

ACKNOWLEDGEMENT

I would like to express my gratitude to Melania Borit for her useful comments, understanding, and guidance. Without her support and sedulous help I am sure I could not have written this Thesis.

I would like to thanks Michaela Aschan, who introduce me to the topic, and whose enthusiasm for it was transmitted to me. Furthermore, I would like to thanks Petter Holm for his key role at supervising my work, and his great wealth of input to the content of the thesis.

My special thanks is extended to the technical assistants and personal from the Cofrarias, specially to Raquel from A Guarda. Her willingness to give her time so generously is much appreciated.

To the board of the Master Thesis for accept my application, and especially to Ane- Marie Heiktoen. She knows how many disturbances I caused her during this period.

Of course I owe a great of gratitude to my family. My academic formation and education is just because they made it possible. Also to my friends, they already know why.

TABLE OF CONTENTS

ACKNOWLEDGEMENT	3
ABSTRACT	11
1. INTRODUCTION	13
1.1 Settings.....	13
1.2 Purpose of this Thesis.	14
1.3 Rationale of the approach - Case Study research method	15
1.4 Structure of the present Thesis.....	16
2. CONCEPTUAL FRAMEWORK.....	17
2.1 Fisheries Management (FM) and Fisheries Management System (FMS)	17
2.1.1 DIFFERENT APPROACHES AS APPLIED IN FMS	17
2.2 FMS and FS in Europe.....	18
2.2.1 CFP AND FISHERIES MANAGEMENT.....	18
2.3 Results - Based Management (RBM) and its application to FM.....	19
2.3.1 DEVELOPING RBM AS APPLIED TO FISHERIES.....	20
2.3.2 CHARACTERISTICS OF AN FMS APPLYING RBM PRINCIPLES TO FM	22
2.3.3 RBM FEATURES FOUND IN THE EUROPEAN FMS	23
2.4 How may RBM be complemented with other arrangements in a FMS?	24
3. CASE STUDY AS RESEARCH STRATEGY	27
3.1 Where subject of the study was located.....	27
3.2 Design of the research method.....	28
3.3 Protocol of investigation and data collection	29
3.3.1 OVERVIEW OF THE PROJECT	29
3.3.2 FIELD PROCEDURE.....	30
3.4 The analytic strategy:	36
3.5 Criteria for interpreting the findings.....	36
3.6 Limitations of the study	37
4. CASE STUDY: MANAGEMENT OF THE GALICIAN GOOSE BARNACLE (POLLICIPES POLLICIPES)	39
4.1 Introduction to Goose Barnacle (Pollicipes pollicipes) resource	39
4.1.1 TAXONOMY AND HABITAT	39
4.1.2 MORPHOLOGY	39
4.1.3 REPRODUCTION.....	40
4.1.4 HARVEST	40

4.2	Goose Barnacle (GB) Fishery-	41
4.2.1	FEATURES OF THE FISHERY.....	41
4.3	The Galician Goose Barnacle Management System (GGBMS).....	47
4.3.1	GENERAL FRAMEWORK AND THE LIMITS TO FM	47
4.3.2	REGULATIONS- MAKING FRAMEWORK: CONSELLERÍA- COFRARÍA AGREEMENT	48
4.3.3	FISHERIES MANAGEMENT	48
4.3.4	ASSESSMENT OF THE STOCK: DATA COLLECTION AND ANALYSIS	50
4.3.5	EVALUATION OF THE GGBMS: PERFORMANCE MEASURES.....	52
4.4	A new MP and its validation- simple feedback	53
4.5	An example of how the management arrangement comes into being– Cofraría de Cangas	54
4.5.1	EXPLOITATION AND MANAGEMENT PLAN	54
4.5.2	REQUEST FOR OPENING OF AREAS- MONTHLY SCHEDULE	57
4.5.3	DAILY WORK	57
4.5.4	PROVISIONS OF DATA AND INFO	59
4.5.5	SUBMISSION OF THE MP FOR 2012	61
4.6	Chronogram as summary of the management tasks conducted along the year. It is presented as a cyclical process.	62
5.	DISCUSSION.....	63
5.1	Top-down features.....	63
5.1.1	OUTCOME TARGETS.....	63
5.1.2	SYSTEM OF DOCUMENTATION	64
5.2	Bottom-up features.....	66
5.2.1	FLEXIBILITY OF THE HARVEST ACTIVITY.....	66
5.2.2	BURDEN OF PROOF OF GB HARVESTERS.....	67
5.3	How GGBMS model might be transferred to others European contexts? Limitations and potentialities of the model of GGBMS here described-.....	69
6.	CONCLUSIONS	73
	APPENDIX A- Management Framework.....	82

TABLE OF FIGURES

FIGURE 1- MAP OF GALICIA WITHIN EUROPE. GALICIA IS FRAMED UP THE RIGHT. THREE BLUE SPOT LOCATE UNITS OF OBSERVATION: A GUARDA, BAIONA AND CANGAS (FROM SOUTHERN TO NORTHERN) SOURCE: ELABORATED FROM MAPS ON MAPASDEEUROPA.COM AND COMMONS.WIKIMEDIA.ORG.....	27
FIGURE 2- SINGLE- HOLISTIC CASE STUDY. SOURCE: (YIN 2008)	30
FIGURE 3- TOOLS FOR HARVESTING GOOSE BARNACLE (LEFT PICTURE) AND A PATCH OF GOOSE BARNACLE ON A ROCK (RIGHT PICTURE); SOURCE: (FARIÑAS CASTRO) AND (JESUS 2002).	39
FIGURE 4 - ADMINISTRATIVE AREAS UNDER GALICIAN JURISDICTION (NEGRO 2010)	43
FIGURE 5- GB PRODUCTION AREAS INCLUDED IN THE MP ELABORATED BY COFRARÍA DE CANGAS. SOURCE: HTTP://WW3.INTECMAR.ORG/SIGREMAR/	55

TABLE OF TABLES

TABLE 1- SCHEDULE OF EXPLOITATION (UPPER TABLE) AND DAILY QUOTA (LOWER TABLE). SOURCE: PESCADEGALICIA.COM NOTE THAT 2011MP INCLUDED A CLAUSE IN WHICH THE INDIVIDUAL DAILY QUOTA WAS PERMITTED TO BE EXTENDED UP TO 7KG DURING ANY CHOSEN 24 DAYS ALONG JANUARY, JULY, AUGUST AND DECEMBER SEE LOWER TABLE).	56
TABLE 2-MONTHLY REQUEST OF OPENING- NB! DATA IS NOT NECESSARILY ACCURATE. THIS DOES NOT ALTER THE PURPOSE OF THE FIGURE TO SHOW WHAT A SCHEDULE OF HARVEST ACTIVITY LOOKED LIKE, AND NOT TO THOROUGHLY ANALYZE ITS CONTENT.....	57
TABLE 3- INFO AND DATA PROVIDED BY COFRARÍA OF CANGAS. EXCEL FILE. NB! DATA IS NOT NECESSARILY ACCURATE. THIS DOES NOT ALTER THE PURPOSE OF THE FIGURE OF SHOWING HOW PROVISIONS OF DOCUMENTATION LOOKED LIKE AND NOT OF THOROUGHLY ANALYZING ITS CONTENT	60
TABLE 4- INFO AND DATA PROVIDED BY COFRARÍA DE CANGAS: SIZE DISTRIBUTION OF CATCHES EXCEL FILE- NB! DATA IS NOT NECESSARILY ACCURATE. THIS DOES NOT ALTER THE PURPOSE OF THE FIGURE TO SHOW WHAT PROVISIONS OF DOCUMENTATION LOOK LIKE, AND NOT TO THOROUGHLY ANALYZE ITS CONTENT	60
TABLE 5- SEQUENCE OF TASK IN GOOSE BARNACLE MANAGEMENT IN COFRARÍA DE CANGAS. NB! THE OBJECT OF THE TABLE IS NOT TO PROVIDE INSIGHTS ABOUT WORKLOAD OR RANK IMPORTANCE OF ONE TASK OVER ANOTHER, BUT TO CLARIFY THE SEQUENCE OF TASKS THROUGHOUT THE YEAR ON THE ISSUE OF FISHERIES MANAGEMENT IN THE COFRARÍA OF CANGAS.	62

LIST OF ABBREBATIONS

BZ	Biologists of zone
CFP	Common Fisheries Policy
DXRM	Department within <i>Consellería</i> that manages GGB fishery
EU	European Union
EMP	Exploitation and Management Plan
GB	Goose Barnacle (<i>Pollicipes Pollicipes</i>)
GBA	Goose Barnacle Aggregation
GGB	Galician Goose Barnacle
GGBMS	Galician Goose Barnacle Management System
MARM	Spanish Department of Fisheries and Maritime Affairs
MP	Management Plan
NFDM	Spanish National Directorate of Fisheries
PO	Producer Organization
RBM	Results Based Management
TA	Technical Assistant

GLOSSARY OF TERMS USED

<i>Area Of Production</i>	Each of the fishing grounds into which TURFs are divided
<i>Autonomic Community</i>	Region within Spain with full authority to fisheries management in its interior waters
<i>Cofraría</i>	Organized guild of fishermen. Unit of management and operational base of fishermen
<i>Consellería</i>	Department of the Rural and the Sea of the Autonomic Community Government. Agent that finally makes decisions and holds responsibility for management of the fishery
<i>Control Points</i>	Spot or location, close to a production area, where surveillance systems are placed in order to register or control registration of catches and number of fishermen; and to discard under-sized individuals
<i>Exploitation And Management Plan</i>	Document in which it is described the rotational harvest strategy and which establishes the regulations under which resource users must operate. Agreement between Galician Authorities and harvesters.
<i>General Direction Of Marine Resources</i>	Branch of Consellería in charge of fisheries management in interior waters
<i>Goose Barnacle</i>	Marine Resource- <i>Pollicipes Pollicipes</i>

<i>GB Management Aggregation</i>	Local organizations of harvesters, which belong to one or several Cofrarías and hold a harvest right to exploit Goose Barnacle.
<i>Implementation</i>	Stage of the management process that comes after approval of the Management Plan and during which measures are applied.
<i>Indicators Framework</i>	Limits specified within the acceptable impact boundaries that are established for a particular fishery in a delimited area. Indicators are the element to measure performance of the fishery. The Outcome – indicator framework is specified by Fisheries Authorities.
<i>Management Plan</i>	Document that establishes the regulations under which resource users must operate. It is a kind of formal contract between the Fisheries Authorities and Resource Users.
<i>Outcomes Target</i>	Specific appropriate results for the fishing activity in a particular context
<i>Performance</i>	Rate of attainment of monitor and control indicators.
<i>Permex</i>	It stands for <i>Permiso de explotación</i> . Permex is a permission of exploitation in Galicia. Certain fishermen and harvesters hold up to five different Permex for different target species, so they switch along the year.
<i>Regulations-making framework</i>	Fisheries management agreement in regards to regulations-making process. Who and how regulations in fisheries management are taken
<i>Technical Assistant</i>	Agents of change. Personnel hired by Cofrarías to conduct certain management tasks that require technical knowledge.
<i>Turf</i>	Territorial Users Rights for Fishing - granted territory to each Cofraría for exploitation of the resources.

ABSTRACT

The European Common Fisheries Policy is under reform. The Green Paper identifies the form of regulating management of the European fisheries as one of the main reasons for which the process of management is ineffective at achieving its objectives and at fitting an ecosystem based management approach. This thesis analyzed the innovative concept of results-based management as applied in fisheries as one alternative to move away from the current regulation process; and linked this RBM concept with the concept of reversing the burden of proof towards fishermen. In order to do that, I choose case study research method with the purpose of exemplifying the practical implications of a fisheries management process to which results based management is applied. I described the Galician Goose Barnacle Fishery in a manner that has allowed me to contrast its management system pattern with the combined bottom-up and top-down conceptual pattern of results-based management. Results suggested there are matches between both so this fact permitted me to look at and discuss about practical implications that this new paradigm has when it comes to be applied. Discussion was also taken around potentialities and limitations that this model has when it comes to be transferred to another European fisheries context. Finally, the thesis concludes that Galician Goose Barnacle is indeed an exemplar of Results Based Management. Furthermore, it is concluded that effective authority-users agreement requires new forms of fruitful interaction between authorities, industry and researchers in order the management system and the regulations of the management process became adapted to the resource specificities and to each context.

Keywords: *fisheries management, results-based management, burden of proof, reform of CFP, innovative paradigm, bottom-up approach, top-down approach, regulations*

1. INTRODUCTION

1.1 Settings

The Common Fisheries Policy (CFP) of the European Union (EU) has long been accused of being unable to provide sustainable fisheries or actually in being an obstacle to this in itself (Gezelius and Raakjær 2008). Moreover, the CFP has produced a manner of managing the European fisheries that has been broadly known as micro-management (Degnbol 2005; Symes 2009) and deemed to perform poorly in achieving objectives (Commission 2009; Symes 2010). Micro-management is characterized by establishing an extensive range of the so-called technical measures whose object is to define where, when, how and how much fishing will occur. Furthermore, new regulations are accumulated as new issues are raised and addressed (Degnbol 2004). Such micro-management has demonstrated to be the right recipe to lead European fisheries towards overexploitation.

Therefore, on the evidence of such ineffectiveness, the European Commission has started a review of the CFP. In the discussion around its reform, the Green Paper (Commission 2009) emphasized “results-based management” (RBM) as one alternative to move away from a traditional over-centralized and top-down regulation process (Degnbol, Kuikka et al. 2009).

According to this model, RBM aims at reducing such a micro-management by a greater involvement of stakeholders in this regulation process (Commission 2009). The Commission seeks to be relieved of the responsibility for the task of detailed technical management in favor of the industry.

Hence, the legislative central issue for the Commission in a RBM paradigm will be specifying acceptable fishing activity impact rather than acceptable ways to work and technology as it is the case in micro-management (Degnbol 2009).

Industry, as long as it shows responsibility for meeting the established limits, will be given enough flexibility to develop the appropriate, practical and economical management means. This requires that the industry demonstrates that required limits are indeed achieved and how this is done.

Notice that the RBM system is an innovative shift in the way organizations operate, so it might meet fierce opposition in its adoption. Hence, it is relevant to understand how RBM comes into being so that it might be useful to understand how it will work for the EU CFP.

According to Nielsen, Holm et al (2012), RBM has only been applied in a limited number of cases of fisheries management around the world, and there are few works published on experiences with such cases. Such examples are the management of scallop fisheries in New Zealand, goose barnacles in Galicia (NW- Spain) and the Spencer Gulf prawns in South Australia.

The aim of this paper is actually to evaluate whether the Galician Goose Barnacle Fishery (GGBF) is indeed an example of RBM and then, to draw some lessons from the practical implications of applying its principles.

