LUCIANA YOKOYAMA XAVIER

Social learning as a process to foster Integrated Coastal Management

Thesis submitted to the Oceanographic Institute of the University of São Paulo in partial fulfillment of the requirements for the degree of Doctor of Science, program of Oceanography, Biological Oceanography area.

Advisors:
Prof. Dr. Alexander Turra
Prof. Dr. Pedro Roberto Jacobi

São Paulo
2017

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Foi bonita a festa, pá
Fiquei contente
Ainda guardo renitente
um velho cravo para mim

Já murcharam tua festa, pá
Mas certamente
Esqueceram uma semente
n'algum canto de jardim

Sei que há léguas a nos separar
Tanto mar, tanto mar
Sei, também, como é preciso, pá
Navergar, Navegar…

(Tanto mar – Chico Buarque)

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RESUMO

XAVIER, Luciana Yokoyama. **Aprendizagem Social como um processo para pormover a Gestão Costeira Integrada.** 2016. 191 p. Tese (Doutorado em Ciência) – Instituto Oceanográfidco da Universidade de São Paulo, São Paulo, 2017.

A gestão costeira integrada (GCI) demanda novos sistemas de gestão onde a aprendizagem social (AS), a aprendizagem conjunta e colaborativa que ocorre por meio de interação, é um elemento-chave. A ocorrência de AS e os fatores que a afetam foram investigados por meio de análise documental, observação de processos em andamento e levantamento da percepção dos indivíduos envolvidos com a gestão participativa de uma área marinha protegida (AMP) no Brasil. A hipótese central é que AS pode qualificar a participação e aprimorar a GCI. Esta pesquisa caracterizou a gestão da AMP e identificou processos de AS e como eles foram favorecidos/prejudicados, com atenção especial ao papel de instituições de ensino e pesquisa e à promoção de troca de conhecimento. A AS foi evidenciada por mudanças no conhecimento, percepção da complexidade do sistema, contexto social e construção de entendimentos coletivos, fortalecendo a organização social, empoderamento social e mudanças institucionais, promovendo o capital social. Para aprimorar a GCI por meio de AS são propostas cinco estratégias: promover diversidade de participação; promover a discussão simultânea de vários problemas; favorecer processos de interação à soluções rápidas; explorar interesses comuns; explorar diferentes papéis, especialmente considerando as organizações de ensino e pesquisa.

Palavras chave: aprendizagem social, gestão costeira integrada, gestão participativa, integração ciência-gestão, área marinha protegida, Área Marinha Protegida do Litoral Norte do Estado de São Paulo, Baía do Araçá

ABSTRACT

XAVIER, Luciana Yokoyama. **Social Learning as a process to foster Integrated Coastal Management.** 2016. 191 p. Thesis (Doctor in Science) – Institute Oceanographic of the University of São Paulo, São Paulo, 2017.

Integrated coastal and ocean management (ICM) requires new management systems where social learning (SL), the joint and collaborative learning trough interaction, is a key element. The occurrence of SL and the factors that affect it were investigated by documentary analysis, observation of ongoing processes and accessment of the perception of people involved with the participatory management of a marine protected area (MPA) in Brazil. The general hypothesis is that SL can qualify participation and improve ICM. To test it, this research characterized the management of the MPA, identifying SL processes and how they were fostered/hindered, with special attention to the role of research and educational institutions and the promotion of knowledge exchange. SL was evidenced by changes in knowledge, perception of the complexity of the system, social context and in the development of new understandings among the stakeholders involved in the processes, leading to strong social organization, social empowerment and institutional changes, promoting social capital. To improve ICM through SL, five strategies are proposed: promote diverse participation, not limited to official membership; promote simultaneous discussions in small groups; favor interaction processes over rapid solutions; explore common interests; explore different roles, especially with reference to research and educational organizations.

Key words: social learning, integrated coastal management, participatory management, science-policy integration, marine protected area, Marine Protected Area of the Northern Coast of São Paulo State, Araçá Bay

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ACRONYM AND ABBREVIATION INDEX

AI. Area of Influence

APA Alcatrazes. Municipal Protected Area of Alcatrazes (Área de Proteção Ambiental de Alcatrazes, in Portuguese)

APAMLN. Marine Protected Area of the Northern Coast of São Paulo State (Área de Proteção Ambiental Marinha do Litoral Norte do Estado de São Paulo, in Portuguese)

CAPES. Coordination for the Improvement of Higher Education Personnel (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, in Portuguese)

CATI. Integral Technical Assistance Coordination (Coordenadoria de Assistência Técnica Integral, in Portuguese)

CEBIMar. Center for Marine Biology of the University of São Paulo (Centro de Biologia Marinha da Universidade de São Paulo, in Portuguese)

CNPq. National Council for Scientific and Technological Development (Conselho Nacional de Desenvolvimento Científico e Tecnológico, in Portuguese)

EBM. Ecosystem Based Management

EIA. Environmental Impact Assessment

EPA. Environmental Protected Area

FAPESP. São Paulo Research Foundation (Fundação de Amparo a Pesquisa do Estado de São Paulo, in Portuguese)

FASS. São Sebastião College (Faculdade de São Sebastião, in Portuguese)

FAU/USP. Faculty of Archtecture and Urbanization of the University of São Paulo (Faculdade de Arquitetura e Urbanismos da Universidade de São Paulo, in Portuguese)

FF. Forestry Foundation (Fundação Florestal, in Portuguese)

HarmoniCOP. Harmonizing Collaborative Planning

ICM. Integrated Coastal and Ocean Management

ICMBio. Chico Mendes Institute for Biodiversity and Conservation (Instituto Chico Mendes de Conservação da Biodiversidade, in Portuguese)

IDB. Inter-American Development Bank

IFSP. Federal Institute of Education, Science and Technology of São Paulo State (Instituto Federal de Ciência e Tecnologia de São Paulo, in Portuguese)

INPE. National Institute for Space Research (Instituto Nacional de Pesquisas Espaciais, in Portuguese)

IOUSP. Oceanographyc Institute of University of São Paulo (Instituto Oceanográfico da Universidade de São Paulo, in Portuguese)

IP. Fisheries Institute (Instituto de Pesca, in Portuguese)

KE. Knowledge Exchange

LA21. Local Agenda 21

LPSD Araçá. Local Plan for Sustainable Development of the Araçá Bay

MAPA. Ministry of Agriculture, Livestock and Food Suply (Ministério da Agricultura, Pecuária e Abastecimento, in Portuguese)

MB. Management Board

MPA. Marine Protected Area, Marine Protected Area

MPAq. Ministry of Fisheries and Aquaculture (Ministério da Pesca e Aquicultura, in Portuguese)

MPS. Marine Spatial Planning

NGO. Non-governmental Organization

PNGC. Brazil's National Plan for Coastal Management (Plano Nacional de Gerenciamento Costeiro, in Portuguese), Brazil's

R&E. Research and Education

Rio 92. United Nations Conference on Environment and Development

SL. Social Learning

SLIM. Social Learning for the Integrated Management and Sustainable Use of Water at Catchment Scale

SMA. State Environmental Agency (Secretaria Estadual de Meio Ambiente, in Portuguese)

SNUC. National System of Conservation Units (Sistema Nacional de Unidades de Conservação, in Portuguese)

TEBAR. Maritime Terminal Almirante Barroso

TG. Thematic Group

UFF. Federal Fluminense University (Universidade Federal Fluminense, in Portuguese)

UNESP. São Paulo State University (Universidade Estadual Paulista, in Portuguese)

WG. Working Group

WG Araçá. Working Group Araçá

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1 INTRODUCTION

Natural ecosystems provide resources and essential ecosystems services (COSTANZA et al., 1997; CURTIN; PRELLEZO, 2010; DE GROOT; WILSON; BOUMANS, 2002). Maintenance of ecosystems quality and processes is essential to the sustainability of human activities. Nevertheless, humans' uses of natural resources have changed natural ecosystems and led to many environmental problems, which solutions require new management systems that consider the interconnectedness of ecosystems and the integration of politics, politicians and different knowledge systems in their co-production (ARKEMA; ABRAMSON; DEWSBURY, 2006; BONNEY et al., 2009; CURTIN; PRELLEZO, 2010; FUNTOWICZ; RAVETZ, 1993, 2003; JARVIS et al., 2015; LONG; CHARLES; STEPHENSON, 2015; RUCKELSHAUS et al., 2008; ZUCKERBERG; BONTER; DICKINSON, 2010).

Among the natural ecosystems affected by human activities, coastal and marine areas stand out by presenting unique characteristics and by supporting specific ecosystem services (COSTANZA et al., 1997; DE GROOT et al., 2010; LANGE; JIDDAWI, 2009; SAMONTE; KARRER; ORBACH, 2010) with unmatched challenges for their management. Marine and coastal areas have been less studied than terrestrial habitats, have areas of difficult access and surveillance and threats to these ecosystems comprise those derived from activities in coastal and marine areas but also from activities in terrestrial areas, even distant ones (ASMUS et al., 2006; CICIN-SAIN; KNECHT, 1998; HALPERN et al., 2008; JABLONSKI; FILET, 2008). Such threats have already compromised coastal and marine ecosystem (ELFES et al., 2014; HALPERN et al., 2012; MEA, 2005), and the need to promote coastal and marine sustainability has led to actions to enhance their sustainability.

The Integrated Coastal and Ocean Management (ICM) is the dominant framework for ocean and coastal management. It emerged as a strategy do solve multiple use conflicts and to overcome the fragmented and sectorial management of the different activities occurring in marine ecosystems (BARRAGÁN, 2016; CICIN-SAIN; KNECHT, 1998; MOKSNESS; DAHL; STOTTRUP, 2013). Through the years, and with the application of the ICM model in practical management experiences, it has evolved and integrated other frameworks, e.g., the Ecosystem Based Management (EBM) (KATSANEVAKIS et al.,

2011; LESLIE; MCLEOD, 2007; LONG; CHARLES; STEPHENSON, 2015; MCLEOD; LESLIE, 2009) and Marine Spatial Planning (MPS) (EHLER; DOUVERE, 2009; FOLEY et al., 2010; JAVIER, 2014; KATSANEVAKIS et al., 2011; SMITH et al., 2010), and operated together with other conservation strategies such as the establishment of Marine Protected Areas (MPAs), which has been greatly stimulated as a strategy for environmental conservation (FOX et al., 2012; MARINESQUE; KAPLAN; RODWELL, 2012; TOROPOVA et al., 2010a).

This many frameworks and management strategies share (to a smaller or larger degree) some common approaches such as the need for an integrated management and for science-policy integration; the ecosystem as a unit to be managed, in opposition to managing different activities individually; and the intent for promoting the participation of different stakeholders (ARKEMA; ABRAMSON; DEWSBURY, 2006; CICIN-SAIN; KNECHT, 1998; EHLER; DOUVERE, 2009; FORST, 2009; HAINES-YOUNG; POTSCHIN, 2011; LONG; CHARLES; STEPHENSON, 2015; SANDERSEN et al., 2013). Similarly, they share common challenges of implementation, such as the establishment of new institutional arrangements that promote integration and power sharing, the difficult and some times unavailable access of relevant information for management, and the effective participation of stakeholders (BENNETT; DEARDEN, 2014; GRANEK et al., 2010; HORIGUE et al., 2012; POMEROY et al., 2005; RUCKELSHAUS et al., 2008; TOROPOVA et al., 2010a; WEVER et al., 2012; XAVIER et al., 2015).

In the context of environmental management, social participation stands out as either a democratic right and a way to promote improved, more resilient, informed and context adapted solutions and social arrangements (ARKEMA; ABRAMSON; DEWSBURY, 2006; BEIERLE; CAYFORD, 2002; BERKES, 2004, 2009; CURTIN; PRELLEZO, 2010; CVITANOVIC et al., 2015a; D'INCAO; REIS, 2002; DIMENTO; INGRAM, 2005; LONG; CHARLES; STEPHENSON, 2015; REED, 2008; RENN, 2006; STEYAERT; JIGGINS, 2007). Through the years, social participation has been increasingly established as a political practice in many environmental areas, as appraisals, impact assessments, conservation planning and management (CHAMBERS, 1994; GLUCKER et al., 2013; O'FAIRCHEALLAIGH, 2010; REED, 2008; SCHUSLER; DECKER; PFEFFER, 2003; WEBLER; KASTENHOLZ; RENN, 1995), including management of coastal and marine areas (BAN; PICARD; VINCENT, 2009; CICIN-

SAIN; KNECHT, 1998; GRANEK et al., 2008; MELLADO et al., 2014; OYANEDEL et al., 2016; WEVER et al., 2012).

There are many obstacles for social participation in management processes, such as coping with the lack of representativeness, overcoming language barriers, sharing knowledge and power among participants, and empowering and engaging the individuals (ASMUS et al., 2006; BROWN; TOMPKINS; ADGER, 2002; DA FONSECA; BURSZTYN; ALLEN, 2012; JABLONSKI; FILET, 2008; KALIKOSKI; SEIXAS; ALMUDI, 2009; TRIMBLE; ARAUJO; SEIXAS, 2014). Participating is more than the mere presence of people in decision making arenas, it is necessary to make them truly engage in the discussion and be part of the joint construction of public policies, otherwise participatory spaces may only serve to endorse the will of a dominant faction or reproduce social exclusions (ARAUJO; SEIXAS, 2012; BROWN; TOMPKINS; ADGER, 2002; MARTIN; LEMON, 2001). In other words, it is necessary to promote "true" participation and build social capital, or "the stocks of social trust, norms, and networks that people can draw upon in order to solve common problems" (LANG; HORNBURG, 1998, p. 4) in the management processes.

In Brazil, the participation of civil society in policy making is a constitutional right and is predicted in the many policies and management instruments applied in the coastal zone, such as the National Plan for Coastal Management (PNGC, acronym for Plano Nacional de Gerenciamento Costeiro, in Portuguese) and its instruments (BRASIL, 1988, 2004), which implements ICM in the country, and the management of Environmental Protected Areas (EPAs) (BRASIL, 2000). The PNGC has been in practice over 25 years, and despite some progress in implementing its instrument and increasing democratic participation in coastal areas it still confronts many obstacle related to its effective operation (e.g., related to financial and power constraints) and engaging civil society in their activities (MMA, 2015; ASMUS et al., 2006; GERHARDINGER et al., 2011; JACOBI, 2013; SANTOS et al., in prep.a; SEIXAS, 2004; XAVIER, 2009). For this reason, a way to improve ICM in Brazil is to qualify and strengthen management processes in order to build social capital.

One aspect of social participation that has been gaining growing aware is its potential to promote social learning. In environmental management discussions, social learning (SL) is the joint and collaborative learning that occurs through the interaction of stakeholders, in constructing collective meaning and new strategies and solutions to

complex environmental problems (ARMITAGE; MARSCHKE; PLUMMER, 2008; BERKES, 2009; BERKES; COLDING; FOLKE, 2000; GARMENDIA; STAGL, 2010; MOSTERT et al., 2007; MURO; JEFFREY, 2008; PAHL-WOSTL, 2006; PAHL-WOSTL et al., 2007; PAHL-WOSTL; HARE, 2004; REED et al., 2010; RIDDER; MOSTERT; WOLTERS, 2005). Social learning leads to stronger, more resilient and sustainable governance systems with stakeholders finding innovative ways for cooperation. It can, therefore, qualify participation processes and be an alternative to build social capital and improve ICM practices.

Studies on SL tend to focus on single recourses and small areas, while broader areas with great socio-ecological complexity have been overlooked (but see (SCHUSLER; DECKER; PFEFFER, 2003), especially in coastal and marine environments. SL is affected by local context and by factors related to the governance processes, which affects stakeholder's participation and interactions. For instance, the more numerous and complex the discussed issues are, the greater are the number of interests at stake, the more unbalanced are power relationships, the less power decision-makers have to enforce their propositions, the less likely is the occurrence of social learning (ARMITAGE; MARSCHKE; PLUMMER, 2008; MOSTERT et al., 2007; MURO; JEFFREY, 2008; PAHL-WOSTL; HARE, 2004; REED et al., 2010; REES et al., 2005).

Management of coastal and marine areas is a delicate subject that involves a complex and fragile social-ecological ecosystem. The participatory management of such environments is conducted through management groups that depend highly on institutional articulation since the management is a shared competence among many multi-scale organizations (DIEGUES, 2001; GERHARDINGER et al., 2011; JABLONSKI; FILET, 2008; JENTOFT, 2000). Local stakeholders (the ones usually involved with the management boards) do not have all the power to promote legal enforcement and compliance of their propositions (LEACH; PELKEY, 2001; MOSTERT et al., 2007). Management and surveillance of coastal/marine areas require more knowledge (they include diverse ecosystems) and resources in comparison to terrestrial ones (ARMITAGE; MARSCHKE; PLUMMER, 2008; JENTOFT, 2000; LEACH; PELKEY, 2001). Diverse uses imply involving diverse stakeholders, but increasing the number of participants may also hinder participation (ARMITAGE; MARSCHKE; PLUMMER, 2008; LEACH; PELKEY, 2001; MOSTERT et al., 2007).

On one hand, coastal and marine management has challenges that can be minimized by social participation and by promoting social learning processes, but on the other hand, it has characteristics that may hinder such processes. Given the lack of studies that report social learning in such contexts, the main questions driving this research were:

a) are there evidences of social learning in coastal management?;
b) how can social learning be fostered in the context of coastal and marine management?;
c) can social learning improve participatory management of coastal and marine areas?

The central hypothesis of this thesis is that social learning can foster and improve ICM, by qualifying participation and promoting social capital,.

In order to test the hypothesis and answer the questions, the processes of managing a marine protected area was analyzed with the primary objective of providing empirical evidence that social learning can occur in such contexts and leads to sustainability-related actions on marine and coastal areas. The establishment of Marine Protected Areas (MPAs), has been greatly stimulated (FOX et al., 2012; MARINESQUE; KAPLAN; RODWELL, 2012; TOROPOVA et al., 2010a) over the years and is a strategy to ICM implementation. Recent evaluations of MPA management have shown that, similarly to other ICM strategies, its challenges are related to establishing sustainable financing; acquiring relevant information for decision-making; increasing the involvement of stakeholders, their empowerment and capacity to engage in management processes; promoting co-management and cross-sectorial cooperation, among others (BENNETT; DEARDEN, 2014; HORIGUE et al., 2012; POMEROY et al., 2005; TOROPOVA et al., 2010b; XAVIER et al., 2015).

For this study, the Marine Protected Area of the Northern Coast of São Paulo State (APAMLN), a sustainable used protected area established in 2008 in Brazil, was selected as a study case. The MPA was created in a very conflicting region, where economic activities related to mass tourism, port expansion, large aquiculture enterprises and oil drilling conflicts conservation-oriented growth in one of the last remaining of the Brazilian Atlantic Forest and the home of traditional communities (AMARAL et al., 2010; TEIXEIRA, 2013). Accordingly, managing the MPA involves aligning national's and great corporations' political and economic interests with local environmental preservation and

the maintenance of local traditional practices, making the effective involvement of local community crucial to the management process.

When this research started, in 2011, APAMLN had already undergone three years of a participatory management process with local stakeholders, having a active involvement in local environmental discussions and accumulating managerial activities that could be analyzed in a social learning perspective, which had already been noticed since I had already became acquainted with some of the activities of the MPA during my master research. Additionally, in 2011, the MPA management board was initiating the discussion of the elaboration of its management plan and had an interest in establishing a closer relationship to the research groups, welcoming research projects, and to evaluating the work that had been in development with its management board and local community. For this reason, there were institutional interest and support, by the MPA for the development of this research, which reinforced the choice for working with this MPA.

This research was carried out in two distinct phases, related to two distinct larger research projects with which I became involved during its development: the "Social Learning and its application in the relationship between science and governance" (the SL Project – Process CNPq 476500/2010-9) and the "Biodiversity and functioning of a subtropical coastal ecosystem: subsidies for integrated management" (Biota/Fapesp Araçá Project – Process FAPESP 2011/50317-5), each project accounting for a scale of analysis of the study case. The results of the two phases of this research are presented in the following chapters in the format of individual articles, for this reason, despite the best efforts applied, the reader should be prepared to find some repetition among the chapters. Each chapter reports one aspect of SL analyzed in APAMLN management and has its own hypothesis or research questions, which dialogues to test the general hypothesis of the thesis and answer the three questions announced in this introduction.

The first phase was based on the observation of APAMLN's management process (Chapters 2 to 4) that provided a general view of whether and how social learning processes occurred and attracted attention to the roles of a specific group of stakeholders in the process: research and education organizations, configuring a more descriptive part of this research. Information for this chapters is derived from the SL Project (2011 – 2013), which general objective was to advance in the discussion of scientific knowledge generation, exchange and application in participatory decision-making processes, analyzing it through a SL perspective. In the SL Project, I worked with a group of

researchers and students who were analyzing SL processes in four EPAs of São Paulo State. The group discussed the theory of SL and jointly elaborated the strategies and questionnaire used to characterize how SL had been occurring in the analyzed EPAs, creating a common framework for analysis. My specific objective in this project was to apply the project's framework in APAMLN and provide information that could be compared to the other EPAs, contributing to the general objective. For the thesis I advanced in the reading of SL theory and in the analysis and discussion of the data collected during the SL Project, so that what is presented here is an independent work from what was produced during the SL Project, which advances in the discussions registered during it[1].

The first chapter of this phase, Chapter 2, is the introductory chapter where SL theory is deeply presented, along with the challenges for the management of coastal and marine areas and how it can be improved through SL processes. The chapter addresses two questions: Is there evidence of SL in the participatory management of a multi-environment coastal and marine protected area? What are the factors that may promote or hinder SL processes in this context?, which are answered considering documentary analysis and observation of APAMLN management process. The chapter also presents a characterization of APAMLN and its governance system and reports five discussions identified in the management of the MPA that have evidences of SL, to further discuss how factors identified in the related literature affected the five discussions and the social learning processes.

Chapter 3 considers the SL bibliography revised in Chapter 2 to deepen the understating of the social learning processes and the factors affecting participation and social learning in the management of APAMLN by analyzing the opinions of members of the MPA's management board using a questionnaire covering some of the factors identified in Chapter 2. This chapter is based on the assumption that the way a person perceives a process affects her willingness to participate and, as a consequence, the outcomes of the processes (DIDUCK; SINCLAIR, 2002; RAAKJÆR NIELSEN; MATHIESEN, 2003). By considering the opinion and perception of stakeholders involved in management and contrasting it with results from process observation it is possible to

[1] For more information of what was produced during the SL Project please refers to (ESTANCIONE, 2015; JACOBI, 2015; JACOBI; XAVIER; MISATO, 2013; MISATO, 2015)

improve the understanding of how SL processes can be fostered in the management of marine and coastal areas and what can be improved or avoided in promoting participatory management that can foster social learning.

To conclude the diagnosis of SL in APAMLN, Chapter 4 focus on the participation of research and education organizations in the management process and how it affected SL, considering the opinion of member of the management board, accessed by questionnaire. The chapter starts by discussing the importance of knowledge exchange (KE) for environmental management and social learning, and the activities and roles research and educational organizations can have in KE processes, which depend on how their role is understood by participants. With reference to this, the chapter first characterizes the participation of R&E organizations in the management of APAMLN and the perceptions of the stakeholders involved with this management process about R&E organizations' role and involvement with the management. Then discusses how the relationship between science and decision-making may foster or hinder social learning processes. By this, it intend to contribute both to the understanding of science-policy interaction and of how they can foster social learning and coastal management.

In the second phase, the observation of the MPA management and SL processes was complemented by the analysis of a direct intervention on the participatory discussion of a specific area within this MPA, the Araçá Bay located in São Sebastião (São Paulo/Brazil), which was conducted by the Biota/Fapesp-Araçá Project. The objective of the Biota/Fapesp-Araçá Project was to produce information to understand the functioning of Araçá Bay (located within the APAMLN in São Sebastião, São Paulo) in a systemic and integrated approach, and apply the produced information to local management processes. One of the specific goals of the project was to develop a Local Plan for Sustainable Development (LPSD) of the Bay, which is an instrument of Local Agenda 21 (LA21) processes. The project was organized in twelve research modules and the second part of this research was developed with the module responsible for discussing the integrated management of Araçá Bay and conduct the elaboration of the LPSD. In this project, I worked with other researchers and students to fulfill the objective of the module, organizing, conducting and registering the participatory meetings that originated the LPSD of Araçá Bay. My specific objective in the module activities was to analyze the LPSD process as a SL processes, to do so I used the opportunities provided by the meeting to observe social interaction, collect specific data during the discussion of the problems of

Araçá Bay (registered in individual tables which were produced and applied during meetings to my specific use and are presented as supplementary material in this documents) and apply questionnaires focused in SL. Despite being collected during modules activities and also referred to in reports and publications of the research module, the information registered in the fifth and sixth chapter of this thesis was produced to serve my specific objectives.

In Chapter 5, the process for the implementation of the LPSD of LA21 is analyzed with reference to SL theory. The basis for LA21 worldwide implementation and evaluation are briefly presented and the argument that common applied measures of LA21 performance may be inadequate to fully access the importance of such processes is built. The hypothesis of this chapter is that SL changes can be observed in the implementation of LA21, increasing the importance of such processes to promote qualified participation and empower community. The chapter introduces the complex social-environmental context of the Araçá Bay, which is representative of other coastal areas, and describes the actions taken to the construction of the LPSD of Araçá Bay, which are analyzed with reference to SL changes described by Garmendia and Stagl (2010): change in knowledge, which involves the adoption of new facts; change in the recognition of the complexities of the system; change in social context; change in the appraisal of facts (framing and reframing). Such changes are accessed through process observation, questionnaire application and information registered in tables during the discussion of Araçá problems. Considering this LA21 process, the chapter discusses how promoting LA21 process to foster SL can heighten effectiveness and continuity of the LA21 processes themselves, and the importance of favoring interaction and qualified processes instead of focusing on results.

On Chapter 6 the way social learning was influenced by the process of knowledge exchange promoted by further engaging local stakeholders, governmental representatives and scientists in the discussion of a proposal for the delimitation of a specific area within APAMLN, the Araçá Area, is analyzed. The Araçá Area discussion, carried in a working group created inside the APAMLN management board – the Working Group Araçá – promoted a strait link between APAMLN' and Biota/Fapesp-Araçá project activities, being a common interest of both initiatives, and integrated scientific and traditional knowledge and the perceptions of different stakeholder groups to propose a definition of the Araçá Area and of it Area of Influence. The hypotheses tested in the chapter are that a delimitation proposal under a KE process could bring substantive changes to outcomes

compared to a proposal elaborated by a single group of stakeholders and that KE processes promotes SL. To test these hypotheses, delimitation proposals and criteria considered for delimitations elaborated first separately by different stakeholder groups and later through joint discussion were compared to understand how they diverge and complement each other and how the KE processes during the joint discussions affected the final proposition and promoted social learning changes, as described by Garmendia and Stagl (2010).

Finally, the last chapter of this document (Chapter 7) presents a synthesis of the SL processes evidenced in the two phases of this research and consider them together to provide insights on how to foster social learning in the context of coastal and marine management, providing answers to the three questions presented in this introduction and retaking the general hypothesis of this thesis

2 SOCIAL LEARNING IN MARINE PROTECTED AREAS: SUCCESSFUL EXPERIENCES AND MAIN INTERFERING FACTORS

ABSTRACT

Social Learning (SL) involves sharing and creating new and collective interpretations of socio-ecological systems in pursuit of solutions to environmental problems. Studies of SL usually focus on single recourses and small areas, whereas broader areas with great socio-ecological complexity that represent a challenge to SL have been overlooked. Despite this challenge, it is in these situations that SL contributions can best benefit the management process. To foster participatory and integrated management, especially in marine areas, it is essential to understand whether and how SL occurs in broader areas. For this reason, this study searched for evidence of SL in the co-management of a large Marine Protected Area (MPA) and investigated the factors that affected it through documentary analyses, participant observation and meetings with the area's manager. Strong evidence was identified in the participatory characterization and proposed solutions to local problems, changes in stakeholder behavior, in stakeholder network and in recognition of the need for joint and collective action toward a common good, indicating that SL can naturally occur in this context. SL was fostered by the existence of a political and institutional structure, the establishment of rules for interaction, i.e., a *modus operandum* for discussing problems based on small-group discussions, information dissemination and the engagement of diverse stakeholders. However, SL processes were hindered by the dependence on external organizations and key actors' absence or limited involvement. The analysis of how these factors affected SL processes reveals strategies for promoting specific factors in the context of large MPAs that can be applied to the management of other coastal and marine areas. These strategies involve developing mechanisms to cope with the increased number of stakeholders and different issues simultaneously and promoting small-group discussions while scaling up the learning to the entire network.

2.1 INTRODUCTION

Recognition of both the complexity of socio-ecological systems and the difficulty with which traditional management systems cope with the sustainable use of natural resources leads to the emergence of new governance systems that focus on the engagement of diverse stakeholders and organizations (BEIERLE; CAYFORD, 2002; BERKES, 2004; D'INCAO; REIS, 2002; REED, 2008; RENN, 2006). In this scenario, stakeholders' capacity to interact and develop new and joint understandings is key, and learning that overcomes individuals to achieve broader social units plays a fundamental role.

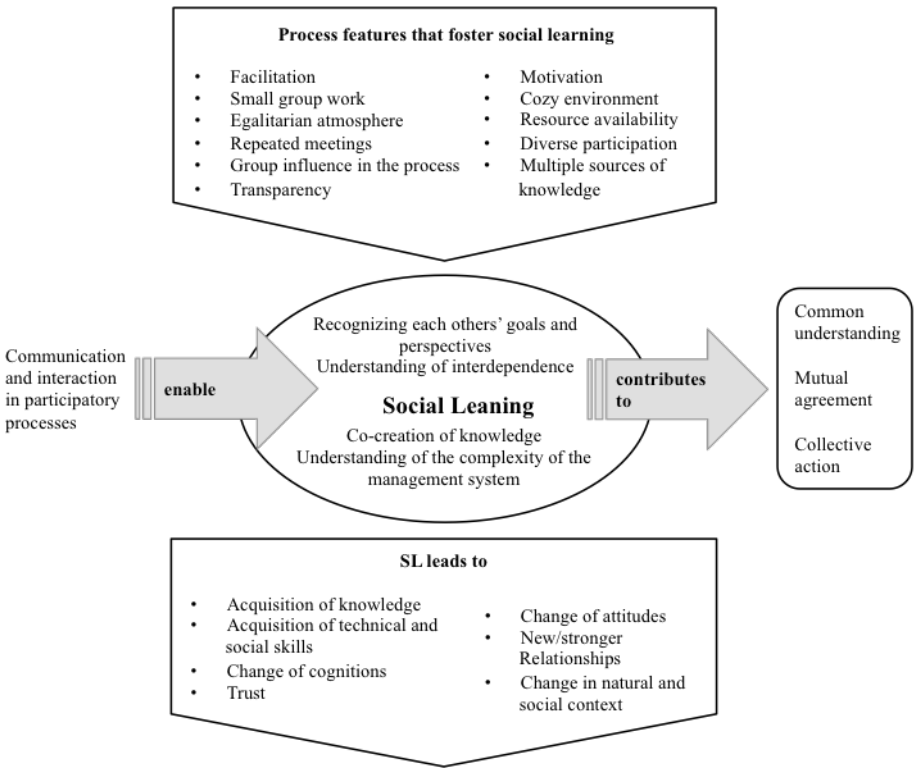
Social Learning for environmental management (SL) is the joint and collaborative learning that occurs through stakeholders' interaction in a process of collective discussion and the search for solutions to environmental problems (ARMITAGE; MARSCHKE; PLUMMER, 2008; BERKES, 2009; BERKES; COLDING; FOLKE, 2000; GARMENDIA; STAGL, 2010; MOSTERT et al., 2007; MURO; JEFFREY, 2008; PAHL-WOSTL, 2006; PAHL-WOSTL et al., 2007; PAHL-WOSTL; HARE, 2004; REED et al., 2010; RIDDER; MOSTERT; WOLTERS, 2005; WOLTERS et al., 2016). Through interaction and communication, social actors acquire new knowledge, technical and social skills and develop trust and new relationships, leading to stronger, more resilient and sustainable governance systems (ARMITAGE; MARSCHKE; PLUMMER, 2008; BERKES, 2009; BERKES; COLDING; FOLKE, 2000; GARMENDIA; STAGL, 2010; MOSTERT et al., 2007; MURO; JEFFREY, 2008; PAHL-WOSTL, 2006; PAHL-WOSTL et al., 2007; PAHL-WOSTL; HARE, 2004; REED et al., 2010; RIDDER; MOSTERT; WOLTERS, 2005).

SL processes are influenced by their natural, social, institutional and political contexts (ARMITAGE; MARSCHKE; PLUMMER, 2008; PAHL-WOSTL; HARE, 2004; REES et al., 2005) and the changes they promote influence and alter those contexts. These changes occur from the micro level (short to medium time scales and changes occurring within the process) to the meso level (medium to long time scales and changes in the actors' networks) to the macro level (long time scales and changes occurring within the governance structure) (PAHL-WOSTL et al., 2007).

Despite the singularities of each process, common features that influence SL (CRAPS; MAUREL, 2003; KUMLER; LEMOS, 2008; MURO; JEFFREY, 2008; PAHL-

WOSTL et al., 2007; SCHUSLER; DECKER; PFEFFER, 2003; WEBLER; KASTENHOLZ; RENN, 1995), along with common trends in the outcomes (ARMITAGE; MARSCHKE; PLUMMER, 2008; BLACKMORE, 2007; CRAPS, 2003; GARMENDIA; STAGL, 2010; MOSTERT et al., 2007; MURO; JEFFREY, 2008; PAHL-WOSTL et al., 2007; REED et al., 2010; STEYAERT et al., 2007) have been observed, illustrating the fundamentals of this concept, which are summarized in Figure 2.1.

Figure 2.1 – Concept of Social Learning (SL) for Environmental Management: features that influence SL processes and general outcomes drawn from the literature



Source: Adapted by the author from Muro and Jeffrey 2008.

Studies on SL tend to focus on a single subject, a single resource or areas with limited extension (for example, a single watershed) (GARMENDIA; STAGL, 2010; KUMLER; LEMOS, 2008; MOSTERT et al., 2007; PAHL-WOSTL; HARE, 2004; STEYAERT; JIGGINS, 2007; WEBLER; KASTENHOLZ; RENN, 1995). There are few reports of SL in broader areas such as larger Environmental Protected Areas (EPAs), which have a multitude of uses that must be managed simultaneously (but see SCHUSLER; DECKER; PFEFFER, 2003). The dearth of studies in the marine environment is even greater, despite the increase in the number and extent of Marine Protected Areas (MPAs) in recent decades (MARINESQUE; KAPLAN; RODWELL, 2012).

Increased recognition of the oceans' importance and threats to coastal and marine ecosystems have led to actions to enhance their protection and guarantee their sustainability (ELFES et al., 2014; HALPERN et al., 2008, 2012; WORM et al., 2006). The establishment of MPAs is part of the global effort to achieve conservation targets, e.g., the Aichi Biodiversity Target to protect 10% of coastal and marine representative ecosystems by 2020 (CDB, 2008, Aichi Target 11), and have been stimulated over the years (FOX et al., 2012; MARINESQUE; KAPLAN; RODWELL, 2012; TOROPOVA et al., 2010a). A 2010 report on ocean protection indicated that MPAs cover approximately 1.17% of coastal and ocean areas (TOROPOVA et al., 2010a), with a growing tendency to be implemented in larger areas (MARINESQUE; KAPLAN; RODWELL, 2012). Examples of this tendency, which has increased ocean protection, include the recently expanded Papahãnaumokuãkea Marine National Monument, which covers approximately 1.51×10^{12} m^2, in Hawaii, and the world's largest marine reserve, covering approximately 1.54×10^{12} m^2 in the Ross Sea in the Antarctic Ocean. However, the increase in the number and size of protected areas does not guarantee the necessary protection not only because their management remains an obstacle but also because some established MPAs either do not operate or fail to fulfill their conservation purposes (TOROPOVA et al., 2010b).

The management of marine areas is a complex challenge that involves coping with a continuous, tri-dimensional, common-use environment with open access, dynamics and processes that vary spatially and over different time periods. In some countries, the management of marine areas is a common competence among the federation/union, states and municipalities (JABLONSKI; FILET, 2008; JENTOFT, 2000). Additionally, marine activities (e.g., fishing, navigation, oil drilling) are under the authority of specific governmental organizations that must be included in the management process (JENTOFT, 2000). Shared competence implies that stakeholders who join management processes, which are usually locally based (e.g., from the municipality covered by the MPA), do not have full decision power to guarantee that their proposals will be enforced.

Furthermore, MPAs can be affected by activities in their vicinity because there are no boundaries in the marine environment. MPA managers must consider this issue. Institutional articulation is key and must extend to organizations operating out of the MPA, increasing the interests at stake. Although diversity of participation fosters SL (as seen in Figure 2.1), the existence of a large number of stakeholders makes participatory meetings

difficult (ARMITAGE; MARSCHKE; PLUMMER, 2008; LEACH; PELKEY, 2001; MOSTERT et al., 2007). In addition, the participation of many organizations and levels of government make transparency and information flow difficult (JABLONSKI; FILET, 2008), increasing the difficulty of creating SL processes that depend on trust among participants.

MPA management is a delicate subject involving a complex and fragile social-ecological system that seems to hinder SL processes. Management boards (MBs) are highly dependent on institutional articulation, which itself is a difficult task. No transparency is guaranteed. Local stakeholders do not have the power to guarantee the enforcement of and compliance with their propositions. There is an increased demand for knowledge (there is less scientific knowledge about marine areas than terrestrial areas) and resources. Finally, the diversity of the participants may lead to a number of stakeholders that is large enough to jeopardize participation. The challenges increase with the size of the protected area. There is a tradeoff between protecting large areas of the ocean and promoting the integrated management of the ecosystem's goods and services, creating implementation difficulties.

The larger the MPA, the greater the social-ecological complexity (ARMITAGE; MARSCHKE; PLUMMER, 2008; JENTOFT, 2000; LEACH; PELKEY, 2001): more ecosystems are included (increasing knowledge demand); more resources are needed for management and control (e.g., the acquisition and maintenance of expensive vessels may be necessary for surveillance); more stakeholders (at different governmental levels) must be involved; and more conflicts between different uses arise, especially between economic uses and coastal and marine ecosystem conservation, which is a MPA's ultimate goal. Large MPAs' characteristics may erect barriers to participation and learning; nevertheless, participatory management itself can be the key factor in overcoming such barriers.

The development of SL in MPAs can enhance management efficiency. For this reason, an understanding of SL mechanisms is key to promoting marine sustainability. Although evidence of SL processes can be found in studies on the participatory management of coastal areas, fisheries and integrated coastal management (CUNDILL; RODELA, 2012; D'INCAO; REIS, 2002; DOMÍNGUEZ-TORREIRO; FREIJEIRO-ÁLVAREZ; IGLESIAS-MALVIDO, 2004; OLSEN; CHRISTIE, 2000), few studies focus on SL in coastal and marine areas and none focus on the management of multi-environment protected areas (ARMITAGE; MARSCHKE; PLUMMER, 2008;

STEYAERT et al., 2007). Therefore, two main questions emerge. First, is there evidence of SL in the participatory management of a multi-environment coastal and marine protected area? Second, if the answer to the first question is yes, what are the factors that may promote or hinder SL processes in this context? This chapter addresses these questions by analyzing an MPA's management processes through documentary analysis and process observation.

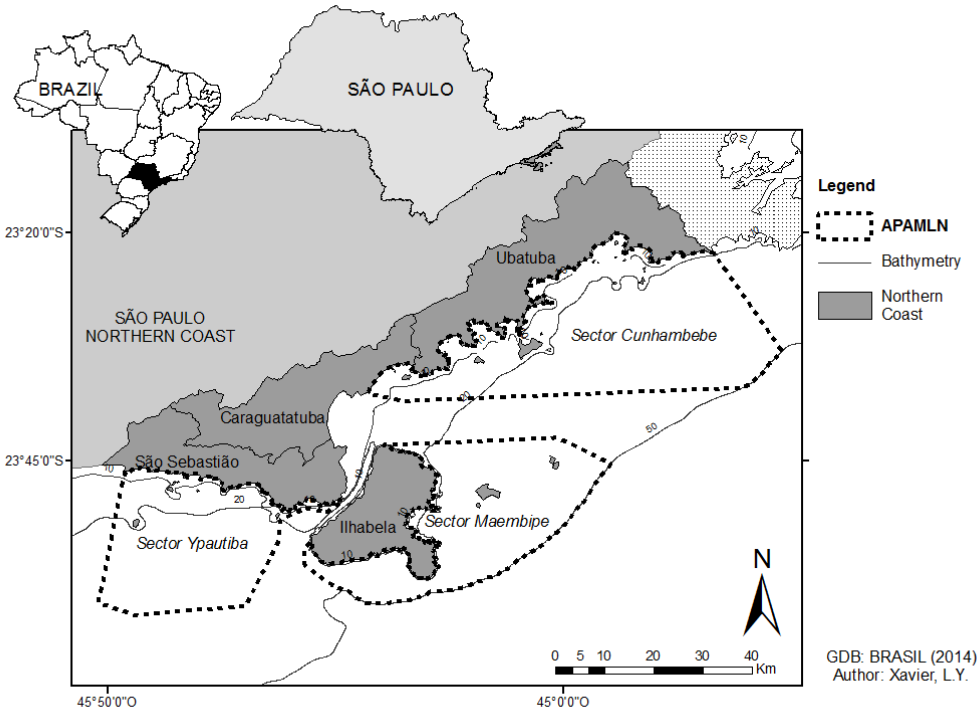
2.2 THE MARINE PROTECTED AREA OF THE NORTHERN COAST OF SÃO PAULO STATE

In Brazil, coastal and marine conservation is a shared competence among various levels of government (DIEGUES, 2001; GERHARDINGER et al., 2011; JABLONSKI; FILET, 2008). Brazilian MPAs are a part of the National System of Conservation Units (SNUC, or *Sistema Nacional de Unidades de Conservação* in Portuguese). They are managed based on a participatory approach and can be created by the federal, state or municipal government (BRASIL, 2000). MPAs cover approximately 1.5% of Brazilian territorial waters and its exclusive economic zone (XAVIER et al., 2015). Effective implementation and management of MPAs, especially considering the integration of the many organizations related to conservation and those organizations' internal activities, is one of the greatest challenges to marine conservation in Brazil (GERHARDINGER et al., 2011; XAVIER et al., 2015).

In response to the threat that unplanned economic development poses to coastal and marine ecosystems, in 2008 the São Paulo State Government created three large MPAs that cover more than $1x10^{10}$ m^2, representing 53.71% of the State's territorial waters. These MPAs are managed by MBs that have been operational since 2009, confronting many of the abovementioned difficulties while making progress in the protection of their ecosystems (SÃO PAULO, 2014). The Marine Protected Area of the Northern Coast of São Paulo State (APAMLN, acronym for *Área de Proteção Ambiental Marinha do Litoral Norte de São Paulo,* in Portuguese) stands out for its participatory management processes (VIANNA; PIRES; CARDOSO, 2014; VIANNA; XAVIER, 2014) and was chosen as a study case to answer this chapter's two research questions.

APAMLN is a sustainable use protected area (IUCN Category IV) established in 2008 in Southeastern Brazil (SÃO PAULO, 2008a). This MPA consists of the coastal waters (up to 50 meters deep) of the four municipalities of the Northern Coast: Ubatuba, Caraguatatuba, São Sebastião and Ilhabela. This MPA is divided into three sectors (Cunhambebe, Maembipe and Ypautiba) (Figure 2.2), and includes islands, mangroves and tidal plains. Its area is approximately $3.6x10^9$ m^2.

Figure 2.2 – Study case evidencing the Marine Protected Area of the Northern Coast of São Paulo State, Brazil (APAMLN), in relation to São Paulo and Brazil. APAMLN is divided into three sectors (Cunhambebe, Maembipe and Ypautiba) that extend from the coastline of the four municipalities of the Northern Coast of São Paulo State (Ubatuba, Caraguatatuba, São Sebastião and Ilhabela) up to 50 m deep, covering approximately $3.6x10^9$ m^2



Source: made by the author.

APAMLN aims to protect the biodiversity of important regional ecosystems, including mangroves, salt marshes, tidal plains, coastal islands and their living and non-living resources (PINCINATO; RIEDEL; MILANELLI, 2009; SÃO PAULO, 2005; SOUZA; LUNA, 2008). It also aims to support activities such as professional and recreational fishing, tourism, aquaculture and aquatic sports (VIANNA; XAVIER, 2014). One managerial challenge is to make these activities compatible both with one another and with environmental conservation, minimizing conflicts concerning the use of space and resources (VIANNA; XAVIER, 2014). Another challenge is to harmonize environmental

conservation with regional economic development, which is based on the existence of large enterprises related to oil drilling and maritime cargo transport, both of which potentially threaten the environment (CUNHA, 2003; LOPES et al., 1997; MEDEIROS; BÍCEGO, 2004; POSTALI; NISHIJIMA, 2013; TEIXEIRA, 2013; ZANARDI et al., 1999).

2.2.1 Governance system in APAMLN

The São Paulo State Forestry Foundation (FF; acronym for *Fundação Florestal do Estado de São Paulo*, in Portuguese), which is under the authority of the State Environmental Agency (SMA; acronym for *Secretaria Estadual de Meio Ambiente*, in Portuguese), is the organization responsible for managing the State's Protected Areas (PAs). The FF occupies the chair of the MB of APAMLN, a pluralist advisory board with a biannual mandate, working since 2009. The MB is composed of 24 full members and 24 alternative members (either from the same organization as the full member or from another organization in the same sector), equally divided between governmental and non-governmental representatives.

When the media reported that the MPA had been created pursuant to a top-down decision, local artisanal fishermen, marinas and yacht clubs organized an opposition movement. Consequently, the MPA's creation was delayed, occurring only after government representatives debated local organizations, resulting in the incorporation of social requirements into the final decree (VIANNA; XAVIER, 2014). This initial opposition resulted in stronger local organizations and heightened interest in joining the MB, making it representative of the most important sectors operating in the Northern Coast of São Paulo State.

Directives were issued by state legislation to govern MB's objectives, composition, seat distribution and functioning (SÃO PAULO, 2003, 2008b). In addition to the chair, the governmental members represent local city halls (4 seats), environmental and fishing regulatory agencies (3 seats), licensing and inspectional bodies (3 seats) and a state research organization (1 seat). The distribution of non-governmental seats was discussed at participatory meetings with the main local sectors interested in participating in the MA.

Non-governmental members represent fishing and mariculture (5 seats) industries, nautical tourism and sports (4 seats), environmental non-governmental organizations (2 seats) and a university (1 seat) (SÃO PAULO, 2008b). To support managerial activities, a team of technicians and trainees works directly with the chair.

The MB's primary objectives are to advise management of the MPA's activities using an integrated and participatory approach, to implement and monitor sustainability-related actions and to analyze environmental impact assessments (EIA) of enterprises that can affect the area. Funding for implementing and operating the MB (e.g., for hiring staff and acquiring equipment and materials) is provided by the Serra do Mar and Atlantic Forest Mosaics System Socio-environmental Recovery Program, funded by a partnership between the State Government and the Inter-American Development Bank (IDB)[2] (VIANNA; XAVIER, 2014).

The MB convenes monthly or bimonthly meetings. Its initial activities were to formulate its statute, to identify management priorities, and to acquaint members with the functioning of the State Environmental System. A series of informative lectures were organized that covered the management system, the role of the board and its members, the MPA's natural characteristics, the marine ecosystem and environmental threats. Special attention was given to information and building capacity of local fishermen.

To discuss specific topics related to the management of APAMLN, either Thematic Groups (TG) (permanent groups that cover many issues related to a specific theme) or more specific Working Groups (WG) (temporary groups that cover a single issue and can be either organized within a TG or directly linked to the MB) are created within the MB. An elected coordinator runs each group with assistance from the management team, with participation open to all citizens. The coordinator is responsible for organizing meetings, leading discussions and reporting those discussions to the parental group and/or the MB. From the first mandate period (2009-2010) to 2012, two TGs and eight WGs were created in APAMLN, some of which were active and some of which were dissolved pursuant to the second mandate (2011-2012) (Table 2.1).

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[2] More information about the program's funding is available at http://www.iadb.org/en/projects/project-description-title,1303.html?id=BR-L1241. (Last accessed February 11, 2016.)

