www.trjfas.org
ISSN 1303-2712
Turkish Journal of Fisheries and Aquatic Sciences 14: 135-144 (2014) DOI: 10.4194/1303-2712-v14_1_15

Recreational Fisheries in Rural Regions of the South-Western Iberian Peninsula: A Case Study

José L. Pérez-Bote[1,*], Rafael Roso[1]

[1] University of Extremadura, Faculty of Sciences, Zoology Unit, Freshwater Ecosystems Investigation Group, 06071, Badajoz, Spain.

* Corresponding Author: Tel.: +34.924 289427; Fax: +34.924 28941;
E-mail: jlperezbote.university@gmail.com

Received 22 July 2013
Accepted 17 January 2014

Abstract

The human dimension of recreational fishing has gained interest worldwide during the last decade for proper management of the natural resources. However, in many rural regions in Southern Europe, the social and economical aspects of recreational fishing remains poorly studied. In this study we conducted a survey to cover this gap of knowledge and draw potential management recommendations for proper exploitation. A survey of recreational fishing was conducted during the 2008-2009 fishing seasons. Data were collected following creel survey procedures and responses to 171 interviews were analyzed for 27 variables. To associate these variables a categorical principal components analysis (CATPCA) was performed. On the first CATPCA axis (44.24% of variance), the correlations among variables showed an "economic" dimension. The most influential variables in this dimension were expenditure, the season, and number of fishing days per year, together with the distance travelled to fishing sites. The second dimension (24.47% of variance) was related to the preferred species, the gear necessary to catch them, and with facility off access to sites where these species are found. The data showed some differences between both young and old fishermen with respect to the variables analysed.

Keywords: Recreational fisheries, anglers, attitudes, sociological characteristics.

Introduction

Recreational fishing has been described as the ritual pursuit of pleasure associated with the experience and such experience is one of the most prized conditions of being human (Kellert, 1984). There are two principal components to be considered; a fishing factor which includes the number and size of fish caught, and a recreational factor which includes non-catch components such as personal satisfaction. According to this management of recreational fisheries means knowledge of the human dimension; however this knowledge is specially lacking in rural areas (Arlinghaus *et al.,* 2008). In addition in many places, recreational fishing is now big business and can be important both in contributing to rural economy and in providing social benefits in urban and rural areas. It is also increasingly recognized that recreational fishing fulfils a valuable role in raising environmental awareness of wildlife and the environment (Hinckley and Tompkins, 1998).

The importance has been emphasized of aquatic resource planning as a tool to aid the management of recreational fishing on a sustainable basis in multiresource user situations (cf. Hinckley and Tompkins, 1998). Such a process must take into account all aspects of the fisheries sector including its social, legal and administrative, economic, and ecological dimensions (Marta *et al.,* 2001). Special attention should be given to the human dimension to guide both scientists and fisheries managers, whilst taking into account biodiversity and sustainabilily (Aas and Ditton, 1998). In this sense it is well-recognized that communities are not homogeneous: a community cannot be considered a single uniform interest group (Chipman and Helfrich, 1988). There are often gender, ethnic, and socioeconomic tensions within a community (Berkes *et al.,* 2001; Salmi *et al.,* 2000; Cowx and Van Anrooy, 2010). This implies that policies and management plans must take into consideration not only the fish component, but also the users of the resources. Therefore, identification of user groups and their characteristics is essential for the establishment of appropriate management policies and strategies (Vigliano *et al.,* 2000).

The importance of recreational fisheries in Iberian freshwaters has been described by various authors (Asensio, 2001; Marta *et al.,* 2001; Clavero *et al.,* 2002; Pérez-Bote *et al.,* 2004). However, only Marta *et al.* (2001) and Pérez-Bote *et al.* (2004)

examine attitudes and sociological characteristics of anglers in the south-west Iberian Peninsula. The objective of the present study was to conduct a creel survey to characterize the anglers that exploit the fishery resources in the Autonomous Community of Extremadura (Spain).

Materials and Methods

Study Area

The Autonomous Community of Extremadura (ACE) is located in the southwest of Spain (area 41,643 km^2, mean altitude 400 m) and is dominated by a Mediterranean-type climate with most rainfall in spring and autumn (average annual rainfall ranges from 450 to 1000 mm, about 90% from November to April; mean temperature: 13.5-17.0ºC). The ACE is traversed from north-east to south-west by the third (River Tagus) and fourth (River Guadiana) the largest rives of the Iberian Peninsula.

The fish fauna of the ACE comprises 34 species (20 native, 14 introduced), belonging to 15 families (Pérez-Bote *et al.,* 2005). Of those, 22 are present in the Tagus basin (11 native, 11 introduced) and 27 in the Guadiana basin (15 native, 12 introduced). The main species of sport interest are cyprinids: barbels (*Luciobarbus bocagei, L. comizo, L. microcephalus, L. steindachneri*), carp (*Cyprinus carpio*), goldfish (*Carassius auratus*), Iberian nase (*Pseudochondrosoma polylepis, P. willkommii*); and predators: largemouth bass (*Micropterus salmoides*), pikeperch (*Sander lucioperca*), pike (*Esox lucius*), and European wells (*Silurus glanis*).

In the ACE there are between approximately 120,000 and 150,000 fishing licenses (Junta de Extremadura, 2005).

