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Local Agenda 21: Planning for the future, changing today

Luciana Yokoyama Xavier[a,*], Pedro Roberto Jacobi[b], Alexander Turra[a]

[a] Instituto Oceanográfico da USP. Praça do Oceanográfico, 191. Cidade Universitária – São Paulo/SP-Brazil. CEP: 05508-120
[b] Programa de Pós-Graduação em Ciência Ambiental (PROCAM) do Instituto de Energia e Ambiente da USP. Avenida Professor Luciano Gualberto, 1289 - Cidade Universitária – São Paulo/SP, Brazil. CEP 05508-010

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ABSTRACT

Agenda 21 is a globally coordinated action plan to promote sustainability and social empowerment. Outcome evaluations of Agenda 21 show a failure both to provide results with a long-term orientation and to promote public participation, the latter of which is essential to the management process. Studies indicate that to achieve sustainable development, the quality of public participation in management processes is more important than quantity. Such quality may be the result of a process of social learning, the joint and collaborative learning among different stakeholders that, through interaction, increases their capability to perform joint tasks related to environmental problems and build social capital. Thus, social learning can foster Agenda 21 implementation, improving the quality of processes and their results. To test whether social learning can occur in an Agenda 21, we analyzed an Agenda 21 process carried out in a coastal bay in São Paulo (Brazil). Through process observation and collection of questionnaire data, social learning changes were identified in a group of participants in the process. The results showed evidence of the acquisition of new information, increased perception of the system's complexity, development of social skills (such as the consideration of other's needs and interests in decision making), change in social context and in social structure with empowerment of local community. These changes, related to how the process was designed, led to social capital crucial to Agenda 21 continuity. This demonstrated the importance of conducting the Agenda 21 processes considering the potential to promote social learning in the search for more democratic and sustainable management practices.

1. Introduction

Agenda 21 (A21) is a globally coordinated action plan aimed at sustainability and social empowerment, derived from the United Nations Conference on Environment and Development (Rio 92). A21 has a hierarchical spatial scale strategy based on subglobal, national and locally settled plans, the latter named Local Agenda 21 (LA21) (United Nations, 1992). Since Rio 92, LA21 has been implemented globally and represents participatory efforts to establish a local plan for sustainable development (LPSD) of a restricted area (school, neighborhood, district, municipality, *etc.*), considering environmental, economic and sociocultural dimensions (Barrutia et al., 2015; Echebarria et al., 2018; International Council for Local Environmental Initiatives (ICLEI et al., 1996).

Implementation of LA21 follows a five steps process, which can be adapted for each context (Fig. 1). From establishing a partnership for the elaboration of a LPSD, to its implementation and monitoring, the participation of local communities is a key element that can result in actions that improve quality of life and promote public policies that have been adjusted to fit local situations (Evans and Theobald, 2003; Otto-Zimmermann, 1994; Varol et al., 2011).

Since Rio 92, LA21 initiatives have been applied worldwide, with varying degrees of success. Studies that analyzed LA21 implementation focus on procedural goals and concrete results. Procedural goals considers process characteristics, as the number of participants, the involvement degree (*e.g.*, consultation or deliberation) (Barrutia et al., 2015; Evans and Theobald, 2003), political support (Feichtinger and Pregernig, 2005; Otto-Zimmermann, 1994; Tuxworth, 1996) or adherence to the steps of the implementation guideline (da Fonseca et al., 2012; Tuxworth, 1996). Analyses of results focus on progress and achievements, such as the degree of implementation (Garcia-Sanchez and Prado-Lorenzo, 2008), achievement of the end objectives and development of indicators to measure them (Corbière-Nicollier et al., 2003; Evans and Theobald, 2003), and the quality of the plan's actions in terms of sustainability principles (Barrutia et al., 2015; Corbière-Nicollier et al., 2003; Echebarria et al., 2018; Evans and Theobald, 2003).

Despite the existing reports of qualitative outcomes in LA21 studies,

* Corresponding author.
E-mail addresses: lyxavier@usp.br (L.Y. Xavier), prjacobi@usp.br (P.R. Jacobi), turra@usp.br (A. Turra).