Table 2.1 – Thematic and Working Groups (TGs and WGs) created in the first four years of managing the Marine Protected Area of the Northern Coast of São Paulo State (APAMLN) and their situation (i.e., whether they were active or dissolved) in 2012

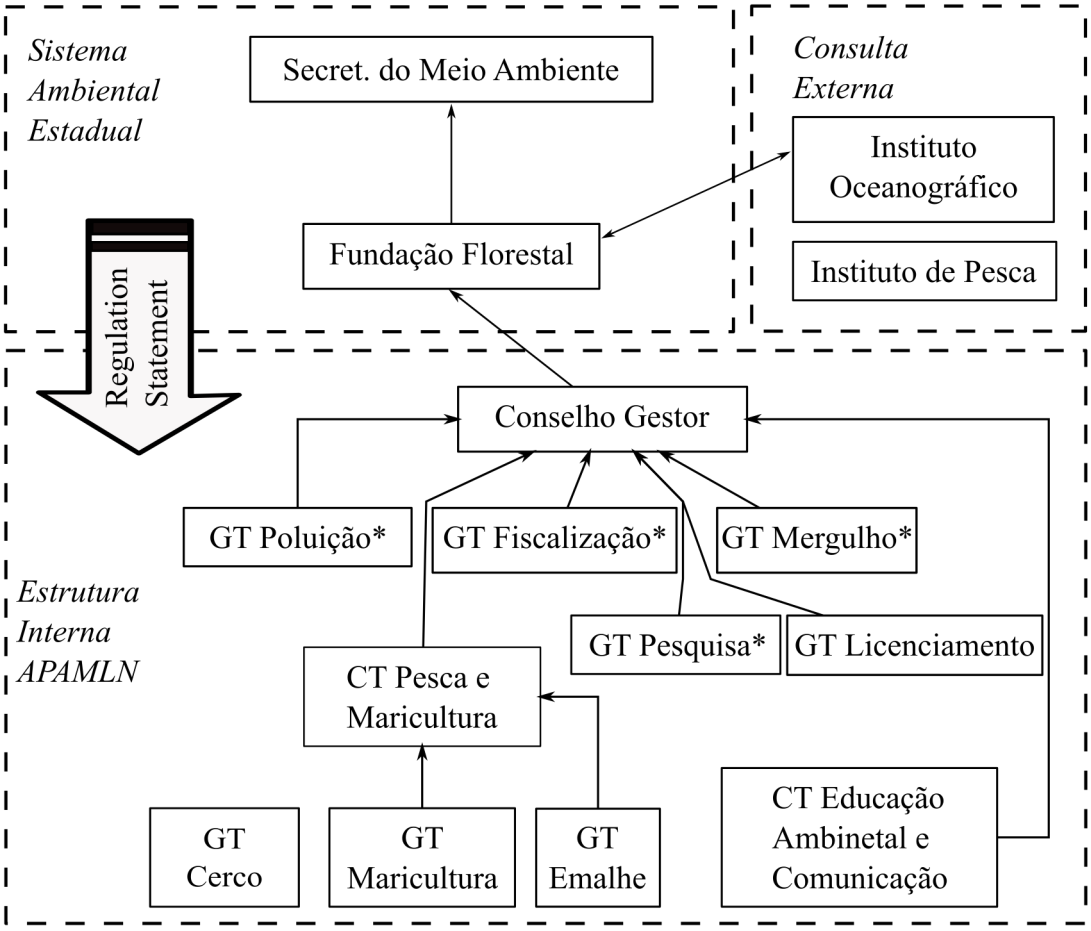
TG/WG	**Parental Group**	**Objectives**	**Situation in 2012**
TG Fishing and Mariculture	MB	Discusses all fishing and mariculture issues, concentrating the discussions held in its associated WGs and discussing other issues.	Active
WG Trap Net	TG Fishing and Mariculture	Discusses issues related to the development of Trap Net Fishing within the MPA territory. Trap Net Fishing is a traditional fishing method that consists of floating nets in a circular arrangement that trap the fish inside its chambers (BEGOSSI, 1995; BLANK et al., 2009). Despite being extensively practiced in the Northern Coast of São Paulo State, Trap Net Fishing is unregulated.	Active
WG Mariculture	TG Fishing and Mariculture	Created to discuss issues related to the establishment and maintenance of mariculture farms in the MPA in relation to farmed species, farming areas, monitoring and best practices.	Active but operating in cooperation with other local groups
WG Gillnet	TG Fishing and Mariculture	Created to discuss issues related to the practice of gillnet fishing within the MPA territory.	Active (recently created)
TG Environmental Education and Communication	MB	Responsible for disseminating information about APAMLN and good practices for marine activities and environmental conservation. Also engaged in elaborating environmental education projects.	Active
WG Pollution	MB	Focused in identifying the sources of pollutants and contaminants that affect the MPA.	Dissolved
WG Inspection	MB	Disseminate information about legislation and rules and diagnose transgressions and violations in APAMLN's territory.	Dissolved
WG Research	MB	Engaged in discussing the term of reference for the elaboration of the MPA's Management Plan.	Dissolved
WG Diving	MB	Created to discuss good diving practices for the MPA and to contribute to the elaboration of a Diving Guide.	Dissolved
WG Licensing	MB	Created to analyze and discuss environmental impact assessments (EIAs) as part of the process of licensing projects that may directly or indirectly affect APAMLN.	Active

Source: made by the author

TGs and WGs discuss the issues and elaborate propositions that are presented to the MB, where the issues are further discussed and a final proposition is elaborated (Figure 2.3 – bottom). Next, MB propositions are sent for FF analysis, which involves consulting two State research and educational organizations related to coastal and marine affairs: the Oceanographic Institute of University of São Paulo (IOUSP; acronym for *Instituto Oceanográfico da Universidade de São Paulo*, in Portuguese) and São Paulo's Fisheries Institute (IP; acronym for *Instituto de Pesca*, in Portuguese). Following the analysis,

eventual modifications, and final approval by the FF, the proposal is sent for analysis by the SMA, which decides whether to promulgate it as a regulation (Figure 2.3– top).

Figure 2.3 – Internal governance structure of APAMLN (bottom) and the State Government Environmental System (top) showing the decision-making pathway. The internal structure of APAMLN shows Thematic Groups (TGs) and Working Groups (WGs) from 2009 to 2012. These groups discuss specific issues and send proposals to the MB, which discusses final propositions that are sent for the Forestry Foundation, which analyzes them and sends them to the Oceanographic Institute and Fisheries Institute for technical consultation. When approved by the FF, the proposition is sent for the State Environmental Agency to be further analyzed and enacted as a regulation



* Indicates groups that have already being dissolved.
Source: made by the author

Over the years, APAMLN's MBs have been developing their activities and strengthening participatory management in the Northern Coast of São Paulo State. It has produced informative material, manifested in licensing processes through EIA analysis, proposed territorial rules and triggered changes in the local social network (VIANNA; PIRES, 2014; VIANNA; PIRES; CARDOSO, 2014; VIANNA; XAVIER, 2014). Such achievements indicate that a possible SL process may be occurring in APAMLN's management. Investigating this management process from a SL perspective represents an

opportunity to improve the understanding of SL. The understanding of whether SL processes are actually occurring, how they occur and the factors fostering or hindering them in this scenario can improve the management of other MPAs.

2.3 ANALYTICAL STRATEGY

To identify evidence of SL process in the management of APAMLN and the factors that affect it, documentary analysis were combined with observation of ongoing processes and informal meetings with the board chair, considering the two first mandates of the MB in 2009-2010 and 2011-2012.

The first step was to identify managerial activities (past and ongoing) that could represent SL processes. To do so, APAMLN documents (the statute, meeting records and reports) were consulted to identify discussions that had two or more of the following characteristics:

a) discussions that were recurrent in meetings: discussions extended to 3 or more (preferably) meetings, considering that SL takes time (GARMENDIA; STAGL, 2010; REES et al., 2005; STEYAERT; JIGGINS, 2007);
b) discussions that involved different stakeholders, guaranteeing diversity of opinions, knowledge, interests and integration among different sectors, which is needed for SL (GARMENDIA; STAGL, 2010; SCHUSLER; DECKER; PFEFFER, 2003);
c) discussions that involved the creation of a dedicated group to discuss the topic (e.g., a WG), resulting in more meetings, the engagement of interested stakeholders and demand for specific actions related to the topic, in which SL processes could be more evident (BERKES, 2009; REES et al., 2005; SCHUSLER; DECKER; PFEFFER, 2003).

Overall, 31 records of MB meetings and 62 records of TG and WG meetings were analyzed over the entire period. After identification of the discussions with possible evidence of SL, the processes were further characterized through deeper documentary analysis and observation (when the discussion was ongoing), consultation of the existing

literature (when available) and formal and informal meetings with the board chair that provided information about the discussions. Observation of ongoing processes was carried out from 2011 to 2012 when a single researcher attended MPA board meetings and (when possible) TG and WG meetings. The selected processes were then characterized in terms of the following issues:

a) which stakeholders were involved and how they behaved during the processes (including group interactions and participants' discourse during meetings);
b) the framing and reframing of the theme being discussed;
c) evolution of the discussion and the emergence of solutions; and
d) results and outcomes.

Finally, factors affecting (i.e., either fostering or hindering) each process were analyzed by considering the reported literature, primarily Mostert et al. (2007), which presents eight groups of factors that affect SL: the role of stakeholder involvement (when and how); representativeness; politics and institutions (how participation and empowerment are settled); opportunities for interaction; the motivation and skills of leaders and facilitators; openness and transparency (management procedures); framing and reframing (problem characterization); and resources (support for participation and activities).

2.4 EVIDENCE OF SOCIAL LEARNING PROCESSES IN APAMLN

The analysis of the records of MB, TG and WG meetings provided information about five discussions that resulted in proposals for sustainable use in the region and were identified as possible SL processes. The discussion themes were related to the fishing techniques banned within the MPA (pair trawl fishing) and the fishing techniques permitted following the adoption of good practices (trap net fishing); mariculture, and more specifically, the proposal to cultivate an exotic algae in the MPA; diving, triggered by the elaboration of a guide to advertise diving spots in the MPA that conflicted with fishing spots; and analysis of EIAs related to licensing projects that could potentially affect the MPA. Each discussion occurred in a specific group dedicated to the theme and was

either reported to or re-discussed in the parental group (TG Fishing for fishing-related WGs) and in MB meetings. A summary of each discussion is presented in Table 2.2.

Table 2.2 – Summary of the discussions with evidence of social learning (SL) identified from 2009-2012 in the process of managing the Marine Protected Area of the Northern Coast of São Paulo State, Brazil (APAMLN). Discussions were held in thematic groups (TG), working groups (WG) and in the management board (MB) and were characterized with reference to the following issues: (a) which stakeholders were involved and how they behaved through the processes (including group interactions and participants' discourse during meetings); (b) framing and reframing the theme being discussed; (c) evolution of the discussion and the emergence of solutions; and (d) results and outcomes

Issue	Group	Characterization	SL Evidence
1. Fishing – Pair trawl fishing	TG Fishing and Mariculture MB	Pair trawl fishing is practiced by two boats navigating in parallel routes, each one towing a net cable, which keeps the net open while dragging the ocean bottom. It is considered a high-impact fishing technique (DE GROOT, 1984). The creation decree of APAMLN prohibited pair trawl fishing by industrial vessels and established that the MB should discuss technical parameters for the prohibition. The discussion occurred during 2009 and was one of the MB's first activities, which led to the creation of the WG Fishing that was later transformed into the TG Fishing and Mariculture. Participating stakeholders were related to the fishing sector, local city halls, environmental agencies and research organizations (a), and other fishermen and researchers interested in the subject. The operational and socioeconomic characteristics of this fishery within the MPA were discussed (b) and the group agreed (c) on a manifest with the exclusion of all pair trawl fishing in the Area, which became a State Resolution (SÃO PAULO, 2009) (d). Later, representatives of the industrial fishing sector, who were not involved in the discussion, questioned the decision, which remains in force.	- Development of a common understanding of this activity and its local characteristics; - Consensus on prohibition; - Elaboration of a proposal that grounded the State Resolution that regulates the prohibition.
2. Fishing – Trap Net[†*]	WG Trap Net TG Fishing and Mariculture MB	To formulate the rules and regulate Trap Net Fishing within the APAMLN area, this WG's members are related to the fishing sector, local city halls, environmental agencies, research organization, licensing and inspectoral bodies (a), meetings to assess information about this fishery also engaged local communities in places where it is practiced. The fishery was characterized with reference to technical and traditional knowledge, and fishing spots were mapped during 60 meetings in fishing communities of the four municipalities of the Northern Coast of São Paulo as a	- Development of a common understanding of this fishing technique; - Intense participation of stakeholders beyond members; - Integration of technical and traditional knowledge; - Consensus on standards and best practices; - Elaboration of a proposal for a resolution to regulate this fishery in APAMLN.

Issue	Group	Characterization	SL Evidence
		means to promote greater participation by fishermen (b). Stakeholders agreed upon a proposal to regularize the fishery in APAMLN and formulated a list of good practices (c). The proposal (d) was sent for and approved by the MB in December 2011 and forwarded to Forestry Foundation (FF), where it was awaiting analysis during the study period. It was not declared a State resolution until 2016. Meanwhile, WG Trap Net activities continued with a process to regulate the fishing spots in partnership with the navy, initiated by collecting all of the necessary documents from fishermen.	
3. Mariculture	WG Mariculture TG Fishing and Mariculture	Exotic brown algae *Kappaphycus alvarezii* farming is prohibited in protected areas without an established management plan, but begin in the region prior to the APAMLN, thus requiring regulation. To discuss the issue, WG Mariculture was created with the participation of the local mariculture industry and researchers (a). After balancing the knowledge of all participants about the algae and its farming techniques, it was concluded that farming would not threaten the local environment (b) and the group discussed alternatives for regulating it prior to the elaboration of the management plan. The chosen solution was to link existing farms to a research project and to formulate a normative regulation for research in the area until the conclusion of the management plan (c). Before concluding the proposal (d), participants lost interest in the discussion and the WG coordinator resigned, with nobody else volunteering to continue the discussion. This situation led to the disruption of the group. A member of the management team assumed responsibility for finishing the draft to send to TG Fishing and Mariculture; this occurred after the analyzed period. After the disruption of the WG mariculture, mariculture issues were further discussed in the meetings of the Association of Mariculture Laborers of the State of São Paulo (AMESP, or *Associação de Maricultores do Estado de São Paulo* in Portuguese), with the participation of members of APAMLN's management team. No further activity was reported during the period of analysis.	- Development of a common understanding of the farming technique and its possible threats; - Search for a joint solution to continue existing farms until the conclusion of the Management Plan; - Agreement between stakeholders that no new farms should be established until the publication of the Management Plan; - Elaboration of a proposal to regulate existent *K. alvarezii* farms linked to research projects.

Issue	Group	Characterization	SL Evidence
4. Diving‡	WG Diving TG Fishing and Mariculture MB	The FF team formulated a proposal for a Diving Guide and called local diving centers to verify the inclusion of diving spots. The meeting was broadcast during an APAMLN meeting and attracted the attention of other stakeholders – i.e., the fishermen – who joined the discussion. The presence of fishermen in the discussion of diving spots revealed the existence of conflicts between diving and professional fishing activity. Fishermen claimed that publicizing diving spots near fishing areas would enhance conflicts. This led to the 2009 creation of the WG Diving, which, in collaboration with TG Fishing and Mariculture, initiated a series of meetings and field trips to fishing communities to identify and understand conflicting diving/fishing spots (b). Joint meetings with fishermen and diving guides (a) were held to identify alternatives and solutions to conflicts and to agree about the diving spots that would be publicized (c). The groups also worked on elaborating a text with information about fishing communities and fishing spots (c) that was inserted into the guide (d), which was finalized in 2009 when the WG Diving ceased its activities, having fulfilled its role.	- Closeness between fishermen and diving operators; - Change in fishermen's behavior toward the publication; - Change in diving operators' behavior, acknowledging conflicts with fishing activities; - Joint search for consensus about publicized diving points; - Search for joint solutions to conflicts; - Addition of fishing information to the guide.
5. EIA – Environmental Impact Assessment*	WG Licensing MB	The WG Licensing was created in 2011 to coordinate the analysis of EIAs and engaged members of every sector represented in the MB (a). The group performs an integrated, regional and holistic analysis in which all uses and interests are considered, revealing the different perceptions of the sectors involved with APAMLN and other local participatory groups that cooperate with APAMLN (Watershed management and other protected areas) (b). After approval by the MB, the analysis is sent for FF and considered for the final analysis of the latter. The first manifesto (d), which addressed a series of oil and gas activities related to the installation and operation of exploration plants by Petrobras, considered the EIA inadequate to characterize the impacts on APAMLN, recommending a series of adjustments (c) that were later negotiated by the FF. To facilitate the elaboration of the next EIA, the licensing organization adopted a closer relationship with the local group, consulting them before the elaboration of the terms or references of the second EIA.	- Stakeholders note impacts in uses other than their own; - Recognition of the importance of joint action to solve the problem; - Possible change in the licensing process; - Sectors that had never been involved in the licensing process (as fishermen) joined the group and began to formulate their own manifestos; - The group learned and evolved in each new EIA analysis; - The group sought autonomy to submit its own manifest directly to the licensing authorities despite the official process.

Issue	Group	Characterization	SL Evidence
		Next, the group discussed enlarging the pier of a maritime gas terminal located in São Sebastião and of the Port of São Sebastião. Each new EIA analysis involved more stakeholders (a) and showed improvements in the group's understanding of licensing and environmental threats (d). Despite these positive outcomes, not every MB recommendation was considered by FF in the final document sent for the licensing agency. This generated internal conflicts and discouraged the group. To overcome this situation, MB members decided to submit the group analysis independently, in addition to the official submission to the FF analysis of future EIA processes (c).	

* Indicates discussions that were ongoing during the research period and that could be characterized by observing the process.
More information about these cases can be found in †Vianna; Pires; Cardoso (2014) and ‡Vianna; Pires (2014).
Source: made by the author considering information gathered through documentary analysis, observation of ongoing discussions and informal meetings with the chair of the MB

With reference to the outcomes of SL expressed in Figure 2.1 and the evidence described for APAMLN's discussions (Table 2.2), there is evidence of knowledge acquisition, changes in cognition (shared among stakeholders in the search for a common understanding of issues), changes in social context and the emergence of new relationships (e.g., between fishermen and diving operators). In addition, considering the overall management process from the creation of the MB to the period analyzed, there is evidence of a change in attitude toward the MPA and the building of trust. Changes in stakeholder attitude were more pronounced among fishermen whose initial opposition to the MPA shifted to a more favorable opinion. Fishermen perceive the MPA not only as a bridging organization between local organizations and regulatory agencies but also as a space for discussing sectorial problems (VIANNA; XAVIER, 2014). This is evidenced both by fishermen's discourse during meetings and by the number of groups created to discuss fishing issues (Table 2.1), resulting in the creation of the first TG and three nested WGs.

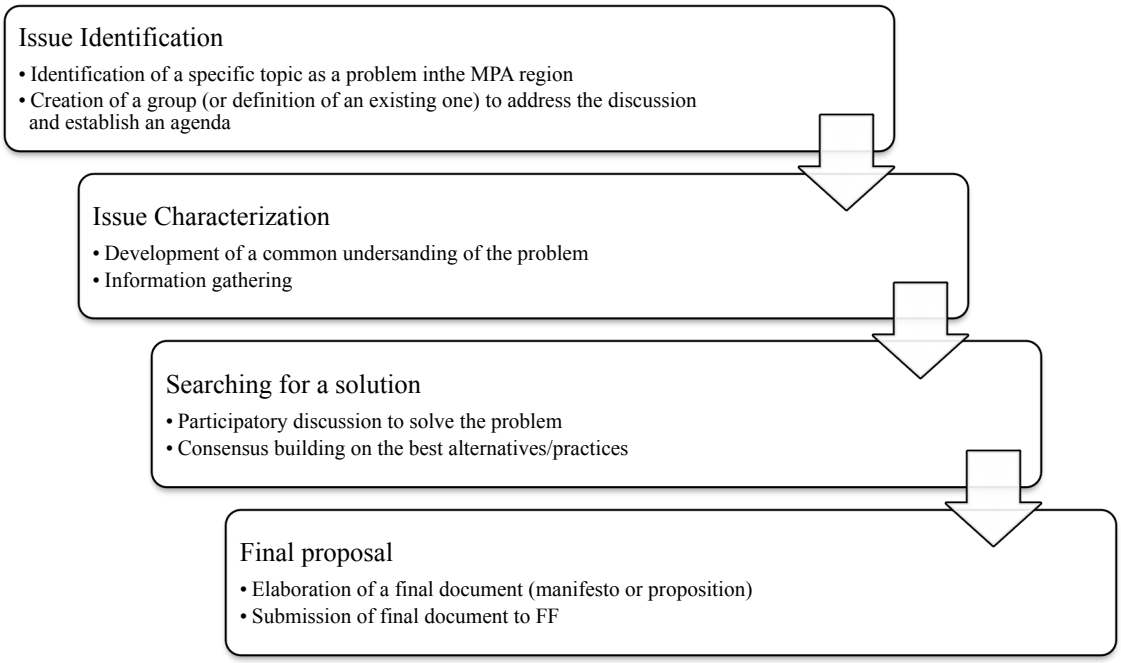
The evidence in Table 2.2 indicates that SL has occurred at different levels (as defined by PAHL-WOSTL et al. 2007). Micro-level changes are evidenced in stronger social organization, social empowerment, changes in stakeholder behavior, collective identification of problems and participatory joint discussions to solve those problems. In contrast, meso-level changes can be found in the establishment of new relationships among

organizations and individuals. No clear evidence of longterm or structural changes was identified. Nevertheless, the early engagement of the MB in licensing processes (during elaboration of the term of reference for EIAs) may be an indicative of macro-level SL.

In APAMLN, SL was issue dependent. In fishing-related discussions, SL is evidenced in the participatory characterization and proposed solutions with the engagement of larger fishing communities, leading to changes both in stakeholders' attitude and in the social context. However, analyses of EIAs tend to involve fewer people but engage different socioeconomic sectors in a broader analysis of problems that considered the entire region, not only a single activity. In these cases, the SL was evidenced both by participants' recognition and indication of impacts that would affect other activities (despite their own sectorial activities) and by the perception of the need for joint and collective action toward a common good focused on the environmental quality of the entire north coast.

Although each discussion had unique characteristics, a common procedure was followed (Figure 2.4). After an issue was identified as a topic for discussion (Issue Identification), a group was created to conduct the discussion (MB, TG or WG). Next, activities and tasks within the group were defined. Group activities were initiated as the development of a common understanding of the issue, with experts and local stakeholders debating the theme and if necessary, conducting field trips to gather additional information (Issue Characterization). After achieving a common understanding of the issue, the group discussed possible solutions (Searching for a Solution), which were structured in a final proposal (Final Proposal). After the MB's endorsement (either with or without modification) the proposal was sent for the FF following the decision-making pathway described in Figure 2.3.

Figure 2.4 – Steps identified in discussions related to management of the Marine Protected Area of the Northern Coast of São Paulo State, Brazil (APAMLN)



Source: Elaborated by the author considering the data gathered by documentary analysis and process observation of APAMLN managerial activities.

2.4.1 Factors affecting SL

In general, the factors described in the cited literature (e.g., MOSTERT et al., 2007) affected SL in APAMLN, fostering or hindering the processes on different scales (internal structure or considering the external governmental system) and having different effects related to the specific social-environmental context. Factors affecting SL in APAMLN preceded the creation of the MPA itself, through federal and state laws (BRASIL, 2000; SÃO PAULO, 2003, 2008a) that determine the need for participatory management of the MPA, thus establishing the fundaments of its *political and institutional structure.* This structure presents two main features that Reed (2008) noted are key to "best practice stakeholder participation" processes, namely, the institutionalization of participation and the possibility of the early engagement of stakeholders, which in APAMLN occurred with the definition of the MB's non-governmental representatives.

Although the MB is formalized and institutionalized, its framework is open, flexible and adaptable, allowing the creation of new WGs or TGs. Some internal *rules* (i.e.,

formalized in the MB's statute) or informal *rules of interaction* agreed upon at meetings (e.g., speaking order, respect for other stakeholders) also guided meetings and board activities. These rules were established in the initial meetings. Although ongoing discussions on the need and beneficial aspects of well-defined rules continue (LEACH; PELKEY, 2001; PAHL-WOSTL et al., 2007; SCHUSLER; DECKER; PFEFFER, 2003), APAMLN seems to have found a balance between the rules necessary to operate (e.g., a minimal quorum, decision by majority vote, minimal attendance for re-election, criteria for creating TGs and WGs) and flexibility during the meetings, favoring both participation and SL.

The SL processes were also favored by the composition of the MB, an institution that assembled the major marine environment-related sectors on the Northern Coast of São Paulo State, representing an important opportunity for the joint action necessary to learning. MB's composition provided both *diversity and representativeness*, which were enhanced through the use of shared board seats between organizations and the presence of other stakeholders at MB, TG and WG meetings and external activities. The MB integrates different sectors that focus on marine-related issues, strengthening or expanding social networks and the flow of information, knowledge and opinions within it, acting as a bridging organization (BERKES, 2009; FOLKE et al., 2005). In turn, this context can foster learning within the group and possibly outside it (KUMLER; LEMOS, 2008; MOSTERT et al., 2007).

Although diversity is key to SL (ARMITAGE; MARSCHKE; PLUMMER, 2008; KUMLER; LEMOS, 2008; LEACH; PELKEY, 2001; MOSTERT et al., 2007; MURO; JEFFREY, 2008; REED, 2008; SCHUSLER; DECKER; PFEFFER, 2003), a large number of stakeholders may make meetings and discussions more difficult, hindering it (LEACH; PELKEY, 2001; MOSTERT et al., 2007). Mostert et al. (2007) suggested that appropriate meeting formats may overcome the problem of having a large number of participants by, for example, working with stakeholders' organizations and umbrella organizations instead of working with individuals. In APAMLN, in addition to working with organizations, the creation of TGs and WGs and localized extra meetings (meeting with a single community at a time) were potential solutions to this problem.

The activities of WGs and TGs can be considered the primary stage for SL processes because it was during those groups' activities that deeper discussions occurred. This arrangement is similar to management processes that focus on a single issue.

Nevertheless, when reporting the discussions of a specific TG/WG to the parental TG and the MB, other members had the opportunity to join the discussion and the SL process could expand, achieving the MB as a whole. TGs/WGs act as a node in a network, linking organizations and sharing their experiences with other nodes (as the MB), enabling SL to affect the entire network (BERKES, 2009; FOLKE et al., 2005).

The same State Law that establishes the institutional structure for the MB establishes its advisory characteristic, which is a major source of uncertainty for the MPA's governance and was the main hindering factor in the period analyzed. SL is hindered in cases in which the group lacks decision-making power (MOSTERT et al., 2007), which can be reflected in occasions when FF does not (either partially or fully) accept MB's propositions. During the analyzed period, most MB proposals were accepted (as in issues 1, 2 and 4 – Table 2.2), which supported board activities and motivated both participation and SL (LEACH; PELKEY, 2001; MOSTERT et al., 2007). Nevertheless, when MB recommendations were not fully accepted, as in the EIA analysis, participants felt discouraged, questioning both their *roles in the management processes* and whether they could actually collaborate. To overcome situations in which the FF does not fully accept the MB's EIA analysis, the group found an alternative method of making the entirety of its work known to the licensing agency. The organizations that participate in the WG's analysis agreed to independently submit their formulated manifest to the licensing agency.

Participatory processes are weakened whenever participants doubt their role and power (WEBLER; KASTENHOLZ; RENN, 1995). Unclear understanding of participants' roles in the management processes and any inappropriate expectation that may result might be built upon a lack of appropriate information (MOSTERT et al., 2007; WEBLER; KASTENHOLZ; RENN, 1995). Therefore, it is highly important for SL that participants' roles be made clear from the beginning (KUMLER; LEMOS, 2008; WEBLER; TULER; KRUEGER, 2001). In APAMLN, information about the role of the MB and its members is reinforced in every new mandate. The MB statute is also distributed to new members so that they are aware of the MB rules.

To promote SL, it is crucial to maintain participants' *motivation and engagement* (MOSTERT et al., 2007; PAHL-WOSTL et al., 2007), especially considering that "champions" have a prominent role in the processes (FOLKE et al., 2005; LEACH; PELKEY, 2001; LEMOS; MOREHOUSE, 2005; ROBERTS; DIEDERICHS, 2002), as is

the case of the MB chair and the coordinators of TGs and WGs. Indeed, in analyzing the keys to success for watershed partnerships, Leach and Pelkey (2001) found that "participation by an effective leader, coordinator or facilitator" (LEACH; PELKEY, 2001, p. 381) (i.e., by a "champion") is one of the two most-cited factors. Nevertheless, leaders' substantial involvement in SL may become a hindering factor when they step away from the process (e.g., issue 3) (KUMLER; LEMOS, 2008; ROBERTS; DIEDERICHS, 2002; VAROL; ERCOSKUN; GURER, 2011). These possibilities enhance the importance of SL to empower other stakeholders and increase process resilience. SL processes may guarantee that even with leadership changes, the group continues to operate.

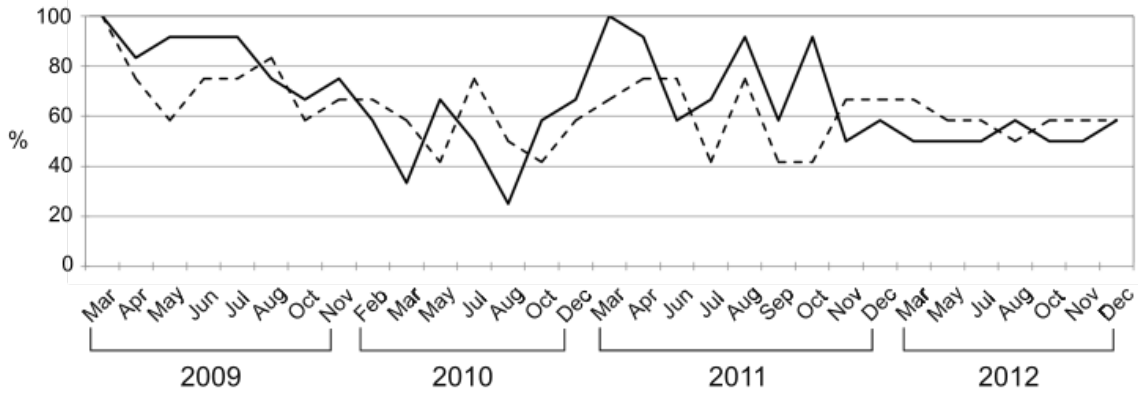
The employment of a skilled neutral facilitator or mediator to coordinate discussions favors both participation and SL (LEACH; PELKEY, 2001; MOSTERT et al., 2007; REED, 2008; SCHUSLER; DECKER; PFEFFER, 2003; WEBLER; KASTENHOLZ; RENN, 1995). Nevertheless, the absence of such a person did not hinder SL in APAMLN, which benefited from the previous *skills* of the chair and other participants. Members' past (personal) experiences in participatory processes can be applied to new groups (KUMLER; LEMOS, 2008) and in APAMLN, these experiences were sufficient both to overcome conflicts and to drive negotiations between stakeholders.

Because SL occurs only through interaction, it is essential to create *opportunities* for actors to meet, discuss, and share their knowledge and interests (GARMENDIA; STAGL, 2010; KUMLER; LEMOS, 2008; MOSTERT et al., 2007; MURO; JEFFREY, 2008; SCHUSLER; DECKER; PFEFFER, 2003; WEBLER; KASTENHOLZ; RENN, 1995). From 2009 to 2012, the board held 31 meetings and the TGs and WGs held another 62 meetings. *Field trips* provided additional and complementary *opportunities for interaction*. This number of meetings required a substantial time investment from the participants. For some non-governmental representatives, attending a meeting requires them to take a day off of work, and not everybody can afford to participate in extended discussions (ARMITAGE; MARSCHKE; PLUMMER, 2008). For this reason, it is necessary to balance the number of meetings to promote discussion and SL without overloading the participants (MOSTERT et al., 2007).

In the Northern Coast of São Paulo State, the same representatives tend to be active in many participatory groups. For this reason, meetings' agenda must consider meetings held by APAMLN and other local groups (i.e., other PAs boards, watershed committee, and regional participatory groups). To avoid overlapping meetings and

discussions, the many regional participatory groups have established an integrated agenda. Nevertheless, a decline in participation in MB meetings from the first to the last meeting of each mandate (March 2009-December 2010 and March 2011-December 2012) was recorded. This resulted in a reduction to a 60% attendance rate considering both governmental and non-governmental representatives (Figure 2.5).

Figure 2.5 – Participation in the meetings of the management board of the Marine Protected Area of the Northern Coast of São Paulo State (APAMLN), Brazil. The graph shows the attendance rate (in percentage values) in APAMLN meetings during the two first mandates (2009-2010 and 2011-2012) considering governmental (continuous line) and non-governmental (dashed line) representatives



The percentage calculation considered the participation of one representative (either a full or an alternate member) per seat out of 24 seats overall.
Source: made by the author.

Attendance varied with the meeting agenda (e.g., EIA discussions tend to engage more people) and place, with greater attendance in central and easily accessed places. Federal representatives were often absent, mainly from the Ministry of Fisheries and Aquaculture (MPAq; acronym for *Ministério da Pesca e Aquicultura*, in Portuguese). The MPAq had little participation in MB meetings and despite receiving frequent invitations, did not join any TGs or WGs. Since fisheries are important subjects in APAMLN discussions, the MPAq's greater involvement could have improved processes and provided closer support for local fisheries. It could also have strengthened the relationship between state and federal organizations and possibly shortened feedback loops and the overall duration of the processes that discussed fishing regulation.

Through TG and WG activities, learning was promoted in the *integration* of different values, different perspectives and *traditional and technical knowledge* into the *joint characterization* of the issues under discussion. Participatory characterization, based on technical and local knowledge, leads to the framing and reframing of issues, creating not only a shared understanding of problems but also a shared recognition of goals and possible solutions, along with a wider ownership of solutions, all of which are

characteristic outcomes of SL (KUMLER; LEMOS, 2008; MOSTERT et al., 2007). This can be identified, for example, in EIA discussions in which participants debated issues related to other participants' sectors despite the presence of those other sectors. Field trips were an extra opportunity to integrate different knowledge and interests and not only represented opportunities to involve more people in the search for a solution (ARMITAGE; MARSCHKE; PLUMMER, 2008) but also publicized information about the MPA.

SL is favored by *openness and transparency* of discussion processes among both participants and the general public (LEACH; PELKEY, 2001; MOSTERT et al., 2007; MURO; JEFFREY, 2008). Openness in APAMLN meetings included openness in discussion themes, which were proposed and prioritized by MB members. Meetings were open to the general public and meetings' records and documents discussed or produced in the MPA were available for consultation, guaranteeing transparency. In addition, during long discussion processes, the strategy of *constant feedback* (both through mailings and during every meeting) was used to avoid a lack of interest.

Despite these local actions, *openness and transparency* did not apply to the entire vertical structure when MB proposals were sent forward. In the EIA analysis, board members received little feedback about the FF's elaboration of the final analysis and were only informed of what was sent for the licensing agency after the processes were complete. Even in cases in which feedback was provided, the time span between the submission of a proposal and the response from FF or other organizations involved tended to be long, and the waiting period may have demotivated stakeholders.

The participatory approach is *per se* time demanding. Moreover, the institutional bureaucracy increases time demands to an extent that may hinder SL processes. A lack of vertical integration has been reported as a hindering factor for SL (MOSTERT et al., 2007), and one expected result of SL processes would be stronger vertical integration, approximating organizations, shortening feedback loops and causing institutional changes, leading to changes at the meso and macro levels (PAHL-WOSTL et al., 2007).

Funding is another important factor for successful participatory processes (KUMLER; LEMOS, 2008; LEACH; PELKEY, 2001; MOSTERT et al., 2007). Unlike other PAs, in which financial support is a problem (GELUDA; SERRÃO; LEMOS, 2014; GERHARDINGER et al., 2011; KUMLER; LEMOS, 2008; PRATES; SOUSA, 2014; TOROPOVA et al., 2010b), APAMLN has been provided with the necessary funding to

provide structural, equipment and personnel resources, facilitate field trips and organize meetings (VIANNA; XAVIER, 2014). Many of APAMLN's achievements have only been possible because of the IDB's financial support. Nevertheless, in light of the fact that this support may not be available in the future, new funding sources must be identified to guarantee continued support for the MB's activities.

2.5 CONCLUSION AND FINAL CONSIDERATIONS

With reference to the difficulties in managing multi-environment MPAs in a participatory cross-scale management processes and the importance of SL in improving participatory management in such complex situations, the characterization of APAMLN's management was based on two questions. First, is there evidence of SL in APAMLN's participatory management? Second, if the answer to the first question is yes, which factors may promote or make SL processes difficult in this context?

Our analysis of APAMLN's management processes showed that SL processes can occur naturally in the management of MPAs with a large number of stakeholders with different interests. Evidence of SL was identified in stronger social organizations and social empowerment, changes in stakeholder behavior, the collective identification of problems and participatory joint discussions to solve them (micro level), the establishment of new relationships among organizations and individuals and proposals for sustainable uses in the region (meso level), as seen in proposals for fishing regulations and the engagement of local stakeholders in environmental licensing processes.

In APAMLN, SL was issue dependent and occurred mainly in the smaller, more focused groups, which acted as nodes in a larger network in which what is learned can be passed through other nodes, ultimately achieving the entire network. The main factors affecting SL in APAMLN were similar to those reported for other participatory processes. They include the existence of a political and institutional structure, proceedings for interaction and information dissemination and the engagement of a diversity of stakeholders. Nevertheless, some strategies involving specific factors promote SL in the context of large MPAs. Those strategies include working with a large number of

stakeholders and discussing different issues simultaneously, promoting discussion in small groups but scaling up the learning.

To engage more stakeholders in the management processes, including representatives of the many activities within the large area affected and representatives of the many organizations related to their management, it was decided that organizations would share board seats. To prevent an excessive number of stakeholders from hindering participatory processes, discussions of issues considered important to the MPA's management are conducted in smaller groups that engage those more closely related to the issue. These smaller groups, nevertheless, can involve more organizations and increase diversity of participation.

The creation of specific smaller groups is also a strategy to discuss different issues at the same time. In APAMLN, simultaneously discussions were possible given the existence of a management team that assisted to coordinated the smaller groups. This attracts attention to one additional factor that contributes to SL in large areas: the need for human resources to engage in managerial activities.

Nevertheless, SL should not be limited within smaller groups; to achieve the entire network, it is important to scale up. Since the internal governance structure establishes that the groups report (and when necessary, rediscuss in less detail) every discussion to the MB, what is learned in the smaller groups achieves the broader social network.

Our analysis was limited to the four initial years of the management process. As a process, SL continues and may achieve broader scales, promoting changes that lead to new social-environmental contexts. There remains much to be understood and improved in co-management of MPAs. However, although local characteristics are crucial to SL and there is no formula for success (LEACH; PELKEY, 2001), other MPAs and participatory management initiatives can build on APAMLN's positive experiences in their own management processes.

3 SOCIAL LEARNING PROCESSES IN MARINE PROTECTED AREAS UNDER A STAKEHOLDERS' PERSPECTIVE

ABSTRACT

The concept of social learning (SL), which is the joint and collaborative learning that a group undergoes, has been increasingly investigated in studies about participatory management of a varied set of themes. The importance of SL processes in promoting stronger and more resilient governance systems increases with the greater social-environmental complexity of the areas to be managed. Identification of factors that contribute to these processes is, for this reason, crucial to guide managers through improvements in governance and management. This chapter aim to increase the understating of the factors affecting social learning processes in the management of marine protected areas (MPA) by analyzing the perception of the stakeholders involved in a process where social learning has already been evidenced, the Marine Protected Area of the Northern Coast of São Paulo State (Brazil). A questionnaire based on the casuistic relationship between the occurrence of factors already identified as influencing SL in this MPA and stakeholders' perceptions was formulated and sent for all representatives of the management board of the MPA. Aspects of conduction and organization of MPA management with focus on SL emerged or were reinforced as: the need of broadly advertising of managerial activities and engaging local community to promote learning beyond the management boards; increasing diversity in participation, considering not only different sectors, but also different organizations within a sector; encouraging participation of local organizations which activities can impact the MPA; guaranteeing diversity of issues discussed as not to favor a single sector; and, especially to large MPAs, give special attention to the selection of meetings' location intending to lower travel costs. The additional information from stakeholder's viewpoint and criticism about the participatory process is an evidence of SL and the importance of a close participation to contribute to process outcomes, but also to process steps.

3.1 INTRODUCTION

Social learning (SL) represents the process of stakeholder's interaction, where knowledge, perceptions and interests are exposed and exchanged in collaborative discussions to solve environmental problems (BLACKMORE, 2007; ISON; RÖLING; WATSON, 2007; JIGGINS; VAN SLOBBE; RÖLING, 2007; KUMLER; LEMOS, 2008; LEACH; PELKEY, 2001; PAHL-WOSTL, 2006; PAHL-WOSTL et al., 2007; PAHL-WOSTL; MOSTERT; TÀBARA, 2008; RIDDER; MOSTERT; WOLTERS, 2005; STEYAERT; JIGGINS, 2007).

Social learning is affected by local context and by factors related to the governance processes, which also affect stakeholder's participation in decision-making (ARMITAGE; MARSCHKE; PLUMMER, 2008; MOSTERT et al., 2007; MURO; JEFFREY, 2008; PAHL-WOSTL; HARE, 2004; REED et al., 2010; REES et al., 2005). As a result, SL processes can lead to an increase in social capital and result in stronger and more resilient governance systems, more fit to environmental, social, institutional and political context where it occurs (ARMITAGE; MARSCHKE; PLUMMER, 2008; BERKES, 2009; BERKES; COLDING; FOLKE, 2000; GARMENDIA et al., 2010; MOSTERT et al., 2007; MURO; JEFFREY, 2008; PAHL-WOSTL et al., 2007; PAHL-WOSTL; HARE, 2004; REED et al., 2010; REES et al., 2005; RIDDER; MOSTERT; WOLTERS, 2005). General features affecting SL processes and possible outcomes, drawn from literature (ARMITAGE; MARSCHKE; PLUMMER, 2008; BLACKMORE, 2007; CRAPS, 2003; CRAPS; MAUREL, 2003; GARMENDIA; STAGL, 2010; KUMLER; LEMOS, 2008; MOSTERT et al., 2007; MURO; JEFFREY, 2008; PAHL-WOSTL et al., 2007; REED et al., 2010; SCHUSLER; DECKER; PFEFFER, 2003; STEYAERT et al., 2007; WEBLER; KASTENHOLZ; RENN, 1995) were summarized in Chapter 2 (Figure 2.1).

The concept of SL has been increasingly applied in water management literature. More recently, SL studies have widened to other environmental context, such as coastal areas and fisheries (ARMITAGE; MARSCHKE; PLUMMER, 2008; STEYAERT; JIGGINS, 2007) and alternative energy policies (GARMENDIA; STAGL, 2010). None of these studies, however, focused on the management of large environments, such as the marine and coastal protected areas that have been increasingly created (FOX et al., 2012;

MARINESQUE; KAPLAN; RODWELL, 2012; TOROPOVA et al., 2010a), e.g., the Marine Protected Area of the Northern Coast of São Paulo State, created in 2008 in Brazil (covering about 316 thousand ha), or the most recent large marine protected areas created in 2016, the Papahãnaumokuãkea Marine National Monument, in Hawaii (covering approximately 151 million ha) and the Ross Sea Marine Reserve in the Antarctic Ocean (covering circa 155 million ha).

Although the social-ecological complexity of MPAs points to the need of participatory management (ARMITAGE; MARSCHKE; PLUMMER, 2008; JENTOFT, 2000; LEACH; PELKEY, 2001), such management represents a difficult task due to some intrinsic characteristics of a tri-dimensional, multi-habitat, open access and common use environment. Such characteristics include limited scientific knowledge, limited budget, multiple stakeholders and interests at stake (ARMITAGE; MARSCHKE; PLUMMER, 2008; JABLONSKI; FILET, 2008; LEACH; PELKEY, 2001; MOSTERT et al., 2007) and shared competence among governmental organizations of the management of marine activities and areas (JABLONSKI; FILET, 2008; JENTOFT, 2000). Such complexities are also known to hinder SL processes.

Despite these challenges to SL, it is in complex scenarios that SL's contributions can best benefit the management process. In Chapter 2, SL processes were identified in the management of the Marine Protected Area of the Northern Coast of São Paulo State (APAMLN; acronym for *Área de Proteção Ambiental Marinha do Litoral Norte de São Paulo*, in Portuguese). Factors that influenced SL were also identified and were mainly related to the external political and institutional management structure (other organizations related to coastal and marine management) and by APAMLN's own governance structure and functioning. Although this study was based on an extensive analysis of APAMLN's documents, complemented by the observation of ongoing processes and interaction with marine board chair, the perception of other stakeholders involved in the process was not considered.

The way a person perceives a process affects her willingness to participate and, as a consequence, the outcomes of the processes (DIDUCK; SINCLAIR, 2002; RAAKJÆR NIELSEN; MATHIESEN, 2003). The factors that affect social learning are related to how APAMLN's management is organized and operates, therefore they directly affect those participating in the process and their perceptions can provide new elements to increase the understanding of participatory management and social learning processes. In this chapter

the factors previously elected as affecting social learning in the management of large MPAs are further investigated by introducing a new element to the analysis, the opinion and perception of stakeholders involved in such management about some of the factors. By considering their opinion in the analysis and contrasting it with perceptions derived from process observation it is possible to improve the understanding of how SL processes can be fostered in the management of marine and coastal areas.

3.2 STUDY CASE AND METHODS

3.2.1 The Marine Protected Area of the Northern Coast of São Paulo State

The Marine Protected Area of the Northern Coast of São Paulo State (APAMLN; acronym for *Área de Proteção Ambiental Marinha do Litoral Norte do Estado de São Paulo*, in Portuguese) was created by State Decree in 2008 (SÃO PAULO, 2008) covering about 316 thousand ha of coastal waters from four municipalities of Northern São Paulo State coastal area (Figure 2.2). When it was created APAMLN confronted great opposition of local stakeholders, who feared the limitation of their activities in favor of environmental protection, as already experienced in the region (BEGOSSI, 2006; REGO, 2006; XAVIER, 2009). Such stakeholders previously interpreted APAMLN as a threat (VIANNA; XAVIER, 2014), but further joined the management board (MB) and engaged in the managerial activities, increasing their understanding and changing their perception of APAMLN's role and objectives (as seen in Chapter 2), which, accordingly to the decree that created the MPA, are to promote environmental protection and the sustainable management of economic activities (fishing, aquaculture, sports, tourism, mineral extraction etc.) within its territory.

APAMLN operates through its MB, which is an advisory group composed of representatives of the main marine related sectors, with 24 seats equally divided between governmental and non-governmental organizations (SÃO PAULO, 2003, 2008). Board seats can be shared by two organizations (one as full member, the other as alternative member), increasing the number of organizations that can participate in the MB. During

2009-2010 mandate the board was composed of 37 different organizations and during the 2011-2012 mandate it was composed of 35. It is chaired by the representative of the State Forestry Foundation (FF; acronym for *Fundação Florestal do Estado de São Paulo* in Portuguese), who counts on a team of technicians and trainees (Chapter 2) that assist in the managerial activities as organizing meetings, field trips, register the meetings etc. As an advisory board, MB'S propositions are under the authority of the FF and the State Environmental Agency (SMA; acronym for *Secretaria Estadual de Meio Ambiente* in Portuguese), which have the power to accept or modify boards' propositions and state them as rules (SÃO PAULO, 2008).

MB's procedures are formalized in its statute, which establishes the main procedures to MB meetings and decision-making process, such as minimum number of meetings per year, necessary quorum for meetings and voting, and guidelines for the operation of Thematic Groups (TGs) and Working Groups (WGs). These groups are created within the MB to discuss specific problems, allowing the development of different discussions simultaneously, which are reported to the MB so that every member is aware of what is happening within the MPA management. Participation in these groups is opened to all interested people.

Through the years, APAMLN has established a procedure for participatory discussion processes that comprises four basic steps: issue identification, issue characterization, discussion and consensus building over a solution and the final proposal of the agreed solution (Figure 2.4). The discussions carried out in MB's, TGs' and WGs' meetings are the main stages for the collaborative problem solving and social learning.

Meetings are generally held in Caraguatatuba, the centermost city of the Northern Coast, during business hours (8 a.m. to 12 a.m. or 2 p.m. to 6 p.m.). They are open to the general public that, although being unable to vote in the case of MB, can actively participate in the discussions. The records of meetings or any other document produced during discussions are made available to the public, disseminating information of APAMLN's activities. Beside meetings, field trips represent additional opportunities to promote stakeholders interaction, produce information and disseminate managerial activities and information about the MPA for the general public.

3.2.2 Data collection and analysis

With reference to factors that were already identified as affecting social learning processes in APAMLN (Chapter 2), a questionnaire was formulated to evaluate the perception of members of APAMLN's management board regarding two main contexts: (a) the external management structure, with factors related to MB's advisory characteristics that subject its proposals to the approval of other State Government organizations – considered the main hindering factor to SL and (b) APAMLN's governance structure and functioning, related to the MPA's objectives, roles and procedures for management discussion and to the composition of the MB and the engagement of the stakeholders.

The questionnaire contained opened and closed questions (Yes or No or a 3-level satisfaction scale: highly satisfactory/satisfactory/unsatisfactory) to evaluate MB members' opinions, views and perceptions on the APAMLN management processes that were linked to the analysis of SL. Questions investigated members' opinions and knowledge about MB's influence in the management of the area, MB's role and activities and stakeholders' engagement (their own and of other stakeholders). Questions were formulated considering a casuistic relationship between respondents' answers and the importance they attribute to the factors identified in the previous analysis of SL in APAMLN (Chapter 2), the factors considered and the casuistic relationship assumed are presented in Table 3.1.

