

A SURVEY OF PONDS AND THEIR LOSS IN ŽUMBERAK-SAMOBORSKO GORJE NATURE PARK, NORTHWEST CROATIA

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This paper presents the results of surveys of ponds in the Žumberak-Samoborsko gorje Nature Park. The data were collected during 2005 and 164 ponds still present in this area were registered, of at least 342 ponds that were here in the past. The trend in pond loss in this area was calculated, and the opinions of the 54 inhabitants about ponds are analysed.

Keywords: pond, pond loss, Žumberak, Samoborsko gorje, Nature Park

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Rad donosi rezultate istraživanja lokvi u Parku prirode Žumberak – Samoborsko gorje. Podaci su prikupljeni tijekom 2005. godine, a zabilježene su 164 lokve, od 342 koliko ih je najmanje postojalo u prošlosti. Izračunat je trend nestajanja lokvi na ovom području te su analizirana mišljenja 54 stanovnika o lokvama.

Ključne riječi: lokva, nestanak lokvi, Žumberak, Samoborsko gorje, Park prirode

INTRODUCTION

In the Žumberak-Samoborsko gorje Nature Park, ponds (Fig. 1) are mostly result of human activities. They were created to provide a source of drinking water for livestock and have been referred to as threatened habitats (FRANKOVIĆ *et al.*, 2004). Ponds are habitats for many plant and animal species and significantly contribute to the biological diversity of a region, especially in the karst area. For example, 50% of amphibians that can be found in Croatia, and 18 species of dragonflies (25% of Croatian species) have been identified in ponds in Žumberak-Samoborsko gorje Nature Park (LJUŠTINA, 2003; VITAS, 2003; ZLATAR, 2004). Many other species are

temporary inhabitants or, like livestock and game, use ponds as a source of drinking water. As a result of human activity, they also represent an important element of the cultural landscape and landscape diversity. Unfortunately, in recent times, most of them are threatened as a consequence of lack of management as well as of some negative influences such as intensive agriculture, filling and introduction of alien species. Previous research into the Žumberak-Samoborsko gorje Nature Park (KLETEČKI, 1990, 1995; RADOŠEVIĆ, 1996; RADIŠA, 1998; LJUŠTINA, 2003; ANČIĆ, 2004; ZLATAR, 2004; OKOVIĆ, 2006) recorded 45 ponds and their fauna.



Fig. 1. Typical pond in the Žumberak-Samoborsko gorje Nature Park.
(Photo: S. Struna)

As a consequence of recent changes in agriculture and modern life in general, habitats like ponds are undergoing rapid decline. This process has led to serious consequences for plant and animal communities, especially populations of amphibians.

In the past, ponds in Žumberak-Samoborsko gorje Nature Park were used as a source of drinking water for livestock and for watering gardens. The abandonment of the ponds led to natural processes of succession and they were gradually filled with sediments and overgrown with neighbouring vegetation (Fig. 2). The problem of overgrown ponds is connected with waste management in Žumberak-Samoborsko gorje Nature Park (ZLATAR, 2004).



Fig. 2. A pond in Žumberak-Samoborsko gorje Nature Park that is both overgrown with plant life and affected by waste disposal. (Photo: S. Struna)

Some authors pointed out losses of ponds in Italy (SCOCIANI, 1999, POLLI & ALBERTI, 1969; DOLCE *et al.*, 1991), in Great Britain (HALLIDAY, 1992; HEATH & WHITEHEAD, 1992; SWAN & OLDHAM, 1993; BOOTHBY, 1997; BOOTHBY & HULL, 1997; WILLIAMS *et al.*, 1998) and Norway, Netherlands, Denmark and the south-eastern United States of America (SCOCIANI, 2001).

During 2005 we conducted systematic investigation to gather data about the number of ponds and the main threats. The aim of this work was to analyse the local people as stakeholders in the Nature Park Žumberak – Samoborsko gorje in Croatia, to get more information on the current status of the ponds in Žumberak-Samoborsko gorje area and to answer the following questions: a) How many ponds are present at the moment in this area?; b) How are they used and have been used in past?; c) What is the habitat loss?; d) What is the attitude of local inhabitants with respect to the ponds?; e) What are the main threats to the ponds and f) Which management measures are needed for the purpose of protection and conservation of ponds?