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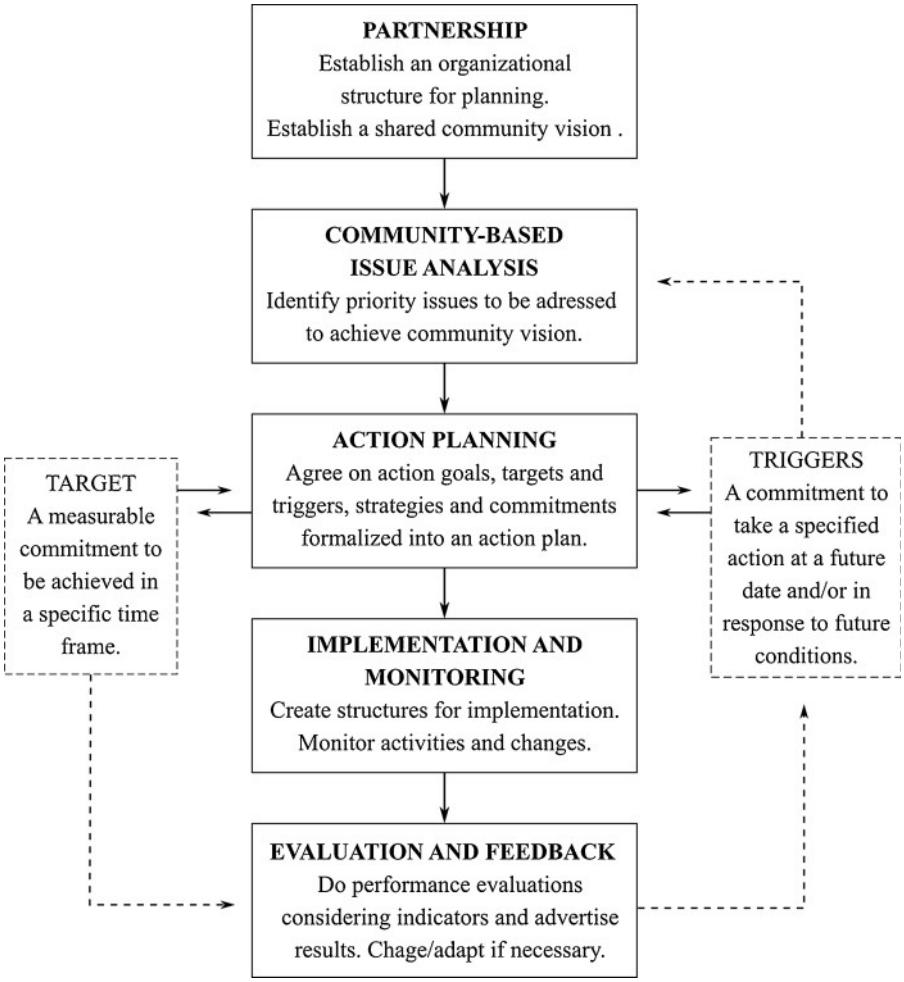

Fig. 1. Steps to sustainability through the implementation of a Local Agenda 21 process. (Adapted from International Council for Local Environmental Initiatives (ICLEI et al., 1996).

as social engagement or the construction of social capital (Barrutia et al., 2015; Miranda, 2004; Roberts and Diederichs, 2002; Varol et al., 2011), the usually applied objectives and quantitative indicators for LA21 monitoring and evaluation fail to measure these outcomes in a systematic and comparable way. Such outcomes are considered imperatives for implementation and continuity of the process (Feichtinger and Pregernig, 2005; Reed, 2008; Roberts and Diederichs, 2002), thus, understanding them can shed new light in the assessment and evaluation of LA21 processes. Of special interest is understanding the capacity of groups to learn together, through interaction, when discussing environmental issues, defined as Social Learning (SL) (Pahl-Wostl et al., 2007; Reed et al., 2010).

2. The social learning framework

Social learning (SL), in the context of environmental management, is the joint and collaborative learning that takes place through social interaction in a process of a collective search for solutions to environmental problems (Armitage et al., 2008; Berkes, 2009; Garmendia and Stagl, 2010; Pahl-Wostl et al., 2007; Reed et al., 2010). SL occurs in a specific social-ecological context that influences, and is influenced by, the process itself and its results (Fig. 2). During the interaction, stakeholders exchange knowledge, opinions and perceptions and build collective frames and possible solutions, resulting in trust, social capital and new personal and technical skills (Armitage et al., 2008; Berkes, 2009; Garmendia and Stagl, 2010; Mostert et al., 2007; Muro and Jeffrey, 2008; Pahl-Wostl et al., 2007; Reed et al., 2010).

The SL framework evidences three important aspects of SL. First, it is a "process within a process", with constant feedback loops, which affect the context throughout the process. Second, it is based in relational practices (*e.g.* meetings, field visit, training) and social interaction, thus social participation is a key element. Third, its outcomes represent improvements to relational practices (the process itself) and to the technical qualities of the solutions to environmental problems. SL outcomes are represented by changes that go beyond the individuals involved in the process and reach wider social structures (Garmendia and Stagl, 2010; Pahl-Wostl et al., 2007; Reed et al., 2010). Garmendia and Stagl (2010) reported four types of changes:

a) In knowledge, which involves the adoption of new facts. This can be categorized as declarative knowledge (new information), procedural knowledge (new practices) and effectiveness knowledge (understanding of the effectiveness of an action towards a defined goal);
b) In recognition of the system's complexity, acknowledging its uncertainties, conflicts and risks;
c) In the social context that affects institutions and provides new possibilities of joint and collaborative actions;
d) In the appraisal of facts (framing and reframing) and an increased understanding of others' perceptions and needs.

Such changes influence the continuity of participatory processes and can happen naturally or be fostered by process design and strategy (Garmendia and Stagl, 2010; Kelly and Moles, 2002; Miranda, 2004; Rees et al., 2005; Roberts and Diederichs, 2002; Steyaert and Jiggins,