1.2 Purpose of this Thesis.

This study aims to analyze the concept of results-based management as applied in fisheries by describing it in regards to certain essential features and by linking it to the concept of burden of proof. Because RBM is an innovative arrangement, it has only been applied in a limited number of cases of fisheries management and not much literature on its practical implications is available. This study will focus on *analyzing* the Galician Goose Barnacle Fishery and deciding whether the management arrangement of this case is an example of RBM. The purpose of this endeavor is to nourish the general discussion in the European Fisheries context about the form of regulating their management and the implications it would have on applying RBM principles. Considering these, the research questions addressed in this study are the following:

- Definition of the concept of RBM as applied to fisheries
 - What is RBM?
 - What features of a management system does RBM have?
 - Which of these features characterizes RBM?

- How these key features are expected to work when applied to a fishery?
 - How to differentiate RBM from other forms of management? Differences and similarities.
- What are the main RBM-like features found in the GGBMS?
 - How do these RBM-like features implemented in the GGBMS?
 - Could then GGBMS be considered as applying principles of RBM in its management?
 - Which are the potentialities and limitations of the RBM concept when it comes to be applied in fisheries?

1.3 Rationale of the approach - Case Study research method

All research strategies, including case study, namely experiments, surveys, analysis of documentation and history (Yin 2008), have their own strengths and weaknesses and no one is better than another in regard to methodology. However, each strategy best suits a particular kind of investigation.

From these, the research strategy I have chosen is the case study (Yin 2008). According to Yin (2008), case study is particularly convenient when the research questions are of the type of how. Also, Yin stated that case studies are especially suitable when the event being investigated is contemporary and the researcher has no control over it.

Among the types of cases study, i.e. exploratory, descriptive and explanatory, I believe that the most suitable one for the purpose of this Thesis was the descriptive case study. The rationale behind my choice is that the descriptive case study allows for a detailed and focused inquiry whose aim is at assessing the case based on a theoretical framework. Theoretical propositions, articulated at the outset, embrace what is already know about the phenomenon. Besides, those propositions help to specify the boundaries of the case and contribute significantly to the rigor of the finished case study. The power and promise of a descriptive case study lie in its potential for avoiding abstract interpretations of data and for developing theory.

Single case studies have been considered as suitable for documenting the precise nature of a phenomenon not well understood, as it is RBM applied to fisheries.

1.4 Structure of the present Thesis

The introduction section identifies a problem that the Green Paper aims at tackling in the process of reforming the current CFP. This concerns a move away from over-centralized and top-down regulation process as it is RBM. A brief description of this innovative paradigm is provided as well as a brief description of the role that the industry plays in it. Also, this section explains the reason behind choosing case study as the research strategy to do so.

The case study as research strategy method section describes how the case study was conducted along each of its stages, namely protocol of research and data collection method, field procedure, analytic strategy, criteria for interpreting the findings, and limitations of the method used.

The descriptive theory section sets the theoretical framework that bounds the scope of the present thesis so as to determine what is within the reach of the present thesis in order to contribute to the rigor of its conclusions.

The empirical results section describes the GGBMS as it is in regards to its components such as management objectives, data collection and stock assessment methods, regulations framework and evaluation of the management system method. Description focuses on describing the practical aspects of how management comes into being and illustrates the division of tasks among Consellería, biologist of zone and resource users.

The discussion section analyzes the GGBMS pattern described in the empirical results section and compares it with the RBM pattern described in the descriptive theory section.

The conclusions section is comprised of a more general discussion of my findings and their relevance for the general discussion about management.

2. CONCEPTUAL FRAMEWORK

2.1 Fisheries Management (FM) and Fisheries Management System (FMS)

Fisheries management is a process that ensures the continued productivity of the resources and the accomplishment of other fisheries objectives (Cochrane and Garcia 2009).

Fisheries management (FM) entails a particular strategy which must be thought of as a set of decision rules from overall principles to implementation that specifies the regulations adopted in the fishery (Kirkwood and Smith 1996) and how those regulations must be taken. Then, those regulations are removed or varied, according to a regulations-making framework, using results from assessments of the status of the fishery (De La Mare 1998) to support decisions taken. Because of these features, management is considered to be a technical issue that can be applied to solve a concrete task, where the goal is clear and the outcome is measurable (Jentoft and Chuenpagdee 2009).

In this sense, fisheries management is embedded in a fisheries management system (De La Mare 1998) which consist of (1) fisheries and management objectives or goals, (2) the management process based on decision rules (regulations-making framework), (3) assessments based on specific data and methods (data collection and analysis) and (4) a prospective evaluation of the entire system using performance measures. Regulations-making framework is defined in this thesis as the fisheries management agreement that specifies who and how regulations in fisheries management are taken.

2.1.1 DIFFERENT APPROACHES AS APPLIED IN FMS

Approach is defined as “A way and means of reaching something. The method used in dealing with or accomplishing something” (Houghton Mifflin Co., 1992 as it is found in (FAO 1996)).

Like any other system or structure, fisheries management systems have to be designed. There are many control measures, assessment methods and tools available. The choices about which to include are taken by the adopted approach (FAO 1996). The

development process is iterative, with various approaches to management being simulated, modified and re-evaluated (De La Mare 1998).

2.2 FMS and FS in Europe

The regulations-making framework in the Fisheries Management System in the European context is the Common Fishery Policy (CFP).

The CFP is expected to be integrated in the Integrated Marine Policy (IMP) together with other marine sector policies. The environmental pillar of the IMP, the Marine Strategy Framework Directive (MSFD¹), urges Member States to adopt an ecosystem approach² so that CFP becomes coordinated with other policies that affect marine sectors, including environmental concerns and achievement of a Good Environmental Status by 2020.

It should be noted that, although the ecosystem-based management was already an underlying principle of the objectives for fisheries management in Europe in 2002, in practice its implementation has generally failed (Froese and Proelß 2010) and adopting an ecosystem-based management approach in fisheries became a long term objective. In the meanwhile, fisheries management conducted under CFP still maintains a strong sector and political approach (Froese 2004) and a single stock focus. Ecosystem consideration or biological interactions between species still play an unimportant role in setting objectives for and making decision in fisheries management. That is why CFP was deemed politically successful but a biological failure (Nielsen and Holm 2007).

2.2.1 CFP AND FISHERIES MANAGEMENT

The problem of the current CFP is that it has not worked well enough to establish effective management processes (Commission 2009; Symes 2010) and has failed to

¹ MSFD is the European Directive that establishes the overall principles for the development of human activities in the marine environment. Its purpose is to make a framework within which the CFP is coordinated with other policies that affect the marine sector, including environmental concerns. The issue is the contribution of the Common Fisheries Policy to an ecosystem approach of marine management. Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008, establishing a framework for community action in the field of marine environmental policy (DO L 164 of 25.6.2008)

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:164:0019:0040:EN:PDF>

² In Spain, this Directive has been adopted in the Law 41/2010 of marine space protection. (ley 41/2010, de 29 de Diciembre, de protección del medio marino (BOE núm. 317, 30 de diciembre de 2010).

meet its requirement of every European fishery to be either managed by a long-term management plan or by a recovery plan (Nielsen and Holm 2007).

CFP limits the fishing effort through Total Allowable Catches (TAC) which are complemented with restrictions on fishing time, on fishing space or technical measures as, for instance, gear specifications, fleet, fish sizes and weights. Also, the TAC based systems are based on the assumption that there is a link between landing and impact, and that catch predictions based on the outcome of certain objectives can be produced. These approaches have been developed into micromanagement system where new regulations are accumulated as new issues are raised and addressed (Degnbol 2004) so regulations have a tendency to spawn more regulations (Jentoft and Mickalsen as it is found in (Nielsen, Holm et al. 2012)). This has produced excessive and detailed regulations and control on the industry and its fishing activity (i.e. micromanagement) (Degnbol 2005; Symes 2009).

In this sense, European fisheries management has been categorized as an over-centralized and top-down regulative process that affects directly the daily work of fishermen such as how, when, where, and how much fishing will occur (Pinkerton, Chapter 4 at (Wilson, Nielsen et al. 2003)). In this process, the role of fishermen is only consultative. It means the role of fishermen is only to advise the Commission on strategic policy decisions, drawing on their practical experience.

Managing the vast and diverse European fisheries through such micromanagement is increasingly complex, difficult to understand and very costly (Commission 2009) as efficient control and enforcement structures are the conditions sine qua non for effective implementation and administration of micromanagement (Gezelius and Raakjær 2008) and require large investment dedicated to research in the complexities of ecosystems. Besides, this paradigm has shown ineffective in achieving the objectives of the CFP (Froese and Proelß 2010)

2.3 Results - Based Management (RBM) and its application to FM

RBM produces a way of management that seeks for striking a balance between top-down direction and bottom-up flexibility in a decentralized environment.

General speaking, RBM relies on establishing a formal agreement between the management authorities and the operator (Nielsen, Holm et al. 2012). In this arrangement the role of authorities shrinks to establishing the standards and results within which operators must operate. Operators seek the more efficient and workable solutions, demonstrate the way those means may meet the standards, and document the results to show the standards are indeed achieved by those means. As long as operators adequately document that the requirements are satisfied, authorities will not intervene in the way operators choose to work. This management paradigm is to be viewed in contrast to other forms of management such as a micro-management in which authorities specify a long list of detailed technical requirements for the way operators must work.

RBM is linked to the burden of proof. It is widely recognized that the burden of proof should be placed upon resource users by demonstrating from the outset that no damage is likely to occur, before consent for any activity can be given by the management authority, on behalf of society (Dayton 1998). This has been already taking place in certain sectors in the EU (Linke and Jentoft 2012), namely nuclear power plants, pesticides products, air pollution regulations (Dayton 1998) and pharmaceuticals (Gerrodette, Dayton et al. 2002) in which there is a well-defined protocol for testing drugs before they can be sold to the public.

Initially, back in the 80's- 90's, RBM started to be used as a strategic instrument in many international organizations with some type of economic development purpose, such as the United Nations (UN), the Organization for Economic Co-operation and Development (OECD), the World Bank and Nongovernmental Development Organization (NGDO). RBM has evolved and been applied to other management contexts such as public administration and in the private sector, where the aim is improvements in defining realistic expected results that guide daily work and lead towards long-term objectives, and in finding which the most effective mechanisms to achieve those are.

2.3.1 DEVELOPING RBM AS APPLIED TO FISHERIES

RBM, as defined in the present thesis, proposes a regulations-making framework that produces a manner of management that must be thought of as an alternative to

move away from traditional fisheries managements characterized by top-down and over-centralized regulative processes (i.e. micro-management).

RBM requires that there is a clear distinction between who decides upon the strategic and operational regulations. Marine Affairs Authorities establish the overarching objectives and quality standards for marine environment, for instance fishing within Maximum Sustainable Yield, adapting fleet capacity to available resources or eliminating discards. Within these, authorities narrow down upon specific appropriate results for the fishing activity in a particular context (i.e. outcome targets). Furthermore, authorities establish the standards for documentation, audits and control (system of documentation). At this point, harvesters are given the right to decide upon the operational means of use of the resource (described in the management plan) to achieve those outcome targets and to meet the standards. Harvesters have the right of management at a collective-choice level (Schlager and Ostrom 1992) in a manner in which the not inconsiderable task of detailed technical management falls on industry itself (Lassen, Sissenwine et al. 2008; Commission 2009). This arrangement is maintained as long as resource users appropriately document how outcomes and standards are to be achieved and whether those are indeed achieved (burden of documentation).

It is useful to think about RBM in fisheries as a formal agreement between Marine Affairs Authorities and harvesters in which there is a balance between rights and obligations or rules (Commission 2009). It means that access to fisheries resources comes with certain obligations for resource users regarding proper management and care of marine environment. In those agreements data and information are the bargaining chips in the agreement (Degnbol 2009) in a manner in which those who exercise responsibility in a proper and effective manner should be the ones to enjoy the access to fish stocks (Commission 2009).

Although Resource users must develop the means for achieving the outcome targets, in order to make this practicable, the authorities may develop a management plan framework that makes it reasonably simple for the resource users to develop a proper management plan and take over responsibilities for management tasks (Nielsen, Holm et al. 2012).

By utilizing this method, resource users acquire flexibility and could be encouraged to optimize their possibilities as the fishing industry (Commission 2009) so that their innovative and creative character for developing and implementing more efficient and workable management solutions is unlocked (Degnbol 2009).

On the other hand, the burden of proof in the fishing sector has been defined in identical terms to the other economic sectors in the EU (Lassen, Sissenwine et al. 2008) as the onus of proving that the fishery is ecologically sustainable is placed upon fishermen. Resource users must demonstrate they operate responsibly in return for access to fishing (Commission 2009). They must demonstrate from the outset that no irreversible damage to the fishery system is likely to occur because fishing activity (Lassen, Sissenwine et al. 2008). This is a concept named as reversal of burden of proof that would have to be linked to RBM (Commission 2009) and still needs further development concerning how it is to be implemented in terms of form, contents and dimensions (Fitzpatrick, Graham et al. 2011). In the main, resource users, throughout the implementation of the plan, must provide data and information that permit to demonstrate that results from the fishing activity are kept within acceptable limits, and the outcome targets are met (Degnbol 2009).

This scenario is to be seen in contrast to the current situation that permits fishing activity until there is evidence that it has caused irreversible damage to the ecosystem (Linke and Jentoft 2012) and the burden of documentation is placed on Member State Authorities.

2.3.2 CHARACTERISTICS OF AN FMS APPLYING RBM PRINCIPLES TO FM

In summary, for the purpose of this thesis I will assume that a Fisheries Management System that applies RBM principles in FM, and where the burden of proof is reversed, presents four essential characteristics, i.e. RBM features:

- the specification of acceptable impact (i.e. outcome targets) by the authorities within which resource users must operate,
- specification of the requirement of documentation by authorities, i.e. system of documentation,

- flexibility of choosing the management means that meet the requirements granted to resource user;
- Documentation of the effectiveness of the management means required to resource users. In business science, documentation is official papers that give information about something or that can be used as proof of something.

2.3.3 RBM FEATURES FOUND IN THE EUROPEAN FMS

There are some of those RBM features that are found in the European Fisheries Management System (Nielsen, Holm et al. 2012).

Total Allowable Catches (TACs) are the Outcome Targets in terms of RBM. These are decided by the authorities, and made explicit for different areas and species (i.e. TAC-areas). Most TACs are set on an annual basis and are the result of a cycle of events ending in the December Council of Fisheries Ministers, which decides on the final TACs for the following year, though to some extent based on ICES advice at different quotas for different species and areas.