Description of the study area

The Žumberak – Samoborsko gorje Nature Park covers 333 km² and is situated in the northwest of the Republic of Croatia, near the border with the Republic of



Fig. 3. Location of the Žumberak-Samoborsko gorje Nature Park in north-west Croatia.

Slovenia, and comprises a hilly area to the southwest of the Pannonian plain bordered by the rivers Sava, Krka and Kupa (Fig. 3). Altogether, various kinds of karst landscape cover around 90% of the Park's territory, which is approx. 300 km² (BRKIĆ *et al.*, 2002.).

IUCN (1995) refers to the high biological diversity of the Žumberačko Gorje mountains due to their position at the juncture of the Alpine, Dinaric, Continental and Pannonian areas. The two main ecosystems are forests and grasslands, but also cultivated areas of ploughed fields, orchards and vineyards can be found (JELASKA *et al.*, 2004). All demographic indicators show that the remaining population is ageing (CRKVENČIĆ, 2002). According to the last census from 2001 (CBS, 2001), there are 4096 people living in 132 settlements within the Park. In comparison with the census of 1991, the population has decreased by 31%. Approximately 37% of the people living in the Park are more than 60 years old (CBS, 2001). Over the last decades, and especially in the 1990s, livestock farming has been seriously declining in the Park (ŽUPANČIĆ, 1996). Abandonment of agricultural land is in evidence. For example, thirty-seven percent of the landowners in the case of meadows and 50% in the case of pastures did not use them (KIPSON, 2003).

The Nature Park is governed by the public authority founded in 1999 by the Croatian Government for the purpose of managing this area.

Material and methods

For the purpose of collecting data we undertook field research and a questionnaire survey in 2005. For the purpose of pond inventarisation, we spent 67 field days. Locations of ponds were recorded using GPS equipment (Garmin Summit), and geographical coordinates for each pond were given. The map was produced with the use of the ArcView 8.1 programme packages (© 1995–2007 ESRI).

A questionnaire survey of 54 people living within the border of the Park was conducted. Twenty seven days were spent on filling in the questionnaires. Altogether, the research was carried out in 43 villages that represent 32.6% of all settlements in the Park area. An effort was made to ensure that all parts of the Park were covered. The questionnaires allowed multiple answers.

Mainly elderly people were targeted. This is because we wanted data about the history of the management of the ponds. The great majority of the questionnaires were conducted in-person and filled in by the researcher.



Fig. 4. Distribution of ponds in Žumberak-Samoborsko gorje Nature Park.

The questionnaires also include data about the number and purpose of ponds, as they used to be and as they are now; how they made ponds; does game use ponds; do they know any animal or plant species from ponds; does such a pond tend to dry up; if so when, and does it happen more in recent times; how they clean ponds; and do they have willingness to clean them now. We were also interested in their opinion about the importance of the ponds and what the Public Institution does about the ponds.

Data management and analysis included basic descriptive statistics such as percentages (%), mean, minimum, maximum and standard deviation (STD).

RESULTS

Altogether 164 ponds in Žumberak-Samoborsko gorje area were recorded. Results of pond inventarisation are shown in Tab. 1 and their distribution is shown in Fig. 4.

Questionnaires were conducted in 43 different villages in the Nature Park, representing 32.6% of villages in Park, including 54 respondents that are filled in the questionnaires completely. The average age of respondents was 62.3 years, while the minimal age was 36 years and the maximal 83 (STD = 14.20393). The majority

Tab. 1. Overview of recorded ponds with their local name, geographical coordinates (x, y) and altitude (z) in Žumberak-Samoborsko gorje Nature Park.