Table 3.1 – Strategy to analyze stakeholders' opinions about the factors affecting social learning processes in the management of the Marine Protected Area of the Northern Coast of São Paulo State (APAMLN). The analysis considered two contexts, the external management structure and the internal governance structure and functioning. The questions (C) were formulated based on the assumption of a casuistic relationship between factors affecting SL (A) and stakeholder opinions (B)

(A) Factor affecting	(B) Casuistic relationship	(C) Questions
CONTEXT: EXTERNAL MANAGEMENT STRUCTURE		
External Political and institutional structure: + MB's relationship with other management organizations;	Respondent has a positive opinion about MB's relationship with other management organizations;	Q1. How do you evaluate APAMLN's MB interaction with other management organizations? (SATS) Q2. How do you evaluate the influence of MB's discussions in the activities of other municipal, state and federal organizations? (SATS)
- Legislation establishes MB's advisory characteristics.	Respondent has a negative opinion about acceptance of MB's proposals by the State Environmental Agency.	Q3. Are MB decisions accepted by the State Environmental Agency? (Y/N)

(A) Factor affecting	(B) Casuistic relationship	(C) Questions
CONTEXT: APAMLN'S GOVERNANCE STRUCTURE AND FUNCTIONING		
Acknowledgement of APAMLN and MB's roles and limitations: + Inform APAMLN's objective and MB's and participants' roles in the management processes.	Respondent is aware of the main objectives of the MPA; Respondent has reasons to participate that are coherent with roles.	Q4. In your opinion, what are the main objectives of the MPA? (Op) Q.5 Why do you participate in the MB? (Op)
Established rules: + (Sufficient) Rules guiding interactions, TGs and WGs procedures.	Respondent recognizes the existence of rules guiding APAMLN management; Respondent has a positive opinion about the existing rules.	Q6. Are there stated rules that guide APAMLN's activities? (Y/N) Q7. If positive, do they facilitate participation? (Y/N)
Diversity and representativeness: + Major marine related sectors represented in MB;	Respondent sees APAMLN's activities as aligned with major local needs and affecting local stakeholders;	How do you evaluate MB's activities considering: Q8. Local relevance: are they aligned with local social needs? (SATS) Q9. Social engagement: are they leading local community to discuss environmental issues? (SATS) Q10. Are MB actions reflected in the daily life of society? (Y/N)
+ Diversified composition of MB.	Respondent recognizes that all the important sectors are represented in the MB.	Q11. Do you identify any organization that should be invited to the MB? (Y/N – Op)
Participants' motivation and engagement: + Members engage in MB's, TGs' and WG's activities;	Respondent has a positive opinion on their own and on other stakeholders involvement with groups' activities;	Q12. How do you evaluate your engagement in MB activities? (SATS) Q13. How do you evaluate other members' engagement in MB activities? (SATS)
+ Leaderships arise, coordinating and facilitating discussions.	Respondent has a positive opinion on the involvement of leading people (e.g.,: TGs and WGs coordinators).	Q14. Do you think that the most engaged members favor other members' participation? (Y/N)
Creation of TGs and WGs: + Focused discussions; + Extra opportunities for interaction; + Involve stakeholders despite MB membership.	Respondent has a positive opinion on TGs' and WGs' activities.	Q15. Do TGs and WGs enable deeper discussion of local problems? (Y/N) Q16. If positive, how? (Op)
Opportunities for interaction: + There are many opportunities to interaction, including meetings and field trips**;**	Respondent has a positive opinion considering the number of meetings;	Q17. Do you think MB hold an adequate number of meetings? (Y/N) Q18. If negative, why not? (Op)
- Increased number of meetings (MB's, TGs' and WGs') is too demanding, hindering participation.	Respondent is demotivated to participate in the meetings.	How do these factors affect your willingness for attending a meeting? Q19. Distance of venues; (SATS) Q20. Meetings' day period; (SATS) Q21. Time availability; (SATS) Q22. Interest in the issues in

(A) Factor affecting	(B) Casuistic relationship	(C) Questions
		discussion. (SATS)
Openness and transparency: + Open activities; + Discussion agenda agreed upon members**;**	Respondent recognizes the collective selection of issues to be discussed;	Q23. Do all members agree upon issues to be discussed? (Y/N) Q24. Are there any organizations that have greater influence in choosing which issues to be discussed? (Y/N)
+ Managerial activities are advertised for local society**;** + Activities' records are available in proper format.	Respondent has a positive opinion on the dissemination of APAMLN information.	Q25. Do you think that communication of APAMLN's activities is effective? (Y/N) Q26. Are APAMLN's documents written in appropriated language that is understandable to all? (Y/N) Q27. Do information about APAMLN's activities reach general public? (Y/N)
Participative and collaborative problem discussion and solutioning strategy: + Participative characterization and search for a solution for a management issue; + Consideration of different interests to reach a common understanding; + Consideration of technical and empirical knowledge.	Respondent has a positive opinion on the discussion process, considering: a) Interaction of members during discussion;	Q28. Do you think MB's members have an opened attitude during discussions? (Y/N) Q29. Do you have an opened attitude during discussions? (Y/N)
	b) New information provided;	Q30. Whenever discussions reach a deadlock, are new information brought to the discussion? (Y/N)
	c) Type of information provided;	Q31. Is traditional knowledge considered for decision-making? (Y/N) Q32. Do technical information prevails over other type of information? (Y/N)
	Respondent recognizes the importance for joint action regardless of their own sector's interests.	Q33. Do you consider that every MB member is essential for APAMLN's management? (Y/N) Q34. Why? (Op) Q35. Who should participate in discussing specific activities within the MPA: every member or the related representatives only?

For each factor (A), "+" indicates positive interferences (fostering factor) and "-" indicates negative interferences (hindering factor) identified in a previous analysis (Chapter 2).
For column (C), SATS indicate closed questions to be answered with a satisfaction degree (highly satisfactory/satisfactory/unsatisfactory); Y/N indicate yes/no closed questions; Op indicates open questions.
For Q35, answers categories were: Specific Organization, MB's chair, Every member or No response.
MB = Management Board; FF = São Paulo State Forestry Foundation; TG = Thematic Group; WG = Working Group.
Source: made by the author.

Questionnaires were distributed in person to every MB members (one for each registered organization) present in the meeting of October 2012, when a brief explanation of the project (about which they were already aware from previous meetings information), of the questionnaire's objective and of the instructions to mail the questionnaires back

were provided. Along with the questionnaire, within an envelope, members received a hand-signed letter encouraging participation and explaining the envelope content, two copies of a signed Informed Consent Form (one to be kept by the respondent and a second one to be sent back to the researcher) and a prepaid postal envelop. For the registered organizations that were not present in the meeting, an envelope and an e-mail with the same content was sent.

The respondents were given a 40 days period to answer the questionnaire and in the middle of this period an e-mail was sent for every MB member to remind and encourage them to participating in the research. Questionnaires were returned personally or sent by e-mail.

Every answer was transcribed to a spreadsheet. For the opened questions, the answers were all read a first time to determine categories of classification (CAPPELLE; MELO; GONÇALVES, 2003). After this first reading, another reading was made to classify the opened answers in the defined categories.

Given the low number of responses (see below), the data was analyzed qualitatively and was complemented with information gathered for Chapter 2, with reference to documentary analysis and observation of ongoing processes.

3.3 RESULTS AND DISCUSSION

Response rate was 11 out of 35 questionnaires, a very low number considering that participation was greatly recommended by board chair since the questionnaire had as secondary objective to contribute to develop an evaluation protocol for MB's activities (comprising some of the questions from Table 3.1 but with additional ones that were not presented here – unpublished work). Because it would serve a specific demand of APAMLN it was a request of the board chair, about which board members were aware of.

Although the number of respondents was low to allow for a quantitative analysis, most of the respondents (9 out of 11) participated in two mandates and had accumulated experience in APAMLN management, providing robustness to the qualitative insights. As a general interpretation, the low number of answers represents the engagement of stakeholders that answered the questionnaire with APAMLN management. Actually, the

respondents were members of some of the organizations most involved with APAMLN's management. Their mean frequency in MB meetings, especially considering the second mandate, when the questionnaire was applied, was greater than the mean frequency of the other representatives in the same sector and of the entire MB members (Table 3.2). Additionally, they are also involved with TG and WG in addition to MB meetings.

Table 3.2 – Sectors that participate in the Marine Protected Area of the Northern Coast of São Paulo State, Brazil, (APAMLN) management board (A) and number of organizations that received and answered the questionnaires for each sector (B), with information about the mean frequency in meetings, for the two mandates for each sector, considering the total number of organizations per sector and the number of respondents of the questionnaire (C)

A - Sector	**B - Nº of MB organizations/Nº of respondents (% of respondents)**	**C - Mean frequency in meetings: MB organizations/Respondents**	
		1st mandate	**2nd mandate**
Non-govern.	20/5 (25%)	42%/69%	45%/55%
Municipal govern.	4/1 (25%)	75%/53%	65%/100%
State govern.	7/3 (37%)	57%/57%	54%/65%
Federal govern.	4/2 (50%)	38%/46%	39%/75%
All members	35/11 (30%)	48%/59%	49%/65%

Source: made by the author.

3.3.1 External Management Structure

Whenever stakeholders are confident of the importance and recognition of their efforts, they feel motivated to participate and SL processes are fostered (LEACH; PELKEY, 2001; MOSTERT et al., 2007; WEBLER; KASTENHOLZ; RENN, 1995). Being advisory, MB lacks decision-making power, which is attributed to FF and SMA (SÃO PAULO, 2008). For this reason, MB proposals must either be supported or adopted by other management organizations, which depends on the relationship and influence of APAMLN in these organizations, or be accepted by SMA to be stated as a legal normative.

In Chapter 2, APAMLN's relationship with other management organizations, the effort to avoid overlapping meetings and discussions and to conduct joint actions, such as in the analysis of environmental impact assessment (Table 2.2), are presented as positive factors that foster social learning. According to respondents, the relationship of APAMLN's MB with other management organizations considering their interaction (Q1) and the influence of APAMLN's discussions in them (Q2) was satisfactory, concurring

with the previous findings that such relationships have a positive influence on SL (Table 3.3).

Concerning the acceptance of APAMLN's proposals by SMA (Q3), responsible for turning it into a legal regulation, it was previously considered a hindering factor since it was observed that some MB proposals (related to EIA analysis) were not fully accepted by FF, leading to a questioning about member roles in the participatory process. Nevertheless, respondents' opinions about SMA's acceptance of MB proposals were divided. One half (six) of the respondents considered that they have been accepted, while two indicated that they didn't and three did not answer to the question.

Table 3.3 – Responses of the members of the management board of the Marine Protected Area of the Northern Coast of São Paulo State, Brazil (APAMLN) to the questionnaire regarding their opinions about factors related to the external management structure the marine protected area is inserted in, identified as affecting social learning in APAMLN management

Questions	**Answer's categories**			
	HS	**S**	**UNS**	**NR**
Q1. How do you evaluate APAMLN's MB interaction with other management organizations?	4	5	1	1
Q2. How do you evaluate the influence of MB's discussions in the activities of other municipal, state and federal organizations?	0	8	3	0
		Y	**N**	**NR**
Q3. Are MB decisions accepted by the State Environmental Agency?		6	2	3

Total number of respondents = 11.
HS = Highly satisfactory; S = Satisfactory; UNS = Unsatisfactory; NR = No response; Y = Yes; N = No.
Source: made by the author

3.3.2 APAMLN's structure and functioning

Factors related to the APAMLN's structure and functioning considered respondent's answers about APAMLN's and its MB's roles and limitations, the existence of rules governing its operation, MB's composition and the involvement of the members in discussion, its internal structure (TGs and WGs), the organization of meetings, the selection of the issues discussed and the discussion processes are presented in Table 3.4.

According to the respondents, the primary objective of the MPA (Q4) is to promote sustainability, since four out of the six categories identified for this question, and the most recurrent category, pointed to it. Sustainability is expressed in the protection of the local natural environment and in the management of the activities developed in the

MPA. Such description of the objectives is in accordance with the objectives in the state decree that created the MPA:

> [...] to protect, order, guarantee and discipline the rational use of regional environmental resources, including its waters, as well as to order tourism, research and fishing activities and to promote the sustainable development (São Paulo, 2008, clause 1).

This indicates that through participation MB's members broadened their understanding of the management processes and changed their initial perception of APAMLN as a threat, acknowledging its main roles. This change of perception and behavior may be interpreted as an indicative of learning through the process (KUMLER; LEMOS, 2008; MOSTERT et al., 2007; PAHL-WOSTL et al., 2007).

The perceived primary objective reflects the main reasons respondents gave for joining MB (Q5), which were to be part of the discussion and of the activities related to the sustainable management of the MPA (with special interests in the sector each respondent represents). These reasons are compatible with MB's objectives to promote the participatory and integrated management of the MPA and implement sustainability-related actions, advising the management of activities within the MPA (SÃO PAULO, 2003, 2008). For this reason, MB's members are aware of the roles of APAMLN and its MB, evidencing that they understand the possibilities and limitations of APAMLN's work, which positively affects social learning processes (KUMLER; LEMOS, 2008; MOSTERT et al., 2007; WEBLER; KASTENHOLZ; RENN, 1995).

In addition to the state laws that guide APAMLN's management (SÃO PAULO, 2003, 2008), the MB created its own statute, formalizing its operation and the operation of the TGs and WGs within it and guiding the processes of discussion and stakeholder interaction. In addition to it, some unstated rules for respect among participants and ordering the discussions (e.g., establishing a speaking order) were also observed during APAMLN meetings (Chapter 2). One half of the respondents recognized the existence of such rules and declared that they facilitate participation and interaction (Q6 and Q7).

The definition of rules for interaction in participatory processes is considered necessary but can not restrict the processes, what requires flexibility to change and adapt (LEACH; PELKEY, 2001; PAHL-WOSTL et al., 2007; SCHUSLER; DECKER; PFEFFER, 2003) In Chapter 2, it was hypothesized that APAMLN had found a favorable balance between stating rules and granting flexibility, facilitating participation, which is corroborated by the responses obtained here.

The factor related to diversity and representativeness, within the management governance structures, considered the insertion of MB activities in local society (as representative groups would be aligned with local needs) and the diversity of stakeholders involved with managerial activities. With reference to the alignment of MB activities with local reality and daily life of society (Q8), most of the respondents considered the alignment of APAMLN's discussion and local needs satisfactory (2 highly satisfactory and 6 satisfactory). Nevertheless, when considering the insertion of MB's actions in society, stimulating social engagement and affecting daily life (Q9 and Q10), the number of satisfied and unsatisfied respondents was more balanced (1 highly satisfactory, 4 satisfactory and 6 unsatisfactory in Q9 and 6 satisfactory and 5 unsatisfactory in Q10). Such responses seem a paradox since one would expect that the discussion of local relevance issues would have a greater impact on the daily life of society.

If APAMLN has been well succeeded in identifying locally relevant issues, two possibilities emerge for the lower insertion of MB's actions in society: its actions and achievements are not properly advertised and society, though benefiting from them, do not relate them to the MPA, or APAMLN has achieved a few concrete results in the period analyzed. The former was considered otherwise by the respondents that pointed out that information about APAMLN reaches the general public (see Q.27). The latter also does not seem to hold since APAMLN has already prohibited trawl fishing in its area, edited a diving guide, conducted a process to regulate trap net fishing and contributed to EIA analysis (SÃO PAULO, 2009; VIANNA; PIRES, 2014; VIANNA; PIRES; CARDOSO, 2014). Nevertheless, since APAMLN's discussions have focused more on fishing activity (Chapter 2), which is practiced by only a fraction of local population, other groups in the society may not be aware of the management achievements.

For this reason, it is possible that MB actions and discussions stay restricted to those already involved with APAMLN's management and there is a need to better advertise APAMLN's activities. As SL can occur in nodes in a social network (BERKES, 2009; FOLKE et al., 2005), APAMLN can be considered as a node to promote change, but that must bridge with other nodes (e.g., local communities) to promote learning exchange, greater social changes and create new opportunities for joint action, increasing its contribution to the sustainability of the region.

The presence of different organizations and sectors in participatory processes grants the representations of different interests and points of view enriching the discussions

and favoring SL (ARMITAGE; MARSCHKE; PLUMMER, 2008; BEIERLE; CAYFORD, 2002; BERKES, 2004; D'INCAO; REIS, 2002; KUMLER; LEMOS, 2008; LEACH; PELKEY, 2001; MOSTERT et al., 2007; MURO; JEFFREY, 2008; REED, 2008; RENN, 2006; SCHUSLER; DECKER; PFEFFER, 2003). The diversified composition of stakeholders in the discussion promoted by APAMLN and in its MB was characterized as one of the main factors fostering SL processes (Chapter 2), favored by the possibility of sharing MB's seats between two organizations and TGs and WGs activities. The documentary analysis considered that all the relevant organizations related to coastal and marine management were represented in APAMLN (Chapter 2), nevertheless, MB's members identified seven missing organizations (Q11), which were:

a) National Institute for Space Research (INPE; acronym for *Instituto Nacional de Pesquisas Espaciais*, in Portuguese): research organization that works in Earth and space context, researching issues such as weather forecast, remote sensing and geoprocessing, natural resource surveys and environmental monitoring;
b) Ministry of Agriculture, Livestock and Food Supply (MAPA; acronym for *Ministério da Agricultura, Pecuária e Abastecimento,* in Portuguese): Brazilian ministry responsible for regulation and standardization of agriculture and agribusiness and its related services. In the case of APAMLN, it can be related to fishing and aquaculture activities;
c) Integral Technical Assistance Coordination (CATI; acronym for *Coordenadoria de Assistência Técnica Integral*, in Portuguese): organization from the State Agriculture Agency responsible for promoting the sustainable development of rural activities through participatory processes. In APAMLN, CATI is related to mariculture development;
d) TAMAR Project: a non-governmental Brazilian organization created to protect sea turtles and other marine wildlife. It has a local office in Ubatuba developing research, monitoring and environmental educational programs in the northern coast of the state;
e) PETROBRAS: Brazilian publicly held corporation operating in petroleum industry. In the Northern Coast it is present in Caraguatatuba, where there is a gas treatment plant, and in São Sebastião, where its subsidiary

company, TRANSPETRO, operates with fuel transportation. Both areas are, nonetheless, excluded from the MPA;

f) Brazilian Bank: Brazilian financial organization that support cultural and social programs;

g) Representatives of local Neighborhood Associations.

Most of the named organizations represent sectors that are already represented in MB, such as research and education organizations (INPE), non-governmental organization (NGOs, e.g., TAMAR Project) and governmental organizations that are related to fishing and aquaculture (MAPA and CATI). Nevertheless, the ones indicated do not have a seat in the management board, what could be interesting to management since they conduct activities that members officially representing their sector do not, and would certainly bring unprecedented information to the management. Some of the organizations listed (INPE, TAMAR and CATI), despite not official MB members, participated in some TGs and WGs discussions, as observed in the documentary analysis (Chapter 2). Others are not present and would also enhance diversity, such as PETROBRAS, representing the greater mineral extraction industry that operates in the coastal area, which is expanding its operation in the region.

The inclusion of neighborhood associations represents the need to increase the number of non-governmental representatives, bringing local community closer to management. Despite the fact that it would increase diversity, it is necessary to have in mind that APAMLN copes with marine related issues and the indiscriminate inclusion of social representatives may increase the number of stakeholders to a degree that might hinder participation and learning (ARMITAGE; MARSCHKE; PLUMMER, 2008; LEACH; PELKEY, 2001; MOSTERT et al., 2007). Nevertheless, local neighborhood associations are organized and, for those in coastal neighborhoods, have been focusing their attention to some immediate actions such as combating solid waste on beaches (BOSA, 2009). They could be partners in discussing such issue, engaging in WGs, for example, and also collaborating to disseminate managerial activities since they occur across the entire northern coast.

As important as diversity is the motivation and engagement of the representatives in the discussions (MOSTERT et al., 2007; PAHL-WOSTL et al., 2007), especially considering leading people that lead the discussions and can affect (motivating or demotivating) other stakeholders participation (KUMLER; LEMOS, 2008; LEACH;

PELKEY, 2001). Respondents evaluated the involvement of MB's member in APAMLN's activities as satisfactory (Q12 and Q13) and expressed that the most engaged members (e.g., TGs' and WGs' coordinator) favor other member participation (Q14). Indicating that participants' motivation and engagement is a factor fostering SL in APAMLN management.

Involvement in APAMLN activities also considers involvement in TGs and WGs, which amplify the discussions and represent extra opportunities for interaction and joint action that favor SL (GARMENDIA; STAGL, 2010; KUMLER; LEMOS, 2008; LEACH; PELKEY, 2001; MOSTERT et al., 2007; MURO; JEFFREY, 2008; SCHUSLER; DECKER; PFEFFER, 2003; WEBLER; KASTENHOLZ; RENN, 1995). The existence of smaller groups was considered a fostering factor in Chapter 2, and was also considered positive by most of the respondents (Q15), who reported that their benefits reside in the greater convergence of interest of its members, which are fewer in comparison to the entire MB's, and in the possibility to engage in focused discussions (e.g., focused in only one aspect of the issue) for a longer period of time (Q16).

The existence of opportunities for interactions is another factor that affects SL processes. Although providing opportunities for interaction is necessary, an increased number of meetings may be overloading (ARMITAGE; MARSCHKE; PLUMMER, 2008; GARMENDIA; STAGL, 2010; KUMLER; LEMOS, 2008; MOSTERT et al., 2007; MURO; JEFFREY, 2008; SCHUSLER; DECKER; PFEFFER, 2003; WEBLER; KASTENHOLZ; RENN, 1995). The number of MB meetings was regarded as adequate by most respondents (Q17). The two respondents that did not think MB holds an adequate number of meetings justified that (a) the number of meeting was too great for non-governmental representatives, who have other issues to attend; and (b) the number of meetings was not sufficient to solve all issues (Q18). The second respondent, nevertheless, considered that an increase in the number of meetings would possibly lead to a great absence of the representatives and pointed out the creation of TGs and WGs was a good alternative to promote discussion, without increasing MB meetings. This reinforces the importance of TGs and WGs and shows that they do not seem to be overloading participants with extra activities. Yet, the number of meetings of such smaller groups must also be considered to establish a balance between fostering or hindering participation by overloading participants.

With reference to factors that affect the attendance at meetings (Q19 to Q22), respondents time availability to attend the meetings was the major one, while the time at which the meeting is held had a medium to high interference, followed by distance of the venue and interest in the issue in discussion, both showing a medium degree of interference. These answers indicate that, despite considered adequate, the number of meetings may already be overloading participants that do not have the time availability to participate in all the meetings, which are conducted during working hours. Once more, it attracts attention to the need of a balanced number of meetings to promote participation and social learning.

With reference to the venue, two characteristics may negatively affect participation. The first one is the size of the MPA and the participation of representatives from the four municipalities involved. The Northern Coast of São Paulo State extend through more than 250 km of coastline and one of its municipalities is an island, with ferry-limited access. Meetings tend to be held in Caraguatatuba, the most central municipality, implying that representatives from the other three sites, and from other regions, must travel. The second one is the fact that APAMLN does not own a place to hold the meetings, depending on the partnership with local organizations to use their space. This implies that it is not always possible to hold meetings in central areas, and it is necessary to move to distant places with difficult access, hindering participation.

The opened and transparent functioning of APAMLN's management was also considered to be a fostering factor for SL within the MPA management. In this chapter it was analyzed with reference to the selection of issues to be discussed and the dissemination and availability of information about managerial activities. Regarding issues selection to discuss, respondents pointed out that they are collectively identified and prioritized by MB members (Q23), corroborating what was observed in Chapter 2. The shared competence to define the issue to be discussed is part of the effort to promote an opened and transparent management processes that can favor SL (LEACH; PELKEY, 2001; MOSTERT et al., 2007; MURO; JEFFREY, 2008). It was pointed out, nevertheless, that some organizations have greater influence in this matter (Q24). This may represent either a power struggle, the consequence of different distribution of number of seats per sector or even different engagement of representatives. As an example, in Chapter 2 it was observed that most discussions were related to fishing, which can be the result of a greater engagement, and consequently, a greater influence of fisheries representatives, who

perceive APAMLN as a bridge to other governmental organizations, proposing many discussions related to fishing activity (VIANNA; XAVIER, 2014).

To assist participants to join the discussions and also to promote social engagement of other actors, it is important to properly disseminate information, which also makes processes more transparent. The dissemination of information was considered effective (Q25), respondents pointed out that documents are written in suitable language to general society (Q26), and that the information reaches general public (Q27), broadening the number of people that can be aware of and follow what is being discussed.

As seen in Chapter 2, a key point in promoting SL in APAMLN was the established procedure for participative discussion of issues (Figure 2.4). The process is based on the participatory characterization of the issue, so it is important that participants are opened to new perspectives, ideas, interests and knowledge, having an opened attitude during discussions (FOLKE et al., 2005; MOSTERT et al., 2007; MURO; JEFFREY, 2008; PAHL-WOSTL et al., 2007). This seems to be the case in APAMLN, where respondents acknowledge that themselves, and other MB members, have a flexible attitude during discussions (Q28 and Q29) and also that the process is based on the available knowledge, aggregating new information when necessary (Q30), with reference to the importance of both technical and traditional knowledge (Q31 and Q32), which favors SL.

The last point analyzed with reference to the participative discussion was whether board members recognize the need for collective action. The basis for participatory management is the acknowledgement that no organization/individual has all the resources (e.g., knowledge, time, funds) needed to confront the complexity of social ecological systems (BEIERLE; CAYFORD, 2002; BERKES, 2004; D'INCAO; REIS, 2002; REED, 2008; RENN, 2006) Such perception is present in the responses that noted to the necessity of every member to the management of the MPA (Q33), justified by bringing different interests and knowledge/experiences to the discussion and also because management proposals affect every stakeholder in the area (Q34). This assumption was also expressed in the indication of who should participate in different activities (Q35), with the majority of respondents indicating "every member" as responsible. Still, some organizations/individuals were attributed a differentiated responsibility, as to the board chair (that sometimes is not considered as "every member") and to some specific organizations (the ones that are closely related to the activity listed). As an example, research organizations were specifically listed as the ones that should participate in

"discussing gaps to direct research initiatives", even though the same respondent also marked "every member" as responsible.

Table 3.4 – Responses of the members of the management board of the Marine Protected Area of the Northern Coast of São Paulo State, Brazil (APAMLN) to the questionnaire regarding their opinions about factors identified as affecting social learning in APAMLN management, related to the internal governance structure and functioning of the marine protected area

Q	Categories	Response			
					Citations
Q4. In your opinion, what are the main objectives of the MPA?	Regulate the activities in the MPA promoting their sustainability				7
	Environmental protection of the MPA's area				4
	Make the different activities developed in the MPA compatible, promoting sustainability and helping to solve conflicts among users				2
	Promote fisheries management to guarantee its sustainability				2
	Research development				1
	Governmental interest in controlling the management of the region				1
Q5. Why do you participate in the MB?	Be informed and participate in the discussions regarding APAMLN's management and the regulation of activities within its area				5
	Relationship between MB activities and the activities developed by the respondent				5
	Interest in the management of the coastal and marine area				3
	To participate in a process of collaborative/integrated management				3
	Was indicated by the organization				1
			Y	**N**	**NR**
Q6. Are there stated rules that guide APAMLN's activities?			6	3	2
Q7.If positive, do they facilitate participation?			6		
		HS	**S**	**UNS**	**NR**
How do you evaluate MB activities considering:					
Q8. Local relevance: are they aligned with local social needs?		2	6	3	0
Q9. Social engagement: are they leading local community to discuss environmental issues?		1	4	6	0
Q10. Are MB actions reflected in the daily life of society?		0	6	5	0
			Y	**N**	**NR**
Q11. Do you identify any institution that should be invited to the MB?			6	0	5
		HS	**S**	**UNS**	**NR**
Q12. How do you evaluate your engagement in the MB activities?		-	10	1	
Q13. How do you evaluate other members' engagement in the MB activities?		1	8	2	
			Y	**N**	**NR**
Q14. Do you think that the most engaged members favor other members' participation?			10	1	0
Q15. Do TGs and WGs enable deeper discussion of local problems?			10	1	0
					Citations
Q16. If positive, how?					
	Greater convergence of interests				7
	Fewer people				4
	Focused discussions/limited subjects				4
	More time to discuss each issue				4
			Y	**N**	**NR**

Q	Categories	Response			
Q17. Do you think MB holds an adequate number of meetings?			9	2	
					Citation
Q18. If negative, why not?	Too many to non-governmental institutions				1
	There is always some issue that can't be discussed in MB meetings for lack of time				1
		H	**M**	**L**	**N**
How do these factors affect your willingness to attend the meetings?					
Q19. Distance of the venue;		1	6	2	2
Q20. Meetings' day period;		4	3	3	1
Q21. Time availability;		5	2	4	0
Q22. Interest in the issue under discussion.		2	5	2	1
			Y	**N**	**NR**
Q23. Do all members agree about issues to be discussed?			9	1	1
Q254. Are there any institutions that have greater influence on choosing which issues are to be discussed?			4	5	2
Q25. Do you think communication of APAMLN's activities is effective?			9	1	1
Q26. Are APAMLN's documents written in appropriate language that is understandable to all?			7	1	3
Q27. Do information of APAMLN activities reach general public?			8	3	
Q28. Do you think MB members have an opened attitude during discussions?			9	2	
Q29. Do you have an opened attitude during discussions?			9	2	
Q30. Whenever discussions reach a deadlock is new information brought to the discussion?			10	1	
Q31. Is traditional knowledge considered for decision-making?			10	1	
Q32. Do technical information prevails over other type of information?			1	7	3
Q33. Do you consider that every MB member is essential for APAMLN's management?			8	2	1
					Citations
Q34. Why?	To represent the diverse social sectors using the MPA area				4
	To bring different knowledge and experiences to the discussions				2
	To equilibrate the different interests				1
	Because every member is directly affected by the management of the MPA				2
	Some representatives do not contribute to discussion				1
		SO	**C**	**EM**	**NR**
Q35.Who should participate in discussing:	Disseminate information about APAMLN and its management, inviting society to join the management process	1	4(6)	6	1
	Suggest issues to be discussed during meetings	1	0	8	2
	Disseminate information about MB activities	2	1(2)	6	2
	Collaborate in the development and implementation of environmental policies	3	0	7	1
	Present information to inform discussions	1(2)	1(2)	7	2
	Join the discussion regarding the licensing process for local enterprises	0(1)	1(3)	9	1
	Identify information gaps to direct research initiatives	3(4)	1(2)	6	1

Q	Categories	Response			
	Ordering mineral extraction activities in the region	2(4)	2(3)	5	2
	Ordering fishing and aquaculture activities in the region	3(4)	1(2)	6	1
	Ordering industrial activities in the region	3(4)	1	4	3
	Ordering tourism activities in the region	4	1	4	2
	Monitor the uses of financial resources destined to the MPA	1	1	8	1

Y = Yes, N = No, NR = No response; HS = Highly satisfactory, S = Satisfactory, UNS = Unsatisfactory, NR = No response; H = Highly, M = Medium, L = Little, N = Nothing; SO = Specific Organization, C = MB's chair, EM = Every member, NR = No response.
For Question 35, some respondents stated that the task was a shared competence among all MB members (EM) but also attributed special roles to a specific institution (SO) or the board chair (C). The total number of citations for each category considering these cases is indicated in the number in brackets. As an example, for the "Join the discussion regarding the licensing process for local enterprises" (Q35), nine respondents indicated that it is a shared responsibility for all MB members (EM) but one of them indicated as specific institution to cope with them and two indicated that the chair was responsible.
Source: made by the author.

3.4 FINAL COMMENTS

The analysis of the opinions of management board members of the factors affecting social learning was based on the factors previously drawn from documentary analysis and processes observations. Despite the few answers that prevented quantitative approach in the data analysis, they represent the opinion of some of the organizations that are deeply involved with APAMLN's management process, therefore they were considered for qualitative analysis.

In addition to the opinions about the factors that affect SL, the answers provided additional evidence of SL processes when they indicated a comprehension of APAMLN's objectives and role of the management board (Q4 and Q5) as well as the necessity of joint actions to solve local problems (Q35), what was obtained through engagement in effective participatory management of the MPA.

Concerning the factors affecting SL, listed in Chapter 2, responses to the questionnaire corroborated what was previously observed, indicating that it can be hindered by the external management structure, since board's proposals are under the authority of FF and SMA approval, what does not always occur, demotivating participation. Likewise, factors related to the local governance structure and the functioning of the MPA, that were identified by external observation and considered

positive for social learning processes (in Chapter 2), were also emphasized by respondents' opinions: acknowledgement of roles, diversity and representativeness of stakeholders, motivation and engagement of stakeholders, creation of small groups to discuss, adequate number of meetings (opportunities for interaction); opened and transparent management practices and procedures to promote a participative, inclusive and collaborative discussion; all have been positively evaluated by respondents reinforcing their roles as fostering factors.

Since there were few responses to the questionnaire it is not possible to rule out any factor, or identify new ones. However, responses indicate some aspects of the elected factors that could not have been observed in documentary analysis or process observation, but only by participating in the process. The first one concerns the diversity of stakeholders. As already expressed, the management board have a very diversified composition and all the relevant sectors operating within the MPA are represented, so it is expected to discuss relevant issues to these sectors. Secondly, MB members do not consider that managerial activities are affecting the daily routines of local residents, indicating that either the MPA is not successfully advertising its deeds or in identifying the themes to be discussed, which could be revised as to promote more social engagement and to connect with nodes of the local network to favor SL.

Additionally, indications of organizations that should be invited to participate evidence the need to increase diversity within the sectors, for instance, INPE's research field is different from the field of every research organization that was present in MB, in the two mandates (see Chapter 4). Also, it emphasizes the need to engage local institutions. In addition to INPE and MAPA, every other organization listed has a local office. Finally, it evidences the need of considering organizations that, despite not based on the territory of the MPA conduct activities that can affect it, as is the case o PETROBRAS and TRANSPETRO, and, it is possible to add, the Port of São Sebastião, the larger regional enterprises operating in the Northern Coast of São Paulo State. For this reason, diverse participation should encompass diversity of sectors and within sectors, focus on local organizations and consider the inclusion of organizations that, despite not based on the MPA, develops activities that can affect it, directly of indirectly.

Concerning the opportunities for interaction, the number of meetings was considered balanced and adequate, not overloading participants, both in Chapter 2 and by respondents. Nevertheless, the fact that time availability was considered as a factor of great

influence in meetings attendance may evidence that the number of meetings is achieving its limit. Another factor that the questionnaire brought to light was the importance of organizing meetings in accessible places concerning the large size of the MPA and the distances across the different municipalities, as to lower travel costs. In Chapter 2, the attendance rates in relation to the venues was briefly discusses and the answers provided by respondents indicate that this is an important factor that could be further analyzed as hindering participation processes (FRASER et al., 2006; WEBLER; KASTENHOLZ; RENN, 1995).

Finally, the answers attracted attention to the fact that participants have the impression that some organizations have greater influence in the electing issues to be discussed. Whether it is an impression that represents a power struggle or the consequence of different participation of sectors (in number or in engagement) it was not possible to determine. But such impression can cause rupture in the SL processes, where all stakeholders must be considered as equals, and should be early addressed by managers.

The findings reported in this chapter reinforce the findings in Chapter 2 and provide new insights on evidences of social learning in the management of APAMLN, as well as on factors to foster it. Although based on the same factors, these results point out to aspects that had not been previously observed, related to stakeholders' perception of the management process. Some of them represent specific situations of APAMLN (advertising information, diversity of stakeholders, number of meetings and issues election) but can be considered in the conduction of any participatory process. One of them, to locate meetings as to favor participation, represents an unique managerial challenge for large protected areas, where stakeholders may have to travel long distances to participate in meetings, making it even more important to motivate and engage them so that they are not demotivated by distance. In this context, promoting SL can be both the means and the ends of the motivation.

4 ROLE OF RESEARCH AND EDUCATION ORGANIZATIONS IN THE PARTICIPATORY MANAGEMENT OF A MARINE PROTECTED AREA: LIMITATIONS AND OPPORTUNITIES

ABSTRACT

The complexities of environmental problems require greater integration between science and policymaking, considering knowledge integration and co-production and social learning. Nevertheless, there still are gaps in science-policy integration and to overcome them it is important to understand how research and education organizations are engaging in decision-making and how stakeholders perceive their roles on the process. This chapter addresses these two issues analyzing the participation of research and education (R&E) organizations in the management of a marine protected area and the perceptions of the stakeholders involved with this processes about R&E organizations role to understand how it can affect social learning processes and, consequently, integrated management. The analyses were conducted by processes observation and by applying a questionnaire to stakeholders, using the Marine Protected Area of the Northern Coast of São Paulo State, Brazil (APAMLN) as a study case. In APAMLN, R&E organizations participate as official members of the management board (MB), or as external consultants/partners in two distinct moments: in engaging in the discussions of the MB and smaller groups, which promotes interaction, knowledge exchange and co-production, favoring social learning; and as external consultants on management propositions, without necessarily engaging in the discussions, which can hinder social learning and lead to a rupture in the participatory process. Concerning stakeholders' perceptions of the roles of R&E organizations, the primary attributed role is knowledge provision. Nevertheless, participants recognize, and call for, a greater involvement of scientists in the discussions and construction of management propositions but neglect possible roles of scientists, as, e.g., facilitating processes, which indicates a need for decision-makers to better understand the limits and possibilities of R&E organization's participation, in order to explore new and complementary roles. With reference to how participation occurs in APAMLN and the need to improve it, four questions should be answered: how, where, when and which

organizations to engage. These questions can be applied to any management processes and help foster science-policy integration and social learning in environmental management. Nevertheless, a coordinated effort must be taken to change how R&E organizations and scientists value and promote their engagement in participatory processes in order to increase active engagement of scientists in decision-making.

4.1 INTRODUCTION

Ecosystems provide goods and services for humans' life, as habitat, resources to sustain their needs and by treating the waste generated by human activities (MEA, 2003, 2005; DE GROOT; WILSON; BOUMANS, 2002; FUNTOWICZ; RAVETZ, 1991). Nevertheless, nature's provision capacity is limited and humans have been requiring more of the ecosystems than they can provide, threatening them and causing environmental problems (DE GROOT; WILSON; BOUMANS, 2002; DUNLAP; JORGENSON, 2012; ELFES et al., 2014; HALPERN et al., 2008, 2012).

These environmental problems and the impacts that arise from them have multiple causes and consequences that extend from the place of generation to distant areas, such as air and water pollution, or even global coverage as is the case of global warming (DUNLAP; JORGENSON, 2012). They represent complex situations that require new management systems that consider the interconnectedness of ecosystems and the integration of politics, politicians, society and knowledge systems (ARKEMA; ABRAMSON; DEWSBURY, 2006; BEIERLE; CAYFORD, 2002; BERKES, 2004; BLACKMORE, 2007; CURTIN; PRELLEZO, 2010; D'INCAO; REIS, 2002; DIMENTO; INGRAM, 2005; LONG; CHARLES; STEPHENSON, 2015; REED, 2008; RENN, 2006).

Recent studies on environmental management have been pointing out that stakeholder involvement is a key element in these new management system and that participatory processes that engage a diversity of stakeholders in the search for solutions to environmental problems can lead to better management proposals based on the singularities of each local/region/community (ICLEI; IDRC; UNEP, 1996; REED, 2008). Another key element is knowledge exchange among different stakeholders (as information and also as understanding and perceptions – BLACKMORE; ISON; JIGGINS, 2007). In

this sense, scientists, as holders of a specific type of knowledge, have an important role in management and there is an increasing call for their involvement in participatory processes and for the application of scientific knowledge in policy making.

Despite these, studies have shown that gaps between science and management remain (BRADSHAW; BORCHERS, 2000; DIEDRICH; TINTORÉ; NAVINÉS, 2010; DIMENTO; INGRAM, 2005; LAVIS et al., 2003; NURSEY-BRAY et al., 2014; RUDD, 2015; WARD; HOUSE; HAMER, 2009; WOLTERS et al., 2016). Such gaps have numerous reasons.

There are incompatibilities concerning the type of knowledge that is being produced and the period to produce it to accomplish with management needs and decision-making timing (CASH et al., 2003; DIEDRICH; TINTORÉ; NAVINÉS, 2010; MCNIE, 2007; WOLTERS et al., 2016), and even when available and applicable, most scientists confront great difficulties to translate scientific information to non-scientists (ARKEMA; ABRAMSON; DEWSBURY, 2006; BRADSHAW; BORCHERS, 2000; CASH et al., 2003; DIEDRICH; TINTORÉ; NAVINÉS, 2010; GRAHAM et al., 2006; MCNIE, 2007; SCHILLER et al., 2001; WOLTERS et al., 2016).

Cultural differences regarding framing environmental problems and of choosing which information is relevant and how to apply it may lead to frustration and mistrust among stakeholders that hinder knowledge exchange (KE) processes (BRIGGS, 2006; CHOI et al., 2005; CVITANOVIC et al., 2015a, 2015b; DIEDRICH; TINTORÉ; NAVINÉS, 2010; MCNIE, 2007; WOLTERS et al., 2016).

Institutional arrangements and the existence of opportunities for KE, the proximity of management and research and education (R&E) organizations and the personal interest and perceptions of participants about their roles are also relevant in the context (CASH et al., 2006; CVITANOVIC et al., 2015b; DIEDRICH; TINTORÉ; NAVINÉS, 2010; NURSEY-BRAY et al., 2014; RUDD, 2015; WOLTERS et al., 2016). Lack of integration may be caused simply because decision-makers are unaware of the type of knowledge being produced/available (CVITANOVIC et al., 2015b) or the type of knowledge needed for the problems decision-making addresses.

The roles of scientists in decision-making processes are varied from information providers to actual engagement in the process as stakeholders, which affects how scientific knowledge is considered into decision-making (REED et al., 2014; STEYAERT et al., 2007). When scientific knowledge is presented as the absolute source of truth, it is possible

that other stakeholders will not embrace scientific findings (specially if the findings are contrary to their interests). Nevertheless, when it is linked to the process of construction of environmental issues, in the co-production of knowledge, scientific knowledge can gain additional value (REED et al., 2014; STEYAERT; JIGGINS, 2007).

In this context, some proposals emerge based not only on the integration of stakeholders and their knowledge, but also on the co-production of knowledge, as in the Ecosystem Based Management (ARKEMA; ABRAMSON; DEWSBURY, 2006; CURTIN; PRELLEZO, 2010; LONG; CHARLES; STEPHENSON, 2015; RUCKELSHAUS et al., 2008); the Post-Normal Science (FUNTOWICZ; RAVETZ, 1993, 2003), and Citizen Science processes (BONNEY et al., 2009; ZUCKERBERG; BONTER; DICKINSON, 2010).

Collaborative co-production of knowledge is also important to promote social learning processes (the collaborative interaction of stakeholders to solve environmental problems), leading to an increase in social capital and stronger, more resilient and more context adapted governance systems (ARMITAGE; MARSCHKE; PLUMMER, 2008; BERKES, 2009; BERKES; COLDING; FOLKE, 2000; BLACKMORE, 2007; GARMENDIA; STAGL, 2010; ISON; RÖLING; WATSON, 2007; JIGGINS; VAN SLOBBE; RÖLING, 2007; KUMLER; LEMOS, 2008; LEACH; PELKEY, 2001; MOSTERT et al., 2007; MURO; JEFFREY, 2008; PAHL-WOSTL, 2006; PAHL-WOSTL et al., 2007; PAHL-WOSTL; HARE, 2004; PAHL-WOSTL; MOSTERT; TÀBARA, 2008; REED et al., 2010; REES et al., 2005; RIDDER; MOSTERT; WOLTERS, 2005; TIPPETT et al., 2005).

Social learning processes are about changes, i.e. individuals who work collaboratively to develop new meanings and strategies to cope with and solve complex environmental problems (ARMITAGE; MARSCHKE; PLUMMER, 2008; GARMENDIA; STAGL, 2010; PAHL-WOSTL et al., 2007). In these processes, not only the solutions are collective built, but also problems' characterization and understating is a social construction based on stakeholders' interaction (PAHL-WOSTL et al., 2007; STEYAERT et al., 2007), requiring, accordingly, that all types of knowledge are shared and considered together in discussions. In this arrangement, scientists should engage in the participatory processes as stakeholders, with specific interests, sharing knowledge, perceptions and understating, with equal value to other participants, and acting in the production of new, collective knowledge.

Studies of social learning drive attention to yet another role of science: developing researches and facilitating participatory processes as to promote social learning, as seen in literature derived from the SLIM Project (Social Learning for the Integrated Management and Sustainable Use of Water at Catchment Scale – (BLACKMORE, 2007; BLACKMORE; ISON; JIGGINS, 2007; ISON; RÖLING; WATSON, 2007; STEYAERT et al., 2007; STEYAERT; JIGGINS, 2007) and HarmoniCOP Project (Harmonizing Collaborative Planning – (CRAPS; MAUREL, 2003; MAUREL, 2003; MCNIE, 2007; MOSTERT et al., 2007; PAHL-WOSTL et al., 2007; REES et al., 2005; RIDDER; MOSTERT; WOLTERS, 2005; TIPPETT et al., 2005). A summary of the role scientists can play in environmental decision-making is provided in Table 4.1.

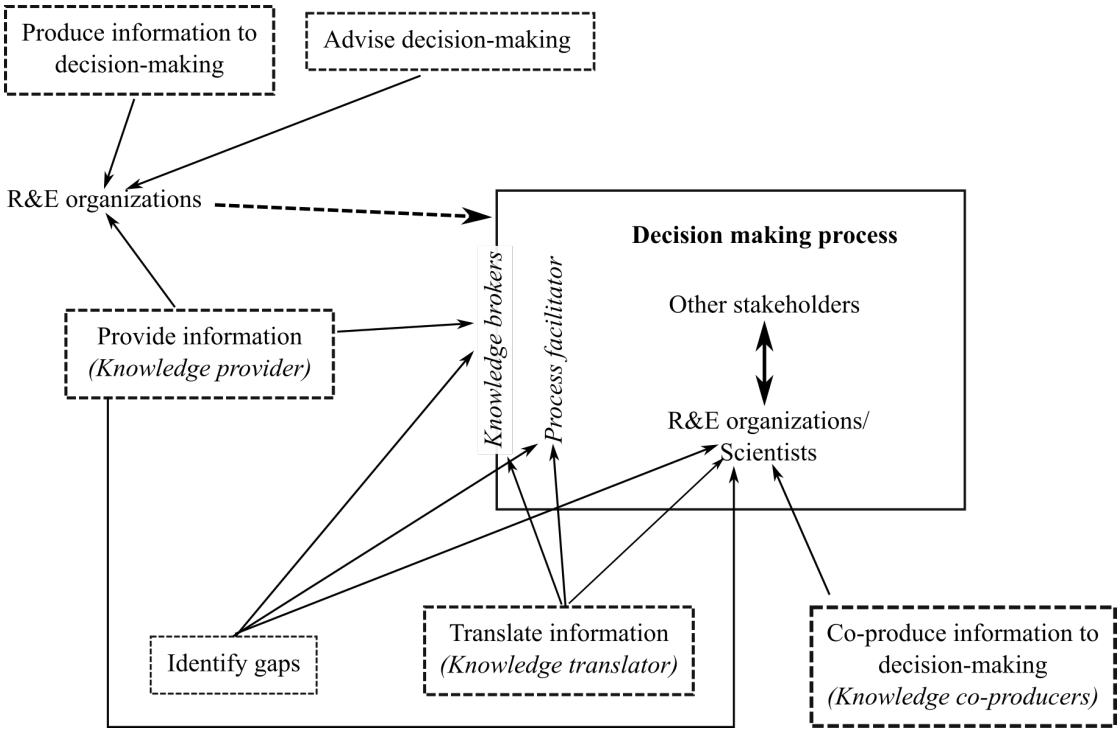
Table 4.1 – Roles scientists can play in environmental decision-making processes

Role	**Role description**
Information/knowledge providers	Provide scientific information on request. When involved in participatory processes act as consultants that answer to specific questions related to their expertise (limited engagement)
Advisers for decision-making	In addition to providing information, experts advice policy-making, providing recommendation to policy outcomes, on demand and with none or limited engagement in participatory processes
Knowledge brokers	Facilitate dialogue between different actors/ knowledge groups, they engage in participatory processes but not necessarily as a stakeholder in the discussion itself, but acting mostly as information translator or bridging individuals
Information translators	Individuals acting as educators contextualizing and interpreting data for non-scientists, engage in participatory processes but not necessarily as a stakeholder in the discussion
Processes facilitators	Facilitate and mediate participatory processes, they engage in the processes but not as stakeholders in the discussion
Knowledge co-producers	Engage in the participatory processes as stakeholders, with specific interests, sharing knowledge, perceptions and understating with equal value to other participants and acting in the production of new, collective knowledge

Source: made by the author considering related literature (BLACKMORE, 2007; BLACKMORE; ISON; JIGGINS, 2007; CRAPS; MAUREL, 2003; CVITANOVIC et al., 2015a; FAZEY et al., 2012; ISON; RÖLING; WATSON, 2007; LEMOS; MOREHOUSE, 2005; MAUREL, 2003; MCNIE, 2007; MOSTERT et al., 2007; PAHL-WOSTL et al., 2007; REED, 2008; REED et al., 2014; REES et al., 2005; RIDDER; MOSTERT; WOLTERS, 2005; RUDD, 2004; STEYAERT et al., 2007; STEYAERT; JIGGINS, 2007; TIPPETT et al., 2005; WOLTERS et al., 2016).

Such roles are non-exclusive and a single organization can have multiple roles at a given discussion, e.g., a process facilitator can also act as a knowledge broker and information translator, while also identifying knowledge gaps to orient future researches. Nevertheless, some roles, as knowledge co-producer, require a greater engagement in the decision-making processes and actually working with other stakeholders to produce knowledge (Figure 4.1).

