Ponta Negra Ethnoecology of Practice: Intergenerational Knowledge Continuity in the Atlantic Forest Coast of Brazil

By

Carlos Julián Idrobo Medina

A Thesis
Submitted to the Faculty of Graduate Studies of The University of Manitoba
In Partial Fulfilment of the Requirements of the Degree of

Doctor of Philosophy

Clayton H. Ridell Faculty of Environment, Earth and Resources
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In Natural Resources and Environmental Management (PhD)

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Abstract

The intergenerational continuity of knowledge has become a concern as small-scale societies worldwide balance the challenges of adapting to environmental change associated with globalization while retaining continuity in their ways of life. This dissertation examines the intergenerational continuity of environmental knowledge through the conceptual lens of an Ethnoecology of Practice framework (EofP) developed to guide this research. Integrating insights from political ecology, social wellbeing and adaptive learning, the EofP provides theoretical and methodological tools based on practice theory to examine the knowledge of small-scale societies. Based on fieldwork in the community of Ponta Negra (Atlantic Forest Coast, Brazil), this dissertation uses a qualitative case study strategy of inquiry guided by a phenomenological worldview. Methods included participant observation, semi-structured interviews covering livelihoods, life histories and marine and terrestrial knowledge themes, document review and a census.

Chapters 4 and 5 examine the perception of marine and terrestrial natural resources by tracing their social life from harvesting grounds to exchange and consumption sites. Chapters 6 and 9 analyse historical and contemporary adaptation to environmental change. While Chapter 6 describes the adoption of the pound net fishery, Chapter 9 illustrates contemporary modes of learning associated with natural resource harvesting and presents the processes associated with production of new knowledge through the example of local participation in the tourism economy. Chapter 7 examines local perspectives on livelihood transition from a social wellbeing perspective and highlights factors underlying the continuity of natural resource harvesting practice in Ponta Negra. Chapter 8 discusses how the term Caiçara, as used in biodiversity conservation and tourism development discourses, circumscribes the relation between coastal people and their local environments to a subsistence economy, denying their current economic engagements as well as their desires and aspirations. This dissertation contributes to ethnobiological understandings of the intergenerational continuity of knowledge by providing a framework and grounding evidence that demonstrates how knowledge is generated through context-specific practice attuned to dynamic environments that leads to individual innovation. It provides a theoretical contribution to our understanding of framing and creating processes inherent to human-in-environment relations that lead to fluidity in ways of life over time.

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Chapter 1. Introduction

This dissertation presents a critical analysis of intergenerational change and continuity of environmental knowledge in small-scale societies using the Ethnoecology of Practice (EofP) framework. Ethnographic fieldwork in the community of Ponta Negra, located in the Atlantic Forest Coast of Brazil, provides the grounding evidence. Coastal people and their relations with the Atlantic Forest Coast environment have undergone constant re-configurations driven by the economic cycles that this region has historically experienced (Begossi 2006, Teixeira 2006). The bust of the fishing economy and boom of the tourism economy are the main drivers of change in the Atlantic Forest Coast and mark the contemporary challenges coastal people are adapting to (Begossi et al. 2011).

This work has been guided by the principle that environmental knowledge, rather than being in people's heads, is immanent to the relations and experiences they have through their active engagement with the world (Ingold 2000, 2011; Davidson-Hunt 2006). The environment, in this context, is an unfolding meshwork of "*entangled lines of life, growth and movement*" (Ingold 2011:63) that includes the ecological, political and economic relations within which an individual is situated and that the individual establishes throughout their life path. Individual and environment mutually produce each other in ever-evolving dialectical relations. As much as adaptation is an intrinsic part of life, the adaptation of knowledge to environmental change is an intrinsic part of being human (Ingold 2011).

Historically, small-scale societies have had interrelations with other societies – both larger and smaller (Wolf 1982). While some of these interactions have resulted in the incorporation of new elements and ways of relating within the environment, others have only brought devastation and subjugation (Diamond 1997). In spite of the normalcy of cultural change, the expansion of forces of capitalism around the world is putting in peril the relations between small-scale societies and the natural resource base they have historically depended on. This process threatens the environments in which small-scale societies live and the environmental knowledge they have produced over generations.

Wade Davis (2001:6) uses the loss of languages as a proxy for the loss of biocultural diversity. According to him fully half of the world's 6,000 languages are effectively dead.

Not surprisingly, the environmental knowledge loss of small-scale societies has generated concern worldwide and prompted research to understand and address it (Maffi 2001). Ethnobiologists and other branches of scholarship (e.g., biocultural diversity, Maffi 2005) have employed knowledge transmission models adapted from cognitivist science to understand the environmental knowledge loss phenomenon (e.g., Cavalli-Sforza et al. 1982, Boyd and Richerson 1985, Hewlett and Cavalli-Sforza 1986). They have focused on evaluating how much knowledge of plants and animals as well as skills necessary for subsistence lifestyles are lost between generations. Their findings often point at general knowledge loss identified as an outcome of integration with markets, access to formal education and livelihood shifts away from natural resources (Godoy et al. 2005, Gómez-Baggethun and Reyes-García 2013).

In spite of these contributions, the cultural transmission of knowledge model (CTKM) as applied in ethnobiology is riddled with contradictions that limit the understandings of the effects of environmental change on the knowledge of Indigenous and rural peoples. The main shortcomings of this model, as outlined in chapter 2, are that it understands learning to be limited to the acquisition of existing knowledge; treats knowledge learners as homogenous, obscuring their agency and capacity for innovation (see also Lave 2009); and assumes change to be failures in transmission of information, rather than the outcome of changing environments and the relations constituting them (Davidson-Hunt 2006: 601). In short, those who use the CTKM understand changes in the knowledge of small-scale societies by looking at their present knowledge and comparing it with what previous generations knew. Nabhan and colleagues (2012:2) points out that the limitations of the knowledge transmission CTKM have been compounded by ethnobiologists themselves, who have "*continued to describe the communities in which they work in some harmonious 'ethno-ecological present' that may also be considered a highly contested construct today.*"

By contrast, Traditional Ecological Knowledge (TEK) and adaptive learning research have taken a proactive stand in dealing with the intergenerational continuity and

change of environmental knowledge. Traditional ecological knowledge and adaptive learning understand learning as an on-going journey in which an individual, with the help of knowledgeable society members, attunes themself to their environment and the ways it changes (Davidson-Hunt and Berkes 2003a, Davidson-Hunt 2006, Berkes 2012). Steeped in resilience thinking, environmental perception and practice theories, the adaptive learning framework has provided insights into how small-scale societies shoulder their adaptation to environmental change in the absence of institutional support, as is the case of the introduction of the pound net fishery in Ponta Negra (e.g., Chapter 6). Adaptive learning has also shown the role of institutions in the production of knowledge in response to environmental change (e.g., Whitefeather Forest Corporation in Northwestern Ontario, Davidson-Hunt et al. 2013).

The EofP framework employed in this dissertation contributes to the line of thinking captured in TEK and adaptive learning research by incorporating perspectives from political ecology and international development studies. These perspectives provide analytical tools to take into consideration the drivers underlying the transformations of environmental knowledge as well as the perspectives of knowledge holders regarding the ways they relate with their local environment, how such relations have changed, how they are configured in the present and what they expect from them in the future.

1.1. Ethnoecology of Practice as a Conceptual Framework

My research employs the EofP as a conceptual framework that examines the connections between learning and harvesting practice as a gateway to better understand the factors shaping the intergenerational continuity of ways of knowing in the context of environmental change. The EofP framework is a theoretical and methodological device that has helped me organise my thinking and gather data. This framework situates my research within a lineage of approaches to Indigenous and rural ways of knowing that deals with them as adaptive and context-relative components of everyday life. This way of approaching ways of knowing in the context of ethnobiology and TEK research, which has been denoted as a "*processual perspective*" (Heckler 2009), invites moving beyond well-established branches of ethnobiology scholarship, such as the CTKM (e.g., Cavalli-Sforza et al. 1982, Zent 1999, Reyes-Garcia et al. 2009), to better understand the

processes and contexts in which environmental knowledge is produced. Rather than assuming knowledge as static packages of information transmitted between generations, the EofP deals with environmental knowledge as an adaptive and relational emergence of the ways people interact with and construct the landscapes in which they live.

As a component of the EofP framework, adaptive learning provides a perspective that deals with environmental knowledge as understandings of the world emerging from practical engagement within a given setting (Davidson-Hunt 2006). Adaptive learning theory suggests that, in the context of a natural resource harvesting practice, knowledge acquisition among younger generations of resource users happens through their perceptual engagement in practice guided by expert resource users and by others in the landscape (Davidson-Hunt and Berkes 2003a, Davidson-Hunt 2006). Learning is a process of coming-into-being that entails the establishment of associations that enable practice, including the necessity and possibility of access to natural resources.

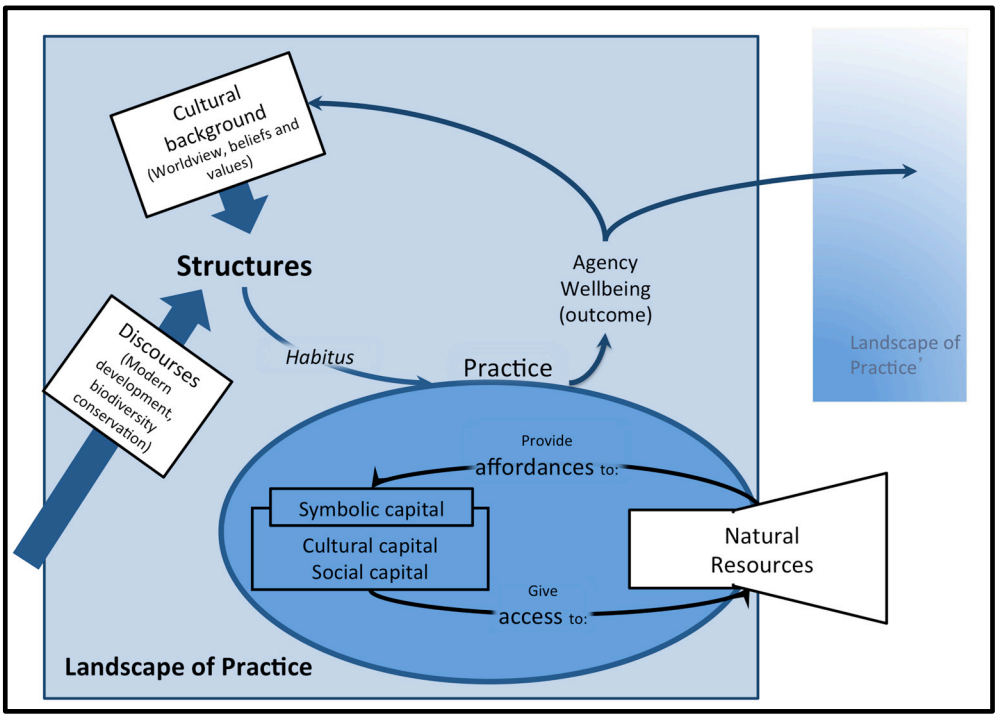


Figure 1. My initial Ethnoecology of Practice framework

I developed the EofP framework drawing upon adaptive learning theory (Davidson-Hunt 2003, 2006) and applying concepts of phenomenology of perception (Merleau-Ponty 1962), dwelling (Ingold 2000) and practice theory (Giddens 1979, Bourdieu 1990).

This framework deals with ecological knowledge as a dynamic process produced and reproduced within societies through the interactions between the domains of structures and practice within a landscape where relations between the individual and other human and non-human entities unfold. The EofP framework borrows elements from anti-essentialist political ecology (Escobar 1999a, b) and social wellbeing (McGregor and Gough 2007) to incorporate the drivers that hinder and enable access to natural resources, as well as people's needs, desires and aspirations (Figure 1).

The EofP is constituted by the domains of structures and practice, which are linked to each other by the driving forces of *habitus* and agency, and takes place within unfolding fields of relations, which I term the landscape of practice. Structures set the parameters that underlie how the individual perceives their surroundings. These structures include cultural background (i.e., worldview, beliefs and values; Berkes 2012), as well as dominant discourses (e.g., biodiversity conservation and modernist development in the case of the municipality of Paraty; Diegues and Nogara 2005, Teixeira 2006). Both cultural background and discourses inform how the individual establishes relations and, therefore, constructs their reality within the landscape of practice. During data analysis the framework was amended to include local history as a structuring force. This and other adjustments to the EofP Framework are described in detail in Chapter 10.

Practice conveys the collection of activities undertaken and relations established by the individual. There is no separation between practice and learning. As practice takes place, the individual engages in learning, a process that is tantamount to the creation, acquisition and embodiment of different forms of capital (i.e., social, cultural and symbolic). These capitals afford creativity and innovation not only in the context of harvesting natural resources, but also in everyday interactions with other human and non-humans in general (Hallam and Ingold 2007). From this perspective, learning not only entails the acquisition of knowledge and information, but also is related to the development of skills attuned to a given social-ecological setting, shaped by beliefs and defined by practical engagement (Berkes 2012).

Social capital refers to the relations that exist among multiple actors involved in practice (Bourdieu 1990). These relations generally involve members of particular

communities of practice, as is the case of boat crews (Pálsson 1994) or artisanal fishers (Vermonden 2009), as well as networks of interchange of knowledge and resources, as is the case of markets (Begossi 1996). Cultural capital is the set of embodied knowledge and skills that enable perception and the coordination between perception and action (Ingold 2000). These skills involve knowledge associated with harvesting activities, such as navigation, safety, resource distribution and seasonality, food procurement and processing techniques. In addition, symbolic capital reflects how individuals perceive themselves as a product of embodied social and cultural capital (Bourdieu 1990). Symbolic capital can be understood as the legitimacy and identity that confers expertise and authority on individuals in a particular domain of practice in relation to themselves and other members of the society (Vermonden 2009).

The relational package of cultural, social and symbolic capital configures perceptual access to natural resources in the form of affordances. An affordance is anything from the physical world perceived by a particular organism in relation to the specific combination of substance or surface properties that an object has (Gibson 1977). Acknowledging natural resources as perceived affordances recognises their socially constructed nature. Even though resources exist on their own as physical entities, they only become perceptually visible, hence important, when the properties they afford become a perceived need. Gibson (1977) uses water as an example to understand the concept of affordances. Even though water exists on its own, we can perceive it because of the properties it affords. Water affords drinking when we are thirsty, as well as drowning if we fall into a water body and cannot swim (Gibson 1977). In the context of harvesting practice, natural resources not only afford food, goods and services, but also are associated with symbolic forms of capital, such as identity and social status (Vermonden 2009).

The landscape of practice is the collection of multiple settings in which practice and learning take place. Drawing upon Bourdieu's notion of field (Bourdieu 1990), I use the concept of landscape of practice to address the knowledge-context associations that are produced during everyday practice. The landscape of practice has a dialectic nature. Although it contains the discursive structures that inform individual practice, it is

reconfigured by the agency deployed by individuals acting in relation to such structures. As my research advanced, I came to understand that the multiple centres of learning in which the individual participates, embodies skills and attunes their perception comprise their landscape of practice.

Habitus and agency are the guiding forces that connect the domains of structures and practice. Habitus, by carrying the embodied dispositions that underlie individual practice within social contexts, is a central constitutive force of everyday social life. Habitus confers the 'feel for the game' behind practice and is associated with the individual's capacity to respond to change (Bourdieu 1977). Agency refers to the individual's transformative capacity and is revealed in the deliberate actions undertaken in order to shape one's future and one's landscape of practice (Giddens 1984). Agency is framed by creativity and innovation that are brought together by practice that iteratively draws upon structure and is undertaken within a landscape of practice (Giddens 1984, Davidson-Hunt 2006).

Both habitus and agency can be linked to wellbeing, as they mobilise the abilities and potentialities that enable the individual to undertake practice and to transform resources into income, dignity and power. Wellbeing, or having the necessary constituents for a fulfilling life (Gough et al. 2007), can be associated with the processes and outcomes of natural resource harvesting. Habitus and agency not only underlie the pursuance of sustenance for individuals and communities, but also inform the procurement of other basic constituents of a fulfilling life, such as freedom of action and empowerment (Bebbington 1999, MEA 2003). A more thorough explanation of the EofP framework and its relation to adaptive learning, as well as political ecology and well-being research, is presented in Chapter 2, Section 2.4, and a revised version of this framework is provided in Chapter 10.

1.2. Purpose and Objectives

The purpose of this dissertation is to understand the continuity and change of ways of knowing associated with natural resource harvesting in the context of the coastal community of Ponta Negra in SE Coastal Brazil. The EofP framework provides

theoretical and methodological tools to examine the continuity and change of ways of knowing through an approach that acknowledges the linkages between learning, harvesting practice, access to natural resources and wellbeing.

The objectives are to:

1. Explore and document the ethnobiology of Ponta Negra in relation to practices, places and resources.

2. Investigate Caiçara perceptions of how economic, political and policy structures influence access to natural resources and how these structures also affect local livelihood strategies.

3. Investigate the contexts and processes by which harvesting knowledge and practice are generated between generations.

4. Analyse the contribution and role that natural resource-based livelihood practice plays in supporting the wellbeing of Ponta Negra as well as the ability of Caiçara communities to engage in micro and social enterprises in the context of place-based development.

1.3. Methodology

1.3.1. Case Study Community

The coastal community of Ponta Negra is located in the Paraty municipality, Rio de Janeiro state, Brazil (Figure 2). During the data collection phase of this research (May 2010 - March 2011), the population of Ponta Negra was 164 people, with 82 adults (47 males; 35 females) and 82 children (40 males; 42 females). The main economic sectors in Ponta Negra are fishing, shifting agriculture, forest product collection, tourism and local civil construction. Although tourism has grown into an important economic sector over the last twenty years, the pound net fishery remains the largest employer in the community and one of the linchpins of the local economy. Ponta Negra has a small school were children attend up to four years of primary education. In spite of the fact that the school has been in the community for more than twenty years, a large segment of the population is functionally illiterate (see Section 3.3. for a more detailed description).



Figure 2. Ponta Negra and regional context

1.3.2. Research Approach and Methods

I followed a single case study strategy of inquiry, framed within a qualitative research design and guided by a phenomenological philosophical worldview (Creswell 2009). I used the presence of a pound net fishery (*cerco flutuante* in Portuguese, a stationary fishing gear technology), isolation from urban centres and heavy reliance on natural resources as criteria to define a suitable community to undertake my research. I identified Ponta Negra as an ideal case study first through field reports generated by Brazilian scholars working with the IDRC research project entitled, '*Community-based Resource Management and Food Security in Coastal Brazil'* (i.e., Begossi et al. 2009, Seixas et al. 2010), and later through a scoping trip in the region.

My data collection approach focused on individual and household engagement in natural resource-based practice as a component of everyday life. I placed special emphasis on how learning about natural resource practice is tied to the pursuance of needs and desired outcomes, which are expressed in the appropriation of natural resources and the construction of landscapes of practice. I also focused on the relations between and among humans and non-humans involved in the harvesting of natural

resources. Since my interest is in understanding the processes associated with continuity and change of ways of knowing, I paid special attention to the harvesting activities in which young people engage as well as what is required for these practices to be undertaken (Davidson-Hunt and Berkes 2003a). Even though the focus of this research is on natural resource-based practice, I did not exclude the contributions of non-natural resource-based activities to overall household livelihood portfolios.

To document natural resource harvesting practice and examine its connections with access to harvest sites, intergenerational continuity and change and wellbeing, my research used ethno-science and social science methods (Cotton 1996, Berg 2005, Hay 2005). Joining experienced harvesters in their harvesting practice was a central activity in my research. The pound net fishery offered an important entry point and served as a gateway to understand the associations between harvesting practice and livelihood portfolios in the community. My decision to work with pound nets as an initial focal point for my research relates to the territorial stability, both in space and time, local rules of resource use and the collaboration of multiple household and community members associated with this fishing technology (Vestergaard 1991, Guimarães-Blank et al. 2009). Studying the pound net fishery, as well as other associated and co-existing natural resource-related practices, allowed me to develop a holistic understanding of individual and household landscapes of practice in Ponta Negra.

Sharing natural resource harvesting spaces and activities with research participants permitted me to become more knowledgeable about the ecological context of my research, identify other community members involved in them, and also provided an opportunity to establish a rapport with research collaborators. The initial identification of research collaborators was aided by information provided by household surveys, as well as the advice provided by local fishers and community leaders already identified and contacted by scholars working in the area (Seixas et al. 2010). My research methods included: document review, participation, semi-structured interviews, community mapping, household surveys and focus-group discussions (Berg 2005, Stake 2005, Creswell 2009). A detailed description of my data collection procedures is provided in Chapter 3.

1.3.3. Research Context

The choice of Paraty as study area is also related to the accumulated experience of the Artisanal Fishers Training Program for Fisheries Management (referred to hereafter as CAPESCA) at State University of Campinas (UNICAMP), the Fisheries and Food Institute (FIFO) and their existing partnerships with local organisations. This dissertation is part of the Traditional Ecological Knowledge component of the research programme, '*Community-based resource management and food security in Coastal Brazil*', funded by the International Development Research Centre (IDRC) and the Social Science and Humanities Research Council (SSHRC) through the International Research Chair at UNICAMP (Dr. Alpina Begossi) and the Canada Research Chair in Community-Based Resource Management (Dr. Fikret Berkes). The main objective of this research programme is to develop integrated approaches to help fishers in Paraty (Rio de Janeiro State) manage local resources, diversify their income sources and increase food security.

1.4. Contributions to Knowledge

By using the EofP framework as an analytical approach to understand the continuity and change of environmental knowledge in small-scale societies, I contribute to a growing body of scholarship that deals with traditional ecological knowledge from a processual perspective. In particular, I contribute to the ethnobiology literature, processual TEK research and adaptive learning theory. An extensive examination of my theoretical and applied contributions is presented in Chapter 10.

Processual TEK is rooted in social constructivist scholarship that researches local ways of knowing from a perspective that focuses on: "*the dynamic (re)constitutive processes and properties of it in fragmented socio-historical contexts marked by encroaching global interconnections of people, materials, goods and information*" (Zent 2009b: 45). From this perspective, change holds potential for innovation and adaptation (Davidson-Hunt 2006, Heckler 2009). Processual TEK research is: "*quite recent, little more than a decade old, still incipient, eclectic, and not yet coalesced into an easily recognizable body of work"* (Zent 2009b: 45). As a result, research within the processual TEK domain will contribute to the pool of available scholarship within this field and thereby help lend legitimacy to this area of research. Focusing on the intergenerational

continuity of ways of knowing, my research framework fits within the central themes of processual TEK research.

The main themes processual TEK research focuses on are: the social organisation of knowledge; knowledge as an emergence of situated practice; the transmission and acquisition of knowledge; and, the relation between modernisation and the intergenerational retention and loss of knowledge (Zent 2009b). My research attempts to take a holistic view on the adaptation of coastal communities to environmental change by focusing on how environmental knowledge is distributed according to age, gender, occupation and class. Likewise, it deals with knowledge as an expression of situated performance by acknowledging how it exists in relation to context, use and purpose (Objective 1; Chapters 4 and 5).

Furthermore, from this perspective, the intergenerational continuity and change of environmental knowledge is recognised as an evolving process reflecting the constantly shifting social and ecological context where learning takes place, rather than the transmission (or lack thereof) of specific pieces of information (Objective 3; Chapters 6 and 9). Finally, my research approach also deals with adaptation to environmental change and its relation to knowledge, as I explore how contemporary contexts shape what people know and also how people's needs and desires contribute to the continuity of particular skills and related practices (Objectives 2 and 4; Chapters 7 and 8).

The EofP framework contributes to processual TEK by providing a holistic framework to understand the intergenerational continuity and change of ways of knowing. On one hand it acknowledges the outcome that structures, such as historical and social context and dominant discourses, have on the dispositions that orient people to undertake natural resources harvesting practice. On the other, it recognises the role that agency and wellbeing have in the dynamics of knowledge and practice in the local environment. Likewise, the EofP framework contributes to the theoretical evolution of adaptive learning scholarship (Davidson-Hunt 2006), by situating harvesting practice and the knowledge related to it in the context of diversified livelihoods. In this sense, I try to generate an understanding of the role current harvesting practice plays in a contemporary coastal society.

1.5. Organisation of the Thesis

This dissertation is organised in ten chapters. Chapter 2 presents a literature review that underpins my research and develops the EofP framework. Chapter 3 explains my research philosophy, methodology and specific data collection procedures that guided the collection and analysis of primary and secondary field data. Each results chapter corresponds to each one of the areas of literature that together form the EofP framework and examines a particular objective related to an area of literature. The interdisciplinary nature of the framework means that the main subject each chapter explores is not isolated to that chapter but intersects with other dimensions of the research.

The ethnobiology part of this dissertation describes the practices, actors and natural resources associated with marine and coastal ecosystems (Chapter 4) as well as terrestrial ones (Chapter 5). Chapter 6 provides an example of adaptive learning by describing the introduction of the pound net fishing technology in Ponta Negra and analysing its consequences. Chapter 7 examines Ponta Negra's livelihoods through a wellbeing lens. Chapter 8 deconstructs the term 'Caiçara' as it is employed in environmental legislation and the tourism economy. Chapter 9 presents environmental learning principles, centres of learning and a case of on-going adaptive learning. Finally, Chapter 10 provides a summary of the findings and theoretical contributions of this dissertation, offers practical recommendations and directions for future research.

Chapter 2. Literature Review

2.0. Introduction

Natural resources harvesting practice is a process by which Indigenous and rural peoples engage in activities that build relations with the local landscape and its natural resources. Harvesting practice entails the management activities associated with the procurement of foods, medicine, and others elements used in daily life as well as the activities surrounding their transformation, consumption and exchange. By bringing individuals and natural environmental together, harvesting enables Indigenous and rural peoples to ensure the continuity of ways of life that link practice and knowledge with society and place (Hunn 1999).

In a world in which environmental change pushed by globalising, market forces, neoliberal conservation and climate change is widespread, the adaptive responses of Indigenous and rural peoples often result in changing relations with the natural resource base (Ellen 2007, Bates et al. 2009, Reyes-García et al. 2009). This is often manifested in transitions from natural resource-based to non-natural resource-based livelihoods in which people reduce their reliance on locally harvested resources to depend more on wage labour. Such transitions reconfigure environmental learning processes by changing the ways individuals build relations with other members of society and other components of their local and supra-local environments.

Understanding the dynamics behind the intergenerational continuity of ways of knowing in rapidly changing environments has become a growing arena of inquiry for academics and practitioners dealing with the adaptation of Indigenous and rural societies and the continuity of their ways of life (Sillitoe 2006, Bates et al. 2009, Heckler 2009). The on-going debates surrounding the continuity of Indigenous and rural ways of life, however, have focused on the conservation of forms knowledge without taking full account of the complex relations that enable their emergence through everyday life (Hewlett and Cavalli-Sforza 1986, Voeks and Leony 2004, Reyes-Garcia et al. 2009, Zent 2009a). This focus on knowledge has produced research agendas that see Indigenous and local ways of knowing as objects in need of preservation, rather than as platforms on

which small-scale societies can craft their own adaptive strategies to environmental change, taking into consideration their own needs, desires and aspirations.

This chapter lays the theoretical groundwork for the Ethnoecology of Practice (EofP), a model that analyses the human-environment relations of rural peoples through the interdisciplinary lens of adaptive learning, political ecology and social wellbeing. The contents of this chapter are a literature review that supports the EofP framework by examining the theoretical foundations of scholarly work on the intergenerational continuity of Indigenous and rural peoples' environmental knowledge while recognizing a context of rapid environmental change. Adaptive learning understands human-environment relations from a perspective that interprets natural resource harvesting practice as the process by which humans and their environments co-produce each other in an ever-changing, adaptive fashion (Davidson-Hunt 2006). Political ecology is useful in visualising how power relations mediate human-environment relations and are embedded in the dispositions that guide the practice by which people come to know the natural environment (Biersack and Greenberg 2006). Finally, the social wellbeing concept is useful for understanding how needs, desires and aspirations influence what kind of environmental knowledge and practice people consider important for living a fulfilling life (Gough and McGregor 2007). This choice of theory is aimed at providing a more holistic understanding of the intergenerational continuity in ways of knowing. In this way, I address not only how learning occurs at local levels, but also acknowledge the multi-level contexts in which learning is situated as well as the forces that shape it over time.

The EofP framework takes into consideration the structures, practices and capitals associated with natural resource harvesting activities, as well as the influence that each of these elements has on the others. These interactions are essential in the construction of the landscapes in which people live. The EofP framework acknowledges that structures, such as those associated with environmental legislation, the regional economy, social class and gender, influence the dispositions and attitudes that underlie natural resource harvesting practice. The landscape of practice is the socio-ecological environment constructed through the activities associated with natural resource harvesting practice.

According to the EofP framework, practice takes place through a network of capitals that enable access to particular natural resources.

I employ the concept of capital according to Bourdieu's (1977, 1990) work[1], in which capital refers to the different assets necessary for everyday life to take place. In order to acknowledge the importance of practice in the process of learning, this model identifies different forms of capitals involved in the generation and acquisition of knowledge. Social capital refers to the community members (or communities of practice, sensu Vermonden 2009) involved in the harvesting practice; cultural capital is the knowledge and skills required for harvesting; finally, symbolic capital makes reference to the role that identity, expertise, legitimacy and authority play in the acquisition of knowledge. Finally, using the social wellbeing concept (White and Ellison 2007), the EofP framework acknowledges the role that individual needs, desires and aspirations plays in shaping interactions with the environment, and hence the kind of knowledge that is generated through individual natural resources harvesting practice in a given setting, at a particular time. The following sections will examine adaptive learning, political ecology and social wellbeing in greater depth, building to a thorough description of my EofP framework.

2.1. Adaptive Learning and TEK Research

Adaptive learning is a branch of Traditional Ecological Knowledge (TEK) research that deals with the ways of knowing of Indigenous and rural peoples related their natural resource management practices in the context of rapid environmental change (Davidson-Hunt 2006). Ways of knowing are an integral aspect of living; they reflect how people's knowledge and perception are contingent outcomes of their historical relations with the landscape, including its human and non-human inhabitants (Ingold 2003), and the processes by which humans adapt to environmental change (Berkes 2009). Understandings of local ways of knowing have been developed in close connection with

[1] The origins of capital as a concept can be traced back to Marx's [1930(1867)] work. Although Marx's use of this concept is limited to the study of the circulation and accumulation of wealth, Bourdieu's (1977, 1990) work extended capital to encompass economic, social, cultural and symbolic dimensions of everyday life.

the study of human-environment relations, especially with regard to Indigenous and rural peoples (Berkes 20012). Approaches to local ways of knowing have become popular within the context of understanding strategies for natural resources management in small-scale societies (Berkes 2008) as well as cultural diversity and conservation (e.g., Maffi 2001, Maass 2005). In relation to the intergenerational continuity of ways of knowing, TEK Research provides a useful conceptual framework for understanding the processes by which knowledge of the environment is produced and reproduced (Berkes 2008, 2009).

2.1.1. Traditional Ecological Knowledge Research

Defining the environmental knowledge of Indigenous and rural peoples has been a challenging endeavour. TEK, Indigenous Knowledge and Local Knowledge are examples of terms commonly used to refer to the ways people know about their local environments (Posey et al. 1984, Nazarea 1999, Ingold 2003, Sillitoe 2006, Berkes 2008, 2009, Bates et al. 2009). There is neither a unique nor an absolute term for denoting the ways of knowing produced through an intimate relation between people and their lived-in environment. Instead, the use of a term depends on how ways of knowing are approached and the rationale behind it.

I employ TEK in this research as it is in keeping with Berkes' (2012) and Davidson-Hunt's (2006) use of the terms traditional and ecology. For these scholars, 'traditional' does not make reference to knowledge from the past, but rather to the processes that connects past and future, and its production through customary institutions of knowledge. Likewise, the use of the term 'ecology' recognises the embeddedness of the individual in the world in terms of their relations within their environment (Ingold 2000, Berkes 2012).

Berkes (2012) has proposed a working definition for TEK that conceives ways of knowing as relational and adaptive processes within a framework that conveys the knowledge, practice and beliefs of humans living in close connection with the natural environment. For Berkes (2012: 7), TEK is "*a cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationships of living beings (including humans) with*

one another and with their environment." According to this definition, knowledge is relative to the ways people are situated within their environments; it is adaptive because it reflects the capacity to respond to changing and emerging situations. In other words, knowledge is an integral component of the individual, as it is the embodiment of perceptual and practical skills necessary to engage in the everyday life in continuously changing environments (Ingold 2000). Understanding knowledge as a dynamic process for establishing relationships within the environment acts as a platform for developing a critical approach to the processes behind the continuity in ways of knowing.

The intellectual roots of TEK research can be found in ecological anthropology and ethnobiology (Berkes 2008). While the ecological anthropology stream deals with understanding society-nature relations, mainly within the frame of adaptation (Moran 1982), ethnobiology focuses on the knowledge and perceptions of the environment held by Indigenous and rural peoples (Hunn 2007). These two approaches have changed over time, and TEK research has developed alongside them.

Cultural ecology, ecological anthropology and systems approaches give insights on the evolution of academic understandings of human-environment relations. Human-environment relations have been a matter of study since the 19th century for cultural anthropologists (Orlove 1980). However, Julian Steward's [1956 (1977)] cultural ecology proposed the first systematic approach for studying human-environment relations in the context of small-scale populations. The basis of Steward's approach was that environmental conditions determined culture and that culture was the mechanism that made adaptation to environmental change possible. Cultural ecology highlighted that some cultural aspects, such as natural resource harvesting activities, technology and social organization, are key in the adaptive response of humans to environmental change (Steward 1972). Cultural ecology set the basis for further developments in ecological anthropology and human ecology (Orlove 1980, Moran 1982). Cultural ecology led to ecological anthropology approaches to human environment relations (Orlove 1980).

Ecological anthropology contributed to the understanding of human-environment relations by trying to integrate anthropology with ecology, something that cultural ecology was unable to do. Ecological anthropology dealt with cultural adaptation in the

context of long-term adaptive strategies of steady-state populations that did not exceed the carrying capacity of their ecosystems (Ellen 2007). Social organization and institutions were understood as functional adaptations allowing societies to interact with their environment in sustainable ways (Applebaum 1987). This strategy for understanding human and environment relations placed emphasis on survival and reproduction as mechanisms of change. Human-environment relations were dealt with as similar to those of any other species and the environment was seen as the local setting limiting human action. Ecological anthropology was criticised not only because of its deterministic understanding of cultural evolution, but also for its naïve use of ecological concepts, including natural selection and behavioural drivers (Orlove 1980, Moran 1982, Applebaum 1987). The population, rather than the individual, was considered the unit that adapts to the environment. This take on cultural adaptation reduces cultural processes to a collective response that ignores the importance of individual creativity and improvisation (Hallam and Ingold 2007).

Systems and resilience approaches introduced a set of concepts to better understand these processes of change and multiple social-ecological equilibria. Instead of being seen in constant maintenance of equilibrium, humans and environment were seen as coupled, social-ecological systems that tend to conserve core properties that enable those systems to respond to uncertainty (Holling and Gunderson 2002, Berkes et al. 2003). From this perspective, cultural adaptation is understood as a complex interplay between change, renewal and diversification (Berkes et al. 2003). After disturbances, social-ecological systems reorganise into possible alternative states without changing the core properties of the system (Holling and Gunderson 2002). The resilience framework has been successful in understanding cultural adaptation and natural resources management issues at local scales (Anderies et al. 2006). Although resilience acknowledges that local social-ecological systems are nested within larger systems, this approach is limited in its ability to deal with the influence that agents operating at supra-local scales have on human-environment relations at local levels (Armitage and Johnson 2006). Also, the resilience framework does not integrate individual agency and power in its understandings of how humans adapt to environmental change (Béné et al. 2012, Coulthard 2012).

Ellen (2007) provides a framework that addresses the shortcomings of previous treatments of cultural adaptation, addressing the role that individuals and the supra-local context play in responses to environmental change. Ellen (2007) acknowledges that cultural adaptation is bound to the local and historical specificities of a place. This includes recognizing how local knowledge is embedded in social strategies and how local knowledge and social strategies are contained in geographically, economically and politically discrete regional systems. In this sense, individual responses are contingent on personal history, position in society and interactions within the supra-local context. Within this framing, the individual becomes a locus of agency and her or his environment goes beyond the local context to encompass the relations at different levels that the individual establishes. For Ellen, local knowledge and adaptation strategies are not bounded by immediate social-ecological contexts, but rather become a necessary outcome of the interactions between situated knowledge and official and global knowledge.

Ellen's perspective provides a refreshing view of cultural adaptation and the role that local knowledge plays within it. For him, cultural adaptation is "*about the constant reorganization of anticipatory behaviour in the context of previous anticipated and unanticipated events and outcomes, to resist future entropy and randomness*" (Ellen 2007:36) and local knowledge is "*devolved in the ecology, distributed in a range of techniques, and not constituting deliberate remembered knowledge, available when it is needed*" (Ellen 2007:36). The evolution of these approaches shows a transformation in the ways human-environment relations are understood. In this context, TEK research integrates the understanding of change provided by systems approaches to recognise ways of knowing as dynamic and fluid processes (Berkes 2008).

Indigenous and traditional ways of knowing have captured the attention of social and natural scholars since the 1800s (Hunn 2007). However, it only became a systematic scientific endeavour after the 1970s, with the emergence of ethnosciences (Hunn 2007). There is no unified term for denoting approaches to local ways of knowing. My use of "ethnosciences" for denoting this field of scholarship refers to the historical origin of the discipline. As the chapter unfolds, I will describe the emergence of ethnobiology,

ethnoecology and TEK research as later developments or intersections related to the academic endeavour of investigating local ways of knowing.

Ethnobiology, the core branch of current ethnoscientific practice, has been defined the International Society of Ethnobiology as: "*the scientific study of dynamic relationships among peoples, biota, and environments*"[2] (see also Salick 2003:1). Ellen (2006: S2) provides a more comprehensive definition that incorporates the role of perception and natural resources management in the understanding of human-environment relations through ethnobiology: *"the study of how people of all, and of any, cultural tradition interpret, conceptualize, represent, cope with, utilize, and generally manage their knowledge of those domains of environmental experience which encompass living organisms, and whose scientific study we demarcate as botany, zoology, and ecology*". Ethnosciences have evolved from describing and collecting information to recognising the potential of knowledge to move forward Indigenous and rural peoples' agendas (Posey et al. 1984, Alexiades 2003, Ellen 2006, Nazarea 2006, Sillitoe 2006).

Several scholars have reviewed the historical development of ethnosciences (Clement 1998, Ellen 2006, Dwyer 2005, Nazarea 2006, Hunn 2007). These reviews identify some common trends concerning how Indigenous and traditional ways of knowing have been approached over time. In this document, I use the review developed by Hunn (2007) as the basis for my description of ethnosciences and its relation to TEK research. I find Hunn's (2007) review particularly relevant, because it highlights how the role of Indigenous and traditional peoples has shifted from being subjects of study to becoming active agents in the development and growth of the discipline.

Hunn (2007: 3-4) identifies four periods as follows: "*Ethnobiology I: first steps*", "*Ethnobiology II: cognitive ethnobiology*", "*Ethnobiology III: ethnoecology*", and "*Ethnobiology IV: "Indigenous Ethnobiology*". Ethnobiology I, equivalent to Clément's (1998) pre-classical period, covers a time period from the 16th century, when the first scholarly work related to ways of knowing was documented, through to the 1930s, when the academic disciplined was formally named (i.e., ethnobiology), and ending in the

[2] See: http://ethnobiology.org/about-ethnobiology/what-is-ethnobiology (accessed on January 12, 2013)

1950s. The main tenet of this phase was the documentation of flora and fauna with utilitarian value for the Western academia. This approach to ways of knowing was outgrown by later developments within ethnosciences (such as Ethnobiology II, sensu Hunn 2007). However, Indigenous and traditional knowledge is still used as a source of data to be extracted, transformed, and be made functional within the agendas of natural scientists. This is often the case, for example, in the use of local ways of knowing in marine conservation (Drew 2005). Drew (2005) argues that Indigenous knowledge can be dissected into useful components for the biological disciplines that comprise conservation biology. Folk systematics becomes useful for systematic phylogenetics and biogeography; population level knowledge can supply behavioural ecology and population genetics; and local knowledge about ecological relationships can be employed to nourish community biology and ecosystem management (Drew 2005).

Ethnobiology II, or the "*ethnoscientific wave*" according to Nazarea (2006: 321), saw the emergence of a formal theory to understand local ways of knowing from the perspective of folk classificatory systems and nomenclature (Conklin 1954, Berlin et al. 1974). Indigenous classification systems were approached as instruments to demonstrate the existence of universal categories that would link them to the Linnaean taxonomic system employed by the western scientific tradition (e.g., Berlin et al. 1974). Ethnosciences furthered an interest in knowledge based primarily on cognitive and linguistic principles (Hunn 2007). This particular focus provided methodological rigour and theoretical significance to the ethnosciences, which was reflected in systematised data collection and analysis (Nazarea 2006).

The emergence of this theoretical orientation generated a division among ethnoscience scholars. On one hand, Brent Berlin and Scott Atran represented the "*structural/intellectualist*" faction, which remained focused on folk systems and structures of classification (Nazarea 2006: 231). The main criticism of the structuralist/ intellectualist ethnoscience faction was that, while looking for the universality of folk classificatory system, the ecological, social and cultural contexts in which local ways of knowing are produced seemed to acquire secondary relevance (Dwyer 2005, Hunn 2007). Meanwhile, Eugene Hunn and Roy Ellen represented the "*utilitarian/ adaptationist*"

faction (Nazarea 2006: 321). This branch moved the focus towards exploring local ways of knowing as adaptation strategies associated with local approaches to resource management (Dywer 2005). As ethnosciences moved forward, other questions of "*wider interest and pressing relevance*" for the lives of Indigenous and traditional peoples started to be asked (Hunn 2007: 6). In this way, the utilitarian/ adaptationist faction opened a space for the emergence of Hunn's (2007) Ethnobiology III.

Ethnobiology III is equivalent to ethnoecology, a sub branch of ethnobiology particularly akin to TEK research due to its interest on resource management (Hunn 2007, Berkes 2008). Ethnoecology can be understood as the ways in which people: "*experience ecology, of ways in which they engage with, and build upon, the ecological relationships of which they are a part*" (Dwyer 2005: 20). This branch of ethnosciences departed from studying non-Western classification schemes to exploring the linkages between perceptions of the environment and decision-making that reflect collective memory, sense of place and identity of peoples with intimate relationship with the local ecosystem (Nazarea 1999, Dwyer 2005). Ethnoecology recognised that research concerning ways of knowing should be directed towards supporting the persistence of natural resource harvesting strategies of small-scale societies with intimate knowledge of the environment (Nazarea 2006).

In terms of method, Víctor Toledo (1992) proposed a framework for ethnoecological research. According to this framework, knowledge associated with cultural traditions can be conceptually subdivided into interconnected domains related to worldview, cognitive knowledge and practice (Toledo 1992). Seen as strategies for appropriating nature, these domains provide complementary perspectives for researching the knowledge associated with cultural traditions (Toledo 2002). However, considering cognitive knowledge as an identifiable component of this ethnoecological knowledge model creates the problem of treating knowledge as an intellectual appropriation of the environment that exists as information inside people's heads (i.e., cognitive knowledge). This approach has the limitation of assuming that knowledge operates in a similar fashion to that of the western-scientific tradition. That is, as an abstraction, disembodied from the context where it emerges, that can be expressed discursively (see Section 2.1.2.1. for

more details). These approaches to ecological knowledge have led to assumptions that culture and related knowledge are a transmissible corpus and the holders of that knowledge are passive recipients of it (Ingold 2000). Since it has direct implications on the ways by which the intergenerational knowledge continuity phenomenon has been dealt, I will fully unpack the shortcomings of this cognitive approach to local ways of knowing in the section on learning (Section 2.3).

Hunn (2007) identifies Ethnobiology IV as one of the most recent developments in ethnosciences. It is distinguished from early stages by its focus on the agendas of Indigenous and traditional peoples. This developmental stage is linked to critical theory and post- structural social sciences that see local and Indigenous people both as objects and agents within wider societal contexts. This perspective forms a link between ethnosciences and development studies that reflects the relevance that the continuity of relations with the local environment has on the future of Indigenous and traditional peoples (Posey et al. 1984).

At this point the connection and differences between ethnosciences in their latter developmental stages (i.e., ethnobiology III and IV sensu Hunn 2007) and current TEK research (Berkes 2008, Zent 2009b) are not easily distinguished. Consequently, in the remainder of this section I refer to TEK research and adaptive learning, which encompasses Berkes' (2008) framework and its relation with current approaches to ethnobiology that theorise the landscape as a broad and dynamic frame of analysis in which place, change and process are central features of investigation (Heckler 2009, Johnson and Hunn 2010).

The literatures reviewed in the two previous sections allow me to situate TEK research as one point of encounter between academic approaches dealing with human-environment relations and local ways of knowing. From the side of human-environment relations, TEK research understands human adaptation to environmental change as a complex interplay between change, renewal and diversification (Berkes et al. 2003). From the local ways of knowing side, TEK research looks at ways of knowing from a perspective that recognises the role that knowledge of the environment plays in Indigenous and rural peoples' natural resource management strategies (Berkes 2008). For

TEK research, local ways of knowing are not necessarily limited to environmental information generated by Indigenous and rural peoples' unique perspectives, but rather a process rooted in an on-going, yet historical, relation that connect people and places. Heckler (2009: 15) refers to this view of TEK in the following terms: "*TEK emerges as an interaction of movement through an engagement with a particular landscape and the socio- economic context in which this knowledge is developed, evaluated, transmitted and applied*."

Likewise, Berkes (2012) deals with TEK using a perspective that conveys a complex of knowledge-practice-belief and consists of four nested levels: local knowledge of animals and plants, land and resource management systems, social institutions and worldview. Berkes (20012: 18) describes his framework for TEK:

> First, there is the local knowledge of animals, plants, soils and landscape. This level includes knowledge of species identifications and taxonomy, life histories, distributions, and behaviour. Based on empirical observations, all such knowledge has obvious survival value. But local knowledge may not be sufficient by itself to ensure the sustainable use of resources. At the second level of analysis, there is a resource management system, one that uses local environmental knowledge and also includes an appropriate set of practices, tools, and techniques. These ecological practices require an understanding of ecological processes, such as functional relationships among key species and an understanding of forest succession […]. Third, a traditional system of management requires appropriate social institutions, sets of rules-in-use, and codes of social relationships […]. Finally, a fourth level of analysis is the worldview, which shapes environmental perception and gives meaning to observations of the environment […]. The fourth level includes religion, ethics, and more generally, belief systems, and rounds out the knowledge- practice-belief complex that describes traditional knowledge.

Knowledge of plants and animals exists in relation to a context of practice and skills that are regulated by institutions, which are crafted within a cultural context specific to a given time and place (Berkes 2012).

This TEK framework is of particular relevance because it highlights how local ways of knowing, instead of being bodies of knowledge that can be passed between generations, are processes rooted in practice, social relations, place and identity. This view of ways of knowing fits into a recent development of TEK research known as '*processual* TEK' (Heckler 2009, Zent 2009b). Processual TEK is rooted in social

constructivist scholarship that researches local ways of knowing from a perspective that focuses on: "*the dynamic (re)constitutive processes and properties of it in fragmented socio-historical contexts marked by encroaching global interconnections of people, materials, goods and information*" (Zent 2009b: 45). The main themes Processual TEK research focuses on are: the social organisation of knowledge; knowledge as an emergence of situated practice; the transmission and acquisition of knowledge; and, the relation between modernisation and the intergenerational retention and loss of knowledge (Zent 2009b).

In the following sections I unpack the remaining theoretical areas identified that contribute to the development of the EofP as a TEK research framework that deals with the intergenerational continuity of ways of knowing as a learning process situated in social, political, economical and ecological contexts and influenced by individual creativity and agency.

2.1.2. Intergenerational Continuity of Ways of Knowing: from Cultural Transmission of Knowledge to Adaptive Learning and Beyond

2.1.2.1. The Cultural Transmission of Knowledge Model

Knowledge transmission theory has been deeply influenced by the Cultural Transmission of Knowledge Model (CTKM; Cavalli-Sforza et al. 1982, Hewlett and Cavalli-Sforza 1986, Zent 1999). Drawing upon cognitive anthropology, cultural transmission is defined as "*the process of social reproduction in which the culture's technological knowledge, behaviour patterns, cosmological beliefs, etc. are communicated and acquired"* (Hewlett and Cavalli- Sforza 1986: 922). The CTKM explains cultural transmission as the diffusion of cultural contents by means of four modes relative to the role that both the transmitter and the transmittee take on in such a process. Such modes are: vertical, horizontal, one-to-many and many-to-one.

Vertical or parent-to-child transmission is considered highly conservative, responsible for maintaining the '*status quo of culture*'. This mode is deemed as the most important one for knowledge transmission because it is related to the role that family plays in the development of the individual (Hewlett and Cavalli-Sforza 1986, Lozada et al. 2006). Horizontal or contagious transmission happens among peers of the same

generation who are not necessarily related. This mode of transmission is considered highly variable, playing an important role in the introduction of foreign elements into given cultural contexts (Hewlett and Cavalli-Sforza 1986). This appreciation of horizontal transmission has been criticised by learning scholars, who recognise the role of peers from the same age in the reinforcement of skills acquired during collective social practice. This is the case, for example, of children engaged in angling activities in SE Sulawesi in Indonesia (Vermonden 2009). When children are skilful enough to undertake these activities on their own, interacting and exchanging information with peers of similar age helps them to improve their fishing skills. Rather than collaborating around the introduction of foreign elements, peers can facilitate the continuity of learned activities related to natural resource harvesting.

One-to-many refers to the transmission from teacher/leader/media to students/citizens. This mode of transmission is perceived as a factor that causes rapid change and homogeneity within communities. The last mode proposed by Cavalier-Sforza's model is many-to-one or concerted transmission. This mode involves transmission from older to younger members of a social group. Many-to-one is considered to allow slow change and to be highly conservative (Cavalli-Sforza et al. 1982, Hewlett and Cavalli-Sforza 1986, Reyes-Garcia et al. 2009).

Evolutionary biologists drew upon cultural transmission to develop dual inheritance theory, a deductive model attempting to visualise the logical relations between genetic and cultural evolution (Boyd and Richerson 1985). For Boyd and Richerson (1985:2), culture is tantamount to "*the transmission from one generation to the next, via teaching and imitation, of knowledge, values, and other factors that influence behaviour.*" From this perspective, culture becomes the very process by which behavioural traits are passed on between generations via vertical and horizontal transmission (see above). Through this process, individuals, referred to as either "*cultural offspring*" or "*naïve individuals*" (Boyd and Richerson 1985: 10), become the repository of cultural information that enables the continuity of culture and society. Even though cultural transmission, and its applications, provided a theoretical framework to understand the processes by which individuals come to know the world they live in, these approaches face a series of

shortcomings and limitations related to how they deal with knowledge and the way it is assessed.

Cultural transmission has limitations that are reflected in its methodological approach, as well as in the interpretation and practical application of its results. Cultural transmission assumes that culture and its subsets, including local knowledge, are traits that can be passed on from one generation to the next (e.g., Boyd and Richerson 1985). This implies that the maintenance of knowledge and culture depends on their preservation, rather than in recognising their adaptability (Davidson-Hunt 2006). This view emerges from considering ecological knowledge as a body of information moved forward by people, rather than as an emerging process integral to a contingent and historical way relating between human and non-human entities (Ingold 2003).

When looking at the methodological strategies employed in researching the cultural transmission of knowledge, it can be found that most of the studies on this topic rely on the quantitative analysis of the transmission of culturally distinctive traits, skills or discrete cultural items evaluated in small-scale, isolated communities (Hewlett and Cavalli-Sforza 1986; Zent 1999, 2009; Voeks and Leony 2004; Maass 2005; Reyes-Garcia et al. 2009). For example, Hewlett and Cavalli-Sforza (1986) and Ohmagari and Berkes (1997) view the transmission of well-defined skills necessary for harvesting practice as a proxy for assessing knowledge transmission. Such evaluation depends on structured interviews and quantitative analyses that describe what skills are possessed and who has shown such skill (see Hewlett and Cavalli-Sforza 1986: 924-28).

Understanding the processes associated with the continuity and change of natural resource harvesting practice in the context of environmental change has been simplified to the possession of given skill sets or defined knowledge traits. CTKM approaches do not consider the ways in which knowledge emerges as an adaptive response to environmental change. Likewise, they do not consider the agency of individual members of society, who can generate innovative options for creating livelihoods in the contexts of culturally forged relations with the environment. For ethnobiologists applying the CTKM, the individual is a passive recipient of information with limited capacity for innovation. This becomes evident in the interest that ethnobiologists have in documenting

how much knowledge from the past is held by current generations (Reyes-García et al. 2009), which does not pay attention to how knowledge adapts in response to both new conditions and individual initiative. Ethnobiologists applying the CTKM have focused on the information that is passed on between generations, but have ignored the processes by which information is produced, acquired and given relevance: "*cultural transmission is viewed as a simple process of imprinting, in which a whole inventory of rules and representations is miraculously downloaded into the passive receptive mind of the novice*" (Ingold 2000: 36).

In a similar fashion, and drawing on cognitivist frameworks, ethnobotanical studies on CTKM have relied heavily on plant lists for assessing Indigenous and rural people's competence in the identification of local flora (e.g., Zent 1999, 2009a, Lozada et al. 2006). This approach fits into Hunn's (2007) Ethnobiology II, which focuses on listing the species and skills people know and use. Their field methods often rely on the collection of plants in habitats close to communities, and then asking local people to identify them (Zent 1999, 2009, Lozada et al. 2006). According to this perspective, knowledge competence is the capacity to identify plant species names according to the name(s) most commonly used among community members (i.e, "*cultural consensus*", Zent 2009a). Since knowledge competence is measured in relation to the use of language structures, it implies that knowledge is treated in abstract categories, which are understood to be expressed and passed on discursively. However, looking at knowledge from a sociological perspective suggests that, even though people are knowledgeable agents, their ecological knowledge is not necessarily explicit or discursive.

Giddens (1984) categorises environmental knowledge in relation to the degree of the consciousness of its holder. Understandings of the environment range from unconscious, through practical conscious, to discursive conscious. Unconscious knowledge refers to the immanent structure that enables society to proceed across time. Embedded in daily activities, practical consciousness is expressed in the skills required to perform a given activity. By contrast, discursive consciousness expresses knowledge rhetorically (Giddens 1984). To rely solely on language as a means for the cultural transmission of knowledge does not take into account the complexity of knowledge in its

unconscious and practical dimensions, or the processes that underlie its production and emergence. Some ethnobiologists argue that certain aspects of everyday life require more than verbal explanation to be embodied (e.g., Ellen 2004, 2006). As Ellen (2006: S56) puts it: "*how would you explain to a child how to tie a shoelace – over the telephone?*"

The cultural transmission of knowledge, understood from the perspective of discrete traits (e.g., skills or linguistic categories), bounds culture and knowledge to the act of passing on of existing information with little room for acknowledging change as an intrinsic aspect of the intergenerational continuity of ways of knowing. This approach to cultural and knowledge continuity has produced a range of perspectives that assume ecological knowledge to be in a constant process of erosion and loss as people experience environmental change (Hewlett and Cavalli-Sforza 1986, Zent 1999, 2009, Maffi 2001, Maass 2005, Lozada et al. 2006). Viewing knowledge loss as the reduction in skills and language does not recognise cultural adaptation as a process of improvisation and creation that leads to adaptation (Hallam and Ingold 2007). Davidson-Hunt (2006: 601) deals with the issue of continuity and change of knowledge by providing a critical look at how tradition has been conceptualised using the lens of the CTKM:

> Unfortunately, the focus on the transmission of the content of knowledge through time and space has resulted in a perspective where tradition is theorized as continuity and change as a loss. In this perspective on tradition, knowledge changes, not through agency and creativity, but as a result of errors in the transmission process.

In spite of the aforementioned limitations, studies using the CTKM have useful elements for understanding the continuity of ways of knowing, especially with regards to how learning takes place in contemporary contexts (Zent 2009b). Some of these elements include the kind of knowledge and skills acquired in relation to age, the role of formal education, livelihood activities, community, as well as other variables that mediate how the individual comes to know the world in which they live (Zent 2009b). One of the main contributions that the CTKM offers for understanding the continuity of ways of knowing is recognising the role that interpersonal relations have on the continuity of knowledge (Zent 2009b).

However, as adaptive learning explains, the role that interpersonal relations play in the continuity of knowledge is not about the transmission of information. It is rather related to how interpersonal relations facilitate experiences that allow the apprentice to become skilful by means of practical engagement within a given setting (Davidson-Hunt and Berkes 2003a, Davidson-Hunt 2006). According to adaptive learning, knowledge is not transmitted exclusively via language. Knowledge, in the form of skills, attitudes, values and dispositions, is rather acquired by the individual through the practical and perceptual engagement with their social-ecological environment (Davidson-Hunt 2006). This practical engagement allows the emergence of cognitive structures that inform the ways by which the individual performs and perceives the dwelt-in world (Davidson-Hunt 2006).

Knowledge transmission sees in social, economic and cultural change the source of erosion and loss of local ways of knowing (Bates et al. 2009, Reyes-García et al. 2009). The recognition of this growing issue has generated policy and academic discussion about the conservation of biocultural diversity (Maffi 2001, Bates et al. 2009, Zent 2009b). Even though the loss of cultural diversity is an important issue that needs to be addressed, any attempt to conserve environmental knowledge should first consider it as an integral part of people's everyday lives. This can be done by acknowledging and accepting the adaptability of knowledge in response to environmental change, and by considering how knowledge allows people to develop their own life projects according to, not only their worldviews, values and beliefs, but also their needs and aspirations (Blaser 2004, Sillitoe 2006).

Adaptive learning provides a critical approach to the intergenerational continuity of knowledge that facilitates local ways of knowing and practice to be addressed as indivisible domains of coupled social-ecological systems (Ingold 2000, Davidson-Hunt and Berkes 2003a). In the following section, I define and explain adaptive learning as the process by which the individual engages in an intimate relationship with their environment.

2.1.2.2. Intellectual Roots of the Adaptive Learning Framework

From the perspective of adaptive learning, the intergenerational continuity of ways of knowing can be treated as a process by which the individual builds relations with the environment and through these relations constructs their own understanding of the world (Berkes 2012). Importantly, the individual is situated as a point of growth within the social and ecological networks that produce historically and socio-culturally constituted landscapes (Ingold 2003).

In order to introduce the EofP as a framework to understand the intergenerational knowledge continuity and change based on adaptive learning, in the following sections I introduce some of the basic concepts that underpin adaptive learning related to phenomenology and the ways by which the individual develops relations with, and hence comes to know, their environment. Phenomenology of perception is a philosophical programme proposed by Merleau-Ponty (1962), and later applied by Ingold (2000, 2011) to explain the perception of the environment by means of practical engagement in everyday life. Others scholars, such as Dywer (2005) and Vermonden (2009) have applied Ingold's concepts to explain learning as the process by which the individual generates practical and perceptual engagement with the environment. However, what makes adaptive learning particularly valuable is its recognition of creativity as an intrinsic component of adaptation (Davidson-Hunt 2006).

Originating in the works of Heidegger and Merleau-Ponty, phenomenology focuses on the description of the body as a ground of experience (Diprose 2008). Phenomenology emerged as a critique of the Cartesian approach in which mind and world are seen as separate entities (Ingold 2000, Wylie 2007). According to the Cartesian perspective, the individual is an observer detached from the observable, external and pre-existing world located '*out there*'. The interactions between individual and natural environments have been explained by what Husserl (Cited in Wylie 2007: 145) called the natural attitude: "*our ingrained and taken-for-granted habits of considering ourselves, first, as discrete subjects with internally realised thoughts and feelings, and the world, on the other hand, as an external and real object.*" This position, which has dominated modern science,

works under the assumption that reality is something external, measurable and describable.

Assuming this separation between individual and environment has direct implications when dealing with environmental knowledge. Within Husserl's natural attitude perspective, knowledge is taken as an abstraction that exists inside the individual's mind and is autonomous from their environment. The individual constructs the world within their mind before actually entering into contact with it (Ingold 2000). According to cognitive scientists, and as the CTKM also suggests, the building blocks employed to construct the world are passed on from generation to generation in the form of knowledge and skills (e.g., Richerson and Boyd 1985). Any change in the configuration or content of these building blocks is interpreted as either loss or erosion (cf. Cavalli-Sforza et al. 1982, Reyes-Garcia et al. 2009). According to this perspective, the environment is external to the on-going process of individual, social and cultural adaptation (Boyd and Richerson 1985).

Phenomenology provides a counterpoint to this Cartesian way of understanding human-in-environment relations. For phenomenologists, human-in-environment relations correspond to the processes by which the individual develops as a being-in-the-world (Merleau-Ponty 1962). The body is a ground of experience through which the individual perceptually engages with the world (Ingold 2000). The extent and breadth of these relations shape the ways in which the landscape comes into existence for the individual. Being-in-the-world generates power of action or agency (Giddens 1979). Thus, agency does not consist of operations undertaken within a pre-given space. Rather, it is the outcome of individual practice and, in fact, creates landscape as practice is undertaken (Hallam and Ingold 2007).

Considering the landscape as a milieu of engagement, Merleau-Ponty generates the concept of intertwining (reviewed in Wylie 2007). Intertwining refers to the process by which individual and environment constantly relate and generate each other. The landscape comes to exist for the individual as an outcome of intertwining: "*I belong to the landscape of visible things that enables my seeing – it is my seeing which enables me to witness that belongingness*" (Wylie 2007: 152). Intertwining refers to the extent of

associations forming the individual's landscape, including those that have been historically constituted and, therefore, inform how the individual is currently situated within a given setting and how such a setting is constituted from the perspective of the individual. Consequently, the continuity, acquisition and emergence of ecological knowledge are subject to a historically situated process that enables its emergence. As Ingold (2000: 153) explains:

> Cultural knowledge, rather than being imported into settings of practical activity, is constituted within these settings through the development of specific dispositions and sensibilities that lead people to orient themselves in relation to their environment and to attend to its features in the particular ways that they do.

Knowledge, and the perception of the environment that underlies it, are a manifestation of how the individual and the landscape are intertwined with each other. What the individual sees depends on how they are attuned with their landscape. It is through this practical engagement that the world becomes a known and meaningful environment. This is the basis of Ingold's (2000) perspective on dwelling, which is a concept that makes phenomenology operational and explains learning as a process framed within a knowing-as-practice point of view.

Borrowing from Heidegger's approach, Ingold (2000) uses dwelling to deal with the dialectical relationship that the individual and the landscape form by means of practice. While in a colloquial sense 'dwelling' refers to a place of residence or residence in a place, from a phenomenological perspective, dwelling refers to the togetherness and intimacy that mutually bind humans and their environments over time and space. This process provides a landscape with its contingent, relational and, hence, unique configuration (Ingold 1993). Dwelling, referring to the individual-in-their-environment, describes an individual-landscape meshwork based on practical and perceptual engagement. If mind is contained within the whole system of body-environment relations, the landscape emerges as a product of the continued formation of such relations. Dwelling provides a position to approach the landscape not as a physical entity that is "*out there*", existing on its own, but rather as something "*immanent (with)in the relational contexts of people's practical engagement with their lived-in environments*" (Ingold 2000:168). Consequently, the landscape is an on-going, generative process that

signifies the practice of individuals within the world, including in their past as well as all of the current relations they establish with other human and non-human entities.

Dwelling sees the individual agent as:

> …a being immersed from the start, like other creatures, in an active, practical and perceptual engagement with constituents of the dwelt-in world. This ontology of dwelling [...] provides us with a better way of coming to grips with the nature of human existence than does the alternative Western ontology whose point of departure is that of mind detached from the world (Ingold 2000: 42).

Instead of being a recipient of knowledge, as cultural transmission indicates, from this dwelling perspective learning implies establishing relations between the individual and their environment (Davidson-Hunt 2006). Learning is inseparable from a person's life in the world; it is a lifetime process. The communication of certain skills, essential within the CTKM, is just one part of the many that constitute the process of engagement in the world. Learning "*is not transmission of information, but an education of attention*" (Ingold 2000: 167).

Learning takes place in an environment of joint practical activity. Here the notion of environment does not imply nature in a physical and tangible sense. Instead environment is the reality constituted in relation to the elements existing within a given landscape where practice takes place, "*a taskscape*"(Ingold 2000). In the context of Indigenous and rural peoples, this individual-landscape relation has been explored from the perspective of natural resource-based practice, which in turn has been the primary object of study for TEK research (Berkes 2012). However, in order to have a more rounded understanding of the individual's perceptual engagement with the world, it has to be examined in relation to the livelihood portfolio in which natural resource harvesting practice is situated.

"*Dwelling in the world*" implies that things are encountered within a relational landscape already integrated into a set of practices that constitute everyday life. Being and world are merged by means of dwelling. The landscape conveys the perception of properties from the physical world that are translated into resources that make possible the maintenance of life and capacity of action (Mace 1977). James Gibson (1977, 1979)

captures the analysis of how the individual links perception and practice in his theory of affordances.

The theory of affordances explains how individuals discover meanings associated with physical objects through the process of using them (Ingold 2011). An affordance is anything from the physical world that is perceived according to the specific combination of the properties of its substance and surface from the perspective of a particular living being (Gibson 1977). Objects acquire value in relation to an individual's practice when there is information available within the environment to make these features visible. The information available to the individual enables them to perceive environmental features and shapes their understanding of those features.

A niche is a setting comprised of environmental features suitable for a particular being (Gibson 1977:67). In this way, affordances can be seen as equivalent to the ecological niche concept. They refer to how the physical world (i.e., habitat) becomes the individual's landscape in relation to the practices that configure its use and appropriation. As the physical world provides elements with a given set of properties, the individual appropriates these elements to integrate them into their way of life. Affordances are neither objective nor subjective; they are properties of the physical world that the individual appropriates and transforms into resources in response to a specific requirement (Gibson 1977). To perceive the landscape in terms of its properties is to perceive what it affords. Therefore, an affordance is what the landscape provides to the individual in relation to how the individual perceives it (Gibson 1979).

Understanding the intergenerational continuity of ways of knowing from a phenomenology perspective acknowledges that the environment where knowledge is produced is a relative emergence of individual practice. If knowledge is produced as an outcome of such practice, then change and adaptation are intrinsic to the process of learning about the environment. In the next section, I present the adaptive learning framework as an approach to the intergenerational continuity of ways of knowing that acknowledges and deals with evolving landscapes (Davidson-Hunt and Berkes 2003a,b, Davidson-Hunt 2006).

2.1.2.3. The Adaptive Learning Framework

Ethnobiology approaches addressing the intergenerational continuity of ways of knowing have dominantly pursued lines of inquiry closer to the cultural transmission research programme (e.g., Hewlett and Cavalli-Sforza 1986, Voeks and Leony 2004, Lozada et al. 2006, Reyes-García et al. 2006). In spite of this predominant focus, Davidson-Hunt (2003) proposes adaptive learning as an approach to learning in the context of resilience thinking. This approach provides a way of looking at change and transformation of ways of knowing as processes of adaptation (Davidson-Hunt 2003).

Drawing from Ingold's dwelling concept, adaptive learning provides a framework for examining how environmental knowledge is acquired through the relationships among individual practice, social memory and learning institutions, all framed within the context of social relations (Davidson-Hunt 2003, 2006; Davidson-Hunt and Berkes 2003a). For Davidson-Hunt (2003), knowledge is acquired and produced by means of experience and practice. According to adaptive learning, environmental learning is a process by which a skilled person creates contexts for a novice learner to acquire and develop knowledge and skills in their own way (Davidson-Hunt 2003). Practice not only enables the individual to develop an intimate relationship with(in) the landscape, but also situates them as part of such processes.

The adaptive learning model is based on the concepts of social memory and learning institutions, both of which support the generation of cultural landscapes as ways by which the environment is perceived and appropriated (Davidson-Hunt and Berkes 2003a). Social memory represents the long-term collective understanding of ecosystems and their dynamics, as well as the process by which this understanding is passed on between generations. Davidson-Hunt (2003:45) defines social memory as a "*legacy of cognitive knowledge and institutions of knowledge that provide the building blocks and structuring of individual creativity and learning.*" Thus, social memory can be assumed as an iterative framework for knowing. While social memory structures individual practice and creativity, practice and creativity shape social memory in turn (Davidson-Hunt and Berkes 2003a).

Learning institutions are sets of rules-in-use that, either formally or informally, regulate the processes by which knowledge is acquired and generated (Davidson-Hunt and Berkes 2003a). Rather than providing any sort of information, learning institutions set the parameters for the learning situation. Thus, learning institutions are "*the rules by which individual memories become authoritative and lead to changes in social memory. An individual must follow the institutions of knowledge if their memories are to become authoritative within a society*" (Davidson-Hunt 2003: 44). According to these learning institutions, knowledge resides in the individual's relations with the landscape and is progressively revealed through experience (Davidson-Hunt and Berkes 2003). Learning institutions apply Bourdieu's (1990) concept of *habitus* (Section 2.4) to learning perspectives in the context of natural resource management (Davidson-Hunt 2003). Learning institutions indicate how structures are embedded in everyday life. Learning institutions are not static; rather, they are shaped by the context that dictates what individuals must know in order to be competent members of a social group (Davidson-Hunt 2006).

Finally, the cultural landscape represents the array of affordances that give account of how the physical environment is perceptually and practically perceived by the individual (Davidson-Hunt and Berkes 2003a). Likewise, the cultural landscape is both the learning environment and also the outcome of the learning process. Since knowledge resides in the landscape and practice reveals it to the individual, the cultural landscape affords relative and contingent spaces where knowledge is produced and reproduced (Davidson-Hunt 2006). It is through the role that cultural landscapes play in learning that memory can be understood beyond cognitive frameworks.

Although memory is similar to cognitive knowledge in the sense that it contains factual information, the main difference between these two concepts is related to the nature of their acquisition. While cognitive knowledge, according to cognitivists, is transmitted as a package of information by means of language, memory is revealed through practical experience with the environment (Davidson-Hunt 2006). For memories to be revealed, they require an experienced individual with access to such memory, the physical context where the memory can be encountered and a novice learner who will

progressively experience the memory, and adapt it to their current circumstances through processes of innovation and creation (Davidson-Hunt and Berkes 2003a)

Learning affords a perspective on knowledge that recognises its emergence from contexts of practice in structured environments. Learning is tantamount to the process by which people come-into-being within their environments (Ingold 2000, Davidson-Hunt 2006). This coming-into-being is historically and spatially situated (Ingold 1993). Adaptive learning provides a framework to understand how change and adaptation are inherent in the continuity and change of ways of knowing. However, as a theoretical development, adaptive learning does not fully address how external drivers, such as environmental change produced by modernist development and biological conservation policy and practice (Section 2.2.3), influence the learning institutions that provide legitimacy to natural resources harvesting practice and the knowledge acquired through it. Likewise, adaptive learning does not fully acknowledge how the continuity of ways of knowing is informed by the desires and needs of the socially, culturally and ecologically situated individual. The following two sections present insights from political ecology and social wellbeing that, integrated into the EofP framework, are expected to fulfil these gaps.

2.2. Political Ecology and Ways of Knowing

In order to develop the analytical tools necessary for a more holistic examination of the intergenerational continuity and change of ways of knowing in the context of environmental change, this section bridges adaptive learning with some elements of political ecology.

2.2.1. Political Ecology: Definitions and Evolution of a Discipline

The main tenet of political ecology is the study of how power is manifested in human-environment relations (Biersack 2006). The perspectives political ecology provides for understanding this phenomenon have evolved in parallel with the growth of political ecology itself. This evolution can be traced to two particular phases, which Biersack (2006) termed as first and second wave.

