UFZ-Discussion Papers

Department of
Economics, Sociology and Law (OEKUS)

8/2004

Comparative analysis of the conflicts between carp pond farming and the protection of otters (*Lutra lutra*) in Upper Lusatia and South Bohemia

Jaroslav Myšiak, Kathleen Schwerdtner, Irene Ring [*]

July 2004

[*] UFZ Centre for Environmental Research Leipzig-Halle GmbH,
Permoserstr. 15, 04318 Leipzig, Germany

Email: Kathleen.Schwerdtner@ufz.de

COMPARATIVE ANALYSIS OF THE CONFLICTS BETWEEN CARP POND FARMING AND THE PROTECTION OF OTTERS (*LUTRA LUTRA*) IN UPPER LUSATIA AND SOUTH BOHEMIA

JAROSLAV MYŠIAK[1,2], KATHLEEN SCHWERDTNER[1] AND IRENE RING[1]

[1] UFZ Centre for Environmental Research Leipzig-Halle GmbH, Permoserstr. 15, Leipzig, *e-mails: jaroslav.mysiak@ufz.de, kathleen.schwerdtner@ufz.de, irene.ring@ufz.de*

[2] FEEM Fondazione Eni Enrico Mattei, Venice, Italy

Keywords: Conflict mitigation, Nature conservation, Pond fisheries, Otter, Saxony, Czech Republic, Compensation payment, Aquaculture

Abstract:

The fishpond landscapes in Central and Eastern Europe have immense historical and cultural value, and are highly significant as a habitat for numerous endangered species. Typical examples of cultural landscapes, their maintenance depends on (extensive) fishpond farming. However, although the protection of endangered pescivore predators in these landscapes such as the otter and the cormorant has been successful in recent years, it is increasingly running into conflict due to the damage caused by these species in the fishponds. We present a comparative analysis of such conflicts with otters in two regions with a long history of carp-farming – Upper Lusatia in Saxony (Germany) and South Bohemia in the Czech Republic. For this purpose we examine various ecological, economic and social aspects of the conflicts in both regions. We compare the recent socioeconomic developments, explore fish-farming practices, and investigate factors likely to influence conflict perception and manifestation. Based on the comparative analysis and drawing on other relevant literature, the problem of biodiversity conflict characterisation is analysed in terms of the extent of a conflict and its dynamics. In this context, basic difficulties of designing and evaluating conflict mitigation measures are discussed.

1 Introduction

Economic development, especially during the twentieth century, has led to many species being endangered at a national, European and global level (Pearce and Perrings, 1995). This is particularly true for large vertebrates that require comparatively large tracts of extensively used semi-natural ecosystems and are attracted to and compete with humans for biological resources. The requirements of large vertebrates and the use of biological resources by humans frequently provoke serious conflicts (Clark et al., 1996). In the past, attempts to solve such conflicts were directed towards eradication and this has led to severe declines and the regional extinction of many species. As a consequence, large vertebrates feature prominently in national red lists and in international conservation agreements (Groombridge, 1992).

Changed attitudes, legal protection and active management have provided a basis for the return and recovery of these species, and their conservation has become a matter of great public concern. As a result of successful conservation policies, the populations of certain large vertebrates are now increasing in areas where they were close to extinction or already extinct for several decades. However, their reappearance or increase is being accompanied by the re-emergence and exacerbation of conflicts with humans because these species often prey on livestock (e.g. cattle, sheep) or commercial biological resources such as fish produced by aquaculture. This pattern can be seen for a variety of large vertebrates on a global scale, for example large predators in the Alps such as the brown bear (*Ursos arctos*), the wolf (*Canis lupus*) and the lynx (*Lynx lynx*) (Breitenmoser, 1998), wild goose populations in Scotland (MacMillan et al., in press), the Asian elephant (*Elephas maximus*) in China (Zhang and Wang, 2002), and the Eurasian otter (*Lutra lutra*) in central Europe (Kranz, 2000; Bodner, 1998).

Biodiversity in central Europe is fundamentally linked to human land use. Different forms of land use led to an increase in species and habitat diversity until the 19th century (Cox et al., 1973; Kaule 1996). In Germany, the Czech Republic and Austria, fish farmers have a long history of creating distinctive pond landscapes and secondary habitats for many species that live in and around water going back to the 13th century. Eutrophication and the ongoing loss of other natural small water bodies leading to the endangerment of several species has even strengthened the role of pond landscapes for biodiversity and nature conservation. Today, about one third of Saxony's red list species depend on swamp and water habitats (Thiem, 2002).

The Eurasian otter is a typical example of an endangered species that nowadays depends on ponds as secondary habitats. Formerly widespread throughout Europe, the otter underwent a rapid decline in numbers in the second half of the 20th century. For centuries otters were regarded as pests whose damage to fish populations caused high losses in aquaculture. They were also intensively hunted for their skin, their meat being sold as food during the fasting time. Special otterhounds were bred to hunt and kill as many otters as possible. As a result, otter populations dwindled and became endangered. However, under strict species protection policies starting in the second half of the 20th century, the persecution and killing of otters were outlawed, allowing otter populations to slowly regenerate. When the Habitats Directive entered into force in 1992, the otter finally became a

"strictly protected species of common interest" (Council of the European Community, 1992), meaning that catching, killing and disturbing otters as well as damaging and disturbing their habitats became strictly prohibited in all European member states.

The main economic sector in potential conflict with growing otter populations is aquaculture. The slow regeneration of otter populations in central Europe was accompanied by complaints about otter damage, especially by carp (*Cyprinus carpio*) farmers. Trouble began for example in lower Austria in the early 1980s, where a compensation scheme was set up in 1984 to mitigate the conflict (Bodner, 1998).

This paper will investigate two study areas that still have compensation schemes in place as one way of mitigating the conflict between fish farmers and otter protection: Upper Lusatia in Saxony, Germany, and South Bohemia in the Czech Republic. On the one hand, these areas have always had viable otter populations that recovered to a population size allowing otters to spread into neighbouring habitats. On the other hand, both areas are characterised by aquaculture in the form of carp farming in artificial ponds dating back to the Middle Ages. Another feature in common is that both study areas once belonged to communist countries in Eastern Europe: Saxony as part of the former German Democratic Republic (GDR) and South Bohemia as part of Czechoslovakia. After the political upheaval in 1989, substantial structural changes occurred in both countries, resulting in new political, economic and social conditions. Saxony joined the European Union in the course of German reunification in 1990, whereas the Czech Republic became a member of the EU on 1 May 2004.

