Catchment Residents-Based SWOT Analysis of a Reservoir Ecosystem for Sustainable Water Management: A Case Study From the Region of Alentejo, Portugal

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The European Union Water Framework Directive (WFD, 2000/60/EC) makes public participation a requirement in managing water resources and maintaining water quality in a watershed. Whilst participatory approaches to sustainable water management are supported by a growing body of research, actively involving people affected by water resources is far from straightforward. This paper investigates the use of the Strengths-Weaknesses-Opportunities-Threats (SWOT) analysis framework as a consultation tool to support catchment populations’ participation in water resources management by a case study developed in a reservoir ecosystem. The application of a multiple correspondence analysis helped identify underlying structures of respondents SWOT stated issues and their associations with socio-demographic characteristics and type of reservoir ecosystem uses. In particular, five clusters of responses were suggested by this analysis, focusing on: the use and importance of the reservoir ecosystem for agriculture, existing qualities/amenities at the study area for recreation, socio-economic issues, concerns about littering and litter management of the area, and issues about reservoir water quality and management. Overall, the issues raised information about public perceptions and understandings of the reservoir ecosystem, which may enable decision makers and water managers to perform fair and sustainable management of water resources.

Keywords: reservoir ecosystem, catchment consultation, SWOT analysis, EU Water Framework Directive, sustainable water management

Introduction

Water management issues, often embedded in seemingly endless ecological, social, and political interactions, across temporal and spatial scales, are context-dependent, socially constructed, and technically uncertain (O’Riordan 1989). Among other things, they are shaped by the interplay of multiple legitimate perspectives and problem definitions, and grounded in the wide range of stakeholder values, worldviews, and histories, found in increasingly pluralistic and fragmented societies (Funtowicz and Ravetz 1992; Munda 2004). Therefore, the achievement of sustainability requires that the human dimension is an integral component of freshwater management, recognizing that people are part of ecosystems, and that people have influenced and will continue to influence freshwater resources (Cordell et al. 1999).

The WFD was created to ensure the sustainable use of water resources in the European Union. However, the success of the WFD relies on close co-operation and coherent action at the community and local level, as well as on information, consultation, and involvement of the public - including water users (European Commission 2000). Therefore, public participation should be a gradual and continuous process, starting with initial identification of significant water management issues.

Early involvement is essential to ensure better input from the public and provide more credibility and transparency in the process (Laird 1993; Rinaudo and Garin 2005).

However, there are still large knowledge gaps and culture clashes which make the realization of participatory processes problematic for most governing bodies (Appelstrand 2002). In certain European member states, where public participation may represent an enormous shift in traditional planning models, decision makers may be tempted to restrict the participation process mainly as a means of legitimizing decisions (Rinaudo and Garin 2005). Although a lot of literature is available on different public participation and consultation methods and approaches (e.g., Roberts 1995; Renn et al. 1995; OECD 2001; Fung and Wright 2003; Rowe and Frewer 2005), some questions still remain unanswered: how to reach beyond the organized stakeholders to the unorganized water users, and how to consult them in a simple and inclusive way for water management?

This paper aims to provide an approach to assess catchment residents’ views on reservoir ecosystems, by using the SWOT framework as a consultation tool to support water management issues. The objectives were: (i) demonstrate how a consultation-based SWOT analysis can be used to identify key issues relevant to reservoir ecosystem water management, (ii) capture possible relationships between key stated issues and respondents socio-demographic characteristics and
type of reservoir ecosystem uses, and (iii) discuss the relevance of such a research approach for the sustainable management of water resources.

**Study Area**

**Regional Context**

The study area is located in Sado Hydrographic Region (12,147 km²) in the Alentejo Region. This is the largest province of inland Portugal, situated in the south of the country with a Mediterranean climate (see Fig. 1a). The dominant rural areas are characterized by an ageing population, low literate levels, and low diversity of economic activities (Mira da Silva et al. 2001; Santos et al. 2006). Nevertheless, the study area comprises the contrast between a quiet environment and a recreational area. Improving the multiple uses of such reservoir ecosystems (particularly for leisure/recreation) could be a way to achieve a more diversified economy and a higher social value for the region.

