perhaps, is the massive emphasis on human relations: We consider the Coast Guard a legitimate enforcement body, because its leaders and inspectors treat us with respect, is the message (Hønneland, 2000).
Meaningful regulations	An essential incentive for compliance is that the imposed regulations are perceived as meaningful. Fishers will not comply with regulations that are not believed to conserve the stocks (Raakjær Nielsen & Mathiesen, 2003).
Moral reasoning	"Fishers' personal moral and perception of what is right and wrong will have a large impact on fishers' attitude towards compliance respectively noncompliance" (Raakjær Nielsen, 2003).
Peer pressure	"Other than economic influences could be for instance morality or peer pressure. It has been postulated that the perceived compliance by ones' peers in itself is an important determinant in the decision to comply with or violate regulations" (Eggert & Ellegård, 2003).
Personal experience with enforcement authorities	"Personal experiences with enforcement authorities and the Court will influence compliance behavior" (Raakjær Nielsen, 2003).
Profit vs. deterrence	Noncompliance may be driven (among other factors) by lack of legitimacy or simply a "need" in terms of profit versus risk of deterrence (Quérou & Tomini, 2013).
Public scrutiny (social pressure)	Fishermen may fear retribution including sanctions or public control (Diogo et al., 2016)
Regulations concur with preferred fishermen behavior	In some cases (e.g. in Norway), the fishermen behavior may accidentally

	concur with the regulations (Hønneland, 2000).
Regulations supported by the fishers	In contrast to the present MCE approach taken by managers, an alternative route could be to promote regulation that, to a large degree, will be supported by the fishers, but managers lack knowledge of the conditions and factors that influence rule compliance and legitimacy of fisheries management systems within the fisher community (Raakjær Nielsen & Mathiesen, 2003)
Reputation	The opinion that people in general have about someone or something, or how much respect or admiration someone or something receives, based on past behavior or character(Cambridge Dictionary, 2016c) .
Sanctions	A strong action taken in order to make people obey a law or rule, or a punishment given when they do not obey (Cambridge Dictionaries Online), e.g. Economic sanctions, confiscation of catches and gear and suspension of licenses (FAO.org).
Severity of the sanctions	The compliance rate is dependent on the sanctions severity degree (my explanation).
The lack of confidence in the marine biological research, lack of trust to the scientists	The lack of confidence in the marine biological research undermine the legitimacy of the management system, which can have negative impacts on the incentive to comply with regulations (Raakjær Nielsen & Mathiesen, 2003).
The perceived right to make a reasonable living from fishing. Distinction between moderation and excess	In that case, fishermen have a distinction between moderation and excess. The question of scale is crucial part of their moral judgment. “Breaking a rule on a small scale in order to ensure a necessary income did not imply any great risk of public condemnation. However, if a

	fisherman was perceived as breaking rules "on a large scale" in order to maximize his personal profit, he became an object of backbiting, social degradation, and potential exclusion» (Gezelius, 2004) .
The risk of conviction in case of exposure	The fisher estimates the cost of non-compliance based on a subjective assessment of the risk for exposure, the risk for conviction in case of exposure and the severity of the expected penalty in case of conviction (Gezelius, 2004)(Eggert & Ellegård, 2003).
Threatening for common good	In this case "the morality of compliance among fishers was connected to a perceived moral obligation to contribute to the protection of a common good" (Gezelius, 2004). The fishermen are generally concerned with the fisheries' effect on the fish stocks (Gezelius, 2006).
Trust	"Studies of public support of environmental policy measures such as environmental taxes demonstrate that trust in authorities is an important factor affecting the level of support and acceptance [28, 37, and 38]. Accordingly, how fishers regard the authorities responsible for deciding, implementing and enforcing regulations is likely to affect their compliance decision" (Jagers et al., 2012).

5. Discussion

The number of publications referring to fishers' compliance with rules per year may be an indicator of researchers' interest and relevance of the chosen topic for the academic community. As indicated in Figure 2, most of the articles analyzing fishers' compliance with rules were published by authors affiliated with an EU/EEA institution in the period 2003-2016, with a steady interest in the last six years. Based on the data from Figure 2, one could say that there is a growing interest of EU/EEA researchers in the topic of fishers' compliance with rules. There are merely 10 articles published in the period from the year 1993 to the year 2009. Whereas, only within the last 5 years 12 articles were published on the chosen topic.

According to the data included in Table 3, the most of the articles on the topic of compliance with fisheries rules authored by EU/EEA researchers were published by the Marine Policy journal. The reason for that could be the specific of this scientific journal. Marine Policy is a peer-reviewed academic journal that focuses on ocean policy studies that analyze social science disciplines relevant to the marine policy development (Elsevier, 2016a). The journal covers marine policies at international, regional and national levels. It offers institutional arrangements for the management and regulation of marine activities, including fisheries (Elsevier, 2016a).

All the articles included in this SLR belong to the Environmental Science domain (Table 4). This is clearly due to the fact that these articles focus on fisheries, as an activity that is deeply embedded in the environment and has an influence on it. At the same time, 77 % of the articles belong to the Social Sciences domain. The social science is the scientific study of human society and social relationship (Oxford Living Dictionaries, 2016). These articles consider social science aspects describing interaction between fishers and managers and policy makers. The digital library did not relate all the obtained articles to the Social Science domain, but after careful reading and analysis personally I consider that there are ample grounds to refer all the articles to this subject area. Thus I find it surprising that not all the authors registered their articles in the Social Science area. However, in contrast, 86 % of the articles belong to the Agricultural and Biological sciences mentioning the biological aspects of the harvested species. At the same time, 77 % articles that belong to Economics,

Econometrics and Finance Domain, discussing economical aspects that related to compliance. There are only few articles (9%) that belong to Earth and Planetary Sciences Domain.