The aim of this paper is to investigate the conflict between aquaculture and otter protection in these two study areas, focusing on the analysis of damage compensation schemes and other selected economic instruments directly addressing the relationship between otter protection and carp farming. Firstly, the two study areas are briefly introduced in terms of their natural and socioeconomic features as a basis for background understanding. Secondly, the fisheries sectors (and more specifically carp farming) are compared, after which the otter populations in the two areas are characterised. In the third step, the respective compensation schemes and economic instruments are presented. Based on this information and combined with estimates of the persisting illegal persecution of otters, the problem of 'conflict' characterisation in terms of the conflict's extent and dynamics are analysed. Specific questions are addressed such as how damage compensation schemes are successfully introduced and what unavoidable difficulties are encountered in connection with the application of economic instruments in conflict mitigation.

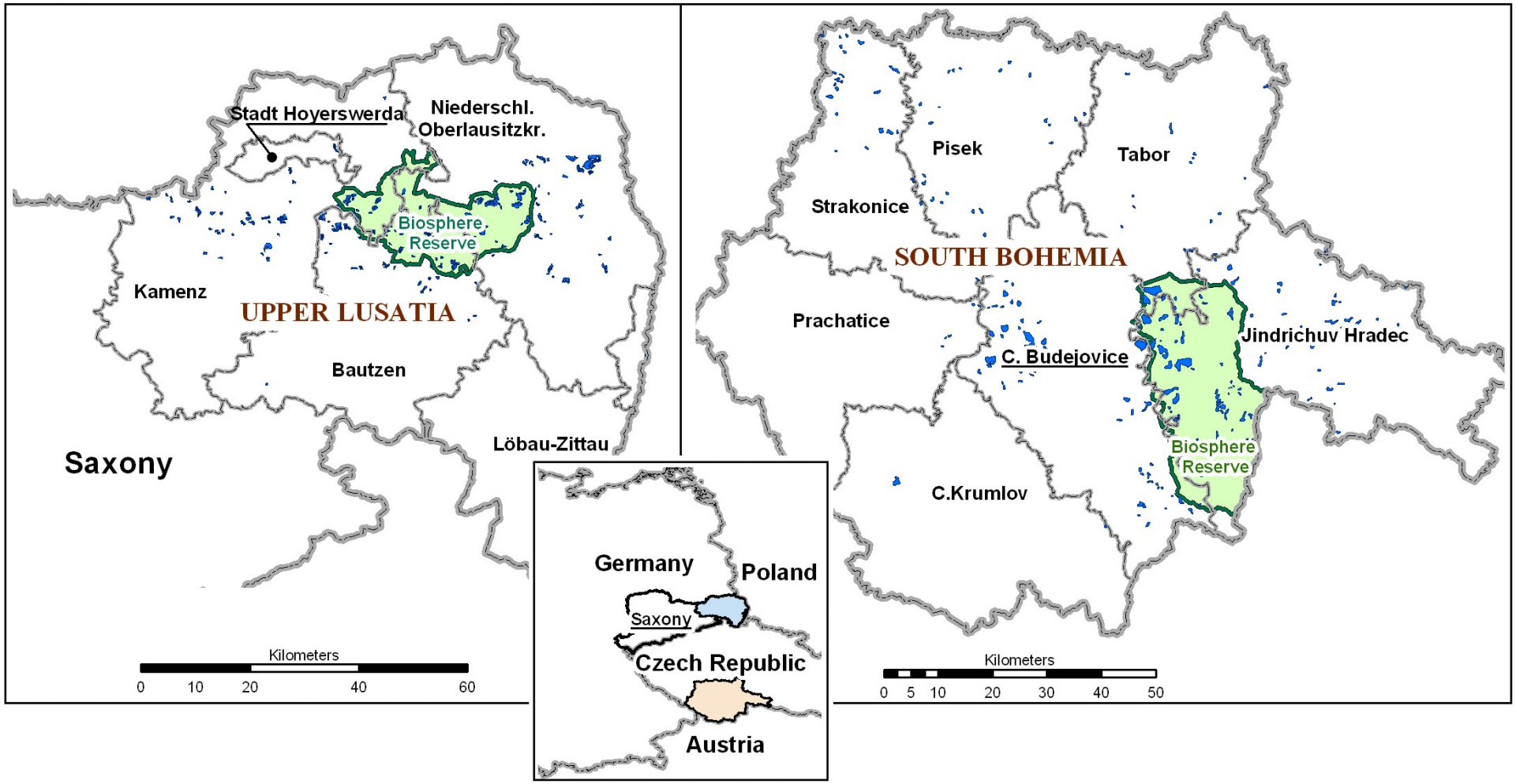

Figure 1: Geographical overview of the study areas with major ponds: left – Upper Lusatia situated in Saxony (Germany), right – South Bohemia (Czech Republic)

2 Natural and socioeconomic characteristics of Upper Lusatia and South Bohemia

Upper Lusatia belongs to the state of Saxony and is situated in the south-east of Germany close to the border with the Czech Republic (to the south) and Poland (to the east). The South Bohemia pond region is located in the southern part of the Czech Republic (CR), on the border with Austria (to the south) and Bavaria/Germany (to the south-west). The two regions have undergone rather similar historical and social development.

The development of pond fisheries in both Upper Lusatia and South Bohemia was prompted by their suitable geological, geographical and hydrological conditions. Ponds were mainly built on regularly flooded moor land or sand and clay soils that are usually poor in nutrients and therefore unsuitable for agriculture. Both areas have numerous creeks and rivers, another main factor for the existence of ponds. Due to thei unique cultural and landscape value, parts of both regions have been declared biosphere reserves – areas of terrestrial and coastal ecosystems where solutions to reconcile the conservation of biodiversity with its sustainable use are promoted.[1] Biosphere reserves are internationally recognised, nominated by national governments, and remain under the sovereign jurisdiction of the states where they are located. They serve in some ways as 'living laboratories' for testing and demonstrating the integrated management of land, water and biodiversity.