Data Collection

Data were collected following creel survey procedures as described by Malvestuto *et al.* (1978) and Malvestuto (1983) during the 2008-2009 fishing seasons (March-November). Anglers were interviewed at reservoirs (46%), rivers (42%), fishing clubs (9%), and other places (fishing shops, cafes, home, 3%). The percentage of respondents in relation to the total number of anglers varied from 100% (rivers and some sections on reservoirs, fishing clubs and other places) to 35% (some weekends with a high number of fishers on fishing places or fishing competition days). All the surveys were done in the shorelines or in the authorized landing areas (fishing recreational boats). Only the 3% of fishers refused to be surveyed. A total of 27 qualitative variables with differing categories were used (Table 1). Questions included sociological, attitudinal, and management items. Sociological items included employment situation, gender, age, maximum distance travelled to fishing places, and trip objective. Attitudinal items included angling and personal satisfaction. Questions related to angling dealt with time spent fishing per day and during the year, preferred season, fish preference and reason for preference, preferred fishing site, gear and bait, years of experience, and expenditure. Questions related to personal satisfaction dealt with escape from daily routine, number and size of fish caught, site chosen because of natural beauty, ease of access, and good climate. Management items dealt with the destiny of fish captured, the knowledge of native/invasive species, impacts of invasive species, and the establishment of no-fishing periods. Questions used to evaluate personal satisfaction were scored according to three categories: not important, little importance, and important. Finally, we asked the anglers for suggestions to improve their sport fishing. These suggestions were not included in the subsequent analysis. The matrix (Table 1) consisted of 171 fishermen (rows) and the categories of 27 variables (columns).

Statistical Analysis

The use of questionnaires to characterize the socio-environmental conditions of a household and the neighborhood led to a difficulty in summarizing such a sizeable bulk of information in a few interpretable indicators. The techniques available to reduce the dimensionality of a multivariate matrix have been traditionally restricted to the nature of the variables to be used (Gamboa *et al*., 2011). Principal Component Analysis (PCA) is a well-known technique to display relationships between cases associated through a set of variables. For (ordered and unordered) categorical variables, PCA is not strictly appropriate, although these variables are often treated as being numerical. In the case of ordered categorical data, the more appropriate technique to use is Categorical Principal Component Analysis (CATPCA), in which the category values are replaced by optimal scores (Heiser and Meulman, 1994). The result of this form of analysis is a new low-dimensional space of variation in which variables and observations can be projected. This method extracts K number of dimensions, called components, from an original M number of variables. An advantage of this method is that it allows the use of variables that are at different levels of measurement (Calero *et al.,* 2008). The analyses were performed using SPSS (Version 11.0, SPSS Inc. 2000).

Results

We interviewed 171 anglers, of whom 159 (92.98%) were men and 12 women (7.02%); 85.38% of them came from towns. Most of the anglers were employed (74.27%), and most (93.57%) were adults of age between 20 and 60 years (Figure 1a). Few (6.43%) were younger than 20 years old. Most travelled between 20 and 100 km to the fishing sites,

Table 1. Variables and their categories used to describe fishermen sociologically and evaluate their attitudinal features in Extremadura (Spain)

Variable	Variable	Category
1	Age (Age)	< 20
		20-30
		30-40
		40-50
		50-60
		> 60
2	Employment situation (Empl.sit)	Work
		Do not work
3	Gender (Sex)	Male
		Female
4	Maximum distance to fishing places (km) (Tr.dist)	< 10
		10-20
		20-40
		40-50
		50-100
		100-200
		> 200
5	Trip objetive (Tr.obj)	Fishing
		Other
6	Preferred sites to fish (Fish.site)	River
		Reservoir
		Both
7	Preferred season for fishing (Season)	Spring
		Summer
		Autumn
		Winter
		Spring-summer
		All
8	Time fishing per year (days) (Ti.fish.y)	5-10
		10-20
		20-30
		30-50
		50-70
		70-100
		> 100
9	Time fishing per day (hours) (Ti.fish.d))	< 2
		2-4
		4-6
		6-8
		8-10
		10-12
		> 12
7	Preferred fishing mode (Fish.mode)	Shore
		Boat
		Belly boat
10	Fish species preferences (Species)	Cyprinids
		Predators
		Salmonids
		All
		Cyprinids-predators
12	Reason for preference (Re.pre)	Fighting
		Combativity
		Fighting-combativity
		Size
		Taste
		None
13	Preferred fishing gear (Fish.ge)	Cyprinids
		Predators
		Both
		Flyfishing
		Carpfishing
14	Bait type (Bait.ty)	Artificial
		Natural
		Live
		Artificial-natural
		Artificial-live
		Natural-live
		All
15	Years of experience (Year.exp)	< 2
		2-5
		5-10
		10-15
		15-20
		20-25
		25-30
		30-35
		35-40
		> 40
16	Expenditure (euro) (Exp)	< 100
		100-300
		300-600
		600-900
		900-1200
		> 1200
17	What do you do with catches? (Catches)	Release (all)
		Release (some)
		Sold
		Gift
		Eat
18	Do you know native fish species? (Native)	Yes
		No