Operational regulations in the European fisheries, which consist of technical measures thought to meet the outcome targets, are defined by the European Commission, not by resource users as required by the RBM, in concern with stock assessments and advice provided by International Council for Exploration of the Sea (ICES). Criteria, on which this advice and assessments are based, revolve around the stock status that is referred to by the spawning stock biomass (SSB) and fishing mortality (F) values. Those values are considered in regards to both maximum sustainable yield approach (MSY), and the precautionary approach (PA) reference points.

The burden of documentation is on management authorities from each of the EU member states, in contrast to the burden being on industry as within an RBM arrangement. As a core element in the CFP, the Commission specifies which biological and economical data must be provided by member states in order to nourish scientific advice. This is consistent with authorities establishing the system of documentation.

The role of fishermen, regarding making decisions on regulations, is limited to a consultative role at the Regional Advisory Council (RAC³), so obviously fishermen have no flexibility of deciding upon management means that will regulate the fishery at strategic and at operational level as it is in a RBM paradigm.

2.4 How may RBM be complemented with other arrangements in a FMS?

RBM has important potentialities in fisheries whether it is adequately integrated with other management arrangements such as ecosystem-based management, right-based management, adaptive management and co-management. In cases those arrangements are properly integrated, synergies would be created.

Brief definition of these:

1. Ecosystem Based Management: To provide the greater specificity for the purposes of the European Marine Strategy, the ecosystem approach could be described as ‘a comprehensive integrated management of human activities based on the best available scientific knowledge about the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of the marine ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of ecosystem integrity’ (Rice, Trujillo et al. 2005).

2. Adaptive management: assuming managers will rarely be in a position to use formal rule-based management frameworks to implement the ecosystem approach, management frameworks will not be static, but continually reassessed and updated as circumstances change. The alternative to rigid and inflexible management frameworks is adaptive management, and adaptive management is part of the ecosystem approach (Rice, Trujillo et al. 2005). Adaptive management is a form of learning by doing, with structured feedback and decision making. The approach attempts to find the correct balance between gaining knowledge to improve management in the future and to achieve the best short-term outcome based on current knowledge. The adaptive approach uses the ecological indicators to support the operational objectives, and

³ RACs are stakeholder-led organizations: RAC are organized geographically and/or by fishery. Each RAC brings together representatives of the fisheries sector with other interest groups, such as environmental organizations, consumers, sport fishers and aquaculture producers. The role of those organizations is to advise the Commission on strategic policy decisions, drawing on the practical experience of their members.

requires that monitoring and assessments are of sufficient accuracy, precision, and frequency to ensure that the effects of management measures can be evaluated in a timely manner, and be adjusted as necessary (Rice, Trujillo et al. 2005).

3. Co-management: in relation with the Ecosystem-based management, co-management is related with governance aspects, “the integration of stakeholders other than fishermen into the planning process”. Co-management must persist as a collaborative and participatory process of regulations decision-making between representatives of user-groups, government, research institutions, and other stakeholders (Jentoft 2003). Co- Management system must facilitate participation of fishermen (give opportunity according to capacity endowment) and secure their rights so resource users are allowed to participate as equal partners in negotiations about strategic decisions so bring legitimacy to the management system.

Co-management requires an arrangement between authorities and resource users in which responsibility and authority are shared between both (Sen and Nielsen 1996). Co-management can be understood as ‘a situation in which two or more social actors negotiate, define and guarantee amongst themselves a fair sharing of the management functions, entitlements and responsibilities for a given territory, area or set of natural resources’ (Borrini- Feyerabend et al., 2000: 1 as it is found in (Carlsson and Berkes 2005))

4. Rights- based management: it is the definition of the right of access to use a fisheries resource, i.e. system of allocating individual fishing rights to any entity such as fishermen, fishing vessels, cooperatives, fishing communities, enterprises or organizations. The reason behind this rights-based management arrangement is that management is most effective when the entities being managed can be identified directly and, in this way, jurisdictional responsibility for management is clear and unambiguous (Rice, Trujillo et al. 2005). It embraces different levels of access with increasingly exclusive privilege for individual or group of resource users, ranging from open access to TURF regimes.

The principle of fishery management is to conduct a careful management such that fisheries are sustainable for future generations. Fishery management System must ensure that the use of the fishery resource is in an ecologically sustainable and

economically efficient manner, while maximizing return to the community. Also, access to the resource to all users must be clearly understood and accepted as equitable, and allocation and level of utilization must be consistent with the needs of the present and future generations.

3. CASE STUDY AS RESEARCH STRATEGY

3.1 Where subject of the study was located

The Thesis was conducted in Galicia (SW Europe) see Figure 1- blue zone.

The units of observations were three, located in the SW of this Region (see zoomed map in Figure 1- blue spots). Cofraría of Cangas, Baiona and A Guarda from the North to the South.

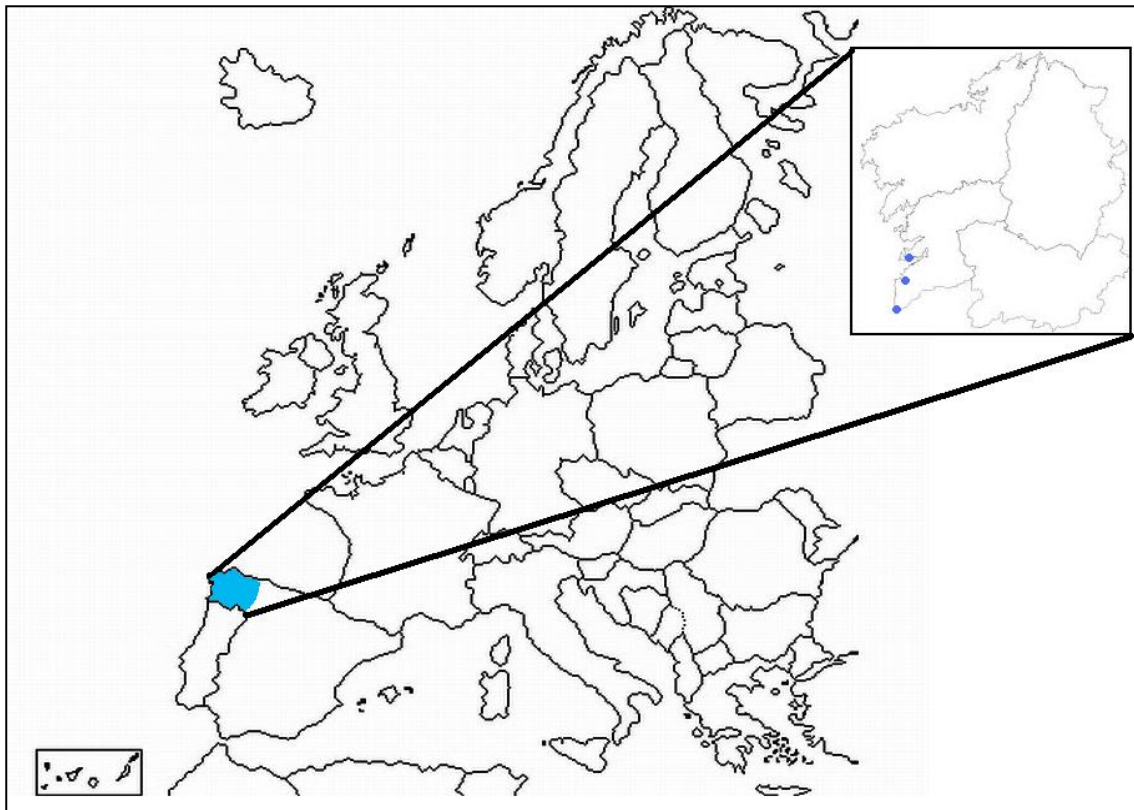


Figure 1- Map of Galicia within Europe. Galicia is framed up the right. Three blue spot locate units of observation: A Guarda, Baiona and Cangas (from Southern to Northern) Source: elaborated from maps on mapasdeeuropa.com and commons.wikimedia.org

3.2 Design of the research method

In this section the logical sequence that underlies the investigation process is presented, connecting the empirical results to the study's research questions, and ultimately, to its conclusions.

This study began with the purpose of exemplifying the practical implications of a fisheries management process to which Results Based Management is applied.

First of all, for the overall purpose of this thesis, it was imperative to ascertain that the case being investigated indeed applied the RBM principles. The descriptive theory, whose theoretical propositions set the criteria for identification of results-based management principles, was articulated at the outset. Each of its propositions became specific as investigation went forward, while directing the attention to the relevant issues that should be investigated within the scope of this thesis. Additionally, they provided ideas on where to look for evidences.

The promising candidate for results-based management in the sense defined in the descriptive theory, was the Galician goose barnacle fisheries. The process of managing the GB fishery is the main entity to be analyzed within this case.

Data was collected following an investigation protocol described below. This protocol is intended to produce context-dependent knowledge (Flyvbjerg 2006) and is also intended to assure appropriate collection of data, accuracy of data collected and to present empirical results as reliable.

Empirical results, resulting from collection, storage, and process of data, were compared to theoretical propositions following a pattern-matching research technique. The features of the Galician goose barnacle management system were compared with those features that the theory predicts to identify in fisheries that apply RBM principles to its management.

Implementing this method, it was possible to interpret which of the RBM features were found in the GGBMS, and to determine to what extent it must be considered as a RBM paradigm. GGBMS would only be considered as a RBM paradigm if all the four RBM features, stated by the descriptive theory, were identified in the management process.

Once it was ascertained that the Galician case was applying RBM principles to its management, it was appropriate to look at how the process performs in order to analyze it. The descriptive theory included a subheading to the topic of crucial contribution of fishermen to the fisheries management process in regards to planning and regulations, and how is the burden of proof placed on them. Therefore, discussion and conclusion were also pertinent at this point, paying heed to how those particular topics were resolved in this fishery and how the process of fisheries management is implemented.

3.3 Protocol of investigation and data collection

3.3.1 OVERVIEW OF THE PROJECT

(a) Background

European Commission called for discussion and debate, through the Green Paper (Commission 2009), on results-based management as an alternative to the current European fisheries micro-management.

The object of deliberations, results-based management, has already been implemented as a management paradigm by development agencies and intergovernmental organizations such as the World Bank, the United Nations, the Development Agencies of many countries, and the Non-Government Organizations; but has scarcely been applied to manage fisheries, of which there are just a few of cases around the world.

These cases are being taken as exemplars in order to shed light on the complex issue of how RBM actually performs in a real-life case, how these fisheries place responsibilities on management functions, and how it would work in the European context. Therefore, cases studies are being selected and conducted on the basis of expectations about their information content in regards to new concepts and theory development.

Galician goose barnacle fisheries are a promising example of somewhere already applying results-based management principles. If this is finally confirmed, GGBF will then also contribute to deliberation.

Discussion and debate, triggered by the Commission, are expected to provide those mechanisms that make possible to transpose fisheries management from theory to practice. Discussion in this thesis aims at nourishing discussion and debate at this point.

(b) Substantive issue

This thesis describes the process of fisheries management as it is, by focusing on the identification of those RBM features that the European Commission mentioned when it called for discussion in the Green Paper; and on how Galician goose barnacle fisheries implement these features in management according to such a theory.

Foremost, all the realistic features that might serve as a complete description of the event were considered, while only those topics that were likely to be the essence of the description in regards to later analysis were selected (hereafter “RBM features”). Description and analysis focused on the presence or absence of those RBM features.

Subsequently, the crucial contribution of fishermen to the management process was described and analyzed, and how this contribution is organized in terms of rights and obligations or responsibilities. Discussion revolved around the essential role of harvesters in the GGBMS.

3.3.2 FIELD PROCEDURE

During the process of collecting evidences, and in order to get a firm grasp of the unit of analysis in purpose, it was necessary to go through three different narrowing steps (see Figure 2). Each step contains different kinds of information, from general to specific, so a particular set of study questions were developed to guide collection of data.

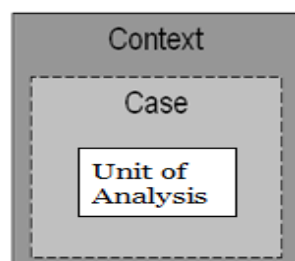


Figure 2- Single- Holistic Case study. Source: (Yin 2008)

Not all study questions were articulated at the outset as many were emerging as a result of understanding and knowledge about the case deepening. Note: study questions were not intended for the interviewee, but for the researcher as a tool to ensure that the data collected was accurate and relevant so as to be able to adequately satisfy the research questions posed.

(a) First step:

Exploration of the context - Initial research conducted to clarify and define the nature of the case being investigated. [January- February 2012]

Study Questions

- Jurisdiction that Galician Autonomous Government has over fisheries matters.
- Features of the fisheries management system applied in the Galician shellfishing sector, in which goose barnacle fisheries are included
 - Concept of Cofraría: Overview, membership, functions and management tasks they are responsible for.
 - Allocation of fishing rights. Concept of TURFs in the shellfishing sector.
 - Management Plan- tool of management in the shellfishing sector.
- How Cofrarías organizes itself in order to integrate management functions for all the target species available? - Resource Fishermen Aggregations: Overview, functions and responsibilities
- Key agents in regards to management issues on the side of Cofraría and Consellería - Biologist of Zone (public workers body) and Technical Assistants (Cofrarías' hired personnel) - role and functions.

Source of evidence:

- Law: Fishing Act (Galicia 1993; Galicia 2008)
- Essential readings: overview of the fishing sector (García Negro 2010); overview of Cofraría and their role (Franquesa and del Mar 2005) role and function of technical assistants (Macho, CETMAR et al. 2010).
- Interviews held on the phone with personnel from administration
- Interviews held at the workplace with administrative staff from Cofrarías. No arranged appointment. Some of those conversation were also held on the phone to clarify very specific issues

(b) Second step:

Exploration of the case- ensuing research step [April-May 2012]

Study questions

- Particularities of GB resource and how these affect the extraction method. Socio-economic dimensions of the GB fishery
- Critical features in the management of Goose Barnacle if it is compared with other shellfish management in Galicia.
- GB aggregations- specific roles and responsibilities- Technical assistant interactions in regards to management of the fishery.
- Which are the objectives of fisheries management? Which criteria are used by government for controlling exploitation and evaluating performance?

Sources of evidence:

- Law: Regulations of goose barnacle as specific resource (Galicia 2000)
- Documentation- Essential readings:
 - Galician goose barnacle management system (Molares and Freire 2003)

- Socioeconomic implications for the design of management procedures in Galician fisheries (Freire 2000)
- Literature review and e-mail exchange with the authors of those essential readings
- Interviews
 - Technical assistants who are contracted by Cofrarías, who I chose as units of observation. Interviews conducted at the workplace with appointment over the phone
 - Fishermen at the first-sales market. No arranged appointment.
 - Biologist of Zone of Administration Area I (Vigo) and e-mail exchange. No arranged appointment.

