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Master of Science (MSc)

Adaptation as a part of system resilience. Insights from Fish Producers Organizations in Portugal

Thesis submitted to the Universidade Nova de Lisboa, Faculdade de Ciências e Tecnologia for the degree of Doctor of Philosophy (PhD) in Environment

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Crazy Clown Time shouldn't work and yet somehow it does.

‘Writing a song is much the same as writing a film’, he explains. ‘It's all about chasing ideas; about telling a story or letting the story tell you’. And this, it turns out, is about as far as he is prepared to go in discussing his working method. ‘Because none of the things are yourself, not really. The ideas come from someplace else.

It's like fish’, he says.

What's like fish?

‘The ideas’, says Lynch. ‘You didn't make the fish. You caught the fish. Now you can cook it in a good way or a bad way, but that's as far as it goes. The fish came from someplace else.

And sometimes …’ His eyes take on a faraway look.

‘Sometimes it talks back to you. Tells you how it wants to be cooked.’

David Lynch, interview in 2011, The Guardian

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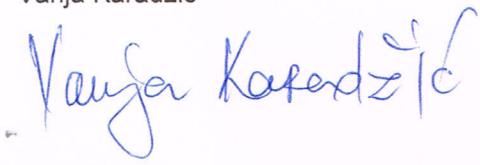

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RESUMO

A sociedade globalizada enfrenta problemas complexos que colocam desafios à sua capacidade de adaptação. No entanto, é precisamente a natureza desses problemas, gerados pelos humanos, que fornece evidências suficientes para mostrar que a capacidade de adaptação pode nem sempre conduzir a um caminho resiliente. Esta tese explora a ambiguidade da ideia de adaptação (e a sua prática) e ilustra as formas em que a adaptabilidade pode contribuir para aumentar a resiliência dos sistemas sócio-ecológicos. A tese combina estudo de caso com a abordagem da teoria fundamentada nos dados e propõe um novo quadro analítico para estudar a adaptabilidade das organizações de utilizadores de recursos: de que fatores depende a adaptabilidade e quais são os principais desafios para a gestão dos recursos e para resiliência do sistema. Nesta tese é abordado o caso específico das organizações de produtores de peixe (OP) em Portugal.

Os resultados obtidos sugerem que, apesar do contexto ecológico e de mercado, incluindo o tipo de crise, poder influenciar o tipo de adaptação dos pescadores dentro das OP (antecipatória, reativa e não-adaptativa), ele não é determinante. Em vez disso, o contexto torna ainda mais crucial a agência (ou seja, a liderança, confiança e percepção dos agentes em termos de seu impacto sobre a motivação dos pescadores para aprender uns com os outros). Em suma, verificou-se que a adaptação interna pode melhorar o contributo das OP para gestão das pescas e para aumentar a sua resiliência, mas não é uma panaceia e pode, em alguns casos, contribuir para aumentar a vulnerabilidade do sistema. A contínua dificuldade de adaptação das OP portuguesas aponta para um problema institucional básico (o regime de mercado do peixe), reduzindo claramente a resiliência da pesca, uma vez que promove a sobrepesca. No entanto, esta mudança estrutural pode não ser suficiente para ultrapassar outras barreiras para a adaptabilidade dos pescadores portugueses (membros das OP), como a história (memória coletiva) e as auto-percepções problemáticas associadas. Os agentes (pessoas envolvidas nas estruturas e nas práticas) também precisam mudar. Em que medida e como é que a mudança institucional e os agentes se influenciam mutuamente (por exemplo, através comparação de governação das pescas em Portugal e noutros países da União Europeia) é um tema a ser explorado em pesquisas futuras.

Palavras-chave: pescadores, adaptabilidade, resiliência sócio- ecológica, organizações de produtores de peixe, instituições.

ABSTRACT

Complex problems of globalized society challenge its adaptive capacity. However, it is precisely the nature of these human-induced problems that provide enough evidence to show that adaptability may not be on a resilient path. This thesis explores the ambiguity of the idea of adaptation (and its practice) and illustrates the ways in which adaptability contributes to resilience of social-ecological systems. The thesis combines a case study and grounded theory approach and develops an analytical framework to study adaptability in resource users' organizations: from what it depends on and what the key challenges are for resource management and system resilience. It does so for the specific case of fish producers' organizations (POs) in Portugal.

The findings suggest that while ecological and market context, including the type of crisis, may influence the character of fishers' adaptation within POs (i.e. anticipatory, maladaptive and reactively adaptive), it does not determine it. Instead, it makes agency even more crucial (i.e. leadership, trust and agent's perceptions in terms of their impact on fishers' motivation to learn from each other). In sum, it was found that internal adaptation can improve POs' contribution to fishery management and resilience, but it is not a panacea and may, in some cases, increase system vulnerability to change. Continuous maladaptation of some Portuguese POs points at a basic institutional problem (fish market regime), which clearly reduces fisheries resilience as it promotes overfishing. However, structural change may not be sufficient to address other barriers to Portuguese fishers' (PO members) adaptability, such as history (collective memory) and associated problematic self-perceptions. The agency (people involved in structures and practices) also needs to change. What and how institutional change and agency change build on one another (e.g. comparison of fisheries governance in Portugal and other EU countries) is a topic to be explored in further research.

Key words: fishers, adaptability, social-ecological resilience, fish producers' organizations, institutions

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ACRONYMS

PO Producer Organization

SES Social-ecological system

CFP Common Fisheries Policy

COM Common Organization of the Market

CHAPTER 1 - INTRODUCTION

'There is science of simple things and art of complex ones.

What is simple is always fictitious.

What is not simple is useless.'

Paul Valery [1]

[1] Freely translated from French by Garcia and Charles (2008). ''Il y a science des choses simples et art des choses compliqueées''. Valéry. P. Tel quel. Gallimard 1996: 495 pp. ''Ce qui est simple est toujours faux. Ce qui ne l'est pas est inutilisable.'' Valéry, P. «Mauvaises pensées et autres» (1941).

INTRODUCTION

1.1 RELEVANCE OF THIS STUDY

Humanity and nature are not just linked, but truly integrated (Folke et al. 2007) within the extended family of the Earth (Vandana Shiva[2]). Their coevolution implies that at any time (change of) each determinates the other (Norgaard 1994). Human activity depends on Earth's life-support goods and services (e.g. Daily 1997) and influences ecosystems in all scales (e.g. Vitousek 1994); nature reacts to human actions in a non-linear and unpredictable manner (Holling 2001).

In the era of the Anthropocene, in which we currently live (Crutzen and Stoermer 2000), humans dominate all Earth system processes from local to global scales (e.g. Foley et al. 2005, Steffen et al. 2007). The Earth as transformed by humans assumes an ongoing transition and acceleration of human-induced pressures (e.g. Turner 1990, Kowalski et al. 2012). Due to globalization, these pressures, even if local in origin, are of worldwide concern (e.g. Young et al. 2006). The major crises they generate, such as climate change, loss of ecosystem services and financial crisis, are all interlinked in their complexity (e.g. Adger et al. 2009, Walker et al 2009), which may likely worsen their impacts (e.g. Biggs et al. 2011).

Moreover, the modern world has become commercially integrated and therefore culturally and spiritually fragmented, which caused humans' mental separation from nature and disrespect of essential spiritual link between humans and nature that provides life for humans (Berkes and Folke 1994, Vandana Shiva[3]).

In consequence, the risk of long-term damage to Earth systems that support humanity is increasing (Rockström et al. 2009, Hughes et al. 2013). The challenges, posed by human population, such as hyper consumption, economic growth, water use, biodiversity loss, overfishing, atmospheric carbon dioxide, etc. should worry us all and demand the very best of science and collective action of humankind (e.g. Turner et al. 1994, Gerst et al. 2014). However, over-emphasizing human powers should also worry us, as it may result in the so-called the 'Anthropocebo Effect', a rather pessimist cultural frame of accepting human destruction as inevitable (Jacquet in Brockman et al. 2013). Instead, acknowledging humans as dominant drivers of environmental change should draw explicit attention to the responsibility humans have as stewards of Mother Nature (Crutzen and Schwagerel 2011, Steffen et al. 2011).

How we as humans use our mistakes, experience and intellect to sustain this relationship, adapt to changes and learn from them is a decisive factor in natural resource management and our life on Earth.

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[2] Vandana Shiva, interview for RTP2, Portugal, 2012, available online: http://vimeo.com/45069821

[3] same as above

1.2 OUTSET

1.2.1 Human adaptation and resilience in social-ecological systems

This realization calls for an understanding of resource management in terms of resilience of social-ecological systems (SESs). SESs, as defined by Berkes and Folke (1998) mean co-evolving systems of nature and humans, which is a continuation of the co-evolutionary perspective suggested by Norgaard (1994). At the core, dynamics in SESs is generated through *interaction* between the system *agents* (e.g. plants, animals, humans), each with a different degree of information processing capacity, the *actions* of agents, and the *effects of those actions* on other agents and the environment (Anderies et al. 2006).

At the centre of the SES debate is resilience – the capacity of a system to absorb change, reorganize and continue to develop (e.g. Walker et al. 2004, Folke et al. 2010). Rooted in ecology and complexity science, the term 'resilience' originates from Holling's (1973) notion of resilience as a measure of ecological systems ability to absorb disturbance and still persist. This explanation entails two ideas that are essential for resilience thinking. The first one is '*acceptance of disturbance'.* The world is not adequately described by concentrating on equilibrium, and conditions near it, as these provide little insight into the complex systems dynamics, where the unexpected is most likely. If disturbances are not allowed to enter the system, they will accumulate and come back later with a much greater force and on a much broader scale (Holling et al. 1995). A management approach based on resilience, thus, embraces change and complexity rather than focusing on the need to control the natural system, manage it for security and keep it in a certain steady state in a command-and-control fashion, e.g. fixed maximum yield approach (Folke et al. 2003). In other words, due to nature's complex behaviour, natural resource management is more of an art than a science (Anderies et al. 2006): science prescriptions cannot 'instruct' someone (e.g. resource users) on how to manage natural resources, but serve only to complement contextual knowledge based on the feedback from nature and from the community (Folke et al. 2005). Withstanding disturbances also assumes using such an event to catalyse renewal and innovation, acknowledged as 'turning crisis into opportunity' (e.g. Folke et al. 2010).

This *'persistence despite change'*, a second idea from Holling's work, is enabled through 'persistence of relationships' within the system, which build system capacity to absorb change without dramatically altering it. System flexibility and fluctuations are essential features that maintain persistence. Hence, a system can be very resilient and still fluctuate (change) greatly, i.e. have low stability. The more resilient the system, the larger disturbance it can absorb before shifting into an alternative regime, known as regime shift (e.g. Scheffer et al. 2001). In ecological systems, resilience is sustained through diversity, such as genetic diversity, biodiversity and the heterogeneity of landscape mosaics (Peterson et al. 1998, Carpenter et al. 2001).

For social resilience, defined as the ability of individuals, groups, organizations or communities to cope with external stresses and disturbances in the face of change (Adger 2000, Hall and Lamont 2012),

adaptability – i.e. the capacity to adapt as a response to external change (Berkes et al. 2003, Walker et al. 2006) is crucial. Besides economic resources, institutional and cultural resources can be understood as the social sources of resilience, embodied in social organizations, social networks and collective imaginaries[4] (Hall and Lamont 2012).

Humans are 'sense-making' creatures (Gunderson and Holling 2002): their ability to seek and create meanings through 'structures of signification' (communication, language, symbols), together with 'structures of legitimation' (norms, rules, routines and procedures) and 'structures of domination' (power, resources and authority) (Giddens 1979) permits high levels of self-organization, crucial to deal with change. Hence, to a large extent, adaptability implies responding to change – the capacity of actors to adjust a system by adjusting their actions in response to change (Berkes et al. 2003, Adger et al. 2005a).

Moreover, instead of merely reacting to change, humans are able to consciously reflect on their past experience and learn new ways of coping. Thus, another aspect of social adaptability and resilience is the added ability of individuals as well as communities to *learn reflexively,* anticipate and plan for the future – i.e. as more than a mere extrapolation of past practices (e.g. Gunderson and Holling 2002, Adger et al. 2005). As a result, both adaptability and transformability are essential for SES resilience (Folke et al. 2010). However, the kinds of social mechanisms at work behind these processes need to be further investigated and better understood. This thesis takes up this challenge.

Besides the role of individual agency - the choices of individuals within the system, their knowledge, values, identity and attitudes (e.g. Giddens 1984, Folke et al. 2005), the ways in which humans organize themselves to extract resources drive environmental change and affect the resilience of SESs (Hardin 1967, Dietz et al. 2003). The research presented here thus pays attention to adaptability in agency and institutional contexts.

Human institutions shape human interactions and behaviour (North 1990, Ostrom 1990). Over the course of human history, institutions have been 'managed' by their environments (Ludwig et al. 1993) to fit to ecosystem dynamics and improve stewardship of natural resources for human well-being and sustainability (Folke et al. 1998b, 2007). This possible convergence of adapting institutions with system resilience (Boyd and Folke 2011) might be particularly relevant in the context of local resource regimes - resource users' capacity to adapt to changes affecting resource condition is crucial if they are to remain viable (e.g. Marschal and Stoke 2014).

1.2.2 Adaptability in resource users' organizations

It is in this context that the thesis approaches adaptability in resource users' organizations. It does so for two reasons. First, interdependence of ecological and social systems is especially evident in the

[4] Hall and Lamont (2012) understand 'collective imaginary' as a form of social connectedness, which often stands in mutually reinforcing relationship with social organizations and policies that contribute to social resilience. In brief, collective imaginaries embody narratives about the past and the future of the community who belongs to it.

context of natural resources management (e.g. Berkes et al. 2003). Natural resources management is, by its very nature, complex (e.g. Levin 1999, Cilliers et al. 2013); to practice it more sustainably, we need to be aware of what Galaz (2011) frames as 'double complexity' - complex systems (biophysical subsystems and additional complexity of organizational and social side) and complex (rapid and unexpected) changes within them. Resource users are encouraged to take care of resources as they are strongly affected by both nature dynamics and their own management failures (Ostrom 1990). Nonetheless, it has become increasingly clear that it is precisely this limited predictability of natural systems (Costanza et al. 1993) that increases the importance of resource users' flexibility and adaptability to change (e.g. Olsson and Folke 2001). Indeed, the literature on common-pool resources has repeatedly demonstrated how resource users self-organize, learn and through collective action develop capacity to adapt to environmental surprises and manage resources sustainably and how they do this faster than centralized agency (Berkes 1989, Ostrom 1990).

Second, resource users' adaptability (with intent) (or lack of it) impacts nature as our commons – common-pool resources. Common-pool resources are resources from which it is difficult to exclude other people; however, as they generate finite quantities of resource units, the use by one actor subtracts or reduces other's opportunities for use (e.g. Ostrom et al. 1994), which may lead to the commons' dilemma (Hardin 1968). As commons are traditionally at risk of exploitation, these problems, which concern us are also our commons (Zizek 2013). Herewith, though organizations associated with natural resources are viewed as key elements for their successful management (Ostrom 1990), they often need to defend themselves from the accusations that they have the biggest blame for the overuse of commons. The question of asking who is responsible and how that responsibility is distributed is necessary when attempting to address any commons' dilemma (Jacquet et al. 2013). From this perspective, adaptation and management pose new problems of unprecedented scale at the local level (e.g. Young et al. 2006). In other words, adaptability in resource users' organizations can not only improve their management practices, but also provide them with a new knowledge base for reinterpretation of problems they face, which might be of a structural nature (e.g. Ternstrom 2011), embedded within the system.

1.3 CONTEXT

1.3.1 Fisheries: complex problematic

A typical example of commons is fishery. Globally, fisheries are in crisis (e.g. Pauly et al. 1998, 2002, Worm et al. 2009), induced by overfishing, climate change, changes in market and regulations. Pressures are all interlinked, which acknowledges the complexity of fisheries systems (Garcia and Charles 2008).

Increasing human appetite for seafood is at the root of the fishery crisis (Jacquet 2009), affirmed by Hilborn (2012) as: 'first, foremost, and always: there is no free lunch' (Worm 2013 review of Hilborn 2012). The erosion of resilience of many marine systems is associated precisely with the attempt to

maintain supply of global market demands (Hughes et al. 2005). The three world major seafood markets are the European Union (EU), Japan and the United States of America (USA), which are all largely dependent on seafood sources well beyond their domestic waters (Swartz et al. 2010).

This results in overfishing, which gives rise to both ecological (e.g. depletion of fish stocks) and socio-economic problems (e.g. lower fish prices). Ecologically, overfishing generates ecosystem modification, changes that are 'gradual and for most of us difficult to see' (Worm 2006, pp. 1546), e.g. fishing-down-the-food-webs phenomenon (Pauly et al., 1998). This is unsustainable and can create sudden and catastrophic shifts in a marine ecosystems (Scheffer and Carpenter 2003), already identified as ecologically vulnerable (Worm et al. 2006).

Furthermore, in globalized fisheries, specialized industry fisheries from developed countries fish in the waters of developing countries (Swartz et al. 2010). As a result, the least developed countries whose inhabitants are largely reliant on fish for their diet and whose fisheries produce 20% of the world's fish exports are most vulnerable to climate change (e.g. Allison et al. 2009).

Besides overfishing, market and climate change, there is also a growing consensus that today's crisis in fisheries is partly related to institutional failure (e.g. Jentoft 2004). Due to deficient regulation and lack of enforcement capacity, resource users are able to practice globally a large amount of illegal and unreported fishing (Agnew et al. 2009). Another part of institutional failure is based on the premise that fishers' contribution to fisheries crisis is not equal (e.g. Castilla and Defeo 2005, Coulthard et al., 2011). In this context, small-scale fisheries face big barriers in terms of fishery resources and market access when compared with overcapitalised, subsidy and fuel- ridden large-scale industrial fishing vessels (Jacquet and Pauly 2008).

In Europe, Common Fisheries Policy (CFP) has failed to achieve its ecological and social goals (e.g. Osterblom et al. 2012). As a result, European fisheries suffer from low profitability; 88 % of assessed European stocks are overfished (30% of these stocks may not be able to replenish) (CFP 2009), compared to the global average of 30 % in 2009 (FAO 2009).

1.3.2 The art of managing fisheries

The described complexity of fishery systems has significant consequences for their management and sustainability (Garcia and Charles 2008). While some might argue that this is bound to lead to a tragedy of the commons (Hardin 1968), others have pointed to strategies to pre-empt this. Among the most influential is the work of Ostrom, saying that social organization can overcome the problem of tragedy of the commons by cooperative action (Ostrom 1990) and work on co-management that typically manifests sharing power and responsibility between the State and resource users (e.g. Pinkerton 1989, Berkes et al. 1991). It has since been broadened into other related forms of institutions, such as adaptive co-management, which combines co-management with adaptive management (Holling 1978, Walters 1986). In adaptive co-management, policy and practice are revised in a 'learning-by-doing' process (experiential and experimental) to accommodate new

ecological knowledge and collective judgment of different stakeholders (Carllson and Berkes 2005, Armitage et al. 2009).

In fisheries, the need for collective management and policy endorsement is exceptionally important given the 'wicked' nature of problems confronting fisheries governance (Jentoft and Chuenpagdee 2009) and the unpredictable nature of marine fish resources (Coulthard et al. 2011). Moreover, its common pool characteristics (subtractability and associated difficulty of exclusion) require legitimacy of institutions and governance (Berkes 1989, Ostrom 1990, 1999, Dietz et al. 2003), including 'rules of the game' (North 1990) to balance individual and collective interest (rationality).

The creation of incentives for fishers through market measures is increasingly recognized as a possible tool for rebuilding fisheries (e.g. Hughes et al. 2005, Beddington et al. 2007). Fishing for maximum profit is perceived to require less fishing pressure and hence overlap with conservation objectives (e.g. Worm 2013 review of Hilborn 2012). In other words, fisheries designed to be sustainable may also be profitable (Pauly et al. 2002).

Yet, institutions imply much more than rules and resources (e.g. Jentoft et al. 1998, 2004, Chuenpagdee and Song 2012). Over the past three decades, a variety of neo-institutionalists have emphasized a wider and more dynamic approach to institutions: institutions also include societal and informal institutions, and of special importance to adaptability - may also be seen as dependent variables (Lowndes 2010). This, more inclusive, notion of institutions is of particular relevance to our work.

The intrinsic uncertainty in fisheries also emphasizes the importance of individual agency and organizations that implement fisheries policies and programs (e.g. Ludwig et al. 1993, Lam and Pauly 2010). As a result, research on fishers' behaviour, attitudes and perceptions (e.g. Pita et al. 2010, 2013) has surged as relevant because it reduces the uncertainty associated with human response to regulation (Wilen et al. 2002, Fulton et al. 2011a). Nonetheless, our current understanding of this issue, including how fishers' communities respond to environmental and economic challenges still remains incomplete (e.g. Coulthard 2011).

This thesis builds on the above mentioned social science research developed in the context of fisheries and uses the framework of resilience thinking to the stewardship of natural resources to explore fishers' adaptive capacity to changes facing their livelihoods. The basic premise of this research follows the argument that fishers and their actions form the very basis for rebuilding global fisheries (e.g. Jentoft 2000a, Mora et al. 2009, Grafton and Kompas 2014). What is more, interconnectedness and unpredictability of problems that beset fisheries explicitly challenge fishers' adaptability - the way they 'manage' themselves in response to changing environment - to secure their livelihoods and increase fisheries system resilience to deal with change and surprise.

1.4 CASE STUDY

1.4.1 Fish Producers' Organizations

This is explored in the case of fish Producers Organizations (POs). In many EU member states, fishers' responses to evolution of the CFP have included self-organization and cooperation in the form of producers groups, known as fish POs. POs are formal organizations that arise out of larger institutional arrangement of the Common Market Organization (COM)[5]. Apart from POs, COM uses three other tools to ensure market stability, such as common marketing standards, price support scheme setting (known as withdrawal price, fixed annually by the Council of Ministers and used by POs) and rules on trade with non-EU countries. The recognition criteria and conditions to be satisfied by POs are laid down by the official legislation[6], i.e. members must sell their fish solely through the organization.

In a nutshell, POs aim to regulate the market, e.g. stabilize first-sale price, through planning of fish production (an annual operational program that includes a catch plan and a marketing strategy). Hereby, POs bring obvious market advantages for fishers. The most relevant are POs capacity to negotiate direct sale contracts and to finance the withdrawing of production surplus and its reintroduction later on in the market, when the price is more reasonable. Moreover, assessments of POs across the EU have shown that POs may increase rule compliance amongst fishers, encouraging them to fish less, and can act as an informative feedback channel to Government on experiences with regulations (e.g. Young et al. 1996, Hatcher 1997, Gibbs 1994, Nielsen and Vedsman 1997).

However, the management of POs is not an easy task, as becomes clear from e.g. Jentoft and Davis (1993) and Phillipson (1999), who question POs' concern with stock management and contribution to market stability. Under the new reform of the CFP, POs will gradually lose financial aid for withdrawing, considered unsustainable because it failed to solve the problem of overfishing.

To respond to these challenges as well as to fluctuations in fish stocks, POs need to adapt to changes and learn from them. We define adaptability in POs as a learning process of dealing with pressures through adjusting management routines (productive and marketing activities), internal structures and membership behaviour to secure their livelihoods for the long term (e.g. Berkes and Jolly 2001, Berkes et al. 2003). The research presented in this thesis aims to understand how adaptation to environmental and market changes among fish POs relates to their capacities (or failures) to manage production and market demand, what are the key organizational features and external conditions that enhance or weaken organizational adaptive response and how it contributes to the overall fisheries resilience.

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[5] Council Regulation (EC) No 104/2000 of 17 December 1999 on the common organization of the markets in fishery and aquaculture products

[6] Commission Regulation (EC) No 2318/2001 of 29 November 2001 laying down detailed rules for the application of Council Regulation (EC) No 104/2000 as regards the recognition of producer organizations and associations of producer organizations in the fishery and aquaculture sector

1.4.2 Fish POs in Portugal: a historical perspective

It does so for the case study of fish POs from continental Portugal. Historically, interdependency of two major issues combined to shape the backdrop for the performance of Portuguese fish POs. First, despite the geographical potential of the Portuguese fisheries (e.g. Pitta e Cunha 2011), the national fishers' community has traditionally demonstrated a low capacity to self-organize (information extracted from the interviews with people working in the sector, personal communications in 2010). Low level of self-organization contributed to fishers' weak role in influencing fish price. Second, and interrelated with the first, Portuguese fisheries have never operated in free-market conditions, passing through a variety of regimes. Both problems date back to Oliveira Salazar's dictatorship regime (1933-1974), the 'New State'. According to Garrido (2004), Salazar's politics of economic recovery (economic growth focused on the primary sector[7]), which was employed early on during his regime, acted as a prime driver for the modernization of fisheries.

Sector economic recovery was based on two axioms: first it concerned the 'cod campaign' ('campanha do bacalhau'); the second axis was related to the export of canned fish (sardine and tuna), ensuring a positive trade balance and economic stability (Leal 1984). In effect, fisheries were highly protected and controlled by the state (Garrido 2003, 2004). The intervention of the state in the market was established through trade control (e.g. the export of canned fish), and a fixed price table (minimum and maximum prices) for domestic producers (Leal 1984).

A regime made of three parties (Navy Ministry, Ministry of Economy and Corporate Fishery Organization), controls fishery administration, policy making and market development. The most important actor in this institutional arrangement is undoubtedly the Corporate Fishery Organization, directly controlled and managed by 'fishery boss' Henrique Tenreiro (Garrido 2009). Under his leadership, corporate structure developed into the sort of power subsystem inside the New State system, 'imperial fishery structure' of numerous organizations and private companies. The main feature of the Corporate Fishery Organization were Associations of Vessel-owners (Grémios de Armadores das Pescas), formed in 1934-39 period for major fisheries (i.e. cod, trawlers and sardine). Grémios were directly controlled by the state through the government delegate; other centralized bodies involved in economic coordination are the Regulatory Commission for the cod market (Comissão Reguladora do Comércio do Bacalhau) and the Portuguese Institute of canned fish (Instituto Português de Conservas de Peixe). People working in the sector are organized in Syndicates, and regional Fishermen Associations (Casas dos Pescadores), grouped in Central Boards (Junta Central das Casas dos Pescadores), directly supervised by the government and without any active role in market organization (Leal 1984). Besides Grémios, all other forms of fishers' organizations had mainly a symbolical / social role; their functioning was supported by the state, giving

[7] In the previous regime Portugal had difficulties in enabling sufficient proteins for its population. Salazar observed this phenomenon at the University, which resulted in writing the thesis - 'Dictatorship of the food', having in mind that the food is a very important element for the country stability. Accordingly, upon his entrance into the government, agriculture and fisheries received the utmost attention (information received from João Reis, Docapesca, personal communication in 2010)

an illusion of '*the system of the social progress, where those who pay are those who have more and those who receive are those who need the most*' (freely translated by the author).[8]

As Garrido (2004) reflects, this regime uses ideology and tradition in a highly pragmatic manner, e.g. promotes fish diet, i.e. 'cod campaign', as a 'cheap diet', parallel to cheap bread, cheap rice, etc. to assure food supply to a poorly paid working force. Fisheries and fishers are perceived as a part of local folklore. Political ideology additionally fosters the sector modernization and development: the vision 'Portuguese return to the sea', 'the economic renascence of the fisheries' is promoted by the New State official discourse in a highly pragmatic way, providing legitimacy to 'the great fisheries' project (Garrido 2006).