Nr	Local name	x	y	z
1	Bajčička	5062337	5524151	514
2	Kuljajska lokva	5064255	5524122	626
3	Pajina lokva	5065447	5524345	704
4	Lokva u Jazovčini	5063171	5524175	485
5	Vranešičeva lokva	5062405	5525252	501
6	Na Brezovlju	5062297	5525627	501
7	Lokva kod crkve	5062316	5525735	472
8	U Slavčev dolu	5062010	5525819	437
9	Lokva u Malincima	5064538	5527364	682
10	U Dubokoj dragi	5064924	5527645	628
11	Borina lokva	5060523	5523538	264
12	Kekićeva lokva	5061472	5529325	382
13	Lokva u Gaju	5062009	5529602	430
14	Lokva Tupci	5062536	5531395	481
15	Lokva Boršt	5062683	5532253	469
16	Lokva Ognjanovci	5063344	5532206	521
17	Lokva Močile	5063023	5529340	643
18	Lokva u dolu	5063003	5529263	628
19	Lokva Stubalj	5062636	5523865	479
20	Lokva u Glavici	5062991	5523758	499
21	Lokva u Koretić mlinu	5072791	5543138	235
22	Lokva Kokote	5064056	5532783	428
23	Vukobratova lokva	5063851	5531493	611
24	Lokva uz cestu Tomaševci 1	5069787	5532667	573
25	Lokva uz cestu Tomaševci 2	5069750	5532570	576
26	Tomčeva lokva-Kekići	5068694	5532381	559
27	Petruševka 1	5061141	5531185	439
28	Petruševka 2	5061158	5531259	437
29	Lokva u pećarićima	5060627	5530858	373
30	Kal na vrhu	5059294	5530609	309
31	Lokva u Stojavnici	5060041	5530386	332
32	Veliki kal u Bukovlju	5060443	5531120	406
33	Lokva u Gorici	5060676	5532824	483
34	Lokva u Hrastovici	5060653	5533150	474
35	Lokva Šavornik	5060214	5532918	372
36	Žljebac	5060068	5533370	360
37	Štubalj	5060004	5533466	346
38	Varčenka	5060077	5533042	348
39	Lokva Krajačiči	5060760	5534947	308

Tab. 1. continued

Nr	Local name	x	y	z
40	Lokva Brezik	5061245	5535045	291
41	Mlaka na brađi	5061069	5535704	278
42	Lokva kod štale	5061020	5535783	283
43	Lokva Kaline	5063847	5533498	404
44	Lokva u Baronima	5061286	5535458	343
45	Trubinkina lokva-velika	5063843	5534247	430
46	Trubinkina lokva-mala	5063835	5534271	430
47	Anina lokva	5063439	5534277	395
48	Jurina lokva	5063430	5534336	401
49	Na kamenica 1	5063434	5532707	374
50	Na kamenica 2	5063439	5532710	374
51	Lokva na poučnoj stazi	5071607	5539027	730
52	Lokva kod vinograda	5063338	5534474	381
53	Močile	5063357	5534234	378
54	Lokva kod bifea Tena	5062564	5534824	342
55	Lokva u borovima	5062544	5534857	338
56	Lokva Logorišće	5062907	5534563	350
57	Brest-kaptaža	5062223	5535814	308
58	Lokva kod vodospreme	5061872	5536258	327
59	Lokva na brdu	5061757	5536422	318
60	Lokva Šobatovići	5070103	5541116	692
61	Zdenac Duralije	5063971	5534247	441
62	Lokva pod Goricom	5063539	5532703	419
63	Točak-Goleši	5061770	5524731	389
64	Bunar-V. liješće	5061358	5524869	387
65	Slapnik	5061882	5525642	409
66	Točak-Dragoševci	5062237	5525509	448
67	Marino vrelo	5062988	5524413	538
68	Bunar-Gudalji	5064647	5524046	614
69	Studena voda	5067121	5524328	928
70	Zdenac-Sekulići	5065386	5524474	736
71	Majer	5065135	5536486	400
72	Mlaka-V. Brdo	5064506	5536641	373
73	Selska lokva-Šinkovići	5064980	5536066	405
74	Na Grmnica 1	5065118	5537231	436
75	Na Grmnica 2	5065135	5537184	436
76	Zobišće 1	5064962	5537542	447
77	Zobišće 2	5064985	5537546	448
78	Lokva Matijevac	5064197	5537842	406
79	Balabanova lokva	5063989	5537776	400