In Saxony, the biosphere reserve *Upper Lusatia Heath and Pond Land* was designated in 1994 whereas the Třeboň Basin in South Bohemia has existed since 1977. The name 'Lusatia' (originally 'Łuża') means marshland or swampland and was given to the region by the Slavic settlers because of its numerous moors and inland waters. Similarly, the river which supplies most of the numerous ponds in the Třeboň Basin is called the Lužnice. The Upper Lusatia Heath and Pond Land Biosphere Reserve encompasses 301 km^2 and is inhabited by 12,800 people. The Třeboň Basin Biosphere Reserve covers an area of 700 km^2 and has a total population of 28,500.

Upper Lusatia comprises the districts[2] of Kamenz, Bautzen and Niederschlesischer Oberlausitzkreis as well as the town of Hoyerswerda. The district of Löbau-Zittau is also included in the analysis, a highland area with fewer and smaller ponds. The total area encompasses 133 municipalities on 4,400 km^2. With just over 10,000 km^2, the pond region in South Bohemia is twice as big as Upper Lusatia. South Bohemia encompasses 7 districts (České Budějovice, Český Krumlov, Jindřichův Hradec, Písek, Prachatice, Strakonice, Tábor) and 623 municipalities. Nevertheless, the two areas

[1] The establishment of a coordinated world network of new protected areas to be designated 'Biosphere Reserves' was one of the projects of the Man and the Biosphere (MAB) Programme officially launched in 1971 by UNESCO.

[2] It is interesting to note that while the districts in Saxony's study area correspond to the NUTS 3 level (explained below) for statistical purposes, the equivalent Czech unit is the whole of the South Bohemia region. In Saxony, the NUTS 4 level is not defined, whereas in the Czech Republic NUTS 4 is represented by the districts. In both areas, the municipalities correspond to the NUTS 5 level. The Nomenclature of Territorial Units for Statistics (NUTS) was established for collecting regional statistics for the EU. The NUTS favours institutional breakdowns (existing administrative units) by considering geographical (e.g. altitude) and socioeconomic criteria (e.g. the homogeneity, complementarity or polarity of regional economies, Eurostat, 2004).

have approximately the same number of inhabitants (about 607,000 in Upper Lusatia and 625,000 in South Bohemia). Both study areas are considered rural regions because of their low population densities (137 and 62 inhabitants/km^2 respectively), which are far below the respective national averages.

	South Bohemia	Czech Rep. total	Upper Lusatia	Saxony	Germany total
Area (km^2)	10,056	78,868	4,400	18,413	357,027[b]
Numbers of inhabitants ('000)	625	10,206	607	4,345	83,000[b]
Changes between 1990 and 2002 ('000)	+2,2	–155.6	–78	–381.9[1]	+2,823[1]
Population density (persons/km^2)	62	129	137	236	231
Share of agricultural and forestry land use (%)	52/30	54/33	47/34	56/27	55/30
Number of employees in agriculture, forestry and fisheries (persons)	26,900	194,000	8,600	52,560	929,000
Unemployment (%)	6.65	9.81	22.5[2]	19.2	10
GDP per capita (€)	5,852	6,195	14,300	16,900	25,2000

Table 1: Selected general socioeconomic descriptors of the compared regions (2002).
Sources: data from Czech Republic – Český Statistický Úřad 2003, from Germany – Usbeck et al., 2004, and [b)] Statistisches Bundesamt Deutschland,[1] data available only up to 2000, [2] data from 2001

The dominant land use in Upper Lusatia is agriculture (47%), followed by forestry (34%). There exist about 1,000 ponds in Saxony, covering more than 8,000 ha. More than 5,000 ha pond area and 71 enterprises are located in Upper Lusatia, revealing that much of Saxony's pond fisheries is concentrated in this area (Usbeck et al., 2004). The political upheaval and German reunification in 1990 led to lasting structural changes in the area. Many industrial enterprises and large agricultural co-operatives collapsed, causing high unemployment which in turn led to high migration losses, especially among younger people. In fact since 1990, Upper Lusatia has lost approximately 78,000 inhabitants or 11.4% of its total population. At the same time, the area lost about 40,000 jobs; the share of people working in the primary sector (agriculture, forestry and fisheries) dropped from 7.5% to 3.6% (Usbeck et al., 2004). The number of people in work is currently about 238,700. The monthly net income in the region is significantly below the average in Saxony, while the unemployment rate in 2001 of 22.5% was more than twice the German average (StaLA Sachsen, 2001). GDP is €14,300 per capita, just 57% of the German average.[3]

[3] For the German case study, socioeconomic indicators are reported for both the study area Upper Lusatia and the state of Saxony as a whole. This is because a number of indicators – especially those related to the fisheries sector presented later – are unavailable for just the study area itself.

The prevailing forms of land use in South Bohemia are agriculture (52%) and forestry (30%). Numerous large and small ponds cover 25,000 ha, about 2.5% of the region's area. South Bohemia does not rank among the country's key industrial areas; in 2001 it accounted for just 5.1% of the Czech Republic's industrial turnover total, although it is responsible for about 11% of its agricultural output. The political and economical changes after 1989 did not affect the population, which by 2002 had slightly increased. The total number of people in work is about 298,700; nearly half of them are employed in the industrial sector, while some 9% work in agriculture, forestry and fisheries. The average gross wage in 2001 was CZK 14,029 (~ €443[4]) per inhabitant, 88.5% of the Czech average. While in other sectors the average gross wage is lower than the national average, in agriculture, forestry and fisheries it is slightly higher for this sector. Registered unemployment in late December 2002 was 6.65%, South Bohemia ranking second best after the capital Prague. Although the area's GDP accounts for only 5.4% of that of the Czech Republic, but when converted to GDP per inhabitant (CZK 185,386 or €5,852) it amounts to just 87.8% of the national average and ranks fourth in the Czech Republic.

3 Carp-pond farming

The Czech Republic and Germany are two of the countries with the highest carp production among the members of the Federation of European Aquaculture Producers (FEAP): with ca. 16,500 tonnes of carp the Czech Republic is the second-largest carp producer (after Poland), while Germany ranks fourth with ca. 10,500 tonnes (MZE, 2003). Carp production in the EU-15[5] amounts to ca. 20,000 tonnes – only a small share of the total aquaculture production of 500,000 tonnes (FEAP, 2002). After the enlargement,[6] carp production in the EU-25 now totals ca. 66,000 tonnes. While aquaculture based on salmon and shrimp is often criticised for its negative environmental impacts (shrimp because of its destructive effect on mangrove forests and salmon for being fed on wild fish caught in the ocean) (Economist, 07.08.2003), the extensive production of herbivorous fish such as carp is seen as an alternative, more sustainable fish-farming practice.

