Available online at www.sciencedirect.com
SCIENCE DIRECT®
Marine Policy 28 (2004) 503–522
MARINE POLICY
www.elsevier.com/locate/marpol

On crafting a fisheries co-management arrangement in the estuary of Patos Lagoon (Brazil): opportunities and challenges faced through implementation

Daniela C. Kalikoski[a,*], Theresa (Terre) Satterfield[b]

[a] GEOLAB, Department of Geosciences, Federal University of Rio Grande (FURG), Caixa Postal 474, Rio Grande RS 96201-900, Brazil
[b] Institute for Resources, the Environment, and Sustainability, University of British Columbia, 2206 East Mall, Room 472, Vancouver, BC, Canada V6T 1Z3

Received 3 December 2003; accepted 23 December 2003

Abstract

This paper aims to analyze a fisheries co-management regime in Brazil. The Forum of the Patos Lagoon, a collaborative partnership among communities, governmental and non-governmental organizations, was established to move fisheries management toward a negotiation-style decision processes. We find that while many successes are evident including the delegation of decision power, greater protection of artisanal fisheries, and greater legitimacy assigned the Forum as a decision-making body, several problems remain. These include conflicting institutional arrangements; minimal recognition of local fishers' interests as concerns rules established; and less than optimal participation of fishers in the Forum. The paper closes with multiple suggestions for improvements of this co-management regime.
© 2004 Elsevier Ltd. All rights reserved.

Keywords: Fisheries co-management; Deliberative processes; Participatory democracy; Estuary of Patos Lagoon; Brazil

1. Introduction

Pomeroy and Berkes [1, p. 466] define fisheries co-management "as the sharing of responsibility and authority between the government and the community of local fishers to manage a fishery". According to these authors "there is a hierarchy of co-management arrangements from those in which the fishers are merely consulted by the government before regulations are introduced, to those in which fishers design, implement and enforce laws and regulations with advice and assistance from the government" [1, p. 466]. Although the spectrum of co-management arrangements vary, the essence of co-management as defined by Pinkerton [2, pp. 3–33] "is the involvement of fisher's organizations and fishing communities in management decision-making through power sharing: sharing both between government and locally based institutions, and among differently situated fishers". To varying degrees, this involves decentralizing decisions, delegating rights and roles to the community and moving toward implementing a joint decision-making process. It has been observed that in many cases natural resource problems cannot be solved through an agreement between single communities and single government agencies; rather, it is the nature of the problem that dictates the necessary parties and levels of governance to be involved. This is identified in Pinkerton [3] as a central feature of the current generation of co-management arrangements—named as the second generation of co-management, where new studies in the field of co-management are looking at more complex arrangements involving multiple parties. Pinkerton [2,3] discusses the potentially broad scope and different levels of operation of fisheries co-management and its potential as (a) a model for a power-sharing arrangement and (b) a tool to deal with resource management problems. Although much attention has focused on the co-management institutional arrangement as a process of effective commons management, studies have indicated that "co-management is a difficult process, and problems

*Corresponding author. Tel.: +55-53-99758991; fax: +55-53-233-6622.
E-mail addresses: danielak@furg.br (D.C. Kalikoski), satterfd@interchange.ubc.ca (T.(T). Satterfield).

0308-597X/$ - see front matter © 2004 Elsevier Ltd. All rights reserved.
doi:10.1016/j.marpol.2003.12.001

associated with its implementation are yet to be overcome'' [2, pp. 273–289].

This paper focuses on the challenges of implementing a fisheries co-management arrangement in southern Brazil. We analyze the case of the estuary of Patos Lagoon, where over-exploitation of most estuarine related fisheries was followed in the late 1990s, by a redesign of local institutions to create a new co-management regime. As a new governance arrangement, the Forum is expected to foster use patterns compatible with the characteristics of the resources and the survival of small-scale artisanal fisheries communities in the estuary. This new regime, known as the Forum of Patos Lagoon (hereafter the Forum), is comprised of multiple stakeholders whose activities are [now] central to resource governance. Three objectives have been identified by the Forum as paramount: (1) to mitigate and/or resolve the problems of the fishers and the crisis in the artisanal fisheries sector, (2) to recover the importance of artisanal fisheries, and (3) to decentralize decision-making so as to address management problems more fully. Following a delineation of site history and characteristics, we examine the initial decision to establish a fisheries co-management regime. We then assess the processes that are influencing the Forum's approach toward participatory management. Thereafter, we turn to a discussion of the lessons learned from the Forum case, focusing on the key characteristics of co-management in reference to their contribution (or not) to forwarding a more sustainable fishery.

2. Methods

Field work in the estuary of Patos Lagoon (in the city of Rio Grande, Brazil) was carried out from November 1999 to February 2002 (the site is described fully in Section 3.1). Data were obtained from primary and secondary sources. Primary sources of data included (1) in-depth semi-structured interviewing, (2) field observations at Forum meetings, and (3) a quantitative survey of four fishing communities. Supplemental data included reviews of scientific reports, local newspapers, meeting minutes, as well as laws, decrees and policy statements from the Federal Institute for the Environment (IBAMA) and from the former Federal Sub-Secretary for Fisheries Development (SUDEPE).

2.1. Interviews

Interviews were done face-to-face. A total of 48 interviews were conducted ranging in length from 45 min to 3 h. The interviewees included knowledgeable fishers, fisher Colony presidents, industrial fishers entrepreneurs, officials from the Port of Rio Grande and IBAMA/CEPERG, IBAMA/Brasília, researchers from the University of Rio Grande, and other Forum representatives. Interviewees included people without any formal education (some of whom where illiterate) through to those with advanced academic degrees and/or significant political influence at the local and federal levels of government. Virtually all interviews were recorded and transcribed; in one case where use of the recorder was denied extensive notes were taken. Interviews addressed but were not limited to: questions concerning decision-making for joint use of the fisheries; the structure and function of the Forum co-management system; and questions about the quality of stakeholder participation and representation. Interviews also addressed perceptions of relationships of power across stakeholders, legal recognition and legitimacy for key parties and institutions, as well the organization of rule making and rule enforcement.

2.2. Field observations

Interview data were complemented by (and used to cross-validate) field observation conducted throughout the research period [4,5]. The aim of much of this observational work was to track efforts to implement the Forum's objectives during and in between meetings and to document the socio-political dynamics evident at meetings. More importantly, this provided an excellent opportunity to study the negotiation processes intrinsic to the Forum as well as the processes through which specific decisions about the governance of the small-scale fisheries were made.

2.3. Community surveys

The observational and interview data were complemented by a survey of local fishers ($n = 623$). Important issues raised during the interviews and Forum meetings were turned into closed-ended question sets appropriate for members of fishing communities adjacent to the estuary. The survey aimed to (a) understand whether or not fishers' interests were well represented by the Forum, (b) whether the fishers supported the Forum, and (c) whether rule compliance and enforcement were supported (i.e. fishers' compliance with the new rules established in the Forum). A further question set was used to capture local knowledge about fisheries management and practice. Particular attention was paid to knowledge of fishing seasons, processes by which official institutions mediate the use of the resources, and/or knowledge of and support for those regulations created by the Forum.

Small-scale fishers reside in small communities along the estuary of the Patos Lagoon, which are spatially organized into four Fishers Colonies (Colônia de

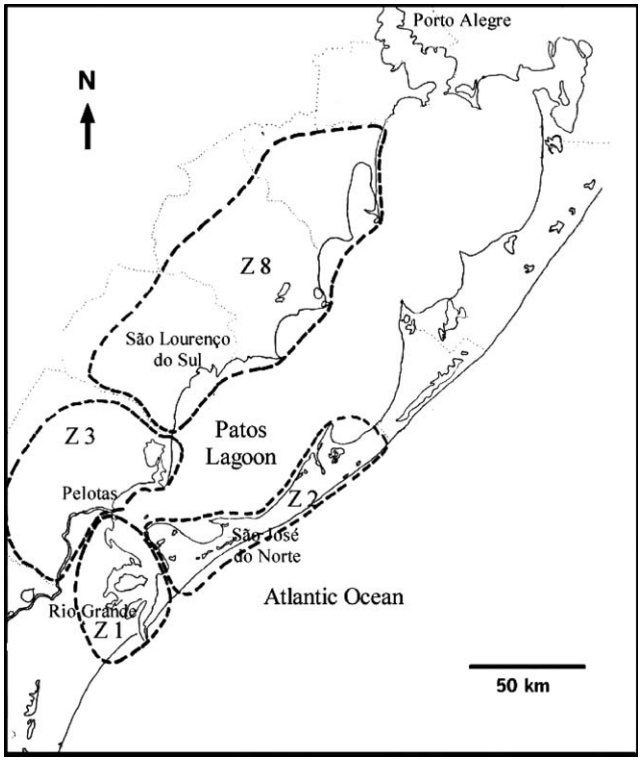

Fig. 1. Map of study area and location of Fishers Colonies (source [6], 1989).

Pescadores). In total, 623 fishers from the municipalities of Rio Grande (Colony Z1; $n = 197$), São José do Norte (Colony Z2; $n = 210$), Pelotas (Colony Z3; $n = 124$) and São Lourenço do Sul (Colony Z8; $n = 92$) were surveyed. The Fisher Colony is a professional organization of fishers of a given municipality which is legitimized by the Federal Constitution as one form of a working union. There are approximately 3500 artisanal fishers in the regions surveyed. Due to the lack of an adequate sampling frame (there is no updated registry for the whole group of fishers in the estuary) the sample population was selected through the snowball technique [5]. This method permits the development of a more directed study when one wants to analyze a special population and yet still obtain a representative sample. In this case, the main small-scale fishing villages along the estuary of Patos Lagoon were first identified based on information obtained from (1) members of the Fishers Colonies, (2) officials from CEPERG/IBAMA where fishers obtain their license permit, (3) the captain of the ports where fishers have to register their boats, (4) the pastoral of fishers that work directly in the field, (5) university researchers, (6) participants in Forum meetings, and (7) individual fishers. Survey data were collected by face-to-face interviews conducted by the first author and locally trained students (Fig. 1).

