Analysis of Recreational Fisheries in the Croatian Areas of the Sava and Danube Rivers

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Summary

The aim of the research was to provide an overview of the status of recreational anglers in the Croatian areas of the Sava and Danube rivers in many aspects: social and demographic characteristics, preferences, level of fishing experience and involvement, understanding of legal regulations, consumptive orientation, attitudes and satisfaction levels, the dynamics of fishing and the structure of catch, etc. A questionnaire of 48 questions was issued and distributed among the recreational anglers on the fishing locations. The survey included a representative number of 383 recreational fishermen. Using Redundancy Analysis (RDA) with dummy variables (explanatory variables), we studied the relationships of important recreational fishery parameters. We concluded that, as there is a variety of competing users of freshwater resources there is a necessity to provide the laws to all the parties involved. In addition, we have found a relationship between knowledge of legal regulations and level of education. Recreational fisheries are often considered satisfactory even if no fish has been caught. The key factors are contact with nature, social interaction and breaks from day-to-day routines. The basis for developing satisfying recreational fishing experiences provides understanding anglers motivations.

Key words

bordering areas, Danube River, Sava River, recreational anglers

Introduction

In some ecosystems, particularly in freshwater ecosystems of temperate coastal regions, recreational fishing has almost replaced commercial fisheries and has become the only fish stock group user (Arlinghaus et al., 2002). This fact emphasizes the social importance of recreational fishing, highly regarded throughout the modern world. It has been undeniably proven that recreational fishing is the path towards greater socioeconomic benefit for the society in increasing profits and the development of tourism (Geertz-Hansen and Rasmussen, 2001; Navrud, 2001; Peirson et al., 2001; Virtanen et al., 2001; Marta et al., 2001). Although the management of recreational fishing has received considerable attention at the regional level, the potential impacts of angling on fish populations and aquatic ecosystems have not been scientifically discussed to the same extent as they have been for commercial fishing (Cooke and Cowx, 2004; 2006). Human population growth and increased demand for fish has gained expression through recreational fishing, particularly as increased leisure time and disposable income continue to grow in the developed world (Kearney, 2001). Conflict with the demands of other consumers, usually expressed via commercial fishers, is an inevitable consequence. The lack of representative socioeconomic studies on the social importance of angling and the difficulty in monitoring highly diverse and disperse angling activities may contribute to the underestimation of the angling impacts (Arlinghaus et al., 2002). Recreational fishermen are a significant resource of the knowledge of spatial patterns of resource use and availability, direct involvement in restoration projects, political leverage and grassroots support for research and conservation measures (Granek et al., 2008). By including an investigation of the social and economic aspects of recreational fishing, the primary objective of this study was to characterize the general profile and specific interest of the anglers fishing in the Croatian areas of the Sava and Danube rivers.

Materials and methods

Croatian areas of the Sava and Danube rivers were investigated for purpose of our study (Fig. 1). The entire 129 km stretch of the Danube river was included in this study. The investigated area of the Sava river was from the city of Slavonski Brod to the Croatian–Serbian border, a stretch of approximately 183 km.

A total of 103 freshwater fish species inhabit the waters of Danube Basin, 14 of which have been introduced from other biogeographical areas (Mrakovčić et al., 2006). Family of *Cyprinidae* is the most represented fish family in the investigated bordering area. It is dominated by: common carp (*Cyprinus carpio* L.), Prussian carp (*Carassius gibelio* Bloch.), common bream (*Abramis brama* L.), white bream (*Blicca bjoerkna* L.), European chub (*Squalius cephalus* L.), ide (*Leuciscus idus* L.), roach (*Rutilus rutilus* Rafinesque), rudd (*Scardinius erythrophthalmus* L.), bleak (*Alburnus alburnus* L.), barbel (*Barbus barbus* L.), and asp (*Aspius aspius* L.). These are followed by the representatives of the *Esocidae* family, with the species of northern pike *(Esox lucius* L.), *Siluridae* with European catfish (*Silurus glanis* L.), and finally *Percidae* with the species of European perch (*Perca fluviatilis* L.*)* and pike-perch *(Sander lucioperca* L.).