Figure 4.1 – Possible roles of research and education (R&E) organizations and scientists in decision-making processes



Dashed boxes present the activities/roles a R&E organization or individual scientist can have in the processes, linking them to their positioning in the decision-making-processes: in an external position, within the processes (facilitator or as stakeholder) and as a bridging organization/scientist (as knowledge brokers). Organizations/scientists acting as knowledge brokers usually stand in the "borders" of the decision-making, nevertheless, the ones inside the process can also act as knowledge brokers, if needed.
Source: made by the author

For every role, the degree of scientists' engagement with participatory process, and consequently their collaboration to social learning, depends, on one side, on processes characteristics: who is involved, how is the involvement promoted, carried out and encouraged by organizations, what are the objectives and the bases for decision-making (political, local or scientific premises) (CASH et al., 2006; CVITANOVIC et al., 2015b; DIEDRICH; TINTORÉ; NAVINÉS, 2010; GERHARDINGER; GODOY; JONES, 2009; NURSEY-BRAY et al., 2014; WOLTERS et al., 2016). Managers and other stakeholders can influence on time and degree of involvement scientists can have by inviting them to join the discussion from the beginning or participating in specific moments, evidencing information gaps, deciding whether to consider scientific advice for decision-making since they handle with diverse amount of knowledge and interests, and scientists' is only one of them (CHOI et al., 2005; PULLIN et al., 2004). On the other side, scientists' engagement depend on their perceptions of their role (BRIGGS, 2006; CVITANOVIC et al., 2015b; RUDD, 2004), a flexible attitude to engage in long lasting participatory processes

(LEMOS; MOREHOUSE, 2005) and on adequate institutional support (BRIGGS, 2006; CVITANOVIC et al., 2015b)

In other words, participants' assumptions regarding the role of scientists in management processes (including scientists and R&E organizations) affect the degree in which they become involved with management processes (CASH et al., 2003, 2006; DIEDRICH; TINTORÉ; NAVINÉS, 2010; HISSCHEMÖLLER; HOPPE, 1996; MCNIE, 2007; NURSEY-BRAY et al., 2014; RUDD, 2015; RUNHAAR; VAN DER WINDT; VAN TATENHOVE, 2016; WOLTERS et al., 2016) and this involvement affect back the management processes.

When analyzing the barriers for KE in Australia's marine management system, Cvitanovic et al. (2015a) found that there is a great willingness of scientists to engage and communicate to decision-makers and that they consider it important both in personal and professional level. For countries in development, nevertheless, there is little evidence. In Brazil, more and more research projects are attempting to communicate scientific information to decision-makers and lay public (as an example refer to the material produced by AMARAL et al., 2016; JACOBI et al., 2015; JACOBI; GRANJA; FRANCO, 2006; JACOBI; XAVIER; MISATO, 2013) and even engage in participatory processes joining management boards and joining participatory researches. Examples of the last type of science and policy integration that have more chance of promoting knowledge co-production, nevertheless, remain very limited (but see chapters 5 and 6 of this document). The situation is similar considering the implications of the science-policy integration for social learning. The majority of examples are from SLIM and HarmoniCOP Projects, which focused in watersheds related discussions, and information about other environments and natural resources are scarce.

SLIM's project findings showed that scientists must be aware of other actors' perception about R&E organization roles before engaging in participatory processes (STEYAERT; JIGGINS, 2007). Therefore, it is not only necessary to improve the understating of the science-policy interaction, but also to understand the perceived role of scientists and R&E organizations in participatory decision-making. This understanding can assist the promotion of scientists' engagement in management processes and support knowledge co-production and social learning.

Considering this, the present chapter first characterizes the participation of R&E organizations in the management of a marine protected area in Brazil and the perceptions

of the stakeholders involved with this management process about R&E organizations' role and involvement with the management. Then discusses how the relationship between science and decision-making may foster or hinder social learning processes. By this, it intend to contribute both to the understanding of science-policy interaction and of how they can foster social learning and coastal management.

4.2 METHODS

4.2.1 Study Case: APAMLN and its Management Board

The Marine Protected Area of the Northern Coast of São Paulo State (APAMLN; acronym for *Área de Proteção Ambiental Marinha do Litoral Norte de São Paulo*, in Portuguese) is a sustainable use protected area (IUCN Category IV) established in 2008 (São Paulo, 2008). It comprises islands, mangroves, tidal plains and the coastal waters up to 50 meters deep of the four municipalities of the northern coast, Caraguatatuba, Ubatuba, São Sebastião and Ilhabela, divided in three sectors that cover about 316 thousand ha: Cunhambebe, Maembipe and Ypautiba (Figure 2.2).

The management of APAMLN is carried out through a pluralist advisory board, the management board (MB), composed of 24 seats equally divided between governmental and non-governmental representatives (Table 4.2) (São Paulo, 2008). These seats can be shared by different organizations (one as a full member and the other one as an alternative member), increasing the number of organizations involved with the management process. For example, in the first mandate 37 organizations were part of the MB and in the second 35 organizations participated. The chair of the MB is the representative of São Paulo State Forestry Foundation (FF; acronym for *Fundação Florestal do Estado de São Paulo*, in Portuguese), the organization responsible for managing State's protected areas. A team of technicians and trainees work along with the chair, assisting managerial activities.

Table 4.2 – Distribution of the seats on the management board of the Marine Protected Area of the Northern Coast of São Paulo State, Brazil (APAMLN) between governmental and non-governmental representatives indicating the sectors represented, according to the state decree that define seats' distribution (São Paulo, 2008). Governmental organizations comprise federal, state and municipal organizations

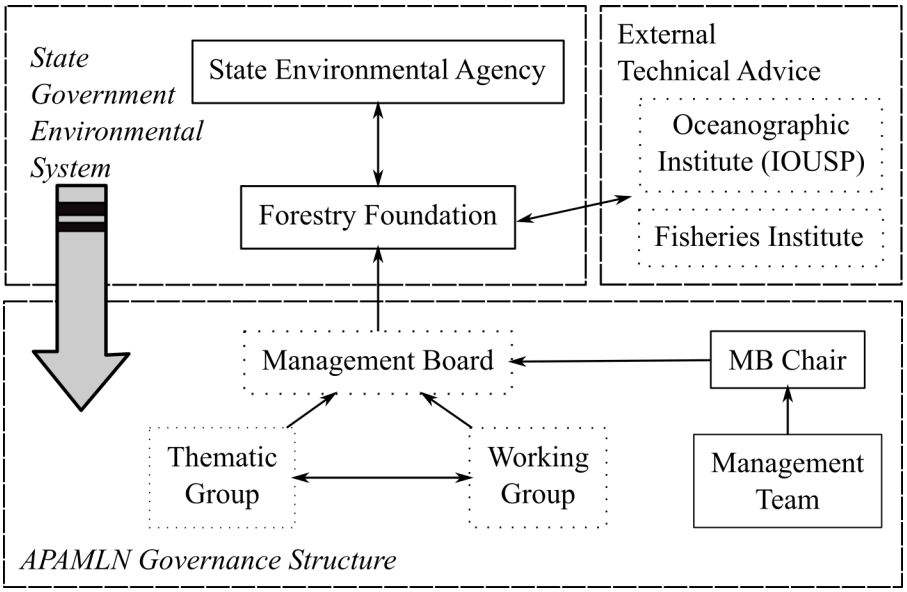
Governmental seats	**Non-governmental seats**
4 Local city halls	5 Fishing and mariculture organizations
4 Environmental and fishing regulation agencies	4 Tourism and sports organizations
3 Licensing and inspectional bodies	2 Environmentalist and non-governmental organizations
1 Research organization	1 University

Source: made by the author

The management board is the main group that discusses every management proposition in monthly/bimonthly meetings. To foster deeper discussions on specific issues, thematic groups (TGs – permanent groups to discuss specific themes) or working groups (WGs – temporary groups to discuss specific issues within a theme) can be created. Participation in these groups is opened (not limited to MB members) and represents another opportunity for increasing the number of organizations involved with APAMLN's management. Although the MPA encourages participants to register as members of the TGs and WGs, many only participate as observers. During the 2009-2012 period there were two TGs (nested in the MB) and eight WGs (nested in the MB or in a parental TG), and the main themes discussed were fishing, licensing processes and environmental impact assessment (EIA) analysis, advertising of APAMLN information, pollution and diving activities (Figure 2.3). Although every discussion is reported to MB, where it can be further discussed with official members, it is in the smaller groups that deep discussions occur and that information is searched and produced to support them.

Since MB is an advisory board, its decisions are submitted to the State Government Environmental System. They have first to be approved by FF, who consults the Oceanographic Institute of University of São Paulo (IOUSP; acronym for *Instituto Oceanográfico da Universidade de São Paulo*, in Portuguese) and São Paulo's Fisheries Institute (IP; acronym for *Instituto de Pesca*, in Portuguese) for technical advice, another opportunity for science-policy interaction. After FF, proposals are analyzed by the State Environmental Agency (SMA; acronym for *Secretaria Estadual de Meio Ambiente*, in Portuguese) to be stated as a legal regulation. Through the years, MB has established a number of partnerships with NGOs, research organizations and individuals scientists that have interest and conduct studies in the area and that collaborate with discussions when possible or invited. The governance structure of APAMLN is represented in Figure 4.2.

Figure 4.2 – The Marine Protected Area of the Northern Coast of São Paulo States, Brazil (APAMLN) governance structure (bottom) showing the hierarchical organization in which management board (MB) is the main group to which thematic groups (TG), and working groups (WG) are linked. MB Chair coordinates MB activities with the assist of a management team. MB propositions are sent for the Forestry Foundation, member of the State Government Environmental System, which consult the Oceanographic and Fisheries institutes and, if approving the proposition, forward it to the State Environmental Agency



Source: made by the author, adapted from Chapter 2

4.2.2 Data collection and analysis

Involvement of research and education (R&E) organizations in the MB and perceived role of R&E organizations in management was characterized by documentary analysis, ongoing processes observation and applying a questionnaire to MB members.

Documentary analysis considered meetings records (of MB, TGs and WGs) and reports, from 2009 to 2012, were used to characterize the contribution of R&E organizations to MB activities. Complementing the documentary analysis, from 2011 to 2012, a single researcher attended MPA meetings observing the participation of R&E organizations.

In the end of the observation period, a questionnaire was administered to MB members to evaluate their perception regarding:

a) the role of research and education organizations in the management board (opened question);

b) the proximity of the management board to research and education organizations (closed question);
c) how research and education organizations have been contributing to management (opened question);
d) how can the contribution of research and education organizations to the management board be improved (opened question).

Questionnaires were delivered during one MB meeting or posted and e-mailed (in cases of absent organizations), one for each MB organization, together with a hand-signed letter encouraging participation, two copies of a signed Informed Consent Form (one to be kept by the respondent and a second one to be sent for the researcher along with the filled questionnaire) and a postage prepaid envelop.

Respondents were requested to answer the questionnaire and send it back to the researcher in 40 days. Response rate was of 30% (11 respondents, with three being form R&E organizations), with participation of governmental and non-governmental representatives. Answers were considered for qualitative analysis, considering the categories that were more cited. Every response was transcribed to a spreadsheet, and a first qualitative analysis of respondents' statements was made to determine categories for the answers (CAPPELLE; MELO; GONÇALVES, 2003). Them every response was re-read and answers were classified in each category. Final analysis considered the total number of citations for each category.

4.3 RESULTS

4.3.1 Participation of R&E organizations in APAMLN management

Six representatives of R&E organizations were identified among the members of APAMLN's MB:

a) São Paulo's Fisheries Institute (IP; acronym for *Instituto de Pesca*, in Portuguese): is a state government research organization linked to the State Agriculture Agency. IP is based on Santos/SP and has a local office

in Ubatuba. IP participated in the two mandates (2009-2010 and 2011-2012) as a full member, occupying the research state government seat. In addition to its membership in MB, is a member of the TG and WGs related to fishing. In addition to participating in the MB, the decree that created the MPA (SÃO PAULO, 2008) establishes that the IP should be consulted about every MB management propositions;

b) Chico Mendes Institute for Biodiversity and Conservation (ICMBio; acronym for *Instituto Chico Mendes de Conservação da Biodiversidade*, in Portuguese) – federal institute linked to the Ministry for the Environment, is responsible for managing federal protected areas, environmental inspection and also carries out researches on natural ecosystem and biodiversity. The institute has a local office in São Sebastião, and participated as a full member in the two mandates (2009-2010 and 2011-2012), sharing a licensing and inspectional seat with other federal organization;

c) São Sebastião College (FASS; acronym for *Faculdade de São Sebastião*, in Portuguese) – private college organization located in São Sebastião and participated as a full member in the first mandate (2009-2010), sharing a civil society seat of the Education and Research sector with CEBIMar/USP;

d) Center for Marine Biology of the University of São Paulo (CEBIMar/USP; acronym for *Centro de Biologia Marinha da Universidade de São Paulo*, in Portuguese): is a specialized research and education institute (for graduation and post-graduation) linked to the University of São Paulo, located in São Sebastião. CEBIMar participated as an alternative member in the first mandate (2009-2010), sharing a civil society seat with the representative of São Sebastião College, representing the Education and Research sector;

e) Oceanographic Institute of University of São Paulo (IOUSP; acronym for *Instituto Oceanográfico da Universidade de São Paulo*, in Portuguese): research and education organization located in São Paulo and with a research station in Ubatuba. IOUSP participated as a full member in the second mandate (2011-2012) sharing a civil society seat from the

educational and research sector with IFSP. As well as IP, the state decree that created the MPA (SÃO PAULO, 2008) establishes that IOUSP should be consulted about every MB management propositions;

f) Federal Institute of Education, Science and Technology of São Paulo State (IFSP; acronym for *Instituto Federal de Ciência e Tecnologia de São Paulo*, in Portuguese): state research and education institute located in Caraguatatuba, participated as a alternative member of the second mandate (2011-2012) of the MB, sharing a seat with IOUSP. Beside participating in MB also participates in TG Fishing and Mariculture and TG Environmental Education and Communication;

These organizations participate in MB meetings and collaborated in the discussions and elaboration of proposals for APAMLN management, contributing with their specific knowledge in cooperation with the other stakeholders. Some of them also participated in thematic groups (TG) and working groups (WG). Participation of IP in the TG Fishing and Aquaculture and related working groups, acting as the coordinator of this TG is especially noteworthy. A synthesis of the participation of R&E organizations that are members of the MB in MB meetings for each mandate and in the TGs and WGs is shown in Table 4.3.

Table 4.3 –Research and education organizations that were members of the management board (MB) of the Marine Protected Area of the Northern Coast of São Paulo State, Brazil (APAMLN) in the two analyzed mandates (MB_1 from 2010-2011; MB_2 from 2011-2012), indicating the frequency of attendance (in percentage) to MB meetings for each mandate, and indicate the participation of the same representatives in other groups, thematic and working groups (TG and WG), within APAMLN governance structure

Organization	**MB_1**	**MB_2**	**TG F&A**	**WG Trap.**	**WG Mar.**	**WG Gill.**	**WG Insp.**	**WG Res.**	**WG Lic.**	**TG E&C**
IP	F(80)	F(70)	M	M	M	M		M	M	
ICMBio	F(33)	F(75)	M				M		M	
FASS	F(13)									
CEBIMar	A(33)							M	M	
IOUSP		F(44)								
IFSP		A(50)	M							M

R&E Organizations/Members: IP = Fisheries Institute; ICMBio = Chico Mendes Institute for Biodiversity and Conservation; FASS = São Sebastião College; CEBIMar = Center for Marine Biology of the University of São Paulo; IOUSP = Oceanographic Institute of University of São Paulo; IFSP = Federal Institute of Education Science and Technology of São Paulo State
Meetings of: MB = Management Board, mandate 1 (MB_1) and mandate 2 (MB_2); TG = Thematic Group; WG = Working Group; F&A = Fishing and Aquaculture; Trap. = Trap Net; Mar. = Mariculture; Gill. = Gillnet; Poll. = Pollution; Insp. = Inspection; Res. = Research; Lic. = Licensing; E&C = Environmental Education and Communication.
Participated as: F = participated as a full member; A = participated as an alternative member; M = registered member coordinator.

In addition to the representatives of these organizations, other researchers (from the same organizations as the representatives or from others) and students (under-graduated and graduated) joined APAMLN meetings and activities, either by their personal interests in the discussed themes or when invited to present information to help discussions. The additional organizations identified were:

a) TAMAR Project: a non-profit Brazilian organization that works to protect sea turtles and other marine wildlife. It has a local office in Ubatuba, developing research, monitoring and environmental educational programs in the Northern Coast of the São Paulo State. TAMAR Project joined the meetings of TG Fishing and Aquaculture and had an unique involvement with activities of the WGs Trap Net and Gillnet;
b) National Institute for Space Research (INPE; acronym for *Instituto Nacional de Pesquisas Espaciais*, in Portuguese): research and education organization that works in earth and space researches, coping with subjects such as weather forecast, remote sensing and geoprocessing, natural resources survey and environmental monitoring. INPE was a member of the WG Research;
c) Federal Fluminense University (UFF; acronym for *Universidade Federal Fluminense*, in Portuguese): research and education federal organization located in Rio de Janeiro State. One researcher of this organization was invited to participate in a meeting of the WG Mariculture for its expertise on *Kappaphycus alvarezii* farming;
d) São Paulo State University (UNESP, acronym for Universidade Estadual Paulista, in Portuguese): research and education organization linked to State government. Some graduated students from UNESP participated in MB's, TGs' and WGs meetings.
e) Faculty of Architecture and Urbanization of the University of São Paulo (FAU/USP; acronym for *Faculdade de Arquitetura e Urbanismo da Universidade de São Paulo,* in Portuguese–): research and education organization located in São Paulo. A graduated student was registered as a member in the meetings of the WG Licensing;
f) Other researchers/students from the organizations that are members of the MB, despite the indicated representatives (see Table 4.4).

Table 4.4 – Members of research and education organizations that participated in the managerial activities of the Marine Protected Area of the Northern Coast of São Paulo State, Brazil (APAMLN) but were not members of the management board. Individuals from these organizations may be researchers or students (under-graduated or graduated) and do not represent the organization they are linked to, participating by personal interests

Organization	**MB**	**TG F&A**	**WG Trap.**	**WG Mar.**	**WG Gill.**	**WG Poll.**	**WG Insp.**	**WG Res.**	**WG Lic**	**TG E&C**
TAMAR		M	M	M	M				O	M
IP	NM	M	M	M	M					
CEBIMar	NM									M
ICMBio	NM	M	M	M			M			
IFSP	NM									
INPE								M		
UFF				I						
UNESP students	NM		NM	NM		NM		M		
FAU/USP student									M	
IOUSP students	NM	M	M					M		M

R&E Organizations/Members: TAMAR = Tamar Project; IP = Fisheries Institute; CEBIMar = Center for Marine Biology of the University of São Paulo; ICMBio = Chico Mendes Institute for Biodiversity and Conservation; IFSP = Federal Institute of Education, Science and Technology of São Paulo State; INPE = National Institute for Space Research; UFF = Federal Fluminense University; UNESP = São Paulo State University; FAU/USP = Faculty of Architecture and Urbanization of the University of São Paulo; IOUSP = Oceanographic Institute of University of São Paulo.
Meetings of: MB = Management Board; TG = Thematic Group; WG = Working Group; F&A = Fishing and Aquaculture; Trap. = Trap Net; Mar. = Mariculture; Gill. = Gillnet; Poll. = Pollution; Insp. = Inspection; Res. = Research; Lic. = Licensing; E&C = Environmental Education and Communication.
Participated as: M = registered member; NM = participated but not as a member; I = Invited to participate by group's coordinator.
Source: made by the author.

TAMAR Project and IP members engaged mainly in fishing related activities. TAMAR was even elected as the coordinator of WG Gillnet. CEBIMAR continued participating in MB meetings during the second mandate, when it was not a MB member. Other members of ICMBio also followed MB discussions and had a particular engagement in WG Inspection, since inspection is also a role of this organization.

Participation of members of the other organizations was more sporadic. Members of IFSP were present in two MB meetings in the first mandate, before joining as MB members in the second. A researcher from the UFF participated in one meeting when he was invited to a round table discussion about the farming of *Kappaphycus alvarezii*.

Members identified as related to UNESP and IOUSP were mainly graduated students who participated in MB and many TGs and WGs. Some were driven by their researches (according to the their introduction in the meetings) and had a longer participation, usually registering as members; others were driven by curiosity and had a single or sporadic participation, as non-members. Analysis of frequency in the meetings

for this last group shows that even the ones that register as members have a sporadic attendance rate.

Despite the participation of R&E organizations and members in the different groups, other interventions observed were:

a) a lecture about the environmental management councils of the Northern Coast of São Paulo State, in May 19, 2009, by a under-graduated student from IOUSP;
b) presentation of researches developed by IP, related the farming of brown algae *Kappaphycus alvarezii*, in August 29, 2011, by a research of this institute;
c) presentation of researches developed by IP related to fishing monitoring, in October 20, 2011, by a member of the institute that was also member of the MB;
d) and presentation of the results of the master thesis about cumulative impacts of the installation of new enterprises in the Northern Coast of São Paulo State, in July 19, 2012, by a graduated student from UNESP.

4.3.2 MB's members perception about participation of R&E organization

The questions related to members' perceptions of R&E organization role and their responses to the questionnaire are presented in Table 4.5. Respondents considered that the participation of R&E organizations in the management of APAMLN is important to subsidize the discussions with technical information. Their expectations regarding how this participation should happen (the role they attribute to R&E organizations) can be summarized in three primary lines of actions:

a) to support decision-making with technical advice (research development and dissemination);
b) to work with stakeholder capacity building, to favor participation (capacity building);
c) to monitor results of management propositions (monitoring).

By far, the first line of action is the most cited by the respondents (Q1), and less attention is given to the possibility of R&E organizations to contribute to build social capital or monitor management outcomes.

With reference to the proximity of R&E organizations to the management of APAMLN, the majority of the respondents considered it to be good (Q2) and reported that they have been providing information and engaging in discussions (Q3). Despite this, respondents indicated that a greater involvement of R&E organizations with managerial activities remains necessary, especially considering involvement with TGs and WGs activities in addition to attending MB meetings (Q4).

Table 4.5 – Perceptions of members of the management board (MB) of the Marine Protected Area of Northern São Paulo State, Brazil (APAMLN), who answered the questionnaire, about the role of research and education (R&E) organizations, their relationship with the MB, their current contributions to the management process and suggestions to improve such relationship

Question	Answers categories	Citations
Q1. What is the role of R&E organizations? (N=11)	Provide information and knowledge*	10(3)
	Develop specific research to support the management of APAMLN*	3(2)
	Build capacity of stakeholders to participate	1
	Support research developed by APAMLN (e.g., lending equipment)	1
	Participate in discussion and construction of management proposals	1(1)
	Monitor the results of proposals	1
Q2. How do you evaluate the proximity of R&E organizations to APAMLN's activities? (N=11)	Excellent	1
	Good	6
	Regular	1
	Poor	1
	NR	2
Q3. How have R&E organizations contributed to the management of APAMLN? (N=10)	Providing technical and scientific information (talks, consultations, reports, seminar etc.)	6(3)
	Engaging in MB meetings and discussions	5(2)
	Participating in TGs and WGs	2(1)
	Conducting specific researches to subside APAMLN's management	1
	Increasing the interaction between local managers and R&E organizations	1
Q4. What should be improved considering contributions of R&E organizations to the management of APAMLN? (N=9)	Engagement of R&E organizations in TGs and WGs	2(1)
	Number of research on APAMLN's environmental characteristics	2
	Number of research organizations and researchers in MB	2
	Meetings attendance	1(1)
	Dissemination of scientific information	1(1)
	Development of fund raising projects	1

First column provide the question and the number of respondents to each questions (in brackets); second column provide the categories that aggregate answers to each questions; and third column shows the number of citations for each category, considering that a single respondent could point out different categories (exception made to the second question), the number in brackets in the citations refer to the number of R&E organizations that cited the categories (from a total of three organizations).
NR = No response was provided.
Source: made by the author.

4.4 DISCUSSION

The integration of scientific knowledge in management processes and new management arrangements are necessary to advance in environmental management and to confront the complexities to guarantee a sustainable use of natural ecosystem (ARKEMA; ABRAMSON; DEWSBURY, 2006; BEIERLE; CAYFORD, 2002; BERKES, 2004; BLACKMORE, 2007; CURTIN; PRELLEZO, 2010; D'INCAO; REIS, 2002; DIMENTO; INGRAM, 2005; LONG; CHARLES; STEPHENSON, 2015; REED, 2008; RENN, 2006). Such integration depends on opportunities for engaging research and education organizations (R&E) and other stakeholders in decision-making processes.

There are many ways for the interaction of R&E organizations in participatory processes, from R&E organizations participating in the decision-making process (acting solemnly as information providers or in a more collaborative integration that lead to knowledge co-production) or facilitating it (BLACKMORE, 2007; BLACKMORE; ISON; JIGGINS, 2007; CRAPS; MAUREL, 2003; CVITANOVIC et al., 2015a; FAZEY et al., 2012; ISON; RÖLING; WATSON, 2007; LEMOS; MOREHOUSE, 2005; MAUREL, 2003; MCNIE, 2007; MOSTERT et al., 2007; PAHL-WOSTL et al., 2007; REED, 2008; REED et al., 2014; REES et al., 2005; RIDDER; MOSTERT; WOLTERS, 2005; RUDD, 2004; STEYAERT et al., 2007; STEYAERT; JIGGINS, 2007; TIPPETT et al., 2005; WOLTERS et al., 2016). The role played in each interaction depends on how participants (scientists and non-scientists) see the objective of the participation of R&E organizations (CASH et al., 2003, 2006; DIEDRICH; TINTORÉ; NAVINÉS, 2010; HISSCHEMÖLLER; HOPPE, 1996; MCNIE, 2007; NURSEY-BRAY et al., 2014; RUDD, 2015; RUNHAAR; VAN DER WINDT; VAN TATENHOVE, 2016; WOLTERS et al., 2016).

In APAMLN governance system (Figure 4.2) there are two moments when R&E organizations interact with the management process. First, by engaging in the discussions and proposition for the management of the MPA in meetings of the marine board (MB), thematic and working groups (TGs and WGs), secondly when the management proposition is sent from the FF to IP and IOUSP, to be analyzed. Such arrangements promote two different types of interaction. The first one can foster knowledge integration and the co-production, with scientists having many roles as knowledge co-producers, knowledge

brokers and information translators. The second one, nevertheless, can be a mixed blessing. On the one side, it is a possibility of approximating management and R&E organizations and can raise awareness of the second to issues under discussion on the former, increasing interest of scientists for participating in and contributing to the management process. On the other side, it also evidences a view of science and management as very separated subjects/worlds, and grants a privileged position of these research organization over the decision-making process by giving them power to interfere in the management proposals without participating in the discussions.

Not only this last characteristic can increase the barriers to science-policy integration (BOUWEN; TAILLIEU, 2004; MCNIE, 2007; STEYAERT; JIGGINS, 2007), but it can also hinder social learning processes since participants can perceive their work as disregarded (LEACH; PELKEY, 2001; MOSTERT et al., 2007). In participatory processes, the problems and the knowledge that base them are socially constructed and the solutions represent agreements and trade-offs established by the different stakeholders participating in the discussion (FAZEY et al., 2012; REED, 2008; SCHUSLER; DECKER; PFEFFER, 2003; STEYAERT; JIGGINS, 2007). Then, an external interference may undermine the entire participatory work.

Concerning how MB, TGs and WGs operate, the sharing of board seats by different organizations and the opened participation on TGs and WGs, that increase the number of organizations and individuals involved with the management of APAMLN, is a characteristic that favors science-policy integration. In the analyzed period, local research organization TAMAR and state research organization INPE, which were cited as missing organizations by MB members (Chapter 3), were involved in the activities of TGs and WGs, and individual scientists from organizations with board seats (despite the nominated to the MB) also participated in the different meetings, indicating a greater involvement of R&E organizations in the management than the mere analysis of management board composition. Such involvement not only can bring more scientific knowledge to the discussions but also increase diversity in the stakeholder group, favoring social learning (ARMITAGE; MARSCHKE; PLUMMER, 2008; KUMLER; LEMOS, 2008; LEACH; PELKEY, 2001; MOSTERT et al., 2007; MURO; JEFFREY, 2008; REED, 2008; SCHUSLER; DECKER; PFEFFER, 2003).

With reference to the perception of the role of R&E organizations and their actual contribution to the management of the MPA, the answers expressed a view of science and

management as separated subjects/worlds. In this view, scientists are producers and providers of expert knowledge, based on which decision-makers can deliberate and make decisions (LACKEY, 2007). Considering that this role was also recognized as the primary contribution R&E organizations actually have, it came as no surprise that the majority of respondents attributed a "Good" score to the proximity of R&E organizations and APAMLN's activities. Despite this, the presence of "Regular" and "Poor" evaluations and the fact that two respondents did not answered the questions (for unknown reasons) already indicated that there is room to improvement, as they pointed out in answers to question 4.

Acting as knowledge provider is one of the most important roles science can have. Nevertheless, scientific knowledge is often produced without considering management needs for information that is contextualized, in appropriated scale for the management problem and transmitted in appropriated language (BLACKMORE, 2007; CASH et al., 2003, 2006; DIEDRICH; TINTORÉ; NAVINÉS, 2010; NURSEY-BRAY et al., 2014). Producing this type of knowledge can be facilitated by scientists' engagement in the management process. By being closer to management discussions scientists can identify demands, information gaps and also understand the social aspects of the problem in debate to be able to present adequate and relevant information and produce more applicable knowledge (ARKEMA; ABRAMSON; DEWSBURY, 2006; BRADSHAW; BORCHERS, 2000; CASH et al., 2003; DIEDRICH; TINTORÉ; NAVINÉS, 2010; GRAHAM et al., 2006; MCNIE, 2007; RUNHAAR; VAN DER WINDT; VAN TATENHOVE, 2016; SCHILLER et al., 2001; STEYAERT et al., 2007; WOLTERS et al., 2016). Similarly, managers can gain awareness of the knowledge being produced. Nevertheless, having scientists acting as knowledge providers is a very limited contribution and, in order to foster social learning potential, this role should be combined with scientists acting in knowledge co-production for decision-making processes. Respondents to the questionnaire recognize this differential role when pointing out that scientists should participate in the discussions and construction of management proposals (Questions 1 and also 4).

Accordingly to respondents' perception, one of the main points to be improved is the involvement of R&E organizations with management, either through increased engagement of existing R&E representatives in MB, TG and WG meetings, also by increasing the number of organizations. In both cases, this greater engagement was proposed as a mean to increase information provision and facilitating the recognition of missing information that should be produced by scientists. Since interaction is the base for

knowledge exchange and social learning, increasing stakeholders' involvement may be the fastest and easiest way to promote both an increased application of scientific knowledge in management decisions and social learning (BLACKMORE, 2007; CRAPS, 2003; JIGGINS; VAN SLOBBE; RÖLING, 2007; MAUREL, 2003; MAUREL et al., 2007; STEYAERT; JIGGINS, 2007; TIPPETT et al., 2005).

With reference to how participation occur and the role attributed to R&E organizations in APAMLN, four additional points that should be taken into consideration for promoting greater interaction: how, where, when and which organizations to engage. In APAMLN, organizations can participate as official members of the MB or without this formalization. Participation as official members is limited to the seats occupied by R&E organizations (Table 4.2), which in the two analyzed mandates represented three seats (two dedicated to this sector and a shared one) and four organizations. Considering this, participation as non-official members should be encouraged since it can increase the number of organizations involved without having to change seats distributions, which can be seen as favoring R&E organizations over other sectors.

Another apparently neglected possibility for how to increase science-policy interaction refers to exploring scientists' other possible roles, such as processes facilitators. SLIM and HarmoniCOP projects evidenced that by developing projects promoting participatory discussions to solve environmental problems, scientists can apply scientific knowledge to promote social learning either by engaging in the facilitation of the processes themselves (PAHL-WOSTL; HARE, 2004; WEBLER; KASTENHOLZ; RENN, 1995) or by developing tools and methodologies that can be applied by others (BACCI; JACOBI; SANTOS, 2013; JACOBI, 2011; JACOBI; XAVIER; MISATO, 2013; MAUREL, 2003; PAHL-WOSTL; HARE, 2004). Although R&E organizations' role to build capacity was recognized in respondents' answers (Table 4.5), this was not mentioned as a needed improvement and, whenever the need for more information is cited, it refers to information about APAMLN's ecosystems and natural characteristics and not to this other type of information. From the documentary analysis and observation of the meetings it was not possible to identify such process of facilitation or the applicability of any tool. Exploring these other roles of scientists and focusing on improvement of the management processes is, then, another way of how to promote science-policy integration.

The greater engagement of R&E organization in TGs and WGs, pointed out as a necessary improvement by respondents (Table 4.5), should consider not only MB official

members, but encompass more organizations. The data of R&E official members participation indicates that, despite IP, most representatives only participate in MB (Table 4.3). This acknowledgment leads to the second question of where to promote participation. As seen in Chapter 2, discussions for decision-making, and social learning processes, occur mainly in the smaller and more focused TGs and WGs, for these reasons, these should be the primary arenas to promote the participation.

As for when to promote it, as already discussed in this chapter, in order to foster co-production of knowledge the best practice would be to promote R&E engagement through the entire processes. Nevertheless, considering the difficulty for scientists to engage in long processes, a punctual participation of specialists in specific turning moments when more information is required should not be disregarded.

Finally, concerning which organizations to engage, the data of TGs and WGs members (Table 4.3 and Table 4.4) indicates that local organizations (IP, ICMBio, TAMAR) engage more than "outsiders". Engagement in participatory processes is a time-consuming activity (BOUWEN; TAILLIEU, 2004; LEMOS; MOREHOUSE, 2005; PAHL-WOSTL; HARE, 2004), and engaging in multiple discussion processes increases the time demand. For "outsiders" time cost is increased since it must consider the journey from their working municipalities. Therefore, fostering the engagement of local organizations may grant better results concerning an active engagement and collaboration to the discussions, and also considering their proximities to the problems and other stakeholders, that can make it easier to establish a personal relationship. As observed by other studies, interpersonal relationship among stakeholders affect decision-making (CHOI et al., 2005; CVITANOVIC et al., 2015b; LEMOS; MOREHOUSE, 2005; WOLTERS et al., 2016).

Providing answers to theses questions, nevertheless, do not overcome the challenge of promoting science-policy integration and social learning through increased participation of scientists in decision-making processes. Integration is not only a matter of providing the opportunities and exploring diverse roles. There are institutional arrangements that also hinder this interaction, e.g., related to how science impact is measured and how the involvement of scientists in participatory processes is valued and promoted. Current measures of science impact foster publication in high impact journals, with restrict accessibility and inappropriate language to non-scientists, and there is a lack of time (considering other activities scientists have to develop) and funding in R&E

organizations to support participation (BRIGGS, 2006; CVITANOVIC et al., 2015b). The type of work involved in participating in decision-making processes is not even recognized as a role of science for some organizations and individual scientists (BRIGGS, 2006; CVITANOVIC et al., 2015a, 2015b; GRAHAM et al., 2006). Therefore, to help to promote scientists' engagement with decision-making, the base to integrating science into policy and social learning, R&E organizations also need to change their perceptions about the role of science in decision-making.

4.5 FINAL CONSIDERATIONS

HarmoniCOP and SLIM Project have evidenced the importance of science to participatory management and social learning (BLACKMORE, 2007; CRAPS, 2003; JIGGINS; VAN SLOBBE; RÖLING, 2007; MAUREL, 2003; MAUREL et al., 2007; STEYAERT; JIGGINS, 2007; TIPPETT et al., 2005). Nevertheless, the predominant view of scientists as information providers (LACKEY, 2007; NURSEY-BRAY et al., 2014) does not fit the new paradigms for sustainability-related knowledge co-production that call for a deeper integration, with scientists actively engaging as stakeholder in decision-making processes (FUNTOWICZ; RAVETZ, 1993, 2003; GARMENDIA; STAGL, 2010; LACKEY, 2007; NURSEY-BRAY et al., 2014; REED et al., 2010; STEYAERT et al., 2007; WOLTERS et al., 2016).

For this transition, two main things are necessary: provide the opportunities to integration and to change in the predominant view of scientists as information providers, both to scientists and to non-scientists. In APAMLN opportunities are provided by the internal governance system and also by external consultation to R&E organizations, with possibility two different outcomes to social learning. With reference to the internal structure, research and education organizations participate as official members of the management board and smaller groups, and also by involving non-members in the discussions promoted by the thematic and working groups, getting involved with knowledge co-production and fostering social learning. The external structure, nevertheless, by imputing differentiated importance for R&E organizations, which may interfere in management proposals without necessarily participation in the discussions,

may lead to a rupture in the participatory processes and hinder social learning. The results also show that, although knowledge provision is recognized as the primary role of R&E organizations, stakeholders recognize, and call for, a need of greater involvement of scientists in the discussions and construction of management propositions.

To encourage science-policy integration through increased participation in decision-making processes, the results indicate that four questions should be considered how, where, when and which organizations to engage. Such questions can be applied to any management process, and answered accordingly to processes peculiar characteristics. For APAMLN, it is recommend that the focus should be in engaging non-official members of MB in WGs and TGs and focusing on local research organizations that have greater proximity to meetings' location, to the problems at stake and to other stakeholders, and also exploring differentiated roles of scientists related to facilitating and developing research to improve the management process itself.

Nevertheless, it is important to note that changing the decision-making arena solemnly may not provide the desired science-policy integration and that a coordinated change in R&E organizations toward valuing, promoting and rewarding scientists' engagement in participatory processes is also necessary.

5 THE ROLE OF A LOCAL AGENDA 21 PROCESS FROM A SOCIAL LEARNING PERSPECTIVE

ABSTRACT

Socio-ecological systems are complex and decision-making processes need to adapt to constant change and multiple interests, so participatory approaches have been increasingly applied to environmental management. Among the many approaches, Agenda 21 is a global coordinated action plan to forward sustainability and social empowerment. Implementation of Agenda 21 has been growing worldwide and, although advances in sustainable plans were made, outcome evaluations show a failure both to provide results with long-term orientation and to promote public participation, which is essential to the process. Where sustainable development is concerned, more important than numbers is the quality of the public participation in management processes. Such quality may be the result of a process of social learning, a joint and collaborative learning among different stakeholders that, through interaction, increase their capability to perform joint tasks related to environmental problems. SL in LA21 processes can foster LA21 implementation, improving the quality of processes and their results. In this chapter, a LA21 process is analyzed to test the hypothesis that the LA21 process can promote social learning. Process observation and questionnaires were applied to identify changes in knowledge, in recognition of the complexities of the system, in social context and in the appraisal of facts in a group of participants in the LA21 process. Results showed evidence of the acquisition of new information, increased perception of the system's complexity, and changes in social skills (such as the consideration of other's needs and interests in decision making), in social context with empowerment of local community, and in social structure. This demonstrated the importance of conducting LA21 processes considering their potential to promote social learning in the search for more democratic and sustainable management practices.

5.1 INTRODUCTION

Natural and social systems are intrinsically connected (LIU et al., 2007), increasing the difficulties and challenges to managers and policy makers worldwide. On one side, humans depend on healthy ecosystems for basic needs such as water supply, nutrient cycling, food and raw material provision, obtained from the services the ecosystems freely provide (MEA, 2005; DE GROOT; WILSON; BOUMANS, 2002). On the other side, the demand for resources and space to support the increasing number of people and economic activities impact the ecosystems and their services (MEA, 2005; HALPERN et al., 2008, 2012).

In addition to the limited understanding of ecological and social systems, the understanding of the interrelationships and interconnections of both systems is even more limited; it is difficult to predict the consequences and impacts of human actions and decisions to the environment. These relations in coastal and ocean areas are especially difficult to grasp; magnitude, continuity, multiple scaled processes (temporal, spatial and in three dimensions) and multiple divergent and frequent competing uses increase managerial difficulties.

The emergent problems brought by human intervention with nature require new mechanisms that can cope with the great uncertainty, constant change and multiple interests at stake in every decision-making process (FUNTOWICZ; RAVETZ, 1993, 2003; GARMENDIA; STAGL, 2010). In this search for sustainability involving diverse stakeholders, the establishment and fostering of democratic and participatory processes emerges as a key feature (ICLEI; IDRC; UNEP, 1996; REED, 2008a) and is the basis of the Ecosystem Based Approach (ARKEMA; ABRAMSON; DEWSBURY, 2006; LONG; CHARLES; STEPHENSON, 2015; TURNER et al., 2014), Post-Normal Science (FUNTOWICZ; RAVETZ, 1993, 2003), Marine Spatial Planning (CEC, 2008) and Integrated Coastal Zone Management (CICIN-SAIN; KNECHT, 1998).

Agenda 21 is an example of framework for a participatory approach. Derived from the United Nations Conference on Environment and Development (Rio 92), Agenda 21 is a global coordinated sustainability-related action plan and social empowerment (UNEP, 1992). Agenda 21 has a hierarchical spatial scale strategy based on sub-global, national and locally settled plans, the latter named Local Agenda 21 (LA21) (UNEP,

1992). Local Agenda 21 is being implemented globally and represents localized participatory efforts to establish a plan for the sustainable development of a restricted area (school, neighborhood, district, municipality etc.), considering environmental, economic and socio-cultural issues (BARRUTIA et al., 2015; ICLEI; IDRC; UNEP, 1996). The construction of the sustainable plan comprises five basic steps: (1) establishment of a working group; (2) elaboration of a local diagnosis, (3) identification of the targets for action, (4) elaboration of the plan and (5) implementation and monitoring of the plan (ICLEI; IDRC; UNEP, 1996; MMA, 2005).

Since Rio 92, Local Agenda 21 has been frequently implemented. Many studies have analyzed implementation cases, focusing on the two goals of LA21: procedural and substantive (FEICHTINGER; PREGERNIG, 2005). Analysis of procedural goals focuses on process characteristics, such as the number of participants involved, the type of involvement promoted (e.g., consultation or deliberation) (BARRUTIA et al., 2015; EVANS; THEOBALD, 2003), political support of LA21 processes (FEICHTINGER; PREGERNIG, 2005; OTTO-ZIMMERMANN, 1994; TUXWORTH, 1996) or concordance with the steps developed in the LA21 implementation guideline (DA FONSECA; BURSZTYN; ALLEN, 2012; TUXWORTH, 1996). Analyses of results tend to focus on progress and achievements, such as the degree of implementation of LA21 (GARCIA-SANCHEZ; PRADO-LORENZO, 2008); achieving the end objectives and developing indicators to measure them (CORBIÈRE-NICOLLIER et al., 2003; EVANS; THEOBALD, 2003; MALHEIROS; ARLINDO; COUTINHO, 2008); and quality of the plan's actions in terms of principles of sustainability (BARRUTIA et al., 2015; CORBIÈRE-NICOLLIER et al., 2003; EVANS; THEOBALD, 2003).

Most of these studies focus on objectives and (mainly) quantitative indicators of procedural and substantive goals, such as the number and diversity of sectors participating, meeting attendance, and the number of actions proposed and implemented or comparison of results with objective sustainability principles. Despite the importance of such studies to foster LA21 processes, they provide a limited understanding of the outcomes of LA21 considering qualitative information. For instance, many studies of participatory processes indicate that importance of the number of participants is secondary when compared to promoting an active and engaged participation (REED, 2008; ROBERTS; DIEDERICHS, 2002). Even some of the assessments of LA21 showed that the lack of social engagement during the implementation phase jeopardizes LA21 processes (FEICHTINGER;

PREGERNIG, 2005), indicating the importance of building social capital and ownership during elaboration, which is not measured by the metrics commonly applied.

Assessment and evaluation of LA21 processes should not be limited to the quantitative and objective characteristics and outcomes of the process. On the contrary, understanding the qualitative and more generic and unspecific aspects of the process and the changes it promotes should also be considered. Of special interest is understanding the capacity of groups to learn together, shown to result in qualified participation and improved environmental management (ARMITAGE; MARSCHKE; PLUMMER, 2008; KUMLER; LEMOS, 2008; PAHL-WOSTL et al., 2007; REES et al., 2005).

Through interaction, stakeholders exchange knowledge, opinions and perceptions and build solutions to solve environmental problems, increasing thrust, capacities and social capital in a process called social learning (ARMITAGE; MARSCHKE; PLUMMER, 2008; BERKES, 2009; BERKES; COLDING; FOLKE, 2000; CRAPS, 2003; CRAPS; MAUREL, 2003; GARMENDIA; STAGL, 2010; MAUREL, 2003; MOSTERT et al., 2007; MURO; JEFFREY, 2008; PAHL-WOSTL et al., 2007; PAHL-WOSTL, 2006; PAHL-WOSTL; HARE, 2004; REED et al., 2010; REES et al., 2005; RIDDER; MOSTERT; WOLTERS, 2005). Social learning is reported to result in stronger, more resilient, egalitarian, integrated, adaptive co-management and governance systems, with strong contributions to sustainability (ARMITAGE; MARSCHKE; PLUMMER, 2008; BERKES, 2009; CRAPS, 2003; CRAPS; MAUREL, 2003; GARMENDIA; STAGL, 2010; MOSTERT et al., 2007; REED et al., 2010).

One important aspect of social learning is the focus on the process and the changes it promotes, of greater importance than achieving an optimal and pragmatic solution (which may not even exist considering the complexity of the socio-ecological system) (PAHL-WOSTL; HARE, 2004; PAHL-WOSTL; MOSTERT; TÀBARA, 2008; REED et al., 2010), meaning that the process is as important as its outcomes. As a process, SL can happen in loops with changes in actions (single loop), to values and behavior (double loop) and governance structure (triple loop) (ARMITAGE; MARSCHKE; PLUMMER, 2008), but also with changes within a process (micro level), to changes in the social networks (meso level) and in the governance structure (macro levels) (PAHL-WOSTL et al., 2007) and different dimensions (GARMENDIA; STAGL, 2010).

Garmendia and Stagl (2010) propose that social learning for sustainability can be organized in three dimensions: system perception, behavioral mode and scale of the

process, and requires moving from a narrower perception of the situation to an expanded, more complex perception. Change in system perception implies recognition of the complexity and uncertainty properties of the social-natural system. The behavioral mode represents learning that moves from the acquisition of simple facts to changes in framing or moral development. The scale represents the extent of SL changes that overcome individual learning and expand to the institutional or structural level, or even different time scales, from short to long term.

Considering the three dimensions, Garmendia and Stagl (2010) analyzed three case studies in Europe and found four types of changes that can occur in a SL process:

a) change in knowledge, which involves the adoption of new facts. This knowledge can be categorized as declarative knowledge (new information), procedural knowledge (new practices) and effectiveness knowledge (understanding of the effectiveness of an action to a defined goal);
b) change in the recognition of the complexities of the system, acknowledging its uncertainties, the conflicts and the risks;
c) change in social context that affect institutions and provide new possibilities of joint and collaborative actions (in the process or social-environmental context or for other opportunities and different settings);
d) change in the appraisal of facts (framing and reframing) and an increasing understanding of others perceptions and needs (also considering future generations and non-humans).

Such changes influence the outcomes and the continuity of participatory processes and can happen naturally or be fostered by process design and strategy (KELLY; MOLES, 2002; MIRANDA, 2004; ROBERTS; DIEDERICHS, 2002; VAROL; ERCOSKUN; GURER, 2011).

Some of the works that describe LA21 processes report changes in social relationships among actors working together and increases in social empowerment and social capital (BARRUTIA et al., 2015; KELLY; MOLES, 2002; MIRANDA, 2004; ROBERTS; DIEDERICHS, 2002; VAROL; ERCOSKUN; GURER, 2011), which may indicate the occurrence of social learning processes. Nevertheless, none of these study cases were analyzed as a social learning process, which could uncover different outcomes that can contribute no only to the commonly analyzed results of LA21 processes, but also

to promote a more qualified participation and the social capital important to the implementation and continuity of LA21.

In this chapter, concept of Social Leaning is applied to the analysis of a LA21 process. The hypothesis is that social learning changes can be observed in the implementation of LA21. To test it, the process of construction of the Local Plan for Sustainable Development of the Araçá Bay (LPSD Araçá), part of a LA21 initiative in Brazil, was analyzed for evidence of SL changes described by Garmendia and Stagl (2010). This analysis promoted an advance in the discussion of evaluation of LA21, including the analysis of social learning changes as outcomes of LA21 processes beyond those usually considered in the literature. Additionally, it extended the SL analysis of Garmendia and Stagl to a new and different social-environmental context, reinforcing or complementing their findings.

Our study case is the Araçá Bay in São Sebastião, Brazil, representative of many coastal areas in developing countries because of the conflict between economic growth and development and the maintenance of local/traditional uses (BURAK; DOGAN; GAZIOGLU, 2004; MASALU, 2000; STEAD, 2005; WEVER et al., 2012). Traditional and marginalized populations are particularly affected from such polarization, not only because of the risk of losing their historically occupied sites, but also because ecosystem degradation derived from such growth affects their economic, social and cultural activities (DIEGUES, 1998, 1999). Despite being part of two protected areas, there are no management proposals that address the specifics of Araçá Bay and the local traditional community not involved with regional or local discussions concerning the future of the region.