With the 1974 revolution, the sector lost its corporative organizational structure, and the state's economic protection (Garrido 2009). Moreover, the end of the empire ('Sea = New State empire') implied the end of the interest for the sea issues ('Sea = the past') (Pitta e Cunha, 2011:23). Perceived as a strategic sector (symbolically and economically) of the previous regime, corporate fisheries became a 'land of no one' ('terra de ninquem' - Henrique Souto, personal communication in 2010) and were restructured and lost in the bureaucracy net. Most of corporate private companies were nationalized and managed by several entities that imposed different policies with frequently overlapping responsibilities. In addition, there exists no link between public administration and economic entities, or people working in the sector (fishers, vessel-owners, commercials, industry representatives) (Leal 1984, Garrido 2009). In the previous regime this link had to be institutionalized and conditioned by the corporate fishery organization.

Externally, the EEZ establishment in 1977, second oil crisis in 1979, and market liberalization in 1981, as global development trends have deeply influenced the sector. Furthermore, Souto (2007) raises the issue of the wars for independence in the colonies as an important factor that deeply shaped the sector's performance. Massive military recruitment resulted in a significant decrease of the labour force in the sector as a vast number of fishers were either mobilized, or many of them left the country illegally, trying to escape military service. When the wars for independence ended, soldiers started to claim salaries they did not receive during the war and this was reflected as an increase in production costs for the entire sector. Faced with these transitions and being overprotected for decades, the sector lacks a proactive approach; national fisheries do not have the capacity to deal with external competition due to lack of appropriate management; blocking behaviour of the national market regime on the one hand, and increasing impact of imports on the other hand further promotes instability of prices and producers income (Leal 1984).

Europeanization brought additional concerns for national fisheries. Subsequent to 1986 (Portuguese entrance into the European community), the idea of Portugal 'as a land where the sea begins', was substituted with the idea of Portugal 'as a land where Europe ends' (Pitta e Cunha, 2011:11), thus trading the national cult of sea with the cult of the EU. Fisheries started to adapt to a continuous

[8] ' …e instituído um sistema de progresso social, para o qual pagam mais os que mais podem e recebem mais os que mais precisam', Boletim Nacional: Organização Corporativa da Pesca Lisboa 1961.

decline of resources, restrictive community policies and new market rules. Murteira (1997) also argues that union is predominantly regional and Iberian, thus competitiveness with Spain as a stronger fishery state became a significant drawback for the national fisheries. As a result, adaptation at the beginning more resemblance to a sector crisis: from 1986 to 1996, national fisheries lost one third of fishers and 27% of production (INE 1998). Coelho (1998) frames the problem around the economic misfit to new market conditions, i.e. the COM in the fishery products. Even though expectations in regard to the COM were largely positive, the Portuguese market was not able to adjust easily to the increased competition from the community and the international market. Many doubts were raised purposely in relation to the PO, such as scepticism regarding the ability of fishers to respect common rules and policies for production and commercialization; fishers' lack of organizational capacity, as well as having in mind large diversity in the sector including variety of species and landing spots. Moreover, vulnerability of the POs was raised as a concern, above all, in front of big buyers (commercials), as well as fishers who do not want to become members of the POs.

Most of the POs from Portugal were formed around 1986, following accession to the European Community. Currently, there are 15 POs: twelve in continental Portugal, two in the Autonomous Region of the Azores and one in the Autonomous Region of Madeira (for a more detailed explanation see Chapter IV). While some of them persisted and adapted to changing environments, others failed to do so. This work explores the nature of this adaptability. To achieve this, we identify trends and changes (e.g. environmental and market changes) POs face and then analyze reasons behind their different adaptive response.

1.5 THESIS SCOPE AND RESEARCH QUESTIONS

This thesis is a study on human and organizational adaptability - how people respond to changes facing their livelihoods and the options they have to respond. Its purpose is to investigate and illustrate the ways in which adaptive organizations contribute to the resilience of socio-ecological systems in which they operate, with a particular focus on adaptability in resource users' organizations.

Thus, the main question that the research aims to answer is:

How does adaptability contribute to social-ecological system resilience?

The main research question is answered by the following sub-questions, through a reflection on the findings in Chapters 3 through 5.

rq#1 - *how can we conceptualize adaptability of resource users' organizations?*

rq#2 - *what can we learn from cases of such organizations and the degree to which, and how, factors from our framework influence (enable or undermine) organizational adaptability?*

rq#3 - *how may organizational adaptability contribute to improving social resilience?*

rq#4 - *what are the challenges for adaptability - when and why may organizational adaptability fail as a social source of resilience?*

To answer these questions, the thesis employs an exploratory case study approach (Yin 2003) and develops an analytical framework to study organizational adaptability, based on various strands of literature.

Hopefully, this thesis contributes to an improved understanding of the societal dimension of resilience. Lessons learned from the case study serve to identify key reasons under which adaptability in resource users' organizations occurs and provide ideas on how it can be fostered and sustained. While the thesis provides context dependent case knowledge that is hardly transferable, it explains the process or the structure (framework) that can help us think about the connection between contextual conditions, 'inside' agency features, types of change, risks associated, different degrees of adaptability and system resilience. Practically, our work directly considers fishers learning within POs – it aims to contribute to fishers understanding on how (through strategies, changes in structure and processes) their organization may behave or act in different contexts to translate the idea of adaptability into their management practices, and thereby improve them. Furthermore, it can support fishers discovering the structural problems underneath their practices. Hence, the knowledge acquired also has policy implications for the local and national institutional context of fisheries governance.

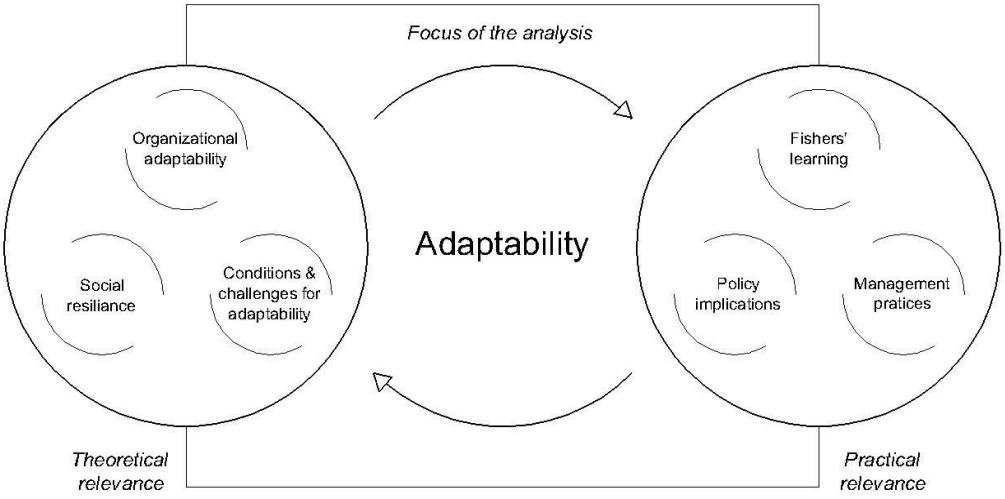

Figure 1-1 – Research framing: general objectives

1.6 STRUCTURE OF THE THESIS

The thesis is divided in three parts. The first part provides the research background, scope and research questions (Chapter I) and explains the research approach and design, along with its methodologies (Chapter II). The second part (Chapters III-V) provides results of the empirical work with the fish POs from Portugal and consists of three research papers. In third part, Chapter VI discusses results in terms of adaptability contribution to system resilience, identifies the flipside of the idea of adaptation and explores societal limits to adaptation and change. The concluding chapter (Chapter VII) briefly reviews the findings and their relationship; reflects on what they may imply for PO design and national fisheries (policy implications) and for human and institutional capacity to deal with change (further research).

Table 1-1 – Structure of the thesis

Parts of a research	Objective	Methods	Results
Paper I - Chapter 3	How to conceptualize organizational adaptability? Analysis and illustration of the ways in which adaptability of resource users' organizations contributes to social-ecological system resilience	Case study/ theory development and exploration	Analytical framework for studying organizational adaptability; Application to one PO case provides insights on crucial factors that foster adaptability; Specific ecological context of a PO required further analysis
Paper II - Chapter 4	What are the main factors that influence (enable or undermine) organizational adaptability? Deeper analysis of factors described in Paper I; Analysis of how adaptability as a management strategy impact POs management practices	Case study / theory exploration and development	Identification of key conditions behind different modes of adaptability among POs– exploration of theory developed in Paper I; evidence of the importance of agency for achieving adaptability (e.g.perceptions and attitudes)
Paper III - Chapter V	How individual fishers' perceptions influence organizational adaptability?	In-depth case study and grounded theory approach/theory development	Additional conditions to achieve / inhibit social learning and adaptability - exploration and further development of theory developed in Paper I and II
Discussion	What are challenges for adaptability? Identification of situations where PO adaptability fail as a social source of resilience	Reflection on findings in Paper I-III/theory development	Adaptability defined as a layered process; Deeper discussion of limits to adaptation at institutional, cultural (historical) and individual level
Conclusions and reflections	What are implications of these findings for human and organizational adaptability to change?	Reflection on findings/ further research	Beyond adaptability: institutional and individual change

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CHAPTER 2 - METHODS

METHODS

A central issue of this research is to understand how resource users' organizations perceive and adapt to pressures their livelihoods are facing and how this adaptability contributes to social-ecological resilience. Thus, besides literature research, the focus of research has been on employment of methods that enable the researcher to understand, assess and learn from resource users' practices (*what they are already doing in their contexts to adapt*) and on interaction with practitioners involved in resource management.

This chapter explains the research approach and research design employed in this thesis, including methodological techniques for data collection and analysis.

2.1 CASE STUDY APPROACH

This thesis has used a case study approach, found as useful when a *how* or *why* question is being asked about a phenomenon, which is hardly distinguished from the context and over which the researcher has little or no control (Yin 2003). Instead of generalizing to other cases, case knowledge enables an understanding of conditions under which specified outcomes occur and the mechanisms through which they occur (George and Bennett 2005). Hence, a particular set of results might be generalized to some broader theory (Yin 2003) or used as a pool of insights that readers themselves are invited to interpret in the context of their own experiences and research (Stake 1995). Either way, case knowledge is central to human learning; the researcher's continued proximity to the studied reality allows meaningful *understanding of human behaviour* and enables *learning through feedback from those under study* (Flyberg 2004). Both these features of case study approach were essential for our empirical work.

This research is exploratory in nature, based on the case study of fish POs. Examined POs participate in market and stock management where their capacity to cope and adapt to pressures from overfishing, market changes, regulatory measures, etc. is crucial for their performance. Therefore, the case of POs is a promising field for studies on the importance of adaptability in resource users' organizations. The empirical work relied on both single and multiple-cases of POs. There is a growing consensus in the literature that the best way of investigating phenomenon from case studies is the use of a combination of within-case analysis and cross-case comparisons within a single study or research program (although single-case studies also play a role in theoretical development) (George and Bennett 2005). We chose not to limit the research to single cases due to wide contextual diversity amongst Portuguese POs (e.g. ecological contexts, market conditions, geography, culture, etc.). These 'interesting contrasts' allow for a holistic study of the PO phenomenon and the possibility of drawing cross-case conclusions and applying them to broader theories is also greater (Yin 2003).

While observations in case study research are theory-led, they are not theory-determinate, thus they can also serve to generate new theories that can be further tested (e.g. Eisenhardt 1989, George and

Bennet 2005). From this perspective, an exploratory case study approach may be developed in line with another approach, that of grounded theory, which essentially implies the discovery of theory from data (Glaser and Strauss 1967). Research presented in this thesis assumes this iterative process of travelling back and forth between the theory and the evidence (Bryman and Burgess 1994). Initial deductive approach to case study design (research questions integrated in the analytical framework, based on the literature, and explored in the context of cases in Paper I and II) (e.g. Yin 2003) overlaps with the more inductive case-oriented process, tightly linked to data (Eisenhardt 1989) (essentially Paper III), in which insights and propositions emerge from the data collection (Strauss 1987).

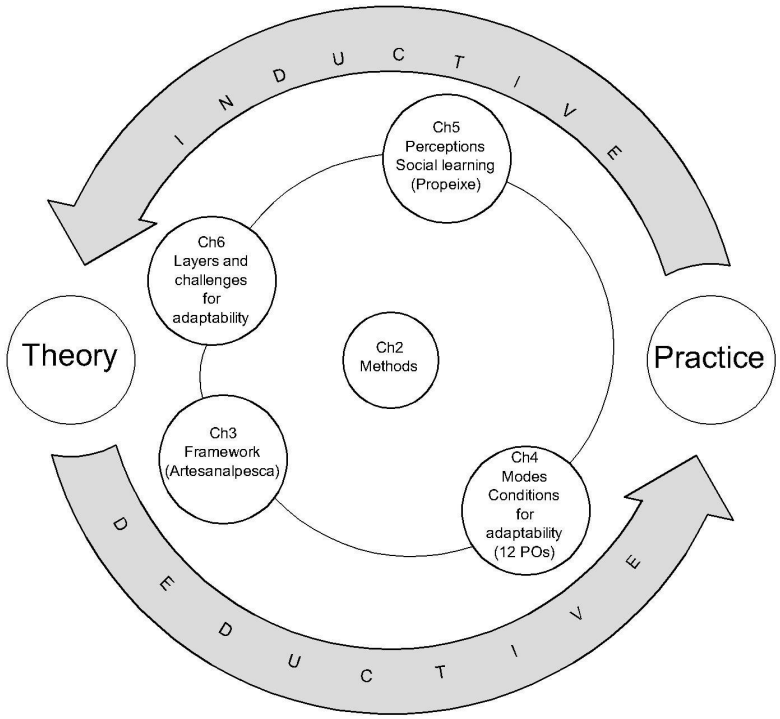

Figure 2-1: Schematic depiction of research approach

2.2 RESEARCH DESIGN

Overall, we investigated a total of twelve cases of POs during a period of four years (2009-2013), with different degrees of intensity.

The empirical research started with a historical analysis of transitions in the Portuguese fisheries (information partly included in the Introduction, Paper I and Almeida et al. *forthcoming*, co-authored paper). The aim was to clarify the wider contextual background (landscape trends) and the management problematic of national fisheries. This phase of the research was an essential component of the main researcher's learning process (due to lack of educational background and working experience in fisheries), establishing contacts and participating in fisheries networks. This phase also resulted in the selection of the case study (PO corresponds to 'embedded unit of analysis' (Yin 2004) within the broader national experience of 'organization of fishers') and the decision to focus

on the idea of *'adaptation'* as a crucial aptitude for PO performance and contribution to fisheries management.

Paper I analyzes and illustrates the ways in which organizational adaptability is important to the resilience of social-ecological systems. An analysis starts with a theoretical framework for studying organizational adaptability, which brings together, on the basis of resilience and organizational literature, the various factors that tend to influence organizational adaptability and identifies the questions by which to 'measure' these factors. ArtesanalPesca PO (Sesimbra) was used to empirically explore the relative weight of these factors and explain how their interaction plays a role in organizational change. Empirical work was based on participant observation and semi-structured interviews with ArtesanalPesca administration and leadership, guided by questions from the framework. The case provided an interesting example of organizational response to market crisis through adaptation as well as evidence of transformation of official market regime via internal adaptation. Moreover, it delivered lessons on how an organization might translate the idea of adaptability into their practices (strategies for adaptation). However, it fell short of presenting diverse realities amongst Portuguese POs due to its specific ecological context (monopoly over a black scabbard fish in continental Portugal).

In order to further understand how different contexts impact adaptability in fish POs – the study required more empirical data than it was possible to obtain through a single case. As a result, in Paper II, semi-structured questions from the framework were asked across multiple cases of twelve Portuguese POs. The method of *structured and focused comparison was used* because questions from the framework guided interviews and because comparisons dealt only with certain aspects of the cases examined (e.g. George and Bennett 2005). Comparative analysis of POs clarified the key factors behind different degrees of adaptability among fish POs (induced by differences in contexts, structures, type of crisis and response). The application of the framework to additional case studies also revealed the importance of agency and subjective attitude or motivations (e.g. perceptions, attitude and behaviour, i.e. egoism, self-interest, defensiveness, etc.). Consequently, the framework was expanded to include these aspects, which emerged from the results.

Once we found the importance of agency, we explored its weight for organizational adaptability on a specific case of Propeixe PO, Matosinhos (Paper III). Unlike ArtesanalPesca, case study evidence in Propeixe (Matosinhos) covered two different levels of analysis – a main unit ('case' of PO) and a subunit (PO membership, 'embedded' within the 'case'). The main methodological challenge was to connect the findings between these two levels of analysis as part of the same case study (Yin 2004). The fieldwork started with semi-structured interviews with fishers (PO membership), guided by the framework and the findings from the previous cases. Immediate fishers' reaction to these questions (i.e. misunderstanding, irritation, impatience) made us question conceptual ideas and the utility of the analytical framework for exploring fishers' opinion. In addition, preliminary analysis or 'open coding' of data (Strauss 1987) resulted in search for additional field evidence on the particular topics, such as *'perceptions'* (of PO membership experience) and *' learning'* (already indicated by the framework in Paper I). Two concepts emerged from the data as important determinants of fishers' adaptive

response to change and for collective engagement in resource management. Accordingly - how fishers (PO members) perceive their membership experience, what they (collectively) learn from it and how this impacts their capacity to adapt – surged as a set of interlinked questions in Paper III. To explore PO capacity to foster learning amongst its membership, the principal author returned to theory and examined the following: new theoretical insights on fishers' attitude and 'social learning', which helped study of perceptions and '*zooming in'* on the learning processes within the initial framework. A new set of interview questions focused on perceptions was designed and once again tested in the field with the Propeixe membership. Based on the social learning literature a social learning analytical framework was developed to analyze final data (perceptions), so-called 'axial coding' in grounded theory, or *putting back the data together in new ways*, by making connections between categories (Strauss and Corbin 1990). To connect the findings between the PO and its membership the deeper causes and outcomes behind (lack of) learning at both levels of analysis were clarified, while indicating how the 'case' of PO may nourish membership learning. The social learning framework further served to generalize from the case study findings in relation to the thesis objective: how social learning amongst fishers impacts PO adaptability. Finally, insights from the case studies in Papers I-III were used as data for a theoretical discussion and concluding reflections on societal dimension of resilience (Chapters 6 and 7).

2.3 DATA COLLECTION

Qualitative, phenomenological and hermeneutic research methods (Yanow 2000) were used to collect data for this thesis. Data were obtained and triangulated from different sources, such as literature review, documents (e.g. legislation, governmental reports concerning fisheries, reports from NGOs, newspapers articles), interviews and participant observation.

In the following section, the purpose and forms of the interviews as well as the use of participant observation for our fieldwork is explained in more detail.

2.3.1 Interviews

Interviews are more adequate when the number of informants is smaller, and the insights of informants, rather than factual knowledge, are sought (Kvale 2007). The purpose of the interviews for this thesis altered throughout research phases and depended on specific research questions (see papers for a detailed explanation).

To comprehend the realities and challenges faced by national fisheries, the existing literature, official reports, legislation and archival documents related to the sector were examined. In addition, semi-structured interviews were employed with key persons from the sector, i.e. professionals, scientists and activists (NGOs). Part of the analytical framework on organizational adaptability was based on focused questions, used to guide the data collection process as well as to organize the data collected for single case study (Paper I) and multiple case studies (Paper II). In both papers, the initial phase of interviews aimed to contextualize the PO work (structural and functional profile; awareness of

environmental and market trends). In the later phase of the interview process, upon acquiring sound knowledge of the subject matter, a narrative form of interviewing (Mischler 1986) was employed. The irreducible quality of good case narratives is essential for case knowledge contribution to learning (Flyberg 2004). Also, certain phenomena are best understood narratively. A narrative communicates the meaning of a series of events (rather than describing a state of affairs) through the use of evaluative statements and through the temporal configuration of events (Elliott 2005). In Paper I and Paper II, the narrative is employed in order to focus on the way in which individuals (PO leaders) make sense of their experience, e.g. how PO adapts and copes with resource/market trend or crisis. In this context, narrative can be understood as a communication tool in which a PO leader can externalize, give meaning and indicate which elements (factors) of communicated (adaptive or maladaptive) experience are most significant. These interviews were the units of observation. They explore both topics that are common for all POs as well as main distinctions between POs in terms of how they deal with their contexts.

In Paper III, interview format went from semi-structured - to more informal, 'conversational' mode of interviewing (Yin 2004) - to new semi-structured format based on new literature on fishers' behaviour and social learning. The specific interview format, covering both PO leadership and membership (some with double membership experience) provided a rich data set and detailed personal accounts (relevant for the objectives of Paper III).

In total (*n=65*) interviews were conducted between March 2010 and July 2013; interviews ranged in length from 90 minutes to three hours.

2.3.2 Participant observation

Participant observation provided additional illustrations of case study evidence (Yin 2004). In the case of Paper I, the principal author went fishing with one of the PO vessels. Informal interviews and participant observation was used to obtain information about what it means to be a fisher – what fishers actually do at work and to understand dynamics between crewmembers. Due to logistical constraints there was no separate time dedicated to participant observation, but it was embedded in the entire interview process – before, during or after the interview. Since most POs (ten out of twelve) are located in landing ports, visiting PO facilities also provided important information regarding the overall dynamics in ports: landing of fish, interaction between fishers (crew members) and ship captains, dynamics between buyers and producers at the fish auctions. Discussion of this evidence was mainly integrated in the explanation of the case study context as well as used a supporting data for contextualizing respondents' narratives.

2.4 DATA ANALYSIS

The interviews were recorded, transcribed and then content analysed by the main author. Unlike laboratory research (e.g., defining hypothesis, collecting, presenting, analyzing data and offering conclusions), case study analysis can occur at a variety of stages, such as while you are still in the

process of collecting data (Yin 2004). In other words, analysis was considered to be a continuous process, rather than a distinct phase of research, that is interwoven with other research processes, i.e. research design and data collection (Bryman and Burgess 1994). This being said, our work provides evidence of a distinct approach to this subject in terms of how soon a researcher engages in data analysis.

The framework on organizational adaptability guided both the data collection and analysis (Paper I and II) phases of the research. Data received were extracted and structured around key themes from the framework (subsequent to data collection). In Paper II this information was used to compare POs and identify different outcomes or modes of adaptation. Factors from the framework are used to explain adaptation modes and results are further discussed in terms of key reasons for different adaptive response amongst POs. In Paper I, one PO was used to explore the framework elements and their multiple interactions; the framework provided the canvas to explain 'spirit of change' in the PO.

In Paper III, interpretative analysis (Blaikie 2000) of interviews took place very early on during the data collection process. This preliminary analysis was of crucial importance for the overall study objectives and conclusions. Overall, analysis was employed in three phases: 1) exploring fishers 'perceptions' (the most relevant aspects emerged from interviews) 2) inferring 'social learning' from perceptions (interpreted in the context of social learning framework) and 3) discussing implications for 'adaptability' in PO (for details see Paper III).

Significant statements/ excerpts from narrative interviews were included in all papers as 'fishers' voice' and used to illustrate organizational adaptive experience or lack thereof.

2.5 ETHICAL ISSUES AND LIMITATIONS OF RESEARCH

> *'…how will I explain this…there are things that you know I cannot tell you…'*
>
> PO leader, quote from the interview, 2013

There are few conceptual and practical challenges that the present research had to take into consideration. To start with, data collection in this work depends almost exclusively on the input, trust and willingness of various persons to reveal facts, opinions and ideas regarding the subject in question. Any research involving human subjects requires that the researcher follows an ethical code which ensures that no participants are harmed (physically or psychologically), that there is mutual respect between researcher and subject and that the latter is respected and treated equally (Murphy and Dingwall 2001).

The principal researcher took every care to ensure that this ethical code was respected and hopes that this work will help those under study (POs from Portugal) by providing a deeper analysis that enables them to understand their own realities better. Such analysis is based on the concept of 'adaptation', which is, in one way or another, interpreted as a positive societal trait. Herewith, by

identifying different modes of adaptation amongst POs and classifying certain POs as ‘maladaptive’ or ‘problematic’ (Paper II), the reader can jump to the conclusion that these POs do their jobs poorly. However, the idea was not to grade anyone, nor to lead to any judgement of ‘who does a better job’. What we tried to do was to clarify different facets of fishers’ adaptation in practices and how it influences their livelihoods. Nonetheless, possible assumptions that ‘being less adaptive’ means ‘doing things badly’ and our duty not to harm research participants framed the way we presented results in Paper II. Indeed, the anonymity for POs was ensured, providing the reader with the space to focus on practices and conditions that led to these practices rather than on the identity of a particular PO. This also gave us the opportunity to communicate valuable, but ’public secrets’ disclosed by respondents. In order to maintain confidentiality, verbal consent was sought from respondents following a brief explanation of the nature and purpose of the research. Interviewees (POs) had an opportunity to view the summary of work (papers) before their final submission to journals for publication. The main practical limitations were the principal researcher’s lack of educational background in fisheries and certain language barriers in the first phase of the empirical research (all done in Portuguese).

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CHAPTER 3 - AN ANALYTICAL FRAMEWORK FOR STUDYING ORGANIZATIONAL ADAPTABILITY

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HOW TO LEARN TO BE ADAPTIVE?
AN ANALYTICAL FRAMEWORK FOR ORGANIZATIONAL ADAPTABILITY AND ITS APPLICATION TO A FISH PRODUCERS ORGANIZATION IN PORTUGAL

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ABSTRACT

This paper analyses and illustrates the ways in which organizational adaptivity is important to the resilience of socio-ecological systems (SESs). Resilience and organizational literature are used as theoretical contributions to help understand the nature of adaptive organizations and how changes in external structure and in organizational practices may reinforce each other. Building on this literature review, we elaborate an analytical framework for studying organizational adaptability. We apply the framework to a case study of the ArtesanalPesca fish Producers' Organization (POs) from Sesimbra in Portugal in order to empirically explore the relative weight of the factors contained in the framework and the relations between them. The case outlined contains lessons on how adaptivity may help an organization to move towards a sustainable business model and how it may be an essential part of such a model.

Keywords: socio-ecological resilience; adaptive organizations; organizational learning; fishermen

3.1 INTRODUCTION

It is widely acknowledged that the problem of ongoing resource depletion cannot be solved by considering humankind and nature independently (Walters 1986, Berkes and Folke 1998, Gunderson and Holling 2002, Berkes et al. 2003). This realization calls for an understanding of resource management in terms of resilience in socio-ecological systems (SESs). Walker et al. (2004) argued that, in order to contribute to system resilience, resource-using organizations essentially need a capacity to learn, self-organize, respond to external shocks and restore balance. However, the kinds of social mechanisms at work behind these processes are still not very clear. Folke (2003) identified four critical factors required by organizations to deal with resource dynamics in complex SESs. They are: (1) learning to live with change and uncertainty, (2) nurturing diversity for reorganization and renewal, (3) combining different types of knowledge for learning, and (4) creating opportunities for self-organization. *In other words, organizations that contribute to system resilience must be what we will call here 'adaptive organizations', i.e. organizations that foster adaptability.* Hahn et al. (2006) regard such organizations as flexible institutions, as they foster an environment that is geared towards learning and enables them to accept and deal with constant change and uncertainties. Recent work by Ostrom (2009) develops the same themes, providing a multi-level nested framework for analysing SESs and focusing in particular on the self-organizing ability of resource users.

