



Is there dialogue between researchers and traditional community members? The importance of integration between traditional knowledge and scientific knowledge to coastal management



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ABSTRACT

The Paranaguá Estuarine Complex (PEC), Paraná State, southern Brazil, has rich biodiversity and attracts the attention of researchers in several areas. In this region, there is a mosaic of protected areas that aim to maintain the natural heritage through regulation of the use of the area and natural resources and are also home to traditional extractive communities, such as fisherfolk. These coastal communities are dependent on local resources and are continually in contact with researchers working mainly on studies related to coastal environmental issues. However, the results generated in these studies realized in marine environment are rarely shared or discussed with these traditional communities before being taken to decision makers, which can result in conflicts between those involved, the acceptance of reduced management measures and the loss of research credibility. The objective of this article is to describe the perception of marine traditional fishermen from the village of Ilha das Peças (VIP) and the village of Ilha do Superagui (VIS), both located in the vicinity of the protected areas, regarding the scientific research conducted in the PEC. In 2012, ethnographic interviews were conducted through semi-structured questionnaires given to fisherfolk in the VIP ($n = 40$) and the VIS ($n = 50$). The level of education among the fishermen in the two villages is low, which can influence the perception of the research conducted in the region. All respondents in the VIP and VIS described not receiving reports from researchers regarding the results. Therefore, there is a feeling of dissatisfaction regarding the lines of research in general, which is extended to the funding agencies and the presence of researchers in the area, representing conflicts with the management of marine resources. According to the respondents, the research does not seek solutions to social and environmental problems but only evaluates and seeks to preserve the fauna and flora, excluding the human component of the broader ecological processes. Dialogue between scientific and traditional knowledge is essential in the joint search for effective solutions to social and environmental problems, especially in areas designated as priorities for biological conservation in the coastal environment.

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1. Introduction

Coastal areas are local that have natural resources disponible for survival and development of traditional communities that depends of fishery (Fitton et al., 2016). The maintenance of these resources

allow the development of activities of traditional communities that inhabits the coastal environments (Özyurt and Ergin, 2009). So, is importante to consider the perception and legitimate culture of these stakeholders to promote the fisheries management (Wilson et al., 2006). In some countries, there are traditional communities that live in areas with conservation problems and with this there is a need to carry out management activities.

In Brazil, traditional community is defined by two federal laws as a “population living in close relationship with the natural

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environment, depending on natural resources for their socio-cultural reproduction through low-impact activities” (Federal Law N° 11.428/2006 Art. 3° section II) and as “culturally different groups and are recognized as such, which have their own forms of social organization and which occupy and use territories and natural resources as a condition for their cultural, social, religious, ancestral and economic use using knowledge, innovations and practices generated and transmitted by tradition” (Federal Law N° 6.040/2007 Art. 3° section I).

The traditional knowledge belonging to these communities is the daily expression of life of each community members and is understood as the knowledge and experience of the individual in relation to the natural and spiritual world, for which there is a link between the environment, the supernatural and social organization in these populations (Davis and Wagner, 2003; Diegues, 2000; Usher, 2000). Community members that inhabit in coastal environment exhibit in-depth knowledge about the occurrence and distribution of marine resources and an understanding of environmental dynamics and establish their beliefs based on this empirical knowledge, which has been passed on orally from other members (Berkes, 2003). In this way, through the daily observation of the coastal environment, knowledge regarding the processes of nature is developed, thereby ensuring the maintenance of the social and cultural system of the people over generations (Davis and Wagner, 2003; Wenzel, 1999).

On the other hand, scientific knowledge is established differently and tends to avoid engagement with mythical questions. It is based on methodical observation and experimentation through a rigid scientific method to seek explanations for the occurrence of observed facts (Carey and Smith, 1993; Galliano, 1986). Such knowledge is not passed among researchers only through an oral tradition but through writing texts with technical language. Such texts require the methods be presented with precision and reproducibility, generating information that can be critiqued and discussed in the context of disproved hypotheses (Nagel, 1961).

Scientific research conducted in coastal areas inhabited by traditional communities and focusing on the management and assessment of natural communities may include the participation of these people during their execution. Such participation becomes limited from the moment that the objectives of the research are not disclosed to community members as well as when the results are generated. These communities are often ignored and their contributions are often not considered during the preparation of projects for the public good (Arruda, 1999). Despite the simple way of life of traditional communities, it is important to present to community members the new information generated from research carried out in their territory so that they may consider the results that may alter their welfare (Albagli, 2006; Baptista, 2007). Some studies considered/included the participation of stakeholders in process of management and development some practices and codes of conduct and the results were positive (see Table 1).

The importance of the transmission of the information obtained from scientific research to traditional communities was identified in 1992 in the promulgation of the Convention on Biological Diversity (CBD). This return of results has been identified as an important step in the completion of projects directly involving communities or affecting their territory and resources. In Brazil, this idea was strengthened in 2001 with the measure of the institution Provisional 2.186–16 and Federal Law 13.123/15, which provide for access to genetic resources, the protection of traditional knowledge associated with benefit sharing and access to technology and the use of resources (Albagli, 2006).