Tab. 1. continued

Nr	Local name	x	y	z
80	Kal Veliki vrh	5063894	5538044	395
81	Točak Balići	5062901	5530376	540
82	Vrelo Kašt	5061838	5528802	469
83	Točak Priselje	5062379	5529027	566
84	Luka-Magovci	5062781	5529079	588
85	Pojilo-Budinjak	5071456	5538320	752
86	Bukovlje-Rajjići	5068727	5541222	626
87	Lokva Grubači	5066792	5541092	558
88	Lokva Stiči	5066425	5541681	672
89	Milanova lokva	5065052	5540683	560
90	Velika lokva-Gračac	5065150	5540848	575
91	Lokva-Stakići 1	5063148	5540089	492
92	Lokva-Stakići 2	5062936	5540011	479
93	Lokva pod kućom-Rude	5062632	5540242	430
94	Lokva kod raspela	5062603	5540108	441
95	Točak Kunčani	5064560	5525356	607
96	Točak Jezernice	5066004	5528573	689
97	Lokva Grgetiči	5066536	5535340	468
98	Miljenovićeve lokva	5066299	5537584	442
99	Lončarica	5065875	5537938	430
100	Krisnik	5065767	5537139	441
101	Vrtanjki	5066019	5537008	449
102	Lokva Ilovice	5066861	5536207	488
103	Baronski Stubalj	5069467	5535611	673
104	Stubalj Podlokvice	5069566	5534767	766
105	Lokva Grič	5069609	5534754	771
106	Močila-Grič1	5069559	5535007	730
107	Močila-Grič2	5069557	5535031	729
108	Lokva kod vodosprema	5069665	5535771	717
109	Tratina	5068743	5528946	696
110	Boljara 1	5068355	5528177	795
111	Boljara 2	5068330	5528182	795
112	Lokva Pavkovići	5067942	5542630	715
113	Lokva Brezovac	5068574	5543062	710
114	Lokva Višoševići	5067474	5542809	728
115	Lokva kod samostana	5067717	5543187	766
116	Deji-Glušac	5061120	5530654	346
117	Lokva na brijevu	5066876	5538687	412
118	Lokva Jarača	5066930	5538657	415
119	Lokva na gnojniku	5066910	5538588	415

Tab. 1. continued

Nr	Local name	x	y	z
120	Lokva pod košarom	5066944	5538567	408
121	Lokva u Mirkovićima	5066821	5538598	406
122	Lokva u Gladnoj Dragi	5069159	5537756	506
123	Lokva Vodice	5072319	5540210	674
124	Lokva na puteljku	5065245	5540484	518
125	Milanova lokva	5065853	5539384	474
126	Petraškina lokva	5065888	5539304	475
127	Pančina lokva	5065801	5539374	492
128	Lokva pod lijeskom	5066622	5540753	531
129	Lokva u Staničićima	5066289	5539517	515
130	Tomićeva lokva	5066327	5539550	518
131	Lokva Čačile	5066342	5539929	495
132	Lokva Kordići 1	5070800	5540111	555
133	Lokva Kordići 2	5070800	5540111	555
134	Lokva uz cestu Tomaševci 3	5069732	5532483	596
135	Lokva Čučići	5066670	5539093	464
136	Lokva u Pečnom	5066617	5540389	506
137	Lokva u Osunji – 1	5075293	5537913	603
138	Lokva u Osunji – 2	5075250	5537936	613
139	Duralije (Grgetićeva)	5063834	5534053	517
140	Vlašić Brdo	5062247	5538840	306
141	Podište	5076484	5543521	635
142	Čemernik	5066003	5526934	657
143	Lokva Bratelji	5072300	5539570	750
144	Pojilo-Bratelji	5072325	5539420	650
145	Lokva Poljanica	5066026	5550739	526
146	Lokva kod Tisovečke Bregane	5072540	5542436	346
147	Lokva kod Bazgovice	5071388	5542523	375
148	Lokva Dubokom dolu	5070147	5544215	475
149	Lokva u Tisovcu	5071738	5540411	619
150	Lokva Novo Selo Okičko	5066698	5554450	368
151	Lokva Šipački Breg-1	5069720	5547855	666
152	Lokva Šipački Breg-2	5069739	5547887	672
153	Lokva kod Eko sela	5073336	5542793	379
154	Ponori iznad Gornje Vasi	5071034	5536672	600
155	Lokva iznad Gornje Vasi	5070871	5536603	611
156	Dragonoš1	5068972	5546464	741
157	Dragonoš 2	5069010	5546501	758
158	Radina Vas	5060891	5531118	455
159	Blate	5066757	5527869	692