The first wave is linked to the origins of the approach and dates back to 1972 when Eric Wolf used the term 'Political Ecology' for the first time (Escobar 1999a, Biersack 2006). Wolf (1972) brings together elements from cultural ecology and political economy to deal with the analysis of the environment from a political perspective (Wolf 1972). Placing power at the centre of analysis allows human-environment relations to be seen in more nuanced terms than the problematic of adaptation proposed by Steward's (1977) cultural ecology framework has been able to. Wolf's theory has been deeply influenced by the work of political economy, which studies how local communities are part of larger political, economic and social contexts (Wolf 1982). Using a "*capitalocentric*" perspective that understands the local as being subordinated within a global system of power structures, this first wave of political ecology visualises the structures of inequality mediating human-environment relations (Wolf 1972, Biersack 2006). In this context, power is seen as historically intertwined with culture and is expressed in everyday life through relations of gender, class and ethnicity (Wolf 1999).

In the 1980s, post-structural analyses, development studies and social movements were incorporated into political ecology's scope (Escobar 1999a). This disciplinary intersection allowed the emergence of a second wave of political ecology that criticises modern ideas, such as the divide between society and nature, as well as progressive notions that see non-Europeans as trapped in the structures imposed by modern colonialism (Escobar 2005, Biersack 2006). This second wave of political ecology moves forward a theoretical re-orientation that assumes reality to be discursively produced. In this sense, nature is a consequence of society's conceptualisations and practice (Biersack 2006). Arturo Escobar (1999a,b) has furthered this theoretical development through his anti-essentialist political ecology approach.

In addition to recognising nature as a social construct, the second wave of political ecology counters the first wave's conceptualisation of the local as an inflection of the global (Biersack 2006). This re-orientation is guided by the acknowledgment of the role that individual agency, in addition to structures, perform in the social construction of nature (Biersack 2006). Drawing on practice theory (Giddens 1979, Bourdieu 1990), individual agency is tied to notions of identity and territory embedded in the continuity of

a way of life. I link this element of political ecology to the analysis of wellbeing (Section 2.3).

The evolving understanding of social inequalities is also an area in which political ecology has advanced. Rather than focusing only on class, current political ecology also deals with issues related to gender and ethnicity (Biersack 2006). Social inequalities, expressed in terms of class, gender and ethnicity, are critical for grappling with the multiple dimensions involved in the constitution of nature by means of natural resource management practice (Elmhirst and Resurrección 2008). Visualising social inequalities allows for an exploration of how different kinds of discourses shape access to natural resources and how gender, ethnicity and other dimensions contribute to the constitution and experience of wellbeing (Resurrección and Elmhirst 2008).

2.2.2. Using the Anti-essentialist Political Ecology Framework

Aligned with political ecology's second wave, Arturo Escobar (1999a,b) proposes an anti-essentialist framework for political ecology. In this framework, Escobar employs a perspective that deals with nature as a historically, contextually and culturally-dependent construction (Escobar 1999a: 280). Phenomenology acknowledges that being-in-the-world implies that the mind, rather than being contained in the brain, exists within an unfolding field of relations that the individual establishes with her environment by means of practice (Ingold 2000). The anti-essentialist political ecology framework supports this phenomenological understanding of the world and works to make visible the relations that inform the ways by which the landscape is experienced, perceived and, hence, constructed (Escobar 1999a). The cultural, social, political and economic relations through which people collectively live their lives filter the experience of the individual in regards to the world. The landscape is therefore constructed through the discourses and meanings underlying such relations. What an individual perceives as normal is, at the same time, relative, collective and discursive (Escobar 2005).

The influence of discourse and power in the constitution of the local landscape is a key element in understanding what and how the landscape of a particular individual comes into being. The dwelt-in landscape of the individual is constructed through the

social relations that situate that individual in space and time. Superseded by structures, these relations generate the habitus, or the dispositions that subsist alongside practice, and therefore produce a particular landscape in relation to what the individual needs and wants (Ingold 2000). It is necessary to be cautious about how the influence of structures over individual practice and action is understood.

The first wave of political ecology suggests that individuals inhabit discursive worlds of culturally generated meaning. This position suggests that perception and action depend on what structures dictate, leaving no room for the expression of agency. The individual is rendered a "*cultural puppet*" moved by directives and structures emanating from an overarching cultural context (Ingold 2000). In line with cognitive sciences and CTKM (see Reyes-Garcia et al. 2009), Indigenous cultures have often been viewed in this light: either as an impediment to modern development or as holders of static packages of knowledge and practice that must be preserved from the homogenising pressures of globalisation (Robson et al. 2009).

In line with the second wave of political ecology, practice theory scholars, such as Giddens (1984) and his structuration theory, provide a counter argument regarding the role of structures and their relation to individual agency. According to structuration theory, structures are both a precondition and outcome of agency. Rather than constraining the individual, the individual has the potential to use structures as platforms for the exercise of their agency. Jackson (1996:22), puts it simply: "*It is not that social structures and discourses are not important, but that the subject, and place, always participate at least in how these forces are played out. The phenomenal world can never be totally reduced to outside forces.*" I will develop this theme further in Section 2.4.4 dedicated to the relation among agency, wellbeing and power.

In the remainder of this section, I will develop the concept of discourse and the influence of discourse on the construction of landscapes for coastal communities. In the context of coastal communities of SE Brazil, the existence of certain structures, brought forth as discursive "nature regimes" (see Section 2.2.3. for a definition) as well as social relations occurring in everyday life, has the potential to either enable or hinder access to certain components of the environment that constitute affordances related to

natural resource-based practice. Discourses influence how nature regimes coalesce in coastal communities. Exploring the intersections between discourse and access to natural resource-based practice is central to the continuity of ways of knowing from the perspective of the EofP framework.

2.2.3. Nature Regimes, Modernist Development and Conservation Discourses

According to Escobar (1999b: 5), nature is: *"differently experienced according to one's social position and… it is differently produced by different groups or in different historical periods."* Nature is constructed according to regimes, which produce structures that organize the worldview shared among society members. According to Escobar (1999b: 5), nature regimes:

> can be seen as constituting a structured social totality made up of multiple and irreducible relations, without a centre or origin, that is, a field of articulations; there is a double articulation, within each regime and between one and another. The identity of each regime is the result of discursive articulations — with biological, social, and cultural couplings — that take place in an overall field of discursivity wider than any particular regime.

This understanding of structures is analogous to the one proposed by Bourdieu (1990), which I use to develop the EofP framework (Section 2.4).

The discourses found in the Atlantic Forest Coast of Brazil are tied to nature regimes constructed through the intertwining of worldviews operating at the national, regional and local level, which at the same time emanate from environmental, economic and development law and policies as well as from the inhabitants of the small coastal communities (Hanazaki et al. 2007). Industrial fishing, tourism development and biodiversity conservation are examples of nature regimes stemming from the supra-local levels (Diegues 1983, Begossi 1996, Adams 2003, Hanazaki et al. 2007, Begossi et al. 2012). On the other hand, the coastal peoples' nature regime is associated with the close relationships between people and the local ecosystem in which natural resources harvesting plays an important role as does a history of ecological and socio-economic marginalisation (Begossi 1998, Adams 2003, Diegues and Nogara 2005).

The aforementioned nature regimes are relational and co-produce each other as they interact and overlap (Escobar 1999a). The analysis of how nature regimes are articulated,

especially in terms of social relations with and demands for natural resources, it is a central matter of Escobar's (1999a, b) political ecology framework. Likewise, this feature is of particular relevance to the EofP framework, as it allows for the exploration of how power originating in regional development activities, connections with markets and biodiversity conservation is enacted in the everyday life of resource users. Since nature regimes operate as discourses, they can be analysed using discourse analysis tools.

Discourse analysis is an analytical tool used in political ecology borrowed from post-structuralist approaches. They analyse the underlying forces that constitute taken-for-granted realities (Foucault 1966). Discourses operate as structures of understanding that set schemes of perception and action within which social relations and practices acquire legitimacy (Escobar 1999a), and thus allow resources to become visible affordances. Discourse analysis inquires about the origins of taken-for-granted elements of everyday life. This position makes it possible to visualise how categories assumed to be universal and objective are in fact historically and discursively constructed (Escobar 1999a).

Discourses are not necessarily something said, they also encompass ways of thinking, acting and relating with other human and non-human entities. Discourses enable properties from the physical world to be made visible, and hence appropriated, according an individual's perception (Escobar 1999a). Discourses can be both enabling and constraining depending on how the individual develops their perception within the context of a particular set of practices. This notion is similar to Giddens' (1979) structures. For Giddens, structures are not constraining but rather platforms for the exercise of agency (see above). Likewise, discourses provide legitimacy to activities within social contexts, rendering them as normal, approved and even natural, or as unusual, marginal and unnatural (Escobar 1996). In the context of Icelandic fisheries, for example, while discourses related to modern development have privileged capitalist nature regimes and the scientific expertise associated with them, they have also marginalised labour, crews and local knowledge (Pálsson 2006). In this way, discourses inform perception in ways that can influence the affordances sought by the individual and,

therefore, dictate what is and what is not considered a resource in relation to a given setting.

In the context of coastal communities and livelihood activities, modernist and biodiversity conservation discourses are testimonies of recent encounters between coastal communities and capitalist nature regimes (Escobar 1998). These encounters give account of the ways by which individuals know and are capable of acting within their landscapes (Escobar 1998, Johnson 2006, Wongbusarakum 2009). The modernist development discourse enacts strategies aimed at achieving modernity modelled after a collection of attributes considered proper for industrialised countries (e.g., high consumption, good health and leisure; Johnson 2001). This form of discourse brings along with it knowledge and practices that impose a particular array of attitudes, dispositions and needs that inform the way in which individuals generate their local landscape.

In the case of Gujarat fisheries development, a mix of market incentives and state intervention has prompted modernisation since 1950s (Johnson 2001). Modern development discourses have brought forth dependence on external technologies and markets, alienation from the natural resource base, social fragmentation and ecological destruction (Johnson 2001). Modernisation has increased the mechanisation of fishing, changing the means by which individual fishers move in their landscapes and generated new types of environmental relations. Harvested resources shift from being locally consumed and distributed to being commodities of monetary value for sale in the international markets. In order to achieve mechanisation, which is assumed to increase efficiency, harvesters must rely on industrially and externally produced inputs (e.g., gasoline, twine and fibreglass) (Johnson 2001).

Similar effects of modernisation and associated ideas of linear social progress have been reported in coastal communities across the world (Pilgrim et al. 2008, Wongbusarakum 2009). New economic engagements in commercial activities, such as commercial agriculture, fisheries and tourism (e.g., Urak Lawoi, former semi-nomads of the Adaman Sea, SE Thailand; Wongbusarakum 2009), bring alongside them new sets of relations that change the way local people relate with their landscapes. For example,

commercial fisheries often involve middlemen who generate dependence on new technologies and control access to the available markets. In the case of new technologies, for example, middlemen subsidise or own the equipment (e.g., motor boats and fishing gear) that enables access to the harvesting grounds (Begossi 1996, Wongbusarakum 2009, Crona et al. 2010).

In SE Coastal Brazil, for example, fish buyers are recognised as powerful agents, who influence how fishers interact with the local environment, other society members, and external markets (Begossi 1996). In the case of Buzios Island (São Paulo State), for example, fish buyers are often related to fishers through kinship, and these ties enable the unfolding of complex relations between fishers and buyers in relation to fish harvest and commercialisation (Begossi 1996). Since fish buyers own boats and motorised canoes, and fishers only own the fishing gear, fishers are forced to trade their catches with particular fish buyers, who in turn control price and weigh (Begossi 1996). These social relations generate inequality, favouring whoever is closer to the market. This situation is similar in other tropical coastal communities across the world (see, Venezuelan Coastal fishers, Breton 1977; Urak Lowoi in SE Thailand, Wongbusarakum 2009). In spite of the fact that commercial fishing activities facilitate contact between people and the sea, in this case, these interactions are determined by market demand (Wongbusarakum 2009). This in turn influences resource harvesters' perception of the resources they collect and use.

The case of Gujarat also shows how modernist discourses alienate the individual from the local landscape and the natural resources it provides (Johnson 2001). As people become a labour force for trawling vessels, fishers receive a wage in exchange for their labour instead of receiving a share of the catch (Johnson 2001). The lengthened supply chain typical of foodstuffs on the international market reduces the profit-share of workers along the chain, including the fishers who used to capture the majority of the profit from their catches. Modern development also leads to ecological destruction because of the temporary wealth that can be generated even as resources become depleted (Johnson 2001). Once the carrying capacity of an ecosystem is surpassed, efforts to maintain yields, and therefore income, lead to increased pressure on that ecosystem (Johnson 2001). This

phenomenon is progressive. As resources are depleted, the gear and fishing strategies are adjusted to enable fishing down the marine food webs. This means more destructive practices in order to maintain catch volumes (Pauly et al. 1998).

The biodiversity conservation discourse has also appeared alongside the patterns of ecological destruction brought forth by modernist development discourse. Although biodiversity exists in a concrete and physical world, the concern about its loss "*anchors a discourse that articulates a new relation between nature and society in global contexts of science, cultures, and economies*" (Escobar 1998: 55). Escobar (1998) approaches the biodiversity discourse from four perspectives: resource management from a globalocentric perspective; sovereignty of the global south; biodemocracy implemented by southern NGOs; and, cultural autonomy and social movements. Although these perspectives are complementary and overlapping, resource management and cultural autonomy are the most relevant to the discussion of the linkage between discourse and intergenerational continuity of ways of knowing within a given landscape. While globalocentric resource management deals with nature as an external entity that has to be isolated in order to be conserved, cultural autonomy gives account of how relations with the local ecosystem can be seen as a source of agency in the context of wellbeing, territory and identity.

Resource management from a "*globalocentric perspective*" refers to how biodiversity is understood by dominant institutions in the global North, including certain academic disciplines (e.g., preservationist conservation biology), the World Bank and "*northern environmental NGOs*" (e.g., World Wildlife Fund and World Conservation Union; Escobar 1998). These institutions centre their efforts to slow, or potentially halt, biodiversity loss on addressing threats to biodiversity (e.g., habitat destruction and species extinction). This focus on localised threats often ignores underlying causes and assumes that "*the North*" has the answer to this crisis. These are words from John Terborgh (1999:12), a renowned conservationist, in relation to the role of Northern institutions in managing biodiversity in the tropics:

> The well-organized societies of the industrialized world are the ones most concerned about biological diversity and most capable of providing the stable, long-

> term institutional support needed to preserve it. But much of the earth's biological wealth is confined to the Tropics, especially tropical forests, nearly all of which are located in developing countries where appreciation of wild nature is minimal and public institutions are notoriously frail. For many residents of the Tropics, nature has only utilitarian value, as an immediate source of wealth or a livelihood. The thought that there might be more exalted reasons for nature to exist has not entered the consciousness of many people who live in and around tropical forests.

This position illustrates how the preservationist discourse of biodiversity conservation from the global North renders local peoples in the tropics incapable of managing their local environments. This dominant narrative is promoted through research, policies and management strategies for territorial planning that tend to alienate local people from the natural environment. Protected areas, some of which are designed to restrict the use of the resources they enclose, are one of the most important implications of the operationalisation of conservation biology discourse for local peoples (e.g., Chapin 2004, Dowie 2006).

The biodiversity conservation discourse has been implemented widely in the territorial ordering of Coastal Brazil. The concern for the loss of the Atlantic Forest, a biodiversity hotspot, has led to the development of policies aiming at establishing protected areas with restrictive use as a strategy for managing biodiversity (Metzger 2009). From the perspective of coastal communities, the existence of protected areas translates to a loss of access to their harvesting territories, as well as to the practices associated with them (Begossi 1998, Adams 2003, Diegues and Nogara 2005). As a result of biodiversity conservation, shifting agriculture and hunting and artisanal fishing, have been rendered marginal and in some case even illegal for Brazilian coastal communities (Hanazaki et al. 2007).

After exploring the processes that mediate how landscapes are perceived according to the complementary perspectives provided by adaptive learning and political ecology perspectives, the next step of this literature review is to provide a strategy to assess how landscapes are constructed as an outcome of individual needs and aspirations. Considering that the landscape is generated through practice, livelihood frameworks provide tools to ground the theoretical elements provided by phenomenology and political ecology in the context of how natural resource-based practice is related to

everyday life, how these practices change over time, and what enables and hinders access to a given activity and the resources associated with it.

2.3. Wellbeing and Livelihoods

Wellbeing and livelihoods are mutually supporting frameworks generated within international development studies. Their objective is to understand how people in rural areas from low-income countries construct a way of life (e.g., Scoones 1998, Rakodi 2002). These frameworks are rooted in alternative approaches to development that depart from a narrow focus on economic matters to conceiving development as a process centred on an individual's needs and aspirations (Gough et al. 2007). As wellbeing and livelihoods address the importance of practice in everyday life, these frameworks are helpful in building an understanding of the processes that intertwine the environment with culture and socio-political processes that generate landscapes in which people live.

2.3.1. Social Wellbeing

Although there is no consensus about its meaning, wellbeing is closely related to having and pursuing a good life (Gough et al. 2007). The Wellbeing in Developing Countries Research Group at the University of Bath has conceptualised wellbeing as: "*a state of being with others, which arises where human needs are met, where one can act meaningfully to pursue one's goals, and where one can enjoy a satisfactory quality of life*" (McGregor 2009:3). This definition is developed into a tri-dimensional theoretical framework, with material, subjective and relational components, that enables the examination of the experience and construction of wellbeing. The material dimension considers the objective circumstances of the individual, while the subjective dimension considers how the individual perceives these circumstances. Finally, the relational dimension considers how the individual establishes relations with their environment (Gough and McGregor 2007). Within this framework, the objective circumstances of individuals and communities, as well as perceptions of them, are situated within a societal context and, therefore, contained within contingently generated frameworks of meaning (Gough and McGregor 2007). Being constituted through social, political, economic and cultural processes, wellbeing entails both the outcomes of livelihoods strategies and the processes that underlie their construction (Gough et al. 2007).

The idea of wellbeing has been applied to examine human-environment relations. The Millennium Ecosystem Assessment (MEA), for example, explores human-environment relations by studying the linkages between ecosystem services and wellbeing (MEA 2003). MEA (2003: 29) defines human wellbeing as having "*multiple constituents, including the basic material for a good life, freedom of choice and action, health, good social relations, and security*." In this context, the ecosystem is understood to provide a set of provisioning, regulatory, cultural and supportive services, which contribute to the construction of human wellbeing. Likewise, wellbeing is understood as an outcome of access to ecosystems through the services they provide. Provisioning services are the products and materials obtained from the ecosystems (e.g., food, fibre, fuel and fresh water); regulating services are the benefits people obtain from processes of ecosystem regulation (e.g., water and air purification, erosion control); cultural services are the nonmaterial benefits that people obtain from the ecosystem (e.g., spiritual enrichment, recreation); and, supporting services are those related to the production of other ecosystem services (e.g., production of oxygen and formation of soil) (MEA 2003).

By treating the resources that ecosystems provide to humans as services, MEA takes for granted the processes that construct such resources and assumes them to exist independent of individual resource user. Although the MEA framework ignores how the constitution of resources is mediated by cultural, social and political structures, it makes reference to the importance that access to natural resources has for the constitution and deployment of individual agency in the form of freedom of action. According to the MEA (2003), certain ecosystem services are strongly linked to specific constituents of wellbeing. For example, access to basic assets for a good life has important connections with provisioning and regulating services. Likewise, social relations depend on cultural services, which inform how human interaction takes place. All in all, freedom of choice and action, or "*the opportunity to be able to achieve what an individual values doing and being*" (MEA 2003: 28), depends on access to the array of ecosystem services.

The connections between ecosystem services and human wellbeing highlight the importance that access to the natural resources has in contexts of diversified livelihood strategies (MEA 2003). In settings where natural resource-based practice takes place, the

social wellbeing framework provides analytical tools to understand the processes by which individuals craft their landscapes in their everyday lives. Through analysing livelihood frameworks, I will expand on the notions of capitals/resources, agency and wellbeing already discussed above, as these concepts highlight the importance of the linkages among ways of knowing, political ecology and coastal livelihoods.

2.3.2. Livelihood Frameworks

Livelihood frameworks focus on analysing how individuals make use of the range of assets available to them and the strategies, such as livelihood diversification or specialisation, they employ to construct wellbeing in everyday life (Rakodi 2002). Although designed as an approach for policy development (Allison and Horemans 2006), livelihood frameworks also provide tools to understand how natural resource-based practice is situated within the context of diversified livelihoods (Ellis and Allison 2004, Rapley 2007). Livelihood frameworks "*recognise that household livelihoods are often diverse, combining various activities of various members, with multiple priorities, strategies, influences and therefore outcomes*" (White and Ellison 2007: 159). Coastal communities in Brazil, where natural based-resource strategies tend to persist alongside rapid environmental change triggered by incoming development and biodiversity conservation policies (e.g., Hanazaki et al. 2007, Hanazaki et al. 2013), exemplify such diversified and diversifying livelihoods strategies.

Different livelihood analysis frameworks have emerged over time with variations in their focus and understandings of how individuals generate linkages with their surroundings (Allison and Horemans 2006). The emergence of livelihood frameworks is also tied to the way poverty has been understood and dealt with within development studies and more generally:

> [F]rom a focus on low income and consumption, first to encompass a lack of basic needs (access to food, shelter, health and sanitation), then to include a lack of basic human rights, and finally to reflect more qualitative understandings that capture peoples' own experiences and definitions, including psychological aspects such as feelings of powerlessness, humiliation and insecurity (Allison and Horemans 2006: 757).

This evolutionary path moves from understanding poverty as an economic measure based on low income and limited access to basic needs to seeing livelihoods as complex resource management strategies that people use not only to survive but also to have good quality of life (see Gough et al. 2007). The later understandings of poverty represent a critical attempt to engage in a more holistic analysis that takes into account how society and culture influence the ways individuals live their lives.

This diversity of ways to understand and deal with poverty and marginalised societies has generated different livelihoods frameworks. Bebbington and colleagues (2007) classify these livelihoods frameworks into two main strands, "*having and controlling*" and "*thinking and doing*". Even though both approaches explore agency and coping strategies, they deal with the ways individuals use and appropriate resources to construct livelihoods and wellbeing differently. These different ways for dealing with the appropriation of the environment, therefore, lead to distinctive understandings of individual and household contexts. I will now explain these approaches, addressing their critiques and their connections to the EofP framework.

2.3.2.1. Having and Controlling

"*Having and controlling*" refers to those livelihood frameworks that use a capital and assets-based approach (Bebbington et al. 2007). An example of this kind of livelihood framework is the Sustainable Livelihoods Approach (SLA) developed by the UK Department for International Development (DfID) and researchers at the Institute of Development Studies in Sussex (Scoones 1998). Having and controlling livelihood frameworks focus on the factors that influence survival strategies, including assets available to individuals, the activities they engage in to accomplish goals and the factors that either hinder or enable their access to these assets and activities (Allison and Ellis 2001).

Having and controlling livelihood frameworks understand assets to include natural capital, physical capital, human capital, financial capital and social capital. The collection of these capitals is known as a livelihood platform (or pentagon) within the context of rural livelihoods (Ellis 2000) and when applied to small-scale fisheries management (Allison and Ellis 2001). Natural capital refers to the natural resource base from which

livelihoods are derived. They include land, water, fish stocks, and other common pool resources. Physical capital (also known as produced or economic capital) refers to the infrastructure, equipment and means available to pursue a livelihood. Human capital refers to the labour resources available, which are manifested as work force, education and health. Financial capital refers to the financial resources available to the individual or household, including savings, credits, wages, remittances, etc. Finally, social capital refers to the social resources, such as kinship networks and associations, facilitating the pursuance of a given livelihood (Scoones 1998, Rakodi 2002).

From the perspective of having and controlling livelihood frameworks, access to both assets and practice is mediated by social relations, institutions and organisations, as well as by a vulnerability context that includes seasonality (e.g., annual cycles), trends (e.g., fluctuation in catch rates and market prices) and shocks (e.g., natural disasters and currency devaluation) which are outside of the control of the individual (Allison and Horemans 2006). According to how assets are accessed, individuals (or households) construct livelihood strategies, which constitute a combination of activities required to create a secure living (Allison and Ellis 2001). According to their relation to natural resources, livelihood strategies can either be composed mainly of natural resource-based or non-natural resource based activities. While the former includes fishing, gathering, cultivation, livestock and others, the latter includes rural trade, services, manufactures, remittances and others (Allison and Ellis 2001, Allison and Horemans 2006). The outcomes of these livelihood strategies, if they are sustainable (according to Allison and Horemans 2006), are related to increased wellbeing, reduced vulnerability to external trends and shocks and a sustained natural capital base.

Having and controlling livelihood frameworks have been useful in understanding the livelihood strategies of marginal sectors of the population and helping to prioritise policy interventions that foster local capabilities and potentialities. As Allison and Horemans (2006: 764) explain in the case of fisheries development:

> [T]he SLA [Sustainable Livelihoods Approach] has emphasised the cross-sectorial diversity of household livelihood strategies among fisherfolk, the pervasive influence of formal and informal institutions on livelihoods and resource management, the social and economic heterogeneity of households engaged in

fishing and the multi-dimensional nature of poverty and the importance of process considerations in attempts to address them.

In spite of these advantages, having and controlling livelihood frameworks have received some criticism related to their instrumental nature, which does not account for analysing or addressing the role of power and culture, and their overemphasis on the use of capitals, even reifying them into fixed categories (Allison and Horemans 2006, Gough et al. 2007, White and Ellison 2007). Capitals exist independently of the individual and are conceptualized as being "*out there*" to be accumulated, stored and used in order to achieve a particular end (e.g., Rakodi 2002). To assume the independence of capitals reflects the assumption that culture plays a marginal role (i.e., external to the basket of livelihood capitals or assumed to be merely an element of social capital, see Gough et al. 2007), rather than a lens through which other assets are constituted. By not fully acknowledging the role of culture, having and controlling livelihood frameworks develop a materialist approach to the ways people live their lives (White and Ellison 2007).

2.3.2.2. Thinking and Doing

"*Thinking and doing*" livelihood frameworks deal with capitals and assets from a sociological and anthropological perspective that recognises how resources are relational and socially constructed (White and Ellison 2007). Developed by the Resources Profiles Framework at University of Bath (Gough et al. 2007), this livelihood framework provides a different understanding of what and how individuals consider resources in relation to need, use and purpose. Rather than being fixed in certain asset categories, resources are socially and culturally constructed. Their appropriation, and therefore constitution, depends on what purposes they are used for.

Goods, services and activities become resources when they are perceived as a means toward a particular end (White and Ellison 2007). Understanding resources in this way draws a direct connection to the theory of affordances (Gibson 1979). As explained above (Section 2.1.2.2), an affordance is a physical feature that is perceived and given meaning according the unique perspective of the culturally-situated perceiver. Cultural contexts provide meaning to a particular good or relation. As they acquire meaning and access to them becomes a necessity, goods and relations turn into resources, which in

turn become part of the landscapes in which people live. Being "*on the land*", either hunting or hiking, is only perceived as a necessity in a context in which the practice related to it has cultural meaning, such as spiritual healing or physical health and nutrition (Parlee et al. 2005).

Understanding resource use strategies, therefore, requires recognising the relative dimensionality of resources, rather limiting them to specific categories (White and Ellison 2007). By dealing with the many dimensions of resources, categories such as natural and cultural capital cease to exist. Rather, resources acquire specific dimensions (i.e., human, social and/or material), which are relative to what they are used for. Culture, instead of being residual or exterior, becomes a lens through which social life is constituted and confers relevance for undertaking certain practices, such as eating certain foods or wearing particular clothes. Goods exist on their own as material entities. However, culture mediates the process by which these goods acquire meaning and come to exist in relation to the individual. White and Ellison (2007) suggest that culture, therefore, has a dual character. It provides meaning to resources as well as the necessity to access them. In a similar fashion, other resources (i.e., material, social and symbolic), *"represent at once specific forms of resource and the means through which resources are constituted"* (White and Ellison 2007: 167).

This cultural meaning is bounded to the needs and aspirations of the individual and their immediate relations with other society members. At the same time, relations with other society members are influenced—being either hindered or enabled—by current social, economic and political circumstances and discourses. In the case of coastal communities in SE Brazil, small-scale fishing as well as other natural resource-based activities (such as shifting agriculture) have been marginalised by the social and political circumstances related to modernist development and conservation (Hanazaki et al. 2007). The fact that these natural resource-based activities are considered culturally meaningful can help explain why individuals and communities continue to make space for them within their current livelihood strategies. White and Ellison (2007:173) provide a rounded connection between resources, identity and power relations:

> Pursuing our concerns with social process and the social and cultural construction of resources is to see, through a practical encounter, how resources are critically associated with social identities and power relations, both within and beyond the household.

2.3.3. Livelihood Diversification and Individual Adaptation

Livelihood framework analyses have been useful in understanding the processes by which small-scale rural societies adapt to environmental change. Much of this work has highlighted the prevalence and importance of livelihood diversification processes. As such, livelihood diversification has been a subject of study in rural development, including in the context of small-scale fishing communities (Ellis 1998, 2000, Béné et al. 2003, Coulthard 2008), and has been adopted as a paradigm for policy intervention (Ellis and Allison 2004). Ellis (2000: 15) defines livelihood diversification "*as the process by which rural households construct an increasingly diverse portfolio of activities and assets in order to survive and to improve their standard of living.*" There is general agreement that diversification is of benefit to people living in poverty by reducing the vulnerability that comes with dependence on a single set of resources or a single economic sector (Ellis and Allison 2004, Marschke and Berkes 2006, Béné 2011).

Livelihood diversification processes have been classified according to two main outcomes (Béné et al. 2003): diversification for survival and diversification for accumulation. While 'diversification for survival' is a reactive strategy followed by economically disadvantaged households as a response to shocks and stresses, 'diversification for accumulation' is a proactive strategy pursued by better-off households in anticipation of both crises and new opportunities. However, the relationships between them are not always clear. Livelihood diversification processes are complex and not uniform; they are facilitated and/or hindered by local circumstances, social status, acceptance of new opportunities, and access to available resources, among other factors (Coulthard 2008). Livelihood diversification is important for understanding the processes of change and adaptation taking place within small-scale societies and their shifting relations with their natural resource base.

2.4. The Ethnoecology of Practice Framework

As introduced in Chapter 1, the EofP framework draws on Davidson- Hunt's (2003, 2006) adaptive learning and links it with elements from Ingold's (2000) dwelling perspective, Bourdieu's (1990) practice theory and perspectives from political ecology (Escobar 1999, 2005) and social wellbeing (White and Allison 2007). The articulation of these theoretical approaches aims at providing a better understanding of the intergenerational continuity and change of local ways of knowing from the perspective the adaptation of coastal communities in the context of environmental change.

The EofP is composed of structures and practice domains, which operate within a landscape of practice and are connected by the directing forces of habitus and agency. Structures generate habitus, which acts as the embodied dispositions that underlie the perceptual engagement with the world. As habitus informs practice undertaken within a given landscape of practice, the individual agent acquires different kinds of capital (i.e. embodied cultural, social and symbolic) and gains access to natural resources. The interaction of these forms of capital direct the individual agent towards the reproduction of structures. Rather than being a constraint, structures are platforms upon which people exercise their agency. In this way, practice, which draws upon structures, produces landscapes and new structures that incorporate the outcomes of such interaction, and conveys the purpose that agency gives to such practice.

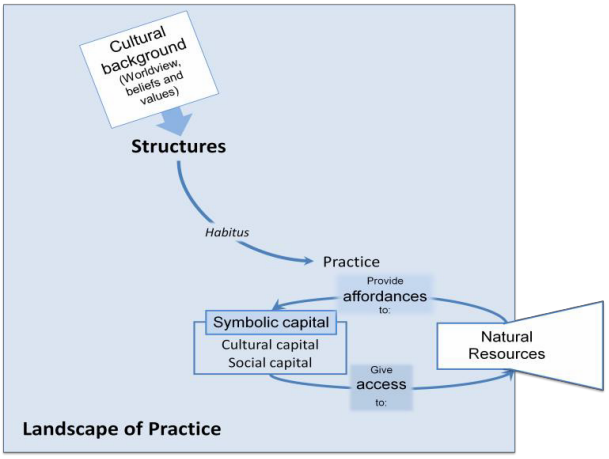
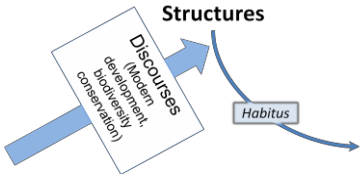
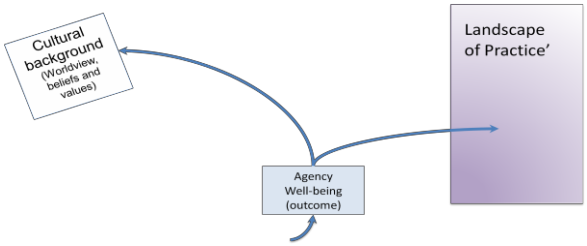
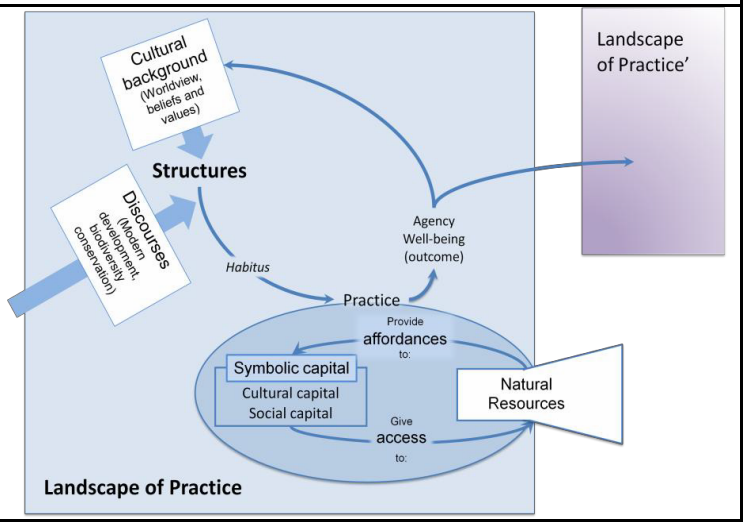
Natural resource harvesting practice entails the continuity of local ways of knowing that emerge through the relations among the individual, society and the natural environment. This practical engagement transforms the individual into a member of society with the potential to use available structures as platforms to create and recreate relations, as well as acquire different kinds of capital to situate their identity and sense of place in relation to changing environments. Structuration and practice theories provide analytical tools for understanding the dynamics that underlie knowledge production within cultural contexts (Giddens 1979, Bourdieu 1990). Their inclusion within TEK research allows natural resource harvesting practice to be visualised as an important part of the process that underlie the dynamics of knowledge and culture (Ellen 2004, Nazarea 2006).

From the perspective of adaptive learning, the environment is in on-going construction, constantly being reproduced and transformed by the action of its individual agents. Local ways of knowing, therefore, are an evolving product of individual practice, which is structured by on-going social relations and shaped by contingent historical processes (Section 2.1.2.3). The concept of capitals allows for an examination of the meshworks that natural resource harvesting creates. Likewise, the concept of habitus serves a dual purpose in the EofP framework. On one hand, habitus conveys the underlying principles that generate and coordinate individual practice within a given cultural context or social group. On the other hand, habitus is also the means by which dominant discourses become part of an individual's attitudes and dispositions. This is particularly relevant in instances in which environmental regulations become embodied as well as when standards of living and dietary preferences change to emulate those of urban contexts. Linked to the habitus concept, political ecology (Escobar 1999a) adds a perspective to the EofP that visualises the linkages that natural resources harvesting practice has, not only with the local environment, but also with supra-local drivers that inform practice and perception (Section 2.2.). Finally, social wellbeing allows the outcomes of natural resources harvesting practice and the relational meaning of these outcomes in a social context to be assessed and for the contributions of individual agency to crafting the future in which Indigenous and rural peoples want to live to be addressed (Section 2.3, White and Ellison 2007). Table 1 shows how each one of these areas of literature contributes to the EofP framework.

2.4.1. Structures and *Habitus*

Drawing upon Davidson-Hunt's (2003) adaptive learning model, the EofP approaches local ways of knowing as dynamic and relational processes that adapt according to history and context. Learning happens by means of structuring situations where people come to know the world in which they live. Structures are patternings of social relationships with human and non-human entities that expose the individual to different forms of practice in everyday life, creating the circumstances in which learning can occur. In this case, structures situate the individual within the associations that enable the processes that bring about an individual's education of attention (Ingold 2000).

Table 1. Literature areas and relation with the Ethnoecology of Practice framework

Literature Areas	Domain(s) in the Ethnoecology of Practice
TEK Research +Adaptive learning	
Political Ecology	
Social Wellbeing	
Ethnoecology of Practice Framework	

As Davidson-Hunt (2003:31) explains: *"The wisdom of elders is not transmitted as representations, but rather, through the structuring situations in which the novice can build his own powers of perception of the environment"*. While structures are enabled by

learning institutions, learning institutions are put in place through the workings of habitus, which conveys the principles that generate and coordinate individual practice within a given cultural context or social group (White and Ellison 2007). Habitus is a key concept for understanding how structures are internalised in everyday practice.

Habitus refers to "*systems of durable, transposable dispositions, structured structures predisposed to function as structuring structures*" (Bourdieu 1990:53). In other words, habitus is the force that situates an individual agent within a given practice, enabling them to construct their landscape of practice. Habitus has four distinctive features: it carries an embodied sense of the world; it is internalised in individuals through interaction with their environmental context; it is durable but not immutable; and, it is transposable – the individual carries pre-existing dispositions when entering into new settings or landscapes of practice (Bourdieu 1990). Similar to learning institutions (Davidson-Hunt 2003), habitus conveys the underlying principles that generate and coordinate individual practice within a given cultural context or social group. Although individual in nature, this practice can be collectively orchestrated without being the product of the organising action of a 'conductor' (Bourdieu 1990). Drawing upon habitus, practice takes place by inducing the active presence of past experiences and existing relations that operate on each individual as schemes of perception, thought and action (Bourdieu 1990).

Habitus does not entail the learning processes as such, but subsists along side them. It confers social status and approval (or the lack thereof) on the individual and the practice they undertake (Ingold 2000). It is through the workings of habitus that the perception of a caribou, for example, and the activities that enable the establishment of relations with it are different for a western teenager than they are for an Inuit one. While for a Western-cultured person hunting caribou would normally take place in a context of leisure and outdoor enjoyment (to use a stereotype), for the Inuit teenager, who is living the Inuit way of life, caribou hunting entails one step in the process of becoming an Inuit cultural adult (i.e., a competent member of the society; Stairs and Wenzel 1992). Although the caribou could have been hunted using similar equipment and even in a

similar habitat, the different motivations underlying the hunt for the caribou in each context reflect the habitus underpinning this practice.

In this way, habitus becomes an important force in the learning process. With the influx of exotic values and ways of life in Indigenous and rural communities, the habitus underlying natural resource harvesting practice may change. The effect on the transformation of habitus is reflected in the reconfiguration of the social status of both a given practice and the practitioner(s) of it. Changes in livelihoods associated with environmental change, such as integration into the tourism economy, bring with them new sets of relations, needs and aspirations, which in turn constitute new habitus and new parameters for social wellbeing. In this emergent context, it is more important for an individual to acquire skills that enable competency in environments in which natural resources harvesting is one component of their livelihood portfolio and not a central part of it. In this context, learning new languages and skills that facilitate participation in new economic opportunities often co-exist with more traditional natural resource harvesting practice.

In the EofP framework, the work of habitus and its relation to structures is twofold. On one hand, structures are constituted under the influence of cultural backgrounds, such as beliefs, worldview and notions of territory and identity, and, on the other, by the discourses that link the local context with mainstream society. Being arbitrary, the separation between cultural backgrounds and discourses allows me to distinguish between processes happening either at the local or the supra-local level. However, these processes become intertwined in the individual's habitus while engaging in practice. In the case of Ponta Negra, discourses such as modernist development and biodiversity conservation reflect how the dominant society informs practice through policy, territorial ordering, tourism development and interactions in the context of the market economy.

2.4.1.1. Cultural Backgrounds

Cultural backgrounds structure how practice is undertaken as well as the resources and social relations it is associated with. Worldview (sensu Berkes 2012) and kosmo (sensu Toledo 1992) are examples of structural elements tied to cultural background that underlie and guide everyday practice. These cultural backgrounds instil human-

environment relations with beliefs, rituals and ethics that are intertwined with natural resources harvesting practice (Descola 1996).

Examples showing how the perception of the environment is situated within these unfolding relations can be found among harvesting societies across the world. For the Inuit in the Canadian Arctic, hunting skills do not only imply technical expertise involved in locating and harvesting resources. They also entail a proper attitude for approaching and treating the harvested resource (Wenzel 1999). According to the Inuit perspective, animals are not hunted. Instead, hunter and animal engage in a negotiation that requires a proper attitude on the part of the hunter towards the animal in order for the animal to present itself to be taken (Stairs and Wenzel 1992). Particular worldviews structure the way interactions take place. While hunting for the Western observer would mean harvesting resources (Hammill et. al. 2007), for the Inuit, it implies maintaining healthy relationships between the human and non-human components of the environment (Tyrrel 2007). Cultural backgrounds provide context to what the individual perceives, experiences and practices.

2.4.1.2. Discourses

Political ecology provides analytical tools to identify and deconstruct the discursive structures that inform the ways by which individuals interact with each other, as well as how the physical environment is perceived and appropriated by means of practice (Escobar 1999). This component of the EofP addresses the influences that elements of environmental management and a changing economy driven by the expansion of tourism have over the perceptual engagement with the world. This evaluation takes into consideration the political context in which harvesting practice is situated and acknowledges the role that government, powerful stakeholders and market demands play in shaping the human-environment relations of coastal communities in SE Coastal Brazil. The analysis of discourses can occur in the context of policies that regulate the use and conservation of natural resources, the relations among resource users and between resource users and government officials, interactions between fish buyers and fishers, portrayals of coastal communities generated by the tourism industry or in any context in which power relations are explicit or implicit.

2.4.2. Practice

Practice is a domain within the EofP associated with the production and reproduction of ways of knowing. Addressing how practice draws upon and recreates structures is essential for understanding the processes associated with local ways of knowing as generative and dynamic processes inherent to cultural adaptation. Practice is brought forth in the context of structure and habitus, and, in this context, constitutes the active process of learning.

Learning is a lifetime process embedded in practice and knowing will continue to take place in the form of accumulated experiences and the constitution of relations with humans and non-humans within a given landscape of practice for as long as the individual continues to engage in everyday life. Bourdieu (1985, 1986) refers to these relations as forms of capital that accumulate synergistically as practice is undertaken. Even though natural resource harvesting has the material appropriation of the physical environment by means of harvested resources as a practical outcome, this material appropriation is not the only kind of capital that becomes part of the individual's landscape of practice. Rather, harvesting entails the (re)creation of relations that connect and reconnect the individual with the physical environment, as well as with other members of their society, during such practice (Hunn 1999). Therefore, from the perspective of the EofP framework, practice represents the embodiment of different kinds of capital: cultural, social and symbolic, as well as access to natural resources.

2.4.2.1. Cultural Capital

Cultural capital is equivalent to expertise in some area of practice valued by a practitioner's society (Bourdieu 1977, 1990). This form of capital can be embodied, as is the case of skills associated with being competent at natural resource harvesting, or it can be represented in institutional forms. These might include formal education or the possession of objectified forms of cultural capital, such as goods of cultural value (Bourdieu 1986). The acquisition of institutional and objectified capitals can shape relations among people and with natural resources, as well as confer social status. Embodied cultural capital, however, is of the most relevance to the EofP because it is associated with the active engagement and competence of the individual agent within a

landscape of practice associated with natural resource harvesting (Bourdieu 1986, Ingold 2000). Embodied cultural capital can be treated as equivalent to skills. In contexts of coastal communities, the acquisition of different kinds of cultural capitals has the potential of providing competence relative to the local and regional landscapes of practice in the context of diversified livelihoods. Considering that the focus of my research is on natural resources harvesting practice, I will expand on the skills associated with it.

Since embodied cultural capital is equivalent to skills, which are defined by Ingold (2004:301) as, "*developmentally embodied capacities of awareness and response built up through a history of involvement with the land and its inhabitants,"* developing embodied cultural capital, in this context, is tantamount to enskillment, or *"understanding in practice*" (Ingold 2000:349). Enskillment is associated with the development of strategies for interacting with the environment that, at the same time, frame understandings of it. Taxonomy, navigation, safety, location and distribution of coastal resources, as well as expertise in shifting agricultural, gathering forest products and processing foods are examples of skills required for natural resource harvesting practices in the context of coastal communities in SE Brazil (Hanazaki et al. 2007).

Skills have been a central focus in the analyses of cultural and knowledge dynamics within cultural transmission theory (Section 2.1.2.1, Cavalli-Sforza et al. 1982). Change in skills held within societies increasingly engaged in wage economies has been interpreted as the erosion of knowledge systems and cultural forms (Hewlett and Cavalli-Sforza 1986, Maass 2005, Zent 2009a). However, this interpretation is essentialist in the sense that it assumes skills to be static cultural items. Learning through practice assumes skills to be a manifestation of culture, generated through active involvement in the world (Ingold 2000). Therefore, skills *are* emergent. They are also relative to the particular engagement of the individual within the environment, in relation to precise structures and habitus, and the practice they underlie. In order to understand learning it is necessary to take a holistic view of the system of relations in which the everyday life exists and moves forward.

2.4.2.2. Social Capital

Social capital is the network of relations that configures a society and provides the individual with complementary assets to acquire skills related to embodied cultural capital (Bourdieu 1986)[3]. The acquisition of social capital implies the continuation and renewal of social relations across time and space. Family, friends, neighbours and other types of social association are forms of social capital (Bourdieu 1986). From the perspective of the EofP, each level of social capital facilitates the embodiment of knowledge in different contexts and at different scales. The family plays a key role in the acquisition of skills that turn the individual into a competent member of society. Experienced members of society facilitate spaces where the individual can learn about the land by imitation and improvisation of practices (Davidson-Hunt and Berkes 2003b, Ingold 2003). As the individual engages in practice within bigger social networks, the interactions that occur enable the emergence of norms and institutions (Ostrom 1990). These institutions situate the practice of the individual within their social context, regulating resource use and interactions with other individuals (Bourdieu 1986). The role of social capital in learning has been recognised in cases of situated learning in which knowledge of the environment is the product of practical enskillment facilitated by a structured array of social relations (Pálsson 2006, Vermonden 2009). From this perspective, knowledge is *"the collective product of a community of practice*" (Pálsson 2006: 80).

2.4.2.3. Symbolic Capital

The interactions between cultural and social capital produces symbolic capital. Symbolic capital is "*nothing other than capital, in whatever form, when perceived by an agent endowed with categories of perception arising from the internalization [embodiment] of the structure of its distribution, i.e. when it is known and recognized as self-evident*" (Bourdieu 1985: 204). In other words, symbolic capital acts as the framework that organises other forms of capital from the perspective of the individual. Symbolic capital

[3] The concept of social capital has its origins in Bourdieu's work, but its use has spread to multiple disciplines and bodies of theory that study natural resources management, such as ecological economics (Constanza 2000) and resilience thinking (Berkes and Folke 1994, Folke et al. 2005).

is related to how individual competence, identity and sense of place are brought forth through the acquisition of cultural and social capital (Heckler 2009). From the perspective of harvesting natural resources, symbolic capital configures the meaning that the socio-ecological environment has by creating the framework in which resources and other kinds of capitals are perceived (Vermonden 2009). Symbolic capital has a close connection with the power that members of society can exercise or be exposed to. This proximity to power makes it possible to explain what kinds of knowledge or interactions are considered legitimate within a social context. Ballet and colleagues' (2007: 362) exploration of symbolic capital makes reference to this situation: "*it [symbolic capital] hence defines what forms and uses of capital are acknowledged as legitimate bases of social positions—that is, the distribution of powers—in a given society, community, or whatever social group*".

2.4.2.4. Natural Resources

According to the EofP framework, natural resources do not exist independent of their users. The perception of natural resources is contingent on how their material availability has been configured by structures as well as the possession of particular cultural and social capitals by the resource users. The individual, through their own experience and practice in the landscape of practice, learns to notice and use the properties that objects in the environment afford. In the case of coastal communities in SE Brazil, a historical review of fish offers perhaps the best example of the relative and contingent nature of natural resources. Fish was a source of protein in the subsistence economy of the inhabitants of small coastal communities in the region at the beginning of the 20th century. The regional boom in the fishing industry turned fish into a sought after commodity from the 1950s to the 1990s. Finally, in the last two decades, fish has become part of the multiple strategies that now bring tourists to the region (Chapter 6, Teixeira 2006). The perception of natural resources is then dependent on how those resources flow in the landscape of practice and how external forces come to shape perception of them.

Paying attention to the context in which natural resources are used and the role natural resources play in the projects people undertake in everyday life is one of the most salient contributions of using phenomenology and practice theory to understanding

Indigenous knowledge in relation to the agents, activities and sites where it persists (Davidson-Hunt and Berkes 2003, 2006, Nazarea 2006, Heckler 2009, Van Oudenhoven and Haider 2012). A practice perspective invites rural and Indigenous knowledge of plant and animal species to be conceived as more than objects with predetermined form and meaning. The concept of affordances argues that the perception of plant and animal species, namely natural resources, is relative to the properties they offer to the people who relate with and depend on them (Ingold 2011). Dealing with natural resources as affordances allows us to conceive of them as fluid materials necessary for our life projects.

Materials and materiality are key concepts necessary to move from dealing with natural resources as static packages and towards embracing their fluidity. Ingold (2012: 439) defines materials as: "*matter considered in respect of its occurrence in processes of flow and transformation*" and materiality as "*the way in which the world is appropriated in humans projects*". These concepts allow understanding of the processes and contexts in which natural resources are socially constructed. Such construction is contingent on the historical interactions the members of a given society have had with particular resources. Using the relational perspective provided by affordances and materiality, new understandings of natural resources or biodiversity emerge. Rather than something 'out there', biodiversity, including the natural resources that comprise it, becomes "*the discursive and material outcome of a socio-material assemblage of people, practices, technologies and other non-humans*" (Lorimer 2006: 540).

The acquisition of the aforementioned forms of capital fosters the configuration of agency. Agency acts as a structuring force that enables the outcomes of practice to become integrated into structures. The importance of agency is related to wellbeing and its potential to reinforce cultural backgrounds, enabling the continuity of relations with the natural environment by means of the harvesting practice linked to it.

2.4.3. Landscape of Practice

As an analytical framework, the EofP provides tools to understand ways of knowing as the relational emergence of practice undertaken within a given field of relations. The

landscape of practice concept is then a bringing together of Bourdieu's concept of field and Ingold's concept of environment. Field is a concept derived from Bourdieu's practice theory. Bourdieu refers to this concept as "*a social arena within which struggle or manoeuvres take place over specific resources or stake and access to them*" (cited in Jenkins 2002: 84). In other words, field constitutes the space of action where the individual agent develops a habitus relative to a set of structures that situates and informs everyday practice, acquiring capitals and resources relative to those structures (Bourdieu 1990). Using the concept of field, however, is problematic because of it is limited to the on-going relations that humans establish with other humans (i.e., social relations; Bourdieu 1990). This position ignores that, in addition to the relations existing among humans, other historically constituted relations, including those with the physical environment and other non-human beings, are involved in the constitution of the individual's context of practice.

In the context of natural resource harvesting practice, the concept of field must be deepened to go beyond a mere social arena limited to interactions among humans. In order to incorporate the complexity of relations surrounding natural resources harvesting practice, field must be seen as a relational setting where the individual develops as an organic, social and cultural entity. In this sense, Ingold's (2000) understanding of environment as the set of relations that an individual builds through time with other humans and non-humans by means of practice offers a wider interpretation of field. Thus, by incorporating these insights from Ingold, field becomes an on-going process that both situates the individual and at the same time is produced through individual practice.

By using the term landscape of practice, I convey that local ways of knowing depend not only on social relations with humans, but also on encounters with non-human social domains, such as natural resources, that contingently constitute the context within which the individual dwells, acts and knows. To acknowledge the existence of such an array of associations and how humans and their environment influence and co-produce each other takes the debate surrounding knowledge continuity and adaptation away from a limited focus on cognitive knowledge, or packages of information, passed between generations independent of the context where such transmission happens. The use of the

term landscape of practice implies an acknowledgement of how physical, social, political and other domains are intertwined in the ways in which the individual comes to know their environment (Ingold 2000). Within an ethnoecological perspective, the concept of cultural landscape has been applied in a similar fashion as field (Davidson-Hunt and Berkes 2003a). Conceived as settings where daily life, social events and interaction happen, cultural landscapes convey the physical, social and cultural context within which people, both as individuals and as part of a collective, undertake everyday practice (Davidson-Hunt and Berkes 2003a).

The use of landscape of practice is also intended to help to make visible how power is intertwined in the processes by which individuals learn about the natural resource harvesting practice, acquiring and constructing different kinds of capital and resources, and expressing their agency (Escobar 1999). Talking about landscape of practice allows a more holistic approach for understanding how social, cultural, ecological, economic and political contexts influence individual perception as well as how individuals establish relations with others, come to know their surroundings, and undertake action within a given context and under given circumstances.

2.4.4. Agency and Wellbeing

Agency is what allows individuals to be "*autonomous, purposive and creative actors, capable of a degree of choice*" (Lister 2004:125). Having agency is a key to the ability to adapt to environmental change. As Ingold (2011: 94) explains, "*[t]he skilled practitioner is one who can continually attune his or her movements to perturbations in the perceived environment without ever interrupting the flow of action.*" Although agency plays an important role in crafting peoples' futures within a given cultural context, studies on the intergenerational continuity of local ways of knowing have underestimated its role. Such studies have largely been framed within Cavalier-Sforza's modes of cultural transmission theory (Eyssartier et. al. 2009, Reyes-García et al. 2009, Zent 2009a), which considers innovation to be an outcome of the influence of external agents and not an embodied and inherent capacity for understanding and dealing with the environment (e.g., Eyssartier et. al. 2009). An exception to this emphasis on cultural transmission can be found in Davidson-Hunt's adaptive learning (Davidson-Hunt 2003, Davidson-Hunt and Berkes

2003), which contextualises the role of agency in the processes of learning within the resilience framework.

For Davidson-Hunt (2003), the capacity of knowledge to be innovative is intrinsic to learning. Situated in dynamic environments, the individual constantly builds awareness and memories: "*Novel changes in the environment will create context where elders teach novices how to respond to events that have not been previously experienced*" (Davidson-Hunt 2003: 33). Adaptive learning calls for the acknowledgement of individual agency as an intrinsic component of the continuity of knowledge across generations. Likewise, the EofP broadens this idea to include the connections that agency has with wellbeing in relation to the continuity of natural resources harvesting practice.

Agency refers to individuals' transformative capacity (Giddens 1979). As transformative capacity, agency is therefore related to the power that individuals have to shape their future according to their own priorities and perspectives (Giddens 1979). Wellbeing refers to how the individual meets objective circumstances, perceives such circumstances and establishes relations with their surroundings that provide the conditions for living and pursuing a fulfilling life (Gough and McGregor 2007, White 2009). Objective circumstances, and perceptions of them, are situated within a societal context and, therefore, contained within contingently generated frameworks of meaning (Gough and McGregor 2007). In this way, agency and wellbeing can be analysed as coupled concepts that provide an understanding of the relative and dynamic importance of the outcomes of harvesting practice. Being constituted through the social, political, economic and cultural processes in which practice is situated, agency and wellbeing embrace the outcomes of natural resource harvesting practice and the processes by which these outcomes reinforce cultural backgrounds that enable the continuity of relationships with the local environment (Gough et al. 2007, Coulthard 2012).

From a learning perspective, agency is expressed through an individual's creativity and improvisation. Because of agency, learning is not about acquiring the knowledge to repeat skills that emerged in contexts that are not necessarily viable. Instead, learning is about the generation of strategies that enable the continuity of ways of life, in this case, in close connection with the natural environment (Davidson-Hunt 2003). Therefore, agency,

from a learning point of view, is important because it highlights the role that the ecological knowledge of Indigenous and rural peoples plays in contemporary contexts where communities are exposed to external drivers. By acknowledging that learning contains possibility for creativity situated in space and time, learning and local ways of knowing can be seen as platforms for creating place-based strategies for development that recognise self-determination from the perspective of particular ways of life that adapt to on-going change (Heckler 2009).

Within approaches that understand local ways of knowing as platforms for creating place-based development strategies, relations with the local ecosystem can enable the use of embodied and social capitals in other overlapping arenas. This is the case of Amapá smallholder farmers in the Amazon estuarine flood plains (Sears et al. 2007). Knowledge, skills and social relations, generated within the context of subsistence agriculture and the harvesting of forest products, have been combined with equivalent elements of the forestry industry culture introduced during a forestry boom in the area. This 'hybridisation' has produced a community-based forestry practice that has enabled people to adapt to political and economic structures of power, maintaining control over their territory through practices not necessarily related to subsistence. Even though there is a cultural practice emerging from being on and knowing the land, the presence of other agents mediating such relations triggers adaptive responses in different domains that constitute a complex and multi-layered environment (Sears et al. 2007).

Considering culture as means for empowerment is related to culturally-based strategies that bring forth narratives counteracting modern development and conservation discourses. As explained above (Section 2.2.2), these counter discourses advocate for identity, territorial control (including access to land and natural resources), alternative place-based development and property rights within local communities (Escobar 1998, Blaser 2004, Johnson 2006, Sillitoe 2006). Wellbeing provides a perspective to recognise that individuals, households and communities can construct landscapes of practice according to what they have, need and aspire to, and are not necessarily constrained by social, cultural and power structures that condemn them to marginal life styles.

2.5. Conclusion

The EofP framework is the outcome of a critical examination of scholarship dealing with cultural adaptation and its relation with local ways of knowing. Through the EofP framework, I develop an approach to address the intergenerational continuity of knowledge in the context of rapid environmental change. This framework considers ways of knowing as an emergence of individual engagement with landscapes of practice defined by natural resources harvesting occurring in the context of diversified livelihood strategies. The EofP takes into account the influence of cultural, social and political structures over natural resources harvesting practice, and considers the importance of agency and wellbeing in the production of knowledge related to current interactions between the individual and the social-ecological environment. This framework is intended to provide an anti-essentialist approach that sees in contemporary harvesting practice an example of the continuity of ways of life that situate the individual within evolving social-ecological systems. Through this lens, the identity and sense of place gained by local peoples through harvesting practice has the potential to transform natural resources into quality of life, dignity and the power to achieve a desired future. Approaching TEK in a processual way focuses on how to local ways of knowing can be mobilised to create collective action towards improved natural resource governance. This perspective has the potential to empower Indigenous and rural societies to pursue what they consider important for their ways of life now and in the future.

Chapter 3. Methodology and Methods

3.0. Introduction

This chapter describes the philosophy and operational considerations that guided me while I carried the fieldwork and data analysis phase of this research. It includes the research design, philosophical worldview, strategy of inquiry, research methods and analysis techniques. The purpose of this thesis is to understand the continuity and change of ways of knowing associated with natural resource harvesting in the context of rapid socio-ecological change in coastal communities in SE Brazil. To achieve this purpose, I followed a case study strategy of inquiry, which is framed within a qualitative research design and guided by a phenomenological philosophical worldview (Creswell 2009).

For the purpose of using a standard lexicon, in the remainder of this chapter I refer to the research design, philosophical worldview, and strategy of inquiry and research methods as Creswell (2009) defines these concepts. Research design refers to "*the plan and the procedures for research that span the decision from broad assumptions to detailed methods of data collection and analysis"* (Creswell 2009:3). Philosophical worldview refers to the general orientation that the researcher assumes in order to understand the world, and thereby their research. Strategy of inquiry refers to the specific methodological package that the researcher uses for undertaking research. Finally, research methods are tools for data collection, analysis and interpretation.

3.1. Research Design and Philosophical Worldview

This research is framed within a qualitative research design and is guided by a phenomenology philosophical worldview. A qualitative research design studies social phenomena using an inductive and interpretive approach, exploring the meanings that people construct from their experience of the world. Qualitative research is context-specific, as it is intended to explain a phenomenon occurring within a given setting (Creswell 2009). As a researcher, my role was to act as the primary research instrument, providing interpretation for data collected during my interactions with research participants in the process of generating a critical description of the phenomena under investigation (Creswell 2009, Robson et al. 2009)

As reviewed in Section 2.1.2.2, phenomenology entails the description and analysis of lived experience as a means of understanding of how meaning is constructed as an outcome of embodied perception of interactions between individuals and their environments (Rasmussen 1998, Sokolowski 2000). Phenomenology provided conceptual tools to address the intergenerational continuity of ways of knowing by focusing on the concept of "dwelling" that identifies a relationship among body, mind and place, with the historical contexts as an influence shaping these relationships (Merleau-Ponty 1962, Ingold 2000). These philosophies and theories provided a methodological ground for the Ethnoecology of Practice (EofP) framework, enabling me to dig deeper into local ways of knowing as a dynamic process that exists inseparably from identity, practice and place (Ingold 2000).

3.2. Case Study as a Strategy of Inquiry

Case study research has no clear definition, mainly because it is a used in a wide range of disciplines that employ this strategy of inquiry for their own purposes (e.g., psychology, law, political science and medicine, and recently in sociology and anthropology; Creswell 2007, Gerring 2007). Case study research can be seen as the process of doing a case study, an end product, or even as a unit of analysis (Merriam 2002). It is the adaptive nature of case study research that makes a relevant strategy of inquiry for social sciences as it creates a platform for understanding a specific situation or phenomenon in depth. Stake (2005) defines case study research as a strategy of inquiry that places more emphasis on the object of study than on the methods it may entail: "*case study is not a methodological choice but a choice of what is to be studied*" (Stake 2005: 443). Case study research is delimited, therefore, by the case under inquiry and, if its purpose requires it, the theoretical framework that locates the relevant phenomenon in a broader context (Berg 2005, Stake 2005). Since case studies are framed by the boundaries of an identified and delimited system, the main challenge for conducting a case study is to actually delineate such a case. The case is the opportunity to study a phenomenon. Thus, one of the basic assumptions for case study research is that such a phenomenon should have identifiable boundaries (Stake 2005). Time, space, and/or the components that the case comprises can be use as criteria to define the boundaries of the system under inquiry (Merriam 2002).

In this case, my research was delimited by how the phenomenon under study operated in the area of study, that is how the intergenerational continuity of ways of knowing took place in the coastal community of Ponta Negra. The defining criteria for undertaking my research in this community were the diversity natural resources harvesting activities being practiced, their relevance in the local livelihood portfolios and isolation from urban centres. Once the community was selected, those households whose members were actively engaged in natural resource harvesting activities in marine, coastal and terrestrial ecosystems became the units of study of my research.

Design and purpose narrow the scope of a case study (Berg 2005, Stake 2005). With respect to design, employing the EofP framework as a guiding lens situates my research as a descriptive case study (Stake 2005, Creswell 2009). In terms of purpose, while intrinsic case studies have independent relevance, instrumental cases studies use a specific case as a means to understand a broader phenomenon. Since I used this case to address the continuity of ways of knowing as a theoretical concern, the purpose of my case study was instrumental (Berg 2005, Stake 2005). My research, therefore, can be typified as a descriptive and instrumental case study: descriptive because a theoretical approach guided the framework of the study; and instrumental because the case study was used to generate insights on a theoretical issue.

3.3. The Coastal Community of Ponta Negra

My research focused on the human-environment relationships associated with natural resources harvesting practice. As a strategy to identify a community with natural resource harvesting practice as an important feature of the local livelihood portfolios, I used the presence of active pound net fishery, presence of shifting agriculture plots and isolation from urban centres as defining criteria to delimit and identify my research site. Based on previous reports on the area (Begossi et al., 2009, Seixas et al. 2010), advice from professors on our Brazilian project team, including Dr. Cristiana Seixas and Dr. Alpina Begossi, and a doctoral student, Luciana Araujo, and visits to multiple communities in the municipality of Paraty, I identified Ponta Negra (Figure 2; Chapter 1) as the most suitable place to undertake my research.

Ponta Negra is a coastal community located in one of Brazil's last remaining expanses of Atlantic Forest. The nearest urban centre to Ponta Negra is Paraty, a small tourist city with a resident population of approximately 40,000. The current population of Ponta Negra is 158 (82 males and 76 females) of whom 100 are children (under 18 years old). The main economic sectors in Ponta Negra are fishing, shifting agriculture, forest product collection, tourism and local building construction. Although tourism has grown into an important economic sector over the last twenty years, the pound net fishery remains the largest employer in the community and one of the linchpins of the local economy. Alongside these activities, people in Ponta Negra receive federal government subsidies linked to national policies to reduce illiteracy (i.e., *Bolsa Familia*) as well as retirement pensions from the Ministry of Fisheries. Currently the school children in Ponta Negra only receive education up to the fourth level of elementary school and most of the adults in the community are functionally illiterate. There is no grocery store in Ponta Negra and community members have to buy all of their supplies in Paraty. There are only three restaurants in the community, which are geared towards the tourist market and are economically inaccessible to the local residents. Details of the community's livelihoods are analysed in depth in the chapter dedicated to social wellbeing (Chapter 7).

Ponta Negra is an isolated community located within the Juatinga Ecological Reserve (*Reserva Ecológica da Juatinga* –REJ– in Portuguese). Reserve management authorities have limited natural resource-related activities, such as shifting agriculture and hunting, and infrastructure development, especially if it is related to the tourism sector (Chapter 8). Furthermore, there is currently no electricity and the water system is comprised of a basic network of rubber hoses that take untreated water from the streams that cross the community. The only available fish storage facilities are shacks on the beach where the catches are preserved in Styrofoam coolers using ice sent from Paraty by fish buyers.

There is no direct road access to Ponta Negra. The most convenient way of reaching the community from Paraty requires a one-hour trip by public transit and then crossing a gated community (i.e., *Condominio Laranjeiras*), where a small harbour can be accessed. From Laranjeiras it takes 30 minutes to reach Ponta Negra using fibreglass

skiffs powered with 15 to 25 HP outboard motors. The trip takes from two to five hours in total, depending on the availability of transportation and weather conditions, and costs $7.5 CAD each way for community members.

The strict security regulations in place around Laranjeiras have become a critical factor influencing the infrastructure required by community members to move between Paraty and Ponta Negra. The security procedures can delay transit through the gated community significantly. Community members can avoid the passage through Laranjeiras by using a very rudimentary 8km-long trail through the forest. However, it is impossible to travel this trail transporting goods (e.g., fish for trade) or any substantial amount of basic supplies for household consumption, especially during the rainy season when then trail turns slippery and treacherous.

My understandings of dynamic human-environment relations in this community and their relation with intergenerational continuity of ways of knowing, was also deepened by the insights offered by other research conducted in Ponta Negra in the early 1990s (Kempers 1993, Brito 2003) and recent studies undertaken as I was conducting my own research (Carpenter 2011, Cavechia 2011, Giraldi 2012, Hanazaki et al. 2013).

3.4. The Caiçara and the Atlantic Forest Coast

The term Caiçara refers to the rural people that inhabit the Atlantic Forest along the coast of SE Brazil. The etymology of the term Caiçara is related to the Tupi Guaraní word "*caá-içara*". Originally, Caiçara was used to refer to the poles made out of tree branches employed for enclosing villages or fish traps. Later on, Caiçara come to refer to beach huts covering canoes and fishing equipment. More recently, Caiçara was used to identify people from Cananéia (South of São Paulo state) and then the people from coastal areas of the states of Paraná, São Paulo and Rio de Janeiro (Adams 2000). Chapter 8 provides a critical examination of the use of the term Caiçara. For the reminder of this thesis, until that chapter, I chose to use "coastal people" as a generic term to refer to this group of rural people.

The origin of this coastal people dates back to Brazilian colonisation in the 1500s when Portuguese settlers mixed with the Tupi-Guaraní, an indigenous group from what is

now coastal Brazil. This process of mestisation generated the *mamelucos,* known for adopting a Tupi-Guaraní way of life, which included extensive and detailed knowledge of the local environments (Dean 1996). The occupation of the Atlantic Forest Coast of Brazil and a way of life based on shifting agriculture and subsistence fishing were the features that made coastal peoples a distinctive group among the mamelucos (Adams 2000).

The importance of shifting agriculture and small-scale fishing as livelihood strategies were also consequences of the marginalisation associated with European economic expansion in SE Coastal Brazil (Adams 2002). From the 1500s, coastal peoples occupied a marginal role in the wider economic and political systems evolving in the region. In spite of being free, the coastal peoples were descendants of Indigenous peoples as well as slaves, both groups with peripheral social or political status (Adams 2002). Thus, coastal peoples were subject to the pressures imposed by sugarcane producers (*senhores de ingenio*), industry (*empresários*), the urban middle class and the state (Adams 2003). This pressure worked, on one hand, to channel coastal peoples toward dependence on participation in the regional labour force, and on the other, to displace them onto marginal lands where they did not have legal tenure.

The formation of coastal communities was related to the European occupation of Coastal Brazil and the economic cycles taking place in this area (Dean 1996, Adams 2000). The agricultural development brought about by Portuguese colonisation took place on easily accessible and fertile lands (Adams 2000). This development was accompanied by the formation of large and medium sized population centres, which were surrounded by smaller ones (Adams 2000). The small populations of coastal peoples were located on the slopes of the mountain ranges that run parallel to the coast in the southeast (e.g., Sierra do Mar, Adams 2000). This isolated geographic position contributed to the formation of distinctive social groups with particular uses of natural resources (Adams 2000).

Until the 20th century, the coastal peoples adapted to the economic cycles to which this region was part. Coastal peoples developed flexible livelihood strategies that involved both subsistence and market-oriented activities (Adams 2000). During times of

economic prosperity, when market-oriented alternatives were available, they relied less on subsistence and the natural resource-related practices associated with it. Conversely, in times of economic stagnation they shifted their livelihood strategies towards natural resource-based subsistence (Adams 2002). Being able to move between livelihood strategies has demonstrated the adaptive capacity of coastal peoples over history (Begossi 2006).

In spite of this adaptive capacity, the 20th century brought a series of opportunities and challenges to the inhabitants of SE coastal Brazil and the continuity of their ways of life. Up to this moment, the natural resource-based activities of coastal peoples were limited to shifting agriculture and fishing techniques that mainly drew upon practices from the Tupi-Guaraní or that were slowly introduced by Portuguese settlers over the course of almost 400 years (Dean 1996). In the period from the 1920s to the1960s, however, the introduction of motorised boats as well as Japanese pound nets brought new humans-in-environment relations to the coastal communities in the region (Adams 2002). These new technologies were introduced almost synchronically with the bust of the coffee economic cycle in the early 1900s, which was related to a drop in international prices (Dean 1996). These emergent conditions motivated coastal peoples to focus their livelihoods on the sea, giving less importance to land-based practices, including shifting agriculture (Begossi 1996, Adams 2000). By the 1950s, the coastal people's harvesting activities were reorganised around marine resources:

> "*… the introduction of boats with inboard engines marked the emergence of a fishing ideology in one sector of the population. During these times, there was not a tradition* [around mechanised fishing] *that could be passed on between generations.* [In this way,] *a new perception of the environment was incorporated by those who practiced it: a mentality of motorised artisanal fishing*" (Mourão 1971 in Adams 2000: 158)[4].

In the 1960s, the opening of roads made the southeast coast accessible to São Paulo, Rio de Janeiro and other bigger cities and in turn made the Atlantic Forest Coast visible to

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[4] Original in Portuguese: "*A partir da introdução do motor de centro nas canoas que começa a se caracterizar a emergência de uma ideologia da pesca, em parte da população. A tradição, passada de pai para filho, não existiu nesta época. A nova percepção do meio ambiente incorporou-se, aos poucos, à mentalidade dos Pescadores artesanais motorizados*"

the urban middle class (Dean 1996). As this middle class found a desirable tourism destination in these coastal areas, an aggressive acquisition process of the land inhabited by coastal peoples was unleashed (Adams 2002). Given that coastal peoples did not have legal land ownership, many were expelled from the area (Adams 2002). In the 1980s, in an attempt to protect the last remnants of the Atlantic Forest, the Brazilian government established protected areas with restrictive use (Dean 1996). The implementation of these protected areas brought new struggles for coastal peoples, as natural resource-based subsistence activities were prohibited within their bounds (Adams 2002).