**Water Issues and Management**

Reservoirs are the most important lentic water bodies in Portugal, providing a significant amount of water for irrigation, domestic supply, energy generation, fishing, and recreational purposes (Matias et al. 2008). However, eutrophication has been recognized as a serious water quality problem throughout the region of Alentejo (Matias and Boavida 2005; Diogo et al. 2008). The basic demand of having sufficient quantity of water is also a major concern for governmental authorities at Sado Hydrographic Region (INAG 2009a).

In Portugal the socio-natural complexity of catchment dynamics is still systematically neglected in favour of top down, prearranged management responses (Ioris 2008; Matias et al. 2008). The mainstream rationality relies on scientific expertise as the source of ‘truth’ that cannot be questioned, but serves to identify problems and formulate management solutions (Ioris 2008). In particular, participation in the governing and management of water resources at the catchment level is restricted to agencies and to those users having an economic stake (e.g., hydropower, agriculture, household water supply companies, industrial enterprises; Matias et al. 2008).

Consultation, public hearings, and information dissemination are considered to be current practices in the Portuguese water management arena. However, there is a widespread opinion among those involved in water management (e.g., public officials, water experts, environmentalists, and other water users) that these public participation mechanisms have had an ineffective contribution to water management and to the implementation of water policy (Vasconcelos 2007). Catchment populations also frequently express frustration, arguing that those mechanisms do not allow issues to be properly discussed and that the responses are often made with specific economic interests at heart (Matias et al. 2008). Thus those methods of engagement appear to be perceived as formal legal practices, with catchment populations only ‘participating’ in strategic decision-making in marginal ways and at predetermined points.

For example, during public consultation regarding the elaboration of River Basin Management Plans, people are initially invited to formally submit comments and/or concerns about water management issues (INAG 2009a).
and are only given the chance afterwards to attend organized events to discuss the River Basin Management Plan draft proposed by experts. Most people affected by the water management decisions are not able to attend these ‘centralized’ meetings, and are therefore repeatedly excluded from discussions. In addition, direct consultation on catchment populations has never been done at the study area.

Another example was a recent round of discussions with public officials, delegates from electricity and water supply companies, and private consultants about the implementation of the WFD. This completely left out the general public, and in particular catchment populations that are affected by water management decisions (Ioris 2008).

**Reservoir Ecosystem Characterisation**

Odivelas Reservoir was built in 1972, and has been exploited since 1991 by the Odivelas Farmers’ Association (Fig. 1b). The maximum water storage volume of the reservoir, spreading over 9.73 km², is 96.0 million cubic meters. The reservoir is included in the Multipurpose Alqueva Project, involving a significant area of agriculture in Alentejo. The reservoir water is primarily used for irrigation: supplying water to an area of 124.51 km² of agriculture land (outside the catchment area). The reservoir and its surroundings are also used for recreation. The direct influence of these activities is high in summer - between 100 and 150 recreational users per day during this period (Matias Unpublished data). Motor sports are not allowed, and motor boating is allowed only with restrictions. Further, the Odivelas reservoir ecosystem is considered an important area for bird and wildlife habitat; it constitutes an ‘attraction point’ for the European otter in terms of water and prey availability, especially during summer when Mediterranean lotic systems usually dry up (Pedroso and Santos-Reis 2006).

Agriculture dominates land use within the Odivelas catchment. Further, the evergreen oak woodlands form an important multiple use agro-silvo-pastoral system, the Montado (Meeus et al. 1990). Forestry (e.g. cork harvesting) and extensive grazing are the dominant exploitation activities on these Montado areas. Data from the surveillance system (INAG 2009b; 1999-2008, N = 10) show no clear trend of water quality improvement in recent years (Fig. 2).

The inventory of water-related problems include: water pollution from sewage treatment operations and farming activities, water level fluctuations because of climatic conditions and perennial water abstraction for irrigation, and inadequate control and monitoring activities regarding sewage treatment operations and water quality (INAG 2009a). The use of water for irrigation has been causing particular concern in regards to the upstream Alvito Reservoir which stores water for domestic supply purposes, since it may result in increasing negative impacts (e.g. loss of river continuity and water quality), as well as affecting recreational users of the beach during the summer months because of low water levels. Management measures include: the preservation of the landscape’s beauty and tranquility by supporting leisure and outdoor activities in balance with nature conservation, enforcement of water quality monitoring, control of sewage treatment operations, and projected areas for development of further infrastructure (e.g., sustainable rural tourism, environmental education centre, a youth centre, and an additional leisure area) in order to promote sustainable use of the reservoir and surrounding area (INAG 2009a, 2009c).