Table 1. Continued

Variable	Variable	Category
19	Do you know invasive aquatic species? (Invasive)	Yes
		No
20	Do you know the impact of invasive species on native ones (Impact)	Yes
		No
21	Dou you think that no-fishing periods are necessary to mantain the natural equilibrium of the rivers? (Fish.reg)	Yes
		No
	What are your motivations and requirements to fish?	
22	Fishing as a way of escaping daily routine (Esc.rou)	Important
		Little importance
		Not important
23	Number of fish caught (Nu.fish)	Important
		Little importance
		Not important
24	Size of fish caught (Siz.fish)	Important
		Little importance
		Not important
25	Ease of acces to site (Sit.acc)	Important
		Little importance
		Not important
26	Good climate (Climate)	Important
		Little importance
		Not important
27	The environment (Env)	Important
		Little importance
		Not important

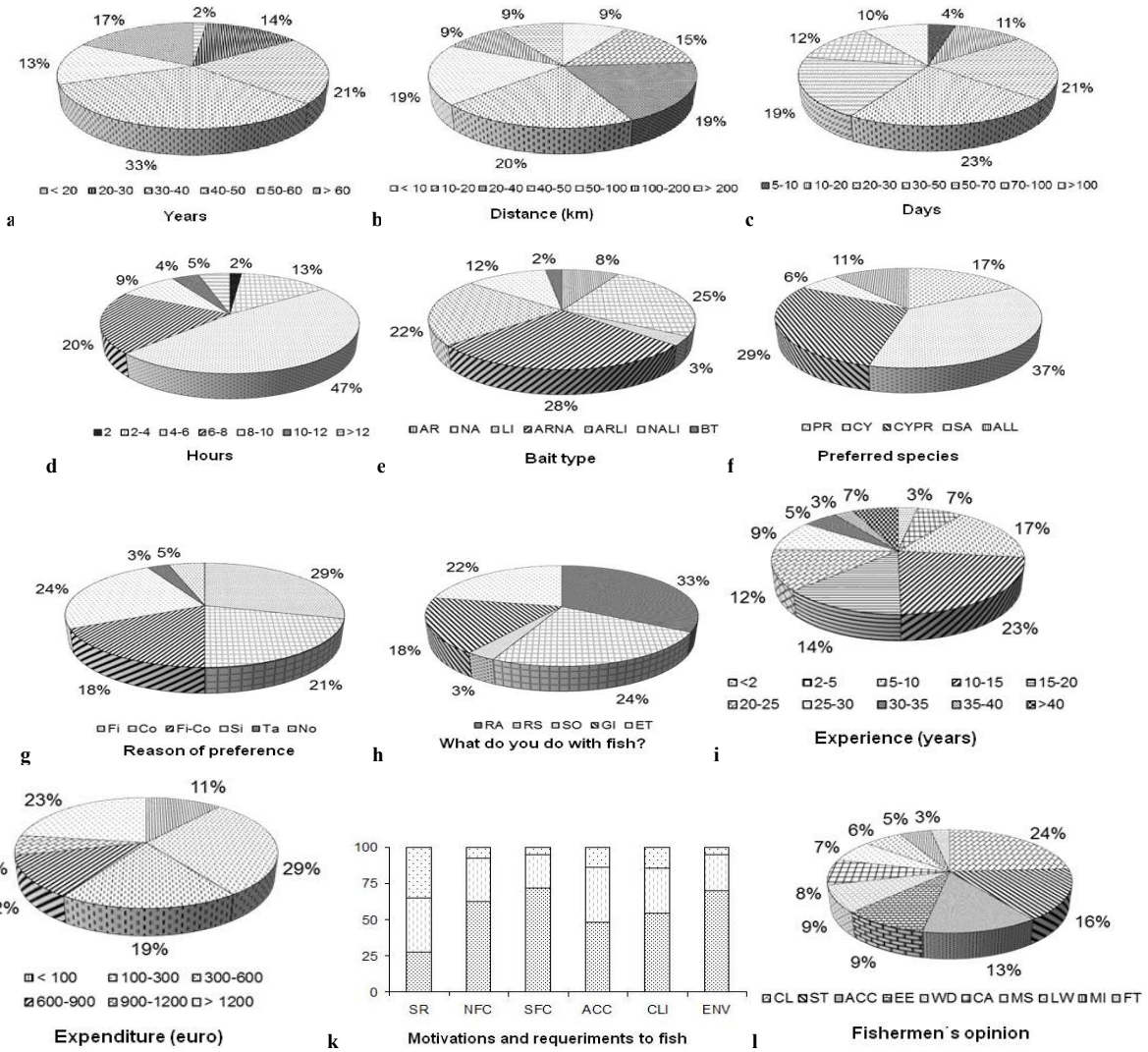

Figure 1. Diagrams showing the response (y axis, in %) of fishermen to the survey questions: a) age; b) distance travelled; c) days of fishing; d) hours of fishing per day; e) bait type (AR: artificial, NA: natural, LI: live); f) preferred species (CY: cyprinids, PR: predators, SA: salmonids); g) reason for preference (FI: fighting, CO: combativity; SI: size; TA: taste; NO: none); h) what do you do with fish (RA: release all; RS: release some; SO: sold; GI: gift; ET: eat); i) experience; j) expenditure; k) motivations and requirements for fishing (SR: escape from daily routine; NFC: number of fish captured; SFC: size of fish captured; ACC: facility of access to fishing sites; CLI: climate; ENV: environment; (important; less important; not important). l) Measures to improve fishing (CL: cleaning of fishing sites; ST: stocking; ACC: facility to fishing sites; EE: eradication of exotics; WD: water depuration; CA: caution of waters; MS: respect the minimum size of fish; LW: law enforcement; MI: more information; FT: illegal fishing).