Tab. 1. continued

Nr	Local name	x	y	z
160	Blate 2	5066290	5527562	699
161	Blate 3	5066533	5527838	695
162	Kod Vranjačkog slapa	5065209	5538852	241
163	Kaptaža Tomaševci	5068529	5534031	555
164	Bernardići	5066797	5534854	300

of people said that there is some pond in the proximity (85.2%) while 40.74% indicated that some other ponds still present. The majority of respondents, 48 of them, (88.9%) declared that they knew of some dried ponds.

The usage of ponds, in the opinion of the inhabitants, is shown in Fig. 5.

Livestock watering was given as the main purpose of ponds (90.7%). Types of livestock are shown in Fig. 6.

Twenty-one respondents said that game used the ponds (38,9%), mainly roe deer (N=20, 37%), afterwards wild boar (N=8, 14,8%), birds (N=3) and foxes (N=2).

No one stated having used plants or animals from the ponds. Almost half said that the pond tended to go dry (N=25, 46.3%), usually once a year (N=17, 31.5%)

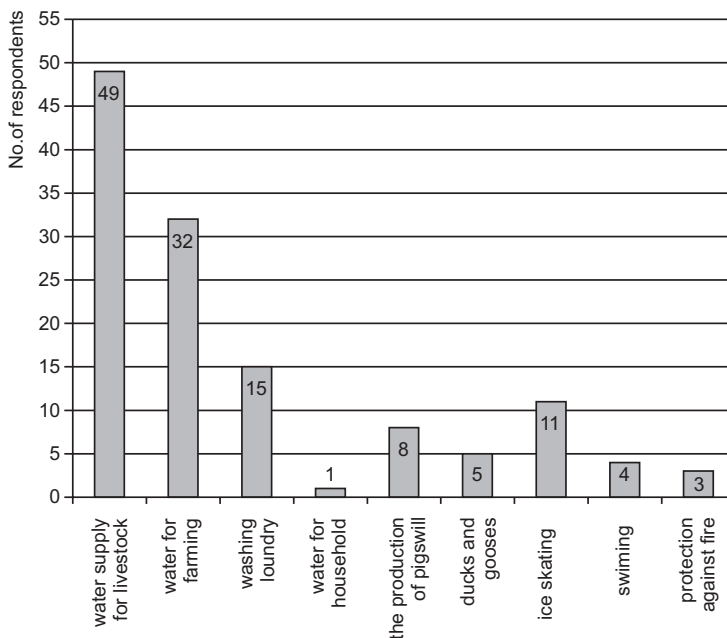


Fig. 5. Usage of ponds according to Žumberak-Samoborsko gorje Nature Park inhabitants (N=54). Multiple answers allowed.