(c) Third step

*Getting a firm grasp of the goose barnacle fisheries management process
[August- September 2012; February- March 2013]*

Study Questions

Bullets specify which elements I looked at during data collection. Those comprise the theoretical propositions on which I based my analysis later on:

- Outcome targets
 - Defined measurable qualities determined in the management plans e.g. fishing mortality, spawning biomass, by-catch and fishing effort
 - Content of the management plans that are decided by authorities
 - Measurable qualities that are legally effective for the period of the fishing plan
- Documentation system

- Means of Government through which it makes sure exploitation activity is kept within specified acceptable limits- which data must be submitted by Cofrarías in order to nourish evaluation.
 - Procedures and standards used to measure performance so that it allows for evaluating whether fisheries management performs as it is expected to.
 - How are fishermen organizations, i.e. Cofrarías, expected to underpin the harvest strategy they propose?
- Burden of documentation
- How do Cofrarías demonstrate the harvest strategy is implemented as agreed?
 - Information and data gathering for which are Cofrarías held responsible. How does a Cofraría organize the harvest activity to make possible to gather reliable and valid documentation?
 - Who funds the cost of contracting human resources, necessary to fulfill those additional requirements of documentation?
 - How does Consellería deals with financial or capacity constraints that certain Cofrarías have?
- Flexibility of selecting the management means
- Measures of the Harvest Strategy upon which Cofrarías decide.
 - Management actions linked to indicators described in the Management plan
 - How is the management plan implemented? How loose it is the Management plan in regards to operational decision taken during harvest activity?
 - How do Cofraría and Government agree to authorize any management plan? How does the Government make sure the proposed management

plan is appropriate? Who evaluates whether the harvest strategy is appropriate?

Sources of evidence:

Units from which I have collected data are participants in the process of management: Consellería and three Cofrarías: A Guarda, Baiona and Cangas; I also consulted a management plan.

- Direct observation of fishermen working during a single working day.
- Consultation of reports that Cofrarías periodically elaborate: size measures, daily record of catches and effort, records at the auction market, monthly reports of data and catches; monthly request of opening. Those archives were consulted during interviews with both Technical Assistants and Biologist of zone.
- Consultation of an Official Management Plan, and several summaries of the Management Plans. The former were consulted during an interview with a Technical assistant, the latter are available on the internet:
pescadegalicia.com => planes de explotación/ planes de explotación de percebe
- Interviews with
 - Biologist of Zone- Administrative area I- Vigo. I met them at their working place- No arranged appointment.
 - Goose Barnacle harvesters from two Cofrarías: Cangas and Baiona. Appointment arranged.
 - Technical Assistants of Cofrarías: those interviews refer those conducted during step two. However, most info was collected though just useful once this third step was conducted. E-mail exchange was needed to update and clarify purposes. E-mails directions were got during interviews.

3.4 The analytic strategy:

Approaching the examination of the context and the case, in which the unit of analysis is embedded, was just under exploratory rationality in order for me to understand the ensuing step and describe it. The purpose of analysis in this thesis was concerned, in essence, to the process of fisheries management i.e. unit of analysis.

The strategy set out in the analysis section was separated into four parts i.e. RBM features, relying on theoretical propositions. Propositions were used as the criteria of what must be included in the description and analysis. Those developed an overall pattern i.e. predicted pattern of what is expected to be found at any fishery considered to be applying result based management principles.

Empirical results, derived from collection, storage, and descriptive display of data, were compared with this predicted pattern so that matches were identified. Portions of the empirical results section, whilst still in draft form, were sent back to interviewees and they verified that my understanding about the process had been accurate.

Discussion is held around to what extent case study pattern and RBM pattern match. Discussion is also held around the crucial role of fishermen in the process of management, regarding how results-based management came into being within the scope of dividing responsibilities between Government and fishermen.

3.5 Criteria for interpreting the findings

The purpose of this thesis was to determine to what extent the Galician goose barnacle fishery is applying RBM principles and to describe the practical implications it has in the Galician GB Fisheries case.

Criteria required any process of management to incorporate all four RBM features in order to be considered as a RBM paradigm: outcome targets, system of documentation, flexibility of fishermen for selecting the management means, and burden of documentation on fishermen. Otherwise, the GGB management process might be categorized as a different system, which is outside the parameters of the present thesis.

Analysis of how RBM performs in the Galician context provided insights into limitations and potentialities this management arrangement faces when it comes to be applied in fisheries.

3.6 Limitations of the study

A case study makes it possible to provide inferences towards the overall theory, but not toward other cases (Castro Monge 2010).

The nature of a descriptive theory is not to enquire into the causes why the Galician GB Management process became as it is nowadays, but describe how it is.

Case study relies much on the researcher's experience and his or her previous knowledge, which in this case is novice. Prevention of lack of reliability, validity and generalization of the work done was taken into account along the investigation process so that inexperience could have been supplemented to a certain extent.

Discussion and conclusions would be nourished by comparing this Case here being described with other cases that had already been considered as applying RBM principles in which a refined analysis was already conducted.

It would be also relevant to identify differences of results based management with rival explanations to avoid the reader might consider GGBMS match other management regime pattern.

At the same time, thorough discussion about the Ecosystem, adaptive and right-based management components in the GGBMS was not feasible because capacity constraints.

4. CASE STUDY: MANAGEMENT OF THE GALICIAN GOOSE BARNACLE (*POLLICIPES POLLICIPES*)

4.1 Introduction to Goose Barnacle (*Pollicipes pollicipes*) resource

4.1.1 TAXONOMY AND HABITAT

Goose Barnacles are sessile intertidal pedunculate (order) cirripedes (infraclass) crustacean (subphylum) (Campo, Molaes et al. 2010). The only truly intertidal pedunculate cirripedes belong to the genus *Pollicipes* of which there are three species. Two of those are found on the west coast of the Americas and the third is European: (1) *P. polymerus* is found on the Pacific coast of North America extending from 27°N to 64°N. (2) *P. elegans* from South America from which there is little information and (3) *P. pollicipes* has rarely been found on the Atlantic coast of France farther north than 48° N, nor on the coast of Senegal farther south than 15°N (Barnes 1996).

Goose Barnacles favor exposed habitats where there is a backwash from surging waves. They form dense aggregations, living firmly attached to rocks and to one another (Figure 3). Goose Barnacle shares habitat with Galician Mussels/Mediterranean Mussels (*Mytilus Galloprovincialis*).

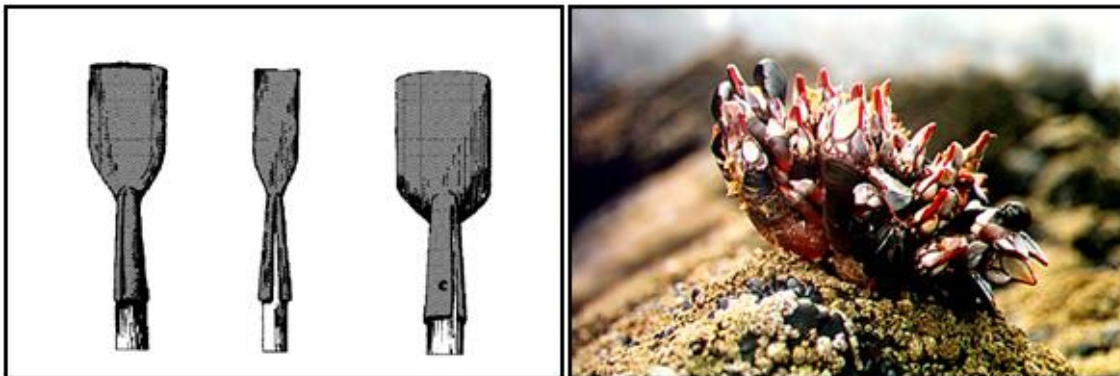


Figure 3- Tools for harvesting goose barnacle (left picture) and a patch of goose barnacle on a rock (right picture); Source: (Fariñas Castro) and (Jesus 2002).

4.1.2 MORPHOLOGY

Adult Goose Barnacles have two distinct parts: the upper part, or capitulum, and the lower part, or peduncle. The latter keeps the individual attached to the rock.

The upper part is also known as the "nail" because of appearance given by its grayish-white calcified plates. The nail protects the vital organs of the barnacle from predators, and also from dehydration during low tides.

The peduncle is cylindrical in shape and covered by a thick skin. It is flexible and strong enough to contract and lengthen in any direction. The strength of the peduncle, and its ability to bring the capitulum into the best position, is related to the filtering method of feeding, and the reproductive method to which it facilitates the rapprochement of adults reproduction.

The length of each individual is not related to its age, but with the habitat where it lives. They become longer with a more lateral incidence of waves, often occurring in the rifts of the rocks (Molares, Tilves et al. 1994).

4.1.3 REPRODUCTION

Adults are hermaphrodites, meaning that each individual has both male and female reproductive systems. However, they are not self-fecundated as two individuals are required for reproduction. The reproductive period lasts 7 months, from March to September (Molares, Tilves et al. 1994). There are two reproductive periods during the year: first in March, in which 10-20% of the adults participate; and second at the beginning of the summer, in which most of the adults participate.

It is accepted that *Pollicipes pollicipes* has a metapopulation structure (Molares and Freire 2003). A metapopulation is a system of local populations that interact by dispersing individuals between populations. In sessile organisms such as goose barnacle, the dispersal is from the planktonic larvae stage. All larvae exhibit active mobility ranging theoretically from 185km to 930km. Larval development takes around a month: naupliar and cyprid stages (Campo, Molares et al. 2010). After the six naupliar stages (around 23days (Molares, Tilves et al. 1994), the cyprid settles specifically to the peduncle of adult individuals (1 month), then they move to the base and fix permanently to the rock. That is why adult individuals of *P. pollicipes* constitute dense aggregations.

4.1.4 HARVEST

The only allowed harvesting method is handpicking, and diving is not permitted. Fishermen can reach rocks on foot or by boat, depending on the accessibility of each

rock. The technique, in both cases, is considered highly dangerous because of sea exposure. It is common to see a fisherman fastened by rope to another fisherman, tied to the other end of the rope, to secure themselves and to gain access to difficult sites with a valuable resource.

A Rasqueta (Figure 3) is the unique hand tool that is permitted for the extraction. By using this hand tool a cluster of goose Barnacle is taken off the rock. To preserve quality of GB individuals, a small portion of the rock substrate must keep attached to the cluster. The accessing extracted individuals are just from the intertidal zone so that sub-tidal zone keeps unexploited.

Experienced fishermen often express concern with stock and rock substrate damage that inexperienced fishermen cause (i.e. newcomers and also poachers and small mussels' collectors⁴). Technique of experience fishermen result in the highest proportion of high-quality and suitable product and minimize damage to the remaining stock and rock substrate because resettlement.

By-catch has been characterized as an important part of the harvest (approximately 50 % of the biomass) peaking in bad weather conditions (Molares and Freire 2003). This happens due to immature individuals being attached to the commercially viable individuals. All discards are mortalities.

In most of the Cofrarías, the extraction activity is conducted throughout the year.

4.2 *Goose Barnacle (GB) Fishery-*

4.2.1 FEATURES OF THE FISHERY

The fishery pertains to the so called S- fisheries (Orensanz, Parma et al. 2005). It means the fishery is small-scale, targets sedentary resources, and uses artisan equipment while stock targeting is spatially structured as metapopulation. Population dynamics are dominated by spatial heterogeneity and the effects of fishing events are localized.

⁴ This fact has produced a large conflict among mussels' framers and GB harvesters. Mussels' farmers need to collect small mussels from the rocks to fatten them at the production plant. This practice was regarded as damaging the substrate of GB so it was necessary to reach an agreement between both sectors and divide certain rocks according to GB extraction allowance or mussels' extraction allowance.

Large spatial heterogeneity affects both quality (the main steering item when making operational decisions) and stocks dynamism (growth and recruit rate).

(a) Jurisdiction

In Spain, licenses are mandatory for all vessels carrying out fishing activities. Vessels are registered in a national census of fishing vessels. Licenses contain information including ownership of the vessel, its technical characteristics, the fishing ground and modality of fishing as well as the validity period of the license. Special management regimes are adapted to the diverse fisheries found in Spain. For example, limited licensing that also incorporates a form of territorial rights is used for shellfish gathering in Galicia (i.e. TURF).

In Spain, licenses are mandatory for all vessels carrying out fishing activities. Vessels are registered in a national census of fishing vessels. Licenses contain information including ownership of the vessel, its technical characteristics, the fishing ground and modality of fishing, as well as the validity period of the license. Special management regimes are adapted to the diverse fisheries found in Spain. For example, limited licensing that also incorporates a form of territorial rights is used for shellfish gathering in Galicia (i.e. TURF).

In Spain, the Ministry of Environment and Rural and Marine Environment (Spanish acronym MARM) is the government branch that establishes the policy for fisheries and agriculture. The National Directorate of Marine Fisheries (NDMF) is the department within MARM that manages Spanish fisheries.

The central government (MARM and NDMF) is in charge of the management of fisheries from 3–12 nautical miles. The basic management instruments are TACs for the most important fisheries, and fishing licenses for all fishing vessels. The principal item of legislation is the Fisheries Law 3/2001.

Autonomous Communities (ACs) are in charge of management of fishing activities in waters up to 3 nautical miles (hereafter ‘interior waters’). Galicia is one of the ACs with full authority over the management of its fisheries in the interior waters. Xunta de Galicia is the Galician AC government authority, while the Department of the Rural and the Sea (Galician name *Consellería Do Medio Rural e Do Mar*; hereafter “Consellería”) is the AC government branch that establishes the policy and regulations.

General Direction of Marine Resources (*Dirección Xeral de Recursos Mariños*; Galician acronym DXRM) is the department within *Consellería do Mar* that manages fisheries in Galician interior waters. Territorial Headquarters of the Consellería are found in each of the 9 administrative areas (I- IX zones -see Figure 4) along the Galician coast for streamlining certain management procedures. In the Territorial Headquarters, there are biologists of zone and managers who are technical public workers. The principal item of legislation is Fisheries Act 11/2008, 3rd of December. The Order from 6th of March 2000 regulates the GB exploitation as a specific resource within the Galician AC.

Who can be GB harvester? Those people who have a GB harvesters professional certification, who hold permission for harvest activity, and they must also be included in a MP from any Cofraría for the current year.