3. Context

3.1. Patos Lagoon

The estuarine region of the Patos Lagoon is located in the Southern Brazilian Coastal Zone (Rio Grande do Sul State). With an area of approximately 10,000 km^2, the Patos Lagoon is recognized as the world's largest choked lagoon, stretching from 30°30′S to 32°12′S near the city of Rio Grande where the lagoon connects to the Atlantic Ocean (Fig. 2).

The estuarine region encompasses approximately 10% of the lagoon, and is occupied by diverse and abundant flora and fauna. The abundant food resources and protection against predation provided by estuarine shoals make this region an ideal nursery ground for several commercially important fish species. The estuary itself is characterized by a shallow body of water (mean depth of 7 m) with variable temperature and salinity depending on local climatic and hydrological conditions [8]. Estuary water dynamics are mainly conditioned by the wind and rain regime; the influence of lunar tides is minimal. In the period from September to April, the dominant winds are from NE, NNE and ENE while in the winter period winds from E, S, SE and SW are more frequent. While the first favor the discharge of freshwater and create a low salinity regime in the estuary, the latter force the penetration of salt waters through the estuarine channel and create conditions for a marine regime in the estuary [7]. The total mean annual precipitation (1200–1500 mm) varies strongly from year to year and is mainly related to the path and passage of cold fronts [9]. Mean monthly rainfall is highest during the winter and spring (June–October), but a second peak

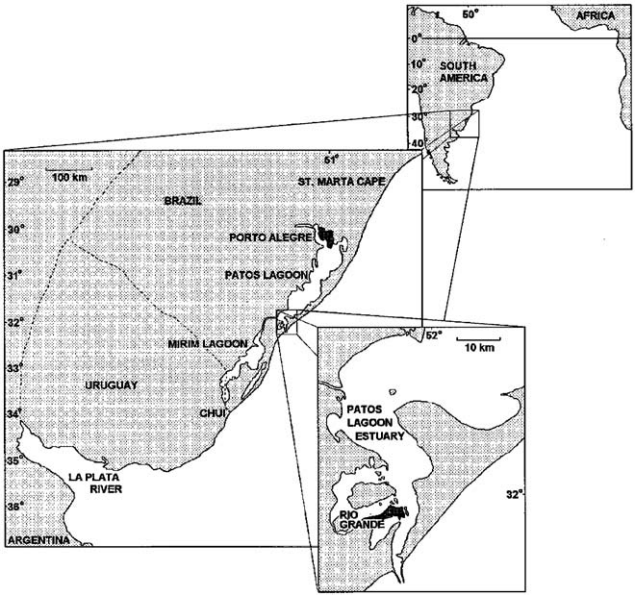

Fig. 2. Location of the Patos Lagoon estuary in southern Brazil (source 7, 1997).

may occur in summer. Interannual variations in precipitation with either a high amount of rainfall or dry periods, seem to be a consequence of the effect on the El-Niño Southern Oscillation cycle on the regional climate [7]. As a general rule, years of strong El-Niño events cause flooding regimes in southern Brazil. These phenomena directly influence the amount of continental freshwater runoff and the biogeochemical processes in the estuary and coastal ecosystem [10].

The Patos Lagoon system connects with the ocean via a channel between a pair of jetties, about 4 km long and 740 m apart at the mouth. All the estuarine dependent marine organisms enter and leave the estuary through this channel for nursery, reproductive and feeding purposes. Based on the seasonal abundance and movement patterns of organisms, Chao et al. [11] identified five distinct bioecological categories in the estuary: estuarine resident species, that complete their entire life cycles in the estuarine environment; estuarine dependent marine species, which utilize the estuary as nursery and feeding ground for young but spawn at sea; the anadromous species that enter the estuary to reproduce; and opportunists and occasional visitors, which include more than 50 marine and freshwater fishes. Of the more than 110 species of fish and shellfish species that appear in the estuary, four represent important fisheries resources, and have sustained artisanal fisheries activities in the estuary for more than a century. They are pink shrimp (*Farfantepenaeus paulensis*), marine catfish (*Netuma barba*), croaker (*Micropogonias furniere*) and mullet (*Mugil platanus*). The life cycle of these species produces seasonal variability, diversity and abundance of resources in the estuary to artisanal fishers.

3.2. Human activities and impacts on fisheries CPRs

Prior to the arrival of the first Europeans, diverse native groups occupied the coastal plain where they exploited abundant fish, shellfish and shrimp resources [12]. From 1750 forward, the coastal region became the center of Portuguese colonization. Settlers along the lagoon's margins exploited the fishery resources for food. The century-old artisanal fishery has provided fish and shellfish products for export to the main Brazilian markets, as well as to Uruguay, the United States and several European countries [13]. Today about 3500 artisanal and 3000 industrial fishers are temporarily or permanently involved in fisheries activities in the estuary and coastal waters off southern Brazil [7]. Artisanal fishers reside in small communities along the estuary and are spatially organized into four Fishers Colonies ("Colônia de Pescadores") (Table 1). These small-scale fisheries are in accordance with classification by FAO [14].

The fishery operates in estuarine and shallow coastal waters and is characterized by minimal fishing technology (Table 2). Fishers normally own their vessels and work together in kin groups. Artisanal fishing gear includes gillnets, stownets and otter trawls. In 1966,

Table 1
Artisanal fisheries communities surveyed in the estuary of the Patos Lagoon

Fisher Colony	Locality	Community	Fishers registered in Colony	Total (registered and non-registered)
Z1	Rio Grande	Bosque,Vila São Miguel, Jocquei Club, 2ª Secção da Barra, Henrique Pancada, Embratel, 4ª Secção da Barra, Ilha dos Marinheiros, Pesqueiro, Torotama, Marambaia	159	197
Z2	São José do Norte	São José do Norte, 5ª Secção da Barra, Praia do Norte, Vila Nova, Cocuruto, Pontal, Passinhos, Varzea, Capivaras, Retiro, Ponta Rasa, Povoação da Barra	189	210
Z3	Pelotas	Colonia Z3—arroio sujo	116	124
Z8	São Lourenço do Sul	Bairro N.S. Navegantes, Bairrinha	85	92
Total			549	623

Table 2
Characteristics of three types of fisheries sharing fish CPRs in southern Brazil (source IBAMA, [16,19,18])

Fishery	Artisanal	Coastal, semi-industrial	Industrial
Area	Estuary, marine inshore	Marine inshore and offshore	Marine inshore and offshore
Boat size (m)	<10	12–15	20–35
Fishers/boat	2–3	6–8	6–10
Power (HP)	10–24	90–120	250–650
Days fishing/trip	1	3–4	10–15
Capacity (tonnes)	<10	12–20	20–120
Main gear types	Gill nets, trawling, stownets	Gill nets, hook and line	Fish and shrimp trawling, gill net, purse seine

artisanal catches accounted for over 80% of the total catches in southern Brazil. Landings declined from a historical peak of 43,600 tonnes in 1972 to ca. 6000 in the late 1990s. Today, the main artisanal resources are either fully exploited, overexploited, or depleted and catches are close to subsistence levels, with the exception of mullet and shrimps which provide sporadic economic returns during ideal environmental conditions [15,16].

All the artisanal resources can be found in both the inshore and offshore coastal waters. Further, the migratory range of croaker, weakfish, Argentine croaker and bluefish, traverses international borders. In these areas, the fishery is exploited by semi-industrial and industrial operators (Table 2). In the early 1980s a coastal gill net fishery, considered semi-industrial due to intermediate technological characteristics, flourished [17]. Industrial fishing fleets from Rio Grande and other Brazilian states operate off Rio Grande do Sul during specific seasons [18]. Purse seiners from Santa Catarina (neighboring state) operate during autumn and winter catching mainly pelagic species (e.g. mullet and bluefish), and some demersal species such as croaker and catfish off the mouth of the estuary. An industrial gill net fishery started operating in 1989 in deeper waters (> 50 m) using nets several kilometers long. The main species caught by this fishery are sharks, croaker, Argentine croaker and weakfish. Bottom trawling (pair-trawl, otter-trawl, double-rig trawl) characterizes the main industrial fishing in the region. Boats from Rio Grande and other Brazilian states actively participate in this fishery year round in inshore and offshore waters (between 10 and 100 m) targeting weakfish, royal weakfish, Argentine croaker, croaker, sharks and shrimps [19].

3.3. Crisis in fisheries and establishment of co-management in Patos Lagoon

The Forum of Patos Lagoon was created in July 1996 as an institutional response to the crisis of estuarine fisheries. Its co-management arrangement was initiated by the Fishers Pastoral (“Pastoral do Pescador”)[1] and the Fishers Colonies (“Colônia de Pescadores”) in conjunction with the local branch of the Federal Environmental Agency (IBAMA-CEPERG). Key elements to be achieved within this new fisheries management regimes were a collaborative partnership among communities, governmental and non-governmental organizations, and a transition to negotiation-style, decentralized decision-making. The Forum recognizes that fisher communities play an important role in the preservation of healthy fish stocks and that resource management will be more effective when communities are granted active participation in the management process. The working assumption underpinning co-management arrangements is that if participants in locally based institutions are granted a significant decision-making role, they will in turn have the potential to devise regulations that are more flexible, adaptable and appropriate to specific situations as compared to those crafted by centralized agencies [3].

In an attempt to include all the institutions impacted by coastal resource management generally and fisheries specifically, a total of 21 institutions representing the principal stakeholders on coastal resource management were invited to be part of the Forum. Across these groups, some were present from the outset while others joined later in 1998 when the Forum’s statute was finalized. Table 3 lists all the institutions that constitute the Forum and states their role as concerns resource management. Participation in the Forum is voluntary, all representatives have the right to speak and to vote. Representatives of the Fishers Colonies and the Fishers Pastoral were given rights to two votes each, while the other institutions have the right of one vote each. Assigning more votes to the Colonies and Pastoral represents an explicit attempt to shift the locus of control to the institutions representing artisanal fishers. Other people that do not officially represent any institution (e.g. researchers) can participate in the meetings but do not have the right to vote. However, the interests and issues raised by all participants are accommodated as fully as possible. To the extent possible decisions are based on a consensus format, whereas voting is secondary (Fig. 3).