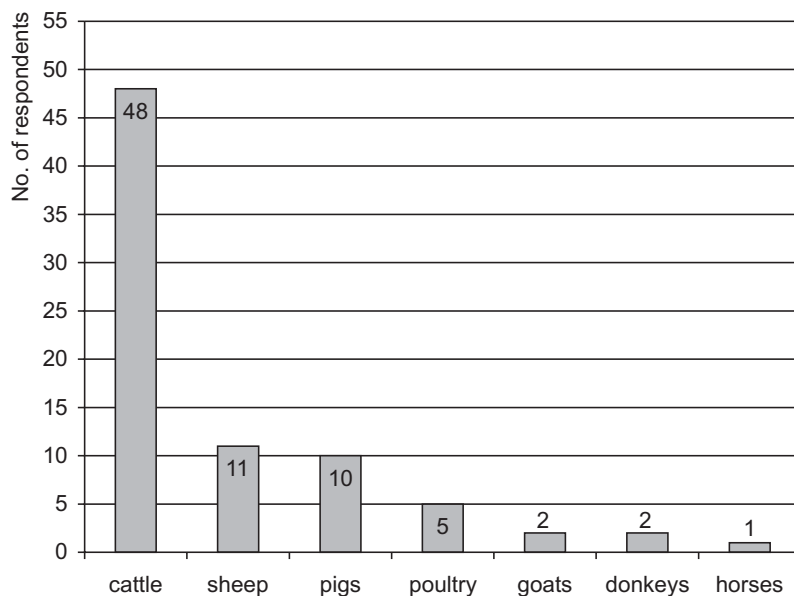


Fig. 6. Usage of types of livestock according to Žumberak-Samoborsko gorje Nature Park inhabitants (N=54). Multiple answers allowed.

while 5 of them declared that this happened periodically (9.3%), and 12 of them (22.2%) that pond had been going dry more in recent times.

Ponds are usually cleaned during the summer (N=34), while some of them are cleaned in spring or autumn (N=14). Summer cleaning used to conduct in the dry period. Ponds were cleaned by the owners (43.8%) or all villagers together (56.2%). During cleaning they usually use shovels and similar tools like hoes and rakes (100%) while only for one pond in recent times have they used a dredger.

The majority of the ponds are on private land, as many as 77% of them while others are on state-owned land (23%).

Almost all of the respondents (N=49, 90.7%) declared that there were more ponds before, and 45 (83.3%) gave as the reason for the reduction in the number of ponds the decreased numbers of people and livestock.

Only a few people responded with reference to the making of ponds, 5 of them (9.3%) in places where water was noted as being retained.

Waste disposal bothers the majority of people (N=47, 87%); 38 of them would like to have a pond in their proximity (70.4%) and more than a half are prepared even to clean up ponds (N=28, 51.9%).

More than a half, 61.1% (N=33) suppose that the Public Institution has to clean, maintain and protect ponds, 12 respondents (2.2%) think that the Public Institution is not required to do anything to maintain them and only a small number of people (N=4; 7.4%) think that the Public Institution has to fill in ponds.

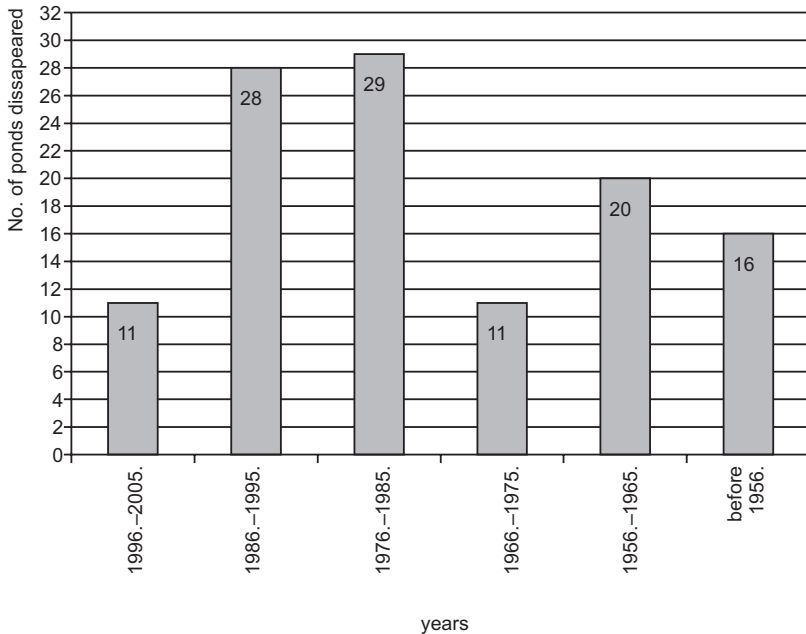


Fig. 7. Loss of the ponds in Žumberak-Samoborsko gorje Nature Park area (N=115) in different periods.

To the query what animals from the pond they know, the majority respond frogs (N=48; 85.2%), while some of them know even species as *Bombina variegata* (N=7, 13%), *Hyla arborea* (N=4, 7.4%) and *Bufo bufo* (N=3, 5.6%).