A mosaic of conservation units in coastal environment is located in the Paranaguá Estuarine Complex (PEC), Paraná State, southern Brazil, each of which has specific characteristics regarding the use

of natural resources. Traditional communities also live in this region, which are highlighted as featured members claiming public policies for cultural and territorial identity (Montenegro, 2012). Among the protected areas is the Superagui National Park, which includes in its territory and surroundings traditional caçara communities, two of which are the village of Ilha das Peças (VIP), located on Peças Island, and the village of Ilha do Superagui (VIS), located on Superagui Island. These communities depend mainly on fishing and tourism for their local income. The PEC region is considered a World Heritage Site by UNESCO (1999) based on its biological and cultural diversity, and several groups of researchers have been attracted to the region to conduct scientific projects that include several thematic lines. The residents of communities such as the VIP and VIS are usually addressed by researchers to achieve the objectives of the research by seeking information related to empirical knowledge or by obtaining logistical aid from the communities. Generally, the research groups working in the area used by traditional communities do not report the results generated by scientific research to these communities (Patzlaff and Peixoto, 2009).

Dialogue between traditional and scientific knowledge allows new perspectives for the development of scientific research and opens the possibility for effective responses for the management of coastal areas and the use of natural resources. Thus, researchers should seek to understand the culture, concepts, customs and regional rites of the traditional community, i.e., the community's way of life, assimilating all traditional knowledge acquired in contact with members and transferring it to the scientific community (Patzlaff and Peixoto, 2009). The information acquired from traditional knowledge can be used in the search for effective solutions to coastal environmental problems, which means that researchers can use the local perception in developing hypotheses and techniques and in conflict resolution (Moura and Marques, 2007).

This dialogue between traditional and scientific knowledge and the incorporation of human dynamics into studies provides perspectives on coastal co-management. The integration of stakeholders, researchers and public managers establishes avenues for discussion to find solutions to problems and conflicts, thereby ensuring coastal environmental conservation and social justice (Marangon and Agudelo, 2004). In this sense, based on the importance of dialogue between researchers that act in coastal environment and traditional communities, the aims of this study were to describe the perception of traditional fishermen from VIP and VIS within the PEC on the scientific research carried out in the region; and to propose actions as a model for the integration of traditional knowledge and scientific knowledge to contribute to the development of dialogue between the groups involved in research and traditional communities that inhabit coastal environment.

2. Materials and methods

2.1. Study area

This study was conducted with the traditional fishing communities residing in the village of Ilha das Peças (VIP) (25°27'S; 48°20'W) and the village of Ilha do Superagui (VIS) (25°28'S; 48°13'W), belonging to the municipality of Guaraqueçaba (25°18'S; 48°19'O), Paraná State, southern Brazil (Fig. 1). These fishermen are registered in Fishing Community Z-2 Guaraqueçaba and include 62 fishermen and 41 boats in the VIP and 130 fishermen and 92 boats in the VIS (Mafra, 2012; Malheiros, 2008).

This region is located in the Paranaguá Estuarine Complex (PEC), considered a World Heritage Site (UNESCO, 1999) and part of the Biosphere Reserve. The entire area is composed of a mosaic of

Table 1
Examples of projects/studies with research practices/codes of conduct that involved stakeholders, managers, researchers and government related to management and conservation.

Local	Research practices/codes of conduct main	Reference
Australia (Nitmilik National Park)	Scientific research projects have been previously evaluated by managers and local actors to preserve the cultural and economic interests of the community and thus to ensure stakeholder participation.	Barraclough and Ghimire, 1990
New Zealand	Scientific research are realized in accordance with traditional knowledge access regulations. Public policies and management plans should include the full participation of stakeholders.	Mauro and Hardison, 2000
Phillipines	Fishermen's organizations were created and these institutions participated of decision-making processes.	Alerosa et al., 2003
South Africa (north coast of KwaZulu-Natal)	Decision-making about the resources and determination of sustainable harvesting occur together to the stakeholders.	Harris et al., 2003
Canada	Elaboration of management plan to achieve sustainable through engaging of stakeholders	DFO, 2005
Phillipines (Mabini)	To performer a management plan that involves artisanal fishermen and enterprises tourism.	Oracion et al., 2005
Malawi, Zambia, Laos, Mozambique, South Africa, Viet Nam	Traditional knowledge of fishers are used in developing to the knowledge base for fisheries management.	Wilson et al., 2006
Europe	The establishment of the regional advisory councils	Jennings and Rice, 2011
Spain and México	Application of step-zero process when stakeholders have opportunity to assert their position, or cooperate with others groups.	Chuenpagdee et al., 2013

protected areas, which is considered one of the largest remaining rainforests and is home to several traditional communities and endangered endemic species ([Mafra, 2012](#)). The communities of the VIP and VIS are located in the area surrounding Superagui National Park, created in 1989 by Federal Decree No. 97,699, where environmental legislation has imposed upon populations restrictions in the use of natural resources ([Pedroso Júnior, 2002](#); [Pereira, 2011](#); [SNUC, 2000](#)). In this region, strategic constraints have been imposed on fishing resources, the main extraction activity carried

out by local members of the islands, which directly affects the traditional ways of life.