This paper takes these principles as a point of departure and expands on them, drawing on theoretical contributions from the fields of resilience and organizational studies to build a framework in which to analyse organizational adaptability as a key condition for resilience in a SES. This framework comprises both the mechanisms and the conditions for organizational adaptation. We then apply the analytical framework to a specific example, in order to explore how it may be used, how its different elements may be interrelated, and to identify key issues for further investigation in additional case studies. The case chosen here concerns an obvious example of resource users' self-organization: a so-called Producers Organization (PO), created in Portugal under the EU's common market policy as an instrument to regulate the market and plan production. We apply the framework to one particular crisis and the post-crisis period, enabling us to investigate how the organization learned to think and act differently, and how its structure and environment influenced this process.

The proposed analytical framework is also relevant and useful for discussions concerning what constitutes a sustainable business model, as it transfers the focus from new products, services and technologies (e.g. Hall and Kerr 2003; Clark et al. 2003) to the competitive advantage of 'processes' within an organization - in particular, learning from change and changing throughout the learning process.

3.2 FRAMING CONCEPTS

3.2.1 From crisis to resilience

Resources used by humans are embedded in complex SESs which are composed of subsystems and which, in turn, form sets of larger systems. Resilience in complex SESs has been defined in several ways (e.g. Folke et al. 2002, Walker et al. 2004). It essentially entails ideas about uncertainty and complexity and probing into the unknown and unexpected. Combining several definitions for the purposes of this paper, we would suggest that a resilient system is able to *buffer or absorb disturbance and continue to develop* while *adapting to changes* by means of *learning and self-organizing.*

Essentially, socio-ecological resilience is based on two main postulates. First, referring to the system approach and adaptive management (Holling 1978, Walters 1986), it conceives of resource management as a complex system involving non-linear relationships and thresholds, in which the ecosystem responds to human actions in a non-linear and unpredictable way. Important in this regard are notions of *feedbacks and thresholds*, that is, points at which the system changes from one state to another. Resilient systems evolve through time, passing through adaptive cycles and multiple stability domains (growth, conservation, reorganization and renewal). Change in resource management rarely occurs during the growth or conservation phases. Crises, *followed by short periods* of rapid change (the Schumpeterian «creative destruction»), *can serve as a source of system reorganization and renewal* (Holling 1978, Colding et al. in Berkes et al. 2003). Adaptive cycles are nested in a hierarchy across time and space (Gunderson et al. 1995). This cross-scale *(panarchy)* depiction helps us to understand the interconnectedness of systems, states and dynamics between different scales (Gunderson and Holling 2002). To maintain resilience, a SES requires *continuous change* and *«acceptance of disturbance»* (Holling 1973). The way a system will respond to change depends on its elements and their diversity: *the greater the «response diversity»* to external changes, *the greater the resilience* (Elmqvist et al. 2003).

The second postulate addresses the particular links and interdependencies between ecological and social resilience (e.g. Berkes et al. 2003 and Adger 2000). While natural systems are inherently resilient, evolving and changing through adaptive repetitive cycles, *social systems are learning systems*, persisting through time mainly as a result of learning processes[9]. To understand SESs analytically we need to appreciate fundamental features of society such as cultural norms and human attitudes and behaviour (Adger 2000). At the same time, human behaviour is framed by wider contextual factors which act as drivers for change within SESs, such as the panarchy of contexts, long-term socio-historical trends and the regime (e.g. the fisheries sector). These factors – including their mutual alignment – constitute the historically evolved structural context of polity, market, civil society and innovation system. In the next section, we use organizational literature to understand what influences an organization's capacity to be adaptive.

[9] Buzz Holling, interview with the Stockholm Resilience Center, 2010.

3.2.2 Organizational learning and change

Since the 1960s, theoretical perspectives on organizations have changed with the adoption of an open system framework (e.g. Katz and Kahn 1966) as well as complex adaptive system (CAS) theory and its application to organizations (Gunderson et al. 1995). Accepting open system ideas implies recognition of organizations as «responsive systems shaped by environments, as collective actors themselves shaping their context, or as component players in larger, more encompassing systems» (Scott 2004: 8). The CAS perspective means that organizations are no longer observed solely through their actors and processes. Traditional organizational definitions emphasized closed structures, planned coordination, fixed boundaries, a clear division of tasks and functions among an organization's members, and a hierarchy of authority and responsibility (Schein 1965). This is the 'performance subsystem of the organization' (Robb 2000), whose purpose is to ensure that the organization performs at its best and remains competitive. As Robb argues, a resilient organization, as a hybrid entity, also includes another, almost opposite, element: the adaptive subsystem, responsible for innovating and adapting to external changes. The characteristics of an organization's context, the organization's specific structure (rules and guidelines) and its processes form a basis for the performance capacity of the organization; *the way an organization deals with its specific contexts (by adapting its structure and through its internal processes) and eventually changes them is perceived as the organization's adaptive capacity*. Contexts, structure and processes are the basic elements of our analytical framework. Among the processes, responses to changes in context are crucial enough to warrant separate attention.

We will conceive of such response processes in terms of organizational learning (Argyris, 1977; Argyris and Schön 1978, Bandura 1977). As argued in Grin and Loeber (2007), approaches that emphasize the social and embedded nature of organizational learning have produced significant insights into the ways in which *organizational learning and structural changes* in organizational context *may reinforce each other.*

Faced with a sense of urgency brought on by events such as unexpected failures, successes, or other surprises, organizations and their members need to develop a capacity to adapt frequently to external changes. This implies not only changing the available means, or tools, for solving problems and achieving goals («single-loop» learning) but also stepping back, reflecting on the problem, on the goals themselves and on the relationship between them: «double-loop» learning (Argyris 1977), or «higher-order» learning (Brown and Vergragt 2008). Learning occurs through feedback stimulus mechanisms (trial and error) during the problem solving process.

Building on Argyis and Schon's work, Senge (1990) developed the concept of organization itself as a learning entity. Learning organizations, because of their learning capacity, are able to understand better and faster the consequences of changes in their environment and to respond to these changes by altering their own underlying values and assumptions. Influencing change has been identified as the essence of leadership in organizational literature (Yukl 2001). Different types of leadership encourage different behaviours, interactions and practices and thus exert different influences on change processes (Sosik and Dinger 2007).

Scott (2004) distinguishes between four interrelated types of organizational change process: changing conceptions, changing boundaries, changing strategies and changing power processes.

Conceptions may change through organizational learning, whereby people re-examine or change their initial perspectives on a problem (problem framings). This serves to expand the range of options and solutions available (Bardwell 1991, Isendahl 2010). Organizational learning may also lead to changed boundaries. Whereas in the context of traditional hierarchical organizations boundaries were mainly perceived as structural divisions between organizations, 'boundary organizations' (Guston 2001, Cash et al. 2003) serve as a bridge between different domains. This bridging is enabled by 'learning at the boundaries' and by networking, and leads to changes in the boundary itself. Boundary organizations may play an important role in co-managing natural resources, e.g. through improved resource management (Miller 2001), empowerment of local communities and establishing of social networks (O'Mahony and Bechky 2008), improvements in organizational capacity (Schneider, 2009), and enhanced trust and adaptive capacity (Carr and Willkinson 2005). Changed boundaries can imply changed strategies, that is, the way organizations relate to their environments (Scott 2004). Strategic choice further impacts organizational performance, organizational design and indeed organizational structure itself. Such strategies will often include the generation of novelty and creativity (Gunderson in Berkes et al. 2003). Organizational innovation can be defined as the adoption of an idea or behaviour that is new to the adopting organization (Damanpour and Gopalakrishnan 1998), leading to either technical innovations and/or social administrative innovations.

Processes are not only induced by (changes in) context, but may also lead to (or at least contribute to) changing the context and changing of power dynamics. As argued in Grin (2010: 282-283; 2011), the realization that power is not merely an attribute of agents and their relations per se is crucial. Power is also a structural feature. As Arts and van Tatenhove (2005) have argued, in addition to actors' *relational* power (including money, knowledge and social capital) that determines their strength vis-à-vis other actors, there is also the power implied in the structural context, which privileges particular practices and discourages or complicates others, thus constituting *dispositional* power. There is thus a complex, bi-directional and dialectical relationship between changes in context and the exercise of power by agents (Grin and Miltenburg 2009, Avelino 2009, Grin 2011).

3.3 FRAMEWORK FOR STUDYING ORGANIZATIONAL ADAPTABILITY

Building on this literature, a conceptual framework was developed (*Table 3-1*) with the aim of (i) compiling the internal and external factors thought to influence organizational adaptability and (ii) identifying the questions, or criteria, by which to 'measure' these factors. The analytical dimensions identified in the framework are explored in more detail in the following paragraphs.

Table 3-1 Organizational adaptability framework

DIMENSION	WHAT to look for: FACTORS	HOW to "measure/consider" them?
CONTEXT(s)	Variety of contexts, i.e. ecological, socio-economic, cultural, political, relational, etc.	Identify the main characteristics of the organizational contexts and how they interrelate between each other.
	Long-term historical trends	How has the organizational environment been evolving through time? Identify crucial periods of change: how did the organization react?
	Evidence of historical change	
	Problem framing (regime)	How does the organization define the main problems regarding the sector and how does it position itself for finding solutions?
CRISIS	Crisis as an opportunity for change	Type of crisis, e.g. resource scarcity, economic crisis
		What happened and why?
STRUCTURE	Land-based facility	What is there in terms of infrastructure, installation, storage capacity and technology?
	Rules and guidelines	How does the organization function (constitutional and operational rules)? Who establishes these rules/guidelines?
		Do rules tend to be strict or flexible?
	Defined roles of members	How are members' duties and responsibilities defined? How do members participate in the decision making process?
	Strong leadership	How easily can the leader be identified? Identify the leadership type.
PROCESSES	Organizational learning	Evidence of "double-loop" learning: what changes as a result of "double-loop" learning? Who facilitates these learning processes and how?
	Capacity for networking and negotiation	What type of network has the organization developed, and with whom? Why were specific actors chosen? Who is the most active in negotiating and networking?
	Leadership processes	How is the leader leading and how do the members feel about his/her leadership? What is the leader's role in influencing change?
Responses to change in context are seen as a part of processes and organizational learning	Changing conceptions: problem statement	Compare conceptions/problem framings before and after the crisis.
	Changed structure - changed strategy and vice versa	How are changes in structures and strategies interrelated? How does organizational innovation influence changes in structure?
	Evidence of organizational innovation	
	Changing behaviour and attitudes; feedbacks to change and learning; internal resistance and inertia	How do organization members react to organizational change? This also includes dealing with problems of resistance and inertia embedded in the regime
	Changed organizational boundaries and identities (of both the organization and other	How has the organization contributed to, and drawn upon, changes at the regime level?
	Changed rules and resource distribution	If the example works well, how to move it further, drawing upon the power changes implied in regime change.
	Changed power relations	

3.3.1 Context(s) or organizational environment

The behaviour of resource users' organizations is framed by a variety of contexts: ecological (type of species, signs of resource scarcity), socio-economic (community dependence on fishing), cultural (norms, attitudes and beliefs, mentality), geographical (location, proximity of large industries), political (regime) and relational (competition, group dynamics within the organization and its relationship with other organizations). Organizational behavior is also framed by long-term socio-historical trends. The way the organization positions itself within the relevant regime (e.g. fisheries sector) and the way it defines the main problems and responds to its obligations (e.g. fish commercialization in the context of the POs) is essential for defining its adaptive and performance capacity. Among resource users' organizations, this is the dimension that accounts for the maximum degree of variation.

3.3.2 Crisis

Here, we concur with Gunderson in Berkes et al. (2003), who considers crisis to be a surprise that cannot be handled using established management practices or policies. The way in which crises are dealt with has a crucial impact on resilience. Folke et al. in Berkes et al. (2003) identify three possible responses to a crisis: (1) 'no effective response', usually followed by institutional inertia and an attempt to maintain the status quo, (2) 'response without experience', which may lead to new types of arrangements, management institutions (new rules and norms) and social learning, and (3) 'response with experience', based on institutional learning and a socio-ecological memory of facing crisis in the past.

3.3.3 Organizational structure

Organizational structure is a formal set of rules and guidelines upon which all partners have to agree. Questions of interest are: How representative is the organization? What are the organization's objectives, and how were they defined? How were rules and guidelines agreed upon and by whom? Were all members involved in the process? Was anyone excluded? How do these rules define roles and duties within the organization?

3.3.4 Processes

In contrast to traditional organizations, where processes are deeply embedded in their structures (Schein 1965), a flexible organizational structure is 'created and recreated' by its processes (Scott 2001b:10913). Our particular focus is on learning processes that systematically stimulate the generation of new ideas while reflecting on what the organization has learned from past experience. An emphasis is also placed on networking, feedback loops and the mechanisms of leadership capable of influencing organizational responsiveness and adaptability.

Responses to change in context are seen as a part of processes and organizational learning. We consider these as processes that are distinct insofar as they result from external changes; otherwise,

they can be depicted on the basis of Scott's four elements discussed above: changing conceptions, changing boundaries, changing strategies and changing power processes.

3.4 CASE STUDY: ARTESANALPESCA FISH PO

3.4.1 Motivation and Methodology

We chose the ArtesanalPesca fish Producers' Organization (PO) in Sesimbra, Portugal as a case study to empirically explore the relative weight of the factors that are believed to influence organizational adaptability and the relations between them. The ArtesanalPesca cooperative was chosen to test and further develop the framework because as an organization it displays a high degree of adaptability: its responsiveness to crisis resulted in a heightened adaptivity to its context (through changes introduced in its structure and processes), while there is evidence that this adaptability contributed to wider system resilience.

We obtained and triangulated data from different sources, including a survey of the literature, a document analysis, interviews, and observation of the organization's dynamics and activities. In total, 12 interviews were conducted with members and with the management of ArtesanalPesca in 2010 and 2011. This included an interview with the biologist who works on the issue of sustainability and quality control. The first set of interviews (February 2010) was semi-structured, based on a short set of questions relating to the categories in our analytical framework. In the second cycle of interviews (October and November 2010), the focus was on interviewees' perceptions regarding a particular crisis, as well as any other stories they thought were relevant to understanding organizational change. In February 2011 the principal author went fishing with one of the ArtesanalPesca vessels, counting eleven crew members (six working on land and five on board). Informal interviews and participant observation were used to obtain information about the fishing work and to understand the dynamics between the crew members. All interviews were recorded and transcribed. Following standard narrative interviews methodology (Mishler 1986), significant statements/phrases were extracted and organized into the themes suggested by the framework.

3.4.2 Background: what are POs?

As the EU's common fisheries policy instrument, POs bring together fishermen or fish farmers on a voluntary basis with the aim of planning their production and ensuring the best market conditions for their products. To accomplish this, the regulation requires that POs prepare an annual operational programme and a marketing strategy. Members must sell their fish solely through the organization, using mainly fish auction markets or direct sale contracts. POs are allowed to use the benefits of the withdrawal price, established on the basis of the guide price fixed by the Council of Ministers. When the price of the fish drops below a minimum level (withdrawal price), members receive financial compensation from their POs in accordance with the rule: the more fish are withdrawn from the market, the lower the intervention paid. In addition, carry-over aid is provided to POs who process and

store their fishery products and return them later to the market when prices are more attractive. This aid is also limited, so that POs have an incentive to be more active in regulating the market by gaining better control over the price of their products.

To be recognized by the EU member state concerned, POs must fulfill several structural, economic and legal requirements. There are currently 15 POs in Portugal at various stages of development. Most fishery products are sold on the fish auction market using the descending-bid type of auction, also called the Dutch auction (where the auctioneer starts at a higher price and gradually lowers it). The problem with this auction system becomes evident when supply is higher than demand, as retailers are able to manipulate the price and significantly lower it. Not knowing how much they will earn, fishermen fish more to earn more, contributing to resource depletion. Fishing more to earn more brings more fish to the auction; more fish on the auction (not articulated with market demand) results in a further drop in price (not evident in the final price for the consumer). Most of the POs in Portugal were formed around 1986, following accession to the European Community. Whereas some POs have maintained the same structure they had in the past, others have changed over time, introducing innovation in organizational practices, services, products, technologies and processes. In the following section a specific example of such an organization is described.

3.4.3 ArtesanalPesca PO

ArtesanalPesca fishermen's cooperative is located in the port of Sesimbra in the district of Setubal, central Portugal (*Figure 3-1*). When the organization was initially created in 1986 its members were mainly fishing for white scabbardfish in Morocco. When a bilateral agreement with Morocco expired in 1999 most of the vessels came back to Sesimbra and started to capture black scabbardfish using the artisanal longline technique (adapted to continental waters from the traditional Madeira longline fishing gears). Today, the organization has exclusive rights to catch the black scabbardfish on the Portuguese continental slope. Of the 43 members (vessel owners) in the organization, 16 are dedicated exclusively to harvesting black scabbardfish in four areas along the Portuguese cost (Sesimbra, Peniche, Figueira de Foz and Matosinhos). All landings are eventually brought for sale to Sesimbra port. According to Bordalo-Machado and Figueiredo (2002), this type of fishery has sustained nearly 300 families in the region in the last 20 years. Although fishery activities have seen several technical improvements in that time, the fleet still displays artisanal features (for a detailed explanation, see Bordalo-Machado and Figueiredo 2009). Other species are dogfish, octopus, sardines and mackerel.

Figure 3-1: Location of the case study (ArtesanalPesca, Sesimbra)

During the last decade, ArtesanalPesca built an industrial facility (fish processing plant) with a size of 1600 m^2 that employs 40 people. As a result of this, the organization has reorganized its work processes and fishery practices as follows. It receives daily orders for black scabbardfish from the supermarkets and local markets. The 16 vessels go out fishing 2-3 times/week, depending on the market demand. The total fish catch is bought by ArtesanalPesca for the fixed price and is further prepared in the fish processing plant. The fish are then sold on at a price including a small margin for marketing to maintain the functioning of the (non-profit) organization. The changes mean: no more retailers, no more working with the withdrawal price, and a fixed and stable income for ArtesanalPesca fishermen (the agreed contract price with ArtesanalPesca is higher than the withdrawal price and the average auction price). But how did this change happen?

The development process went through several phases and is still continuing today. Between 1993 and 1995, in order to become less dependent on the constant market fluctuations, ArtesanalPesca decided to build a storage facility and asked its members to contribute financially. Not everyone reacted with enthusiasm. Of the 60 members (based on membership since 1986), only 20 believed in the project, invested their money, and remained members of ArtesanalPesca. The first phase of the fish processing plant was inaugurated in May 1995; the second phase was finalized in 2003.

However, the real change happened in December 2004, during the maximum landings of black scabbardfish (September – January), when the price on the auction market fell to less than 1 euro/kg. All the fishermen dedicated to this species (most of them left the organization during the period 1993-95) decided to stop fishing, as they were not able to cover their production costs. They also requested a meeting with the ArtesanalPesca management, asking if the organization could do anything to protect their interests. The board of directors responded immediately: they supported the interruption of fishing operations as a temporary solution, but assured the fishermen they would also do something

more substantial. Following this, ArtesanalPesca invited all those fishermen who had left the organization to join it again. This decision gave rise to conflict: current members were against the admission of the new ones, as in the past they had not believed in the joint strategy regarding investment in facilities. This conflict was mediated during several meetings until finally, in January 2005, the majority of vessels became members of ArtesanalPesca. In the same year the organization started freezing and packaging its products. Risky investments in internal structures to store, preserve and process fish partly resolved the problem identified above of unfair pricing when captures are high. It also led to initial contracts between ArtesanalPesca and major supermarkets, assuring periodical sale of large quantities of fish at the fixed price, which was higher compared to commercial prices on the auction market. In addition, these contracts (the first, in 2005, guaranteeing the purchase of 20-30% of the fish caught, rising to 50% under the second contract in 2006) propelled ArtesanalPesca into the world of relations with the fish buyers. This was the good news.

The bad news was that the price of the black scabbardfish that stayed on the auction market started to increase (the same number of buyers chasing fewer fish). The first reaction of the fishermen was revolt: they felt deceived and, surprisingly (or not), started to consider the fish within the contract as a 'bad deal' in comparison to the fish that stayed on the auction market. As a result, many of them stopped delivering to the organization what was previously agreed. The 'bad deal' with the contract quickly became a very good one, though, once there was plenty of fish on the auction market and the price there went down as a result. These ups and downs caused a lot of problems for the organization: when members were not delivering the agreed quantities, the organization lost money as it had to buy the missing quotas on the auction market, paying a higher price compared to the contract. It seemed that the organization's members were unable to recall the overarching objective of dealing with the unpredictability of the auction price – which is why they had approached the organization in the first place. This internal resistance to organizational strategy also created a bad atmosphere between the members who were delivering the agreed amount and those who were undermining the agreement and earning more at the expense of the cooperative. 'We had to decide: all [buying all the fish] or nothing[10]'. Once again, the management organized meetings with its members to resolve the conflicts and to explain the problem using real numbers (the difference between average earnings on the auction market, with large price fluctuations, compared to earnings within the contract).

Finally, in September 2007 the organization gathered enough capital to buy the total amount of fish caught from its members and to remove their fish from the auction system. Despite having secure distribution channels, buying everything was a complex and risky process. One management member of ArtesanalPesca recalls this period: 'When you 'do change' (go through change) no one is satisfied. But we knew that this was the only direction we should choose for the future. If you go now and speak with a fisherman, he will tell you that he is satisfied with the way things are now; he doesn't want to change anything…but, before, initially, it wasn't like this at all…It took time, but we've all learned[11]'. *Figure 3-2* summarizes this crisis.

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[10] Personal interview with Carlos Alexandre Pinto de Oliveira Macedo, Fiscal director, ArtesanalPesca, November 2010

[11] Personal interview with Manuel José Gomes Pólvora dos Santos, Treasurer, ArtesanalPesca, November 2010

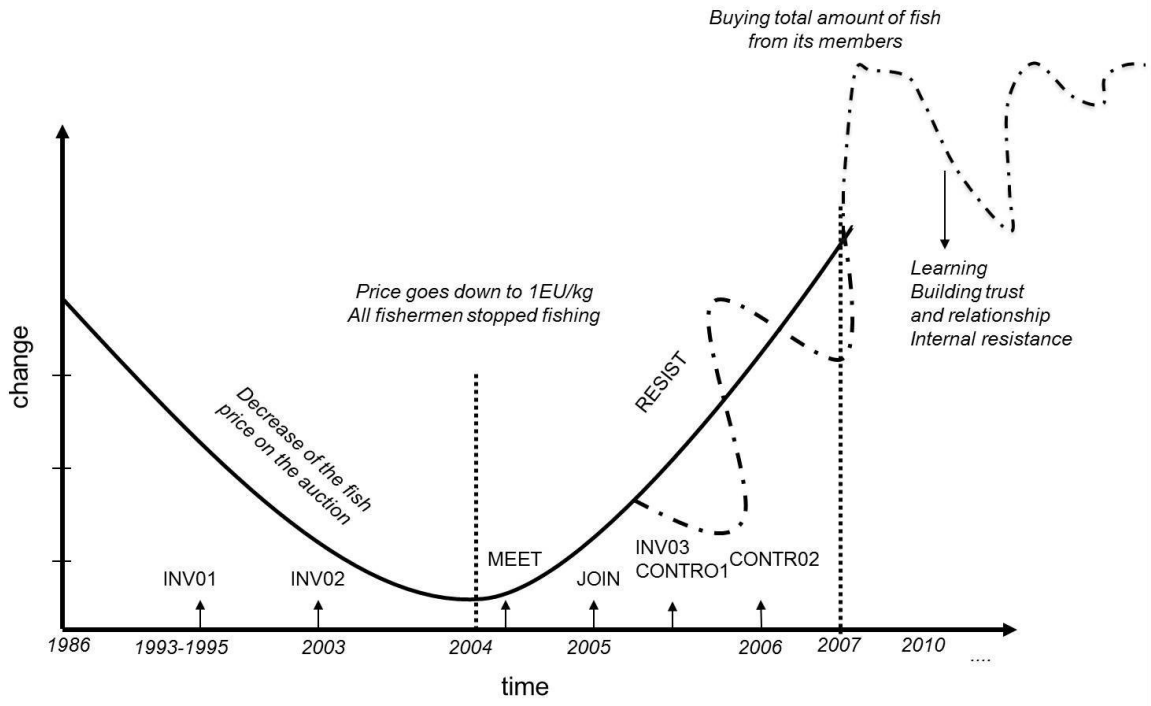

Figure 3-2: Crisis period

INV01 – 1st storage facility; inauguration of the first phase of the fish processing plant; INV02 – 2nd phase of the plant finalized; MEET – Both members (4) and other fishermen fishing black scabbardfish asked for a meeting with ArtesanalPesca; JOIN – Majority of vessels became members of ArtesanalPesca; INV03 – Start-up of freezing and packaging industry; CONTR01 – Contracts with the supermarkets, 20-30% of the first sale through contracts, the rest going to auction; CONTR02 – At the beginning of 2006, sales through the contracts increased to 50%; RESIST – Fishermen feeling deceived: auction price increase; not delivering agreed amount to ArtesanalPesca.

3.5 ANALYSIS: TRACKING DOWN ORGANIZATIONAL ADAPTABILITY

In this section, the framework elements and their multiple interactions are used to explain the 'spirit of change' in ArtesanalPesca as it evolved over time.

3.5.1 Contexts

The core of the initial problem was that political structural (contextual) factors in particular (*the black scabbardfish monopoly, rules of the auction system, and the withdrawal price*) generated incentives that led to both low fishermen incomes and high catch volumes. This in turn gave rise to persistent socio-economic and ecological (resource) problems. Working within an *unjustified market model has been a historical reality for a long time:* national fisheries have never operated in free market conditions, passing through a variety of regimes, from protected corporate fisheries (supportive of the retailers lobby) to the EU subsidy system. This long-term historical trend has resulted in a *market-averse attitude within the fisheries community, making people structurally 'trapped' within a traditional*

definition of their role and contributing little to solving the resultant problems: 'The main problem in the way we work is our *mentality*. We are used to getting to the shore with the fish, delivering it to 'someone else' for sale, and then coming back and waiting for the earnings. It's only that every year we earn less, and we understood that we need to be sellers of our own product. But most of us do not have the time or competence to do this. That's why we needed an organization'[12].

3.5.2 Crisis

New opportunities arose during an economic crisis that was related to the failure of the market regime. Although it was far from unusual, the local fisheries community did not anticipate its magnitude. ArtesanalPesca's responsiveness to the crisis can be classified as 'response without experience' (Folke et al. in Berkes et al., 2003), based on the idea that it is necessary first to stabilize the wholesale price*, 'as fish is always the same'*[13].