**Fig. 2.** Annual variation of total phosphorus and chlorophyll a concentrations between 1999 and 2008 (all figures shown between brackets refer to geometric means). Horizontal lines refer to trophic state classification boundaries: TP < 10.0 mg m⁻³ = oligotrophic, 10 mg m⁻³ < TP < 35 mg m⁻³ = mesotrophic, TP > 35 mg m⁻³ = eutrophic; CHLa < 2.5 mg m⁻³ = oligotrophic, 2.5 mg m⁻³ < CHLa < 10.0 mg m⁻³ = mesotrophic, CHLa > 10.0 mg m⁻³ = eutrophic (INAG 2009b).
Methodology

The SWOT Analysis

In SWOT analysis, water resources and their potential use are studied from the viewpoints of economic, ecological, and social sustainability, in order to support the decision making process (Srivastava et al. 2005). It is generally based on a structured brainstorming session aimed at eliciting group perceptions of the positive factors (strengths), the negative factors (weaknesses), the possible improvements (opportunities), and the constraints (threats) of a given initiative with respect to the external environment (Borrini-Feyerabed et al. 2000). SWOT is a very efficient way of identifying strong and weak points, and of examining the opportunities and threats of certain area or resource (Lozano and Valles 2007) in the preliminary stages of decision-making or strategic planning processes (Srivastava et al. 2005).

SWOT has been widely applied to environmental management and planning (e.g., European Commission 1999; Vonk et al. 2007; Nouri et al. 2008). In particular, it is an approach which might be profitably used in the management of freshwater resources at a time when the human impacts on them are unprecedented (Moss 1992). The SWOT analysis has been applied in the optimization of water resource management (Doummar et al. 2009), in modeling activated sludge systems (Sin et al. 2005), to characterize a drainage basin (Petříková 2003), and to appraise groundwater resources sustainability (Diamantopoulou and Voudouris 2008).

Research Approach

Some researchers have applied a participatory SWOT framework to identify relevant issues for the sustainable management of a resource or situation (e.g., Mollenhorst and de Boer 2004; Srivastava et al. 2005; Ferreyra et al. 2007). However, sensitive topics and differences of opinion may arise during the discussions, and some group members may attempt to dominate both the debate and discussed issues (Borrini-Feyerabed et al. 2000). Alternative community oriented techniques (e.g., citizen juries, focus groups, public hearings, foresight seminars, etc.) may show additional disadvantages for the purpose of this study. Mainly, they may not ensure representative participation, selection criteria may create bias in eliciting opinions, and there is potential for ideas/opinions to be influenced/shaped by interaction with others – especially those with more dominant voices (Involve 2005).

The use of SWOT analysis framework adapted for a catchment consultation exercise is particularly appropriate for the evaluation of the reservoir ecosystem. It allows the local populations’ knowledge and understanding of the reservoir ecosystem to be obtained in a non-confrontational manner (Matias et al. 2008). Confidential interviews held between the interviewer and each participant in the catchment residents-based SWOT analysis provide a ‘safe space’ for people to reflect on their own individual experience, and express any concerns they may not feel comfortable bringing to the attention of a group. Bringing multiple perspectives into the SWOT analysis maximizes the possibility of exploring a wider range of relevant issues (Mollenhorst and de Boer 2004).

The approach used in this study was selected because: (i) it is community oriented – it is open to participants from all sectors of the study area, (ii) the data collection process is not overly long and complex, (iii) it promotes the understanding of multiple (or even contradictory) views and helps to set the basis for future negotiations and trade-offs, and (iv) it is straightforward enough to be adopted by water management agencies for future use with minimal assistance. This last point is quite important as water managers may be interested in learning about techniques that would reach local social actors who had not typically been a part of their traditional public involvement processes.