with a peak between 40 and 50 km (Figure 1b). The main purpose of the trip was to fish (70.18%). Anglers prefer to fish in both rivers and reservoirs (36.84%), only in reservoirs (34.50%), or in rivers (28.65%). Most (37.43%) fish throughout the year or during the hottest months (30.41%), especially at weekends and holidays. Most state they fish between 20 and 70 days a year (Figure 1c), with a peak (22.81%) between 30 and 50 days. The length of the fishing day (Figure 1d) is 4-6 hours (47.37%), although some prolong it for more than 12 hours (4.68%). Most prefer to fish from the shore (89.47%), about 7% fish from boats, while 2.93% liked to fish with belly boats. Most use natural bait (worms) alone or combined with artificial or live (fish) baits (Figure 1e). Most of the anglers interviewed expressed preference for a particular group of species (Figure 1f), especially cyprinids. The remainder (27.49%) expressed no preference for any particular fish group. The species are preferred (Figure 1g) for their fighting capacity (29.3%), size (23.90%), and combativity (19.80%). All (33.94%) or a few of fish (23.39%) are returned to the water after capture (Figure 1h). However, the 19.27% are given to acquaintances, and others are used as food (22.48%). Most anglers have more than two years experience (97.81%), and those with 10-15 years of experience were the most numerous group (22.81%) (Figure 1i). Expenditure on equipment, permits, baits, and fuel by anglers was highly variable and difficult for the anglers themselves to evaluate (Figure 1j). Thus, 29.24% of them spend between 100 and 300 euros per year, and 22.21% more than 1200 euros. The anglers know native (83.04%) and invasive species (78.95%) and the impact of exotic species on freshwater ecosystems (71.35%). Most of them (83.95%) believe that it is necessary to take measures to preserve fisheries. They consider that motivations and requirements to fish are in general important (Figure 2k). However, fishing is not a way to escape the daily routine (not important: 35.09%). The measures, that in their opinion, would contribute to the improvement of recreational fishing were (Figure 1l): cleaning fishing sites (24.3%), stocking (15.93%), improving the access to fishing sites (11.95%), eradication of exotic species (9.16%), water depuration (8.70%), and others (more river wardens, increase the minimum takeable size, etc.).

The CAPTCA analysis extracted two dimensions that explain 71.71% of the total variance of the 171 samples (Figure 2). The first dimension explains 44.24% of the total variance, and may be defined as an "economic" dimension (Table 2). This dimension is related with to expenditure (Exp), the season (Season), number of fishing days by year (Ti.fish.y), and the distance travelled (Tr.dist) to fishing sites. The second dimension (Table 2), which explains 27.47% of the total variance, is related with to preferred species (Species), the gear required (Fish.ge) to catch them, and the facility of access (Sit.acc) to sites where these species are found.

Discussion

Our results indicate that fishing in the ACE is clearly not a commercial activity. Thus, recreational or sport fishing is mostly conducted by local anglers. However, it seems that there has been a tendency for this situation to change in recent years, and more foreign anglers are attracted to our waters as a result of the presence of new sport species (exotics such as European wells, pikeperch), advertising campaigns and a better hotel infrastructure. National anglers mainly come from neighbouring provinces (Madrid, Ciudad Real, Salamanca, and Toledo), whereas foreign anglers come from Portugal, France, and Italy (source: Junta de Extremadura, Consejería de Agricultura y Medio Ambiente, Dirección General de Medio Ambiente). However, in the ACE the number of local anglers is decreasing. In other countries, decreasing numbers of anglers has been attributed to advancing age of anglers, development of other leisure options, and rising fishing costs (Sipponem and Gréboval, 2001; Pintér and Wolos, 1998).

The socio-economic characteristics of the ACE´s anglers are similar to those reported by other authors for Iberian freshwaters (Marta *et al.,* 2001; Pérez-Bote *et al.,* 2004) and others parts of the world (Vigliano *et al.,* 2000; Ferrer *et al.,* 2005; Arlinghaus *et al.,* 2008; Toivonen *et al.,* 2004). Obviously, some differences can be found, but they can be attributed to such factors as age, motivations for fishing, species, etc.

In the Portuguese Guadiana Basin (PGB) the majority age of anglers was between 31 and 40 years in 1999 (Marta *et al.,* 2001), whereas in the ACE it was between 25 and 39 years in 2000-2001(Pérez-Bote *et al.,* 2004). In the present study, the majority age of anglers was between 45 and 50 years. It seems that the angler community is aging slowly, with few young people entering to practise this activity. The same pattern has been observed in Germany, where the majority age of anglers is between 46 and 50 years (Arlinghaus *et al.,* 2008). In all cases men predominate over women. Similar patterns have been identified in North and South America (Schramm *et al.,* 1996; Vigliano *et al.,* 2000; Ferrer *et al.,* 2005; Peixer and Petrere, 2009) and in Europe (Arlinghaus *et al.,* 2008). Sweden and Finland are exceptions, with a slightly higher number of women practising this sport (25% in Sweden and 35% in Finland) (Bogelius, 1998; Salmi *et al.,* 2006). According to Toivonen *et al.* (2004), in the Nordic countries, half of the anglers are occasional, and 25% of those who usually fish are women. According to Vigliano *et al.* (2000) the observed differences between men and women can be explained by women being generally more interested in the possibility of escaping their daily house-hold routine than angling.