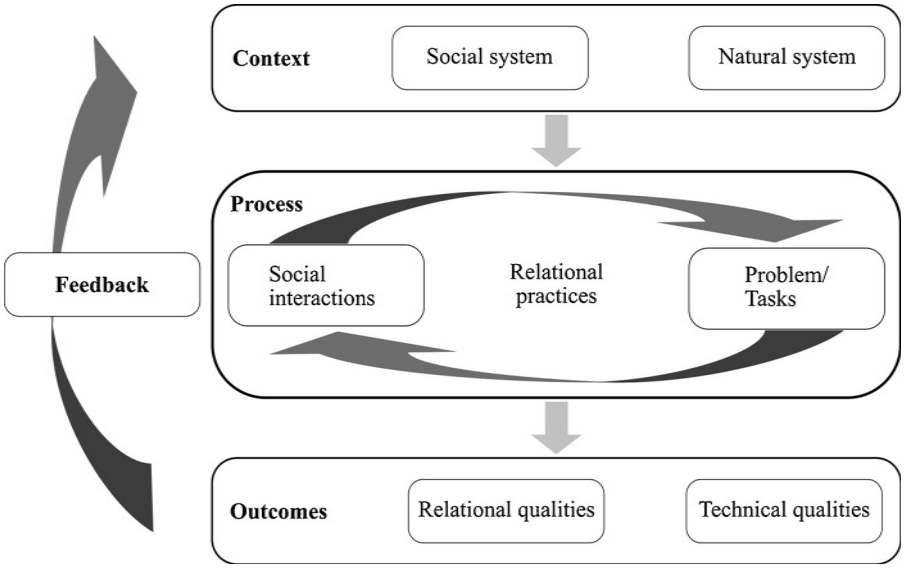

Fig. 2. The Social Learning for Environmental Management framework. (Adapted from Pahl-Wostl et al., 2007).

2007; Varol et al., 2011). Since LA21 is designed to promote social interaction, it is logical to presume that SL is a possible, if not desired, outcome. Thus, analyzing the LA21 process under the SL framework can contribute, not only to the commonly applied monitoring and evaluation frameworks, but also to promote more qualified participation and the social capital important to the implementation and continuity of LA21. In this article, we explore this possibility by analyzing an LA21 process carried out in the Araçá Bay/Brazil. The hypothesis is that SL changes can be observed in the implementation of LA21 and can improve the processes beyond its concrete results (the implementation of the LPSD).

3. Data gathering and analysis

A mixed-method approach was applied to identify evidence of SL in the case study. We applied the systematic observation technique (Gil, 2008), in which the researcher observes a group without engaging with the group, looking for specific information. This was conducted during the entire process by a single person (in meetings and by analyzing meeting reports, audio and video recordings). We were interested in observing changes in actions, interactions, participation and relationship among participants. The changes observed were registered at the moment of observation, discussed with the group of researchers during meetings' evaluation reunions and later classified according to the four types of change under analysis. It is important to stress that this was a process coordinated by researchers, who did not join the discussion (it was not a participatory research – Gil, 2008), but who counted on the participation of other researchers who joined every phase and interacted with other social sectors. Thus, when we describe researchers' participation on the process and its outcomes (Section 4), we are not making reference to the researchers engaged in the coordination activities.

Complementing process observation, changes in knowledge and recognition of the system's complexity and social context were analyzed by applying a questionnaire (Table 1). We were interested in the comparison of perceptions before and after the interaction in planning meetings when there was a greater exchange of information and perceptions. Thus, questionnaires were applied in the beginning of Meeting IV (time before interaction), and in the beginning of each subsequent meeting (time after interaction). For analysis, only the first and last questionnaire of each respondent was considered. For example, if a participant attended the four planning meetings, we considered the questionnaires of Meetings IV and VII. This resulted in 17 questionnaires for analysis. Answers were analyzed with descriptive statistics and the Wilcoxon nonparametric test for two related samples (Pallant, 2002).

For evidence of changes in the appraisal of facts, we considered the material used in the discussion of the eight priority problems during the planning phase. These consisted of individual tables in which participants registered their perceptions of the characteristics and possible solutions to each problem, and posters with the same information elaborated after group discussion of the same problem. Individual and group answers were coded in keywords/phrases and compared to compute the number of codes and which individual answer was included or not in the groups' final proposal[1]. Descriptive statistics were applied to data analysis, considering the average number of codes for characterization and solution proposals for each problem.

4. A local plan for sustainable development of the Araçá Bay

4.1. The context: the Araçá Bay

The Araçá Bay (or just Araçá) is a 550,000 m^2 tide dominated bay located in the central region of the Municipality of São Sebastião (São Paulo State/Brazil) (Fig. 3). Araçá is of ecological relevance given its many ecosystem services, such as food provision, sewage treatment and biodiversity maintenance; and of social relevance, related to research and educational activities and to local traditional uses (Amaral et al., 2016, 2010; Carrilho and Sinisgalli, 2017).

The Araçá Bay suffers from impacts related to the urbanization of its surrounding, such as sewage and solid waste discharge, diffused pollution and irregular activities, as well as the existence of great enterprises such as the Port of São Sebastião (PSS) and the Maritime Terminal Almirante Barroso (TEBAR). The main direct threat to the bay is related to the PSS activities. Constructed between 1936 and 1954, it underwent two expansions, in 1972 and 1987, and has recently proposed a third that would bring significant negative environmental impacts to the bay (Turra et al., 2017).

Araçá's context is marked by the duality between its social-ecological relevance and the economic development portrayed by the local enterprises, which threaten the bay. Historically, little attention has been given to its management (Mani-Peres et al., 2016), and even though it is included in two marine protected areas, the Municipal

[1] The tables with this comparison are presented as supplementary material.

Table 1
Questionnaire applied to the participants during planning meetings. Social learning changes were tested through different questions that were answered based on a Likert scale (Cohen et al., 2005) ranging from 1 - "Not at all" to 5 - "Very much".

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 social context and new possibilities of and for 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?