4. Co-management in practice: legitimacy of the Forum from the perspective of fishing communities

4.1. Fisher participation in the Forum

The proper involvement and representation of artisanal fishers in the Forum is a pre-condition for the design of policies that reflect the interest of communities and are consequently supported by them. The challenge in co-management is how to reconcile local-level rules and government regulation and improve fisheries management [20]. One important step is to legitimize the process in the eyes of higher-order decision authorities while maintaining comparable legitimacy at the level of resource users. As argued by Jentoft [21, pp. 142 and 147]:

> [Legitimacy should not be anticipated regardless of institutional design of co-management. Co-management may perhaps be the best available solution to the legitimacy problem but it may also, in itself, be the source of disappointments and loss of legitimacy. What if decisions resulting from collaborative

[1] The Fishers Pastoral is an organization that seeks to foster small-scale fisheries communities social and economic organization.

Table 3
Institutions that compose the Forum of Patos Lagoon according to its statute and their attributions in environmental management

Institutions	Duties	Level
Port authority	Navigation security, defense of the territory and aquatic pollution management To provide the infrastructure and support for monitoring fisheries management	National
Fisher pastoral/CNBB	To foster small-scale fisheries communities social and economic organization	National
Environmental police (PATRAM)	To monitor fisheries management and enforce regulation	National
IBAMA/CEPERG	To execute the national policies for the environment in order to preserve the environmental quality for the present and future generations To conserve, enforce and manage overfished and/or depleted resources	National
Local universities (FURG; UFPel and UCPel)	To promote education and research development in the Southern Brazilian Coastal Zone and inland watersheds	National
State of RS (FEPAM and SAA)	To promote the development of small-scale fisheries activity through financing of activities that promote a rational use of natural resources; income generation and infrastructure, and funds for research by demand	Regional
EMATER/ASCAR	To provide the link between financial programs supported by the state government and small-scale fisheries priorities To foster the social organization of small-scale communities	Regional
Fishers Colonies Z1, Z2, Z3 and Z8	To represent small-scale fishers' interests within the development of the small-scale fishers sector	Local
Public Ministry	To act as a watchdog for environmental issues and represent the interests of the society as a whole	
NGO (NEMA, CEA)	To develop an environmental conservationist conscience in the coastal communities through programs on environmental education, planning and monitoring	Local
Municipalities of Rio Grande, Pelotas, São José do Norte and São Lourenço do Sul	To monitor the environmental quality of the municipality	Local
	To identify environmental problems, degraded areas and illegal activities in the municipality and inform the State Environmental Agency to execute and enforce the law	
Fisheries industry syndicate	To represent fisher's industry sector within the environmental management organizations	Local

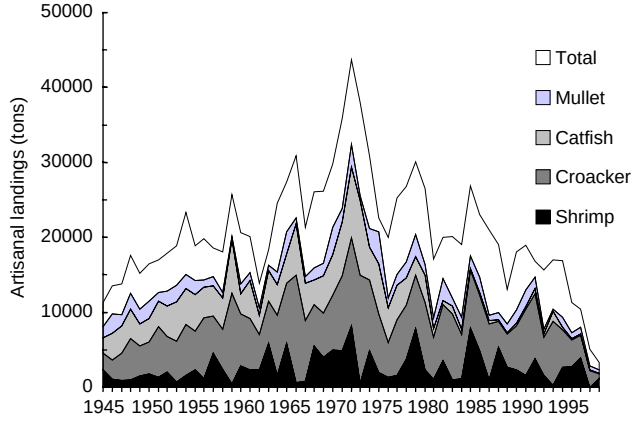

Fig. 3. Artisanal fisheries landings in the estuary of Patos Lagoon (data source SUDEPE and IBAMA).

and communicative processes produce regulatory outcomes that do not fullfil expectations of user-groups?… [T]the current legitimacy crisis in fisheries management must also be explained by the mismatch between what users see as reasonable and imperative within the local context in which they operate, and what governments regard as rational and efficient from a global perspective.]

Sharing management authority among users is not, in itself, a sufficient requirement for creating more legitimate fisheries management systems [22]. The co-management system must also achieve legitimacy on its own terms. The main argument for implementing fisheries co-management systems is the opportunity to provide an institution in which the users are guaranteed input in the management process. Because management decisions are based on user participation, a certain amount of responsibility is handed down to the users which ultimately may lead them to become more conscientious when harvesting the resource. In this study, we ascertained the Forum's legitimacy in the eyes of fishing communities through the above-noted survey

of 623 fishers and via the semi-structured interviews. The survey and interviews questions addressed problems related to the representation of fishers interests in the Forum as well as fishers understanding of the mechanisms in place for participation in decisions. Importantly, we asked: To what extent is the Forum creating opportunities for artisanal fishers communities to influence their own development and achieve sustainability in the management of small-scale fisheries?

The majority of fishers surveyed knew of the Forum (Table 4, question A). Few, however, have ever participated in its meetings. Of the 623 fishers surveyed, less than one-third (156 fishers) have participated in a meeting at least once; only 3% of the fishers participated in meetings monthly (Table 4, question B). Observations at the Forum across an 18-month period confirm this as the presence of a significant number of fishers was evident at only a few meetings. Specifically, this included meetings held in the communities of Pelotas and São Lourenço do Sul (Colonies Z3 and Z8, respectively). The participation of fishers in these two communities is higher than those from Z1 and Z2 (Table 4, question B),

Table 4
Results of survey questionnaire by fisher Colonies
(A) Do fishers know the Forum of Patos Lagoon?

	No	Yes
Z1 ($n = 159$)	26	74
Z2 ($n = 189$)	14	86
Z3 ($n = 116$)	4	96
Z8 ($n = 85$)	7	93
Not registered ($n = 74$))	41	59
All ($n = 623$)	18	82

(B) How often do fishers participate of the Forum meetings?

	Never	1 or 2	>2	Monthly	No answer
Z1 ($n = 117$)	74	15	8	1	2
Z2 ($n = 162$)	77	10	2	1	11
Z3 ($n = 111$)	40	24	19	8	9
Z8 ($n = 79$)	38	33	23	4	3
Not registered ($n = 44$)	89	7	2	0	2
All ($n = 513$)	63	18	10	3	6

Obs: Only fishers who knew the FORUM were asked this question

(C) How did they hear about the Forum?

	Radio/TV	Newspaper	Fisher pastoral	Other fishers	IBAMA	Colony	Others
Z1 ($n = 173$)	28	6	12	29	9	13	3
Z2 ($n = 193$)	21	4	3	30	2	41	0
Z3 ($n = 131$)	13	5	2	23	3	53	2
Z8 ($n = 80$)	5	0	0	15	4	73	4
Not registered ($n = 53$)	38	8	2	30	2	21	0
All ($n = 630$)	20	4	5	26	4	38	2

Obs: n is different from A because some fishers provided more than one way they know about the Forum

(D) Why do they not participate more often?

	Place	Time	Travel cost	Did not know	Other	No answer
Z1 ($n = 42$)	21	19	5	31	17	7
Z2 ($n = 28$)	18	39	7	32	0	4
Z3 ($n = 75$)	15	55	7	23	1	0
Z8 ($n = 55$)	11	33	5	47	4	0
Not registered ($n = 5$)	20	0	0	80	0	0
All ($n = 205$)	16	38	6	34	5	2

Obs: n is different from 156 because some fishers provided more than one reason for not participating more often

Note: Numbers represented as percentage of total responses (n).

despite the fact that during the 18-month research period the vast majority of the meetings were held in city of Rio Grande at IBAMA/CEPERG. No meetings were held in Colony Z2, and only two meetings in the Colonies Z3 and Z8.[2] The percentage of fishers from Z3 and Z8 that participated two or more times in the meetings is 43% and 56%, respectively, compared to 23% and 12% for fishers from Z1 and Z2. One possible reason for this difference is that fishers from Z3 and Z8 are concentrated in a much smaller number of communities than those from Z1 and Z2 (see Table 1). This might facilitate the exchange of information among fishers and hence their knowledge of and access to the meeting locations. Differences may also reflect different levels of organization across communities (discussed in more detail in the next section). One of the most important means of Forum-specific information delivery is through the Fishers Colonies (Table 4, question C); Colonies Z3 and Z8 have successfully communicated meeting news to fishers as compared to the other two Colonies (Table 4, question C).

All respondents recorded as participating in at least one Forum meeting were asked to provide reasons for their non-participation in further meetings (Table 4, question D). The two most frequent reasons given by fishers are that the meetings usually occur when they are out fishing or that they did not know of the meetings in time. Field observations confirm this latter reason. Meeting dates are often changed without notice or announced at the last minute making it difficult to inform every participant. The location of the meetings and travel costs are the third and fourth most common reasons for the lack of participation. Meeting location is an important impediment as meetings usually occur in the city of Rio Grande and many fishers have to travel long distances from their communities to attend. For instance, fishers from Colonies Z3 and Z8 live 60 and 140 km from Rio Grande, respectively. Others live in areas not well served by roads and public transport (such as communities in Colonies Z1 and Z2).

In sum, a minimal proportion of fishers participate in the Forum; it is thus reasonable to ask whether fishers concerns and interests are taken into consideration by the Forum given their sub-optimal participation in meetings.

4.2. Representation of fishers' interests in the Forum

Two question sets were used to evaluate the quality of representation of fishers interests in the Forum. The first set asked fishers directly whether or not the Forum represents their objectives and concerns. Results are shown in Table 5. Of the 156 fishers recorded as participants in at least one meeting, only 38% consider their interests well represented by the Forum, 31% regard their interests as represented "some of the time", and 31% report that their interests are "not represented" in the Forum (Table 5, question A). Most of the respondents, in all Colonies, agree that the Forum has failed to help many fishers, and 23% of fishers regard the Forum as not helping them at all (Table 5, question B). Only 24% of all fishers surveyed evaluated the Forum as working toward their needs. In contrast, 36% think that it is not (Table 5, question C). Table 5, question D shows regardless that the majority of participating fishers recognize the Forum as providing an opportunity to express their concerns at meetings. In short, it is evident from survey results that the Forum is not yet fully representing fishers' interests. Support for the Forum is at best ambivalent in that respondents are generally critical and yet also concede that the Forum does represent an important opportunity for their involvement. This inherent contradiction between widespread satisfaction with the opportunity to be heard alongside dissatisfaction with the representation of interests indicates a failure to realize changes indicative of fishers' core concerns. The likely causes of this contradiction are discussed below.