Sampling Criteria and Procedure

The WFD Guidance on Public Participation (European Commission 2003) states that ‘consultation aims at learning from comments, perceptions, experiences, and ideas of stakeholders and citizens’. In particular, the focus of this study is on identifying the salient and plural viewpoints and local priority issues. The decision was made to work with local social actors instead of stakeholders groups (e.g., organizations, institutions, etc.), because such an approach would result in a lack of participation from certain social groups (e.g., women, older people, recreational users, students, etc.) in the research sampling process.

In this context, participants do not act as formal representatives of groups or interests, but as lay assessors reflecting a cross-section of the community. Individuals take part as members of society, in their capacity as citizens (Meadowcroft 2004). Since there can be considerable discrepancies between managers’ (decision-makers) and stakeholders groups’ beliefs, and values held by the public (Miller and McGee 2001), investigating local social actors’ views on reservoir ecosystem was considered crucial to promote an inclusive and sustainable water management.

The local social actors sampled were catchment residents 16 years old or greater, and selected at random to participate. The survey questionnaire was conducted in the study area from August to September 2008 in order to obtain a representative socio-demographic sample of the catchment residents. Interviews were conducted at different hours of the day and at different days of the week to gather responses from a range of ages, gender, phases in the life cycle, and livelihoods. Respondents were approached individually through face-to-face interviews, and after a brief introduction to the survey aims, answered the questions orally.
Sample Characterisation

523 catchment residents were surveyed (sampling error $\pm 3.81\%$ at the 95% confidence interval), of which 54% were women. The age range varied from 16 to 93 years old ($M = 48.95, S.D. = 19.41$). About 53% of the respondents had received primary or secondary school education, 13.6% did not complete primary school, and 10.1% were illiterate (the last group was largely comprised of higher age classes). The occupational structure of respondents was clearly dominated by people working in the services sector (53.4%), followed by pensioners (35.9%), students (8%), and farmers/agricultural workers (4.4%). The gender ($\chi^2 = 0.77, d.f. = 1, p = 0.38$) and age ($\chi^2 = 5.28, d.f. = 2, p = 0.07$) of the survey sample were similar to the general population of the study area: there were proportionately less illiterate respondents individually to state in sequence the ‘strength’, ‘weakness’, ‘opportunity for development’, and ‘threat’ to the reservoir ecosystem; ‘I want you to think about the Odivelas Reservoir and surrounding area. Please tell me what you consider to be the main strength (weakness/opportunity for development/threat) of the Odivelas Reservoir and surrounding area.’

Respondents were asked open-ended questions, allowing them to expand in their own words on their survey responses. Identification of relevant issues per group (namely strengths group, weaknesses group, opportunities group, and threats group) was one for each respondent. Additionally, respondents were asked about reservoir ecosystem uses on a 5-point Likert scale (ranging from 1 = ‘Never’ to 5 = ‘At least twice a week’) as well as to state the time of year they undertake in each activity.

SWOT Data Analysis

The results of the SWOT analysis provided a summary of the catchment residents’ views about the reservoir ecosystem. Based on their answers, a set of themes were developed in order to allocate the responses in categories with similar meaning (de Vaus 2002). As per the methodology (European Commission 1999), SWOT analysis classifies the internal aspects of the considered resource as strengths or weaknesses and the external situational factors as opportunities or threats. The stated strengths and weaknesses of the Odivelas reservoir ecosystem refer to things as they stand today (internal issues), and opportunities to be seized and threats to be averted in order to optimize its future (external issues).

A multiple correspondence analysis (MCA) was used to map and reveal systematic patterns among the categories of the SWOT stated issues, as well as their association with socio-demographic characteristics and type of reservoir ecosystem uses as ‘supplementary’ variables. The respective categories are placed by the MCA at the centre of the subset of active modalities (i.e. SWOT stated issues) to which they are closest associated. However, the relations of the ‘supplementary’ variables between themselves must be ignored because they did not participate in axis construction.

The MCA seeks to summarize the associations between a set of categorical variables and to display these associations graphically. Categories that are closely associated will lie close together in a ‘map’ of the relationships between categories, while those which are not will lie in different ‘regions’ of the space (Phillips 1995). By overlaying the categorical variables (in this case, the SWOT stated issues) the interconnections can be usefully unravelled in a readily accessible form which does not demand statistical expertise (Gayo-Cal et al. 2006). Also, the MCA does not try to confirm or reject hypotheses about underlying processes that generated the data (Claussen 1998).