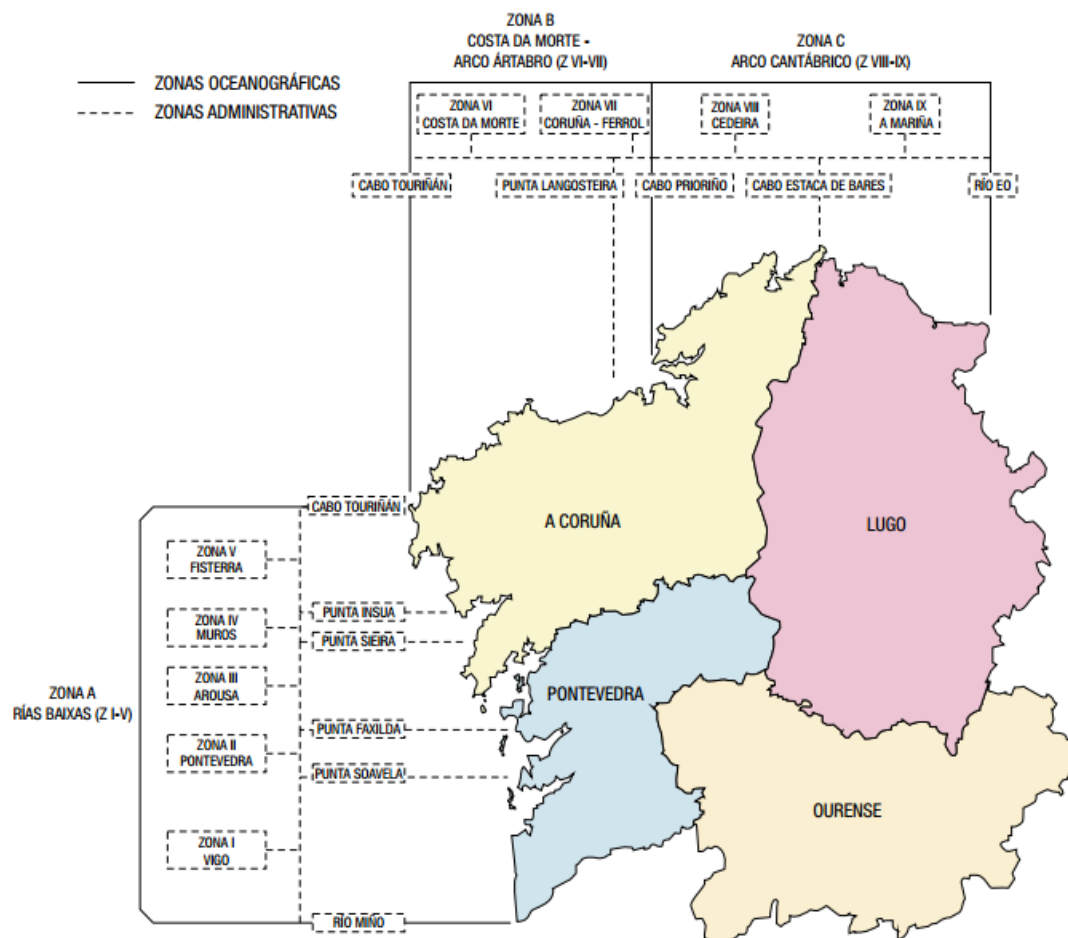


Figure 4 - Administrative areas under Galician jurisdiction (Negro 2010)

(b) Cofraría- Fishermen organization

Cofrarías are defined as local organized guilds of fishermen and serve as operational bases for them. Cofraría has been defined as multipurpose organization that reinforce the management and commercial functions of fishermen (Jentoft 1989). The number of fishermen in a Cofrarías varies from one to the next.

Each Cofraría establishes its own normative in regard to internal functioning, though it must never be against the law. Functioning is subject to the Statute of Cofrarías.

Who must be a member of a Cofraría?

Membership in a Cofraría is voluntary though it is a legal requirement when obtaining permission for harvest certain specific resources such as Goose Barnacle within the marine territory granted to it. Cofrarías accommodate all competing resource users within its granted territory so it is used as a tool of controlling access.

A Cofraría and its granted adjacent fishing ground (i.e. TURF) form the social/geographical templates of the Galician fisheries in general and GB fishery in particular. In Galicia there are 62 Cofrarías. 32 out of those have fishing ground of GB within its territory and the right to access to harvest it.

Organization and Structure

Within the locality-based Cofrarías, members of specific fisheries holding a PERMEX independently organize themselves into Fisheries Management Aggregations, such as Goose Barnacle Management Aggregations, in order to focus on issues confronting their fisheries. Those aggregations perform certain management tasks though they are legally dependent on Cofrarías.

GB management aggregations may either be formed by fishermen who work by foot, by boat, or by both.

Cofrarías have three different governing bodies: a General Assembly, in which all fishermen have the right to participate; an Executive Board, in which a limited

number of fishermen are selected to conduct the management tasks; and a President of this Executive Board.

GB management aggregations have the same governing bodies so both are identical in regards to structure: There is a General Assembly, an Executive Board, and a President.

Functions, Responsibilities and Participation

Apart from those functions that concern the defending of interests of its members and giving advice to the Administration in regards to fishery issues, any Cofraría ensures commitment to the fisheries legislation, and is responsible for the surveillance of their TURFs. This includes organization and planning of the resource production, controlling the access to the resource, and organizing the trading.

Participation of members is regulated by law in the manner that fishermen are divided into owners and workers; and that all fisheries operating within the Turf of the Cofraría must be represented in the governing bodies.

GB management aggregations conduct the task of organizing and planning the resource production and trading, though are legally dependent on the Cofraría. Then, the GB management aggregations elaborate a long term plan concerning production, organization and selling issues; and also daily plan concerning operational issues of the harvest activity.

Participation takes place under a democratic principle of one vote per member, with decisions concerning design of the MP and operational decisions taken by simple majority. Certain decisions, for instance variations in by-law of the organizations, would require a three-quarters majority.

Other forms of association within the extractive sector

Cofrarías, and resource management aggregations within it, are prevalent among other legal forms of association in Galicia, such as Producers Organizations, Cooperatives and Capital Companies.

CFP promotes Producers Organizations in the European fisheries. Membership in the Cofrarías is mandatory in order to gain access to rights to harvest, in contrast to the voluntary condition in PO. Members of a Cofraría include both ship owners and crew, while in POs there are only ship owners (Franquesa and del Mar 2005).

(c) The figure of Technical assistant - Agents of change –

Since new Management has been established in 1993, the relationship between fishermen and science has qualitatively changed. Previously, the relationship was weak or nonexistent (Macho, CETMAR et al. 2010) while nowadays I realized both fishermen and researchers notice their mutual interdependency in terms of management and reporting.

Reflecting this change in perception is the fact that a technical assistant is contracted in almost all Cofrarías in Galicia, and they conduct a wide range of management tasks (Macho, CETMAR et al. 2010).

Technical assistants have a biological profile and most of them have a biological and marine science University degree. They have been considered as agents of change (Prince 2010) or barefoot ecologist (Prince 2003; Macho, CETMAR et al. 2010; Fernández-Boán, Freire et al. 2013) in the Galician management system, whose role has improved the innovative character of Cofrarías to develop projects in several fields (Macho, CETMAR et al. 2010).

4.3 The Galician Goose Barnacle Management System (GGBMS)

4.3.1 GENERAL FRAMEWORK AND THE LIMITS TO FM

The Galician Fisheries Management system is defined by the Fishing Act of 2008 (Galicia 2008). Its approach is not ecosystem-based, but sector-based, though the overarching objectives and standards are increasingly incorporating elements of an Integrated Management approach (García Sanabria and García Onetti 2011).

In 1993 the Galician government implemented a new model for shellfishing and promoting the actual management arrangement between Consellería and local organized guilds of fishermen (i.e. Cofrarías). This arrangement is based on allocation of territorial user rights (TURF) to Cofrarías, access to harvest subject to individual rights (PERMEX), and the existence of an authorized Plan of Management and Exploitation for each target specie (hereafter “EMP”).

The Fishery Management Arrangement for Goose Barnacles seeks to maintain fishing activity within certain limits and achieve a more rational exploitation of the resource.

In principle this arrangement means Consellería and each Cofraría must reach an agreement on how latter TURFs will be managed. In practice, however, Consellería establishes certain limits within which harvest activity must take place, and Cofrarías design the means to accomplishing them i.e. EMP.

These limits are the method that Consellería uses for controlling effort and they are expected to be met by the implementation of the EMP. Limits are the baseline for evaluating effectiveness of fishery management conducted by each Cofraría.

Local limits are adjusted with the aid of a continuous feedback process by using the experience gained in each territory (Freire and García-Allut 2000) and state-of-the-art knowledge. This feedback process has already run for 20 years, since 1993, so now harvest limits are quite stable for most organizations.

Limits are the maximum individual daily quotas, number of total working days a year, and number of fishing licenses. A surveillance system effectively enforces the individual harvesting limits (Molares and Freire 2003).

4.3.2 REGULATIONS- MAKING FRAMEWORK: CONSELLERÍA-COFRARÍA AGREEMENT

GB management is based on regulations of distribution of effort in space and time within the limits of effort established by the Consellería. The Galician Government holds, in principle, the right to modify the content of any EMP regarding to a greater rationalization of the harvest activity (Galicia 2000).

In practice, unless the assessment of the stock shows a negative trend in abundance or fishermen ignore their obligations contracted in the management agreement, Consellería will not intervene in the design of the forthcoming EMP, aside from limits of effort. Results obtained are not formally incorporated in the ensuing plan because there is not a quantitative methodology on which regulations included in the EMPs are routinely based. In its place is a qualitative method, based to a large extent on local knowledge.

Then, regulations are proposed by the GB harvesters through the annual EMP, which must be validated by Consellería before harvesters are authorized to implement them.

In return, harvesters must detail the foreseeable distribution of effort (see 4.3.3. (a) subheading) and submit certain relevant information and data in regard to fishing activity, this is so biologists of zone are able to track stock status and fishing activity in each production area.

Consellería validates the EMP if the proposal falls into the limits of the legal framework (Parada, Outeiral et al. 2012) and there is not a real threat of damage to the stock (Macho, CETMAR et al. 2010) according to evaluation by the biologists of zone.

Functioning of this agreement is still dependent on a co-funding scheme between Consellería and Cofrarías in terms of services of technical assistance and monitoring and surveillance. Though sector and Consellería understand the need for evolving towards a self-sustaining model in terms of cost, it is true that any motion in that direction provokes significant disturbances.

4.3.3 FISHERIES MANAGEMENT

This process is conducted by GB harvesters. They make decisions and operate in accordance with the EMP that delineates the harvest strategy for one year; and with a corresponding authorized monthly schedule that specifies the operational aspects of the harvest.

(a) EMP: planning the fishing activity for one year

An authorized EMP is a legally binding document that regulates the extractive activity. It must be authorized by the Consellería and describes a harvest strategy in which it specifies the likely distribution of effort and the measures and actions to be taken along the year.

Marine territory is divided in production areas (i.e. detailed map) and fishermen specify which area is to be exploited during which month.

The harvest strategy, or harvest plan, aims at constraining effort and catches, and suitably directing them by location and time throughout the year. Its measures revolve around a rotational harvest strategy that focuses on the space-temporal variations in quality and abundance of the GB resource.

This harvest plan must be thought of as a draft or a preliminary to actual distribution of effort that is confirmed when requesting the monthly schedule of opening of areas.

As a matter of fact, it has been reported that, in the Galician context, the control of the compliance of Galician fishermen with non-taken zones is considerably easier than with other regulations of fishing effort (Freire and García-Allut 2000).

Design of all MPs keep the same structure and follow the Official Guidelines – see Appendix A-

(b) Monthly Schedule for opening of areas- planning the daily work

Every month, GBA, through the Cofrarías, must confirm the harvest plan and give some more details about exploitation activity: Aggregations must elaborate a monthly schedule for the opening of production areas and it must be authorized by DXRM. The schedule delineates the harvest activity for a month regarding which production area (where), the amount of catches (how much), and which days and at what time (when) harvest will occur.

Consellería permits GBA to distribute effort at the marine territory throughout the year according to the seasonal availability and quality of the resource, environmental conditions, and conditions and demand of the market. Consellería, whose decision takes into account the auspicious evaluation of the biologists of zone, must give its seal of approval for the months schedule. In this sense GB fishery develops an adaptive and real-time spatial management of permitted harvesting areas.

This Monthly Schedules are very useful to properly distribute effort in time and to maintain a stable production all throughout the year.

(c) Daily work

Actual distribution of effort is made effective during daily work. Every day, fishermen decide upon in which area and how much catches, according to the validated monthly schedule for opening of areas.

In cases sector decides, for whatever reason, no to go harvesting or to increase maximum dailyquota, such a days DXRM must be properly informed thorough established protocol.

4.3.4 ASSESSMENT OF THE STOCK: DATA COLLECTION AND ANALYSIS

In GB Fisheries Management, there is not either an official stock assessment model (direct and indirect) or robust parameters linking stock dynamism and harvest rate. Instead, Consellería has developed a particular stock assessment method that allows for continuous estimations of the abundance of the stock in each fishing ground. Consellería states that in order to improve GB management and avoid overfishing it is required to control effort, harvest and size distribution of catches disaggregated by production areas.

The method relies on provisions of info and data generated during harvest activity. Info is collected and stored by Cofrarías. It is periodically processed by technical assistants at the Cofrarías and submitted to biologists of zone in order to be analyzed for the latter.

Therefore, as estimation of GB abundance is done mainly by analyzing info generated during harvest activity, Consellería has specified certain standards and procedures for collection and submission of this info, and for its analysis.

For meeting those requirements, Cofrarías might need assistance because technical so Cofrarías are responsible for contracting research services i.e. technical assistant as needed (Macho, CETMAR et al. 2010).

(a) Procedure 1, 2 and 3: info generated during harvesting

The idea is to tap into the wealth of information generated by fishers themselves as a by-product of the fishing process (Fernández-Boán, Freire et al. 2013). Anyway, the Consellería is aware that not all Cofrarías have the same resources and means to register the extractive activity, so this is considered when demanding documentation from the organizations.

Procedure 1: daily control of extractive activity.

A control point is established and located at a strategic spot close to each production area. At this control point it is mandatory for all harvesters to weigh the catches after harvesting. They also indicate which area they exploited. A Surveillance body is placed at such control point.

A technical assistant in the Cofraría stores this information and every month it must be processed and reported to biologists of zone. In these reports there is an analysis of the accumulated catches in each production area (in order to detect if production rate in the area tapers off quickly), the daily activity in regard to number of harvesters (if presence of harvesters tapers off) and the Catch Per Unit Effort (if daily kg/harvester tapers off).

Procedure 2: periodic control of size of catches.

At the control point, at least once a month, aside from daily control of effort and catches, the size frequency distribution of catches is registered for each exploited area.

These records must be reported to the biologists of zone. In the reports the descriptive statistics of the sample are analyzed (in order to detect decrease in mean size), and the size frequency distribution of catches (decrease in legal sized individuals in the catches) disaggregated by areas.

Procedure 3: daily control of sales and the collation of data and info

Cofrarías register the daily quantity and prices at the first-sales market. Daily data registered at the control point and daily amount of sales and their value are collected together.