The response entailed creating a changed structure, in this case, *a fish processing plant*. By *controlling market supply,* this facility already solved some of the problems. ArtesanalPesca's *monopoly on black scabbardfish* was an ecological contextual condition that gave the organization an additional competitive advantage compared to other POs and significantly facilitated commercialization practices. New practices encouraged changing conceptions and an associated change in strategy: instead of looking at daily income (short-term perspective, typical within the fisheries community), the organization applied a *long-term strategy* (calculating the average price in a good fishing year and taking this price as a point of reference for the following years, including operational costs). Structural change resulted in new forms of rules and guidelines and redefined organizational boundaries, implemented through the creation of networks and through negotiations with supermarkets that require a regular supply and large quantities. A crucial factor behind the processes of response that led to these structural changes, as all those interviewed reported, was the principal manager's capacity for networking, negotiating and managing investments in a credible way. This was framed by the leader himself as 'we have the capacity to structure things so that they work out![14]' The processes just discussed were shaped by and led to further changes in organizational structure.

3.5.3 Changing the context

Yet, the market power of retailers, as part of the political structural context, undermined the system established by ArtesanalPesca. One immediate response to change made by some of the PO's members was to pursue a traditional solution (selling fish on the auction market) rather than to go

[12] Personal interview with Carlos Alexandre Pinto de Oliveira Macedo, Fiscal director, ArtesanalPesca, October 2010

[13] Personal interview with Manuel José Pinto Alves, President, ArtesanalPesca, November 2010

[14] Personal interview with Manuel José Gomes Pólvora dos Santos, Treasurer, ArtesanalPesca, November 2010

along with the solutions proposed by the PO. This led once again to a situation in which high (and unplanned) catches led to low (and unpredictable) prices. This internal resistance and inertia, framed by one of the members as an 'addiction to the old way of doing things', was related to existing power relations as well as to the fishermen's individualism, independence and short-term focus on profit. The PO dealt with it by creating an environment for continuous organizational learning, referred to by PO management as "*the daily battle of explaining, convincing and listening*[15]". Finally, these issues were resolved by another structural change, a rather rapid and risky decision to entirely bypass the auction system. Thus the context not only triggered processes of adaptation but was also the object of adaptation. A changed market regime resulted in changed rules and resource distribution and encouraged further changes of boundaries and identities of various actors within the structural (market) context. Although the PO's capacities and power vis-à-vis others increased there are still examples of regime actors' inertia and fondness of the status-quo. For example, some major retailers do not like the fact that ArtesanalPesca is the only agent from whom they can buy the black scabbardfish, and so they sign contracts with individual vessels to buy fish from them at a lower price). The PO's remedy for these cases (as well as for the ongoing 'addiction' to inertia) consists in increasing its 'response diversity' through organizational innovation (diversifying its products and services) and by remaining aware of continuous change as a learning process.

3.6 CONCLUSION AND LESSONS FOR SUSTAINABLE BUSINESS MODELS

The case of ArtesanalPesca outlined above contains *lessons on how adaptability may* help organizations to *move towards a novel, more sustainable business model.* We focus here on the processes resource users' organizations may employ to translate the idea of adaptability into their practices.

3.6.1 'Making sense' of crisis

How people *choose* to deal with crisis appears to either increase or decrease their own resilience and thus the resilience of the wider SES of which they are a part (Gunderson in Berkes et al. 2003). Crisis and change are essential parts of our lives. When things go wrong, most organizations reach for familiar, official rules and past solutions. Yet this can make organizations static and vulnerable to unexpected uncertainties. ArtesanalPesca's experience provides an example of organizational improvisation and creativity in response to crisis. Furthermore, it hints at the notion that if and when organizations learn to see crises as opportunities – 'when one door closes, another one opens' – and if and when this risk-taking behaviour – probing into the unknown – results in a success story,

[15] Personal interview with Manuel José Gomes Pólvora dos Santos, Treasurer, ArtesanalPesca, November 2010

organizations become 'addicted' to this form of thinking. By acknowledging their mistakes and learning from them, they are inspired to respond dynamically to unexpected disturbances, while also being able to deal with other examples of 'addiction', i.e. internal/external resistance and inertia. The motto is: *do not fear a crisis, but make sense of it.*

3.6.2 Think differently and plan transitions

As stated by Bardwell (1991), the ways people understand and frame a problem often discourage and frustrate them, rather than motivating them to act. Bardwell reminds us that, according to cognitive psychology, people use information from the external environment according to their mental modes, which are deeply socio-culturally and psychologically embedded and built up throughout their life experience. Thus a successful organization will require the skills to frame a problem so as to question, re-examine and adjust their role in solving it. This active way of framing a problem helps organizations to think about the future by finding out what is *their contribution to the resilience of the system in which they are operating.* This is evident from the ArtesanalPesca case in two respects: i) their capacity to adapt to fluctuations in market demand and catch volumes through the processing plant's capacity to control market supply, and ii) the PO's capacity to develop market power through redefining market structure.

3.6.3 Practising adaptability through learning

Although they depend on contexts, processes are made, learned and developed. In the proposed framework an organization reacts to crisis, or extended difficult periods, by creating and acquiring knowledge and adapting its behaviour to respond to this knowledge. The act of removing the fish from the auction system, in the case of ArtesanalPesca, is an example of double-learning in the fishermen's behaviour (from a short-term perspective related to individual profit to thinking and acting according to long-term/common organizational interests). According to Lozano (2008) collaboration is a crucial element in combating points of view that tend to be unconscious, culturally embedded and individualistic. The organization itself provided a supportive learning environment that made these processes possible: «learning by doing» to solve internal conflicts and resistance; learning and sharing from experiences to increase mutual trust and improve relationships; learning how to react – a combination of well thought-out rational strategy, creativity and instinctive, snap judgements and reactions (when to use what?).

Finally, the new business model adopted by ArtesanalPesca, acquired through the process of adaptation just outlined, can be seen as being more adaptive than its predecessor: it was able to respond better to market (demand) fluctuations as well as to fluctuations in catch volume. This introduced both socio-economic benefits for the fisherman and ecological benefits in terms of fish resources. The case thus contains *lessons on how adaptability may be an essential part of a sustainable business model.* Further application of the framework through additional case studies is expected to result in *understanding POs different ways of being adaptive*: the patterns in the way in

which contextual and structural factors shape adaptation and how these interactions are affected by organization (nature and quality of leadership; ways of dealing with power differentials).

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CHAPTER 4 - ADAPTABILITY IN FISH PO(S)

'If you find yourself in a hole, stop digging.'

Denis Healey's First law of holes, 1986.

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ADAPTING TO ENVIRONMENTAL AND MARKET CHANGE: INSIGHTS FROM FISH PRODUCERS' ORGANIZATIONS FROM PORTUGAL

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ABSTRACT

To ensure the best market conditions for their fish, vessel owners are incentivized to create fish producers organization (PO), with obvious market advantages for fishers. However, the management of POs is not an easy task. This paper aims to understand how adaptation to environmental and market changes among fish POs relates to their capacities (or failures) to manage production and market demand. Drawing on an analytical framework the authors developed, twelve Portuguese POs are compared in terms contexts, structures, evidence of crisis and adaptability of response. Results revealed three modes of adaptation amongst POs (anticipatory, maladaptation and reactive adaptation) and identified key reasons explaining different degrees of adaptability in POs: 1) prejudiced market regime, which makes small scale fishers vulnerable and inactive and 2) prevalence of the sardine fishery, as contextual conditions; 3) evidence of market crisis; 4) leadership, 5) trust and 6) perception of self-interest; 7) learning, based on shared experience, and 8) collaboration with demand side. Though internal reorganization could improve POs' contribution to sustainable fishery management, adaptation is not a panacea. POs that are not adaptive rather indicate the problems with the fishery market whose transformation is the requisite for enabling adaptive governance of national fisheries. POs could be used as tools to operationalize this positive change.

Key words: fish producers' organizations; fishers; adaptability; agency; change; crisis; Portugal

4.1 INTRODUCTION

Fisheries and the livelihoods that depend on them face threats from overfishing, climate change, changes in market and regulations (e.g. Pauly et al. 1998; Jacquet 2009; Kalfagianni and Pattberg 2013). To respond to these challenges, fishers need to accept and understand the changes that shape their lives and work (Folke 2003), learn from their mistakes (Adger 2003) and generate experience of dealing with change (Berkes et al. 2003, Paavola and Adger 2006). This adaptability (with intent) is fundamental for understanding resilience in social-ecological systems (SESs), their capacity to deal with change, which is at the center of SES debate (Walker et al. 2006, Folke et al. 2010). In this context, scholars have been interested in strategies for adaptation, to mediate the relationship between humans and nature (e.g. Tompkins and Adger 2004, Somers 2009).

In many EU member states, fishers' responses to evolution of the EU Common Fisheries Policy (CFP) have included self-organization and cooperation in the form of producers groups, known as fish producers' organizations (POs). POs[16] aim to regulate the market, e.g. stabilize first-sale price, through planning of fish production (annual operational program including catch plan and marketing strategy). Herewith, POs bring obvious market advantages for fishers. The most relevant are POs capacity to negotiate direct sale contracts and to finance the withdrawing of production surplus and its reintroduction later on in the market, when the price is more reasonable. However, the management of POs is not an easy task due to numerous structural and contextual constraints (e.g. Jentoft and Davis 1993, Phllipson 1999). The research presented in this paper aimed to understand how adaptation to environmental and market changes among fish POs relates to their capacities (or failures) to manage production and market demand. To explore these issues we use the case study of fish POs from continental Portugal.

We define adaptability in POs as a learning process of dealing with pressures through adjusting management routines (productive and marketing activities), internal structures and membership behavior to secure livelihoods for the long term (Berkes and Jolly 2001, Berkes et al. 2003). To a large extent, adaptation is a response to change (e.g. Cooper and Pile 2014), but it may also be anticipatory (e.g. Angell and Stokke 2014) in terms of foreseeing conditions in the future and acting based on this assessment (Adger et al. 2005). In addition to these two modes of corrective adaptation, there may be adaptation to structures that are obviously problematic from the actor's point of view, so-called maladaptation, which accommodates to the existing problems, instead of resolving them (Fleischman et al. 2010).

The inherent question, then, is what are the key factors explaining different degrees of adaptability in

[16] Council Regulation (EC) No 104/2000 of 17 December 1999 on the common organisation of the markets in fishery and aquaculture products

fish POs. Understanding why and under which conditions adaptation occurs is necessary to support and sustain local level adaptation practices (e.g. Coulthard 2008, Storbjork and Hedrén 2011). By drawing upon twelve cases of Portuguese POs, we try to shed light on this subject. Studying Portuguese fish POs also provides important insights on an issue underemphasized in literature: the relevance of ecological diversity for shaping different modes of local adaptation. Although POs tend to have more or less defined structures, i.e. membership, rules, monitoring and sanctions, we are primarily interested here in the agency involved: adaptability as a part of management strategy.

The remaining of the paper is structured as follows: drawing on a framework (Section 3), based on the literature on adaptability (Section 2) the case study of fish POs in Portugal (Section 4) is analyzed: twelve POs are compared in terms of context, structure, evidence of crisis and adaptability of response. Different modes of adaptation are identified (Section 5), pointing to key conditions and factors that foster or limit PO adaptability (Section 6) and some practical implications of the analysis (Section 7).

4.2 ADAPTABILITY IN INDIVIDUALS AND ORGANIZATIONS

Social actors (individuals, organizations) have inherent capacities to adapt to complex social and ecological settings (Adger et al. 2004). The contextual setting affects the entire institutional dynamics and plays a critical but identifiable role in co-management success (MacNeil and Cinner 2013). Contexts may include resources, market context, policy restrictions and social and cultural context, as well as long-term drivers of local change, such as market liberalization or Europeanization.

Yet, contexts do not determine organizational behavior. Agency usually plays a vital role in achieving transformations from less adaptive to more adaptive management and governance (Westly et al. 2013). People and the organizations they form are able to act on the structures and systems of which they are a part (Giddens 1989). In a socio-institutional context, adaptive response in an organization is shaped by on organizational position within the social networks and institutional arrangements and on internal factors, including organizational structure (e.g. physical, human and social capital) and processes (e.g. capacity to network and learning processes) (Folke et al. 2002). Interplay of both external and internal conditions shapes human subjective attitudes to adaptation. Observed in this manner, institutional arrangements 'come with particular strengths that make them suitable for certain circumstances' (Chuenpagdee and Song 2012: 312); they have co-evolved with dominant practices (Grin et al. 2010). However, SESs are constantly changing (Holling 1986), shaping the context in which organizations are working. Therefore, the challenge for an organization is to strategically act in concert with this broader system dynamics (Westly et al. 2013).

Learning in organizations is particularly important from this 'evolutionary' perspective. Organizations learn from experience when, faced with a new situation, existing management routines through which they operate prove inappropriate or ineffective (Gavetti and Levinthal 2000). However, evidence from experience may fail to be recognized as pertinent for changing of routines (Levitt and March, 1988) due to mental models humans use to perceive reality around them (Senge 1990).

Disturbance or crisis may impact these mental models, shaping the desirability of system change (Walker et al. 2006). Crisis can foster adaptation through creating a space for learning and novelty (Folke et al. 2010), encouraging collaboration for governance of resources (Osterblom and Folke 2013) and restructuring power relations among stakeholders (Baral et al. 2010). Schoon and Cox (2012) and Fleischman et al. (2010) provide first typologies of disturbances in SESs, found as important for understanding institutional change and persistence (Deadlow 2013).

4.3 THEORETICAL FRAMEWORK AND METHODS

4.3.1 Theoretical framework

To understand adaptive organizations' contribution to system resilience we have developed (Karadzic et al. 2013) an analytical framework (*Table 3-1*).

Though resilience and SES literature provide initial frameworks to study SESs from a social science perspective (e.g. Anderies et al. 2004, Ostrom 2009), we chose to use this framework as it explicitly includes organizational learning theories into resilience concepts. In this framework external (context, crisis/disturbance) and internal (structure and processes) factors are supposed to influence organizational adaptability; a list of questions enables 'measuring' these factors. We assess crisis by looking at simple attributes such as speed of change (slow–fast), degree of the disturbance (minor or fundamental changes), or whether the disturbance occurred in the social or ecological system (Schoon and Cox 2012, Fleischman et al. 2010).

4.3.2 Data Sources

We used a qualitative research method to collect information. Semi-structured questions from the framework were asked across a multi-case study of twelve POs from continental Portugal. We used the method of structured and focused comparison (George and Bennett 2005) where the framework guided data collection on certain aspects of cases examined. Interviews were conducted with twelve key leaders in charge of POs (PO executive presidents or PO administrative officers as informal leaders). The initial phase of interviews aimed to contextualize the PO work. After acquiring sound knowledge of the PO at hand, we used a narrative form of interviewing (Mischler 1986). Focus was on the way in which individuals (PO leaders) make sense of their experience, i.e. POs adaptation to resource/market trend or crisis. In this context, narrative was used as a communication tool in which a PO leader externalized, gave meaning and indicated which elements (factors) of communicated experiences are most significant. These interviews were the units of observation. Supplementary information was gathered during semi-structured interviews (*n=65)* with PO administrative staff, fishers-POs members and other key persons from the sector (March 2010 - July 2013).

4.3.3 Data analysis

All interviews were recorded, transcribed and then content analyzed. Data from the interviews were extracted and structured around key elements from the framework (*Table 3-1*). This information was used to compare POs in terms of framework categories and identify different modes of adaptation response. Factors from the framework were used to explain these modes. To ensure the anonymity of respondents, each PO was identified by a letter code (i.e.: A-PO, B-PO, etc.) Excerpts from narratives are included to help contextualize adaptive experience (or lack thereof) of the interviewee. Results are discussed in terms of key factors that foster or limit PO adaptability.

Next, we introduce the case study of fish POs in Portugal and describe the environmental and market trends that POs face.

4.4 FISH POs IN PORTUGAL – A HIGHLY DIVERSE ENVIRONMENT

4.4.1 The structure and function of POs

From a total number of Portuguese licensed vessels (4 653), 33% (1 525) are members of POs (INE, 2013), accounting for 78% of the total landings at the national level *(DGPA- the Directorate General of Fishing, personal communication, November 2013)*. There are currently 15 POs: 12 in continental Portugal, two in the Autonomous Region of the Azores and one in the Autonomous Region of Madeira. The location of POs is indicated in *Figure 4-1*. The structural and functional profile of POs is provided in *Table 4-1*.

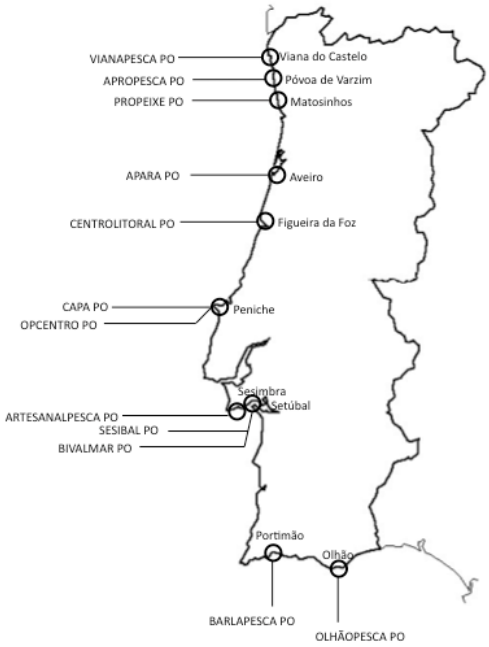

Figure 4-1: Location of fish POs in continental Portugal

The majority of POs developed around 1986 (see *Table 4-1*), following the Portuguese accession to the European Community. POs differ significantly regarding membership size: the largest PO, with 566 members (VianaPesca) is around 40 times the size of the smallest, with 14 members (Sesibal). Membership size does not correspond to the mean value of individual member's production, e.g. Propeixe with only 21 members adds up to 38% of national sardine production (Almeida et al. 2013). Two POs invested in the processing industry; six POs created new structures and diversified their activities (improvements of port infrastructures or membership vessels conditions, employment opportunities, etc.); the remaining four are structurally at the same level as when they were created (small office in the port with maximum two employees).

Table 4-1: Structural and functional profile of fish POs in continental Portugal

POs	Year founded	No of members	No of fish species recognized	Type of fishery arts	Commercialization		Use of withdrawals	Involvement in processing:
					% auction	% contracts		
VIANAPESCA	1989	566	147	Small-scale (534) Purse-seine (7), Trawl (ganchorra) (11)	47,09	52,91	Yes	No
APROPESCA	1986	88	71	Small-scale (76) Purse-seine (12),	76,21	23,79	No	No
PROPEIXE	1986	21	4	Purse-seine (21)	95,34	4,66	Yes	Yes
APARA	2008	117	39	Small-scale (100) Purse-seine (10) Trawl (3) Drag nets (4)	79,9	20,1	Yes	No
CENTRO LITORAL	2000	35	32	Small-scale (22) Purse-seine (11) Trawl (2)	67,3	32,7	Yes	No
CAPA	1990	154	66	Small-scale (135) Longline (11) Trawl (8)	82,2	17,8	No	No
OPCENTRO	1986	115	139	Small-scale (56) Purse-seine (14) Trawl (27) Hooks and lines (13) Gill nets (5)	82,31	17,69	Yes	No
ARTESANALPESCA	1988	42	27	Longline (18) Traps (24)	6,67	93,33	No	Yes
SESIBAL	1987	14	6	Purse-seine (14)	88	12	Yes	No
BIVALMAR	1992	21	7	Trawl (ganchorra) (21)	0	100		No
BARLAPESCAS	1986	20	29	Purse-seine (20)	84,31	15,69	Yes	No
OLHÃOPESCA	1989	116	63	Purse-seine (13) Traps (37) Trawl (2) Gill net (6) Trawl (ganchorra) (58)	80,89	19,11	Yes	No

4.4.2 Resource related opportunities and problems

The Portuguese fishing fleet is highly diversified with a wide range of vessel types targeting different species (STECF 2013). Considering the fishery type, multispecies and multi-gears vessels (small-scale and coastal artisanal fleets) dominate in terms of catches (46.5%), followed by the purse-seine (44 %) and trawl (9.6%) (INE 2013). Ten POs practice purse-seine fishery, grouped in the Anopcerco (Portuguese Association of Purse Seine Producer Organizations), launched in 1993. Three of them even exclusively focus on purse seine fishery. Though representing a small segment of the national fleet, purse seine is one of the key fisheries in Portugal (Stratoudakis and Marçalo, 2002) and the most economically important fleet in Portugal (Anderson et al. 2012). Sardine is the main target species; approximately 98% of sardine and 85% of chub mackerel landings are carried out by vessels associated with POs (INE 2013). The sardine fishery has been under Marine Stewardship Council certification (MSC) since 2010. The main management advisory body is ICES (International Council for the Exploration of the Sea).

Unpredictability, and strong fluctuations in sardine productivity, is associated with environmental conditions, e.g. climatic changes (Borges et al. 2003). In high peak production periods supply exceeds demand, which leads to a low fish price and lack of retailers' interest in the product. This is the main reason why purse seine producers made the most of withdrawal aid. PO administration serves as a mediator between producers and the sardine can industry, which is the main sardine buyer. With regards to resource management, fluctuations in productivity require membership production planning. Currently, purse seine POs are actively involved in the management measures for the Atlanto-Iberian sardine stock, i.e. an overall limitation in fishing days and a yearly quota for producers (POs and a few non-associated vessels). Since 1999, purse seine POs in northern Portugal have voluntarily introduced daily landing limits on their vessels to manage the annual quota as a function of local market demand.

In contrast, multispecies vessels (small-scale and coastal artisanal), as the principal segment of Portuguese fisheries, is by far less represented by the POs. Approximately 82% of the national fleet is classified as small-scale (STECF 2013) and distributed amongst six POs with a diverse membership (*Table 4-1*). Deficient regulation, together with lack of market and resource management incentives is the main reason for weak participation of these vessels in POs. First, the official legislation [17] and the recognition criterion for POs that the Portuguese state decided to apply limit, or in many cases, hinder the possibility of small-scale multispecies vessels to self-organize and congregate sufficient membership to create a PO. To create a PO, vessels need to commercialize, *'at least 15 % by weight of the total production in its area'*[18]. Second, multispecies vessels usually have small, but diversified

[17] Commission Regulation (EC) No 2318/2001 of 29 November 2001 laying down detailed rules for the application of Council Regulation (EC) No 104/2000 as regards the recognition of producer organisations and associations of producer organisations in the fishery and aquaculture sector

[18] Two other recognition conditions are: i) the number of vessels operated by members of the producer organisation is at least 20 % of the total number of vessels habitually present in that area, and ii) at least 30 % by weight of the total production in a major port or market in its area, the Member State concerned defining what is meant by 'major' for this purpose. The Member State decide which of the conditions laid down shall apply in their territory (it is not possible to apply more then one).

catches. Hence, their production falls short of benefits from withdrawal aid. Finally, this type of fleet captures a large variety of species and their management is much more complex. Though POs administer fish quotas of their membership[19] PO leaders recognize their role as merely informative rather than steering. One of the PO leaders frames this issue saying that *'we worry about quotas, but we are not giving orders to our vessels'*. Unfortunately, this fails to solve the problem of discards and illegal sale in cases where quotas are exceeded.

4.4.3 Problems with the fish market model

In Portugal most fishery products are sold on the fish auction market (20 fish auctions and 33 sale sites) using a descending-bid type of auction, also called the Dutch auction (where the auctioneer starts at a higher price and gradually lowers it). Dutch auctions may not be appropriate mechanisms for fishers to extract the maximum revenue from buyers as they increase competition not between buyers, but between sellers (Fluviá et al. 2012). Eight out of the twelve POs are unsatisfied with the current market model (information extracted from the interviews with POs leaders, personal communications). The problem is especially evident in landing ports with lower nominal catches, which corresponds to 13 from 20 auctions in total (INE 2013) where a few retailers are able to manipulate the auction price and significantly lower it.

The current fish market model dates back from the Salazar political regime (1934-1974) when the sector was highly controlled by the state. While both internal and international conditions changed, the model nevertheless persists, including positions, roles and relationships of actors that operate in the system. Docapesca is a case in point as it continues to be the regulating authority responsible for the management of fish auctions. Through Docapesca, the Portuguese state ensures control of fishery activity (registration of total fish catch and quality control), collects taxes (4% of the value, paid by both seller and buyer) and guarantees fishers wages (except in cases of direct sale contracts where payments are managed by the PO). In other words, while Docapesca has an important social role and provides a sort of 'financial pillow' (fishers are paid on a daily/weekly basis), it also charges high taxes to *'finance huge and unnecessary administration and infrastructure'*, as framed by one of PO leader.

Apart from the importance of fish auctions for purse seine fishery, fish auctions are still an essential element for first sale of a large variety of species with low market value. Despite large supermarkets' interest in buying the fish through contracts from POs, POs often refuse to do business with them for two main reasons. First, supermarkets want specific quantity of certain species. Therefore, a significant part of multispecies vessels' production (fish of lower value) eventually ends up at the auction where the price further decreases. Second, supermarkets often delay payments and POs who lack financial security and access to bank loans cannot ensure regular payments to their membership.

[19] Quotas emanate from the EU through ICES advice with the IPMA (Instituto Português do Mar e da Atmosfera) participation

As a result, many POs prefer making contracts with smaller retailers who guarantee to buy the entire catch and pay on the spot.

4.5 AN ANALYSIS OF POs ADAPTIVE CAPACITY: DIFFERENT MODES OF ADAPTATION

A cross-case comparison of twelve POs revealed three distinct modes of POs' adaptation (summarized in *Figure 4-2*). Though contingent on contexts, adaptation modes depict the key agency's features (structure, processes, individual behavior), including attributes of crisis or change that shape the specific mode.

4.5.1 Adapting to the context (when it is 'convenient') – 'easy' and anticipatory adaptation

'Convenient' contexts imply that both physical system and market share facilitate fishers' work. Hence, adaptation seems natural and 'easy'. PO administration usually perceives 'no problems' or has difficulties in identifying problems pertinent to their fisheries. This is the case of northern seine POs, i.e. ***A-PO, B-PO*** and ***C-PO***, which operate in big landing ports in terms of nominal catches. Significant membership production and proper structuring of demand (can and freezing industries) bring high revenues for POs and create satisfaction with the fish auctions, as exemplified by one of the leaders: *'we have a lot of fish and as many contracts we make, we could never sell everything'*. PO involvement additionally co-creates market interdependency between producers, retailers and industries, framed as: *'it is well-known that every kilo of sardine sustains at least 5 people here in our community.'*

Major market disturbances are caused by the unpredictability of the resource base. To anticipate market changes POs are enforcing operational rules that aim to minimize surplus of production and stabilize the price. Furthermore, disturbances are anticipated through structural changes. Investments in land-based facilities enabled ***A-PO*** to increase the value of members' production, facilitate better use of market support funds and employ additional work force. Yet, according to the majority of PO leaders, land-based facilities only make sense in the context of POs with high production. Otherwise, (irregular) excess of production is stored with PO clients, i.e. industries, which tend to reduce the price. Structures on land also require financial security and credit loans, a condition many POs do not have.