According to the data of the Croatian Sports Fishing Association for 2005, the total number of registered anglers in
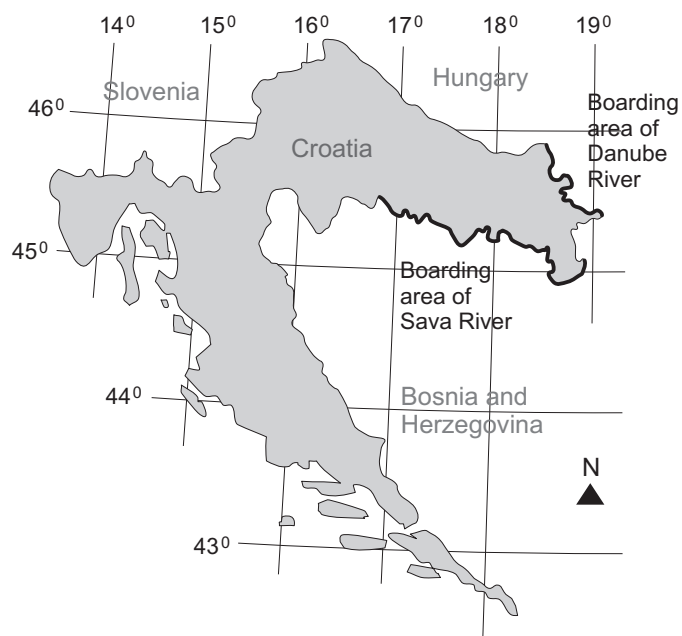

Figure 1. Map of Croatia with indicated bordering area of the Sava and Danube rivers

Croatia was 32337. In the surveyed area, the total number of registered recreational anglers was 9775, majority of them being seniors (8797), followed by disabled persons (549) and juniors (429).

The survey included 383 recreational anglers who are the members of a fishermen society with a fishing license along the country border in the area of the Sava and Danube rivers.

In the fishing season of 2005 at different locations (e.g. fishing shops, fishing clubs, rivers, home and cafes) the recreational anglers were given a questionnaire of 48 questions. After the anglers were told what the questionnaire was about, they were left alone in order to avoid the interviewer to influence their answers. We based the questionnaire on the legal regulations of the Republic of Croatia and the international scientific literature was consulting. Also the professionals from the Faculty of Agriculture and Faculty of Philosophy, University of Zagreb and the company Akvaplan Niva AS, Norway were consulted. Using Redundancy Analysis (RDA) with dummy variables (explanatory variables) using the CANOCO for Windows 4.5 software package, we studied the relationship between the educational level and the knowledge on legal regulations, dependence on fishing location and structure of catch of recreational fishermen, as well as the correlation between the average distance from home to the fishing location (km) and average time spent in fishing from arrival to departure (hours, days) (response variables). RDA analysis is constrained form of the linear ordination method of principal component analysis (PCA) (ter Braak and Šmilauer, 2002).

Results

Majority of recreational anglers had more than ten years of experience in fishing. With regard to legal regulations, most of those surveyed (97%) had passed the fishing examination, and only 3% did not (Table 1a).

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Table 1a. Main results analysis of the questionnaire on recreational fisheries in the Croatian areas of the Sava and Danube rivers – Fisheries part