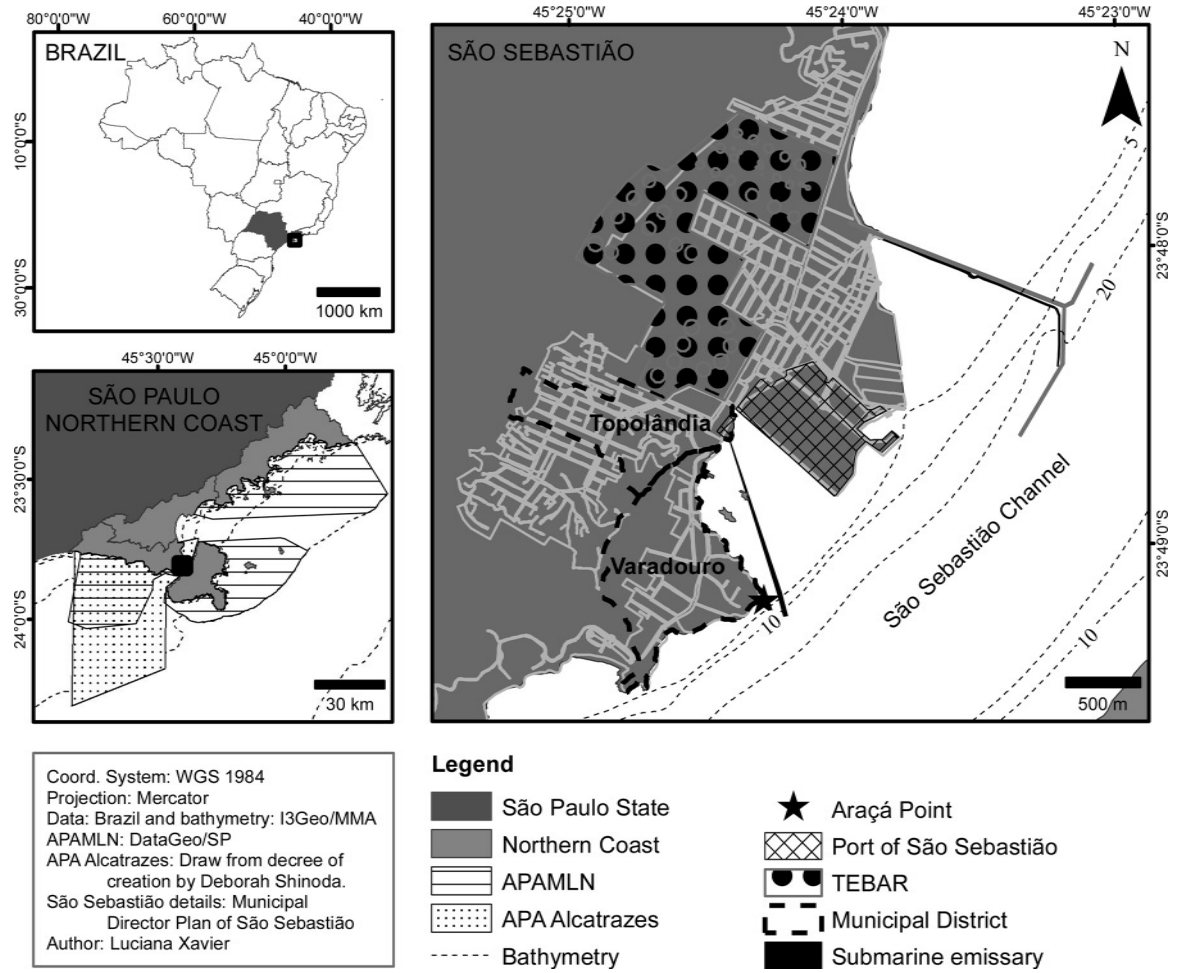

Fig. 3. Location of the Araçá Bay and the limits of the two protected areas that include the bay: Municipal Protected Area of Alcatrazes (APA Alcatrazes) and the Marine Protected Area of the Northern Coast of São Paulo State (APAMLN) (left bottom,). Right map shows the Araçá Bay and the features that surround and cross it.

Protected Area of Alcatrazes (APA Alcatrazes), and the Marine Protected Area of the Northern Coast of São Paulo State (APAMLN), there were, up to 2018, no specific regulations for the area.

Similarly, up to 2016, there was little local social capital. Local residents were not mobilized or organized to discuss Araçá's management, the local social network was weak and did not participated in any local forum (*e.g.*, in the management board of APAMLN) (Nunes, 2015).

4.2. The process: a LA21 for the Araçá Bay

The PSS expansion proposal, which initially included covering 82% of Araçá Bay (Turra et al., 2017), triggered a regional movement against it, spearheaded by nongovernmental organizations (NGOs) from Ilhabela (the municipality facing the bay, across the São Sebastião Channel), APAMLN's management board and scientists. The movement advocated for an alternative future for the bay, nevertheless, only a few residents of the Araçá's surrounding neighborhoods engaged in it. To broaden this discussion and promote a stronger local social