In recent years, the Iberian sardine stock has decreased due to environmental conditions, e.g. climate change, and some uncertainty regarding sardine stock dynamics (Almeida et al. 2013). Due to increased fishing mortality and low biomass, ICES advises that catches in 2014 should be no more than 17 000 t, a sharp decrease in comparison to 75 000 t in 2010 and 96 000 t in 2006 (ICES 2013). POs specialized or largely dependent on seine fishery are especially problematic in this context. Homogenous composition of membership in terms of vessels interest and size is in many ways easier

to manage; the downside of this low diversity is that 'easier to manage' especially holds for situations of abundance; management becomes complicated when resources are scarce. Coulthard (2008) found that the least able to adapt are fishers who have become locked into an overly specialized fishery.

Another concern for resources is the 'domino' effect of 'bad' attitude amongst purse seine producers. Exceeding the daily landing limits in 2010, as was the case of ***C–PO*** membership, made members of other purse seine POs behave in the same manner. The statement of the leader of this particular PO, *'without purse seine members, PO doesn't make sense'* is an added concern. According to this leader, even in heterogeneous POs seine producers might be privileged when it concerns the decision-making process. (*'We have 10 big seine vessels (mine are 5); 30 are little ones, but they do not 'eat' a lot of time; if they do, I warn them and collect a levy. We want the sector to be stable, but they are aware of their place. They are not discriminated; legally they have the same vote like the others, but the ones who contribute the most have advantages that they cannot have and this is the type of agreement everyone understands and respects'*).

4.5.2 Adapting to the context (when it is 'bad') – maladaptation

'Bad' contexts imply essential difficulties in the market. This is a typical setting for POs who operate in landing ports with lower nominal catches, i.e. ***D-PO, E-PO***, ***F-PO*** and ***G-PO***. Low concentration of production structures the demand side; fish auctions in these ports have small number of retailers, who are able to manipulate and significantly lower the fish price. This encourages illegal sale, known as *'escape from the auction'*, additionally facilitated by high taxes to be paid to Docapesca. In this context, though price stability should be the main aim of the POs, few manage to achieve this. *'Supermarkets underestimate our work',* i.e. delays in payments, demand for particular type and quantity of fish. In contrast, in contracts with local retailers, declared price is only half of the price offered by the supermarket; the other half is received illegally hence it is free of taxes. According to one PO leader, local retailers encourage the practice of illegal sale: *'to overcome this, we try to make more contracts, but retailers organize themselves and offer more money to our members "through the back door" than they would receive through the official contract'*.

Maladaptation may also be less intentional as it is driven by regulatory environment. Severe limitations to fishery activity are summarized by one of the PO leader as: *'to comply with the rules of the game, means ending with the game'.* In 2006, the EU implemented a Recuperation Plan (effective until 2016) in order to replenish hake stocks until they reach safe biological limits. Initially, fishers acknowledged restrictions, as hake scarcity was noticeable. However, as soon as hake recovered (according to fishers perceptions and working experience) they continued to fish *'as if there were no limits'*. This is how one PO leader understands the setback of illegal sale using the example of hake fishery: *'you bring the fish to the buyer – he weighs it and only the next day he tells you the price. If he sells well, he gives you good money, if not, he gives you bad. Well, he gives whatever he wants. Because he knows you can not sell on the auction and you do not have an option...that's how we learned to get*

away...If we register everything we catch we are done with our quotas in a month…and then what do we do? What is the alternative? What we want is to have work.'

4.5.3 Transforming the context (when it is 'bad') – reactive adaptation (or resistance to change)

Conversely, there are cases of POs, i.e. ***H-PO***, whose capacity to actively cope with a biased market model through ecological advantage (species exclusivity), leadership attitude and land-based facilities, managed to transform the model itself, as explained in Karadzic et al. (2013). Another example is one exclusive to purse seine ***I–PO***, where temporary sardine scarcity and leadership capacity to network changed the way producers perceived fish marketing. Earlier PO's leadership was patronizing big member companies whose large captures were exceeding local demand and decreasing fish price. This was generating a low level of trust amongst the membership. To regulate supply, the new leadership managed to enforce strict operational rules. Collaboration with Docapesca permitted temporary change of the market rules and entrance of a new group of retailers interested in fresh fish who rapidly joined the auction. Prior to this, two freezing industries were controlling the whole region (still present as main buyers). More buyers at the auction market led to an increase of fish price and decline of fishery effort. In both POs, leadership capacity to network and negotiate was essential for PO reorganization.

There are, though, cases of POs, whose responsiveness to crisis started to change the context itself, and then it stopped, i.e. ***J-PO, K-PO*** and the evidence of bad experience with internal reorganization in ***L-PO***. In 1996, administration of ***J-PO*** had serious difficulty selling their products. To address the problem, PO manager (an informal PO leader), *'in a moment of madness',* decided to try to sell the products directly from producer (PO member) to consumer, with the obvious market advantages for the membership. He went to Spain, where he found a client interested in the entire PO production: *'when I arrived, the director of the industry was not there. It was Friday. So, I spent the weekend sleeping at the beach, in a sleeping bag and kept the money I had. On Sunday I went to the city market, bought a clean shirt and did business in a half an hour. The man just wanted to know if we had the capacity to guarantee the quantity he needed'.* As a result of this business deal, PO members started to earn more and receive payments on time. This *'tremendous effort'* ended in the following year, when a couple of members *'started to think that what we are doing is easy'*. After finding out where and to whom PO sells the product, they offered the same quantity for a lower price. *('And that was it. Never again I would repeat the same experience'.*)

Internal resistance to change and price stability is a sort of 'intermezzo' experience amongst POs. In the case of contracts for octopus between ***K-PO*** and one supermarket, the initial price for octopus was based on the average market price. However, the market price soon decreased and for more than a year 42 vessels were getting 2 Euros more for their fish than the auction price. The buyer never asked for a change in the contract or a decrease in the agreed price. When situation was reversed (due to lack of resources market price started to increase) and the auction price for octopus reached only 10 cents above the contract price, membership started to fail with deliveries. Currently, only 3 vessels

continue with contracts. PO leader reflected on this episode by saying that *'my members do not understand stable price. If they earn less through the contract than they would earn at the auction, we end up as thieves…no one wants to take responsibility.'*

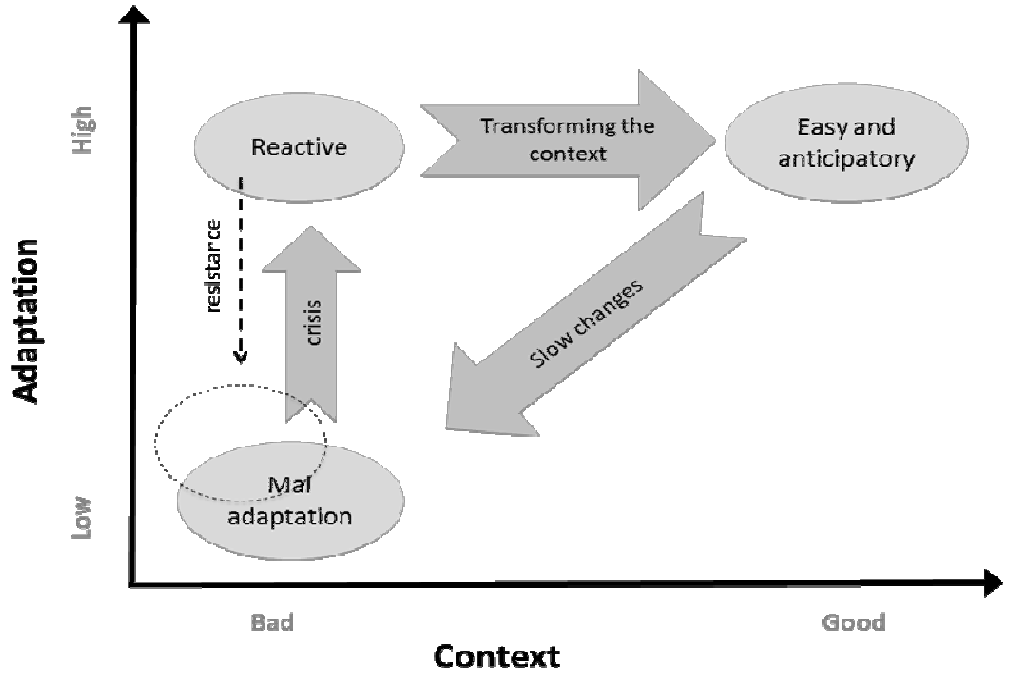

Figure 4-2: Summary: Modes (states) of adaptation and types of change creating the mode

4.6 DISCUSSIONS: KEY REASONS FOR DIFFERENT POs ADAPTIVE RESPONSE

Three modes of adaptation amongst POs were identified (anticipatory, maladaptation and reactive adaptation) caused by four types of changes: i) 'slow' changes induced by environmental conditions and overfishing; ii) unexpected market crisis; iii) wider system transformation via internal adaptation and iv) human resistance or inertia to change that inhibits adaptation (*Figure 4-2*). Next, we discuss key contextual conditions, attributes of crisis and agency features that impact POs adaptability.

4.6.1 How contexts matter

Prejudiced market regime. As evident from our results, an obligatory system of the fish first sale 'competes' with the POs' idea to a certain extent. While long-term contracts negotiated by POs stabilize the price of their membership products, they also increase the price of the fish remaining in the auction. Hence, producers every now and then view contracts as a '*loosing money'* deal. As a result, POs do not bother to compel membership to sell their fish through contracts, used merely '*as a plan B to play with the price'* when there is plenty of fish at the auction. Moreover, concentration of production is important as it leads to a more or less appropriate structure on the demand side. In

landing ports with lower nominal catches, as found in ***D-PO, E-PO, F-PO, G-PO*** (maladaptive) and ***H-PO***, ***I–PO*** (reactive), Dutch auctions further sustain the problem as they facilitate retailers manipulation of the price. Low fish price creates incentives for overfishing and illegal sale, which further decreases the price and creates uncanny relationships between fishers and retailers.

Silent power of sardine –Another important contextual condition relates to 'easily' and anticipatory adaptable seine ***A-PO, B-PO*** and ***C-PO***. Walker et al. (2006) argue that increasing adaptability (e.g. through intervention mechanisms and operational rules) to regular shocks (e.g. fluctuations in sardine productivity) may 'optimize' the system to this regime of shocks, decreasing its general resilience to unexpected shocks (e.g. long-term resource scarcity). This issue becomes very relevant in the light of current sardine scarcity and the CFP reform, which plans to gradually end with withdrawing subsidies, used essentially by purse seine POs. Moreover, the situation is worrisome due to the traditional dependence of the fishery sector in Portugal on seine fishery *(DGPA, personal communication, November 2013)* and (inter) dependence of involved actors. Collaboration among producers, can industry, scientists and the government are perceived as crucial to recover MSC certification (MSC, 2013), following certification suspension in 2011 (ICES 2012). Actors' interdependence also reduces independence (Bodin and Crona, 2009), which could delay the individual PO adaptation response. Our results also reveal some indication of superior position of seine *vs.* multispecies vessels in POs with heterogeneous membership due to their higher profit and concentrated production. Multispecies fishers' vulnerability and inactivity is again sustained by the official market regime. Bandura (1977) claims that individuals with low self-esteem (or an external locus of control) do not perceive themselves as able to act, which directly reflects their adaptation response.

4.6.2 How attributes of crisis matter

When the market crisis 'tips over'. POs capacity to adapt to a crisis partly depends on the nature of crisis. While long-term dissatisfaction with the market trend is common for both maladaptive and reactive POs, ***D-PO, E-PO, F-PO*** and ***G-PO*** (maladaptive) lack the evidence of market crisis. Market crisis occurs when a problematic market trend reaches its threshold and finally 'tips over'. In ***H-PO*** and ***I–PO,*** adaptive response to 'tipping over' of market crisis implied transformation of the market model via internal reorganization, which led to restructuring of power relations among actors. Although found to trigger PO adaptability, ***J-PO*** and ***K-PO*** also show that in the long run, attributes of crisis might be leveraged by actors' motivations in the reorganization process, also found in Deadlow et al. (2013) and further discussed below.

Delayed response to slow resource change. Other than market crisis, resource scarcity is built slowly and steadily. Changes in slow variables are often overlooked hence human learning from experience may seem delayed (Carpenter et al. 2001). Slow changes in sardine stock might generate problems for ***A-PO, B-PO*** and ***C-PO***. As a result, 'easily' adaptable might become problematic in the future. Furthermore, it is difficult to analyze societal adaptation to environmental problems, as they are contested and hard to quantify (Coulthard 2008). In this context, fishers maladaptation (e.g. 'getting-by' practices, i.e. continue to fish and illegal sale) as a response to prolonged resource scarcity and

consequent regulation, damages the environment and keeps the resilience of the problematic market regime – resilience here defined as persistence despite change (Gunderson and Light 2006). Cooper and Pile (2104) term this as 'resistance' response since it involves resisting environmental change in order to preserve existing activities.

Clearly these two types of changes (market and environmental) may interact, e.g. through the price mechanism connecting fish supply and fish demand. Case of ***I–PO*** indicates how temporary resource scarcity may encourage POs to think differently about fish marketing (*'less fish generate higher and stable price'*) and ('*more buyers means higher price hence require less fishing'*). Accordingly, through transformation of the market contexts the ***I–PO*** managed to increase its adaptation to resource scarcity, reduce fishing effort, thereby giving their local fisheries resilience a chance to increase. This is in line with other studies where the perceived scarcity of resources was identified as a reason for institutional transformation (e.g. Oldekop et al. 2012). This might also be promising for the current context of sardine scarcity.

4.6.3 How agency matters

While ecological context may influence the character of fishers' adaptation within POs (e.g. some seine PO are 'easy' anticipatory PO), it does not determine it (e.g. some seine PO are maladaptive), but makes agency even more crucial. Key agency features with direct impact on PO adaptability are leadership, trust and perception of self-interest. Communication and learning based on shared experience as well as collaboration with the demand side (processes) have a more indirect impact – through their effect on leadership, self-interest and trust. Hence, our work confirms the insights about the importance of social capital and actors' behavior for natural resource management (Ostrom 1990; Gutiérrez et al. 2011). Individuals' attitudes and perceptions also play a critical role in organizational adaptation response (cp. Storbjork and Hedrén 2011). We discuss these factors in more detail.

Leadership is the decisive factor for PO performance and adaptation response. There is no single style of leadership optimal for adaptability and transformability (Walker et al. 2006). Rather, leadership needs to be a dynamic process, responsive to prevailing socio-ecological conditions. Nevertheless, our results demonstrate that certain personal characteristics of PO leaders enhance fishers' collective capacity to adapt, namely: problem-solving attitude: ('*Minimum sign of weakness is sufficient for them to stop believing…because they are already with low level of trust, they were always family companies, learned to be on their own');* readiness to assume risks: *('I never tell them (membership) what I will do, but what has been done'*); capacity to network and negotiate; communication skills, in particular listening capacity; an interest in change and the ability to foresee: (*'...we are slowly changing their mentality...if they were all with the vision it would be easy. You need to reach them and convince them that what you want is the best for them. But at the same time you need conscience that other people are still 'not there'. These are phases of understanding; as a leader you need to be aware of them').*

Conversely, the main common attribute of ***D-PO, E-PO, F-PO and G-PO*** is 'complaining' and a defensive type of leadership. As 'bad' contexts are persistently problematic leaders lack capacity to focus on specific matters pertinent to their fishery; they usually articulate (too) many problems they can cope with and offer no practical solutions. Sometimes this occurs as the leader himself is specialized in a specific fishery, hence he lacks knowledge in managing other types of fisheries. Accordingly, a leader's capacity to network and negotiate with the demand side is weak, thus failing to maximize the value of membership production. Entangled in problems, 'complaining' leaders as a rule lack support from their membership and, as viewed by one interviewee, *'a PO that doesn't recognize a leader is completely disoriented'.* As a result, members distrust each other and the PO, which inhibit their collective actions.

Trust. This leads us to the issue of trust. Trust influences the capacity to adapt because it reveals whether individuals and groups use relationships for their own or collective good (Adger et al. 2004). Trust is central to network steering (see e.g. Rhodes 2000), providing the context through which community bonds. Herewith, the work of ***A-PO, B-PO*** and ***C-PO*** contributes to community social capital, based on market interdependency. Internal trust in 'easy' seine POs is built through what Sztompka (1999) has designated as ´virtuous cycles of trust´, i.e. membership experience that others obey the rules of 'when and how much' fishing and this promotes collective interest (Karadzic et al. 2014). In systems governed from the bottom up, changing rules are part of the adaptive process (Ostrom 1999). However, trust here is based on internal control - '*I know that others will do the same*', hence not on mutual loyalty and confidence in others actions. This is similar to what Lewicki and Bunker (1996) call "calculus-based" trust, which is the product of cost-benefit analysis, but accompanied by a suspicion of the other. In other cases, we see that trust is more shaped by Sztompka´s structures of trust or mistrust. In maladaptive POs, defensive leadership sustains fishers' dissatisfaction and distrust in PO and in each other. By contrast, in reactive POs, the driver for internal trust is leadership attitude that manages to encourage fishers to act in their collective interest, defined by Paavola and Adger (2006) as social capital.

Self-interest. In Hardin's famous essay the tension between group and self-interest is at the core of the tragedy of the commons (Hardin 1968). Following Ostrom (1990) we see e.g. in ***H-PO*** and ***I–PO*** as well as in ***A-PO, B-PO*** and ***C-PO*** how communication and established rules among the subjects in the group generate trust and reciprocity, which then reduce overconsumption of commons substantially.

Nevertheless, resistant ***J-PO*** and ***K-PO,*** including maladaptive ***D-PO, E-PO, F-PO*** and ***G-PO*** demonstrate that even as members of social organizations fishers continue to act out of self-interest (cp. Jentoft and Davis 1993). Usually, some individuals forget how mutual trust and collectively agreed upon rules were able to solve their problems. Mere aspiration to earn more makes them rely on old behavior and reluctant to reflect on reasons that led to a problem in the first place. As a result, PO adaptation response (e.g. new market strategy) is perceived as a threat rather than an opportunity. In other words, (individual) egoism reduces (individual and collective) capacity to adapt as it impedes individuals from learning from their mistakes and from each other. By contrast, in ***H-PO*** and ***I–PO***, the

ability to fight back the membership resistance and self-interest is a measure of PO adaptability. Also, as Hardin argues, people differ in 'conscience'; hence their contribution to the tragedy of commons is asymmetrical (Jacquet et al. 2013). In ***H-PO*** and ***I–PO***, self-interest was moderated with collective learning on how experimentation with internal reorganization increases POs' performance and how this has collective benefits.

The main reasons for fishers' self-interest behavior lie in PO incentive structure, which is critical for success of any management scheme (Hilborn et al. 2005). Although PO market strategy directly impacts stock management (fishing less to increase the fish price), vessel owners enter the PO because, as Hardin puts it, 'each herdsman seeks to maximize his gain' (Hardin 1968: 1244). In other words, the market base of POs supports both self-interest and competition. Also, PO institutional structure lacks rules that indicate who is responsible, which is necessary when attempting to address any commons dilemma (Jacquet et al. 2013). As POs depend on membership production, egoist members are often left unpunished, which creates general inertia and lack of confidence in the PO. While not a part of the initial framework, the issue of attitudes and perceptions, which shape individual motivation to adapt, emerged from the results and should, thus, be included in the framework as the fifth dimension.

One way to deal with this problem is through more restrictive PO regulation. PO simple governance structure enables so-called direct line of responsibility (Hilborn et al., 2005): PO producers know who is in charge, and often, both leadership and members know who makes mistakes. In addition to operational rules, this includes a stringent penalty system to ensure individual commitment to PO objectives and market strategy (e.g., responsibility towards direct sale contracts, penalties for illegal sale practices).

Besides individual responsibility, to enhance management performance through enhanced adaptability, more attention to the relationship between collective and adaptive capacity is required (Adger 2003).

In this context, *communication and learning, based on shared experience* seems essential. Through collective exchange of experiences, i.e. knowledge building about ecological resources (e.g. Bodin and Crona 2009) and communication, which produce social learning, groups retain or revise mental models that determine their management strategies (Tompkins and Adger 2004, Ostrom 2005). Moreover, this helps them to move from 'calculus-based' to real trust, such as 'knowledge-based' trust and 'relational-based' or 'social trust', where people have positive expectations about others' motives, abilities and reliability (Lewicki and Bunker 1996). Ostrom (2005) further argues that social learning occurs mainly when individuals in a group participate with an induced need to increase performance. From this perspective, POs are a good setting for nurturing social learning, identified as the core strategy for PO adaptability (Karadzic et al. 2014).

Collaboration. At present, collaboration among POs portrays typical features of fishers' communication: competition, conflicts and distrust, where *'each house has its own rules'*. Co-management performance is associated with the collaboration capacity among resource users (Marin et al. 2012). This study concludes that best performing fishers' organizations are those with the

capacity to collaborate not only amongst each other, but with multiple actors. Experiences of ***H-PO***, ***I–PO***, ***A-PO, B-PO*** and ***C-PO*** confirm these findings; they show change of fishers' mentality in terms of growing enthusiasm to network and negotiate with the demand side. The main body responsible for encouraging these relationships on behalf of the PO is again a PO leader, a "gatekeeper" of co-management and the links between fishers and the organizational environment (Marín and Berkes 2010). Only through collaboration with the demand side are fishers able to solve the problem of low fish price and find alternatives to a biased market context.

4.7 CONCLUSIONS

This cross case analysis of twelve fish POs from Portugal has shown how different degrees of POs adaptability to environmental and market changes relate to their capacity to manage production and market demand. Thus, we found that internal reorganization and adaptation could improve POs' contribution to fishery management. Different modes of adaptation and types of changes creating specific mode were identified in the research. Key factors impacting PO adaptability are 1) prejudiced market regime and 2) prevalence of the sardine fishery, as contextual conditions, 3) evidence of market crisis, 4) leadership, 5) trust and 6) perception of self-interest, influenced by 7) membership mutual learning and 8) collaboration with demand side. However, adaptation is not a panacea. POs that are not adaptive rather indicate the problem with the market regime in Portuguese fisheries and alert to basic issues, which constitute this problem. The official system of fish first sale not only inhibits the PO idea and jeopardize fishers' interests, but clearly reduces system resilience as it promotes overfishing.

Given our findings, the better way to increase the system flexibility (resilience) is to reduce market regime resilience through alternative models of fish commercialization. POs could be used as a tool to operationalize this system change, mainly through their job in fish marketing. And under the conditions thus created, POs could better promote system resilience.

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CHAPTER 5 - SOCIAL LEARNING IN FISH PO

'If you want to go fast, go alone.

If you want to go far, go together.'

African proverb

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SOCIAL LEARNING IN FISH PRODUCERS' ORGANIZATIONS: HOW FISHERS PERCEIVE THEIR MEMBERSHIP EXPERIENCE AND WHAT THEY LEARN FROM IT

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ABSTRACT

Fish producers' organizations (POs) bring together fishers or fish farmers on a voluntary basis so as to ensure the best market conditions for their fish. How fishers perceive and understand their membership experience is crucial to their capacity to learn from each other and adapt when interacting with their environment. These issues are explored by using the case of Propeixe, a Portuguese PO of purse seine fishers. Fishers 'perceptions' of their PO experiences are discussed using an analytical framework based on social learning literature. POs appear to stimulate social learning amongst fishers through changes in practices, economic and other incentives, rules and trust in leadership. Moreover, POs add to a simple market structure the properties of network coordination: interdependency and trust as a basis for co-operation. However, POs fail to change modes of interaction and communication amongst fishers. Within the PO network there are informal subnetworks, differing in terms of interests and influences, and disagreeing on problems (e.g. resource status) and on how to deal with them. By enhancing their members' social learning capacity, POs may increase their capacity to learn and cooperate with other actors in the sector. Leadership strategy, to encourage day-to-day dialogue and deal with power relations, is essential in this respect.

Key words: fishers; organizations; perceptions; social learning; adaptability.

5.1 INTRODUCTION

Understanding the response of fishers – individual, communities and organizations – to policy has been identified as one of the key themes in the field of social sciences work on fisheries management and policy related research in Europe (Symes and Phillipson 2009, Symes and Hoefnagel 2010, Urquhart et al. 2011). Contributing to this are studies that explore fishers attitudes and perceptions to try to understand what motivates their decisions and responses to management measures and how this influences fishing strategies (Pita et al. 2013, Brewer 2013). Social science research in fisheries policy might expand from resilience theory and adaptive co-management, 'more closely attuned to the needs of resource users' and 'more cognizant of learning and adapting' (Berkes 2009:1698). Management instruments are seen as 'learning by doing' experiments, designed to continuously respond to changes in the ecosystem, using different knowledge about complex socio-ecological dynamics (Colding et al. 2003, Olsson et al. 2009, Plummer et al. 2012). Local stewards' knowledge is especially relevant in this theory (e.g. Colding and Folke 2009). Fishers themselves are perceived as a memory pool, able to retain the memory of past events and provide adaptive response to future challenges (Berkes et al. 2001). Within the scope of learning literature (Grin and Loeber 2007), learning is located in communities engaged in practices.

One important example of how fishery communities have organized themselves is Producers Organizations (POs). POs bring together fishers or fish farmers on a voluntary basis with the aim of planning their production to ensure the best market conditions for their fish. Members may sell their fish solely through the organization, using mainly fish auction markets or direct sale contracts. POs are allowed to use the market support funds, which ensure finance of withdrawing the surplus of the production and reintroducing it later on the market, when the price is more reasonable. The EU Common Fisheries Policy (CFP) regulation requires that fish POs draw up and implement an annual operational programme that includes a marketing strategy and a catch plan for the fisheries exploited by their members.

Evaluations of fish POs during the 1990s from the UK (Young et al. 1996, Phillipson 1999, Hatcher 1997), the Netherlands (Gibbs et al. 1994) and Denmark (Nielsen and Vedsmand 1997) have shown that POs play an important role in crisis management by increasing rule compliance, encouraging fishers to fish less and as an informative feedback channel to Government on experiences with regulations. Thus viewed, POs seem to act as a perfect foundation towards a policy of increased co-management of EU fisheries (Young et al. 1996). However, POs' interests and concerns with stock management are disputed due to numerous structural and contextual issues (Phillipson 1999, Jentoft and Davis 1993). Externally, the complex EU regulatory context and a wider economic environment have caused the fish POs traditional marketing functions to erode. As follows, current reform of the CFP plans to gradually reduce and finally end with financial aid for withdrawing, considered unsustainable as it failed to solve the problem of overfishing.

To respond to these challenges as well as to fluctuations in fish stocks, POs need to adapt, changing their production and marketing activities and internal structures to secure livelihoods for the long-term

(Berkes and Jolly 2001). The adaptability of fish POs to apparent changes in the fishery system depends, at least partly, on members' behavior and adaptability. Conversely, a failure to understand how fishers perceive and make sense of their membership experience and what they learn from it may undermine PO performance. Furthermore, "dialogue" within the PO community is crucial to its capacity to learn and adapt in interaction with its environment.