Fisheries part

Nr.	Q.	A.		n	%	Nr.	Q.	A.	n	%
1.	Years of fishing experience	< 1		9	2	4.	Partners in fishing*	Alone	121	32
		1 - 5		16	4			With a family member	95	25
		5 - 10		21	5			With a friend	230	60
		> 10		337	89	5.	The use of a fishing boat**	Yes, personal property	168	44
2.	Have you passed the fishing examination?	Yes		373	97			Yes, rented	50	13
		No		10	3			No	169	44
3.	Importance of specific factors for choosing fishing as a hobby**	To be relaxed and have recreation	Very important	243	63	6.	Length of boats (m)**	< 4	47	12
			Important	113	30			4 – 6	151	39
			Only somewhat important	16	4			> 6	18	5
			Not important at all	5	1	7.	Material the boats are made of**	Wood	130	34
			Don't know	7	2			Plastic	43	50
		Escape from every day life	Very important	131	34			Iron	50	13
			Important	123	32			Inflatable	5	1
			Only somewhat important	63	16	8.	Motor power (HP)**	< 5	114	30
			Not important at all	46	12			5 – 10	34	9
			Don't know	18	5			> 10	26	7
		Socializing with a family	Very important	173	45			Don't use it	34	10
			Important	123	32	9.	Average distance from home to a fishing location (km)	< 3	120	31
			Only somewhat important	48	13			3 - 10	113	30
			Not important at all	20	5			10 - 50	132	34
			Don't know	13	3			> 50	18	5
		Socializing with friends	Very important	222	58	10.	Average time spent in fishing from arrival to departure (hours, days)	< 4 h	88	23
			Important	125	33			4 – 8 h	175	46
			Only somewhat important	25	7			8 – 12 h	67	17
			Not important at all	7	2			12 – 24 h	20	5
			Don't know	4	1			1 – 2 days	10	3
		Adventure and excitement	Very important	128	33			2 – 3 days	17	4
			Important	132	34			> 3 days	6	2
			Only somewhat important	88	23	11.	Hours spent actively angling *	< 2	31	8
			Not important at all	17	4			2 – 4	161	42
			Don't know	10	3			4 - 8	142	37
		Sport and competition	Very important	130	34			8 – 12	41	11
			Important	130	34			12 - 24	10	3
			Only somewhat important	71	19			> 24	7	2
			Not important at all	39	10	12.	Days spent in fishing during one calendar year	< 10	21	5
			Don't know	11	3			10- 30	85	22
		To catch a personal trophy	Very important	78	20			30 – 60	104	27
			Important	101	26			60 – 180	124	33
			Only somewhat important	130	34			180 – 240	29	8
			Not important at all	63	16			240 - 300	15	4
			Don't know	9	2			> 300	5	1
		To improve their fishing skills	Very important	84	22	13.	Most frequent types of water in the fishing area*	Flowing rivers	340	89
			Important	128	33			Stagnant lakes	87	23
			Only somewhat important	108	28			Commercial fish farms	21	5
			Not important at all	44	11	14.	Catch content of recreational anglers *	Common carp	170	44
			Don't know	15	4			Grass carp	30	8
		Learning new techniques and applying new tools	Very important	103	27			Catfish	110	29
			Important	143	37			Pike	192	50
			Only somewhat important	101	26			Pikeperch	181	47
			Not important at all	28	7			Trout	3	1
			Don't know	8	2			Prussian carp	178	46
		Fishing for food	Very important	59	15			Largemouth bass	8	2
			Important	84	22			Other	216	56
			Only somewhat important	144	38	15.	Average amount of time spent in fishing during the year (of all respondents)*	I	60	16
			Not important at all	85	22			II	54	14
			Don't know	8	2			III	85	22
								IV	181	47
								V	237	61
								VI	282	73
								VII	296	77
								VIII	289	75
								IX	336	87
								X	289	75
								XI	169	44
								XII	78	29

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Nr.	Q.	A.		n	%
16.	Factors which the catch depends on**	Fishing gear and technique	Very important	151	39
			Important	179	46
			Only somewhat important	34	9
			Not important at all	11	3
			Don't know	8	2
		Choice of a bait	Very important	222	58
			Important	145	38
			Only somewhat important	7	2
			Not important at all	8	2
			Don't know	1	0
		Choice of a fishing spot	Very important	214	55
			Important	147	38
			Only somewhat important	13	3
			Not important at all	7	2
			Don't know	2	1
		Fishing season	Very important	170	44
			Important	168	44
			Only somewhat important	30	8
			Not important at all	9	2
			Don't know	6	2
		Time of the day	Very important	173	45
			Important	143	37
			Only somewhat important	57	15
			Not important at all	7	2
			Don't know	3	1
		Weather conditions	Very important	184	48
			Important	165	43
			Only somewhat important	24	6
			Not important at all	7	2
			Don't know	3	1
		Fisherman's luck	Very important	137	35
			Important	122	32
			Only somewhat important	85	22
			Not important at all	28	7
			Don't know	10	3
		The skills of the fisherman	Very important	201	52
			Important	155	40
			Only somewhat important	18	5
			Not important at all	5	1
			Don't know	4	1
17.	Factors which influence the seasonal character of the catch**	Catch ability of species	Very important	149	39
			Important	197	51
			Only somewhat important	16	4
			Not important at all	5	1
			Don't know	15	4
		Fisheries legislation	Very important	274	71
			Important	75	19
			Only somewhat important	14	4
			Not important at all	5	1
			Don't know	13	3
		Time of the year	Very important	228	59
			Important	141	37
			Only somewhat important	11	3
			Not important at all	3	1
			Don't know	0	0