4.3. Rules on paper: representing fishers' interests by means of fishing calendar

An additional set of questions were answered by all surveyed fishers independently of their attendance at the Forum. These questions addressed fishers' agreement with new management rules defined by the Forum. Such questions evaluate indirectly the Forum's capacity to close extant gaps between "rules on paper" and fishers interests and practice, particularly those pertinent to the fishing calendar. Figs. 4 and 5 show the results from survey questions related to the designation of fishing calendars for croaker and catfish by IBAMA Decrees 171/98 and 144/01. Decrees 171/98 and 144/01 were created by the Forum as a way of redesigning the rules regarding the use of fish resources in the estuary of (e.g. access limitation, closures, technologies, etc.). These figures also present the results of questions investigating the judgments of fishers as concerns more appropriate fishing calendars for each commercial species (see [23] for further detail).

Consider, first, the croaker fishing season: 71% of all fishers surveyed agree with the calendar from October to February defined in Decree 144 (Fig. 4). This high level of support is consistent with the fact that changes were made to Decree 171/98 through the creation of Decree 144/01 based on fishers' request that new rules be devised that were congruent with the dynamic of the resource. There are, however, some differences of opinion as to appropriate calendars across Colonies.

[2] According to the Forum's Statute the meetings are to be held alternatively in each of the four Colonies.

Table 5
Results of survey questionnaire applied to fishers that participated at least once in the meetings of the Forum of Patos Lagoon
(A) Are fishers interests represented in the Forum?

	No	Sometimes	Yes
Z1 ($n = 28$)	14	36	50
Z2 ($n = 20$)	40	35	25
Z3 ($n = 57$)	28	35	37
Z8 ($n = 47$)	38	22	40
Not registered ($n = 4$)	50	25	25
All ($n = 156$)	31	31	38

(B) Does the Forum help fishers?

	No	A little	A lot	Do not know
Z1 ($n = 28$)	14	64	18	4
Z2 ($n = 20$)	10	80	10	0
Z3 ($n = 57$)	30	49	21	0
Z8 ($n = 47$)	26	49	23	2
Not registered ($n = 4$)	25	50	25	0
All ($n = 156$)	23	56	20	1

(C) Does the Forum works toward the needs of fishers?

	No	Sometimes	Yes	No answer
Z1 ($n = 28$)	18	46	32	4
Z2 ($n = 20$)	30	40	30	0
Z3 ($n = 57$)	35	47	16	2
Z8 ($n = 47$)	51	21	28	0
Not registered ($n = 4$)	25	50	25	0
All ($n = 156$)	36	38	24	2

(D) Do fishers have a say in the Forum meetings?

	No	Sometimes	Yes	No answer
Z1 ($n = 28$)	25	21	54	0
Z2 ($n = 20$)	25	35	35	5
Z3 ($n = 57$)	16	37	47	0
Z8 ($n = 47$)	15	32	53	0
Not registered ($n = 4$)	0	75	25	0
All ($n = 156$)	18	33	48	1

Note: Numbers presented as percentage of total number of responses (n).

Decree 171/98 was revised based on requests made specially by fishers from Colony Z3. While many fishers from Colonies Z1 and Z2 (fishing mostly in the lower and medium estuary) defend the possibility of ending the croaker season as early as December, practically all fishers from Colonies Z3 and Z8 (mostly in the medium and higher portions of the estuary) agreed on the necessity of a calendar extension through February. Some defend also the possibility of leaving the fishery open all year round. These differences reflect distinct fishing strategies and territories among artisanal fishers each of which need to be taken into account in the design of rules defining the calendar. The current calendar for this species seems to be in agreement with these differences and therefore it is well accepted among fishers. The obvious success of many of these revisions does show that changes due to Forum are happening and that there exists an improved capacity to better accommodate fishers inputs (including the correction of early calendar errors).

Further adjustments are nonetheless necessary. Unlike the rules defined for croaker, the calendar for catfish is largely opposed by fishers in all Colonies (Fig. 5). Over 60% of all fishers interviewed do not agree with the catfish calendar defined in Decree 144; the season is therein designated as October–November and March–May. Notably, a significant number of fishers, particularly those from Colonies Z1, Z2 and Z3, do not have a formed opinion about the catfish calendar. This lack of knowledge probably reflects the fact that for most Colonies (with the exception of Colony Z8), catfish has not been an important fishery due to the collapse of this

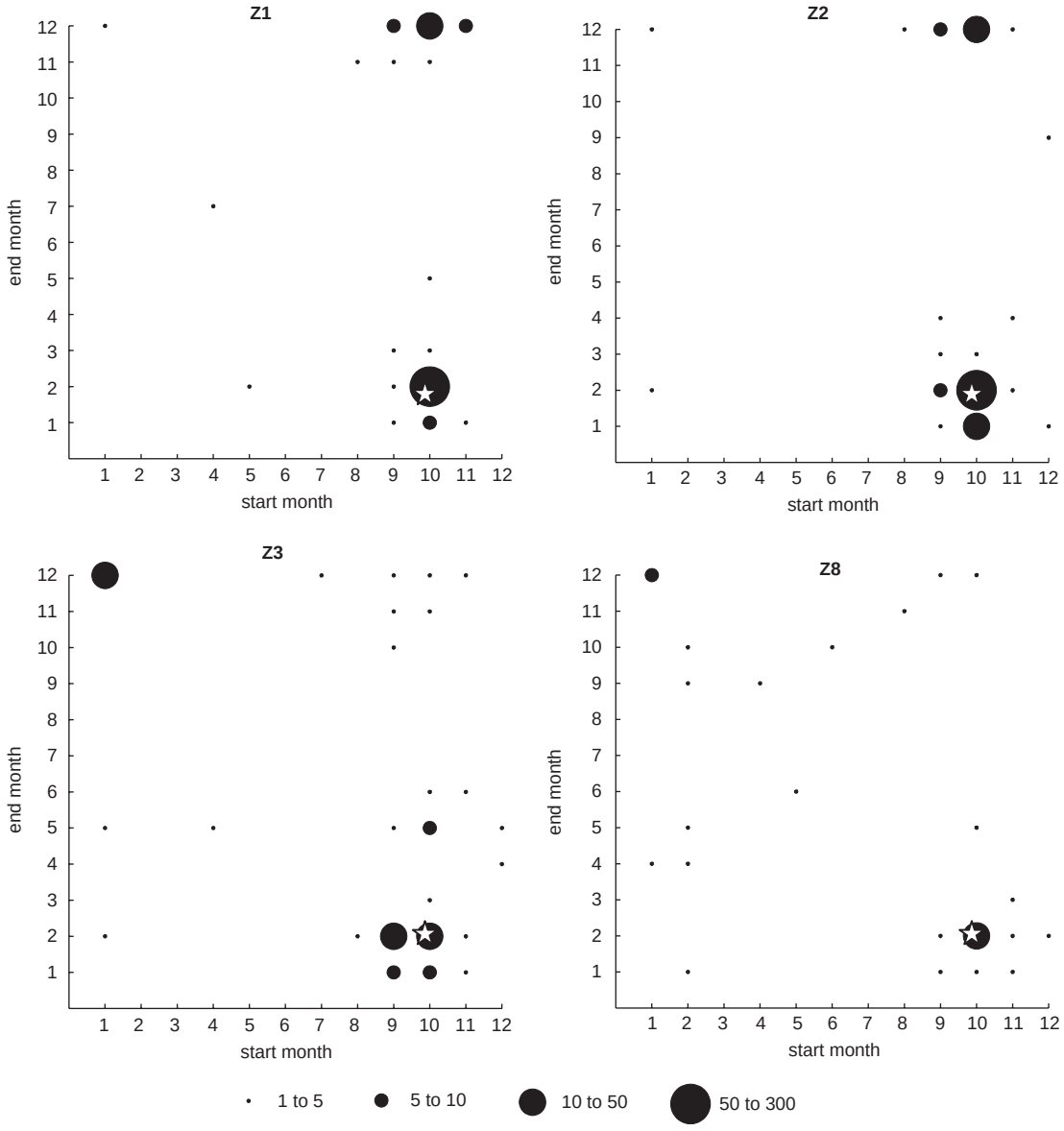

Fig. 4. Proposed length of croaker fishing season by fishers of Colonies Z1, Z2, Z3 and Z8. The stars in each graph represent the croaker season as defined by Decrees 171/98 and 144/01. The size of the dots is proportional to the number of responses.

resource in the early 1980s (see Fig. 3). Fig. 5 also shows that although some fishers agree with the calendar from October to November and March to May, a large number of fishers, particularly from Colonies Z1, Z2 and Z8, consider that the fishery should be opened during the winter (June–August). These differences of opinion across Colonies reflect a critical point in reference to the heterogeneity of resources. Communities in the higher estuary (Colony Z8) require a calendar of activities (e.g. catfish) that differs from those communities in the lower estuary (Colonies Z1 and Z2). This difference, the cause of sustained conflict today, was not taken into account when the Forum first designed the new calendar rules.