Snakes were recognised by 35 respondents (64.8%), and between them *Natrix natrix* was pointed out by 82.35%. Afterwards came dragonflies (N=17, 31.5%), newts (N=4, 7.4%) and *Salamandra salamandra* (N=3, 5.6%).

The majority of the respondents, as many as 70%, did not see any disadvantages of ponds, while just few stated as disadvantages mosquitoes, frog calling, waste disposal, bad smells and potential traffic hazards. As the most important advantages, the respondents listed water supply for livestock (53.7%), water supply in general (13%), biodiversity protection (18.5%) and protection against fire (16.6%).

As a part of pond inventarisation we recorded 164 ponds. Through questionnaires we identified at least 178 more. In the case of 63 ponds (35.4%) the respondents could not recall the time of their disappearance. Of the 115 ponds, that had disappeared within living memory, almost half had gone dry in the period of 11 – 30 years previously (N=57, 49.5%). Fig. 7 shows the loss of ponds in the Žumberak-Samoborsko gorje Nature Park area.

If we consider 70 years as the time that the respondents can remember, taking 178 ponds as having disappeared in this period, the loss of the ponds is 2.5 ponds/year or 0.74% per year.

DISCUSSION

The opinions and attitudes of the inhabitants of Žumberak-Samoborsko gorje Nature Park have been evaluated as very important for the determination of protection and management measures with this sensitive ecosystem (FRANKOVIĆ *et al.*, 2004). From the data collected during this research it has been established that as well as the 164 present ponds there were at least 178 ponds more in the past. If we try to estimate the state in the future assuming that 2.5 ponds are lost per year, in 65 years from now there will no be ponds in this area. Exceptions will be temporary ponds that came into existence from stream overflows and other natural ponds. If we consider the average loss of 0.74% of ponds per year, the situation is somewhat better, but still the trend of disappearance of ponds is very big. Some 60 years ago there were at least 342 ponds in this area or approximately 1 pond per square kilometre. Of the 115 lost ponds, for which the respondents recall the time of disappearance, most of them were lost in the period between 11–30 years ago. This time period can be connected with the declines in the numbers of livestock. Over the last decades, and especially in the 1990s, animal husbandry has been seriously declining in the Park (ŽUPANČIĆ, 1996). Data from literature (ŽUPANČIĆ, 1996; FRANKOVIĆ *et al.*, 2004; KIPSON, 2003; VRBEK & BUZJAK, 2002, 2003) show that due to emigration of the inhabitants and abandonment of the rural way of life, all of the habitats and species whose survival depends on regular maintenance will gradually disappear within the climate-zonal vegetation growth. This is revealed that the succession has been caused by a decrease in the number of people and livestock, which is a major threat to the maintenance of ponds in this area. Extensive livestock rearing is a powerful tool for maintenance of this habitat and it should be supported in order to preserve them. This could also benefit other kinds of habitat conservation, e.g. grasslands (KIPSON, 2003; FRANKOVIĆ *et al.*, 2004).

Some authors (SCOCCIANI, 1999) have discussed losses of ponds in Italy in the past 60 years. This study showed that, compared with historical situation, 12.5% of ponds disappeared and 50% of them showing clear signs of succession, with a gradual accumulation of sediment and vegetation overgrowth, with 37% still in good condition and suitable for amphibian reproduction. The situation in Žumberak-Samoborsko gorje Nature Park is even more unsatisfactory for in the last 60 years more than half of all ponds have been lost. This trend of losses is even more pronounced than in Italy (SCOCCIANI, 1999). Their endangerment was recorded for the Park area before (FRANKOVIĆ *et al.*, 2004), the main reason adduced being the reduction of traditional livestock farming. The Park inhabitants agreed with this, the majority of them giving as the main reason the decreasing number of people and livestock. The roles of the ponds are, besides water supply for livestock, in conservation of biological diversity, protection against fire, but also in recreational purposes such as ice skating and swimming. We were surprised with the relatively big number of answers that the ponds were used for ice skating (20.4%). Besides that, as many as 38.9% of the respondents noticed that ponds are used by game, particularly roe deer and wild boar. Respondents gave as advantages of the ponds water supply, protection against fires, garden watering, but also aesthetic considerations.