Nr.	Q.	A.	n	%
18.	Knowledge of the most recent (valid) legal regulations	Completely	134	35
		Partially	182	48
		Superficially	48	12
		Nothing	19	5
19.	Review of the importance of the fishing examination	Very important	142	37
		Important	148	39
		Only somewhat important	59	15
		Not important	34	9
20.	Opinion on the amount of the cost (price) of the fishing examination**	Not too high	203	53
		Too high	161	42
		Too low	12	3
21.	Number of fishing licenses per fisherman**	One	331	86
		Two	37	10
		Three	9	2
		More than three	1	0
22.	Opinion on the price prescribed for a fishing license	Not too high	85	22
		Too high	287	75
		Too low	11	3
23.	Fishermen's opinion on the law on the minimal size of the fish caught	Well-defined	335	87
		Too high	21	5
		Too low	27	7
24.	View of the period of the closed season for certain fish species	Well-defined	277	72
		Too short	28	7
		Too long	28	7
		At the wrong time	36	9
		Don't know	14	4
25.	View of the definition of bordering area/zone of certain owners of the fishing rights (one valid fishing license)**	Well-defined	195	51
		Too big	30	8
		Too small	145	38
26.	View of the definition of the type and amount of fishing gear, equipment and bait allowed in recreational fishing	Well-defined	315	82
		Too big	19	5
		Too small	49	13
27.	View on withholding the catch*	Yes, all	35	9
		Yes, all legally permitted	161	42
		Only certain species	108	28
		Only larger specimens	60	16
		Never withhold the catch	46	12
28.	View on consumption of the fish caught	Eat all	214	56
		Eat only some of them	138	36
		Don't eat freshwater fish	11	3
		Don't eat fish at all	20	5
29.	What is to be done with the fish that is caught	Eat all	163	42
		Eat only some of them	134	35
		Give to friends / relatives	118	31
		Let the fish caught	66	17
30.	How well are recreational fishermen informed (journals, TV, newspapers, radio)	Enough	125	32
		Insufficiently	254	66
		In detail	4	1

*offered the possibility of multiple answers,
**not all respondents declared themselves

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Table 1b. Main results analysis of the questionnaire on recreational fisheries in the Croatian areas of the Sava and Danube rivers – Social part

Social part Nr.	Q.	A.	n	%
1.	Gender	Male	360	94
		Female	23	6
2.	Marital status	Single	60	16
		Married	300	78
		Widowed	23	6
3.	Total number of members of your household	One	25	6
		Two	84	22
		Three	94	25
		Four	110	29
		Five	51	13
		Six	13	3
		Seven	3	1
		Eight	3	1
4.	Education	No school	5	1
		Elementary school	33	9
		Technical school	72	19
		High School	203	52
		College	29	8
		University	41	11

*offered the possibility of multiple answers,
**not all respondents declared themselves

Table 1c. Main results analysis of the questionnaire on recreational fisheries in the Croatian areas of the Sava and Danube rivers – Economic aspects

Economic aspects		HRK	n	%
Estimate of annual expenses for fishing (HRK)	Annual expenses for the equipment	< 100	13	3
		100 - 300	50	13
		300 – 500	71	19
		500 - 1000	98	25
		> 1000	151	39
	Annual expenses for transportation and time spent in fishing**	< 100	27	7
		100 - 300	49	13
		300 – 500	79	20
		500 - 1000	69	18
		> 1000	147	38
	Annual expenses for fishing license and membership fees**	200 - 500	275	71
		500 - 1000	75	19
		> 1000	21	5

**not all respondents declared themselves

In the sample of 383 recreational anglers, 94% of them surveyed were male and only 6% were female (Table 1b). Most of the anglers surveyed were over 40 years of age. About 78% of them were married, and 52% had secondary school qualifications.

The RDA revealed significant relationship between educational level and knowledge of legal regulative at first canonical axis (p<0.01) (Table 2). Interpretation was conducted on the first four axes, accounting for 100% of the total level of education explained by the knowledge of legal regulative (Fig. 2).

It is obvious that the anglers with no school or primary school only, do not know the current legislation. On the other hand, the higher and tertiary educated anglers are quite familiar with the law. The anglers with secondary school have only partial knowledge of legislation.