The characteristics of the resource vary along the estuary as does the way in which fisher communities use the resources. However difficult managing such a complex system is, these differences have to be addressed to ensure a better fit between resource dynamics and community use. The lack of the presence of fishers within the Forum only serves to maintain these identified problems as representatives that do attend the Forum are regularly forced to make decisions based on an incomplete knowledge of the conditions in communities with which they are not familiar. More broadly, the 'one calendar suits' all decision reflects possible misconceptions on the part of some Forum participants about the complexity of fish activity in situ. It also

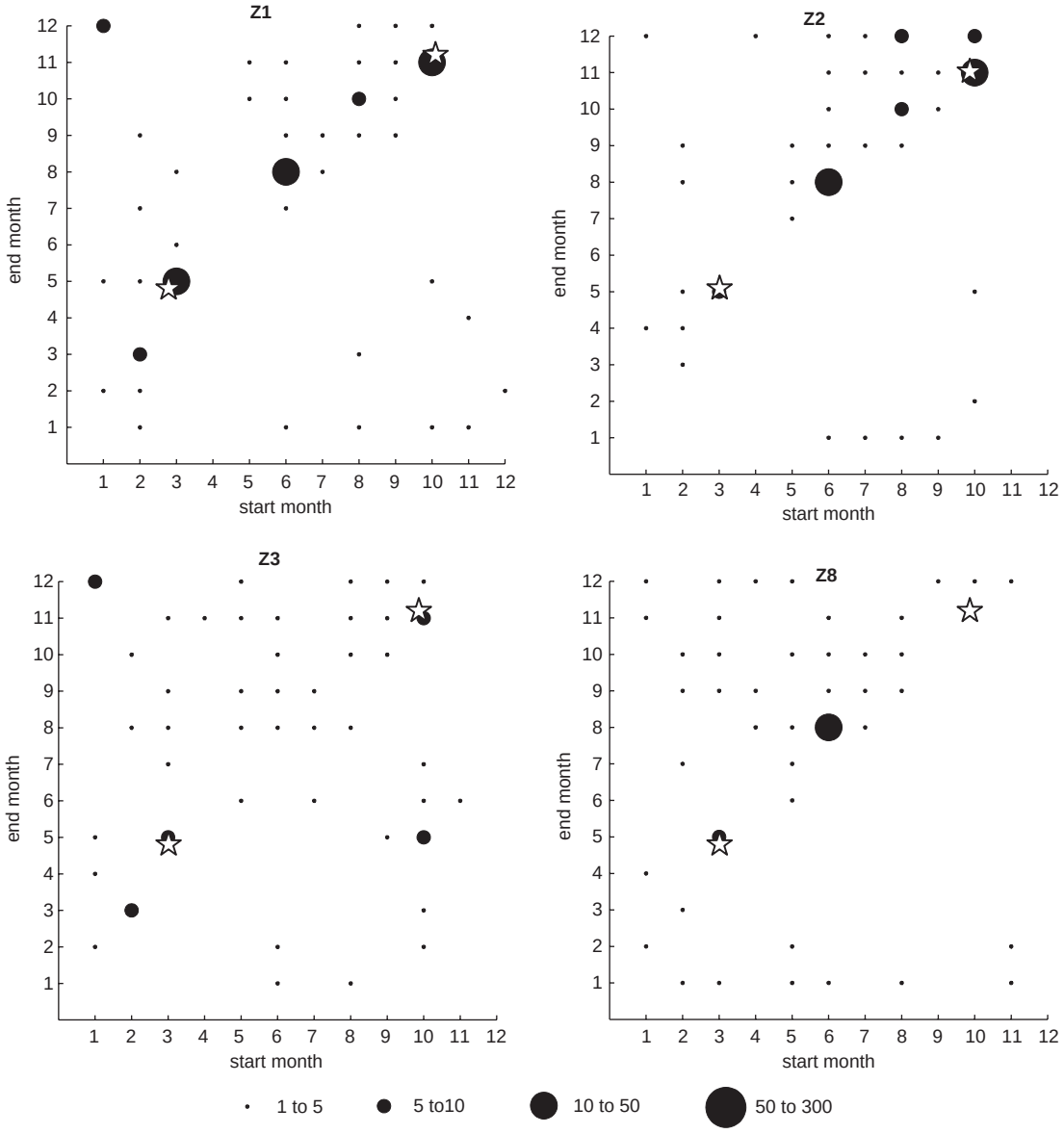

Fig. 5. Proposed length of catfish fishing season by fishers of Colonies Z1, Z2, Z3 and Z8. The stars in each graph represent the catfish season as defined by Decrees 171/98 and 144/01. The size of the dots is proportional to the number of responses.

reflects a general failure to realize more fully a premise central to fisheries co-management: Fishers as a matter of course actively pursue knowledge of the resource on which they depend; incorporation of that knowledge is central to good management. Kalikoski and Vasconcellos' [24] study of fishers knowledge in the estuary of the Patos Lagoon has demonstrated that fishers' knowledge can provide valuable information about the practices, tools and techniques that lead to more sustainable pattern of resource use. Such knowledge can contribute to the formulation of present management plans to better adapt rules to local social and environmental conditions. However, this system of knowledge has still not been recognized and fully accepted within the Forum; the poor fit between the catfish calendar and specific site characteristics illustrates this particular problem (see also [23,24]).

4.4. Forum outcomes and fishers' management priorities

Further insight into fishers' satisfaction with the Forum was achieved by permitting fishers to assign importance rankings to key Forum decisions and to, equally, identify and prioritize decisions as yet made. An accompanying set of questions was used to evaluate fisher representation at the Forum based on the ranking of a number of Forum achievements and management priorities. In order of importance, fishers ranked the

main achievements of the Forum as follows (Table 6): (1) unemployment benefit received during the fishing closure, (2) the control of access of Catarina fishers, (3) the opportunity created for fishers to participate directly in decisions affecting artisanal fisheries, and lastly (4) the definition of fishing calendars for each of the main resources. The high importance given to the unemployment benefit and to the access/boundary definitions have empowered artisanal fishers. In the first case, the Brazilian federal government granted artisanal fishers (a historically marginalized group) professional and hence the right to affiliated employment benefits. In the second case, the limitation of fishing access within the estuary represents a first step toward reorganization of fisheries activity in the region. The low importance given to the definition of fishing seasons indicate that, although fishers agree to a certain extent with the calendars currently defined in the regulations, the majority of them think that this issue warrants finer-grained distinctions so as to better calibrate the calendar to the dynamics of the resources.

Fishers were also asked to rank a number of management priorities defined in previous semi-structured interviews as centrally important. The results (Table 7) indicate the higher importance given by artisanal fishers to the control of industrial fishing activities on the coast, such as the operation of purse seiners in the mouth of the estuary and the illegal fishing of industrial trawlers in the 3-mile zone. Fishers ranked as a lesser priority rules regulating artisanal fisheries activities in the estuary, such as the increase in enforcement, the legalization of artisanal trawling and the reduction of the number of stownets in use during the shrimp season. Overall, these rankings indicate that many high priority issues have been addressed by the Forum, but that there exists a pressing need to regulate fisheries activity in the coastal zone, most notably regulation that forbids the use of purse seiners within the 3-mile zone. If accepted by IBAMA, these new regulations to address the above-mentioned issues (already proposed by the Forum as a new decree to regulate the fishing activity outside estuarine boundaries) will likely mean that many artisanal fishers will buy into the Forum as without such regulation, changes within the estuary appear futile at best.

This speculation was verified by interviews with fishers as indicated by the following quotes:

> …I think that closure will help us for sure. It will help the recover of the resources but the law has to be followed. However, it is useless to have fishing closure inside the lagoon, if fishing is still open at the mouth of the lagoon on the coastal area. The fishing closure for croaker started today for the artisanal fisher but the big boats continue fishing croaker outside, because there is no law regulating that activity. The mullet fishing season will start for us tomorrow but it was open the whole year to be fished outside the lagoon… The big boats, the industrials, work 24 h, they work even when is windy, they stop working only during storms. Then they clean the coast and when we go there we do not catch anything…

> Now I will tell you how the fishing will recover and within 3 years we would have a fishing activity for everybody: if you forbid the fishing activity at the mouth of the lagoon within the three miles because

Table 6
Rank of importance (1 = more important; 4 = less important) of the main achievements of the Forum of Patos Lagoon according to fishers

Forum's achievements	1	2	3	4	Unimportant	No answer
Receive unemployment benefit during closure	**54**	23	7	5	9	2
Impede access of Catarina fishers	21	**32**	12	14	19	2
Participatory space	16	14	**29**	11	28	2
Definition of fishing seasons	3	11	19	**35**	30	2

Note: The number of fishers that considered the achievements unimportant are also shown. Numbers represented as percentage of total responses ($n = 623$). The most frequent rankings are highlighted in bold.

Table 7
Ranking of management priorities according to all artisanal fishers interviewed in the estuary of Patos Lagoon (1 = more important; 4 = less important)

Priorities	1	2	3	4	5	Unimportant	No answer
Forbid industrial purse seiners of fishing in the mouth of the estuary	**63**	20	8	2	1	5	1
More enforcement in the 3 miles zone	16	**29**	22	9	3	20	1
More enforcement in the Lagoon	10	15	**21**	20	8	25	1
Legalize otter trawling in the estuary and coastal waters	8	**17**	16	14	**17**	27	1
Reduce the number of stownets in use in the estuary	2	8	8	18	30	**33**	1

Note: The number of fishers that considered the achievements unimportant are also shown. Numbers represented as percentage of total responses ($n = 623$). The most frequent rankings are highlighted in bold.

the fish we catch here are the same that they catch outside and if they stop fishing there the fishing would improve, the catfish would get inside again, we would have croaker that we do not have anymore, apart from sporadic occasions of good weather… because the industrial trawlers go inside the three miles and catch everything from Santa Catarina to Rio Grande…

4.5. Challenge of representation of fishers interests by fishers Colonies

Finally, fishers were asked to what extent they regard the institutional setup of the Forum as truly representing their interests. Of all surveyed fishers, 22% evaluated the presidents of the Colonies as not representing their interests; another 38% think the Colonies represent fishers to a lesser or poorer degree than that expected initially (Table 8, question A). As with other results, there are differences of opinion across Colonies. The percentage of fishers that consider their interests well represented by the presidents of the Colonies is higher for Colonies Z3 and Z8. The same pattern was obtained when fishers were asked if the Colonies work on issues of interest to them (Table 8, question B). These differences are explained by the activity of the different Colonies, namely the frequency with which presidents gather fishers in meetings to discuss issues of interest. In this respect, Colonies Z3 and Z8 are more active, while Colonies Z1 and Z2 rarely organize meetings with fishers (Table 8, question C).

A great challenge for the Forum is to redefine the mechanisms for the representation of fishers' interests in the local decision-making process. Central to this challenge was the decision to assign two votes to each Colony and other representatives of fishers within the Forum (i.e. the Fishers Pastoral). The matter was the source of intense discussion and conflict during the definition of the statute of the Forum. While some people agreed that assigning two votes for each Fishers Colony representative would be enough to represent fishers interests, others feared that the presidents of the Colonies would not truly represent fishers and would instead only put forth either their own interests and/or simply maintain the status quo. As put by a Colony representative:

The assignment of one vote to each participant institution was already set…however in order to balance fisher representation in the Forum we [the presidents of the colonies] requested that 2 votes

Table 8
Representation of fishers interest by the fishers Colonies
(A) Are fishers well represented by the fishers Colonies representatives?