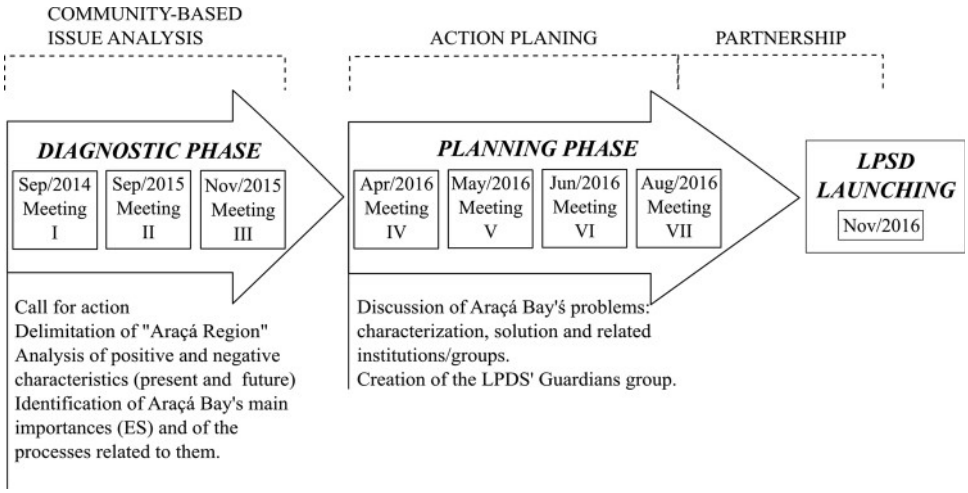

Fig. 4. Time line of construction of the Local Plan for Sustainable Development of the Araçá Bay, with information of the type of the activities of each phase and the corresponding steps related to ICLEI et al. (1996) framework (Fig. 1).

organization, cohesion and involvement, an LA21 process was initiated (Santos et al., 2018). The LA21 process in Araçá was a civil society initiative (Type 2 of LA21 - Echebarria et al., 2018), coordinated by researchers, which is not uncommon in LA21 (Echebarria et al., 2018; Kelly and Moles, 2002).

The LA21 process was conducted as an adaptation of the steps described by ICLEI et al. (1996). After an initial mobilization and awareness raising with local community, seven participatory meetings were held, with two distinct phases: diagnostic (2014–2015) and planning (2016) (Fig 4). This process resulted in the elaboration of the Local Plan for Sustainable Development for the Araçá Bay, published as the booklet "LPSD of Araçá Bay" (hereafter referred to as LPSD/Araçá) in November 2016[2]. A total of 141 people participated in the meetings, including Araçá Bay residents (21%); other residents from the North Coast of São Paulo (28%); researchers and scientists (28%); and representatives of public organizations (11%), nongovernmental organizations (NGOs - 9%) and the private sector (3%).

The diagnostic phase was a call to action for the local community and provided information about Araçá Bay's limits, characteristics, importance and main threats, as perceived by participants. During Meeting III, participants discussed and produced mental maps of the characteristics and process involved with the most relevant benefits derived from the bay; this assisted them in understanding the interconnections and relations among components of the system in providing ecosystem services. Participants identified the main problems (negative characteristics of the bay) (Table 2), which were prioritized and discussed during the planning phase.

When the LPSD/Araçá was launched, a group called Araçá Bay Guardians was formed, composed of members from the Araçá Bay community as well as from other regions the Northern Coast of São Paulo State, including researchers, representatives from the APAMLN and of the municipal administration. The group assumed the task of publicizing the LPSD and organizing future activities to further discuss and implement the propositions involving other stakeholders.

4.3. The outcomes: SL changes on the LA21 for the Araçá Bay

4.3.1. Changes in knowledge

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 and Stagl, 2010). Changes in declarative knowledge were related to the importance of Araçá, knowledge of social and environmental issues, the different institutions involved with Araçá's management and the different interests for the future of the bay.

Changes in declarative knowledge were evident through process observation, as changes in the terms that participants used to describe Araçá Bay and oceanographic processes. For instance, 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". Information exchange and knowledge acquisition are common characteristics of SL (Garmendia and Stagl, 2010; Pahl-Wostl et al., 2008; Steyaert and Jiggins, 2007) and LA21 (International Council for Local Environmental Initiatives (ICLEI et al., 1996; Roberts and Diederichs, 2002) processes. In this study case, the involvement of researchers of the ongoing Biota-Araçá Project, with non-scientific publications of its results (Amaral et al., 2016; Schaeffer-Novelli et al., 2015; Xavier et al., 2016), favored the acquisition of scientific knowledge by lay participants. Researchers also benefited by knowledge exchange, both in ethnographic studies (Mani-Peres et al., 2016), participating on meetings, or by finding new research subjects through interaction (Xavier et al., 2018).

Changes in knowledge of local institutions involved with the bay's management were observed through the process. The approximation of local residents with the management group of APAMLN is the most prominent example. Few members of the local community knew about or had ever participated in activities related to APAMLN, despite a recent (2013) regional effort to perform a participatory assessment of activities within its area. In a network analysis of the institutions/groups operating in the Araçá Bay, Nunes (2015) identified 11 different institutions/groups; none of his 14 interviewees from the local residents cited APAMLN. Similarly, APAMLN's management had no local action in Araçá. Approximation between the two occurred through the LPSD process, when representatives of APAMLN participated in the activities and information was disseminated.

No statistically significant differences were observed in the answers to the questionnaire (Q1-Q5 - Table 3), but there was a tendency of increase in the average scores for most of the questions. The greater number of increases in scores were registered for the familiarity with social issues of Araçá Bay (Q2), which was expected since planning meetings were an opportunity to discuss such issues. The meetings were also evidence of the diversity of stakeholders and of interests involved with Araçá's management. It is possible that this led to the decrease in average scores related to the familiarity with different interests (Q5), leading participants to perceive their vague awareness of interests from

[2] A detailed description the construction of the LPSD/Araçá can be found at PLDS/Araçá, 2016; and Santos et al., 2018.

Table 2
Problems identified and prioritized during the process of elaboration of the Local Plan for the Sustainable Development of the Araçá Bay (São Paulo/Brazil).