Table 2. Results of RDA between educational level (response variables) and knowledge of legal regulative (explanatory variables)

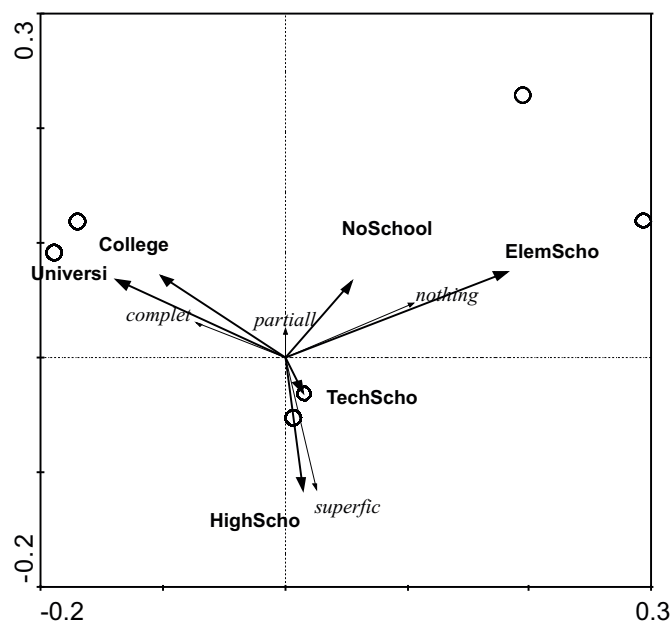| Axes	1	2	3	4	Total variance
Eigenvalues	0.014	0.006	0.001	0.000	1.000
Response-explanatory correlations	0.216	0.140	0.040	0.032	
Cumulative percentage variance					
on response data	1.4	2.0	2.0	2.0	
on response-explanatory data relation	68.5	96.9	99.6	100.0	
Sum of all eigenvalues					1.000
Sum of all canonical eigenvalues					0.020

Figure.2. Relationship between level of education and knowledge of legal regulations (*Noschool* = no school, *Elemschool* = elementary school, *Techscho*. = technical school, *Highschool*= high school, *College* = college, *Universi* = university; - *complet*=completely, *partiall*=partially, *superfic*=superficially, *nothing*=nothing)

The RDA revealed significant relationship between dependence of fishing location and catch content of recreational fishermen at first canonical axis (p<0.01) (Table 3). At first four axes 98.9% of the total variability of analyzed data is explained (Fig. 3).

Most of the anglers fish only in the rivers. Fishing in the rivers is mostly associated with fish species like pikeperch and catfish. Many anglers used a combination of fishing on rivers and lakes or combination on rivers and commercial fish ponds, or fish on all three together. Hence, those who fish on rivers and commercial fish ponds usually catch pike, carp and grass carp. Those who fish on rivers and lakes usually catch various fish species. The anglers who fish on the commercial ponds or lakes usually catch Prussian carp. Given that trout does not inhabit the area of the Danube and Sava rivers, it was caught in the lakes.

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Table 3. Results of RDA between dependence of fishing location (response variables) and catch content of recreational fishermen (explanatory variables)

Axes	1	2	3	4	Total variance
Eigenvalues	0.042	0.021	0.009	0.004	1.000
Response-explanatory correlations	0.406	0.356	0.234	0.200	
Cumulative percentage variance					
on response data	4.2	6.4	7.3	7.7	
on response-explanatory data relation	54.4	82.0	93.6	98.9	
Sum of all eigenvalues					1.000
Sum of all canonical eigenvalues					0.078

Table 4. Results of RDA between dependence of average distance from home to a fishing location (km) (response variables) and average time spent in fishing from arrival to departure (hours, days) (explanatory variables)

Axes	1	2	3	4	Total variance
Eigenvalues	0.067	0.002	0.001	0.477	1.000
Response-explanatory correlations	0.515	0.105	0.068	0.000	
Cumulative percentage variance					
on response data	6.7	6.9	7.0	54.7	
on response-explanatory data relation	96.6	98.8	100.0	0.0	
Sum of all eigenvalues					1.000
Sum of all canonical eigenvalues					0.070

The RDA revealed significant relationship between dependence of average distance from home to a fishing location (km) and average time spent in fishing from arrival to departure (hours, days) at first canonical axis (p<0.01) (Table 4). At first three axes 100.0% of the total variability of analyzed data is explained (Fig. 4).

Anglers, who are fishing at a distance up to 3 km, spend in fishing up to four hours. Those who are 3-10 km away spend in fishing from four up to 24 hours. Those who are 10-50 km away spend in fishing from eight hours to three days. Who in search of a suitable fishing location come from more than 50 km, spend in fishing from one to seven and more days.