These issues may be better understood by drawing on insights from social learning literature. Social learning (Bandura 1977) has been recognized as a key dimension of adaptation (e.g. Lee 1993, Armitage and Plummer 2010, Johnson et al. 2012) and has become a prevalent approach to natural resources management (e.g. Schusler et al. 2003, Keen et al. 2005, Plummer 2006). However, there is no commonly accepted definition of the concept. Different interpretations of social learning may hamper its application. Responding to this call, Reed et al. (2010) characterize social learning as a change in understanding that goes beyond the individual, achieved through interactions between actors within the social group. In the same vein, Rodela (2011) identifies three social learning research perspectives: 'individual-centric', 'network-centric' and 'system-centric'.

For the context of POs a particularly relevant approach could be the 'network-centric' perspective, which emphasizes the potential of nurturing social learning within user groups or other network settings by experience shared between a community (fishers) around a specific practice (fishing) that is embedded within the learner context (fisheries) (Wenger 1998). Similar to this concept is Johannessen and Hahn's (2012) spontaneous, self-organized and stable social learning as a result of 'professional day-to-day deliberations on the job'.

The objectives of this study are to understand the potential and limitations of POs to foster social learning within their membership and their implications for POs adaptability to changes in the fishery system. To achieve this aim, fishers' perceptions and interpretations of their experience as PO members are explored.

The paper proceeds by setting out in a more detail the social learning analytical framework and our methodological choices. Section 3 provides a background of Portuguese purse seine POs, their relevance to fishery management and a short description of the case study – Propeixe PO. Section 4 presents fishers 'perceptions' of their PO experience. Section 5 uses perceptions to unpack PO potential to foster social learning within its membership and discusses implications of these findings for POs adaptability to changes in the fishery system. Section 6 highlights the main conclusions and gives recommendations for practice.

5.2 RESEARCH DESIGN AND METHODS

5.2.1 Analytical framework

Our data collection and analysis followed an analytical framework (*Figure 5-1*), proposed earlier (Karadzic et al. 2013), based on work by Kolb (1984), Schusler et al. (2003), Reed et al. (2010), Rodela, (2011) and Johannesen and Hahn (2012).

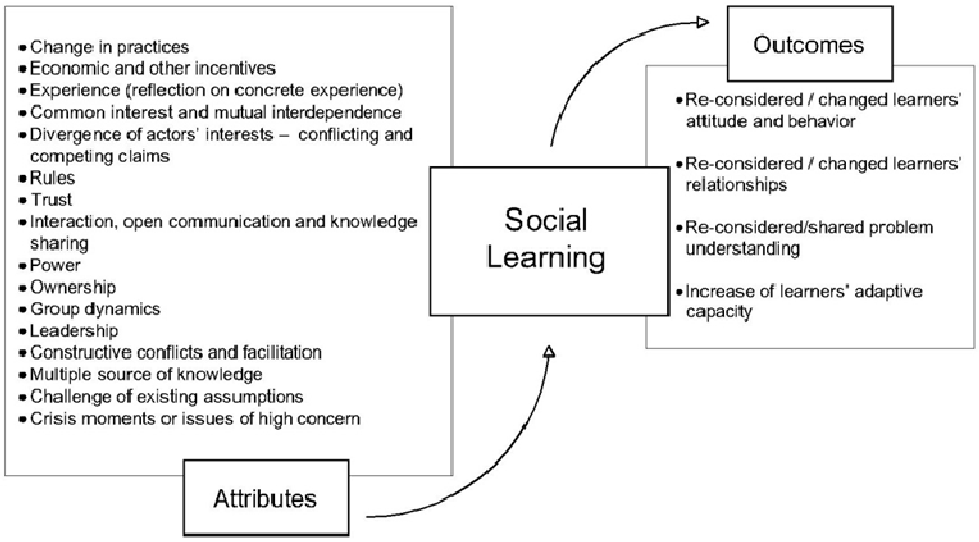

Figure 5-1: Social learning analytical framework

This framework outlines what influences social learning (attributes) and what may be expected to change as a consequence of social learning (outcomes). The framework enables empirical identification of relevant attributes and explores relations between these attributes and outcomes.

In order to understand POs potential to foster social learning it is critical to examine how PO members perceive their membership in relation to four issues (e.g. Young et al. 1996, Rodela 2011): i) *PO membership incentives* (for entering or exiting the PO); ii) *satisfaction with PO membership experience* (the effects on their fishing activity and business); iii) *interactions within PO and relationships with other actors* (the effects of PO membership experience on their mutual interaction and with other actors) and iv) dealing with everyday *problems and opportunities*, including the impact of PO membership in the *generation of new knowledge*. The first two issues represent the individual fishers' perception of the ability of the collective organization to represent their needs, considered as key for the success of any management scheme (Young et al. 1996). The second two issues draw on ideas

about 'network-centric' social learning (Rodela 2011), which assume that learning within user groups is rooted in experience that is shared between other members. *Table 5-1* outlines issues and examples of interview questions.

Table 5-1: Example of interview questions

Issues covered	Example of questions	Additional questions
i) PO membership incentives	Why did you become/remain a PO member?	Fishers asked to explain more in detail listed reasons
	Why did you exit PO?	Fishers with 'double membership' experience asked to explain reasons for exiting one PO
ii) Satisfaction with PO membership experience	General PO performance; Fishery management; marketing of their products	Satisfaction in general with the PO work and satisfaction in regard to the effects PO membership experience has on members fishing activity and fishing business, i.e. daily fishing limits, possibility of contracts, benefiting from the PO intervention mechanisms, i.e. withdrawal price and carry-over aid; fish price
	Membership contact with the PO	How many times / year you meet with other PO members at the PO offices; how these meetings look like? Do you think you are involved in PO decision-making process, i.e. rules design? What happens if some members disobey the rules?
iii) Interactions within PO and relationships with other actors	Mutual communication and relationships	The effects of the PO membership experience on their mutual interaction and relationships and relationships with other actors: did your mutual interactions/relationships changed under the influence of PO? Did PO membership influenced change of relationship with other actors in the sector?
	Relationship with other actors	If yes, how it changed? If no, why you think this didn't happen?
iv) (Dealing with) everyday problems and opportunities	Fishers problem(s) framings, including the impact of PO membership on the generation of new knowledge	What problems you encounter on your everyday work: especially focusing on potential resource scarcity or market problems. What causes these problems? Where do you see solution? PO as a part of solution? The effects of the PO membership experience on generation of new knowledge

5.2.2 Methodology

Qualitative data was collected from semi-structured interviews (*n*=26), conducted between April 2011 and February 2012. Interviews covered 15 of the 21 members of Propeixe (five of them are former members of Apropesca PO, Povoa de Varzim, Portugal) and two former Propeixe members (current members of Apara PO, Aveiro, Portugal). The interviewed fishers are ship-owners and ship-captains (e.g. father is a ship-owner; family relatives), aged 34 to 56. Most of them have long-standing experience in purse seine fishery, with a few exceptions of fishers who previously practiced small-scale or coastal artisanal fishery. The Propeixe president and administrative officer were interviewed on several occasions to collect data on PO as well as to clarify certain issues raised during interviews with membership. In addition, management administration of Apropesca and Apara POs, one person from Anopcerco (Portuguese Association of Purse Seine Producer Organisations), and two

government representatives, were interviewed to understand the context of purse seine POs and their challenges. All interviews were recorded and transcribed.

This sample size and interview format provided a rich data set, including detailed personal accounts and a meaningful perspective on PO membership experience. Interpretative analysis (Blaikie 2000) of interviews took place in three phases. Fishers' accounts of their membership experience were first explored in relation to issues (*Table 5-1*). Within each issue, most relevant aspects were identified and presented - *'perceptions'* (Results; Section 5.3). These aspects were not sought by the researcher but rather emerged as a predominant theme in response to questions (*Table 5-1*). We looked for accounts that were empirically based, i.e. differences in knowledge based on experience and age. Shared knowledge, e.g. observations shared by family (kinship) members, was also highlighted as valuable to the study. Excerpts from these accounts are included in the paper to help contextualize received information and observations.
The second phase of analysis involved interpreting *'perceptions'* in the context of social learning framework, by discussing them in terms of the potential social learning outcomes as well as the attributes that might lead to these outcomes (*Figure 5-1*). The aim was to infer what fishers learn from their PO membership experience and what has (not) changed as a result of this process - *'social learning in PO'* (Discussion; subsection 5.4.1). The final stage of analysis involved understanding of how (lack of) learning through shared experience influence fishers' collective ability to manage resources while adapting to pressures facing their livelihoods. To achieve this, *'perceptions'* were analyzed in terms of opportunities and challenges they imply for *'adaptability in POs'* (Discussion; subsection 5.4.2).

The following section provides a brief explanation of the Portuguese purse seine fishery context and outlines the grounds for choosing Propeixe as a case study.

5.2.3 Case study

5.2.3.1 Portuguese purse seine fishery context

There are currently 15 POs in Portugal, most of them founded around 1986, following Portugal's adhesion to the European Community. From the 4653 licensed fishing vessels, 1525 (i.e.33%) belong to a PO, corresponding to 78% of the total landings at the national level[20]. Currently, 10 POs are involved in purse seine fishery (sardine, chub mackerel, horse mackerel and anchovy), as one of the key fishing activities in Portugal (Stratoudakis and Marçalo 2002). Sardine (*Sardina pilchardus W.*) is the main target species; approximately 98% of sardine and 85% of chub mackerel landings are carried

[20] Personal conversation, with Manuela Duarte and Carlos Gonçalves, Direcção Geral das Pescas (DGPA; the Directorate General of Fishing), November 13, 2012.

out by vessels associated with POs (INE 2013).

Sardine fishery is characterized by strong fluctuations, believed to be associated with environmental factors and climatic changes (Borges et al. 2003). Current knowledge is insufficient to fully understand or predict recruitment variability (MSC 2013), hence a precautionary approach is needed in relation to stock management (Almeida et al. 2013). The Atlanto-Iberian sardine stock is managed by Portugal and Spain through minimum landing size, maximum daily catch, limitations on fishing days and closed areas. In Portugal, POs involved in purse seine fishery are grouped in the Anopcerco (Portuguese Association of Purse Seine Producer Organisations), launched in 1993. Since 1997, landing limits have been set annually, and distributed among POs and a few non-associated vessels. Since 1999, POs in northern Portugal have voluntarily introduced daily landing limits on their vessels in an attempt to manage the annual quota of the PO as a function of local market-price fluctuations.

In 2010, the purse-seine sardine fishery became the first Portuguese fishery to be considered a sustainable and well-managed fishery under the Marine Stewardship Council (MSC) certification. In 2012 the certification was suspended as the stock fell below the acceptable sustainable level. To tackle the suspension, a Sardine Commission made up of Anopcerco, Docapesca (regulating authority), the scientific body IPMA and the canned fish producers association ANCIP, chaired by the DGRM (government authority) became involved in the implementation of several measures including landing limits and a fishing ban during a period for each production region. An action plan for 2012-2015 was adopted and the certification was reinstated in January 2013.

5.2.3.2 Motivation for case selection

Given the exploratory nature of our research, the Propeixe fish PO (further discussed in subsection 3.3.) has been chosen as having strategic importance in testing the social learning idea within the theory of ‘how adaptability actually works’. Propeixe’s structure, i.e. small membership size and exclusive purse seine membership, enables in-depth exploration of learning processes (the objective of this paper) within a significant part of the organization. Due to ‘double’ membership experience of some fishers, the Propeixe case can reveal what may go wrong with the PO experience and how this relates to fishers' learning capacities. Finally, Propeixe can be considered as a representative example among purse seine POs in Portugal, due to its large production and grounded establishment.

5.2.3.3 Propeixe PO

The Propeixe fishers’ cooperative is located in the port of Matosinhos in the district of Oporto, north Portugal (*Figure 5-2).*

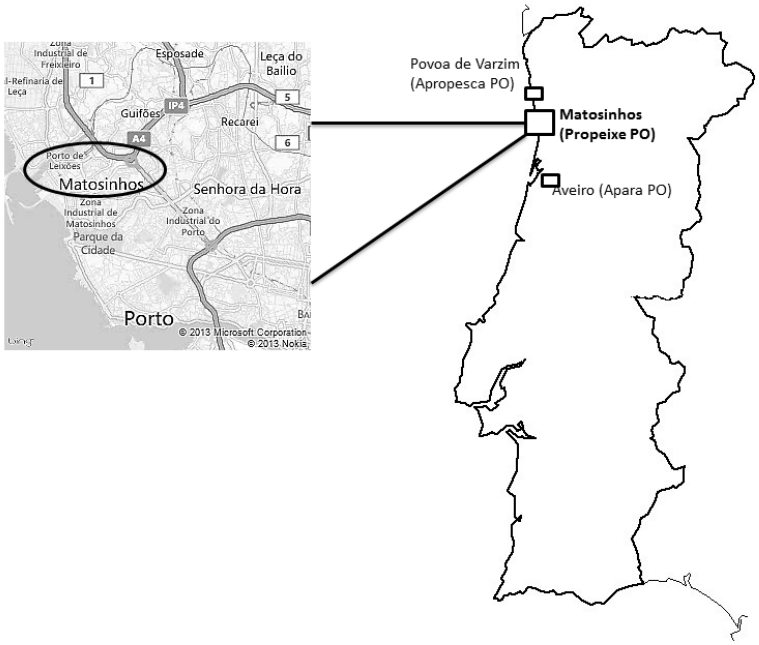

Figure 5-2: Location of the case study (Propeixe, Matosinhos)

Historically, Matosinhos port is recognized for its organization (fishing rules) and good functioning of the fish auction system (diversity of buyers and competition among them).

When Propeixe was formed in 1986 it had over 70 members. Currently it counts 21 members (ship owners), originating from Póvoa de Varzim, Vila do Conde and Matosinhos. The urbanization of Matosinhos, combined with the abatement of vessels during the 1990s and lower profitability, led to the gradual disappearance of the fisher community. Propeixe membership further decreased due to the founding of new POs in neighboring ports, such as CentroLitoral in Figueira da Foz (formed in 2000) and Apara in Aveiro (formed in 2010).

Propeixe is well-known for its bylaws that refer to the practice allowed (exclusive purse seine) and vessel size (minimum 14m). Operational rules regulate fishing hours (fishery starts each day around midnight) and fish sale (one sale/day). Members are entitled to 190 fishing days/year. The main target species is sardine; other pelagic species, such as chub mackerel, horse mackerel and anchovy account for around 10 % of the total catch (Almeida et al. 2013). The crew includes between 21 and 25 people and fishing takes place within the inner continental shelf off the mainland between landing ports Figueira da Foz and Viana do Castelo. The annual quota is managed through daily landing limits and a fishing ban that starts in the middle of February and can last until the end of March.

Propeixe members' production corresponds to 38% of the national sardine catch (Almeida et al. 2013); fish is sold through the fish auction system to processing industries and retailers (95,34%), or direct

sale contracts (4,66%)[21]. The main buyer is the canning industry: each day four members sell their fish through contracts with the industry. During the last decade, Propeixe has invested in land-based facilities. In 1996 it rented a fridge structure from Docapesca and started freezing, packaging and selling its own products. Other investments included a gasoline pump, fish transport forklifts and four vehicles (one with freezing storage). Propeixe is financed in a number of ways including entrance fees, landing levies and company earnings (freezing and packaging industry). It currently employs 10 people working for the PO administration and 14 temporary workers in the freezing and packaging industry. Additionally, it introduced innovative services, creating a 'Propeixe' label, which is used for both canned and frozen fish.

5.3 RESULTS: 'PERCEPTIONS'

As explained above, data analysis was performed in three main steps: 1) exploring fishers 'perceptions' 2) inferring about 'social learning' from perceptions and 3) discussing implications for 'adaptability' in PO. Findings are summarized in *Table 5-2*.

5.3.1 PO membership incentives

Economic power, common interests and need to belong

First, Propeixe's *economic power* was definitely the most dominant incentive for PO membership. All interviewed fishers recognized that the more assets a PO has the more beneficial it is to them. Fishery and commercialization benefits include: quota management, possibility of making contracts, use of intervention mechanisms, as well as providing better working conditions for its members. Conversely, lack of economic power, due to low captures or bad management, appears to be a prevailing reason for membership withdrawal. Fishers relate this to PO's weak structural characteristics (e.g. lack of employed workers: the organization is usually managed by ship-owners who still exercise fishery, limiting their daily availability). One fisher with double membership experience commented on this in the following manner: '*My father was a president of PO because of his experience as a fisher…he was almost illiterate…and he was never there because he was fishing. It can't be like this. We need someone who is here all the time.'* Lack of capital additionally reflects absence of evolution and changing composition of the PO, which fishers themselves perceive as very negative as it fails to encompass their needs regarding fish marketing.

Second, Propeixe's (constitutional) rules on fishery type and vessel size brought together fishers with *common interests*. The homogenous nature of PO membership is perceived as important for fishery activity and business, as it facilitates PO management by increasing internal control amongst

[21] Personal conversation, with Manuela Duarte and Carlos Gonçalves, Direcção Geral das Pescas (DGPA; the Directorate General of Fishing), November 13, 2012

members, summarized by one Propeixe member as: (*'It avoids conflict. There is no one to pull for his own art.')* Simultaneously, structural heterogeneity is seen to impede communication among members and implementation of common rules on resource use and may lead to members' disunity. Fishers with double membership experience recalled how they felt about this internal dynamics: *('When they (artisanal vessels) needed an organization we accepted them. We were sustaining that PO, but after a while they became the majority and in terms of voting they had more authority. The prey turned against the hunter! That's why we agreed to leave and come here.').* Finally, conflicts of interest, experienced either as conflict with the leader or with other members, are likely to emerge as a reason to exit a PO, framed by one of the respondents as: *('I left when interest of some members became more important than the rules of the PO.')*

Finally, while economic incentives and common interest are listed as dominant reasons for membership, fishers *'need for organization – to belong, to feel protected and secure'* remains an important background issue. *('We are very aggressive when we go to the sea. But here...we don't know how to defend ourselves.')*.

5.3.2 Satisfaction with PO membership experience

Fishers expressed a high level of satisfaction with the effects POs have on their fishing activity and marketing practices and with contact from the PO to members.

Rules, leadership and change

PO bylaws on vessel size and fishery type increased members' competition. Fishers view competition as vital for their activity and fish marketing as well as for organizational development – as one of them put it: '*Competition is good for evolution.'* PO fishing rules (e.g. daily landing limits and fishing hours) brought changes in productive practices with the obvious market advantages for their members, currently perceived by all interviewed Propeixe members as: *'The less fish I bring to land the more money I earn.'* Besides regulating offer and stabilizing fish price, members appreciate rules, as they increase internal discipline and trust in one another. ('*Here we are always controlled and this is good for us. Organization is like a police. Without a police there would be no respect and no understanding between fishers.*') Finally, satisfaction with rules relates to fishers ability to participate in rule design and enforcement. Younger Propeixe fishers commented on this issue in the following way: *'Here, who decides on things are us. Because without the vessels Propeixe is nothing, and without Propeixe, vessels are still something!'*

The current PO president is identified by all members as their principal leader and the main person responsible for internal discipline, demonstrated in the following statement: *'If he wasn't here I don't know what would happen with us.'* His education and fishery experience make fishers trust his ability to communicate. They see the leader as someone who is necessary and crucial for both their jobs and their contact with the PO, articulated by one of the respondent as: *'We will always need someone to lead us.'* Fishers highlight as very important their leader's interest in, and capacity to, facilitate change, such as PO investments in freezing industry. This land-based facility enables improved use of

intervention mechanisms, perceived by fishers as beneficial for regulating the price of their products. Also, they acknowledge how he succeeded in transforming their mindset: from previously being reluctant to change and associated risks towards now appreciating organizational changes as being in their best interest. (*'Sometimes we don't trust him...but when the time comes we see that he is right').*

5.3.3 Interactions within PO and relationships with other actors

Fishers articulated a quite consistent view of the effects of PO membership experience on their mutual interaction and with other actors. In sum, they argue that PO does not facilitate members' mutual interactions, summarized by Propeixe eldest fisher as *'There are no friendships in fisheries!'*, nor substantially changes relationships with other actors in the sector.

Subnetworks

Twenty one Propeixe fishers are divided in five subnetworks or as they call them 'marriages'. Members of one of these groups commented on this by saying that *'People fall in love with a woman…here it is the same.'*. 'Marriages' are based on their origin and family bonds. Both at sea and on land they are used to working and interacting within these subnetworks and defending their interests. As part of a close social circle, members do interact on a daily, informal level: they eat together, play cards, tell jokes or share information on basic community issues. However, concrete experiences with regard to production and market activities between subnetworks remain unspoken and hidden. This is framed by one fisher as: *'If I could catch fish alone, I wouldn't tell anyone; but I can't, so I have a partnership with 4 vessels, but then what I do only my group knows'.*

Conflicts among members and examples of non-compliance are resolved through discussion and voting during PO meetings. Yet, the entire membership rarely meets. Contact with the PO is based on fishers informal communication with the leader who serves as a 'listener' and mediator of everyday problems, as demonstrated by following statement: *'when we need something we speak with our president.'*. Propeixe leader explained further how this communication strategy benefits PO performance: *'Fishers are individualists…well, this creates difficulties in bringing them together…but their competition is what pulls Propeixe forward.'* Some fishers articulated that the direction of Propeixe is currently experiencing difficulties with internal discipline. (*'Now, we are 21 and if 15 want something and 6 do not, they say: 'ok, if it is like this, then we are going'…and PO can't do anything…it is a bad sign when you lose members.')*

Mentality, history and tradition

Elder fishers, with long-term membership, view the lack of interaction as a contemporary problem brought by the self-interest of their younger colleagues, expressed as: *'young fishers have this idea of money: they want to earn everything today. Tomorrow is not important for them.'*. Younger ones are also perceived as less respectful to their colleagues and to the resources, commented as '*young fishers today think: 'older ones…they didn't know anything'…Ha! Everything we know today they*

taught us! Young fishers know because they have technology…but this is only half of the way...older ones knew because of their experience, their way of dealing with nature…years they've lost to the sea, you could see these years…today it is very easy going at sea.' Thus, they are often less adherent to collective actions, e.g. fishing hours and fishing ban.

Conversely, according to PO membership, the past still conditions their relationships with other actors in the sector. The historical interdependency of actors is perceived as an important part of the social fabric of the Matosinhos community, demonstrated by the Propeixe leader comment: *'we can't live without each other'.* There is a canning industry, which is an icon of the region, two dominant regional retailers (freezing and packaging industry), numerous smaller retailers and the regulating authority, Docapesca. Interdependency is maintained through PO market philosophy, '*keeping well for everyone,'* where competition is nurtured within membership and others, i.e. the canning industry and retailers are seen as partners. PO members do complain about some ingredients of these relationships, i.e. the sardine price they pay through contracts with the canning industry. One of interviewed fisher perceived this issue as: *'They are the most secure clients, but the price is not reasonable'.* However, they doubt PO capacity to foster change on this issue, articulated by the other member as: *'PO cannot give the orders to the industry.'*

5.3.4 What has (not) been learned: problems and opportunities

All interviewed fishers recognize radical change, recapped in the excerpt: *'the less fish I bring–the more money I earn',* in both their fishery and marketing practices induced by the PO. Another issue they articulated as being obtained from their membership concerns their own increased appreciation of change as something beneficial both individually and collectively.

This being said, fishers' subnetworks have different views of the problems their fishery is facing, such as resource scarcity, sardine price, catch limits, price of gasoline, commercial sellers who generally dictate prices, lack of government support, lack of communication between purse seine POs, amongst others. However, from these, the two most relevant issues that arise are resource state and sardine price.

Resource state

Even though all fishers talk about resources, they lack agreement on resource state and the consequent need for resource management. There are two opposing views on this matter. About half of the interviewed PO members look at the resource as a never-ending asset: they do not perceive sardine scarcity, or see it as a temporary problem, caused by others. These 'non-concerned' fishers support theories that temporary lack of sardine is a cyclical fluctuation caused by environmental factors and climatic changes. (*'They always evaluate stocks in periods when there is no sardine, when it is cold…fish also feel cold…').* Likewise, 'non-concerned' fishers respond to the 'temporary' decline by '*looking for sardine more intensively'* and catching what is available. In the long term, certain

scarcity is viewed as positive for their business, illustrated by the following statement: *'The less sardine there are, the more money it will give us'.*

The other half of the interviewed fishers, the 'concerned' ones, are continuously alert to apparent decline in sardine stock. In their own experience and memory the problem of sardine scarcity is caused by: i) weak implementation of the fishing ban: *('When some POs stop, others work. (In the last 5 years) we have stopped doing this and we are already paying for it');* ii) fishers self-interest / competition: *('if I catch more than I can bring to land I will throw away the rest. I'm not giving to the others…if I give them I will earn less…I am against this, but I do the same'.*); iii) non-PO members' activity (*'It's a crime how small vessels work. They fish close to the coast and they kill juvenile fish');* and *iv)* advanced technology *('Arms are more deadly today, so our vessels are looking for something that before was very difficult to find').* For 'concerned' fishers catching what is available is part of an irreversible change they are afraid of, articulated by the eldest Propeixe member as: (*'if we depended only on sardines we would die'.)* They argue that the entire purse seine fishery community should reduce or stop fishing entirely (during the fishing ban) in order to reduce the pressure on the fish stock and increase profitability. Benefits of the fishing ban are viewed in the following manner: (*'sometimes when we do not work we earn more than when we work'.)*

Sardine price

Fishers' subnetworks agree on this problem and perceive sardine price as low, especially the price they get from the canning industry. Most fishers perceive this as an 'acceptable' problem the PO cannot do anything about. (*'The price of our fish has been stagnating for a long time and it will stay like this.)* They view price as a result of traditional interdependency between the fishers community and the canning industry. The continuous industry demand for high quantities of fish gives security to the PO, but requires low prices, commented by the Propeixe leader as: (*'low sardine prices give a certain stability to the entire sector.')*

The issue of low price is further related to competition with other purse seine POs and with other dominant buyers in the region, as *'sardine is everywhere, from north to south'*. Finally, fishers label sardine price as a *'psychological price'* that reflects established consumer habits and current willingness to pay for canned sardines, which is traditionally low. *('If you, as a buyer, see a can of sardines in the supermarket that costs twice the usual, you will say: 'what is this?'...and you will end up buying two steaks, because everyone is used to sardines being cheap. This can shake the canning industry, and us.'*)

5.4 DISCUSSION

5.4.1 Social learning in PO

As explained in subsection 2.2, fishers 'perceptions' are used to infer conditions leading to social learning and potential outcomes (*Figure 5-1*).