	No	A little	Sometimes	A lot	Do not know
Z1 ($n = 159$)	25	23	23	26	3
Z2 ($n = 189$)	30	14	25	28	3
Z3 ($n = 116$)	21	20	19	40	1
Z8 ($n = 85$)	5	5	9	80	1
Not registered ($n = 74$)	16	15	34	23	12
All ($n = 623$)	22	16	22	36	4

(B) Do fishers Colonies work on issues of interest for fishers?

	No	A little	Sometimes	A lot	Do not know
Z1 ($n = 159$)	18	30	29	21	2
Z2 ($n = 189$)	17	24	23	32	3
Z3 ($n = 116$)	12	20	24	43	1
Z8 ($n = 85$)	0	4	9	87	0
Not registered ($n = 74$)	15	14	28	24	19
All ($n = 623$)	14	21	24	38	4

(C) How often do Colonies gather fishers to discuss important issues for the communities?

	Never	Once year	More than 2	More than 5	Monthly	No answer
Z1 ($n = 159$)	66	7	8	11	6	3
Z2 ($n = 189$)	56	7	16	13	5	3
Z3 ($n = 116$)	16	4	14	49	16	1
Z8 ($n = 85$)	0	1	8	41	48	1
Not registered ($n = 74$)	57	5	9	7	9	12
All ($n = 623$)	44	5	12	22	14	4

Note: Numbers represented as percentage of total responses (n).

should be given to the Fishers Pastoral and to each Colony, otherwise all colonies would not be part of this Forum… With the support of all Colonies the statute was therefore changed and we acquired what we wanted.

In the view of other Forum participants, replying upon the Colonies as a primary basis for representation in the Forum is not sufficient.

What we wanted was to have the fishers in the Forum, because we knew that counting only with the Colonies would be a representative democracy that sometimes does not work. According to them [the other participants] the president of the Colonies would be at the meetings but the issues would be discussed back and forth within the fisher communities to bring their interests on the table… But some of us knew that this would never work…

The problem of the weak representation of fishers by the Fishers Colonies has historical roots [25]. The organization of fishers in Colonies was a product of the nationalization of Brazilian fisheries carried out by the Navy between 1919 and 1923. The main goal of the program was to organize fishers for the military defense of the Brazilian coast and also, by grouping them in Colonies, to supply fisher communities with basic social services. The Colonies are organized in Federations at the state level and in a Confederation at the national level. In 1973, the organizational structure of the Colonies was redefined by the Ministry of Agriculture as fishers unions. In practice, however, the extant military-derived authoritarian decision-style was maintained. As a result the Colonies have rarely functioned as fishers community organizations, nor have they worked toward fishers' interests. For many years the election of Colony presidents were controlled by the Federation and the president of the Confederation was appointed by the Ministry of Agriculture. In the case of the Colony Z1, in the municipality of Rio Grande, the president's position has been de facto inherited; the last election was held 12 years ago in 1989. One aggravating factor is that in the vast majority of the cases the presidents of the Colonies are not fishers but politicians or middlemen [25]. Given this reality, it is not surprising that fishers are weakly represented by the Colonies in the Forum. The pattern is also entirely consistent with Brazil's authoritarian political history, including its once dictatorial military system wherein people were granted limited rights of freedom of opinion and expression, and the educational system was similarly repressive [26].

The problem of inclusion or representation of fishers is also rooted in the illiteracy and socio-economic marginalization of fishers, which has resulted in turn in low expectations among scientists and decision-makers as to the value of fishers' knowledge [25, pp. 92–103; 27, pp. 40–41]. There are many myths about artisanal fishers that still haunt management arenas and hinder a more productive interaction between fishers and decision-makers at large. Diegues [25] paraphrased some of the most common myths about artisanal fishers in Brazil: "artisanal fishers are beach beggars, they are a social problem that needs to be treated by social aid programs"; "artisanal fisheries are in transition to industrial, capitalist fisheries, and therefore are doomed to disappear"; "artisanal fishers are unintelligent and resist the technological innovations"; "artisanal fishers are predators, individualists and are not able to organize themselves". Over time, these myths helped to exclude fishers from decision-making and consequently made them more vulnerable to the management process. As Pauly [27] notes, the marginalization of fishers and their limited formal education have often blinded managers and scientists to the ecological knowledge that small-scale fishers have, a key factor in many successful common property systems as a basis for traditional community-based management.

5. Co-management in practice: the challenge of cross-scale management

5.1. Problem of absent or resistant stakeholders

Small-scale fisheries are impacted by other economic activities such as port, industry, agriculture and urban development activities, which are not otherwise engaged in the participatory management of coastal resources.[3] The Forum's success also depends heavily on the active participation of those key stakeholders that are currently enfranchised as members of the Forum. A total of 21 institutions involved in the management of fisheries are invited to participate and vote in the Forum. Currently not all institutions able to participate do so. It is equally the case that many of those currently enfranchised as members of the Forum fail to participate.

Fig. 6 shows the frequency of participation of the 21 institutions in 43 monthly meetings held between 1996 and 2001. The institutions most frequently present are the Fishers Colonies, Fishers Pastoral, EMATER and IBAMA. Others, such as universities and municipalities of Rio Grande and Pelotas, also frequently participate at the meetings. Notably, institutions with high decision power or influence such as the Public Ministry, Port Authority and Fisheries Industry Syndicate are rarely present at the meetings. The Forum will have

[3] Pinkerton [2, pp. 11–12] has noted that successfully co-management depends upon the creation of mechanisms for resource protection caused by other resource users.

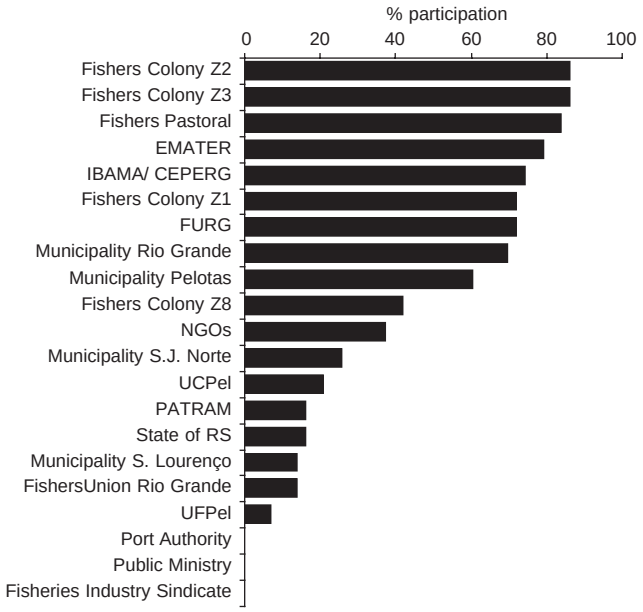

Fig. 6. Frequency of participation of institutions representatives in 43 Forum meetings between 1996 and 2001.

to address this resistance to participation as the comparative absence of these stakeholders has important implications for the legitimacy of the Forum as concerns appropriate governmental participation and endorsement.

While lack of involvement of these institutions represents an important weakness of the Forum,[4] the reasons behind their reduced participation varies. The Fishery Industry Syndicate does not participate because it sees its interests conflicting with the Forum's emphasis on artisanal fisheries, and thus the Forum's propositions to restrict access to industrial fisheries. That industrial stakeholders do not rely upon the Forum to articulate their grievances also suggests that alternate avenues for influencing industry-favorable policy are extrinsic to the Forum. The involvement of the Port Authority and Public Ministry is restricted by extant legal mandates. According to the representatives of the Port Authority and Public Ministry, these institutions represent the interests of society as a whole and thus they cannot legally take part in the Forum as the Forum deals with a particular interest group, namely small-scale fisheries. The lack of involvement of these institutions also reflects the historical and artificial separation of institutions dealing with coastal zone management in Brazil, and hence the failure to take into account the interrelationships among coastal activities and the agencies that govern those activities [28,29]. Additionally, the Forum lacks a mechanism to better inform the role and importance of these institutions for local co-management initiatives, information that might persuade these parties to buy into Forum-based governance. This latter applies most specifically to the Port Authority. The Port Authority does not consider itself directly related to fisheries management. It regards its mandate solely as concern for navigation safety and coastal pollution. However, decisions made by the Port Authority can directly affect the activity of small-scale fishers. For instance, the enforcement of safety rules for navigation in coastal waters have fueled conflict because artisanal fishers lack the safety devices (which are very expensive) required by the Port Authority. Fishers have, consequently, been prevented from fishing in traditional grounds adjacent to the estuary. Because the Port Authority resisted participation, it took considerable time and effort to arrive at a solution that would (a) meet the Port Authority's safety requirements and, (b) remain affordable to fishers.

The Public Ministry also attributes non-participation to legal restrictions. The Public Ministry acts as an environmental watch dog representing the interests of society as a whole, and thus cannot, legally, operate as a voting member of the Forum (which represents primarily the interests of artisanal fishers). However, the Public Ministry can legitimize the outcomes (decisions) of the Forum at higher levels of decision-making and has done so on several occasions. Thus, while neither the Port Authority nor the Public Ministry have frequented the Forum's meetings or participated in the decisions reached therein, they have supported the Forum on several key occasions when called to do so. Collaboration between the Forum and the Public Ministry has led to the recognition that fishing in the estuary is allowed only to those who can prove that fishing activity as their historical basis of subsistence. Another important outcome of such a partnership is the passing of responsibility for licensing of fishery activity inside the estuary from the Department of Fisheries and Agriculture back to IBAMA and the Forum. This has served to improve the monitoring of fishing activity and has enhanced the Forum's capacity to exclude outsiders from the activity. Because the Port Authority and Public Ministry represent higher level (i.e. federal) institutions, their involvement in the Forum serves to improve the cross-scale linkages between communities and government. Moreover, the legitimacy that their presence and occasional endorsements grants the Forum significantly empowers the small-scale fisheries sector. Thus, despite the absence of a broader multi-stakeholder, multi-interest involvement in the Forum, multiple opportunities have been created wherein small-scale fishers can bargain on more equal footing with powerful sectors.

[4] This weakness has been recognized and is the subject of discussions preceding the revision of the statute to redefine the roles and involvement of each participant institution.