Discussion and conclusions

There is a significant relationship between the educational level and the knowledge of legal regulations (Fig. 2). Anglers do not pay much attention to the fisheries legal regulations that include recreational fishing because the regulations are observed only partly and occasionally. There is also a correlation between the average distances from home to the fishing spot and average time from arrival to departure spent in fishing (Fig. 4). Analysis of the fish species in the catch shows a weak catch of "prized" fish species. Under the assumption that recreation fishing is primarily recreational/entertainment, amusement, satisfaction, and only partly a source of food for consumption, the results of survey
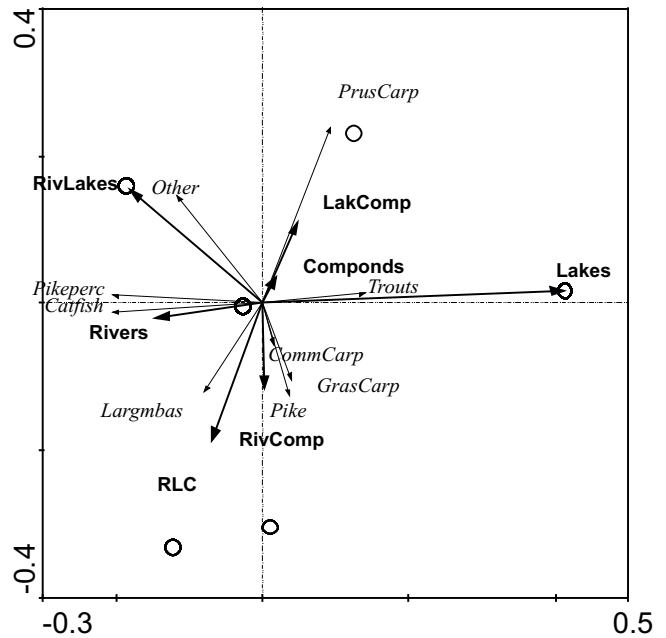

Figure 3. Anglers dependency on fishing location and the catch content (*RivLakes*=Rivers and lakes, *RivComp*=Rivers and compounds, *RLC*=River lakes compounds, *LakComp*=Lakes and compounds, *Componds*=compounds, *Rivers*=Rivers, *Lakes*=lakes, - *PrusCarp*=Prussian carp, *Trouts*=trouts, *Pikeperc*=Pike perch, *Catfish*=catfish, CommCarp=Common carp, *Pike*=Pike, *Largmbas*=Largemouth bass, *GrasCarp*=Grass carp, *Other*=Other)
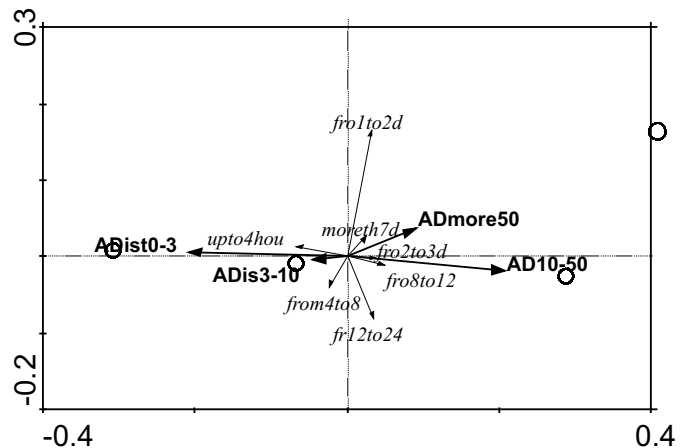

Figure 4. Average distance from the home to a fishing location (km) in correlation with average time spent in fishing from arrival to departure (hours, days). (*ADist0-3*=Average distance from the home to a fishing location is from 0 to 3 km, *AD3-10*=from 3 to 10 km, *AD10-50*=from 10 to 50 km, *ADmore50*=more than 50 km; - *upto4hou*=up to 4 hours, *from4to8*=from 4 to 8 hours, *fro8to12*=from 8 to 12 hours, *fr12to24*=fro 12 to 24 hours, *fro1to2d*=from 1 to 2 days, *fro2to3d*=from 2 to 3 days, *moreth7d*=more than 7 days)