Daily quantity and prices are reported to Consellería every day. These records must be reported to the biologists of zone every month. In the reports the prices (decrease in prices) and profitability of different production areas are analyzed.

(b) Procedure 4: Direct Observation of the production areas-

In the GB fisheries management, direct observation is not rigorously exigent in its extensiveness. In contrast, visiting the GB beds is only conducted on those production areas where available data is insufficient according to biologists of zone evaluations.

Direct observation demands extensive hours of intensive work and it is unaffordable due to the GB fishery dimensions if it is to be the unique method for stock assessment in S-fisheries such as GB (Freire and García-Allut 2000). Also, the method entails a high risk for those in charge as it is difficult to access certain grounds. Samplings are conducted by personnel of the Cofraría (usually technical assistants) under coordination of Biologist of zone, though sometimes the latter might also collect samplings. Anyway, this method does not provide enough satisfying data reliability.

A quick and simple sampling methodology, based on photographs, has been developed (Parada, Outeiral et al. 2012). Authors state the method allows managers to estimate relative values of abundance and commercial biomass. They state that information generated during harvest is to be thought of as complementary to direct observation of stock beds, as long as the latter is high quality. However, it has just recently been applied so will require a long time before it becomes sound for fisheries management.

4.3.5 EVALUATION OF THE GGBMS: PERFORMANCE MEASURES

The EMP is enclosed with the recording of the harvest activity for the previous year. These records indicate daily effort and production: total number of working days,

and catches and number of harvesters in those days. Those show the results of the fishing activity, and performance.

4.4 A new MP and its validation- simple feedback

The fact Consellería will not intervene in the design of EMP does not mean there are not pressures to keep improving the rationalization of the fishing activity. To rationalize the harvest exploitation is to correctly distribute effort in each GB ground (Molares and Freire 2003) throughout the year. It is required to know which are the grounds, how much effort is applied in each, and their biological characteristics and the dynamism of the GB resource.

In this sense, according to the opinion of technical assistants and biologists of zone, EMPs have become more detailed and information generated has become more accurate and reliable in terms of actual distribution of effort in space and time. That has enabled them to improve knowledge about GB dynamics in regards to abundance, quality, growth, and accessibility in harvesting grounds. As a result, they have improved the overall assessment of GB in each fishing ground and previsions of how it will be affected by the harvest strategy proposed by GBA.

Evaluation of the EMP, conducted by biologists of zone, is essential for its validation, though it is not binding. Harvest limits in each Cofraría are the result of a trial and error process that has already been running for 20 years. So far, there is not a protocol of how to incorporate the performance measures obtained during one previous year with the harvest limits to be established for the following year.

4.5 An example of how the management arrangement comes into being– Cofraría de Cangas

As it was just mentioned, in order to maintain the Cofraría-Consellería agreement, GB harvesters have the right to plan and organize the harvest activity, while they are required to make provisions of certain relevant data and information that have been derived from fishing.

Description below refers to how the process of GB management is implemented within the GGBMS during 2011 in the Cofraría of Cangas.

In the first step, it is described what the harvest strategy described in the EMP and the corresponding months schedule for opening of areas looks like. July was taken as an illustrative example.

Secondly it is described how required provisions of data and information, collected and processed by technical assistants in July, are conducted.

Finally, a chronogram summarizes the results in regards to the fisheries management process as a close cyclical design. It specifies the management tasks that are conducted during a year, who conduct them, and when.

4.5.1 EXPLOITATION AND MANAGEMENT PLAN

The design of the EMP for 2011 responded to effort restrictions imposed on 65 GB harvesters, who were allowed to work for 160 days along the year and to harvest 5 kg of maximum individual quota (7kg along 24 out of those 160days). This harvest framework was exactly the same as for 2010 EMP except for the number of days in which fishermen are permitted to extend the quota, which was increase from 16 days in 2010 to 24 days in 2011.

The Management plan was submitted by 1st November of 2010 becoming Legal through the Order on 20th December 2010. The EMP was evaluated by biologists of zone who reported, as very often do, the appropriateness of tighter measures in the management of the resource and a more precise and detailed rotational harvest strategy. Anyway, Consellería validated the proposal coming from the fishing sector almost entirely.

(a) TURF in the 2011EMP

The marine territory that 2011 EMP embraces was divided into 3 areas (see Figure 5):

- Area 1: Costa da Vela (VI- 096 orange line) and
- Area 2 and 3: National Park Atlantic Islands (orange line VI- 097; VI-098-1; VI-098-2; VI-099).

EMP split those three areas into 10 sub-areas according to operational aspects of GB harvesters, though this fact had resulted in no practical implications regarding the rotational strategy. This is in addition to 2010 EMP.

TURF are quite stable and rarely modified, in this exemplar this unusual request was proposed. In the EMP of 2011, Cofraría de Cangas requested extension of the limits of the Atlantic Islands' production areas by including a small island named *Ilote de Viños* (black circle -Figure 5). Biologists of zone, and subsequently Consellería, asked for a GB biomass assessment in that area in order to permit harvest activity to take place at that spot. Because no sampling was conducted at that time, the small island had been kept out of the EMP of 2011.



Figure 5- GB production areas included in the MP elaborated by Cofraría de Cangas. Source: <http://ww3.intecmar.org/Sigremar/>

(b) Rotational Harvest strategy-

As previously stated, the rotational harvesting plan for the 2011 EMP (see Table 1) was exactly the same as the 2010 EMP. The harvest plan specified which areas would be exploited during each month: during January (JAN) harvest would take place at production areas number 1 and 2; during February (FEB) areas 1, 2 and 3; during March (MAR) areas 1, 2; and so on.

Table 1- Schedule of exploitation (upper table) and daily quota (lower table). Source: pescadegalicia.com Note that 2011MP included a clause in which the individual daily quota was permitted to be extended up to 7kg during any chosen 24 days along January, July, August and December see lower table).

YEAR SCHEDULE											
MAXIMUM DAYS OF EXTRACTION						160					
FORESEABLE PERIODS OF HARVESTING: FROM JANUARY TO DECEMBER											
METHOD OF EXTRACTION						ON BOAT					
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
X	X	X	X	X	X	X	X	X	X	X	X
1, 2	1, 2, 3	1, 2	1, 2	2, 3	1, 2, 3	1, 2, 3	1, 2, 3	1, 2, 3	2, 3	1, 2	1, 2

MAXIMUM INDIVIDUAL QUOTA	
Specie	HARVESTER ON BOARD/DAY
Goose barnacle	5 KG NET (6KG GROSS) 7KG NET (8KG GROSS) only during 24 days to allocate in January, July, August and December

During 2010, the same clause only authorized GB harvesters to increase individual daily quota up to 7 kg during 16 days during the same months. Extension had been permitted according to request of enlarging this restriction from Cofraría and there were no signs of overfishing in the evaluation conducted by biologists of zone.

4.5.2 REQUEST FOR OPENING OF AREAS- MONTHLY SCHEDULE

For July, as usual, the requested areas of exploitation for opening were the same as those propounded in the harvest plan in the EMP.

Also, the schedule indicates the working days during July on which fishermen foresee to go harvesting. This is additional information in regards to the information included in EMP. It also included the clause in which the individual daily quota might be extended up to 7kg on any day the fishermen decided upon.

Monthly schedule for opening of areas during July (Table 2) was submitted by 15th of June and went straight to validation by Consellería. It was also evaluated by biologists of zone, so it became effective on 1st of July.

Table 2-Monthly request of opening- NB! Data is not necessarily accurate. This does not alter the purpose of the figure to show what a schedule of harvest activity looked like, and not to thoroughly analyze its content

APPLICANT	COFRARÍA CANGAS “PESCADORES DE SAN JOSÉ”
MONTHLY OPENING	JULY
WORKING DAYS	1 ST , 5 TH , 6 TH , 7 TH , 8 TH , 12 TH , 13 TH , 14 TH , 15 TH , 20 TH , 21 ST , 22 ND , 27 TH , 28 TH , 29 TH
AREAS OF EXPLOITATION	1, 2, 3
QUOTA	5KG/HARVESTER/DAY 7KG/HARVESTER/DAY
CONTROL POINT	AREA OF WORKING

4.5.3 DAILY WORK

On a daily basis, the Executive Board makes the operational decisions by majority on whether it is appropriate to work, which daily amount of catches, areas of

exploitation, and minimum prices of catches are the most suitable in regard to circumstances. Whatever they decide, all harvesters are committed to.

4.5.4 PROVISIONS OF DATA AND INFO

At the time Cofraría requested the opening of areas for August (similar document as Table 2), recordings of data and information from 1, 2, 3 and 4 procedures until 15th of July were already available for biologists of zone' evaluation. This meant that the monthly schedule for opening of areas for August was validated.

Recordings are held in an Excel network between Cofrarías and biologists of zone (see what the Excel file looks like: Table 3 for daily records and Table 4 for periodic sampling of size distribution of catches).

(a) Results generated from harvest activity: procedure 1 and 3

These results are generated on a daily basis. Every day, at the control point after harvesting, harvesters were counted and their catches were weighed and registered. Afterwards, data was collated at the first-sales market and prices reached at auction were registered. Data collected at the control point and first-sales market was stored and processed by the technical assistant who reported it to biologists of zone, as shown in the Table 3.

In this report, it is indicated which area among five sub-areas was actually exploited (see Table 3- column "area"), instead of among three as it is indicated in the management plan. Area 1 was reported as area 1 (VI-096- detailed map, figure 5), but area 2 and 3 were split into 4 subareas when reporting: reporting areas 2 (VI-097), 3 (VI-098-1), 4 (VI-098-2), and I. Boeiro (VI-099).

Reports also indicate working days, kg harvested, number of harvesters, sales at the first-sales auction market, and kg sold (see Table 3).

The report was submitted by 15th of July so data, as is required, was processed until the last working day prior to 15th of July: in this example, 14th of July.

Table 3- Info and data provided by Cofraría de Cangas. Excel file. NB! Data is not necessarily accurate. This does not alter the purpose of the figure of showing how provisions of documentation looked like and not of thoroughly analyzing its content

ACCUMULATED NUMBER OF WORKING DAYS								68
ACCUMULATED DAYS QUOTA UP TO 7KG								5
JULY								
DAY	AREA	KG	Harvesters	CPUE	SALES €	KG	€/KG	
01/07/2011	4	288,84	58	4,98	14497.25	194.95	74.36	
05/07/2011	2	310,59	63	4,93	18074.00	308.00	58.68	
06/07/2011	1	260,76	53	4,92	7263.75	290.55	25.00	
12/07/2011	I. Boeiro	193,7	65	2,98	23050.30	193.7	119.00	
13/07/2011	4	397,3	58	6,85	14421.44	352	40.97	
14/07/2011	1	9	3	3	87	3	29.00	

(b) Size distribution of catches: procedure 2

Size frequency distribution of catches for the three areas were measured and reported. Below (Table 4) is what the Excel file looks like, in which the samplings that were taken in Area 1 (2011, until 15th July) are recorded (the document is similar to the corresponding data for Areas 2 and 3). Samples were taken at the first-sales market instead of at the control point. The technical assistant analyzed the mean size of the sample, and the percentage of individuals legally undersized.

Sampling does not include by-catch, which might be up to 50% of the total harvest (Molares and Freire 2003).

Table 4- Info and data provided by Cofraría de Cangas: size distribution of catches Excel file- NB! Data is not necessarily accurate. This does not alter the purpose of the figure to show what provisions of documentation look like, and not to thoroughly analyze its content

AREA 1		
DAYS	MEAN SIZE	% UNDERSIZE
15/01/2011	19	24
08/02/2011	18,9	19
23/02/2011	17	7
11/03/2011	18	12
25/05/2011	18	19
06/07/2011	16,5	6

(c) Direct observation of the harvesting ground: procedure 4

As previously stated, procedure 4 is not mandatory and it is rarely conducted by technical assistants when annually submitting the MP. Instead, there were periodic meetings, every three months, held by biologists of zone attempting to gather all technical assistants contracted by Cofrarías from Administrative Area I –Vigo. This was so TAs could be coordinated to conduct assessments in different grounds which were considered necessary and urgent by the biologists of zone because data provisions were not in enough detail.

Additionally in 2011, biologists of zone collaborated with technical assistants of Cangas to conduct a stock assessment and estimate the GB biomass in the *Illote dos viños* in order to include this ground in the MP of 2012.

4.5.5 SUBMISSION OF THE MP FOR 2012

By 1st November of 2011, Cofraría de Cangas submitted the EMP for 2012 which became legal through the Order on 2nd of January of 2012. The Order validated a request from the Cofraría to increase the number of licences up to 69, and to enlarge the Turf by including *Illote dos Viños*.

The EMP enclosed a registration of effort and catches during working days for the current year, dated until 15th October 2011, and for previous years.

The 2012 EMP was approved by the General Assembly of the GBA. The meeting was held over one evening in September, in which decisions upon changes to the 2011MP were brought by the President of the Aggregation. Those proposals were already discussed through informal channels, such as in the working and selling place where GB harvesters gather every working day throughout the year.

In the formal meeting, technical assistant showed results of the harvest activity such as CPUE, mean size, total amount of kg, prices of the harvest in each production area, total number of working days, and so on; Approval of the EMP took place just afterwards by a show of hands.

The EMP is enclosed with the minutes of this meeting, and also within those of the meetings in which the Executive Board and the Major Skipper of the Cofraría approved the submitted document.

5. *DISCUSSION*

In this section, I aim to contribute to the current discussion in the European context about the reform of the CFP in regards to how to regulate fisheries management in such a way that this process increases its effectiveness.

The innovative paradigm introduced in this thesis, RBM, claims for important changes to the current CFP, such as combining top-down and bottom-up approaches in its regulations-making framework, in contrast to its current top-down approach. The former approach is identified by fisheries authorities establishment of outcome targets and the system of documentation; and the latter by management means defined by harvesters, and those harvesters taking the burden of proof of documentation.

In this section I contrasted this RBM pattern to the pattern found in the GGBMS to analyze to what extent they match. This made it possible to look at the practical implications of the RBM principles so that some lesson could be drawn.

5.1 Top-down features

In a RBM agreement, the role of authorities shrinks to establishing the standards and results or outcome targets within which harvesters must operate.

5.1.1 **OUTCOME TARGETS**

In principle, the Outcome Targets are established by the corresponding authority by narrowing down overarching objectives upon specific appropriate results for the fishing activity in a particular context. In practice, the main outcome target is to keep the fishing activity within certain limits, as the result of applying the precautionary principle to fishery management (FAO 1996) in a manner that they are to be maintained until greater limits are shown to be justified (Gerrodette, Dayton et al. 2002). Those limits are the objectives for management and reflect the overall policy objectives (Nielsen, Holm et al. 2012).