Contemporary coastal peoples engage in a mixed economy composed of natural resource-based livelihood practices and wage labour related to the tourism and industrial fishing sector (Sanches 2001, Hanazaki et al. 2007). In terms of the contribution of natural resources to the coastal livelihoods, fish is known to be both a source of both protein and cash (Begossi 2003). In addition, plants, either gathered or cultivated, contribute to households in terms of foods, medicine and material for construction and handicrafts (Begossi 2003). Shifting agriculture is a remarkable source of carbohydrates in the form of manioc flour, sweet potatoes and yams (Hanazaki and Begossi 2003). Likewise, home gardens contribute to the local diet by providing leaf vegetables and spices (Hanazaki and Begossi 2003). As a result of tourism, handicrafts have become an important source of income in the area (Begossi 1996). In terms of gendered division of labour, men are generally in charge of fishing, shifting agriculture, and handicraft production, while women are in charge of house care and home garden maintenance (Begossi 1996).

Contemporary livelihood portfolios are not homogeneous along the Atlantic Forest Coast of Brazil. Even though service provision related to the tourism industry and commercial fishing co-exist with subsistence fishing, shifting agriculture, house gardens and sporadic hunting and gathering, the relevance of each activity is relative to each community (Begossi 1996, Hanazaki and Begossi 2003, Hanazaki et al. 2007). The persistence of natural resource-based activities within local livelihood portfolios of coastal peoples makes communities in the municipality of Paraty an interesting case to examine human-in-environment relations in a contemporary setting.

3.5. Research Methods

I lived in Ponta Negra from June 2010 to March 2011. During this time I conducted ethnographic research, which involved living in the community and participating in everyday activities associated directly and indirectly with natural resource harvesting. In accordance with case study strategy of inquiry procedures, this research included a range of research methods (Creswell 2009). Table 2 presents a summary of how data was collected in relation to each objective. The use of these methods was adaptive and contingent on the circumstances found in the study site. Multiple data-collection techniques allowed me to triangulate data from complementary perspectives and, thereby, reducing the likelihood of misinterpretation (Stake 2005).

As a starting point I conducted document review of research previously undertaken in the area, development plans for the Paraty region as well as the management plans for the protected areas in the region. I also interviewed community members, the managers of the protected area, tourism operators, fish buyers, NGO members and government officials involved with Ponta Negra. Some interviews with community members included mapping exercises that gave me a spatial idea of where natural resources harvesting activities take place as well as the location of particular resources. Demographic data for the community were produced by a household survey conducted at the beginning of my time in the field and a rapid census at the end. The household survey was part of a diagnosis of the livelihood diversity in selected communities of the Paraty municipality (see Hanazaki et al. 2013) and the rapid census was designed and conducted in association with the personnel of IGARA *Consultoria em Aquicultura e Gestão Ambiental*, the consultant company in charge of gathering the baseline for the on going re-categorisation process of the REJ (see Cortines and Nogara 2011).

Table 2. Summary of data collection techniques per objective

Objective	Data collection technique	Data collected
1. Explore and document the ethnobiology of Ponta Negra in relation to their practices, places and resources.	Participation Semi-structured interviews Mapping exercises	Collected knowledge associated with natural resource harvesting practice, such as navigation, safety, topography, animal and plant taxonomy, resource distribution and seasonality, harvesting and food processing techniques. Collected information about harvesting practices as they relate to harvest site access.
2. Investigate the perceptions Ponta Negra natural resource harvesters on how economic, political and policy change are re-structuring their access to harvest sites and how these changes have affected their livelihood practices.	Document review Semi-structured interviews	Compiled and analysed documents relevant to government policies related to land regulation and community settlement. Gathered narratives that reflect local perceptions about change and continuity of natural resource harvesting practice.
3. Investigate the contexts and processes by which natural resource harvesting knowledge and practice are constructed and acquired between generations.	Participation Semi-structured interviews	Compiled information about how people relate with harvesting practice, including relevant knowledge and skills and the social networks involved, and how they understand the connection between these activities and their present and future wellbeing.
4. Analyse the contribution and role that natural resource-based livelihood practices play in supporting local wellbeing.	Participation Semi-structured interviews Household survey and census	Identified who engages in harvesting practices in terms of age and gender, what the specific activities being undertaken are, and what the motives for individual's engagement or disengagement with these activities are. Household survey and census provided general information about the contribution of natural resource-based activities to the livelihood portfolios.

3.5.1. Entering the Field

I arrived in Brazil on May 5, 2010. My first destination was the city of Campinas, where I spent two weeks studying Portuguese and gathering baseline data at the *Núcleo de Estudos e Pesquisas Ambientais* (NEPAM) and *Centro de Memória Unicamp* (CMU) both in the campus of the Campinas State University (*Universidade Estadual de Campinas* -

UNICAMP). On May 19, I arrived to Paraty, where I stayed for nine days. This time was invaluable as it gave me the opportunity to visit surrounding communities and select my community of study as well as assist other researchers in the field. One of these was Vinicius Nora, a biologist and expert on the regional marine fauna. Although I hold a Bachelor of Science Degree in Biology and have experience with taxonomy of birds and plants, I was to be working with a vast diversity of tropical fish species for the first time. Assisting Vinicius to identify and sample fish gave me very important cues that I used during my own work with the fishers in Ponta Negra.

Once I had identified Ponta Negra as my study community, I met with Adenicio dos Remedios, the president of the community-based organization (i.e., *Associação de Moradores da Ponta Negra*). He had previous knowledge of the IDRC funded project my research is a component of, "Community based resource management and food security in coastal Brazil" (Begossi and Berkes PIs), and had met with Dr. Cristiana Seixas and Dr. Fikret Berkes during previous scoping trips (see Seixas et al. 2010). In this meeting, we discussed the overall purpose and objectives of my study. He believed that my research could have valuable outcomes for Ponta Negra and invited the participation of Ponta Negra community members in this study. I proceeded to rent a small house from a former community member currently living in Paraty and moved there permanently in June 2010 (Figure 3). From then on, I spent as much time as I could in the community, only leaving when I needed groceries and communicate with the outside world. On average, I spent between seven to ten days in Ponta Negra, followed by three to four days in Paraty. The times I spend in Paraty longer than expected were associated to bad weather or illness.

Once I was living in Ponta Negra, I started interacting with people in the community, especially pound net fishers (both owners and crewmembers) on a daily basis. These interactions were framed by fishery related activities, such as visiting the pound nets to gather fish, help landing canoes, storing fish and mending nets when the gear was landed (Figure 4). Starting my research in this way allowed me to become acquainted with the people and the everyday dynamics of the community, as well as normalise my presence there and improve my Portuguese skills so I could communicate more fluently at later stages of my research. From this entry point, I was able to meet harvesters involved in

broader sets of natural resource harvesting activities as well as identify the networks, agents and resources intertwined in the processes by which the people in Ponta Negra live daily and construct the landscapes in which they dwell.



Figure 3. Research headquarters in Ponta Negra



Figure 4. Mending pound nets on the beach of Ponta Negra (Photo K. Turner)

3.5.2. Document Review

With the purpose of better understanding the historical, political, geographical and environmental context in which natural resource harvesting practice takes place in Ponta Negra, I carried out a document review before, during and after fieldwork. During my fieldwork, through conversations with local scholars, protected area managers, public workers and other relevant stakeholders, I identified and collected relevant documents. These included working papers, policy documents, monographs of research conducted in the area, land-use and occupancy studies and maps, as well as technical reports that document the lexicon of local natural resources and the practice associated with them.

At the national level, I reviewed policies and action plans related to small-scale fisheries and marine ecosystems (e.g., CIRM and GI-GERCO 2005, Decree 6.981/2009, Federal Law 11.959/2009, Vasconcellos et al. 2007); environmental regulations, such as the National System of Protected Areas (SNUC 2000) and the Environmental Crime Law (Federal Law 9.605/1998); and, the management plan for the Cairuçú Environmental Protection Area (i.e., *Area de Proteção Ambiental –APA- Cairuçú*; Brasil 2005). This management plan is particularly relevant for the REJ as the APA Cairuçú, a federal protected area that overlaps the REJ, provides the guidelines for the REJ as this reserve does not have a management plan yet. At the state level, I reviewed the decree of declaration of the REJ (Rio de Janeiro 1992) as well as official documents produced by the state environmental authority [i.e., currently INEA – *Instituto Estadual do Ambiente* (State Environmental Institute) - and formerly IEF – Instituto Estadual de Florestas (State Forestry Institute)] associated with the REJ (e.g., Silva and Brandão 2004, INEA 2010). I also reviewed monographs from undergrad and Master's theses on the REJ and its inhabitants in recent years. The topics of these include: small-scale fisheries (e.g., Monge 2008); conflicts between coastal populations and real estate development associated with the growth of the tourism industry in the region (e.g., Tanscheit 2010); and, territorial construction among coastal peoples (De Francesco 2010).

This extensive review built my knowledge base related to previous research undertaken in Ponta Negra and the region, the conflicts between coastal peoples and the protected area authority, and the policy context that regulates the access and practice

surrounding natural resources in SE Coastal Brazil. The information that came from the document review was also useful in complementing and triangulating data gathered using other research methods (Merriam 2002).

3.5.3. Participation

Participation is a method by which the researcher develops rapport with research participants and gains understanding of context of the research (Berg 2005). Participation requires the researcher to get intensively involved with the research participants in their everyday lives. This includes involvement in aspects of daily life that range from natural resources harvesting to wider dimension of their livelihoods and human-environment relations. From a phenomenological perspective, this degree of involvement allows the researcher to gather data related to the meaning that lived experience has for the research collaborators (Moustakas 1994).

I intentionally chose to refer to this method as participation, rather than participant observation, as it is frequently called (e.g., Berg 2005, Creswell 2009). This choice was based on the fact that I actively took part of natural resources harvesting activities as well as the other livelihood activities in which natural resource harvesters and their families were involved. Furthermore, I identified and worked with people actively involved in natural resource harvesting activities, such as fishing and shifting agriculture. Joining experienced harvesters in their natural resource harvesting activities was central to my research. In addition to providing an opportunity to establish a rapport with my research collaborators, sharing these spaces and activities allowed me to become more knowledgeable about the environmental context of my research.

Participation allowed me to identify key informants who became central in the multiple dimensions of my research, learn about the biological and ecological dimensions of natural resource harvesting (Chapters 4 and 5), and understand the complex social and economic networks within which natural resources harvesting activities and their material outcomes are enmeshed (Chapter 6). Through participation I learned about the relationship between social class and natural resources harvesting (Chapter 7) and how interactions with the environmental authority and representatives of

the tourism economy influence the relations between coastal peoples and their local environment (Chapter 8 and 9). The perspectives and knowledge I gained through participation became key for the development of research instruments and the collection data through other data collection techniques.

I kept track of my participation by keeping field notes and by analysing my experiences every night in a field journal. The lack of electricity in Ponta Negra forced me to keep this journal in written form. I digitalized this information during my stays in Paraty, when I had access to electricity. Even though I tried to circumvent the lack of electricity by acquiring a gas-powered electrical generator, the difficulty involved in both buying gasoline in or bringing it to Ponta Negra forced me to limit the usage of the generator to a minimum. One of the first times I was trying to buy gasoline, a community member epitomised how valuable fuel, as well as ice, are in Ponta Negra as basic supplies for the local fishery: "*A gasolinha e o gelo são ouro*" (Gasoline and ice are gold; Fieldwork Journal, November 2010).

3.5.4. Semi-Structured Interviews

Interviews are opportunities for face-to-face interchange between a researcher and research collaborators. They allow collaborators to reflect upon a specific issue or theme, and to provide input on the research process (Hay 2005). From a phenomenological perspective, interviewing is a useful method for eliciting research participants' accounts and stories related to their perception of the phenomenon of interest (Moustakas 1994). Before conducting any interview, I sought to spend as much time as possible with the interviewees to provide context to the conversation. Although I count interviews as individual events, informal follow-up conversations to verify information accompanied each interview.

For this research, I employed semi-structured interviews to cover a diverse array of topics. This interviewing technique enabled me to explore specific themes in an ordered but flexible way (Hay 2005). Through semi-structured interviewing I engaged in conversations with key community members, such as active harvesters, elders and tourism operators, as well as external actors, such as protected area managers and fish

buyers. Key informants from the community were people with renowned knowledge of the local environment who were keen to share their knowledge and spend time with me in their homesteads as well as in harvesting settings. Semi-structured interviews were useful in building a deeper understanding of the themes that emerged from document review and participation. Interviews focused on exploring the importance of harvesting practice from the multiple dimensions that the EofP framework provides. Semi-structured interviews included general aspects of household livelihood portfolios, the recent history of the community from the perspective of its inhabitants, and marine and terrestrial knowledge. They also included particular sets of interviews about learning as well as with pound net owners and relevant stakeholders (Table 3).

Table 3. Types and number of interviews

Type of Interview	Code	Number of Interviews
Livelihoods	Li	14
Life history	LH	9
Learning	Ln	7
Marine knowledge	MK	7
Terrestrial knowledge	TK	6
Pound net owner	PO	5
Other stakeholders	OS	8
Total		56

Table 4 presents a summary of the semi-structured interviews according to their category as listed in Table 3. The name of each research participant was blinded with a numerical code to keep confidentiality while ensuring the participation of each individual in each type of interview remained traceable.

Table 4. Summary of semi-structured interviews

Interview ID	Research Participant Code	Gender	Type of Interview	Date
Li01	001	M	Livelihoods	January 26, 2011
Li02	002	M	Livelihoods	September 23, 2010
Li03	003	F	Livelihoods	February 3, 2011
Li04	004	M	Livelihoods	September 15, 2010
Li05	005J	M	Livelihoods	November 30, 2010
Li06	006 &007	M&F	Livelihoods	January 15, 2011
Li07	008	M	Livelihoods	February 3, 2011
Li08	009	F	Livelihoods	January 14, 2011
Li09	010	M	Livelihoods	February 3, 2011
Li10	011	F	Livelihoods	January 26, 2011
Li11	012	M	Livelihoods	October 24 2010
Li12	013 & 014	M&F	Livelihoods	September 8, 2010
Li13	015	M	Livelihoods	November 1, 2010
Li14	016	M	Livelihoods	October 23, 2010
LH01	017	M	Life History	October 23, 2010
LH02	018	M	Life History	October 25, 2010
LH03	019	F	Life History	October 24, 2010
LH04	020	M	Life History	September 16, 2010
LH05	021 & 022	F&M	Life History	February 3, 2011
LH06	023	F	Life History	October 23, 2010
LH07	024	M	Life History	October 22, 2010
LH08	025	M	Life History	September 20, 2010
LH09	026	M	Life History	January 24, 2011
Ln01	029	M	Learning	February 13, 2011
Ln02	031	F	Learning	February 17, 2011
Ln03	018	M	Learning	February 18, 2011
Ln04	010	M	Learning	February 3, 2011
Ln05	016	M	Learning	February 12, 2011
Ln06	013	M	Learning	February 26, 2011
Ln07	020	M	Learning	February 15, 2011
MK01	027	M	Marine Knowledge	February 1, 2011
MK02	025	M	Marine Knowledge	February 1, 2011
MK03	028	M	Marine Knowledge	January 30, 2011
MK04	029	M	Marine Knowledge	January 26, 2011
MK05	030	M	Marine Knowledge	February 1, 2011
MK06	016	M	Marine Knowledge	February 12, 2011
MK07	013	M	Marine Knowledge	January 16, 2011
TK01	013	M	Terrestrial Knowledge	November 6, 2010
TK02	012	M	Terrestrial Knowledge	January 16, 2010
TK03	025	M	Terrestrial Knowledge	February 2, 2010
TK04	020	M	Terrestrial Knowledge	February 15, 2011
TK05	002	M	Terrestrial Knowledge	January 20, 2011
TK06	031	F	Terrestrial Knowledge	February 17, 2011
PO01	028	M	Pound Net Owner	September 20, 2010

Interview ID	Research Participant Code	Gender	Type of Interview	Date
PO02	029	M	Pound Net Owner	January 26, 2011
PO03	032	M	Pound Net Owner	November 30, 2010
PO04	030	M	Pound Net Owner	October 13, 2010
PO05	033	M	Pound Net Owner	October 22, 2010
OS01	TouristEntrepreneur1	M	Other Stakeholders	January 28, 2010
OS02	TouristEntrepreneur2	M	Other Stakeholders	January 25, 2010
OS03	Chief EMATER	M	Other Stakeholders	October 18, 2010
OS04	REJ Superintendent	M	Other Stakeholders	February 7, 2011
OS05	Re-categorisation	M	Other Stakeholders	February 23, 2011
OS06	Fish buyer 1	M	Other Stakeholders	February 22, 2011
OS07	Fish buyer 2	M	Other Stakeholders	February 13, 2011
OS08	TouristEntrepreneur1	M	Other Stakeholders	July 20, 2012

3.5.4.1. Livelihood Interviews

I conducted livelihood interviews (Li) with households that had natural resource harvesting activities as important parts of their livelihood portfolios during the main fieldwork phase of this research (June 2010 – March 2011). I identified these households through participation (Section 3.4.3) and well as through the livelihood survey that was deployed in June 2010 (Section 3.4.4). These interviews were conducted with household heads, both female and male. I actively sought to conduct these interviews with both household heads whenever possible. Livelihood interviews covered topics such as levels of education, sources of income, access to material and social capitals as well as natural resources, relations with the environmental authority (INEA), community-based organisation (*Associação de Moradores da Ponta Negra*) and other relevant stakeholders.

3.5.4.2. Life History Interviews

Life history interviews covered remarkable features of every day life during different life stages (childhood, early adulthood, late adulthood), preferences and experiences of key events in Ponta Negra and the Atlantic Forest Coast Region. These events included the arrival and diffusion of the pound nets, the boom and bust of industrial fishing and its relations with the community, the emergence of local tourism, the effects of real estate developments (i.e., *Condominio Laranjeiras*) and the declaration of the REJ. Some questions included: "*How was life in Ponta Negra when you were a child?*"; "*When did you start fishing?*"; and, "*What do you know about the first pound nets in Ponta Negra?*"

I conducted these interviews with Ponta Negra elders who were well-known in the community for their memory and story-telling skills. Similar to the case of marine and terrestrial knowledge interviews, the interview events became a gateway that allowed me to visit Ponta Negra elders to verify information or simply spend time with them on other occasions as well. In addition to these interviews that specialised on elder's narratives, the livelihood interviews had similar components that explored similar facets of growing-up with other members of the community.

3.5.4.3. Learning Interviews

Learning interviews allowed to me explore the phases and different centres of learning within which natural resource harvesters are socialised with their local environments at different life stages. These interviews also became spaces to reflect upon how the changes associated with the decrease of fish stocks, transformation of the regional economy and implementation of environmental regulations have produced new centres of learning while making others obsolete. These interviews were conducted with research participants of middle age with teenage or young adult offspring who were keen to share their insights about their environmental learning and the one of their children.

3.5.4.4. Marine and Terrestrial Knowledge Interviews

Livelihood interviews allowed me to identify expert harvesters in marine, coastal and terrestrial ecosystems, with whom I conducted the marine (MK) and terrestrial knowledge (TK) interviews (Section 3.4.3.2). These interviews covered topics focused on exploring the biology and ecology of Ponta Negra from the perspective of natural resource harvesting.

Marine knowledge interviews were divided intro three main sections. They started with mapping exercises (1) that elicited topographic, ocean current, and other knowledge of physical features associated with marine and coastal resource harvesting. The fishing techniques section (2) focused on the gear employed by each fisher according to fish species, fish locations and seasonality. This section also included questions related to the people associated with the operation of every fishing gear as well as the factors that either hinder or enable access to a particular fishing technique. The last section of these

interviews covered knowledge of specific fish species (3), such as seasonality, feeding habits, behaviour, uses, commercialisation strategies as well as taboos and stories.

Before conducting terrestrial knowledge interviews, I did transect walks (De Leon and Cohen 2005) with selected interviewees. I encouraged each interviewee to visit paths and areas of special significance to them, such as family shifting agriculture as well as other land resource harvesting areas. During these transect walks, we identified and collected plants with different uses and identified different stages of forest succession along the paths and in abandoned shifting agriculture plots. These transect walks became an introduction to specialised knowledge interviews that started by describing the biology and ecology, including location in the forest and seasonality of the collected plants, their uses and other aspects related to their harvest and the formal and informal institutions that surround their access. After covering aspects associated with plants, I moved to more general questions related to forest harvesting activities, such as collecting timber, harvesting foods and medicines and past hunting activities. Furthermore, I tailored a special set of questions to those interviewees (three in total) with active shifting agriculture plots. All the spatial data was always discussed over a map overlaid with a piece of acrylic laminate to allow us to sketch over it (Figure 5).



Figure 5. Example of mapping exercise

The taxonomic identification of animals and plants I encountered during interviews and participation was conducted with the help of field guides, taxonomic keys, previous research conducted in the area and the help of local and scientific experts. Marine and coastal fauna were identified with the help of Szpilman's (2000) field guide, Monge (2008), Ramires (2008) and Guimarães-Blank and colleagues (2009) research as well as with the collaboration of Vinicius Nora, Robson Dias Possidonio and Leopoldo Gerhardinger. Terrestrial mammals were identified with the help of Emmons' (1997) field guide and Hanazaki and colleagues' (2009) research. Birds were identified using Van Perlo's (2009) field guide. My prior knowledge from working with flora in the Colombian tropics helped me to identify plants used by people in Ponta Negra to taxonomic family and sometimes to genus. Then I compared the local names with research conducted in Ponta Negra (Kempers 1993, Giraldi 2012) and in the REJ (Borges and Peixoto 2009, Brito and Senna-Valle 2011). Mariana Giraldi, an ethnobotany student working in Ponta Negra at the same time that I was conducting my research, helped identify the plant species with which I had difficulties. Some of them were collected with her research licence and identified by a team of botanists from the Universities of São Paulo and Santa Catarina, and the Rio de Janeiro Botanical Garden (for a full list of specialists see Giraldi 2012: iii).

3.5.4.5. Pound Net Owner Interviews

Pound net owner interviews were conducted with five of the six owners of this fishing technology. These interviews provided accounts of the dynamics surrounding the pound nets, their particular history, payment system, and the influence of the pound net fishing technology on current livelihood diversification patterns in Ponta Negra.

3.5.4.6. Interviews with Other Stakeholders

In addition to active harvesters, I also interviewed the superintendent of the REJ, the local chief of EMATER (Agency for Technical Assistance and Rural Extension)/ FIPERJ (Fisheries Institute of Rio de Janeiro), a local environmental consultant, the two fisher buyers who bought fish catches from Ponte Negra during the time this research was conducted and two tourist entrepreneurs with businesses in Ponta Negra. The accounts provided by these actors offered me a complementary perspective on how natural

resources harvesting practice is situated in the political, economic, social and ecological context of Ponta Negra and the wider Atlantic Forest Coast Region it belongs to. For example, the interviews with the REJ's superintendent, EMATER/FIPERJ's chief and the leader of *IGARA Consultoria em Aquicultura e Gestão Ambiental* gave a perspective on the historical and current interactions between Ponta Negra community members and the environmental authority as well as other official institutions. The interviews with fish buyers provided accounts of the destination of fish caught in Ponta Negra as well as the structural limitations Ponta Negra fisheries face regarding fish trade.

3.5.5. Household Survey and Closing Census

3.5.5.1. Household Survey

Household surveys are a research method employed to map the distribution of resources and needs within communities (McGregor 2007). Originally designed to gather basic demographic socio-economic information useful for developing indicators to inform policy in developing countries (United Nations 2005), household surveys can be applied to analyse different dimensions of human life in rural contexts. This is the case of household survey assessments of wellbeing (Gough and McGregor 2007) and food security (Ford and Berrang-Ford 2009), which incorporate complex elements of human life, such as their ecological, social and cultural dimensions.

During my research, I participated in the design, piloting and deployment of a household survey developed by the Brazil-Canada team from the IDRC-funded research programme (see Hanazaki et al. 2013). The objective of this component of the Brazil-Canada project was to analyse the relationships between livelihood diversity and food security from a resilience perspective. The survey was deployed in Ponta Negra in late June 2010, sampling a total of 32 households, which in turn encompassed 140 people. This represented 88% of the Ponta Negra population. In addition to providing useful demographic and livelihood data for my study, this household survey gave me the opportunity for initial interactions with the majority of community members, something that proved invaluable for my entrance into the community as well as at later stages of my research.

3.5.5.2. Closing Census

The end of my main fieldwork season was timed with the gathering of socio-economic baseline data for the re-categorisation of the REJ. This gave me the opportunity to join forces with the consultancy team in charge of this re-categorisation process to design a census instrument that would gather basic information needed for their objective (Cortines and Nogara 2011) and help me to fill a specific gap in my research related to the participation of community members in the tourism economy. I conducted this census, with the aid of a hired community member, from February 1 to 4, 2011. It included all the dwellings in the community both owned by locals and outsiders.

3.6. Data Analysis

Data analysis involves an iterative and inductive process in which the researcher de-contextualises the gathered data to then re-contextualise it (Starks and Brown 2007). De-contextualising involves sorting the data by assigning codes to units of meaning. Re-contextualising implies examining the codes for emergent patterns, which lead to organising the data in relation to central themes related to the phenomenon under study.

The data gathered during the course of this research was analysed progressively during and after its collection. During the field season my journal entries and notes were handwritten and analysed in an on-going fashion. This systematic process allowed me to identify emerging patterns and categories that became useful for adjusting interviews and other research instruments while in the field. Interviews were transcribed into English after fieldwork was finished and I had steady access to electricity. Data gathered through the household survey and the closing census were compiled and analysed by employing descriptive statistics.

3.6.1. Coding

I used Computer Assisted Qualitative Data Analysis Software (CAQDAS) to code my fieldwork journal as well as the data gathered using semi-structured interviews. I employed ATLAS.ti Qualitative Data Analysis, Version 6.2. Following a comprehensive reading of my fieldwork journal and interview transcriptions, I analysed the texts according to categories and themes. The main analysis categories were associated with

the research objectives. As the analysis and coding progressed, secondary coding categories emerged, providing a more nuanced understandings of the intergenerational continuity of ways of knowing phenomenon (Creswell 2007).

3.6.2. Discourse Analysis

As discourse analysis aims to understand how different systems of meaning, shaped by power relations, are intertwined in people's everyday lives (Sharp and Richardson 2001), coding for discourse analysis entailed identifying themes in which structures are manifested through language (Starks and Brown 2007). This type of analysis was useful in identifying how different categories can be used as a lens to perceive and express the structures that mediate human-environment relations in the contexts of coastal natural resource harvesting practice in Ponta Negra. This particular data analysis technique provided me with insights on how aspects, such as development and conservation policies, either hinder or enable the engagement of coastal peoples in natural resource harvesting activities and how they intergenerational continuity is influenced. This was particularly pertinent to Chapter 8 where I analyse the affect that the "traditional population" category has had on the human-environment relations of coastal peoples in the Atlantic Forest.

3.7. Consent and Anonymity

Permission to carry out this research in Ponta Negra was granted by the president of the community association, after consultation with community members. Participant consent for this research was oral. In rural coastal Brazil, consent forms can be problematic for reasons that include low literacy levels and a suspicion on the part of research collaborators as to the motives of the researcher. This was particularly pertinent to this region, where cases are widely known about how signing documents for foreigners have led to the expulsion of people from their lands (e.g., De Francesco 2010). For the interview sessions, I met with research collaborators in settings of their preference, which included their homes, the beach and shifting agriculture plots. Research participants agreed to digitally record the interviews. The recorded files were stored in my personal computer and back-up devices and were password-protected. All data was kept confidential, with only my academic advisor and myself having access to raw data. I did not include community members who did not want to participate in this research and

those research participants who did so were able to withdraw information upon request during the course of the research. Given that some of the topics dealt with in this research were sensitive, research participants remained anonymous.

3.8. Validation and Reliability of Data

During my research I tried to validate the data as I was gathering it. For this, I always compared information shared by multiple research collaborators and contrasted it with information produced by other research occurring in the region. When data collected during the interviews was unclear I came back to the source to verify any possible misinterpretation. For the verification trip (July 2012), I prepared an executive summary of my results that I presented to the president of the Community Association and other key informants individually as well as during a general community meeting. The individual and community feedback I received was incorporated into this document.

As other ethnobiologists and anthropologists have stated (Martin 1995), I am aware that as a social scientist, who was the primary data collector of my research, it is impossible to be completely objective while gathering data. My biases, dispositions, cultural perspectives and other aspects of who I am were always with me as I was gathering the data that became the basis of this dissertation. However, I tried to reduce the noise or subjectivity I could introduce to my data by encouraging research participants to express their ideas freely and at their own pace and I drew interviews to a close whenever I saw signs of fatigue. My questionnaires were always designed with the advice of people with previous research experience in the area and adjusted after every interview so I was sure I was asking questions in the best way possible.

I always tried to pool the information I gathered to see the degree to which answers about similar topics either complemented or diverged from each other. Previous experience doing ethnoecological research taught me that it is necessary to develop a critical awareness of how multiple narratives and pieces of information fit into a broader picture (Idrobo and Berkes 2012). For that reason, my participation in natural resources harvesting activities as well as everyday life in the community, coupled with multiple types of interviews with people of different ages, genders and socio-economic status

allowed me to draw a multi-layered, complex understanding of human-environmental relations in Ponta Negra. This included how people have and are responding to environmental change taking place in multiple dimensions of coastal life.

3.9. Dissemination

In July 2012, I returned to Ponta Negra to present several products of my research. These were comprised of:

- An executive summary in Portuguese of results that was handed to the Community Association and the Community School and Library.
- A booklet with representative photos of natural resources harvesting activities of community members and other aspects of life in the community.

In addition to these dissemination activities, the president of the Community- Based Organisation also attended the project workshop held in Paraty in December 2010, in which I presented some of my preliminary findings at. Furthermore, I will provide a copy of the final version of the full thesis document (once bound), accompanied by an executive summary in Portuguese to the community library and the regional environmental authority office.

Chapter 4. Marine and Coastal Ecosystems

Chapters 4 and 5 are the natural resources components of the Ethnoecology of Practice Framework (Section 2.4.2.4). They examine the ethnobiology of natural resources from the perspective of their materiality, or the ways by which natural resources become part of everyday projects in Ponta Negra. While Chapter 4 deals with the harvesting activities, resources and networks associated with the marine and coastal ecosystems, Chapter 5 centres on these dimensions in the context of terrestrial ecosystems. Each chapter describes the following activities through which resources associated with different domains are harvested; the most important resources as identified by community members, as well as the conditions that allow access to these resources or their subsequent transformations; and the possible outcomes of the practices surrounding each natural resource.

The marine and coastal ecosystems are perhaps the most important sources of natural resources in Ponta Negra at the present time. They furnish most of the resources that become income as well as the main source of protein for community households. The first section of this chapter presents a typology for local fish species that elaborates on how the value of fish is constructed in relation to the perception of commercial and consumption properties. The second section gives insights on the construction of marine resources through everyday practice by following four key fish species from their harvesting sites to their final destinations. The third section describes the social life of marine resources in the community to examine how community members perceive them. Finally the fourth and fifth sections describe marine and coastal harvesting techniques employed in the community from a perspective that takes into consideration their social organisation, use of the marine space as well as the exchange and distribution of resources.

4.1. A Functional Classification for Marine Species

The perception of fish and other marine species in Ponta Negra is relative to their economic and consumption value. Such value intertwines physical characteristics of the fish species themselves - such as their size, meat colour and texture - with the way in

which community members perceive such features in terms of taste and economic value. Ecological aspects, such as seasonality and abundance, as well as behaviour, also determine how community members interact with and perceive particular species. The perception of these properties has emerged through the historical interaction between people and the resource in question in the context of the opening of regional markets as well as access to means to capture and commercialise these resources.

The fish captured in the community can be divided into two functional and fluid categories relative to the final destination of the fish. These categories are first- and second-class fish. First-class fish includes species with high commercial value [e.g, king mackerel (*Scomberomorus cavalla*), dusky grouper (*Epinephelus marginatus*), and snapper (*Lutjanus* spp.)[5]. Fishers in Ponta Negra prefer to sell fish in this category rather than consume it when they have access to markets. Second class fish includes species [e.g., small rockfish, largehead hairtail (*Trichiurus lepturus)*] with low commercial value, which, depending on the circumstances, are sold, consumed and shared, used as bait in other fisheries or even discarded. There is a third category that corresponds to by-catch or fish that does not have commercial or alimentary value. Appendix 1 presents a detailed list of fish species, including local names, the functional category in which they fit, the ecosystems in which they can be found and the techniques used to harvest them.

A review of price behaviour in the São Paulo General Warehouse Company (CEAGESP for its acronym in Portuguese), a frequent destination of Ponta Negra fish (OS06, OS07), from May 2010 to April 2011, reveals the average monthly value of fish species (Figures 6 and 7). This review suggests that the relative values of Ponta Negra's first- and second-class fish species are comparable with their market value in São Paulo. While the average price of first-class fish ranges between $1.8 CAD/Kg [blue runner (*Caranx crysos*)] and $8.0 CAD/Kg (dusky grouper), the average price of second-class fish ranges between $0.45 CAD/Kg (*mistura* – generic low valued fish) and $1.05 CAD/Kg.

[5] All species are identified according to their English and scientific name the first time they are mentioned in the text. Additionally, Appendix 1 contains the local name for marine species.

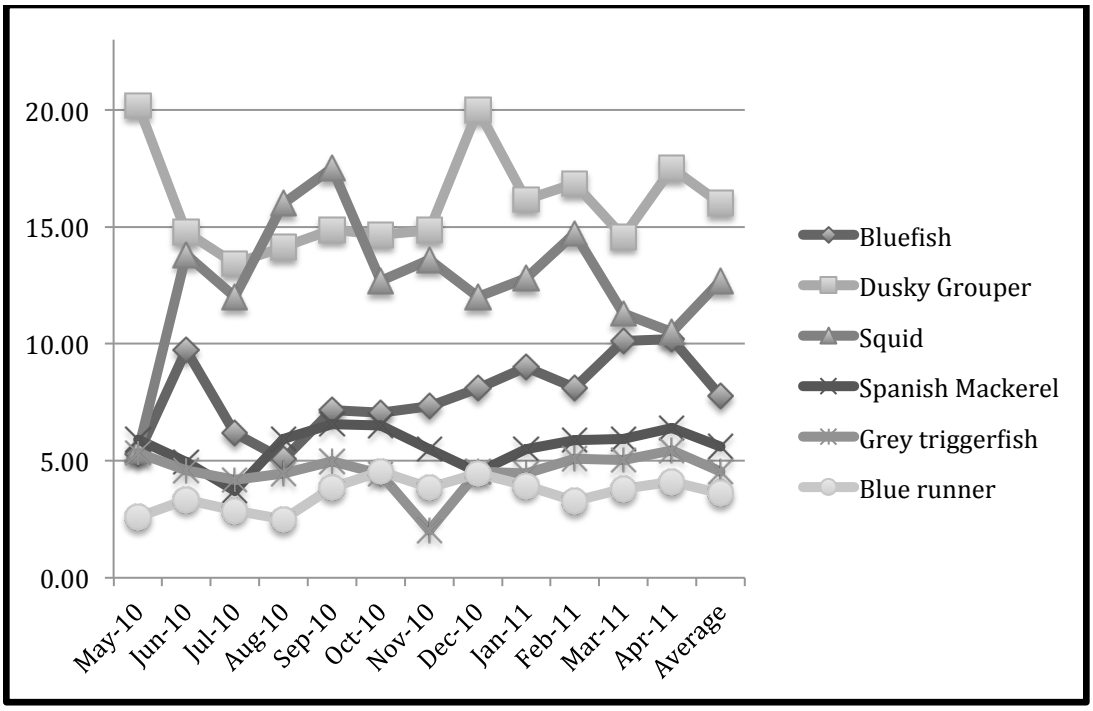

Figure 6. Annual market price behaviour of selected first-class fish species

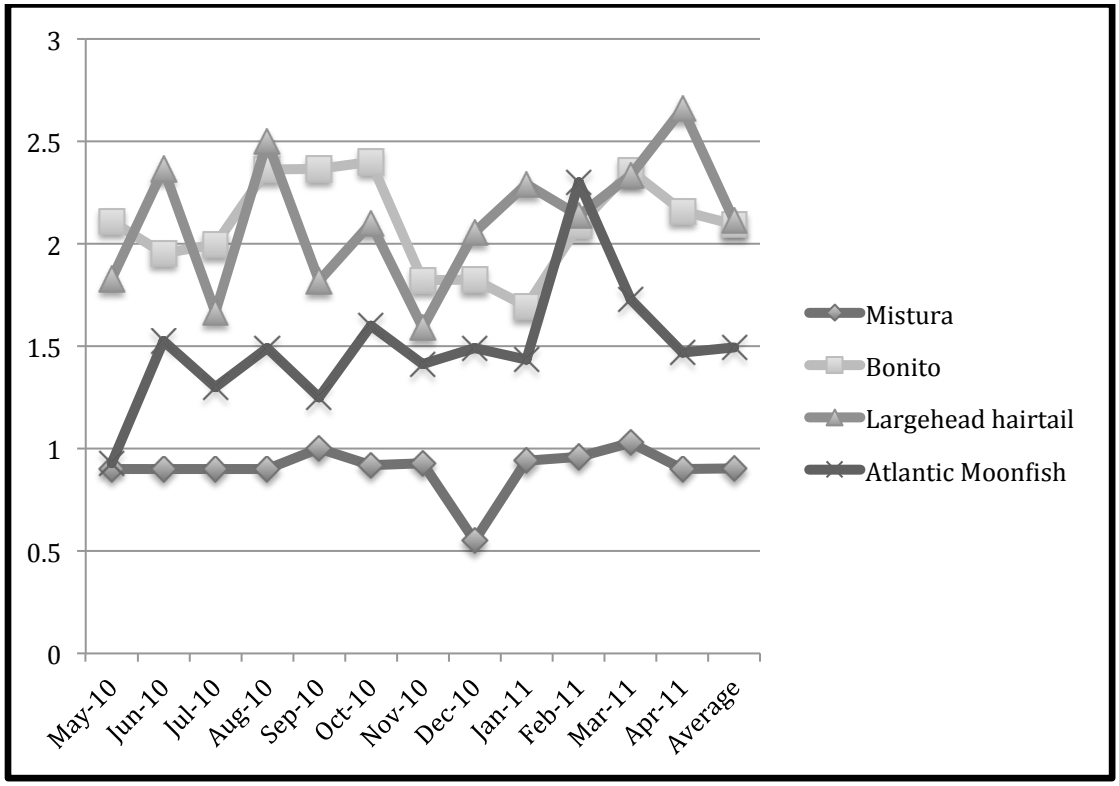

Figure 7. Annual market price behaviour of selected second-class fish species

4.2. The Flows of Key Fish Species

The following section follows the flows of four key fish species [i.e., king mackerel, blue runner, largehead hairtail (*Trichiurus lepturus)* and small fish from the tuna family grouped under the name of *bonito*]. While the first two are examples of species that belong to the first-class fish category, the latter two belong to the second-class category. Additionally, *mistura* is added as a fluid commercial category in which some fish species are located depending on access to markets, their abundance and the abundance of other species. These key fish species are selected based on their relevance to the Ponta Negra economy with respect to their abundance and monetary importance.

4.2.1. First-class Fish: King Mackerel and Blue Runner

King mackerel (Figure 8) is an example of how the perception of economic and consumptive value locates a fish species solidly within the first-class category. People in the community not only appreciate the physical characteristics of this fish but also its economic potential. King mackerel has almost no bones, it is easy to fillet and its meat has a mild flavour that makes it an excellent base for many recipes. Captured mostly in the pound nets, but also with surface gillnets and trolling, king mackerel is perhaps the most important species in Ponta Negra. Fishers anticipate the seasonal arrival of king mackerel as they consider this species among the most valuable fish they can capture. Depending on the market conditions fishers receive between $4 and $6 CAD/Kg for this fish.

As a migratory pelagic fish, king mackerel is mostly caught in summer, the time of the year when the local fisheries are economically feasible: *"...the truth is that we wait for the summer to fish. February and March are the months of blue runner, from February to April we catch king mackerel"* (PO05). Although fish buyers send most of the first-class fish to the general warehouses in São Paulo and Rio de Janeiro cities, king mackerel is the only species in this category that receives special treatment. Because of its high-value and high local desirability, this fish species is distributed to the restaurants in Ponta Negra, sent to Paraty where the fish buyers distribute it to the restaurants in the city or stored in freezers in Paraty to supply the local restaurants when the fish is out of season.



Figure 8. King mackerel: fresh (left) and served in a Ponta Negra restaurant (right)

Blue runner (Figure 9) is a fish species that can be located at the bottom end of the first-class category. This is a fish species with mid-range value ($1.8 CAD/Kg average price) that is highly appreciated and sought after by people in Ponta Negra. Similar to the king mackerel and other pelagic schooling species, blue runner is mainly caught in the pound net fishery, but is also caught with surface gillnets and trolling. When available in high numbers, pound net owners sell this fish to fish buyers. However, when blue runner is caught (i.e., from September to November and from late January to February) it is also common to see pound net owners and crewmembers sharing this fish species with people in the community. This is perhaps the only fish species with relatively high monetary value that is also widely shared among community members. The perception and norms of exchange relate to second-class fish though are more fluid.



Figure 9. Blue runner catch in a fibreglass skiff ready to be sent to the fish buyers

4.2.2. Second-class Fish: Largehead Hairtail and Bonito

Second-class fish is sold for lower prices and is the fish that is shared among community members. Largehead hairtail (Figure 10) and bonito are good examples of second-class fish; they have low market value and are disliked by community members. Although these fish species can be captured in large quantities in the community pound nets, they are considered undesirable, not only because of their low market value, but also because of negative interactions and taboos surrounding them. Largehead hairtail is generally disliked in the community because it destroys the nets and is dangerous to handle.

A pound net owner (PO02) provides a compelling narrative about his perception of largehead hairtail in comparison with highly valued fish species:

> I have been working in the pound net for the last 12 years [beginning circa 1999]. We prefer to catch the good fish: Spanish mackerel, king mackerel, bluefish, etc., and release largehead hairtail. If we visit the net and it is full of this fish species, we just let it go. Largehead hairtail not only has low market value but also destroys the nets. Anywhere this fish goes by it cuts and rips the nets. It also bites you and can cause severe injuries. There have been instances in which largehead hairtail bit the fishers and they had to go to the doctor for stitches. That fish is not worth it.

Other fishers provided similar accounts about the undesirability of this fish species: "*largehead hairtail is the fish we sell the least. We catch lot of it, but it destroys the nets and does not have a good price. It is not worth catching it; we better release it*" (PO05); "*Largehead hairtail is the same today as it was before. People don't like it and it is not targeted by anybody in particular* (MK06).



Figure 10. Largehead hairtail: head detail (left), sold with other fish species (right)

Pound net owners recall that often trucks full of this species are sent back from the distribution centres because they are not sold (e.g., PO05). On average, the price of this species at CEAGESP from April 2010 to April 2011 was 1.06 $CAD/Kg, reaching its lowest point ($0.80 CAD/Kg) in November 2010 and its highest ($1.33 CAD/Kg) in April 2011.

The relations that people in the community have with bonito offer another window to understand the interactions and perceptions surrounding second-class fish. Bonito is the generic commercial name of a four taxonomic species complex: *bonito banana (*frigate tuna; *Auxis thazard;* Figure 11), *bonito cadelão* (bullet tuna; *Auxis rochei), bonito listrado* (skipjack tuna; *Katsuwonus pelamis*), and *bonito pintado* (little tunny; *Euthynnus alletteratus*). Even though the four species are captured in the pound nets throughout the year, each species receives particular use and treatment.



Figure 11. Fresh bonito banana

Fishers and community members actively avoid the capture and consumption of bonito banana. Despite the fact that these fish species belong to the same taxonomic family as tuna and mackerel (i.e., Scombridae), which are higher value species, people dislike the texture and taste of these fish. Their flesh is generally claimed to be soft and full of blood (*carregado*). Part of the aversion towards bonito is related to the common belief that people with injuries or sickness should not eat it because it will make them feel even sicker. Begossi (1992) and Ramires (2008) found that these fish species are also disliked and avoided in other coastal communities in the region. In more than one instance, as I was taking fish of this species home, I was asked why, with so many good quality fish species around, my preference was bonito. Likewise, some people from the community, including children, were clearly shocked when I offered them bonito sashimi during a community event. They downright rejected it, called me pig (*porco!*) and said among themselves: '*I am not a grouper to eat raw bonito'* (*Não sou garoupa para comer bonito cru*). Meanwhile, sashimi made with Spanish mackerel and blue runner had better reception (Fieldwork Journal, November 2010).

Similar to the case of largehead hairtail, bonito banana is often released because its low market value often makes it commercialisation economically unfeasible. This fish species is very delicate and requires a proper cold storage chain to maintain its quality (OS07). Given the lack of proper storage in Ponta Negra, catches of this species frequently go bad and are discarded or given away as bait before they can be transported to Laranjeiras. The main use of bonito banana is thus as bait to catch other fish, such as

dusky grouper, a highly valued fish, or other rockfish that do not have commercial value and are consumed in the households (Figure 12). Begossi and Silvano (2008) found similar perspectives on the relation between grouper and bonito among fishers from other coastal communities in the region.



Figure 12. Bonito banana used as bait in a bottom long line

Fishers and fish buyers prefer to capture, trade and consume the other two bonito species: bonito listrado and bonito pintado. These two species are more resistant to the poor cold storage available in the community than bonito banana, so shipping them to the buyers is easier (MK04, MK06, OS07). When consumed, these fish species are bled soon after being caught, cut up into pieces and left soaking in brine for a couple of hours and rinsed very carefully with fresh water. This procedure washes the blood away and makes the meat more palatable.

4.2.3. Mistura

Whether low quality fish is sold under its commercial name or as generic low-value fish (*mistura*) depends on the amount caught. Fish buyers weigh the fish they purchase using 20Kg totes. Whenever less than 20Kg of a single second-class fish species is caught, the fish are mixed with other low-value species and are sold as mistura (PO04). Often the

market price of mistura is low to the point that pound net owners prefer to give mistura fish away or discard it, rather than sell it, as the amount received for the fish does not compensate for the cost of handling it. In December 2010, for example, mistura reached $0.25 CAD/Kg, its lowest market price during the fieldwork period of this research.

4.3. Local Perception of Marine Resources

The variety of ecosystems and the complex life histories of each species allow people in Ponta Negra to have steady access to fish and other marine and coastal habitats throughout the year. These ecosystems and species in turn also afford a variety of resources according to the networks in which each species flows and the relative value each species. A systematic count of the fish species registered in Ponta Negra during my fieldwork offers a total of 80 species, but the number could be higher due to rare and vagrant species (Appendix 1). All the fish species ever shown to me had a name that was often widely known and accepted by active fishers. Some fish species were not as commonly known by those removed from the capture dimensions of the fishery. As could be expected, not all the marine and coastal species harvested by community members afford the same properties.

As Section 4.5 shows, some of the resources harvested in this domain, such as mussels (*Perna perna*) and sea urchins (*Echinometra lucunter)*, are exclusively for household consumption and sharing with relatives and friends. Beyond their nutritional contributions, these resources and the activities involved in accessing them are associated with spending time outdoors with family and friends and also with being able to enjoy foods that are considered delicacies. Spending time outdoors with family and friends offers the chance to share and remember stories and plan future trips. Eating mussels and sea urchins comes in a package of interactions among family, community members and places that would be hard to re-create in other contexts (Figure 13). Similarly, fishing along the coastline affords resources without monetary value, but that become important source of protein when other resources are scarce. Coastal fishing offers adult women the opportunity to spend time with their children of different age and other female relatives outside the context of the homestead.



Figure 13. Ponta Negra family enjoying a mussel and sea urchin harvesting outing

Both coastal harvesting and coastal fishing are centres of learning in which children are initiated into resource harvesting under the supervision of their parents and older relatives and friends (Chapter 9). It is important to remember that these harvesting activities and the resources associated with them are found within networks of exchange tied to household consumption. The regional networks for commercial trade of marine resources have not dramatically influenced the use and perception of these resources. This is not the case, however, for fish species captured in the context of the pound net fishery or in other fisheries that use the pound net as a channel for their commercialisation.

As shown in the previous section, for Ponta Negra people, fish species afford well-defined properties. In an effort to develop a deeper understanding of how fish are perceived by active resource harvesters in terms of the properties they afford, seven active fishers, including pound net owners (3), crewmembers (2) and those independent of the pound nets (2), volunteered to list the ten most important fish species captured in the community and to explain the importance of each species. Each fish species was scored in decreasing order of importance from ten (10) to one (1). In cases where the

number of species mentioned by the fisher exceeded ten, all the species after the 10th one received one point. The results were pooled together, and the scores summarised and divided by the number of fishers. According to these results, 29 fish species were identified and discussed (Figure 14).

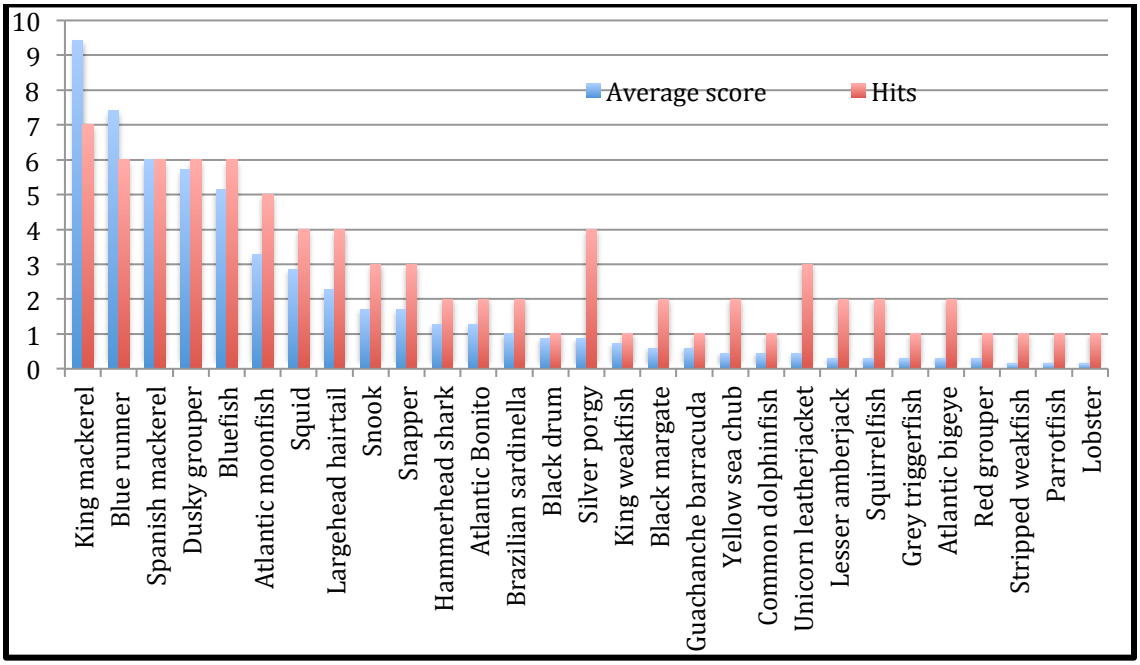

Figure 14. Important fish species as scored by local fishers

As a general pattern, commercial value prevailed over consumptive value to determine the importance of each fish species. The fish species with higher commercial value (i.e., first-class species) received the highest average scores (≥ 2.5/10) and were frequently mentioned (≥ 4/7 hits). King mackerel (9.43/10; 7/7 hits), blue runner (7.43/10; 6/7) and Spanish mackerel (*Scomberomorus brasiliensis*) (6.0/10; 6/7) were some examples. Fish species with low commercial value (i.e., second-class species), which are captured mainly for household consumption scored lower and were mentioned less frequently. Black margate (*Anisotremus surinamensis*) (0.57; 2/7), yellow sea chub (*Kyphosus incisor*) (0.43; 2/7), and squirrelfish (*Holocentrus adscensionis*) (0.29; 2/7) were some examples. The only fish frequently consumed in the household that was frequently mentioned was silver porgy (*Diplodus argenteus*) (4/7). However, its importance score was still low (0.83) compared to most of the commercial fish. Unicorn leatherjacket filefish (*Aluterus monoceros*) (0.43; 3/7) and grey triggerfish (*Balistes capriscus*) (0.29/2) were commonly captured during my time in the community, but

neither had high scores nor were frequently mentioned. The fact that the occurrence of these fish species is unpredictable may influence why they were not considered as important as other valuable fish species. The last wave of unicorn leatherjacket filefish recorded occurred six years ago (MK04).

These results partially coincide with research previously conducted in Ponta Negra. Begossi and colleagues (2010) found that king mackerel and blue runner are respectively the first and second most sold fish species in Ponta Negra. Bluefish, which was the fifth most important fish in my case, was identified as the third most sold fish (Begossi et al. 2010). Begossi and colleagues (2010) also found that king mackerel, blue fish and dusky grouper are the most consumed fish in the community. Similarly, the high scores these fish species have in my case are associated with their commercial value. Even though people in Ponta Negra would like to consume the best quality fish, they are aware that by doing so they can jeopardise their family income and, in the case of the pound nets, the viability of the fishery (Section 4.4.1.3). The household consumption of species with high scores takes place in times when they are abundant (Section 4.2.1) or when there is no access to commercial markets.

The perception of fish affordances was commonly shared among fishers, no matter their social position in relation to the local fishing economy. Pound net owners, crewmembers and fishers independent of the pound net fishery shared similar views on the importance of each fish species. Figure 15 presents how fishers perceive highly valued fish species according to their role and position in the local fishery. Those fish species with high commercial value consistently scored highly independent of the position of the fisher in relation to the local fishery. Likewise, fish with low commercial value, even if it is available year round and provides sustenance during times of hardship, normally scored low if they even made it to the scoring tables. This evaluation of different species according to the importance given by the resource users is an important tool to understand the properties that each fish species affords to individuals active in the fishery.

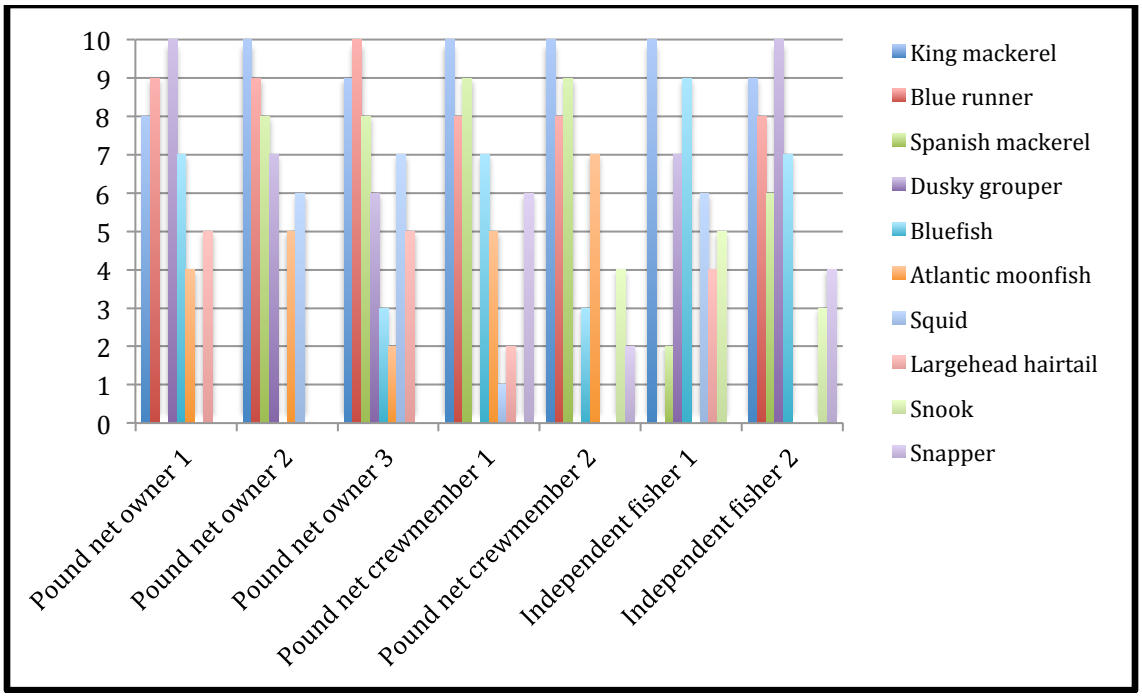

Figure 15. Species importance relative to position of the fisher

King mackerel had the highest scores (between 8 and 10). Likewise, blue runner and Spanish mackerel were mentioned at least 6 out of 7 times. Considering that these species are mainly caught in the pound nets suggests that, even though some people do not get a direct economic benefit from this particular fishery, they still recognise the economic importance of the higher-valued species captured by this gear. Dusky grouper, a species normally caught with bottom hand line, offers an exception. This species was considered the most important species both by a pound net owner and an independent fisher and scored relatively high among the rest of the respondents (higher than 6). Only the pound net crewmembers did not include this species on their lists. It is possible that working in the pound net fishery full-time during the summer, the time of the year when groupers are more active, does not allow them opportunities to interact with or receive benefits directly from this species.

4.4. Marine Harvesting Techniques

People in Ponta Negra harvest marine resources through a number of activities and techniques. Each harvesting activity is associated with particular sets of material capitals (i.e., gear and infrastructure), places as well as particular actors, networks and institutions that enable people in the community to perceive and access the properties different

marine resources afford (Table 5). Likewise, they are linked to particular places where resources can be found.

4.4.1. The Pound Net Fishery

The pound net or *cerco flutuante* fishery is the most important fishing activity and type of gear in Ponta Negra. This fishery is historically tied to the emergence of the regional fishing economy and the consolidation of the local fishing economy (Chapter 6). Multiple aspects of this fishery define its current importance: its seasonality spans most of the year; it captures most of the fish consumed and traded in the community; and, it represents a relatively steady source of income for many community members and their households. Furthermore, the pound net fishery has structured the use of the local marine space and the exchange of marine resources both in the community and between the community and external markets (Chapter 6). There are currently seven active pound nets in Ponta Negra (Table 14; Figure 24, Chapter 6) that employ on average 25 people in the community (Chapter 7). Even though the pound nets have been in the community for over 40 years, their number and owners have not been stable (Chapter 6). Likewise, some pound nets are better located and hence more productive than others. The limited number of productive spots is tied to the necessary distance between cercos, their position in relation to pelagic schooling fish movement patterns, and protection from bad weather events.

4.4.1.1. Description, Location and Productivity

Pound nets are a type of stationary fishing gear adapted from the Japanese pound net (von Brandt 1972). The type of pound net employed in Ponta Negra corresponds to the *daibo-ami* stage of this gear, which was widely used in Japan by 1900 and has undergone major modification thereafter (He and Inoue 2010). Kaku-ami was the designation this fishing technique had by the time it was introduced to the Brazilian coast (Begossi 2006). The pound nets are relatively large tri-dimensional fish trap systems into which fish enter voluntarily, but are hampered from leaving (von Brandt 1972; Figure 16).

Table 5. Summary of marine fishing techniques employed in Ponta Negra

Technique/ Activity	Natural Resources	Material capital (Gear and infrastructure associated)	Actors, networks and institutions	Outcomes (fish for:)
Pound Net /*Cerco flutuante*	Schooling pelagic fish	Vessels (at least two dugout canoes and a fibreglass skiff with outboard motor) Nets Fishing spot Landing and storage sites Gear maintenance sites Fish markets	Fishing crew Membership within family networks Reciprocity institutions Fish buyers	Commercial trade with fish buyers and local restaurants (income) Household consumption Sharing within family networks Bait
Canoe handline fishing/ *linha de mão*	Rock fish Pelagic and benthic fish	Vessel, lines, hooks, weighs Bait Fishing spots Landing and storage sites Fish markets	Membership within family networks Fish buyers	Commercial trade with fish buyers Household consumption Sharing within family networks
Gillnet/ *Rede de espera*	Pelagic and benthic fish	Vessel, nets, weighs Fishing spots Landing and storage sites Fish markets	Membership within family networks Fish buyers	Commercial trade with fish buyers and local restaurants Household consumption Sharing within family networks
Squid jigging/ *Zangareio*	Squid	Vessel, fishing lines, jigs Fishing spots Landing and storage sites	Membership within family networks Fish buyers, mainly local restaurant owners	Commercial trade with local restaurants Household consumption Sharing within family networks
Mullet seine/ *rede de tainha*	Mullet	Vessels (2), mullet seine Shoreline Landing and storage sites	Fishing crew Membership within family networks Fish buyers	Commercial trade with local restaurants Household consumption Sharing within family networks

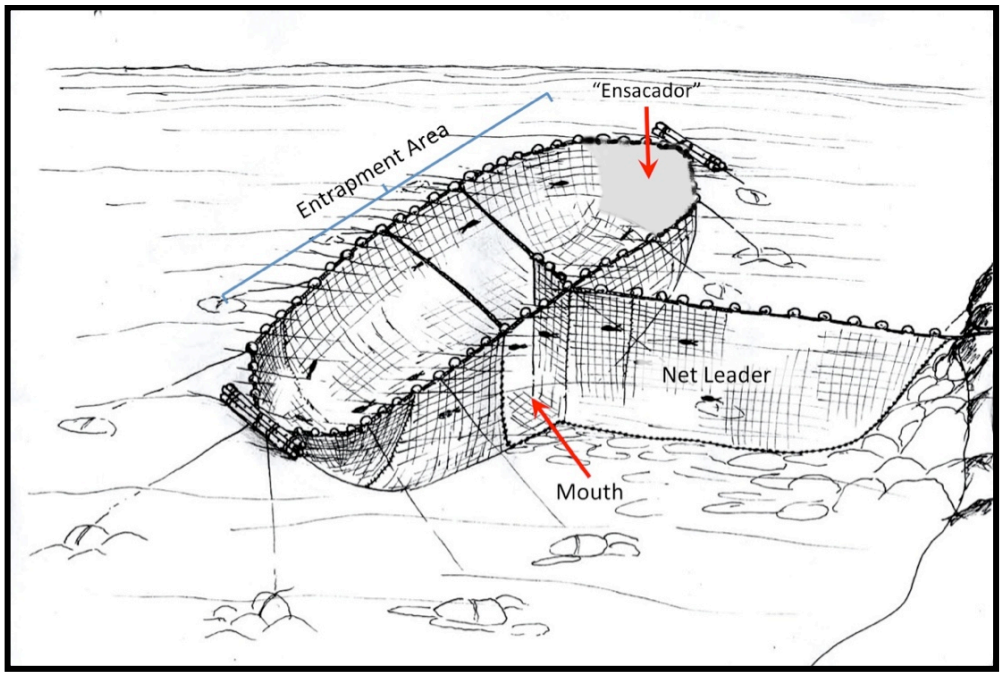

Figure 16. Ponta Negra pound net (Drawing by K.L. Turner)

Structurally, a pound net consists of a net leader (*caminho* in Portuguese) that is anchored to the shore and directs fish towards the oval-shaped entrapment area (*casa*), where fish circle until they are collected. The entrapment area is shaped like a basket and has a mouth (*boca*) and a collecting area (*ensacador)*. The mouth is the opening through which the fish enter and is located at the junction of the net leader and the entrapment area. As a general pattern in Ponta Negra, the pound nets are located on the west side of Ponta Negra Bay and Antigos Bay and their mouths open landwards. The only exception to this is the pound net 5, which its mouth opens seaward. All the pound nets have the fish collecting area at the end of the entrapment area, located on the side of the net that points to the sea. At this end, the fish are gathered and transferred to the canoes. Both the net leader and the entrapment area are anchored to heavy rocks (approx. 300Kg), which are fastened to long cords (between 30m and 50m). This anchoring system functions to keep the tension and shape of the nets, especially during bad weather.

Each pound net, including both the net leader and the entrapment components, varies in size depending on its location and the preferences of the owner. On average, the net leader is 50m long, the entrapment area diameter is 70m, and the depth is 15m. The entrapment area and the net leader are made with net that is woven by community

members with industrial nylon used for car tire casings. The nets have approximately 11cm mesh size, which is the standard for all the nets made in the community and responds to a similar pattern shared by all the net makers. The origin of this pattern is neither recorded in documents nor existent within the memory of fishers. The collecting area is made with old net from purse seiners and has a 2cm mesh size.

The pound net fishery targets mostly migratory pelagic schooling fish, locally known as '*peixe de passagem*', which have an abundance peak during the summer months (January to April) and plummet in late winter (August). The pound nets also capture resident rock or reef fish that sporadically swim into the net or get entangled in the net leader. The catch volume of these species, though, is insignificant compared to the amount pelagic fish captured. During wintertime most of the pound nets in the community are landed because operating them becomes uneconomic. During the 2010 fieldwork season only one pound net remained in the water during August since the crew of this net had no other employment option during this time. Likewise, during the end of the year holiday (i.e., *Réveillon* – end of December and early January), which is timed with the peak of the tourist influx in the region, the traffic of landed fish through the gated community of Laranjeiras is halted and hence all pound net-related activities are temporarily suspended (Chapter 6).

Pound nets are generally visited twice a day (in the morning and afternoon), but this frequency changes according to fish abundance. While in winter the nets are visited as little as once a day, in summer they can be visited up to three times. Each pound net operation must have two paddle-propelled dugout canoes and an outboard motor-powered fibreglass skiff. A pound net is normally visited with two vessels, either two big-size dugout canoes (between 7 to 9 m from bow to stern) or a canoe and an outboard-powered fibreglass skiff. The use of the vessels also depends on the availability of fish. During the peak season, the nets are visited with the help of the skiff, which makes the visit faster and more efficient. During the low season, the nets are visited with two canoes. Using two canoes, rather than a skiff and a canoe, reduces the running costs of the pound nets, thereby increasing the crewmembers' income.

A total of ten dugout canoes are allocated for visiting the pound nets and five skiffs are mainly used to transport fish to Laranjeiras. As nets 4 and 7 share management, and nets 5 and 6 are owned by the same family, these grouped nets each share dugout canoes and skiffs. The use of these vessels is not restricted to the pound net fishery. Dugout canoes and skiffs are often used for fishing or jigging squid as well. During the peak of the tourism season, while the pound nets are landed, the skiffs are also used to transport tourists back and forth from Laranjeiras (Chapter 7)

Pound net catches are stored and transported to fish buyers according to their sizes. When large enough to fill an entire fibreglass skiff (around 400Kg), the catches are sent to Laranjeiras directly from the nets. Most of the time, though, the catch is landed and stored in Styrofoam containers in beach huts with ice sent from Paraty by the fish buyers until there is a sufficient quantity to transport to Laranjeiras. The lack of appropriate cold storage affects the quality of the fish and therefore its final sale value (Chapter 6).

4.4.1.2. Tenure of Fishing Spots

The establishment and operation of the pound net fishery was triggered the emergence of rules regarding tenure of pound net fishing spots in the nearby waters of Ponta Negra Bay (Figure 24, Chapter 6). Although there is a formal dimension to the tenure of these fishing spots, the informal tenure arrangements that exist among the owners of pound net fishing gear have been key to the use of the marine space related to this fishery. Some current pound net owners as well as other people who have been historically involved with the fishery admit that, when this fishing gear was introduced in the 1970s, they had to register the spots they were using with the Rio de Janeiro State Port Authority (*Capitania dos Portos*) (e.g., PO03, PO05, LH09). Although registration gave legitimacy to the use of the fishing spots at the time, the lack of enforcement and facilitation on behalf of the Port Authority rendered the Port Authority's formal recognition irrelevant to the subsequent negotiations of the tenure of pound net fishing spots among community members over the last 40 years. Pound net owners have developed informal institutions to regulate tenure of and access to fishing spots.

Informal institutions have emerged to exclude users from using the same fishing spot and to regulate the distance between fishing spots in order to avoid conflict among users. Those who were able to set up a net at the time the fishery started gained an advantage over other community members who were not able to do so. From then on tenure over fishing spots has been secured and normalised through well-known codes of respect for the continued use of a given spot. Today, people in Ponta Negra respect the fishing spot each net occupies to the point of considering them part of a family tradition (PO01). In addition to respect, the informal tenure system in place is reinforced on the basis of use. If somebody is using a fishing spot regularly, nobody is allowed to deploy gear there: **"***To keep the right for using a spot you need to keep your fishing gear there and use it constantly"* (LH09).

Considering the topography of Ponta Negra Bay, the local currents and the fish migration routes, the number of potential spots available for setting up pound nets is limited. Once outside Ponta Negra Bay both the topography and the currents make it impractical to set a pound net spot permanently at any potential spot within a reasonable distance. To avoid over crowding within the bay, pound net owners have determined that pound nets have to be between 100m and 150m away from each other. This is considered enough distance for the sets of gear not to cause mutual interference (e.g., PO02).

The transfer of the tenure of a fishing spot has occurred within and among family circles, either through agreements between users or as economic transactions. The tenure of fishing spots is often perceived as a family asset that can be passed on between generations. This is the case of pound net spot 1, which is currently in the process of being transferred to an offspring interested in taking over the fishing operation and hence keeping the fishing spot in the family. In cases when a fishing spot has been left unused, the potential new user has to establish communication with the former user or a relative. If the former user has no interest, or is not able to continue using the fishing spot, the new user can take it over (LH09). During my time in the community, a community member took over a fishing spot that was used by a community member before he left the community (current pound net 4). In this

negotiation the new owner asked a relative of the previous user for permission to adapt and deploy his gear at the spot in question. Since nobody in the family of the previous user wanted to continue fishing, the new user was allowed to deploy his gear there.

In other instances, pound net owners have sold their user rights to others. This is the case of pound net 2:

> The fishing spot used to belong to PO02, I bought it from him for what would correspond to $2500 CAD today. When he got the spot close to the land he resolved to sell his former point to me. He sold it because he had another place to work and what I paid for it was a symbolic amount (PO01).

The aforementioned rules of keeping and maintaining fishing spots have been effective for avoiding conflicts. The only conflicts mentioned were related to instances of shared tenure of pound net spots or associated gear. As a pound net owner mentions, people in the community have worked around these issues by limiting tenure and ownership to within households:

> Thirty years ago we would struggle a lot to maintain a spot. People would start and finish partnerships leaving a lot of issues behind. I don't like to work in partnership with anybody. The only partnership I have is with people in my family (PO04).

4.4.1.3. Exchange and Distribution of Resources

The resources related to the pound nets are exchanged and distributed among community members following a set of rules related to the characteristics of production of this fishery. These rules range from the distribution of income between the pound net owner and crewmembers to the distribution of fish among community households.

Distribution of Income

Income from the commercial trade of fish is distributed among those involved in the fishery according to their position. Each pound net operation sells its catch to a fish buyer, who provides fuel for the skiffs, ice, twine and other supplies needed for the operation of the fishery. Fish buyers pay for the fish (*fechar conta*) at the end of a fishing stint (*riada*), which goes from the deploying (*largar a rede*) to the retrieval *(tirar a rede*) of the net and lasts between 14 and 21 days according to weather and

water conditions. After buyers discount the running costs of the pound net stint from its gross production, the outstanding amount is the net payment. While the pound net owner keeps half of the net payment, the rest is distributed in equal parts among the crewmembers. If the owner also works as crewmember, he is also entitled to receive a crewmember's part. This payment system is the same across all the pound nets in the community, even though not all the pound nets have the same crewmember structure. Pound nets 4, 5 and 6 are managed within the same household unit, while pound nets 1, 2, 4 and 7 have crews with no direct kinship ties to the owners.

When the pound nets were adopted, their owners worked on their own nets as crewmembers. As some of the owners began engaging in other economic activities, such as tourism, they opted to stop working actively in the fishery. In order to keep the pound nets running and maintain control over the fishery, some of the owners created the net master position (*"responsável da rede"*) (PO01). Under that structure crewmembers are in charge of visiting the cerco to collect the fish, handling the catches on the beach, and deploying and retrieving the nets. The net master is in charge of managing finances, maintenance, and packing and transporting the fish catches to Laranjeiras.