The projected ‘map’ of the relationships between the SWOT stated issues suggested a five-cluster structure. To verify the suggested ‘types of responses’, the object scores generated by the MCA were entered in a Hierarchical Cluster Analysis (Squared Euclidean distance and Ward’s aggregation method) and then in a K-Means Cluster Analysis to validate and optimize the five-cluster solution, respectively (Carvalho 2008). The statistical analyses were performed with SPSS® version 15.0.

Results and Discussion

The survey results indicated that only a small proportion of respondents used the reservoir for economic related activities (e.g., livestock drinking water, livestock grazing, and irrigation) and these continued throughout the year. In addition, the majority of respondents favoured passive forms of recreation (e.g., walking/sightseeing, relaxing, and picnicking), with fishing and swimming the following most favoured activities (Fig. 3). Not surprisingly, recreational use of the reservoir was higher in late spring and summer than autumn or winter.

Overall, the SWOT analysis showed that respondents stated quite similar key issues relevant to reservoir ecosystem water management: Strengths group = 7, Weaknesses group = 10, Opportunities group = 9, and Threats group = 8 (of a maximum of 523 possible different stated issues per group). The MCA yielded a two-dimensional solution with a good consistency (shown by the respective Cronbach’s $\alpha$ values), with the first dimension explaining 18% and the second dimension 14% of the total inertia variance (Table 1). The characterisation of each cluster regarding the SWOT stated issues (Fig. 4) and associated ‘supplementary’ variables (Fig. 5) are presented and discussed below.
Five clusters of response categories among SWOT stated issues are evident:

- **Cluster 1**: Focuses mainly on the use and importance of the reservoir ecosystem for agriculture. The reservoir’s irrigation value was considered the strong point of the reservoir ecosystem: this may reflect the fact that agriculture was typically perceived as the most important economic activity in this rural area. The excess of water used for irrigation (by farmers outside the catchment area) and consequent low water levels were seen as negative aspects. This can be explained by the widely fluctuating water levels that are a result of adverse climatic conditions (the stored water volume suffers a marked reduction during summer) together with perennial water abstraction for irrigation. The abandoned farm land was another negative aspect highlighted by these respondents.

- **Cluster 2**: Focuses on existing qualities/amenities at the study area for recreation. This may reflect the fact that most of these respondents tended to be recreational users of the reservoir ecosystem (mainly for fishing, motor boating, swimming, and walking/sightseeing). The highly valued aesthetic qualities and tranquility of the area is not surprising, as water is one element which has a strong positive attraction for people (Kaplan and Kaplan 1982), and the stated importance of the area as a place for recreation and socializing probably exists because of the physical features (i.e., the presence of trees/shaded areas) and existing infrastructure (i.e., beach, campsite, coffee house, picnic park, and playground). Promotion of information and environmental education campaigns about the reservoir ecosystem was also considered an essential issue by these respondents. In terms of respondents’ profile, this cluster was principally characterized by female respondents, people with lower-or upper-secondary school education or a university degree.

Respondents considered local investment in irrigation infrastructure to be important for catchment farmers. The importance of addressing multiple stakeholder objectives and problems in water resources management was also noted, indicating the underlying disappointment about the recent construction of irrigation infrastructure without consideration of their land. The drought/lack of water was the threat most commonly cited. This reflects the fact that the study area is located in a semi-arid region with a four to five month period of water stress, where its inhabitants have experienced water shortage problems over the years. In addition, forest fires and abandonment of agriculture were also perceived threats.

This cluster was principally characterized by male respondents and people with no formal education: employers/self-employed respondents in the services sector, farmers, pensioners, people over 61 years of age, and respondents that use the reservoir ecosystem for economic related activities (e.g., irrigation, livestock drinking water, and livestock grazing).