Problem (Prioritization score)	Brief description
Sewage discharge and contamination (19)	Residential sewage discharge in the environment, linked to the inefficient/nonexistent sewage treatment system and outfall discharge.
Operation of current local enterprises (19)	Existing enterprises, especially regarding activities of the Port of São Sebastião and of the TEBAR.
Solid waste pollution (17)	Presence of solid waste from sea and land sources in the bay.
Industrial & Urban growth (16)	Urban growth and local industrial development without adequate planning
Chemical pollution (15)	Environmental contamination by chemicals.
Drug consumption (12)	Smuggling and consumption of drugs in the region.
Poor management (5)	Unsatisfactory actions of local managers and public institutions.
Fishing (2)	Irregular fishing activities.
Impacts on Permanent Protected Areas (1)	Environmental degradation of permanent protected areas as mangroves and watercourses.
Port of São Sebastião's infrastructure (1)	Existing infrastructure of Port of São Sebastião.
Low social involvement (1)	Little social engagement and social power within decision-making processes.
Lack of infrastructure for tourism and leisure activities (1)	Lack of public infrastructure to serve the local population and tourists in the development of leisure activities in a planned and sustainable way.

Table 3
Results of the questionnaires that were considered for analysis of social learning changes in the process for elaboration of the Local Plan of Sustainable Development of Araçá Bay, São Sebastião (São Paulo/BR) (N = 17). Although Wilcoxon test revealed no statistically significant difference in questionnaire scores prior to and after interaction, it is possible to observe trends of increase/decrease in average scores and in standard deviation that point to changes in respondents' perceptions.

	Av.F	Std.F	Av.L	Std.L	Decr.	Incr.	No dif	Z	*p*-value
Q1	4.41	0.939	4.65	0.493	3	5	9	−1.100	0.271
Q2	3.76	0.970	4.29	0.772	3	8	6	**−1.812**	0.070
Q3	4.29	1.105	4.65	0.493	2	5	10	−1.403	0.161
Q4	3.00	1.225	3.41	0.939	2	6	9	−1.161	0.107
Q5	3.53	1.068	3.35	0.996	4	3	10	−0.879	0.380
Q6	4.00	0.935	3.82	1.286	4	5	8	−0.183	0.854
Q7	4.88	0.332	4.94	0.243	0	1	16	**−1.000**	0.317
Q8	4.94	0.243	4.94	0.243	1	1	15	0.000	1.000
Q9	4.76	0.752	4.88	0.332	1	2	14	−.0816	0.414
Q10	4.94	0.243	4.88	0.332	1	0	16	−1.000	0.317
Q11	4.88	0.332	4.65	0.786	3	1	13	−1.134	0.257

For each question (Q1 to Q11) we present 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 who changed their responses to lower (Decr.) and higher (Incr.) scores, or who 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.

different stakeholder groups.

There was no evidence of changes in practices (procedural knowledge) and little change regarding the understanding of the effectiveness of an action for a defined goal (effectiveness knowledge). Since the LPSD did not focus on proposing objective actions to solve the problems, there was no room for discussion concerning types of practices and their effectiveness. Nevertheless, analysis of the proposed solutions to Araçá Bay's problems (Section 4.3.4) evidenced a change in the understanding of what kind/characteristics of actions would be more effective, based on a more participatory approach.

4.3.2. Changes in recognition of the system's complexity

Complex systems are characterized by multiplicity, interconectedness, adaptability and uncertainty (Berkes and Folke, 1988), and social participation has been a tool used to face the challenges to their management (Berkes, 2009; Reed, 2008). The problem of low social involvement was not among the eight priority problems of Araçá, but through the process, participants perceived that it was, in fact, a major problem and a constant solution for many problems. This recognition may be regarded as a change in the recognition of the system's complexity.

This change was also observed in the discussions of Araçá's characteristics and processes that support the bay's ecosystem services (Meeting III). When asked about what makes the bay important, respondents initially 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. The food provision service, for example, was explained in the mental maps as a result of 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).

We had expected that the increased understanding of the complexity of Araçá processes and of the many causes/consequences of the problems discussed would lead to an increased understanding of the management challenges. Nevertheless, there was no statistically significant evidence that it happened (Q6). Indeed, we observed a slight decrease in the average score on the question related to management difficulty, despite the greater number of increases in comparison to decreases (Table 3).

4.3.3. Changes in social context

Changes in social context provide new possibilities of joint and collaborative actions (Garmendia and Stagl, 2010). The creation of the Araçá Bay Guardians group is the most prominent change within the social context. Following the proposed steps for LA21 (International Council for Local Environmental Initiatives (ICLEI et al., 1996), there was a first attempt to create the group in the Meeting I (2014), which failed given the small number of local community members in the meeting. It was only during the planning phase, after community mobilization to participate, that the creation of the group was possible and was carried out by participants themselves. When collectively discussing the problem of "Low social involvement", a participant questioned how social control would be exerted for LPSD/Araçá's implementation. Many volunteered to assist and thus, the group was born and to date is working to implement the LPSD (PLDS/Araçá, 2016). The creation of new institutional arrangements is usually necessary for LA21 implementation (International Council for Local Environmental Initiatives (ICLEI et al., 1996; Miranda, 2004; Roberts and Diederichs, 2002; Tuxworth, 1996). For Araçá, it was only possible after the SL process created the social capital necessary to it.