In situations such as these, implementation of the LA21 process can improve quality of life and promote public policies that have been adjusted to fit local situations. Nevertheless, local communities' engagement is key for Agenda 21 implementation (EVANS; THEOBALD, 2003; OTTO-ZIMMERMANN, 1994; VAROL; ERCOSKUN; GURER, 2011). Social learning can increase this participation and empower the community. Therefore, promoting LA21 process to foster SL can increase effectiveness and continuity of the LA21 processes themselves.

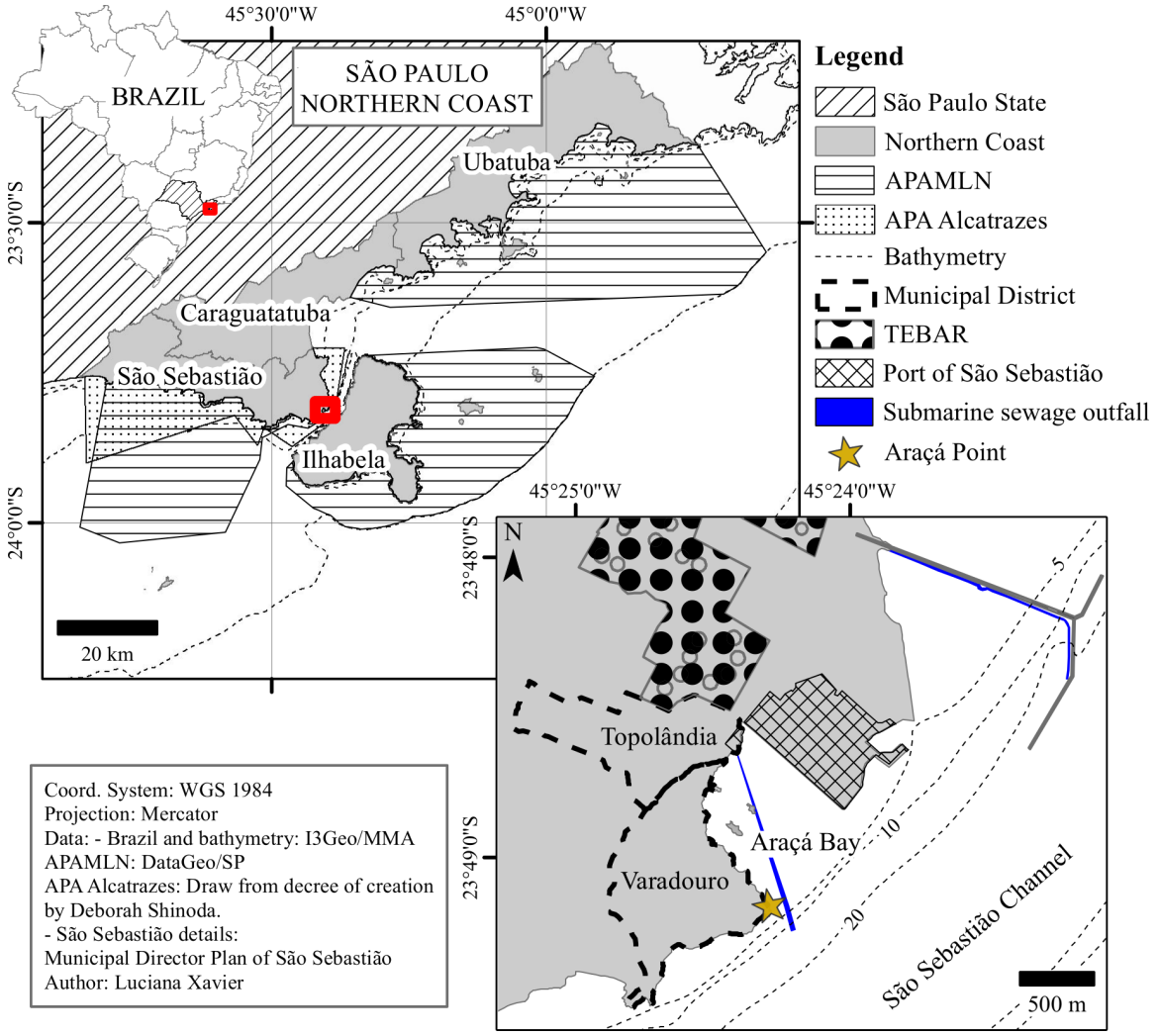
5.2 THE ARAÇÁ BAY

The Araçá Bay is located in the central region of the Municipality of São Sebastião, on the northern coast of São Paulo State (Brazil). It comprises circa 550,000 m^2, limited by the coastline (landward) and the São Sebastião Channel (seaward), surrounded by the municipal districts of Varadouro and Topolândia and by the Port of São Sebastião, ranging from the Port's landfill to Araçá Point (Figure 5.1).

Araçá Bay is a modified bay, resulting from historical human alteration of the coastline of São Sebastião, mainly related to construction of the Port of São Sebastião (AMARAL et al., 2016; MANI-PERES et al., 2016). Over the years, it has suffered the impacts of human activities, yet the region maintained its ecological and social relevance (AMARAL et al., 2016).

The ecological relevance is related to the biophysical characteristics of the bay. The bay is protected against waves, storms and winds by its protected position both behind São Sebastião Island, the municipality of Ilhabela, and in the middle of the São Sebastião Channel. This position of the shallow bay results in an area of calm water, dominated by tidal currents (DOTTORI; SIEGLE; CASTRO, 2015). Araçá Bay has many different habitats: sandy beaches, rocky shores, a tidal plain, tidal pools, a shallow water column, unconsolidated soft bottoms and remnants of mangrove forest (AMARAL et al., 2016; MANI-PERES et al., 2016). These habitats support a great diversity of life – from small diatoms and benthic organisms to bigger fishes, crustaceans and sea birds – a complex food web (AMARAL et al., 2010, 2016). It also provides many ecosystem services, such as food provision, sewage treatment and biodiversity maintenance (AMARAL et al., 2016; CARRILHO, 2015). The ecological importance of the Bay is recognized by public policies since it is part of two marine protected areas, the Municipal Protected Area of Alcatrazes (APA Alcatrazes – SÃO SEBASTIÃO, 1992), and the Marine Protected Area of the Northern Coast of São Paulo State (APAMLN – SÃO PAULO, 2008).

Figure 5.1 – Study Area showing the North Coast of São Paulo State and the two protected areas that include Araçá Bay: Municipal Protected Area of Alcatrazes (APA Alcatrazes) and the Marine Protected Area of the Northern Coast of São Paulo State (APAMLN) (larger map). On the bottom, the Araçá Bay region is detailed, showing the bay, the municipal districts that surround it, Varadouro and Topolândia, the location of Port of São Sebastião and the Maritime Terminal Almirante Barroso (TEBAR – pier and inland facilities), the biggest enterprises settled in São Sebastião central region, and the location of the Sewage Submarine Outfall that crosses the bay area



Source: Elaborated by the author

The social relevance is related to research and educational activities developed in the bay and to the traditional uses of the local community. Research activities in the bay date back to the 50's and have produced a great quantity of knowledge as well as capacity building of undergraduate and graduated students (AMARAL et al., 2010). Traditional uses are related to the *caiçara* (traditional people from the coast of São Paulo) (DIEGUES, 1999, 2007; SANCHES, 2001), who use the calm waters for fishing and harvesting, mooring of small vessels, access to the more dynamic waters of São Sebastião Channel, leisure, to practice sports activities and the maintenance of *caiçara* culture (AMARAL et al., 2010, 2016; CARRILHO, 2015; MANI-PERES et al., 2016).

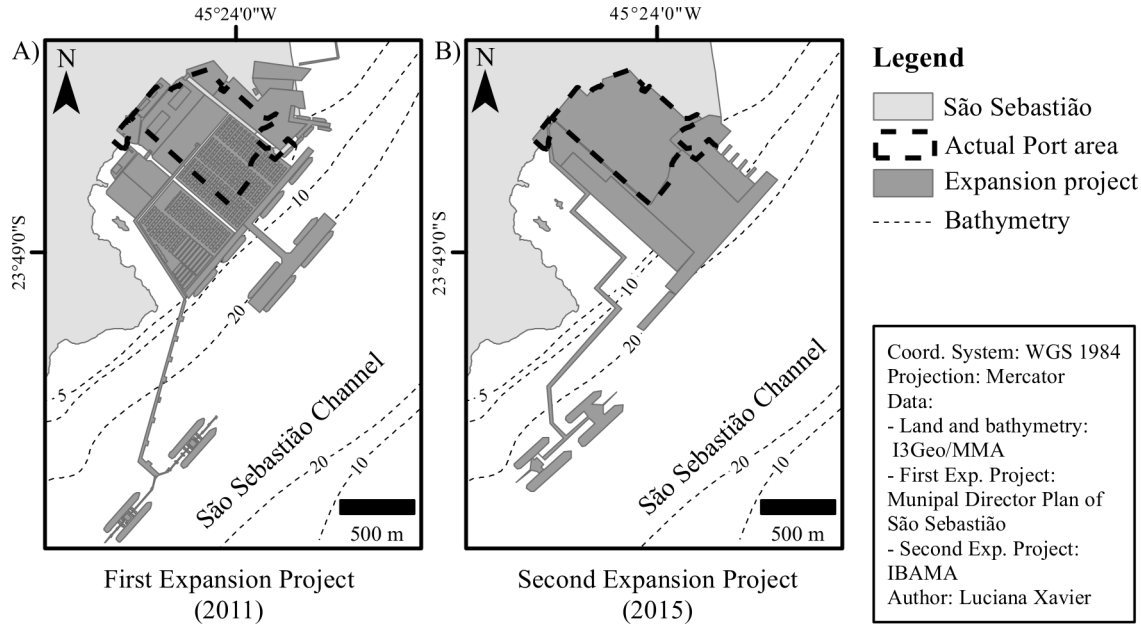
Araçá Bay suffers from impacts related to urban occupation in its surrounding areas, as sewage and solid waste discharge, diffused pollution and irregular activities, and the existence of great enterprises such as the Port of São Sebastião and the Maritime Terminal Almirante Barroso (TEBAR). The primary direct threat to the bay is related to the activities of the Port of São Sebastião. Constructed between 1936 and 1954, it underwent two expansions, in 1972 and 1987 (RESSUREIÇÃO, 2002), and is currently proposing a third one, which would initially cover most of the bay (Figure 5.2.A)

The expansion proposal is based on an environmental impact assessment (EIA) that failed to report the bay's natural and social characteristics and to provide a proper description of the impacts it would bring, especially considering the cumulative impacts with other regional enterprises (LEGASPE, 2012; TEIXEIRA, 2013). Impacts were minimized by declarations that Araçá Bay was "dead", proclaimed by expansion defenders and municipal authorities, assuming it has little (or no) environmental importance, and with total disregard to the community's uses of the bay.

As a response to this situation, a social movement questioning the expansion project and the EIA started in São Sebastião, in the neighboring city of Ilhabela, in APAMLN's management board and among the scientists who conducted research in the area. Despite social criticism, the license was granted. This license was judicially questioned and further invalided, requiring improvements in the EIA. During this process, the entrepreneur modified the expansion project to cover a smaller area of the bay, which is the proposal actually under discussion (Figure 5.2.B).

Prior to the suspension of the license, many local residents felt powerless against the situation and were resigned to port expansion. The involvement of other actors (such as non-governmental organizations (NGOs) from Ilhabela, the management board and the scientists) in the community's actions questioning the EIA about the port expansion as well as the judicial license suspension were sources of hope and strength to the community and a sign that an alternative future for the Bay was possible. Nevertheless, the local community remained disorganized; only a few local individuals actively engaged in the process. To discuss alternative futures for Araçá Bay based on a stronger social organization, cohesion and involvement, a group of researchers coordinated a process to elaborate a Local Plan for Sustainable Development of the Araçá Bay (LPSD of Araçá Bay).

Figure 5.2 – Proposed projects for Port expansion. The expansion would initially have covered most of the Araçá Bay (A) but was changed to a smaller project during the licensing process (B)



Source: elaborated by the author.

5.2.1 Elaboration of the LPSD for Araçá Bay

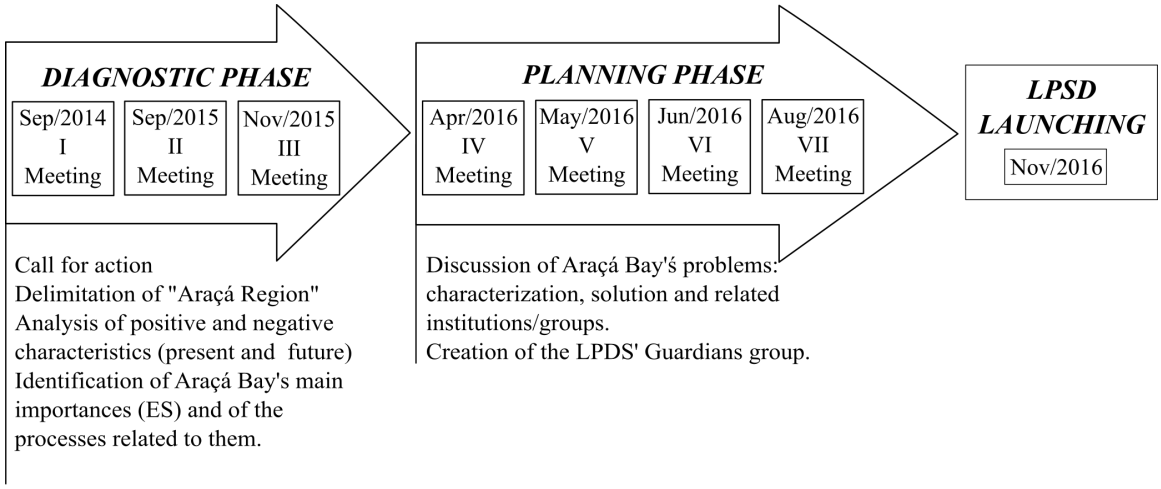
The elaboration of the Local Plan for Sustainable Development of the Araçá Bay was an activity of the Biota-Araçá Project. This research project funded by the São Paulo Research Foundation (FAPESP) aimed to characterize Araçá Bay's environment (biophysical and social characteristics) and support management of the area. The process was conducted by researchers and not by the local authorities, who were instead invited to participate along with other interested citizens, institutions, or organizations.

The LPSD is an instrument of the Local Agenda 21; the process in Araçá Bay was initiated considering an adaptation of the steps described by MMA (2005): mobilization and awareness raising; participatory assessment; participatory planning; creation of the LA21 forum and plan launching.

The process for construction of LPSD of Araçá Bay was carried through seven participatory meetings, from September of 2014 to August 2016 (Figure 5.3), with two distinct phases, assessment (2014–2015) and planning (2016). This process resulted in the publication of the booklet "LPSD of Araçá Bay" (PLDS/ARAÇÁ, 2016) in November

2016[3]. A total of 141 different people participated in the meetings including citizens from São Sebastião, exclusive of the Araçá Bay's community (28%), researchers and scientists (28%), Araçá Bay's community (21%), representatives of public organizations (11%), NGOs (9%) and private sector (3%).

Figure 5.3 – Time line of the process of construction of the Local Plan for Sustainable Development of the Araçá Bay (LPSD of Araçá Bay), showing the two different phases (assessment and planning) and the month and year of each participatory meeting in each phase (boxes within the arrow) and of the launching of the publication that synthetizes the process



Source: elaborated by the author

Mobilization and awareness raising were continuous activities that started with researchers' interaction with community, through other activities related to research for the Biota-Araçá Project. Many locals participated in the project, being interviewed and also assisting with field trips and data gathering. Specific actions to elaborate the LPSD started with Meeting I, in September 2014, entitled "Let's talk about Araçá?", that proposed a discussion about the bay and its characteristics, guided by five questions: (1) What is the importance of Araçá Bay? (2) What don't you like about Araçá Bay?; (3) What do you want to know about Araçá Bay?; (4) What do you want for Araçá Bay in the future?; (5) What can you do for Araçá Bay?

During the first meeting, the proposal for construction of a LPSD for the bay was presented and participants were called to be part of a process to discuss the future of the bay and construct the LPSD. The intention was to create the LA21 forum in the meeting.

[3] A synthesis of the construction of the LPSD of Araçá Bay based on the full description of the methods involved in its construction is reported by SANTOS et al., in prep.b and registered in the final publication, PLDS (2016).

Nevertheless, given the small number of community members, the moment was not appropriate and creation was delayed.

To increase involvement of local community, the LPSD process suffered strategic changes. First, there was a pause in the meetings, during which researchers strengthened the relationship with community members (see SANTOS et al., in prep – a and b). Secondly, the assessment phase focused in facilitating the participation of Araçá Bay's local community in the process. Meetings were then conducted in Araçá Bay's beaches, closer to the community, and assessment activities had a more ludic characteristic, using simple language, simple tools and visual aid items to facilitate communication.

The Meetings II and III also assisted local community mobilization, discussing Araçá characteristics and calling for action to change local problems. During Meeting II, participants discussed the limits of the Araçá region, completed an evaluation of the positive and negative characteristics of Araçá Bay both in the present and projected into the future (scenarios). At the end of the meeting, a collective discussion on what should be done to get to or to prevent the future scenarios was performed. Meeting III discussed the goods and services provided by the Bay (results from Meeting II and from CARRILHO, 2015) and the ecosystem characteristics (geophysical, biological, social) and processes (water circulation, primary production etc.) responsible for them.

The planning phase was conducted through the Meetings IV, V, VI and VII, all entitled "Lets' talk about Araçá Bay's future?", where participants had access to the results of previous meetings that were explained to return participants and newcomers. Participatory planning focused on discussion of the 12 problems identified in Meeting II (negative characteristics) (Table 5.1). These problems were prioritized in Meeting IV; their discussion aimed to promote each participant's interaction and knowledge/perception exchange in order to achieve a collective understanding of the problems and of possible solutions.

For the planning process, MMA (2005) recommends the establishment of objectives and specific goals, concrete actions to achieve the goals and objectives and strategies for actions implementation. LPSD of Araçá Bay was adapted considering the time and participation constraints of the process. There was not enough time to promote in-depth discussions of the problems and of the solutions and yet elaborate an operational plan with actions and indicators for assessment of implementation. Therefore a choice had to be made considering the number of problems discussed and the quality and depth of the

discussions. Additionally, despite the success with involving citizens, many important stakeholders remained absent. For this reason, instead of focusing on discussing specific and detailed actions and strategies for their implementation, the process focused on providing space to participants to discuss the problem, to debate their different aspects and how they affect each stakeholder, promoting an amplified and collective understanding of their many aspects. As a result, LPSD of Araçá Bay presented directives and some examples of actions, instead of a detailed executive action plan, which was considered to be part of the implementation phase and to be detailed with broader participation of other stakeholders and institutions that are related to the problems, such as the municipal administration, the Port of São Sebastião, the sewage treatment company etc.

Meetings IV and V discussed the eight main problems (four in each meeting). In these meetings, participants were divided in groups where a facilitator conducted discussions that were organized into three segments: first the problem was characterized, then the solutions were proposed and finally a list of stakeholders or institutions that could assist to solve the problem was produced. For problem characterization participants were asked to first reflect individually on the causes and consequences of the problem and write their individual answers in a printed table, which was latter collected by researchers. After the individual segment, participants were encouraged to use their notes to discuss with the group to achieve a collective understanding of the issue. Topics that attained a consensus within the group were written on cardboard to compose each group's final poster. The same approach was used for proposals of solutions. The listing of possible stakeholders/institutions was carried as a group activity only. Results of group discussion written on the cardboard were organized and glued in a craft poster and presented in the final plenary when other participants could complement/comment on group's proposals. Meeting VI discussed the last four problems, using an adapted approach in which no individual table was produced and the consensus of the discussions were registered directly in group poster and validated in the final plenary.

Table 5.1 – Problems identified and prioritized by local citizens to be discussed during the planning meetings of the process of elaboration of the Local Plan for the Sustainable Development of the Araçá Bay, São Sebastião (São Paulo/Brazil), indicating the prioritization score for each problem and providing a brief description

Problem (Prioritization score)	**Brief description**
Sewage discharge and contamination (19)	Problems related to residential sewage discharge in the environment, linked to the inefficient sewage treatment system and outfall discharge.
Operation of current local enterprises (19)	Problems related to the actual enterprises existent in the city, mainly to the activities of the Port of São Sebastião and of the TEBAR.
Solid waste pollution (17)	Problem related to the presence of solid waste from different origins (sea and land) in the bay.
Industrial & Urban growth (16)	Problem related to urban growth and local industrial development without adequate planning.
Chemical pollution (15)	Problem related to environmental contamination by chemicals.
Drug consumption (12)	Social and environmental problems related to the smuggling and consumption of drugs in the region.
Poor management (5)	Problem related to the unsatisfactory actions of local managers and public institutions.
Fishing (2)	Problem related to fishing activities.
Impacts on Permanent Protected Areas (1)	Environmental degradation of permanent protected areas such as mangroves and watercourses.
Port of São Sebastião's infrastructure (1)	Problem related to the actual infrastructure of Port of São Sebastião.
Poor social control (1)	Problem related to the little social engagement and social power within decision-making processes.
Lack of infrastructure for tourism and leisure activities (1)	Problem related to the lack of public infrastructure to serve the local population and tourists in the development of leisure activities in a planned and sustainable way.

Source: Elaborated by author based on PLDS (2016)

After Meeting VI, the research group organized and synthetized the results of the planning activities in a first proposal of the LPSD booklet. The preliminary material was widely distributed to get additional contributions, which were organized by the research team to be presented and discussed with the participants of the Meeting VII, thus ending the planning phase. At the end of the meeting, a group called Guardian of the LPSD was formed, composed of members from Araçá Bay's community as well as from other regions of São Sebastião and the Northern Coast of São Paulo State, including researchers, representatives from the APAMLN and from the municipal government. The group assumed the task of publicizing the LPSD and organizing future activities to further discuss and implement the propositions, involving other stakeholders.

5.3 DATA GATHERING AND ANALYSIS

In order to analyze SL in the development of the LPSD Araçá, qualitative and quantitative approaches were combined. The analysis of the process was based on the hypothesis that the four changes proposed by Garmendia and Stagl (2010) could be identified in the elaboration of the LPSD of Araçá Bay: change in knowledge, in recognition of system's complexity, in social context and in the appraisal of facts. Evidence of these changes in the study case were based on data from questionnaires that were applied to participants at; specific moments and from materials produced during meetings. The analysis was complemented by observation of the entire process to identify changes in participants' discourse.

To analyze changes in knowledge, recognition of system's complexity and social context, questionnaires concerning these changes were administered to meeting participants in the planning phase at the beginning of each meeting (questions are presented in Table 5.2). They were answered with the use of a Likert scale, which provided a range of response to a given question/statement (COHEN; MANION; MORRISON, 2005). It varied from 1 to 5, with 1 being the "Not at all" and 5 being the maximum "Very much". The intent was to compare perception before and after participant's interaction in planning meetings. Accordingly, the application of the questionnaire was done in the beginning of the Meeting IV (representing the time before interaction), and in the beginning of the subsequent meetings (representing the time after interaction). Participation in the meetings varied, with every meeting having newcomers. It was not possible to predict the last time a participant would attend the meeting; therefore questionnaires were administered to all participants and only the first one and the last one were considered for analysis. For example, if a participant attended the four planning meetings, only questionnaires of meetings IV and VII were considered. Answers were analyzed with the Wilcoxon non-parametrical test for two related samples, a paired test which compares scores of a sample measured on two different occasions (PALLANT, 2002), and descriptive statistics.

Considering that changes are the result of a process of interaction and that they take time to occur, the analysis also considered only participants who attended three or more meetings for analysis. This reduced the analyzed sample to seven participants, since

not every participant answered the questionnaire in all the meetings that he/she attended (some would arrive late and go directly to the meetings' activities), some institutions changed representatives during the process and the majority of the participants who answered the questionnaire (a total of 75 respondents) participated only in two of the planning meetings. Although low, the number is sufficient for the intended analyses and was complemented by qualitative observation of the process.

Table 5.2 – Questionnaire applied to the participants in the beginning of each planning meeting of the process for elaboration of the Local Plan for the Sustainable Development of Araçá Bay, São Sebastião (São Paulo/Brazil). Changes proposed by Garmendia and Stagl (2010) were tested through different questions which were answered based on a Likert scale varying from 1 to 5 (with 5 being the maximum)

Type of change	**Question**	
Change in knowledge	(Q1)	How familiar are you with the importance of Araçá Bay?
	(Q2)	How familiar are you with the social issues of Araçá Bay?
	(Q3)	How familiar are you with the environmental issues of Araçá Bay?
	(Q4)	How familiar are you with the different institutions involved with Araçá Bay's management?
	(Q5)	How familiar are you with the different interests for the future of Araçá Bay?
Change in the recognition of the complexities of the system	(Q6)	How difficult do you think Araçá Bay's management is?
Changes in institutions and new possibilities of and joint and collaborative actions	To what extent can the following groups contribute to Araçá Bay's Management?	
	(Q7)	Scientists and researchers
	(Q8)	Politicians and managers
	(Q9)	Local society (individuals_
	(Q10)	Non-governmental organizations (NGOs)
	(Q11)	Can you see opportunities for joint action for Araçá Bay's management?

Source: elaborated by the author.

To test change in the appraisal of facts, the individual tables were filled in by participants during problem characterization and proposal of solutions. In meetings IV and V, these were considered for analysis of the different items proposed by individuals and registered in group discussion. All the individual answers were inserted in a spreadsheet and synthetized in keywords/phrases, considering the same elements present in meetings' discussions. Then individual answers were compared to group discussion (recorded in the reports of every meeting) and with the group's final proposition (recorded on group posters), computing which individual answer was included or not in groups' final proposal. Descriptive statistics were applied to data analysis. Additionally, after group discussion in meetings IV and V, a short Likert scale (1 = "Not at all" to 5 = "Very much") based on a

questionnaire was applied to verify participants' opinions about: (a) To what extent participating in the activity helped to understand the problem at hand; and (b) To what extent participating in the activity helped to propose solutions to the problem. The answers were analyzed applying descriptive statistics.

5.4 EVIDENCE OF LEARNING IN THE CONSTRUCTION OF THE LPSD OF ARAÇÁ BAY

Social learning is the process of change resulting from participative processes. It can foster development and improve outcomes of participatory processes, such as in Local Agenda 21 (LA21). Despite the importance of the other LA21 outcomes, which are usually used as a quantitative measure of the successful implementation of LA21, SL focus on the process and social changes it promotes, enabling further and enhanced sustainability-related environmental changes. In this work, the general hypothesis that SL changes are evident in LA21 implementation processes is tested.

Accordingly to Garmendia and Stagl (2010), there are four basic changes related to social learning processes: to knowledge, recognition of system's complexity, social context and the appraisal of facts. Considering participants' perceptions, Garmendia and Stagl (2010) analyzed three case studies and found evidences that such changes were promoted to different degrees in each case. By process observation and questionnaires applied to participants of a process to implement a LA21 Local Plan for Sustainable Development, it was also evidenced changes in attitude of members of the local community, who were empowered and encouraged to take action to build a more suitable future for Araçá Bay.

Local community representatives engaged early in the process had the opportunity for a longer interaction with researchers (before the LPSD meetings or assisting with data collection, for instance) with whom they were constantly exchanging knowledge on the bay's characteristics and socio-ecological processes.

Changes in knowledge involve the adoption of new information (declarative knowledge), new practices (procedural knowledge) and understanding of the effectiveness of an action to a defined goal (effectiveness knowledge) (GARMENDIA; STAGL, 2010). Changes in declarative knowledge were mainly evident through process observation,

present in changes in the terms participants started using to describe Araçá Bay and oceanographic processes. As an example, the mangrove, previously cited as “breeder”, was later referred to as a “nursery” area. The term “erosion” substituted what was previously described as the action of “the sea eating the land”.

Questionnaires did not capture knowledge changes related to the importance of Araçá Bay (Q1), social (Q2) and environmental issues (Q3), the different institutions involved with Araçá Bay’s management (Q4) and the different interests for the future of the bay (Q5). Wilcoxon test results (Table 5.3) revealed no statistical significant difference in questionnaire’s scores prior and after participant’s interaction during planning meetings, despite a trend of increase in average scores and decrease in standard deviation observed.

Questionnaires’ scores were high from the first time, therefore it is possible that the maximum possible score (5) limited an increase in scores sufficient to promote a statistically significant change. For these questions, most participants did not change their answers; nevertheless some increase in individuals’ scores, representing knowledge acquisition, was present in all the questions. With the exception of Q4, all others registered a decrease in some individual scores, which can also indicate an increase in knowledge: participants perceived that there was more to be discussed in the issues than what they initially thought they knew, being aware of their lack of information about the facts and scoring less.

With reference to the knowledge acquisition about local institutions involved with bay’s management (Q4), changes were evident through process observation. Although Araçá Bay is part of the Marine Protected Area of the Northern Coast of São Paulo State (APAMLN), which had recently undertaken a great regional effort to realize a participatory assessment, including São Sebastião area (unpublished data), a few members of the community knew about the marine protected area (MPA), although none had participated in its regular meetings. Similarly, APAMLN’s management was not focused in Araçá Bay and had no local action. However, during the participatory process, researchers developed some activities in partnership with APAMLN, including disseminating information about it and creating a group to discuss Araçá Bay’s issues within the managerial structure of the APAMLN. As a consequence, Araçá Bay’s local community became closer to the MPA (which was cited as part of the local social network – NUNES, 2015) and joined APAMLN meetings, first the ones related to Araçá and then meetings to discuss fishing and the MPA management plan. In contrast, representatives of

the management team became acquainted with Araçá Bay's issues, participated in some of the LPSD meetings. In the end, MPA's manager volunteered to be part of the LPSD' Guardians, showing a change of knowledge (one got more information about the other) that led to a change in institutional relationships.

There was little evidence of changes in practices (procedural knowledge) and understanding of the effectiveness of an action to a defined goal (effectiveness knowledge), which is highly related to the type of discussions and knowledge exchanges that occurred during the process. Since the LPSD did not focus on proposing objective actions to solve the problems, there was no room for knowledge exchange concerning types of practices and their effectiveness to solve Araçá Bay's problems. For effectiveness knowledge, however, analysis of the proposed solutions to Araçá Bay's problems (discussed further) showed a change in the understanding of what type/characteristics of actions would be more effective to solve problems, mainly based on a more participatory approach.

Changes in recognition of the system complexity were also observed in the discussions of Araçá Bay's characteristics and processes that support bay's ecosystem services (Meeting III). When stimulated to think about what made the bay important, most answers in the beginning of the process pointed to biodiversity. After Meeting III, they also referred to the characteristics of the water (water temperature, depth and process of water exchange with the channel), of the bay (shallow, protected from currents) and to the presence of nutrients and organisms to support food production, as important to support the biodiversity. The food provision service, as an example, exists due to the sum of several characteristics of the Bay, "warm, rich in nutrients, and protected" and the presence and maintenance of the local fishermen, (without the fishing community, food provision loses its importance). Increased understatement of system complexity was also observed during problems' discussions in planning meetings (discussed further).

We had assumed initially that the greater the understanding of system complexity, the greater the understanding of the challenges to manage it would be. Nevertheless, there was no evidence that an increase in the first led to a increase in the second in the question about perception of the difficulties to manage Araçá Bay. This question (Q6) had an average score of 3.86 (Table 5.3) with an equal number of higher and lower answers in the last questionnaire (2). This may be due to the fact that its management was already perceived as a difficult action, considering that the future of the Bay depends on decisions

against the Port expansion project, which remain under discussion. Initial resistance of the local community to joining the LPSD process was in part because they didn't believe the expansion could be stopped, which changed with license suspension. Although still perceived as a difficult task, positive and negative differences in the questionnaire answers may be indicatives that changes in the perception of complexity led to high scores concerning managerial difficulties, or the planning process shed a "light at the end of the tunnel" making participants more optimistic, thus lowering the score.

We then considered changes in social context and the recognition of possibilities for joint and collaborative actions. Questions related to the perception of the possibilities of different groups to contribute to Araçá Bay's management (Q7 to Q8) and of the possibilities for joint actions (Q11) varied little with an increase in the score of only one respondent for Q7 and Q8, and one decrease for Q11, with no statistically significant difference (Table 5.3). These questions had the highest scores from the questionnaire, which is logical since presence in planning meetings indicated that participants were prone to, or even expected, joint and collaborative actions. Since LPSD activities aimed to promote collaboration among stakeholders, no negative changes were expected. Nevertheless, the absence of some stakeholders related to the problems discussed in planning meetings (public institutions, licensing and inspection bodies, representatives of the major local enterprises and other cited in problems' discussions) may have led to the score decrease registered in the question about the perceived existence of opportunities for joint action (Q11).

Despite questionnaire results, great changes in social context were perceived through process observation. The ties formed between APAMLN and the local community was one of them and a second one is shown through the empowerment of the local community, exemplified in the changes in their relationship with researchers from the Biota-Araçá Project and the creation of the group Guardians of the LPSD of Araçá Bay.

From the first interactions with local community, perceived roles of researchers were related to their responsibility to solve Araçá Bay's problems. Since researchers "had the knowledge" and the project was financed with public funds, meetings' participants required actions from researchers. In the first phase of the LPSD construction "You should" and "You could" statements were common:

> "You receive lots of public funds to do your research, you should do more to solve our problems."

> "Students should learn about Araçá's importance in school. You should teach them or build capacity for the teachers do so."
>
> "Schools should take field trips to Araçá, you could bring students to the bay and teach them."
>
> "You could provide teaching and studying material about Araçá Bay to schools."

Participants were encouraged to discuss such propositions in planning meetings if they felt compelled to. Every time such statements were made, the role of the project and of the university itself (to which researchers were related) were explained, including explanation of projects' costs and expenses, and about what could/could not be achieved through project activities.

Through the process, perception of researchers roles changed dramatically. At the end of the planning meetings, researchers from the project were referred to as "interlocutors", "partners" of the local community who took the responsibility for LPSD's further development and implementation. An even greater change was evidenced during LPSD' launching event when, informed that the project would continue for only six more months, local community volunteered to find new financial support for the continuity or a second edition of, in their words, "Our Araçá Project" so that researchers could increase their support and engage in future LPSD activities. Perception about role of the researchers changed from providers to partners that, if possible, could even be supported by the LPSD' Guardians, demonstrating changes in social context and social relationships.

The creation of the LPSD' Guardians group in the last planning meeting is also indicative of change in the social context. Following the proposed steps for the implementation of the LPSD (MMA, 2005), there was a first attempt to create the group in the first LPSD meeting (in 2014). The absence of local community, however, made it impossible. During the assessment phase, though local representatives were present in the meetings, they still charged others with the responsibilities to solve local problems (namely the researchers who were facilitating the process). It was only during the planning phase, when the community's role was elucidated and the lack of social engagement was perceived as a major local problem, that the creation of the group was possible. Although researchers who were facilitating the meeting had planned to propose the creation of the group, the participants themselves started the discussion that led to its creation. During the plenary discussion about the problem of "Poor social control", one of the participants questioned how social control would be exerted for LPSD's implementation. Many

volunteered to advertise the problems and speak to other related stakeholders. Researchers then seized the opportunity to suggest that volunteers formed a group to facilitate action coordination and the Guardians group was born.

Table 5.3 – Results of the questionnaires that were considered for analysis so social learning changes in the process for elaboration of the Local Plan of Sustainable Development of Araçá Bay, São Sebastião (São Paulo/BR), representing seven participants (N = 7) who attended three or mores of the planning meetings

	Av. F	Std. F	Av. L	Std. L	Decr.	Incr.	No dif	Z	p-value
Q1	4.71	0.756	4.71	.488	2	1	4	0.000	1.000
Q2	3.71	1.113	4,29	.951	2	3	2	-0.962	0.336
Q3	4.57	0.787	4,71	.488	2	2	3	-0.378	0.705
Q4	3.00	1.414	3,57	1.272	0	2	5	-1.342	0.180
Q5	3.71	1.380	3.71	1.380	1	2	4	0.000	1.000
Q6	3.86	1.069	3.86	1.069	2	2	3	0.000	1.000
Q7	4.86	0.378	5.00	0.000	0	1	6	-1.000	0.317
Q8	4.86	0.378	5.00	0.000	0	1	6	-1.000	0.317
Q9	5.00	0.000	5.00	0.000	0	0	7	0.000	1.000
Q10	5.00	0.000	5.00	0.000	0	0	7	0.000	1.000
Q11	5.00	0.000	4.86	0.378	1	0	6	-1.000	0.317

For each question (Q1 to Q11) the average scores and standard deviation of responses in the first (Av F and Std. F) and in the last (Av. L and Std. L) application of the questionnaire, the number of participants that changed their responses to lower (Decr.) and higher (Incr.) scores, or that gave the same response (No dif.), the value of the Wilcoxon test (Z) and the p-value for each question, considering a 95% confidence interval are presented.
Source: elaborated by the author.

The next changes considered were in the appraisal of facts (framing and reframing) and increased understanding of others perceptions and needs (Figure 5.4). These factors were observed throughout the process, especially considering the concern about maintenance of Araçá Bay for future generations to have a space for sports and leisure activities, fishing and, most of all, to maintain the connectivity with the seascape and the *caiçara* culture. One of the primary concerns of local community is that current system's degradation has already caused the alienation of younger generations and that in the future, *caiçara* culture would be a museum piece.

Activities to discuss problems in planning meetings provided stronger evidence of changes related to the appraisal of facts. Comparing individual and collective work, registered in individual tables and group posters, the number of items considered for problem characterization and solutions were always greater in group's final poster (see supplementary material). On average, a group poster registered 9 characteristics and 7.5 solutions more than individual tables. Groups' discussion and final poster included most of

each individuals' items and new characteristics/solutions emerged that had not been proposed by any individual.[4]

Participants were encouraged to speak freely about problem characteristics, focusing on their causes and consequences and aiming to understand how they affect each participant in his daily routine. Not only did this approach provide exchange of personal experiences and perceptions about the problem, but was also a way to sensitize participants, even though they may not be directly affected (e.g., those who do not understand fishing could best understand and become sensitive to fishing-related problems by listening to the affected ones). Participants could then also relate to the problems and see connections between them (considering fishing again, its relationship to other problems, such as pollution, environmental impacts and threat to the *caiçara* culture – Chart 1).

Changes in framing of the problems were observed comparing individual and group items, indicating increased complexity in groups that increased the understanding of the problems that led to a new, collective frame of reference. For the "Drugs consumption" problem, for example, individual answers characterized the problem as caused by lack of education and perspective for a change in life. After group discussion, other characteristics emerged, such as the difficulties confronted by drug addicts to recover, the lack of proper treatment and the influence of local infrastructure on solving the problem (Chart 2). Participants pointed out that the construction of a wall to surround the Port area created an isolated place in the bay where drug addicts tend to be more numerous and that the apparent "abandonment" of the place also led to depreciation of the area.

Proposals of solutions reflected framing changes, incorporating perspectives of others regarding the problem into the proposed solutions. Changes from individual to group proposals followed a similar pattern of changes in characteristics; group proposals were more numerous and more complex in relation to those from any individual. For "solid waste disposal", for example, individuals' solutions focused on two actions: increase and improvement of the monitoring and management system, and development of information and education public campaigns (Chart 3). Group discussion built on these elements

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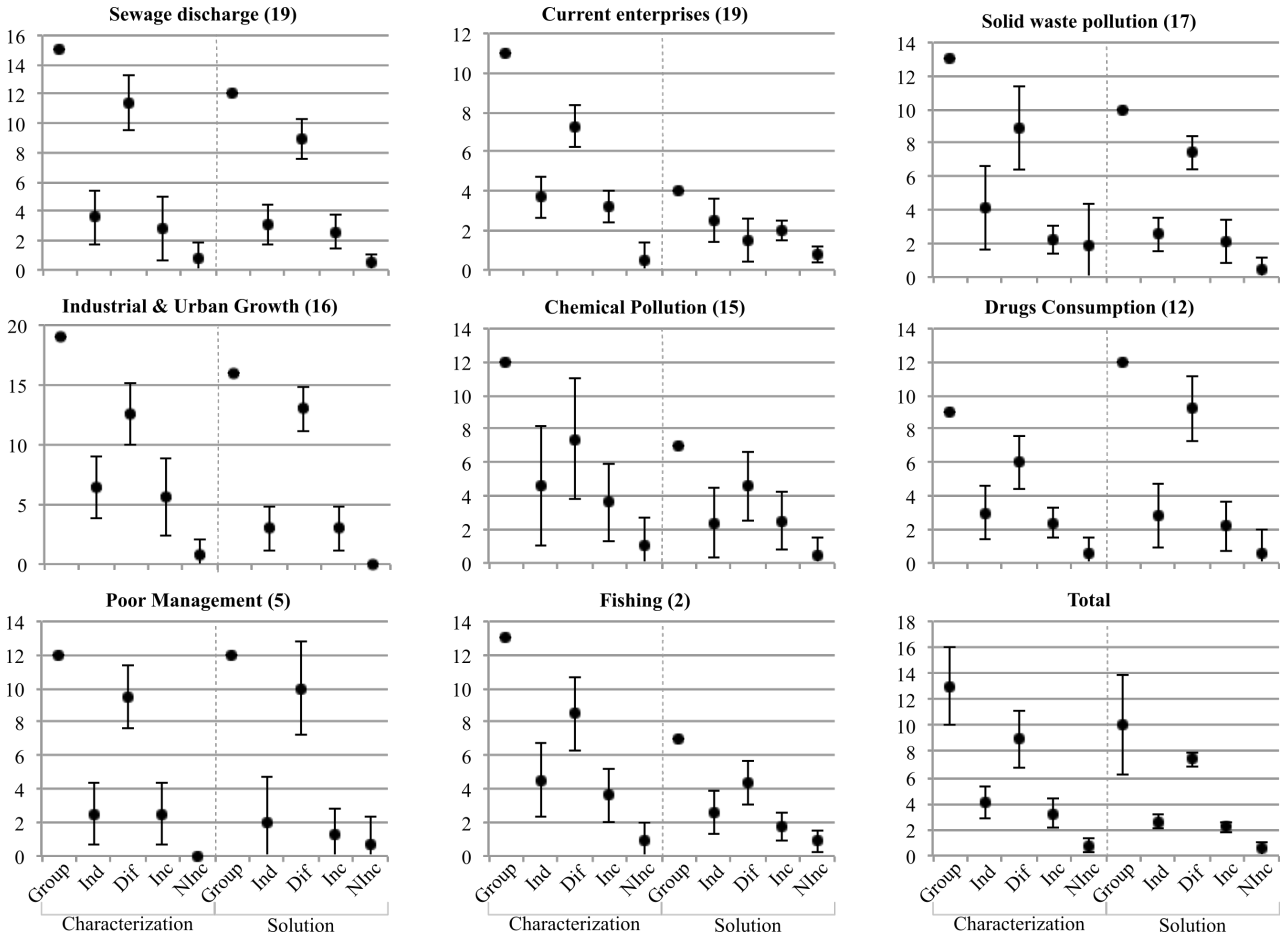
[4] For the eight problems discussed in meetings IV and V, supplementary material with the items of group posters and indication of which individual item was considered for groups' final propositions is provided – Charts 1 to 8.

additionally pointed the importance of inserting the issue in governmental plans such as the City Hall Planning, which included a political, managerial and planning aspect that were not considered by individuals alone. This indicates a change both in framing and in effectiveness knowledge, based on the understating that local and punctual actions focusing only on the impact (remediation) would not be effective to solve the problem; other measures must be taken to prevent them, including political decisions.

In addition to the comparison of individual and group items, participant's answers to the questions related to the extent to which problem discussion during planning meetings helped with understanding and to propose solutions to each problem showed they considered participating in the activity a positive experience, with the majority of answers scoring 4 or 5 (Figure 5.5).

Changes expressed in problem characterization and proposals of solutions also demonstrated changes in the understanding of system complexity. Particularly for solutions, understanding the greater complexity of the problem led to proposals that went further than directly combating the problem (such as treating sewage, law implementation or cleaning solid waste) and were inserted in a more complex arrangement that considered providing information to society, promoting education and behavioral changes, implementing new and focused public policies and an increase in social participation and control over institutions, which were pointed out in most of the cases.

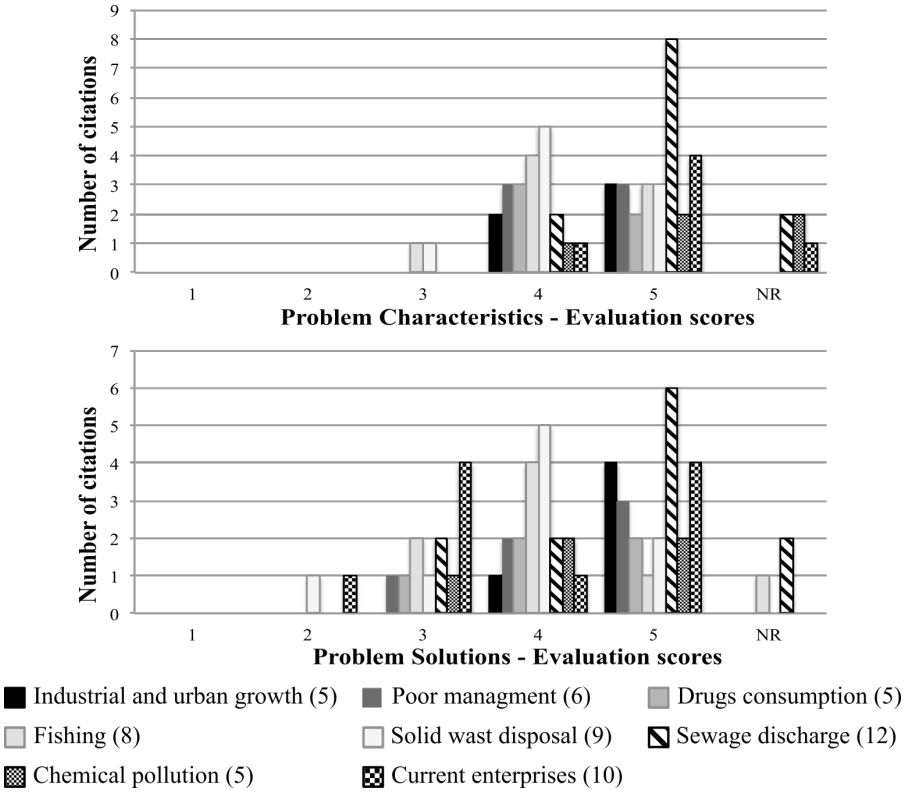
Figure 5.4 – Average number of items considered for the Araçá Bay's problem characterizations and solutions during planning meetings for the elaboration of the Local Plan for Sustainable Development of Araçá Bay, São Sebastião (São Paulo/Brazil), considering the main problems that affect the bay, identified and prioritized by participants



For discussion for characterization and solution the total number of participants (N), the total number of items registered in group's table (Group), the average number and standard deviation of: items proposed by each participant, individually (Ind), the difference between the number of items included in a groups' table and proposed by individuals (Dif), individual items included in a groups' table (Inc), individual items not included in a groups' table (NInc) are presented. Averages considering the number of each item for all the problems are presented in the last graphic.

Source: elaborated by the author.

Figure 5.5 – Participant's perception about the extent to which problem discussion in breakout groups during planning meetings for the elaboration of the Local Plan for Sustainable Development of Araçá Bay, São Sebastião (São Paulo/Brazil) helped to understand (upper graph) and to propose solutions (bottom graph) to each problem



Scores varied from 1 (Nothing) to 5 (Very much). For each problem the number of participants in the group discussion is showed in brackets.
Source: elaborated by the author.

The combination of results from questionnaires and observations showed strong evidence of social learning in the process of elaboration of the LPSD of Araçá Bay, corroborating the general hypothesis that social learning changes can be identified in the LA21 process. This hypothesis is also sustained by works that, despite not being focused on analyzing the LA21 process under a SL perspective, reported changes in social relationship, increase in social empowerment and in social capital in LA21 initiatives (BARRUTIA et al., 2015; KELLY; MOLES, 2002; MIRANDA, 2004; ROBERTS; DIEDERICHS, 2002; VAROL; ERCOSKUN; GURER, 2011).

Concerning the construction of LPSD of Araçá Bay, it was possible to observe changes in knowledge of participants, with the acquisition of new information that increased perception of system's complexity, in social skills, that involved handling with and considering other's needs and interests in decision making and finding alternatives way to cooperation and change in social context with empowerment of local community and the emergence of new social structure (the Guardians of the LPSD of Araçá Bay) and

institutional relationships, in accordance with SL literature (ARMITAGE; MARSCHKE; PLUMMER, 2008; CRAPS, 2003; CRAPS; MAUREL, 2003; GARMENDIA; STAGL, 2010; MAUREL, 2003; MOSTERT et al., 2007; MURO; JEFFREY, 2008; PAHL-WOSTL, 2006; PAHL-WOSTL et al., 2007; PAHL-WOSTL; HARE, 2004; REES et al., 2005; RIDDER; MOSTERT; WOLTERS, 2005).

Considering the social learning dimensions proposed by Garmendia and Stagl (2010), the study case showed an increase in behavioral mode (from the acquisition of new facts to changes in framing and moral development) and system perception (recognition of system complexity) dimensions. However, it also showed a smaller change in scale dimension, with changes that went beyond the individuals involved and seem to be achieving a institutional level, manifested in the great proximity of the APAMLN management process to Araçá Bay.