Both study areas have a long tradition of carp-pond farming going back to the 13th century. Driven by the continuing land settlement and high population growth, fishpond construction boomed in 14th and 15th century. Many ponds were built in this period, including the largest pond ever built in the Czech Republic (and possibly in Europe), the Rožumberk pond, which when completed covered an area of ca. 1,000 ha. At that time the total pond area in both countries was as much as twice that nowadays. The high popularity of fishpond farming was due to the higher profitability of fishponds compared to cropping on low fertility soil (Hartstock, 2000). The Thirty Years' War (1618–48) precipitated a decline from which fishpond farming in Central and Eastern Europe never completely recovered. In addition, since the 18th and 19th centuries many ponds (especially those on more

[4] For the paper we adopted the change rate 1€ = 31,68 CZK as on 02.01.2002.

[5] EU15 – the European Union as before 01.05. 2004.

[6] EU25 – the European Union after the most recent enlargement on 01.05.2004

fertile soils) have been transformed into fields and in many places were replaced by sugar beet plants. The publication of Justus von Liebig's book on using chemicals in agriculture to greatly boost production certainly contributed to this trend. Towards the end of the 19th century, the systematic use of additional feeding (Benecke, 1885; Vogel, 1928 in Thiem, 2002) and fertilisers (Demoll, 1925 in Thiem, 2002) allowed increased pond productivity. This marked the beginning of intensification and mechanisation in (carp dominated) aquaculture (Thiem, 2002).

Under the communist regimes installed in both countries shortly after the end of the Second World War, fishpond farms were nationalised and merged to form large-state owned enterprises. Fish production was carried out intensively, often involving high additional feeding, fertilising and stocking rates. Following the political changes in 1989 – which in Germany led to the reunification West and East Germany in 1990 – the fishponds were returned to their previous owners or privatised. In South Bohemia about half of the companies previously owned by the state were transformed into privately owned corporations, nearly half were directly sold off, and the rest were either privatised by auction or placed under local authority ownership (CFFA, 2003). While in Saxony the carp production has diminished ever since (from 6,686 tonnes in 1989 to 2,620 tonnes in 2002 (Sächsische Landesanstalt für Landwirtschaft, 2002), production in South Bohemia remained stable or even increased. The production decrease in Saxony is mainly a result of the changed economic conditions, including reduced demand. Additionally, the fact that most ponds are included in one or more conservation support programmes has led to a generally more extensive production scheme (Thiem, 2002).

	South Bohemia	Czech Rep. total	Upper Lusatia	Saxony	Germany total
Fish production (tonnes)	> 10,000[a]	~ 20,000	n.a.	2,931[g]	~ 36,000[e]
Of which carp (tonnes)	~ 9,000[a]	~ 18,000	n.a.	2,620[g]	~ 11,000[e]
Fishpond area (ha)	~ 25,000[a]	~52,000	5,016[d]	8,419[g]	30,000[f]
Number of ponds	~ 7,000	~ 50,000	n.a.	~ 1,000[j]	n.a.
Number of employees	n.a.	~ 2,000[b]	n.a.	~ 600[h]	n.a.
Stock density (kg/ha)	n.a. (in some cases more than 1,200[c])	~ 600[b]	~ 600[i]	~ 600[i]	n.a.

Table 2: Comparison of main production characteristics of the two fishpond areas:
Sources: [a] Český Statistický Úřad 2003, [b] Czech Fish Farmers Association CFFA 2003; [c] Bureš 2000, Faina 2000, Kranz 1998; [d] Usbeck et al., 2004, [e] FEAP 2004, [f] Wedekind et al., 2001, [g] Sächsische Landesanstalt für Landwirtschaft 2002, [h] StaLa Sachsen 1995, [i] Thiem 2002, [j] SMUL 2004

Due to the data protection issue and the lack of periodical statistical surveys, only little statistical information about current fishpond farming in terms of number of employees, turnout and profit is available at a regional and local level.

In Saxony, some 8,419 ha of pond area exists today, almost all of which is used for carp production. This makes the state of Saxony the second biggest carp producer in Germany, following Bavaria. Large companies dominate carp production in Saxony, the 15 biggest operating on 56% of the total pond area. Out of the total of 170 companies, 55 work on primary occupation, 99 on secondary occupation, and 16 producers are angling or conservation associations (Sächsische Landesanstalt für Landwirtschaft, 2002). Annual fish production varied between 3,351 tonnes in 2001 and 2,931 tonnes in 2002 (Bundesanstalt für Landwirtschaft und Ernährung, 2002). The average pond area is 153 ha; however, in Upper Lusatia the average pond area per company varies between 218 ha in the district of Bautzen and 2.4 ha in the district of Löbau-Zittau, where for most of the fisheries employees this is a second occupation.[7] Saxony's average production is about 600 kg/ha and therefore rather low compared to 2,000 kg/ha during GDR times (Thiem, 2002). Some 89% of all the fish produced is carp. In 1994, 622 people worked in aquaculture in Saxony (StaLa Sachsen, 1995). The data indicate that the importance of aquaculture in Saxony is rather low in terms of employment, although high in terms of production and relevance to the German market.

In South Bohemia ca. 7,000 fish ponds have a total area of about 25,000 ha, almost half the total pond area in the Czech Republic (ca. 52,000 ha). Carp dominates production (ca. 87%), with other species such as salmonids, tench, whitefish are of less importance. More than half the fish produced in the region is exported (CFFA, 2003). All in all, more than half the Czech Republic's output of fish is produced here (ČSU, 2003). In terms of company size, 124 of the 131 companies have fewer than 10 employees, most of whom work on a part-time basis (ČSU, 2003). By contrast, only 9 companies have more than 10 employees, and just one has over 100 employees. A small number of companies own most of the fishponds. One single company operates on ca. 400 fishponds mostly located in the Třeboň Basin Biosphere Reserve. The total area of these ponds amounts to 7,000 ha fishponds (~ 30% of the region's pond area), 1,213 ha of which are situated in nature reserves. The company, which is the biggest single carp producer in Europe, produces ca. 3,000 tonnes of fish annually – about the same as the total production of Saxony. According to the CFFA (2003), average production in fishponds in the Czech Republic accounts for ca. 450 kg/ha. However, in many ponds the stocking density exceeds 1,000 and in some cases even 1,200 kg/ha (Bureš, 2000; Faina, 2000; Kranz, 1996).