2.2. Data selection and analysis

Information related to the perception of fishermen regarding the groups involved in research and their work carried out in the PEC was collected between the months of March to September 2012 from 40 ethnographic interviews of VIP fishermen and 50 of

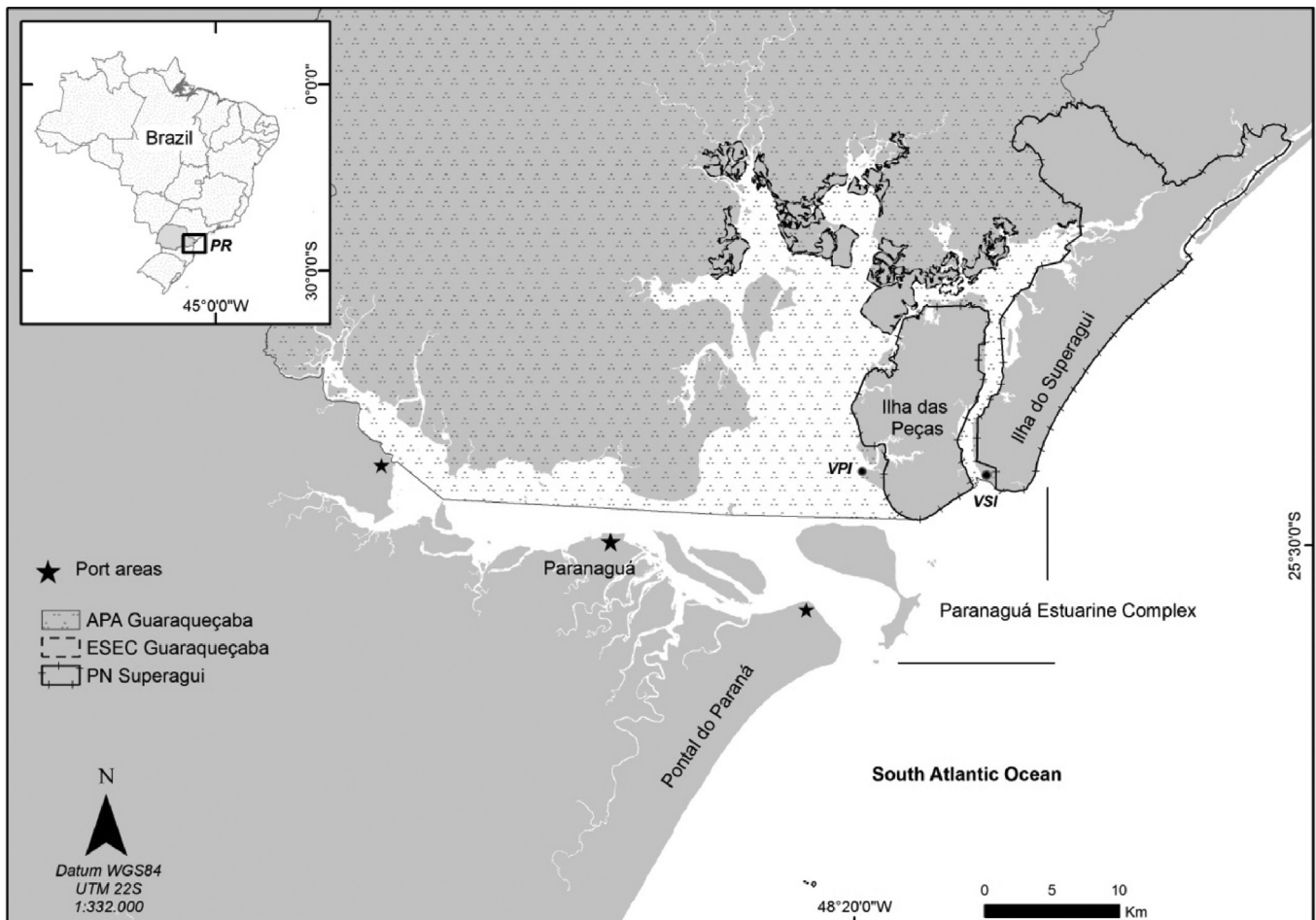


Fig. 1. Location of the study areas in Paranaguá Estuarine Complex, southern Brazil.

VIS fishermen. The number of interviews in each community is justified by the fact that two fishermen can work on the same boat and after the tenth interview, the same pattern of responses is identified (Zappes et al., 2013). The difference in the number of interviews conducted in each community did not interfere with the results because all fishermen perform artisanal fishing activities in the PEC. According to Morse (1994) and Bernard (2000), the optimal sample size in studies related to traditional knowledge varies from 30 to 60 interviews, indicating that a proper sample size was used in this study.

In order to comply with the Brazilian legislation about ethical procedures, the objectives of the study and assurances that information would not be exploited in producing marketable products were explained to each interviewee, and to the president of Fishermen Community Z-2. The anuence (Prior Consent) to this study, which accessed the knowledge traditional, was provided by this president, since he is the legal representative of this professional category in the communities studied (Azevedo, 2005). So, the interview was initiated after the acceptance of each fisherman.

In the VIP, the researchers were accompanied by R. Siqueira (local resident and fisherman's son), who served as a local guide during the field stage to identify some fishermen for the interviews. When the local guide was not present, the snowball method was used, which involves the indications of possible respondents by the fishermen who have already been interviewed (Bailey, 1982). This technique uses reference chains for the recruitment of respondents, making use of the relationships between people (Patton, 1990). These indications of new members allow for the appearance of different insertion points (Goodman, 1961). When this method discontinued, the interviews were conducted randomly by opportunistic meetings with fishermen. No possibility of assistance from the local guide was available in the VIS. In this case, the establishment of trust between the researchers and the community through participant observation was necessary when the interviews were initiated. This method consists of the inclusion of the researcher into the group to be studied to act as an outside observer of the participants (Malinowski, 1978; Martins, 2004). In this sense, the selection of potential respondents in the two communities occurred in three stages: (1) aid of a local guide; (2) snowball technique (3) at random.

The following criteria were established for the selection of respondents: 1) the respondent should be an employed fisherman; 2) fishing should be their main source of income; and 3) they should practice artisanal fishing in the PEC. To avoid interference in the responses, the interviews were conducted individually according to the availability of each interviewee. All interviews occurred through dialogue using a dynamic question-and-answer approach

to establish trust between the interviewee and interviewer and to ensure the collection of robust data. The reports were not recorded because interviewees did not feel comfortable in the presence of a recorder.