The years of experience are similar in the PGB (6-15 years: 36% of anglers; 16-30 years: 37% of anglers; Marta *et al.,* 2001) and in the ACE (10-15 years: 22.81% of anglers). In Argentina (Vigliano *et*

al., 2000) the angler´s ages peak at 30-40 years; however, they are less experienced (2-10 years experience in the most numerous group) than in the ACE and in the PGB (Marta *et al.,* 2001).

Angling is the main objective of the trip for anglers from the ACE; however, motivations for fishing and its importance are diverse as has been reported by other authors (Marta *et al.,* 2001; Arlinghaus and Mehner, 2003, 2004). Rest and relaxation, enjoying nature, being with friends and family, being alone, and practising new techniques are among the most frequently cited motives for fishing.

Time spent fishing per day and trough the year confirm the recreational use of the fishery in the ACE. Fishing activity is most intense in the warm months, and is limited to morning. A similar pattern was found

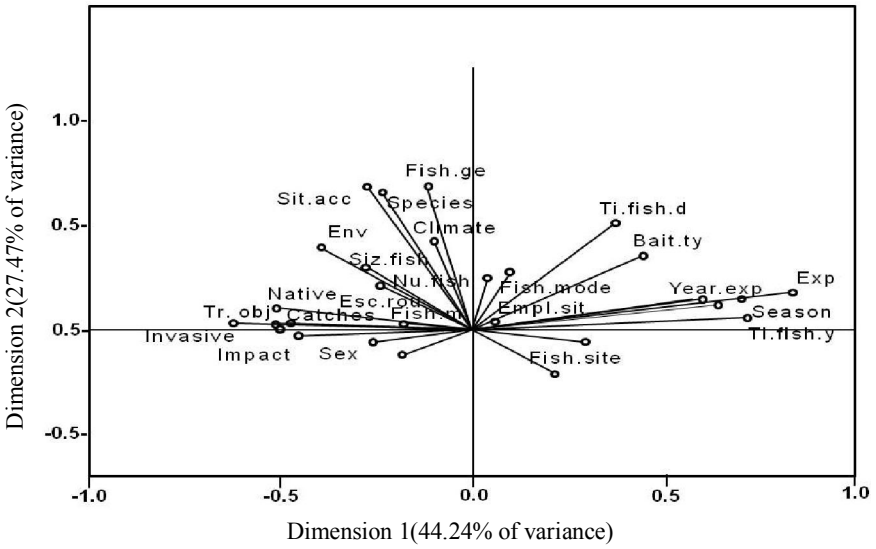

Figure 2. Categorical principal component analysis ordination diagram (CAPTCA) of the fishermen´s responses (171 cases x 27 variables).

Table 2. Contributions of variables to the two first dimensions of the CAPTCA (see table I for description of variables)

	Dimension	
	1	2
Tr.dist	0,617	0,115
Fish.site	0,203	-0,200
Fish.mode	0,084	0,266
Ti.fish.d	0,378	0,520
Ti.fish.y	0,699	0,050
Season	0,694	0,148
Species	-0,257	0,699
Catches	-0,435	0,006
Re.pre	-0,186	-0,106
Fish.ge	-0,134	0,684
Year.exp	0,566	0,135
Bait.ty	0,443	0,359
Exp	0,827	0,186
Esc.rou	-0,235	0,205
Nu.fish	0,020	0,233
Siz.fish	-0,286	0,276
Sit.acc	-0,283	0,671
Climate	-0,115	0,428
Env	-0,402	0,401
Empl.sit	0,048	0,041
Age	0, 622	-0,040
Sex	-0,272	-0,051
Invasive	-0,214	0,022
Impact	-0,454	-0,017
Native	-0,517	0,105
Fish.reg	-0,166	0,026
Tr.obj	-0,498	0,009

in Portugal (Marta *et al.,* 2001) and Germany (Arlinghaus *et al.,* 2008); however, those anglers fish fewer days per year than Spanish anglers. Preferred species also differ between Spanish and Portuguese anglers. The latter prefer exotic species such as largemouth bass (44%) and carp (31%), whereas in the ACE cyprinids (carp, barbels, and goldfish) are preferred. In this regard, in a previous study (Pérez-Bote *et al.,* 2004) detected two clear types of anglers in the ACE: those that prefer cyprinids and those that prefer predators. These differences are also reflected in the type of bait, gear, fishing mode, and the type of site. In this regard, new techniques (carp-fishing, casting) and equipment (belly boats, boats) have been incorporated by anglers in recent years. According to Cooke and Cowx (2006), the main objective of this new equipment is to reduce the reduction on the capture of undesirable species and to minimize environmental impacts.

The distance travelled by the ACE´s anglers has increased from previous studies (Pérez-Bote *et al.,* 2004). According to Sipponen and Gréboval (2001), fishing close (less than 100 km) to the angler´s home is becoming common in Europe. Thus, in Portugal most of the anglers (50%) do not travel more than 50 km from home (Marta *et al.,* 2001). Most of the anglers of Liege (Belgium) travel 38 km by car on average (Frank *et al.,* 1998), whereas in Germany many travel from 3 to 8 hours to fish (Wedekind *et al.,* 2001).