The trade balance between the two countries in terms of carp is clearly in favour of the Czech Republic. Carp exports from the Czech Republic to Germany vary between 2,510 tonnes in 1999 and 3,847 tonnes in 2002, making up 70–90% of Germany's total carp imports. Since 2000 the exports have not slipped below 3,000 tonnes. On the other hand, exports from Germany to Czech Republic are only sporadic, accounting in 2001 for 7 tonnes of carp (MZE, 2003).

4 The otter population in Saxony and South Bohemia

The Eurasian otter (*Lutra lutra*) is distributed among inland waters all over Europe. The natural distribution area stretches from the Iberian Peninsula to Northern Siberia and from Scandinavia to

[7] Data gathered from the Office of Fisheries in 2004, own calculations.

South India. Otters are also to be found in North Africa and the Middle East. In Central Europe, the western border of the current otter distribution covers extensive distances across Germany. To the east and south, German, Polish and Czech otter populations are more or less connected (Reuther et al., 2002).

Persecuted for centuries, the study areas with their numerous fishponds played a crucial role as refuges for otter populations from which, having been protected, they then spread to neighbouring states. There are numerous references to the severe persecution of otters in the past: For example Stubbe (1990) quotes Cornelius, who in 1885 recommended *"Hunters, catchers and fishers may helpfully shake hands with each other for a sustainable persecution of this fish predator..."*. Another reference (Schulthess, 2004) reports about a single English hunter who with the help of otterhounds killed more than 700 otters from 1870–90. In Czech lands an agricultural exhibition was held in 1889 where a large sign reading "*death to otters*" in large letters constructed from dozens of otter skulls invited visitors to demonstrations equipment for catching and killing otters (Anonymous, 1891).

Under the German Federal Conservation Act, the otter is a specially protected species. It is also protected under the Hunting Act, which guarantees a closed season throughout the year. However, prior to reunification, different regulations concerning otters existed in the two German states. In the former GDR, the otter was initially protected under the Hunting Act with a closed season being introduced in 1962 with certain exceptions to protect fishponds. In 1984, it was removed from the Hunting Act and covered by the highest protection status, which included measures for the conservation of otter habitats (Stubbe, 1990). In West Germany, the otter had always been covered by the Hunting Act. However, a closed season was introduced first in Lower Saxony in 1966 and then in the rest of the country two years later (Reuther et al., 2002). In the Czech Republic the otter is listed under the Act No. 114/1992 on the Protection of Nature and the Landscape and Directive 395/1992 as a severely endangered species. In addition the otter is covered by the Hunting Act. Although the Hunting Act allows an open season for the otter throughout the year, it may only be stalked by hunters who have obtained a special permit from the conservation authorities beforehand.

The German study area Upper Lusatia is home to one of Europe's most viable otter populations of approximately 200 (–50, +100%) individuals. The otter population in eastern Germany is of special importance for the conservation and spread of the species into bordering states (Lower Saxony, Schleswig-Holstein, Saxony-Anhalt, Thuringia) and for integration with populations in Bohemia and Bavaria (Reuther, 1999). Until the end of the 19th century, otters were present on all suitable inland waters and wetlands in Germany. By the mid-20th century, however, the species had disappeared in most areas in western and central Germany. Since the early 1990s, there have been clear indications that otters have started to re-colonise their former habitats. Nowadays, approximately 20% of German territory is populated by otters again (Reuther, 1999).

In the Czech Republic, in the early 1990s the otter was distributed on only 25–30% of the area in three isolated groups (Toman and Kadlečík, 1992). Later on (1998–2001), an increase in the South

Bohemian population was observed. The entire Czech population currently numbers ca. 800–1,100 individuals distributed over 40% of the country's area (Roche, 2003). The results of recent mapping of otter distribution suggest a continuous spread and increase in numbers in mainly Southern Bohemia and the Czech-Moravian Highlands. The main cause of the present expansion is probably the decrease in water pollution together with more intensive fish farming following the restitution programme in 1989 (Toman, 1998a; Kučerová, 2000). The study area contains the largest and most stable otter population in the CR, which is extends across the South Bohemian fishponds (Třeboň basin), the Šumava Mountains and the Czech-Moravian Highlands. This population is connected to the remaining populations in the Bavarian forests and the Austrian Waldviertel.

5 Compensation payments

Financial losses caused by protected pescivore species are compensated in both the Czech Republic and in Saxony. Apart from the otter, these payments are also made for damage caused by other protected species.

In Saxony compensation is paid (i) under the 'NAK'[8] programme partly designed to support environmentally sound aquaculture and to maintain the historical pond region, and (ii) under a programme for compensation in cases of 'hardship'.[9] In addition, there is an aquaculture programme supporting the protection of fishing stocks against pescivore predators by technical mitigation measures such as fencing and wires, under which some €25,559 was used in 2001–02 for pond fencing in Upper Lusatia (SMUL, 2004 in lit., own calculations).

The NAK programme is based on Council Regulation (EC) No. 1257/99 for agro-environmental programmes. Taking the form of voluntary contracts for a duration of five years, fish farmers can choose from various measures such as no additional feeding, no additional stocking or extra stocking to create feeding habitats for endangered species. In Upper Lusatia, 91% of all fish companies participating in NAK also take part in the specific programme measure to create feeding habitats for endangered species, for which they receive €103 per ha and year. Since this measure is only used for otters, it is known informally as the "otter bonus". A figure of 250 was adopted for this programme as the reference size for the otter population in Saxony in an agreement between fish farmers and the conservation authorities in 1998 (Langner, 2004, personal information). According to the Department of Fisheries, which is responsible for all fishery concerns in Saxony including licensing, the training of fishing personnel, payments under the NAK programme and the hardship regulation, it is assumed that a single otter normally occupies a habitat of 8 ha. The Department of Fisheries further assumes that each otter causes annual damage of €500. Multiplied by the number of 250 otters, annual fish losses totalling €125,000 are the basis used for the general

[8] NAK stands for "Naturschutz und Erhalt der Kulturlandschaft" – nature protection and conservation of cultural landscapes.