5.2. Institutional support and collaboration

Incentives to decentralize fisheries management in recent years have created opportunities for co-management initiatives, such as the Forum. Co-management's emphasis on multi-stakeholder partnerships is a strong alternative when managing resources under complex conditions, and when significant power imbalance across stakeholders exists. A key ingredient in the success of such initiatives is the government's willingness to share power when devising and enforcing rules [2, p. 1]. At the same time, artisanal fishers must develop the appropriate institutional and infrastructural pre-requisites to operate successfully as co-managers. These include the ability to organize collectively and develop locally appropriate representative institutions that can be said to properly articulate their interests. This necessary institution building in the Patos case, among others, is a long-term and costly process. Evidence from other co-management systems shows that community organization can take 3–5 years or more, before a self-sufficient institution is in place [1].

In the Patos Lagoon case, we find that several factors were key in facilitating this institutional development. Necessary infrastructural support and development was provided by IBAMA, the federal institution responsible for environmental management. The presence of IBAMA in the Forum has helped secure both the legitimacy and accountability of the Forum and has helped achieve cross-scale linkages where decisions taken at the local level by the Forum have been legitimized at the federal level through the creation of policy decrees. A case in point is the above-mentioned IBAMA Decrees 171/98 and 144/01 which established rules restricting access to resources, seasonal restrictions, catch size limits, fishing gear restrictions and habitat protection. As many prescriptions were generated by the Forum, their formalization in the decrees represents an important step toward the empowerment of the Forum.

5.3. Ambivalent power-sharing and competing regulatory and industrial interests

Despite the increased local autonomy of the Forum, attempts to deliver a genuine sharing of resource management power in the lagoon have not been fully achieved. The decentralization of management policy adopted by IBAMA has taken the form of delegation and not devolution. As defined by Pomeroy and Berkes [1], delegation is the passing of some authority and decision-making to local officials, but central government retains the right to overturn local decisions and can at any time, take these powers away. Devolution is the transfer of power and responsibility for the performance of specified functions from the national to the local governments without reference back to a central government [1, p. 411]. In the Patos case, authority to devise and revise local rules and direct artisanal fisheries management was assigned to the Forum but final decisions still have to be approved by central government to become a law.[5]

The devolution of fisheries management authority from the central government to local-level organizations is not easily resolved because legislation and policy for co-management are embedded in a broader network of interests, laws, policies and administrative procedures at both national and local government levels. On the one hand, decentralization has been supported by federal (IBAMA) and state (program RS-RURAL artisanal fisheries) programs. On the other hand, centralizing forces remained until 2002 in the form of federal institutions (Department of Fisheries and Aquaculture—DPA) whose political tendency were to sustain a centralized decision-making structure.

From 1998 to 2002, authority for fisheries management in Brazil has been split between two agencies: the Ministry of Agriculture (DPA) and the Ministry of the Environment (IBAMA). IBAMA became responsible for conservation, enforcement and management of overfished and/or depleted resources, while the DPA was responsible for licensing and the development of fisheries regarded as under-exploited. Notably, the DPA was not one of the Forum's participant institutions, despite numerous attempts by the Forum to seek partnership. Yet, its decisions had a significant impact on local co-management arrangements. At least two policies adopted by DPA have had a negative impact on local small-scale fisheries management, and have conflicted directly with the Forum's goals. The first was the transferring of licensing from the local agency of IBAMA to the Ministry of Agriculture's office in the capital of the state of RS (Porto Alegre) affecting attempts to limit entry to the fishery mandated by Decrees 171/98 and 144/01. This specific problem of limiting entry, which was later overcome by the Forum through political lobbying, shows the strong influence that central government still has on local decisions. The second problem was the opening of access to foreign factory trawlers to operate in waters off Rio Grande do Sul disregarding the fragile status of the resources and the weak capacity of local institutions to enforce the activity of these open ocean fisheries. As demonstrated by a recent research program of assessing fisheries resources in the Brazilian Economic Exclusive Zone

[5] We do not mean to naively suggest the full devolution of decision control will automatically produce ideal management arrangements. Attempts at local management will also face difficulties whenever artisanal fishers interests conflict with the interests of other activities such as port and industrial activities. The problem of the fishery is in this case beyond the scale of the traditional fisheries management framework.

(EEZ), most of the important resources in this zone are already being fully exploited and not much surplus production is available for exploitation [18]. Disregarding the results of the above program and also the interests of local artisanal fishers, licenses were given to industrial foreign trawlers from Asia and European countries to operate in the EEZ of southern Brazil [18]. This greatly increased the pressure exerted on the already over-exploited resources ostensibly shared by local industrial and artisanal fisheries. This policy was part of the Ministry of Agriculture's Strategic Plan of Action for the Development of Fishing and Aquaculture.

At the writing another change in the fisheries governance system has occurred at the National Level with the creation of the new Special Secretariat of Aquaculture and Fisheries (Secretaria Especial de Aqüicultura e Pesca—SEAP) under the new elected Labour party. This Special Secretariat has the mission of formulating, coordinating and implementing guidelines and policies for the development and fostering of a sustainable national fishing and aquaculture production under an economic, social and environmental perspective. In order to undertake this mission, the Special Secretariat of Aquaculture and Fisheries relies on a small structure—necessary only to implement their policies and function as a consultative and prepositional organ, represented by the National Council of Aquaculture and Fisheries that will be composed by members of the government, society and the productive sector. The Secretariat's objective is to redesign fishing policies through (a) a Federal Program for Fisheries Management and Development via (b) local-federal partnerships with all stakeholders (e.g. fishers, scientists, industrials, etc.) (A. Lobo da Costa, Pers. Comm., Artisanal Fishers Coordinator, SEAP). The Forum has had an active role in this evolving redesign process and as such was able to assert the interests of artisanal fisheries and its sustainable management agenda. Important manifestations of this agenda are the current moratorium (1) on purse-seiners industrial fisheries at the mouth of the estuary of the Patos Lagoon and (2) on foreign fisheries until an assessment of its impact on local fisheries can take place (expected in the next few months).

The constant transition of policy design in fisheries management in Brazil has led to both positive and negative impacts on the capability of local institutions to govern and manage local resources, as discussed above. Those impacts are the outcomes of the strategy used by each higher level institution, on the one hand facilitating power-sharing and implementing mechanisms as to guarantee the sustainability of both the fisheries resources and local traditional communities, and on the other constraining the sharing of power and acting as a way to maximize economic returns to the industrial sector.

6. Reflections on the barriers and opportunities for implementing co-management: lessons learned from the Forum

6.1. Moving toward shared governance

The goal of this paper is to analyze the process of implementing a local fisheries co-management regime of fisheries in the estuary of Patos Lagoon. Crises in the management of common property resources worldwide have led to the recognition of the need to change the basis of resource management by involving local resource users and communities in a meaningful way. The Patos Lagoon case provides an ideal example of this shift from a top-down management toward a decentralized co-management arrangement. It exemplifies also the struggle to shift systems of governance given different levels of preparedness of people and institutions to make such a shift.

In this case, and elsewhere, it is clear that co-management is neither solely community based nor solely government based, but rather involves cross-scale linkages between different levels of governance. Co-management involves different institutional mechanisms of partnership, power sharing and integration between community-based and government-based management systems. These linkages are fundamental to the governance of fisheries, characterized by a multiplicity of actors all of whose interests converge and conflict in a dynamic fashion.

Federal government agencies have played an important role in creating favorable conditions to implementing co-management arrangement. The Federal environmental agency and the State government created incentives to decentralize fisheries management decisions, including legitimizing locally devised rules and have empowering local institutions. However, some clashes were identified. The general lack of an integrated participatory management of coastal resources echoes a sectorial governmental structure, which has been supporting development policies that threaten local efforts to sustain small-scale fisheries activities. Within the Brazilian national scene competing and conflicting policies may jeopardize local management initiatives such as the Forum. One notable example was the split of fisheries management authority between IBAMA (resource conservation) and DPA (economic development) at the federal level, and the consequences this had for local efforts to control access to fisheries in extra-estuarine areas. The decision power of the Federal Environmental Agency (IBAMA) is still marginal as compared to political institutions aimed at fisheries development. IBAMA, for instance, lacked the necessary authority to reverse the decision provided access to industrial boats. That is, the DPA has used its authority to open fishing rights to the industrial sector despite the

collapse of fisheries introduced by these practices. However, IBAMA's legislation has strengthened artisanal fisheries by enabling the Forum in the first place and the Forum has in turn successfully aided several mechanisms that benefit communities within (but not beyond) the estuary. The DPA had to accept, at least for the estuary of Patos Lagoon, the rules devised by the Forum including the Forum's capacity to approve licenses within the estuary.

Ultimately, management problems have to be tackled simultaneously at several levels of decision-making by different institutions. Forum co-management involves multiple parties instead of one government agency and one local group. This represents a vast improvement over the previous management regime but, as yet, the institutional and ecological variables at play remain too complex for the existing Forum to properly manage fisheries resources. The Forum's strength lies in the fact that it is a multi-stakeholder co-management regime composed by 21 institutions, including institutions with interests that transcend fisheries. The Forum brings to the table sectorial interests that may influence positively or negatively the achievement of its goal. It has also clearly empowered the artisanal fisheries sector as bargainers in the governance of coastal resources. In this sense, this process of making decision in the Forum has created the conditions for legitimacy of the Forum's outcomes. We refer, here, to "political legitimacy", defined by O'Riordan [30] as "the shared acceptance of an outcome that may not be liked, but which is tolerated because it is arrived at by means that are trusted and understood".

Important adjustments still need to be made before the outcomes of the Forum can be said to better reflect the interests and knowledge of fishers. First, the Forum has yet to find an ideal balance between the empowerment of fishers versus elite representatives. Conflicting rights over the use of the estuary for purposes other than fishing (e.g. port activity, tourism) persist as does the historically rooted power of governmental and industrial agents. Second, problems with the representation of fishers' interests at the hands of community representatives remain. When combined with the very low participation of fishers in the Forum, decisions that are insufficiently supported by artisanal fishers have followed. In this regard, not much progress can be expected until the Forum finds a way to widen the basis of power by enabling fishers to define problems from their perspective and seek solutions which they regard as appropriate (e.g. solutions for fishing in extra-estuarine waters, more enforcement in the 3-mile zone, etc.).