Some of the observed changes could be possible because researchers conducted the process. Local municipal authorities were perceived as having a favorable position toward Port expansion, because the mayor was one of the people who declared the Araçá Bay was dead. Scientists, in contrast, were considered to have a pro-environmental (or pro-Araçá), and pro-community position, since researches also depends on Araçá Bay's maintenance.

In addition, regular LA21 implementations follow the steps proposed by Brazil's Ministry for the Environment (DA FONSECA; BURSZTYN; ALLEN, 2012; MMA, 2005), which would not fit Araçá Bay's social context. The process of LA21 in Araçá Bay had a greater focus on mobilization and facilitating the participation of the local community, favoring interaction among participants instead of focusing on detailed objectives and actions. This resulted in the engagement of individual citizens, in opposition to the more common engagement of organized participants (NGOs, neighbor or labor unions) and public and private institutions (EVANS; THEOBALD, 2003). Such engagement is in greater accordance with LA21 emphasis upon the involvement of local communities (ICLEI; IDRC; UNEP, 1996; MMA, 2005).

Such process characteristic led to what can be considered the most substantial outcome of SL in LPSD of Araçá Bay's construction: the empowerment of local community and the recognition of the need for joint action and social participation in management and planning initiatives. Local community moved from an initial inertia and non-participation attitude to a more active and engaged one. What was impractical in the

beginning of the process, to create a group to discuss the future of Araçá Bay, naturally happened by the end of the planning meetings. Additionally, local community also joined other participative initiatives related to the management of the APAMLN.

Considering process peculiarities, the study case would get a poor score if analyzed applying the traditional metrics used to evaluate an LA21 process, related to the procedural and substantive goals previously described. Nevertheless, considering the process as a whole and the SL changes demonstrated in it, the importance of the construction of the LPSD of Araçá Bay is emphasized, supporting the need to consider the entire process to evaluate LA21 implementation reported by Evans and Theobald (2003).

In this context, the findings draw attention to the importance of process design to promote learning opportunities, as already stated by other works (BLACKMORE, 2007; GARMENDIA; STAGL, 2010; ISON; RÖLING; WATSON, 2007; MAUREL et al., 2007; REES et al., 2005; STEYAERT et al., 2007; STEYAERT; JIGGINS, 2007; TIPPETT et al., 2005). Focusing on the mobilization and on promoting the engagement of local community, it promoted the changes in social context that overcome the construction and implementation of the LPSD of Araçá Bay and may guarantee that the process does not stop with LPSD publication. The need for a critical social mass to promote LA21 continuity has already been pointed out by other works (DA FONSECA; BURSZTYN; ALLEN, 2012; FEICHTINGER; PREGERNIG, 2005; ROBERTS; DIEDERICHS, 2002). It is possible that social changes and social capital built in the process for construction the LPSD of Araçá Bay may guarantee further steps.

5.5 FINAL COMMENTS

In this chapter it was shown that social learning changes can be identified in Local Agenda 21 implementation processes by analyzing changes in knowledge, in recognition of system complexity, social context and the appraisal of facts in the elaboration of a Local Plan for the Sustainable Development of the Araçá Bay. Such findings advance in the discussion of SL in participatory management linking it to the implementation of LA21, a global sustainability-related effort. Additionally, it also collaborates with the studies that

analyze LA21 initiatives, by shedding light on a new element to be considered in the analysis: promotion of SL.

This study is a assessment of the initial phase of LPSD of Araçá Bay's process, which needs time to be fully implemented. The LPSD has only recently being published and is now being disseminated by the group of Guardians of Araçá Bay, with the research team members acting as partners. There remains a long way to go to engage other stakeholders and local authorities. Future events will clarify whether SL outcomes will guarantee the continuity of the process. Accordingly it is recommend that future studies continue to evaluate the process for implementation of the LPSD of Araçá Bay, including evaluation of how SL contributed to LA21's other outcomes, and also the involvement of local community with other local participatory processes. It is also important that the analysis of SL changes within LA21 processes are conducted in other areas and contexts to advance the discussion of SL and LA21 implementation and the importance of focusing on processes characteristics rather than only frequently applied metrics to evaluate LA21 implementation. By recognizing SL changes as necessary outcomes of LA21 and fostering their development, implementation of LA21 and maintenance of long-lasting LA21 processes can improve sustainability-oriented management.

6 ON THE ADVANTAGES OF WORKING TOGETHER: SOCIAL LEARNING AND KNOWLEDGE INTEGRATION IN THE MANAGEMENT OF MARINE AREAS[5]

ABSTRACT

The interconnectedness of ecosystems and the integration of policy and society are relevant aspects of integrated management that are grounded in knowledge exchange (KE) practices. Such processes may also promote social learning (SL), the joint and collaborative knowledge to tackle environmental problems. For this reason, understanding KE is an additional strategy to promote and understand SL. This chapter analyzed a KE process related to the elaboration of a proposal for the spatial delimitation of a marine protected area in a developing country. By combining process observation and geographical information system tools, proposed areas and criteria for delimitation elaborated by different groups of stakeholders (non-scientists and scientists), separately and in an integrated discussion, were compared and used to test the hypotheses that integration under a KE process can bring substantive changes in the outcomes and that KE processes can promote SL. Results showed that the integration of different knowledge led to results that none of the groups achieved in separate discussions, e.g., the identification of new delimited areas of influence and criteria for delimitation. Changes in knowledge, understating system complexity, social context and the framing and reframing of the processes were observed, what indicates that KE promoted SL. Additionally, the criteria used to support the delimitation proposals in the studied area can be applied to other marine protected areas in other contexts, and the methods used to guide the discussion can be adapted to other issues to promote KE and SL.

[5] Article submited on June 15 to be published on Marine Policy journal, awainting editorial response.

6.1 INTRODUCTION

Impacts on the natural environment have grown in extent and magnitude and complexity (ARKEMA; ABRAMSON; DEWSBURY, 2006; BLACKMORE, 2007; FUNTOWICZ; RAVETZ, 1993, 2003; GARMENDIA; STAGL, 2010; HALPERN et al., 2008; MEA, 2005b; REED et al., 2010), which present a challenge to managers and decision-makers. To address these challenges, new management systems that consider the interconnectedness of socio-ecological systems and the integration of policy and society are needed (FUNTOWICZ; RAVETZ, 1993, 2003), which require new ways of producing, disseminating and integrating scientific knowledge in decision-making.

There are many obstacles to science-policy integration, e.g., cultural differences regarding the production and application of scientific information (CASH et al., 2003; MCNIE, 2007; NURSEY-BRAY et al., 2014), difficulties in accessing scientific information (considering its availability, language barriers and the temporal incompatibility between information production and management exigencies), a lack of clarity about management demands (ARKEMA; ABRAMSON; DEWSBURY, 2006; CASH et al., 2003; CVITANOVIC et al., 2015b; MCNIE, 2007; WOLTERS et al., 2016), institutional barriers that do not encourage or support integration (CVITANOVIC et al., 2015b; WOLTERS et al., 2016), and insufficient conditions to improve knowledge exchange (CVITANOVIC et al., 2015a).

Knowledge exchange (KE) refers to many processes of knowledge-based interactions, including knowledge translation (communication using a mediated language modified for recipients), knowledge transfer (knowledge “changing place” in a linear direction, from the producer to the receiver), knowledge exchange (knowledge “changing place” in a two- or multiple-path process with reciprocity and mutual benefits) and knowledge co-production (knowledge that is produced through interaction with others, cooperative endeavors and mutual learning) (FAZEY et al., 2012; STRAUS; TETROE; GRAHAM, 2009).

The type of process applied to KE depends on the social-political context, the individuals involved and the objectives of the exchange (FAZEY et al., 2012). Although scientists have long been characterized as knowledge providers (NURSEY-BRAY et al., 2014), recent studies (theoretical and empirical) have noted that greater integration

between researchers and decision-makers in the production of knowledge can lead to the production of more applicable knowledge and thereby improved participatory management (CVITANOVIC et al., 2015a; FUNTOWICZ; RAVETZ, 1993, 2003; NURSEY-BRAY et al., 2014; WOLTERS et al., 2016).

Participatory processes and collaborative work are also basic elements of social learning processes (SL), which represent joint and collaborative learning in a process of collective discussion and search for solutions to environmental problems (ARMITAGE; MARSCHKE; PLUMMER, 2008; BERKES; COLDING; FOLKE, 2000; GARMENDIA; STAGL, 2010; GRANEK et al., 2010; PAHL-WOSTL et al., 2007). SL is evidenced in changes in behavior (attitudes and values), social organization (with new social arrangements and new opportunities for collaborative work), and system perception (through the acquisition of "new" knowledge) (ARMITAGE; MARSCHKE; PLUMMER, 2008; GARMENDIA et al., 2010; PAHL-WOSTL et al., 2007). KE is part of SL processes; accordingly, increasing the understanding of KE processes will lead to increasing the understanding and promotion of SL processes.

Recognition of the importance of KE to heighten social, environmental and economic impacts of research is increasing. Nevertheless, there remains a need to characterize and understand the KE process both theoretically and empirically (FAZEY et al., 2012). Most studies on the subject are qualitative and theoretically evidenced, and there is a lack of empirical analysis documenting and evaluating the outcomes of KE processes (CVITANOVIC et al., 2015a). Concerning marine resource management, most studies are from developed nations, with clearly defined governance structures and greater access to scientific information, which are unlikely to be representative of other areas, especially developing ones (CVITANOVIC et al., 2015a).

Considering this state of affairs, this chapter describes a process that integrated scientific and traditional knowledge and the perceptions of different stakeholder groups that resulted in a proposal for the delimitation of a marine protected area on the Northern Coast of São Paulo State. Knowledge here is defined as information (which can be learned) and understanding (which is perceived) (BLACKMORE, 2007), which are differentiated in their scientific, traditional and environmental components. Scientific knowledge is knowledge obtained through scientific inquiry, is understood to be systematized, objective, explicit, and based on replicable methods, and attempts to construct general explanations of observed phenomena (AGRAWAL, 1995; NURSEY-BRAY et al., 2014; WOLTERS et

al., 2016). Traditional knowledge (also called local knowledge or local ecological knowledge) is a cumulative body of knowledge, practices and beliefs that emerge from the interaction and observation of natural phenomena by a given group and is transmitted through generations (AGRAWAL, 1995; BERKES; COLDING; FOLKE, 2000; BERKES; FOLKE; GADGIL, 1995). Environmental perception, in turn, represents how an individual is aware of, understands and relates to the environment, considering both sensations (the kinetic and biochemical relationship between an individual and the environment) and cognitions (mental process mediated by personal culture and knowledge) (WHYTE, 1977).

The hypotheses tested in the chapter were that a delimitation proposal under a KE process could bring substantive changes to outcomes compared to a proposal elaborated by a single group of stakeholders and that KE processes promotes SL. To test these hypotheses, delimitation proposals and criteria considered for delimitations elaborated first separately by different stakeholder groups and later through joint discussion were compared to understand how they diverge and complement each other and how the KE processes during the joint discussions affected the final proposition.

6.2 STUDY CASE: DELIMITATION OF THE ARAÇÁ AREA

The case analyzed here considered the discussion of a proposal for the delimitation of a marine protected area in southeastern Brazil. The Marine Protected Area of the Northern Coast of São Paulo State (APAMLN, acronym for Área de Proteção Ambiental Marinha do Litoral Norte de São Paulo, in Portuguese) (SÃO PAULO, 2008a) was established with the primary objective of promoting the sustainable use of the natural resources and managing economic activities within the area. The decree that establishes it indicates that the local mangroves (25 overall), and two special areas, Araçá and "Enseada/Canto do Mar", are included in APAMLN, but it fails to delimit their perimeter.

Araçá Bay is located in the central region of the Municipality of São Sebastião, limited by the coastline and the São Sebastião Channel from Araçá Point to the landfill of the Port of São Sebastião and surrounded by residential areas (Figure 5.1). It is a place where conflicts between economic growth and social-environmental conservation are evidenced in the proposal for port expansion over the bay and the social movement against

it, which advocates for the use of the area to promote environmental conservation, research, education and the *caiçara* culture (traditional people that habit Brazilian coast) (PLDS/ARAÇÁ, 2016), the main services provided by the bay (AMARAL et al., 2010, 2016; CARRILHO, 2015; MANI-PERES et al., 2016). In addition to APAMLN, the bay is part of the Municipal Protected Area of Alcatrazes (APA Alcatrazes) (SÃO SEBASTIÃO, 1992), which has not yet been implemented, evidencing its environmental importance.

Given the importance of and the threats confronted by the Araçá Bay, an interdisciplinary project called "Biodiversity and functioning of a subtropical coastal ecosystem: subsidies for integrated management" (Biota/Fapesp-Araçá Project) was initiated, integrating several research institutions. One of the specific goals of the project was to develop a Local Plan for Sustainable Development (LPSD), which required the delimitation of what the community considered the area embraced by the plan, the Araçá Area. Therefore, the delimitation of the Araçá Area was a common need of APAMLN and the Biota/Fapesp-Araçá Project, and a combined effort by the project and a working group within APAMLN management was carried out to promote a discussion of the boundaries of this area.

6.3 ANALYSIS STRATEGY

To test the hypotheses, this chapter considers delimitation proposals for the Araçá Area elaborated by different stakeholders: two groups that participated in the LPSD process and a group of scientists from the Biota/Fapesp-Araçá Project (referred to as the LPSD and scientific proposals), which were later aggregated in a single discussion to elaborate a final proposal (integrated proposal).

The groups involved with the LPSD proposals were the local community living in the areas surrounding the Araçá Bay (Group 1) and other stakeholders interested in the discussion but who did not live in the surrounding areas (e.g., other residents of the municipality, non-governmental organizations (NGOs), researchers and managers who conduct activities in the area – Group 2). The LPSD proposals were elaborated as part of the LPSD process in a specific meeting. The scientific proposal was elaborated in a

meeting organized with this specific objective with the leading researchers on the Biota/Fapesp-Araçá Project.

These three proposals were later integrated in a single discussion of the Working Group Araçá (WG Araçá), which was created within the management structure of APAMLN. The group was created to promote the discussion of society's interests in the management of Araçá Bay and was coordinated by members of the Biota/Fapesp-Araçá Project and APAMLN. Participating in the group were members of the Araçá Bay community, representatives of the DOCAS Company (manager of Port of São Sebastião), representatives of government institutions responsible for environmental conservation and inspection (APAMLN, Federal and State Environmental Agency), environmental NGOs and members of local research and education institutions. The discussion of a proposal for delimitation of the Araçá Area was one of the WG Araçá activities and engaged WG members and other stakeholders from the LPSD process and the research project.

Each proposal was elaborated through the following general steps:

a) creation of an individual delimitation proposal based on a map of the region – participants were asked to illustrate what they understood as being the Araçá Area;
b) presentation of the individual proposal and its explanation to the other involved in the activity;
c) collective discussion and elaboration of a collective proposal.

Each proposal (individual and collective) was manually digitized and organized in a georeferenced database using a Wacom pen tablet and the ArcGis 10.2 ArcView® program. Each individual proposal was represented as a polygon composing a layer that was overlapped with the others to allow comparison between individual and collective proposals, of collective proposals among different groups and of each collective proposal with the integrated proposal. The analysis considered differences in the proposed boundaries and in the arguments supporting each proposal, which were obtained by analyzing the records of each discussion and observing the process.

To test whether the KE process led to substantive changes in the outcomes (hypothesis 1), the LPSD, scientific and integrated proposals, considering the arguments for delimitation and the final boundaries proposed, which were overlapped on a single map were compared. To test whether KE processes fostered SL (hypothesis 2), the discussion carried out during WG Araçá meetings, which was longer, provided more time for KE and

engaged the different stakeholders was considered. A single researcher observed all the meetings, and their records were analyzed for evidence of changes promoted by SL described by Garmendia and Stagl (2010):

a) change in knowledge, which involves the adoption of new facts;
b) change in the recognition of the complexities of the system;
c) change in social context;
d) change in the appraisal of facts (framing and reframing).

Changes in the appraisal of facts were also analyzed comparing the change from individual to collective proposals, considering the areas covered by each.

In the following section, a brief description of each discussion conducted in the different meetings analyzed is presented, including the maps of the proposals (individual and collective) elaborated and the main arguments that were provided during the discussions. Later, the process for discussing the delimitation proposals is analyzed with reference to the two hypotheses.

6.4 DELIMITATION PROPOSALS

6.4.1 LPSD Proposals

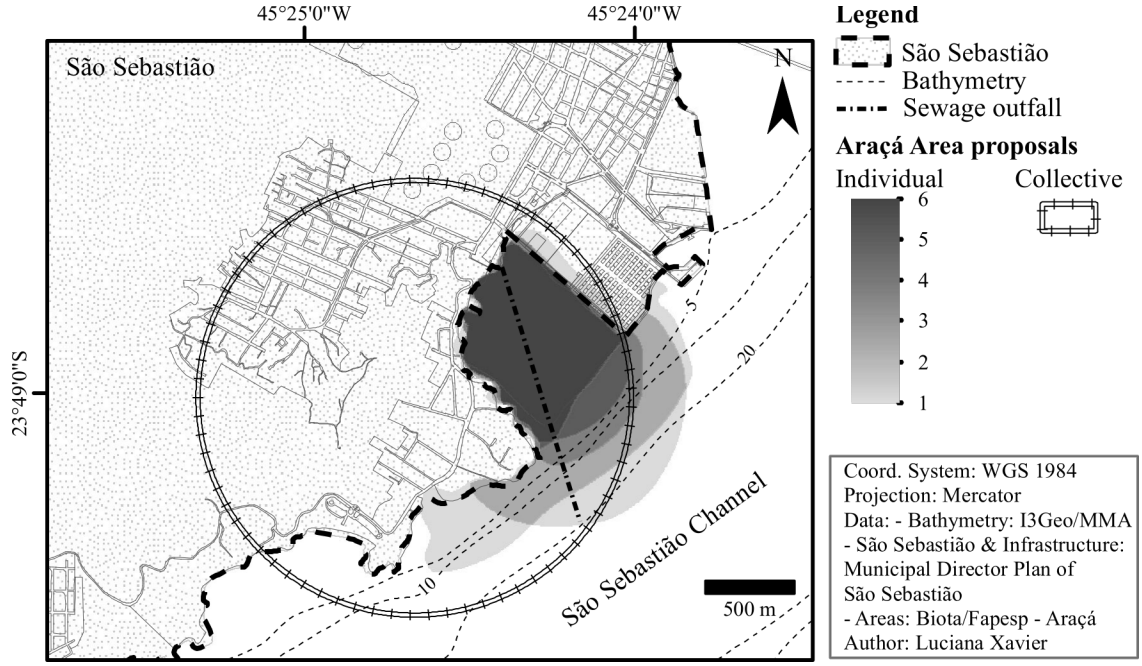
The discussion of the Araçá Area was conducted in two separate groups on September 20, 2015. Group 1 comprised nine people, some descendants of the *caiçaras* and others who had lived in the area for a shorter period of time. Six of the participants created individual proposals that focused on the marine area. Every proposal included the Araçá Bay, with most of them (four) limited to the bay itself or extending slightly to the channel (Figure 6.1).

Explanation of individual proposals began with the testimony of a local *caiçara* fisherman, who included the entire São Sebastião Channel in the Araçá Area. The proposal for including areas beyond the Araçá Bay was supported by others, who described the included areas in relation to fishing grounds, past marine and terrestrial uses and the *caiçara* lifestyle, including the channel and part of the Port of São Sebastião landfill. After

this testimony, participants whose proposals had originally been restricted to the bay were already expressing a change in their understanding, suggesting new proposals for larger areas.

Based on individual proposals, focused on the marine area, the collective proposal initially covered part of the port landfill, the bay and a marine portion extending to the southwest of the bay. The area resembled a semi-circle including the waters closest to the shore. The participants agreed on the proposal and noted that the area's historical uses and natural characteristics could be used to extend the delimitation to terrestrial areas that were once used by the *caiçara* community and had shell deposits, mangroves and sandbank vegetation. One participant suggested completing the semi-circle drawn for the marine portion to delimit the terrestrial portion and complement the proposal for the Araçá Area, which was accepted by the others, leading to the final collective proposal presented in Figure 6.1.

Figure 6.1 – Proposal for the delimitation of the Araçá Area, made by the group formed by the local community (Group 1), composed of individuals living in the areas surrounding the Araçá Bay

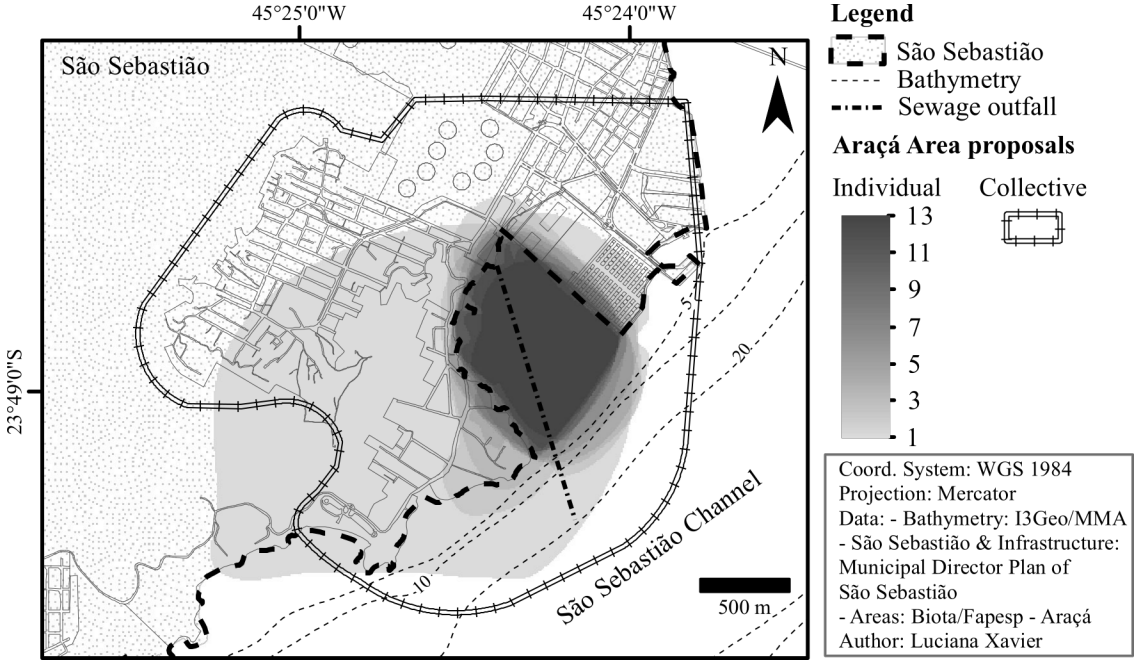


The map shows the overlapping of the individual proposals (gray, with darker shades indicating areas that were considered in a greater number of proposals, with the maximum being 6) and the final proposal agreed upon after group discussion (fenced line).
Source: made by the author

Group 2 comprised 13 people, including São Sebastião residents, researchers, and representatives of NGOs and government entities. Each participant created an individual delimitation proposal, most of which were restricted to the Araçá Bay and its vicinity, extending slightly over the marine and terrestrial areas surrounding it (Figure 6.2).

Individual proposals were based on many criteria, including the definition of the Araçá Bay and areas that influence it and connect it to other ecosystems.

Figure 6.2 – Proposal for the delimitation of the Araçá Area, made by the group formed by residents from other areas of São Sebastião and other municipalities, including researchers and representatives of NGOs and government entities (Group 2).



The map shows the overlapping of the individual proposals (gray, with darker shades indicating areas that were considered in a greater number of proposals, with the maximum being 13) and the final proposal agreed upon after group discussion (fenced line).
Source: made by the author

The collective discussion initially focused on which criteria to consider. The group envisioned two possibilities: considering the geographical definition of a bay by using the landward and seaward limits of Araçá Bay to delimit the Araçá Area, as proposed by most of the participants, or considering the socioeconomic characteristics (uses and activities) that directly affect the Araçá Bay.

The participants opted for the second approach and proposed the inclusion of municipal districts surrounding the bay and of the Port of São Sebastião in the terrestrial portion. For the marine portion, the delimitation followed the criteria used in the terrestrial proposal and considered the positioning of the sewage submarine outfall, whose discharge affects the bay, and of the most inshore areas of the São Sebastião Channel. The inclusion of the Port of São Sebastião was a point of conflict in the discussion; however, considering both the parameters used to justify municipal district inclusion (the direct influence on the Araçá Bay) and coastline configuration prior to the port, the port area was maintained in groups' final proposals for the Araçá Area (Figure 6.2).

The groups' final proposals included different areas (Figure 6.1 and Figure 6.2, fenced lines) and were explained by different arguments. Whereas Group 1 considered historical uses and characteristics, Group 2 focused on current interactions and threats to Araçá Bay. Nevertheless, some points of convergence were identified in the two proposals:

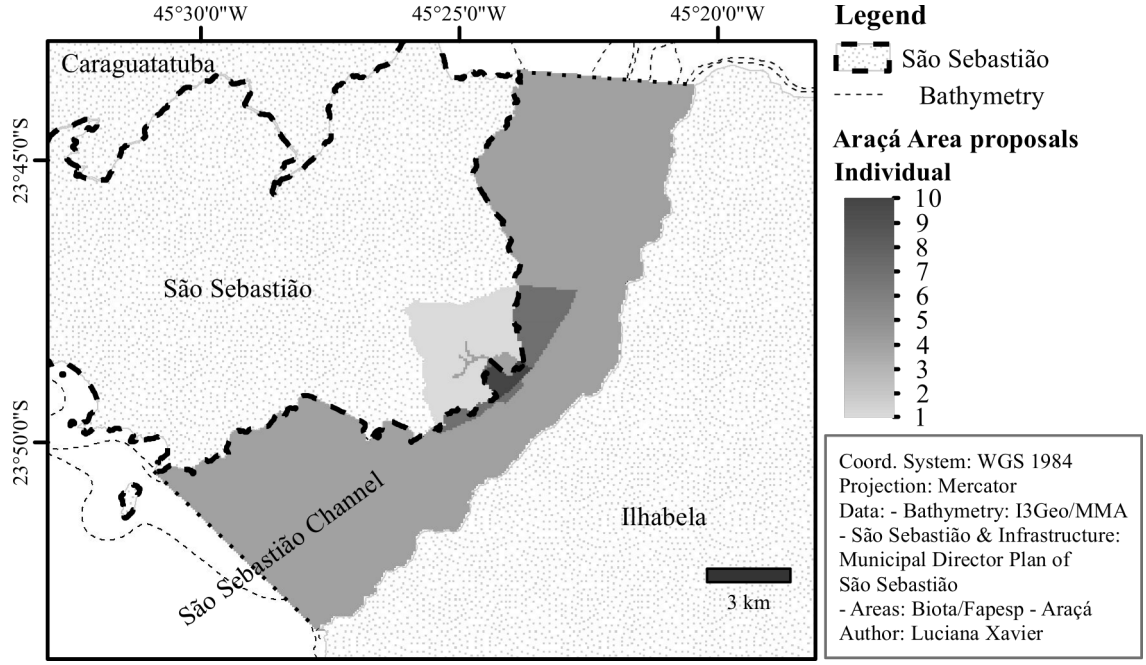
a) Araçá Area includes Araçá Bay but is not limited to it;
b) Araçá Area is composed of marine and terrestrial portions;
c) Port of São Sebastião infrastructure is part of the area, considering past human uses and coastline characteristics;
d) the marine portion includes the Araçá Bay and the most inshore part of the São Sebastião Channel, extending south-westerly;
e) both groups noted the influence of the São Sebastião Channel on the Araçá Area, indicating an understanding that any modification of the former would affect the latter (and vice versa);
f) the terrestrial portion includes areas of the municipal districts that surround the Araçá Bay. For this portion, each group had a different explanation, related to their connection to the Araçá Area. Group 1 considered historical uses and characteristics, whereas Group 2 considered the current influence of threats to the Araçá Area.

6.4.2 Scientific proposals

A total of 10 individual proposals were produced by the leading researchers on the Biota/Fapesp-Araçá Project (Figure 6.3). The researchers were approached individually through in-person meetings or virtual calls to elaborate individual proposals, which were recorded along with their explanations. All of the proposals included the bay, and most (8) included parts of the channel, usually up to 20 m deep, after which sediment and fauna have distinct characteristics from those found in the bay. Of the eight proposals that included parts of the channel, four did not provide an exact border, as was the case with two researchers who indicated that the Araçá Area might include the São Sebastião Channel and extend beyond it. In these cases, the proponents indicated that more data, related to their expertise, were needed to define the area.

Proposals also included a terrestrial portion. During the individual meeting, APAMLN's need to delimit the Araçá Area was explained to the researchers; for this reason, most of the researchers limited their proposals to the beaches and rocky shores, since APAMLN is a marine protected area. Despite limiting the terrestrial portion to coastal ecosystems, researchers recognized the influence of terrestrial activities and occupation patterns on the marine area, indicating a need for an integrated management approach. One proposal, nevertheless, included the surrounding watersheds and another that included the area occupied by the Port of São Sebastião, explaining that it was originally part of the bay area.

Figure 6.3 – Individual proposals for the delimitation of the Araçá Area made by leading researchers on the Biota/Fapesp-Araçá Project

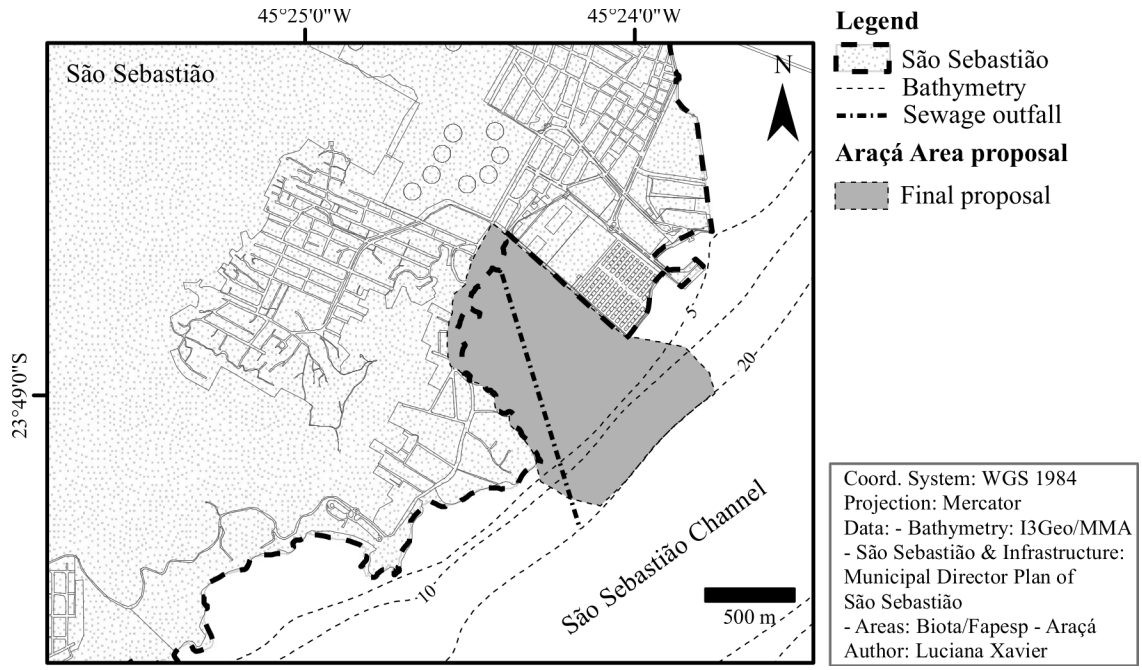


The map shows the overlapping of the individual proposals (gray, with darker shades indicating areas that were considered in a greater number of proposals, with the maximum being 10). The dotted lines at each end of São Sebastião Channel indicate that the limit is not a final proposal because the proponents indicated that more studies were needed to precisely define the total extent of the Araçá Area in the channel.
Source: made by the author.

The meeting to elaborate the collective proposal occurred on November 16, and only three leading researchers participated. The participants presented their individual proposals, and a synthesis of the other researchers' proposals was presented. Discussion focused on defining the terrestrial portion and the extension of the area to the channel, since inclusion of the Araçá Bay was a point of consensus. For the terrestrial portion, two possibilities were noted: limitation either to the Marine Lands (federal lands extending 33 m landward from the Line of High Tide of 1831) or by the state highway that passes

behind the bay. The participants considered the road the limit to pluvial draining that reaches Araçá Bay, since the exact dimensions of the Marine Lands may be difficult to define. The marine portion extending to the channel was defined as the area closer to the bay and that directly influences its hydrodynamic, sediment and fauna distribution. This area includes the area of the sewage outfall and waters up to 25–30 meters deep; however, its actual extension could not be determined. No consensus on the terrestrial or marine limits was achieved in the meeting, and the "final" map that illustrates the discussion is presented in Figure 6.4.

Figure 6.4 – Proposal for the delimitation of the Araçá Area made by leading researchers on the Biota/Fapesp-Araçá Project during the meeting held on November 16, 2015



The dashed line encircling the researchers' proposal indicates that the boundaries are only an expression of the meeting discussion and do not represent a final proposal, since no consensus on extension to the terrestrial and marine portions was achieved.
Source: made by the author.

Although the proposal limited the Araçá Area to the inner part of São Sebastião Channel, researchers stressed the importance and influence of São Sebastião Channel and adjacent coastal environments (other beaches, bays and nearby areas) to the maintenance of Araçá Bay's environmental quality, biodiversity, processes and ecosystem services.

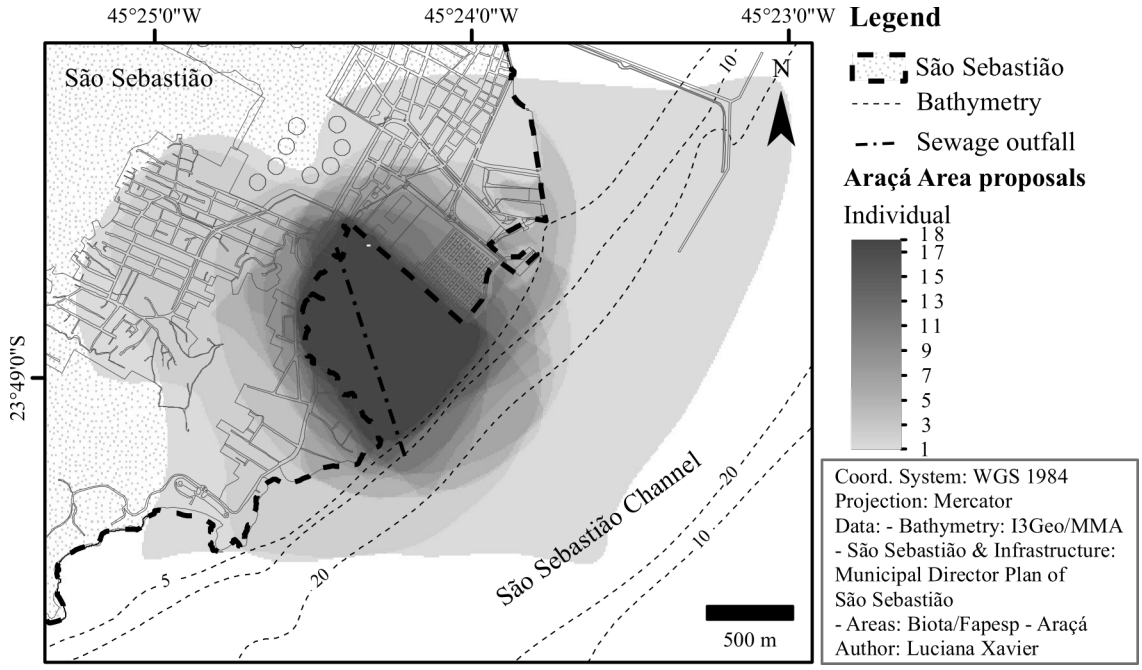
6.4.3 Integrated proposal

The discussion of the Araçá Area in the WG Araçá occurred during three meetings (March 31, May 19 and June 24, 2016). Participation varied among the meetings, with an average of 17 people attending each meeting and 30 people from 12 institutions attending overall.

Individual proposals were elaborated in the first meeting, where 18 proposals were presented (Figure 6.5). The individual proposals were centered on the Araçá Bay, with the majority covering terrestrial and marine portions closer to the bay. Individual explanations referred to historical and natural characteristics of the area; knowledge of fauna and sediment distribution and water circulation patterns; terrestrial and marine uses and occupation; and the geological definition of the bay, surrounding watersheds and catchment basin. Three points were highlighted: first, that the Araçá Area includes the Araçá Bay and some terrestrial and marine areas surrounding it; second, that it has changed throughout the years and that the historical characteristics should be considered in the delimitation; and third, that there is a larger area surrounding it that influences and is influenced by what occurs in the Araçá Area.

Many explanations referred to the areas that affect/influence the Araçá Area, which were considered extremely important to its maintenance. Some proposals even included these influencing areas in the delimitation of the Araçá Area. For this reason, the first point discussed collectively concerned the definition of what would be the Araçá Area and the Area of Influence (AI). The discussion led to a simple and objective definition that fit both the local community and other participants. The Araçá Area was understood as the area people referred to as actually “being in Araçá”, also considering the historical aspects, whereas all other areas initially proposed as parts of the Araçá Area given their influence would make up the AI. The participants deemed it necessary to delimit both the Araçá Area and AI.

Figure 6.5 – Individual proposals for the delimitation of the Araçá Area made on March 16 during a meeting of the Working Group Araçá of the Marine Protected Area of the Northern Coast of São Paulo State



The map shows the overlapping of the individual proposals (gray, with darker shades indicating areas that were considered in a greater number of proposals, with the maximum being 18).
Source: made by the author

During the discussions, the participants listed information considered important to define the limits (presented below). All of the participants were encouraged to bring the data that they or their institutions had to complement and inform the discussions. Information from the Biota/Fapesp-Araçá Project was presented as thematic maps. Information from other sources was not available to be presented in a spatialized form; nevertheless, some participants expressed knowledge in their discourses, contributing to the delimitation. The following information was considered in the discussion:

a) depth – local bathymetry was considered insufficient for establishing a border but was nevertheless considered a possible reference to the delimitation because limits based on isobaths are commonly used in zoning proposals;
b) sediment distribution – seasonal distribution of sediment in four distinct months throughout the year, showing a general seaward pattern from coarse sand to silt grains, with temporal variation. Considering sediment distribution, the limits between medium and coarse silt patches were proposed as the area's boundaries. Nevertheless, since distribution patterns

vary throughout the year, the data alone were not considered sufficient to define a precise border;

c) fauna diversity –abundance and occurrence (species richness) of benthic organisms (crustaceans, mollusks and polychaetes). Species abundance and richness decrease seaward, with a great gradient between the Araçá. Greater values were considered representative of the Araçá Area and were limited to the bay area. Nevertheless, researchers explained that the data also showed seasonal variations and that when considering other species (especially benthic macrofauna), studies showed that the abundance and richness patterns extend up to 20 m deep in the channel. In face of this information based on scientific knowledge, the participants proposed that the 20 m depth should be considered the border;

d) water currents – results from a circulation model evidencing tide-induced water currents. The participants identified the different current velocities in the region: one region with slower currents and a tendency to accumulate water in some areas where coastline presents an obstacle or a point of reentry and another with faster currents with no areas of water accumulation. Discussion noted that the region of slower currents is coincident with the Araçá Area, whereas the faster currents are a characteristic of the São Sebastião Channel;

e) traditional uses of the Araçá Area – areas used by local residents for fishing, leisure activities and vessel mooring in the "Araçá Area". This was considered the most representative information to define the Araçá Area because it evidences the historical and current aspects of the use of the territory and encompasses most of the previous limits. Data from the research project were complemented by information from local residents, who indicated non-mapped fishing areas that should also be considered;

f) legislation – legal norms applied to the management of the region, e.g., other protected areas, classification of areas of importance for conservation, delimitation of the Organized Port Area (area in addition to the port infrastructure related to port operations) and the Ecological Economic Zoning of the Northern Coast of São Paulo State, which indicate possible uses for marine and terrestrial areas. The information

showed incongruence between the overlapping of protected areas and areas destined for industrial use. It was proposed that the delimitation could help define desirable uses for the Araçá Area and should try to overcome the incongruences.

The information presented was complemented by the participants' local and empirical knowledge during the discussions in a quest for proposals and arguments for possible boundaries. Each type of information was discussed separately but considered together to achieve the final proposal because the participants realized that without working together, they could not provide sufficient robustness to the delimitation.

6.4.3.1 PROPOSAL FOR THE ARAÇÁ AREA

Although APAMLN is a marine protected area, limited landward by the mean high tide, the participants considered it important to define marine and terrestrial portions of the Araçá Area. This decision was made even though they acknowledged APAMLN had no legal support to manage terrestrial areas. Nevertheless, they felt that if the terrestrial limit were known, then the MPA could work in partnership with the institutions responsible for managing these areas (or activities in them), considering the need to integrate terrestrial and marine management systems.

According to the proposal, the terrestrial part of Araçá would comprise the municipal district of Varadouro and part of the municipal district of Topolândia, limited by the watercourse that flows across this last district (Figure 6.6). This area is understood as the Araçá Area for housing descendants of the *caiçara* people who first inhabited and used the area and for its historical and natural characteristics. According to traditional and scientific knowledge, before the construction of the actual port infrastructure, the area occupied by Topolândia was part of the original mangrove ecosystem and an extension of the beach.

The marine portion of the Araçá Area would start in the line of sandbank vegetation, on the beaches, and in the upper line of rocky shore organisms, all of which mark the transition from marine to terrestrial domains. In places where the natural ecosystem is already suppressed and this transition in not clear, the construction closer to

the sea (houses, walls and fences) marks the boundaries. On the coastline, the area extends from the southern part of the Varadouro district to the Outeiro mangrove, surrounding the actual infrastructure of the Port of São Sebastião. The watercourses that discharge between the two coastline limits are also considered part of the Araçá Area, since there is no physical barrier between them and the sea, and this area is perceived as a continuous environment.

The extension of the Araçá Area to Outeiro mangrove was based on the historical characteristics of the area, which was continuous before the construction of the Port of São Sebastião, and on actual connectivity between the Outeiro and Araçá mangroves. According to traditional knowledge, connectivity is evidenced by the mangrove species in the Outeiro mangrove (the Araçá mangrove is the last remnant of mangrove trees in the region, as the source of mangrove seeds to the Outeiro mangrove) and is maintained by fish and birds moving between the mangroves and the water circulation patterns. Although the participants supported this inclusion, there was no consensus concerning the inclusion of the port infrastructure in the Araçá Area.

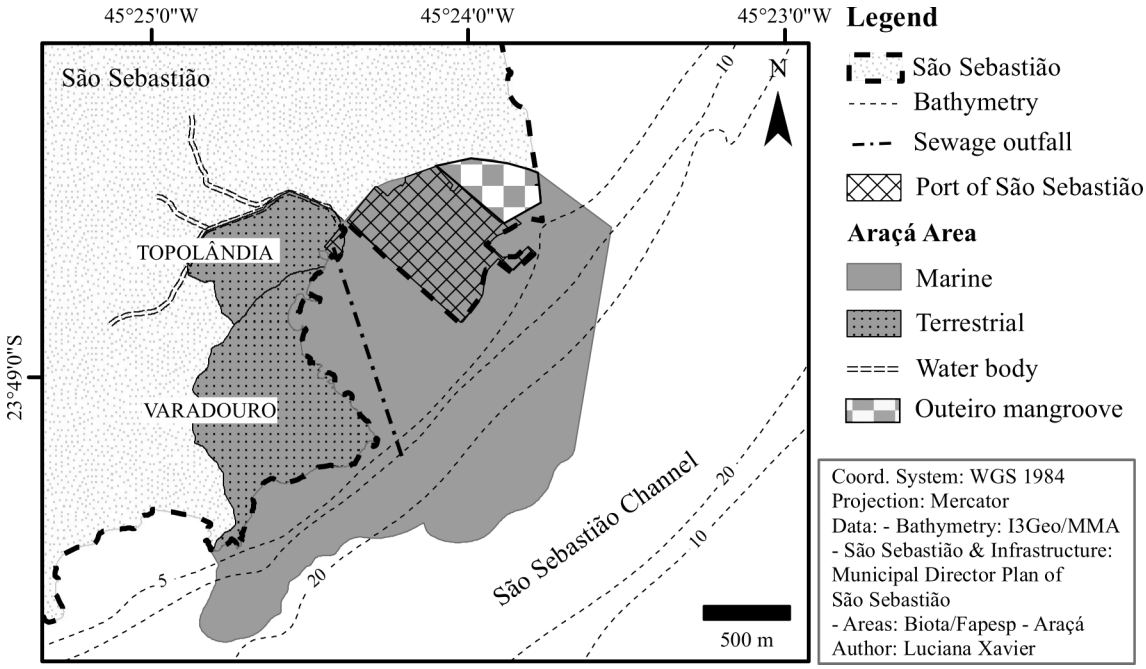
Although most of the representatives considered the port infrastructure part of the Araçá Area, for the same historical reasons, representatives of the port administration expressed concern regarding the implications of such inclusion for port management, since it is a competence of a specific institution. The argument against inclusion of the port area was also based on the fact that the decree that created APAMLN excluded from the MPA "areas destined to port service, its terminals and support facilities" as well as anchoring areas, areas for the passage of ducts and sewage outfalls (SÃO PAULO, 2008a). This argument led to a debate of whether to limit the discussion to the existent decree or extend the delimitation to the excluded areas and to propose a change to the decree. The participants opted for the latter.

The participants in favor of the inclusion of port infrastructure in the Araçá Area cited international examples of positive coexistence of ports and MPAs and argued that even with inclusion, port activities would still have to respect the MPA's environmental quality parameters. Initially, some participants expressed an expectation that including the port administration in the MPA would lead to increased port environmental responsibility with regard to its surrounding areas. It was explained that inclusion would not entail new regulation of port activities (governed by specific licensing regulations) nor impose any additional responsibility on the port administration. Even with this explanation and the

recognition that little, if anything, would change with the mere inclusion of the port in the Araçá Area, most of the participants expressed support for maintaining the area occupied by the port as part of the Araçá Area for the historical reasons; however, there was no consensus on this point.

Concerning the limits of Araçá Area in the São Sebastião Channel, the participants considered the differences in fauna and sediment between the bay and the channel, the tide currents and, mainly, the area used for fishing by artisanal fishermen. Fishing areas were identified by Mani-Peres (MANI-PERES, 2016) by interviewing 18 fishermen about where they fish in the Araçá Area. They originally extended from the Port landfill to the south (from the port landfill to the south, the fishing territory limits is coincident with the WG Araçá's final proposal). During the discussion, local residents reported the existence of more fishermen and noted other areas to the north of the original fishing area, connecting it to the Outeiro mangrove.

Figure 6.6 – Proposal for the delimitation of the Araçá Area resulting from discussions of the Working Group (WG) Araçá. Araçá Area includes the Araçá Bay, the Outeiro mangrove, part of the São Sebastião Channel used by local fishermen connected to the Outeiro mangrove, the watercourses that discharge in the area, the municipal district of Varadouro and part of the municipal district of Topolândia, limited by the watercourse that flows through the district. Most of the participants supported the inclusion of the infrastructure of the Port of São Sebastião in the Araçá Area because it occupies areas that were originally part of it; however, there was no consensus on this point in the WG



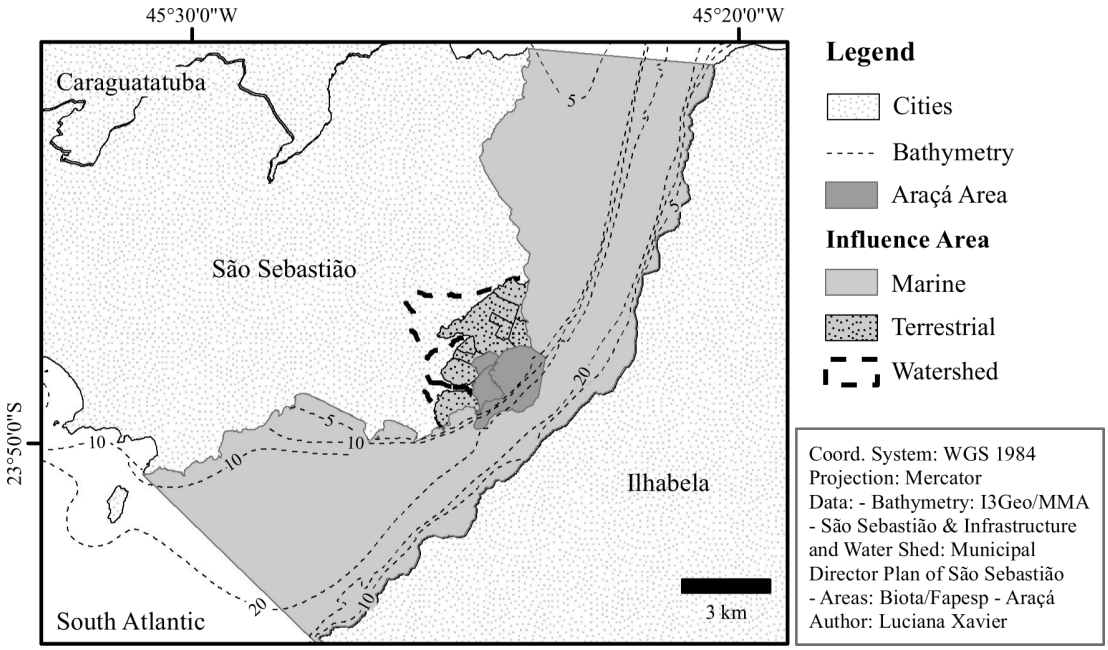
Source: made by the author.