[9] Economic losses in agriculture, forestry and fisheries caused by protected species are understood as 'hardship' when they exceed a certain amount.

calculation of damage compensation. In reality, some 2,959 ha are supported as feeding habitat in the fishpond region. This 2,959 ha actually supported by the programme measure could therefore be inhabited by 365 otters. In other words, funding covers 119 more otters than are expected by the Department to live in the region. Then again, the amount of 365 otters is still within the range of estimated by ecologists (100–400).

The compensation scheme for damage or 'cases of hardship' has been operating in Saxony since 1995. Saxony is the only German state with such a regulation. Compensation is paid if damage exceeding a certain level is caused by protected species.[10] Damage to aquaculture is calculated by subtracting a standard loss of 30% from the expected fish production. The standard loss is supposed to cover all natural losses due to regular fish diseases etc. If actual losses exceed this 30%, fish farmers can claim compensation for damage without the need to furnish any additional proof even though damage is very likely to be caused by other species apart from the otter (such as cormorants, herons or divers). Additionally, losses may occur due to higher disease rates, bad water quality or poor cultivation. On the other hand, this calculation also covers secondary damage such as injuries. From 1995–2001, fish farmers in Upper Lusatia applied for average damage compensation of €52,147 per year. There is no legal entitlement to such payments – compensation is paid as long as public funds are available. Fish farmers who receive payments for feeding habitats cannot apply for damage compensation within the same area.

Additionally, more or less informal damage compensation is paid in the districts of Kamenz and Löbau-Zittau. In the case of very small ponds, which are especially common in the 'highlands' of the respective districts, fishing personnel are compensated in the form of live carp instead of money. These carp are usually of low quality and bought by the lower conservation authorities from local fishing personnel. Such compensation has been effected since 1993 (Wilson, 2004).

In the Czech Republic, compensation for the damage caused by protected species has been paid since 2000. Besides the otter and the cormorant, damage caused by the bear (*Ursus arctos*), wolf (*Canis lupus*), moose (*Alces alces*), beaver (*Castor fiber*) and lynx (*Lynx lynx*) is also compensated. By protected pescivore species only damages caused to artificial fishponds are compensated, the damages in streams and rivers are not object of the compensation. Scant information is available about the actual payment at the national and regional level. Šilhavý (2003) reports that in 2002 ca. 13 million CK (~€410,350) was paid for damage caused by both the otter and the cormorant to the members of the Czech Fish Farmers' Association, which represents 60 fish producers managing ca. 85% of the fishpond area in the Czech Republic. According to Roche (2003), by September 2003 the Czech Otter Foundation, the institution which examines most of the compensations claims[11] for otter damages in South Bohemia, had registered 160 claims for ca. 6.5 million KC (~€205,180).

To apply for compensation, fish farmers have to report the damage to the responsible local authority, which inspects the fishpond and confirms the damage. An independent expert gives a

[10] Damage must exceed a total of €1,000 per year to claim for compensation.

[11] The Foundation examines ca. 90% of all compensation claims, mostly in the fishpond regions.

report about the presence of otters in the area where the fishpond is situated and assesses the damage. Damage assessment covers the direct damage (fish actually eaten by the otter), since the secondary damage (caused by injuring or stressing the fish in winter) are not regulated. Assessment considers the number of otter visiting the fishpond and the frequency of visits. The compensation payment is then calculated for the duration of the otters' presence, average consumption and the average fish price. Certain factors like pond size etc. are also considered.

In 2003 a compensation programme (up to €32/ha) was introduced which rewards the protection of littoral zones, the reduction of fish feeding, fertilisation of the fishpond bottom and other measures aimed at environmental protection in ponds larger than 5 ha. Tolerating protected pescivore species is not addressed by the programme. An additional subsidy programme is aimed at supporting the fish farmers to tackle the increasing siltation of the fishponds. Under this programme some €10.5 million was spent in 2003 on removing the sediments from the ponds and repairing the damage to ponds caused during the flooding in 2002 (Vaníček, personal communication).

6 Conflict analysis and evaluation of mitigation measures

Mitigation measures such as payments for damage compensation are designed to take the edge off the conflict. In a broader context, the damage caused by the otter to fishpond farmers is only one aspect of a wider problem. The loss of natural habitats for breeding and resting, the decline of water quality and subsequent insufficient natural prey, as well as the channelling of water courses (and the corresponding loss of riverine habitats) and mankind-driven changes of fish populations in water courses (e.g. Toman, 1998a), to name but a few anthropogenic activities which together result in otter-related damage to fishpond farms increasing. Indeed, the conflicts as complained about by fish farmers and also anglers may be seen as a consequence of humans' intensive land and natural resource use which limits the ecosystems' natural self-regulation. The cause-effect chains underlying these conflicts are complex and often immeasurable, comprising a variety of stakeholders.

As far as nature protection and biodiversity conservation are concerned (see also Toman, 1998b; Roche, 1998; Kranz et al., 1998; Kranz et al., 1996), the damage to aquaculture is a consequence of for example (i) the high-density fish stocks in fishponds, which provide an 'appreciated' substitute for natural prey (e.g. amphibians (frogs) or crabs) along with the reduced diversity of the fish species in ponds and water courses (especially the absence of species with less economic value or of less interest to anglers); (ii) the intensive agricultural/industrial activities leading to habitat loss and water quality decline; (ii) modifying water flows and bankside vegetation, which subsequently lead to the loss of habitats for both the otter and its prey. In this context, the intensive fishpond farming practices provide secondary habitants for otters on the one hand, but on the other hand often lead to the decline of aquatic moorland ecosystems due to high stock density and pond fertilisation.

Regarding the fish farmers (Hafellner, 1998; Poupě, 2003; Šilhavý, 2003; Kepr, 2003), the fishponds are man-made and thus artificial structures are exclusively built for fish production. The secondary effects such as (i) the high flora/fauna diversity for instance in the littoral zones of the fishpond, (ii) providing secondary habitats for species endangered elsewhere, (iii) increased water

retention capacity, or (iv) the aesthetic value of the landscapes are complementary outcomes that are basically welcome if they do not imply any restriction of production. If the production restrictions do occur, they need to be compensated accordingly. Since the fishponds (both land and water) are often privately owned, the biodiversity protection measures usually restrict the unlimited exertion of property rights. Furthermore, the continued existence of fishponds depends on their regular use and any temporary abolition of fish production may have irreparable consequences for the fishpond ecosystems. In this context, the high siltation of fishponds and fierce market competition (resulting in low fish prices) constitute additional pressures on the fish farmers.