A semi-structured questionnaire was used as part of the interview (Schensul et al., 1999). The interviews followed a pre-established scheme that was flexible enough to allow additional reports of fishermen to be included (Quivy and Campenhoudt, 1992). The questionnaire was divided into the following categories: (1) Fisherman characteristics; (2) Perception of scientific research and the involved groups (Table 2).

The information was organized by subject according to the questionnaire applied (Bernard, 2000). To compare the information contained in the reports, the technique of repeated information in synchrony was used, in which the same questionnaire was administered to all respondents (Opdenakker, 2006). For the initial analysis of the reports, the Triangulation method was applied, which consists of joining the information collected through participant observation, field diary and interview-questionnaire, and to identify similarities and discrepancies in the data (Yeasmin and Rahman, 2012). There was the integration of quantitative and qualitative data, giving support to the questions raised by this study (according to Blaikie, 1991; Regan and Colyvan, 2000). The reports were quantified and their percentage frequencies were described.

To analyse the perception of artisanal fishermen about the relationship with researchers/scientific research was conducted an analysis of the identification of strengths, weaknesses, opportunities and threats denominated by SWOT. This analysis can help to improve decision-making and to indicate directions for strategic planning (Helms and Nixon, 2010). Using the SWOT is possible to evaluate the system's strengths and weaknesses by perception of artisanal fishermen which may present opportunities and threats (Panigrahi and Mohanty, 2012). SWOT analysis is useful in early stages of long-term strategic planning (Helms and Nixon, 2010). Yet, due to the small number of fishermen in the communities studied, it was possible to obtain the opinion of these local actors for the application of the SWOT analysis. Therefore, it is suitable for this study.

Reports of artisanal fishermen about scientific research and the groups involved were summarized in four quadrants according the categories: Internal environment (1) Strengths, (2) Weaknesses; and External environment (3) Opportunities and (4) Threats (Fig. 2). The internal environment are the deficiencies and qualities of the researchers, so, they themselves can control and change these points. The external environment is the relationship between the researchers/scientific research and the communities whose points can affect positively or negatively and therefore are not

Table 2

Topics covered in the semi-structured questionnaire applied to artisanal fishermen from the village of Ilha das Peças and the village of Ilha de Superagui in the Paranaguá Estuarine Complex, southern Brazil.

Topics	Questions
1. Profile of fisherman	Gender Age Education Period in which works with fishing in the region Fishing autonomy
2. Perception of scientific research and the groups involved	Do researchers presents himself for the community? Do researchers explain the objectives of the research? Do researchers describe the participants involved in the research? Is there is dialogue between researchers and communities members? What is your opinion of the scientific research conducted in the region? Why do you have this opinion? What is your opinion about the groups involved in scientific research? Is scientific research important?

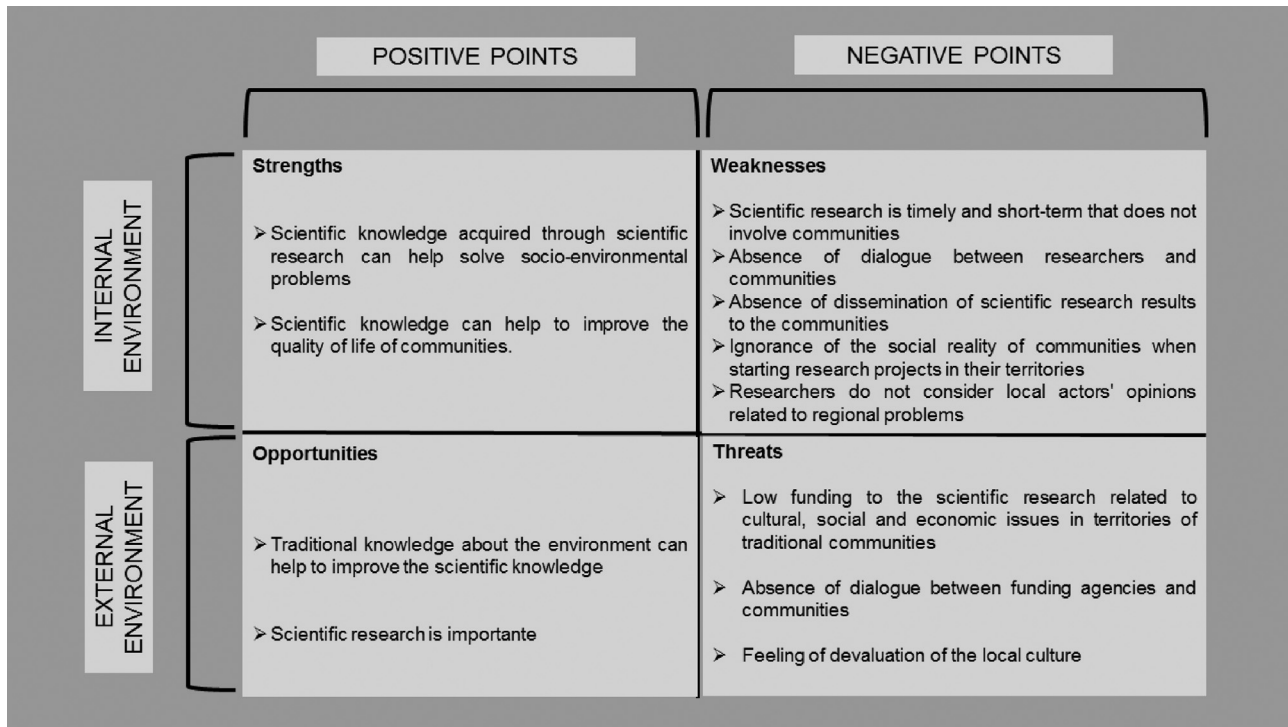


Fig. 2. Schematic of SWOT analysis: analysis the perception of artisanal fishermen about the relationship with researchers/research project.

controllable. The clustering of reports into categories helps to elaborate inferences from the data collected (Helms and Nixon, 2010).