The fraction of fish released after capture is higher in the ACE than in PGB (Marta *et al.,* 2001). This is because in Portugal freshwater fish consumption is more established than in Spain, and some species attain a considerable value in local markets (Collares-Pereira *et al.,* 2007). Indeed, the proportion of fish returned is similar to those reported worldwide (Cooke and Cowx, 2004). From the period 2001-2002 (Pérez-Bote *et al.,* 2004), catch-and-release has increased in the ACE as it has in other areas (Arlinghaus *et al.,* 2007). According to Hahn (1991) catch-and-release fishing is common practice among angling specialists.

Expenditure on equipment, permits, and fuel by anglers is difficult to evaluate. We think that the figures are underestimated by local anglers. In Portugal the average expenditure on a normal fishing day was estimated to be around 15 euros. This value is greater than in Extremadura for the period 2000-2001(9 euros/day; Pérez-Bote *et al.,* 2004). In the present study, the expenditure is 100-300 euros per year. These values are lower than in Germany, where average net monthly income is 1500-2000 euros (Arlinghaus *et al.,* 2008).

Anglers´ opinions on how to improve fishing are highly variable, but in general are related with the same objective around the world: facility of access to fishing places, and promoting the increase of stocks. In the first case, Arlinghaus *et al.* (2008) found that improved access was rated among the priorities by fisheries managers and anglers living in cities and predominantly fishing in rural fisheries. This question was less important for rural anglers. Shoreline fishing access and boat ramps were the most demanded improvements in the ACE as also in the case of Germany (Arlinghaus *et al.,* 2008). Stocking is a management strategy that is currently under intense debate in Europe, and new strategies to improve recreational fisheries such as habitat management techniques are being developed (Arlinghaus *et al.,* 2008). In the south-western Iberian Peninsula, the environment and inland water are well preserved, and the main problem related with the quality of the medium is the garbage and some point focuses of contamination.

According to Munn *et al.* (2010) fishing, hunting, and wildlife watching recreation activities occupy an important position in natural resource management and hold promise in revitalizing rural development. The emergence of new fishing methods (and species) can be advantages and disadvantages in a region such as Extremadura. This is not a surprise. Angler preferences can be seen to change with time. For example, in England and Wales the preferred target species among non salmonid anglers during 1969–1970 was cyprinids (Hickley *et al*., 2004). Using reports in the angling press as a barometer of angler preference, not only is the popularity of carp fishing continuing to increase but the number of specialist anglers wanting to catch the exotic, novelty species is also increasing (Garcia *et al*., 2012). In this way, there has long been a fascination with introducing non-native species. In Extremadura, few anglers would regard some invasive species (carp, goldfish, pike, and largemouth bass) as pests but exotic species have had in many places negative impacts. As example, largemouth bass has been introduced outside its native range specifically for recreational angling and has had a serious impact upon populations of endemic fish, such as in parts of the Iberian Peninsula (Godinho and Ferreira, 1998). Of course, angler demands for new experiences need be taken into account but non-native introductions should only be allowed where there are demonstrable social and economic components to any recreational benefit. It is essential to influence anglers, and managers to stock non-native fish only where it is ecologically sound to do so and the precautionary approach (FAO, 1996) should be adopted always when taking account of potential impacts. As example, largemouth bass has been introduced outside its native range specifically for recreational angling and has had a serious impact upon populations of endemic fish, such as in parts of the Iberian Peninsula (Godinho and Ferreira, 1998). Fishing as tourism is a particularly important component of the recreational fisheries economy in some regions Lloret *et al.* (2008). It can be a specific species, rather than fishing in a particular region or country, that provides anglers with the motivation for fishing away from home.

Freshwater angling tourists visit Ireland seeking high quality roach (*Rutilus rutilus*) and bream (*Abramis brama*), France for specimen carp and Spain for the famous, giant European wells of the River Ebro.

Considering the socioeconomical implications of recreational fisheries, planning and implementing comprehensive management strategies must be included. Hence management authorities should implement education and management programmes targeting fisheries managers and the general angling population.

Acknowledgments

The authors thank all the recreational anglers who participated in the study and A.J. Romero and V. Vicente for technical assistance. This research was supported by the Environmental Service of the Autonomous Government of Extremadura, Spain.

References

Aas, O. and Ditton, R.B. 1998. Human dimension perspective on recreational fisheries management. In: P. Hinkley and H. Tompkins (Eds.), Recreational Fisheries: Social, Economic and Management Aspects. Fishing New Books, Oxford: 153-164.

Arlinghaus, R. and Mehner, T. 2003. Socio-economic characterization of specialized common carp (*Cyprinus carpio* L.) anglers in Germany, and implications for inland fisheries management and eutrophication control. Fisheries Research, 61: 19–33.

Arlinghaus R. and Mehner, T. 2004. A management-orientated comparative analysis of urban and rural anglers living in a metropolis (Berlin, Germany). Environmental Management, 33: 331–344. doi: 10.1007/s00267-004-0025-x.