### TABLE 1. Multiple correspondence analysis: model summary

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<th>Variables</th>
<th>Discriminate measures</th>
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<td>Dimension 2</td>
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<td>0.71</td>
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<td>SWOT threats</td>
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<tr>
<td>Inertia</td>
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<td>0.54</td>
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<td>(Cronbach’s Alpha)</td>
<td>(0.77)</td>
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*The percentage of the variance explained by each dimension when using this method is known to under evaluate the information summarized, so the percentage of explained variance of each dimension was calculated using the Benzecri’s formula (Abdi and Valentin 2007).*
Catchment residents-based SWOT analysis of a reservoir ecosystem

Fig. 4. Multiple Correspondence Analysis of SWOT reservoir ecosystem key issues to water management: ■ Strengths; ▲ Weaknesses; ◆ Opportunities for development; and ◆ Threats. Clusters (grey dashed circles; ◆ cluster centroid): Cluster 1, n = 67 (12.8%); Cluster 2, n = 88 (16.8%); Cluster 3, n = 164 (31.4%); Cluster 4, n = 67 (12.8%); Cluster 5, n = 137 (26.2%).
● Cluster 3: Focuses on socio-economic issues in relation to the reservoir ecosystem. The perceived importance of water resources for local populations may be related to the potential economic benefits of the reservoir ecosystem. The non-existence of services related to tourism (and publicity/promotion of the area), lack of recreational infrastructure (e.g., lifeguards and safety equipment, green areas, etc.), and lack of outdoor activities were all perceived weak points. Respondents considered local investment to be important, particularly in services related to: sustainable rural tourism, recreational infrastructure at the reservoir (e.g., lifeguards, improved accessibility, more green areas), promotion of outdoor activities (e.g. water sports), and local transport services during late spring and summer. Young people leaving for bigger towns was considered the greatest threat; respondents felt this had serious social and economic consequences for the local community. Low levels of economic growth locally and lack of investment were also noted as economic related threats to the reservoir ecosystem. This cluster shared some of ‘Cluster 1’ respondent characteristics, namely, respondents with no formal education and pensioners.

● Cluster 4: Focuses on concerns about littering and litter management of the area. In particular, the presence of litter in the reservoir area was considered a weak point. Respondents stressed that in order to really make a long-term impact on the problem and respond effectively to community needs, it was essential to take a combined approach together with effective public awareness, to: tackling litter, utilizing education, developing efficient litter removal and cleaning services, and targeted enforcement. Some respondents also considered the lack of respect towards the environment and the littering of the area by local users threats to the reservoir ecosystem. This cluster was principally characterized by some of the characteristics of ‘Cluster 2’: mainly female respondents, full-time employees in the services sector, and aged 16-60 years old.
● Cluster 5: Focuses on issues about reservoir water quality and management. ‘Poor water quality’ was perceived as the greatest weakness of the reservoir ecosystem. Partly related to this, is the recurring water pollution issues observed by respondents (e.g., livestock grazing near streams and the reservoir, the use of motor boats and watercrafts, deficient sewage treatment operations) and the inadequate reservoir water management.

Respondents highlighted the need to mitigate the poor water quality by ensuring adequate control on sewage treatment operations and preventing livestock grazing in the vicinity of streams and the reservoir. The pollution of water as a result of deficient sewage treatment operations, livestock grazing in the vicinity of streams and the reservoir, the use of motor boats and watercrafts at the reservoir, and farming in the surrounding areas of the reservoir, were all considered threats to the reservoir ecosystem.

This cluster was principally characterized by respondents with second cycle of basic education or professional qualification, agricultural workers, and recreational users of the reservoir ecosystem (mainly for boating/canoeing/sailing, watching nature/wildlife, picnicking and relaxing).

The MCA provided a simple and quick method for representing the relations among the SWOT stated issues, as well as the associations with respondents’ characteristics. The SWOT analysis responses of catchment populations suggest several environmental, social, and economic considerations, for the management of the reservoir ecosystem. Respondents highlighted the importance of water resources for irrigation, the aesthetic qualities and tranquility of the reservoir area, and its importance for ‘recreational’ related activities and socialization.

Respondents also mentioned the negative impacts (e.g., sewage treatment operations, livestock grazing near the reservoir, littering and behaviour of users, agriculture, peripheral location, etc.) on the reservoir ecosystem and how they believe these impacts can be mitigated (e.g., control of sewage treatment operations, buffer zones preventing livestock grazing near reservoir banks, environmental education, etc.). In addition, respondents regarded the creation of facilities for sustainable rural tourism and on-site recreational activities as essential, feeling it would help promote job opportunities, development of the local economy, and also encourage involvement of local young people.