In this sense, the Consellería establishes, for the marine territory in each Cofraría, effort limitations expected to provoke acceptable impact on the GB stock. These are a limited number of harvest licenses, maximum individual daily quotas, and maximum effective working days. Keeping the fishing activity within these limits is the

purpose of the management in order to be effective. Those limits are reviewed annually and it is useful to look at them as the yard stick or tool (Lassen, Sissenwine et al. 2008) for judging whether harvest activity has indeed remained within the limits, and for judging management performance.

The values for each Cofraria are the result of an adaptive trial and error process that has already been running for 20 years. It has sought to translate results of the fishery into required outcomes of acceptable impact, and has evaluated whether the harvest strategy, implemented every year, was effective at meeting these limits.

It would have been interesting to look at mechanisms of legitimating through industry participation at this point, but I have not come across data that might shed light on such an issue.

Then, I assume that those limits match the concept of the outcome target.

5.1.2 SYSTEM OF DOCUMENTATION

The specifications of the outcomes target for a fishery cannot be separated from considerations of the proof that can be used to assess the impact of the fishery⁵ (FAO 1996) in a manner, demonstrated from the outset, that the harvest activity will pose no damage to the stock before consent for such activity can be given. The valid proof, or system of documentation, is determined by authorities which retain responsibility on behalf of society (Lassen, Sissenwine et al. 2008). Authorities specifies the two elements of the system of documentation (Gerrodette, Dayton et al. 2002): requirement of information i.e. metrics; and the procedures to do the measurements of this information and to report it i.e. standards of proof.

As opposed to the description above, the aim of the proof in the GGBMS is not to demonstrate that harvest activity supposes no damage to the stock, but to detect whenever harvest impact exceeds acceptable levels, before unacceptable damage occurs. It means in the GGB fishery, the Conselleria has not developed a model to predict how a harvest strategy will impact on the ecosystem and stock, but a monitoring system. It uses measurements of the activity and provides valuable and timely feedback,

⁵ Original statement in the source is “The specification of operational targets and constraints cannot be separated from consideration of the types of data and methods that can be used to assess the status of the stocks”.

mainly to biologists of zone, though also to harvesters, in order that harvest strategy and its regulations adapt accordingly. Also, the Consellería has established a controlling system that uses recordings from the fishing activity and displays the rate of attainment of each of the three elements of the outcome target. This helps to schedule the fishing activity throughout the year and ensure the target is met.

(a) The metric

The metric is broadly acknowledged to be properly defined by a set of indicators (Degnbol 2005). In the GGBMS, there are two types of indicators: indicators of monitoring, linked to the status of the stock and so to the monitoring system, and indicators of controlling, linked to the outcome target and so to the controlling system.

In regards to indicators of monitoring, in the GGBMS two different indicators and their trends are used: CPUE and mean size, though there are some others which are also recorded and taken into account to certain extent, namely €/ kg at the auction market, daily number of harvesters, and accumulated catches in each fishing ground. All these indicators build up the abundance profile of the GB stock in each location and it is this abundance index, meta-indicator in terms of Degnbol (Degnbol 2005), that is taken into account for rotational management decisions, and not each indicator in isolation. Personnel of the Consellería understand the indicators characteristics and they interpret their trends and values in relation to the abundance levels in each production area (Rice and Rochet 2005). The indicators used in the GGBMS are direct measures of the fishing activity, in contrast to those indicators whose required data is independent from harvest activity, such as surveys (Fitzpatrick, Graham et al. 2011).

In the other hand, indicators of control are a set of values used to measure against: working days at sea, daily catches, and number of harvesters. Those three indicators continuously display how the implementation of the harvest strategy performs in regards to meeting the outcome target, and the way it is used by resource users to schedule the harvest activity throughout the year. Indicators of control are followed up by biologists of zone in a manner that helps ensure the outcome target is met.

(b) The standards of proof

The Galician authorities specify the requirements of how to measure metrics, i.e. standards of proof, named as procedures 1, 2, 3 and 4. Those procedures consist of mechanisms of enforcement, including location of control points close to the harvesting grounds, identification of harvesters and registration of their activity just after work, and location of the first-sales market where daily recordings are collated; and specifications of what information must be recorded in different phases during implementation of the EMP. Note Galician Authorities do not specify how those mechanisms must function or where control points and first-sales markets must be located as this task is left to resource users. EMP must include and describe those elements in a feasible manner in order to ensure information collected is accurate and reliable.

Furthermore, recordings are processed and performance is reported through ad-hoc computer software developed by Galician Authorities, based on Excel.

Therefore, there is obviously a system of documentation in the GGBMS which is established by the Consellería in terms are defined in this thesis.

5.2 Bottom-up features

In a RBM agreement, the role of authorities shrinks to establishing the standards and results within which harvesters must operate. Harvesters then seek the most efficient and workable solutions to meet these requirements, demonstrate that these solutions meet the standards, and document the results to show the standards are indeed achieved.

5.2.1 FLEXIBILITY OF THE HARVEST ACTIVITY

According to the RBM principles, harvesters must have the right to regulate operational patterns of use of the resource, meaning they determine how, when, where and how much fishing will occur. In this sense, SAFMAN project workshop (Lassen, Sissenwine et al. 2008) states that harvesters should be given the opportunity to assume a greater level of responsibility by designing and implementing their own harvest strategies. This is the result of the widely acknowledged statement that the participation of local users in the creation of regulations concerning their fishing ground is vital if the future of these resources is to be safeguarded (Symes 1998).

Also, RBM requires harvesters to set up any solution which is practical and meets documentation standards (Degnbol 2009).

Firstly, harvesters in the GGBMS describe the EMP, including the harvest strategy. I could say, in terms of (Schlager and Ostrom 1992), that GB harvesters have the right of management at a collective-choice level in a manner in which the not inconsiderable task of detailing technical management falls on industry itself (Lassen, Sissenwine et al. 2008) as well as designing the harvest strategy to be conducted throughout the year to meet the outcome target.

Because of this, GB harvesters have acquired the flexibility to respond to the demand of the market by differentiating product supply for the purpose of optimizing their possibilities as a fishing industry (Commission 2009). It means that harvesters can choose among different production areas in order to provide a given quality product according to abundance and prices expected. Those who are permitted can even switch the target species. Certain procedures have been developed so they can also respond to adverse weather conditions. Such flexibility has been considered feasible thanks to an agreement for adjusting management actions ahead of time, ensuring they can be implemented without delay under rapidly changing conditions (Gerrodette, Dayton et al. 2002).

Secondly, the EMP also includes a detailed description of the operational aspects required to meet the standards of proof: control points, their locations, and people/the entity in charge (as described in procedures 1, 2 and 4 in the case study); location of the first-sales market and its functioning (procedure 4); and how the surveillance system is organized and which people/entity is in charge.

In terms of the present thesis, Cofrarías have flexibility, within certain precautionary limits and subject to validation by Consellería, to choose the regulations that are to be implemented in their fisheries. Harvesters can also describe the most suitable way of meeting the standards of proof.

5.2.2 BURDEN OF PROOF OF GB HARVESTERS

Rights are the product of rules, the prescriptions that create authorization (Schlager and Ostrom 1992). In terms of the present Thesis, the rules consist of

compliance of harvesters with the system of documentations i.e. burden of proof. In this scenario, it is enough that harvesters demonstrate they operate responsibly for meeting the requirements of the system of documentation (Commission 2009).

It should be emphasized that the burden of proof in the GGBMS relies on the fact that the system will be able to curtail the harvest activity before its impact exceeds acceptable bounds (De la Mare 2005).

Bearing this in mind, in the GGBMS the burden of proof of harvesters comprises of the burden of documenting, and also the burden of applying the means needed to ensure reliability.

a) Burden of documenting

Enclosed in the EMP, indicators of control are reported so it is documented whether the outcomes target is met, and its rate of attainment: Daily catches and effort throughout the year.

During the year, TAs report on these indicators through the monthly reports attached to the monthly schedule for opening of areas.

Burden of documenting also comprises reporting on indicators of monitoring on a monthly basis. These are recordings of the harvest activity and are also reported through the monthly reports attached to the monthly schedule.

It is noteworthy that not every Cofraría is required to meet the same requirements in the fisheries management process. Consellería adapts requirements to each particular Cofraría, aware of their individual limitations and potentialities. It is important at this point to recognize the fact that the system of documentation is not very costly, and it is easily used by TA and personnel from the Cofraría. However, it is considered to be time consuming by TA of those Cofrarías where there are more sedentary resources aside from GB.

b) Burden of ensuring reliability and accuracy- meeting the standards of proof

In most Cofrarías, tasks of enforcement and recording of fishing activity are conducted by contracted personnel.

In one hand, it is up to GBA or Cofrarías to choose between contracting a service provider for these enforcement and surveillance tasks, or arranging to do it themselves. In both cases they must detail how these tasks are to be done and the Consellería must validate the plan.

In the other hand, Cofrarías are responsible for contracting technical assistants in order to conduct the recording and reporting tasks. Cofrarías contract technical assistants with their own initiative, though they receive financial aid from the Consellería.

5.3 How GGBMS model might be transferred to others European contexts?

Limitations and potentialities of the model of GGBMS here described-

Regarding the question of whether the experience and lessons drawn from the GGBF case could be transferred to other European contexts, at least three issues are essential for discussion.

Firstly, It must be highlighted that the GGBMS has been developed in an environment almost free from conflicts of interest, due mainly to its features of being small-scale, and targeting a sedentary species. Choosing a particular management form is not only a question of feasible implementation, it is also a question of solving distributional tasks (Gezelius and Raakjær 2008). Regulated scarcity, arising from limited fish resources, generates distributional conflicts of interest. The chance of satisfying groups with interests is reduced as scarcity increases, and distribution thus becomes increasingly costly from a political perspective. In this sense, the CFP is considered politically successful: it has managed to resolve disputes regarding fish allocations between member states, and also to allow for members to moderate national fisheries conflicts (Nielsen and Holm 2007). This is because quota-based systems facilitate the solving of conflicts due to exchanging extractive quantity units in negotiations, such as TACs (Gezelius and Raakjær 2008).

In contrast, GGBMS was developed in a Government isolation context so that Galician Government has enjoyed enough autonomy to design its own FMS approach.

A similar case has also been described for the Faroe Island system, whose FMS has switched from a quota system i.e. TAC- to an effort regulation system (Gezelius and Raakjær 2008). Additionally, in the GGBMS, to solve conflicts of interest with other resource users in internal waters, it was enough to divide the marine territory granted to the Cofrarías up into specific resource production areas, so each harvesters/fishermen aggregation takes over responsibility for managing its own activity and space. The major conflict of GGB harvesters took place with mussel farmers, for which an effective solution has been to declare which spots mussels' collectors are allowed to access, and which spots GB harvesters are allowed to access.

However, many European fisheries do not have such a simple solution, mainly because their FMSs deal with larger interest variability, including different gears, fleets and governments. This produces additional organizational and coordination costs. I am aware discussion regarding this topic is out of the reach of data coming from my work, though I believe this thesis might support the statement that industry must be given the chance to find workable solutions from a bottom-up approach. It would require industry to organize itself in order to take over responsibility for regulating and managing the fishery at operational levels, as it is described in this thesis, even when fisheries are mixed. This is an important limitation to the transferability of the model. An alternative to this organizational requirement might be to develop a kind of European call for bids system in which industry, as individual units of fish product production, must meet certain required criteria, design a feasible management plan, and compete with each other in order to obtain long-term permission to access to fish in any ground in Europe. Anyway, in Europe it is a must to change the political approach with a single stock focus as it is illogical. Furthermore, it has prevented European FMS from adopting innovative and efficient management practices and improving the system.

Secondly, related to this, the historical existence of strong and legitimate Cofrarías might be seen as an obstacle to transferring the GGBMS model to another context, in regards to delegating responsibility for management functions to the extent found in GGB fisheries, where harvesters have no such organization and coordination asset. However, it must be noted that GB aggregations, organizations that in practice manage the fishery, stem from the implementation of the new FMS approach for management, back in 1993. Then, though those organizations operate under the umbrella of Cofrarías, their constitution in the Galician GB fishery case still provides an

example of harvesters becoming effectively organized recently, in response to top-down incentives. Mandatory membership of harvesters to GBA, official recognition of GB harvesters as professionals, and submission of a feasible MP has been the main requirements for fishermen during this development period. It would be interesting, in subsequent investigations, to analyze the incentives structure that has fostered the creation of the GBA.

The third issue that is important in this discussion is the presence of an autonomous Regional Fisheries Management Authority i.e. Consellería, as a layer of authority between European Commission and industry. RBM requires an active and committed Regional Government, and this might also be seen as an obstacle to transfer the model here described as without strong advocacy from Regional Governments, RBM principles are unlikely to be adopted in any fishery system.

Decentralization has been a necessary step in order to adapt and narrow down the overriding principles and standards to each particular Cofradía in an attempt to simplify policy, and get closer to the real needs of the fishing sector in each location. Furthermore, decentralization was necessary in order to incorporate the bottom-up features to the GGB management system. Co-management was defined as a form of arrangement between government and user groups to manage a resource (Pomeroy and Berkes 1997) so RBM must be considered as a particular form of co-management. Decentralization and co-management often go together (Pomeroy and Berkes 1997) and there is no blue-print solution of how the process must be. However, adaptive management or "learning-by-doing" in the evolution of co-management, and feedback learning in general, is likely to be critically important in any decentralization arrangement for co-management (Pomeroy and Berkes 1997). The role played by the Consellería in the GGBMS, through closeness to and commitment with the harvesting sector, has been essential in the process of developing the RBM agreement as it is nowadays. This fact might be seen as an obstacle to transfer the model to other locations and fisheries. Further research must include a thoughtful analysis in which the pattern of the RBM agreement is matched with the pattern of the co-management agreement, and in which rival explanations of other management arrangements are also taken into account.

It is well known that enabling and authorizing fishermen to conduct management tasks is a long-term process (Jentoft 1989), in which higher authority must hold certain responsibility (Jentoft 2003), assuming that successful co-management can only occur when the community is enabled, authorized and organized (Jentoft 2003). Galician Authorities have a large amount of resources dedicated to developing management skills of harvesters and other functions, as well as technical support, if required, to improve management and profitability of the extractive sector. It would be interesting for further research to report the developing process in which responsibilities have been gradually devolved from Galician authorities to GB harvesters, since 1993 when the management system was implemented.

6. CONCLUSIONS

Features of the Galician Goose Barnacle Management System are consistent with the conceptual pattern of RBM, as described in this thesis, when it comes to be applied to GB management. All four RBM features are found in the GGBMS so therefore, I declare that GGBMS is a case in which RBM is applied to fisheries management.