Arlinghaus, R., Cooke, S.J., Lyman, J., Policansky, D., Schwab, A., Suski, C.D., Sutton, S.G. and Thorstad, E.B. 2007. Understanding the complexity of catch-and-release in recreational fishing: an integrative synthesis of global knowledge from historical, philosophical, social, and biological perspectives. Reviews in Fisheries Sciences, 15: 175–167. doi: 10.1080/10641260601149432.

Arlinghaus, R., Bork, M. and Fladung, F. 2008. Understanding the heterogeneity of recreational anglers across an urban–rural gradient in a metropolitan area (Berlin, Germany), with implications for fisheries management. Fisheries Research, 92: 53–62. doi:10.1016/j.fishres.2007.12.012.

Asensio, R. 2001. Efectos de la pesca deportiva sobre las poblaciones de peces. In: I. Doadrio (Ed.), Atlas y libro rojo de los peces de España. MMA-CSIC, Madrid: 274-285.

Berkes, F., Mahon, R., McConney, P., Pollnac, R. and Pomeroy, R. 2001. Managing small-scale fisheries. Alternative directions and methods. International Development Research Centre, Ottawa, Ontario, Canada, 309 pp.

Bogelius, A. 1998. National survey of recreational fisheries in Sweden. In: P. Hinckley and H. Tompkins (Eds.), Recreational fisheries: social, economic and management aspects. Fishing News Books, Oxford: 24-26.

Calero, J., Delgado, R., Delgado, G. and Martín-García, J.M. 2008. Transformation of categorical field soil morphological properties into numerical properties for the study of chronosequences. Geoderma, 145: 278–287. doi: 10.1016/j.geoderma.2008.03.022

Chipman, B.D. and Helfrich, L.A. 1988. Recreational specialization and motivations of Virginia river anglers. North American Journal of Fisheries Management, 8: 390–398. doi: 10.1577/1548-8675(1988)008<0390:RSAMOV>2.3.CO;2.

Clavero, J.L., Ruíz, I. and Munilla, S.P. 2002. Especies piscícolas alóctonas. Análisis de situación y relación con el ejercicio de la pesca. Referencia específica a la Comunidad Autónoma de Aragón. CIVA 2002 (http://www.civa2002.org), 449-458.

Collares-Pereira, M.J., Filipe, A.F. and Moreira, L. 2007. Os peixes do Guadiana. Que futuro? Ediçoes Cosmos, Chamusca, 294 pp.

Cooke, S.J. and Cowx, I.G. 2004. The role of recreational fisheries in global fish crises. BioScience, 54:857–859. doi: 10.1641/ 00063568(2004)054[0857:TRORFI] 2.0.CO;2.

Cooke, S.J. and Cowx, I.G. 2006. Contrasting the recreational and commercial fishing: searching for common issues to promote unified conservation of fisheries resources and aquatic environments. Biological Conservation, 128: 93-108. doi:10.1016/j.biocon. 2005.09.019.

Cowx, I.G. and Van Anrooy, R. 2010. Social, economic and ecological objectives of inland commercial and recreational fisheries. Fisheries Management and Ecology, 17: 89–92. doi: 10.1111/j.1365-2400.2010.00739.x.

FAO 1996. Precautionary Approach to Capture Fisheries and Species Introductions. FAO Technical Guidelines for Responsible Fisheries 2. FAO, Rome, 54 pp.

Ferrer, O.J., Dibble, E.D., Jackson, D.C. and Rundle, K.R. 2005. Angling assessment of the fisheries of Humacao Natural Reserve lagoon system, Puerto Rico. Fisheries Research, 76: 81–90. doi: 10.1016/j.fishres.2005.05.010.

Frank, V., Lejeune, A. and Herman, D. 1998. Recreational fisheries survey in the Liege province of Belgium. In: P. Hinckley and H. Tompkins (Eds.), Recreational Fisheries: Social, Economic and Management Aspects. Fishing New Books, Oxford: 19-23.

Gamboa, M.I., Navaona, G.T., Orden, A.B., Torres, M.F., Castro, L.E., and Oyhenart, E.E. 2011. Socio-environmental conditions, intestinal parasitic infections and nutritional status in children from a suburban neighborhood of La Plata, Argentina. Acta Tropica, 118: 184-189. doi: 10.1016/j.actatropica.2009.06.015

Garcia, C., Gajardo, J. and Consuegra, S. 2012. From Best to Pest: changing perspectives on the impact of exotic salmonids in the southern hemisphere. Systematics and Biodiversity, 8: 447-459. doi: 10.1080/14772000.2010.537706

Godinho, F.N. and Ferreira, M.T. 1998. The relative influences of exotic species and environmental factors on an Iberian native fish community. Environmental Biology of Fishes, 51: 41-51.

Hahn, J. 1991. Angler specialization: measurement of a key sociological concept and implications for fisheries

management decisions. In: D. Guthrie, J.M. Hoenig, M. Holliday, C.M. Jones, M.J. Mills, S.A. Moberly, K.H. Pollock and D.R. Talhelm (Eds.), Creel and Angler Surveys in Fisheries Management. Proceedings of the American Fisheries Society Symposium, vol. 12, Bethesda, MD: 380-389.

Heiser, W.J. and Meulman, J.J. 1994. Homogeneity analysis: exploring the distribution of variables and their nonlinear relationships. In: M. Greenacre, J. Blasius (Eds.), Correspondence analysis in the social science. Recent developments and applications. Academic Press, London: 179-209.