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are satisfactory. As Knjaz (2007) inferred considering the catch per fishing zone in Croatia, most of the fish caught by anglers in recreational fisheries come from the Drava and Danube rivers (60%), then from the Sava River (about 34%) and only 5-6% of the catch partakes other locations visited by the anglers. The fish species that the anglers mostly catch are carp, pike, catfish, bream and perch. Our survey shows that most of the anglers prefer fishing in the rivers. We have found strong correlation between the anglers' fishing location and catch content (Fig. 3.). Fishing in the rivers is mostly associated with either pikeperch or catfish. Schramm et al. (2003) concluded that clean environment and availability of the desired type of "sport" fish species in the freshwaters of Mississippi are mayor arguments in choosing a fishing location. Although fishing as a hobby stands for recreation, relaxation and socializing for over 90% of Croatian anglers (Table 1a.); fishing also means a low cost food provider (Schramm and Gerard, 2004). Only 22% of anglers questioned, declared that fishing for food was of no importance to them at all. According to Falk et al. (1989), anglers often consider a fishing trip to be satisfactory even if no fish is caught. The key factors are contact with nature, social interaction and breaks from day-to-day routines for this type of evaluation. The basis for developing satisfying recreational fishing experiences provides understanding anglers motivations (Knopf, 1983; Fedler, 1984; Driver, 1985; Graefe and Fedler, 1986). The same understanding results in the expected angler's response to the specific changes in management actions (Fedler and Ditton, 1994). Schramm and Gerard (2004) stated that fishery managers in Mississippi extensively use restrictive harvest regulations to manage recreational fishing. Whether intended to increase the size or number of fish caught, to distribute the fish among more anglers or to affect a change in the fish assemblage, managers are often concerned about angler resistance to harvest restrictions. In our survey even 42% of the anglers eat all of the fish they catch in recreational fishing. Thus, the concern about angler's resistance is warranted. Although, a high percentage of anglers (87 %) take that the law on the minimal size of fish which can be caught is well-defined, most of the anglers in their annual expenses for fishing licenses and membership fees are in lower class of investment (over 70 %) (Table 1c.) and most of the anglers (86 %) have only one fishing license. Because many people live in the cities, urban population is often considered a potential source of new recruits to recreational fishing and as a source of increased or continued license sales that support public natural resource agencies programs and aquatic ecosystem management (Allen, 1984). Increased or sustained angling participation among urban populations may not only affect towns and cities but less developed rural areas surrounding metropolitan centres (Arlinghaus and Mehner, 2003a; 2004a). The importance of aquatic resource planning as a tool to aid management of recreational fishing on a sustainable basis in multi resource user situations has already been pointed out (Cowx, 1998; Hickley and Tompkins, 1998). The evaluation of fish stocks of certain fishing areas make sense only when they are coordinated over the entire area, which emphasizes the importance of monitoring of the bordering areas. Such a process must take into account all the aspects of the fisheries sector including social dimensions, legal and administration dimension, economic development and the ecological dimension. Special attention should be given to the human dimension (Aas and Ditton, 1998), in guiding both scientists and fisheries managers, whilst taking into account the biodiversity and sustainability of the ecosystem.

References

Aas Ø., Ditton R.B. (1998.). Human dimension perspectives on recreational fisheries management. In: P. Hickley & H. Tompkins (eds) Recreational Fisheries. Social, Economic and Management Aspects. Oxford: Fishing News Books, Blackwell Science, pp. 153±164.

Allen L.J. (1984.). Urban Fishing Symposium Proceedings. Am. Fish. Soc., Bethesda, Maryland.

Arlinghaus R., Mehner T., Cowx I. G. (2002.). Reconciling traditional inland fisheries management and sustainability in industrialized countries, with emphasis on Europe. Fish Fish., 3: 261–316 (2002).

Arlinghaus R., Mehner, T. (2003a.). Characteristics of anglers living in the metropolitan area of Berlin (Germany): implications for urban fisheries management and research. In: Coleman, A.P.M. (Ed.), Regional Experiences for Global Solutions. The Proceedings of the 3rd World Recreational Fishing Conference 21–24 May 2002, Northern Territory, Australia. Fisheries Report 67. Fisheries Group, Department of Business, Industry and Resource Development, Darwin, Australia, pp. 117–120.

Arlinghaus R., Mehner, T. (2004a.). A management-orientated comparative analysis of urban and rural anglers living in a metropolis (Berlin, Germany). Environ. Manage. 33, 331–344.

Cooke S. J., Cowx I. G. (2004.). The role of recreational fishing in global fish crisis. BioScience, 54: 857–859 (2004).