Sharing Fish within the Community

The distribution of fish from the pound nets among people in Ponta Negra also responds to a set of unwritten rules between the individual receiving fish and the owner of the fishing gear or crewmembers. Pound net owners and crewmembers are entitled to take and share as much fish as they want, as long this fish is for household consumption. Even though both pound net owners and crewmembers often mention this rule (e.g., PO01), there are some caveats to it that are relative to the quality of the species being used or shared. Crewmembers generally do not take first-class fish home as its domestic consumption is counter-productive for the income of the entire crew. A pound net master (PO02) explains: *Crewmembers can take home any kind of fish that gets caught in the net. However, if crewmembers take home only the good fish to eat, we would be left with fish of low quality to sell.* The ideal unlimited access to fish that crewmembers have is in reality constrained by value, quality, and quantity available.

These factors determine which fish species are consumed within the fisher's household or shared with relatives, and which ones are destined for commercial trade.

When sharing the pound net catches with community members, rules based on reciprocity are followed. Sharing fish is a responsibility for pound net owners and crewmembers. Without additional help to that offered by the crew, running this fishery would be more difficult, if not impossible. A pound net owner (PO01) explains the sense of reciprocity that underlies the act of sharing fish: "*I like to give and I need to give. To visit the pound net we only need the crewmembers. However, to beach the canoes we sometimes need ten people. So I need to give to make things even. It is a form of reward.*" Helping in pound net-related duties on the land becomes a form of exchange that allows access to fish for those not directly involved in the fishery. But people have to deserve this fish: "*Those who deserve fish are those who help me land the canoes on the beach, to store the fish in the beach hut and whatever comes up. We* [pound net owners] *give* [them fish] *from the heart*[6]*"* (PO01).

Community members who receive fish share similar thoughts as pound net owners and crewmembers regarding reciprocity. For them, deserving fish implies not only collaborating in activities related to the fishery, but also not relying on the pound net catches as their single source of fish. Community members without direct involvement in the fishery, explain sharing fish from their perspective:

> Sometimes in this house we spend almost a week without eating fish from the pound nets, because we do not like to ask for fish too often. When I go to the beach to get fish I help to land canoes. If the pound net fishers offer me fish I pick it up. Even when I help I do not ask for fish often. I do it once a month. When you help, you have the moral right to pick up fish (Li12).

Net owners also commented that they share fish with friends and people they respect. This is the case of the oldest person in the community who likes blue runner and receives it from many fishers without needing to ask for it (PO03).

In terms of the kind of fish shared with community members, the same principle

[6] *A gente dá de coração.*

applies as the one used with crewmembers: community members take home second-class fish. They respect that the 'good fish' (or first-class fish) is sold, since it is the fish that provides the highest economic return (PO02). Although community members consider good fish desirable, eating king mackerel or bluefish in the community is a rare phenomenon.

The distribution of the fish also depends on its seasonality. During wintertime, when the catches are small and of low quality fish [e.g., ballyhoo (*Hemiramphus brasiliensis*) and bonito], net owners sometimes prefer to distribute the catches among crewmembers and the community in general instead of selling it (PO01). During the summer, when the catches are bigger and with high-value fish, pound net owners distribute second-class fish. The only exception to this rule happens when blue runner is abundant, as this fish species is widely shared with and appreciated by everybody in Ponta Negra

The aforementioned sharing rules are currently perceived to be eroding because of regional processes impacting the local fishery. The destructive practices of the industrial fishing fleets in the region have led to a constant decline in fish catches in Ponta Negra, as well as other small communities along the coast of Rio de Janeiro. Less fish caught implies less fish available to share. However, in spite of the reduced availability of fish, community members expect as much fish as they were used to receiving when the catches were bigger. This situation often leads to misunderstandings and disagreements between net owners and some people in the community: *"people in the community are always expecting me to give them fish, but sometimes there is not enough fish to share with everybody"* (PO03). With the current situation, net owners have been forced to reduce the amount of fish they share with the community during the lean times of the year, limiting it strictly to those who actively help in the fishery (PO05).

With the limited availability of fish, some community members have become reluctant to offer any help in the cerco fishery. This has generated issues of mistrust between net owners and groups of community members.

> They [net owners] don't like to share fish because sometimes they need help, but certain people refuse to help. Some people just stay on the beach and do not give a hand landing the canoes. Later, when people want fish, the net owner doesn't like to share (Li12).

This attitude is often related to a perceived loss of community values connected to willingness to work and respect towards elders (LH07).

Other Forms of Fish Exchange

The pound nets also provide bait for other fisheries. Long line fishing vessels often come to Ponta Negra Bay to collect live bait from the pound nets. The pound net fishery provides small pelagic fish (e.g., small blue runners, Atlantic bumpers and various sardine species) to the long line boat crews, who scoop the fish directly out of the net. The boat owners pay for the fish by its estimated weight. Community members also benefit from the bait that the pound net fishery provides. This is the case of bonito, a species of particular importance in terms of bait, but with low commercial and consumptive value (see above). Because of its intense flavour, the meat from these fish species is an excellent lure for more desired fish species. Bonito is readily available and widely used as bait for hand line fishing, either from canoes or rocky outcroppings along the coast.

4.4.2. Other Fishing Techniques

Bottom lines, trolling, surface and bottom gillnets and mullet seines are the multiple fishing techniques people in Ponta Negra have at hand to access marine resources available in the waters close to the community. As explained above, all these techniques are intertwined with specific gear, networks of actors as well as different outcomes relative to the quality of the fish caught. Each fishing technique is also linked to particular places in which resources are harvested (Figure 17; Table 6). Depending on the ecology of the target fish, fishing spots can be fixed (e.g., groupers and other big rockfish) or mobile (e.g., pelagic and demersal migratory fish species).

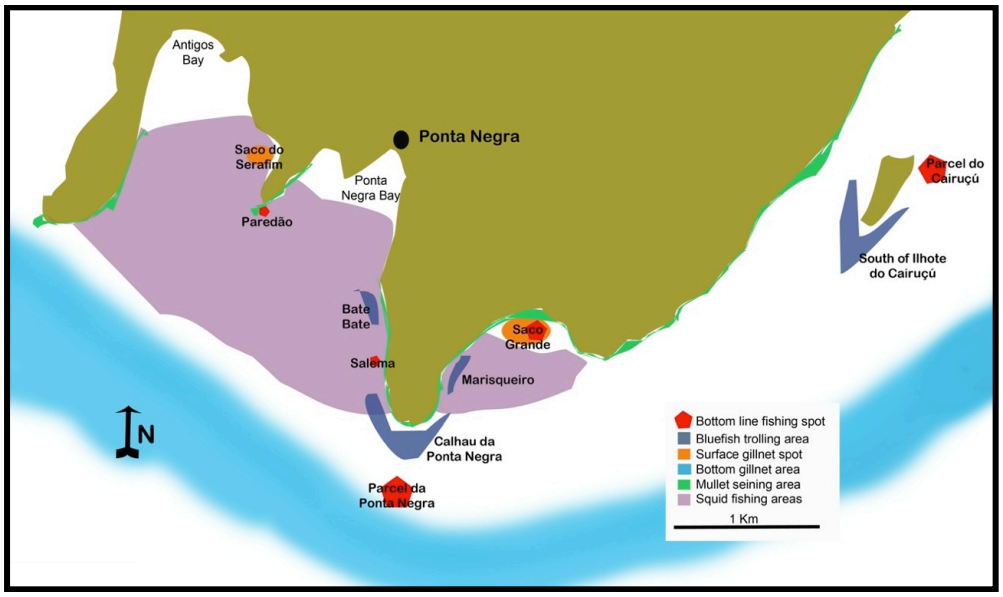

Figure 17. Marine fishing spots and areas in Ponta Negra

Table 6. Marine fishing techniques in Ponta Negra

Technique	Fishing Spot/ Area	Targeted Resource
Canoe fishing		
Bottom line	Salema	Big rockfish (e.g., Groupers, snappers, black margate, Atlantic bigeye)
	Paredão	
	Saco grande	
	Parcel do Cairuçú	
	Parcel da Ponta Negra	
Bluefish trolling	South of Ilhote do Cairuçú	Bluefish
	Calhau da Ponta Negra	
	Bate Bate	
	Marisqueiro	Bluefish (*Enchova marisqueira*)
Gillnet		
Surface gillnet	Saco de Sarafim	Pelagic fish (e.g., King mackerel, Spanish mackerel, blue runner, bluefish, etc.) and some rockfish (e.g., yellow sea chub, Atlantic bigeye, squirrelfish, silver porgy, etc.)
	Saco Bravo	
Bottom gillnet	Outside Ponta Negra Bay and nearby bays	Demersal fish (e.g., Jamaica weakfish, Smooth weakfish, whitemouth croaker)
Squid jigging	Ponta Negra Bay, Gaetas Bay, Antigos Bay, Antiguinhos Bay	Squid
Mullet seine	Along the shoreline from Gaetas Bay to Cairuçú das Pedras	Lebranche mullet *(Mugil liza)*

4.4.2.1. Canoe Fishing

This category groups all the fishing activities outside the pound net fishery that are performed from canoes and using some combination of hook and line gear. Ponta Negra people fish from canoes throughout the year and are able to adapt their fishing gear to different target species with only minor adjustments. In the summer, when fishing from canoes is more intense, fishers use bottom lines to target groupers, snappers and other first-class rockfish species. During this time of the year, when the water warms up, big rockfish become more active and voracious. Consequently, they become easier to lure and catch (Li06). In other times of the year and according to the availability of certain fish, fishers employ different techniques, such as trolling for pelagic fish (e.g., blue runner and common dolphin fish), during early summer, spring and fall, or using lighter lines to target smaller benthic rock species, such as grey triggerfish, which was unusually abundant in Summer 2010/2011. During winter, fishers often target benthic fish that inhabit sandy bottoms close to the coast, such as Jamaica weakfish, using weighed bottom lines. In terms of bait, fishers prefer to use bonito when it is available. In the absence of bonito, other baits, such as isopods captured along the rocky shoreline, crayfish captured in the freshwater creeks close to the community, and shrimp shared by otter trawlers that moor in the Ponta Negra Bay, are used.

Fishing from canoes normally takes places along the shoreline of the area surrounding the community. Ponta Negra fishers often paddle as far as 7 km westward (Praia do Sono area) and 11 km eastward (Ilhote do Cairuçu area) looking for fish. These fishing trips, however, do not happen randomly. The physical characteristics of rockfish spots are related to the habitat of the targeted species. In order to find rockfish, such as dusky grouper, Ponta Negra fishers visit well-known fishing spots, known as *pesqueiros,* where these species can be found. Rockfish fishing spots are generally located within small, rocky, calm inlets in the Ponta Negra Bay and nearby bays with depths ranging between 5 and 15 m. Salema and Paredão are examples of these spots. Likewise, Ponta Negra fishers also fish in places generically known as “parcels”. These are areas with rocky bottoms separated from the shoreline, which are habitat for big rockfish. The Parcel do Cairuçu, at the Northeast side of Ilhote do Cairuçú, and the

Parcel da Ponta Negra, located at the mouth of Ponta Negra Bay are examples of this marine geographic feature.

Trolling for pelagic fish does not correspond to particular fishing spots or times of occurrence. People normally troll when fish schools are spotted and stay mostly within the Ponta Negra Bay. The main species caught using this technique are blue runner, common dolphin fish and mackerels. The only exception in which trolling is used to capture a particular fish species at a particular spot is bluefish. Bluefish forages where waves break against steep, rocky shores (MK07). Because of this habitat preference, Ponta Negra fishers target this fish at points exposed to Southeast currents, where the water is rough and foamy. Calhau da Ponta Negra (Ponta Negra Point) and South of Ilhote do Cairuçú are examples of bluefish fishing spots. Fishing spots, such as enchova *marisqueira*, are specialised for capturing bluefish that have particular dietary preference for shellfish. The name of this spot makes particular reference to that fact (in this case, *marisco* refers to shellfish in Portuguese).

There are a total of 16 dugout canoes in the community, in addition to the canoes employed in the pound net fishery (see Chapter 7 for more details). Even though all the canoes can potentially be used for fishing, people in Ponta Negra prefer to use small (around 3.5 m long) and medium-sized (between 5 and 6 m long) canoes to fish with hook and line, as they are faster and more manoeuvrable. Although not every household in the community owns a canoe, the use of this equipment is widely shared. Male children and young adults are the primary users of these canoes throughout the year and capture fish mostly for household consumption. During the summer months, however, when groupers and other highly valued fish become more readily available, male adults generally take over the canoes and capture fish for commercial purposes. This time of the year grouper fishing generates supplementary household income. In terms of fishing gear, Ponta Negra fishers use nylon line and hooks of a gauge and size relative to their prey. In the case of trolling, regular hooks covered with pieces of latex hose, which, according to the fishers, resemble the shape of shrimp, are used as a lure.

The fish caught from canoes is consumed within the household or sold depending on its value, in a similar fashion to the fish caught in the pound net fishery.

First-class fish, such as grouper, Spanish mackerel or bluefish, is sold to fish buyers and sent to Paraty through the commercial channels facilitated by the pound net fishery. These fish species are also sold to the local restaurants and tourists. First-class fish caught in small quantities, such as troll-fished blue runner, and second-class fish, such as largehead hairtail or squirrelfish, are often shared among friends and family and consumed within the household of the fisher.

4.4.2.2. Gillnet Fishing

Gillnets are not used in Ponta Negra as often as the previously described fishing gears. Depending on the season and availability of resources, the same gillnets are employed either for surface or bottom fishing by changing the gear (i.e., ropes and buoys) accordingly. These nets are between 90 and 150 m long, between 2 and 2.5 m tall, and approximately 8 cm in mesh size. In the summer months gillnets are deployed on the surface and are used to target the same pelagic schooling fish as the pound net and trolling fisheries. Because these nets are set in proximity to the rocky shore, they also capture some fish from this habitat, such as yellow sea chub and bluefish. In the winter months, the same nets are adapted as bottom gillnets to target benthic fish, such as white mouth croakers and other fish with similar habitat requirements from the same taxonomic family (i.e., Sciaenidae).

People in the community deploy surface gillnets mostly from dugout canoes, but sometimes also use outboard motor powered skiffs, at spots both well-known for their passage of migratory fish and protected from bad weather. The preferred fishing spots are adjacent to small inlets, such as Saco de Serafim and Saco Bravo. Unlike the pound nets, the spots for the surface gillnets are used on a “first-come, first-served” basis. Due to the limited use of this fishing gear, the use of gillnet fishing spots does not seem to create conflict among fishers in the community. At the time of the research there were five active owners of this kind of fishing gear.

Less used than surface nets, bottom gillnets employ more specialised gear, including longer ropes, anchoring weights and buoys. Because of these more demanding specifications and heavier gear setting bottom gillnets requires the use of fibreglass skiffs. During the time I spent in the community only two community

members employed this type of fishing gear. These nets were set on the bottom of the mouth of Ponta Negra bay, at depths that varied between 15 and 20 m. The catches from gillnets are used and distributed according to their class, in a similar fashion to the catches from the aforementioned fishing techniques.

4.4.2.3. Mullet Seining

This fishing gear targets Lebranche mullet (*Mugil liza*). Mullet seines are used during the winter months (mostly June and July). This fishing technique is specialised for a single, migratory fish species and, therefore, depends on its availability. The nets employed for mullet seining, locally called *bate-bate* or *rede de tainha*, are adapted gillnets, approximately 30 m long and 1.5 m tall. There were three active crews using this fishing gear during the 2010 mullet-fishing season and no crew made more than four trips.

Mullet seining is perhaps the most skill-demanding fishing technique practiced in Ponta Negra. According to several community members, only experienced fishers engage in this fishing activity. During my time in the community, four young community members (between 16 and 20 years old) were involved in an accident in which they broke a dugout canoe, lost the paddles and one net. This unfortunate event prompted community members to assert that this activity is inherently dangerous because of the place and the time in which this activity takes place (along the rocky shoreline at night).

When mullet seining, fishers follow the shoreline spotting mullet schools, either by noticing their reflection on the water surface or by spotting individual fish jumping close to the rocks. Two crafts with two persons in each are generally used: an outboard motor-powered fiberglass skiff, which hauls a medium-size dugout canoe. Once a school is spotted, the outboard motor boat stays still while the people in the dugout canoe surround the school as they deploy the net. When the school is surrounded, fishers on both sides make noise to drive the fish into the net, where they entangle. Then, both crafts gather the net and the catch and meet at a middle point, where the catch and the net are retrieved into the skiff. Fishers repeat this task until dawn. On

average, ten to fifteen mullet are caught each time a net is deployed. A night can produce between 50 to 100 mullet.

Even though mullet is highly appreciated in the community, it is considered a second-class fish and fetches a relatively low market price (sold to the public between 1.5 and $2.2 CAD/Kg at the fish market in Paraty). When there are pound nets in the water and there is fish freight traffic some mullet are sent to Paraty to the fish buyers. However, as this fishery happens at the lowest point of pound net activity most of the mullet caught is locally consumed and shared among family and friends. Mullet is cooked in various ways, but the most common ways include stewing it with green plantain and deep-frying it. Likewise, raw mullet roe is considered a local delicacy that is highly sought after.

4.4.2.4. Squid Jigging

Squid jigging is the second most important fishery in the community after the pound net. Its importance is reflected in catch volume, the amount of people it involves, the income it generates and the multiple networks in which squid flows within the community and outside of it. Squid (*Doryteuthis plei* and *D. sanpaulensis*) is a resource available only during the summer months (November to March) and its abundance varies from year to year. While in summer 2009/2010 squid peaked between November and December, in 2010/2011, it only peaked at the end of December and lasted throughout January.

The availability of squid within its peaks of abundance depends on spotting schools of this species passing through the area. The exchange of information both among community members and with people from the surrounding communities is necessary for successful access to this species. Young adults, fishing with hook and line, and boat drivers transporting tourists in and out Ponta Negra are normally the first ones to spot the squid runs and inform the rest of the community about them. Likewise, people from Laranjeiras or Praia do Sono often communicate with Ponta Negra fishers using cell phones to indicate the presence of a squid run. Once this happens those fishers with cell phones inform other fishers who also join in (MK01).

During the 2010/2011 season, most of the fishers were male children and young adults (between 8 and 21 years old) and they used the small and medium-sized canoes available in the community. Adults who did not work in the pound net fishery or pound net crewmembers who found somebody else to temporarily replace them in the fishery were the only exceptions of other age groups taking part of the squid fishery. Also, relatives of people from Ponta Negra living elsewhere came to stay in the community while the squid runs lasted. In some less frequent instances, entire families (father, mother and two children), dating couples and groups of friends went squid fishing using pound net canoes. During the most intense days of the season, as soon as somebody would land a canoe somebody else would take it to continue jigging. This combination of factors made it hard to quantify how many squid fishers were in the community and how much squid was caught during the season.

The squid was distributed according to size. The restaurant owners bought most of the bigger squid to turn it into '*calamari',* which is a top item on their menus. The rest of the bigger squid was also regularly sold directly on the beach to tourists or sent to the fish buyers through the commercialisation channels of the pound net fishery. The fishers received between $5 and $6 CAD/Kg for the bigger squid at the highest point when squid started to peak and $2.5 CAD/Kg at the lowest point when the regional markets were already glutted (MK05, MK07). Squid prices, even in the community, depended on the regional prices of this species. While fishers took home and shared the medium to smaller size squid among family members and friends, the smallest squid were given away as bait to children who used it to fish from along the shoreline.

With the objective of making better profits from this resource, some community members employed alternative strategies for storage and sale that avoid intermediaries, such as fish buyers, and bring the squid directly to the Paraty markets and restaurants. One community member, for example, prefers to sell the squid himself in Paraty. He buys ice for storage, harvests the squid and drives his own skiff to Paraty where he can find better prices. He is able to sell the squid directly to restaurants often for almost double the price he would get in Ponta Negra (MK06). Likewise, one of the Ponta

Negra restaurant owners buys the squid from the fishers, pays somebody in the community to clean it ($0.54 CAD per Kg), and sends to be frozen in Paraty either for bringing it back to Ponta Negra for use in the restaurant later in the year or for shipping it to the distribution centres in São Paulo or Rio de Janeiro. During the squid off-season local restaurants sell food made with squid imported from Chile. Restaurant owners prefer the taste of the local squid, but sometimes they have no other choice than to buy the imported variety. Although not widely used in the community, the aforementioned strategies are employed by some to circumvent the relatively low market prices associated with the limited channels for fish vending available and the lack of long-term cold storage facilities in Ponta Negra.

4.5. Coastal Harvesting Techniques

The coastal ecosystem is a steady source of resources that community members can utilize throughout the year. Although it is not as important as the marine ecosystem, either in terms of the diversity of techniques employed and resources it affords and the income it provides, people value the coastal ecosystem as a source of food in times of scarcity as well as collection of places to interact with people from the family and the community. Activities in the coastal domain in Ponta Negra can be divided into two distinctive bundles: coastal fishing and coastal harvesting (Table 7).

Table 7. Coastal resource bundles in Ponta Negra

Activity	Natural resources	Ecology	Material access	Human Actors	Outcomes
Coastal fishing/ *pesca na costeira*	Low-value rockfish	Along the shoreline/ year round	Fishing rod, hook, weighs and line	Mostly women and children	Fish for household consumption
Coastal harvesting/ Mariscar	Mussels, sea urchins, crabs	Exposed reefs in the low tide / year round, but depends on the spring tide	Baited sticks, buckets, canvass bags	Recreational family activity / Women and children	Sea food for outdoor consumption, “treat” for household consumption

4.5.1. Coastal Fishing

Coastal fishing is performed from the shore at a number of regularly used spots (Figure 18, Table 8). Each fishing spot is associated with particular fish species and the conditions under which fishing takes place. Additionally, each spot has a particular name that is well-known among local fishers. In the fishing spots inside Ponta Negra, Galhetas and Antigos bays, people mainly target small rockfish with low commercial value [e.g., squirrelfish, palometa pompano (*Trachinotus goodei*) and silver porgy] as well as small high-value fish that is not commercialised because of their size [e.g., mutton snapper (*Lutjanus analis*) and dusky grouper] (Figure 19). In the fishing spots outside the bays, however, people have access to deeper water edged by steeper rocky slopes. The latter fishing spots are habitat for bigger species, such as black margate, lesser amberjack and small groupers. All these fish species are caught using bamboo rods (*varejo*) or simply with a hook and line. Ponta Negra fishers also use particular spots that are protected from breaking waves during winter storms. This is the case of Saco do Serafim, where the water remains relatively calm when anywhere else it is difficult to fish due to bad weather.

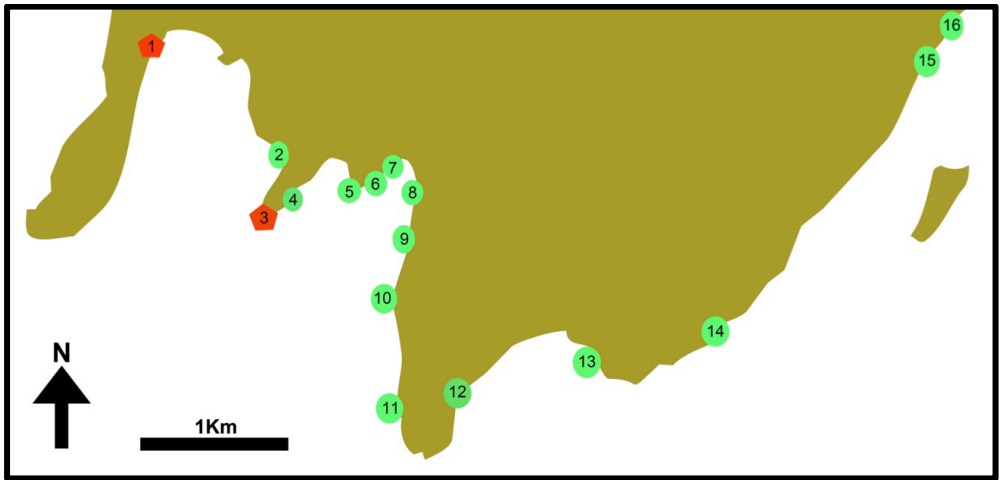

Figure 18. Location of coastal fishing and harvesting spots

Table 8. Description of coastal fishing and harvesting spots

ID	Name	Targeted resources	Notes
1	Canto Bravo de Antigos	Mussels	Most commonly visited spot for harvesting mussels
2	Saco Serafim	Fishing	Even when sea conditions are bad this point remains calm. It is good for fishing in the winter, when anywhere else is difficult to fish
3	Ponta do Furado	Mussels	Accessed only using canoes
4	Mesa	Fishing	
5	Laja de Vinta Costa	Fishing	
6	Calhau Grande	Fishing	Deep water allows fishing bigger fish than other spots
7	Pontinha	Fishing	Close to the community; frequented by small children
8	Ponta do Saquinho	Fishing	
	Pedra Chata	Fishing	
10	Ponta	Fishing	Rod fishing spot
11	Ponta do Arpoador	Fishing	People used to harpoon rock fish at this point
12	Marisqueiro	Mussels	Fishing spot for bluefish
13	Ponta do Saco Grande	Fishing	
14	Saco Bravo	Fishing	
15	Banana Prata / Costão	Fishing	Fishing spot for those with shifting agriculture plots close to the Cairuçú das Pedras settlement
16	Cairuçú das Pedras	Fishing	



Figure 19. Fish caught along the shoreline [from upper left to bottom right: mutton snapper, squirrelfish, ladyfish (*Elops saurus*), dusky grouper, palometa, silver porgy]

Coastal fishing is the least demanding marine fishing activity in terms of material resources needed to undertake it. The gear employed in coastal fishing is limited to thin, locally harvested bamboo rods, approximately 2m long, fishing line, hooks and lead weights. Some children also frequently cast weighted lines towards the centre of the bays and retrieve them slowly. This technique is locally called *"negaça"*, emulates trolling and targets small pelagic fish, such as blue runners. The bait employed in these fishing techniques is the same as that described above in the fishing canoe hook and line fishing section.

Different kinds of social groups form around coastal fishing according to the season. In winter, when people in the community have higher dependence on this fishery, small groups of women, who are often related, and their children gather bait and hike toward particular points close to the community where they catch fish for their own and their relatives' households (Figure 20). Likewise, when the families that have active shifting agriculture plots outside the community are preparing the soil and planting, coastal fishing is their main source of protein. While men work in the shifting agriculture plots, women and small children fish along the coast. In summer, when fishing resources from other sources are more abundant, small groups of children often fish in proximity to the community as a pastime. Although coastal fishing affords a steady source of protein throughout the year, it becomes particularly relevant in the winter when the catches from the cercos dwindle. When I asked about the seasonality of the fish caught along the shoreline, people in the community agreed that the species from these locations are available year round: *"O peixe da costeira da o ano inteiro"* (MK04).



Figure 20. Family fishing along the coast in wintertime

4.5.2. Coastal Harvesting

Coastal harvesting bundles together the harvest of resources found along the shoreline. This bundle of activities, which is locally known as "*mariscar*", involves the collection of blue mussels (*mexilhão* or *marisco*), sea urchins (*pindá* or *ouriço do mar*), and rock crabs (*guaiá – Menippe nodifrons* - and *santola – Mithrax hispidus*). Adult women normally lead coastal seafood harvesting but receive collaboration from small children (MK01). Male adults do not engage in this harvesting activity often and when they do their role is supportive, rather than central. People in the community make clear distinctions about their participation in family mussel harvesting:

> 'Mariscar' is a women's duty. My mother and my wife do that on the rocky reefs. However, harvesting mussels from the sea (as in diving) requires other skills. In that case, I am the one who collects the mussels, but we do not do it that way often. We mostly harvest our mussels in the Canto do Antigos, which is the best point in the area. There, the sea is calmer and hence it is easier for everybody to harvest. We go there whenever my wife wants to go (Li11)

Harvesting coastal seafood does not conform to a particular season. This activity is generally timed with the lowest tide of the month and when the weather is calm (MK06). Coastal harvesting does not require specialised tools. Mussels are harvested by hand, often with the help of kitchen knives used to cut the thin rope (i.e., byssus)

that fastens the mussels to the rocks. Dugout canoes and small shovels are used for mussel diving (MK04).

Harvesting spots vary according to the resource. Mussel beds are located on flat and gently angled rock slabs situated at wave breaking points (Li11). Points such as Canto Bravo do Antigos, at the far end of Antigos Beach, and Marisqueira do Saco Grande are the preferred spots in the community because they can be accessed on foot during the spring tide (MK02, MK05, MK07). Other spots, such as Ponta do Furado, are harvested by diving off canoes when the water is calm (MK04). The use of these harvesting spots is not exclusive to anybody in the community. People can go whenever they want and harvest as much as they can. Due to the recreational nature of this activity and the limited storage available people do not harvest mussels in big quantities (MK02). People from neighbouring communities and even tourists have access to the same harvesting spots and this is a situation that causes no concern to the local users at this point in time.

Sea urchins and crabs are found in different habitats than mussels and, therefore, demand different harvesting strategies. Sea urchins and crabs are abundant in rocky reef formations, which can be found throughout the inner bays in the surroundings of Ponta Negra. Sea urchins are collected barehanded with the help of kitchen knives. They are stored in canvassbags until they are processed. Crabs are lured from cracks in the reefs with baited bamboo sticks, which are around 1m-long and have rotten fish attached to one of their ends. As soon as a crab is spotted, the sticks are set against a flat surface, where the harvester waits until the crab grabs the bait firmly. The sticks are set in a way that leaves enough room for the harvesters to lift the crabs from behind and quickly place them in a plastic bag or bucket. As people search for crabs they whistle a soft, ascending melody, which, according to the harvesters (Fieldwork Journal, July 2010), is meant to attract crabs as they relate the sound to the availability of food.

Mariscar implies going out with family and close friends, including people of all ages, spending time together and sharing foods. The collected items are considered delicacies that are consumed at their harvesting sites and/or taken home to prepare

special meals. When eaten at their harvesting sites, mussels are boiled in rudimentary pots over a fire, with no condiments added, and eaten from the shell (Figure 21). Sea urchin roe is considered '*o caviar dos pobres*' (poor people's caviar, MK02); it is either eaten raw or roasted right after the urchins are harvested. In the latter case, the roe from many sea urchins is collected in a single sea urchin shell, which is roasted over a fire by the beach. These outdoor meals are often accompanied by bread and sweet coffee, which are normally brought on the harvesting trip. Those resources brought back to the dwellings are shared among relatives and friends. Mussels are eaten boiled in the household (MK04). Crabs are generally taken home, where they are stewed with rice, onions and garlic (MK07). When crabs are cooked they are generally eaten in family meetings that become special occasions. None of these resources have commercial value for people in the community. Nobody harvests them for trade purposes and they are not even featured in the menus of the local restaurants.



Figure 21. Mussels and sea urchins cooked in situ

Chapter 5. Terrestrial Ecosystems

Harvesting activities associated with terrestrial ecosystems have furnished people in Ponta Negra with foodstuffs, construction materials and medicines since long before living memory can recall. Although natural resources harvested and produced in terrestrial ecosystems have declined in relevance over recent decades, the diversity of land-based activities in Ponta Negra and the resources associated with them remains high. Harvesting activities taking place in terrestrial ecosystems include shifting agriculture, home gardens, hunting, the collection of timber and non-timber forest products and crayfish harvesting. Each activity is associated with particular natural resources, locations, material assets, actors and places and also to several social, regulatory and environmental conditions that either enable or hinder their performance.

This chapter describes the ethnobiology of natural resources and harvesting activities associated with terrestrial ecosystems. The first section examines shifting agriculture in relation to the forest successional stages, the production of manioc flour and the land tenure and sharing networks associated with this practice. The second section describes the forest according to the harvesting activities and resources associated with this ecosystem. The third section examines hunting from the perspective of people who used to conduct this harvesting activity before it was banned by the environmental authority. Finally, the discussion focuses on the changes in use and perception of natural resources and landscapes in times of change. Table 9 presents a summary of terrestrial activities and resources.

5.1. Shifting Agriculture

5.1.1. Plots: Types and Composition

Shifting agricultural activities are a legacy that Brazilian rural populations, including the inhabitants of coastal Atlantic forest, inherited from Indigenous Peoples (Adams 2000, Dean 1996). This type of agricultural activity has been identified as one of the key factors that has modified the landscape in the coast of Rio de Janeiro state (Adams 2000), where Ponta Negra is located. Shifting agriculture used to be the primary source of bitter manioc, which is the basis of manioc flour, a staple foodstuff of rural

populations throughout Brazil (Dean 1996). The historical relevance of shifting agriculture in Ponta Negra becomes evident when people talk about who they are and where they come from. *Roça* means both the practice of shifting agriculture and the place where it happens. Mature adults are proud of referring to themselves as being from the *roça* when talking about their origins and identity: "*eu sou da roça*!"

Shifting agriculture takes place in the low hills in the vicinity of Ponta Negra. A walk along the trails in the area or a glance at the surroundings of the community through a satellite image suggests intense cultivation and different successional stages of the forest. Although these signs of intense use show how important shifting agriculture has been in the community, this practice has lost the prominence it once had. The main drivers behind this loss of relevance are improved access to store bought foods, cash resulting from the commercialisation of marine resources and wage labour in the industrial fishing sector (Chapter 6, 7). Additionally, the environmental regulations that came with the declaration of the REJ, a protected area with restrictive use, have banned the opening of new plots in the forest, hence limiting the area available for crop rotation (Chapter 8). The outcome of these drivers is fewer people involved in agricultural activities, less area cultivated and higher dependence on store-bought foodstuffs.

There are a total of sixteen shifting agricultural plots in use by community members in which food for home consumption is produced. These plots are actively cultivated and looked after and are located both inside and outside the community. Additionally, there are at least two abandoned plots in the forest from which people continue to collect plantains and tubers as well as two other plots that are exclusively used as bait areas for attracting game. Table 10 summarises the different types of agricultural activities contributing to households in Ponta Negra, the households associated with each operation as well as size and location of each plot.

Table 9. Terrestrial activities and resources in Ponta Negra

Activity	Natural resources	Location	Material assets	Actors and Networks	Access and Institutions	Outcomes
Agriculture **Shifting agriculture**	Tubers (mainly manioc, sweet potato, yam), plantain, corn, sugar cane, beans	Plots on the hillsides close to the community	Agriculture equipment (shovels, hoe, machete)	Family activity, male household head coordinates activities, other family members collaborate	Protected Area Management (PAM) limits opening new plots Local institutions for land tenure and sharing food Vandalism and thieving	Foodstuffs for household consumption and exchange
Home garden	Medicinal plants, leaf vegetables, tree fruits, domestic fowl	Surrounding homestead		Women and young children look after and collect from the household garden	Plagues such as leaf cutting ants destroy crops Vandalism and thieving	Foodstuffs for household consumption and exchange
Hunting* **Forest: tree stand hunting and trapping**	Forest dwelling mammals and birds	Trails inside primary forest	Shotguns, ammunition; rope, wire and machete for building traps	Adult males	PAM discourages traps in the forest and regulates firearms PAM limits game to household consumption only Institutions for safety and distribution of food	Game for household consumption and exchange
Roça: tree stand hunting	Forest dwelling mammals	Cultivation areas, including areas specially prepared for hunting				
Bird hunting and trapping	Songbirds	Trails in the vicinity of the community	Slingshots and home-made cages/traps	Male children and young adults		Birds for consumption and decoration
Collection of timber forest products	Timber	Secondary and primary forest	Axe and chainsaw	Mainly male adults with assistance from adult females and children	PAM discourages logging; legislation unclear	Lumber for home construction; canoe and paddle making
Collection of non timber forest	Palmito and forest fruits	Forest trails and palm stands	Axe and machete	Family activity	PAM limits palm heart harvesting to	Fruits and nuts consumed in-situ and in

Activity	Natural resources	Location	Material assets	Actors and Networks	Access and Institutions	Outcomes
products					household consumption only	the household; specialty foods (palm hearts) Materials for handicrafts sold to tourists
Crayfish harvesting	Crayfish (3 species)	Creeks in the vicinity of the community	Small nets, fork spear and homemade spear-gun	Children		Food for household consumption

*Hunting was deemed illegal in Ponta Negra after the declaration of the Juatinga Ecological Reserve in 1992. The data I present in this section correspond to narratives from hunters who were active before the declaration of the protected area.

Table 10. Shifting agriculture plots in Ponta Negra

Type of Plot	Main household	Households associated	Approximate size (Has)		Location
			Total/ Average	Cultivated / Average	
Outside the community (cultivated in 2010)	LH04 (1)	3	3.70	0.42	Cataco Hill
	Li06 (2)	2	2.74	0.49	Comprido Hill
	Li04 (3)	2	3.90	0.40	Selado Hill
	Li02 (4)	2	1.10	0.2	Masimiano
	Li08 (5)	2	0.50	0.15	Cataco Hill
(Looked after)	LH05 (6)	1	0.59	0.59	Masimiano
	Li08 (7)	-	0.94	0.94	Masimiano
	Total	**12**	**13.47/ 1.92**	**3.19 /0.46**	
Backyard	Li05	1	0.18	0.18	Ponta Negra
	LH03	1	0.6	0.6	Ponta Negra
	LH09	2	0.4	0.4	Ponta Negra
	Total	**4**	**1.18/ 0.39**	**1.18/ 0.39**	
Abandoned plots	MK05	1	0.66	-	Selado Hill
	LH07	2	1.45	-	Selado Hill
Hunting plots	Selado Hill	1	-	-	Selado Hill
	João Hill	1	-	-	João Hill
Plots in other communities close to PN		**4**			Cairuçú das Pedras

The six shifting agriculture plots outside the community use different management strategies. The plots cultivated in 2010 (1 to 5) consisted of small active areas (between 0.15 and 0.49 Has) located within bigger areas that had been previously cultivated and left fallow (between 0.5 and 3.9 Has). As soon as the productivity of a plot declines, the farmer moves to another plot within the previously cultivated area. Environmental regulations (Federal Decree 750, Brasil 1993, and Atlantic Forest Law, Brasil 2006, 2008), which prohibit opening new plots in primary and secondary forest, have confined plot rotation to already used areas. Likewise, farmers prefer to use these areas because they are close to the community settlement and are also still productive enough to make shifting agriculture worthwhile. The other plots outside the community (i.e., 6 and 7) are cultivated to their full extent and do not have a fallow area. These latter plots were not slashed, burned or cultivated during the time of the research, but were looked after and harvested.

Backyard plots have similar structure and composition as actively cultivated plots, but are smaller (average 0.39 Has) and lack a fallow area. In these plots people prefer to cultivate sweet manioc as it requires less processing and infrastructure than bitter manioc and does not pose a threat to the livestock that forage around the homesteads. While sweet manioc is edible after being peeled and boiled for a few minutes, bitter manioc contains toxic cyanides that need special treatment. This kind of manioc is only edible after it is turned into flour (a process I describe in more detail below: see Section 5.1.4).

There are also two abandoned plots that are harvested on a regular basis, but are not actively tended. Community members asserted that in places with high humidity the forest does not displace cultivated plants, but rather coexists with them. During a walk in the forest with some community members, including a 70-year-old elder, I was shown a stand of *banana-prata* (silver banana) in the understory close to a trail. This stand has been harvested for as long as anybody can remember. In addition to being a source of foodstuffs, these plots in the forest also represent a repository of genetic diversity as some community members collect cuttings from the banana plants located in these sites and transplant them into their home gardens and new plots in the forest.

While the actively cultivated plots have drier and more sun-exposed microhabitats, the plots that have not been cultivated recently tend to have thicker vegetation, higher humidity and cooler temperatures due to forest succession. After a shifting agriculture plot is left fallow, the areas that are the farthest from the forest are colonised by pioneering grasses and other herbaceous plants that rapidly outgrow the cultivated plants. The areas in the margins of the plot that are closer to the forest go through a succession process in which the cultivated plants co-exist with the forest plants. While plantain trees, lemon trees and cultivated yams dominate the understory, tree species typical of the primary and secondary forest dominate the canopy. Farmers take advantage of this differential succession by cultivating plants in the marginal areas of the plots. With time, these areas grow into mixed assemblages of wild and domestic plants that require less care and still yield several edible species that are important in the community. This diversity of microhabitats allows for a high diversity of cultivated plants. A total of 33 edible plants were registered in the different kinds of plots (Appendix 2).

The abandoned plots that I registered were originally established by people currently living in Ponta Negra. However, as the aforementioned banana-prata stand shows, there are more plots of this kind spread throughout the forest in the proximities of the community that have such a normalised presence that people do not talk about them or consider them to be cultivated areas. Different succession stages and even abandoned buildings within secondary forest are examples of the intense use this area has historically had. The fact that the Ponta Negra landscape, even the areas covered with primary forest, shows so many signs of human activity is a testimony of the active relations that people have had with the terrestrial ecosystems over the many generations that they have lived there.

Hunting also used to be linked to some agricultural activities in the community. It was common to find tree stand hunting platforms (*espera*) beside agricultural plots (LH02). Some community members also had plots specially cultivated to attract game. These baiting plots were small and located either within the forest or close to it (see Section 5.3 for more details). I only identified two hunting plots, but similar to the case of abandoned plots, it is possible that there are more of these plots along the hunting trails that I never visited and people did not recall during the interviews.

5.1.2. Forest Succession and Rotation of Plots

Shifting agriculture involves land preparation, cultivation, plot maintenance, harvesting and the preparation of manioc flour, which is the main product of shifting agriculture. Each step in the shifting agriculture process involves actors who hold specific knowledge of processes and seasons and perform particular activities. Forest succession patterns, soil quality, the direction of the wind, the phases of the moon and key moments in the rainy and dry seasons are examples of ecological knowledge taken into consideration at the time of cultivation. The involvement of family members and other people associated with a particular shifting agriculture plot varies at each stage. While the male household head is in charge of preparing the soil, planting and harvesting, women and children normally are the ones in charge of weeding.

Shifting agriculture occurs in relatively poor soils and its productivity relies on

taking advantage of forest succession and its associated recycling of nutrients (Adams 2000). Forest succession varies according to the topography, history of use and soil quality of each plot. There is no clear or straightforward answer for how long a plot should be used or how long it should be left fallow. General forest succession patterns are used to explain the rotation of shifting agriculture plots.

The main forest succession stages are the planted plot (*roça*) and different fallow (*pousio*) succession periods: early second growth with colonising grasses, ferns and other pioneering bushes (*capoeira*); late secondary growth with distinguishable understory and canopy (*capoeirão* or *mato fino*); and, fully-grown forest that resembles primary forest (*mata virgem*). A given plot may be used for between two to seven years. How long a particular plot is used, however, depends on the topography, proximity to the household, quality of the soil and how often it has been used in the past. A farmer explains how long he has been using a plot on the steep hill of Cataco:

> I have planted for three years in a row here and it is still producing. Every time I planted there, the manioc grows pretty good. So, as long as it keeps producing good manioc, I continue planting. When the soil is good (*forte*) I normally plant in the same place for between two and four years. When the soil is bad (*fraco*), I plant for a year and then move elsewhere. It all depends (TK04).

These plantation times and the rules of thumb used to determine when to move to a new spot are consistent with what other community members said (e.g., TK06). People plant until the soil becomes depleted. While places with good soil are productive for up to seven years, in places with bad soil the plantation period can be as short as one year. In other neighbouring communities, such as Cairuçú das Pedras, where the planting areas are not as steep as in Ponta Negra, the plantation time is often longer. A resident from that area reported normally planting continuously in the same spot for periods of between five and seven years before moving to a new plot (Fieldwork Journal, October 2010).

New plots are selected on the basis of factors such as the smell and texture of the soil:

> When we are going to a new place to plant we take into consideration the smell of the soil, the stronger the better. If the smell is not strong (*cheiro fraco*), we would plant there, but it is not good land. It does not produce well. The soil that has a lot

> of sand is not good for planting either. Good soil has to be muddier than sandier (TK04).

The regeneration of the forest also depends on the quality of the soil, which in turn depends on history of use. The places that have been overused in the proximity of the community already have their soils depleted and the forest has not grown back despite being abandoned for decades. This is the case of the areas adjacent to the trails to Morro Indaiá, where only ferns and some pioneering Melastomataceae shrubs grow. Other places with more frequent rotation take up to four years to reach the capoeira stage, 20 years to reach the capoeirão stage and about 25 years for the forest to resemble primary forest (*mata virgem*). This distinction as to whether a plot grows back into *mata virgem* or not has become particularly relevant to people in the area because the continuity of shifting agriculture practice depends on it (see Section 5.2 for an explanation of terms related to forest successional stages).

After the declaration of the REJ (circa 1992) and the passing of the Atlantic Forest Law (Brasil 1993), the INEA (*Instituto Estadual de Ambiente*) prohibited opening new plots in primary forest and planting above 150 m above sea level. These regulations, though, are not explicit in the interim management plan of the reserve (Brasil 2005). In order to avoid problems with the environmental authority, community members have no choice other than to continue using the plots that are already open and to not let the forest regenerate, as they face the risk of losing their rights of use if they do so. Here a community member gives his insight on the matter:

> In Ponta Negra we do not let the soil rest for long. We plant continuously, year after year, until the manioc grows lean. After that we let the soil rest for a couple of years and then start again. We cannot let the patches re-grow into secondary forest because, if we do so, we would have to open new patches in the forest and the environmental authority prohibits that *(*TK02).

These regulations are found counterproductive to the natural succession processes of the forest and therefore the environmental authority is blamed for the environmental degradation occurring in the surroundings of the community (Fieldwork Journal, December 2010). There is general agreement in the community that the soils in the available plots are becoming less and less productive. In spite of these challenges and declines in productivity, shifting agricultural plots continue to provide important

components of many people's diets. Manioc flour is an example of a complex, knowledge intensive food produced locally that many families take great pride in. The following section examines manioc and manioc flour production as an example of the crop cultivation and transformation associated with shifting agriculture in Ponta Negra.

5.1.3. The Context of Making Manioc Flour

The most important products from shifting agriculture are manioc and manioc flour. Therefore, a great deal of effort revolves around their production and many of the other products produced and harvested from the agricultural plots gravitate around manioc production and processing activities. Manioc and manioc flour production are a fluid and multi-situated process that involves the interaction of knowledge and skill of numerous actors in multiple contexts. Here one community member outlines some of the knowledge involved in cultivation:

> My father had experience working in the roça. He knew the time for cutting and burning the forest, which slope sides where best for every kind of plant, which was the good moon for planting. All the things somebody needs to know to have plentiful harvests with no pests (LH09).

Narratives like this point to some of the important dimensions of knowledge and experience involved in shifting agriculture and the production of crops, such as manioc. The main stages of shifting agricultural production include brush or forest clearing, burning, cultivation, cleaning and coppicing, harvesting and flour making.

Shifting agriculture activities are often coordinated by the adult males in the households and involve multiple family members during each production stage. Likewise, shifting agriculture not only involves the entire nuclear household, but also includes members from other households (Table 11).

All the stages of manioc production before harvesting and manioc flour making are carefully timed with the season and the phase of the moon. Forest clearing and burning are wintertime activities conducted mainly by the adult males of the household with sporadic collaboration from younger males when they are not fishing outside the community. Winter is the season with the lowest precipitation. Farmers take advantage of this by cutting the forest in the selected cultivation plots at the beginning of the dry

season (i.e., June) and leaving the brush (*chigueira*) to dry for between one and three months (Fieldwork Journal, June/August 2010). The brush is then gathered into mounds in preparation for burning.

Table 11. Shifting agriculture stages

Stage	Actors	Time of the year
Forest clearing	Adult male – directs Teenagers and young males participate	June – August Dry season
Burning	Adult male – directs Teenagers and young males participate	August – September Between one and two months after slashing Before seasonal rains
Cultivation	Family activity	August – September 1 month after burning
Cleaning and coppicing	Adult female directs – Children and young female adults participate	Weeding - 1 starts month after planting Coppicing of manioc – 6 months after planting
Harvesting	Family activity	Sweet potato 3 months Beans and corn 6 months Sweet manioc 9 months Bitter manioc from 12 up to 24 months
Flour making	Adult male- coordinated Involves nuclear household	Right after harvesting bitter manioc

"*Botar fogo*", or burning, is timed with the arrival of the rainy season. As soon as farmers learn of impending rain, which is predicted by listening to meteorological reports on the radio, they rush to do final preparations for setting fire to their plot according to wind direction. The preparations involve opening a fire barrier about two metres (2m) wide with a hoe (*enxada)* between the plot and the forest. Fire is then set. The first fire is started from the fire barrier. Then, at the opposite end of the forest plot, and against the wind direction, the second fire is set (Fieldwork Journal, July/August 2010). Fires are set generally in the afternoon as soon as it starts to cool down and are continually looked after. This controlled burning strategy allows the fire to be managed so that it does not get out of control and ignite the surrounding forest (Figure 22).

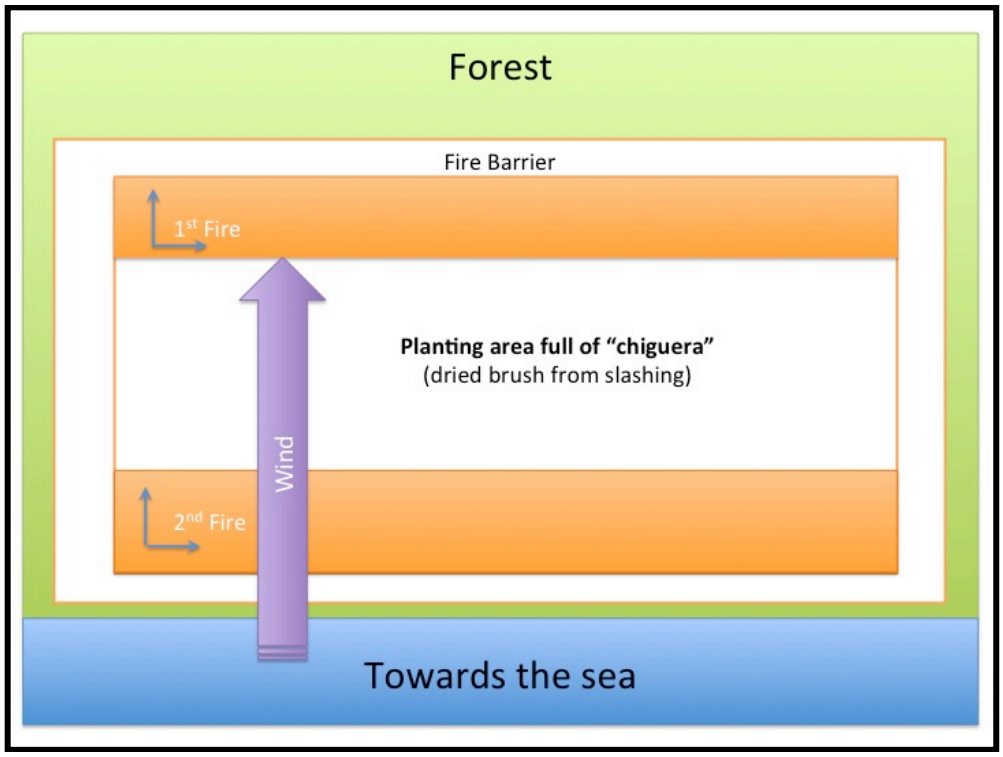

Figure 22. Fire management in relation to wind patterns

Cultivation occurs a month after burning and is timed with the phases of the moon. People in the community not only avoid planting, but also refrain from conducting other activities (e.g., cutting wood and even receiving surgery), during the new and waxing moon. Domingo talks about the relationship among moon phases, cultivation and other aspects of everyday life:

> You cannot perform any agricultural activity during the new and waxing moon. During that time the moon has too much force, which causes plants not to grow properly. You can plant only three days after the waxing moon. That is why you have to pay attention to the moon. If you plant banana over the moon, what you harvest is rock solid. If you plant sugarcane in the wrong moon it gets full of bugs. The same thing happens when you cut wood. If you cut wood during the force of the moon, the wood you cut gets full of bugs. You have to wait for three days after the moon changes to be able to plant or do anything. If you get surgery during the times the moon is strong you won't heal easily. "*A lua mete com tudo*" (the moon messes with everything) (TK04).

Cultivation is the most intense stage of shifting agriculture. During this stage, which coincides with the leanest time of the year in the local commercial fishery, those actively involved in agriculture land their fishing gear. Those household members cultivating plots far from the community – as is the case of the families with agriculture

plots in the Masimiano area or those with families in the neighbouring community of Cairuçú das Pedras – move temporarily to their plots. Those with plantations close to the community stay in their regular dwellings and visit their plantations daily.

In preparation for cultivation the male household head collects manioc stalks from plots in the vicinity, often from older plots or from the plots tended by relatives. The farmer cuts stalks of approximately 1.5 m in length, which are transported to the plot, where they are kept overnight and planted the following day. Before planting the stalks are cut into 30 cm pieces (Fieldwork Journal, August/September 2010).

Planting is a labour intensive activity that involves all the members of the household. Normally the males in the household turn the soil (*cabocar*) making mounds where the sticks are to be planted. Younger children (i.e., between four and eight years old) follow those turning the soil spreading out the manioc stalks on the mounds prepared for planting. Lastly, the women and older children (i.e., older than eight years old) are in charge of burying the stalks. Planting parties normally range from five to twelve people. This number varies according to the number family members available.

Farmers have two considerations regarding how to bury the manioc stalks: direction and depth. In terms of direction, the stalks should be buried in the same direction they were growing in the original plant. To be sure about this, the stalks are inserted with the buds pointing upwards. The depth at which the stalks are buried depends on the prevailing weather conditions around planting time. When it is rainy the manioc stalks are left close to the surface so they do not get buried under wet soil, which makes germination harder. When it is hot and dry the sticks are dug deeper so that the sun does not dry them out. Whether the stalks are covered or not is a decision made by the farmer *in situ,* at the time of planting (Fieldwork Journal, August/September 2010).

After planting, shifting agriculture requires maintenance that is limited to cleaning and coppicing. About month after planting, women and teenagers are in charge of cleaning the plot. This consists of weeding with a hoe and covering the manioc plants with soil up to the lowest growth of leaves. Coppicing happens around six months after planting, when farmers cut the manioc plants down to 50cm above the ground. Manioc

plants are coppiced so that their roots can grow thicker (*"as raízes ficam mais grossas",* Fieldwork Journal, January 2011).

While planting happens around the same time of the year, harvest times depend on the variety of manioc and other cultivated foodstuffs. Sweet potato is harvested after three months of cultivation and beans and corn after six months (TK05). While sweet manioc can be harvested after nine months, bitter manioc requires a year to reach maturity. Sweet manioc does not require processing after harvesting. It is normally consumed boiled as a side dish or deep-fried as a snack. Bitter manioc has the advantage that it can stay in the ground for up to two years without rotting (TK03). This property of bitter manioc turns it into a resource that people can use in times of need (TK05, TK06). Bitter manioc harvesting happens based on necessity and does not depend on particular season or moon phase (TK04).

Similar to planting, reaping the bitter manioc harvest requires the involvement of all available household members and relatives. It is a labour intensive process that extends from the collection of the tubers to their transformation into manioc flour. The adults, both male and female, start the harvest by unearthing the manioc tubers, followed by younger family members who gather the tubers and clean their lignified tops. Then the tubers are taken to the flour-making house (i.e., *casa de farinha*), where they are turned into manioc flour (see next section).

A flour-making house consists of a hand-powered mill, a press and a wood-burning stove with a top comprised of a large concave metal pan where the manioc flour is toasted. In structural terms, the flour-making house is made of wattle and daub with a thatched or zinc roof. The three flour-making houses left in Ponta Negra are located either close to the plots (i.e., 4, 7) or within the community (1). The latter is used to process the manioc produced in the plots adjacent to the community (e.g., plots 1, 2, 3). Those families with plots outside the community normally stay in the manioc-floor house during the intense periods of cultivation and harvesting/flour making. Regulations from the protected area authority prohibit the construction of any building outside the community area. As a result, flour-making houses located outside the community area cannot be maintained. The impact of these regulations can be seen in the Masimiano area,

where flour-making houses are almost in ruins (Figure 23). These regulations make the future of these buildings and the use of the resources with which they are associated uncertain.

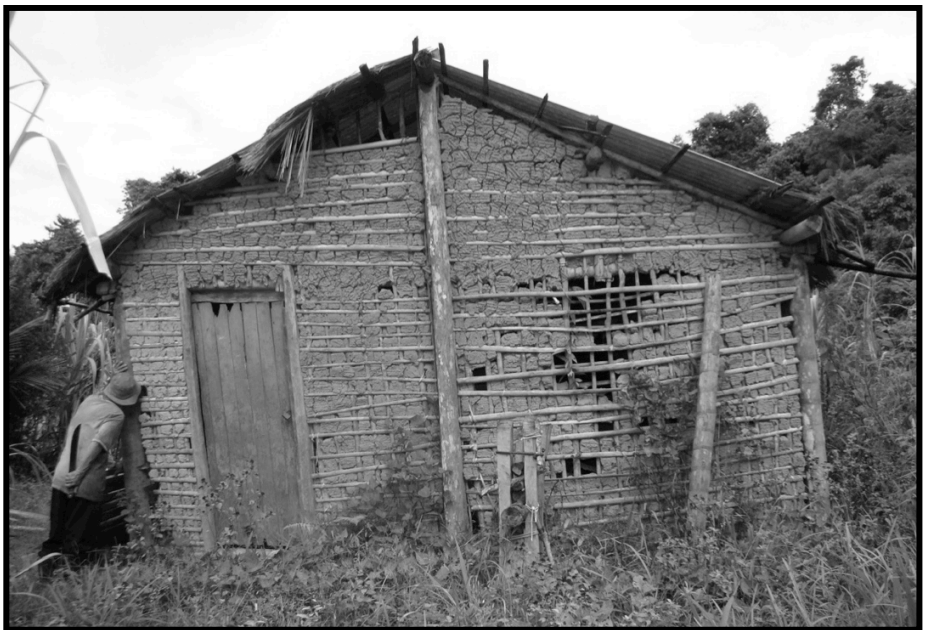

Figure 23. Flour-making house outside the community area

5.1.4. Flour-making Process

Through the flour-making process, the poisonous cyanogenic glycosides naturally contained in bitter manioc are dissolved and digested, making the bitter manioc edible for humans. The making of the manioc flour requires six steps in which the entire family is involved. From peeling to toasting, manioc flour is made over the course of an evening and a day of intense family work.

- Peeling (*descascar a mandioca*): consists of peeling the manioc tubers after their harvest. It occurs outside the flour-making house and involves as many people, including males and females of different ages, and as many knives and machetes as are available. Once peeled, the tubers are washed and grated.
- Grating (*virar*): *virar*, literally means 'to spin' in Portuguese and refers to the action of spinning the hand crank of the mill. After peeling, the manioc roots are grated in a homemade manual mill. While the stronger family members, normally adult males, spin the grating drum, the women or young male children feed the mill with the peeled tubers. Grating happens at night and takes between three and six hours depending on

the amount of manioc being processed. Grating is a non-stop activity that requires attention and collaboration from multiple family members. While some people are involved in the spinning, the remaining people cook or simply make conversation.

- Pressing (*prensar*): the grated manioc is dumped into a stretchy basket (*tipití*) made locally with *timbopeva,* a type of vine widely used for making baskets and other decorative items. Once filled, the basket is pressed with a rudimentary lever weighted down with heavy stones (weighing more than 20Kg each). The manioc is left pressed overnight so it can drain as much liquid as possible.
- Crumbling (*misgalhar*): *Misgalhar* is the Ponta Negra slang for the Portuguese verb *esmigalhar*, which means 'to crumble'. The pasty cake resulting from the pressing is crumbled by hand to facilitate the next step: sifting.
- Sifting (*cuar*): *Cuar* is the local slang for the Portuguese verb *coar*, which means 'to strain'. The paste, which results from crumbling, is sifted through a fine wire meshed strainer (2mm) before it is toasted.
- Toasting (*fornear*): the sifted manioc is stirred in a copper pan built into in the top of the wood burning stove with a narrow wooden shovel. Toasting lasts for at least six hours, until the flour is completely dry. Two people are required permanently throughout toasting: while one is in charge of stirring the flour, the other is in charge of regulating the heat emanating from the stove. These tasks are not associated with a particular gender role. These tasks are allocated to adults who can manage the tools and have the skills to perform them.

The flour resulting from this process is an important part of the daily diet in the Ponta Negra. It is most commonly eaten sprinkled onto rice and bean dishes or with other stews. It acts a thickening agent and offers a flavour and texture that people appreciate and seek. The flour is regularly stored for up to two years. Although it is possible to buy industrially produced, relatively inexpensive equivalents at the grocery store, the people in Ponta Negra with access to shifting agricultural plots prefer eating their own, artisanally produced flour. They prefer the flavour of the flour they produce and enjoy the process and activities surrounding manioc cultivation and production. For these reasons, access to land and the products of that land are embedded in multiple local institutions.

These will be examined in the following section.

5.1.5. Land Tenure and Sharing Networks – Institutions Tied to Agriculture

Unwritten rules (or institutions) that regulate access to land and the distribution of foodstuffs are associated with shifting agriculture. These rules have clear parallels with those related to pound net fishing spots (Section 4.4.1.2). Access to land for cultivation is based on use. Ponta Negra people do not have legal tenure over the plots of land they cultivate (or any land whatsoever). Specific areas around the community have been historically tied to particular families. The users of the Masimiano area (plots 4, 6 and 7), for example, are siblings and descendants of the previous users of this area (Li11, Li13). Additionally, two family groups used the currently abandoned Indaiá Hill during two generations (TK04), while another family has cultivated the area around Comprido Hill for three generations (TK06).

The regulations that ban cutting primary forest to open new agricultural plots not only have shortened the time that land is left fallow, but have also reduced the areas available for cultivation. In response to this, local farmers have regulated access to the use of cultivation areas: anyone is unofficially entitled to a plot for as long as it is used and cared for. The right to use the land can be transferred to whomever they prefer. Although the land normally stays within the family, when there is nobody interested in cultivating it within either the close or extended family circle, the main user has the prerogative to give over their user's rights to whomever they wish.

An active farmer (TK04) provided an illustrative example:

> If anybody wants to cultivate where I have a plot left fallow that person has to talk to me first. If I have been working in a given place for 15 years, that place somehow becomes mine. I have the right to decide what happens and what it is produced there. Somebody from the community came to me recently to ask for a spot in the area I have fallow in Cataco. I said no because he comes from a family that is known to be problematic. I didn't allow him to cultivate in my area because I know how his family behaves and I don't want to have any problems with anybody.

The limited access to new cultivation areas has had compounding effects over the quality of the lands available for cultivation. The areas in close proximity to Ponta Negra have been heavily overused, some of them to the point of not being able to re-generate

their soil nutrients. Old plots can be seen along the first kilometre of the trails that connect the community to other areas. According to the local farmers, ferns (*samambaia*) and sandy soils are indicators of such soil exhaustion. Where this fern is found it means that the soil is not only unproductive, but has lost its regenerative capacity. Therefore, the places close to the community that are available for cultivation are limited. The optimal ones are either in use or left fallow. Those who still want to cultivate, but do not want to venture far away from the community, often opt to plant in areas that have not had enough time to rest. In some cases, even though the soil is low in nutrients and the expected yields are not optimal, some people prefer to cultivate those areas and have access to food they grow themselves.

5.1.5.1. Consumption and Exchange of Produce

The consumption and exchange of produce from shifting agriculture plots mainly has been confined to the boundaries of the community. There was a historical commercial trade in local foodstuffs, such as banana and manioc flour, outside the community (Chapter 6). However, the access to cash enable through local participation in the fishing and tourism economies, coupled with contradictory regulations from the protected area authority, have discouraged the production and trade of food stuffs. Limited production, combined with the structural and functional isolation of the community, has affected consumption and exchange patterns related to agricultural products.

The commercial trade of agricultural products is almost non-existent in Ponta Negra. It is expensive and troublesome to take produce out of Ponta Negra and what is produced within the community, such as manioc flour, has neither high market value nor proper marketing channels that would justify the high transportation costs. At the local scale, there is only one person in the community who has mobilised knowledge and resources from agricultural practice towards the tourism economy. This person is hired by the tourist operators to offer demonstrations of the manioc flour production process to international tourists, who visit the community on guided tours mostly during the winter. Some tourists buy manioc flour by the kilo from the local farmer at just above the commercial price of the industrially produced manioc flour available in the city supermarkets (~$1.0 CAD/Kg).

Other than these few exceptions, local products, particularly manioc flour, are hardly available in the community for petty trade. With the exception of some bananas, which are not supplied on a regular basis, not even the local restaurants offer local products. Community members are aware of this situation and recognise it as an unfortunate outcome of the transition from agriculture to fishing and tourism service provision that many people in the community are experiencing:

> I cannot believe that among about 40 families that live in Ponta Negra nobody will sell you a kilo of manioc flour. While I used to make manioc flour for sale, these days you can see that everything is gone. Nobody plants, nobody produces, and nobody sells (LH07)

The consumption of local agricultural products is therefore mostly restricted to the household, and their exchange is limited to the extended family and a limited network of local households. The rules underlying such exchange are based on kinship, reciprocity and respect. Sharing agricultural products with family, community members and other beings that co-habit the local environment is an intrinsic part of having an agricultural plot: "*We have our roça divided for different purposes. One part is to feed the game, another part for the neighbours, especially those in need, and the other part for our own use*" (LH09).

As mentioned before, the agricultural plots attract game that regularly feed on the produce of the plots. Farmers take advantage of this attraction to hunt the game that visits their plots and they understand that the disturbance that game causes in the plots is a trade-off they have to live with. This is a dimension of reciprocity built into the interactions between people and local fauna. In addition, members of the household and people associated with the plots are entitled to harvest and receive the products of the family plot. People outside the family circle have to ask the farmer's permission to harvest foods from the plots. It is considered a transgression to harvest foods without consent. A farmer expressed his perspective on the informal rules that regulate the exchange of local produce:

> I like to share food with anybody who asks me for it. They ask me for something and then we go to the plot to pick it up. What I don't like is when people go there and harvest things without my permission. I like to keep track of who is using what I produce in my plots. In that way I can avoid misunderstandings (TK04).

Mistrust among community members is common. People frequently refer to theft, not only of agricultural products, but also of small livestock, as a common phenomenon that discourages them from growing or raising certain items. People have often found themselves forced to replace the items they do not grow anymore with equivalents readily available in the food store.

> There are things I can grow, but because of the constant theft and vandalism I am exposed to, I chose not to. This is the case of sugarcane. Since I don't want to grow sugarcane I am forced to buy sugar in Paraty (TK04).

5.2. The Forest: *Capoeira, Capoeirão, Mato*

In this section I outline the multiple relations people in Ponta Negra have with forest resources. In Ponta Negra, the forest (*mato)* is comprised of the multiple succession stages of uncultivated land outside the community. These succession stages include scrubland (*capoeira*), secondary forest (*capoeirão*) and primary forest (*mata virgem*) (for a detailed description see above, section Forest Succession and Rotation of Plots). Harvesting activities that take place in different forest ecosystems frame the relations people have with plants, animals, and the resources that are outcomes of these interactions. People in Ponta Negra interact with the forest through the collection of materials that afford resources for construction, food, medicine and other uses (Table 12; Appendix 3). The most important uses for forest resources are related to construction and food.

Table 12. Uses for forest plants

General Category	Specific Category	Code	Number of Species
Construction	Housing construction	HC	18
	Canoe construction	CC	7
	Furniture	Fu	2
Food	Children's fruit (Fruta das crianças)	FC	15
	Foodstuff brought home	FH	7
Other technology (includes paddles and handicrafts)		OT	5
Firewood		Le	2
Medicine		Me	9
Poison		Po	1
Strengthen nets		SN	2
Game bait		GB	7

5.2.1. Lumber for Civil and Canoe Construction and Other Uses

Harvesting timber is a widespread practice in the community, as this is a basic resource for home construction. The 90 dwellings found in Ponta Negra use local lumber for their foundations, framing and roofs structures as well as doors and furniture. Wood harvesting takes place along the trails that connect Ponta Negra to other surrounding communities. Wood harvesting is a male activity, and, as such, the knowledge to identify which trees to cut, where, when and how is restricted to this gender (TK01).

Once a piece with the needed shape and quality requirements is spotted, people wait for the appropriate moon phase to cut it. Cutting wood during the new or waxing moon is adviced against, as doing it during this time of the month will reduce the resistance and durability of the timber. This is particular important for high quality woods, such as *canela da mata* (*Ocotea elegans*), which, in spite of being a very resistant wood, will rot and become bug-infested shortly after being harvested if it is cut at the wrong time.

Cutting is performed mostly with felling axes. Chainsaws are highly appreciated tools by community members, but are deemed illegal by the Protected Area authority (TK05). After cutting, fine woods are left in the forest for between one and two months. This combination of treatments ensures that the timber will not crack (*vento da madeira*) or bend and that it will be more durable (TK03). Once the timber has been cured, it is cut with handsaws and transported to the community by foot, either on the shoulder or dragged using ropes (TK05). Community members consider this hard work, since, depending on the distance, transporting a single piece of wood from the forest can take one or even two days (TK01, TK02, TK05).

Housing construction involves tree species that provide different qualities of timber. Slow growing, heavy woods that grow in the primary forest are preferred for structural components of buildings, such as house beams, because of their durability (TK01). Fast growing, lightwoods, such as guapuruvú *(Schizolobium parahyba)*, are preferred for roofing structures (TK01). Although the aforementioned categories are the ideal, the limitations tied to harvesting hardwoods imposed by the Protected Area authority and the increased distance required to access high quality timber often force people to harvest

lower quality timber in second growth forest for general purposes (TK01, see Appendix 3).

Canoe construction is also a male-dominated activity. The methods for harvesting wood for canoe construction are similar to those for the fine woods already described for housing construction. Making canoes involves knowledgeable adults and it requires between two and three months to complete a canoe (TK02). Canoes are built through a very delicate process in which the canoe maker carefully carves the log with the help of chisels, machetes and ropes. A canoe is carved where it is felled until the rough shape of its final form is achieved. At this point, family and friends are summoned to transport the canoe from the forest to the closest shoreline. From there it can be towed to the community. This event is locally called *puxada de canoa* (pulling the canoe) and is perceived as one of the most important social events in the community. Once in the community, the canoe is landed and stored in a beach shed where it is finished and painted. During my time in the community this event only happened once (Fieldwork Journal, November 2010).

Although there are five renowned canoe makers in Ponta Negra, three of them do not own a canoe. The few canoes they make are normally sold to people in the community actively engaged in fishing activities, including pound net owners. During the time I spent in Ponta Negra, only one canoe was partially made in there and a professional boat maker in Paraty finished it. The final users of this canoe preferred to have it made this way because they wanted to extend the canoe's life as much as possible by giving treatments to the wood that are not available in the community (Fieldwork Journal, November 2010). Also, two community members bought small used canoes from residents of the neighbouring community Cairuçú das Pedras, which is renowned for the quality of the canoes made there (Fieldwork Journal, October 2010).

The furniture made in Ponta Negra is limited to rustic tables and chairs. People with furniture making skills are constantly discouraged from making products for commercial trade for logistical and economic reasons. The limited supply of materials, as a result of environmental regulations, coupled with the low economic returns and the limited market available for their products offer few incentives (see section 5.2.3). With the growth of

tourism businesses as well as the influx of urban second homeowners (or *veranistas*) the demand for furniture, however, has increased. In spite of rising demand, the monetary compensation carpenters receive for their crafts has remained low enough to keep carpentry from becoming a profitable activity (Li02, Li11, Li13).

5.2.2. Forest Food Resources

Forest food resources fit into two functional categories, which are relative to who consumes them and in what context: *frutas das crianças* (children's fruit) and foods brought home. Frutas das crianças are those fruits community members of all ages come across, generally on the trails, when hunting in the forest, collecting wood for construction or travelling to nearby communities (TK01, TK02). Many adult community members referred to this category of foods in such a way (i.e., frutas das crianças) because children are those who harvest them most actively during their outings in the forest (which generally revolve around hunting songbirds). Likewise, this functional category also reflects the nostalgia adults feel for the time they spent in the forest during their formative years (Li05). Frutas das crianças and the activities that surround their harvest represent an important dimension of the process by which plants in the forest become socialised among people in the community.