Hinckley, P. and Tompkins, H. (Eds.) 1998. Recreational Fisheries: Social, Economic and Management Aspects. Fishing New Books, Oxford, 310 pp.

Junta de Extremadura 2005. Anuario estadístico. Consejería de Agricultura y Medio Ambiente. Mérida, 220 pp.

Kellert, S.R. 1984. Assessing wildlife and environmental values in cost‐benefit analysis. Journal of Environmental Management 18: 355–363.

Lloret, J., Zaragoza, N., Caballero, D. and Riera, V. 2008. Biological and socioeconomic implications of recreational boatfishing for the management of fishery resources in the marinereserve of Cap de Creus (NW Mediterranean). Fisheries Research, 91: 252-259.

Malvestuto, S.P. 1983. Sampling the recreational fishery. In: L. Nielsen and D.R. Johnson (Eds.), Fisheries Techniques Manual. American Fisheries Society, Bethesda, MD: 397-430.
doi: 10.1016/j.fishres.2007.12.002

Malvestuto, S.P., Kendall, W., Davies, W.D. and Shelton W.L. 1978. An evaluation of the roving creel survey with non-uniform probability sampling. Transactions of the American Fisheries Society, 107: 255-262. doi: 10.1577/1548-8659(1978)107%3C255:AEOTRC%3E2.0.CO;2.

Marta, P., Bochechas, J. and Collares-Pereira, M.J. 2001. Importance of recreational fisheries in the Guadiana River basin in Portugal. Fisheries Management and Ecology, 8: 345-354.
doi: 10.1111/j.1365-2400.2001.00262.x.

Munn, I.A., Hussain, A., Spurlok, S. and Henderson, J.E. 2010. Economic Impact of Fishing, Hunting, and Wildlife-Associated Recreation Expenditures on the Southeast U.S. Regional Economy: An Input–Output Analysis. Human dimension of Wildlife: An international Journal, 15: 433-449. doi: 10.1080/10871209.2010.508193.

Peixer, J. and Petrere, M. 2009. Sport fishing in Cachoeira de Emas in Mogi-Guaçu River, state of São Paulo, Brazil. Brazilian Journal of Biology, 69: 1081-1090. doi: 10.1590/S1519-69842009000500011.

Pérez-Bote, J.L., Roso, R. and Pula H.J. 2004. Los hábitos de pesca en Extremadura: implicaciones en la gestión y conservación de la fauna piscícola. Revista de Estudios Extremeños, 50: 1241-1253.

Pérez-Bote, J.L., Roso, R., Romero, A.J., Méndez, E. add Martín, A.B. 2005. Los peces de Extremadura. Universitas Editorial, Badajoz, 145 pp.

Pintér, K. and Wolos, A. 1998. Summary report of the symposium topic session on the current status and trends in recreational fisheries. In: P. Hinckley and H. Tompkins (Eds.), Recreational fisheries: Social, Economic and Management aspects. Fishing News Books, Oxford: 1-4.

Pitcher, T.J. and Hollingworth, C.E. 2002. Fishing for fun: where's the catch? In: T.J. Pitcher and C.E. Hollingworth (Eds.), Recreational Fisheries: Ecological, Economic and Social Evaluation. Blackwell Science, Oxford: 1-16.

Salmi, P., Auvinen, H. and Jurvelius, J. 2000. Finnish lake fisheries and conservation of biodiversity: coexistence or conflict? Fisheries Management and Ecology, 7: 127-138. doi: 10.1046/j.1365-2400.2000.00183.x.

Salmi, P., Toivonen, A.L. and Mikkola, J. 2006. Impact of summer cottage residence on recreational fishing participation in Finland. Fisheries Management and Ecology, 13: 275-283. doi: 10.1111/j.1365-2400.2006.00503.x.

SPSS Inc. 2000. SPSS Software. Headquarters, 233 S. Wacker Drive, 11th floor, Chicago, Illinois.

Schramm, H.L., Bray, G.S., Gill, D.A. and Forbes, J.T. 1996. Measurement of Mississippi angler characteristics. Freshwater Fisheries Report No. 149. Mississippi Department of Wildlife, Fisheries and Parks, Jackson, Mississippi.

Sipponem, M. and Gréboval, D. 2001. Social, economic and cultural perspectives of European inland fisheries: review of the EIFAC symposium on fisheries and society. Fisheries Management and Ecology, 8: 283-293. doi: 10.1111/j.1365-2400.2001.00280.x.

Toivonen, A.L., Roth, E., Navrud, S., Gudbergsson, G., Appelblad, H., Bengtsson, B. and Tuunainen, P. 2004. The economic value of recreational fisheries in Nordic countries. Fisheries Management and Ecology, 11: 1-14. doi: 10.1046/j.1365-2400.2003.00376.x.

Vigliano, P.H., Lippolt, G.E., Denegri, A., Alonso, M., Macchi, P. and Dye, C.O. 2000. The human factors of the sport and recreational fishery of San Carlos de Bariloche, Río Negro, Argentina. Fisheries Research, 49: 141-153. doi: 10.1016/S0165-7836(00)00200-9.

Wedekind, H., Hilge, V. and Steffens, W. 2001. Present status, and social and economic significance of inland fisheries in Germany. Fisheries Management and Ecology, 8: 405-414. doi: 10.1111/j.1365-2400.2001.00261.x.