3. Results

3.1. Profile of fishermen

In the village of Ilha das Peças (VIP), artisanal fishing is practiced mostly by men aged between 21 and 72 years. The low level of education already shows that half ($n = 20$) did not complete elementary school (<8 years of schooling); nearly a half ($n = 12$) did not complete high school (<11 years of study); few fishermen ($n = 3$) completed elementary school; finished high school ($n = 2$); did not study ($n = 2$) and did not answer ($n = 1$). The fishing practice time varies between 14 and 64 years, and the time of autonomy in the sea varies between the “middle period of the day” (exit and return to the sea on the same day with an approximate duration of 8–12 h) up to seven days.

In the village of Ilha do Superagui (VIS), artisanal fishing is practiced mostly by men whose ages range from 15 to 77 years. Regarding education, more than half ($n = 30$) completed elementary school (<8 years of schooling); few fishermen ($n = 7$) completed high school (<11 years of study); did not study ($n = 7$); did not answer ($n = 4$) and attended a technical course in aquaculture (offered by the Federal Institute of Paraná) offered in the village ($n = 2$). The fishing practice time varies between four (4) and 65 years, and the operating time at sea varies from the middle period of the day (from 8 to 12 h) and one and a half days (approximately 36 h).

3.2. Perception about scientific research and the groups involved

All respondents in the VIP ($n = 40$) and more than half ($n = 34$) in the VIS reported that their perception is that most research

groups do not relate the scientific research carried out in the region to the communities, do not explain the objectives of the research performed in the area, do not mention which institutions are involved in this work and do not promote dialogue with communities members. All respondents in the VIP ($n = 40$) and more than half ($n = 34$) in the VIS expressed dissatisfaction with the conduct of scientific research and the presence of researchers not only in the villages but also in the area of Ilha das Peças and Ilha do Superagui. The causes cited as justification for this sentiment are shown in Table 3. Each respondent described more than one cause, which explains the total sample size being greater than the number of respondents.

The feeling of discontent was also described by all respondents in the VIP and more than half ($n = 34$) in the VIS in relation to the funding agencies of scientific research, which are cited as not welcome in both communities. According to the respondents, such discontent occurs because there is a heavy financial investment in studying and evaluating parameters related to the conservation of fauna and flora, but there is not the same incentive for research related to cultural, social and economic issues. Through the SWOT analysis the items weaknesses and threats were the most perceived by the interviewees. The degree of influence of these items directly interferes with the relationship between researchers/scientific research and local actors (Fig. 2).

When asked about the importance of scientific research, none of the interviewed residents of the VIP could answer this question. Despite the dissatisfaction of the VIS community, nearly a half ($n = 12$) consider scientific research in the region to be important and expressed concern about the reduced knowledge exchange that occurs between researchers and the local stakeholders when it is performed. In both communities, the respondents [all fishermen of VIP and more than half of the fishermen of VIS ($n = 34$)] reported a feeling of devaluation of the local culture by the groups involved in scientific research, as they have not been asked about this question. These respondents reported that they do not feel

Table 3

Causes of the feeling of discontent described by the respondents of the village of Ilha das Peças and the village of Ilha do Superagui, Paranaguá Estuarine Complex, southern Brazil.

Causes	Number of VIP respondents	Number of VIS respondents
Non-governmental organizations, scientific research institutions and funders/sponsors are not concerned with the human reality.	20	–
There is no presentation and explanation to the community about the scientific research being carried out.	40	–
Scientific research is aimed only toward the local fauna and flora without there being a concern for the community.	40	34
Results generated by scientific research and/or possible solutions to the social and environmental problems encountered are not presented to the community.	40	34
The projects are often short and are abandoned soon after, harming the residents involved.	–	34

included in the research and consider this to signify disrespect toward the communities because they consider the study area to be part of their land.

4. Discussion

Through the SWOT analysis, the weaknesses and threats were the most cited by fishermen which shows that these items have a greater weight in the relationship between researchers/scientific research and local actors. So, these items negatively interfere in relationship between researchers and local actors. Weaknesses are deficiencies (Panigrahi and Mohanty, 2012) of researchers/scientific research identified by fishermen. If, these faults were not corrected may interfere in the actions of the research projects in the communities. These deficiencies are internal failures of the academic environment, in this way the researchers should seek from community leaders what action should be taken as the starting point for a better relationship between these groups.

Threats are external factors (Glass et al., 2015) to the researchers, but may interfere in scientific research and relationships with communities. To prevent the spread of threats suggests increasing funding for research related to cultural, social and economic issues and consequently to promote dialogue between researchers and local actors. Research projects realized in Australia, Canada, Mexico, New Zealand, Philippines, South Africa and Spain describes partnerships between traditional communities and researchers. These stakeholders act together to the research groups and this indicate the development of dialogue and consequently good practices of management of resources (Alerosa et al., 2003; Barraclough and Ghimire, 1990; Chuenpagdee et al., 2013; DFO, 2005; Harris et al., 2003; Mauro and Hardison, 2000; Wilson et al., 2006).