As for the implications of the model, there are important limitations to its transferability into other fisheries and contexts. The model might be suitable for S-fisheries in Europe, though it will need some time to develop before being effective. The industry needs to become organized and coordinated, and the management system, including the system of documentation and the outcome targets, to adapt to the specifications of the corresponding fisheries and their contexts. Authorities and researchers seem essential in the process.

The argument I follow is that features of the target species determine the fisheries management system, if this system is based on a rationalistic design. Under this logic I mean that gears and boat characteristics, and harvest method and techniques adapt to the characteristics of the resource obtained, and as a consequence, how the fishing activity is regulated i.e. regulations- making framework, the stock assessed, and the system evaluated. That is why I believe it would be appropriate that S-fisheries were differentiated from large scale fisheries, in the European context, when it comes to defining its regulations-making framework and its entire management system, as it is for the case described in this thesis.

This thesis described a regulations-making framework that combines top-down and bottom- up approaches in the management regime. It is now clear that in-depth scientific research of the biological foundations of the exploited system, and to micro-regulate the harvest activity accordingly, cannot be enough for good management (De la Mare 2006). Then, biology is necessary but not sufficient for managing human activities (De la Mare 2006). Regulations of the operational aspects of the harvest activity in the GGBMS are up to harvesters, though subject to evaluation of biologists of zone and validation by corresponding Galician authorities. This approach is to be seen under the logic that recognizes that effectiveness of management depends on an enormous number

and range of variables that centralized systems can simply not take into account (Schlager and Ostrom 1992) to regulate from a top-down approach.

Assessments of the stock status made by biologists of zone are reliant on spatially explicit abundance indexes that use data from the harvest activity collected by the monitoring system instead of on precise parameters of stock population derived from intensive research stock assessment. This stock assessment-based management paradigm has been too expensive, too incomplete, too uncertain, and too impractical to address the needs of small-scale fisheries, as they were originally developed for large-scale fisheries (Townsend 1995; Berkes 2003). I do not mean that detailed research of ecosystem and resource dynamics is not necessary, in contrast, it is important to identify the information and indicators that are to be required as relevant and legitimate in each system and context (Lassen, Sissenwine et al. 2008). Effectiveness of the assessment relies, to a higher extent, on the input of resource users.

It is interesting to recognize that the bottom-up features of the GGBMS have made it possible to utilize and integrate the embedded local knowledge of resource users in the management system, and to orient investigation towards concise elements and problems of the fishery with the aim of improving the monitoring and management practices of the system. In the terms of de la Mare, I could say the bulk of the research in the fishery is issue-oriented, focused on those challenges coming up from the sector (De la Mare 2006) so GB harvesters, GB aggregations and Cofrarías play an essential role in it. This approach is also to be seen under the logic that recognizes that effectiveness of management depends on an enormous number and range of variables that centralized systems can simply not take into account (Schlager and Ostrom 1992).

Then, different elements of the system i.e. Government, researchers and fishermen, perfectly complement each other. In order to foster such a complementarity system, the structure of the system should allow, promote and maintain the participation of all of them, while the interaction between them is facilitated by a well designed system allowing for good communication. A good interrelation between elements is much more important than the individual elements themselves. Because of this, the design of efficient communication channels is essential to ease a constant flow of information and knowledge. This is a way to exploit synergies as RBM paradigm proposes an effective manner of doing so. I believe this model sets the foundations for

the fishing industry to develop as a competitive sector, helping it to move out of the crisis scenario in which it perpetually seems to be.

Bibliography consulted

Barnes, M. (1996). "Pedunculate cirripedes of the genus *Pollicipes*." Oceanography and Marine Biology: an annual review **34**.

Berkes, F. (2003). "Alternatives to conventional management: Lessons from small-scale fisheries." Environments **31**(1): 5-20.

Campo, D., J. Molares, et al. (2010). "Phylogeography of the European stalked barnacle (*Pollicipes pollicipes*): identification of glacial refugia." Marine biology **157**(1): 147-156.

Carlsson, L. and F. Berkes (2005). "Co-management: concepts and methodological implications." Journal of environmental management **75**(1): 65-76.

Castro Monge, E. (2010). "El Estudio de Casos como Metodología de Investigación y su Importancia en la Dirección y Administración de Empresas." Revista Nacional de Administración **1**(2): 31-54.

Cochrane, K. L. and S. M. Garcia (2009). A fishery manager's guidebook, Wiley-Blackwell.

Commission, E. (2009). Reform of the Common Fisheries Policy: Green Paper, Office for Official Publications of the European Communities.

Dayton, P. K. (1998). "Reversal of the burden of proof in fisheries management." Science- New York then Washington: 821-821.

De La Mare, W. K. (1998). "Tidier fisheries management requires a new MOP (management-oriented paradigm)." Reviews in Fish Biology and Fisheries **8**(3): 349-356.

De la Mare, W. K. (2005). "Marine ecosystem-based management as a hierarchical control system." Marine policy **29**(1): 57-68.

De la Mare, W. K. (2006). "What is wrong with our approaches to fisheries and wildlife management?-An engineering perspective."

Degnbol, P. (2004). Fisheries science in a development context. Fisheries development: The institutional challenge. Ebron: 131-155.

Degnbol, P. (2005). "Indicators as a means of communicating knowledge." ICES Journal of Marine Science: Journal du Conseil **62**(3): 606-611.

Degnbol, P. (2009). Future Fisheries Management in the EU- What are our options? ICES Annual Science Conference. D. M. A. a. F.-E. Commission. Berlin.

Degnbol, P. (2009). New governance in the CFP - reversing the burden of proof in fisheries management. Decision making in the reform of the CFP. I. R. M. S. DEFRA. Edinburgh, DG Maritime Affairs and Fisheries.

Degnbol, P. (2009). result based management. NS RAC Demersal WG special meeting, DG Maritime Affairs and Fisheries-European Commission

FAO (1996). Technical Guidelines for Responsible Fisheries - Precautionary Approach to Capture Fisheries and Species Introductions FAO Fisheries Technical Paper. Rome, Italy, Fishery Resources Division, FAO Fisheries Department. **T350/2**: 210 p.

Fariñas Castro, M. Artes e aparellos de pesca empregados en Galicia. Consellería de Pesca, Xunta de Galicia.

Fernández-Boán, M., J. Freire, et al. (2013). "Monitoring the fishing process in the sea urchin diving fishery of Galicia." ICES Journal of Marine Science: Journal du Conseil.

Fitzpatrick, M., N. Graham, et al. (2011). "The burden of proof in co-management and results-based management: the elephant on the deck!" ICES Journal of Marine Science: Journal du Conseil **68**(8): 1656-1662.

Flyvbjerg, B. (2006). "Five misunderstandings about case-study research." Qualitative inquiry **12**(2): 219-245.

Franquesa, R. and G. E. del Mar (2005). Las cofradías en España: Papel económico y cambios estructurales, Universidad de Gerona.

Freire, J. (2000). "Socioeconomic and biological causes of management failures in European artisanal fisheries: the case of Galicia (NW Spain)." Marine policy **24**(5): 375-384.

Freire, J. and A. García-Allut (2000). "Socioeconomic and biological causes of management failures in European artisanal fisheries: the case of Galicia (NW Spain)." Marine policy **24**(5): 375-384.

Froese, R. (2004). "Keep it simple: three indicators to deal with overfishing." Fish and Fisheries **5**(1): 86-91.

Froese, R. and A. Proelß (2010). "Rebuilding fish stocks no later than 2015: will Europe meet the deadline?" Fish and Fisheries **11**(2): 194-202.

Galicia, X. d. (1993). Ley 9/1993, de 8 de julio, de Cofradías de Pescadores de Galicia. C. A. d. Galicia. Boletín Oficial del Estado, núm. 203 de 25 de agosto de 1993, Gobierno de España: páginas 25666 a 25669 (4 págs).

Galicia, X. d. (2000). ORDE do 6 de marzo de 2000 pola que se regula a explotación do percebe (*Pollicipes pollicipes*) como recurso específico no ámbito da Comunidade Autónoma de Galicia. M. e. A. Consellería de Pesca. Santiago de Compostela, DOG. **Orde 17-12-1997, DOG nº 246, do 22.**

Galicia, X. d. (2008). Ley 11/2008, de 3 de diciembre, de pesca de Galicia. Presidencia, DOGA. **num. 243. 16 de Diciembre de 2008.**

García Negro, M. d. C. (2010). Economía pesqueira: achegas dende un curso universitario. Santiago de Compostela, Sotelo Blanco Edicións.

García Sanabria, J. and J. García Onetti (2011). La Gestión del litoral en Galicia. El papel de las comunidades autónomas en el camino hacia una Gestión Integrada de las Áreas Litorales (GIAL). Cádiz. **Proyecto Red Española de Gestión Integrada de Áreas Litorales (REGIAL)**.

Gerrodette, T., P. K. Dayton, et al. (2002). "Precautionary management of marine fisheries: moving beyond burden of proof." Bulletin of Marine Science **70**(2): 657-668.

Gezelius, S. S. and J. Raakjær (2008). Making Fisheries Management Work: Implementation of Politics for Sustainable Fishing, Springer.

Jentoft, S. (1989). "Fisheries co-management: delegating government responsibility to fishermen's organizations." Marine policy **13**(2).

Jentoft, S. (2003). "Co-management-the way forward." Fish and Fisheries Series **26**: 1-16.

Jentoft, S. (2005). "Fisheries co-management as empowerment." Marine policy **29**(1): 1-7.

Jentoft, S. and R. Chuenpagdee (2009). "Fisheries and coastal governance as a wicked problem." Marine policy **33**(4): 553-560.

Jesus, D. (2002). Entre o mar e a pedra - o Percebe e os Percebeiros.
<http://www.naturlink.pt>.

Kirkwood, G. P. and A. D. M. Smith (1996). Precautionary approach to fisheries. Part 2: Scientific papers. Lysekil, Sweden, Fisheries and Aquaculture Department.

Lassen, H., M. Sissenwine, et al. (2008). Reversing the burden of proof for fisheries management- managing commercial fisheries within sustainable limits. A SAFMAMS Workshop, Copenhagen, Denmark, Scientific Advice for Fisheries Management at Multiple Scales.

Linke, S. and S. Jentoft (2012). "A communicative turnaround: Shifting the burden of proof in European fisheries governance." Marine policy.

Linke, S. and S. Jentoft (2012). "A communicative turnaround: Shifting the burden of proof in European fisheries governance." Marine policy
<http://dx.doi.org/10.1016/j.marpol.2012.06.011>.

Macho, G., C. T. M. F. CETMAR, et al. (2010). The key role of the Barefoot Ecologists in the co-managed TURF system of Galicia (NW Spain). World Small-Scale Fisheries Congress (WSFC), Kasetsart University, Bangkok, Thailand (October 18-22, 2010).

Molares, J. and J. Freire (2003). "Development and perspectives for community-based management of the goose barnacle (*Pollicipes pollicipes*) fisheries in Galicia (NW Spain)." Fisheries Research **65**(1-3): 485-492.

Molares, J., F. Tilves, et al. (1994). "Larval development of the pedunculate barnacle *Pollicipes cornucopia* (Cirripedia: Scalpellomorpha) reared in the laboratory." Marine biology **120**(2): 261-264.

Negro, M. d. C. (2010). "o arrastre interindustrial en Galicia." Economía pesquera de Galicia.

Nielsen, K. N. and P. Holm (2007). "A brief catalogue of failures: Framing evaluation and learning in fisheries resource management." Marine policy **31**(6): 669-680.

Nielsen, K. N., P. Holm, et al. (2012). Ecosystem-based Responsive Fisheries Management in Europe. FP7- 26540- Deliverable no.4.1- Project co-funded by European Commission within the 7th Framework Programme.

Orensanz, J., A. M. Parma, et al. (2005). "What are the key elements for the sustainability of "S-fisheries"? Insights from South America." Bulletin of Marine Science **76**(2): 527-556.

Parada, J. M., R. Outeiral, et al. (2012). "Assessment of goose barnacle (*Pollicipes pollicipes* Gmelin, 1789) stocks in management plans: design of a sampling program based on the harvesters' experience." ICES Journal of Marine Science: Journal du Conseil **69**(10): 1840-1849.

Pomeroy, R. S. and F. Berkes (1997). "Two to tango: the role of government in fisheries co-management." Marine policy **21**(5): 465-480.

Prince, J. (2010). "Managing data-poor fisheries: solutions from around the World." Managing Data-Poor Fisheries: Case Studies, Models & Solutions **1**: 3-20.

Prince, J. D. (2003). "The barefoot ecologist goes fishing." Fish and Fisheries 4(4): 359-371.

Rice, J., V. Trujillo, et al. (2005). Guidance on the application of the ecosystem approach to management of human activities in the European marine environment, International Council for the Exploration of the Sea.

Rice, J. C. and M. J. Rochet (2005). "A framework for selecting a suite of indicators for fisheries management." ICES Journal of Marine Science: Journal du Conseil 62(3): 516-527.

Schlager, E. and E. Ostrom (1992). "Property-rights regimes and natural resources: a conceptual analysis." Land economics: 249-262.

Sen, S. and J. R. Nielsen (1996). "Fisheries co-management: a comparative analysis." Marine policy 20(5): 405-418.

Symes, D. (2009). "Reform of the European Union's Common Fisheries Policy: Making Fisheries Management Work." Fisheries Research 100(2): 99-102.

Symes, D. (2010). "Europe's common fisheries policy: Changing Perspectives on Fisheries Management." Mast 9 (1): 47-50.

Symes, D. G. (1998). Property rights and regulatory systems in fisheries, Fishing News Books.

Townsend, R. E. (1995). "Transferable dynamic stock rights." Marine policy 19(2): 153-158.

Wilson, D. C., J. R. Nielsen, et al. (2003). The fisheries co-management experience: accomplishments, challenges, and prospects, Springer.

Yin, R. K. (2008). Case study research: Design and methods, SAGE Publications, Incorporated.

APPENDIX A- Management Framework

Information necessary for Cofrarías to fulfill the official requirements of Management Framework so Cofrarías obtain fishing rights for exploiting Goose Barnacle. Source (Molares and Freire 2003):

General Data:

- Number of fishers (nominal relation)
- Number of boats (nominal relation of crewmen)
- Production zones (detail map)

General objectives:

- Production objectives
- Economic objectives

Assessment of resources:

- Methods
- Conclusions

Control of exploitation:

- Daily effort
- Daily production

Harvesting plan and commercialization:

- Foreseeable calendar
- Number of total days
- Maximum individual quotas
- Gears used
- Control points (location, personnel in charge and functioning)
- Market system: location of first- sales market, minimum prices,
- Surveillance

Stock enhancement actions:

- Description
- Cost

Financial plan:

- Income
- Expenses, inversions and capitalization