Similar to the Araçá Area, the AI also has terrestrial and marine portions (Figure 6.7). The terrestrial portion comprises the districts (which are not included in the Araçá

Area) and the watersheds of the central region of São Sebastião that drain into the Araçá Area. It is the terrestrial area closer to the Araçá Area whose rain and river drainage and natural and anthropic impacts directly affect Araçá Area and, likewise, is affected by it.

The marine portion comprises the entire São Sebastião Channel, given the connection between processes in the channel and in Araçá Bay. The tide circulation model (presented during the discussion) and sediment transport model (information from one of the researchers participating in the discussion, which was not presented) from the Biota/Fapesp-Araçá project evidence this spatial integration by describing water exchange between the channel and the Araçá Area and sediment transport from areas closer to Ilhabela and from the northern and southern parts of the channel to the Araçá Area (scientific knowledge). Additionally, local residents reported fauna exchange from the Araçá Area to beaches to the south and north of the area (traditional knowledge).

Figure 6.7 – Proposal for the delimitation of the Influence Area of the Araçá Area resulting from discussions of the Working Group Araçá of the Marine Protected Area of the Northern Coast of São Paulo State. The area of influence includes the central districts and watersheds of São Sebastião and the entire São Sebastião Channel



Source: made by the author.

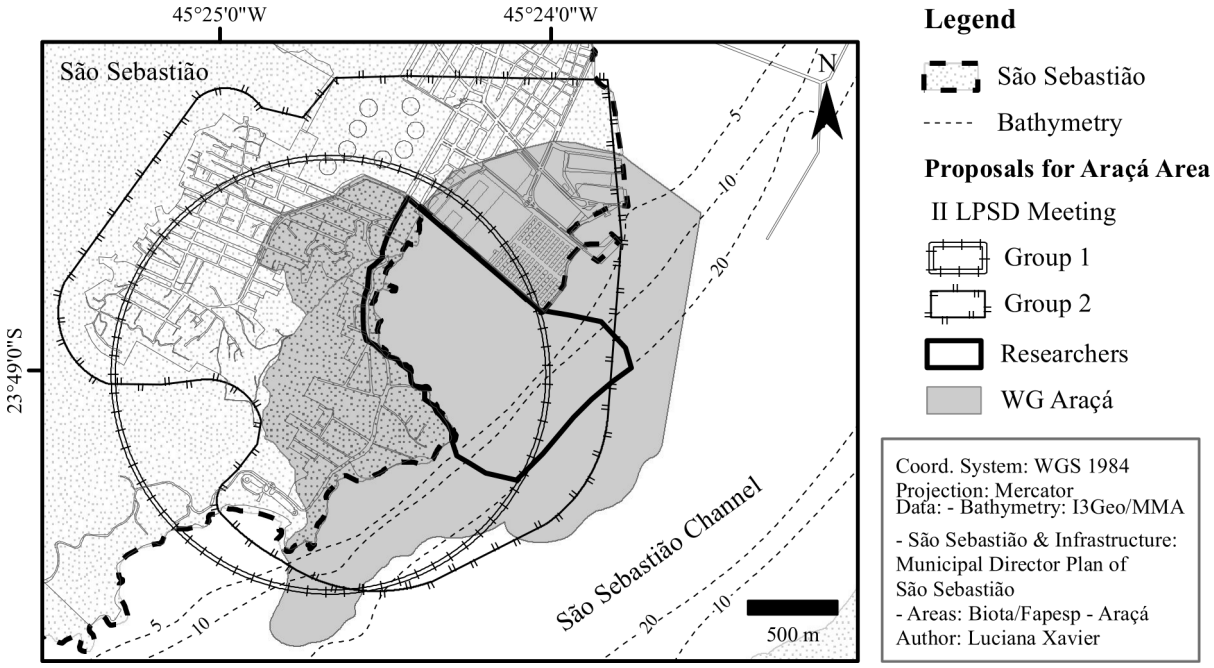
6.5 INTEGRATING THE DIFFERENT PROPOSALS: KE OUTCOMES

The integration of the different proposals and stakeholders in the WG Araçá, with their knowledge and interests, led to a final proposal that was larger than the simple sum of the original proposals (Figure 6.8), considering new criteria on which to base the delimitation, integrating scientific and local knowledge with users' perceptions, including the delimitation of the AI and of areas that were not previously considered part of the Araçá Area. These results corroborate the hypothesis that KE process would lead to substantive changes in the outcomes compared to a proposal elaborated by single groups of stakeholders.

The number of criteria used to formulate the proposals was greater in the WG Araçá's discussions (Table 6.1). During the LPSD discussion, proposals were mostly based on participants' perceptions of the territory (Group 1) and infrastructure that directly affected the Araçá Area (Group 2). With the exception of the terrestrial delimitation of Group 2, which aimed to follow the human occupation patterns, the limits were basically free-hand creations. None of the groups, for example, indicated depth limits or other sources of information as references in delimiting marine areas. Additionally, none of the groups indicated a need for more information to discuss limits.

The researchers, in contrast, noted that more information was needed to precisely delimit the Araçá Area; hence, their "preliminary" delimitation could not precise the extension of the area to the channel. However, the researchers were the first ones to note depth as a limit, considering that the average depth where fauna distribution (benthic fauna) changes indicates a transition from the Araçá to the channel area. Their proposal was based on scientific knowledge of the area, considering each individual study in the Biota/Fapesp-Araçá Project and the need for more information related to extending the sampling area for their own data and data from other modules of the project.

Figure 6.8 – Overlapping of the final proposals for Araçá Area elaborated in the different meetings that discussed the delimitation of the Araçá Area: related to the process of elaboration of the Local Plan for Sustainable Development of the Araçá Bay (LPSD – II LPSD Meeting), with researchers on the Biota/Fapesp-Araçá Project (Researchers) and of the Working Group Araçá of the Marine Protected Area of the Northern Coast of São Paulo State (Brazil)



Source: made by the author.

Delimitation of the Araçá Area in the WG Araçá meetings occurred gradually. First (March 31), the inner portion of the area was discussed (inclusion of the bay, port infrastructure and Outeiro mangrove). Then, the marine outer limits and terrestrial portion were discussed (May 19 and June 24) and, finally, the influence area (June 24). Delimitation of the inner portion was based on the participants' perceptions and knowledge. Inclusion of the bay was a point of consensus, whereas the inclusion of the port infrastructure, based on historical natural characteristics, was a point of dissension. Inclusion of the Outeiro mangrove, based on its connectivity with the Araçá mangrove, as reported by local residents, was a point of consensus. Including this mangrove because of its ecological characteristics had not yet been proposed (the mangrove area was part of the Group 2 terrestrial proposal, considered part of the municipal district but not a mangrove *per se*) and was based on the local residents' traditional knowledge.

Delimitation of the extension of the Araçá Area to the channel occurred after more information about the region was identified and presented. Although most information had geographical limits, being restricted to the Biota/Fapesp Araçá Project sampling area that focused on the Araçá Bay, the participants discussed it and complemented the "gaps" with their empirical knowledge. As in the case of inclusion of

the Outeiro mangrove, local knowledge of residents and of researchers was used to discuss sediment and fauna distribution and fishing territories.

For the delimitation of the terrestrial portion, local knowledge was again the basic source of information. The notion of considering historical characteristics as criteria was presented in the LPSD II Meeting proposals and emerged as a justification for including Port of São Sebastião infrastructure in the Araçá Area. In the WG discussion, this criteria was mainly employed to delimit terrestrial area. The discussion focused not on the municipal districts that directly influence the Araçá Area (which were considered part of the Influence Area) but on indicating regions that had been occupied by coastal ecosystems (mangrove and sandbank vegetation, shell deposits) in the past and that now housed many *caiçara* descendants, despite the district zoning (i.e., only half of Topolândia district is considered part of the Araçá Area). Local residents from the vicinity of Araçá Bay had experienced the changes in the coastal area resulting from the Port of São Sebastião installation and past expansions and could report impacts consistent with scientific literature (MANI-PERES et al., 2016); accordingly, it is logical to assume that their report of past natural characteristics was also accurate. The results of the WG discussion of the terrestrial portion, although it was based on the same criteria (historical and natural characteristics and actual uses and occupation), were much more objective and refined than the former proposals, resulting in a proposal that was narrower than that delimited by II Meeting participants.

The Araçá Area and the AI proposed by the WG Araçá represented an advance when considering the three other proposals. It promoted the exchange of local and technical knowledge and considered specific criteria, leading to discussions in greater depth and to the inclusion/exclusion of areas that no other proposal had previously considered. This corroborates the hypothesis that the integration of different knowledge and perceptions in participatory process leads to improved management propositions.

Table 6.1 – Main criteria used to justify final proposals for the Araçá Area indicated by participants in the different meetings that discussed the subject: related to the process of elaboration of the Local Plan for Sustainable Development of the Araçá Bay (LPSD Meeting), with researchers on the Biota/Fapesp-Araçá Project (Researchers) and of the Working Group Araçá (WG Araçá) of the Marine Protected Area of the Northern Coast of São Paulo State (Brazil)

Criteria	LPSD Meeting		Researchers	WG Araçá
	Group 1	Group 2		
Current natural characteristics	X	X	X	X
Historical natural characteristics	X	X		X
Current uses & occupation	X	X		X
Historical uses & occupation	X			X
Transition bay-channel		X		X
Watershed and watercourses		X		X
Land-Sea interrelation		X	X	X
Fauna distribution			X	X
Marine lands			X	
Depth			X	
Draining area			X	X
Sediment distribution				X
Water currents				X
Connectivity				X
Legislation*				X

* Legislation was presented; however, legal limits concerning areas excluded from the Araçá Area were disregarded.
Source: made by the author

6.6 EVIDENCE OF SOCIAL LEARNING IN THE DISCUSSION OF THE ARAÇÁ AREA

The discussion of the delimitation of the Araçá Area in the WG Araçá was an additional opportunity for interaction and the exchange of knowledge among different stakeholders. They were part of ongoing SL processes, which were fostered by the KE in the WG Araçá meetings, supporting the hypothesis that KE is an opportunity to promote SL.

The discussion of the Araçá Area promoted KE and knowledge translation between the Biota/Fapesp-Araçá Project and the community. Project members provided new scientific information (yet to be published), and the local community shared their traditional knowledge of local characteristics and processes. The connectivity between the Araçá and Outeiro mangroves, reported by local community members, had gone unnoticed by researchers who, despite gathering extensive data in Araçá Bay and its surroundings,

had no technical evidence to support this claim, which aroused their interest in further investigation. The emergence of scientific questions from the interaction with local and traditional knowledge evidences the importance of closer relationships among researchers, stakeholders and decision makers to conduct more focused investigations and enhance science-policy integration (CVITANOVIC et al., 2015b; MCNIE, 2007; STEYAERT et al., 2007) and reinforces the importance of including traditional knowledge in the management process (BERKES; FOLKE; GADGIL, 1995).

Information about the role of some institutions was also provided, which did not occur during LPSD elaboration. Information about APAMLN´s objectives and functioning was provided to explain the aim of the WG Araçá and the path that the WG's delimitation proposal would follow. Information about the roles of IBAMA (federal licensing and control institution) and port administration was also needed to manage expectations about possible changes with the inclusion of the Port of São Sebastião in the Araçá Area. Initially, some expected that with its inclusion, port administration would assume the responsibility for cleaning and maintaining the surrounding areas:

> "[…] with the inclusion of the port in the Araçá Area, things can change […] IBAMA can demand that the port cleans the stream that discharges in Araçá because the port has resources that city hall does not […]" (Participant of the WG Araçá Meeting).

This expectation was eliminated after information about the port administration's roles and demands related to the licensing of port activities was provided.

The expressed need to delimit the influence area, which is considered crucial to the maintenance of environmental quality and functioning of the Araçá Area, and the call for integrated terrestrial and marine management evidence recognition of the interconnection and complexity of the ecosystem, a knowledge change promoted by SL processes (GARMENDIA; STAGL, 2010):

> "Anything that happens or is installed in the São Sebastião Channel affects the Araçá Area" (Participant of the WG Araçá Meeting)
> "For the influence area […], it would be necessary to articulate with other institutions to manage the territory and promote the protection of Araçá Area. […]" (Participant of the WG Araçá Meeting)
> "[…] it is important to identify the responsible institutions and talk to them about the problem […]" (Participant of the WG Araçá Meeting)

Civil society's participation in the WG Araçá meetings was fostered by the changes in social context promoted by the LPSD elaboration processes and helped consolidate these changes. The participation of some members of the local community

occurred after local community became acquainted with APAMLN, during the LPSD elaboration process, and by participating in the WG Araçá, local community became involved with other working groups and with meetings of the management board.

Evidence of SL in the Araçá Area discussions was also expressed where existent norms were questioned (ARMITAGE; MARSCHKE; PLUMMER, 2008; GRANEK et al., 2010), as in the discussion of the inadequacies of the state decree that included the Araçá Area in APAMLN but excluded some areas and infrastructure present in Araçá Bay from the MPA. The participants questioned not only the exclusion of port infrastructure from APAMLN but also every exclusion because the decree does not state where the areas are or whether it refers to existing or future uses. With reference to the attributed environmental importance of the Araçá Area, the participants expressed a need for adequate environmental protection and not to fit environmental legislation to existing uses:

> "The decree is contradictory. […] It says the Araçá Area is part of the APAMLN and excludes it at the same time. […] The sewage outfall crosses the Araçá Area; how can it be excluded? Should there be a hole in the MPA?" (Participant of the WG Araçá Meeting)
> "Araçá has been here prior to the installation of such infrastructures as the port and the sewage outfall. […] We must consider what existed first. Some uses of the area are in conflict with other environmental legislation, as the one that protect the mangroves […]" (Participant of the WG Araçá Meeting)

Another change was in the participants' attitude. If the initial proposal for inclusion of the port area were seen as an opportunity to increase port administration responsibilities, then the greater the area was, the better the situation would be. Such reasoning was abandoned during the process, and the participants worried about guaranteeing robustness to the proposal, including only areas that they could justify. For example, when discussing the influence area, concern about including a too-extensive area was reported. According to one of the participants, the delimitation of a too-extensive area risked not being accepted by the State Governmental Environmental Agency under the argument that there was insufficient information on which to base it. Indicating a smaller area, with plenty of information to justify it, would increase the chances of the proposal being accepted. This provided evidence of attitude change and of increased understanding of possible political constraints on the decision-making processes:

> "[…] wouldn't it be better to propose a smaller area that we know everything about? If we propose something too big, it can be rejected […] (considering the activities that affect Araçá area) […] It would be better to propose the entire channel. […] But if it is too big, it may be

> questioned further in the process […]" (Participant of the WG Araçá meeting)

The final proposal for the Araçá Area, compared to the initial proposal for each participant, evidenced the changes in framing and reframing, resulting in a collective understanding of the boundaries of the Araçá Area and of the criteria that justified the delimitation proposal.

6.7 CONCLUSION AND FINAL CONSIDERATIONS

This chapter evidences the importance of integrating different stakeholders and knowledge systems in decision-making processes to advance in the management of coastal areas. The work with the Working Group Araçá of APAMLN led to advances in the discussion of and proposal for the boundaries of the Araçá Area, identified possible criteria that can be used to discuss the delimitation of other coastal areas and promoted SL. These results corroborated the hypothesis that the integration of different knowledge and perceptions in participatory processes results in substantive changes in outcomes compared to a proposal elaborated by single groups of stakeholders. Additionally, evidence of changes (in knowledge, recognition of the complexities of the system, social context and framing/reframing the understanding of Araçá Area) corroborates the hypothesis that KE processes foster SL.

In addition to SL changes, the processes advanced the practices of integrating science, management and KE. The discussion promoted KE, knowledge sharing and knowledge translation, and the final proposal for the Araçá Area was not the only management improvement in the processes. The identification of criteria to be considered in the discussions was another improvement that can be applied to the delimitation of protected coastal regions. The definition of these criteria is another example of KE, the co-production of knowledge, based on the interaction of different academic and non-academic actors in a transdisciplinary approach fit to post-normal scientific practices (FUNTOWICZ; RAVETZ, 1993, 2003). In such practices, knowledge is constructed in the interaction among different actors who learn by participating and make room for concerted action and SL.

The process described here attracts attention to another aspect of science-policy integration, the need to incorporate scientists in management processes. Araçá Bay has specificities in relation to other coastal regions. Although the general tendency is a dearth of information about coastal areas, Araçá is one of the places where the most information has been gathered on the São Paulo coast (AMARAL et al., 2010). Additionally, the Biota/Fapesp-Araçá Project is the largest and most recent effort to produce more information about this region, considering many disciplines and with the objective of providing information for managing the area (AMARAL et al., 2016), which granted it a prominent position within the financing agency (FAPESP, 2015).

Other than the group that produced the LPSD of Araçá Bay, few other researchers on the Biota/Fapesp-Araçá Project were in contact with APAMLN management processes or even with the local community. Despite Biota/Fapesp-Araçá's focus on providing information for management processes, the project design did not consider the managerial needs of the area. Taking the delimitation discussion as an example, the project's information provided was limited to the sampling areas and could not alone be used for a precise delimitation. Emerging literature shows that if scientific information is to be used in decision-making, new relationships between researchers and decision-makers are required, with greater proximity and trust between the two groups and with new methods for knowledge production (CASH et al., 2003; CVITANOVIC et al., 2015a, 2015b; MCNIE, 2007). The process of delimitating the Araçá Area was a step in the direction of this necessary arrangement; nevertheless, there remains much progress to be made.

7 FINAL CONSIDERATIONS

New arrangements are needed to confront the problems derived from human intervention in natural ecosystems and, through the years, participatory management of natural resources and ecosystems has been producing improved, more resilient, informed and context adapted solutions (ARKEMA; ABRAMSON; DEWSBURY, 2006; BEIERLE; CAYFORD, 2002; BERKES, 2004, 2009; CURTIN; PRELLEZO, 2010; CVITANOVIC et al., 2015a; D'INCAO; REIS, 2002; DIMENTO; INGRAM, 2005; LONG; CHARLES; STEPHENSON, 2015; REED, 2008; RENN, 2006; STEYAERT; JIGGINS, 2007).

Nevertheless, participation by itself is not sufficient given the increasing complexity and uncertainties related to environmental problems. It is also necessary to promote social and institutional changes and engage stakeholders to find new collaborative ways to work together. Promoting social learning (SL) is one way to achieve such changes and reports of SL in the management of single resources and small areas is well documented (BLACKMORE; ISON; JIGGINS, 2007; CRAPS, 2003; CRAPS; MAUREL, 2003; ISON; RÖLING; WATSON, 2007; KUMLER; LEMOS, 2008; LEACH; PELKEY, 2001; MOSTERT et al., 2007; PAHL-WOSTL, 2006; PAHL-WOSTL et al., 2007; PAHL-WOSTL; MOSTERT; TÀBARA, 2008; TIPPETT et al., 2005). The research presented here collaborate with the social learning discussion by providing evidence of social learning occurred in the management of a marine protected area and of ways to foster it.

Compared to other ecosystems, management of coastal and marine areas is a more complex challenge that involves handling a continuous, tri-dimensional and multi-ecosystem environment with multi-scale dynamics and processes, making it difficult to have all the information necessary to management, control impact drivers (which may be external to the managed area) and foresee impact and management outcomes, granting a great degree of uncertainty to decision-making. Additionally, it is a common use and open access environment, which results in the need to engage multiple stakeholders in the management process and requires more resources to managerial activities and surveillance. The management of such areas is usually a shared competence with many governmental organizations in different hierarchical levels, increasing even more the complexity since local stakeholders (usually involved with the participatory management) do not have all the information and power to enforce their management proposals. These challenges

increase with the size of the area to be managed. In synthesis, the management of MPAs may offer additional barriers to social learning to occur, but may also represent new opportunities to it. In Chapter 1, three questions were presented: are there evidences of social learning in coastal management? How can social learning be fostered in the context of coastal and marine management? Can social learning improve participatory management of coastal and marine areas? In this final chapter these questions will be adressed in view of the evidence presented in the previous chapters.

Concerning the existence of evidences of SL, Chapter 2 shows that given the proper governance structure, stakeholder involvement and funding, social learning can occur naturally in the management of MPAs. In the four years considered to the analysis of APAMLN management, social learning is evidenced by strong social organization, social empowerment, change in stakeholder behavior, collective identification of problems and participatory joint discussions to solve them, establishment of new relationships among organizations and individuals, and proposals for sustainable uses for the region.

In APAMLN, SL was issue dependent and occurred mainly in the smaller, more focused groups, which acted as nodes in a larger network in which what is learned can be passed through other nodes, ultimately achieveing the entire network. Especially through the activities of the smaller groups discussing specific problems, learning was promoted by the integration of different values and points of views, and of local and scientific knowledge to the joint characterization of the issues under discussion. This resulted in a shared understanding of problems, shared recognition of goals and solutions, a wider ownership of solutions and the establishment of a *modus operandi* to discuss environmental issues in the MPA.

Evidences of the SL changes reported by Garmendia and Stalg (2010) were also observed both in the LPSD process (Chapter 5) and the delimitation of the Araçá Area (Chapter 6). In the LPSD processes, changes in declarative knowledge involved the adoption of new information and scientific terms applied to the discourse of local community and about the role of the different institutions involved with APAMLN and Araçá Bay's management. Changes in effectiveness knowledge, though evidenced in lesser degree, were present in the analysis of proposed solutions to Araçá Bay's problems, concerning a change in the understanding of what type/characteristics of actions would be more effective to solve problems, mainly based on a more participatory approach.

Changes in recognition of the system complexity were observed in the discussions of Araçá Bay's characteristics and processes that support bay's ecosystem services. To explain the importance of the bay, participants on the meetings, who initially limited their reference to the bay's biodiversity, started referring to the characteristics of the water (water temperature, depth and process of water exchange with the channel), of the bay (shallow, protected from currents) and to the presence of nutrients and organisms to support food production, as important to support the biodiversity. Increased understandment of system complexity was also observed during problems' discussions in planning meetings. Collective understanding of the greater complexity of the problems led to solution proposals that went further than directly combating the problem (e.g., treating sewage, law implementation or cleaning solid waste) and were inserted in a more complex arrangement that considered providing information to society, promoting education and behavioral changes, implementing new and focused public policies and an increase in social participation and control over institutions.

Changes in social context were mainly related to the establishiment of new relationships between Araçá local community and APAMLN, and of the empowerment of local community through participation, leading to a more pro-active behavior of local agents, who took to themselves the responsibility for the implementation of the LPSD of Araçá Bay, portrayed by the voluntary creation of a local group to discuss Araçá Problems, the LPSD Guardians group, organized and coordinated by local champions.

Changes in the appraisal of facts (framing and reframing) and increased understanding of others perceptions and needs were observed throughout the process, especially considering the concern about maintenance of Araçá Bay for future generations to have a space for sports and leisure activities, fishing and, most of all, to maintain the connectivity with the seascape and the *caiçara* culture. Activities to discuss Araçá problems provided stronger evidence of such changes, registered in the individual and collective characterization and proposals of solutions to them. Comparing individual and collective work, the number of items considered for problem characterization and solutions were always greater in group's final poster. On average, a group poster registered 9 characteristics and 7.5 solutions more than individual tables. Groups' discussion and final poster included most of each individuals' items and new characteristics/solutions emerged that had not been proposed by any individual.

Analysis of the process for delimitation of Araçá Area (Chapter 6) provided more evidence of SL changes related to the LA21 process, this time fostered by emphasis on knowledge exchage. The discussion of the Araçá Area promoted KE and knowledge translation between the Biota/Fapesp-Araçá Project and the community, fostering changes in knowledge. Project members provided new scientific information (yet to be published), and the local community shared their traditional knowledge of local characteristics and processes. During the discussion of each data considered for the delimitation, participants also perceived the need to consider different information toghether for a comprehensive characterization of the processes that delimit Araçá Area, evidencing changes in the recognition of system's complexity. Another change was in the participants' attitude and in the recognition of possible political constraints on the decision-making processes. Initially, proposals for larger areas were seen as an opportunity to increase conservation and the resposatility of local institutions for the solution of Araçá problems. Such reasoning was abandoned during the process, and the participants worried about guaranteeing robustness to the proposal, basing it in strong justifications that would limit future political constraints. The final proposals, collectively built, are the strongest evidences of changes in the appraisal of facts, since collective proposals embraced different views and knowledge systems.

As for how to foster social learning, the main factors affecting SL in APAMLN, reported in Chapter 2 and Chapter 3, were similar to those reported for other participatory processes. From Chapter 2 it was shown that they include the existence of a political and institutional structure, proceedings for interaction and information dissemination and the engagement of a diversity of stakeholders. Nevertheless, some strategies involving specific factors promote SL in the context of large MPAs. Those strategies include working with a large number of stakeholders and discussing different issues simultaneously, promoting discussion in small groups but scaling up the learning. Results of the two chapters also showed tat SL can be hindered by the external management structure, since board's proposals are under the authority of FF and SMA approval, what does not always occur, demotivating participation

Chapters 3 adds to the discussion of factors affecting social learning and notes aspects that had not been previously observed, related to stakeholders' perception of the management process. Some of them represent specific situations of APAMLN (advertising information, diversity of stakeholders, number of meetings and issues election) but can be

considered in the conduction of any participatory process. One of them, to locate meetings as to favor participation, represents an unique managerial challenge for large protected areas, where stakeholders may have to travel long distances to participate in meetings, making it even more important to motivate and engage them so that they are not demotivated by distance. In this context, promoting SL can be both the means and the ends of the motivation.

With reference to the combined results of Chapters 2 and 3, some specific indicatives on how to foster SL in large MPAs can be drawn. Limitation of participation should be avoided since diversity of participation is key to social learning. One way to do this is to increase the number of official members of the management board by favoring the occupation of a single seat by two different organizations (one as full and one as an alternative member). This can result in a duplicated number of organizations involved and an increase in the number of individuals. Diversity should also consider different organizations within the same sector. As an example, research and educational organizations should involve organizations that have different and complementing research fields. Participation, nevertheless, should not be limited to official members, since management boards have limited number of members. Creating opportunities to non-members to engage in the discussions is another way to increase the involvement of different organizations and individuals, as in the thematic and working groups, where participation is opened. Considering the facility to attend meetings and engage in smaller groups activities the involvement of local organizations that already operate in the area being managed is recommended.

Promoting social learning is not about gathering all the interested stakeholder at a single place at a time (BOUWEN; TAILLIEU, 2004). Rather it is better to engage specific stakeholders in deeper discussions, organizing them in smaller groups as the TGs and WGs. Such groups allow that multiple issues can be discussed simultainiously, without overloading participants and acting as nodes in a network, sharing their experiences with other nodes and thus allowing social learning to affect the entire network. In APAMLN, governance structure with the smaller groups that report to the management board guaranteed that many issues were discussed not only at the same time in these different groups but also (with less operational details) in the management board.

Identifying common interests that aggregate different stakeholders in constructive discussions fosters integration and learning. In APAMLN, discussion of environmental

impact assessment was a great opportunity to increase the interaction of all stakeholders that have a common interest in protecting the area against impacts from local enterprises.

Adding to this discussion, Chapter 4 attracts attention to the need to understand which roles each organization has in the process and identify possibilities to explore different roles. Especially in the case of scientists, they can act from information providers to process facilitators. The results also show that, although knowledge provision is recognized as the primary role of R&E organizations, stakeholders recognize, and call for, a need of greater involvement of scientists in the discussions and construction of management propositions. In APAMLN governance system there are two moments when R&E organizations interact with the management process. First, by engaging in the discussions and proposition for the management of the MPA in meetings of the marine board (MB), thematic and working groups (TGs and WGs), secondly when the management proposition is sent from the FF to IP and IOUSP, to be analyzed. Such arrangements promote two different types of interaction. The first one can foster knowledge integration and the co-production, with scientists having many roles as knowledge co-producers, knowledge brokers and information translators. The second one, on the one hand, can be a possibility of approximating management and R&E organizations and can raise awareness of the second to issues under discussion on the former, increasing interest of scientists for participating in and contributing to the management process. On the other hand, evidences a view of science and management as very separated subjects/worlds, and grants a privileged position of these research organization over the decision-making process by giving them power to interfere in the management proposals without participating in the discussions.

To encourage science-policy integration through increased participation in decision-making processes, the results of Chapter 4 indicates four questions to be considered: how, where, when and which organizations to engage. How relates to the role the R&E instituions can have in the processes, form official members of the management group to external consultants. Where is related to the particiatioin in the management board or in specific groups, to discuss specific issues. When relates to the moment of the participations, in a specific momento of the discussion or, preferably, through the entire process. Nevertheless, considering the difficulty for scientists to engage in long processes, a punctual participation of specialists in specific turning moments when more information is required should not be disregarded. Concerning which organizations to engage, Chapter

4 results indicate that local organizations engage more than “outsiders”. Accordingly, fostering the engagement of local organizations may grant better results concerning an active engagement and collaboration to the discussions, and also considering their proximities to the problems and other stakeholders, that can make it easier to establish a personal relationship.

When discussing new roles for instituions, individuals should also be considered. Finding new roles for individuals, e.g., encouraging WGs members to act as coordinators, is another possibility to foster SL. Finding and exploring new roles depend on changing individuals and organizations perceptions of their own roles in the management process, and should also be carried out as a participatory discussion.

Participatory practices are important also to determine how the management processes itself should operate, aiming to further engage individuals with the process and promoting social learning and change. In this sense, Chapter 5 findings draw attention to the importance of process design having the LPSD process as an example. Focusing on the mobilization and on promoting the engagement of local community, and giving time for interaction and collective discussion, it promoted social capital and changes in social context that overcome the construction and implementation of the LPSD of Araçá Bay and may guarantee that the process does not stop with LPSD publication. Were the LPSD of Araçá Bay process to be analyzed with the usual metrics applied to LA21 processes, it would score poorly. Nevertheless, considering the process as a whole and the SL changes demonstrated in it, the importance of the construction of the LPSD of Araçá Bay is emphasized, supporting the need to consider the entire process to evaluate LA21 implementation.

Social learning, as a participatory process, takes time. Time is necessary to build the relationships of trust needed in participatory groups, to give voice and attention to all the involved stakeholders and to promote active involvement and the co-production of knowledge and new solutions. For this reason, the process of discussing a given issue should be favored in relation to the need of producing a rapid solution. In the LPSD process, for example, diagnosis phase took a long time for mobilizing and engaging local community for the construction of the plan, and after that, building a collective understanding of the problems, during planning phases, was prioritized in relation to focusing on solutions. This fostered the social changes that made participants acknowledge the necessity for greater social involvement and control in the management of the region,

and led to the establishment of the Araçá Bay Guardians Group, to continue the activities to implement the plan. Had the time being used differently, it is possible that, despite having a planning proposal, there would be no group to promote its implementation.

Chapter 6 provides the last discussion of the importance of KE to foster SL and a practical example of the improvement of such process to ICM. The integration of the different proposals and stakeholders in the WG Araçá, with their knowledge and interests, led to a final proposal that was larger than the simple sum of the original proposals, considering new criteria on which to base the delimitation, integrating scientific and local knowledge with users' perceptions, including the delimitation of the AI and of areas that were not previously considered part of the Araçá Area, indicating changes in the recognition of the complexity of the system and in framing the problem. The expressed need to delimit the influence area, which is considered crucial to the maintenance of environmental quality and functioning of the Araçá Area, and the call for integrated terrestrial and marine management evidence recognition of the interconnection and complexity of the ecosystem. The results corroborate the chapter's hypothesis that KE process would lead to substantive changes in the outcomes compared to a proposal elaborated by single groups of stakeholders.

Processes described in Chapter 2 also provide evidences of SL improving APAMLN management. In APAMLN, the improvement of social participation is embodied in the creation of the management board itself, since it was the first participatory arena to promote discussions focused on coastal and marine issues. This brought to the decision-making processes stakeholders that had little tradition in participating, as artisanal fishermen. By engaging with the SL process, first focusing on discussing fishing related issues, such stakeholders increasingly joined broader discussions, as participating in environmental impact assessment analysis and producing their own analysis in addition to APAMLN's one. This evidences that participation was not limited to the APAMLN and has also been extended to regional participatory processes. The establishment of the *modus operandi* to develop management proposals in APAMLN is "*per se*" an indicative that social learning can improve participatory management of coastal and marine areas, promoting a more democratic discussion of problems related to the use and occupation of coastal waters.

During the elaboration of the LPSD of Araçá Bay (Chapter 5), the changes promoted by social learning also affected participation of local stakeholders in other

management processes. In this case, local community was unaware and had never joined activities of APAMLN management processes, which was altered by institutional changes promoted by the LPSD process. Local communities engaged with APAMLN activities, first in the Working Group Araçá and later on fishing related issues and management board meetings. In this processes, another group was formed to foster social engagement in the implementation of the LPSD, the Araçá Bay Guardians Group.

In the LPSD, the changes promoted by SL, expressed in the recognition of the complexity of the system led to the proposition of solutions that were more complex and expressed the need to solve the problem in a more systemic approach, considering its natural and social drivers and not only the impacts that they promote. The proposed solutions, when implemented, will affect the role region, improving local ICM practices and achieveing beyond the Araçá Area. The recognition that the SL reported in this thesis did not only affected the context in which the management discussions occurred, but also extended to other groups and regions corroborate the central hypothesis that SL can improve ICM

Results of the management of APAMLN represents an initial analysis of an ongoing process that has continued to change the social-environmental context it is inserted in, for longer than the period analyzed here. At least that is what is expected as a consequence of the learning that has been occurring in the management of APAMLN so far and the empowerment of local instituions and representatives. The management of EPAs in São Paulo State, nowadays, confronts the threat of being ruined from inside, with political choices guiding the indication of new managers and the renovation of the management boards to a minimum number of seats predicted in federal law, diminishing the possibilities of social involvement in the management processes. APAMLN's MB has also suffered from the replacement of its chair (first in March and again in May), from the interruption of the activities for the formulation of its management plan and the meetings performed by the MB and its smaller groups have stopped, with the exception of the meetings of the Working Group Araçá (WG Araçá), which creation was related to the activities of the Biota/Fapesp-Araçá Project.

The process related to the implementation of the Araçá Bay LPSD, has just started and has already evidenced a great potential to foster even more SL processes and integrate the different sectors with interest in the Araçá Area, especially considering science-policy

integration. After the research reported in this thesis the Guardians group has been meeting and establishing agendas with municipal authorities and other instituions indicated as related to the solutions of the problems identified in the bay. The groups' meetings have been conducted in cooperation with the meetings of the WG Araçá and continued despite the manament difficults of APAMLN, reported above. A result of the SL and capital social built in the processes reported in here. For the near future, ous analysis is that the group will continue to work and increasing the reach of the improvements achieved so far.

The actual context of the Northern Coast of São Paulo State and the operation of APAMLN and the Guardians Group configure a scenario for further studies of SL and its implications for ICM and to corroborate, or question the findings and predictions registered here. Still, integrated management based on knowledge exchange and social learning processes still need greater application and understanding in environmental management, especially with reference to coastal and marine ecosystems. This highlight yet another role of research organizations, despite the ones already discussed in this document: the political role to act as activists so that participatory and integrated management processes are fostered and have the conditions to happen in a proper way, improving environmental management in all areas. This sums to the challenges confronted by promoting sustainability to the oceans.

REFERENCES[6]

AGRAWAL, A. Indigenous and scientific knowledge: some critical comments. **Indigenous Knowledge and Development Monitor**, v. 3, n. 3, p. 3–6, 1995.

AMARAL, A. C. Z. et al. Araçá: biodiversidade, impactos e ameaças. **Biota Neotropica**, v. 10, n. 1, p. 219–264, 2010.

AMARAL, A. C. Z. et al. (EDS.). **Life in Araçá Bay**. São Paulo: Lume, 2016. 96 p.

ARAUJO, L. G. DE; SEIXAS, C. S. **Fishers' participation in coastal fisheries co-management: The case of the community of Trindade, in Southeastern Coast of Brazil.** Proceedings of the 65th Gulf and Caribbean Fisheries Institute. Santa Marta, Colombia: 2012.

ARKEMA, K. K.; ABRAMSON, S. C.; DEWSBURY, B. M. Marine ecosystem-based management: from characterization to implementation. **Frontiers in Ecology and the Environment**, v. 4, n. 10, p. 525–532, 2006.

ARMITAGE, D.; MARSCHKE, M.; PLUMMER, R. Adaptive co-management and the paradox of learning. **Global Environmental Change**, v. 18, p. 86–98, fev. 2008.

ASMUS, M. L. et al. Gestão costeira no Brasil: Instrumentos, fragilidades e potencialidades. **Gestão Costeira Integrada**, v. 5, p. 52–57, 2006.

BACCI, D. DE L. C.; JACOBI, P. R.; SANTOS, V. M. N. DOS. Aprendizagem social nas práticas colaborativas: exemplos de ferramentas participativas envolvendo diferentes atores sociais. **ALEXANDRIA Revista de Educação em Ciência e Tecnologia**, v. 6, n. 3, p. 227–243, 2013.

BAN, N. C.; PICARD, C. R.; VINCENT, A. C. J. Comparing and integrating community-based and science-based approaches to prioritizing marine areas for protection. **Conservation Biology**, v. 23, n. 4, p. 899–910, ago. 2009.

BARRAGÁN, J. M. **Políticas, gestão e litoral: uma nova visão da gestão integrada de áreas litorais**. 1. ed. Madrid: Editorial Tebar Flores, 2016. 683 p.

BARRUTIA, J. M. et al. From Rio to Rio+20: twenty years of participatory, long term oriented and monitored local planning? **Journal of Cleaner Production**, v. 106, p. 594–607, 2015.

[6] References in the Author-date system, ABNT NBR 6023

BEGOSSI, A. Fishing Spots and Sea Tenure : Incipient forms of local management in Atlantic Forest coastal communities. **Human Ecology**, v. 23, n. 3, p. 387–406, 1995.

BEGOSSI, A. Temporal stability in fishing spots: Conservation and co-management in Brazilian artisanal coastal fisheries. **Ecology And Society**, v. 11, n. 1, p. 5, 2006.

BEIERLE, T. C.; CAYFORD, J. **Democracy in practice: Public participation in environmental decisions**. Washington DC: Resources for the Future, 2002. 149 p.

BENNETT, N. J.; DEARDEN, P. From measuring outcomes to providing inputs: Governance, management, and local development for more effective marine protected areas. **Marine Policy**, v. 50, p. 96–110, dez. 2014.

BERKES, F. Rethinking community-based conservation. **Conservation Biology**, v. 18, n. 3, p. 621–630, jun. 2004.

BERKES, F. Evolution of co-management: role of knowledge generation, bridging organizations and social learning. **Journal of Environmental Management**, v. 90, p. 1692–702, abr. 2009.

BERKES, F.; COLDING, J.; FOLKE, C. Rediscovery of traditional ecological knowledge as adaptive management. **Ecological Applications**, v. 10, n. 5, p. 1251–1262, 2000.

BERKES, F.; FOLKE, C.; GADGIL, M. Traditional ecological knowledge, biodiversity, resilience and sustainability. In: PERRINGS, C. A. et al. (Eds.). . **Biodiversity Conservation: Problems and policies (Ecology, Economy and Environment)**. Netherlands: Springer, 1995. p. 281–299.

BLACKMORE, C. What kinds of knowledge, knowing and learning are required for addressing resource dilemmas?: a theoretical overview. **Environmental Science & Policy**, v. 10, p. 512–525, out. 2007.

BLACKMORE, C.; ISON, R.; JIGGINS, J. Social learning: an alternative policy instrument for managing in the context of Europe's water. **Environmental Science & Policy**, v. 10, p. 493–498, out. 2007.

BLANK, A. G. et al. A pesca de cerco-flutuante na Ilha Anchieta, Ubatuba, São Paulo, Brasil. **Série Relatórios Técnicos do Instituto de Pesca**, v. 34, p. 1–18, 2009.

BONNEY, R. et al. Citizen science: A developing tool for expanding science knowledge and scientific literacy. **BioScience**, v. 59, n. 11, p. 977–984, 2009.

BOUWEN, R.; TAILLIEU, T. Multi-party collaboration as social learning for interdependence: developing relational knowing for sustainable natural resource management. **Journal of Community & Applied Social Psychology**, v. 14, p. 137–153, 7 maio 2004.

BRADSHAW, G. A.; BORCHERS, J. G. Uncertainty as information: Narrowing the science-policy gap. **Conservation Ecology**, v. 4, n. 1, p. 7, 2000.

BRASIL (PRESIDÊNCIA DA REPÚBLICA). **Lei 7.661, de 16 de Maio de 1988**, 1988.

BRASIL (PRESIDÊNCIA DA REPÚBLICA). **Lei 9.985, de 18 de Julho de 2000**, 2000.

BRASIL (PRESIDÊNCIA DA REPÚBLICA). **Lei 5.300, de 07 de Dezembro de 2004**, 2004.

BRIGGS, S. V. Integrating policy and science in natural resources: Why so difficult? **Ecological Management & Restoration**, v. 7, n. 1, p. 37–39, 2006.

BROWN, K.; TOMPKINS, E. L.; ADGER, W. N. **Making waves: Integrating coastal conservation and development**. New York: Earthscan, 2002. 176 p.

BURAK, S.; DOGAN, E.; GAZIOGLU, C. Impact of urbanization and tourism on coastal environment. **Ocean & Coastal Management**, v. 47, p. 515–527, jan. 2004.

CAPPELLE, M. C. A.; MELO, M. C. DE O. L.; GONÇALVES, C. A. Análise de conteúdo e análise de discurso nas ciências sociais. **Organizações Rurais e Agroindustriais**, v. 5, n. 1, 2003.

CARRILHO, C. D. **Identificação e valoração econômica e sociocultural dos serviços ecossistêmicos da Baía do Araçá - São Sebastião, SP, Brasil**. 2015. 170 p. Dissertation (Master in Science) – Programa de Pós-Graduação em Ciências Ambientais da Universidade de São Paulo,. São Paulo, 2015.

CASH, D. W. et al. Knowledge systems for sustainable development. **Proceedings of the National Academy of Sciences of the United States of America**, v. 100, n. 14, p. 8086–8091, 2003.

CASH, D. W. et al. Scale and cross-scale dynamics: Governance and information in a multilevel world. **Ecology and Society**, v. 11, n. 2, p. 8, 2006.

CHAMBERS, R. The origins and practice of participatory rural appraisal. **World Development**, v. 22, n. 7, p. 953–969, 1994.

CHOI, B. C. K. et al. Can scientists and policy makers work together? **Journal of Epidemiology and Community Health**, v. 59, n. 8, p. 632–637, 2005.

CICIN-SAIN, B.; KNECHT, R. W. W. **Integrated Coastal and Ocean Management: Concepts and practices**. Washington DC/Covelo, California: Island Press, 1998. 517 p.

COHEN, L.; MANION, L.; MORRISON, K. **Research methods in education**. 5th. ed. London: Taylor & Francis, 2005. 463 p.

COMMISSION OF THE EUROPEAN COMMUNITY (CEC). **Roadmap for maritime spatial planning: Achieving common principles in the EU.** Brussels, 2008. 12 p. Available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0791:FIN:EN:PDF>

CONVENTION OF BIOLOGICAL DIVERSITY (CDB). **Aichi Biodiversity Targets**. Available at: <https://www.cbd.int/sp/targets/>. Acessed in: 25 set. 2014.

CORBIÈRE-NICOLLIER, T. et al. Assessing sustainability: An assessment framework to evaluate Agenda 21 actions at the local level. **International Journal of Sustainable Development and World Ecology**, v. 10, n. 3, p. 225–237, 2003.

COSTANZA, R. et al. The value of the world's ecosystem services and natural capital. **Nature**, v. 387, n. May, p. 253–260, 1997.

CRAPS, M. (ED). **Social learning in river basin management – HarmoniCOP WP2 Reference Document**. Bruxelles, Belgium, 2003. 70 p.

CRAPS, M.; MAUREL, P. **Social learning pool of questions: An instrument to diagnose social learning and IC-tools in European river basin management – HarmoniCOP combined WP2/WPE deliverable**. Cemagref, Montpellier, 2003. 65 p.

CUNDILL, G.; RODELA, R. A review of assertions about the processes and outcomes of social learning in natural resource management. **Journal of Environmental Management**, v. 113, p. 7–14, 30 dez. 2012.

CUNHA, Í. Conflito ambiental em águas costeiras: Relação porto–cidade no Canal de São Sebastião. **Ambiente & Sociedade**, v. VI, n. 2, p. 83–98, 2003.

CURTIN, R.; PRELLEZO, R. Understanding marine ecosystem based management: A literature review. **Marine Policy**, v. 34, n. 5, p. 821–830, set. 2010.

CVITANOVIC, C. et al. Improving knowledge exchange among scientists and decision-makers to facilitate the adaptive governance of marine resources: A review of knowledge and research needs. **Ocean & Coastal Management**, v. 112, p. 25–35, 2015a.

CVITANOVIC, C. et al. Overcoming barriers to knowledge exchange for adaptive resource management; the perspectives of Australian marine scientists. **Marine Policy**, v. 52, p. 38–44, 2015b.

D'INCAO, F.; REIS, E. G. Community-based management and technical advice in Patos Lagoon estuary (Brazil). **Ocean & Coastal Management**, v. 45, p. 531–539, jan. 2002.

DA FONSECA, I. F.; BURSZTYN, M.; ALLEN, B. S. Trivializing sustainability: Environmental governance and rhetorical free-riders in the Brazilian Amazon. **Natural Resources Forum**, v. 36, n. 1, p. 28–37, 2012.

DE GROOT, R. S. et al. Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making. **Ecological Complexity**, v. 7, n. 3, p. 260–272, set. 2010.

DE GROOT, R. S.; WILSON, M. A; BOUMANS, R. M. A typology for the classification, description and valuation of ecosystem functions, goods and services. **Ecological Economics**, v. 41, n. 3, p. 393–408, jun. 2002.

DE GROOT, S. J. The impact of bottom trawling on benthic fauna of the North Sea. **Ocean Management**, v. 9, n. 3, p. 177–190, 1984.

DIDUCK, A.; SINCLAIR, A. J. Public involvement in environmental assessment: The case of the nonparticipant. **Environmental Management**, v. 29, n. 4, p. 578–588, 2002.

DIEDRICH, A.; TINTORÉ, J.; NAVINÉS, F. Balancing science and society through establishing indicators for integrated coastal zone management in the Balearic Islands. **Marine Policy**, v. 34, n. 4, p. 772–781, 2010.

DIEGUES, A. C. Environmental impact assessment: The point of view of artisanal fishermen communities in Brazil. **Ocean & Coastal Management**, v. 39, p. 119–133, abr. 1998.

DIEGUES, A. C. Human populations and coastal wetlands: conservation and management in Brazil. **Ocean & Coastal Management**, v. 42, n. 2–4, p. 187–210, fev. 1999.

DIEGUES, A. C. **Ecologia Humana e Planejamento em áreas costeiras**. 2. ed. São Paulo: NUPAUB, 2001. 225 p.

DIEGUES, A. C. **O Vale do Ribeira e Litoral de São Paulo : meio-ambiente , história e população.** São Paulo: CENPEC, 2007. 41 p.

DIMENTO, J.; INGRAM, H. Science and environmental decision making: the potential role of environmental impact assessment in the pursuit of appropriate information. **Nat. Resources J.**, v. 45, n. 2, p. 283–309, 2005.

DOMÍNGUEZ-TORREIRO, M.; FREIJEIRO-ÁLVAREZ, A. B.; IGLESIAS-MALVIDO, C. Co-management proposals and their efficiency implications in fisheries management: the case of the Grand Sole fleet. **Marine Policy**, v. 28, p. 213–219, maio 2004.

DOTTORI, M.; SIEGLE, E.; CASTRO, B. M. Hydrodynamics and water properties at the entrance of Araçá. **Ocean Dynamics**, v. 65, n. 1731, 2015.

DUNLAP, R. E.; JORGENSON, A. K. Environmental problems. **The Wiley-Blackwell encyclopedia of globalization**. 1st ed., Blackwell Publishing Ltd., 2012. p. 1–8.

EHLER, C.; DOUVERE, F. **Marine spatial planning: A step-by-step approach**.

Intergovernmental Oceanographic Comission and Man and the Biosphere Program. IOC Manual and Guides Nº 53, ICAM Dossier Nº 6. Paris: UNESCO, 2009. 99 p.

ELFES, C. T. et al. A regional-scale ocean health index for Brazil. **PLoS ONE**, v. 9, n. 4, 2014.

ESTANCIONE, L. M. B. **Governança ambiental e aprendizagem social: Um estudo de caso da APA Itupararanga**. 2015. 206 p. Dissertation (Master in Science) – Programa de Pós-Graduação em Ciências Ambientais da Universidade de São Paulo,. São Paulo, 2015.

EVANS, B.; THEOBALD, K. LASALA: Evaluating Local Agenda 21 in Europe. **Journal of Environmental Planning and Management**, v. 45, n. 5, p. 781–749, 2003.

FAPESP - FUNDAÇÃO DE AMPARO À PESQUISA DO ESTADO DE SÃO PAULO. **Relatório de atividades 2015**. São Paulo: FAPESP, 2015. 338 p.

FAZEY, I. et al. Knowledge exchange: a review and research agenda for environmental management. **Environmental Conservation**, v. 40, n. 1, p. 19–36, 2012.