In this way, strategic planning for coastal co-management indicates a sure path to good relationships between researchers and communities as well as anticipates the threats of this relationship and to allow to enjoy the opportunities as they become available. So, it is possible to optimize forces and to enjoy the opportunities and thereby reduce weaknesses and threats. Through the SWOT analysis it was possible to define strategies for coastal co-management to seek improvement of the quality of life of local actors and marine environmental conservation. The steps this planning should be reviewed in periodic meetings with communities where it is important to follow up on local leaders so that activities can be successfully carried out. In the initial phase of this planning initiatives will be suggested whose capacity of realization may not be feasible, so it is important to define the priority activities (David, 1998).

The lack of or even the types of interactions between traditional communities and researchers in their territories can result in discontent among the local residents and hinder their integration as key members concerning the issues affecting the environment in which they reside (Chuenpagdee et al., 2013; Kasseboehmer and

Silva, 2009). The scarce knowledge of the VIP and VIS fishermen in relation to the scientific research carried out within their communities or in their territories indicates a possible scenario of conflict. This situation is a result of the absence of dialogue between the groups of researchers working in the PEC and the communities members or may even indicate the lack of the maintenance of the relationships between research and the community and the clarification of the objectives and products generated by research. The participation of the community should not be construed as mandatory at all stages of research, but community members can contribute their traditional knowledge to the development of conservation actions and in the practical application of obtained results (Guivant, 1997; Mauro and Hardison, 2000). A challenge in this communication and in the maintenance of relationships is related with the differences in the language used by the communities and research groups. In this sense, scientific language is not accessible and/or understandable to the entire local community and is restricted to a minority, excluding part of the group (Milanez, 2015).

The level of education can influence not only the way members influence the family income but also social development and how they interact with outsiders, for example, researchers involved in scientific research (Oliveira et al., 2016). The level of education presented by respondents may be a consequence of the fact that in traditional communities, young members participate in the work activity practiced by the family and seek to supplement their income (Oliveira et al., 2016). This inclusion in the labor market occupies most of their time and results in the early abandonment of studies (Oliveira et al., 2016). Even if researchers can speak the language of the communities, their low level of education can hinder dialogue and the understanding of concepts and the purposes of scientific research (Borges and Pinheiro, 2002).

Still, there is a preconception of some researchers that the information obtained from local actors with low education is not reliable, and they are thus not included in data collection and discussions (Borges and Pinheiro, 2002). For these researchers to partner with these communities can induce misleading conclusions from the results of research (Borges and Pinheiro, 2002). However, it is important to emphasize that a member observes and experiences the surrounding environment and thus becomes an evaluator of environmental issues, as knowledge of ecosystem dynamics and structures is required to ensure their livelihood. All this accumulated empirical knowledge is complex and rich in detail and is essential in complementing the scenarios established by scientific research (Begossi, 2001; Diegues, 2000; Mauro and Hardison, 2000).

In this study, the respondents indicated that the objectives of the scientific researches conducted in the PEC were not presented to the communities. This situation has resulted in the development of a sense of dissatisfaction between local actors because they feel excluded of the facts, of the participation in scenario building and resource management involving their territory. The perception of

the local fishermen cannot reflect the effective action of researchers in the region, but it shows that even if there are communication and attempts toward local involvement, the research group has no credibility within communities, and the acceptance of their actions is part of an integration process. A objective presentation of informations through tools and alternative strategies become important and facilitates how the researchers address the local reality. This enables the development of a mutual trust between them and the community and thus allowing the exchange of information and the joint construction of diagnostics as well as the proposal of effective solutions for conflicts and social and environmental problems in coastal areas (Chuenpagdee et al., 2013).

When the involved community members perceive themselves as being excluded, they often would rather not display their opinions regarding decisions because they feel coerced by those who have the power to understand them, in this case, the researchers (Alerozo et al., 2003; Suassuna, 2005). As a solution to promote dialogue between research-related groups and traditional communities, detailed planning is required from the beginning of the research until its closure. Researchers who wish to work in areas where traditional communities live should continue to address not only data collection in the early stages of the research but also the community so that local stakeholders can understand and participate directly or indirectly in research (Chuenpagdee et al., 2013).

Another factor to be considered in the interaction between researchers and communities members is related to major funding announcements for research or even famous financiers. Historically these financiers directing resources only for the conservation of fauna and flora, disregarding direct incentives to study cultural factors, the development of alternative sources of income, the sustainable exploitation of natural resources, or even the relationship between traditional communities and the environment (Rocha, 2011). This investment directed toward research that is focused exclusively on environmental components is negatively perceived by respondents who even question the intentions of the funding agencies. Fishermen from Praia do Forte, state of Bahia, and Regency, state of Espírito Santo, also believe that the conservation theme should be expanded by development agencies to include the community as well as wildlife, incorporating human components (Suassuna, 2005). In Brazil, there is still a small number of research groups that work in an interdisciplinary way to find solutions to social and environmental problems that occur in the territories of traditional communities (Patzlaff and Peixoto, 2009).

The absence of dialogue between traditional knowledge and scientific knowledge can hinder the linkage of the information generated by these two lines (Guivant, 1997; Harris et al., 2003). Yet, can weakening of the interaction between the community and research may have its origin in different actions or a lack thereof. Unfulfilled promises made by researchers considered to be outsiders, i.e., people outside the community at the beginning of the relationship with communities members, can be one of the causes (Chuenpagdee et al., 2013). Mistrust in relation to outsiders is a barrier that hinders cooperation between the traditional community and the scientific community as well as in making decisions involving coastal management and natural resource management (Chuenpagdee et al., 2013).