5.4.1.1 Re-considered / changed learners' attitude and behavior

Social learning processes at a deeper level may (or may not) encourage a change in behavior (Reed et al. 2010). Learning may lead to behavioural change if there is an incentive for such change (van de Graaf and Grin 1999). Through (economically rewarded) PO experience fishers learned to think differently about their business and accordingly behave differently, *'less fish I bring– more money I earn'.* This confirms the assumption that learning within user groups is rooted in experiences and results from a change in how things are done (Rodela 2011). Other learning incentives are fishers subjective needs, '*to belong, to feel protected and secure',* based on individual experience, mainly '*how it feels to work alone*'. PO economic power and how leadership uses this power to satisfy fishers needs, creates member security and satisfaction with their jobs, which may increase their learning capacity. Gutierrez et al. (2011) identify strong leadership as the most important attribute contributing to success of fisheries. Our results verify that PO leadership personal characteristics, i.e. expertise (experience), competence (education), daily presence and communication skills are essential for shaping fishers' attitudes towards work and day-to-day practice. Moreover, leadership interest in PO structural change and consequent commercial benefits for fishers encouraged them to accept collective responsibilities and think in a collective manner about their livelihoods. This has resulted in 'shared wisdom' on how much change is important for their activity as well as for PO adaptation to external pressures.

5.4.1.2 Re-considered / changed learners' relationships

Social learning contributes to co-management by identification of common purpose and transformation of relationships to collaborative ones, i.e. strengthening good relationships, transforming adversarial ones and creating new relationships (Schusler et al. 2003). Our results demonstrate that fishing practice of PO community strengthens already good social networks in the region, providing the context through which community bonds, as found in other studies (Ross 2013). Our results also show that, internally, through its rules, Propeixe succeeded in transforming relationships among its members. PO rules brought together fishers with common interests, which enhanced membership interdependency. Members' common interests facilitated (fishing) rules compliance and implied fewer management problems for the PO. Through experience over a long time and learning that others obey the rules, fishers learned to trust each other. Relations of trust, based on fishers' self-commitment to follow the rules (Ostrom 1990) are prerequisite for their cooperation and social learning (Berkes 2009, Gilmour et al. 2013).

Yet, the study of Propeixe also indicates that there are issues on which no social learning, leading to common understanding has been achieved. Important differences remained within Propeixe regarding resource state and sardine prize. These two issues highlight that although trust exists among membership at the PO level, there are also smaller networks of fishers (subnetworks), with differing interests and influences, amongst whom there is even more trust. Subnetworks share family and kinship relations, found to be of vital importance in how the Portuguese live and work with one another (Solsten 1993). Trust within subnetworks works out and is maintained through family bonds, thus seemingly more *a priori* given, than an achievement, as was the case for the PO as a whole.

As a result, the potential for social learning is undermined. Subnetworks competition, nurtured by the PO itself as good for fishers productive and marketing practices, negatively impacts their interaction and the development of relationships. Moreover, subnetworks relationships depend on membership size. Smaller POs may experience difficulties in introducing strict discipline, as the PO is afraid of losing members (Phillipson 1999). Our results confirm these findings. As perceived by some fishers, outnumbered groups might use this fact to influence the decision-making process or slightly 'bend' jointly agreed rules. Moreover, our findings indicate that PO policies are influenced by different economic capacities of subnetworks and the consequent power relations this might create. As Propeixe lives from its members' production, those who fish more and bring more economic capital to the PO may gain more power in decision-making processes, reducing members' interdependency and capacity for collective learning.

One might think that lack of internal discipline could eventually lead to general distrust in PO, yet it does not happen due to leadership capacity to overcome these problems by reconciling subnetworks' interests. Thus our findings confirm, in a way, Ison et al 's (2007: 508) claim that "cross-scale networks characterized by strong linkages and nesting hold the potential to create opportunities for actors operating at broader scales to mobilize knowledge and exert power over local resource users" - but adds as a key factor trust in leadership at these broader scales.

5.4.1.3 Re-considered / shared problem understanding

Social learning may promote the generation of new knowledge, e.g. problems and opportunities, areas of agreement and disagreement (Schusler et al. 2003). Users' ability to agree on resource related problems and resource status is vital for their collective action in the scope of adaptive co-management (Ostrom 2005, Gilmour 2013). Propeixe fishers' diverse problem(s) formulations show that the PO hardly influenced knowledge sharing among members on problem(s) pertinent to their fishery. One might understand this as a reflection of the fact that the fisheries problem is an unstructured one: actors disagree as how precisely to define it as there is no certainty about relevant knowledge and no consensus on values at stake (Hoppe 2010). Resource state is especially relevant in this aspect. Opposite views on this problem and ways of dealing with it show that Propeixe fishers agreement on rules for managing the resources does not necessarily result in mutual learning on resource status. This may partly be explained by subnetworks dynamics within the PO. Subnetworks

who share family and kinship relationships communicate better and have similar knowledge; their reluctance to share these framings limits PO learning capacity.

The second problem, the price of sardines for the canning industry, is a shared, unstructured problem among PO fishers. Prolonged sardine scarcity might lead to an increase in price. Instead of perceiving this as potentially beneficial for fish marketing, fishers react counter-intuitively: they fear this change because they doubt the adaptive response of the canning industry and the consumer. Moreover, they fear their own adaptability since they recall that purse seine vessels are structurally rigid (equipment, design), which makes the switch to another type of fishery hard to accomplish. Collective awareness of low sardine price creates the potential for building shared knowledge and finding solutions to the problem. In other words, fishers might learn from this problem.

Still, variations in problem framing reveal fishers awareness on PO need to adapt to overfishing, environmental conditions and problems with market and regulations. The important question is then to what extent fishers with various problem understandings contribute to social learning. Bommel et al (2009) argue that one of the pre-conditions to be met for the social learning process is precisely a divergence of actors' interests, with conflicting or competing claims. From this viewpoint, PO members' different problem framings, as a 'multiple source of knowledge' (Schusler et al. 2003), might be essential for learning, and thus adaptability, by diversifying the possible responses to changes and uncertainties.

5.4.2 Adaptability in PO

Learning can be seen as a process of change in the way fishers perceive their world – their thoughts, feelings, relationships and actions. Social learning in PO implies that fishers share these perceptions and learn through shared experiences, which may diversify their responsiveness to changes in fishery system and increase their livelihood options.

5.4.2.1 Opportunities

Our findings suggest that social learning in PO occurs in layers. The first layer implies the level of the PO network as a whole, where learning is nurtured through members' individual satisfaction with the PO's work. Secure in their jobs and trusting each other to keep the rules going, members trust PO ability to collectively represent their needs in the sphere of fish production and commercialization. Extended engagement with the PO is pertinent in this aspect as both trust building and social learning, as key determinants in building adaptive capacity, are long-term concerns (Armitage and Plummer 2010). By experiencing change, i.e. change in management practices and structural change of PO, fishers realized that although they do not control all the conditions that affect them they might change some of them. In short, they learned to sustain themselves through change via adaptation and occasional transformation.

Furthermore, the framework used for data analysis revealed a positive feedback of outcomes on the attributes. For example, trust is actually increasing through a positive feedback of outcomes, such as

members' security and confidence (including trust) on the conditions that promote social learning (*Figure 5-1*). This feedback loop is promising for the POs role over time and their adaptability to contemporary problems.

5.4.2.2 Challenges

The second layer reaches the PO membership. Our results suggest that in contemporary fisheries, the culture of the 'self' among fishers may increase over time as the 'contemporary fisher' lacks the interest to learn through shared experience. Furthermore, fishers' compliance with rules seems to decrease amongst the younger generation of fishers, also found by Ballestro et al. (2013). Due to PO age structure this could be worrisome for PO adaptability in the future as elder fishers memory of past events, i.e. environmental fluctuations, might provide a basis for adaptability through modification of rules in periods of change and crisis (Berkes and Folke 2002).

Our findings also reveal that 'ensuring the best marketing conditions for their products' is still by far the most important incentive for PO membership, as 'learning together to manage together' (Ridder et al. 2005) sometimes works against their interest *('might earn less'*) and mentality (*'want to earn everything today'*). This decreases members' ability to agree and act collectively on resource related problems. Hence, it may be interpreted as evidence of weak PO adaptability. 'Non-concerned' fishers views on decline of sardine stocks, i.e. compensation with other species or increase of fishing effort are especially worrisome in this aspect. This type of reaction indicates signs of so-called 'short-term positive' fishers adaptation that may in the end force them out of business (Cinner et al. 2011). The 2012 suspension of MSC certification for the Portuguese sardine fishery provides evidence for this concern.

5.4.2.3 Why the positive outweighs the negative

However, Pretty (2003) argues that this is a typical manner of thinking for fishing communities worldwide: they hardly appreciate that what they are doing might be harmful on a wider scale. That is why cooperation with other institutions is needed. Some signs of resource scarcity are potentially powerful attributes in stimulating users need to manage for the future (Ostrom 2009). The temporary crisis of the sardine stock that led to suspension of the MSC certification for the Portuguese sardine fishery triggered collaboration and collective actions within the purse seine fishing community. Learning in this process has been operationalized as a change in management practices at higher levels, e.g. policy, with interest in ecosystem responses, and finally as a certification reinstatement. Enabling legislation and commitment from higher order institutions is crucial to support knowledge co-production for learning and adaptation (Armitage et al. 2011). PO might contribute to co-management of fisheries as a local institution that monitors and responds to environmental feedback (Olsson et al. 2004) to assure appropriate follow-up of this collaboration and learning to deal with change. In other words, PO adaptability should be observed both within as well as in the context of its interactions with

other institutions.

Table 5-2: Summary of findings

1. PERCEPTIONS - PO EXPERIENCE		2. SOCIAL LEARNING IN PO		3. ADAPTABILITY IN PO	
Issues	**Aspects (emerged from interviews)**	**Attributes**	**Outcomes**	**Opportunities**	**Challenges**
Incentives	Economic power	Changes in practices Economic and other incentives	Security and satisfaction with the jobs, new job attitude - 'less fish I bring– more money I earn' (a)	X	
	Common interest	Mutual interdependence Constructive conflicts and facilitation	Identification of common purpose and enhanced membership interdependency; less management problems for the PO; Increase of membership competition (b)	X	X
	Need to belong	Power Ownership	Fulfilment of subjective needs - protection and empowerment (a)	X	
Satisfaction	Rules	Change of practices Experience (reflection on concrete experience) Ownership Trust	Increase of internal discipline and control; enhanced trust in each other; enhanced members self-commitment to follow the rules (b)	X	
	Leadership and change	Leadership	Satisfaction and confidence in PO, appreciation and interest in change (a)		
		Change in practices Constructive conflicts and facilitation Trust Change of existing assumptions	Internal discipline and enhanced trust; Dependence on leader for communication (b)	X	X
Interactions	Subnetworks	Lack of interaction Group dynamics Trust; Power Divergence of actors' interest –competing claims Lack of reflection on concrete experience Leadership	Strengthening of already good relationships, i.e. family bods and friendships; subnetworks competition, power of outnumbered subnetworks (b)		X
	Mentality	Lack of communication and knowledge sharing Lack of reflection on concrete experience	'money-driven' young fishers mentality (a) Less respect and less obedience (b)		X
	History and tradition	Mutual interdependence Challenging existing assumptions	Security and stability; embedded problems, i.e. sardine price (b)	X	X
Problems & opportunities	Different problem formulations	Multiple source of knowledge	Lack of agreement on problems (c)	X	X
	Resource state	Multiple source of knowledge Experience (reflection on concrete experience) Crisis moments or issues of high concern	Opposite views of the problem (c)		X
	Sardine price	Knowledge sharing Mutual interdependence No challenging of existing assumptions	Shared problem among membership; uncertainty on issues at stake; acceptance of problem and fear of change (c)	X	X

(a) Re-considered / changed learners' attitude and behavior; (b) Re-considered / changed learners' relationships; (c) Re-considered / shared problem understanding.

5.5 CONCLUSIONS

In line with the exploratory nature of the study, the conclusion section explicitly presents findings as inputs for further research.

POs may make a difference with regard to fishers' adaptability to changes in the fishery system by stimulating social learning. The following attributes are essential in this regard: change in practices, economic and other incentives, rules and trust in leadership. Moreover, POs add to a mere market structure the properties of network coordination: interdependency and trust as a basis for co-operation. Trust between fishers is achieved through experience over a long time and learning that others obey the rules set by the PO. This brings members security for their livelihoods and further increases trust and confidence within the PO. Finally, trust within the PO is maintained through the confidence in the leader and his ability to communicate, enforce rules and foster change. Thus POs indeed represent the sort of arrangement which Ostrom and the co-management literature (e.g. Ostrom 1990, Berkes 2009) call for, as it may help promote the adaptability needed.

However, limited interaction among members may limit the potential for social learning, making the PO less adaptive than it otherwise might have been. Our study indicates that even within a homogenous PO membership smaller subnetworks of fishers who are socially close to each other, e.g. through kinship relations or old ties between families, may occur. As trust within these subnetworks is much larger than trust between members from different subnetworks, this may hamper learning within the PO as a whole. In addition, different mentalities among the members, i.e. younger and older fishers, tend to limit proper interaction and knowledge sharing within the PO. This has resulted in a lack of agreement on problems pertinent to their fishery and eventual differences between subnetworks in how they deal with them.

In order to play a more significant role for fishers' adaptability through stimulating social learning, POs should serve their membership as much a possible through proper management and fulfillment of market responsibilities. They should provide members with the resources — daily support, commercial contracts and land-based facilities— to increase satisfaction and security in their jobs as fishers. Probably more important, though, is to promote interactions and communication between fishers so as to reduce the constraints to learning amongst them. To that end, POs leaders might for instance promote membership meetings on shared concerns and issues as they arise. This would create conditions for members to deliberately discuss and negotiate rules, power relations and marketing strategy. By improving conditions for membership collective learning, POs enhance their adaptive response to pressures in fisheries; furthermore they increase their capacity to learn with and from other actors in the sector, which is crucial for fisheries co-management.

Further research should involve different examples of fish POs to understand how different contexts (e.g. ecological contexts, heterogeneous membership) and power dynamics influence the ability of POs to foster social learning and adaptability. It is important to validate the social learning model applicability to analyze how POs communicate with each other and how communication occurs across organizational levels.

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CHAPTER 6 - DISCUSSION: THROUGH THE LOOKING GLASS OF ADAPTATION

The Caterpillar was the first to speak.
'What size do you want to be?' it asked.
'Oh, I'm not particular as to size,' Alice hastily replied; 'only one doesn't like changing so often, you know.'
'I DON'T know,' said the Caterpillar.

Alice's Adventures in Wonderland, by Lewis Carroll, 1865

DISCUSSION: THROUGH THE LOOKING GLASS OF ADAPTATION

Many have claimed that complex problems of globalized society challenge its adaptive capacity (e.g. Folke et al. 2005, Hughes et al. 2007, Carpenter and Brock 2008). In this context, institutions that manage human –nature relationships must be transformed to better match the complexity and dynamics of the planet's biophysical systems, while also dealing with humans' capacities to overuse these systems (e.g. Folke et al. 1998b, Young et al. 2008, Deadlow et al. 2013). Nevertheless, there is widespread evidence that human adaptation in the Anthropocene is not on the path of social-ecological resilience (e.g. Rockström et al. 2009, Gerst et al. 2014). As a result, a deeper understanding of how organizations in particular institutional contexts can improve social resilience (e.g. Boyd and Folke 2011, Hall and Lamont 2012) and how this contributes to overall social-ecological resilience is required.

This thesis explored this claim by focusing on adaptive resource users' organizations contribution to resilience and by investigating four central questions:

rq#1) how can we conceptualize adaptability of resource users' organizations?

rq#2) what can we learn from cases of such organizations and the degree to which, and how, factors from our framework influence (enable or undermine) organizational adaptability?

rq#3) how may organizational adaptability contribute to improving social resilience?

rq#4) what are the challenges for adaptability - when and why may organizational adaptability fail as a social source of resilience?

In this Chapter, the research questions will be discussed through a reflection on the findings presented in Chapters III – V.

To explore these issues, the Discussion chapter proceeds as follows. The first section provides a summary of the work developed with the fish POs from Portugal: it describes how organizational adaptability was analyzed, what are the main results and their interaction, which answers rq#1 and rq#2. Based on the case studies, the next section answers rq#3 by identifying three layers of social resilience and adaptability, and introduces several key ideas behind these layers that increase the organizational contribution to social resilience. This is followed by a section that discusses specific examples of situations where PO's adaptation failed to contribute to social-ecological resilience, and a section which identifies reasons behind this, discussed as societal limits to adaptation and resilience. Together these two sections answer rq#4. The final chapter of the thesis then reflects on the implications of this set of observations for human and institutional capacity to deal with change.

6.1 SUMMARY OF FINDINGS

In Chapter III (Paper I) resilience and organizational literature formed the analytical basis to develop a framework to analyze organizational adaptability. Integration of these theories on the case of a specific PO (ArtesanalPesca, Sesimbra) allowed us respond to rq#1 and contributed to responding rq#2. Though SES literature provides initial frameworks to study SESs from a social science perspective (e.g. Ostrom 2009), this model was chosen as it focuses on organizational behaviour and explicitly includes organizational learning theories into resilience concepts. It was found that the key dimensions relevant when analyzing adaptability in resource users' organizations are external (panarchy of contexts, long-term historical trends and evidence of crisis) and internal (organizational structure and processes). The framework also brought together, on the basis of the existing literatures, the various factors thought to influence organizational adaptability, including questions that enable their 'measuring'.

Chapter III further discussed their relevance by exploring one specific PO case in these terms by triangulating various sources of data and factors included in the model. Empirical exploration of relative weight and the relations between these factors contributed to provide a first answer to rq #2. Main factors found to enable adaptability in this specific case were the ecological context (e.g. monopoly over the fish species), evidence of crisis, structural change, and above all, leadership capacity to foster learning and collective action essential to deal with crisis. Furthermore, the empirical work illustrated the ways in which PO adaptive response relates to its capacity to manage production and market demand and how it contributes to overall fisheries resilience (rq#1). The chapter concluded with the ideas on how this adaptability might be translated into resource management practices (i.e. 'making sense' of crisis, practicing adaptability through learning and planning transitions), which partly answered rq#3. Nevertheless, it remained ambiguous what was the exact weight of the ecological context in this case (e.g. the black scabbard fish monopoly) and how it simplified PO adaptive response.

Hence, in order to further develop our answer to rq#2, we wanted to explore how different contextual (i.e. physical system; market institutions) settings impact PO adaptive response and if theoretical notions of adaptation (the same factors that influence adaptability) are also valid. To achieve this, in Chapter IV (Paper II) the same framework was applied to twelve cases of POs, each of which has been investigated on the basis of narrative interviews with key leaders in charge of POs. Comparisons of POs in terms of contexts, organizational structures, awareness of problematic trends and crisis and type of response contributed to clarifying different modes of adaptability amongst PO (anticipatory, maladaptive and reactively adaptive). Modes are found to be contingent to contexts (´convenient' or 'bad') and types of change or trends (e.g. 'slow' environmental change, market crisis, transformational change and inertia or resistance to change).

Furthermore, this chapter made it possible to answer rq#2 by identifying key factors that explain different degrees of adaptability: prejudiced market regime, prevalence of specific fishery and market crisis as contextual conditions; and leadership, trust and perception of self-interest as agency features, whose impact depends on organizational processes such as learning and collaboration with the

demand side. On the one side, the study demonstrated that internal adaptation could improve POs' contribution to fishery management and resilience (rq#1). On the other, however, it emphasized that continuous maladaptation practices of some POs point at a basic institutional problem (fish market regime), which clearly reduces system resilience as it promotes overfishing. Finally, the weight of agency, including subjective attitude towards adaptation, was revealed as crucial for organizational adaptability hence the initial framework was revised to include this dimension (contribution to rq#1).

Consequently, Chapter V (Paper III) further explored the importance and nature of agency for internal adaptation by exploring this in one PO case (Propeixe, Matosinhos) in more detail. It was partly based on ethnographic research, as this suited that question. This chapter aimed to understand how individual fishers' (PO members) behaviour and perceptions influence adaptability of organization, thus contributing to answer the rq#1. It was confirmed that the POs' adaptability depends in part on the way fishers perceive their membership experience (i.e. membership incentives; satisfaction with membership experience; mutual interactions and relationships with others; and dealing with everyday problems, including the impact of PO on the generation of new knowledge), by means of perceptions' direct impact on fishers' behaviour and motivations to learn from each other. As a result, this chapter emphasized the learning dimension of adaptation, proposed earlier (Chapters III and IV), while zooming-in on the importance of 'network-centric' social learning (Rodela 2011 and Wenger 1998) - as a key strategy for organizational adaptation (contribution to rq#3). By studying perceptions in terms of social learning impact, this study found additional factors viewed to contribute to organizational adaptability such as changes in practices, economic and 'need to belong' incentives, rules and trust in leadership, which foster interdependency and trust (contribution to rq#2). Nevertheless, the study demonstrated that certain institutional aspects of fisheries exist, like incentives, social and cultural issues, etc. that limit fishers' interaction and communication and hence their collective learning. As a result, even fishers (PO members) who share a common interest disagree on problems pertinent to their fishery (e.g. resource status) and on how to deal with them, which may inhibit their capacity to adapt to environmental changes.

The framework for analyzing adaptability in resource users organizations has evolved throughout the empirical work, from context, crisis, structure and processes as basic framework elements (Chapter III), to a more in-depth exploration of the learning dimension of adaptability and recognizing the weight of individual agency (Chapter IV and V), to thinking about how types of crisis and associated risks impact adaptability in organizations (Chapter IV). The case studies reveal how each element of the organizational adaptability model, and most importantly, their mutual interactions, matter to organizational problem framing, understanding of change and consequent response. Analytically, the framework may inform an organization on how different agency, structure and processes may influence their adaptability to the specific contextual settings and changes within.

6.2 ADAPTABILITY AS A SOCIAL SOURCE OF SYSTEM RESILIENCE

The above described work contributed to SES literature by paying attention to the dimension of societal resilience (e.g. Adger 2000, Hall and Lamont 2012) in the context of resource users' organizations. Based on the case studies, this section identifies three layers below as layers of that issue and introduces key ideas institutions may employ to increase their social resilience (rq#3).

This section also tentatively answers our main research question: how may social adaptability contribute to overall system resilience? Tentatively, because there are some limits to that answer, as we will discuss in the next section, thus answering rq#4 with some qualifications to answer to our main research question.

1) adaptability - accepting change and disturbances;

Embedding in both resilience and complexity thinking is the management of social-ecological systems that implies embracing change, rather than focusing on the need to control nature and keep the system in some optimal state (e.g. Anderies et al. 2006, Rogers et al. 2013). Internal adaptation in the Propeixe PO case (Chapter V) illustrates how organizational openness to change contributes to both social and ecological resilience: 1) acceptance of system's low stability (e.g. fluctuations in sardine productivity), 2) anticipation of consequences (e.g. irregular supply and price) and 3) thinking of ways to increase fishers' resilience to environmental change and regulate fish production (e.g. changed institutional rules on fishery practices, or land-based facility to control supply). ArtesanalPesca's reorganization and creativity in response to market crisis (Chapter III) further strengthens the idea of perceiving crisis as opportunities (e.g. Folke et al. 2010), as they ask for rapid changes in the way we understand the world and the way we behave, critical to deal with social-ecological complexity (e.g. Rogers et al. 2013).

Adaptation as acceptance of change and complexity also calls attention to the networks that are part of institutional contexts, which requires re-thinking relationships – the effects that our actions (openness vs. resistance to change) have on others. POs that demonstrated the capacity to actively adapt to market or environmental change (Chapter IV) could not achieve this without support from their membership or through networks of relationships with other actors, perceived as partners in the adaptation process. Networking and building knowledge (e.g. Olsson et al. 2007) is particularly relevant for resource users capacity to deal with environmental surprises, framed by Gunderson et al. (1997) as Type II surprise - a collective action problem where individuals are not independent and need to act in concert.

Conversely, cases of resistance and inertia amongst fishers (Chapters III and IV) to PO adaptation response (e.g. new market strategy) revealed a dominant reductionist mode of thinking: unlike incremental change, fishers resist to a transformation of market institutions due to the impacts and disturbances it may create (e.g. fishery practices, tension between group and self-interest, power relationships, etc.), which they cannot control and seem to be uneasy with. Institutional adaptability as accepting change and complexity help to enlarge what Rodgers et al. (2013) call the problem space – which again increases people's ability to manage for resilience. In this context, if adaptability as an

organizational strategy changes the context (introduction of different *kinds* of change), organization (through its structures and mechanisms) needs to inform membership and help them recognize, beyond mental inertia, interconnectedness of things – e.g. in a context of POs how new market rules, which ask for collective responsibility, aid price stability (social resilience) hence decreasing fishery efforts (ecological resilience).

2) adaptability – (individual and social) learning from change;

In the scope of organizational literature, organizational learning, framed as deeper learning, i.e. double and triple-loop learning (Argyris and Schön 1978) implies collective environments where people reflect on problems and challenge their assumptions (Senge 1990) or even the whole frame of reference before acting (Raelin 2001). We can refer here to the ArtesanalPesca case (Chapter III), where active re-framing of the problem domains (Gunderson et al. 2006) and consequent experimentation with land-based facilities helped the organization to redefine market structure, adapt to fluctuations in market demand and increase its market power. In other words, the organization learned to think holistically about its role in terms of contribution to the resilience of the system in which it is operating. Propeixe study (Chapter V) reinforces the importance of social (experiential) learning as a key strategy for organizational adaptability. People learn socially (collaboratively) within the community of practice (fishers – PO members) around a specific practice (fishing) (Wenger 1998) – which is in fact the 'glue' for the co-evolutionary relationship between PO's, industry, auctioneers, etc. on the one hand and fish stocks on the other.

Adaptation as learning from change and mistakes calls for attention to the institutional context – how attributes of institutions, including organizations, might be designed and managed to nurture learning (Boyd and Folke 2011).

Our work contributes to literature by revealing three concerns in this respect. First, several case studies indicate the problematic of fishers' internal interaction and communication (e.g. Chapters IV and V), which seriously limits PO capacity to respond to change and crisis. Homogenous membership structure of Propeixe case (Chapter V) offers a rather pessimistic outlook on opportunities for learning within other POs, where different interests and practices might inhibit sharing of experience and reflecting on it. As demonstrated by our findings, the incentive structure matters to this problem: when the institutional embedment of a PO promotes competition and self-interest, this constrains fishers' learning and cooperative action. To deal with this issue, resource users' organizations need to elaborate mechanisms that match other incentives, i.e. 'need to belong' incentive (Chapter V), while enabling increase of membership sensation of protection, security and ownership. The same case also indicated how membership common interest increases organizational performance due to high competitiveness, but works in an opposite way for adaptability as it may reduce the likelihood of learning. To increase resilience by increasing diversity, which broadens the scope of a vision necessary to adapt to changes, bonding links from informal institutions (e.g. social ties between family or kinship members based on same fishery) need to be combined with bridging links to a heterogeneous web of resources (e.g. experimentation with other types of fishery) and associated opportunities (Newman and Dale 2005).

Third, and under the conditions given, the results of this research disclose that resource users' individual and collective (experimental and experiential) learning, as a result of daily deliberations on the job, is rarely spontaneous, stable or self-organized, as claimed by e.g. Johannesen and Hahn (2012). As such, it requires facilitation as well as orientation. Leadership is found as a crucial learning facilitator (also found in Nykvist 2014) through fostering internal trust (Chapters IV and V) and mutual learning as 'never-ending battle of explaining, convincing and listening' (Chapter III). Especially important is the leadership´s own learning process - experimenting the best way to approach its membership and communicate vision, while dealing with old mental models, internal resistance and inertia.