Conflict analysis in such a situation is inevitably based on reducing the complexity of the problem at hand. This can be achieved by leaving out of consideration 'less' important aspects of the conflict which either cannot be addressed by the corresponding authority or are likely to be too costly or not implemented under the current political or economic conditions. As shown above, the conflicts in the two study areas have already been (at least) partly institutionalised (e.g. by the compensation regulations). However, the extent of payments and eligibility rules for such compensation do not satisfy all the stakeholders affected because of the conflict simplification mentioned above. Generally speaking, conflicts related to biodiversity conservation can only be well structured to a certain extent and by doing so numerous interdependences and interrelations are either simplified or neglected. Despite this general insight, we try to approach this problem by structuring the conflict in terms of its extent and dynamics, building on indicators from an ecological, economic and social angle. This interdisciplinary perspective integrating knowledge from ecology and the social sciences is inevitable for any conflict mitigation or resolution, for biodiversity conflicts involve at least two stakeholder groups who disagree on issues related to or caused by protected species or measures to protect biodiversity.

Any conflict analysis and evaluation of mitigation measures encompasses several steps described in more detail below: (i) an assessment of the extent of the conflict; (ii) analysis of the conflict dynamics; (iii) an assessment of the effectiveness of the measures. The insights and results of these steps may be taken up in subsequent conflict mitigation processes, for the facilitation of which a variety of techniques (e.g. mediation, participative planning and decision making, etc.) have been developed (Rijsberman, 1999).

The evaluation of different actions for conflict mitigation requires an assessment of the conflict before and after the implementation of the actions. First of all, an analysis of the legal and institutional framework relevant to the conflict situation has to be conducted. Species protection regulation at various governmental levels as well as land-use restrictions for fish farmers due to the location of farms within protected areas need to be investigated. However, further assessing a conflict may be difficult because of (i) the low availability of information (direct or indirect) describing the conflict and (ii) multiple aspects of the conflict to be characterised. Indeed, any conflict can be measured by a variety of ecological, social and economic indicators, each of them describing the conflict from a certain perspective. Understanding the conflict or evaluating the effectiveness of the mitigation measures means making an assessment based on all these indicators and their dynamics. In the following, we will mainly focus on the potential indicators for assessing

the extent and dynamics of a conflict and discuss these aspects with respect to our study areas and the conflicts existing.

6.1 Assessment of the extent of the conflict by ecological, economic and social indicators

There are a number of potential ecological, economic and social indicators useful for describing the extent of the conflict and the distribution of the subsequent social and economic costs among the (conflicting) parties involved or affected (see Table 3 for an overview). Besides its development in time described in the next section, the conflict may also vary considerably in space depending on the specific geographic, natural or socioeconomic conditions. Below we distinguish between direct and indirect indicators, although we acknowledge that this distinction partly depends on the conflict's assumed perspective. The direct indicators describe the immediate outcomes of the conflict – in terms of costs (not necessarily in monetary terms) and benefits to the conflicting parties. Indirect indicators on the other hand relate to the conflict's environment and help to assess its wider context. Both types of indicators can be expressed in ecological (e.g. the number of otters killed or the degree of environmental degradation), social (positive or negative attitudes towards biodiversity conservation) or economic (financial damage, market competition or subsidies for environmentally sound farming) terms.

There may be a smooth transition between indirect and direct indicators, and at a certain stage of conflict development indirect indicators might become directly relevant to conflict resolution (e.g. in the case of a substantial increase in species population numbers). What makes the situation more complicated is the fact that in many cases the conflicting parties do not agree on the actual magnitude of the indicators, augmenting the conflicts about values or interests[12] with disagreements about the facts.

One of the most obvious direct ecological indicators of a conflict is the number of animals illegally killed by the affected stakeholder. In some cases hints exist about illegal otter killing (Gutleb et al., 1998; Kranz et al., 1996; Kranz et al., 2003; Řeřábek, 2004) and some assessments in this regard were also made in the past (Kranz et al., 1998). Generally speaking, these estimates are not reliable enough to base the evaluation of the mitigation measures on them. The actual damage to fishponds (in kg of fish per hectare) is a more reliable direct ecological indicator of the conflict. Normally, these assessments are made: (i) by calculating the difference between the actual and expected production in the ponds, obtainable after the ponds have been drained at the end of the production period (i.e. the final weight of the fish); or (ii) by calculating the damage from the assumed number of otters in the area and the average amount of fish an otter consumes per day. As will be shown later, different methods are applied in our case areas. The former approach is often criticised for not taking into account the variety of factors to which fish mortality can be attributed (other predators, diseases, etc; see also Bodner, 1998). The latter approach on the other hand may be difficult to

[12] The conflicts are manifested in different values, interests, and in disagreements about the facts (see Rijsberman, 1999; Wilson et al., 2004).

apply if the conflicting parties disagree on the average consumption of fish by the otter. An indirect ecological indicator of the conflict is the population size or the population distribution pattern (for related problems see Kranz and Knollseisen, 1998). This is an indirect indicator because an increase in the population size does not necessarily lead to the exacerbation of a conflict. For example, if predators can prey on food in natural and semi-natural habitats, they do not depend as much on resources in managed habitats.

One of the most obvious direct economic indicators relates to financial losses and shortfalls caused by otter predation on commercial fish. These assessments are based on the measurement of the predation (population size of pescivore species, daily consumption), the uncertainty of which is projected to this indicator (e.g. Bodner, 1998). The estimation of the economic value of the fish preyed on by otters varies considerably among the affected actors and potentially also during the year. Different financial losses are borne by professional fish farmers and anglers, often because different prices are employed to quantify them. Another direct economic indicator relates to the existence of payments for damage compensation: the mere existence of such an instrument indicates the existence of the conflict. The number of applications for damage compensation, the damage claimed and the actual amount of payments made by the authorities to fish farmers may be an indicator of the extent of a conflict. Alongside damage compensation, support for technical mitigation measures such as fences or wires to keep predators off also fall in this category.