Frutas das crianças include at least fifteen plant species found in different successional stages of the forest, but mainly in primary and secondary forest. They are harvested from the end of winter onward throughout spring (TK01, TK02). These fruits are eaten *in-situ* and rarely brought back home. This functional category includes nuts from three palm species (see Appendix 3), germinating sprouts from palm trees species (e.g., coco preto, *Astrocaryum aculeatissimum*), fruits from timber-producing trees and from understory trees, shrubs and lianas. Ponta Negra people explained that some forest fruits can qualify as either a fruta das crianças or a foodstuff brought home depending on where it is consumed. This is the case of forest palm nuts that are consumed on the trails or brought home as snack.

In addition to frutas das crianças, people in Ponta Negra also have the foodstuffs harvested in the forest that are consumed at home. Palm hearts from two species, palmito-

jussara (*Euterpe edulis*) and palmito-amargoso (i.e., sour palmito; *cf. Syagrus pseudococos*), are likely the most important forest foods fitting within this category (TK01, TK06). While people in general prefer palmito-jussara, only a few people like palmito-amargoso. Palmito hearts are eaten raw, boiled for salad or turned into savoury cakes.

Harvesting palmito hearts is not an activity everybody in Ponta Negra partakes in. Because it is an activity that neither happens regularly nor has a specific season, it is hard to quantify how many families harvest palmito or how much palmito is harvested. A pound net crewmember explains his rationale for harvesting (or not) palmito: *"I harvest palmito, but it is hard. Even though there are areas where I can harvest palmito close to the community, my household and pound net obligations leave no time to go there and harvest it*" (Li13). Only four families harvested palmito actively during my time in the community. For them, this is a family activity undertaken during weekends or free time.

While the adult males are in charge of cutting the palm trees with felling axes, women and children peel the palm hearts using machetes (Fieldwork Journal, June/July2010). These palm heart-harvesting outings I joined were full of play and laughter. Harvesting palm hearts comes with an opportunity to go outdoors, have a good time and enjoy the forest with family and friends. Palm hearts also represent an alternative source of food when bad weather does not allow people to fish or go to Paraty to buy groceries (Li12). Unlike forest fruits, palm hearts are available year round.

As with other forest resources, the protected area authority has regulated the harvest of palm hearts (Li02). People in the community can harvest as many palm hearts as they wish, but only for household consumption. Even though this regulation exists in theory, it is unambiguous in practice. People in the community are afraid of talking about this activity because of the unclear enforcement surrounding it since the protected area was declared.

5.2.3. Other Technological Uses

"Other technological uses" is a functional category that includes forest resources employed for making paddles and handicrafts. It encompasses at least five species of

plants: two species are employed for making paddles [e.g., caxeta (*Tabebuia cassinoides*)] and one for wooden handicrafts, such as toy boats [guacá (*Pausandra morisiana*)] (TK02, TK05). Baskets are produced in the community using various species of forest vines, such as timbopeva (*Heteropsis* sp.) and imbé-zipo (indet.) (Li11).

Four people in the community are widely renowned for their skills in making handicrafts. They all recognise that these skills have not been part of their family tradition, but that they have acquired them on their own, mostly by imitating other people outside the community (Li13, LH03, TK02, TK 05). Even though baskets are widely used in the community for transporting fishing gear and small fish and squid catches, community members currently use baskets manufactured in neighbouring communities and even ones bought in Paraty whose origins are not certain. Superficially, handicraft making may look like an alternative source of income as baskets and paddles are used by community members and can be sold to tourists either in Ponta Negra or even Paraty. However, handicraft makers recognise the limitations on handicraft income generation due to isolation and lack of social networks in this particular trade:

> I have sold handicrafts here and even in Praia do Sono, but I don't do it anymore. For handcrafting to be profitable you need a fixed buyer. In that way you are sure that all that is made is going to be sold. When you do not have such a buyer you ended up losing time making and trying to sell your products. Making crafts demands time, if you can't sell those crafts you ended up losing money… Also, things sold here [in the community] are not well priced. While a paddle is sold in Paraty for $35 or $40 CAD, here we cannot sell them for more than $15 CAD (Li13).

Additionally, the unclear official regulations governing the use of forest products discourage people from harvesting raw materials for handicraft making. This is particularly relevant in the case of vines necessary for making baskets. This combination of factors has resulted in general lack of interest of community members to make handicrafts either for themselves or for the limited available markets.

5.2.4. Firewood

Some people in the community cook using firewood burning stoves. While those with the lowest incomes only have this option, the rest use these firewood stoves to save propane gas, as an alternative during gas shortages, or simply because of the flavour associated

with cooking particular recipes with firewood (e.g., stewed beans and fish, Fieldwork Journal June 2010/January 2011). Normally women and young children are in charge of collecting firewood in the vicinity of the community. When they do not collect brush from the newly cut shifting agriculture plots, they collect wood from pioneering species in scrublands. Although any kind of available wood can be used as firewood for cooking, there is clear preference for pimentinha (*Erythroxylum vacciniifolium*) and aroeira (*Schinus terebinthifolia*). These species are preferred because they are readily available and can sustain heat for long periods of time (TK01).

5.2.5. Medicinal and Poisonous Forest Plants

Medicinal plants are divided into two functional categories "*medicina mansa*" (good medicine) and "*medicina brava*" (dangerous medicine) (TK02, LH03, LH06). Medicina mansa comes from plants that are regularly used and can be easily identified. Medicina brava comes from plants that require a lot of care when handled. This kind of medicine involves plants that are used not only for healing, but also as poison to control pests and even for *macumba* (witchcraft) (LH06). The last use is something some elders mentioned in passing, but were not keen to discuss. The Pentecostal church has become highly influential in the area over the last few decades and has prohibited practices related to magic (LH06).

The medicinal knowledge of forest plants in Ponta Negra is multi-gendered and processual. Both men and women know medicinal plants, yet they know different dimensions of the same material entities. Wives and mothers often ask the men who visit the forest regularly to bring medicinal plants home from their outings. While the men know ecology, location of and required parts of the medicinal plants, women are the ones in charge of their preparation (Fieldwork Journal, September 2010/ January 2011). Medicines from forest plants are used to treat a wide variety of conditions, including parasites, painkillers (ingested or applied topically), as well as kidney, lung and intestinal ailments (TK01, TK03).

Some examples of medicinal plants and their uses are *carobinha, bicuíba, bacuparí* and *jataí*. Other examples can be found in Appendix 3 under the category of medicinal

plants. The leaves of carobinha (*Jacaranda caroba*), a scrubland shrub, are boiled to treat scabies. The affected person has to bathe with the infusion while it is still hot. The oily seeds of bicuiba (*Virola bicuhyba*) are rubbed over wounds and minor cuts to accelerate healing (TK01). Parts and exudates of bacuparí (*Garcinia gardneriana*) and jataí (*Hymenaea courbaril*) are used to treat throat ailments. In the case of bacuparí, a cut is made on the bark of the tree to gather its latex, which is left to flow for between two to tree days until it hardens. The final product is sucked as a candy to clear the throat. The bark of this species is also cooked and used as an infusion that acts as a pain reliever for stomach illnesses (TK01). Jataí is processed in a similar way as bacuparí. The hardened resin, called "*pedra de jataí*" (a stone made with hardened sap), is used to treat bronchitis, asthma and other pulmonary ailments. Bicuíba, bacuparí and jataí are trees found only in the primary forest (TK01). The locations of these tree species are well-known by community members and often represent important markers in the trails that connect Ponta Negra with other communities (Fieldwork Journal, October 2010).

5.2.6. Strengthening Nets

In addition to the aforementioned resources that forest plants afford, people in Ponta Negra also use some forest plants to give to the pound nets what is locally called *banho de resistência* (resistance bath). The most important forest plants used for this purpose are *quaresma* (*Tibouchina* sp.) and *mangue* (*Calophyllum brasiliense*), which are shrubs that grow in early forest succession stages (Fieldwork Journal, August 2010). The bark of these tree species is stripped, pounded with stones and boiled in a steel drum for over six hours. The hot solution is poured into a dugout canoe, where the nets are soaked overnight. This bath dyes the nets so they are invisible to the fish, cleans the algae that accumulate on the nets while in the water and provides added resistance to the fibres. Banhos de resistência are given to the nets every time they go through major repairs. This happens at least once a year and is timed with the fishing off-season during the cold months (Fieldwork Journal, August 2010).

5.2.7. Bait for Hunting

People in Ponta Negra are knowledgeable about the ecology of the animals they use and employ this knowledge to their own advantage. Game food is a functional category that

brings forth some of these complex relations. People used their geographical knowledge of plants in the forest to locate hunting sites (*fruteiro*) or to collect fruits to trap game (TK01). The first was the case of forest trees, such as bacuparí, bicuiba and *jabuticaba* [*Myrciaria* sp., (*sensu* Giraldi 2012)]. Through constant monitoring people knew when and where trees were fruiting (TK01, TK02, Ln03). During their fruiting season, the hunters in the community made tree stands (*espias*) close to fruiting trees frequently visited by game (Fieldwork Journal, August 2010). In the case of using forest fruits as bait, children and young adults used to collect *aroeira (Schinus terebinthifolia)* fruits in the scrubland and use them as bait to capture various species of sabiá (*Turdus* spp.) with homemade traps during the altitudinal migration of these species (see Section 5.3.2) (Ln01).

5.3. Hunting

Hunting was considered illegal by the environmental authority after the declaration of the REJ and currently is not undertaken in Ponta Negra. The people who cited and explained the hunting techniques below drew on their memories and experiences from their childhood and youth. These accounts are useful to illustrate the intimate relationship that people in Ponta Negra have had with their local environment, in this case the forest and the animals that live there. Through hunting activities people, animals and forest used to interact, forming complex networks that enabled the flow of resources. Hunting not only supplied fresh protein during times of scarcity, but it was also an activity that people enjoyed and sought out to partake in. Hunting and the resources it afforded were particularly important for some families during the winter months when fish became scarce and bad weather made leaving the community to buy food more difficult:

> I liked to hunt, but I mostly did it during the weekends, when I had time. I hunted mostly macuco, porco do mato and jacú. Hunting took place during the winter when the sea is rough and it is hard to fish or bring food from Paraty. I also hunted when I wanted to eat wild game (Li13)[7].

With the exception of hunting birds with slingshots, the hunting activities that took place in the forest were limited to male adults. They were in charge from locating and taking

[7] See scientific names in Table 13.

the animals to their cleaning, while women were the ones who normally did the cooking (Fieldwork Journal, August/September 2010).

Being a successful hunter required being fully able to locate oneself within the complex networks of trails existing in the forested areas close to the community (Ln03). Knowledge of trails and places was paramount for hunting not only because it was useful for locating prey, but also to communicate to family and other community members when and where hunting activities took place (Ln03). The exchange of this kind of information was useful to reduce hunting pressure on particular areas of the forest and to avoid dangerous encounters among different hunting parties (Chapter 8). A community member talks about the relevance of the knowledge of places and communication in the forest and how holding knowledge was a reflection of the intimate relation between resource users and the local environment:

> In Ponta Negra every active hunter had a very clear idea about where everything in the forest is: trails, good hunting areas, fruiting spots. Every place with a name could be found by anybody in the community. Everybody knew its exact location, like an address in the city (Ln03).

5.3.1. Hunting and Game Ecology

Hunting activities were associated with the ecology and behaviour of the targeted animals. The hunting strategy was determined by whether the target animals were diurnal or nocturnal. In Ponta Negra, hunters had passive and active strategies, which, according to targeted species, involved particular actors and gear and were conducted in particular locations (Table 13). Passive hunting targeted a wide variety of animals, independent of whether they were diurnal or nocturnal. This hunting strategy included unattended stationary traps, such as deadfall traps (*mundéu)* and snares (*laço)*, and attended tree and platform stands. Active hunting included tracking animals using firearms, dogs and slingshots.

Nocturnal animals, such as paca and armadillo, were hunted from tree stands (*espera*) by fruiting trees (*fruteiro*) and baited spots (*ceva*) inside primary and secondary forest, as well as in shifting agriculture plots (*roça*) (TK02, Ln03). Diurnal animals, especially forest birds (i.e., guans and quails), were tracked along forest trails (TK02). Some other diurnal mammals, such as wild boar and agouti were hunted from tree stands

close to regular shifting agriculture plots or plots especially planted to attract game (*roça de ceva)*. Agouti, a delicacy, was known to be particularly elusive and hard to hunt (*esperta*) (Ln03). Predators, such as the jaguar (*Panthera onça*) and other forest felines were known to have both nocturnal and diurnal habits, but were not hunted because their meat was not considered edible (LH08).

Table 13. Hunting* techniques and associated actors and resources

Type /Technique	Targeted Resource	Actors/ Gear	Location
Trapping	Terrestrial mammals: Porco do mato (collared peccary, *Pecari tajacu;* white lipped peccary, *Tayassu pecari)* Cutia (agouti, *Dasyprocta azarae*) Paca (*Agouti paca*)		
***Mundéu* – deadfall trap**		Males in the family, coordinated by adult males / Rope (or lianas), machete	Primary forest, on heavily transited game trails
***Laço* – snare trap**		Adult males / rope, machete and shotgun	Primary forest close to fruiting trees, shifting agriculture plots or baiting spots
***Zarpão* – small cages**	Sabiá (Various species of Thrushes, *Turdus* spp.)	Children and young males / home-made trap made with local reeds (sp. Indet)	Forest understory close to the community
***Espera/Ceva* Tree stand hunting**	Same as deadfall and snare traps	Same as snare trap, plus old net (as hammocks)	Same as snare trap
Active Hunting	Tatu (armadillo, *Dasypus novemcinctus)* Jacú (forest guan, *Penelope obscura*) Macuco (solitary tinamou, *Tinamus solitarius*) Uru (spot-winged wood quail, *Odontophorus capoeira*)		
***Rastreamento* - Tracking**		Adult males / shotgun, hunting whistle, dogs when hunting armadillo	Along hunting trails in the forest
***Estilingue* - Slingshot**	Small passerines	Children / young adults, homemade slingshots	Along trails in the community and its surroundings

*Hunting was deemed illegal in Ponta Negra after the declaration of the REJ in 1992. The data I present in this section correspond to narratives from hunters who were active before the declaration of the protected area.

Hunting also took place during particular times of the year and depended both on the hunters' preferences, and the prey's abundance and breeding season. Hunters

preferred to hunt in the forest during late winter and early spring, when most of the trees were fruiting, as game was easier to locate, it was cooler and there were fewer mosquitos (TK02, Ln03). During the summer, animals were harder to spot and track, as the heat decreases their activity and the foods they depend become scarcer. Likewise, the intense summer heat discouraged people from going to the forest, as it became an uncomfortable place to spend time (Ln03). In the summer, people preferred to hunt early in the morning or at dusk close to the shifting agriculture plots, when forest rodents and wild boars feed on the crops, especially manioc, yams and sweet potatoes (TK01). As a general norm, hunters avoided hunting breeding female animals (TK01, TK02, Ln03).

5.3.2. Trapping

Mundéu and *laço* were the most common trapping techniques historically employed in Ponta Negra (TK01, Ln03, LH03). Mundéu was a deadfall trap consisting of two suspended heavy wooden logs set on game trails known for their high traffic. This trap targeted small to medium-sized forest mammals and could be operated throughout the year (TK01). Laço was a snare-type of stationary trap that was set in the forest along similar trails and targeted similar prey to the mundéus (TK01). Once mounted, both mundéus and laços were left unloaded so animals could get familiar with their presence on their trails. After approximately a week, these traps were activated and then were checked everyday (TK01, TK02). These traps were de-activated during the breeding season of the hunted items (TK01, TK02, Ln03).

Mundéus and laços involved the participation of different generations of males from the same household or family nucleus and were known to provide game during the leanest season of the fishery when the protein supply is low:

> My brother and I used to set up to ten mundéus in the Mata Varge area. We used to have them set and visit them everyday during the winter, so our families and ourselves had permanent access to game when there was not a lot of fish around (TK01).

5.3.3. Tree Stand Hunting

Espera was a tree stand hunting technique that targets medium-size rodents and employed shotguns (*espingardas*) fired from elevated hunting blinds mounted either in

forest trees or on platforms set beside shifting agriculture plots. During the fruiting season, this hunting technique was deployed close to the fruiting trees. Outside the fruiting season, hunters employed *cevas* (baited spots) in the forest or close to the shifting agriculture plots to attract game. In this case, tree stands were set close to animal trails that have been previously baited with manioc and green bananas (LH02).

Esperas were prepared in anticipation of the season. At the beginning of winter hunters mounted stands in areas transited by game. Every hunter made his own stand, but shared its use with other hunters. Hunting was generally a nocturnal activity that could last for the entire night or until the hunter was successful (LH02). Hunters ventured into the forest at dusk with their shotguns, dry meat to snack on during the journey and old nets that were used as hammocks to lie in while waiting. When the hunt was successful, hunters left the catch in the forest and picked it up the day after.

Mainly children in their early teens conduct zarpão, perhaps the only hunting activity still taking place in Ponta Negra. This hunting technique receives it name from the home-made cages constructed with local reeds and canes, which have a sophisticated pulley system that enables them to capture more than one prey without needing to be re-armed (Ln01). Zarpãos mainly target forest thrushes (e.g., *Turdus* spp.), which are eaten or kept in cages as house pets.

5.3.3. Active Hunting

Tracking was perhaps the most important active hunting technique in Ponta Negra. This technique was conducted depending on the prey. In the case of forest birds, such as macuco and jacú, two hunters armed with a shotgun and homemade whistles used to seek the birds along well-known forest trails attentive for bird songs or calls in the early morning or at dusk. As soon as a bird was spotted, the hunters whistled back to the bird. These calls were meant to attract the bird and were repeated until it was within shooting distance (Ln03). Tracking forest birds was the most skill-intensive hunting technique because of the knowledge of forest trails and firearm safety it involves (LH02). Most of the aforementioned safety concerns applied to this hunting technique. For that reason only mature hunters engaged in this activity (Section 9.1.4. for more details on safety).

In addition to tracking birds, hunters also tracked *tatu* (armadillo). Armadillos were hunted with the help of dogs, who were in charge of detecting them. They were normally hunted during the day close to watercourses where they build their burrows. Once an armadillo was detected and driven into the open, it was trapped with a net and killed immediately with a firearm kept on hand (TK02). Due to the lack of well-trained hunting dogs in the community, hunting armadillos was rare in the community (LH08).

5.4. Discussion: Landscapes and Resources in Times of Change

Thinking about Ponta Negra's ethnobiology from a practice perspective means considering not only how natural resource harvesting activities bind together individuals and their landscape but also the influence of economic and political relations and processes on those processes. This meshwork of interactions influences how natural resources are perceived, harvested, and hence, appropriated from the landscape (Ingold 2012). The high diversity of natural resources in Ponta Negra exists in relation to harvesting activities, forms of use and exchange and available infrastructure. The access to and perception of these resources, therefore, depends on the networks structured around each resource, or bundles of resources, that enable their flows and transformations (Ingold 2012). Examining which natural resources flow, and how they do so, from their harvesting to consumption sites, the social networks through which they move as well as their seasonality, provides deep insights into how people relate with their landscapes, and the outcomes that emerge from such relationships.

In Ponta Negra, marine, coastal and terrestrial ecosystems furnish local households with different kind of materials necessary for their life projects. The current landscape and natural resources of Ponta Negra are a contingent outcome of both the historical engagements of its inhabitants that have shaped their local landscape as well as of regional processes and drivers that have contributed to shaping it. The local landscape can be seen as textured by such historical engagements in such a way that each place in which resources are harvested or produced can be linked to particular uses, desires, needs and aspirations. The main forms of use and exchange of natural resources found in Ponta Negra are household consumption, sharing and bartering among households and commercial trade.

The marine ecosystem furnishes a wide set of resources that are used in each of these ways. The coastal ecosystem mainly provides resources used for household consumption in times of hardship as well as recreational foods. The bundle of terrestrial ecosystems produces resources mainly used as foods and medicines for household consumption and as a source of construction materials.

Whether a given resource has consumptive or commercial value depends on the properties it affords within local and extra-local contexts. Commercial value, for example, is a decisive factor influencing whether a given resource, particularly fish, is consumed or sold. Fish species with high commercial value are often sold in the regional markets or to the restaurants located in the community. Fish species with low commercial value are often consumed within the household or shared among neighbours. Other resources, such as agricultural produce and game, are often limited to household consumption and sharing due to the scale of their production and the environmental restrictions related to their production, harvesting and trade. These restrictions are enacted and enforced by the management of the REJ.

Chapters 4 and 5 present a synchronic description of the current relations people in Ponta Negra have with marine, coastal and terrestrial ecosystems through their harvesting activities and the resources that emerge out of such relationships. However, neither those relations, nor the resources associated with them, are static. Multiple external and internal drivers have affected the ways by which people interact with the local landscape, and hence are changing the way the resources these ecosystems afford are constructed and perceived.

Over the last several decades the diversity of marine resources has changed for Ponta Negra inhabitants. These changes are tied both to local and regional process that affect physical aspects of the marine resources, such as their abundance and composition, as well as how resources have been used and perceived. Commercial fishing only became an important livelihood activity in Ponta Negra around the 1950s as the regional fishing industry grew and with it the markets that enabled the commercialisation of the captured fish. In the 1970s, the adoption of pound nets transformed this fishery into the most important livelihood activity in Ponta Negra (Chapter 6). The pound net fishery has

structured current access to the regional fishing markets to the point that even the catches from other fisheries are sold through the channels opened by this fishery. However, by the 1990s, the destruction caused by the expanding and unregulated industrial fishing sector (Diegues 1983, 2004) rendered small-scale fishing unviable in many coastal communities, such as Ponta Negra. The local effects of industrial fishing are obvious: the size and abundance of fish schools have decreased over the course of the last four decades. Today, commercial small-scale fishing is an undesirable fishing activity in Ponta Negra (Chapter 7).

At the same time that commercial fishing is becoming an unfavourable activity, shifting agriculture activities in Ponta Negra have also declined in relevance, along with the networks and resources associated with them. This is linked with changes in individual preferences, desires and aspirations related to changing economic and political relations. Changes in individual preferences are a response to increased access to markets and cash tied to the boom of the fishing and, later, tourism sectors, as well as the environmental restrictions placed on shifting agriculture and hunting that came along with the declaration of the REJ. These changes have encouraged people to become more dependent first on the fishing and then on tourism sectors of the economy as sources of income as well as on stores in nearby urban centres as sources of food (Chapter 7).

Community elders talk about the past as a time in which food from the shifting agriculture plots and the forest was abundant and few food items were bought in the city (Chapter 6). The diversity of food resources locally harvested four decades ago is now considered a source of wealth that does not exist anymore. Some even compare having an agricultural plot back then to having savings in a bank account: "*o meu 'Banco do Brasil' era a minha roça*" [8](LH09). In fact, before the community become more integrated with urban centres, the only products people used to buy were salt, rice and other non-perishables (LH04). Rice and beans, which are now every day food items, were considered delicacies (Chapter 6). These days, only a small proportion of what people eat in the community is locally produced. In a recent food security study conducted in Ponta

[8] My Banco do Brasil (Brazilian National Bank) was my shifting agriculture plot

Negra, Giraldi (2012) reports that only 8.6% of the land-based food items consumed are either produced or harvested locally. These items are comprised mostly of tubers, fruits and spices (Appendix 2).

Changes in the use of plants over the last two decades are a testimony to the dynamic relations people have with their local landscape and how supra-local forces have played a role shaping it. Bicuiba is perhaps the clearest example of a plant whose multiple uses have changed over time. This forest plant species currently provides high quality wood for house construction and canoe making. It is also used as medicine, and children its fruit. However, 20 years ago, bicuiba fruit was also a source of fuel for lamps, wax for candles as well as oil to prevent steel tools from rusting (Kempers 1993). Access to store-bought paraffin candles and the inclusion of cooking oil in the local diet has discouraged the use of bicuiba for such purposes. Another example of changing perceptions and use of forest plants is fiddlehead ferns (sp. Indet). When Ponta Negra was more isolated from urban centres, these used to be an alternative food item in times of hardship (Fieldwork Journal, February 2011). However, this plant species is neither desired nor consumed anymore. People in the community are aware of these changes in their relationship with the forest and are also aware of the drivers behind them: better access to store bought foods, healthcare and cash are the most important ones (Chapter 7).

Relations with the forest and its associated natural resources are also changing as an outcome of environmental legislation (Chapter 8). The environmental authority has prohibited hunting activities in Ponta Negra. Hunting historically furnished animal protein in times of need and provided foods that are considered delicacies. In a similar way as with forest plant resources, the activities that link people to forest animals have changed due to the pressure exercised by the environmental authority. Unclear environmental regulations, which have induced fear in community members, have curtailed the desire and reduced the need to harvest forest products as alternatives have been sought and gradually become more viable. These trends are similar to those found in other coastal communities in the Atlantic Forest of São Paulo and Rio de Janeiro where hunting has been prohibited and deemed illegal by protected area authorities (Adams 2003, Ferreira et al. 2009).

The use and exchange of terrestrial resources has also been affected by changes in Ponta Negra's extra local environment as well the infrastructure that allows people in the community to interact with it. Before the 1970s there was commercial trade in manioc flour and plantains (LH04, LH09). The produce of the community was either shipped to Paraty and Ubatuba in the diesel boats owned by people in the community or was picked up by boats from elsewhere (Chapter 6). The construction of the Governador Mário Covas Highway (BR101) in the early 1970s integrated Ponta Negra with its regional context by reducing commuting time to Paraty from two days to a few hours (LH08). By then Ponta Negra had both terrestrial and maritime means of transportation. While travelling by land through the Laranjeiras passage became a fast means of reaching the city, the sea remained an efficient means of transporting fish and produce from the land. However, with the fisheries crisis of the early 1990s, the diesel boats were sold or decommissioned (Brito 2003). This forced a shift towards smaller, less costly fibreglass skiffs and a heavy reliance on transportation by land through Laranjeiras passage[9]. Markets for land resources became inaccessible due to the high cost of transportation and the inherently low returns on the marketed products. As a result of this transition, the commercial trade in land resources has lost relevance in comparison with the trade in marine resources.

Isolation, coupled with environmental regulations, acted against the selling and consumption of land resources and hence the simplification of the land resources used in the community. From being both commercially traded and locally consumed, land resources became items of limited and nearly-exclusively local consumption. This trend in Ponta Negra is the opposite of what is found in other communities in the region that have better access to roads and markets. The landlocked *Quilombola* (maroon) communities in São Paulo and Rio de Janeiro States, for example, have focused on commercial products (i.e., manioc flour and bananas) and left aside the production and harvest of items for household consumption (Adams et al. 2013). However, both in Ponta Negra and the Quilombola communities, income-generating activities have enabled

[9] The issues associated with dependence on the Laranjeiras passage are explored from the perspective of the trade of products from the community (Chapter 6) and its impact in the wellbeing of the people in the community (Chapter 7)

people to buy externally produced food items and other materials, which have eventually come to replace many locally available equivalents.

People in Ponta Negra agree that the use of medicinal plants has also followed similar declining trends. These declines have been associated with improved access to medical care in urban centres facilitated by government policies that have increased health coverage in rural areas of Brazil since the 1990s (Adams et al. 2013). The protestant churches in the community have also played an important role in limiting certain practices that involve forest plants, such as in the case of medicina brava mentioned above, by deeming them as witchcraft. These declines in the use of medicines, along with the decline in the use of forest resources for food and construction materials, associated with the environmental regulations already mentioned, suggest that the interactions with the terrestrial ecosystems are dwindling in Ponta Negra. These findings are not new to small communities located along the Brazilian coast. In fact, similar trends have been found in communities in the Atlantic Forest region (Hanazaki et al. 2007), elsewhere in coastal Brazil (Sousa et al. 2012), as well as in other small coastal communities around the world (Reyes-García et al. 2009, Wongbusarakum 2009).

Local relations with the natural resource base are not the only ones that configure the local landscape. The regional economy, access to markets and environmental regulations have played a role in shaping how the local landscape is experienced and perceived. Marine harvesting activities, for example, are heavily dependent on the regional fishing economy, including access to regional fish markets. By enabling integration into the regional economy, the pound net fishery changed the relations people in the community have with fish resources, not only to those directly related to the fishery but also those who depend on the marketing channels opened by the fishery. The continuity of these relations, however, is contingent on the economic viability of the pound net fishery as it coexists with destructive industrial fishing fleets and its dependence on fragile access to markets. Likewise, the relations with terrestrial ecosystems and the use of land resources overall are being re-shaped by access to cash and store-bought food, as well as unclear environmental regulations associated with the protected area within which the community is located.

As is examined in Chapters 6 and 9, fishing and tourism have brought new opportunities and introduced sets of skills and resources that have enabled people to perceive and mobilise natural resources in ways local people believe are desirable. Over the last 60 years, shifting agriculture and manioc flour have transformed from being a primary source of food and identity to a marginal activity that just a few people continue to practice. The new spaces brought by the tourism economy, however, offer the chance for shifting agriculture to acquire new currency and relevance both as an on-going practice of production and a new, culturally relevant way to produce products (i.e., manioc flour and experiential tourism) for tourists with symbolic and economic value. The desire to both maintain culturally important practices and associated products through tourism has been identified in other small coastal communities elsewhere in the world (e.g., Turner et al. 2012).

The challenge now is to craft a policy context that recognises coastal peoples as dynamic agents, capable of innovatively modifying their economy and maintaining their relations with their local landscape at the same time. Unfortunately, the legislation that deals with traditional populations living in protected areas in the Atlantic Forest of Brazil is not sensitive to the adaptation of these peoples, and attempts to force them to maintain the subsistence economy they had before the boom of the fishing economy reached them (Chapter 8).

In the remainder of this thesis I present a multifaceted analysis of the Ponta Negra landscape of practice from historical (Chapter 6), social wellbeing (Chapter 7) and adaptive learning perspectives (Chapter 6, 9). My hope for this work is that it may serve as an invitation to think about the so-called Caiçara as dynamic agents capable of determining and pursuing their own life projects. I argue that the issue at hand is not how the Caiçara should or should not remain traditional as defined by outside actors, but rather how they can retain healthy relations with the local landscape and live the lives they want to live. Part of my work is a careful analysis of the factors and processes that are either enabling or hindering the ability of different groups of people in Ponta Negra to find this balance. Although this thesis is about the coastal peoples of Ponta Negra, many

Indigenous and rural populations all over the world share this very same challenge of designing meaningful futures while maintaining cherished links with the past.

Chapter 6. Adaptive Learning, Technological Innovation and Livelihood Diversification: The Adoption of Pound Nets in Ponta Negra[10]

6.1. Introduction

This chapter analyses the context and consequences of the adoption of the pound net fishery in Ponta Negra. This historical examination of adaptive learning according to the Ethnoecology of Practice framework (Section 2.1.2.3) complements the analysis conducted in Chapter 9, which looks at contemporary modes of environmental learning and an example of innovation framed in the participation of people from Ponta Negra in the tourism economy. A detailed description of the pound net fishery can be found in Section 4.4.1. I use this fishery as a focal point to trace the emergence of this technology within the regional economy and document the web of social relations and structural changes it engendered within the community. While this chapter tells the story of a livelihood diversification process in the recent history of Ponta Negra, marked by the adoption of the pound net fishery in a context of growth, modernisation and restructuring of the regional fishing economy, Chapter 7 analyses Ponta Negra contemporary livelihood portfolios from a social wellbeing perspective.

Livelihood diversification is examined through the everyday practice of fishers from the early stages of learning to utilise the technology, through its implementation in Ponta Negra, to the use of monetary surpluses gained by households with this technology to invest in other diversification strategies. This perspective allows me to consider the role of individual learning and innovation in the process of livelihood diversification while tracing the emergence of structures, which result from an exercise of agency, and then reflect back upon the opportunities for future livelihood diversification.

[10] An earlier version of this chapter was published as: Idrobo and Davidson-Hunt (2012).

In this chapter, I use an adaptive learning perspective (Davidson-Hunt 2006) to illustrate how individual adaptation associated with technological innovation is nested in the political economy of a place, grounded in ecological limitations, and reverberates into collective dimensions of social differentiation, access to natural resources and livelihood diversification opportunities. An adaptive strategy, in such a case, may position innovators with increased opportunities for diversification and lead to social differentiation within a community.

An approach rooted in practice theory reveals how individual adaptations are linked to broader socio-economic and historical contexts and, therefore, allows an understanding of the social differentiation processes related to the adoption of pound nets as a technological innovation. While adaptation occurs at the individual level, it has led to the emergence of a new centre of learning and, with it, new institutions that govern access to natural resources. The ecological context is such that there are only a limited number of sites suitable for deploying pond nets along the coast near to the community. This has resulted in a condition in which pound net sites are a scarce resource linked to a specific set of social and economic relations that influence how sites are appropriated and benefits distributed. As such, the pound net fishery constitutes a field that has structured social-economic relations in Ponta Negra through a process of livelihood diversification and in turn created new opportunities for subsequent diversification, for some, while constraining the opportunities for others.

Studies of human adaptation and adaptive learning have highlighted the central role of individual learning in adaptation processes (Ellen 1982, Davidson-Hunt and Berkes 2003a, Davidson-Hunt 2006). Processes of individual adaptation have also been suggested as an important focus in efforts to understand local responses to social-ecological change in the absence of human capacities and financial resources for institutional adaptation (Coulthard 2008). In the case of the Atlantic Forest Coast of Brazil, adequate policies and incentives to mitigate the effects of declining fish stocks and changing regional economies are conspicuously absent (Diegues 2002). Moreover, while studies on human adaptation have looked at the mechanisms and process by which individuals adapt to a changing environment, they have not considered how adoption of

technological innovation may reverberate through a community, causing social differentiation processes.

This chapter is divided into three main sections. The first section of which recounts the experience of the pound net fishery in Ponta Negra in three movements based on the living memory of key community members. It describes Ponta Negra livelihoods and their relations with the regional economy before the arrival of this fishery in the community (1940s – 1970s), during the period of its adoption (1970s – 1990s), and the contemporary dynamics of the fishery and its relation to the emergence of tourism in the community (1990s – present day). The second section deals with current dynamics surrounding the pound net fishery in terms of territoriality and ownership. This section reviews how community members appropriated pound net fishing spots and how that ownership changed over time. The third section deals with current livelihood diversification patterns as they relate to pound net ownership. This chapter concludes with a discussion of the consequences of adopting a fishing technology in a limited ecological setting on social relations and structures of Ponta Negra, and the implications of using this technology on current livelihood diversification patterns.[11]

6.2. A History of the Pound Net Fishery

I recount the history of the pound net fishery in Ponta Negra according to three periods. The first period is before the introduction of this technology (1940s – 1970s), when the local livelihoods were structured around shifting agriculture and community members lived through the first manifestations of the rise and modernisation of the regional fishing economy. The second period corresponds to the adoption of the pound net technology (1970s – 1990s). This period sees the start of social differentiation processes and subsequent restructuring of the local livelihoods. The local economy shifts from being based on the land to the sea. The third period deals with the contemporary dynamics of the local livelihoods (1990s – 2011). This period shows the consequences of the restructuring of the regional fishing economy, regional integration and the arrival of

[11] See section 4.4.1 for technical details about the pound net fishery.

tourism. During this period community members experience increased limitations on the fish trade and growing opportunities in the tourism economy.

6.2.1. Local Livelihoods Before the Pound Nets (1940s – 1970s)

6.2.1.1. Shifting Agriculture and Fishing for Consumption and Petty Exchange

Before the introduction of the pound nets in Ponta Negra, fishing activities were not a primary element of local livelihoods and the economy. Back then, livelihoods in Ponta Negra relied mainly upon shifting agriculture and other associated harvesting activities, such as hunting and picking forest fruits (LH03, LH07). These agricultural activities structured everyday life and influenced the connections the community had with the outside world. Shifting agriculture and harvesting activities were the basis of local nutrition and monetary income, as their outputs were consumed locally and traded both locally and regionally.

A 70 year-old elder from the community, provides a glimpse of the relations that people from the community had both with land and sea before the arrival of the pound nets in the community:

> When I was a child we had lot of work in the *roça* [shifting agriculture plot]. We used to plant many things there, but we did not have the means we have today to harvest and sell things from the sea. [….] I used to produce manioc and banana. Boats from Rio de Janeiro City used to come here to pick up the items we used to produce (LH07).

While agriculture provided the core for the domestic economy of Ponta Negra households, fishing was nevertheless an important secondary contributor. However, the technologies people used to catch the fish as well as the ways by which fish were traded, preserved and eaten were simpler than those available today. People used to fish mostly with hand lines cast either from shore or from small dugout canoes and surface gillnets (*meijoada*) (LH08, LH09). Other techniques, such as harpooning from the shoreline and small bamboo traps (*covos*), were also occasionally used (LH01). Fish, at this time, were consumed by the household and shared with others in the community. A small quantity of the catch was traded in nearby urban centres, such as Ubatuba (São Paulo State) and Paraty (LH07).

The fish destined for sale and storage was gutted, soaked in brine and sun-dried on the beach (LH07). Dried fish, as community members recalled, was an important part of people's diets (LH06). Boiled fresh fish and banana (known as "*azul marinho*") were also described as a frequent part of the local diet (LH06). Even though fish is still important in the local diet, the aforementioned ways of eating fish are not as prevalent. These recipes belong to a past that people talk about with nostalgia as contemporary access to money and grocery stores has introduced other staples and with them new tastes: deep-fried fish, rice and beans now feature as the main staples in the community.

> Ponta Negra was very poor back then [approximately 40 years ago]. We used to eat beans, rice and dry meat only once a year; they were a treat for us. Our main food items were fish and green banana. […] Only during Christmas or Carnival people went to the city and spent some money on special foods, just to eat something different (LH06).

The amount of fish sold and the frequency of visits to the nearby urban centres were constrained by the isolation of Ponta Negra. Better access to the urban centres over the last 40 years was one of the changes that improved their lives in recent decades:

> Even though there was much more fish than what we have today, there was not a lot of commercial fishing going on in Ponta Negra. Why could we not do so? It was because we had no way to transport fish products. [Commercial] fishing did not exist because we had no buyers for our catches. We used to catch the fish, dry it and pack it in a canoe and take to Ubatuba or Paraty, so we could sell the dried fish there. […]. These days you bring the fish to the beach and deliver it directly to the buyer (LH07).

6.2.1.2. Rise and Growth of Regional Industrial Fishing

National and regional changes associated with the promotion and steady growth of the fishing industry in the first part of the 1900s brought important changes to coastal livelihoods is SE Coastal Brazil (Diegues 1983). These processes marked the transformation of fishing practice and economy from subsistence to commercial (Diegues 2004). In Ponta Negra, these regional changes were mainly manifested in new markets for the local catches and new job opportunities for community members to work as crewmembers in the growing industrial fishing fleets (LH07). These changes in the fishing industry affected most, if not all, the small coastal communities in the states of São Paulo and Rio de Janeiro (Diegues 1983, Diegues and Nogara 2005, Vianna 2008).

As large-scale fishing became more prominent regionally, nationally, and even internationally, boats from nearby urban centres began to buy fresh fish in Ponta Negra:

> When I was 14 years old [circa 1954] I remember many fishing boats from Rio de Janeiro and Paraty, and even from Portugal, came around here. These boats used to come to fish and buy fresh fish (*'peixe verde'*). There were no pound nets back then; we mainly fished with hand lines and gillnets (LH07).

The growth of large-scale fisheries in SE Brazil was also accompanied by job opportunities for residents in small coastal communities (Diegues 1983; Vianna 2008); Ponta Negra was no exception. The jobs provided by this growing industry became an important source of the local income (LH04, LH08). The oldest community members in Ponta Negra started fishing in large-scale fishing vessels as young adults (between 15 and 20 years of age), during the 1950s and 1960s. Working in large-scale fishing boats, mainly sardine seiners, provided workers with extra income, which was invested in improving their living conditions and quality of life in general:

> In the past all the houses in the community were made of wattle and daub (*pau pique*) and thatched roofs (*zapé*). After people left to work in Santos [São Paulo State] and other places in large-scale fishing boats there was money available to buy better construction materials. Life improved many times from how it was when I was a little boy. Access to better jobs and to more money has been responsible for the improvement of our lives (LH07).

In 1967, the Brazilian government, through the newly created Department for Fisheries Development (*Superintendência do Desenvolvimento da Pesca),* developed a series of policies incentives to enhance commercial fisheries (Diegues 2002). These incentives focused on the growth and modernisation of industrial fishing fleets by increasing the number of fishing vessels and equipping them with more efficient technologies (Diegues 2002). These industrial-fishing fleets were mainly based out of larger urban centres and owned by wealthy consortiums of boat owners (Diegues 1983).

Although policy incentives were aimed towards large-scale fishing production, the expansion of the regional fishing economy also created markets and channels for distribution of fish, which coastal communities, such as Ponta Negra, used to their advantage to develop and expand their own fish-based economies. This was the crucial turning point when many small-scale fishers shifted from mainly subsistence to primarily

commercial production. The establishment and subsequent development of the pound net fishery in Ponta Negra is an example of this process.

6.2.2. Adopting the Pound Net Technology in Ponta Negra (1970s – 1990s)

6.2.2.1. Arrival of the Pound Net Fishery to Ponta Negra

Japanese immigrants introduced the pound nets to SE Brazil in the 1920s (Mussolini 1980). This type of fishing technology entered through the coast of São Paulo State, in Saõ Sebastião, and radiated from there to the rest of coastal Brazil, from Santa Catarina State in the South to Rio de Janeiro State in the North (Martins and Perez 2008, Vianna 2008). Japanese immigration and the spreading of pound net technology were related to economic incentives provided by the Brazilian government to boost the incipient fishing industry at the time (Mussolini 1980, Diegues 1983).

Initially, the pound net fishery was not intended for local fishers from rural areas in São Paulo and Rio de Janeiro (Mussolini 1980). Because of the high costs involved in building and maintaining the pound nets and the lack of skills, few local fishers from the area were able to enter this fishery, except as waged crewmembers; Japanese immigrants managed and controlled it (Mussolini 1980). The prohibitive cost of entry was likely the main reason why the dispersal of the pound net fishery along the Rio de Janeiro coast occurred slowly. In spite of being only 100km away from the first pound net operations, the pound nets only reached the North side of the Juatinga Peninsula in the early 1940s, brought by a Japanese immigrant that settled in the area (Vianna 2008).

The pound nets took even longer to arrive in Ponta Negra. Unlike the pound net operations on the North side of the Juatinga Peninsula, Ponta Negra community members introduced them in the early 1970s (LH07). Ponta Negra fishers had learned to manufacture and manage this fishing technology in nearby communities, such as Praia do Sono, and applied their existing knowledge of net making to construct the nets. The extra income obtained by those who joined the large-scale fishing fleets allowed them to invest in this fishing technology. This was the case for LH08: "*My work in large-scale fishing boats allowed me to save enough money to make my own pound net. As I made the pound*

net, I also made some canoes. That was the time when fishing in Ponta Negra became my main livelihood."

But large-scale fisheries not only gave access to financial resources to Ponta Negra fishers, they also provided them with skills to handle the large-sized nets that were employed in the newly arrived fishery:

> When I became a teenager I worked as crew in industrial fishing boats. I did not work for long, only three years. That was an important phase of my life in which I grew a lot and acquired many skills that I could later use in the work with the pound nets (LH02).

Three pound nets were established during this period; though they have changed owners, these same pound nets, in addition to four newer ones, are still in operation today**.**

6.2.2.2. Fishing Predominance and Social Differentiation in Ponta Negra

The establishment of the pound net fishery brought profound changes to Ponta Negra livelihoods and social structures. The pound net fishery became not only a profitable economic activity, but also the main fish source for community members in Ponta Negra. At the beginning of the pound net fishery, their owners used the commodity networks established by the industrial fishery to trade the newly available quantities of fish (LH07). As fishing boats from Rio de Janeiro came to Ponta Negra to buy fresh fish, drying fish became less important: "*By then our practice of drying fish to store and trade started to vanish. Fresh fish could be sold because of the boats. That was a big improvement here*" (LH07)

As fresh fish could be exchanged for cash, those participating in the pound net fishery had access to new food items and better construction materials. Rice and beans became the new staples of the community (LH06). Likewise, access to cash generated within the community also accelerated the house improvement process that started with people working for large-scale fishing boats in the 1960s. Building newer and better houses was not only a possibility, but also a priority. LH02 attests: "*Most of the money I received from the pound net fishery was invested in improving my house. In fact, every time I had leftover money from the monthly expenses I invested that money in improving my house*".

The pound net fishery also reorganised social relations in Ponta Negra by creating and structuring social hierarchies. These became evident when the few who could manufacture and manage a pound net gained an advantage in relation to other community members in terms of access to harvesting and selling marine resources. Pound net owners were able to build up other assets, which in turn facilitated more control over the fishery, marine resources and, later on, other economic sectors, such as tourism. The investment in tourism assets was tied to the process of house improvement that had started in the 1950s, when people started working in industrial fishing boats. However, by now, people had realised that investing in better housing would allow them to rent the houses during the holidays when tourists visited the community (LH02). Likewise, some pound net owners were able to buy diesel boats, which were used to collect the catches of the fishery, transport them to Paraty, and have access to other fish habitats in the nearby areas using long-lines and surface gillnets (LH07).

Pound net owners who established a permanent net in the limited number of highly productive spots were able to appropriate more economic advantages provided by the newly available fishing technology. This resulted in further social-economic differentiation between those with the highly productive pound nets and those with less productive ones or without ownership. As the pound net fishery became established many community members who were not owners became crewmembers in this fishery. At the time they entered into operation, each pound net ran with a crew of four to five. Between owners and crewmembers, this fishery came to employ at least fifteen adults of working age in the community. Work in a pound net was initially based on kinship, with brothers, sons and occasionally wives and daughters being actively involved (LH09). However, as a result of family differences, some owners started to recruit more crewmembers outside family circles. The pound net fishery adopted the payment system that has been used across the region since its arrival in the 1920s (Mussolini 1980). This payment system is described in Section 4.4.1.3.

6.2.2.3. From Land-based to Sea-based Economy

The pound net fishery also changed everyday activities in Ponta Negra, as people reorganised their lives to be able to engage in both terrestrial and marine-based activities.

In the 1970s shifting agriculture was still a common practice in the community (LH04). Those involved in both activities had to visit the nets at least twice a day and between four to five times during the peak of the fishing season. The available time to work in agriculture and to travel to the plots, sometimes kilometres from the beach, was substantially reduced (LH07). Even though internal division within households allowed some members to focus on agricultural activities while others focused on fishing, easier access to store-bought products facilitated by more available cash and enhanced means of transportation contributed to the decline of shifting agriculture and the availability of associated products. People in the community perceived fishing activities to be less demanding than agricultural ones and started preferring to engage in the former rather than the latter (LH09).

6.2.2.4. Marginalisation within the Regional Fishing Economy

Although the pound net fishery gave access to larger amounts of fish and cash than ever before, the Ponta Negra fishing economy remained marginal within the regional context. This was a result of the inability of the fishery to compete with the industrial fishing sector. Following the modernisation of the industrial fishing (Diegues 2002), large-scale fishing boats flooded the market with large quantities of fish, which resulted in a permanent decline in fish prices. This was exacerbated by the price differential across the fish commodity chain, which, from the 1960s to the present day, has not favoured Ponta Negra fish producers. Today they receive, on average, approximately 20 per cent of the final sale price. While community members sell blue runner, one of the most valuable fish caught by Ponta Negra pound nets, $1.00 CAD/Kg to fish buyers, the same fish is sold to the final consumer in Rio de Janeiro and Sao Paulo for between $3.5 and $4.00 CAD/Kg (OS07). Some of the Ponta Negra fishers who were active in the 1970s mentioned that even though they could catch relatively large amounts of fish, the return they received from their catches was still low:

> We caught large quantities of fish, between 5 and 10 tons every two weeks, but we sold it for between 10 and 30 Cruzeiro[12] cents/Kg. For example, largehead hairtail and blue runner were very abundant, yet very cheap. We used to catch

[12] Brazilian currency from 1942 to 1986 and from 1990 to 1993.

tons of fish and sold it for nothing [‘*troco de nada*’], so the fish would not rot (LH02).

6.2.3. Contemporary Dynamics of the Pound Net Economy (1990s – Today)

6.2.3.1. Local Manifestations of the Crisis in the Regional Fishing Economy

The late 1980s and 1990s came with several local and regional changes that affected Ponta Negra and its pound net fishery activities. Between 1980 and 1995, the fishing sector all across SE Coastal Brazil experienced a drastic decline in fish catches (Diegues 2002). This decline was related to unregulated fishing that had started in 1967. Primary culprits in this decline were purse seiners targeting schooling epipelagic species without a quota system (Diegues 2002). In Ponta Negra, community elders recalled that in the late 1980s, and the beginning of the 1990s, their catch of fish was so low that they began to question whether fishing was still profitable (LH07).

These circumstances forced boat owners to abandon or sell their diesel boats. This hindered access to markets in urban centres for the fish caught in Ponta Negra. By 1994, there were only four boats left in the community, and only two in working condition (Brito 2003). Within less than a decade, all the diesel boats in Ponta Negra were either sold or decommissioned and pound net owners started using less costly fibreglass skiffs as the main means for maritime transportation (OS07). This change in transportation technology changed access to regional markets and services for Ponta Negra community members. However, this change did not happen only because of the decline in the fish catches. It was tied to regional changes, such as road construction and tourism development.

6.2.3.2. Regional Integration and Tourism Developments

The opening of the Rio-Santos Highway, which connected urban centres along the Rio de Janeiro and São Paulo State coastlines and provided road access to the Paraty region at the end of the 1970s (Teixeira 2006), was another critical factor that impacted the daily lives of Ponta Negra dwellers. Road access made the Atlantic Forest and its adjacent coast accessible to the São Paulo’s middle and upper middle class. This triggered aggressive tourism development all over the region, which skyrocketed the value of real estate (OS04). One tourism development that particularly affected Ponta Negra was the

gated community of Laranjeiras. The construction of this gated community restricted local access to two key beaches in the area. Considering that beaches are public in Brazil, and therefore, by law access cannot be denied, Laranjeiras was required to allowed people from Ponta Negra and other nearby communities to use their marina as an access point for travelling to the Rio-Santos Highway and Paraty (LH09).

The passage through Laranjeiras had been available since 1978 (Costa 2009), but it was not until 1995 that it became a conduit for trading fish (OS07). While it was economically viable, Ponta Negra pound net owners preferred to use the route around the Juatinga Peninsula to transport fish using diesel boats because it allowed them to bring better quality fish to the markets and find better deals for their catches (OS07). After the aforementioned loss of most of the boats owned in Ponta Negra, the newly available passage through Laranjeiras became a critical transportation hub for people, fish and supplies.

The new route to the city through Laranjeiras, coupled with the shift from diesel boats to fibreglass skiffs as the means for fish transportation, opened a door for commercial fish buyers to become more dominant players in the trade of fish from Ponta Negra (OS07). Fish buyers in the region started a process of vertical integration, gaining control over more aspects of the supply chain (Giesbrecht 2011). Fish buyers started negotiating deals with the pound net owners to send their trucks to Laranjeiras to pick up the catches around 1995 (OS07). Fish buyers became the providers of fuel, ice and other resources necessary for keeping the pound nets running in exchange for their monopoly over the purchase of the catches. Pound net owners secured a fixed buyer who would always buy their catch at the expense of having to accept any price offered for their product.

LH08 reflects upon the outcomes of the commercial relations between fish buyers and local pound net owners:

> During the last two decades, during the time we have been dealing with them, fish buyers' businesses have grown. They have been able to buy boats and trucks and to expand their facilities in Paraty. At the same time, we have stayed in the same or perhaps even worse condition.

Trading the fish catches through Laranjeiras also brings logistical constraints in the delivery of the catch imposed by the management of the gated community. Since the establishment of this site of exchange there has been regular and severe congestion at the dock. The pier at Laranjeiras only has the capacity for mooring one skiff at a time, yet it is intended to serve all the pound nets in Ponta Negra and those in the neighbouring community of Praia do Sono. This logistical limitation causes delays in the unloading, loading and delivery of fish. Sometimes the catches have to wait under the sun for more than five hours before they can be delivered, causing them to lose quality and value (Fieldwork Journal, September 2010). The more time fish is exposed to hot weather and sun, the lower its price becomes (OS07).

The management of Laranjeiras has consistently enforced limitations and constraints on the passage of fish through their premises. In addition to the logistical limitation of only being able to unload one skiff at a time, Laranjeiras also has imposed limited hours to move fish (from 9:00 am to 5:00 pm, Monday to Friday). Furthermore, every year, between December and January, when the fishing season is starting to peak, the management of Laranjeiras puts a ban on the passage of fish (Conselho da Administração Condominio Laranjeiras 2009). Pound net owners are forced to ground their fishing gear until the ban is over. These conditions have left the Ponta Negra fishery and those associated with it in a disadvantaged position in relation to the regional economy. The fish produced in Ponta Negra, in addition to being sold for low base prices, as a result of the glut of fish on the market because of industrial fishing, depreciates because of the structural limitations that constraint its fair access to the markets.

6.2.3.3. Structural Limitations for Fish Trade

Lack of adequate storage facilities and means of transportation are the main structural limitations that fishers from Ponta Negra face that prevent fair access to the markets. The fish caught by industrial boats in the region is immediately stored in ice and sent either to cold rooms or straight to the markets; it exists within carefully controlled temperature throughout the supply chain (OS07). The fate of Ponta Negra fish catches is different. After being caught from the pound nets and landed, fish is stored in Styrofoam boxes with ice brought from Paraty and provided by the fish buyers. The catch stays in storage until enough fish is caught to make a shipment to Laranjeiras worthwhile. This waiting

period normally lasts between one and three days. After that, the fish is transferred into lidless, plastic flats, which are used to carry the fish to uncovered skiffs waiting on the beach. The fish is poured from the flats into the bottom of the skiffs. From this point on, the fish is directly exposed to heat and sunlight until it is finally loaded into the fish buyer's trucks at Laranjeiras. Sun exposure sometimes lasts for several hours before the fish is picked up and stored in ice again. During every step the fish is tossed around and bruised, losing value and quality. A fish buyer (OS07) from Ponta Negra, talks about the treatment that Ponta Negra catches receive and its quality:

> The fish from Ponta Negra loses price because it is not stored properly, because it is exposed to sun and heat. When it reaches the market it is already soft and smelly. The fish from Ponta Negra does not have good quality. When you eat it in Ponta Negra it is the best fish. However, by the time it arrives to its final distributor it is tired fish (*peixe cansado*), not fresh fish (*peixe vivo*). After Ponta Negra pound net owners started selling fish through Laranjeiras, the quality of the fish dropped.

6.2.3.4. Pound Net Locations and Associated Dynamics

Even though the pound nets have been in the community for over 40 years, their number has not been stable nor have their owners. Some pound nets are better located and hence more productive than others. The limited number of productive spots is tied to the necessary distance between pound nets, their position in relation to pelagic schooling fish movement patterns, and protection from bad weather events (Figure 24). Pound net owners provided a qualitative estimation of the productivity of their nets (Table 14), which can be linked to the stability of their ownership: the pound net locations with higher productivity have tended to show more stable ownership over the years with the exception of fishing spot 4.

Table 14. Pound net fishing spots in relation to productivity and ownership stability

Id	Fishing Spot	Productivity*	Ownership Stability
1	Pedra raiada	++	Yes
2	Porto	++	Yes
3	Tapicirica	+++	Yes
4	Pesqueiro de Salema	+++	No
5	Paredão	+	No
6	Boquerão de Furado (E)	+	No
7	Saco de Serafim	+++	Yes

*Productivity: low (+), medium (++), high (+++)

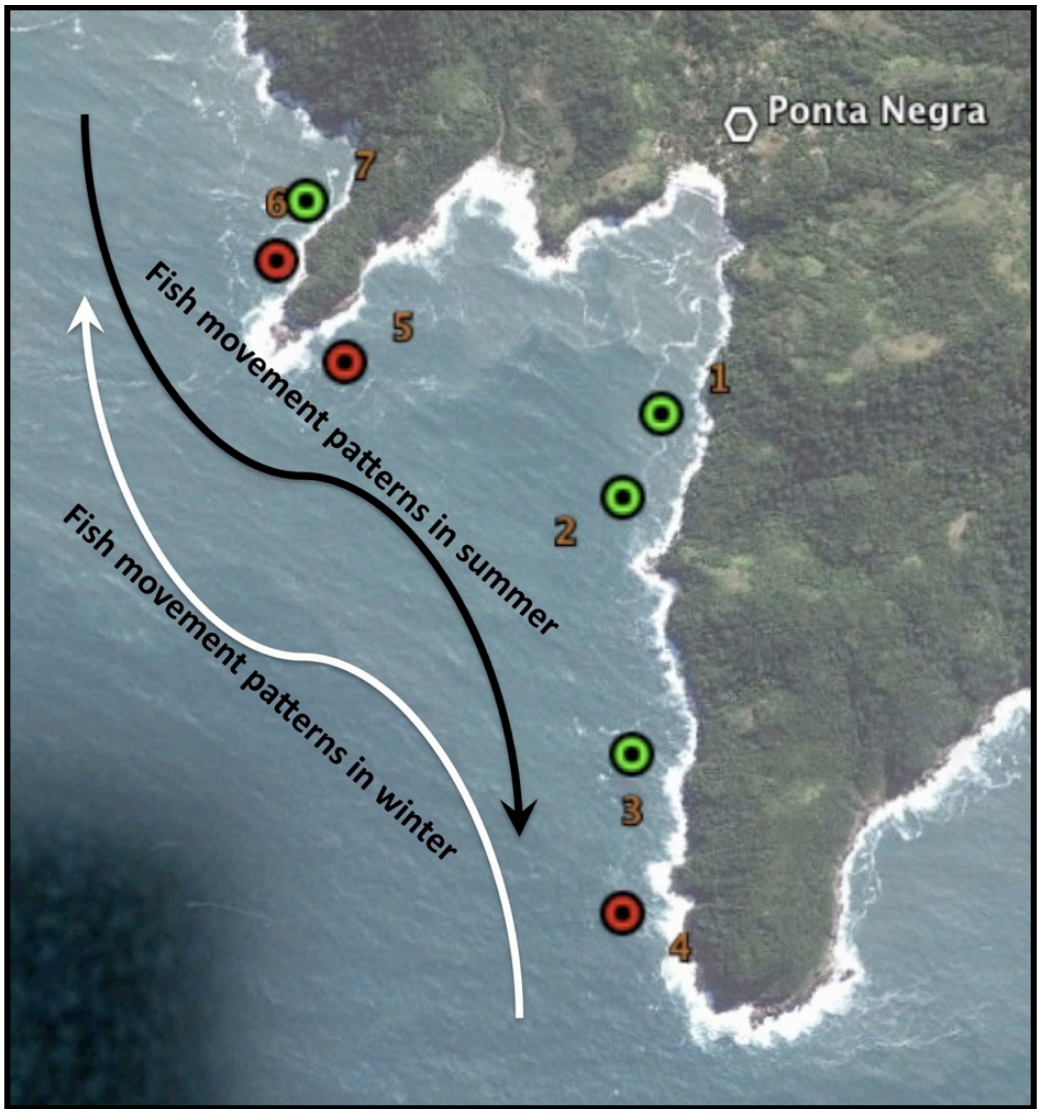

Figure 24. Location of pound net fishing spots

The most productive pound nets are 3, 4 and 7. Their productivity is associated with their position on the West side of Ponta Negra and Antigos Bay, which is the summer passage area for high-value migratory pelagic schooling fish, such as king mackerel, Spanish mackerel (*Scomberomorus brasiliensis*) and blue runner. Although they are on the West side of Ponta Negra Bay, as a result of their position in relation to Antigos Point, schooling fish often by-pass Pound Nets 1 and 2. As a result, they are not as productive. Pound nets 3 and 7 have an advantage over 4 because of their more sheltered positions within the Bays. Pound net 4 is often damaged during bad weather events. The location of a productive pound net is a fine balance between exposure to fish migration routes and protection from damaging waves and currents.

Pound net productivity is also linked to the stability of their ownership. This is evident with pound nets 4, 5 and 6, which have frequently changed hands because of their low profitability linked to low-catching power (5 and 6) and high maintenance costs (4). Pound net 4 also has high access costs because of its distance from the Ponta Negra Beach. The owners of the more marginal pound nets (4, 5, 6) have also tried to compensate for the limited productive spots available through innovation and experimentation. For example, the mouth opening of pound net 5, as mentioned above, is oriented seaward to intercept the winter school migration, which is not as abundant as the summer one.

6.3. Territoriality and Pound Net Ownership

To further analyse how the ownership of the pound nets is linked to local territoriality and livelihood diversification in Ponta Negra, dynamics of pound net ownership are examined across three moments in the pound net fishery history (Table 15). The first moment is in the early 1970s when the pound nets were introduced in the community. The second moment is 1994. The data for this mid point is found in Brito (2003). The year 1994 is relevant for pound net ownership dynamics in the community, since it marks the re-organisation of the pound nets after the Japanese entrepreneur left the community. The last moment is based on the current owners as of March 2011. Additionally, we take into consideration the current relationships between pound net owners and their respective crews.

Table 15. History of pound net ownership and current labour patterns

ID	Owners in the 1970s	Owners in 1994	Owners in 2011	Workers	
				Net Master	Crew
1	Not in use yet		PO02*	Sons	Kinship, non kinship
2	PO02	PO02	PO01	Employee	Non kinship
3	PO07**	PO03	PO03	Employee	Non kinship
4	Not in use yet		PO06***	Self	Kinship
5	Not in use yet	PO08**	PO04	Self	Kinship
6	Not in use yet		PO04	Self	Kinship
7	LH09	PO01	PO05	Employee	Non kinship

*The codes used to identify the pound net owners are the same ones used in the interviews
**These former pound net owners have no connections with the community or are deceased
***This current pound net owner was not interviewed because his discomfort giving interviews related to a speaking impairment

PO02 built pound net1 after selling pound net 2 to PO01 around 1995. This was the last pound net with stable ownership built in Ponta Negra Bay. His two sons, who also work in large-scale fishing boats during the winter, currently manage this pound net, which is used only in summer. In addition to the pound net, PO02 family owns several houses that are rented during the summer holidays. The family also owns two skiffs, which, other than delivering the pound net catches, are used for transporting tourist during the summer holidays.

PO02 built pound net 2 at the time this fishery was introduced in Ponta Negra. This pound net was kept under PO02's management until he sold it to PO01, who currently has control over it. In addition to this pound net, PO01's family owns several houses, which are rented especially during the summer holidays. PO01's family lives in Paraty and his daughters currently attend college in Paraty and Rio de Janeiro. PO01 and his brother PO05, owner of pound net 7, advertise their rental properties through the Internet website administered by their brother, who lives in Paraty and has an extended network that brokers tourism services in Brazil and abroad. Likewise, some of PO01's properties are leased to a tourist operator from São Paulo that caters services to clients from São Paulo City and abroad.

Pound net 3 is the most renowned one in Ponta Negra because of its size and productivity. It was the first pound net built in Ponta Negra. PO07, its original owner, sold it to the Japanese entrepreneur and then moved to Paraty where he continued buying fish from the community using his diesel boat (LH09). PO03 took over the management of this net after PO07 sold it. When the Japanese entrepreneur left the community, PO03 took over its ownership. Currently PO03 does not work directly in the pound net, devoting his time instead to managing his tourism business. He hires a non-relative from the community to manage his net. In addition to pound net 3, PO03's family owns a restaurant and several houses that they rent during the summer holidays. They also own a skiff that is used for freighting fish catches to Laranjeiras, and transporting tourists. PO03's children live in Paraty where they receive secondary and post-secondary education. PO03's older son is starting to advertise the tourism services catered by his

family through the Internet and a travel agency in Rio de Janeiro City that brokers tourism in Brazil and abroad.

Pound net 4 is the most distant pound net from the beach in west Ponta Negra Bay (~2Km from shore) and is known in the community for constantly changing owners. PO06 started using this pound net in summer 2010/2011. He moved his gear to this spot after receiving permission from the family of the last users, who are no longer in the community. PO06 and his family live in Ponta Negra. Other than owning pound net 3, PO06 and his family manage pound net 7. They also own a skiff that is used for pound net-related duties and transporting tourists during the summer holidays.

The origins of pound net 5 are uncertain; nobody in the community remembers when this spot came into use. PO08, its owner in 1994 (Brito 2003), moved to Paraty in the 2000s. PO04 took over this fishing spot soon after. This is the only pound net in the community that has the mouth open seaward. This innovation is tied to catching schools of winter migrating fish, especially Spanish mackerel.

PO04 built pound net 6 recently and only uses this spot during the summer. This spot, like pound nets 4 and 5, is exposed to bad weather conditions. PO04's family owns a diesel boat, which they use for transporting fish to Laranjeiras and for deploying surface gillnets and jigging squid during their respective seasons. Their participation in tourism activities is limited because their boat lacks the necessary licence to perform these activities.

Pound net 7 is one of the first pound nets built in Ponta Negra, dating back to the introduction of this fishing technique. The maker and original owner, sold this pound net to the Japanese entrepreneur, who hired PO01 to manage it. PO01 took over as pound net owner until he sold it to his brother PO05. PO05 hires PO06, a non-relative, to manage this pound net. PO05 does not live in Ponta Negra anymore, but keeps active connections with the community. Other than the pound net, PO05 owns a house that he rents during the holidays. PO05 also works as a guide for his brother, who caters to foreign tourists doing long hikes in the REJ. PO05 has a son who receives secondary education in Paraty.

6.4. Livelihood Diversification

Certain patterns become evident in reviewing the history of each pound net in relation to their location, owners, crewmembers and other community members. Most of the community members who own a pound also have control over resources in sectors other than fishing. Pound net ownership has resulted in differentiation within Ponta Negra between those who own the means of production and the labourers of the fishery. Pound net ownership has allowed some to control fish resources and appropriate more of the benefits of the catch, providing a surplus that was invested in other economically productive sectors in the community.

Pound net ownership has been a means for social mobility and livelihood diversification. Most of the resources pound net owners have are being used to take advantage of the tourism sector, which has grown in importance as the fishing sector has dwindled over the last two decades. Likewise, for most of the pound net owners, it has become important to invest in the education of their children outside of the community. This is the first time that a sub-set of community children (i.e., children of productive pound net owners) has had access to more education than the rest, who receive only what is provided by the local school (Chapter 7).

Many children of the owners of the most productive pound nets, some of whom are now young adults, are no longer involved directly in the fishery or in other natural resource-based activities. They have either moved away from the community entirely or have taken on the role of marketing their family businesses, particularly tourism (see Chapter 9 for an example). Literacy and computer skills gained through education outside Ponta Negra have been essential for this transition. This contrasts with the children and other family members of the less productive pound nets and community members with no pound net ownership, whose livelihoods depend directly on the pound net fishery, other fishing activities and on the service economy. The options for these children are constrained by their limited educational opportunities, which reflect the economic situation of their families and the poor education available within Ponta Negra.

For those with no assets in the fishery, the cost of augmenting the education level available in Ponta Negra is significant as it necessitates relocation to Paraty or other urban centres. When this happens, not only does the child being educated need to move to the city, but the entire family does as well. This has been the case for many families that have left the community in the past decade. In the urban centres, families tend to face low-skill, poorly paid job opportunities and high costs of living. Often family decision-making is focused on addressing short-term needs and the longer-term advantages of investing in education are forfeited (Chapter 7).

6.5. Discussion and Conclusions

Livelihood diversification is not new to the inhabitants of SE Coastal Brazil. Prior to the opportunities created by growth in the regional fishing economy throughout the 1900s, local residents had pursued livelihood alternatives afforded by the economic cycles related to sugar cane and coffee production (Begossi 1996, 2006; Dean 1996; Adams 2000). Consequently, coastal peoples in the region have been known to take advantage of economic opportunities as they have presented themselves (Adams 2002). During such periods they have relied less on direct household consumption of local natural resources as they produced commodities for sale in regional markets and had access to store-bought products as a result of their work in the sugarcane and coffee plantations (Adams 2002). Conversely, in times of economic stagnation created by "busts" in commodity markets, they have been known to shift their livelihood strategies towards natural resource-based subsistence (Adams 2002). After the bust of the coffee economic cycle in the late 1800s, the inhabitants of SE coastal Brazil turned to shifting agriculture and fishing to meet the needs of their households (Adams 2000).

Adaptive learning processes associated with previous economic cycles have been shrouded by the passage of time. However, the "boom" in fishing provided an opportunity to document the relationships between individual adaptive learning and livelihood diversification patterns within living memory. While learning related to a new technology has been structured by a regional economy, it has contributed to the structuring of local institutions related to access to natural resources and livelihood diversification.

In Ponta Negra, the adoption of the pound net fishery led to a process of livelihood specialisation, which in turn, influenced future diversification patterns. The opportunity that emerged out of the growth in the regional fishing economy and the newly available technology allowed some to generate surpluses through the use of that technology. Community members in general associate pound net with an improvement of their quality of life as they have provided for increased local employment opportunities. The emergence of such periods of livelihood specialisation is a pattern found in other small-scale fishing systems, in which the access to high-valued resources and the opportunity to trade them have come hand in hand with elevated incomes (Béné et al. 2003, Coulthard 2008).

Livelihood specialisation also generated social differentiation. Given the physical limitations of Ponta Negra Bay, only a few people in the community were able to set up productive pound nets. In this way, the fishery created socioeconomic categories for community members and their households (i.e., pound net owners and non-pound net owners), which had important consequences in the subsequent livelihood diversification patterns (Chapter 7). As the regional fishing economy entered into crisis, and the surplus of the pound nets shrunk, some owners began to use their financial capital and the intellectual capital gained by family members to diversify through investment in the tourism sector (Chapter 9). While the pound net owners and their close relatives adopted a livelihood diversification strategy equivalent to "diversification for accumulation", non-pound net owners adopted "diversification for survival" (Béné et al. 2003).

Community livelihoods, therefore, diversified in two distinct yet co-dependant ways. As the effects of the regional fish crisis were experienced in the community, participation in the tourism sector became an opportunity for those who could invest in the sector. Pound net owners were able to move their existing assets into the tourism sector and invest in new ones, such as infrastructure for restaurants. Non-pound net owners, on the other hand, came to depend on the owners not only in the fishing sector but also in the tourism sector.

Livelihood diversification linked to the pound net fishery is also reaching the next generation in Ponta Negra. The secondary and post-secondary education opportunities

obtained by the children of pound net owners have also been mobilised to support their families' engagements in tourism through the use of new media technologies, especially Internet, unavailable to other community members (Chapter 9). This new generation is growing up removed from everyday fishing activities and currently lives in urban centres, where they are removed from the structural limitations (such as the lack of educational opportunities) restricting livelihood opportunities in Ponta Negra. While diversification for accumulation has also facilitated the process by which people's livelihoods do not depend directly on the natural resource-base, diversification for survival has strengthened dependence on natural resources as part of people's livelihood basket, increased dependence on pound net owners and limited livelihood opportunities for the coming generations. Investing in children's education as a strategy to increase long-term capabilities is frequently found in rural contexts, where the access to education beyond post-elementary levels is a perceived necessity, yet is limited to those with the assets or the social networks necessary to support children in urban settings (Bebbington et al. 2007).

Throughout the history of Ponta Negra fish has been perceived as a resource in multiple ways. Before the pound nets and the boom of the industrial fishing sector, fish was a marginal component of Ponta Negra livelihoods. As the fishing sector grew, fish was transformed into cash that provided access to better housing and a more diverse diet. Fish prices fell at the same that time dependency on the pound net fishery and store-bought commodities grew. Consequently, fish has come to mean, using the words of a pound net crewmember: "*a lot of work, but no money*" (MK01).

As a result of Ponta Negra's disadvantaged position within the regional economy, the community as a whole experiences poverty expressed in low and variable income, lack of basic services and low organisational capacity. The effects of poverty, however, are disproportionally distributed across the community. Having or not having ownership of a productive pound net became strongly correlated with control over the natural resource base and the multiple dimensions in which these resources can be appropriated. While owners were able to accumulate financial capital and invested it in other resources (including the education of their offspring), crewmembers became dependent on pound

net owners and proportionally more vulnerable to environmental uncertainty and variation in the fish market. The history of the pound net fishery in Ponta Negra from the perspective of its users and beneficiaries provides an example of a process by which the introduction of a new technology has tied individual innovation to the boom and bust of the regional fishing economy.