Third, current rules and regulations specific to the calendar, and designed to better manage artisanal fisheries, do not address the heterogeneity of resources and community patterns of resource use. As evidenced above, the communities in the higher estuary (Colony Z8) proposed a calendar of activities for the catfish season that was inappropriate for communities in the lower estuary (Colonies Z1 and Z2). This imposition remains the basis for much conflict. Fourth, the estuary area managed by the Forum differs from the boundaries of the ecosystem in which the artisanal fishing communities operate. Consequently, the management priorities defined in the Forum also differ from those of fishers, who see no point in enforcing rules inside the estuary when there is no control of access and exploitation of resources in the ocean by industrial fishing operations. This misfit between the institutional powers and the ecosystem is a factor affecting the acceptance of the Forum among fishers [31].

Fifth, a very small percentage of the surveyed fishers in the estuary have participated in the meetings of the Forum of Patos Lagoon, and the adopted mechanisms for fishers representation in the Forum (through the Fishers Colonies and Pastoral) are not yet sufficiently effective in bringing fishers' inputs into the process. Recognizing the value of fishers knowledge is a precondition for the willingness of institutions to involve fishers communities in the management process. A reforming and restructuring process, including the revision of rules, is occurring within the Forum at this time. Change toward a more inclusive process of rule making has been recently observed as when the fishers inputs were used to revise the Decree 171/98 and create Decree 144/01. Although, inputs from fishers were taken into account in the revision of regulation (e.g. mesh size, and calendars for catfish, mullet and croaker), their knowledge was only considered valid following considerable scientific scrutiny.

To close our analysis has demonstrated that the Forum is an attempt to share responsibility and authority as concerns the management of fisheries resources. However, it still lacks the mechanisms for empowering the community and delivering fully the principles affiliated with fisheries CPRs. Following O'Riordan [30] "the achievement of pluralist power relationships in a society implies the capacity of empowerment, where all individuals are aware of their ability to recognize what is going on in their name, and have a capability to express their needs and reactions in such a manner as to be respectfully heard". According to the same author, "in many instances, however, pluralism gives way to neo-elitism where coalitions collude to determine what is to be done and how. Empowerment thus becomes possible in different forms of policy space" [30], such as in the case of the estuary of Patos Lagoon, where it has been shown to work via a combination of partial empowerment augmented by the support of elite representatives. In this respect, the model adopted by the Forum resembles more that of a stakeholder centered co-management than a community-centered co-management. Berkes et al. [20]

distinguished these two types of arrangements based on the level of empowerment and community involvement. While community-centered co-management is focused on community development and social empowerment, the stakeholder-centered co-management focuses more on getting the users participating in the resource management process. This latter of co-management often has fishers and other stakeholders represented through various organizational arrangements in management. Such procedures can be helpful, as discussed by O'Riordan [30] "if genuinely representative groups are present", but as it has been shown here, this is still not the case in the Forum.

The transition from a top-down management approach to a more decentralized one is not a rapid process [30,32]. One does not quickly change an institutional culture. The Forum has achieved important positive outcomes and has gained legitimacy over time. Notably, and for the first time, the small-scale fisheries sector is recognized and is gaining bargaining power in the decision-making process.

Acknowledgements

The authors thank Les Lavkulich, Marcelo Vasconcellos and Milton Asmus for their valuable support during the development of this work. Many thanks go to the students from FURG that helped us to do the field work. Without the help and support from the Forum of Patos Lagoon representatives and the fisher communities of the Patos Lagoon, this work would not exist. This project was supported by the UBC Hampton Award.

References

[1] Pomeroy RS, Berkes F. Two to tango: the role of government in fisheries comanagement. Marine Policy 1997;21:465–80.
[2] Pinkerton E. In: . Co-operative management of local fisheries: new directions for improved management and community development. Vancouver: University of British Columbia Press; 1989.
[3] Pinkerton E. Directions, principles, and practice in the shared governance of Canadian marine fisheries. In: Newell D, Ommer R, editors. Fishing places, fishing people. Traditions and issues in Canadian small-scale fisheries. Toronto: University of Toronto Press; 1999. p. 340–54.
[4] Creswell J. Research design: qualitative and quantitative approaches. Beverly Hills, CA, USA: Sage; 1994. 228pp.
[5] Czaja R, Blair J. Designing surveys: a guide to decisions and procedures. Thousand Oaks, CA: Pine Forge Press; 1996. 269pp.
[6] Asmus HE, editor. Estrutura e dinâmica do Sistema Lagoa dos Patos. Secretaria da Comissão Interministerial para Recursos do Mar. Comunicado Técnico, 1989.
[7] Seeliger U, Odebrecht C, Castello JP, editors. Subtropical convergence environments. The coast and sea in the Southwestern Atlantic. Berlin (Heidelberg/New York): Springer; 1997. 308pp.
[8] Castello JP. The ecology of consumers from dos Patos Lagoon estuary, Brasil. In: Yañez-Arancibia A, editor. Fish community ecology in estuaries and coastal lagoons: towards an ecosystem integration. Univ. Nac. Avt. Mex: México, 1985. 654pp [Chapter 17, p. 383–406].
[9] Klein AHF. Regional climate. In: Seeliger U, Odebrecht C, Castello JP, editors. Subtropical convergence environments. The coast and the sea in the southwest Atlantic. Berlin: Springer; 1997. p. 5–9.
[10] Ciotti AM, Odebrecht C, Fillman G, Moller Jr OO. Freshwater outflow and subtropical convergence influence on phytoplankton biomass on the Southern Brazilian Continental Shelf`. Continental Shelf Research 1995;15(14):1737–56.
[11] Chao LN, Pereira LE, Vieira JP. Estuarine fish community of the Patos Lagoon, Brazil. A baseline study. In: Yañez-Arancibia A, editor. Fish community ecology in estuaries and coastal lagoons: towards an ecosystem integration. Univ. Nac. Avt. Mex: México, 1985. 654p [Chapter 20, p. 429–450].
[12] Vieira EF, Rangel SS. Planície Costeira do Rio Grande do Sul: geografia física, vegetação e dinâmica sócio-demogrzáfica. Porto Alegre: Ed. Sagra; 1988.
[13] von Ihering H. Os peixes da costa do mar no estado do Rio Grande do Sul. Anuario do Estado do Rio Grande do Sul para o anno de 1896, Porto Alegre, 1896. p. 98–124.
[14] FAO. Report of the expert consultation on small-scale fisheries development. FAO Fish Report 1975;169:16.
[15] IBAMA, Peixes demersais. Ministério do Meio Ambiente, dos Recursos Hídricos e da Amazônia Legal. Coleção Meio Ambiente. Séries Estudos de Pesca, 1995. 16pp.
[16] Reis EG, D'Incao F. The present status of artisanal fisheries of extreme southern Brazil: an effort towards community based management. Ocean & Coastal Management 2000;43(7):18.
[17] Reis EG. Classificação das atividades pesqueiras na costa do Rio Grande do Sul e qualidade das estatísticas de desembarque. Atlântica, Rio Grande 1993;15:107–14.
[18] Haimovici M. Recursos pesqueiros demersais da região sul. Programa REVIZEE. Ministério do Meio Ambiente, Recursos Hídricos e da Amazônia Legal. FEMAR 1997. 80pp.
[19] Haimovici M, Pereira SD, Vieira PC. La pesca demersal en el sur de Brasil en el periodo 1975–1985. Frente Maritmo 1989;5:151–63.
[20] Berkes F, Mahon R, McConney P, Pollnac R, Pomeroy R. Managing small-scale fisheries. Alternative directions and methods. IDRC: Ottawa, 2001. 320pp.
[21] Jentoft S. Legitimacy and disappointment in fisheries management. Marine Policy 2000;24(2):141–8.
[22] Karlsen GR. Can formalisation help? The introduction of fisheries co-management in the inshore fisheries of Dingle, Co. Kerry, Ireland. Marine Policy 2001;25:83–9.
[23] Kalikoski DC. The Forum of the Patos Lagoon: an analysis of co-management arrangement for conservation of coastal resources in southern Brazil. Vancouver: University of British Columbia Press. Ph.D. thesis, 2002. 257pp.
[24] Kalikoski DC, Vasconcellos M. Fishers knowledge role in the management of artisanal fisheries in the estuary of Patos Lagoon, southern Brazil. In: Neiss, B, Haggan N, editors. Putting fishers' knowledge to work. Oxford: Blackwell, in press.
[25] Diegues ACS. Povos e Mares: leituras em sócio-antropologia marítma. University of São Paulo, Brazil: NUPAUB; 1995. 260pp.
[26] Freire P. Pedagogy of the oppressed. New York: Continuum; 1983. p. 186.
[27] Pauly D. Small-scale fisheries in the tropics: marginality, marginalization and some implication for fisheries management. In: Pikitch EK, Huppert DD, Sissenwine MP, editors. Global trends: fisheries management. Bethesda, MD: American Fisheries Society; 1997. p. 40–9.

[28] Asmus ML, Calliari L, Tagliani PR, Kalikoski DC. Ecosystem based integrated coastal zone management in the estuary of the Patos Lagoon: opportunities and constrains. Proceedings of the Workshop Ecosystem Based Integrated Coastal Zone Management. Vancouver, Canada: UBC; 1999. 10pp.

[29] Kalikoski DC, Asmus ML, Lavkulich LM. Environmental analysis of the Lower Camaquã River watershed (Brazil). A study of planning and environmental education, vol. 3. Journal of Environmental Assessment Policy and Management. London: N2 Imperial College Press; 2001.

[30] O'Riordan T. Deliberative democracy and participatory biodiversity. In: O'Riordan T, Stoll-Kleemann S, editors. Biodiversity, sustainability and human communities: protecting beyond the protected. Cambridge: Cambridge University Press; 2002.

[31] Kalikoski DC, Vasconcellos M, Lavkulich LM. Fitting institutions and ecosystems: the case of artisanal fisheries management in the Patos Lagoon. Marine Policy 2002;26(03):179–96.

[32] Dorcey AHJ, McDaniels T. Great expectations, mixed results: trends in citizen involvement in Canadian Environmental Governance. Paper Prepared for SSHRC Environmental Trends Project, September 2001.