FEICHTINGER, J.; PREGERNIG, M. Participation and/or/versus sustainability? Tensions between procedural and substantive goals in two local agenda 21 processes in Sweden and Austria. **European Environment**, v. 15, n. 4, p. 212–227, 2005.

FOLEY, M. M. et al. Guiding ecological principles for marine spatial planning. **Marine Policy**, v. 34, n. 5, p. 955–966, 2010.

FOLKE, C. et al. Adaptive governance of social-ecological systems. **Annual Review of Environment and Resources**, v. 30, p. 441–473, 2005.

FORST, M. F. The convergence of Integrated Coastal Zone Management and the ecosystems approach. **Ocean & Coastal Management**, v. 52, n. 6, p. 294–306, jun. 2009.

FOX, H. E. et al. Explaining global patterns and trends in marine protected area (MPA) development. **Marine Policy**, v. 36, p. 1131–1138, set. 2012.

FRASER, E. D. G. et al. Bottom up and top down: analysis of participatory processes for sustainability indicator identification as a pathway to community empowerment and sustainable environmental management. **Journal of environmental management**, v. 78, n. 2, p. 114–27, jan. 2006.

FUNTOWICZ, S. O.; RAVETZ, J. R. A new scientific methodology for global environmental issues. In: CONSTANZA, R. (Ed.) **Ecological economics: The science and management of sustainability**. New York: Columbia University Press, 1991.

FUNTOWICZ, S. O.; RAVETZ, J. R. Science for the Post-Normal Age. **Futures**, v. 25, n. 7, p. 739–755, set. 1993.

FUNTOWICZ, S.; RAVETZ, J. **Post-Normal Science.** International Society for Ecological Economics, 2003. Available at: <http://leopold.asu.edu/sustainability/sites/default/files/Norton, Post Normal Science, Funtowicz_1.pdf>

GARCIA-SANCHEZ, I. M.; PRADO-LORENZO, J. M. Determinant factors in the degree of implementation of local agenda 21 in the European Union. **Sustainable Development**, v. 16, n. 1, p. 17–34, 2008.

GARMENDIA, E. et al. Social multi-criteria evaluation as a decision support tool for integrated coastal zone management. **Ocean and Coastal Management**, v. 53, p. 385–403, jul. 2010.

GARMENDIA, E.; STAGL, S. Public participation for sustainability and social learning: Concepts and lessons from three case studies in Europe. **Ecological Economics**, v. 69, p. 1712–1722, 15 jun. 2010.

GELUDA, L.; SERRÃO, M.; LEMOS, R. Desafios para a sustentabilidade financeira das unidades de conservação no Brasil. In: BENSUSAN, N.; PRATES, A. P. (Eds.) **A Diversidade cabe na Unidade? Áreas Protegidas no Brasil**. 1. ed. Brasília: Mil Folhas, 2014. p. 184–218.

GERHARDINGER, L. C. et al. Marine protected dramas: the flaws of the Brazilian National System of Marine Protected Areas. **Environmental Management**, v. 47, p. 630–643, abr. 2011.

GERHARDINGER, L. C.; GODOY, E. A. S.; JONES, P. J. S. Local ecological knowledge and the management of marine protected areas in Brazil. **Ocean & Coastal Management**, v. 52, n. 3–4, p. 154–165, mar. 2009.

GLUCKER, A. N. et al. Public participation in environmental impact assessment: Why, who and how? **Environmental Impact Assessment Review**, v. 43, p. 104–111, 2013.

GRAHAM, I. D. et al. Lost in knowledge translation: time for a map? **The Journal of continuing education in the health professions**, v. 26, n. 1, p. 13–24, 2006.

GRANEK, E. F. et al. Engaging recreational fishers in management and conservation: Global case studies. **Conservation Biology**, v. 22, n. 5, p. 1125–1134, 2008.

GRANEK, E. F. et al. Ecosystem services as a common language for coastal ecosystem-based management. **Conservation biology: the journal of the Society for Conservation Biology**, v. 24, n. 1, p. 207–216, 2010.

HAINES-YOUNG, R.; POTSCHIN, M. Integrated Coastal Zone Management and the Ecosystem Approach. **Deliverable D2.1, PEGASO Grant agreement n^{o}: 244170**, v. CEM Workin, n. 7, p. 1–19, 2011.

HALPERN, B. S. et al. A global map of human impact on marine ecosystems. **Science, New Series**, v. 319, n. 5865, p. 948–952, 2008.

HALPERN, B. S. et al. An index to assess the health and benefits of the global ocean. **Nature**, v. 488, p. 615–620, 2012.

HISSCHEMÖLLER, M.; HOPPE, R. Coping with interactable controversies: The case for problem structuring in policy design and analysis. **Knowledge and policy: The International Journal of Knowledge Transfer and Utilization**, v. 8, n. 4, p. 40–60, 1996.

HORIGUE, V. et al. Marine protected area networks in the Philippines: Trends and challenges for establishment and governance. **Ocean and Coastal Management**, v. 64, p. 15–26, 2012.

INTERNATIONAL COUNCIL FOR LOCAL ENVIRONMENTAL INITIATIVES (ICLEI); THE ITERNATIONAL DEVELOPMENT RESEARCH CENTRE (IDRC); THE UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP). **The Local Agenda 21 planning guide: An introduction to sustainable development planning**. 1. ed. Toronto: ICLEI/IDRC/UNEO, 1996. 241 p.

ISON, R.; RÖLING, N.; WATSON, D. Challenges to science and society in the sustainable management and use of water: investigating the role of social learning. **Environmental Science & Policy**, v. 10, n. 6, p. 499–511, out. 2007.

JABLONSKI, S.; FILET, M. Coastal management in Brazil – A political riddle. **Ocean & Coastal Management**, v. 51, p. 536–543, 2008.

JACOBI, P. (Ed.). **Aprendizagem social: diálogos e ferramentas participativas: aprender juntos para cuidar da água**. 1. ed. São Paulo: IEE/PROCAM, 2011. 86 p.

JACOBI, P. R. Aprendizagem social e formação de professores em educação para a sustentabilidade socioambiental. **Geologia USP**, v. 6, n. Publicação Especial, p. 5–10, 2013.

JACOBI, P. R. et al. (Eds.) **Temas atuais em mudanças climáticas: para os ensinos fundamental e médio**. 1. ed. São Paulo: IEE - USP, 2015. 112 p.

JACOBI, P. R. (Ed.). **Aprendizagem social e áreas de proteção ambiental**. 1. ed. São Paulo: Annablume, 2015. 154 p.

JACOBI, P. R.; GRANJA, S. I. B.; FRANCO, M. I. Aprendizagem Social: práticas educativas e participação da sociedade civil como estratégias de aprimoramento para a gestão compartilhada de bacias hidrográficas. **São Paulo em Perspectiva**, v. 20, n. 2, p. 5–18, 2006.

JACOBI, P. R.; XAVIER, L. Y.; MISATO, M. T. (Eds.). **Aprendizagem Social e Unidades de Conservação: Aprender juntos para cuidar dos recursos naturais**. 1. ed. São Paulo: IEE/PROCAM, 2013. 94 p.

JARVIS, R. M. et al. Citizen science and the power of public participation in marine spatial planning. **Marine Policy**, v. 57, p. 21–26, jul. 2015.

JAVIER, G. S. The scope of marine spatial planning and integrated coastal zone management: New challenges for the future. **Journal of Coastal Development**, v. 17, n. 2, p. e109, 2014.

JENTOFT, S. Co-managing the coastal zone: is the task too complex? **Ocean & Coastal Management**, v. 43, p. 527–535, jun. 2000.

JIGGINS, J.; VAN SLOBBE, E.; RÖLING, N. The organisation of social learning in response to perceptions of crisis in the water sector of The Netherlands. **Environmental Science & Policy**, v. 10, n. 6, p. 526–536, out. 2007.

KALIKOSKI, D. C.; SEIXAS, C. S.; ALMUDI, T. Gestão compartilhada e comunitária da pesca no Brasil: avanços e desafios. **Ambiente & sociedade**, v. 12, n. 1, p. 151–172, jun. 2009.

KATSANEVAKIS, S. et al. Ecosystem-based marine spatial management: Review of concepts, policies, tools, and critical issues. **Ocean & Coastal Management**, v. 54, n. 11, p. 807–820, nov. 2011.

KELLY, R.; MOLES, R. The development of Local Agenda 21 in the mid- west region of Ireland: A case study in interactive research and indicator development. **Journal of Environmental Planning and Management**, v. 45, n. 6, p. 889–912, 2002.

KUMLER, L. M.; LEMOS, M. C. Managing waters of the Paraíba do Sul River Basin , Brazil: A case study in institutional change and social learning. **Ecology and Society**, v. 13, n. 2, p. 22, 2008.

LACKEY, R. T. Science, scientists, and policy advocacy. **Conservation Biology**, v. 21, n. 1, p. 12–17, 2007.

LANG, R. E.; HORNBURG, S. P. What is social capital and why is it important to public policy? **Housing Policy Debate**, v. 9, n. 1, p. 1–16, 1998.

LANGE, G.-M.; JIDDAWI, N. Economic value of marine ecosystem services in Zanzibar: Implications for marine conservation and sustainable development. **Ocean & Coastal Management**, v. 52, n. 10, p. 521–532, out. 2009.

LAVIS, J. et al. How can research organisations more effectively transfer research knowledge to decision makers? **Millbank Quarterly**, v. 81, n. 2, p. 1–28, 2003.

LEACH, W. D.; PELKEY, N. W. Making watershed partnerships work: A review of the empirical literature. **Journal of Water Resources Planning and Management**, v. 127, p. 378–385, 2001.

LEGASPE, L. B. C. **Os potenciais impactos cumulativos das grandes obras - Novo corredor de exportação e exploração de hidrocarbonetos do Campo Mexilhão no território da APA Marinha Litoral Norte (SP)**. 2012. 111 p. Dissertation (Master in Geoscience and the Environment) – Universidade Estaudal Paulista (UNESP), Rio Claro, 2012.

LEMOS, M. C.; MOREHOUSE, B. J. The co-production of science and policy in integrated climate assessments. **Global Environmental Change**, v. 15, p. 57–68, 2005.

LESLIE, H. M.; MCLEOD, K. L. Confronting the challenges of implementing marine ecosystem-based management. **Frontiers in Ecology and the Environment**, v. 5, n. 10, p. 540–548, 2007.

LIU, J. et al. Complexity of coupled human and natural systems. **Science**, v. 317, n. September, p. 1513–1517, 2007.

LONG, R. D.; CHARLES, A.; STEPHENSON, R. L. Key principles of marine ecosystem-based management. **Marine Policy**, v. 57, p. 53–60, jul. 2015.

LOPES, C. F. et al. Coastal monitoring program of São Sebastião channel: Assessing the effects of "Tebar V" oil spill on rocky shore populations. **Marine Pollution Bulletin**, v. 34, n. 11, p. 923–927, nov. 1997.

MALHEIROS, T. F.; ARLINDO, P. S.; COUTINHO, S. M. V. Agenda 21 nacional e indicadores de desenvolvimento sustentável: Contexto brasileiro. **Saúde e Sociedade**, v. 17, n. 1, p. 7–20, 2008.

MANI-PERES, C. et al. Stakeholders perceptions of local environmental changes as a tool for impact assessment in coastal zones. **Ocean & Coastal Management**, v. 119, p. 135–145, 2016.

MANI-PERES, C. **Gerenciamento costeiro integrado sob uma perspectiva etno-oceanográfica: o conhecimento tradicional na Baía do Araçá**. 2016. 147 p. Dissertation (Master in Oceanography) – Instituto Oceanográfico da Universidade de São Paulo, São Paulo, 2016.

MARINESQUE, S.; KAPLAN, D. M.; RODWELL, L. D. Global implementation of marine protected areas: Is the developing world being left behind? **Marine Policy**, v. 36, p. 727–737, maio 2012.

MARTIN, A.; LEMON, M. Challenges for participatory Institutions: The case of village forest committees in Karnataka, South India. **Society & Natural Resources**, v. 14, n. 7, p.

585–597, 2001.

MASALU, D. C. Coastal and marine resource use conflicts and sustainable development in Tanzania. **Ocean & Coastal Management**, v. 43, n. 6, p. 475–494, 2000.

MAUREL, P. **Role of Information and Communication Tools – HarmoniCOP WP3 Report**. Cenagref, Noontpellier, 2003. 94 p.

MAUREL, P. et al. Concepts and methods for analysing the role of information and communication tools (IC-tools) in social learning processes for river basin management. **Environmental Modelling & Software**, v. 22, n. 5, p. 630–639, maio 2007.

MCLEOD, K.; LESLIE, H. Why ecosystem-based management? In: MCLEOD, K. L.; LESLIE, H. M. (Eds.) **Ecosystem Based Management for the oceans**. Washington DC: Island Press, 2009.

MCNIE, E. C. Reconciling the supply of scientific information with user demands: an analysis of the problem and review of the literature. **Environmental Science & Policy**, v. 10, p. 17–38, fev. 2007.

MEDEIROS, P. M.; BÍCEGO, M. C. Investigation of natural and anthropogenic hydrocarbon inputs in sediments using geochemical markers. II. Sao Sebastião, SP-Brazil. **Marine Pollution Bulletin**, v. 49, p. 892–899, dez. 2004.

MELLADO, T. et al. Use of local knowledge in marine protected area management. **Marine Policy**, v. 44, p. 390–396, fev. 2014.

MILLENIUM ECOSYSTEM ASSESSMENT (MEA). **Ecosystems and human well-being - Health synthesis**. France: WHO Press, 2005a.

MILLENIUM ECOSYSTEM ASSESSMENT (MEA). **Ecosystems and human well-being: Synthesis**. Washington DC: Island Press, 2005b. 155 p.

MINISTÉRIO DO MEIO AMBIENTE (MMA). **Passo a passo da Agenda 21 local**. Brasília: Ministério do Meio Ambiente, 2005. 54 p.

MINISTÉRIO DO MEIO AMBIENTE (MMA). **Plano Nacional de Gerenciamento Costeiro - 25 anos do gerenciamento costeiro no Brasil**. PEREIRA, F. C.; OLIVEIRA, M. R. L. (Eds). Brasília: MMA, 2015. 181 p.

MIRANDA, L. Cities for Life revisited : capacity-building for urban management in Peru. **Environment and Urbanization**, v. 16, n. 2, p. 249–262, 2004.

MISATO, M. T. **Análise da gestão da Área de Proteção Ambiental (APA) Tietê-SP: Sobreposições e limitações nos tratos com o patrimônio natural e cultural**. 2015. 148 p. Dissertation (Master in Science) – Programa de Pós-Graduação em Ciências Ambientais

da Universidade de São Paulo,. São Paulo, 2015.

MOKSNESS, E.; DAHL, E.; STOTTRUP, J. **Global challenges in integrated coastal zone management**. 1. ed. John Wiley & Sons, 2013. 259 p.

MOSTERT, E. et al. Social learning in European river-basin management: Barriers and fostering mechanisms from 10 river basins. **Ecology and Society**, v. 12, n. 1, p. 19, 2007.

MURO, M.; JEFFREY, P. A critical review of the theory and application of social learning in participatory natural resource management processes. **Journal of Environmental Planning and Management**, v. 51, n. 3, p. 325–344, maio 2008.

NUNES, F. O. **Análise de redes sociais como subsídio para a gestão ambiental: um estudo de caso**. 2015. 61 p. Dissertation (Master in Science) – Eacola de Artes, Ciências e Humanidades, Universidade de São Paulo, São Paulo. 2015.

NURSEY-BRAY, M. J. et al. Science into policy? Discourse, coastal management and knowledge. **Environmental Science & Policy**, v. 38, p. 107–119, abr. 2014.

O'FAIRCHEALLAIGH, C. Public participation and environmental impact assessment: Purposes, implications, and lessons for public policy making. **Environmental Impact Assessment Review**, v. 30, n. 1, p. 19–27, jan. 2010.

OLSEN, S.; CHRISTIE, P. What are we learning from tropical coastal management experiences? **Coastal Management**, v. 28, p. 5–18, 2000.

OTTO-ZIMMERMANN, K. Local implementation of Agenda 21. **Marine Policy**, v. 18, n. 2, p. 112–115, 1994.

OYANEDEL, R. et al. Establishing marine protected areas through bottom-up processes: insights from two contrasting initiatives in Chile. **Aquatic Conservation: Marine and Freshwater Ecosystems**, v. 26, n. 1, p. 184–195, 20 fev. 2016.

PAHL-WOSTL, C. The Importance of social searning in restoring the multifunctionality of rivers and floodplains. **Ecology and Society**, v. 11, n. 1, p. 10, 2006.

PAHL-WOSTL, C. et al. Social learning and water resources management. **Ecology And Society**, v. 12, n. 2, p. 5, 2007.

PAHL-WOSTL, C.; HARE, M. Processes of social learning in integrated resources management. **Journal of Community & Applied Social Psychology**, v. 14, p. 193–206, 7 maio 2004.

PAHL-WOSTL, C.; MOSTERT, E.; TÀBARA, D. The Growing Importance of Social Learning in Water Resources Management and Sustainability Science. **Ecology and Society**, v. 13, n. 1, p. 24, 2008.

PALLANT, J. **SPSS survival manual: A step by step guide to data analysis using SPSS**. 2nd. ed. Sydney: Bookhouse, 2002. 334 p.

PINCINATO, F. L.; RIEDEL, P. S.; MILANELLI, J. C. C. Modelling an expert GIS system based on knowledge to evaluate oil spill environmental sensitivity. **Ocean & Coastal Management**, v. 52, p. 479–486, set. 2009.

PLDS/ARAÇÁ. **Plano local de desenvolvimento sustentável da Baía do Araçá**. 1. ed. São Paulo: Instituto Oceanográfico da Universidade de São Paulo, 2016. 69 p.

POMEROY, R. S. et al. How is your MPA doing? A methodology for evaluating the management effectiveness of marine protected areas. **Ocean & Coastal Management**, v. 48, n. 7, p. 485–502, 2005.

POSTALI, F. A. S.; NISHIJIMA, M. Oil windfalls in Brazil and their long-run social impacts. **Resources Policy**, v. 38, p. 94–101, mar. 2013.

PRATES, A. P.; SOUSA, N. O. DE M. Panorama geral das áreas protegidas no Brasil: desafios para o cumprimento da meta 11 de Aichi. In: BENSUSAN, N.; PRATES, A. P. (Eds.) **A Diversidade cabe na Unidade? Áreas Protegidas no Brasil**. 1. ed. Brasília: Mil Folhas, 2014. p. 82–119.

PULLIN, A. S. et al. Do conservation managers use scientific evidence to support their decision-making? **Biological Conservation**, v. 119, n. 2, p. 245–252, 2004.

RAAKJÆR NIELSEN, J.; MATHIESEN, C. Important factors influencing rule compliance in fisheries lessons from Denmark. **Marine Policy**, v. 27, n. 5, p. 409–416, 2003.

REED, M. S. Stakeholder participation for environmental management: A literature review. **Biological Conservation**, v. 141, n. 10, p. 2417–2431, out. 2008.

REED, M. S. et al. What is social learning? **Ecology and Society**, v. 15, n. 4, p. r1, 2010.

REED, M. S. et al. Five principles for the practice of knowledge exchange in environmental management. **Journal of Environmental Management**, v. 146, p. 337–345, 2014.

REES, Y. et al. **Good European practices for stakeholder involvement – Lessons from real planning processes case-studies and experiments. WP5 report of the HarmoniCOP project**. Swidon, UK: WRc plc, 2005. 76 p.

REGO, E. H. DO. **Conflitos do zoneamento ecológico econômico: A experiência do Decreto Estadual n. 24.215, de 07 de Setembro de 2004.** XV Encontro Nacional do CONDEPI, Anais. Recife: CONDEPI, 2006.

RENN, O. Participatory processes for designing environmental policies. **Land Use Policy**, v. 23, p. 34–43, jan. 2006.

RESSUREIÇÃO, R. D. **São Sebastião: transformações de um povo caiçara**. São Paulo: Editora Humanitas, 2002.

RIDDER, D.; MOSTERT, E.; WOLTERS, H. A. **Learning together to manage together - Improving participation in water management**. Osnabrück, Germany: University of Osnabrück, 2005. 115 p.

ROBERTS, D.; DIEDERICHS, N. Durban's Local Agenda 21 programme: tackling sustainable development in a post-apartheid city. **Environment and Urbanization**, v. 14, n. 1, p. 189–201, 2002.

RUCKELSHAUS, M. et al. Marine Ecosystem-based Management in Practice: Scientific and Governance Challenges. **BioScience**, v. 58, n. 1, p. 53–63, 2008.

RUDD, M. A. An institutional framework for designing and monitoring ecosystem-based fisheries management policy experiments. **Ecological Economics**, v. 48, n. 1, p. 109–124, jan. 2004.

RUDD, M. A. Scientists' framing of the ocean science–policy interface. **Global Environmental Change**, v. 33, p. 44–60, jul. 2015.

RUNHAAR, H. A. C.; VAN DER WINDT, H. J.; VAN TATENHOVE, J. P. M. Productive science–policy interactions for sustainable coastal management: Conclusions from the Wadden Sea area. **Environmental Science & Policy**, v. 55, p. 467–471, jan. 2016.

SAMONTE, G.; KARRER, L. B.; ORBACH, M. **People and Oceans**. Arlington, Virginia, USA: Conservation International, 2010. 20 p.

SANCHES, R. A. Caiçara Communities of the Southeastern Coast of São Paulo State (Brazil): Traditional Activities and Conservation Policy for the Atlantic Rain Forest. **Human Ecology Review**, v. 8, n. 2, p. 52–64, 2001.

SANDERSEN, T. H. et al. Knowledge Issues in ICZM and EBM applied on small geographic scales: Lessos from a case study in Risør, Norway. In: MOKSNESS, E.; DAHL, E.; STOTTRUP, J. (Eds.) **Global challenges in integrated coastal zone management**. 1. ed. John Wiley & Sons, 2013. p. 127–144.

SANTOS, C. R. DOS et al. Prática da gestão costeira integrada: da mobilização à elaboração participativa de um Plano Local De Desenvolvimento Sustentável. In: **in prep**.a

SANTOS, C. R. DOS et al. Collaborative work as a way to promote "Coastal Literacy" in a public school in São Sebastião (Brazil). **in prep**.b

SÃO PAULO (ESTADO). **Decreto Estadual 48.149, de 9 de Outubro de 2003**, 2003.

SÃO PAULO (ESTADO). **Litoral Norte**. São Paulo: 2005 112 p.

SÃO PAULO (ESTADO). **Decreto Estadual 53.525 de 8 de Outubro de 2008**, 2008a.

SÃO PAULO (ESTADO). **Resolução SMA 089, de 19 de Dezembro de 2008**, 2008b.

SÃO PAULO (ESTADO). **Resolução SMA 69, de 28 de Setembro de 2009.** São Paulo, Secretaria de Meio Ambiente, 2009.

SÃO PAULO (ESTADO). **Conservação de áreas costeiras marinhas: Intercâmbio São Paulo/Brasil - PACA/França**. São Paulo: SMA/FF, 2014. 128 p.

SÃO SEBASTIÃO (MUNICÍPIO). **Lei Municipal N. 848/92**São Sebastião, 1992.

SCHILLER, A. et al. Communicating ecological indicators to decision makers and the public. **Ecology and Society**, v. 5, n. 1, p. 1–19, 2001.

SCHUSLER, T. M.; DECKER, D. J.; PFEFFER, M. J. Social learning for collaborative natural resource management. **Society & Natural Resources**, v. 16, n. 4, p. 309–326, 1 abr. 2003.

SEIXAS, C. S. **Barriers to local-level , participatory ecosystem assessment and management in Brazil.** Millennium Ecosystem Assessment Conference. Alexandria: 2004

SMITH, H. D. et al. The integration of land and marine spatial planning. **Journal of Coastal Conservation**, 20 abr. 2010.

SOUZA, C. R. DE G.; LUNA, G. DA C. Unidades quaternárias e vegetação nativa de planície costeira e baixa encosta da Serra do Mar no Litoral Norte de São Paulo. **Revista do Instituto Geológico**, v. 29, n. 1/2, p. 1–18, 2008.

STEAD, S. M. Changes in Scottish coastal fishing communities – Understanding socio-economic dynamics to aid management, planning and policy. **Ocean & Coastal Management**, v. 48, n. 9, p. 670–692, 2005.

STEYAERT, P. et al. The role of knowledge and research in facilitating social learning among stakeholders in natural resources management in the French Atlantic coastal wetlands. **Environmental Science & Policy**, v. 10, p. 537–550, out. 2007.

STEYAERT, P.; JIGGINS, J. Governance of complex environmental situations through social learning: a synthesis of SLIM's lessons for research, policy and practice. **Environmental Science & Policy**, v. 10, p. 575–586, out. 2007.

STRAUS, S. E.; TETROE, J.; GRAHAM, I. Defining knowledge translation. **Journal of the Canadian Medical Association**, v. 181, n. 3–4, p. 165–168, 2009.

TEIXEIRA, L. R. **Megaprojetos no Litoral Norte Paulista: O papel dos grandes empreendimentos de infraestrutura na transformação regional**. 2013. 274 p. Phd (Doctor in Environment and Society) – Núcleo de Estudos e Pesquisas Ambientais do Instituto de Filosofia e Ciências Humanas da Universidade Estadual de Campinas, Campinas. 2013.

TIPPETT, J. et al. Social learning in public participation in river basin management—early findings from HarmoniCOP European case studies. **Environmental Science & Policy**, v. 8, n. 3, p. 287–299, jun. 2005.

TOROPOVA, C. et al. (EDS.). **Global ocean protection: Present status and future possibilities**. 1. ed. Brest, France: Agence des aires marines protégées, Gland, Switzerland, Washington, DC and New York, USA: IUCN WCPA, Cambridge, UK : UNEP-WCMC, Arlington, USA: TNC, Tokyo, Japan: UNU, New York, USA: WCS. 2010. 98 p.

TOROPOVA, C. et al. Benefits and challenges of MPA strategies. In: TOROPOVA, C. et al. (Eds.) **Global ocean protection: Present status and future possibilities**. France: Agence des aires marines protégées, Gland, Switzerland, Washington, DC and New York, USA: IUCN WCPA, Cambridge, UK : UNEP-WCMC, Arlington, USA: TNC, Tokyo, Japan: UNU, New York, USA: WCS: 2010. p. 11–24.

TRIMBLE, M.; ARAUJO, L. G. DE; SEIXAS, C. S. One party does not tango! Fishers' non-participation as a barrier to co-management in Paraty, Brazil. **Ocean & Coastal Management**, v. 92, p. 9–18, maio 2014.

TURNER, R. A. et al. Measuring good governance for complex ecosystems: Perceptions of coral reef-dependent communities in the Caribbean. **Global Environmental Change**, v. 29, p. 105–117, 2014.

TUXWORTH, B. From environment to sustainability: Surveys and analysis of local agenda 21 process development in UK local authorities. **Local Environment**, v. 1, n. 3, p. 277–297, 1996.

UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP). **Rio declaration on environment and development**, 1992.

VAROL, C.; ERCOSKUN, O. Y.; GURER, N. Local participatory mechanisms and collective actions for sustainable urban development in Turkey. **Habitat International**, v. 35, p. 9–16, 2011.

VIANNA, L. P.; PIRES, J. S. Proposta de ordenamento da atividade de mergulho recreativo na APA Marinha do Litoral Norte (SP). In: SÃO PAULO (ESTADO) (Ed.) **Conservação de áreas costeiras marinhas: Intercâmbio São Paulo/Brasil - PACA/França**. 1. ed. São Paulo: SMA/FF, 2014. p. 76–82.

VIANNA, L. P.; PIRES, J. S.; CARDOSO, S. M. Processo de gestão da arte de pesca cerco flutuante na APA Marinha LN e ARIES de São Sebastião. In: SÃO PAULO (ESTADO) (Ed.) **Conservação de áreas costeiras marinhas: Intercâmbio São Paulo/Brasil - PACA/França**. 1. ed. São Paulo: SMA/FF, 2014. p. 82–90.

VIANNA, L. P.; XAVIER, L. Y. A APA Marinha do Litoral Norte (APAMLN) de São Paulo: do conflito à gestão participativa. In: BENSUSAN, N.; PRATES, A. P. (Eds.) **A diversidade cabe na unidade? Áreas protegidas no Brasil**. 1. ed. Brasília: Mil Folhas, 2014. p. 608–621.

WARD, V.; HOUSE, A.; HAMER, S. Developing a framework for transferring knowledge into action: a thematic analysis of the literature. **Journal of health services research & policy of health services research & policy**, v. 14, n. 3, p. 156–164, 2009.

WEBLER, T.; KASTENHOLZ, H.; RENN, O. Public participation in impact assessment: A social learning perspective. **Environmental Impact Assessment Review**, v. 15, p. 443–463, set. 1995.

WEBLER, T.; TULER, S.; KRUEGER, R. What is a good public participation process? Five perspectives from the public. **Environmental Management**, v. 27, n. 3, p. 435–450, 2001.

WEVER, L. et al. Decentralization and participation in integrated coastal management: Policy lessons from Brazil and Indonesia. **Ocean & Coastal Management**, v. 66, p. 63–72, set. 2012.

WHYTE, A. V. T. **Guidelines for field studies in environmental perception**. Paris: UNESCO, 1977.

WOLTERS, E. A. et al. What is the best available science? A comparison of marine scientists, managers, and interest groups in the United States. **Ocean & Coastal Management**, v. 122, p. 95–102, mar. 2016.

WORM, B. et al. Impacts of biodiversity loss on ocean ecosystem services. **Science**, v. 314, p. 787–790, 2006.

XAVIER, L. Y. **Participação de comunidades de pescadores tradicionais na elaboração de políticas públicas para a zona costeira: Um estudo de cado sobre o Zoneamento Ecológico-Econômico Marinho no Litoral Norte de São Paulo**. 2009. 185 p.Dissertation (Mater in Oceanography) - Institute Oceanographic of the University of São Paulo, São Paulo, 2009.

XAVIER, L. Y. et al. Gestão de áreas marinhas protegidas. In: JACOBI, P. R. (Ed.). . **Aprendizagem social e áreas de proteção ambiental**. 1. ed. São Paulo: Annablume, 2015. p. 73–97.

ZANARDI, E. et al. Distribution and origin of hydrocarbons in water and sediment in São Sebastião, SP, Brazil. **Marine Pollution Bulletin**, v. 38, n. 4, p. 261–267, abr. 1999.

ZUCKERBERG, B.; BONTER, D. N.; DICKINSON, J. L. Citizen Science as an Ecological Research Tool: Challenges and Benefits. **Annual Review of Ecology, Evolution, and Systematics**, v. 41, n. 1, p. 149–172, 2010.

SUPPLEMENTARY MATERIAL

Chart 1 – Problems related to fishing activities – problems' characteristics and proposals of solutions listed during the group discussion in planning meetings for the elaboration of the Local Plan for the Sustainable Development of the Araçá Bay (first column), indication of items from the individual tables from each participant in the discussion (presented as numbers in line 2) which were included in the group final panel (X) and which were not (lowercase letters – the meaning is presented in the end of the chart)

Problem: Fishing		**Participants**							
Item		1	2	3	4	5	6	7	8
Characteristics	Pollution (oil from vessels)	X		X	X		X	X	X
	Industrial fishing						X		
	Indiscriminate fishing leads to environmental imbalance	X		X			X	X	
	Overfishing impacts fishing stocks	X		X	X			X	X
	Legislation does not fit local reality								
	Non-compliance of fishing and environmental law			X	X				
	Lack of surveillance		X	X		X	X	X	
	Reduction of fishing grounds can lead to incidental captures					X			
	Great bureaucracy to sell fishing products								
	Lack of dialogue						X		
	Lack of awareness/information		X	X					
	Lack of interest of young people affects fishing traditional culture					X			
	Conflict of interests						X		
	Individuals items not included in groups'	a, b	0	c, d,e	0	f	0	0	g
Solutions	Lectures and campaigns to raise awareness aligned with public policies.		X	X	X		X	X	
	Fit fishing laws to local reality			X			X		X
	Fishing monitoring			X			X		
	Empower fishing cooperatives and associations					X			
	Increase respect among fishermen								
	Install fishing schools	X				X			
	Discuss fishing in schools							X	
	Individuals items not included in groups'	h		i, j	k		k	j	l
Related stakeholders: NGOs; Civil society; Municipal, State and Federal public managers; Fishing community; Tourists; Private sector; Research organizations and Universities.									
Individual answers not included: **Characteristics:** a – Lack of respect for other fishers; b – Lack of valuation of fishing activities; c – Food demand; d – Income demand; e – Foul smell; f – Lack of information about how to access fishing subsides (for fishermen); g – Increased accidents at sea. **Solutions:** h – Promote handcrafting with fishing material/waste; i – Self-management and regulation; j – Promote dialog between stakeholders; k – Surveillance; l – Make artisanal fishery "evolve/develop".									

Source: made by the author.

Chart 2 – Social and environmental problems related to the smuggling and consumption of drugs in the region – problems' characteristics and proposals of solutions listed during the group discussion in planning meetings for the elaboration of the Local Plan for the Sustainable Development of the Araçá Bay (first column), indication of items from the individual tables from each participant in the discussion (presented as numbers in line 2) which were included in the group final panel (X) and which were not (lowercase letters – the meaning is presented in the end of the chart)

Problem: Drugs consumption		**Participants**				
Item		1	2	3	4	5
Characteristics	Drugs are easily purchased		X			
	It is easy to start on drugs but it is difficult to get out					
	Lack of options and leisure activities			X		
	Lack of perspective of life/employment, Hindrance in developing traditional practice	X		X		X
	Insufficient education (family and school)	X	X	X		X
	Police force can not control it		X		X	
	Drug users are not sent for treatment					
	Problem increased after the construction of a wall in the are of the Port of São Sebastião					
	Loss of aesthetic value of the site, hindering other uses	X				
	Individuals items not included in groups'	a		b		
Solutions	Install morel schools closer to the neighborhood					
	Full time education					X
	Increase leisure options		X	X		
	More awareness programs		X			
	Expand the program "Guarda Mirim" (engages and sensitizes children)					
	Invite ONGs to conductactivities					
	Training workshops (aiming social inclusion)	X				X
	Install a rehabilitation center, and treat the problem as a public health issue.		X	X		
	Install a center to support drug users families	X	X			X
	Install a police base					
	Install surveillance cameras					
	Train police force to a more educational approach to drug users					
	Individuals items not included in groups'	0	0	c, d, e	0	0
Related stakeholders: State and Municipal Departments of Health, Education, Social Promotion, Public Security, Culture and Sports; NOGs; Neighborhood associations, Churches, Port of São Sebastião, ENOB, Civil Policy and City Guard Forces.						
Individual answers not included: **Characteristics:** a – Stakeholders are not interested in getting involved with this problem; b – Marginalization of local society. **Solutions:** c – Revitalization of Araçá Bay; d – Revive and promote the *caiçara* culture; e – Conservation of marine resources.						

Source: made by the author

Chart 3 – Problem related to the presence of solid waste from different origins (sea and land) in the bay – problems' characteristics and proposals of solutions listed during the group discussion in planning meetings for the elaboration of the Local Plan for the Sustainable Development of the Araçá Bay (first column), indication of items from the individual tables from each participant in the discussion (presented as numbers in line 2) which were included in the group final panel (X) and which were not (lowercase letters – the meaning is presented in the end of the chart)

Problem: Solid waste disposal		Participants								
Item		1	2	3	4	5	6	7	8	9
Characteristics	Plastic disposal (sacks, bags and packaging)									
	Ruble									
	Wastes from local enterprises				X					
	Port and harbor wastes									
	Abandoned nautical structures									
	Solid waste deposit by the Bay									
	Government indifference	X	X	X		X				
	Lack of surveillance and law abiding	X	X			X			X	
	Lack of education and social awareness	X	X	X		X	X	X	X	X
	Lack of awareness to the problem, and to the need of cooperation							X	X	
	Lack of publicizing environmental analysis									
	Too few actions to solve									
	Depreciation of Araçá Bay									X
	Individuals items not included in groups'	a, b	c	d	0	e	f, g, h	i	0	f, g, j, k, l, m, n, o
Solutions	Discuss the demands of Araçá Bay in the municipal director plan.									
	Make Araçá part of political candidates' proposals									
	Bring Araçá Bay to schools and schools to Araçá Bay									X
	Research to determine pollution levels									
	Infrastructure, revitalization and increasing the value of the region					X				X
	Infrastructure for visitation and tourism									
	Campaigns for raising awareness, education and social empowerment for local community		X	X		X		X	X	X
	Visual campaigns (videos, documentaries) and greater publicity to Araçá Bay	X								
	Collective actions and initiatives					X	X			
	Modify waste monitoring and management system	X	X			X	X	X	X	X
	Individuals items not included in groups'	p		q, r	r					
Related stakeholders: NGOs; Municipal Departments of Environment and Infrastructure, in collective actions; Local community; Municipal Department of Education; Research organizations.										
Individual answers not included: **Characteristics:** a – Consumerism; b – Impact to the environment (fauna, flora, habitats); c – Lack of appropriate area for rubble disposal; d – Local hydrodynamic favor waste accumulation; e – Irresponsibility; f – Plastic can be consumed by living organisms; g – Waste slurry can contaminate the bay; h – Harbor waste can contaminate the environment; i – Lack of a infrastructure to divulge and discuss the problem; j – Population growth; k – Inadequate waste management; l – Plastic takes long to degrade; m – Plastic is carried to other areas; n – Plastic generates microplastics that can also be consumed by living organisms; o –										

Rubble attract urban pests. **Solutions:** p – Political will; q – Make managers accountable for their tasks; r – Constant cleaning and waste removal.

Source: made by the author.

Chart 4 – Problems related to residential sewage discharge in the environment, linked to the inefficient sewage treatment system and outfall discharge – problems' characteristics and proposals of solutions listed during the group discussion in planning meetings for the elaboration of the Local Plan for the Sustainable Development of the Araçá Bay (first column), indication of items from the individual tables from each participant in the discussion (presented as numbers in line 2) which were included in the group final panel (X) and which were not (lowercase letters – the meaning is presented in the end of the chart)

Problem: Sewage discharge		Participant											
Item		1	2	3	4	5	6	7	8	9	10	11	12
Characteristics	Insufficient sewage treatment plant	X											
	Only 60% of the wastewater generated in the city is collected	X				X			X				
	Houses that are not connected to the sewage treatment plant					X	X						
	Lack of institutional information about how to connect houses to sewage treatment plants					X							
	Population growth								X				
	São Sebastião Channel is a source of solid waste and sewage to the bay							X					
	Outfall is too close to the shore	X				X	X	X					
	Outfall sewage is not treated					X	X						
	Affects animal growth and development				X			X			X		
	Causes water contamination				X						X		
	Causes lack of oxygen for fauna				X			X			X		
	Lack of cleaning of the railing system leads to flood					X	X	X					
	Lack of education			X	X				X	X		X	
	Causes public health problem				X			X	X				
	Lack of disclosure of the results of environmental monitoring												
	Individuals items not included in groups'	a	b	c, d, e	f	0	0	0	0	0	0	0	g, h, i
Solutions	Increase in public administration's responsibility						X						
	Investment from the state government	X					X	X					
	Improve sewage collect system						X	X					X
	Rebuild some sewage pipeline					X							
	Improve planning and management systems in sewage companies		X						X	X	X		
	Social control			X		X							
	Demand actions from public organizations			X									
	Promote social monitoring program			X					X			X	
	Mobilize social groups		X	X									
	Environmental education to children and the overall public	X	X		X		X	X	X	X		X	X
	Increase local activities to raise awareness	X											
	Conductnew education and awareness raising activities						X						
	Individual items not included in groups'	j			k	l		m	n				o
Related stakeholders: Population: citizens, NGOs and Neighborhood associations; Municipal and State public managers; SABESP (sanitation company).													
Individual answers not included:													

Characteristics: a – Lack of a proper railing system; b – Ignorance of the importance of Araçá Bay; c – Irregular activities (causes); d – Facility to dispose off sewage in the environment; e – Lack of social control; f – Lack of public awareness to the problem; g – Uncontrolled and unplanned city growth; h – Impacts water resources; i – Decrease of the quality and the value of the region. **Solutions:** j – Monitor sewage treatment; k – Increase surveillance and report offenders; l – Implement railing systems; m – Promote cleaning activities; n – Connect houses to sewage treatment plant; o – Increase the number of sewage treatment plants.

Source: made by the author.

Chart 5 – Problems related to the actual enterprises existent in the city, mainly to the activities of the Port of São Sebastião and of the TEBAR – problems' characteristics and proposals of solutions listed during the group discussion in planning meetings for the elaboration of the Local Plan for the Sustainable Development of the Araçá Bay (first column), indication of items from the individual tables from each participant in the discussion (presented as numbers in line 2) which were included in the group final panel (X) and which were not (lowercase letters – the meaning is presented in the end of the chart)

Problem: Current Enterprises		Participants									
Item		1	2	3	4	5	6	7	8	9	10
Characteristics	Intense traffic of vessels	X				X					
	Anchorage areas close to the shore		X			X					
	Vessels' stranding					X		X			
	Source of ballast water	X									
	Vessel's traffic interfere with other uses	X		X			X		X	X	X
	Invasive species			X		X		X	X	X	X
	Lack of surveillance				X				X		
	Nautical equipment abandonment										
	Generic pollution – sound, waste, visual and chemical		X	X	X		X	X	X	X	X
	Affect ecological dynamic		X	X	X			X		X	
	Collision with sea animals										
	Individuals items not included in groups'	0	0	0		0	0	a, b	c, d	0	e
Solutions	Revise anchorage areas	X	X	X	X	X		X	X	X	
	Invest in surveillance		X	X	X			X	X	X	X
	Improve Port management	X						X			X
	Apply environmental compensation resource to the area that suffers with port related problems.										
	Individuals items not included in groups'	f	0	g	0	h	NR	i	j	l	l

Related organizations: Municipal Department of Environment; CETESB (States' licensing and inspection body); TRANSPETRO (oil transport enterprise that operates the TEBAR); ANTAQ (National Agency of Maritime Transportation); Brazilian Navy; Cia. DOCAS (administrator of Port of São Sebastião), IBAMA.

Individual answers not included:
Characteristics: a – Affects the entire environment; b – Increase the risk to oil spills; c – Problems related to the size of the enterprises; d – Lack of information; e – Risk of vessel collision.
Solutions: f – Increase port operational capacity; g – Raise crewmen awareness concerning ballast water; h – Do not discharge ballast water on bays' surroundings; i – Develop a system to treat and discharge ballast water; j – Decrease consumption of petroleum and industrialized goods; k – Diminish cargo shipment and vessel traffic; l – Investigate other sources of pollution.

NR – No response was provided

Source: made by the author.

Chart 6 – Problem related to urban growth and local industrial development without adequate planning – problems' characteristics and proposals of solutions listed during the group discussion in planning meetings for the elaboration of the Local Plan for the Sustainable Development of the Araçá Bay (first column), indication of items from the individual tables from each participant in the discussion (presented as numbers in line 2) which were included in the group final panel (X) and which were not (lowercase letters – the meaning is presented in the end of the chart)

Problem: Industrial & Urban growth		Participant				
Item		1	2	3	4	5
Characteristics	Lack of consensus on the region's vocation					
	Emergence of new industries/enterprises				X	X
	Port and TEBAR expansion	X				
	Deficiency of current legislation		X			
	Lack of surveillance and increased environmental damage		X			
	Population growth and disordered urban sprawl	X				
	Increase of irregular occupation of the land	X			X	
	Increased noise		X	X		
	Increase of organic matter concentration		X			
	Increase of diverse pollution	X	X	X		X
	Increased use of drugs		X	X		
	Road expansion leading to an increase in tourism activities	X				
	Traffic intensification and consequent increase of pollution	X	X	X		
	Increased environmental problems		X			
	Impacts on wildlife		X		X	
	Bioaccumulation					
	Risk of diseases and food poisonings			X	X	
	Increase in social problems such as criminality		X	X		
	Individuals items not included in groups'	a	0	0	0	b, c, d
Solutions	Investment in cleaner industry, such as tourism	X				
	Transition to a solidary economy, prioritizing site production	X				
	Increase industries' combat of environmental problems				X	
	Consider land-sea connection to combat pollution					
	Expand the discussion to preserve other mangrove areas					
	Promote law enforcement and abiding				X	
	Strict surveillance	X			X	X
	Public policies for access to housing	X				
	Birth control policies					
	Promote the use o public transportation instead of private ones	X				
	Increase dialog and communication between different environmental agencies		X			
	Social pressures on public managers for planned development and environmental protection					
	Increase population's environmental awareness			X	X	X
	Increase social participation in environmental forums/organizations					
	Grow seedlings and promote nursery gardens					X
	Mangrove recovery and restoration					X
	Individuals items not included in groups'	0	0	0	0	0
Related stakeholders: Population; Traditional communities; Municipal, State and Federal public managers						

Individual answers not included:
Characteristics: a – Economy growth; b – Lack of environmental awareness; c – Lack of knowledge about mangrove's importance; d – Lack of respect for the mangrove.

Source: made by the author.

Chart 7 – Problem related to environmental contamination by chemicals – problems' characteristics and proposals of solutions listed during the group discussion in planning meetings for the elaboration of the Local Plan for the Sustainable Development of the Araçá Bay (first column), indication of items from the individual tables from each participant in the discussion (presented as numbers in line 2) which were included in the group final panel (X) and which were not (lowercase letters – the meaning is presented in the end of the chart)

Problem: Chemical pollution		Participants				
Items		1	2	3	4	5
Characteristics	Diffuse, uncontrolled and not inspected sources (there is no control mechanisms)		X		X	X
	Operational failures, malpractices and accidents			X	X	
	Chemical pollution from domestic and industrial sewage			X		
	Oil spill					
	Trawlers that wash their holds in the bay			X		
	Insufficient surveillance of vessels	X				
	Environmental passive from the municipal district of Itatinga					
	No interest to solve environmental passive from the municipal district of Itatinga	X		X		
	Lack of awareness and information		X	X	X	
	Environmental contamination: fauna, flora and water	X		X	X	
	Impacts fishing and leisure activities				X	
	Risk to human health				X	
	Individuals items not included in groups'	a	0	0	b, c, d, e	f
Solutions	Implement programs for adequate collection and disposal of chemical waste of local enterprises.				X	
	Financial incentives to improve chemical waste disposal (e.g., tax reduction and certification)					
	Increase and improve (with new technology) surveillance		X	X	X	
	Implement reverse logistic				X	
	Programs for environmental education and awareness		X	X	X	X
	Integrated and participative management of waste disposal surveillance and collection programs				X	
	Increase participatory meeting with different social sectors					
	Individuals items not included in groups'	NR	0	g, h	0	0
Related stakeholders: TRANSPETRO and Port of São Sebastião; CETESB; IBAMA (federal licensing and inspection body); Research organizations; Municipal government; Public prosecution office; SABESP; Community, Media organizations; Schools.						
Individual answers not included: **Characteristics:** a – Lack of punishment for polluters; b – Lack of risk management; c – Lack of a integrated and participative management; d – Lack of appropriate areas to dispose chemical waste; e – Insufficient treatment system; f – Population growth. **Solutions:** g – Increase environmental impact fees; h – Demand that enterprises set an environmental management plan.						

NR – No response provided

Source: made by the author.

Chart 8 – Problems related to the unsatisfactory actions of local managers and public organizations – problems' characteristics and proposals of solutions listed during the group discussion in planning meetings for the elaboration of the Local Plan for the Sustainable Development of the Araçá Bay (first column), indication of items from the individual tables from each participant in the discussion (presented as numbers in line 2) which were included in the group final panel (X) and which were not (lowercase letters – the meaning is presented in the end of the chart)

Problem: Poor Management		Participants					
Item		1	2	3	4	5	6
Characteristics	People with inadequate training/education for their position						
	Lack of technical competence						X
	Public employee or agent of the Public Administration who do not fully perform jobs					X	
	Lack of communication and dialog between different organizations						X
	Lack of support from public organizations to actions in Araçá Bay						
	Lack of definition of an identity/vocation of the city				X		X
	Lack of knowledge of the city's history						X
	Other political and economic interests prevent the divert attention from actions that could benefit Araçá Bay			X			
	There is no recognitions that the area could benefit the community (development view predominates)			X	X		
	Lack of public engagement in management			X			X
	Lack of knowledge about the people/organizations involved with management						X
	Management organizations charge fees but do not offer services.	X	X			X	
	Individuals items not included in groups'	0	0	0	0	0	0
Solutions	Community must take responsibility for actions				X		
	Implement citizen participation			X	X		
	Create mechanisms to promote and motivate participation						X
	Accomplish effective participation of every stakeholder						
	Bring general population close to Araçá, as residents and students						
	Promote ludic and pleasant interactions among stakeholders						X
	Elect managers with a similar point of view about Araçá Bay			X			
	Create and keep a connection between representatives and represented people						
	Provide knowledge about managers' responsibilities and action limits						X
	Promote and transform Araçá Bay in an area of interest and of economical relevance			X			
	Demand basic public services						
	Individuals items not included in groups'	0	0	0	0	0	a, b, c, d
Related stakeholders: Environmental educators; Municipal, State and Federal public managers; Community.							
Individual answers not included: **Solutions:** a – Understand the problem; b – Promote Technical capacitation; c – Discuss conflicts; d – Implement public policies.							

Source: made by the author.