Describing livelihood diversification processes in Ponta Negra through re-storying the life history of some of its community members reveals a process by which adaptive learning (Davidson-Hunt 2006) related to a new technology is rooted in individual innovation that in turn can lead to the emergence of new local institutions for natural resource management through the everyday dynamics of a fishing community. The regional economy and the limited number of fishing spots available in the Ponta Negra Bay structured the adoption of the pound nets in Ponta Negra by a limited number of individuals. Individuals from the community gained both the financial and intellectual capital through their participation in the regional fishing industry to establish pound nets in Ponta Negra. Those who could establish pound nets earlier were able to have access to the most productive fishing spots. Later on they were able to extend their control over other economic sectors as new opportunities emerged. Some elements of the relationships between these processes are more apparent and recognised by research participants than others. For example, it is very common for people to mention that their lives have improved over the last decades in the community because of the income that fishing activities have provided. However, the connection between the adoption of the pound nets and social differentiation has been obscured by the normalcy of daily life and the passage of time. Some people acknowledge that there are better off families in the community, but do not provide clear explanation about the origin of these differences.

Our case shows how both local and regional forces continually shape adaptive learning processes. The relationships between these can be understood using elements from Bourdieu's practice theory: field, practice and habitus. The pound net fishery represents the field, as it is the means by which fish became commercialised in Ponta Negra. Practice can be understood as the social and economic activities performed everyday around the pound nets. This includes the operation of the fishing gear, the

interactions among owners, crewmembers, and other members of the community, as well as other interactions among fish buyers and other agents involved in the fish trade and its supply chain. The interaction between field and practice has generated a habitus reflecting the historical emergence of structures. These structures dictate who has had access to the surplus generated through selling fish in the regional market and hence have structured social differentiation processes and subsequent livelihood diversification strategies.

Established out of individual adaptation (i.e., pound nets), which is dependent on a particular resource (i.e., pelagic schooling fish) and limited locations, the adoption of a new technology resulted in re-structured socio-economic relations within the local fishing sector. The financial capital appropriated from this new field of practice by the owners of the technology allowed some to invest in educational opportunities for their families that open up new opportunities for livelihood diversification in the tourism sector (Chapter 7). Interestingly, the establishment of new beachfront restaurants is also a limited resource that provided pound net owners (or their relatives) with an early foothold during the initial establishment of the tourism sector in the community (Chapter 9). Some families were better able to capture the new opportunities than others. This case demonstrates that the conditions of social differentiation are provided when a technological adaptation is applied to resources in a context of limited access.

Chapter 7. Should I Stay or Should I Go? Human-environment relations and coastal livelihoods from a social wellbeing perspective

7.0. Introduction

In this chapter, I examine the continuity of human-environment relations in the coastal setting of Ponta Negra in the context of environmental change. This chapter develops the agency and wellbeing components of the Ethnoecology of Practice (EofP) framework (Section 2.4.4.). Social wellbeing provides an analytical lens to examine how people associate changes in their quality of life with environmental change as well as how people's desires and aspirations are framed by such changes. The inhabitants of Ponta Negra, as well as in the rest of the Atlantic Forest Coast (Adams 2003, Begossi 2006, Teixeira 2006), have adapted to the opportunities emerging from the multiple changes in the regional economy. Chapter 6, for example, illustrates how people in Ponta Negra adapted to the growth of the regional fishing industry. The transition to the tourism economy is no different as it is offering new prospects that are in turn shaping the ways people relate and want to relate with their environment.

One hot summer day, chatting and drinking coffee, an adult member of the community and I stumbled upon the dilemma of whether having a good life had to do with staying or leaving Ponta Negra. We could not come to terms with a definitive, all encompassing answer. She does not want to leave the community for anything in the world. She loves to fish, she loves to eat fish; she loves to look after the family shifting agriculture plot and to eat whatever it produces. The life in Ponta Negra is hard, there is no electricity, good education or other basic services, but she loves to live there anyway. However, when we talked about her children, the stakes were different. She said that she wants the best for them and such a thing implies leaving the community to look for better alternatives. According to this member of the community, education is key to having a better life these days. Ponta Negra only offers education up to the fourth grade; accessing

higher education levels necessitates moving out of the community. The question of whether to stay or to leave is one that not only this member of the community, but also many others in Ponta Negra ponder. There is not a straightforward answer to whether staying or leaving will have a better outcome for the quality of life of those taking such decisions. Why is it that the same place that is the paradise of the current generation of people living in the community is not a desired one for the next?

To stay or leave their coastal environments and their natural resource-based livelihoods is not a decision that only small-scale fishers in Ponta Negra or Coastal Brazil struggle with (Vasconcellos et al. 2011, Trimble and Johnson 2013). This is a tension that can be found throughout the world, wherever small-scale fishing communities are absorbed by the tentacles of globalisation (Daw et al. 2012). The depletion and destruction of marine ecosystems as a product of unregulated industrial fishing activities (e.g., Johnson 2001, Cinner et al. 2009), environmental change (e.g., Lam et al. 2012) and integration into market economies and mainstream society (e.g., Palsson 2006, Wongbusarakum 2009, Muallil et al. 2011, Vansconcellos et al. 2011) are drivers that demand quick adaptation, not only from the side of those who are directly affected but also from the decision makers in charge of developing policy to mitigate the effect of these drivers. However, understanding fishers' decisions, as well as the hopes and aspirations that go alongside them, is key to developing policy interventions aimed at improving not only the health of the ecosystems but also the quality of life of the people who depend upon them (Coulthard et al. 2011)

Understanding people's experiences of and perspectives about environmental change through the lens of social wellbeing allows breaking down the complexity of everyday life to answer questions regarding what people need to live the lives they want to live and to address policy intervention in that direction (Coulthard et al. 2011). In order to explore what underlies the choice of staying or leaving Ponta Negra, this chapter is organised in sections that deal with the multiple dimensions of wellbeing. To illustrate the material dimensions of wellbeing in Ponta Negra, I start by presenting a profile of the community that outlines its demography and other general considerations. Then, I proceed to outline the livelihood activities of the community and explain their material

dimensions in relation to the multiple transformations of the local economy during its recent history. In the next section, I present the social dimensions of wellbeing according to the landscape of relations of selected research participants. The final results section takes a look at the construction of subjective wellbeing via assessing people's understanding of quality of life and its multiple constituents. The combination of the multiple dimensions of social wellbeing opens an insider's perspective about the complexity and the current challenges living in small, natural resource dependent coastal communities entail. Understanding wellbeing from the perspective of the inhabitants of a coastal village provides a glimpse of what people want in their lives and the areas in which interventions can be designed in order to ensure the continuity of healthy relations between people and their local environments.

7.1. Profiling Ponta Negra Livelihoods

The data this chapter draws upon was generated using multiple data collection techniques. At the beginning of the research, livelihood interviews were conducted with households engaged in natural resource harvesting activities. These interviews provided a general perspective on the multiple productive activities people engage in, their seasonality and the relations these households have with other households in the community and with people in other communities through the exchange and flow of resources. Participation in everyday activities, including harvesting both in the land and on the sea, provided descriptions of people's engagement with natural resources via harvesting activities. A census of the community households (n=39) provided a full account of the local livelihood portfolios. Finally, in the verification phase of this research, instruments from the WeD toolkit (Coulthard et al. *in prep*) were applied in order make explicit the relations among the control over material and social resources, people's understanding of their wellbeing and the decisions they make. The data collected through this toolkit are complementary to data collected via ethnographic tools over the span of my research.

The productive activities that provide income and other resources to people in Ponta Negra are diverse, seasonal and not all depend directly on the local natural resource base. The main sectors in which productive activities can be situated are small-scale commercial fishing and tourism. Gathered using the closing census instrument (Section

3.4.4.2), Table 16 presents productive activities available in Ponta Negra and the participation each household has in them. Primary activities correspond to those that generate the monetary income necessary to cover living expenses and provide access to other resources, mainly food, and secondary activities those that provide supplementary income and other resources (e.g., food and construction materials).

Table 16. Productive activities per household

Productive activity	Primary activity (number of households)	%	Secondary activities (number of households)	%
1. Industrial fishing	**6**	**15.38**		
a. Purse seiner	3	7.69	1	2.56
b. Gillnetter	3	7.69	3	7.69
2. Small-scale fishing				
a. Pound net	11	28.21	11	28.21
b. Bottom hand line (off canoes)			17	43.59
c. Hand line (off the rocks)			16	41.03
d. Gillnet			6	15.38
e. Squid jigging			18	46.15
3. Shifting Agriculture	**1**	2.56	**12**	30.77
4. Handicrafts			**4**	10.26
5. Tourism				
a. Caretaker for '*veranistas*'*	6	15.38	9	23.08
b. Boat driver	1	2.56	6	15.38
c. Restaurant owner	2	5.13		
d. Holiday home rental	1	2.56	12	30.77
e. Tourist guide			5	12.82
f. Waiter/ess			4	10.26
6. Housing construction	**4**	10.26	**6**	15.38
7. Government transferences				
a. Retirement pension	5	12.82	5	12.82
b. *Bolsa Familia*			19	48.72
8. Public servant			**3**	7.69
9. Private worker			**1**	2.56
10. Supported by relative working outside the community permanently	**1**	2.56		
11. Supported by relative living in the community	**1**	2.56		
12. Fish buyer			**1**	2.56
13. Sell catalogue products			**1**	2.56

**Veranistas* refers to urban vacationers who have bought properties within the community.

The most important activities and sources of income community members report to have engaged in during the last year are working in the pound net fishery (28.21% of the households in the community), working in industrial fishing boats (15.38%), looking after *veranistas'* houses (15.38%) and retirement pensions from the Ministry of Fisheries (12.82%). Engagement in fishing activities varies by season and is segregated by age group and gender. The pound nets are predominantly operated during the summer months (December through May); the time when their productivity, and hence work available, peaks. Conversely, the productivity of this fishery plunges in the winter (April/May through November). During this time the gear is landed and the workers of the fishery move to other activities, such as housing construction, use other fishing gears or look after their shifting agriculture plots. Only those fishers without other sources of income stay working in the fishery. During 2010 only one pound net, which involved four households, remained in the water. During the winter months, some people leave the community to work on industrial fishing boats. These boats normally target species (e.g., sardines and whitemouth croaker) whose capture is only legally allowed during the winter months.

In addition to the season, the work either in small-scale or industrial fishing is age and gender dependent. While adult men with established families are those who normally work in the pound net fishery, young adults are the ones who normally leave the community to work in the industrial fishing fleets. Teenagers start helping in the pound nets when they are around twelve years old, but at the time they finish school (normally between 15 and 16 years old, as most of them have to repeat a school year several times before passing it) they leave the community to work as part of industrial fishing crews as it was already explained. In addition to the fishery related activities, looking after veranistas' houses and retirement pensions complement the primary activities and source of income in Ponta Negra.

Looking after veranistas' houses and retirement pensions are perhaps the only steady sources of income that people can rely upon. Veranistas only use their houses for a few days, but many of them pay somebody to look after them throughout the year. Although six households depend primarily on the income from veranistas (15.38%), a

total of fifteen households (38.46%) report this as a source of income. Retirement pensions also supply the older people and their relatives with a steady source of income, which in many cases is the only income to which they have access. Additionally, housing construction (10.26%) for both local residents and veranistas is an emergent livelihood alternative.

Secondary activities are more varied in terms of what people do and the resources with which they are associated. They include activities based on natural resources harvesting, such as squid fishing (46.15%), fishing with hand lines both off canoes (43.59%) and off the shoreline (41.03), and shifting agriculture (30.77%). While some of these activities provide both income and food, others only provide food. Squid and hand line fishing off canoes are seasonal activities, also peaking in the summer, that provide access to resources that are transformed into income or food according to their quality and the necessity of the households involved. Fishing off the rocks is not a commercial activity and provides protein during the winter when fish from the pound net fishery is not available. Twelve households (30.77%) participate actively in shifting agriculture. This is not a primary food source, providing a small percentage of what these families consume. Although approximately 82% of the animal non-protein food consumed in Ponta Negra is bought in Paraty (Giraldi 2012), shifting agriculture provides foods that people particularly value for their flavour.

In terms of non-natural resource based activities and sources of income, 'Bolsa Familia' (48.72%), a social welfare program from the Brazilian government, and holiday home rental (30.77%) are the most important activities/sources of income. The Bolsa Familia subsidy gives the equivalent of $ 45 CAD/month per child attending to school. Considering that most of the households that have children of school age have more than one child, this subsidy becomes an important supplement for the income of many families. Holiday home rental is an important source of income during the Brazilian holidays, when the influx of tourists to the community reaches its maximum. For some families renting their houses becomes a priority, as in some cases it provides the equivalent of half of what they would make through their other livelihood activities combined throughout

the year (Li12). The 24 houses available for renting during the holidays speak to the relevance of this activity in the community.

Productive activities are also intertwined with gender in Ponta Negra. Activities in the industrial fishing fleets as well as in the pound net fishery are predominantly male dominated. Males of different ages employ almost all the fishing techniques used in Ponta Negra (Tables 5 and 7 in Chapter 4). Although the fish is cleaned by whoever is available, women often do the cooking. In addition to cooking, women, with the help of older children, are also in charge of other reproductive activities that include child rearing and cleaning the homestead. Caretaking for veranistas and other service activities related to the tourist sector have become important activities and sources of income for many households in the community in the recent years. Adult women are the ones who have taken over these emerging options; they consider that many of the skills associated with the aforementioned reproductive activities can be transposed to the jobs opening in the service economy. Given the diversity of local livelihoods, it is hard to quantify what the gender contribution to the livelihood portfolios in each household is. Ponta Negra households work as organisations. As result, even though there are activities that are often considered gendered, in practice they can be performed by whoever is able to undertake them.

The number of productive activities per household also shows how diverse household livelihood portfolios are. While few households engage in less than three productive activities (17.95% or 7 HHs), the bulk of the community households have between three and nine productive activities; one family even reported eleven productive activities (Figure 25). The diversity of the portfolios suggests a resilient community whose households are able to tap into different sectors according to season and availability of opportunities and resources (Marshke and Berkes 2006). However, resilience is not tantamount to wellbeing (Coulthard 2012). The following sections describe how the material and social dimensions of life in Ponta Negra have influenced the way people currently live, the decisions they make and their desires for future generations.

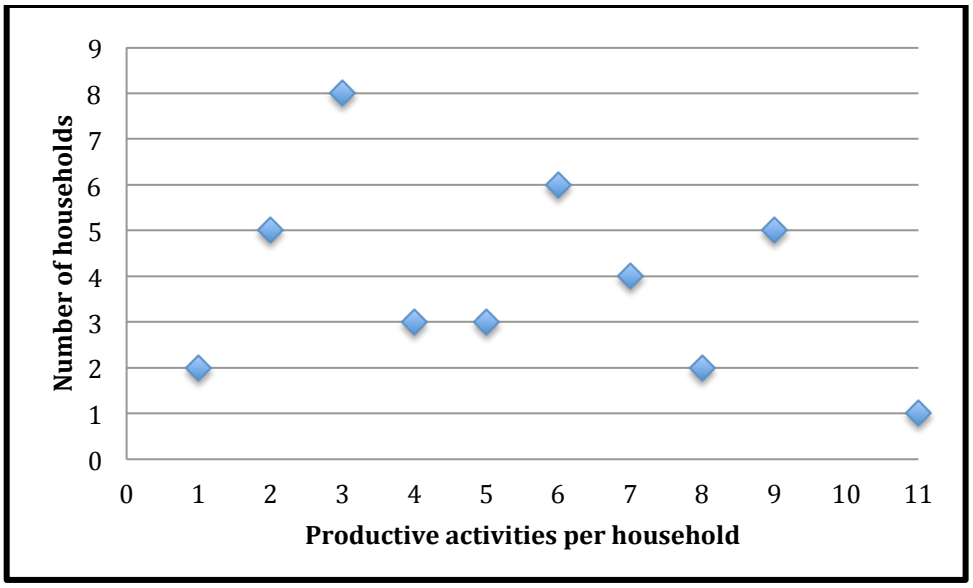

Figure 25. Productive activities per number of households

7.2. Material Dimensions of Wellbeing

The material dimensions of wellbeing encompass material assets, welfare and standards of living (White 2010). In the context of Ponta Negra, these material dimensions include the resources associated with the productive activities of the community. Fishing resources include the natural resources that people harvest, the means by which people access such resources, as well as the outcomes of transforming those resources. Tourism resources include the assets people have to participate in this economic sector. Even though exploring the material dimensions of these to sectors provides deep insights on some aspects of wellbeing, material resources cannot be seen in isolation. They are enmeshed in assemblages of human and non-human actors that enable (or hinder) their flows and transformation (Ingold 2012).

In order to understand the material dimension of Ponta Negra's wellbeing, it is necessary to see it in the context of its relational dimensions. The relational dimension of wellbeing refers to the networks of social relations individuals belong to and through which resources flow are transformed into multiple outcomes (White and Ellison 2007). This relational dimension not only includes interactions with other members of the household, community and governmental and non-governmental organisations, but also the capabilities that are associated with accessing and controlling the material dimensions of the resources (White 2010). As the concept of affordances shows (Section 2.1.2.2),

fish does not have intrinsic value; it is relative to the networks within which it is accessed and the position one has within them (Section 4.1). While good quality pelagic fish represents good income to the owners of fishing gear and the fish buyers that facilitate their sale, the same fish represents a lot of work to the crewmembers who are in charge of catching and handling it (Chapter 6).

A useful way to understand wellbeing in Ponta Negra is to consider the assemblages of its material and relational dimensions in the context of its productive activities. The pound net fishery and the tourism sector have structured and are structured by material resources to which they are associated and enable access as well as the social contexts in which they exist. The pound net fishery was the means by which people in Ponta Negra could participate in the boom of the regional fishing industry. This fishery has in turn changed the value and perception of fish according to the position in which people have had in it (Chapter 6). From a social wellbeing perspective, these bundles of material resources and the relations surrounding them do not only enable the access to the natural resource base, such as valuable fish species, but also enable the transformation of those natural resources into the necessary materials to live a fulfilling life. Fishing, for example, is not only about the nutritional and the economic value of the harvested fish, it is also about job satisfaction and being outdoors with friends and family; it is about expecting and celebrating the good catches, sharing with relatives and other people in the community. From this perspective, material and social resources are enmeshed in complex assemblages that are hard to separate.

In addition to the resources associated with the fishing and tourism sectors, education has recently become a necessity for living a good life. Even though not too many of the adults in the community are literate, parents think that their children need to be able to read and write in order to have a successful life. Conversely, there are other components of life in Ponta Negra that used to be important for people living there, but are currently decreasing in relevance. Shifting agriculture is perhaps the best example: what used to be a basic component of life in Ponta Negra and a source of identity for people in the community a couple of generations ago is no longer sought by the younger generations.

Accessing the aforementioned resources goes beyond monetary income and protein sources; they are an intrinsic part of who people are, what they do and what they value. In this section I describe and analyse the material and social resources associated with fishing, tourism and education as they have structured life and therefore have influenced the experience and construction of wellbeing in Ponta Negra over its recent past. I began by explaining the material and social dimensions of the multiple fishing activities occurring in Ponta Negra, now I move to situate these resources within the regional social context. Looking at the multiple contexts within which fishing practices are enmeshed allows taking into consideration the factors motivating or discouraging people to continue engaging in these activities. In parallel to this, I illustrate the development of the tourism economy as Ponta Negra community members have experienced it. This narrative takes into consideration both the material and social dimensions associated with this economic sector, including the benefits people may or may not receive from this activity. The end of this section deals with the emergence of education as a necessity for community members. Looking at the fluidity of the material and social dimensions of wellbeing illustrates that the processes by which what people understand and seek their wellbeing are contextual and contingent.

7.2.1. Fishing Activities and Resources Associated

Fishing activities comprise a complex domain within which different types of resources can be accessed. Fish in Ponta Negra can be located along a spectrum of two classes (i.e., first and second, see Section 4.1). These classes of fish depend on the commercial value and social life of different species of fish. While first class fish have relatively higher value and are generally destined for regional markets, second-class fish have relatively lower value and, although some of them are sold when available in big quantities, they are widely consumed and shared within the community. As noted above, fishing from canoes with hand lines targets first class fish, pound nets target both classes, fishing with rods along the shoreline only the targets second-class fish. Being able to capture valuable fish and transform them either into income or a food item depends on the material and social resources over which a person or a household has control. Likewise, the objectives and circumstances underlying the participation in each activity indicate the positionality

of each fisher and household within the fishing economy. For details about the relations among classes of fish, fishing techniques and social class see Chapter 4.

7.2.2. Questioning the Fishery: Status quo and future

Commercial fishing activities have shaped everyday life in Ponta Negra since their establishment in the 1970s (Chapter 6). Beyond their economic relevance, these activities are closely tied to the attachment to the place that people have. The social differentiation process unleashed by the pound net fishery produced both people in positions of advantage (i.e., owners) and disadvantage (i.e., crewmembers) relative to their role and dependence on the fishery. While the pound net owners and their households have been able to diversify their livelihood portfolios in proactive ways to not depend solely on the fishery, crewmembers' and other households in the community depend on the fishery in terms of income as well as a source of food (Chapter 6). The growth of the regional industrial fishing sector, which facilitated the emergence and development of the local fishery, is now the culprit of its current crisis. Fishing fleets have overfished and destroyed the regional ecosystems to the point of affecting the volume and quality of the local catches (Diegues 2004). The mix of lack of infrastructure, isolation from markets and effects of industrial fishing are structural factors that put in jeopardy the Ponta Negra fishing sector, along with people that depend on it (Section 6.3.3.3).

In the context of this isolation, fish buyers have become necessary brokers in the fish trade. Each pound net owner has a fixed deal with a particular fish buyer, who in addition to buying the fish catches provides the fuel, ice and other supplies to run the fishery. Through the pound net owners, the fish buyers also buy the catches from other fisheries, especially the squid, that leaves the community. There are three fish buyers dealing with fishers in the community. While two of them have no direct kinship ties to Ponta Negra, one of them was born in the community and is the brother of two pound net owners. Even though fish buyers play a key role linking the local fishery and the regional markers, the relations fishers have with them have been historically negative (LH08). Fishers have always felt that fish buyers take advantage of them. This is an account from a community elder about interactions with fish buyers at the time the pound net fishery started (circa 1970):

> Enrique used to buy our fish and ship it to São Paulo. He used to pay for the fish on a month-to-month basis. Although we were able to pay everything with the money we received, Enrique became rich with money from so many fish that my brothers sold to him. Somebody who worked for Enrique told us that he paid the fish to us from the "*juro do peixe*" (interest from the fish). He used to pay us every month so he could accumulate interest. He would take a truck full of fish to São Paulo one day, sell everything and get paid right after. He would do that many times during the month, getting paid after every delivery. He kept the money in the bank and paid us with the interest. While he became rich, we stayed the same here (LH09).

This twofold role of fish buyers, who on one hand enable local fishers to reach local markets but on the other take advantage of their privileged position, is not exclusive in Ponta Negra. Similar relations have been documented in other places along the Brazilian Eastern Coast (e.g., Begossi 1996) as well as elsewhere (Crona et al. 2010).

Fishers are also aware of the effect that the growth and modernisation of the regional industrial fishing fleets have had on their livelihoods and attachment to fishing activities. Too many industrial fishing boats, fishing all that they can, are accountable for the decline of the regional stocks, the destruction of the regional ecosystem and the crisis that has come with it (Diegues 2004). Because of the effects of industrial fishing, local fishers doubt the future of their fishing stocks:

> In the old days fishing boats were small. They used to handle 200 totes [20 Kg each] of fish. Today it is only profitable if they catch between 100 and 200 tons. The purse seiners if they do not locate big schools they do not bother to catch it. Can you imagine the effect of thousands of boats doing that? Neither fish nor fishing has a future here (LH01).

Social differentiation and the marginalisation that has come with it, lack of infrastructure, inability to market fish at fair prices and the depletion of stocks by industrial fishing fleets are structural factors within the fisheries that have been enticing people in Ponta Negra to consider the continuity of their engagement in the fishery. In fact, the emergence of tourism due to opening of the Rio-Santos Highway in the 1970s encouraged people to diversify their livelihood portfolios by incorporating the tourism and the construction sectors. Tourism became an income alternative, but carried forward some of the social structures created during the consolidation of the fishing economy and exposed the limitations that have inhibited people from entering into this relatively new economy on even terms.

7.2.3. Moving Towards Tourism

Tourism is one of the multiple economic cycles that the Atlantic Forest Coast has historically experienced (Begossi 2006). In Ponta Negra, this economic sector is based on the provision of lodging, restaurants and cleaning services to visitors mainly from São Paulo and Rio de Janeiro, the biggest cities close to Paraty. The tourist season coincides with the southern hemisphere summer (from December to March), and reaches its peaks during the main national holidays: r*eveillón* (new year's passage), carnival (before lent, February or March) and holy week (March or April). The rest of the year the number of visitors drops and depends on good weather during long weekends.

Ponta Negra's tourism economy has grown since the 1990s. It started with a few people visiting the community to camp and spend the day and now has grown into an important economic sector that employs a large percentage of the households in Ponta Negra (LH02, LH08). As fish stocks were declining and the region was gaining importance as a tourist destination, many people recognised the structural limitations of the fishing sector and acted upon the early warning signs. Those who did not emigrate found an alternative for maintaining and improving their quality of life through tourism.

> Since I was born and raised here, I know how things work. Nobody improved their lives through fishing. Those who could improve their lives did so because they left Ponta Negra to live elsewhere. A lot of people have left Ponta Negra. The oldest people from Ponta Negra do not live there anymore. If people did not improve their lives when there was a lot of fish, they will not improve them now that fish has become so scarce. If I did some renovations to my house it was with money coming from tourism. Person 1 made his houses and his bar with tourism money. The same thing happened with Person 2, 3 and 4. All the houses they rent these days were built with tourism money (LH02).

In the context of crisis in the fishing sector, some people even recognised that tourism allowed them to avoid hardship: "*If it weren't because of tourism, we would experience hard times*" (PO04).

Today, including all the activities associated with the sector, tourism is the main source of income for ten households (22.22%) and provides supplementary income for another 23 (51.11%). Additionally, other sectors have grown because of tourism. The way the tourism economy has developed in Ponta Negra, around holiday house rental and

veranistas, turned housing construction into a niche many could tap. Housing construction is the main source of income for four households in the community (10.26%) and provides complementary income for other six (15.38%). This number of households involved in this sector show the current, even though indirect, importance of tourism in this community.

As tourism gained weight in the local economy, certain structures shaped it and developed alongside it. Topography, resources in other economic sectors and education have been key in configuring the tourism economy and the position of those involved in it. The particular topography of Ponta Negra, a steep hill with a small sandy beach, has allowed the development of a tourism economy different form that in other communities in the area. While the neighbouring community of Praia do Sono, which has a flatter topography, has 26 bars and restaurants and 23 camp sites (Cortines and Nogara 2011), Ponta Negra has only two restaurants and one camp site. These geographic features influence the quantity and quality of the tourists that visit the communities. At the same time that Praia do Sono reported a total of 1,488 of tourist visits during the end of the year holiday of 2009, Ponta Negra only reported 248 (Instituto BioAtlantica 2011). Tourist operators in the region praise Ponta Negra as a place that caters "*turismo de qualidade*" (quality tourism) as opposed to "*turismo de barraca*" (tent/camping tourism), the main strategy found in Praia do Sono (OS02).

Ponta Negra tourism is renowned for its quality because of the available infrastructure and the services it provides. Most of the people who come to the community for more than one night stay in houses owned by community members (OS01, OS02). These houses offer a rustic but private opportunity to spend time in an isolated place. There are a total of 24 houses available for renting in the community. Although other communities also have houses used for those purposes, the proportion in Ponta Negra is higher that anywhere else (24/45 vs. 22/97 in Praia do Sono, vs. 25/95 in Pouso da Cajaiba, according to Cortines and Nogara 2011). The consolidation of this tourism business model was perceived as something that benefited the community in general. An elder who saw the start of this tourism strategy described it this way: "*with the arrival of tourism, people started making more money. It helped the community a lot, as it gave the*

possibility for people to rent their houses for the holidays" (LH07).

Renting houses as a strategy for catering tourism services has been linked to the historical perception of the improvement of living conditions in the community. This is something that is in turn associated with the perception of the general improvement in the quality of life already started by the income made in the early days of the community's engagement in the industrial fishing sector and the local commercial fishery (LH02). With the advent of tourism, people felt more motivated to renovate their houses. Brick and tiles became the preferred construction materials and progressively replaced the traditional wattle and daub. It all escalated from there; better housing meant higher renting prices, and higher renting prices meant more surplus that could be reinvested in local dwellings:

> We didn't rent houses before. Tourists would come to stay with people they knew. Nobody had any house to rent either. With time, as more tourists arrived, we learned that renting houses could be a good source of income and started building better houses, both for dwelling in and renting (LH08).

> My first house in Ponta Negra was built with wattle and daub and had *Eternit* (fibre cement) roof, very simple. When tourists started renting back then (circa 1990) it was not for a lot of money, but with it I could do some renovations. The turnout of tourists improved with time. Those who started to come told their friends about the beauties of the region. With time, more and more tourists came and it became the way it is today. With more tourists coming people could invest more money in their houses and rent them at higher prices (LH02).

Ideally, renting houses during the holidays could be a strategy for providing tourist services that would allow all the owners of rental properties to provide these services. However, this has not been the case. The competition over renting houses has caused division and disagreements among community members since the dawn of the tourism economy in the community. An elder explained:

> As renting houses became an economic option, lot of competition started over who would get into this started in the community. When tourists arrived asking for somebody's house, people from other families said that they did not know this person and offered their houses instead. This caused a lot of division within Ponta Negra (LH07).

As the influx of tourists grew, the competition among community members grew also bigger and became more complex.

Only those with the adequate assets and who were able to build entrepreneurial skills could take full advantage of the emerging economy. Some of those who were able to make a profit in the fishing sector were in turn able to have a position of advantage during the emergence of the tourism economy (Chapter 6). The households that had beach properties before the tourism boom had an advantage over those who did not. Both restaurants in the community, for example, were originally shacks for storing fish and pound net related gear. One of the current restaurant owners saw the possibility for making more profit from fish by selling it cooked to the incoming tourists. Within the space of a decade a small shack grew into a fully-fledged restaurant with a specialised menu that can cater to up to 50 people at the time (PO03). In addition, the people who profited from the pound net fishery could invest, not only in improving their housing infrastructure, but in sending their children to receive better education in the nearby towns too. While in Paraty, some of them worked and received training in jobs in the tourism sector or costumer services (see Chapter 9 for an example). This combination of circumstances gave a few a position of advantage as they could offer better services and also access and control the networks needed to lure more tourists to the community. The gross participation of Ponta Negra residents in tourism is as workers for the limited number of tourism providers.

The people who did not have a head start in the tourism business became dependent on those who did, not only in terms of jobs but also in terms of renting their houses. Currently nine households depend partially on income from service-related jobs created by the tourism sector. While looking after veranistas' houses provides a small but steady source of income throughout the year, most of the jobs at the local restaurants are only available during a short time window in the summer. Renting houses for the holidays is a permanent source of conflict in the community, as these services are offered through Internet and controlled by two families. They are in charge of offering the rental houses for the entire community in exchange for a 10% commission fee off the rental value that is charged to the house owners. The families controlling the rental services also have their own houses to rent, which they give priority to over those of non-relatives. As a result, it has been common for certain families not to be able to easily rent their houses.

> Renting houses during the holidays, even though it can provide a substantial source of income, is hard. By hard I mean it does not happen every year. I have rented my house only a couple of times over the last ten years. At the end of the year sometimes you can rent, more often you cannot (LI02).

Some people are more explicit about their perception of those families in control of the rental networks:

> I have a house for rent, which I have available for rent during New Year's, carnival and holy week holidays. This house is rented through them [families in control of the rental networks]. I mostly rent my house during the New Year's holiday, but during carnival it is pretty hard. When I can rent it, I normally receive about BRL 2000 for renting my chalet during New Year's. The service they provide is really unfair as they always give priority to renting the properties of their families sometimes even twice during the same holiday. We are always selected last, if we get selected. Because of that, many times we do not end up renting our properties (LI05).

Families invest in the maintenance of their houses every year with the hope of renting them during the summer holidays. When a house is rented it provides a substantial income, often totalling as much as half of the monetary income a household needs over a year; however, when it is not rented, it can become the omen of a year of hardship (Li12). Despite the fact that many households invest in renovating their houses, the means for advertising these services are quite limited. Most of the community households depend on a few community members with Internet skills and connections with the regional tourism networks to act as brokers. Some community members mentioned that they have not rented their properties over the last couple of years. Those who have access to such specialised skills and networks come from privileged families who have been able to provide them with education and opportunities to live in nearby urban settings (Section 9.3). While for these members of the community with marketing skills, the income they receive from tourism-related activities represents a relatively regular and stable component of their livelihood, this is not the case of the community members who have not had access to education beyond what is provided in Ponta Negra

In parallel to the development of the tourism economy, Ponta Negra has seen a process of gentrification taking place in the last decades. As opposed to temporary outmigration associated with seasonal jobs in the industrial fishing sector (Section 7.1), outmigration associated with gentrification is a permanent outcome of the lack of jobs

and proper education in the community coupled with the increased importance of the region as a tourism destination. Between five and eight families have left the community over the last two decades; they have either abandoned or sold their properties (OS01). As people in the community have emigrated, veranistas and affluent people from the community have bought some of the properties left vacant. Even though such gentrification process enabled the creation of new jobs (e.g. caretaker) and triggered the growth of the construction sector, older veranistas have encouraged relatives and friends to buy properties in the community and thereby facilitating real estate transactions and the promise of quick money. Likewise, many families have taken advantage of the influx of more veranistas to sell their properties close to the beach and build new houses up the hills in less attractive spots. At the same time, people in the community have also bought and renovated houses to use them as rental properties. Currently 27 veranistas own properties and there are 24 houses available for rent. This means that, out of a total of inhabitable 96 houses, community members dwell only 42 in permanently. Gentrification also becomes a lens to understand the dimensions of social differentiation in Ponta Negra, as three local families own 17 rental properties; these same families own pound nets, but do not consider them their main source of income.

The households that control tourism resources, pound nets and have members living in the city making steady income do not depend solely on local natural resource base. On the other hand, the rest of the community is still heavily dependent on local resources, their seasonality and the complexities of their sale. Although tourism has diversified the local economy and increased livelihood options, it has also increased social differentiation as well as the dependence of the poorest people in the community on the wealthier ones. Life in the community for the first group is a constant struggle to find odd jobs to supply their income. Income in Ponta Negra is not easy for many people in the community and people have to be very resourceful in order to avoid hardship:

> Income is sometimes lean. As a tourist guide, I only work in August, when the French come to Ponta Negra. I made BRL 1400 (BRL 120/day). Sometimes I receive more because of tips the tourist give to me. The rest of the year I work doing temporary jobs mainly in the construction sector. The length of these jobs depends on the type and size of the construction I have to do. I do not have a permanent job here; I can only work on what is available (Li12).

With the crisis in the fishing sector, the limited offer of employment opportunities within the community and the emergence of jobs that demand specialised skills, education has emerged not only as a necessity but also as an obligation for people in Ponta Negra.

7.2.4. Education and the Need for it

Access to formal education in Ponta Negra is quite limited. The local school only offers elementary school (up to 4th grade). If somebody wants to receive more education, there is no other choice but to move to a nearby urban centre, such as Paraty or Angra dos Reis. This structural limitation is reflected in the overall levels of education found in the community (Figure 26). The biggest percentage of adults in the community did not attend school (23.78%), attended elementary school but did not finish (37.20%) or only finished elementary school (12.80%). Few people have been able to leave the community and have access to higher levels of education. In the recent history of the community only four people have finished high school (2.44%); of those three are currently attending University.

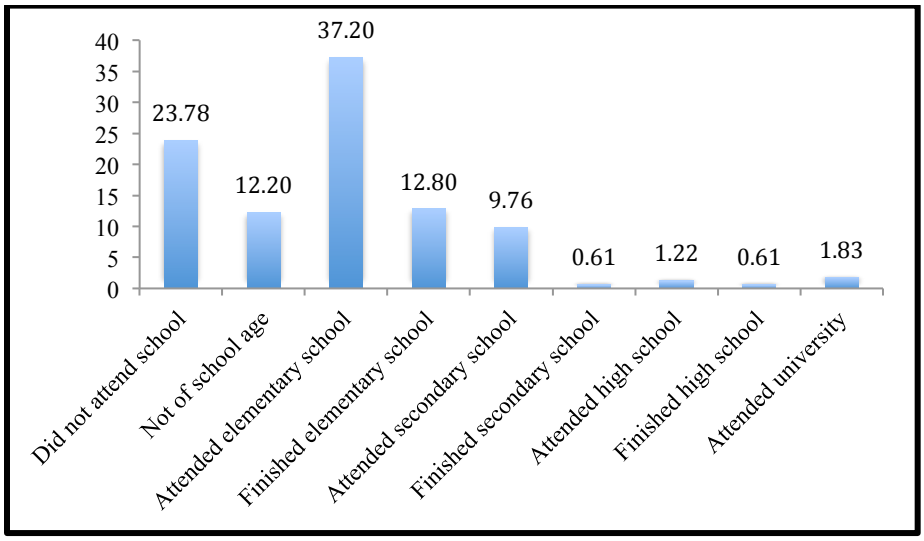

Figure 26. Levels of education in Ponta Negra

Considering this low level of education, why is it that education has become a recognised necessity in the community? Community elders acknowledge that when they were growing up attending school was neither a requirement nor an option (LH07). Everyday life was limited to helping older family members in agriculture and fishing

activities. However, as the relevance of these activities has declined, people have needed to diversify their livelihood portfolios (Chapter 6). The current options are staying in the community working in tourism-related activities or searching for employment in nearby urban centres. However, those who have lived in the urban centres know that being able to read and write is now a requirement for accessing well-paid jobs (Li11). Also those who have tourism assets see education as an opportunity to acquire skills that would enable them offer better services and to advertise their service in more effective ways (Li12). But recognising the importance of education is just one part of the equation; the other part is to have access to it (Chapter 9).

The children who are able to finish the elementary education cycle start working in income generating activities. While young males generally join the industrial fishing fleets and spend the winter fishing on the high seas, young women stay in the community helping their parents in their productive activities until they find a partner and start having children. The few who have been able to leave the community to receive secondary and high school education have been able to do so because their families have support networks in the urban centres or the financial resources to sustain their offspring in the city. The families that do not have the aforementioned resources but still feel the need to invest in their children's education have no choice other than moving to the city with all the household members. While the children study the parents work in low skilled jobs, such as helpers in housing construction or maids in the region's multiple inns, hotels and hostels.

Those who have stayed in the community recognise that education should be a priority, but they are also aware of the limitations to access it. Sending one's offspring to study in Paraty is a tough decision; the bottom line always resides in the lack of funds to maintain children in the city:

> I can only afford for my children to study here in the community. My oldest daughter won't be able to study anymore as she is finishing 4th grade, the last grade she can take here. If there were other options here she would be able to continue studying. The way things are, she can't study anymore (Li08).

Elders and mature adults bring together the changing of perspectives about education in their narratives. They portray how life has changed over the course of their

lives regarding the improvement of living conditions and changes in the local economy. The need for formal education features as a central piece:

> I struggled to raise eight children. They studied a bit, but they studied. I am the most illiterate person in my family. All my offspring know how to read and write. They studied as much as they could. I am really proud of them. […] In the time of my parents and grandparents there was no school, so nobody learned to read and write. Today people not only have the chance but also the necessity to read and write (LH07).

> I do not know how to read and write; I never had the chance to learn. Today children need to understand that education is important for them so they can live better lives. Knowing how to read and write is key for all the new generations. Education opens access for them to find better jobs and hence have better lives (LH08).

7.2.5. Social Dimensions of Wellbeing

Social wellbeing refers to the relationships people have and value for living a good life (White and Ellison 2007). These relationships include interactions among members of the same households and with relatives and neighbours living in the same community, with relevant stakeholders (i.e., fish buyers and environmental authorities). These relations affect everyday life in the community, influence access to natural resources, the material and immaterial benefits people get from them and the decisions they make. This evaluation of relational wellbeing was conducted using the Relational Wellbeing Assessment (RWA) tool developed by the WellFish Project (Coulthard et al. in press). This tool allowed me to map relational landscapes from a household perspective, identifying what relationships are important in the everyday life of the community, assessing the level of satisfaction with these relationships (from 1 to 10 scores) and indicating what relationships a household wishes to change, why and how. I applied this tool with ten households (Table 17).

Evaluating the relational landscapes shows that relationships cited as important happen at the local level. However, the levels of satisfaction vary. The relations with relatives (both extended and from the same households) and neighbours and friends have high levels of satisfaction (i.e., between 7.29 and 9) and nobody wants to change them. Collaboration and affective relations among family members are key in the everyday activities of the community. Many households work as organisations in which all

collaborate and contribute. Parents and children often fish together. Likewise, in the households that own a pound net all the capable family members are available as crewmembers. The relations among households, including extended relatives and friends and neighbours, are framed in the sharing of resources and mutual collaboration in multiple activities. Pound net owners often admit that without the collaboration from people in the community for landing canoes and skiffs and handling the catches they would not be able to run the fishery. As explained in Chapter 4, they respond to this collaboration by sharing part of their catches with those who help and those in need. Extended relatives also lend money to each other and also help with household tasks such as child rearing.

Table 17. Important relations that influence everyday life

Relationships important for living well in Ponta Negra	HHs citing this relation as important	Level of satisfaction	Relations that need change
Extended relatives (different households)	10	7.80	0
Close relatives (same household)	9	9.00	0
Community-Based Organization (CBO)	9	2.89	10
Ministry of fisheries	9	6.11	1
Neighbours and friends	7	7.29	0
Fish buyers	6	5.50	4
Supermarket in Paraty	6	6.00	0
Boat owner/cerco owner	4	5.75	3
Environmental authority	4	1.67	4
Local rules	3	7.33	0
Church	2	3.00	0
People in other communities	1	6.00	0
Tourist operators and travel agents	1	8.00	0

The interactions with the community-based organisation (CBO)[13] are an example of relations with low satisfaction levels (2.89) that all the interviewed households want to change. For many community members, the CBO is the only organisation that voices the

[13] The Ponta Negra CBO is an association formed by its residents with objective of creating a forum to address community concerns, including access to basic services such as education and health. The CBO's president, who is democratically in the community elected every two years, is in charge of moving these concerns forward to the municipal authority and executing multiple projects in the community (http://pontanegra.webnode.com.br/news/estatuto1/ accessed on August 26, 2013).

concerns of the community to the municipality. While some people try to engage as much as they can in the activities of the organisation, the large majority seem to avoid it. The interviewed households consider the CBO to be ineffective in the projects they undertake and that its leaders do not work for the community but for themselves (W8). Other people think that those who manage the association are not accountable in terms of the funds they receive from the municipality (W2). There is a general consensus that the CBO should work in favour of the general interests of the community, such as leveraging funds from the multiple royalties that the municipality of Paraty receives as well as working towards improving the community organisation in such a way that it could benefit the livelihoods and quality of life in the community (Focus Group, July 20).

Nine households cited the relations with the Ministry of Fisheries as important, receiving a level of satisfaction of 6.11. The main interaction local fishers have with the Ministry of Fisheries is through the monthly payment of their professional fishing licences (*carteira de pesca*). Having their licence payments up-to-date enables them to work in the industrial fleets, have insurance in case of accidents and also contribute towards their retirement pension. This payment is something that all the active fishers do without question. Fishers see in the retirement pension a source of security and stability that everybody should seek out. Retired fishers report that their pension becomes the main source of income for them and their families and gives them economic relief (WB5). However, not all the relations with the Ministry of Fisheries were deemed positive. With a recent announcement of restrictions on unregistered vessels and fishing gear, some fishers are concerned that in a couple of years the regulations could be tightened to the point that nobody will be able to fish legally (WB2).

As noted in Chapter 4 and 6, Ponta Negra fishers can be roughly divided between those who own the means of production, as in fishing gear and boats, and those who do not own them. For many households, working for these owners is their main source of income. Four households cited the relations they have with skiff and pound net owners as important. All the households who reported these relationships agree that the way earnings are distributed is fixed. Owners and workers divide what is produced in equal parts after running costs have been deducted (Chapter 4). Workers have good relations

with gear and skiff owners; they admit that working for somebody else, beyond the access to income, allows them to do things they enjoy and appreciate and to also have access to steady sources of food. When talking about the relations that need to change, three people mention that they would like to be able to own their own gear and means of transportation so they could be independent and profit better from the activities associated with that technology "[*He] lets me work for him and gives me access to a boat. I would like to have my own boat though*" (WB4).

The relations with pound net owners are often perceived negatively because of the asymmetry in the power relations they involve: while owners concentrate the wealth, crews concentrate the work. Transactions related to first class fish illustrate this point. Every time people talk about fish trade with pound net owners they use the very same sentence: "*O peixe na praia é engraçado*" (Li12). This expression speaks to the asymmetries that exist in the transactions in which this type of fish is involved. When the fisher catches first-class fish outside a pound net, pound net owners buy it so as to re-sell it either to the fish buyers or to prepare it in the restaurants. The value of this transaction, which is decided by the pound net owners, is often low and discourages non-pound net fishers to have commercial deals with pound net owners, as they see that their catches cannot have good prices. Furthermore, when people from the community want to treat themselves by buying the same first-class fish, the transaction favours pound net owners again. King mackerel that pound net owners distribute to the fish buyers at around $4 CAD/Kg would be sold to the locals at the Paraty fish market price, around $7.5 CAD/Kg. Ponta Negra community members see these transactions as unfair and in this context refer to pound net owners as *espertos*, people who would not lose the opportunity to take advantage of them. This example is related to first-class fish transactions, but according to many households the issue is common to other transactions, such as payment of salaries and exchange of labour in contexts outside the fishery. The rules of reciprocity associated with sharing fish explained in Section 4.4.1.3 only apply to second-class fish, which has low and sometimes no commercial value.

As mentioned in Section 7.2.3, fish buyers are also key players in the community. They enable the fish caught in the community to access the regional markets. Although

fish buyers buy most of the fish that is produced and provide basic supplies for running the fishery, fishers are not happy about the economic transactions related to the fish trade. Fishers indicate that their discontent is not only about the ever-low market prices but also the multiple ways in which fish buyers manage to take advantage of them (see Section 6.3 for details). Poor book keeping, weighing the fish badly or changing the fish prices to their benefit are examples of the ways in which local fishers consider fish buyers to be dishonest:

> Although [the fish buyer] buys all the fish we produce, the deal is not the best for us. Many times he loses track of the fish we sent to him or underestimates the amounts of fish he receives. In addition, he buys the fish really cheap. Often [he pays us] according to the price of the market in São Paulo, even though he sells it in Paraty at a better price (WB2).

Because of the balance between buying all the fish produced in the community and the reasons that produce discontent to the fishers, the level of satisfaction with fish buyers is neither high nor low (5.5). However, three of the four respondents said that they would like to change their relations with these fish buyers. When asked about how they would like to do that they all agreed that there is a need for better infrastructure to market the local catches so people in the community can improve their profit margins.

Considering that Ponta Negra is located within the REJ, a state protected area, the environmental authority, represented by Environmental State Institute (INEA for its acronym in Portuguese), is another government institution with which people in this community have sustained relationships. The four households that cited the relations with the environmental authority as important all agreed on the negative nature of these relations. The interactions between the environmental authority and the people in Ponta Negra are limited to restricting natural resource harvesting activities in the forest - such as hunting and timber extraction, the opening of new shifting agriculture plots and the construction of new buildings.

These are perspectives from some community members on the matter: "*I do not like the INEA; they make life in the community harder than it should be by prohibiting building new houses or opening new plots for agriculture*" (WB1); "*the INEA is always giving us trouble for living here. We cannot bring construction materials because they do*

not allow it" (WB8). These accounts explain the low satisfaction level found (i.e., 1.67) and the fact that all households expressed that the relations with this particular stakeholder should change.

The regulation over the use of pound net fishing spots was the only local institution mentioned in the RWA assessment (Section 4.4.1.2). Nobody can set a pound net in somebody else's fishing spot or set a new fishing spot too close to a pre-existing one. Respecting these rules is basic for avoiding conflicts in the community.

> The only rule we have is that each pound net owner has a fishing spot that nobody else uses. If we are not going to use it anymore we can sell the right to use this spot to somebody else who wants to use it (WB10)

Even though only three people mentioned this set of rules in the RWA assessment, it is highly respected and complied with in Ponta Negra, as this research collaborator states:

> We have a rule that prevents us from setting pound nets too close to each other [around 150m]. With this rule we avoid disturbing the fishing efforts of other people. Everybody respects that rule here (WB3).

High levels of satisfaction were reported (7.33) and none of the respondents wanted to change the fishing spots rule.

Only the household whose main productive activity is providing tourism services cited relations with people in other communities and other tourist operators and travel agents as important to them. Both types of relations had a relatively high level of satisfaction (i.e., 6 and 8 respectively). It is important to acknowledge that, even though only one household acknowledged these relations, they are important for positioning the community in regional and even international tourism markets. Although, these relations are not visible for most of the people in the community, they are fundamental for bringing a big part of the tourism happening in the community, which in turn allows other jobs related to this economic sector to be made available. Ecological landscapes are not homogenous, nor are relational landscapes. Tourism relations show how access to networks of knowledge and resources can be limited to certain individuals who deploy them for their own benefit.

7.3. Subjective Dimensions of Wellbeing

The subjective dimension of wellbeing is deeply intertwined with its material and relational dimensions. In fact, this dimension deals with people's own perspectives on their current living conditions, the resources to which they have access and what can be done with these resources (White 2010). In order to assess subjective wellbeing, I adapted the quality of life score and the quality of life evaluation from the WellFish Project toolkit (Coulthard et al. *in prep*) to the Ponta Negra context. The same ten households interviewed in the previous sections provide their insights on this dimension of wellbeing. Additionally, I enrich the results from the WellFish Project toolkit with perspectives on wellbeing expressed by research participants over the course of my fieldwork.

7.3.1. Quality of Life Score

To evaluate quality of life in Ponta Negra (Table 18), I asked representatives of each household to indicate the five most important aspects for living well and to rank each aspect in hierarchical order (i.e., giving from five points for the most important aspect to one point for the least important). Satisfaction with each aspect was evaluated using a scale from one to five (1 = lowest; 5 = highest). The numbers I present in Table 18 refer to average satisfaction, which is the summary of the values assigned by household representatives divided by number of households that identified each aspect. Finally household representatives were asked to allocate ten imaginary spending points towards the aspects that they consider most important for living well in the community. The values presented are the sum total of spending points per aspect.

Table 18. Quality of life score

Aspects important for living well	Importance (HHs identified this aspect)	Satisfaction (0-5)	Spending points
Education	32 (8)	3.00	27
Small-scale fishing	30 (9)	2.67	19
Tourism	20 (7)	2.43	19
Shifting agriculture	15 (5)	2.80	7
Good quality housing	11 (4)	3.00	9
Better employment	9 (3)	2.25	2
Collaboration	8 (3)	3.00	6
Healthcare	7 (3)	1.33	2
Electricity	5 (2)	1.00	2
Traditional foods	4 (1)	3.00	2
Fish buyers	3 (1)	3.00	3
Better access to the community	3 (1)	3.00	2
More attention from the government	1 (1)	1.00	0

Formal education, small-scale fishing, tourism and shifting agriculture were considered the most important aspects for living a good life in Ponta Negra. Formal education, the most important aspect, is particularly relevant when people reflect upon the future of their children: "*[T]here is nothing without education. These days you need to have education in order to do anything*" (WB2). Although the satisfaction levels for education are the highest reported, they are acceptable according to the scale used. Even though the access to education has improved when compared to previous generations, there is still a long way to go before it can satisfy the demand for education that provides the skills needed to be successful prepare young people from the current economic context of the region: "*School has improved from what it was before, but it still needs to improve more in order to give good options to the children in the community*" (WB5). This concern is related to the limited grades available in the local school and the low quality of the schooling provided: "*Children only have access to the 4th grade of elementary school and the quality is not really good. They barely learn to read or write by the time they finish their education here*" (WB1). There is a direct link between the quality of education and access to better employment options: "*Children learn something, but the quality needs to be improved so they are better prepared to find better jobs*"(WB2). The fact that education received the biggest amount of spending points

strengthens the argument that good quality formal education is necessary for living well in Ponta Negra.

Many of the households I interviewed identified fishing as their most important economic activity: *"Fishing is our main source of income and food. Without fishing we have nothing***"** (WB2). In terms of satisfaction, fishing scored 2.67 (i.e., between dissatisfaction and acceptable with room for improvement). The decreasing fish stocks tied to destructive practices of the industrial fishing fleets operating in the area and its seasonality are concerns that relate to the dissatisfaction people have towards fishing: "*Fishing was better before. Now fish is dwindling because of industrial fishing boats. Twin trawlers that catch everything and leave a lot of damage behind*" (WB8); "*Fishing is seasonal. In the summer it can give us a lot of money, but we cannot depend on it year round. The income from the pound net is not enough; we need to do other things*" (WB2). Although not captured by the wellbeing assessment tools, the social structures around the ownership of fishing gear, particularly the pound nets, are also a source of discontent for those who depend on the gear owners. The intrinsically unequal distribution of income and the many instances in which owners take advantage of the workers are also important causes of dissatisfaction in the fishery.

Fishing received a total of 19 spending points, making it, along with tourism, the second spending priority. The perspectives about whether to allocate spending points in this sector or not were divided. Those willing to invest in this sector focused on the fact that fishing brings their most important source of income together with what they enjoy doing the most (e.g., WB3, WB8, WB10). Conversely, those who would not invest in the fishery recognise the decline of the stocks and the lack infrastructure available for marketing the fish and for getting a good profit out of it. Based on those arguments they believe it is not worth investing in this sector (WB1, WB7, WB9).

The tourism sector is seen by many as an option for diversifying available sources of income and job opportunities as well as to continue fishing. The income received from tourism is often used for improving housing infrastructure and buying assets associated with the fishery (e.g., WB1, WB2, WB8). Beyond the economic benefits, local tourism operators see tourism as an opportunity to attract people who appreciate the local culture

(WB4). In terms of satisfaction levels, this sector scored 2.43 (between dissatisfaction and satisfaction with room for improvement). The main reasons tourism does not score higher in terms of importance are tied to its strong seasonality: *"The income from tourism is limited to a few days during December and January; there are no more tourists after that*" (WB1). As well as to its unpredictability, which is likely associated with the impacts of the global economic crisis: "*Last year's season was pretty lean. Tourism is becoming leaner and leaner*" (WB7). The allocation of spending points for tourism was divided. For some, tourism activities are not something they are interested in (WB8); others, such as the tourism operator (WB4) and boat driver (WB7), see it as their main source of income. Some dislike this sector because they believe participation in it should be more equal and that most of the income that enters the community via this economic sector is monopolised by the few people who have control over it (WB2).

Shifting agriculture ranked as the fourth most important aspect in the community's wellbeing. However, the low satisfaction levels (2.80) and low allocation of spending points (7) show how this activity is currently losing importance. Although shifting agriculture produces foods that they prefer to eat (WB10) and is considered a comforting activity that provides a chance to be active outdoors (WB9), many do not see it as a priority anymore and prefer to invest their time and efforts in fishing and tourism activities (e.g., WB3, WB6). As explained in Chapter 5, the abandonment of shifting agriculture can be found in the interplay between the changing economy that requires time to be allocated differently and the environmental regulations that restrict cultivation practices: "*We do not have time anymore to cultivate and the INEA gives us too many troubles to keep planting* "(WB3).

The rest of the aspects recognised as important for living well are characteristics of the four primary aspects identified and already described. Good quality housing is associated with good living conditions. Having a good house to live in often equates to having good house for renting to the tourists as well: "*It is important for us to be able to improve our living conditions and make some extra income*" (WB1). Better employment opportunities available would reflect a healthier local economy, which in turn would discourage outmigration and prevent people from experiencing its potentially negative

outcomes: "*with good employment opportunities people do not have to leave the community and move to the city where they experience hardship*" (WB2). Collaboration among community members was mentioned as another important aspect for living well. Those who mentioned this aspect related it to the fact that activities in the fishery require collective work, not only among the crewmembers but also among community members in general. Collaboration becomes key for healthy living: "*The more we help the more we know we can count on everybody else*" (WB3).

The representatives of the households also identified aspects for living well related to basic services other than good quality education. Healthcare was recognised as an important need that they have little control of and access to: "*There is no doctor visiting the community and it is hard to leave the community to get medical care. Although this affects all of us, we cannot change this by ourselves*" (WB1). Similar thoughts can be found related to the lack of electricity: "*Electricity would be something that would improve our lives a lot. With electricity we could store catches for longer, not only to eat better, but also to provide tourists a wider diversity of products*" (WB2). People in Ponta Negra are aware of the need to access basic services and infrastructure to be able to live well as well as the role the state should fulfil by supplying them: "*The community needs a lot of help from the municipality. We need electricity and better means to transport fish and bring food into the community*" (WB5).

Recognising the aspects that people consider important for living well sheds light on the multiple dimensions of wellbeing and their interdependence. However, having a more holistic idea of people's accounts of wellbeing can show how each one of the aforementioned aspects influences the decisions people make as well as how the perception of wellbeing can change among different actors according to their social position, age and other variables. A more narrative-rich evaluation of quality of life was elicited using semi-structured questions and enriched through my participation in the everyday life of the community. The next section builds on enquiring about wellbeing from the perspective of important life events of household members, hopes and aspirations for the future for both the current and the next generation, changes that have affected the community and how these have affected community members.

7.4. Discussion

7.4.1. Understanding Coastal Wellbeing(s)

Wellbeing is not static when considered from the perspective of the life someone lives and desires to live. It depends on individual life paths, socio-economic position, education and so on. As the social, economic and ecological environment changes so also people's desires and aspirations. The dynamic perception of wellbeing in Ponta Negra can be examined in relation to the discourse of improvement product of local integration to regional commodity markets: fishing in the mid 1950s and tourism in the 1990s. Through the interactions with the regional economy, facilitated by each commodity market, people have had access to cash and other resources. Such interactions enabled and were enabled by the introduction of the pound net fishery, which came with more job opportunities and also with the local structuration of the social order (Chapter 6). What implications have these structural changes had for the ways by which people perceive wellbeing?

Wellbeing is multifaceted: there are multiple wellbeings that people experience, have experienced and to which they aspire. One of these is a historical wellbeing framed by the perception of how quality of life has changed in the recent decades. People perceive that the overall quality of life in Ponta Negra has improved as they have gained access to cash through jobs in the industrial fishing sector and to store-bought commodities that have allowed them to diversify their diet (Chapter 6). Faster and more reliable transportation to urban centres is also an indicator that things are better than they were in the past. There is an inter-generational wellbeing characterised by the dissimilar aspirations parents have for themselves and their children. At the same time that parents themselves do not want to emigrate to the city and want to continue having natural resource-based livelihood portfolios, they want their children to acquire skills that would make them competent in urban environments. Finally, there is also an interclass wellbeing manifested in the ways by which the poorer people in Ponta Negra aspire to have the skills and the resources of the better off individuals and households. This is particularly evident in the tourism economy, where the success of tourist entrepreneurs in advertising and providing services, in addition to creating class resentments, has shown

other people in the community the potential that Ponta Negra has in this emerging sector (Chapter 9).

When asked to reflect on their wellbeing from a historical perspective, most of the adults would say that the quality of life has improved from what it was when they were young (*melhorar*). The reasons they provide rest upon the integration of Ponta Negra into the regional economy via access to cash and improved transportation to urban centres. These factors widened the local diets from containing mostly fish, manioc flour and plantain to include other staples and other sources of protein. Rice and beans moved from being a yearly indulgence to everyday items found on everybody's plates. Cash and better transportation also led to access to construction materials that in turn allowed people to move from houses made with wattle and daub to brick and tile. This change is associated with improvement in sanitary conditions and overall comfort (Section 6.3.1).

A community member reflects upon the changes in the community related to access to cash and better transportation:

> Life conditions have improved a lot in the last decades. It is easier to make money with anything. If you fish you can sell your catch; you can make money from tourists; you can work in housing construction too… When I was a child, going to the city took an entire day. These days it only takes a couple of hours because of the skiffs and the bus system. These alternatives were not available for our parents (WB2).

Although the access to cash and better transportation improved the quality of life across the board in the aforementioned ways, the classes that emerged as a product of the social differentiation associated with the establishment of the commercial fishery and the later transition to the tourism economy brought with them different values and aspirations and therefore different perceptions and experience of wellbeing in Ponta Negra (Chapter 6). While there is an attachment to the place felt by everybody living there, those who have been able to capitalise on the fishing and tourism economy have been able to have a more fluid mobility between Ponta Negra and the Paraty. That has allowed them and their offspring to benefit from the resources available in both contexts. Tourist operators and providers derive their income from their businesses in the community, but their families live in Paraty. While they consider themselves successful in what they are doing, their

goals for their children gravitate around more urban contexts. Yet, they would also like them to retain certain connections to the community:

> My business has grown and I can live comfortably from it here in Ponta Negra. I would not like to leave the community. I can work here and have my house in Paraty […] I would like my children to learn how to fish like people do in Ponta Negra, but my priority for them is to go to school and university. I would like them to succeed as professionals and never forget they are from here (WB4).

The story of those who depend on the natural resource base more directly is different. They value living in Ponta Negra, close to the sea, the forest and the shifting agriculture plots; they also love the freedom that comes with being owners of their own time. Those who have had the means to buy their own skiffs and fishing gear like their independence; those who do not have them aspire to own these assets to then be more independent and be able to tap into the fishing and tourism economy in more efficient ways. However, when they talked about their children these same parameters do not apply. When people in the community described what they consider a good life, the tension between themselves and the next generation became apparent:

> Everything is right in my life. I like to fish, go to the banana plantation. I fish for myself and I like it. I like to be independent. I have work and I like it. To not have a job or anything to do is really bad. My future is in the fishing sector; however, I hope my children's is not. I want for them study and find good jobs (MK05).

> I want to be able to be an independent fisher. Have my own gear, a skiff and nets, I would also like to be able to work in tourism, transporting people, but being my own boss... I want my children to improve their way of life. I think good education is a means for them to get out of fishing. I would like my children to study and find a job outside Ponta Negra. I do not want them to become fishers, but I do not want to leave the community either. Life here is peaceful and quiet, but I want my children to leave community so they have more opportunities (MK01).

Current fishers all agree that the good times in fishing are gone. They do not want their children to become fishers. For this generation of economically active adults, being a fisher is not a choice but an obligation; it is what you do when there is no other choice. Parents, however, want their children to be able to choose their futures and see that investing in their education is key:

> I do not want my children to be fishers. Fishing is not for those who want to become fishers; it is for those who have no other option. You cannot live out from

> fishing anymore. You become fisher here because as soon as you finish school in the community; you have no other choice than start fishing. There is nothing else for you to do here. Children become fishers because that is the only thing they can become. In most of the cases, if your father is a fisher, you have no other choice to become one. That is the way it is (WB2).

Wellbeing aspirations within each social class are tied to participation in the tourism economy. Directly or indirectly, many people are involved in this sector and receive benefits from it. The success some local entrepreneurs have had with their local businesses have set parameters for the rest of community members in relation to the way they want to participate in this relatively new economy (Chapter 9). The ability to offer services through the Internet, such as renting holiday homes and offering guided tours in the region, and to keep the flow of tourists from around the world steady throughout the year have become aspirations for many in Ponta Negra. Those who have been successful with these business models have been able to do so by accumulating new sets of skills through formal education and experience working in the tourism sector in nearby urban centres (see Chapter 6 for details). For many of those who do not have these skills, it has become paradigmatic to acquire them. That means moving to the city to facilitate access to education for their children. While the better-off parents aspire for their children to attend University and seek professional degrees, the rest aspire for their children to build up skills that will enable them to tap into the local tourism economy on more equal terms than they themselves have been able to.

7.4.2. Adaptation, Agency and Changing Human-Environment Relations

Historically, the human-environment relations of the rural inhabitants of the Forest Coast have not been static. Although they have been framed by changes in the regional economy, individual responses have allowed the adaption to such changes. As Chapter 6 shows, the boom in the fishing industry changed the relations Ponta Negra people had with fishing resources, shifting them from mainly subsistence to commercial. The adoption of the pound nets was an individual adaptation to the new economy that has been structured by the lack of access to markets and the depletion of the fish stocks by industrial fishing. At the same time, the pound nets structured the social hierarchy in Ponta Negra and eventually gave a few households an advantage in entering the emerging tourism economy.

The use of a wellbeing lens to address individual responses to environmental change brings to light how historical relations with the local environment and individual economic and social position influence people's decisions to either stay or leave the community. Lister (2004) and Coulthard's (2012) notions of agency see individuals as purposive and creative agents, capable of making choices according to their circumstances and needs. Most of the older people from Ponta Negra, no matter their background and resources available to them, treasure their lives in the community, including the harvesting of resources and the outdoor life associated with them. For them out-migrating is out of question. However, for a few younger families as well as young adults either staying or leaving the community is associated with decisions that reflect how they deploy the resources they have at hand in order to achieve their wellbeing, which is deeply interconnected with the wellbeing of their offspring.

An adaptation of Lister's (2004) forms of agency (Figure 27) provides a perspective to contrast the multiple choices people in Ponta Negra make in relation to the wellbeing on their children. This framework presents individual forms of agency according everyday and long-term strategies as well as the relationships between them. The need for education is the main driver behind the decision to stay or leave the community. The strategies different households follow are framed by the resources they have at hand. Better off households pursue post-secondary education for their offspring and are able to sustain them in the city by renting them places to stay or relying on relatives living in the city. These households were able to accumulate assets during the period in which the fishery was profitable, invest them into their tourism assets as the economy changed and now consider it a priority for their children to seek professional occupations (Chapter 6). This accumulation of assets has been fundamental for increasing their adaptive capacity to changing environments (Béné et al. 2012). Meanwhile, the poor households who also consider education as a main driver in their decision pursue secondary and technical education for their offspring and opt to out-migrate as a unit. Members of poor households generally end up living in slums and work in low-skill service jobs (men in housing construction and women as maids and waitresses) so that they can sustain their children while living in the city. In turn, those households who maintain the *status quo* see no option other than to continue fishing in spite of the poor returns and consider that

the next generation will continue fishing in turn. The strategy followed by the latter two groups of households is reactive as they try to cope with the changes in the economy without having the assets to anticipate them (Chapter 6, Ellis and Allison 2004).

The expectations of their children's fate also differ between social classes. While better off households expect their children to gain professional degrees and find permanent jobs in the city, poor households expect their children to acquire skills so they can come back to the community with their assets and participate in the tourism economy in similar ways as the better-off households have done. The poorest households see no reason to emigrate and their offspring continue fishing in spite of the low returns.

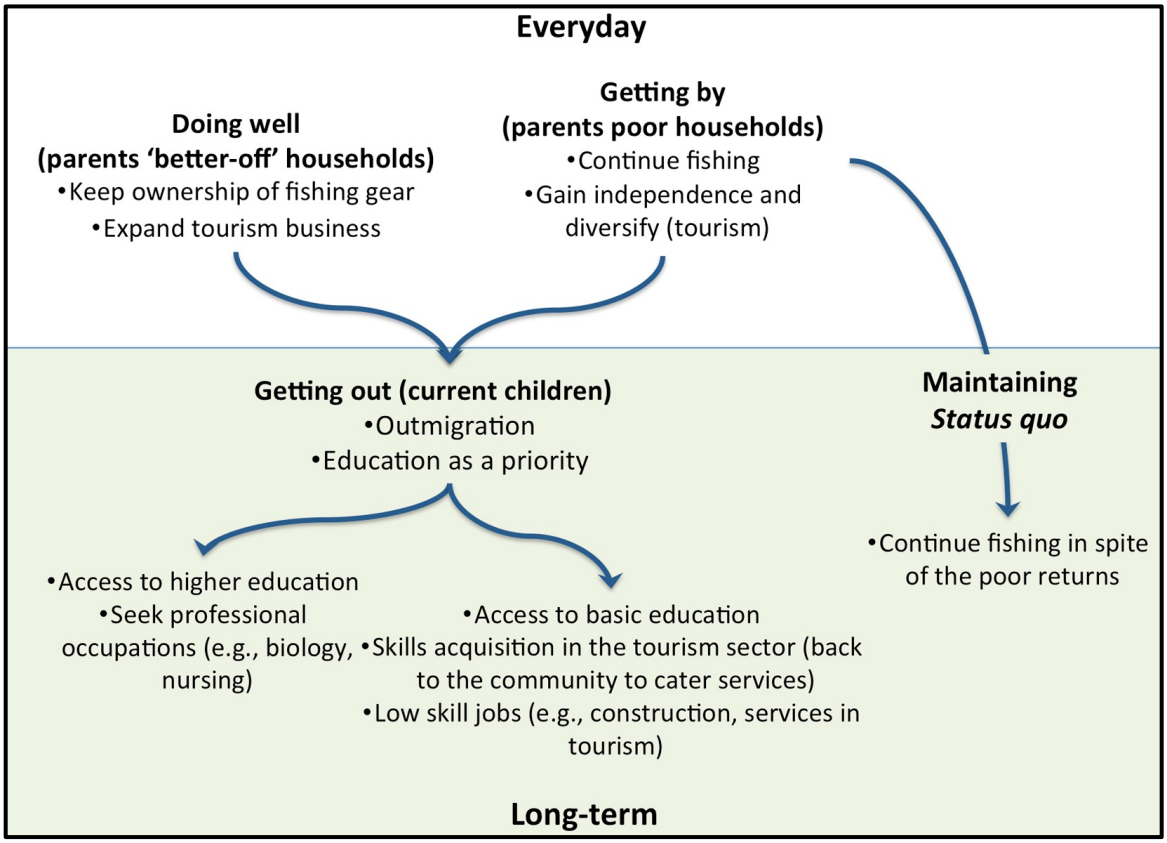

Figure 27. Forms of agency in Ponta Negra

The need for education as a driver shaping livelihood strategies and households choices is not exclusive to the Ponta Negra case. In the regional context of Ponta Negra, the interest in accessing formal education has been identified as one of the defining characteristics of the inhabitants of coastal communities in the Atlantic Forest since the 1950s (Willems 1952). Bebbington et al. (2007) found similar patterns in farming

communities in the Andes in which access to education for some was considered to be a way to increase the wellbeing of household by reducing pressure on the natural resource base (land in this case). In Ponta Negra, education has become a proactive response, or an adaptive preference (Teschl and Comim 2005), to a decreased reliance on natural resource based livelihoods as well as to new desires and aspirations that bring together a continuum of rural and urban environments.

Natural resource management and social policy in the Atlantic Forest Coast would benefit from incorporating the insights drawn from a social wellbeing lens. Most of the policy interventions in the region have concentrated on the conservation of the Atlantic Forest along the coast and the people living in it (Vianna 2008). The policy related to costal peoples, namely "Caiçara", has focused on conserving the steady state stage in which they were described by some social scientists during the 1950s (e.g., Bernardes 1952, Mussolini 1980). These policies have in turn ignored coastal people's historical engagements with the regional economy, including the effects of booms and busts in the commodity markets, as well as the marginalisation they have been subject to (Adams 2003). The few policies that have attempted to improve the quality of life of coastal peoples (e.g., *Bolsa Familia* and PRONAF) have failed by ignoring the barriers created by a lack of infrastructure, such as adequate schools in the small communities (see Adams et al. 2013) as well as the storage and transportation facilities necessary for selling quality fish (Giesbrecht 2012).