Cooke S. J., Cowx I. G. (2006.). Contrasting recreational and commercial fishing: searching for common issues to promote unified conservation of fisheries resources and aquatic environments. Biol. Conserv., 128: 93–108 (2006).

Cowx I.G. (1998.). Aquatic resources planning for resolution of fisheries management issues. In P. Hickley & H. Tompkins (eds) Recreational Fisheries. Social, Economic and Management Aspects. Oxford: Fishing News Books. Blackwell Science, pp. 97±105.

Driver B.L. (1985.), Specifying what is produced by management of wildlife by public agencies. *Leisure Sciences*, 7, 281–296.

Falk J.M., Graefe A.R., Ditton R.B. (1989.). Patterns of participation and motivation among salt-water tournament anglers. Fisheries, 14, 10–17.

Fedler A.J. (1984.). Elements of motivation and satisfaction in the marine recreational fishing experience. In: R.H. Stroud (ed.) *Marine Recreational Fisheries* 9. Washington DC: Sport Fishing Institute, pp. 75–83.

Fedler A.J., Ditton R.B. (1994.). Understanding angler motivations in fisheries management. Fisheries 19, 6–13.

Graefe A.R., Fedler A.J. (1986.). Situational and subjective determinants of satisfaction in marine recreational angling. Leisure Sciences, 8, 275–295.

Granek E.F., Madin E.M.P., Brown M.A., Figueira W., Cameron D.S., Hogan Z., Kristianson G., De Villiers P., Williams J. E., Post J., Zahn S., Arlinghaus R. (2008.). Engaging Recreational Fishers in Management and Conservation: Global Case Studies. Conservation Biology, Volume 22, No. 5, 1125–1134.

Hickley P., Tompkins H. (1998.). Recreational Fisheries. Social, Economic and Management Aspects. Oxford: Fishing News Books, Blackwell Science, 310 pp.

Kearney R.E. (2001.). Fisheries property rights and recreational/commercial conflict: implications of policy developments in Australia and New Zealand. Marine Policy 25 (2001) 49-59.

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Agric. conspec. sci. Vol. 75 (2010) No. 4

Knopf R.C. (1983.). Recreational needs and behavior in natural settings. In: I. Altman & J.F. Wohlwill (eds) Behavior and the Natural Environment: Advances in Theory and Research. New York: Plenum Press, pp. 205–240.

Knjaz V. (2007.). Slatkovodno ribarstvo RH. Ribarstvo, 65, 2007, (3), 111—121.

Marta P., Bochechas J., Collares-Pereira, M. J. 2001. Importance of recreational fisheries in the Guadiana River Basin in Portugal. *Fisheries Management and Ecology,* 2001, 8, 345±354.

Mrakovčić M., Brigić A., Buj I., Ćaleta M., Mustafić P., Zanella D. (2006.). Red Book of Freshwater Fish of Croatia, Zagreb, Ministry of Culture, State Directorate for Environmental Protection. Croatia.

Navrud S. (2001.). Economic valuation of inland recreational fisheries: empirical studies and their policy use in Norway. Fisheries Management and Ecology. 8(4-5):369 – 382.

Peirson G., Tingley D., Spurgeon J., Radford A. (2001.). Economic evaluation of inland fisheries in England and Wales, [Article]. Fisheries Management and Ecology. 8 (4-5):415-424.

Rasmusen G., Geertz-Hansen P. (2001.). Fisheries management in inland and coastal waters in Denmark from 1987 to 1999. Fisheries Management and Ecology. 8(4-5): 369 – 322.

Schramm H.L.Jr., Gerard P.D., Gill D.A. (2003.). The Importance of Environmental Quality and Catch Potential to Fishing Site Selection by Freshwater Anglers in Mississippi. North American Journal of Fisheries Management 23(2):512-522

Schramm H. L.Jr., Gerard P.D. (2004.). Temporal changes in fishing motivation among fishing club anglers in the United States. Fisheries Management and Ecology, 2004, 11, 313–321.

ter Braak, C.J.F. & Šmilauer, P. (2002.). CANOCO Reference Manual and CanoDraw for Windows User's Guide: Software for Canonical Community Ordination (version 4.5). Ithaca, NY, USA (www.canoco.com): Microcomputer Power.

Virtanen J., Ahvonen A., Honkanen A. (2001.). Regional socio-economic importance of fisheries in Finland. Fisheries Management and Ecology. 8(4-5):393-403, 2001

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