Such local decisions can occur not only in relation to conservation but mostly in the way the community receives and participates in the scientific research conducted in their territories. Understanding related to scientific research and the interests of those involved in participating in these studies appears to be different for each community member because not everyone understands how conservation processes determined by outsiders are instituted at the same time and in the same way (Jentoft et al., 2011). Obviously, the traditional community does not understand

the function of research aimed at preserving the process for its implementation, and a project's success can be decelerated or decline; in addition, any product or proposal arising from this research will rarely be accepted and incorporated by communities, even those that are normalized to some point.

The fact that the VIS and VIP communities do not feel part of the scientific research conducted in their territories indicates the need to work toward the inclusion of communities using other methodologies and by establishing other forums for discussion. This interaction can help in the understanding of communities members in relation to the research results generated and the role of research institutions, financiers and even managers in the full process that involves scientific research. Therefore, it is important to conduct targeted studies to address strategies for the integration of communities and research involving community participation. This action can approach these communities members and research groups working in the region as well as to clarify how the information generated can affect the lives of residents, their interpretation of the ecosystem in which they live or even be used to assist in the planning of the use of space and resources to benefit social and economic issues.

Researchers cannot always report the results of research to communities because in some situations, the project is not successful due to a lack of financial support or because the researchers are disinterested in presenting the information found (Chuenpagdee et al., 2013). In New Zealand, the lack of feedback from research results to local actors restricted researchers' access to areas where communities lived. This made it difficult to obtain information for future research (Mauro and Hardison, 2000). Therefore, it is important that the researchers participants address the return to communities and seek resources from funding sources for the social closure of projects even during project planning. Another issue is related to the projects for which the results are achieved over the long term and therefore develop within the communities members a sense of doubt about their success (Chuenpagdee et al., 2013). Especially in these situations, the community must be informed of the minimum and maximum execution time of the research to find a workable result, and even the presentation of the results in steps can be a solution to maintain the relationship with the active community.

The method known as the zero-step method is applied to initiate the processes involved in the establishment of conservation areas and management plans with traditional communities (Chuenpagdee and Jentoft, 2007). This method consists of the observation and identification of environmental problems, which are then discussed among the local stakeholders, governmental and non-governmental organizations, and educational and research institutions seeking solution tools. This methodology is effective in the initial interactions between outsiders and the community and thus becomes an important diagnostic step that can be applied to establish dialogue between researchers and communities members.

Through applying the zero-step method, all involved participants (communities members and researchers) are presented and are thus recognized; in addition, explanations and task negotiations are initiated, local environmental problems are surveyed and described by members to researchers and more importantly, this method results in the implementation of cooperative action among all. This is the time of discourse with the community, allowing their interaction with the outsiders. As this step develops slowly, it is based on building trust between researchers and the community (Chuenpagdee et al., 2013). Still, with the application of the zero-step method, it is possible for researchers to identify which communities members are experts in the specific and insightful aspects of traditional knowledge that are directly related to their scientific

questions (Davis and Wagner, 2003). This identification will allow the exchange of information among the focal stakeholders, deepening the local conservation issues and thus reducing the chances of conflicts between the groups related to scientific research and the traditional communities of the PEC.

In the case of the PEC communities analyzed, because they are small and consider environmental laws to be restrictions on their traditional way of life, the presence of researchers is accompanied by all community members, generating curiosity and even suspicion about the activities in their territory. In general, being in the vicinity of protected areas, the management of the territory has a direct influence on the environmental agencies, and the inclusion of communities is affected via participatory councils. However, the absence of a social support structure in the state and the low human development index has added demands that are not under the obligation or domain of researchers and local managers, a fact that results in conflict within the local management.

People who have their territory turned into environmental protection areas may experience gains and losses related to the use of resources, which will depend on the objectives of the conservation plan for the area and how these communities members will be included in the process (Jentoft et al., 2011). In these regions, the technical management should be working together toward legal pluralism, i.e., involving the socio-economic, cultural and political aspects of the surrounding communities (Bavinck, 2005). These social issues usually involve fishing and tourism in marine protected areas (Chuenpagdee et al., 2013). In the PEC region, these are the main income activities of the traditional communities living in the protected area of Superagui National Park.

Because these communities are included in the ecosystem in which they live, their social, economic and cultural demands must be integrated with conservation models, as their way of life may be a strong ally in terms of conservation processes and protected species (Barraclough and Ghimire, 1990; Pedroso Júnior, 2002). Despite traditional knowledge being treated as unique to each community, it changes due to technical changes and new ideas arising among the communities members (Guivant, 1997; Davis and Wagner, 2003). In this sense, the dialogue must be consistent between researchers and traditional communities, identifying sympatric actions, discussing the differences in demands and interests, and preventing conflicts from entering the space for discussion and drafting agreements.

5. Conclusions

The SWOT analysis provides relevant information to let the elaboration of strategies to identify the strengths, weaknesses, threats and opportunities present in the relationship between researchers/scientific research and traditional communities in southern Brazil. Identifying the items can help to promote good relationships between researchers and communities. Items of strengths can increase opportunities or protect against threats. Identifying weaknesses has made it possible to devise strategies so that opportunities are not wasted. Such actions can be used in other communities where local actors coexist with groups of researchers.