Overall, respondents’ considerations reveal a considerable balance between the demands for development and environmental consciousness. Since some of the above issues are foreseen in the reservoir ecosystem management plan, the results of this consultation exercise suggest (as discussed earlier) that the communication and processing of information about water management takes place within a centralized ‘techno-bureaucratic’ institutional system.

The remainder of this section discusses some of the key findings from the application of this method by comparing them with some relevant literature. For example, the analysis of five water related projects regarding the application of participatory processes for the sustainable river basin governance showed that the consultation techniques used (public hearings and public comments) fell short of including the interests, perceptions and values of the participants (Antunes et al. 2009). In contrast, respondents of the present study felt consulted and valued, positively surprised by the scope of the survey, and stated that they were able to say what they considered to be important about the reservoir ecosystem key issues.

In another public consultation study, participatory modeling workshops used in the scope of basin problems, pressures, and impacts (Videira et al. 2009) showed that the participation rate decreased dramatically over the workshops, and therefore that the model failed to achieve full potential in terms of engaging people. In contrast with the participants of the present study, those participants may well have regarded time-consuming modeling events as relatively unimportant, especially given the travel costs to attend the meetings. Also, the issue of representation - one of the major weaknesses of participatory modeling workshops - was another strong point of the consultation-based SWOT analysis experience. This may be explained by respondents’ feeling that in such a consultation approach they could speak about their own individual experience without the constraints of a group discussion.

Furthermore, most of the previous applications of the SWOT analysis framework (e.g., Sin et al. 2005; Diamantopoulou and Voudouris 2008; Doummar et al. 2009) for managing water resources were based on problems, pressures, and impacts, determined solely by experts/researchers. In contrast, this paper build on a consultation-based SWOT analysis to describe the development and application of a technique to scope the issues regarding water resources (and/or freshwater ecosystems) as perceived by local populations, which may also be integrated into experts/researchers analysis.

Conclusions

The catchment residents-based SWOT analysis has helped to identify the strengths and weaknesses of the reservoir ecosystem and the issues that matter most to people, which suggests some important considerations and challenges to the sustainable management of water resources:

- The primary advantage of ensuring representative participation is for decision-makers to get an accurate picture of the range of knowledge and thoughts about a particular issue. In this study, catchment populations stressed that formal, legally required participation methods in decision making do not incorporate a broad
spectrum of the public. Rather, these methods often discourage busy and thoughtful individuals from wasting their time going through what appear to be nothing more than rituals designed to satisfy legal requirements. However, respondents felt the approach used in this study to be simple, stimulating, and inclusive.

- One premise of participation lies in the assumption that the integration of plural perspectives may lead to better decisions by creating a holistic view of key issues (Laird 1993; Videira et al. 2009). The consultation-based SWOT analysis helped collect and structure the diversity of ideas, and knowledge and opinions of catchment residents about the reservoir ecosystem. Consequently, valuing and harnessing local knowledge and locally perceived needs about water resources can lead to greater public involvement, and promote environmental citizenship and social learning.

- The evaluation of the above mentioned elements of the catchment residents-based SWOT analysis may give decision makers and water managers’ new insights into choosing the most appropriate strategies for sustainable water resource management of the reservoir ecosystem. Nevertheless, an interesting development of this study would be presenting the results of the survey to a range of stakeholders (representative of users’ interests, such as farm lobbies) and water managers (e.g., from the National Water Institute and Alentejo Hydrographic Region Administration) to compare and contrast the possible discrepancy between decision-makers and stakeholder groups.

- Finally, the endeavour of this exercise was to provide a framework to facilitate the participatory analysis of reservoir water management in which multiple local social actors’ perspectives can be represented and explored. The perceived value of such a consultative practice lies not in the fact that the public has any direct involvement in, or control over, decision making. Their potential lies instead in features such as the information they provide to decision makers, the legitimacy they add to policy outcomes, and the positive effect they have on civil society. As each public participation method has advantages and disadvantages, a combination of methods appropriate to different decision-making needs vis-à-vis policy or planning stages, appears a much better strategy than relying on a single method (Kallis et al. 2006). There is no reason why the in-use open call for public views and public hearings about water issues cannot be complemented by such a straightforward public consultation exercise, as well as integrating it at scoping stage with other participatory approaches (namely, participatory modeling workshops).

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