Working together in the L21 process fosters new relations (International Council for Local Environmental Initiatives (ICLEI et al., 1996; Roberts and Diederichs, 2002). In Araçá, ties were formed among participants of different sectors, between local residents and researchers, and among them and between institutions, as with APAMLN. The relationships of Araçá residents with researchers changed from considering researchers with greater responsibility to solve Araçá problems, since they would have "the knowledge" and the funds, to

considering them as “interlocutors” or “partners” of the local community who took responsibility for LPSD’s further development and implementation. The approximation with APAMLN resulted in the creation of a specific working group to discuss Araçá in its management structure (Xavier et al., 2018) and, by participating in this group, Araçá residents became acquainted with other local groups who were already involved with APAMLN as fishermen associations and NGOs, and joined these other working groups. This indicates a social change that goes beyond the individual and has been institutionalized in APAMLN management structure.

These changes were not captured by the questionnaire (Q7 - Q11). The questions related to them had the highest scores from the beginning, which is logical since attendance at planning meetings indicated that participants were prone to, or even expected, to participate in joint and collaborative actions. Since LPSD activities aimed to promote collaboration among stakeholders, no negative changes were expected. Nevertheless, the absence of some stakeholders in planning meetings (public institutions, licensing and inspection bodies, representatives of the major local enterprises and others cited in problems’ discussions) may have led to the decrease registered in the question about the perceived existence of opportunities for joint action (Q11). Engaging local governments is a challenge related to civil society initiatives to LA21 (Echebarria et al., 2018), in this study case, another challenge was to involve the private sector, such as the PSS, which could greatly contribute to the LPSD/Araçá implementation.

4.3.4. Changes in appraisal of facts

Changes in the appraisal of facts (framing and reframing) and increased understanding of others’ perceptions and needs were observed throughout the process, especially as it relates to the maintenance of Araçá Bay for future generations. One of the main voiced concerns of the local community was that the current system’s degradation had already caused the alienation of younger generations and that in the future, *caiçara* culture would be locally extinguished.

Problem discussion in planning meetings provided stronger evidence of such changes. The number of codes considered for problem characterization and solutions was always higher in a group’s final poster than in individual tables (Fig. 5). On average, individual tables registered 4 characteristics and 2.6 solutions. A group’s discussion and final poster included most individual codes, and new characteristics/solutions emerged[3], resulting in 13 characteristics and 10 solutions on average.

Additionally, codes from group posters showed a new, collective frame of reference with increased complexity. 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. Group discussion pointed to other characteristics, such as the difficulties drug addicts faced in recovery, the lack of proper treatment, and its relation to the isolation of the area caused by port infrastructure[4].

For the solutions for “solid waste disposal”, individuals’ solutions focused on two actions: increase and improvement of the monitoring and management system, and development of informational and educational campaigns[5]. Group discussion built on these elements and added the importance of discussing the problem in governmental plans, such as the City Hall Planning, which included a political, managerial and planning aspect. This can also indicate a change in effectiveness knowledge and of system complexity based on the understating that local and punctual actions are not effective in solving the problem and that solutions are part of a more complex arrangement that considers providing information to society, promoting education and behavioral changes, implementing new and focused public policies and increasing social participation and control over institutions.

5. Final considerations

Social learning is the process of change resulting from participatory processes (Armitage et al., 2008; Berkes, 2009; Garmendia and Stagl, 2010; Mostert et al., 2007; Pahl-Wostl et al., 2008; Reed et al., 2010). It can foster development and improve outcomes (Armitage et al., 2008; Berkes, 2009; Garmendia and Stagl, 2010; Pahl-Wostl et al., 2008; Reed et al., 2010), 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 focuses on the process and social changes it promotes (Pahl-Wostl et al., 2008; Reed et al., 2010), enabling further and enhanced environmental changes towards sustainability. In this work, we tested the general hypothesis that SL changes can be evidenced in LA21 implementation processes and can improve it beyond its procedural results.

We observed changes in knowledge, with the acquisition of new information that increased perception of a system’s complexity; in social skills, which involved addressing and considering others’ needs and interests in decision making and finding alternative ways to cooperate; and in the social context, with empowerment of the local community and the emergence of a new social structure (the Guardians of the LPSD/Araçá) and institutional relationships, going beyond the individuals involved with the process.

Considering the commonly applied metrics to measure LA21 outcomes considering procedural goals and concrete results, the case study would receive a poor score. Although we registered a suited number of participants and good involvement degree, there was little political support (since local government did not engage and APAMLN was the only institution who joined the Araçá Bay Guardians) or adherence to ICLEI et al. (1996) steps. The LPSD/Araçá is not an action plan and was not implemented after the processes, thus it is not possible to measure the concrete results of the actions related to it. Its most substantial outcomes were the empowerment of the local community, the recognition of the need for joint action and social participation in the management of the bay, and the creation of the Araçá Bay Guardians. These are strongly related to the SL changes evidenced in the LA21 process.

The SL changes evidenced here emphasize the need to consider the entire process to evaluate LA21 implementation, already advocated by Evans and Theobald (2003). In this context, we draw attention to the importance of process design to promote learning opportunities (Garmendia and Stagl, 2010; Rees et al., 2005; Steyaert and Jiggins, 2007). From the diagnostic phase to the planning, the LPSD process was designed to mobilize and engage Araçá residents, to promote a more holistic understanding of the bay and of the benefits it promotes, to favor a collective understanding of the problems prior to discussing solutions and to empowering local citizens.