A wellbeing approach not only describes how diverse local livelihoods are, but also takes into consideration how they are historically constituted, the social structures and classes that underlie them as well as people's preferences, desires and aspirations. Wellbeing allows the labels of "traditional" or "artisanal fishers" that have been cast upon coastal peoples to be shed and to embrace coastal and rural peoples as dynamic and creative actors (Chapter 8). Applying a wellbeing lens to understand and to create policy affecting coastal peoples can perhaps bring to light ideas from Diegues (2004) about coastal producers. Diegues (2004) proposes that rather than considering coastal peoples as fishers, it is more reflective of their historical and contemporary engagement with their environment to consider them as coastal producers. By producers Diegues is hoping to

capture the diversity of economic activities that coastal people have engaged in, including as shifting agriculturalists, small-scale fishers, industrial fishing crews, tourists operators as well as entrepreneurs. Rather than framing coastal peoples as rural, isolated and backward, a social wellbeing perspective recognises them as dynamic actors capable of living along a continuum spanning the rural and the urban, seeking and taking advantage of opportunities that both domains afford as well as those afforded by their unique bridging position spanning the two.

Chapter 8. The Construction of the Ponta Negra ‘Caiçara’ in Conservation and Tourism Discourses



Figure 28. *"Enjoy Caiçara"*



Figure 29. 1000 Caiçara families in darkness in the Paraty Municipality

8.0. Introduction

Other chapters in this dissertation have dealt with the effect of the Caiçara discourse on the continuity of natural resource harvesting practice and the everyday life in Ponta Negra. Chapter 5 presents some direct implications associated with the environmental regulations that came with the declaration of the REJ in terms of the continuity of harvesting activities associated with terrestrial ecosystems, such as restricting the rotation of shifting agriculture plots (Section 5.1.2) and the illegalisation of hunting (Section 5.3.1). Chapter 7 shows how processes of outmigration are being triggered by the limited access to services, infrastructure for trading local products and job opportunities, which are associated with Ponta Negra’s location within the REJ boundaries.

By examining the discourse underlying these structural forces shaping Ponta Negra's environment, this chapter serves as the political ecology component of the Ethnoecology of Practice (EofP) framework (Section 2.4.1). It employs the lens of anti-essentialist political ecology (Escobar 1999, 2008) as a theoretical perspective to consider the discourses that both enable and constrain the everyday life and the access of rural coastal people to the natural resources existing in the landscapes they inhabit (Section 2.2). This analysis shows how human-in-environment relations in the Atlantic Forest Coast have been essentialised within timeless, artificial categories, such as Caiçara and traditional populations.

When I started fieldwork in Ponta Negra, the locals were identified and identified themselves as *Caiçara*. A quick look at the available literature showed me that Caiçara are the rural people of mixed Portuguese, African and Amerindian descent inhabiting the Atlantic Forest Coast who have maintained the practice of natural resources harvesting activities, such as fishing and shifting agriculture (See Section 3.4). However, I wanted to know what the meaning of this term, Caiçara, was for those it has been bestowed upon. Perhaps, the deepest and most compelling answer I found was: *Sou Caiçara porque nasci aqui* (LH04)[14].

The rural inhabitants of the Atlantic Forest Coast of Brazil and the ways they have shaped and have been shaped by their local landscape have been contingent on the discursive tensions and interactions surrounding human-in-environment relations since colonial times (Adams 2003). The current environment in which these Coastal people live is the result of historical process of participation in the economic cycles linked to expansion of Portuguese colonial power and the consolidation of Brazil as a nation. These rural people have morphed from being labour in plantations during the booms of commodity markets (e.g., timber, sugar and coffee) to almost living in economic autarchy during their busts (Adams 2002, Teixeira 2006). The results of these wider economic processes have been the destruction of 88.3% of the Atlantic Forest biological hotspot through timber extraction, agriculture, cattle ranching and urban expansion (Ribeiro et al. 2009) and the marginalization of its rural inhabitants, coastal peoples, inland peasants and maroon communities among them

[14] *I am Caiçara because I was born here.*

(Adams 2003, Adams et al. 2013). This state of affairs has left in its wake the contemporary tensions among divergent environmental discourses, or narratives of nature (sensu Escobar 1999a, 2008), struggling for the same physical space.

In this chapter I examine how different actors have used the term Caiçara to understand and control how the inhabitants of the coastal community of Ponta Negra interact with their local environment and how, as a result, this term has been a conduit for their economic and ecological marginalisation. My central argument is that, through legislation, management plans, tourism materials and everyday interactions, the representatives of the REJ and the tourism economy have constructed and operationalised the use of the term Caiçara, and "traditional population" alongside it, as equivalent to ecologically noble savage.

As an introduction to the central argument of this chapter, the first section of this chapter compares how the coastal peoples of the Atlantic Forest have been represented and how they are representing themselves. The second section analyses how academia, the regional environmental authority and the tourism industry have used the term 'Caiçara', constructed within the ecologically noble savage discourse, to doom coastal peoples living in areas slated for environmental protection to live in economic stagnation. As I trace back the origin of the use of the term Caiçara to identify the rural inhabitants of the Atlantic Forest Coast, I contrast these depictions against the framework proposed by Ramos (1998), which deals with the ecologically noble savage as being part of nature and in need of protection by an external agent, and Adams' (2000, 2003) criticism of the ecologically noble savage in the context of the so-called Caiçara. Although there is abundant literature on the ecologically noble savage discourse in relation to Indigenous and rural peoples (e.g., Ulloa 2005, Raymond 2007), I chose to use the works of Ramos and Adams because of their geographic and political relevance to my case. The third section reviews how the term Caiçara is used in key pieces of literature and environmental legislation and contrasts this with interviews and ethnographic material from the Ponta Negra case in which coastal peoples are depicted as being constrained by their so-called traditional lifestyles. This section also compares the views of the environmental authorities with those of the inhabitants of Ponta Negra. The last results

section analyses expressions of the Caiçara as ecologically noble savages as they are found in tourism promotion materials. The discussion analyses the disconnections between the three discourses discussed and examines the implications of the disconnections between them. I conclude that labels such as Caicara have served as tools of disempowerment and marginalization for coastal peoples and call for coastal peoples to be recognized as dynamic agents in the environments that they have historically dwelt in.

8.1. Two Sides of the Same Coin

Figures 28 and 29 portray two dimensions of the reality that coastal peoples in South-eastern Brazil face. Photo 1, which I title "*enjoy Caiçara*", represents how coastal people have become an attraction that lures people to the South-eastern Coast of Brazil. These coastal people have become objects of cultural tourism packages, restaurant menus, festivals, coffee table books, and even t-shirts as the photo shows. On the other hand, the second T-shirt (Photo 2) reads, "*1000 Caiçara families in darkness in the municipality of Paraty*." It voices, from the perspective of the Caiçara, how the same people that have become the focus of cultural tourism development and the face of the region do not have access to the basic services to which the average Brazilian citizen is entitled. Their marginalisation and invisibility to the state is expressed in their lack of access to education, healthcare and, as the t-shirt in the second photo shows, electricity. One t-shirt is clean, new and meant to be worn by a tourist from urban Brazil or overseas and the other is dirty, ragged and used by somebody who wants to voice their discontent. In the difference between these t-shirts lies a quandary that relates to the current conditions in which the Caiçara live, the forces that perpetuate such conditions and the ways by which local populations try to adapt to their changing environments.

8.2. "Caiçara": Ecologically Noble Savages

The rural inhabitants of the Atlantic Forest Coast of Brazil are known as "Caiçara". Caiçara, which in Tupi-Guaraní literally translates to "*the man from the coast*" (Adams 2003:22), was originally used to refer to the poles employed for enclosing the dwellings of the people from the coast or the fish traps they made out of tree branches. Later on,

Caiçara referred to beach huts used for storing canoes and fishing equipment. More recently, Caiçara was used to identify people from the coastal areas of the states of Paraná, São Paulo and Rio de Janeiro (Adams 2000).

As a group of people, the Caiçara are the outcome of a historical process of miscegenation that has pushed them to the geographic and social margins of Brazilian social and economic history. The origin of the Caiçara dates back to the arrival of the Portuguese in Brazil in the 16th century, when a miscegenation process started among the newly arrived Portuguese, slaves of African origin and local tribes (Dean 1996). The descendants of this process were known as the first Brazilians, or *mamelucos* (Dean 1996), and had no place within the Brazilian colonial society of the time, mostly constituted by landowners and slaves (Adams 2003). As such, the mamelucos were not recognised as full citizens and hence had no rights to legal land ownership (Adams 2003). In spite of this marginal position, they were an important labour force during the different economic cycles happening in the region (e.g., coffee, sugar cane, gold extraction; Teixeira 2006) as well as suppliers of basic goods from their small land holdings for the owners of the plantations (*fazendas*) dedicated to producing single commodities (Adams 2003). While Portuguese immigrants used most of the flat lands along the coast for sugar cane farming, the mamelucos occupied rugged lands that garnered no economic interest, such as the Serra do Mar Ridge, which runs along the south-eastern coast (Dean 1996).

It is not clear when the term Caiçara as a way to identify coastal peoples gained currency over mameluco or other possible connotations (Adams 2003). What is clear is that the recent use of this term, Caiçara, by academics, media and society in general is connected with profound social and economic changes in the region as well as discourses about what coastal peoples should do and look like (Adams 2003). In the late 19th and early 20th centuries the Atlantic Forest Coast became the refuge of mamelucos after the bust of the sugar cane economy. During this period, shifting agriculture and small-scale fishing became the main livelihood of coastal peoples and their adaptive response to the economic stagnation reigning in the area. This same period also saw the arrival of multiple anthropologists and social scientists to the area, who carefully described the local ways of life and harvesting activities (Willems 1952, Bernardes 1955, Mussolini

1980). Bernardes (1955: 36) points out that 'Caiçara' was what people from São Paulo city called the locals of the Atlantic Forest coast, a name that prevails in all descriptions of the time. Although these academics agreed that Caiçara cultural traits are homogenous throughout the Atlantic Forest Coast, perspectives about this group differed diametrically.

While Bernardes (1955) refers to the Caiçara as people "living in equilibrium" and dependent on the local environment with little willingness for innovation, Willems (1952) describes them as people with alertness and openness to participate in new economic opportunities and a strong interest in formal education. Bernardes' description and those similar to hers (e.g., Mussolini 1980) reflect the moment of economic stagnation coastal peoples were living in, but ignore the recent history of this group of people as well as their successes overcoming the busts and taking advantage of the booms of the regional economy (Willems 1952, Begossi 2006). Bernardes' and similar accounts facilitated the later labelling of the Caiçara as ecologically noble savages as an equivalent to traditional populations by conservationists and regional environmental authorities (Adams 2003).

As Chapter 6 explains, the boom in tourism development from the 1970s on skyrocketed the value of land in the region and triggered real estate speculation in the region (Dean 1996, Teixeira 2006). The permanence of the Caiçara in the land to which they had retreated was at stake. Tourism developers took advantage of the fact that the Caiçara had no legal ownership of the lands they occupied and tried to take them over by falsifying legal documents, exercising violence or paying stingily for the land (Vianna 2008, De Francesco 2010). In some cases, tourism developers were successful, but in others they could not overcome local resistance, as happened in the village of Trindade (Paraty, Rio de Janeiro) during the 1970s (Vianna 2008).

With tourism development threatening the last remnants of Atlantic Forest, national and state environmental authorities began to create protected areas along the coast. The studies that supported the declaration of those protected areas were lacking (Dean 1996). In the particular case of the REJ, where the community of Ponta Negra is located, the situation was not different. This protected area was declared regardless of the fact that there were fourteen coastal communities within it (Diegues and Nogara 2005). The case of the REJ was no different than other protected areas in Brazil that were created with no

consultation with local people and through the top-down imposition of a restrictive Protected Area status that forbade resource use in an area inhabited by several fisher communities that depended on the natural resource base for their livelihoods (e.g., Peixe Lagoon National Park, Almudi 2008).

The REJ was one of the first protected areas in Brazil that had the conservation of traditional populations and the promotion of their culture among its objectives (Rio de Janeiro 1991, 1992, Adams 2003). However, the understanding of these traditional populations by the environmental authority was limited to assumptions about local ways of life and lacked an adequate baseline regarding the biological and cultural diversity existing in the area (Brito 2003). Additionally, there was no consultation with the local communities living inside the REJ either. The documentation that supported the declaration of the REJ was based on two fieldtrips and the promise of gathering enough information to create a management plan that would consider the needs and perspectives of the human inhabitants of the reserve (Brito 2003). Today, more than 20 years after the declaration of the REJ, the regional environmental authority has done little to achieve the management objective of protecting and promoting the Caiçara and their culture. Instead, by branding them as traditional and imposing restrictions on their access to natural resources within the reserve boundaries the regional environmental authority has triggered outmigration and gentrification (Chapter 7).

For the environmental authority, academics and the Brazilian public in general, the Caiçara are traditional because they are held to have subsistence economies based on the extraction of natural resources, and are said to live in harmony with nature and be isolated from mainstream society (Diegues 2004). As traditional populations, they are assumed to have limited technological development and low consumption patterns, and their livelihoods to depend directly and mostly on natural resources and their cycles and not on wage labour (Diegues 2001). The natural resources associated with the Caiçara include those harvested from the sea via small-scale fishing technologies, game and fruit from the forest and the products from small-scale, shifting agriculture (Diegues 2001).

Visualising the similarities between the traditional population label with which the Caiçara have been branded and the ecologically noble savage discourse is a subject on

which some critical scholars in the area have worked (e.g., Adams 2002, 2003; da Costa 2011). Their intention has been to call for a re-thinking of the Caiçara beyond the traditional population label and to recognise how their dynamic and historical origin is connected to their current desires and aspirations. In spite of these efforts, little has changed in the way the environmental authority and the tourism industry understand and interact with them. The environmental authority is still clinging to romantic ideas about the Caiçara living in "harmony with nature" in order to cast the current engagements of coastal peoples in the tourism economy in a negative light

Ramos' (1998) treatment of the ecologically noble savage in the context of Brazilian indigenism shows the problem of labelling the Caiçara as traditional. For Ramos, the noble savage discourse mobilises a romantic idea that sees Indigenous Peoples (or traditional populations in this case) as part of nature and hence pure, "*less affected by the evils of the world*". They have the burden of keeping that purity rather than becoming fallen angels, spoiled by mainstream society. Being an integral part of nature also means that they need to be protected by the civilised ones. However, as soon as traditional populations breach such state of purity they become underserving of protection. The ecologically noble savage discourse puts traditional peoples in a: "*social limbo between a paradise of purity and a hell of savagery*" (Ramos 1998: 85). The ecologically noble savage discourse, as expressed in the traditional populations discourse, denies any attempt by individuals to exercise their agency and adapt to the opportunities emerging from the changing economy. The perception of the environmental authority regarding the participation of the Caiçara in the tourism economy, as well as the way by which the tourism industry has represented them, provide testimony of the power the noble savage trope has in the everyday life of these coastal peoples.

8.3. "*You are Privileged to Live Here*"[15]: Caiçara and the REJ

In this section, I contrast the understanding the managers of the REJ have of the Ponta Negra inhabitants with the understanding these coastal peoples have of themselves in

[15] This is a phrase used by the REJ superintendent during a community meeting conducted in Ponta Negra (October 29, 2010).

relation to their interaction with the protected area managers and their participation in the tourism economy. I base this comparison on documents produced by the Rio de Janeiro State Institute for Environmental Management (INEA for its acronym in Portuguese), the environmental authority in charge of the REJ, meetings conducted by the INEA staff in charge of the REJ in the community and interviews with the REJ's superintendent and other related stakeholders as well as on testimonies from different community members. Although the INEA has remained silent in their official publications regarding their perceptions of the traditional population that inhabit the protected areas they manage, documents prepared by their lawyers (e.g., Silva and Brandão 2004) dealing with the legal dimensions of traditional populations living inside protected areas bring forth the ecologically noble savage discourse.

The Brazilian laws that regulate the management of protected areas refer to traditional populations in vague ways. According to the law that governs the Brazilian National System of Nature Conservation Units (SNUC 2000), a Traditional Population is one that relies on the natural resources found in a given protected area to survive. One of the objectives of this law regarding traditional populations is to: "*protect the natural resources necessary for the subsistence of traditional peoples, respecting and valuing their knowledge and culture and promoting them socially and economically*"[16] (SNUC 2000, Article 4, XIII). The law that regulates the permanence of traditional peoples within protected areas in the Rio de Janeiro State (Governo de Rio de Janeiro, Law 2394/1995) shares similar objectives. It stipulates two main criteria to define whether a population is traditional or not: (1) at least 50 years of permanency within a given protected area and (2) the retention of subsistence economies and direct dependence on the natural ecosystem. In spite of the existence of these two criteria, the environmental authority has weighed people's activities heavier than their historical relation with the land when it comes down to evaluating permanency within a protected area (Silva and Brandão 2004). This is the case of the REJ and the treatment given to its inhabitants in the context of shifting livelihoods and the increased dependence on the tourism sector.

[16] Original text in Portuguese: *Proteger os recursos naturais necessários à subsistência de populações tradicionais, respeitando e valorizando seu conhecimento e sua cultura e promovendo-as social e economicamente* (my translation).

8.3.1. Discourse from the INEA

The relation between the INEA staff and the inhabitants of the protected area has been problematic from the outset. Because of its biological and ecological uniqueness, the INEA staff in change of the management of the REJ has argued that this reserve has the characteristics of a protected area that deserves integral protection – that is, without people living inside it:

> According to the management system within which the reserve was created, people are not meant to live inside it. Even though this is a reserve with almost 2000 people living inside, it is managed by an internal division of INEA that is responsible for conservation units [Protected Areas] with integral protection. This division works under the premise of paying compensations so people can leave the reserves. We need to define the legal situation of those areas, so there is no insecurity for the people in these areas (OS04).

Even though Caiçara permanence and the conservation of their culture were management objectives for the protected area, for the INEA staff the stability of the Caiçara within its boundaries is interim and dependent on the availability of funds to enable their relocation (Silva and Brandão 2004). However, given the lack of availability of funds for relocation, the INEA staff justified the need for removing people from this protected area based on the cultural and economic change that the REJ's inhabitants have experienced since its declaration (OS04). The perception of the environmental authority is that the changes associated with regional participation in the tourism industry are transforming the identity of the Caiçara. The people who "ancestrally" depended on the natural environment and its resources have become reliant on the tourist economy and are therefore on the path to losing their traditional lifestyle and the values that enable their apparent so-called seamless integration with the natural environment. As soon as such transition happens, people will cease to be traditional and hence lose their right to remain in the protected area:

> The relationship between traditional populations and the environment is positive when there is the possibility to maintain human progress at bay in order to preserve cultural identity. This in turn ensures the perfect harmony of natural resource use with environmental preservation...The relationship between traditional populations and the environment is grounded in respect for the natural cycles of the resources they use. Once that bond ceases to exist these populations are no longer traditional and should be treated as any other community (Silva and Brandão 2004: 6-7)

The current INEA staff recognises that this vision about the Caiçara is out-dated and that it needs to include Caiçara participation in the tourism economy as part of the new reality of the reserve: "*Our administrative and technical vision is that it is not possible to kick people out from their territories as we had advocated before"* (OS04). However, as long as the INEA staff understand the REJ as a conservation unit that demands integral protection, the presence of the present-day Caiçara remains a contradiction and perhaps undesirable in their eyes:

> We need to adjust the legislative framework of the reserve to the reality of tourism. When the reserve was created, one of its objectives was to protect the traditional populations living inside it. We had few practical means to do that, but that was the objective. The Caiçara we wanted to protect was a Caiçara that used dugout canoes as a main means of transportation and that fished and practiced shifting agriculture. That Caiçara was attuned to our legislative framework. Today, because of the economic cycle within which the Caiçara are inserted [i.e., tourism], they want to build [using industrially-made construction material] and use the land with tourism-oriented infrastructure. That creates conflicts with the mandate of a conservation unit with integral protection (OS04).

The lack of a formal management plan 20 years after its declaration, the exponential growth of the tourism industry and the gentrification of some communities within the protected area may hint that the REJ is in fact a 'paper park' with little accomplishment of its management objectives:

> There has been really bad communication [between the INEA staff and the communities within the protected area]. There are a lots of people within the reserve who still do not know that they live within a reserve; they do not have adequate information about the implications of living within a reserve, do not know what the benefits are, and do not know what they can and cannot do. We have never been clear in providing such information during our management of that area (OS04).

Despite the negligence, the INEA staff have been successful in implementing the discourse of traditional populations since the reserve was established. This operationalisation has occurred through direct interactions between staff and people living inside the REJ in the context of meetings and also via tight control over residents' activities, especially in terms of shifting agriculture and hunting (Chapter 5).

With the publication of the National System of Protected Areas in 2000 (SNUC 2000), the Ecological Reserve (i.e., *Reserva Ecológica*) category ceased to exist. This forced the regional management authority to initiate a re-categorisation process (still in progress as of 2013) that has become a forum for steady interaction among the aforementioned INEA staff and REJ inhabitants, including the community members of Ponta Negra. On October 29, 2010, I had the opportunity to document one of those meetings in which the REJ superintendent explained the forthcoming re-categorisation process and expressed that it would be an opportunity to correct the mistakes from the past. In spite of the positive attitude, he proceeded to criticise the way the tourism economy has been growing in the community. The boom of uncontrolled housing construction in Ponta Negra is an example of the conflicting relations existing between the INEA staff and the residents of Ponta Negra. Holiday homes owned by outsiders (i.e., *veranistas*), houses used exclusively for renting and the recent renovations done to the local beach restaurants were considered to breach the expectations of what Caiçara should do within the reserve, yet the contribution of housing construction to the livelihood portfolios of many households was ignored (Section 7.1):

> The Caiçara should be able to build new houses as long as they are used for dwelling purposes. That is, housing meant to satisfy survival needs for the families. At the same time we had prohibited construction that does not belong to locals and that is meant to cater services for tourists (Re-categorisation Meeting, October 29, 2012).

This discourse is enacted through requiring construction licences for new homes or for renovating already existing ones, controlling the amount of construction materials brought into the community and dismantling buildings used for tourism purposes. The INEA staff, in coordination with the management of the gated community of Laranjeiras, which is located at the midpoint between Ponta Negra and Paraty and offers the most convenient access to the community, has put in place several controls on the people living in the community so they can only bring construction material in under a specific construction licence. In addition, in recent years the management of Laranjeiras has banned the transportation of construction material through their premises, increasing the costs of delivery of the materials and their arrival times.

The controls on tourism and the activities related to this economic sector can get even worse for the people in Ponta Negra, as the management board of Laranjeiras often threatens to ban the transit of tourists through their premises (Conselho da Administração Condominio Laranjeiras 2009). During legal processes over the right of passage through Laranjeiras premises that the inhabitants of the REJ have engaged in, the lawyers of the gated community have often argued that, since tourism is not a traditional Caiçara activity, the transit of the tourists to visit these communities through the premises of this gated community should not be allowed (Costa 2009).

Control of tourism activities and infrastructure has become more aggressive in the recent years. In early 2012, the INEA staff required a community member from Ponta Negra to dismantle a group of chalets within the community boundaries built for tourist use (Fieldwork Journal, July 2012). Since the INEA staff is known to use explosives to control illegal constructions in the area (INEA 2010), this community member had no choice other than to dismantle the buildings in order to not lose the valuable construction materials. In October 2012, in the middle of the so-called participatory re-categorisation process, the INEA launched an environmental police unit (*Unidade de Polícia Ambiental*) with 22 armed guards in charge of controlling environmental crimes in the REJ, which include illegal hunting and housing construction within this protected area (INEA 2012). These moves from the INEA staff are indicative of the nature of their on going interactions with the inhabitants of the REJ.

The INEA staff also enact the ecologically noble savage discourse in subtle ways. In spite of the problems brought to the local communities by the declaration of the reserve and the failure to accomplish the proposed management objectives, the INEA staff constantly remind community members that they are the stewards of a land in which they do not have the right to live. Rather than the right of residence, they have been granted with the privilege to live in Ponta Negra: "*to live here is a privilege you have*" (Re-categorisation Meeting, October 29, 2010). By ensuring that the Caiçara continue to live in harmony with nature, the INEA staff expect them to sacrifice their desires and aspirations to ensure the quality of life of the Brazilian citizenry: "*The Juatinga Reserve*

is important for the quality of life of us all" (Re-categorisation Meeting, October 29, 2010).

The INEA staff are also aware of the ways by which they have affected the livelihoods and multiple dimensions of the lives of the inhabitants of the reserve by limiting a number of traditional activities. Community members have been discouraged from remaining within the REJ through impediments and pressures that make life harder than it should be. The contradictions are obvious even for the reserve superintendent:

> The environmental authority created the reserve and with it some mechanisms to protect the people living within it. However, it also constrained traditional activities, such as cutting forest after it has reached certain height to open new shifting agriculture plots. This kind of management has affected the normal cycles around itinerant agriculture. Also, cutting a tree big enough to make a dugout canoe became an environmental crime. These are examples in which the environmental legislation has curtailed Caiçara's traditional activities. The reserve has protected the region from the big tourism developments, but at the same time it has hindered the practice of a lot of traditional activities (OS04).

8.3.2. The Position from the People in Ponta Negra Caiçara

The people in Ponta Negra have not remained silent to the ways the environmental authority has cast the ecologically noble savage discourse upon them. Their perspectives can be found in the every day interactions among community members as well as in their reaction to the presence of INEA staff in the community. In the every day life, the REJ is equated to the many limitations that have been imposed on the people living in the community: They consider the regulations on shifting agriculture, hunting and tourism activities contradictory. On the one hand, so-called traditional practices have been restricted via fear-based controls:

> The INEA does not like us to hunt. The old people used to hunt a lot, but now we cannot. If they [environmental authority] catch you in the forest hunting they can seize your weapon and your game and send you to jail. Hunting is now a crime. (Li12).

Furthermore, the vision of the INEA staff do not match with the way tourism currently operates in Ponta Negra. If the INEA's vision on tourism was enacted, the local livelihoods would be limited to fish trade and consumption, a dwindling shifting agriculture and the current infrastructure for tourism would be left unused:

> If we can make a better and more sustained living out of tourism, we will not need to be hunting in the forest or cutting down the forest. That is what I think, but people from INEA only want to put limitations to our lives, without giving us new alternatives. But if we have no other ways to make a livelihood, what can we do? (Li05).

Some community members are even more analytical about the mismatch between current legislation and the changes that have been steadily generated and experienced by the Ponta Negra people in the last decades. These changes have provoked the coastal peoples to have a different understanding of whom they are in relation to the ecologically noble savage trope used to characterise them. In the aftermath of the October 29 meeting, a community member said that the environmental authority is designing regulations for the Caiçara that inhabited the area 50 or 60 years ago, not for the current Caiçara:

> They [INEA staff] think that we live in the past, the way our parents lived. They want us to live in harmony with nature, but I need the income I make from the houses I rent to pay for my children's university (conversation with community member, October 29, 2011).

Similar thoughts were shared regarding the role that the gated community of Laranjeiras plays in facilitating execution of the controls proposed by the environmental authority: *"Laranjeiras is behind these limitations. They want Ponta Negra to be their backward backyard, deemed to stay still, with no progress whatsoever"* (informal conversation with community member, October 29, 2010).

8.4. The Ecologically Noble Savages of the Tourism Economy?

Their participation in the booming tourism economy has not helped the so-called Caiçara to shed the traditional skin with which many anthropologists and the environmental authority have shrouded them in the last decades. Instead, using the Caiçara trope, the tourism industry has been in charge of portraying the inhabitants of the communities along the Atlantic Forest Coast as exotic, timeless people who can give an opportunity to experience the past and what a sustainable way of living looks like to those coming from fast-paced urban centres. Manifestations of the use of the ecologically noble savage discourse can be seen throughout tourism industry's advertising material that offer services related to the Caiçara. As examples of these discursive elements I present a set of coffee table books, magazines, tourism booklets and websites.

Materials developed for tourist consumption that involve the Caiçara have perpetuated their image as noble ecological savages. Beautiful coffee table books such as '*vida caiçara*' (Caiçara Life; Alves 2007) or '*Dias de Caiçara*' (Caiçara Days; Pascalicchio and D'Alessi 2006) are easy find in the lobbies of luxury hotels, restaurants and tourist agencies in Paraty's colonial downtown. With their astonishing photos, romantic narratives and matte finishing, they portray the Caiçara as people living in harmony with nature:

> The Caiçara makes no distinction between man [sic] and nature: [he] lives accordingly, as part of the whole, and faces the uncertainties and dangers from the land and the sea on equal terms. His creativity supplies him with techniques and simple tools and he follows the path of understanding and harmony[17] (Alves 2007: 108).

Similar to what is found in other coffee table books, this narrative brands the Caiçara within an idyllic and timeless notion, as people who were born by the beach, grew up playing on white sand dunes and hunting in the forest; people who fish by following the phases of the moon and who can predict the weather only by dipping their toes in the water (Alves 2007:5). This vision locks the Caiçara back into the time of the stagnant economy that followed the bust of the sugarcane commodity market, ignores their active past involvement in other commodity markets and the changes in the economy and in the ways of life that have happened ever since. Remaining stagnant is often equated by the tourism industry as the path to sustainability. The authors of these coffee table books may argue that the books themselves are attempts to keep the Caiçara culture alive, but the simple fact that each one these books costs no less that $50 CAD means that the final holders of these books will not be those who are portrayed in them.

Isolation, timelessness and sustainability are repeated themes in the discourse the tourism industry casts upon the Caiçara. Examples of this can be found in the magazines that showcase the beauties of the region as well as in the multiple websites that advertise 'eco-cultural tourism' products. Ponta Negra was featured in "*Paraty em Revista*" (Elage

[17] *O Caiçara não faz distinção entre homen e natureza: vive de acordo, como parte de todo, e enfrenta as incertezas e perigos do mar e da terra em condições de igualdade. Se abastece de técnicas e ferramentas simples que inventou ou adquiriu e segue pelo camino de entendimento e da harmonia* (my translation).

2011), a magazine that promotes touristic attractions in the Paraty municipality. In spite of mentioning the changing lifestyles experienced in the community as a product of the changing economy in the region, what is important about Ponta Negra is that it provides peace and isolation to its visitors, who are able to ignore such changes: "*Even with these vast changes in their lifestyle, little can be noticed by the eyes of those coming from bigger cities for a few days in search of peace and isolation*" (Elage 2011: 29).

Similarly, a tourist provider from São Paulo who offers tourist packages in Ponta Negra on the Internet uses a similar discourse related to isolation, timelessness and sustainability. For him, the geographic isolation in which the people of the community live has contributed positively to visiting a place '*out of our time*'[18]. Among the objectives of this tourist entrepreneur is to turn tourism development into a sustainable enterprise by bringing together 'new ideas of ecotourism' with old concepts of 'subsistence'. One of the strategies by which this objective is touted to be reached is by turning the 'traditional Caiçara architecture' into 'an object of desire' for both the public in general and the community itself[19]. Even though houses made with wattle and daub and with thatched roofs are recognised by some as traditional (e.g., Adams 2000), this type of construction has been progressively abandoned as people have found the means to replace the traditional materials by brick and tile, as they are considered to be more comfortable and hygienic (Section 7.2).

These three examples portray the Caiçara as the ecologically noble savage, people living in harmony with nature and whose culture belongs to a timeless 'living museum'. The discourse from the tourism industry takes for granted that the Caiçara way of life offers important lessons for biodiversity conservation and achieving sustainability that have to be protected as Brazilian heritage. However, it also becomes disempowering as it reinforces the image of the Caiçara as backward rural people with little willingness for innovation or need for change. Initiatives, such as the Caiçara Manual for Community-

[18] *O isolamento geográfico do local e da comunidade atuam positivamente para que visitemos um lugar fora do nosso tempo.* (Vila Iandé website; URL http://www.vilaiande.com.br/br/conceito/index.html accessed on December 3, 2012).
[19] *Elevar a "arquitetura caiçara" a condição de objeto de desejo do público em geral, assim como na percepção da própria comunidade.* (Ibid footnote 4).

Based Ecotourism (Instituto Ecobrasil No date), portray the Caiçara as providers of basic services, as fishers, boat drivers, waiters and waitresses and maids, and without major participation in the marketing of tourism packages in terms of their design and promotion. While the hindrances for the Caiçara to participate in higher levels of the tourism chain are structural, including the lack of basic education and training in the sector (Chapter 7), the aforementioned initiative does little to promote local initiatives and organisation and favours the continuation of the current power structures that turn the Caiçara into objects that are part of the landscapes and resources they seem to have conserved, rather than dynamic agents of change.

8.5. Discussion and Conclusion

This chapter has showcased the junction of three environmental discourses that have the Brazilian Atlantic Forest Coast and its rural inhabitants as its main characters: (1) biological conservation, (2) Ponta Negra people and (3) tourism industry. Each one of these discourses carries forward an understanding of rural peoples and its relation with the environment that structures and dictates what people should and should not be and do, now and in the future, in terms of environmental regulation and participation in economic activities. The relevance of making explicit these environmental discourses and their interactions brings valuable theoretical insights to understanding the continuity of human-environment relations in small-scale, resources dependent societies in the context of globalisation.

Ethnobiology and other fields that study local and traditional ways of knowing have avoided an active analysis of the political, economic, cross-cultural and media driven 'external' pressures that influence the multiple dimensions of the access small-scale societies have to natural resources (Nabhan et al. 2011). Enquiring about the intergenerational continuity of knowledge could be a lens to understand how human-environment interactions change over time and the forces that direct such change. Cultural transmission of knowledge, the branch of scholarship that has dealt with the intergenerational continuity phenomenon, has recognised the effects of globalisation and its forces by measuring their effects in the local corpus of knowledge (e.g., integration to

markets, Godoy et al. 2005), but has remained silent to the responses that these societies have used to adapt to the changing world in which they live.

This gap resides in the fixation cultural transmission of knowledge scholarship has with conserving and recording the knowledge of small-scale societies have from their past activities, rather than having a critical look to their current activities and environments (Davidson-Hunt 2006, Heckler 2009). The dualistic understandings of the world in which knowledge transmission and cultural conservation are deeply rooted often tend to box rural societies within categories that see them in harmony with nature and deny their agency as they adapt to changing worlds. Such dualisms permeate the way the environmental authority, tourism industry and academia deal with and conceptualise rural peoples. In the case of Ponta Negra, the dualism exists and reproduces at different levels: on the one hand they are embedded in the understanding of the Caiçara as ecologically noble savages existent in the Brazilian legislation related to Indigenous and traditional populations living within the boundaries of protected areas; on the other, they are ingrained in the way by which the intergenerational continuity of knowledge has been understood.

"Caiçara" and "traditional populations" are labels employed by the Brazilian government and society to give a position and a role to coastal peoples. Caiçara, a derogatory term equivalent to coastal peasant, was branded upon coastal peoples and has been used as a foundation to conceptualise them as either fallen angels or noble savages, depending on who is talking. This conceptualisation of the Caiçara has been a forum of intense debate between two main schools of Brazilian scholarship: preservationists and conservationists (De Castro et al. 2006). While the preservationists see the permanence of rural populations in the Atlantic Forest illegitimate and incompatible with conservation goals (e.g., Galetti 2001, Galetti et al. 2009), the conservationists see in rural populations allies of biodiversity conservation given their supposedly harmonic relation with the local environment and the low impact of their natural resource harvesting activities (e.g., Viana 1999). Beyond academia, preservationist ideas that enact the fallen angel discourse have gained traction in the environmental legislation and the official management of protected

areas. Meanwhile, conservationist ideas have been appropriated by the tourism industry to incorporate the Caiçara as part of ecotourism packages.

For the environmental authority, the Caiçara are fallen angels as they have been affected by the evils of the changing economy. The testimonies from the INEA staff suggest that the Caiçara are no conservation allies as long as they are part of the tourism economy outside the parameters dictated by them. The power of the environmental authority to produce a desired 'other' becomes apparent when they define the Caiçara as a subsistence society without carefully examining their livelihoods and perspectives (Brito 2003) to then render as undesirable when the actual Caiçara does not match with the ideal one that is only found on paper.

This view of biodiversity conservation poses contradictions. The environmental authority approves the permanence of rural peoples who only existed for a period of time that was the product of the then stagnating regional economy and ignores that they are currently dealing with agents that have historically been integrated to the market economy. The environmental authority has equated conservation with a state of being and has tried to freeze the Caiçara into it, rather than recognising them as active agents with whom it is possible to negotiate conservation agreements on the ground of common interests. The fact that the INEA prefers to invest in hiring 'environmental police' to control Caiçara activities in the area (INEA 2012), rather than opening forums for negotiation is testament to that. While the world, along with the so-called Caiçara, is always adapting, environmental protection laws in Brazil, and even worse, those who interpret and apply them have remained stagnant.

Even though, according to the environmental authority, tourism is the evil that spoiled the Caiçara's traditional essence, the tourism industry has been able to produce an ecologically noble Caiçara in a more pure form. With the veil of 'living in harmony with nature', the tourism economy has managed to make the tourist overlook aspects of material poverty that coastal people themselves identify as necessities, such as electricity and adequate quality education in Ponta Negra (Chapter 7). This industry sells the Caiçara as a product that invites tourists to experience peoples and places from another time. The Caiçara has been produced as an exotic 'other', sensualised and naturalised;

people who are passive and timeless (Ulloa 2005). The tourism industry has constructed the Caiçara according to a discourse of environmental crisis in which Indigenous peoples represent the path to sustainability via living in harmony with nature (Ulloa 2005).

Either as fallen angels or ecologically noble savages, these ideas of the Caiçara have been perpetuated by the environmental authority and the tourism industry and become normalised through a *habitus* brought into existence both through the constant control environmental authorities exercise over the local Caiçara as well as in the tourism material that features the Caiçara as timeless people living in harmony with nature. In academic contexts, the study of the Caiçara's knowledge has described the vast understanding of the local environment this group of people have and has produced compendiums of local names and activities in the multiple ecosystems to which they have access. The knowledge of the Caiçara is still seen important for the conservation of biodiversity and find the path to sustainability (Borges and Peixoto 2009, Hanazaki et al. 2009). Yet, at the same time, the desires and aspirations of the Caiçara, such as better access to education, are identified as the cause of the erosion of the knowledge of and changing relations with the local environment (Sousa et al. 2012).

In spite of how ingrained these discourses are, critical analyses about deconstructing ecologically noble savage trope in the Caiçara context are emerging (Adams 2003, de Francesco 2010, da Costa 2011). These perspectives bring forth historical and practice perspectives to understand the Caiçara as dynamic agents of the Atlantic Forest Coast. Adams (2003), for example, applies the concept of ethnogenesis, to develop a critical historical analysis of the Caiçara. By providing a perspective that takes into consideration how political struggles and the historical consciousness of them shape culture, ethnogenesis presents the Caiçara beyond static labels to recognise how dynamic they are. De Francesco (2010), in fact, presents how Caiçara communities within the REJ are giving new meaning to their so-called traditional identity by asserting their historical right to defend to stay and hence defend their territory. My use of the adaptive learning framework (Chapters 6 and 9) contributes to this academic enterprise that attempts to visualise the adaptive richness of the Caiçara. This framework considers the dialectic relations individuals have with the environments in which they live through every day

practice and recognises the agency individuals have to shape such environments. By enquiring about the local perspectives of conservation, livelihoods and wellbeing in the everyday practice of the Caiçara, other perspectives emerge. In my case, many research participants rejected the traditional veil cast upon them and embrace a Caiçara identity that prioritises the education of their children over remaining "traditional".

Using a political ecology lens provides a critical perspective on the ecologically noble savage discourse and the intergenerational continuity of knowledge that invites us to consider Indigenous and rural peoples and their knowledge in more dynamic ways, rather than as essentialised, timeless and static. In the case of the Caiçara, it is necessary to throw away the coin that has the ecologically noble savage and isolation on its sides and provide the Caiçara with the opportunities they need to live the lives they want to live in the territory that has been historically theirs. It is possible that to be Caiçara is more about having been born in a small community along the Atlantic Forest Coast, rather than conforming to images that no longer exist and perhaps never existed.

Chapter 9. Environmental Learning through the Lens of Practice: Ponta Negra, Fishing and Tourism

9.0. Introduction

This chapter examines the intergenerational change and continuity of environmental knowledge in the context of the coastal community of Ponta Negra. Changes in the natural environment and the transition from a natural resource-based to a service-based economy have resulted in constant adaptation on the part of the inhabitants of this community. Such adaption involves the attunement (sensu Ingold 2000) of pre-existing skills to the new conditions as well as the emergence and introduction of new ones. The dynamic interactions within a local environment that take place in Ponta Negra allow for an examination of environmental learning from perspectives sensitive to practice, which in this context refers to the activities that enable access to the resources and social relations that make up everyday life.

This chapter uses an adaptive learning perspective as used in the Ethnoecology of Practice (EofP) framework (Section 2.1.2.3). While Chapter 6 examines the adoption of the pound net fishing technology and the effects it has had in Ponta Negra from a historical perspective, this chapter describes the current learning processes associated with natural resources in the context of both natural resource harvesting and emergent activities, particularly in relation to the case of tourism. This chapter focuses on how the habitus and the knowledge, capitals and resources associated with it are produced and reproduced through a set of basic modes of environmental learning, as they are understood by Ponta Negra community members. Next, it presents the fields in which environmental learning takes place. Presented as centres of learning, each field brings together people, their habitus, knowledge, capitals and particular ecosystems with the objective of accessing and controlling targeted resources. Finally, the case of a tourism provider from the community provides an example of innovation in the context of a changing economic environment. This case describes and analyses the emergence and structuring of a new centre of learning in Ponta Negra along with a new habitus produced

alongside the adaptations community members are making to a new economy and the new resources at stake. The evidence presented in this chapter provides an on the ground perspective on the dynamism of local knowledge systems.

9.1. Modes of Environmental Learning

Learning is intertwined with participation in everyday life activities from infancy to old age. Perhaps for this reason, learning about the local environment in Ponta Negra, or in any other context (Lave 2009), is a nuanced process that is often taken for granted. This does not mean that learning occurs haphazardly. This process is framed by a set of modes that structure the ways people interact with and, hence come to know, their local environments. These modes are equivalent to what Davidson-Hunt and Berkes (2003a) denote as institutions of knowledge. Such principles describe how people from a young age interact with other members of their society who facilitate their learning process as well as their socialisation with non-human components of their environment. In this case, modes of environmental learning can be summarised in terms of self-initiation, empirical observation, imitation and innovation, mentoring, and safety (Table 19). In Ponta Negra, environmental learning involves both the acquisition of skills related to the harvesting and production of natural resources and other activities that are part of the local livelihood portfolios, such as housing construction and participation in the tourism industry.

9.1.1. Learning is Self-initiated – *Eu aprendí sozinho*

For people in Ponta Negra, learning is a self-initiated process. Whenever I enquired about learning, be it fishing, shifting agriculture or housing construction, the answer was always the same: '*Eu aprendí sozinho*'[20]. 'By myself' does not imply that people embody skills on their own, but rather that they lead their own learning projects. People learn what they want, what they need and do so when they need it. This perspective on learning suggests that each person's life history has its nuances and contingencies that shape their preferences, desires, needs and aspirations to construct the environment in which they want to live. A local fisher illustrates this idea using net making and mending as an

[20] I learned by myself

example: "*Not everybody knows how to fix or make nets. Those skills, even though they are simple to acquire, depend a lot on the motivation of the person"* (Informal conversation with community member, July 11, 2010). It is not unusual to find some people in Ponta Negra who prefer to engage in fishing activities, while others prefer to remain working in land-based activities, particularly shifting agriculture in the past and now in increasingly important tourism-related activities.

Table 19. Modes of environmental learning in Ponta Negra

Principle	Description	Example(s)
Learning is self initiated	Individuals decide what they want to learn and at what pace they want to do so	Certain individuals in the community master specific skills and trades, such as net making, net mending or housing construction
Empirical observation, imitation and innovation	Individuals learn by observing others perform a given activity, imitating that performance and innovating how a given technique is embodied or appropriated	Watching experienced harvesters fishing in the pound nets Learning housing construction techniques from others and experimenting on their own Applying surfing techniques to land boats on the beach
Mentoring	Knowledgeable experts facilitate the acquisition of skills by guiding their apprentices through their learning experience in different settings of practice	Canoe-making experts correcting young apprentices Parents helping children to make traps and cages
Safety	Several principles are in place to guarantee the safety of individuals as they are socialised in different environments	Parental supervision of children (up to ~6yrs old) playing close to the water Detection and avoidance of dangers (e.g., snakes and cliffs) Communication protocols when hunting in the forest Maturity and judgment

9.1.2. Observation, Imitation and Innovation

Self-initiation, observation, imitation and innovation are key components of environmental learning in Ponta Negra at the individual level or, in other words, what underlies the acquisition of a habitus for a given centre of learning. Individuals learn particular skills by observing others perform a given activity to then imitating their performance. However, as Ingold (2000) reminds us, observation is not the act of gathering information about a particular trade and imitation is not repeating other's

movements mechanically. Observation allows people to pay attention to other's actions so these actions can be later imitated. Imitation, rather than repetition, is the way by which an individual attunes their body movements to a particular task in a particular environment. Innovation is the outcome of using observation and imitation to adapt particular skill sets to either new environments or new circumstances. The adoption of pound nets in Ponta Negra is a testimony of the ability of Ponta Negra individuals to adopt a particular technology to exploit fish from an economic perspective in the midst of the growth of the regional industrial fishing sector (Chapter 6).

The personal experience of one such community member related to experimenting with the pound nets talks about the importance of self-initiation as well as observation, imitation and innovation in the adoption of new technologies in the community:

> I learned what I know by myself, looking at other people close to me. I made one of the first pound nets in Ponta Negra, copying one already existing in Praia do Sono. The first net wasn't made very well (*deu torto*), but with time I improved [my skills] to the level I am [at] today (MK02).

Self-initiation and imitation also apply to contexts outside the harvesting of natural resources. Housing construction, a trade that has grown in importance in the last decades in the community (Chapter 7), provides an example:

> I make most of my income working in housing construction, which I learned by myself… Since I had no idea how to lay bricks, I asked a friend to teach me how to do it. After that I continued working on my own. Sometimes I have to do jobs in which I do not need anybody to teach me. It is enough to observe and imitate the techniques employed by somebody else. I see what I should do and end up building in the best way possible. There are things that you don't need anybody to teach you. It is matter of observation. Sometimes, the first time I make something I've never made before, things don't end up looking perfect, but I keep trying. Practice allows me to improve my technique (Li12).

Further examples of innovation can be found in other aspects of everyday life in the community. In addition to the pound nets and housing construction, new skills have been developed in recent times as new technologies have become available. This is the case of landing fibreglass skiffs onto the beach. Skiffs with small outboard motors were introduced in the community no more than 20 years ago when they replaced the wooden boats with central diesel motors previously dominant in the area (Section 6.3.3).

Considering the lack of infrastructure for mooring these vessels, people have developed landing techniques that take advantage of local wave patterns. Skiff drivers ride waves braking onto the beach to land their vessels more efficiently. Those who master this technique not only save time and energy, as they need to drag their skiffs on the beach sand for shorter distances, but they also gain a reputation as good boaters. For the boat drivers that transport people and goods, reputation comes with benefits, as they become the first choice to service locals and tourists coming in and out the community. People in the community recognise that younger men who have experience surfing have better chances of perfecting these skills as they have had better exposure and more chances to learn to "*read the waves*" in diverse settings (Fieldwork Journal February 1, 2011).

Innovation is not exclusively associated with newly available technologies. Older people think that the newer generation of fishers are more skilled than them because they are able to understand fish better. The decline in the abundance of fish has made fishing harder than ever before:

> Compared to the way things used to be when I was growing up, children these days are more active. They seem to know fish better. This makes sense, since the fish seem to know better than before ("*o peixe é mais sabido que antes*"). People need to be more intelligent these days (MK02).

This section has shown us isolated cases related to individual aspects of learning that testify how people have been able to attune themselves to different emerging centres of learning, such as the pound net fishery, housing construction and boat driving, as well as to changes in existing centres of learning such as fishing. These dimensions of learning show how the inhabitants of Ponta Negra have been able to adapt to changes to their environment both in the context of natural resources harvesting and outside of it. However, as important as these individual aspects are, learning is nested in other modes of environmental learning that legitimate what is learned and what is not. Mentoring is one of these.

9.1.3. Mentoring

In spite of the fact that their role is not openly recognised, mentors play an important role in the learning projects of individuals in the community. They are in charge of enabling

the participation of apprentices in the learning environments as well as correcting their actions through daily practices of fishing, producing food and building. Experienced members of the community often fish and work in shifting agriculture with young apprentices, normalising the participation of the latter in those environments. These mentors are not necessarily related to the apprentices by kinship. People remember that as children they wanted to learn skills that were not held by anybody in their family or that they preferred the instruction of particular experts instead of the one provided by their parents.

> I learned most of the things that I know from my uncle. I used to spend a lot of time with him, fishing and hunting. At the beginning, I started by looking at what he used to do. I started helping him with pound net tasks, such as visiting and fixing the net. With time I became a full crewmember until I decided to start working on my own pound net (MK05).

Parents and older relatives play a crucial role initiating children in their harvesting endeavours. They have done this both by facilitating the preparation of tools and equipment needed for children-specific harvesting activities, such as crayfish harvesting and songbird hunting, and the participation of their children in these activities. People remember that the first time they went harvesting or hunting was with their parents and older relatives (Fieldwork Journal, November 2010).

Canoe making is an example of a skill that is not transmitted orally but one in which the apprentice has to be guided so they can learn to discover for themselves the shape of the canoe inside the log of a tree. The canoe maker does not impose measurements over the log, but rather discovers the canoe inside the tree. Standard measures are not used in this process. Instead, the maker begins with a unique piece of rope or vine. Once the diameter of the tree is estimated at its narrowest point, the rope is folded twice. This length is then used to create a pattern that provides the dimensions for the canoe's mouth. The measurement used to refer to this pattern is the length of the canoe maker's hand (*palmo*). This size reference is unique to each canoe as it corresponds to the intertwinement between canoe maker and tree. Proof of this is that when the canoe maker carves the wood they constantly use their hands to check and rectify the progress of their work (Fieldwork Journal, September 2010). To learn how to make canoes

requires patient observation and supervision, as an expert canoe maker explains:

> I learned to make canoes observing my father and other expert canoe-makers. Once I learned how to make a canoe and how to use the tools, I used to help my father with minor jobs. When I started making canoes, there was always a person who knew how to make canoes well correcting my work. With time I became more involved and started making my own canoes. The first canoes I made were to laugh about. Today people come to me asking for advice about to make their own canoes (MK02).

9.1.4. Safety

Safety has been recognized as a characteristic of practice that denotes competence and skill (Gherardi and Nicolini 2002). It is an integral component of any activity, both in natural resource-based livelihoods (Johansson and Manseau 2012) as well as in non-natural resource-based ones (Gherardi and Nicolini 2002). People in Ponta Negra recognise safety as an important dimension of environmental learning. Modes of environmental learning associated with safety encompass parental supervision, detection and avoidance of dangers and sophisticated communication protocols within the forest. Safety is relative to the setting and the age of the apprentices. Adults strictly supervise children younger than six years old in their activities in or close to the sea, such as harvesting mussels, fishing along the shoreline or just playing in the water with other children. After children learn to swim, parents become more confident in letting their children spend most of their outdoor time with other children of their own age who look after each other (Fieldwork Journal, October, November and December 2010). The home range and harvesting activities of children change as they grow older and acquire different skills and responsibilities.

Being in the forest brings together safety protocols related to the detection and avoidance of danger as well as communication. Parents are emphatic that children need to learn both how to be safe and to handle themselves in the forest. Being safe in the forest is a type of awareness that comes with time and experience (Field journal, December 2010). This awareness implies knowing the trails, the location of stationary resources (e.g., forest fruits and timber), how to track or wait for animals, which dangerous places have to be avoided (e.g., snake habitat, cliffs), and how to communicate with other people in the forest.

> Any active hunter has a very clear idea about where everything in the forest is: trails, good hunting areas, fruiting spots. Every place with a name can be found by any hunter in the community. If a hunter knows the name of a place, he knows its exact location. (Ln03)

Although hunting is forbidden and no longer practiced in the community, memories related to hunting were frequently offered when discussing safety. Communication rules were key when multiple people were hunting in a given area. When trailing terrestrial birds, such as *macuco* [solitary tinamou; *Tinamus solitarius*], people remember they had sophisticated calls that enabled them to identify whether they were following prey or another hunter:

> I have had years of experience hunting and I know the forest can be very deceptive. Every time I heard a macuco call, I would have to make macuco calls a couple of times and then change to a monkey call. If I didn't receive a monkey call in response I'd have certainty that what I was close to me was a macuco and not another hunter. Then I would get closer and prepare to shoot. These procedures are of basic safety and allowed us to avoid tragedies, such as shooting somebody else. If two people were hunting macuco at the same time we could be calling to each other, so we needed to establish rules and strategies of communication that would prevent mistakes from happening. Miscommunication can lead you to think that something that is coming towards you is an animal that you can shoot. My obligation then is to indicate that I am a hunter and not an animal. The other person should do the same. In that way, I could unload my gun and get ready to greet whoever is coming (Ln03).

Maturity and judgement were intertwined in every hunting activity. Experienced hunters recognised that apprentices needed to learn how to handle themselves in the forest. This applied particularly to hunting with firearms. As in the example above, before firing a gun the hunter needed to be sure of the identity of their target. They had to be mature enough to go hunting without a mentor. Nobody younger than 16 years old was allowed to go to the forest by themselves with a firearm.

The aforementioned learning principles show some of the parameters that underlie the process by which individuals are socialised within their local environments as well as the role that more experienced society members play in facilitating such socialisation processes.

9.2. Natural Resource Harvesting and Centres of Learning

Centres of learning are fields or nodes of practice that enable the embodiment of existing skills as well as the generation of new ones through natural resources harvesting and other types of practice that sustain the livelihoods of coastal peoples. Each node of practice is an assemblage of people, resources and places in which individual apprentices are socialised with other human and non-human elements of the environment.

Table 20 presents the multiple components of the centres of learning related to natural resource harvesting in Ponta Negra. A domain corresponds to the ecosystem in which practice takes place. Sea, coast, forest and shifting agriculture plots are examples of domains directly related to the harvesting of natural resources. As it will be examined in the following section, recent processes of integration between rural and urban contexts have brought forth new, hard to bound domains in which new centres of learning (i.e., local tourism) have emerged. The column identifying people involved refers to the human actors that normally engage in each centre of learning. The knowledge and skills column describes the main activities and associated skills involved in each centre. Finally, the column outlining the engagement of apprentices indicates the typically entry point of individuals and the pathway they often follow. As an illustrative example, I present the case of centres of learning associated with the marine domain below.

Pound nets, canoe fishing and squid jigging are the main centres of learning found in Ponta Negra's marine domain (for a detailed description of the ecology of these centres of learning see Chapter 4). People's relations with the marine environment are established through the multiple centres of learning they engage in, which in turn involve multiple and mutually dependent skills. However, just as particular skills and knowledge are common across centres of learning, each one of these centres has skills that are also unique to them (Figure 30). Each centre enables practitioners to interact with, and hence know, particular dimensions of the marine ecosystem. Those who work in the pound nets, for example, not only know about the particular skills of this centre, but also know about the ecology of the pelagic schooling fish better than somebody who is not active of this centre.

Table 20. Examples of centres of learning associated with natural resources harvesting

Domain/ Centre of Learning	People involved	Knowledge and skills	Engagement of apprentice
SEA	Male dominated activity. Each pound net is operated by a net master and at least three more crewmembers with children often helping when crewmembers are not available	Operating, making and fixing nets and ropes Pulling nets (balance) Operating canoes and skiffs Taxonomy	Children start working when they can operate dugout canoes and are strong enough to lift nets (~10 yrs. old) Become crewmembers when they are strong enough to pull nets by themselves (~14 yrs. old)
Pound nets			
Canoe fishing	Mostly young men and male adults who have access to small and medium-size dugout canoes	Operating canoes and fishing gear (hand lines) Geographic location Locating and handling rockfish Taxonomy	Children start fishing with their parents, but start fishing autonomously after they can swim (~8 yrs. old). They often fish with friends of the same age
Squid jigging	Mostly young males throughout the season, but during the peak children and male and female adults join in	Operating canoes and fishing gear (squid jigs) Geographic location	Young children start fishing when waters are calm, gateway to other fishing techniques
COAST	Winter: lead by adult women, joined by young male and female children Summer: mostly children as a leisure activity	Walking along rocky shorelines Detecting crabs and sea urchins Taxonomy Walking along rocky shorelines Fishing with bamboo rods Taxonomy	Young apprentices follow the person in charge, gathering resources as they find them Young apprentices fish together with their relatives
Coastal harvesting			
Coastal fishing			
LAND	Male adults in charge of coordinating, locating new plots, planting and harvesting. Female adults in charge of coordinating care of the plot throughout	Agricultural skills. Seasonal, ecological and geographic awareness Plant taxonomy	Children begin helping parents with minor tasks and progressively become responsible of their own plot
Shifting agriculture			
Songbird hunting	Children and young adults	Operating sling shots, building traps Seasonal and ecological awareness Animal taxonomy and behaviour	Children and young adults trap and hunt songbirds along trails nearby the community

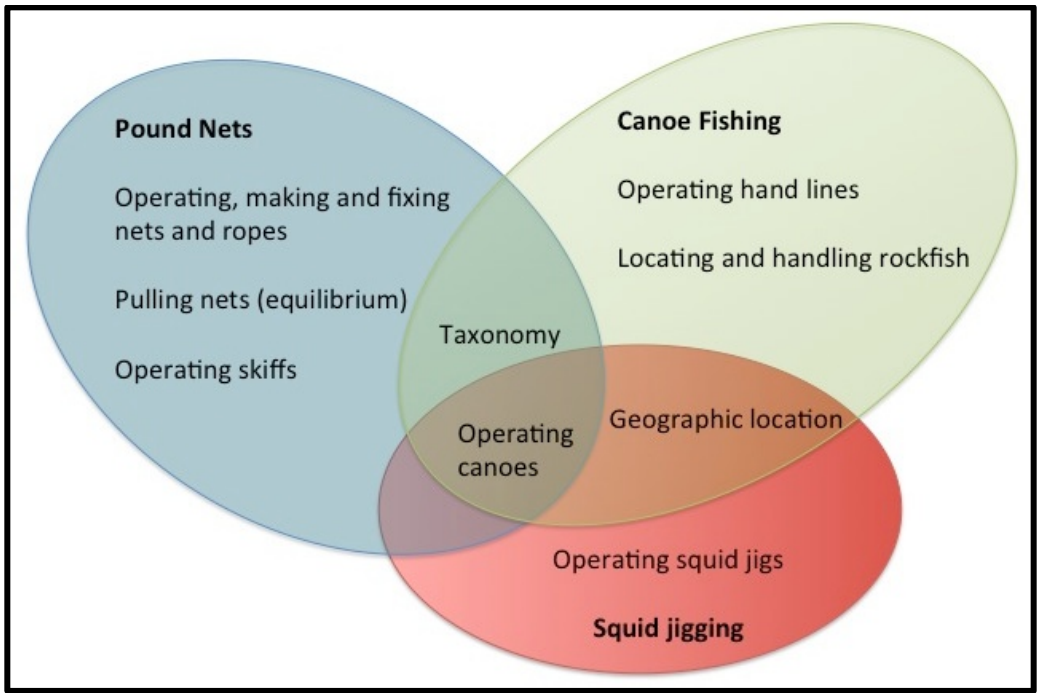

Figure 30. Centres of learning in the sea domain

Operating dugout canoes is an example of a skill that is transposable among the three centres of learning. Young children begin to acquire this skill by spending time canoe fishing with their parents and perfect it as they go squid jigging. While canoe fishing with their parents, children gain the ability to maintain their balance as they undertake activities in the canoes. Squid jigging allows children to acquire and improve basic skills such as manoeuvring and landing canoes, which become paramount in the everyday life of those involved in other fishing activities. This centre of learning also provides an opportunity for young children to spend time in the water with peers of their own age during the summer, which is a time of the year when the water is calm. As children grow up and become stronger, they start venturing out on canoe fishing journeys by themselves. With time they are able to go fishing even during times of the year when the water is rough and requires more expertise. Engagement in squid jigging, therefore, enables young practitioners to join other centres of learning that demand the embodiment of more complex skills and knowledge.

Young practitioners learn about geographic location in Ponta Negra Bay and nearby waters through squid jigging and canoe fishing. Squid runs happen unpredictably throughout the summer. During this time of the year, groups of young practitioners scout

the waters around the community looking for these cephalopods. As soon as a run is spotted, some start jigging right away while others go back to the community to share the location of the current run. Canoe fishing uses a different kind of geographic location as it is practiced in specific fishing grounds (‘*pesqueiros’)* whose locations are well known among fishers. These spots are frequently visited and used as points of reference for other activities happening around them (see Section 4.4.2). Each geographic feature along the coast has a particular name that fishers use to triangulate their position and the location of resources. Squid jigging and canoe fishing enable young practitioners to develop navigation skills by associating topography with the location of resources, both for permanent harvesting grounds (e.g., rockfish) and temporary spots (e.g., squid).

Canoe fishing also demands special skills for handling fishing gear in order to catch and manipulate rockfish. When a medium to large-sized rockfish (e.g., grouper, *Epinephelus* sp.) is hooked, fishers need to be prepared to deal with a strong animal that can easily cut their hands with the line and even capsize their canoe. When children are between 10 and 15 years old, they are experienced enough to face these challenges by themselves. In the summer, rockfish are more accessible for fishers because they are more active and also, with calmer waters, their harvesting grounds are easier to reach (Li06). As mentioned above with respect to squid jigging, summer offers opportunities to gain and improve skills necessary for becoming fully competent fishers.

The pound net fishery has a division of labour between net master and crewmembers based on ownership and expertise (Chapter 6). In order to work in a pound net, crewmembers need to master basic skills acquired in other centres of learning, such as operating canoes, but they also need to acquire additional skills that are particular to this centre. Although it depends on the ability to balance in a dugout canoe gained in other centres, pulling the nets to gather the trapped fish is a skill that is unique to the pound nets.

Working with, making and fixing nets and ropes are other skills required to operate a pound net. Some crewmembers acquire these skills working in the pound nets, while others learn them by working in industrial fishing fleets during their early adulthood: “*When I was a teenager I worked in industrial fishing… That was an important phase of*

my life in which I grew a lot and acquired many skills that I could later use in the work with the pound nets" (LH02). Others simply do not learn these skills at all. The net master, who is often the gear owner, is a very experienced fisher deft in all the skills required for running a pound net, from visiting the net and collecting fish, through to making a net from scratch, coordinating other people, and managing the finances of the net. Being a net master requires years of experience, which only a few people in the community can achieve.

As individuals gain expertise they move from the periphery to the centre of each centre of learning (see Lave and Wenger 1991). The case of the pound net exemplifies how this process of enskillment occurs. Individuals gather expertise during their life paths as they engage in new fishing techniques and get to know different dimensions of the marine domain. When somebody becomes a crewmember of a pound net at an early age (i.e., ~13 years old), they mobilise some skills acquired in other centres of learning as they begin participating in the pound net fishery. Time and practice allow these skills to improve and at the same time other skills are embodied. Those with the talent, spirit and financial assets may move to the core of the pound net centre of learning to become net masters, while others may remain as crewmembers or move into other centres of learning.

9.3. Innovation and Learning in the Tourism Economy

To this point, I have focused the discussion of environmental learning on the principles related to natural resource harvesting and housing construction. The examples above illustrate how environmental learning implies an on-going process of adaptation of the relations within specific centres of learning such as pound nets or housing construction. However, the learning environment of Ponta Negra is not limited to the harvest of natural resources or livelihood activities constrained within the local setting. The boom of the tourism industry has enabled some people in the community to create new centres of learning. This section presents the case of an entrepreneur from Ponta Negra who has been able to tap into this emergent industry by creating a new centre of learning. This new centre is a tourism business in the community that is able to provide competitive tourism services that draws in clients from around the world. This case shows that so-called traditional peoples can be creative agents and are able to thrive in a new domain of

practice, such as tourism, that they have not had historical engagement with and thereby generate new centres of learning. The data for this section primarily draws upon two interviews conducted with Adenicio dos Remedios, commonly known as Teteco, a Ponta Negra community member and entrepreneur, who has given consent to be identified by his name in this thesis. The first interview documents his life history in general (OS01) and the second one focuses on his particular relations with the regional tourism industry (OS02).

In Ponta Negra, tourism-related activities feature as the primary economic sector for 25.63% of the households in the community and provide secondary income to another 51.11% (Section 7.1). Likewise, 24 out of the 45 inhabitable dwellings owned by people from the community are available for short-term rent (Section 7.2.4). There are also three restaurants in total in the community, two of which are opened year-round during the weekends. In addition to Teteco, there is another tourism entrepreneur from the community, who has followed a similar life path as his and has been able to create a tourism business of similar breadth. Additionally, there is an entrepreneur from São Paulo, who provides lodging services and hires Teteco to provide boarding services to his clients.

The story of Teteco and his tourism business begins in the mid 1990s, but the circumstances that allowed him to get involved in this sector in the way that he is today can be traced to the time when he left the community in search of formal education. Unlike many other people of his generation in Ponta Negra, Teteco moved to Paraty to study high school as soon as he finished the formal schooling available in the community. Teteco is an exception. He is one of the three people in Ponta Negra who have finished high school as of 2012 (Section 7.2.5). Living in Paraty gave Teteco exposure to multiple jobs and activities, including some in the tourism industry, that changed his perception of Ponta Negra and its potentials:

> I took barman lessons in Paraty, worked at the "*Pousada* do Ouro" hotel as a valet and at the Bank. Working at that hotel as well as at the bank I learned how to interact with clients. I use all those skills in my work here in Ponta Negra. All that experience outside Ponta Negra helped me a lot to understand the value of local resources (OS01).

Teteco's participation in the tourism economy in Ponta Negra started with offering

basic lodging and homemade food to the few incoming tourists, but soon moved to opening a restaurant and actively bringing tourists to the community. Around 1996 he saw that more and more tourists were visiting the community. He took advantage of this opportunity by renovating his existing properties and building cottages to receive tourists on land he inherited use rights to from his parents.[21] He encouraged his brothers to do the same. Around the same time, he also had the opportunity to travel to other tourist destinations in the region that offered him ideas for new buildings in the community, such as the chalet style cottages that are now commonplace[22]. Working in Paraty allowed Teteco to save money and become eligible for loans so that he could invest in his assets back in Ponta Negra (OS08). He not only improved the infrastructure for lodging, but also obtained use rights from another community member over beachfront property where he was able to start the restaurant in which he serves traditional foods (OS01).

Teteco's marketing strategies have been key to the expansion and success of his business. Word-of-mouth marketing, partnerships with ten national tourism agencies and a French agency, and two websites manage to attract and keep a flow of tourists in Ponta Negra throughout the year (OS08). Teteco has managed to incorporate the services he provides into several tourism packages that offer hiking trips along the Atlantic Forest of the Juatinga Peninsula (e.g., Brazil Insider[23] and Terra Cordillera[24]). He explains the seasonal fluctuation in the tourism market and how he has managed to tailor his services accordingly, so he can maintain a steady flow of costumers:

> During the winter, most of the people that visit come with pre-defined tour plans and stay for a few days. Some of them are school tours with people who like to experience the traditional life of the community. A few Brazilians come during the winter and they only stay for the day. They don't like to come to the beach when it's cold. Last year I received about 70 tourists, but there have been years in which I have received up to 150 people. During the summer I receive between 180 and 200 people throughout that season. In this case most of them are Brazilians. Foreigners

[21] Since Ponta Negra is located within a protected area, people do not have formal land titles but rather use rights (see Section 5.1.5).
[22] Some of the chalets he built were destroyed by the environmental authority in 2010 because they were deemed an illegal development in a protected area (Section 8.3.1)
[23] http://www.brazil-insider.com/visualizar.asp?id=921&l=2&btn=1 (accessed on May 10, 2013)
[24] http://www.trekking-andes.com/brazil-costa-verde/brazil-costa-verde-5d.html (accessed on May 10, 2013)

are rare during this time of the year (OS02).

The knowledge that Teteco has of the Ponta Negra environment also plays a role in his business. He knows the area and what activities, places and resources might be of interest to the people he brings to the community. Fishing, shifting agriculture, beaches, waterfalls and local foods are important components of his tourism brochure. He sees this dimension of his business as common sense: "*As a local you do not need to take courses to show the place to the tourists. You just need to bring the tourist and show them around*" (OS01).

Teteco's tourism model has changed the way tourism is conducted in Ponta Negra and created a new centre of learning in the community. Many people in the community see Teteco's tourism business as a model to imitate. Teteco has a permanent, year-round staff of three people from the community and during peak season he hires up to 20 temporary workers. As a result, this tourism business has enabled the emergence of a new centre of learning that offers a context for the acquisition of certain skills and an attunement of attention for other community members that has allowed them to participate in the emerging tourism economy. Among these skills are waiting and serving clients and adapting traditional dishes to the tastes and standards of presentation required to meet the demands of urban tourists. Some are mobilising these skills into other dimensions of the local tourism economy, such as improving the quality of the lodging services they provide (Section 7.2.4).

Even though many households have a desire to participate in the tourism economy and have the assets to do so, many still lack key skills required to effectively advertise such assets and make a profit from them (Li02, Li05). Only Teteco and another community member have key skills, such as computer skills and knowledge of the Internet, and networks that allow them to advertise their services to wider audiences. As a result, in spite of opportunities this new centre of learning affords, the only prospect for many individuals and households wishing to enter this industry is as service sector employees (Li12). The possibility of becoming a service provider or business owner relies heavily on access to economic resources that enable the access to formal education so specialised skills can be embodied (Chapter 7). In Ponta Negra, this access has been

historically tied to the participation in the pound net fishery, which gave a position of advantage to a few community members while it marginalised others (Chapter 6).

According to Teteco (OS08), the lack of proper infrastructure and the skills for interacting with clients are other examples of the limitations to participating more actively in the tourism economy people in the community face. Proper food storage provides one example: "*The infrastructure my brother [a fish buyer] has in his fish buying business [in Paraty] has helped me a lot. I can store fish there and bring it back. In that way I do not depend on fish caught elsewhere*" (OS08). An inadequate interface with tourists is another:

> Somebody needs to like interacting with people. You have to be pleasant and charismatic. You can't show bad temper to your clients or bring the problems from your home to work. I think this is the main point (OS08).

Teteco has also been able to mobilise some of the skills he learned during his childhood in the community in his business. For example, his mother and other relatives used to cook many of the dishes that now feature on his restaurant menu. However, he also recognises that there are certain skills needed in the tourism economy that require formal instruction. Customer service skills are an example. He gained these skills through his employment and training in the city. Possessing these skills, or not, makes a difference when dealing with people from different cultural backgrounds:

> Interacting with tourists isn't something that everybody can do. You need to have quality training in service. Fishing is different. When you fish, you handle the fish without much care; it is anyways dead. Working with people it's different. Boat drivers are particularly important. They are the first people tourists interact with, but unfortunately they are the least trained ones. Some tourists often cry because the boat drivers are too rude to them (OS08).

This section has focused on the historical emergence of a new centre of learning in Ponta Negra: offering tourism services. Key for this centre of learning is how its champion, Teteco, has acquired skill sets from different social contexts, including both rural and urban, through his life experience and has been able to mobilise them to proactively adapt to the growing tourism economy. The lessons from Teteco's case, combined with the modes of environmental learning and lessons from other centres of learning in Ponta Negra, invite a re-thinking of how the intergenerational continuity of

knowledge phenomenon has been understood by those who study it.