If we consider all these factors it can be seen that the significance of the ponds is not only as water supply for livestock but also in biodiversity and landscape protection, and local inhabitants are also familiar with this fact. The main threat to the ponds is that they are overgrown by plant life, consequent upon the population decrease, reduction in livestock and the fact that as many as 35% of the inhabitants are over 60 years old. They do not have sufficient reasons to maintain the ponds (or, because of age, they are not capable of doing so). Because the primary function (water supply for livestock) of the ponds has decreased, the main role in the protection will have to be taken over by the park authority. These actions have to be done in concert with the local inhabitants. Besides benefits for biodiversity protection, this could lead to good relationships between the authority and the local stakeholders. These actions have to be accompanied by awareness-raising and education about ponds and their living world. Cleaning of ponds has to be done in the traditional way (with hoe, shovel and rake) at the time when the pond is going dry, usually in the summer. The time of reproduction and hibernation of amphibians (and other pond inhabitants) has to be avoided. It is necessary to make a list of priority ponds that have to be maintained and consider and include actions in the future management plan of Nature Park.

Respondents showed a very good knowledge about pond fauna. The majority recognized frogs and snakes, and some of them even know the species. Dragonflies were recognized by a third of the respondents, the reason for this could be two recently conducted investigations (LJUŠTINA, 2003; VITAS, 2003), where the inhabitants were in contact with the researchers. As many as 70% of respondents would like to have ponds in their proximity, and more than a half are prepared to clean up the ponds. We were surprised by this positive attitude but we have to keep in mind that we chose elderly people that appreciate the traditional way of life. And although they are willing to participate in pond maintenance, their ages may make this unrealistic.

Ponds in Žumberak-Samoborsko gorje Nature Park represent very valuable habitats for amphibians, dragonflies, and reptiles such as the grass snake (LJUŠTINA, 2003; ANČIĆ, 2004; ZLATAR, 2004) and some mammals such as game and bats, especially because this is a karstic and mountain region. Some of the amphibian species such as *Triturus carnifex*, *Bombina variegata* and *Hyla arborea* are listed on annexes of EU Habitats Directive (92/43/EEC). Ponds represent a very valuable habitat for them. The importance of ponds at higher altitudes has been referred to in some research (LACHAVAENE *et al.*, 2004; HINDEN *et al.*, 2004). RUGIERO *et al.* (2004) pointed out the great importance of ponds above 1000 meters for breeding and persistence of aquatic organisms and they are marked as sensitive habitats. Although it is still possible to find quite a large number of ponds in this karstic area, the loss trend is very pronounced and it is necessary to carry out measures for their protection immediately.

SUMMARY

During 94 days of field research into the ponds in Žumberak-Samoborsko gorje Nature Park, the 164 ponds that are still present on this area were identified. A questionnaire survey of 54 people living in 43 villages within the border of the Park was conducted. Data from questionnaires indicate that, as well as the current ponds, in this area there were once at least 178 more, and that more than a half were lost in the last 60 years. The majority of ponds were lost in period between 11–30 years ago, which can be connected with fact that over the last decades, and especially in the 1990s, livestock farming has seriously declined in the Park. The loss trend has been quantified at 2.5 ponds per year or 0.74% per year. The main purpose of the ponds is specified as water supply for livestock and water supply for farming. As for other purposes the ponds have been used for laundry, the production of pig swill, keeping ducks and geese, ice skating, swimming and protection against fire. The attitude of local inhabitants is surprisingly positive. As many as 87% of respondents said that waste disposal in the pond bothered them, 70.4% wanted ponds in their proximity and more than a half would even clean the pond. Only few of respondents thought that the ponds had to be filled in. The main threat to the ponds is their being overgrown with plant life, caused by the decline in human and livestock population. Park inhabitants agreed with these as the main threats. For the purpose of managing this threatened habitat, the role of the park authority is pronounced, and this was also recognised by the park's inhabitants. The task of the park authority has been partly implemented through the inventorisation of ponds, but some management measurements for their protection are still required.

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