We applied a mixed method approach to identify social learning changes. Unfortunately, the questionnaire was not efficient in registering the information we were looking for and most of the SL changes were evidenced through observation. Despite the relevance of observational data, questionnaires could assist in comparing different cases. Thus, developing strategies to collect them should be addressed by future studies. In the Araçá case, questionnaire scores were high from the first application; thus there was a limit to an increase in scores sufficient to promote a statistically significant change. Giving respondents the possibility to change their initial answer or asking about the degree of change in their perception about each issue could have led to more appropriate measures.

This study is the first attempt to evaluate LA21 as a SL process with a mixed method approach. It is necessary to broaden this analysis to

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

[4] See Chart 6 of supplementary material.

[5] See Chart 3 of supplementary material.

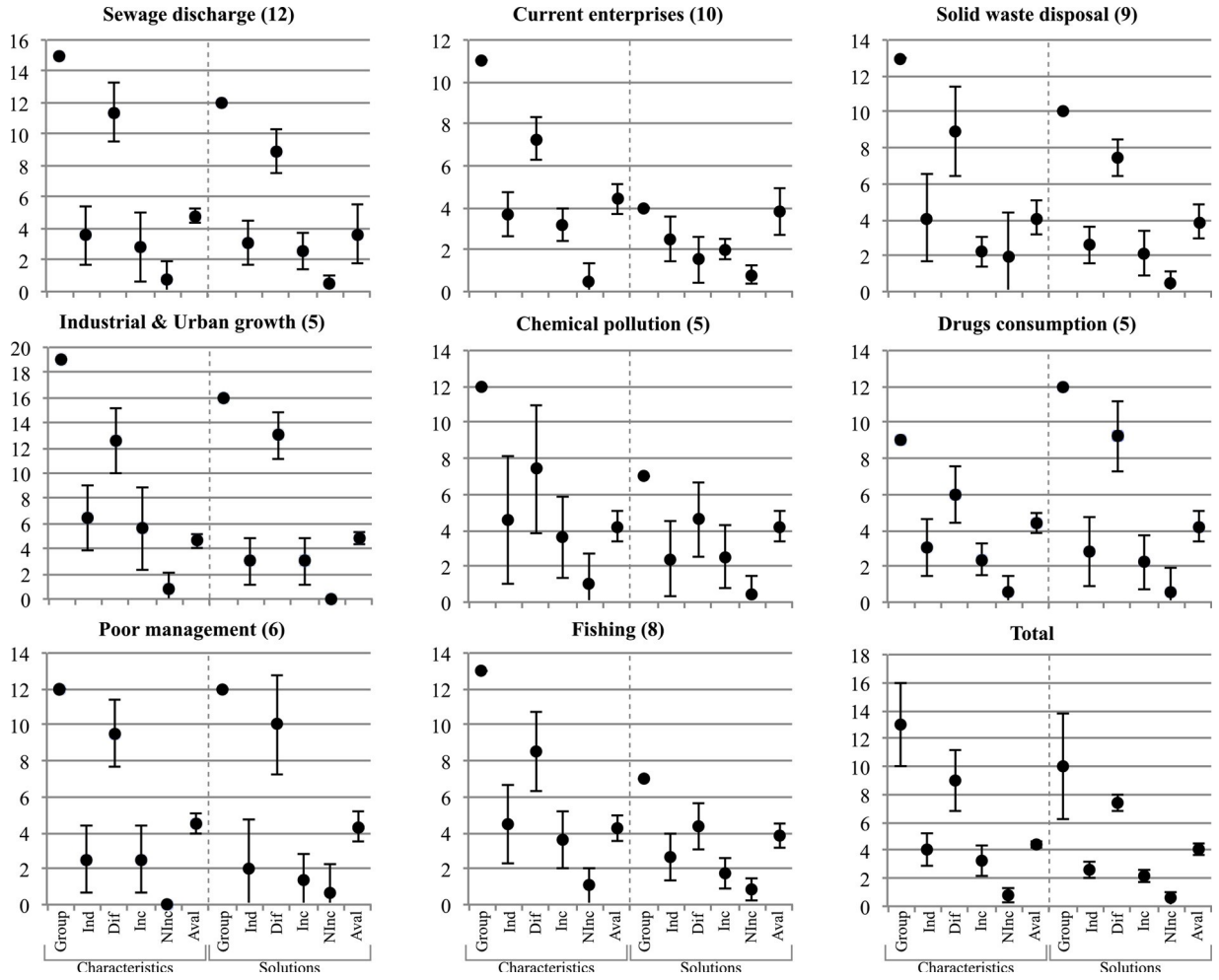

Fig. 5. Average number of codes considered for the Araçá Bay's problem characterizations and solutions during planning meetings for the elaboration of the Local Plan for Sustainable Development of Araçá Bay, São Sebastião (São Paulo/Brazil), considering the main problems that affect the bay, identified and prioritized by participants. To discuss characterization and solution we present the total number of participants (N), the total number of codes registered in group's table (Group), the average number and standard deviation of codes proposed by each participant individually (Ind), the difference between the number of codes included in a group's table and proposed by individuals (Dif), individual codes included in a group's table (Inc), and individual codes not included in a group's table (NInc). Averages considering the number of each code for all the problems are presented in the last graphic.

other areas and contexts to advance the discussion of SL and LA21 implementation and the importance of focusing on process characteristics in addition to 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 assist in the quest for sustainability.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.envsci.2019.07.006.

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