Most of the articles published by researchers focus on the commercial fisheries that take place in the North Atlantic (Tables 5-7). This is not surprising, considering that one criterion for selection of articles to include in this SLR is that the first author is affiliated with an EU/EEA institution. However, this might also indicate a high degree of Eurocentrism of the EU/EEA researchers. At the same time, this might also indicate that maybe there is too much focus on commercial (other than small-scale) fisheries, when, for example, about 40% of the employment in the EU fishing sector is actually in the small-scale fishery (EPRSLibrary, 2012). Moreover, most of non-compliance with fisheries rules is considered to take place in small-scale fisheries (Hauck, 2007).

An obvious trend that can be observed is that the topic of compliance with fisheries rules is mostly studied by researchers from Northern and Southern Europe, indicating a high interest in this topic compared with other regions in EU/EEA.

When it comes to the drivers for compliance, the results from Tables 8 and 9 can be grouped based on the nature of driver, e.g. biological, social, individual, as indicated in Table 10. Some of these drivers, such as stock condition and enforcement, are found both among the compliance and non-compliance drivers, but with positive or negative wording accordingly (e.g. good status of stock = compliance driver; bad/poor status of stock = non-compliance driver). According to the study, total number of drivers is 48. Among the extracted drivers 29% are related to management/law/enforcement group, 21 % of drivers have an economic nature, and 17 % of drivers are rooted in social background.

Table 10. Groups of drivers for compliance with fisheries rules (Ndrivers=48). Number in brackets indicate how many articles (Narticles=22) identified the respective driver. Light grey cells indicate drivers for non-compliance. Dark grey cells are drivers mentioned for both compliance and non-compliance. The penultimate row indicates the number of articles that mentioned that specific group of drivers.

Biological	Social	Law/Management / Enforcement	Economical	Awareness	Individual (other than awareness)	Politics
Stock condition (2)	Competition between fishers (2)	Complexity and inconsistency of rules (2)	Economic gain vs. economic sanctions (5)	Failure of understanding regulations (2)	Justification (1)	Lack of political will (2)
The lack of confidence in the marine biological research, lack of trust to the scientists (1)	Non-compliance behavior of fellow fishers (1)	Decoupled management from the available resources (2)	Economic incentive (8)	Lack of information about rules (1)	Lack of moral constraints (1)	
Threatening for common good (1)	Distributive fairness (2)	Management void (2)	Fines (4)	Low level of environmental awareness (2)	Compliant behavior follows as the most desirable choice of action independently of management and enforcement measures (1)	

	Peer pressure (4)	Poor landings control system (1)	Profit vs. deterrence (1)	Managers lack knowledge of the conditions and factors that influence rule compliance and legitimacy of fishery management (1)	Distinction between commercial and "food fisheries" (1)	
	Public scrutiny (7)	Chance of getting caught (4)	Sanctions (3)	High level of environmental awareness (1)	Moral reasoning (9)	
	Reputation (2)	Efficacy of imposed regulations (1)			The perceived right to make a reasonable living from fishing. Distinction between moderation and excess (1)	
		High quotas (1)			Involvement in rulemaking (7)	
		Legitimacy in the regulations (4)			Trust (2)	
		Legitimate enforcement (3)				
		Meaningful regulations (1)				

		Personal experience with enforcement authorities (2)				
		Regulations concur with preferred fishermen behavior (2)				
		Regulations supported by the fishers (2)				
		Severity of the sanctions (2)				
		The risk of conviction in case of exposure (1)				
4	18	30	21	7	23	1
Biological	**Social**	**Law/Management / Enforcement**	**Economical**	**Awareness**	**Individual (other than awareness)**	**Politics**

6. Conclusions

This thesis presents a Systematic Literature Review on compliance with fisheries rules, as reflected in research conducted by EU/EEA institutions. The issues concerning fishers' compliance still exist, to different extents, in all parts of the world. Non-compliant behavior of fishers is a serious problem that can affect the fishery sustainability and the environment. Therefore, there is a necessity to identify and investigate the motives that cause fishers' disobedience with rules. However, among the EU/EEA researchers, one may observe the growing research interest on fishers' compliance with official regulations only within the last five years. This study makes a contribution to this area of knowledge.

Analyzing data obtained from the 22 articles included in the Systematic Literature Review, it was found that there are several research trends in compliance and non-compliance that researchers with the EU/EEA affiliation focus on. Taking into consideration the prevailing number of drivers related to law and management issues, one may make a conclusion that majority of authors examine mostly those drivers. Also, there is apparent interest among the researchers in drivers that are related to social and economic field. Also, this study shows that there is not so much research conducted on drivers related to biological aspects. Moreover, this analysis shows that most of the EU/EEA researchers preferred to publish their articles on compliance with fisheries rules in Marine Policy journal, most probably due to the specific focus of this journal. Most of the articles published by researchers focus on the commercial fisheries that take place in the North Atlantic. In addition, most of the authors are form Nordic countries which can be an explanation of their interest in this area.

This study might be of relevance in, for instance, the formulation of new fisheries rules and in the improvement of governance processes in general. In addition, if a similar study would be performed on articles authored by researchers affiliated with institutions in a different region (e.g. North America, Asia), this study would provide a basis for comparison of different research approaches and traditions.

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