Nonetheless, an overall dependence on a single individual might be problematic for long-term organizational performance and resilience. To increase social resilience through increasing capacity to collectively learn from complex problems and changes, resource users' organizations require additional institutionalized communication and collaboration mechanisms and platforms. Besides supporting internal communication as well as collaboration with other actors and institutions, this substructure might store the 'institutional memory' (e.g. Dale et al. 1998) - organizational members' experiences concerning episodes of resource scarcity, management practices and responses to crisis, which provide the context for social resilience to ecological disturbance (Olsson 2003). Thus, a change in leadership (current reservoir of institutional memory) or the young fishers' visible lack of interest to learn from their elder colleagues' experiences (e.g. Chapter V) would not imply a loss of collective memory on how to deal with changes in resource and social conditions.

3) adaptability – acting and shaping change

Humans ultimately respond to change through action, which should be a result of the learning process. Nykvist (2012) argues for the need to open up a self-organizational framing of adaptation (e.g. Folke et al. 2003, Olsson et al. 2004a) to be able to understand and learn how it is organized by real people. The research presented here contributes to this argument by highlighting the importance of adaptability with intent, as a part of an organizational management strategy.

In this context, though different degrees of adaptability amongst POs (see Chapter IV) are contingent to contexts and partly shaped by PO's position, as a formal structure, within the social networks, as informal structures (e.g. Prell et al. 2010), the work repeatedly shows the crucial importance of agency in achieving transformations for adaptability (e.g. Olsson et al. 2006). We refer here to leadership, fishers' incentives, perceptions of self-interest, self-perception – how this influence fishers' actions and the impact this has on their mutual trust and learning, found to be key aspects of adaptation (e.g. Armitage and Plummer 2010).

In cases of proactively adaptive POs (Chapters III and IV) key individuals seem sufficient to leverage their organization to overcome the contextually embedded problems and eventually transform the context itself. Deeper understanding of the skills and capabilities of these agents enables a more complete understanding of how networks may improve their social capacity to respond to complex problems and heighten resilience (Moore and Westley 2011, Westley et al. 2013). Our work contributes to this respect by emphasizing skills and personal traits of proactive and adaptive PO

leaders that enhance fishers' collective capacity to adapt (see Chapter IV). What seems particularly relevant for organizational adaptability is leadership ability to inspire and motivate by communicating his/her vision. Visionaries and inspirers / innovators and experimenters (Berkes et al. 2003), change agents (Crawford et al. 2006), transformative or visionary leaders (Westley 2002, Olsson et al. 2004a, 2007) in PO cases frame problems in a backcasting manner (e.g. Vergragt and Jansen 1993, Quist and Vergragt 2006): from where they want to be towards the present. In pursuing their vision for the organizational future, these individuals demonstrate persistence to make this dream collective and patience to withstand others dissatisfaction, including inertia to change. Trust in leadership fosters membership collective action; otherwise, even as members of the same association they continue to feel and behave as individuals.

The research presented in this thesis also confirms the role of informal structures, i.e. social networks in influencing individuals' behaviours (e.g. Prell et al. 2010). For example, the relationship between leadership skills and the structural aspects of a network that mark leadership position is acknowledged as important (e.g. Westley et al. 2013). In this manner, as in large part of purse-seine fishers community strategic relationships are already built (i.e. social networks interdependency) leaderships is more diplomatic and conservative (Chapters V and IV) – the main role of leaders is to connect and engage with others as networkers and facilitators / sense-makers (Berkes et al. 2003) or knowledge and resource brokers (Moore and Westley 2011). In 'inconvenient contexts' of problematic market share (Chapters III and IV) – a key leadership skill is what Moore and Westley (2011) frame as 'pattern recognition' – agent's recognition and understanding of the patterns causing the rigidity (system) trap. We can see this from ArtesanalPesca PO and cases of POs with reactive adaptation response (with or without cases of resistance) – leadership recognized so called rigidity trap within market institutions (Carpenter and Brock 2008) and realized that optimization of future choices depends precisely on the change of this pattern, which occurred through structural change and relationship building.

In sum, strategies for adaptability in resource users' organizations increase system resilience by improving its social capacity to deal with complex problems through accepting change and system complexity, encouraging learning from change and the capacity to act and shape change.

6.3 CHALLENGES FOR ADAPTABILITY

Nevertheless, this is not always the case. This section answers rq#4 by providing examples of situations where PO adaptive response to change failed to contribute to social-ecological resilience.

Consider the aforementioned examples of anticipatory adaptive POs (see Chapter IV). Withdrawal mechanisms introduced by the POs made producers more resilient in the face of stock fluctuations and consequent market fluctuations of the fish price. However, adaptive strategies that led to social resilience did not reduce overfishing. Instead, subsidized fishery might have contributed to ecological vulnerability at the regional scale (see Chapter IV and V), while increasing resilience of the malfunctioning market regime. To a certain extent, this illustrates the supposition made by Gunderson

et al. (2006): communities rich in resources and monetary capital (e.g. purse-seine community), may fail to learn from mistakes they keep making because resources eventually provide them with solutions and learning can be replaced with organizational infrastructure. Likewise, some signs of resource scarcity may work as an incentive for resource users to manage better and adapt (Ostrom 2009).

Another example where human adaptation occurs at the cost of social-ecological vulnerability is found in the case of Propeixe members' adaptation to temporary resource scarcity through an increase of fishery effort (see Chapter V). This example of 'getting-by' behaviour or short-term positive adaptation (Cinner et al. 2011) lacks collective action for the benefit of sustainable resource management. Moreover, fishers are unaware of the costs their actions have for the ecosystem and how interconnected their actions are (how many are doing the same thing and what this implies for fish stock). Instead, they all individually think that they are doing the right thing (adapting to secure their livelihoods), when they are in fact feeding each other in a negative activity that may in the end leave them out of work.

Maladaptation is another form of 'bad' adaptability. One may also conceive it as a lack of adaptation (including us – Paper II). However, as we can see from the experiences of maladaptive POs, their members do adapt in a sense of adjusting (e.g. through illegal sale) to the persistence of the existing market regime, problematic in terms of adding to fish price uncertainty. As fish price determines their subsistence, maladaptation seems voluntary - and at costs – for both people and resources. And again, interconnectedness of many of these decisions and maladaptive behaviours (perfectly justified from the individual perspective) add up to the situation of low social and ecological resilience. Maladaptive fishers become more vulnerable to environmental surprises and at the mercy of actions of other agents, e.g. retailers.

In sum, strategies for adaptation, perfectly desirable from a social perspective, might fail to contribute to social-ecological resilience (Walker et al. 2006). Very adaptive people may simultaneously deplete their natural resource base (e.g. Crona and Bodin 2011) and, thus, increase their own vulnerability.

Finally, from the perspective of complexity thinking, it is interesting to discuss how these adaptive responses and actions are interconnected - how every change, even a positive one affects others' actions and the system itself. The exiting the auction system in the case of reactively adaptive ArtesanalPesca (Chapter III), which is evidence of over-passing a system trap (e.g. transformation of the unjustified market context), as a response to crisis, brought upon rather negative consequences for the local fish market and its social dynamics ('dying out' of local fish auction; PO's monopoly in fish supply). Likewise, the work and adaptability of some purse-seine POs increased community social capital and commercial interdependence (Chapter IV). Nevertheless, as clarified in Chapter V, social interdependence is based on industry demand for high quantities of fish. Though this gives financial security to the PO, it requires low prices - example of a system that is socially resilient but might degrade the environment as encouraging overuse of resources.

The following section contributes to answering rq#4 by discussing underlying reasons for these challenges, which are understood as rooted in institutional and historical limits to adaptation in the case of the Portuguese fisheries.

6.4 LIMITS TO ADAPTATION AND RESILIENCE

The above described cases confirm the definitional nature of adaptation: adaptation is response to external change – conditions change and we adapt. As change often brings problems, adaptation, to a certain extent, transmits the idea – as long as we adapt we are fine. Nonetheless, the same cases clarify challenges for adaptability. Adaptability might be in fact a symptom of wicked system problems – we adapt as we have no other option. From this perspective, purse seine POs' adaptation through withdrawal mechanisms is a consequence of the subsidized regime of EU fisheries, which does not solve the wicked problem of overfishing. The lack of precise knowledge and scientific certainty with regards to fish stock is partly a source of fishers' 'getting-by' practices; the prejudiced market regime motivates Portuguese fishers' maladaptation. In other words, adaptation does not actually solve the problem, but keeps feeding it. From a complex system perspective, we all produce results in the system that we do not want, and we do it out of rational response to constraints the system impose on us (Meadows 2008).

The reasons underlying these challenges might be understood as limits to adaptation that contribute to system resilience. Limits to adaptation are endogenous to society and contingent on culture, knowledge, perceptions, power structures and attitudes to risks (Adger et al. 2009). Integration of results from our case studies strengthens this argument while identifying four crucial barriers to adaptation in the case of Portuguese POs, thus also contributing to answering rq#2.

First, what we may call the institutional rigidity (Gunderson and Holling 2002) and inertia (Grin et al. 2010) of the national fisheries (e.g. market institutions) is the most obvious reason why POs' internal adaptation is not a panacea for fisheries social-ecological resilience (see Chapter IV). Over time, social structures or institutions, including environmental regimes[22], become more homogeneous and more resistant to change (Giddens 1979). Besides influencing individuals' behaviours, social structures shape the way actors relate to each other (e.g. Prell et al. 2010), which can hinder or encourage adaptation (e.g. Winsvold et al. 2009).

How rigid market institutions motivate maladaptive practices is clearly evident in landing ports with lower nominal catches. On the one hand, forces of power (e.g. market rules, government laws) add to fish price uncertainty. On the other hand, few and very well organized forces of profit (e.g. retailers) manipulate and further decrease the price, which undermines the advantages of the competitive

[22] Environmental and resource regimes are systematically interconnected sets of elements (i.e. rights, rules and decision-making procedures), organized around functions or purposes and differentiable from their environments (which may include other institutions) (Meadows 2008). Although they change continuously, they can remain in place even they have lost their effectiveness in terms of mismatching biophysical and socioeconomic settings; in other words they have become ill-adaptive to the environment with which they interact (Young 2010). Keessen et al. (2013) frame this as negative resilience when applied to social systems.

market. Connection and mutual reinforcement of power and profit create a rigidity trap or a persistent maladaptive state (Gunderson and Holling 2002, Carpenter and Brock 2008). Price and the dominant position of retailers are key signs of actors' coordination, so called market mode of coordination (Thompson et al. 1991). As a result, fishers lack connectedness; POs lack focus, financial resources or proactive leadership that would bring solutions to the problem so they stick to maladaptive practices.

As for the case of purse-seine fishers, ill-adaptation of market regime to their needs is not quite apparent. On the contrary, market rules and withdrawal mechanism seem to facilitate their jobs: commercialization of large quantities of fish sold relatively fast to established partners (canning industry) and other retailers. As such, some purse-seine POs (e.g. Chapter V) are an example of a network mode of governance (Thompson et al. 1991) where the PO itself seems to actively participate in fisheries and market governance. However, views of fishers ('they (industry) are the most secure clients, but the price is not reasonable', 'PO cannot give the orders to the industry') reveal that mutual reinforcement of forces of profit (industry, retailers) and political power that traditionally supports this type of fishery, partly due to the profits it brings – is based precisely on low price, which confirms the regime trap (in the long term) for both fisheries and fishers.

Second, institutional limits relate to PO internal structure, i.e. incentives and informal social institutions. For example 'getting-by' behaviour in Propeixe case seems to occur in part because of PO market incentives. Another reason is existence of close social (bonding) ties between family or kinship members that discourage collective learning of resource status on the level of PO as a whole. The problematic of bonding social capital for networks' resilience and adaptation is described in Newman and Dale (2005): bonding ties create strong, but localized trust, impose strict social norms that might inspire group homophily, which tends to reduce diversity. In this context, on one hand, the very close social network of purse-seine community (fishers, PO, canning industry, retailers, fishers' wives, etc.) develops resilience (also found in Tompkins and Adger 2004) through interdependency, trust and collaboration. On the other hand, however, its lack of diversity might impede long-term adaptation to environmental change.

Hence, while institutions permit a high level of societal self-organization (e.g. Gunderson and Holling 2002), they can also inhibit humans ability to interpret problematic trends and deal with change. To be motivated to initiate or support change people must be able to "see" the system traps, embedded in rules, resources and power authority; this is very challenging for individuals or groups whose ability to affect change has been traditionally impeded by these institutions (Moore and Westley 2011). Moreover, sticky ill-adaptive institutions (Young 2010) shape and co-create collective memory of society and individual perceptions. Both are crucial for interpretation and 'sense making' of problems and this research shows how both add to inertia of national fishery regime.

Social memory, supported by social context and structures, captures collective experience of societies or groups about their living past (e.g. Mcintosh 2000, Climo and Catell 2002). It is transmitted and revived as a legacy or a shared history among people through participation, communication, imitation of others' practices, reviving and re-inventing them (Wenger 1998). As such, collective remembering

plays an important role in the self-organization process and is acknowledged as a social source of resilience in times of crisis and change (e.g. Folke et al. 2003, Barthel et al. 2010). However, in our work (e.g. maladaptive practices, acceptance of low sardine price) the collective memory might act as third limit to fishers' adaptability. The Portuguese fishers' collective memory is partly developed through the experience with the i) the oppressive Salazar political regime (1934-74); ii) the post-revolutionary regime and iii) the Europeanization, after 1986 (see Chapter I, page 9-11). Throughout these periods, fisheries lost political interest, economic support, and to a certain extent social interest, which is in contradiction with the fact that the Portuguese eat more fish per capita than any other country in the EU and rank third in the world (Almeida et al. 2014, forthcoming, co-authored paper). While nowadays national interests are changing, we can say that institutional inheritance (Healey 1998) of fishery regime in many ways shaped fishers' collective history, as being revived through mechanisms of coordination and personal expectations as explained above – how regime shape the way actors relate to each other and how these power-profit relations inhibit institutional change, despite its inadequacy. Social memory also affects Portuguese fishers' mindset and the story they are telling themselves about themselves - ('we are not able to sell our fish'; 'we cannot do anything, we could never do anything') – history – which may not be true – and which additionally disarms fishers.

Thus, the final limit to adaptation concerns the individual level: fishers' self-perceptions that directly impact the way they perceive the problems facing their livelihoods and how they respond to them, examined in Chapter IV and V. In this context, in landing ports with a market mode of coordination, disempowered fishers and their complaining leadership pessimistically interpret their surroundings – defend their problems instead of proactively seeking solutions. Due to their low self-esteem they are inactive and do little to adapt. In a certain way, fishers seem incapable of 'unlearning the old invalid thinking processes' (Rodgers et al. 2013), embedded in context and revived/remembered through social interaction. In other words, adaptation is not a well thought organizational strategy, but an old way of getting-away with problematic trends and relationships from which no new knowledge is produced.

CHAPTER 7 - CONCLUSIONS AND REFLECTIONS

CONCLUSIONS AND REFLECTIONS

The purpose of this thesis was to investigate and illustrate the ways in which social adaptability contributes to the resilience of socio-ecological systems. To explore this, the thesis focused on adaptability in resource users' organization. A case study approach was combined with grounded theory on the case of fish POs from Portugal. This resulted in the production of three 'Matryoshka mode' inter-related research papers that contributed to answering the main research question and related research sub-questions (see Chapter I, page 11).

7.1 MAIN CONCLUSIONS

With regards to first question, the thesis adds to SES literature by focusing on the contribution of organizational adaptability to system resilience. Combination of organizational and resilience literature provides a good framework for thinking about this matter: a) what dimensions are the basis for organizational performance and adaptability (contexts, structure and processes); b) what are possible sources of change (social-ecological system (SES) dynamics, evidence of trends and crisis); c) what (factors) within these dimensions might influence adaptability in organizations (i.e. fishery type, land-based facilities, membership nature, leadership, trust, rules, collaboration with the demand side, etc.) and d) how to measure this influence.

Secondly, empirical evidence in this thesis clarifies that although an organization naturally co-evolves with its contextual settings, and in part as a response to a particular type of trend or crisis (slow resource change or 'tipping over' of market crisis), the importance of agency (capacity of actors to act otherwise to structural conditions) is vital for its adaptive response to a changing environment. Hence, adaptation is rarely a spontaneous, self-organized process. Instead, it is very reliant on proactive, visionary *leaders*, maintained and reproduced *trust* by agents' actions and agents' *perceptions* in regard to self, practices, experiences, expectations, problems and the future options.

Third, the thesis adds to SES literature by conceiving organizational adaptability processes as layered processes, interdependent on each other. Among - accepting change and complexity, - learning from change and - acting, while shaping change, the most important for organizational contribution to social resilience is the learning layer. Without it, the strategies for adaptation lack consciousness and intention and seem to further promote persistence of institutional inertia and maladaptive practices.

Finally, the thesis identifies the main reasons for these challenges for adaptation, which are, in the specific context of the Portuguese fisheries, rooted in *ill-adaptive institutions, history and associated self-perceptions of individuals*.

7.2 BEYOND ADAPTABILITY: INSTITUTIONAL AND AGENCY CHANGE

So, what are the implications of this set of observations for social (e.g. resource users' organizations) capacity to deal with change?

On the one hand, adaptive organizations (through the impact of agency and some structural changes) enable resource users' response to market changes and resource scarcity and help in the fulfillment of social needs. In other words, society (e.g. resource users) is able through adapting institutions to improve its capacity to manage natural resources and add to overall system resilience.

On the other hand, findings in this thesis confirm evidence in the existing literature (e.g. Walker et al. 2006, Crona and Bodin 2011) that social adaptation is not a panacea and may, in some cases, increase system vulnerability to change. Continuous maladaptation of some Portuguese POs points at a basic institutional problem (fish market regime), which clearly reduces fisheries resilience as it promotes overfishing. Hence, transformation of fish market institutions in Portugal, which have been experiencing difficulties for several decades, could increase both ecological and social resilience. Besides reconciliation of market and ecosystems to promote sustainable fisheries, institutional change includes fostering change in a way people perceive and accept change, and learning how to shape it (layers of social resilience), which may ensure adaptability in management practice. In these terms, though research in this thesis supports the claim that the attributes of institutions must adapt to the dynamics of the Earth's biophysical systems (e.g. Folke et al. 1998b, Young et al. 2008), it emphasizes the social aspect of institutions - the same attributes must find ways to better respond to the needs and incentives of people whose behaviour they shape, which is expected to increase social resilience. In the context of fisheries, Grafton and Kompas (2014) frame this as offering incentives that link individual with collective interest, offering long-term incentives that matter for fishers to increase their responsibility and aligning them with the sustainability of fisheries. In other words, through institutional adaptation and change fishers might wish to behave differently in regard to resource use.

This leads us to the second important conclusion. As evident from the empirical research, structural change may not be sufficient to address other barriers to adaptation, which add to institutional inertia and maladaptive practices of Portuguese fishers, such as collective memory and problematic self-perceptions. The agency also needs to change. Briefly, individual change implies thinking in systems about human-nature problems (e.g. Meadows 2008); self-critical reflection on oneself and confronting not only the self-induced problems (e.g. overuse of resources, illegal sale), but also the structures that frames one's practices, so called 'second-order reflexivity' (Voß & Kemp 2006). Based on the findings, organizational agency (i.e. leadership), including institutionalized communication and collaboration mechanisms could facilitate members' collective re-thinking and recognition of system traps and opportunities for change.

In the scope of resource users' organizations, thinking in systems and reflexivity implies asking: 'how do I (we) contribute to the resilience of the system in which I am (we are) operating, in particular ecological resilience?' and 'what eventually needs to change, other than my own practices, to increase my contribution to sustainability?' Thereby, more freedom in thinking about future options - visioning (e.g. Meadows 2008) is a third part of individual change: designing our future instead of merely adapting to it (e.g. Newman and Daly 2005); planning ahead for institutional changes (e.g. Young 2010), reaching for other narratives (and memories) than the ones that are familiar to us (e.g. Eisenstein 2011).

Insights of institutional and individual change are discussed in the next two sections as reflections for policy (PO design and Portuguese fisheries management) and for further research.

7.3 POLICY IMPLICATIONS

The study presented in this thesis is small in size and in order to draw more extensive conclusions about PO's contribution to fishery management more research is needed. This being said, this thesis provides insights that have policy implications that are particularly important for the national context, and which could prove useful elsewhere in the EU. They concern fisheries managers, professionals involved in the fishery regime and fishers community.

New CFP reform and its main objective of preserving fish stocks through decentralized fishery management, rules on maximum sustainable yield, transferable fishing concessions and banning discards will certainly bring different dynamics for managing EU fisheries. In the context of the reformed CFP, the social objectives and market policy predict changes to PO role, i.e. empowering POs with new production and marketing objectives and supporting them financially to implement discard ban and handle landed catches; increasing the bargaining power of producers through market measures, incentives and premiums for sustainable practices, etc. Considering these challenges, the first set of policy implications concerns the formal design of POs, including their link with the larger institutional arrangement (e.g.COM) of which they are a part. In regard to institutional structure, to increase their contribution to fisheries management, PO should adopt more stringent rules to penalize membership responsible for overfishing. Also, to decrease membership self-interest, PO should create incentives and mechanisms for recurrent membership interaction and discussion of market strategies, rules and power relations. This is expected to increase fishers' sense of protection, security and ownership thereby stimulating collective action. Through intensifying internal membership communication, PO might increase not only internal adaptive capacity, but the capacity to learn and collaborate with other actors in the sector, thus increasing its involvement in fisheries co-management. Finally, in the specific national context, the current criteria for PO recognition should be re-evaluated and adapted to national fisheries context, which would increase participation of multispecies small scale vessels. Bearing in mind a planned decrease of withdrawal funds, the internal structure of some purse-seine POs (e.g. by-laws on membership nature, norms of behaviour) should be re-evaluated to promote diversity and transform the situations of locked-in family sub-networks to networks based on diverse fisheries that may increase overall adaptability. Also, evidence in both the literature and this thesis point to the benefits of POs' participation in scientific projects that concern fisheries as they have information of practical relevance in regard to production and marketing that could be difficult to find otherwise.

The second set of policy implications concerns the need for change of national fisheries market institutions. Below we summarize alternatives to an official market model, based on interviews with POs and other actors in the sector, which were not included in Chapters 3-5.

- *Delegate responsibility for auctions management to POs;* the idea was already offered to POs in 2010, following a period of serious financial problems for Docapesca, the official regulating authority responsible for the management of fish auctions in Portugal. Only a few POs, mainly those in big landing ports, accepted this proposal. By contrast, POs working in ports with lower nominal catches did not want to take on this responsibility as auctions in these ports are difficult to manage (e.g. bad infrastructural conditions, financial debits, etc.). Docapesca managed to recover from financial deficit and the current management strategy (2012-2015) is based on various types of investments, including investments in port infrastructure;
- *Change the auction type*: from decreasing to increasing auction type. Especially in ports with lower nominal catches, decreasing auctions[23] are perceived to facilitate the combination of price between retailers. At present, Docapesca is planning to experiment with increasing auctions in two ports. The project has been delayed as few landing ports demonstrated their interest to be a trial case. Main concerns for implementation of increasing auctions are of speculative type, i.e. auction process would become slower hence this would complicate the overall commercialization process;
- *Open auction to wider public to increase competition;* in this alternative, though the fish would always pass through the auction system as the system of fish first sale, the producer would have an option to leave a certain criterion about the price (e.g. minimum price). If the fish price at the auction reaches the price below this minimum price, the auction would be open for the wider public. In this way, retailers would have market advantage, but there would be additional competition with the general public, which would increase the price of the product.
- *Reduce number of auctions*; closing down small auctions or aligning them into fewer, bigger ones, which would facilitate concentration of production and encourage retailers' competition. The importance of having the auction close to the landing port might be addressed through PO's land-based facilities (e.g. vehicles, vehicles with freezing storage) that may rapidly transport production between neighbouring ports;
- *Introduce other regime of fish first sale other than auctions; o*ne PO leader suggested the Spanish fish market model as an example: instead of a state regulating authority, fish is sold to an intermediary with a particular interest in specific product who looks for further buyers *('more fish he sells (and better), more he earns'*). This implies radically different market dynamics from the Portuguese setting, where *'Docapesca always wins!'* through charging fees.

[23] According to auction theory (e.g. Klemperer 2004) deceasing Dutch model of auctions make sense if there is a high quantity of the product that needs to be sold down quickly (e.g. flower market, market of cigarettes, etc), which provides an additional argument to why in landing ports with lower nominal catches Dutch auctions are not the most appropriate mechanisms for fish commercialization (our reflection, shared with interviewees)

7.4 FURTHER RESEARCH

'Perhaps in the 20th century we have tried to change the world too quickly (as following the famous Marxist formula: 'philosophers have only interpreted the world, the time is to change it!'). The time is to interpret again, to start thinking' (Slavoj Zizek[24]).

First, although the results of this research are contextually dependent, it has covered the specific steps – process (i.e. framework) taken to produce evidence of organizational and institutional adaptability, social learning and (sub) networks dynamics. Hence, it would be important to verify the usefulness of such an analytical framework to estimate adaptive capacity of POs in other EU countries as well as in other resource users' organizations or local communities. Second, more effort should be made to understand institutional adaptability and transformability processes at the regional or at the national level of the fishery management considering the perspective of adaptive governance and collaborative adaptive management within the SES literature (e.g. Berkley 2013, Fabricius and Cundill 2014).

Third research direction concerns exploring attitudes and perceptions towards other policy instruments. For instance, an interesting research topic would be the upcoming implementation of discard ban. Research would aim to identify ongoing practices of fish discards in Portugal (and in the EU) and contribute to clarification of the main causes of discards (e.g. Catchpole and Gray 2010, Johnsen and Eliasen 2011). Empirically, it would focus on fishers' / managers' / policy makers' perceptions and insights of discards problem, i.e. main barriers for the upcoming implementation of this measure and the most appropriate (contextually adapted) incentives for discard mitigation in Portugal.

Finally, much is written on building institutional capacity to break the institutional inheritance by means of creative agency (Healey 1998, Healey et al. 2002). Ideally, individual change and institutional change reinforce each other: through self-reflexivity agency is able to realize that institutional change is required, how external changes affects institutions and appreciate what kind of opportunities these changes, including the consequences of their own actions, are bringing for change of structures (e.g. González and Healey 2005, Grin et al. 2010). In line with this theory, future research aims to study these processes. While emphasizing an analysis based on governance of fisheries in Portugal, adding a comparative perspective using insights from other EU countries would be interesting. It would be focused, on the one hand, on the evaluation of institutions - structures and policies (e.g. fisheries management in Portugal) to identify main external forces that drive institutional change (i.e. Europeanization, globalization, etc.) and national level institutional barriers to change, and on the other hand, it would explore the role of agency (e.g. people involved in structures and in practices): what and how institutional change and agency change build and add to one another.

[24] Slavoj Zizek, interview for Big Think, 2012, available online: http://bigthink.com/users/slavoj-zizek

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