Traditional communities realize the devaluation of their knowledge compared to scientific knowledge, as researchers working in their territory do not consider local knowledge as an asset when finding solutions to environmental issues. Research project schedules should incorporate a period during which the researchers can present the research objectives to the community. Even if the projects do not involve cultural issues, they should still be concerned with relaying the results already found in studied areas that are part of the territory of traditional communities. The lack of dialogue between those involved develops a sense of

exclusion and can contribute to building conflicts between communities members and research groups. The low level of education should not be a factor that rules out the participation of communities members in scientific research but rather an indication that there is a necessity to provide equal education and the dissemination of knowledge. Still, it shows the importance of the interaction between traditional and scientific knowledge in the search for solutions to environmental and social issues. In this way, decisions would have the support of communities members who experience the problems and would comply with the needs of those involved.

5.1. Proposed actions for the gradual integration of traditional knowledge and scientific knowledge in the search for solutions to social and coastal environmental problems in priority areas for conservation and use by traditional communities, such as Paranaguá Estuarine Complex, southern Brazil (based in Swot analysis)

The development of strategies for the merging of traditional and scientific knowledge in the pursuit of solutions to social and environmental problems requires the long-term participation of researchers working in social, cultural and coastal environmental areas located next to coast. Understanding the behavior of traditional communities that inhabits the coast is still necessary for such actions. Below are indicated the actions for strategic planning to take advantage of strengths points and opportunities and to prevent the development of the weaknesses and threats identified in the SWOT analysis:

5.1.1. Actions to increase 'strengths'

- 1) Carrying out activities to attract researchers' interest in social problems that involves traditional communities that inhabits coastal environment. Responsible for the activity: researchers and members of non-governmental organization;
- 2) Realization of research projects in coastal environment in which there is intense local participation. Responsible for the activity: researchers and members of non-governmental organization;
- 3) Use of equipment and machinery developed in the academic environment that can improve the quality of life of communities. Responsible for the activity: researchers and government.

5.1.2. Actions to decrease 'weaknesses'

- 1) To incentive and dissemination of long-term research projects in coastal environment with the participation of local actors. Responsible for the activity: funding agencies, researchers, government and members of non-governmental organization;
- 2) To allow researchers more time on community fieldwork to recognize local problems. Responsible for the activity: funding agencies and research institutions;
- 3) To encourage extension project programs that allow for effective community participation, as project that involves artisanal fishery. Responsible for the activity: funding agencies, researchers, government and members of non-governmental organization;
- 4) To encourage research groups with financing to interdisciplinary research projects. Responsible for the activity: funding agencies, researchers, government and members of non-governmental organization;
- 5) Dissemination of research results within the communities themselves using local language and vocabulary. Organize meetings to clarify doubts about the scientific research, benefits for the region and possible problems and solutions found

- allowing the community to express their opinions. Responsible for the activity: funding agencies, researchers, and members of non-governmental organization;
- 6) To ensure the acquisition of robust data as they are support for coastal management, strategic decision and error reduction. Responsible for the activity: funding agencies, research, members of non-governmental organization and government;
 - 7) Identify the perception of local actors about scientific research realized in the coast, and from this result, develop a common language for communities members and researchers. Responsible for the activity: researchers and members of non-governmental organization;
 - 8) Understand the social and political issues in the region through the application of the zero-step method. Responsible for the activity: researchers and members of non-governmental organization;
 - 9) Create a dialogue network so that the perceptions of residents are disseminated among traditional communities and the academic community through the exchange of experiences between the individuals of different subgroups. Responsible for the activity: researchers, local actors, members of non-governmental organization and public managers.

5.1.3. Actions to enjoy 'opportunities'

- 1) Implementation of brazilian legislation requiring companies to comply with environmental compensation. Responsible for the activity: Inspection institutes and government;
- 2) Application of brazilian environmental legislation that considers the culture of traditional communities. Responsible for the activity: Inspection institutes and government;
- 3) Encourage partnerships to use traditional and scientific knowledge in the search for local solutions to the problems in coastal environment. Responsible for the activity: research institutions, funding agencies and non-governmental organization;
- 4) To realize activities to attract the interest of the community for the coastal conservation of their own environment using traditional management and scientific techniques. Responsible for the activity: researchers, local actors, funding agencies and members of non-governmental organization.

5.1.4. Actions to decrease 'threats'

- 1) To incentive to fund for research projects related to society and culture. Responsible for the activity: funding agencies, government, research institutes;
- 2) Promoting dialogue between researchers and communities. Responsible for the activity: funding agencies, researchers and members of non-governmental organization;
- 3) Establish performance priorities for the good relationship between researchers and communities to act in marine conservation and coastal co-management. Responsible for the activity: funding agencies, researchers and members of non-governmental organization;
- 4) Determine which communities members would like to participate of scientific research and which groups they represent within the community. This action can be realized by the method of participant observation with the communities and contribute to increase the reliability in the data collection when there is the participation of the local actors. Responsible for the activity: local actors, local leaders, researchers and members of non-governmental organization;

- 5) Identify the individual skills of the community members indicating each local actor to specific functions within the research so that they can offer their experience and in this way to valorize their knowledge and life experiences. Responsible for the activity: local actors, local leaders, researchers and members of non-governmental organization;
- 6) Understand the standards and values of the local culture that contribute to the achievement of the common good (social capital). To promote social programs that seek to preserve the customs, cultures and way of life of each community. Responsible for the activity: local actors, local leaders, researchers and members of non-governmental organization;
- 7) Allow the community itself to indicate the main socio-environmental problems suffered by it, organize priorities and propose ideas for research projects that seek solutions to problems with the communities members. Responsible for the activity: local actors, local leaders, researchers and members of non-governmental organization.

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