9.4. Discussion and Conclusion

Environmental learning in Indigenous and rural societies has garnered attention among scholars as the effects of rapid globalisation processes are becoming more apparent (Bates et al. 2009). This phenomenon has generally been problematised as intergenerational knowledge continuity and, as such, has most commonly been addressed using the cultural transmission of knowledge model (CTKM; Section 2.1.2, Cavalli-Sforza et al. 1992). Widely employed by ethnobiologists and anthropologists in the field, the CTKM assesses how knowledge and other cultural traits are passed on between generations (see Reyes-García et al. 2009). Those using the CTKM are dedicated to measuring the effects of Indigenous and rural societies' changing environments on their ethnobiological knowledge (Voeks and Leony 2004, Godoy et al. 2005) and report a general 'knowledge loss', which is understood as failure in the transmission of knowledge and skills from the previous to the current generation (Bates et al. 2009, Zent 2009a). This loss has been linked to integration into markets and increased access to education and healthcare experienced by many Indigenous and rural peoples (Zent 1999, Voeks and Leony 2004, Godoy et al. 2005, Srithi et al. 2009, Gómez-Baggethun et al. 2010). Few studies using the knowledge transmission model find that knowledge remains stable across generations or that new knowledge can be produced in particular contexts (Ladio et al. 2009; McMillen 2012; Reyes-García et al. 2013).

In the context of ethnobiology, CTKM research has contributed to indicating risks to the conservation of biocultural heritage and its holders as well as to identifying the drivers behind intergenerational knowledge loss (Reyes-García et al. 2009). In spite of these contributions, the knowledge transmission model is not sensitive to the innovation that underlies the responses of Indigenous and rural peoples to environmental change (Davidson-Hunt 2006, Lave 2009). Likewise, it does not take into consideration the factors that either enable or hinder successful adaptations to new environments and associated opportunities.

Examining the intergenerational knowledge continuity phenomenon from a practice perspective pays attention to the processes by which knowledge is generated through the activities individuals engage in as well as the factors that hinder and enable the generation of particular knowledges. Using this perspective in Ponta Negra brings valuable insights to understanding the role of environmental learning in the adaptation to environmental change of individuals living in small-scale communities.

Approaching environmental learning from a practice perspective in Ponta Negra shows how individuals, rather than being passive repositories of knowledge, are active agents in their own learning projects. Likewise, practice also shows that learning projects depend on the opportunities an individual has during their lifetime. Certain individuals are sensitive to environmental change and, therefore, are able to generate new knowledge in particular settings of practice, mobilise particular skills and are even able to create new centres of learning. Concepts, such as habitus, capitals and skills, and field, make it possible to deal with environmental learning from a dynamic perspective that takes into consideration people's identity, desires and aspirations through their current activities rather than reducing learning to a set of cognitive codes and their transmission across generations.

There is no single habitus in Ponta Negra. The modes of environmental learning (Table 19) demonstrate how one's positionality within, and awareness of, the environment is contingent upon one's own learning projects, observing and imitating others, the role and availability of mentors as well as knowledge of the rules necessary to engage safely in an activity in a given environment. Similar to the institutions identified in the adaptive learning framework (Davidson-Hunt and Berkes 2003a), these modes of learning are not equivalent to individual's habitus but subsist alongside it. Modes of learning show that knowledge is not imparted and allow for an analysis of how apprentices attune their perception towards the activities in which they are engaged during their lifetime.

The fact that older fishers recognise that younger fishers understand fish better is evidence that knowledge is not a static corpus of knowledge for Ponta Negra residents, even in activities many deem to be traditional (Diegues 2002). Additionally, cases such as

the introduction of the pound net fishery, fibreglass skiffs and housing construction skills illustrate how knowledge is generated through one's direct experience, abilities and positionality. The knowledge an individual possesses is reflective of their degree of engagement in different activities. This knowledge has direct relevance and implication for the particular environments in which individuals are situated and for those that they produce.

The case of Ponta Negra also demonstrates the influence of an individual's habitus on their life choices and subsequently on their acquisition of skills. Although some scholarship has shown that knowledge is distributed according to gender and age (e.g., Sousa et al. 2012), in Ponta Negra there is variation in the knowledge held by individuals of the same age group and gender. That learning is self-initiated implies that it is not expected for everybody within the same age cohort to have the same knowledge and skills. A testimony of that is that some people specialise in marine activities while others decide to remain on land working in housing construction and shifting agriculture in the past. Other factors, particularly a family's social and economic background, seem to weigh heavily on the development of an individual's habitus. Therefore, among the diverse sets of awareness and dispositions, it is possible to find fishers as well as entrepreneurs in Ponta Negra. Each habitus can be associated with particular perceptions of the environment. For some people in the community, natural resources and the places where they are harvested form the direct consumption basis of their livelihoods. For others, particularly tourist entrepreneurs, natural resources are appreciated primarily for their scenic value and relative novelty, which are drawing cards for tourists.

Access to material resources, such as fishing gear, also plays an important role in the generation of a particular habitus, their associated learning projects and the ways people perceive and interact with their environments. Research on fishing communities of practice in Indonesia has shown that expertise is relative to the access individuals have to natural and material resources (Vermonden 2009). Yet, the relation between access to material resources and individual learning projects is more complex than expected in Ponta Negra. Those individuals whose households own or have access to fishing gear and vessels outside the context of the productive pound nets have developed a habitus framed

by the harvesting of marine resources. On the other hand, those whose households own productive pound nets have developed a habitus that has made them capable of linking natural resources from Ponta Negra with the regional tourism industry (Chapter 6). In this case, the financial surplus produced by the productive pound nets has been transformed into access to formal education that in turn has generated the necessary skills to capably operate in emerging centres of learning.

From a knowledge transmission perspective those individuals who developed habitus associated with the harvest of natural resources would have adapted so-called traditional knowledge and skills. In the last generation, fishers have modified their habitus through new harvesting technologies, environmental conditions and forms of exchange (see also Chapter 6). This reworking of their habitus has come with new ways of perceiving and interacting with marine resources and the actors and resources associated with them. Meanwhile, those who have been able to gain competence in the tourism industry have been able to change their relationship with the local natural resources and have created new centres of learning in the community, as the case of Teteco illustrates. Their relations with the natural environment and knowledge associated with it have not been eroded or lost. Rather, those in the tourism industry have adapted their way of being-in-the-world (Ingold 2000) alongside the transformations that have taken place in the multiple fields in which people participate in their everyday lives.

Equivalent to Bourdieu's (1986) field or Lave and Wenger's (1991) communities of practice, a centre of learning is an analytical concept to understand the emergence of knowledge and skills in settings in which practice brings together people with different levels of expertise, material assets and natural resources. In these centres, individuals find structured settings in which they are able to generate knowledge by interacting with expert practitioners. Apprentices join particular centres according to their interests and socio-economic position. In these centres they find experts they can observe and imitate as well as mentors who can guide their learning projects. With time and practice apprentices become skilful in generating their own ways of relating with the world (Pálsson 1994). Each centre generates specific knowledge and skills that allow access to particular resources within a given domain. As the example of marine centres of learning

shows, some skills are transposable among different settings. Operating canoes, a skill that is shared among the three centres of learning described in relation to the marine domain (i.e., pound nets, canoe fishing, squid jigging), is an example of this. Other skills, such as fish taxonomy, are less transposable and are only shared between canoe fishing and pound nets.

The more different the resources at stake are, the less transposable the skills associated with them become. The particular configuration or patterning of a given field can either enable or constrain the agency of those involved in it (Fløysand and Jakobsen 2010). Even though most people in the community have been able to use local natural resources for direct consumption and economic exchange, few of them have been able to mobilise their skills and resources into the tourism economy successfully. Using a practice perspective and the centre of learning concept, it is evident that the networks in which tourism resources and knowledge flow are beyond the grasp of many people in Ponta Negra. Even though tourism operates locally and centres of learning related to it are emerging in the community, the tourism industry is a domain that encompasses resources and skills not readily available for many people in the community. This domain has a wider geographic span, involves complex sets of local, regional, national and international actors, and has a particular flow and perception of natural resources. The life history of Teteco shows how he was able to develop a particular habitus and set of skills that enable him bridge the local perception and knowledge of resources with skills, such as costumer services and use of the Internet, that have allowed him to mobilise those resources into the field of tourism.

Teteco's success in the tourism domain is an outcome of his formal education, which in turn depended on his family's strong material resource base, and interaction with people acquainted with the tourism industry. That experience granted him a feel for the game that not many other people in the community have had the opportunity to develop. Teteco's activities have in turn changed the environment in Ponta Negra by creating a new centre of learning in which other community members can participate. In doing so he has also made visible to other members of the community the potential of tourism to offer new livelihood alternatives in a context in which the decline in fish

stocks (Chapter 6 and 7) and restricted access to forest resources associated with restrictive environmental regulations (Chapter 8) call for innovative ways to interact with the environment.

In this chapter, rather than showing how knowledge and skills from previous generations have been passed on to newer ones, I deliberately decided to focus on how modes of environmental learning and centres of learning provide insight into the ways by which people in Ponta Negra have been able to generate new skills, or attune pre-existing ones, to different dimensions of environmental change. The case of Teteco epitomises the adaptability of Ponta Negra people to such environmental change. In the wake of a livelihood transition from a natural resource based economy (e.g., shifting agriculture and fishing) towards a service based economy, he was able to seize upon the new opportunity by creating a centre of learning that hones so-called traditional knowledge and skills by mobilising them into new arenas of knowledge production, such as those of the tourism economy. Teteco's case shows us that such livelihood transitions from fishing to service provision are not as easy as scholars in the area have indicated (Bartholo et al. 2008), but that engagement of individuals in particular settings to acquire key skills is paramount, as is having the resources to enable one to do so. By sharing his life path, Teteco also showed us that turning a fisher into a successful tourism operator goes beyond encouraging them to provide tourism services rather than to catch fish (e.g., Fabinyi 2010).

Teteco's case is particularly relevant because he has been able to be successful in a livelihood transition process without institutional support. A lack of institutional support is something that is often the case in remote communities (Coulthard 2008). So the question is, how was he able to do so? By building specific skills at a specific time, he was able to develop a habitus based, not only on understanding the complexities of the immediate local environment of Ponta Negra, but also on what is needed to mobilise the materials available in that environment and to confer new meanings on them in novel contexts such as tourism.

Textbook definitions of ethnobiology characterise this field of study as the investigation of the relationships between humans and environment. The inherent

dynamism of these relations and the environments in which we live in should be embraced within the discipline. The complex, evolving, tangible and intangible relationships that link humans and environments should not be essentialised as packages of knowledge and then fixated on as objects that can be lost (Heckler 2009). This perspective does not do justice to traditional peoples, who are agents capable of responding and adapting to changing environments. Nor does this perspective sufficiently acknowledge how changing needs, desires and aspirations are intertwined for Indigenous and rural peoples in the relations that constitute the environments in which they live. Ethnobiology should actively recognise that environments and our knowledge of them are ever changing and that it is natural for the relations we have with local resources to change accordingly (Davidson-Hunt 2006, Sears et al. 2007, Heckler 2009, Ingold 2011). An approach to ethnobiology rooted in practice theory opens a window to understand our relations with the world based on the embodied experience of being-in-the-world and not on mourning a past that may never return and perhaps may never have existed.

Chapter 10. Intergenerational Knowledge Change and Continuity through the Lens of the Ethnoecology of Practice

10.0. Introduction

This chapter presents the discussion and conclusions of this dissertation. The purpose of my research has been to understand the continuity and change of ways of knowing associated with natural resource harvesting in the context of the coastal community of Ponta Negra in SE Coastal Brazil. This purpose was unpacked through the following objectives: (1) Explore and document the ethnoecology of Ponta Negra in relation to practices, places and resources; (2) Investigate Caiçara perceptions of how economic, political and policy structures influence access to natural resources and how these structures also affect local livelihood strategies; (3) Investigate the contexts and processes by which harvesting knowledge and practice are constructed and acquired between generations; and, (4) Analyse the contribution and role that natural resource-based livelihood practices play in supporting the wellbeing of Ponta Negra as well as the ability of Caiçara communities to engage in micro and social enterprises in the context of place-based development.

This chapter is structured in terms of the main theoretical and applied contributions of this dissertation. These contributions include a revised version of the EofP framework, which served as the theoretical basis of this dissertation (See Chapter 1 and 2 for the original version). Next, I outline the contributions to each area of literature. The final sections of this chapter present practical contributions of this work and a reflection on possible directions for future research.

10.2. Theoretical Contribution I: The EofP Framework

10.2.1. A Rationale for the EofP Framework

The EofP examines the intergenerational continuity and change in ways of knowing through a multi-dimensional lens. Ethnoecology and practice theory are key components

of this framework as they offer complementary perspectives on human-environment relations. Ethnoecology provides a relational understanding of the ways in which people experience, engage with and know the environments they are part of (Nazarea 1999, Dwyer 2005). Practice provides a practical and theoretical grounding that makes it possible to expand the goals of ethnobiology to deal with the intergenerational continuity and change in ways of knowing. From a practical perspective, practice takes into consideration individual natural resource harvesting assemblages by tracing back the multiple resources, capitals and actors with which they are associated.

From a theoretical perspective, practice theory provides an ideal ground of intersection for bringing together complementary perspectives on natural resource harvesting practice. Practice theory adds phenomenological perspectives on perception and cognition to ethnoecology by acknowledging that environmental knowledge does not exist as representations inside people's heads but rather is generated in the settings where practice takes place (Ingold 2000, Davidson-Hunt 2006). From a practice perspective, knowledge is emergent, relational, embodied and contextual (Lauer and Aswani 2009:323).

Practice theory also allows ethnoecology to be bridged with political ecology by bringing the interactions between structures and agency into the discussion of environmental knowledge production (Biersack 2006). Structures are not only constraints but also platforms for the exercise of individual agency (Giddens 1979). In this context, the concept of habitus becomes key for understanding how individuals develop a 'feel for the game' that enables them to anticipate and react to environmental change (Bourdieu 1977, 1990). This theory provides a critical ground to see through labels that lock coastal peoples in discourses produced by dominant stakeholders and institutions (i.e., Environmental Authority and Brazilian legislation bodies) and to visualise current engagements and perspectives of individuals from small-scale societies (Escobar 1999b). Applying the same ideas of structure and agency to the context of international development studies, practice theory feeds social wellbeing approaches with a critical orientation that unveils how individual social position is relative to others and becomes normalised in everyday life (White and Ellison 2007). Thus, by using practice theory in

the EofP framework, my intention is to bring an encompassing lens to the intergenerational continuity of ways of knowing phenomenon with a focus on the relations surrounding natural resource use, which has long been the focus of ethnoecology. This perspective sees knowledge as an outcome of practice. Knowledge production thus is situated within structures operating at multiple levels but determined by the exercise of individual agency framed not only by embodied skills, but also by needs, desires and aspirations.

10.2.2. The EofP Framework

The EofP framework is a theoretical and methodological device that has helped me organise my thinking and gather data. The basis of the initial thinking behind this framework can be found in Chapters 1 and 2. Each results chapter of this thesis (i.e., Chapters 4 to 9) has contributed a particular component to my wider objective of offering a new theoretical framing for examining the phenomenon of intergenerational continuity and change of ways of knowing in small-scale societies. My review of the EofP framework is interwoven with contributions from each chapter, some of which will be touched on again in subsequent sections.

Figure 31 presents the EofP framework revised according to the analysis of the data produced during my fieldwork in Ponta Negra. The EofP takes the individual and their practice (i.e., natural resource harvesting activities) as a starting point and considers the multiple relations that constitute that individual's local environment as well as the forces that guide their practice. The main components of the framework are structures, centres of learning/practice, habitus, agency and landscape of practice. Each one of these components in turn has sub-components that provide more details as to the workings of this processual framework.

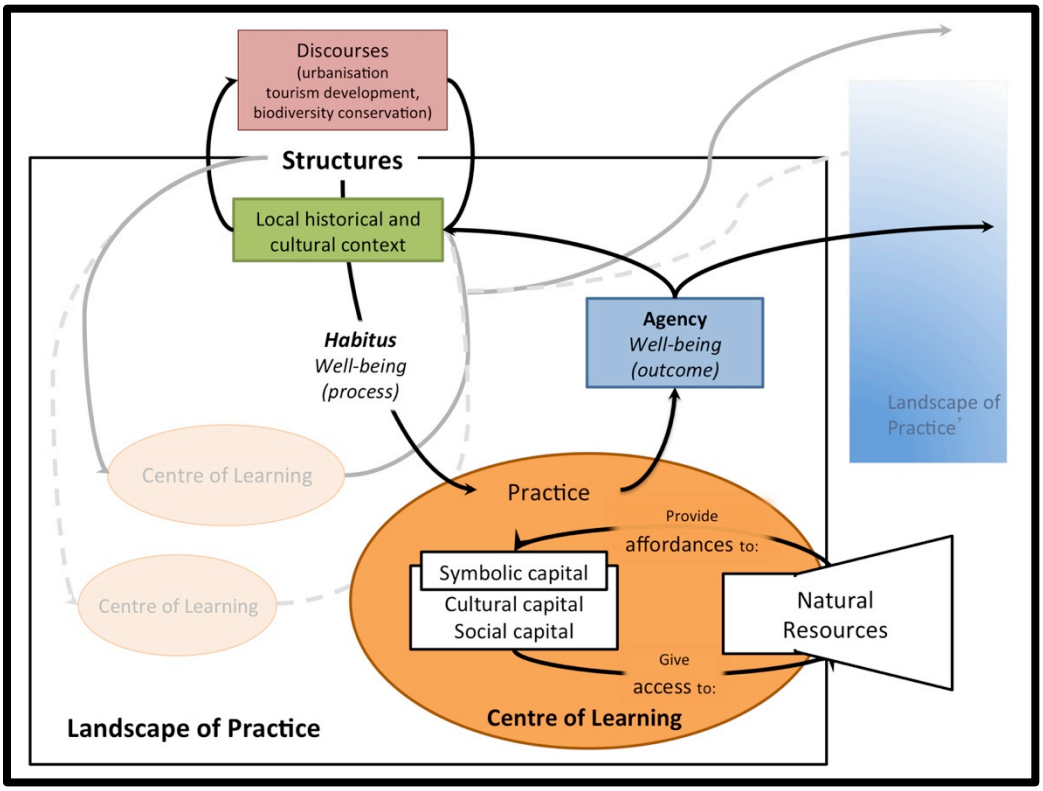

Figure 31. Revised Ethnoecology of Practice framework

10.2.2.1. Structures

Structures are the driving forces that surpass individual practice both in terms of space and time. They comprise the cultural, social, political and economic relations through which people collectively live their lives (Section 2.2.2). During fieldwork, I identified two main sets of structures, 'discourses' and 'local history and cultural context', in which Ponta Negra is embedded. This classification is rather arbitrary as both set of structures influence each other and, in turn, influence individual practice. Discourses bring together processes of urbanisation, tourism development and biodiversity conservation. Access to markets, cash and construction materials are examples of how urbanisation has become an ever-present force shaping the ways people relate with the local environment.

Associated changes in perception are evidence of these processes. Chapter 6 shows how the value of fish in Ponta Negra has changed from being a part of a subsistence economy to becoming a valued commodity as people in the community have created relations with the regional fishing economy. Likewise, access to construction materials turned brick and tile housing into a necessity and housing construction into a new

livelihood for many (Chapter 7). The best indicator of the work of forces of urbanisation is how people in the community associate access to urban goods and services, as well as their perception of the need for better education and (at least to some extent) the process of outmigration associated with it, as part of an on-going process of improvement of the quality of life in the community (Chapter 7).

Tourism development has also become a driving force of change in Ponta Negra, as well as along the coast of Rio de Janeiro State generally, since the opening of the Rio-Santos Highway (BR101) in the early 1970s (Teixeira 2006). Looking at the economic history of the Atlantic Forest Coast (Dean 1996, Begossi 2006, Teixeira 2006), we can find that the tourism boom is one of the many economic booms this region has experienced since colonial times. Coastal peoples have been able to adapt to these many booms and their respective busts. The boom of the tourism sector has boosted the development of multiple discourses associated with the continuity and change in ways of knowing and the perspectives urban dwellers have of coastal peoples as well as how coastal peoples see themselves (Chapter 8). Coastal peoples have used the niches opened by the tourism industry to widen their livelihood portfolios [e.g. participating as waiters, waitresses, boat drivers, etc. in the emergent service economy (Chapter 7) and becoming service providers themselves (Chapter 9)]. In spite of this, the tourism industry has essentialised these same coastal peoples by representing them as autarchic societies living in 'harmony with nature': the so-called Caiçara.

Biodiversity conservation is another discourse at play in Ponta Negra, although in contradictory ways. Chapter 8 shows how the necessity for conserving the remnants of the Atlantic Forest brought about the declaration of protected areas in the region. The REJ is of particular relevance for this dissertation. Having thirteen coastal communities within its boundaries, this reserve was declared, without prior consultation or studies, as a protected area with restrictive use of natural resources (Brito 2003, Diegues and Nogara 2005). Today, more than 20 years after its declaration, and still lacking a management plan, this reserve has subjected the people living inside it to persistent anxiety and struggle emerging from unclear legislative frameworks and a fear-based approach to management (Chapter 8). While the managers of the protected area have prohibited some

natural resource harvesting activities (i.e., hunting) and restricted others to the point of rendering them unsustainable (i.e., shifting agriculture) (Chapter 5), the legislation that regulates the permanence of so-called traditional populations within protected areas deems them as autarchic, with no right to engage in the market economy. Legally, if traditional populations were to engage in the market economy they would lose their right to continue living within the protected area (Chapter 8).

Local history and cultural context have also structured the change and continuity of ways of knowing in Ponta Negra in ways that are distinct from the discourses discussed above. As the introduction of the pound net fishery (Chapter 6) shows, the people in Ponta Negra have been able to adapt to environmental change in their recent history. The identified trends show a decline in the relevance of natural resource-based livelihoods as well as an increase in the relevance of livelihoods associated with the service economy (Chapter 7). This shift is in response to dwindling fishing stocks as well as restrictions on natural resource use. Adaptation and resilience are at the core of coastal peoples' ways of life (Willems 1952, Adams 2000, Begossi 2006, Begossi et al. 2012), the recent history of Ponta Negra testifies to that. Additionally, a local understanding of the term that has been used to label coastal peoples (i.e., Caiçara, see Bernardes 1950) may also be seen as a counter-discourse based on their own appreciation of local history and culture. While the term Caiçara has been treated as an equivalent to 'traditional population' in the Brazilian environmental legislation, and hence romanticised by some as societies that live in autarchy (see above), people in Ponta Negra themselves associate the term Caiçara with being born on the coast, between the sea and the forest (Chapter 8).

10.2.2.2. Habitus

The tensions between the aforementioned sets of structures inform natural resources harvesting practice and the habitus that subsist alongside it. Habitus has been a crosscutting theme in this dissertation and appears in multiples dimensions. White and Ellison (2007: 172) consider that the role of habitus "*is to generate regular practices, perceptions and attitudes that are not governed by rule or conscious calculation.*" Habitus is the 'feel of the game' that enables people to seize upon the opportunities offered by changes in their environments (Bourdieu 1990). As such, habitus is the

common sense that enables adaptation. It is what lies beneath decisions to adopt new technologies (Chapter 6) or try new economic enterprises (Chapter 9). It also can be found in the testimonies of research participants that talk about being sensitive to possible new behaviours of fish and even bringing in surfing skills to aid in boat landing (Chapter 9). As such, it is reflected in what people have, what they value doing and who they aspire to be.

10.2.2.3. Centres of Learning and Practice

Learning is an integral part of everyday practice (Lave 2009). Following that logic, I see centres of learning and practice as part of an assemblage that is hard to tease apart. As explained in Chapter 9, a centre of learning is an analytical concept to understand the emergence of knowledge and skills in settings in which practice brings together people with different levels of expertise alongside material assets and natural resources. A focus on practice acknowledges natural resources as embedded in assemblages that make possible their flows, transformations and perceptions of what they afford (Chapter 4).

Rather than existing independently of their users as blocks of information passed on between generations (e.g., Voeks and Leony 2004, Reyes-García et al. 2009), the perception of the properties afforded by natural resources is relative to the position of the individual, which in turn depends on the capitals they accumulate through their lifetime (i.e., social and cultural capital) and the ways they deploy them (i.e., symbolic capital). Even though we can talk about a classification of fish in Ponta Negra (i.e., first and second-class fish, see Section 4.1.), their properties are perceived differently according to whether one is a pound net fishery crewmember or a gear owner (Chapter 6). Other examples of the relative perception of resources can be found when community members venture into the tourism economy. In this context, fish and the skills associated with their capture can be perceived as a source of subsistence livelihoods for some or as part of a marketing strategy for their tourism business for others (Chapter 9).

10.2.2.4. Agency and Wellbeing

The relation between agency and wellbeing as an outcome of practice in a centre of learning is of paramount importance for understanding the continuity and change of ways

of knowing. These concepts are useful tools to understand people's responses and choices, as well as the trade-offs they imply, in the context of environmental change (Coulthard 2012). Although agency and wellbeing are treated with some detail in Chapter 7, these concepts have also managed to permeate other chapters that deal with historical (Chapter 6) and current (Chapter 9) adaptations to environmental change.

Framed in the tension of deciding whether to stay in the community or emigrate to the city, Chapter 7 discusses how the lack of jobs and aspirations for a good quality education in Ponta Negra are forcing many households to emigrate to nearby urban centres. This process is marked by grief. Adults find it hard to leave the peaceful life in the community and adapt to urban contexts, where natural resource harvesting-based livelihoods are often replaced by low-skill jobs in the construction and service sectors. The lack of access to education is seen in Ponta Negra as an important driver separating children from their natural resource base (Chapter 7). This is contrary to what the users of the knowledge transmission model have sometimes found (see Reyes-García et al. 2013).

As Chapter 6 and 9 show, decisions associated with outmigration are not homogenous across the community. Those who were able to gain economic advantage during the boom in the fishing economy have been able to provide formal education to their children, who are in turn taking advantage of the current boom in tourism economy thanks to the skills they gained in urban contexts. Meanwhile, those who could not gain the same advantage have had to emigrate or stay dependent on those in the community who have been able to profit from the economic booms.

10.2.2.5. Landscape of Practice

Landscape of practice brings together relational understandings of the environment and centres of learning. If an individual's environment is conformed by an unfolding meshwork of relations, "*entangled lines of life, growth and movement*" (Ingold 2011: 63), then their landscape of practice represents the multiple centres of learning in which they are entangled. This perspective highlights that environmental knowledge is immanent to the centres where it is produced and that individuals know the world through their participation in those centres (Chapter 9). This shows that knowledge is not homogenously distributed among everybody in the community, but rather that there are

specialised knowledge holders who through their life paths have engaged in activities that hone their perceptions of the world in order to become competent in particular domains of practice (Chapter 6 and 9). Individuals do not access an environment that is external to them. They are entangled in meshworks that are both a pre-condition and an outcome of individual practice (Ingold 2008).

10.3. Theoretical Contributions II: Objectives and Areas of Literature

My goal in using the EofP framework has been to generate an interdisciplinary perspective on the intergenerational continuity and change of ways of knowing. That goal made me link ethnobiology with other areas of literature in order to problematize continuity and change in ways of knowing. Beyond the lists of plant and animal names that people either know, or do not know anymore, which are often the focus of ethnobiologists working in the area (e.g., Lozada et al. 2006, Zent 2009, Leonti 2011), this framework pays attention to what people are doing and the forces that enable and hinder the continuity of their activities. Looking at practice opened my interests to think about the continuity and change of ways of knowing in terms of perception, relations, power and, most importantly, people's needs, desires and aspirations.

Each chapter in this dissertation corresponds to each one of the areas of literature that together form the EofP framework. In turn, each chapter explores a particular objective related to an area of literature. The interdisciplinary nature of the framework means that the main subject each chapter explores is not isolated to that chapter but intersects with other dimensions of the research. In that way, some dimensions of different objectives and areas of literature are developed in more than one chapter (Table 21). For example, wellbeing was a key component for both objectives two and four that were brought together in Chapter 7. For clarity, I summarise my findings in terms of contributions to each area of literature. I demonstrate the links between areas of literature and research objectives by making explicit reference to other relevant chapters as they intersect with the main findings of each literature component of this dissertation in discussion below.

Table 21. Contributions to literature areas according to objective

Area (s) of literature	Objective(s)	Themes covered according to chapter
Ethnobiology	1	Flows and perception of marine and coastal (Chapter 4) and land (Chapter 5) natural resources
Political ecology	2	Examination of the term Caiçara according to biodiversity conservation and tourism development discourses (Chapter 8)
Social wellbeing	2, 4	Ponta Negra perspectives on livelihood transition from a social wellbeing perspective (Chapter 7).
Adaptive learning	3,4	Environmental learning principles and two cases of historical (Chapter 6) and contemporary (Chapter 9) adaptation to environmental change through micro-enterprise development

10.3.1. Ethnobiology

Objective 1 was developed using a relational approach to document the ethnobiology of Ponta Negra (Chapters 4 and 5). These chapters shows the flows of natural resources from their harvesting sites to households, among households, within the community and across the region, and how they are constructed during such processes. Numerous drivers, mostly originating in supra-local contexts, have shaped the use and perception of natural resources available in the landscapes of practice of Ponta Negra. These include environmental legislation and integration into regional markets. In spite of these constraints, there are still socially, culturally and economically significant flows of resources entering household economies and the community economy more widely from each of the three domains (i.e., land, sea and coast) examined in this research.

The coastal domain (Section 4.5) is perhaps the least affected by external drivers shaping resource use and perception, because it has been the subject of little pressure for economic commercialisation and has not come under the gaze of conservation authorities (at least not yet). The coastal domain persists as an important component of the subsistence dimension of many households in the community as it remains a domain to access resources that people can draw on in times of need.

By contrast the land and sea domains have experienced significantly higher interactions with supra-local contexts and, therefore, have felt a higher degree of change

in the perception and practice surrounding the resources they afford. The sea domain has been the basis for the transition from a subsistence to a commercial economy in the recent history of the community (Chapter 6). It has, therefore, been subject to profound change in the perception of the resources it affords, particularly the transformation of fish from a food to a financial resource (Sections 4.1. and 4.2). The sea domain is also subject to significant uncertainty related to its future. This is because its persistence as a viable domain of natural resource harvesting practice depends on good management at multiple levels in order to ensure continued access to sea-based resources for people in the community. Many of the management practices affecting the sea domain in Ponta Negra take place at supra-local levels that community members have little ability to meaningfully influence. The continuation of the sea domain also rests on continued access to channels for market exchange of sea resources as well as the quality of those market relations with respect to their outcomes for community members. Fish buyers and the administrators of Laranjeiras have both played key roles in shaping market access and market relations in the past and many aspects of the contemporary economy surrounding the sea domain are contingent upon their behaviour in the future.

The land domain (Chapter 5) involves a highly complex set of relations that have changed significantly in recent decades. Many of these changes are a product of environmental legislation and changes in the regional economy that have affected collective and individual desires and aspirations. These forces have resulted in a two-fold compound effect related to what is possible (e.g. environmental regulations, Chapter 8) and what is desirable (e.g. Wellbeing, Chapter 7). What is possible is directly linked to the ban on hunting activities and the fear-based management with which this ban has been enforced. What is desirable is associated with the decline in the interest of new generations to participate in shifting agriculture activities. Changes within these domains are reflected in dietary transition and in people's priorities, including changes in how people relate to resources and how the preferences, norms and values of mainstream Brazilian society have entered the community.

Treating natural resources from a relational, practice-based perspective recognises their constructed nature. The case of Ponta Negra shows how the perception of natural

resources, at least what they afford, has been shaped by changes in the regional economy, environmental legislations and changing attitudes and dispositions of its inhabitants. Additionally, this perspective also shows how people of different social status and gender can perceive a given resource differently.

10.3.2. Social Wellbeing

Chapter 7 uses social wellbeing as a crosscutting concept to develop Objectives 2 and 4. On the one hand, a wellbeing lens shows the effects of the dwindling of fish stocks, environmental regulations and growth of the tourism economy on the livelihood portfolios of people from Ponta Negra from their perspectives. On the other, it shows the trade-offs between staying in the community and out-migrating to the city.

People's desire for formal education suggests that access to good quality formal education in the community could be key for creating the conditions necessary for families, especially those with school-age children, to stay in the community and, thereby, likely retain more active connections with the natural resource base. Recognising the importance of formal education, and people's desire for it, is part of accepting how dynamic coastal peoples have been in relation to historical changes in the regional economy and their dynamic of living within a rural-urban continuum that has allowed them to take advantage of what both contexts can offer at different moments (Chapter 8, see also Begossi et al 2012). This component of the history and background of coastal peoples has largely been ignored within legislation affecting their use of and access to natural resources and modern infrastructure and within academia (Adams 2003).

By employing a social wellbeing lens of analysis within the EofP framework, this dissertation highlights an important area of discontent within ethnobiology related to the trade-offs associated with the continuity and change in ways of knowing. Ethnobiology has failed to adequately acknowledge the role and importance of formal education in enhancing adaptive capacity to environmental change by enriching the agency of indigenous and traditional peoples. This is exemplified in the important tension within Ponta Negra related to staying in or leaving the community (Chapter 7).

10.3.3. Political Ecology

Chapter 8 applies the anti-essentialist political economy framework (Escobar 1999a) to deal with how economic, political and policy structures influence access in Ponta Negra to natural resources and affect local livelihood strategies as well as the local perspectives on those structures. Chapter 8 develops the discourse dimension of Objective 2 by analysing how the idea of Caiçara, a common label for coastal peoples living along the Atlantic Forest Coast, has been generated, interpreted and applied both by the environmental authority in charge of managing the REJ and the regional tourism industry.

The use of political ecology as part of the EofP framework is useful in de-essentialising coastal peoples. According to the environmental authority, which follows Brazilian environmental law (SNUC 2000), the Caiçara fit into the traditional populations category and therefore should maintain a subsistence economy in order to allow their permanence within protected areas (Chapter 8). Similarly, the tourism economy has also produced a Caiçara that lives in "harmony with nature" as part of the attractions of the region (Chapter 8). While the environmental authority has contributed to the isolation of coastal peoples by limiting their access to education and basic infrastructure, the tourism industry has taken advantage of such isolation to construct consumptive products that encourage urban people to visit places and people "out of time".

10.3.4. Adaptive Learning

Adaptive learning provides a lens to analyse how people in Ponta Negra have responded to environmental change in recent history (Chapter 6) as well as in the present (Chapter 9). The introduction of the pound nets (Chapter 6) shows how the adoption of a new technology, which is dependent on a particular resource and limited locations, re-structured socio-economic relations within the local fishing sector and generated a ripple effect in local livelihood portfolios. The introduction of the pound net fishing technology created social classes (owners and crewmembers) tied to gear ownership and generated livelihood specialisation as the people in the community became reliant on the fish trade. Pound net owning households were able to mobilise their capitals toward the tourism economy and invest in training and education to understand and deal better with this emerging sector. Those who were not pound net owners either out-migrated or remained

dependent on wealthier community members, outsiders or subsistence livelihood activities.

Chapter 9 analyses environmental learning by linking learning principles to how people in Ponta Negra perceive their adaptation to changes in specific features of their everyday life. This approach to learning shows how people are capable of adjusting their environmental perception to changes, not only in the context of natural resource harvesting practice, but also in emerging livelihood activities, such as housing construction. Chapter 9 also examines environmental learning as a social process through the context of centres of learning and shows how people come to embody skills as they participate in different contexts of everyday life. The concept of centres of learning also demonstrates how learning is not a homogenous process. Its outcomes depend on personal preference, social position and available opportunities. Finally, by reviewing a case of local participation in the tourism economy I show how certain people have been able to build and mobilise skills related to the tourism economy gained in urban contexts and apply those skills in the context of Ponta Negra.

Applying insights from adaptive learning to understand environmental learning in Ponta Negra shows how participation in every day life endows people with a 'feel for the game' that enables them to attune their perception to the world around them and the way it changes. Experts play a key role in the individual learning journey; however, where that journey can take them depends on the individual. In other words, learning processes are guided by individual agency.

10.4. Practical Contributions

This dissertation offers some practical contributions to understand coastal peoples in the Atlantic Forest Coast of Brazil. By de-essentialising the Caiçara and looking at their current activities and expressions of creativity, this dissertation suggests several points of intervention to not only support the people of Ponta Negra and the management of the REJ, but also to ensure the continuity of the presence of rural peoples along the Atlantic Forest Coast of Brazil:

- Redefine the traditional population concept in the Brazilian environmental law in relation to their rights to live inside protected areas. This includes moving beyond an exclusive focus on their historical activities to emphasise their historical presence in the region.
- Develop a management plan that regulates but does not ban subsistence hunting and that stimulates shifting agriculture practices as part of Brazilian biocultural heritage as well as the resilience of coastal peoples.
- Prioritise the provision of quality in situ education, including the use of modern technologies (e.g., computer skills), as part of the management of the Juatinga Ecological Reserve.
- Legalise and support small-scale (individual or community) tourism enterprises, where locals are service providers and not cheap labour.
- Improve the marketing of local products, including fish, by allowing and building better infrastructure to store, transport and process them.

10.5. Directions for Future Research

When I began this research I wanted to examine continuity in ways of knowing. What I found was that the cultural knowledge transmission model (CTKM) was the prevailing body of literature employed in ethnobiology to examine the relations between environmental knowledge and environmental change (Reyes-García et al. 2009). CTKM has focused on comparing knowledge held by different generations as a means to understand the transmission of knowledge and the factors that lead to success and failure in this process. The challenge that has been raised with this model is that continuity is measured as successful transmission, leaving adaptation to be classified as the result of transmission failure (Davidson-Hunt 2006). Another perspective is that individuals and society adapt to changing environments (Ingold 2000, Davidson-Hunt 2006). Continuity, in this perspective, would focus on the conditions that enable and constrain the ability to make appropriate changes in a dynamic environment (Davidson-Hunt and Berkes 2003a, Davidson-Hunt et al. in press). This enticed me to integrate insights offered by ethnobiology, adaptive learning, social wellbeing and political ecology into an Ethnoecology of Practice (EofP) framework.

Bridging insights offered by diverse areas of literature and linking the daily life of individuals with the wider environments in which they are enmeshed, the EofP allows the examination of the processes by which knowledge is produced through the practice that attunes individuals to their environment. Looking forward, I would like continue building upon these ideas in the context of ethnobiology and the study of Indigenous knowledge in general by incorporating new theoretical directions regarding materiality and working with small-scale communities on applied projects. Materiality has emerged out of a discussion within anthropology and other social sciences and is concerned with dealing with the departure from studying materials as fixed objects with intrinsic properties that transcend time, space and culture, to dealing with the processes that bring them into existence (Miller 2005). Recent work in this area has moved the concerns regarding materiality toward dealing with the properties of things in relation to their active engagement in human projects (Ingold 2012). This approach takes into consideration the multiple transformations materials experience as they: "*circulate, mix with one another, solidify and dissolve in the formation of more or less enduring things*" (Ingold 2011: 16).

Developing research about Indigenous knowledge and biocultural diversity grounded in materiality would bring a perspective that takes into consideration the current flows and transformations of natural resources in contexts of rapid environmental change to my research. The danger of not considering the materiality of natural resources lies in simplifying and essentialising their importance in multiple facets of small-scale societies and their environments. Thinking about natural resources in this way would move my research forward in terms of designing things that enable the fluidity of ways of life.

My future research will focus on collaboration and co-creation to contribute to emerging areas that bridge natural resources, understood as biocultural diversity, with design thinking (Davidson-Hunt et al. 2012, Gunn et al. 2013, Escobar *work in progress*). Working in this promising area would allow me to continue bringing environmental perception and materiality closer to the thinking underlying ethnobiology. This has the potential for theoretical and practical contributions to ethnobiology, Traditional Ecology Knowledge, biocultural diversity and related areas. In terms of theory it looks at biocultural diversity as an encounter between materials, environments, and agents that co-

produce each other through on-going activities and practice. It terms of practice, it allows a focus on being a facilitator in the development of teams that design materials/things that allow the continuity of human-environment relations in ways that people consider desirable.

The geographic locations for where this kind of research could be developed comprise settings that have traditionally been sought by scholars, such as small-scale, isolated communities, as well as new settings where the emergence of new knowledges is actively taking place. I would like to continue working in Ponta Negra with tourism developers facilitating processes in which more inclusive opportunities for the people living in that community can be developed. I would also like to continue looking at ethnobiology in different settings of production and exchange, such as by working with the emergence of centres of learning associated with biocultural diversity in immigrant communities. This approach would allow me to contribute to the development of a "multi-sited" ethnobiology (e.g., Pardo-de-Santayana et al. 2010, Łuczaj et al. 2012) that deals with knowledge as an ever unfolding process reflecting the changing environments and personal histories of individuals and that is in tune with the globalisation in which we live today.

10.6. Concluding Thoughts

It is said that globalisation is associated with acculturation or cultural erosion of Indigenous and rural populations (Brodt 2001, Brosi et al. 2007, Voeks 2007, Bates et al. 2009, Maffi and Woodley 2012). With this concern in mind, the goal of some ethnobiologists has been to keep Indigenous and rural peoples away from development in order to minimize changes in their way of life and preserve traditional knowledge (Nabhan et al. 2011). One of the pillars of scholarly work supporting this type of response has been knowledge loss identified through the cultural transmission of knowledge model. Within this framing, environmental knowledge exists as cognitive packages of information that become eroded through faults in transmission from one generation to the next. Although knowledge transmission research has helped raise the profile and underscore the importance of Indigenous and rural peoples' knowledge, the responses emanating from it have tended to be simplistic and reactive.

By linking loss with engagement in the market economy, formal education and other aspects of mainstream society, including access to modern infrastructure and technologies, the concept of knowledge loss has sometimes caused harm to Indigenous and rural peoples. Efforts from scholars, NGOs and governments to address knowledge loss by keeping Indigenous and rural peoples in isolation has resulted in *arresting* their development and has contributed to the current marginalization of many indigenous and rural peoples from political, socio-cultural and economic centres of power (Adams 2003). As a result this type of thinking runs the risk of forgetting people and forgetting that people have agency.

If we were to arbitrarily define maintaining a relation with the natural resources surrounding the community of Ponta Negra as a good, my findings clearly contradict some of the assumptions of ethnobiologists using the knowledge transmission model. For example, Chapter 6 shows those who were able to import skills to develop the pound net fishery were able to integrate themselves into the regional fishing economy without alienating themselves from the natural resource base. Likewise the articulation with the tourism economy shown in Chapter 9 presents a case in which skills associated with urban contexts, such as broader communication skills, have been key to maintaining people living in the community. These findings suggest that rather than trying to keep people living in autarchy in order to protect knowledge from the past, it is important to conserve and develop settings in which natural resource harvesting practice can remain viable (see Davidson-Hunt et al. 2013).

The issue is not conserving packages of knowledge or relations with the land. Rather the issue is about generating the conditions under which those things are desirable. Therefore, the continuity of Indigenous and rural people's knowledge is much more complex than simply conserving elements associated with a subsistence way of life. It has to deal with people as equals and not as subjects of "conservation". It is this mind set and the unintended consequences of it that are at issue. For example, while outsiders are turning Caiçara architecture into an object of desire, the people of Ponta Negra are concerned about their health and hygiene and want access to the same basic living conditions that those outsiders have.

Turning away from the knowledge transmission model and other more traditional approaches being used in ethnobiology will lead us to consider the conditions in which people *want* to maintain natural resource harvesting practices in the future and where they identify that as a good life choice. Environmental knowledge is not something transmitted and transmittable from one generation to the next, nor is it a loss if there is a difference in transmission between generations. It must be acknowledged that people *produce* environmental knowledge as an outcome of their entanglements with the world as well as an expression of their agency to construct the worlds in which they want to live. Wellbeing helps me to acknowledge these tensions and offers an approach to highlight powerful ideas from and for Indigenous and rural peoples themselves, rather than those of academics or policy makers reflecting on the fate and future of Indigenous and rural peoples from the comfort of their homes and offices where they have everything they want.

All of this pondering invited me to take a different look at the inter-generational knowledge phenomenon by pushing forward the teachings of the people who have problematized this issue before (e.g. Ingold 2000, 2011, 2012; Davidson-Hunt 2006; Heckler 2009). I have done this by looking at how power manifests in the relations between environments and people and by incorporating the perspectives of coastal people on the lives they want to live. Life is produced, exists and persists in everyday practice. Because of this I produced a framework to look at the intergenerational continuity and change of environmental knowledge phenomenon from multiple perspectives linked to practice. This framework is the Ethnoecology of Practice.

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Appendices

Appendix 1. Fish and other marine species captured and known in Ponta Negra

#	Common name	Local name	Scientific name	Capture techniques[25]	Known habitat[26]	Main use(s)[27]	Quality Tier[28]
	LOLIGINIDAE						
1	Slender inshore squid	Lula	*Doryteuthis plei*	Pn, Ca	Pe	So, Sh, Co	1st and 2nd, depending on size
2	São Paulo squid	Lula	*Doryteuthis sanpaulensis*	Pn, Ca	Pe	So, Sh, Co	1st and 2nd, depending on size
	CARCHARHINIDAE						
3	Tiger shark	Tintureira	*Galeocerdo cuvier*	Pn, Gi	Pe, along the shoreline. Used to be common, but disappeared because of the shark fisheries in the region.		
	SPHYRNIDAE						
4	Hammerhead shark	Cação martelo/ Cambeba	*Sphyrna sp.*	Pn, Gi	Pe, school close to the shoreline	So	1st
	ODONTASPIDIDAE						
5	Sand tiger shark	Mangona	*Carcharias Taurus*	Pn, Gi	Pe, school close to the shoreline	So	1st
	ALOPIIDAE						
6	Thresher shark	Cação-raposa	*Alopias vulpinus*	Pn	Pe, close to shore	So	1st
	RHINOPTERIDAE						
7	Cownose ray	Ticonha	*Rhinoptera bonasus*	Pn	BP	Bc	ne
	MOBULIDAE						
8	Manta ray	Jamanta	*Manta birostris*	Pn	Pe, mostly oceanic but comes to shore often	Bc	ne
	DASYATIDAE						
9	Southern stingray	Raia-prego	*Dasyatis americana*	Pn	Be	Sh, CH	2nd

[25] Pound net (Pn), gillnet (Gi), hand line off canoe (Ca), hand line off shore (Sh)
[26] Pelagic (Pe), Bentho-pelagic (BP), Benthic (Be)
[27] Sold (So), shared (Sh), consumed in the household (CH), by-catch (Bc), bait (Ba), live bait (LB)
[28] First quality (1s), second quality (2nd), not edible (ne)

#	Common name	Local name	Scientific name	Capture techniques[25]	Known habitat[26]	Main use(s)[27]	Quality Tier[28]
	GYMNURIDAE						
10	Spiny butterfly ray	Raia-manteiga	*Gymnura altavela*	Pn	Be	So	1st
	ELOPIDAE						
11	Ladyfish	Ubarana	*Elops saurus*	Pn, Gn, Ca, Sh	Pe	Bc	ne
	MURAENIDAE						
12	Spotted moray	Moréia	*Gymnothorax* sp.	Pn, Ca	Pe	Sh, CH Dried in the past	2nd
	CLUPEIDAE						
13	Brazilian sardinella	Sardinha	*Sardinella brasiliensis*	Pn	Pe	So during season, Sh and CH when fishery is closed (*defeso*), LB	2nd
	ENGRAULIDAE						
14	Broadband anchovy	Manjubinha	*Anchioviella lepidentostole*	Pn	Pe	Sh, CH, LB	2nd
	ARIIDAE						
15	Gafftopsail catfish	Bagre	*Bagre marinus*	Ca	Be, sandy bottoms	Sh, CH	2nd
	EXOCOETIDAE						
16	Tropical two-wing flying fish	Peixe-voador	*Exoceotus volitans*	Pn	Pe	Co, Sh, CH	2nd
	HEMIRAMPHIDAE						
17	Ballyhoo halfbeak	Farnangaio	*Hemiramphus brasiliensis*	Pn	Pe	Co, Sh, CH, LB	2nd
	BALONIDAE						
18	Agujon needlefish	Agulhão	*Tylosuros acus*	Pn	Pe	Bc	ne
	HOLOCENTRIDAE						
19	Squirrelfish	Mangorra	*Holocentrus adscensionis*	Ca, Sh	Be, reefs close to shore	Sh, CH	2nd
	TRIGLIDAE						
20	Bluewing searobin	Cabrinha	*Prionotus punctatus*	Pn, Sh	Be, muddy bottoms close to shore	Bc	ne

#	Common name	Local name	Scientific name	Capture techniques[25]	Known habitat[26]	Main use(s)[27]	Quality Tier[28]
	SERRANIDAE						
21	Atlantic goliath grouper	Mero	*Epiphenelus itajara*	Ca	Be, reef along rocky shore. Used to be common, but disappeared because of overfishing. Its trade is banned.		-
22	Dusky grouper	Garoupa	*Epinephelus marginatus*	Pn, Ca, Sh	Be, reef along rocky shore	So, Sh, CH	1st
23	Snowy grouper	Cherne	*Hyporthodus niveatus*	Ca	Be, reef along rocky shore. Used to be common, but disappeared because of overfishing. Its trade is banned.		-
24	Gag grouper	Badejo-sapateiro	*Mycteroperca microlepis*	Ca	Be, reef along rocky shore	So, Sh, CH	1st
	PRIACANTHIDAE						
25	Atlantic bigeye	Olho de cão/ Foguiera/ Casaco do ferro	*Priacanthus arenatus*	Pn, Ca	BP, reef along rocky and sandy shores	So, Sh, CH	2nd
	POMATOMIDAE						
26	Bluefish	Anchova	*Pomatomus saltator*	Pn,	Pe	So, Sh, CH	1st
	CARANGIDAE						
27	Blue runner	Xerelete / Carapau	*Caranx crysos*	Pn, Ca	Pe	So, Sh, CH, LB	1st
28	Crevalle jack	Xaréu	*Caranx hippos*	Pn	Pe	So, Sh, CH	2nd
29	African pompano	Xaréu-branco	*Alectis ciliaris*	Pn	Pe	So, Sh, CH	2nd
30	Horse-eye jack	Guaricema	*Carax latus*	Pn	Pe	So, Sh, CH	2nd
31	Atlantic bumper	Palombeta	*Chlroscombrus crysurus*	Pn, Sh	Pe	So, Sh, CH, LB	2nd
32	Round scad	Xixarro	*Decapterus punctatus*	Pn	BP, rarely close to shore	So, Sh, CH	2nd
33	Atlantic leatherjack	Guaivira	*Oligoplites saurus*	Pn, Gi	Pe	So, Sh, CH	2nd
34	Atlantic moonfish	Galo	*Selene setapinnis*	Pn	BP, close to rocky shores	So, Sh, CH	1st
35	Lookdown	Galo de penacho	*Selene vomer*	Pn	Pe	So	1st
36	Greater amberjack	Olho de boi	*Seriola dumerili*	Pn, Ca	BP	So, Sh, CH	2nd
37	Lesser amberjack	Olhete	*Seriola fasciata*	Ca	BP	So, Sh, CH	2nd
38	Permit	Pampo/ Garabebéu	*Trachinotus falcatus*	Pn, Sh	Be, shallow rocky reefs	Sh, CH	2nd

#	Common name	Local name	Scientific name	Capture techniques[25]	Known habitat[26]	Main use(s)[27]	Quality Tier[28]
39	Palometa	Pampo galhudo	Trachinotus goodei	Pn, Sh	Pe, shallow rocky reefs	Sh, CH	2nd
	CORYPHAENIDAE						
40	Dolphinfish	Dourado	*Coryphaena hippurus*	Pn, Ca	Pe	So, Sh, CH	1st
	LUTJANIDAE						
41	Mutton snapper	Caranha	*Lutjanus* sp.	Sh, Ca	Be, shallow reefs close to the shore	So, Sh, CH	1st
42	Snapper	Vermelho	*Lutjanus* sp.	Ca	Be, deep reefs	So, Sh, CH	1st
	GERREIDAE						
43	Jenny mojarra	Carapicu	*Eucinostomus gula*	Sh	Be, shallow sandy bottoms close to the coast	CH	2nd
	HAEMULIDAE						
44	Black margate	Sargo-de-beiço	*Anisotremus surinamensis*	Ca, Sh	Be, shallow reefs	Sh, CH	1st
45	Porkfish	Salema	*Anisotremus virginicus*	Sh	Be, shallow reefs	Sh, CH	2nd
46	White grunt	Cocoroca	*Haemoludon plumieri*	Sh	Be, shallow reefs	Sh, CH	2nd
	SPARIDAE						
47	Sheepshead seabream	Sargo de dente	*Archosargus probatocephalus*	Sh	Be, shallow reefs	Sh, CH	1st
48	Silver porgy	Marimbá	Diplodus argenteus	Sh	Be, shallow reefs	Sh, CH	2nd
49	Common seabream	Pargo	*Pagrus pagrus*	Ca, Sh	BP, shallow reefs	Sh, CH	2nd
	Sciaenidae						
50	Jamaica weakfish	Goete	*Cynoscion jamaicensis*	Pn, Gi, Sh	Be, sandy bottoms close to shore	So, Sh, CH	2nd
51	Stripped weakfish	Maria mole	*Cyanoscion striatus*	Pn, Gi, Sh	Be, sandy bottoms close to shore	So, Sh, CH	2nd
52	King weakfish	Pescada	*Macrodon ancylodon*	Pn, Gi	Be, sandy and muddy bottoms	So, Sh, Co	1st
53	Whitemouth croaker	Corvina	*Micropogonias furnieri*	Pn, Gi, Sh	Be, sandy and muddy bottoms	So, Sh, Co	1st

#	Common name	Local name	Scientific name	Capture techniques[25]	Known habitat[26]	Main use(s)[27]	Quality Tier[28]
54	Black drum	Miraguaia	*Pogonias cromis*	Gi, Ca	Be, sandy and muddy bottoms	So, Sh, Co	1st
	MULLIDAE						
55	Spotted goatfish	Trilha	*Pseudopeneus maculatus*	Pn, Sh	Be, shallow sandy bottoms	Sh, Co	1st
	KYPHOSIDAE						
56	Yellow sea chub	Piranjica	*Kyphosus incisor*	Pn, Gi, Sh	BP, shallow reefs	Sh, Co	2nd
	EPHIPPIDAE						
57	Atlantic spadefish	Enxada	*Chaetodipterus faber*	Pn, Gi	BP, shallow reefs	Sh, Co	2nd
	POMACANTHIDAE						
58	Grey angelfish	Paru	*Pomacanthus arcuatus*	Pn, Sh	Be, shallow reefs	Sh, Co	2nd
59	French angelfish	Frade	*Pomacanthus frade*	Pn, Sh	Be, shallow reefs	Sh, Co	2nd
	POMACENTRIDAE						
60	Sergeant major	Sargento	*Abudefduf saxatilis*	Sh	BP, shallow reefs	Sh, Co	2nd
	Mugilidae						
61	White mullet	Parati	*Mugil curema*	Pn, Gi	Pe	So, Sh, CH	2nd
62	Lebranche mullet	Tainha	*Mugil liza*	Pn, Gi	Pe	So, Sh, CH	2nd
	SPHYRAENIDAE						
63	Guachanche barracuda	Bicuda	*Sphyraena guachancho*	Pn, Gi	Pe	So, Sh, CH	1st
	SCARIDAE						
64	Parrotfish	Budião	*Sparisoma* spp.	Ca, Sh	BP, shallow reefs	Sh, CH	2nd
	TRICHIURIDE						
65	Largehead hairtail	Peixe-espada	*Trichiurus lepturus*	Pn	Pe	So, Sh, CH	2nd
	SCOMBRIDAE						
66	Wahoo	Cavala do norte	*Acanthocybium solandri*	Pn	Pe	So	1st
67	Little tunny	Bonito pintado	*Euthynnus alletteratus*	Pn	Pe	So, Sh, CH	2nd
68	Frigate tuna	Bonito banana	*Auxis thazard*	Pn	Pe	So, Sh, CH	2nd
69	Bullet tuna	Bonito cadelão	*Auxis rochei*	Pn	Pe	So, Sh, CH	2nd
70	Skipjack tuna	Bonito listrado	*Katsuwonus pelamis*	Pn	Pe	So, Sh, CH	2nd
71	Atlantic bonito	Serra	*Sarda sarda*	Pn, Gi	Pe	So, Sh, CH	1st
72	Chub mackerel	Cavalinha	*Scomber colias*	Pn, Gi	Pe	So, Sh, CH	2nd

#	Common name	Local name	Scientific name	Capture techniques[25]	Known habitat[26]	Main use(s)[27]	Quality Tier[28]
73	King mackerel	Cavala	*Scomberomorus cavalla*	Pn, Gi	Pe	So	1st
74	Spanish mackerel	Sororoca	*Scomberomorus brasiliensis*	Pn, Gi	Pe	So, Sh	
	XIPHIIDAE						
75	Swordfish	Meca, espadarte	*Xiphias gladius*	Pn	Pe	So	1st
	ISTIOPHORIDAE						
75	Atlantic sailfish	Agulhão	*Istiophorus albicans*	Pn	Pe	So	2nd
	STROMATEIDAE						
76	American harvestfish	Gordinho	*Peprilus paru*	Pn, Sh	BP, from shallow to deep reefs	So, Sh, Co	1st
	PARALICHTHYIDAE						
77	Flounder	Linguado, peixe xinelo	*Paralichthys* sp.	Pn (rare)	Pe, sandy bottoms	Sh, Co	1st
	BALISTIDAE						
78	Grey triggerfish	Peixe porco, porquinho	*Balistes capriscus*	Ca	BP, shallow reefs	So, Sh, Co	1st
	MONOCANTHIDAE						
79	Unicorn leatherjacket filefish	Peixe chinelo, peixe capuxo	*Alutherus monocerus*	Ca	BP, shallow reefs	So, Sh, Co	1st
	TETRAODONTIDAE						
80	Smooth puffer	Baiacu	*Lagocephalus laevigatus*	Pn, Ca	BP, shallow reefs	Bc	ne

Appendix 2. Plants associated with shifting agriculture plots and home gardens

#	Family/Local name	English name (if available)	Scientific name	Type of cultivation[29]	Use(s)
	ALLIACEAE				
1	Cebolinha	Welsh onion	*Allium fistulosum*	AO, HG	Food
	APIACEAE				
2	Salsinha	Parsley	*Petroselinum crispum*	AO, HG	Seasoning, medicine (digestive ailments)
	ARACEAE				
3	Taioba	Tannia	*Xanthosoma sagittifolium*	NO	Food (roots)
	BRASSICACEAE				
4	Couve	Kale	*Brassica oleracea*	NO	Food (leaves)
	BROMELIACEAE				
5	Abacaxi	Pineapple	*Ananas comosus*	NO	Fruit
	CARICACEAE				
6	Mamão	Papaya	*Carica papaya*	NO	Fruit
	CONVOLVULACEAE				
7	Batata-doce	Sweet potato	*Ipomoea batatas*	NO	Food (tubers)
	CUCURBITACEAE				
8	Abóbora-moranga	Pumpkin	*Cucurbita sp.*	AO, HG	Food
	DIOSCOREACEAE				
9	Cará	Cultivated yam	*Dioscorea alata*	AO, HG	Food (tubers)
	EUPHORBIACEAE				
10	Aipim	Sweet manioc	*Manihot esculenta*	AO, HG	Food (tubers)
11	Mandioca	Bitter manioc	*Manihot esculenta*	AO, HG	Food (flour)
	LAMIACEAE				
12	Alfavaca	Hoary basil	*Ocimum americanum*	AO, HG	Seasoning
13		Wild sweet basil	*Ocimum campechianum*	AO, HG	Seasoning
14	Hortelã-de-galinha	Indian borage	*Plectranthus* cf. *amboinicus*	HG	Seasoning
15	Manjericão	Basil	*Ocimum basilicum*	HG	Seasoning
	LAURACEAE				
16	Louro	Bay leaves	*Laurus nobilis*	AO, HG	Seasoning
	MUSACEAE				
17	Banana-da-terra	Plantain	*Musa* sp.	NO	Food
18	Banana-nanica	Dwarf banana	*Musa* sp.	NO	Fruit
19	Banana-ouro	Sugar banana	*Musa* sp.	NO	Fruit
20	Banana-prata	Lady's finger banana	*Musa* sp.	NO	Fruit
21	Banana-preta		*Musa* sp.	NO	Fruit
22	Banana-São-Tomé		*Musa* sp.	NO	Fruit
	MYRTACEAE				
23	Cambucá		*Plinia edulis*	NO	Fruit
24	Goiaba		*Psidium guajava*	AO, NO,	Fruit

[29] Active plot outside the community (AO), non-active plot outside the community (NO), home garden (HG)

#	Family/Local name	English name (if available)	Scientific name	Type of cultivation[29]	Use(s)
				HG	
25	Jabuticaba		*Plinia trunciflora*	AO, NO, HG	Fruit
	PASSIFLORACEAE			NO	
26	Maracujá	Passion fruit	*Passiflora edulis*		Fruit
	SOLANACEAE			NO	
27	Batata-branca		*Solanum tuberosum*		Food
28	Pimenta-cumbari	Bishop's crown chili	*Capsicum baccatum*	HG	Seasoning
29	Pimenta-malagueta	Cayenne pepper	*Capsicum frutescens*	HG	Seasoning
	POACEAE			HG	
30	Cana	Sugarcane	*Saccharum officinarum*		Sweetener, children snack
31	Cana-preta		*Saccharum officinarum*	AO, HG	Sweetener, children snack
	RUTACEAE			AO, HG	
32	Laranja	Orange	*Citrus spp*.		Fruit
33	Limão-cravo		*Citrus* x *limonia*	NO	Fruit

Appendix 3. Plants associated with forest ecosystems

#	Local Name	Species [30]	Location[31]	Habit	Use[32]	Comments
	ANARCARDIACEAE					
1	Aroeira	*Schinus terebinthifolia* (Borges and Peixoto 2009)	SL	Shrub up to 10m	Le, B	Firewood, bait for trapping birds
	APOCYNACEAE					
2	Peroba	*Aspidosperma polyneuron* (Borges and Peixoto 2009)	PF	Tree up to 30m	HC	Wood for house construction
	ARACEAE					
3	Timbupeva	*Heteropsis* sp. (Borges and Peixoto 2009)	PF, SF	Forest liana	OT	Used for making baskets (balaio)
	ARECACEAE					
4	Coco natal	*cf. Bactris vulgaris* (Giraldi 2012)	PF, SF	Spiny leaf palm, up to 4 m tall	FH, FC	Fruit, brought home. Fruits from December to January
5	Coco indaiá	cf. *Attalea dubia* (Giraldi 2012)	PF, SF	Palm up to 15m	FH	Fruit, brought home
6	Coco preto	*Astrocaryum aculeatissimum* (Giraldi 2012)	PF, SF	Spiny leaf palm, up to 6 m tall	FH, FC	Fruit, brought home, germinating seeds eaten right after shooting in the forest
7	Palmito-jussara	*Euterpe edulis* (Giraldi 2012)	PF, SF	Palm up to 10m	FH	Palm hearts
8	Palmito-amargoso / Coco-pati	*cf. Syagrus pseudococos* (Giraldi 2012)	PF, SF	Palm up to 15m	FH, FC	Palm hearts and nuts
	BIGNONIACEAE					
9	Carobinha	*Jacaranda caroba* (Borges and Peixoto 2009)	SL	Shrub up to 3m	M	Medicine for scabies

[30] The reference following scientific names indicates previous studies where the species has been previously reported in Ponta Negra or Paraty municipality
[31] Primary forest (PF), secondary forest (SF), scrubland (SL)
[32] See conventions in Table 12

#	Local Name	Species [30]	Location[31]	Habit	Use[32]	Comments
10	Ipê-amarelo	*Tabebuia sarratifolia* (Borges and Peixoto 2009)	PF, SL (planted)	Tree up to 15 m	HC, CC	High quality wood for house and boat construction, It is used as a decorative tree in the home yards
11	Caxeta	*Tabebuia cassinoides* (Kempers 1993)	PF, SF	Tree, 12m high	OT	Used for paddles and handcrafts (toy boats)
	CALOPHYLLACEAE					
12	Mangue	*Calophyllum brasiliense* (Kempers 1993)	SL	Tree up to 7m	SN	Considered stronger than quaresma
	CHRYSOBALANACEAE					
13	Simbiba	*Hirtella hebeclada* (Brito and Senna-Valle 2011)	PF	Tree, 6 m tall	HC, GF	Wood for house construction. Yellow fruit similar to cambucá, eaten by game
	CLUSIACEAE					
14	Bacuparí	*Garcinia gardneriana* (Giraldi 2012)	PF	Tree, 15 m high	HC, M, FC, GF	Medicine (treat throat ailments and pain reliever) A cut is made on the bark to gather its latex, which is left between two to tree days until it hardens. The final product is suck as a candy. The bark is also cooked and used as infusion. It is a pain reliever and clears the throat. Good for house construction. Fruit eaten by game, considered edible. Fruits from July to September
	COSTACEAE					
15	Cana-do-brejo	*Costus spicatus* (de Brito and Senna-Valle 2011)	PF, SF, SL	Herb	M	Used in infusions for kidney related diseases.
	ERYTHROXYLACEAE					
16	Pimentinha	*Erythroxylum vacciniifolium* (Borges and Peixoto 2009)	SL	Shrub up to 4m	Le	Firewood
	EUPHORBIACEAE					
17	Guacá	*Pausandra morisiana* (Borges and Peixoto 2009)	PF, SF	Tree up to 6m	OT, GF	Wood for paddles, Yellow fruit eaten by game
	FABACEAE					
18	Ingá	*Inga laurina* (Borges and Peixoto 2009)	PF	Tree up to 25m	CC	Preferred wood for canoes

#	Local Name	Species [30]	Location[31]	Habit	Use[32]	Comments
19	Timbuiba	*Balizia pedicelaris* (Borges and Peixoto 2009)	SF	Tree up to 25m	CC	Good for canoes. Has to rest on the soil a month after cut. Fruit used to be used as soap (Kempers 1993)
20	Guapuruvú	*Schizolobium parahyba* (Kempers 1993)	SF	Tree up to 30m	HC, CC	Good for canoes and house construction. Light wood.
21	Jataí	*Hymenaea courbaril* (Borges and Peixoto 2007)	PF	Tree up to 30m	M	Used to treat bronchitis, asthma and other pulmonary ailments. It is used as "pedra de jataí" (a stone made with hardened sap).
	LAURACEAE					
22	Canela da mata	*Ocotea elegans* (Borges and Peixoto 2009)	PF	Tree up to 20m	HC, Fu, CC	High quality wood for house, furniture and canoe construction. Highly valued because of its durability. Cut 3 days after new moon and 3 days after waning moon. Otherwise it splints (vento da Madera), becoming a risk.
23	Canela mole	*Ocotea sp.* (Kampers 1993)	SF	Tree up to 15m	HC, Fu, CC	Similar uses as canela da mata, but not as strong and grows faster
24	Noz-moscada	Indet.	PF	Up to 12m	FC, HC	Children fruit and wood. Fruits from July to August
	LECYTHIDACEAE					
25	Canudo	*Couratari pyramidata* (Borges and Peixoto 2009)	PF, SF	Tree up to 15m	HC	Used for construction. However, it is classified as weak wood and employed for eternity and other light structures. Available and hence commonly used. Good woods for construction are found far away within primary forest.
26	Sapucaia	*Lecythis lanceolata* (Kempers 1993)	PF, SF	Tree up to 20 m	FC, HC	Children fruits and wood for house construction.
	LORANTHACEAE					
27	Erva-de-passarinho	*Struthanthus concinnus* (de Brito and Senna-Valle 2011)	SF, SL	Parasite	M	Used to relieve pain. Pounded and made into a plaster, which is bound over the wound.

#	Local Name	Species [30]	Location[31]	Habit	Use[32]	Comments
	MELASTOMATACEAE					
28	Quaresma	*Tibouchina sp.* (Borges and Peixoto 2009)	SL	Tree up to 10 m	SN	Bark used to give resistance baths to pound nets. This bath dies the net, cleans it and provides resistance to the fibres. The bark is pounded with a stone, then cooked for six hours. Once cooked, the quaresma is poured into a canoe where the net is submersed overnight
29	Jacatirão	*Miconia cinnamomfolia* (Borges and Peixoto 2009)	SF	Tree up to 15m	HC	Wood for house construction
30	Chorão	*Miconia albicans (*Borges and Peixoto 2009)	SL	Tree up to 10m	HC	Wood for house construction. Common, but not very resistant.
	MELIACEAE					
31	Cedro	*Cedrela fissilis* (Borges and Peixoto 2009)	PF, SF	Tree up to 25m	HC, CC	Good for canoes and house construction
	MENISPERMACEAE					
32	Cipó abuta	*Cissampelos pereira* (Chiquinho 2007)	PF	Woody Vine	M	Used to manage intestinal parasites
	MYRISTICACEAE					
33	Bicuiba	*Virola bicuhyba* (Borges and Peixoto 2009)	PF	Tall tree, up to 50m tall.	HC, CC, M, FC, GF	High quality wood. House construction and canoes (cracks easily) Today used as medicine for healing wounds and cuts. Seeds used in the past for oil lamps. Kempers (1993) reports that in the early 1990s people still used wax from the seeds for making candles and lubricant to prevent rusting. Fruits from August to October. Eaten by children and game.
	MYRTACEAE					
34	Araçá-goiaba	*Psidium guineense* (Giraldi 2012)	SL	Shrub up to 3m	FC	Fruta das crianças Incidentally eaten when come across in trails
35	Araçá	*Psidium cattleianum* (Giraldi 2012)	SL	Shrub up to 3m	FC	Fruta das crianças

#	Local Name	Species [30]	Location[31]	Habit	Use[32]	Comments
36	Grumixama	*Eugenia* cf. *brasiliensis* (Giraldi 2012)	SF, SL	Tree up to 10 m	FC	Fruta das crianças (August to October)
37	Araçarana verde	*Calyptranthes grandifolia* (Borges and Peixoto 2009)	PF	Tree, 15m high	HC, FC, GF	Wood for house construction, Fruit similar to cambucá, pursued by children and game. Fruits from September to November.
38	Araçarana vermelha	*Indet.*	PF, SF	Tree, 10 to 15m high	HC, GF	Wood for house construction. Fruit is small, only eaten by game. Fruits from September to November
40	Jabuticaba	*Myrciaria sp.* (Giraldi 2012)/ Plinia trunciflora (Borges and Peixoto 2009)	PF	Tree up to 25 m	FC, GF	Eaten by game and children (when children came across these fruits the look carefully at them and tried to figure out what wild animal nibbled them).
	PASSIFLORACEAE					
41	Maracujá das cobras	*Passiflora* sp.	PF	Forest vine	FC	Fruta das crianças and incidentally eaten when found on the trails. Fruits from September to November
	PIPERACEAE					
42	João-borandi	*Piper mollicomum* (de Brito and Senna-Valle 2011)	SF	Shrub up to 2m	M	Used for toothache (chewed leaves). Poisonous if swallowed
	RUBIACEAE					
43	Maria peidorreira	*Posoqueria latifolia* (Pilla and Amoroso 2009)	PF, SF	Woody shrub up to 5m tall	FC, FH	Fruta das crianças (brought home); good wood for house construction
	SAPINDACEAE					
44	Cubatão	*Cupania oblongifolia* (Kempers 1993)	PF, SF	Tree up 12m	HC	Wood for house construction. It is known to be strong enough to support roof tiles.
	SAPOTACEAE					
45	Maçaranduba	*Manilkara subsericea* (Kempers 1993)	PF	Tree up to 25m	HC, CC	Heavy and hard wood. Used for small canoes and house construction.
	INCERTAE SEDIS					
46	Carquera	Indet.	SF	Tree up 14m	HC,	Commonly used for house and canoe construction

#	Local Name	Species [30]	Location[31]	Habit	Use[32]	Comments
					CC	
47	Joaninha	Indet.	PF, SF	Herbaceous, along river courses	M	Syrup for cough. Steams are washed and boiled with lemon, pitanga and sugar until thickens. It is good for bronchitis and other lung illnesses.
48	Catinguda	Indet.	SL	Shrub, 2m high	P	Used as rat poison (medicina brava). Cooked for pest control
49	Maminha de Sapo	Indet.	SL	Shrub, up to 2 m tall	FH, FC	Small yellow fruit. If not brought home, it is eaten on the trail. Similar to Jabuticaba, fruits from July to September
50	Imbé Zipó	Indet.	PF, SF.	Vine	OT	Used for making baskets.
51	Bapeba	Indet.	SF	Tree up 12m	HC	Commonly used for house construction purposes