Indirect economic indicators may be seen in the decline of certain economic activities which might not be profitable any more. Here, the transition between economic and social issues is very smooth. Usually, a variety of economic and social factors exert pressure, especially on small-scale traditional land uses. Predators, even if only marginally adding to the burden to be borne, may just be the last straw and used as a scapegoat for other problems.

The perceived benefits of conservation activities are other indirect indicators which, although expressed in economic terms, reveal the social preferences or non-use value attached to both fishpond farming and otter protection. The general public's willingness to pay (WTP) for conservation programmes targeted at these species and investigated by contingent valuation studies expresses the perceived use (or usefulness) of the protection of threatened and endangered species (MacMillan et al., in press; Loomis and White, 1996). There are few studies quantifying the WTP for otters and none of them apply to the case study areas compared. For example White et al. (1997) investigated the willingness to pay for otter protection in North Yorkshire. The mean WTP obtained from his survey amounted for £11.91 which, when aggregated over the whole population of the county, is well in access of the calculated costs for the UK action plans for the otter. A similar study exists for the sea otter (*Enhydra lutris*) carried out by Hageman (1985) in which the WTP amounted to $29.

Probably the most important category in terms of conflict assessment is the social indicators which express the differences in views or values between various groups of stakeholders. The direct indicator in this regard is the conflict's severity as perceived by different actors involved (fishing personnel, anglers, nature conservationists, authorities, etc). Numerous publications show that a

higher value is attached to the protection of some 'flagship' species (e.g. for the otter, Kučerová, 2000; Kruuk, 2002). The otter is such a flagship species and can also be regarded as a keystone species, given its role at the top of the predation hierarchy. Furthermore, in view of its sensitivity to water quality, the otter acts as a bioindicator for environmental (especially water) quality.

Group of indicators	Indicator
Ecological	Illegal persecution pressure (otters killed)
	Damage to fish stock in managed and natural habitats
	Population size and distribution
	Predation pressure by other species (e.g. the cormorant)
	Landscape structure (number of ponds, suitable habitats, etc)
	Other environmental pressure on the otter population (e.g. water quality)
Economic	Costs of damage
	Payments for damage compensation
	Subsidies for technical mitigation measures
	Compensation payments for ecological services of fish farming (environmentally sound farming practices)
	Intensity of fish farming (production intensity)
	Decline in economic activities (fisheries sector, tourism, etc)
	Market pressure (e.g. low price of fish)
	Benefits or non-use values from environmentally sound fish farming practices or otter protection
Social	Conflict perception by actors and general public
	Balance between the perception of the importance of fisheries and otters
	Number of jobs lost due to predation
	Distribution of perceived costs and benefits across the social groups

Table 3: Examples of indicators potentially suitable to describe the conflict between fisheries and otter protection.

It is possible to observe the severity of a conflict as perceived by different actors in terms of spatial distribution. In the first stage, only stakeholder groups directly affected by the conflict are involved at the location where the conflict occurs; at the second stage, the general public is also involved at the location where the conflict occurs (e.g. depending on local media and social networks). Finally, the spread of conflict perception outside the immediate area of the actual conflict by the media and NGOs (conservation or anglers associations) might be observed.

In South Bohemia, there is evidence about the killing of otters in the past and at present (Horáčková and Poledník, 2002; Řeřábek, 2004). For example Kranz et al. (1996) reports about three cases of otters verifiably killed by humans. These three otters were part of a sample of eight radio-tracked otters and although they document the illegal persecution of the otter, they rarely provide a sufficient basis for an assessment of its extent. More recent evidence about the illegal persecution of

otters is reported by Řeřábek (2004). Although the population in the Czech Republic and South Bohemia is well documented, the estimated size differs considerably among the conflicting parties (see also e.g. Adámek et al., 2003; Hanzal and Havránek, 2000). For example, the Czech Anglers Association (Sýkorová, 2003) reports more than 1,400 otters in the Czech Republic (some 800 otters in the study area), the Association of Hunters (2003) ca. 1,300, while the monitoring programme established by the Nature Protection Agency and the Czech Otter Foundation assesses the population size at ca. 800–1,000 individuals (Roche, 2003). Strong disagreement also exists about the damage caused by otters due to (i) the different assessment of the population size and (ii) daily consumption and secondary damages. Assessments of otter consumption per day vary between ca. 0.5 (Toman, 1998b; Kranz et al., 2004) and more than 1 kg/day (e.g. Czech Anglers' Association). The secondary damage is assessed by a factor of 1.9 by fish farmers and anglers, but neglected by the compensation scheme. The average price of preyed fish varies between €4.2/kg (according to the anglers) and €1.6/kg (fish farmers). Subsequently the damage assessments reported by the Czech Anglers' Association (based on an assumed population size of ca. 1,460 otters, daily consumption of 1 kg fish at a price of €4.2/kg and secondary damage of a factor of 1.9) amount to 131.99 million KC (~€4.16 million). The corresponding assessment (based on the daily consumption of 0.75 kg/otter and fish price €1.6) by fish farmers amounts to 22 million KC (~€694,444) for 2002 (Šilhavý, 2003).

The perception of the conflict was high before the damage compensation schemes were adopted (Kranz, 2000) and is still high among some stakeholders (Myšiak, in preparation). A survey reported by Roche (2003) revealed that more than 60% of those interviewed believed that the damage caused by otters had steadily increased in recent years, the damage ranging between 5–30%. These perceptions varied considerably across the administrative districts surveyed and the groups of interviewees (anglers and fish farmers). The same survey revealed that although the current damage compensation payments in South Bohemia are well known, ca. 40% did not believe that this scheme would solve the conflict. The highest discontent with the damage compensation scheme was reported among the owners of small fishponds. According to Kranz (2000), the farmers complain more about secondary damage (stress and surplus killing), which are perceived as being far higher than direct consumption. In Spurný et al. (2003), the acceptance of protected pescivore species among the anglers was investigated, revealing rather high acceptance of the otter (55%) while discontent with the protection of the cormorant is reported to be high (75%). In contrast, Novotná (1998) reports that many respondents confused the otter with the mink (*Mustela vison*) when shown pictures of them, a finding which may suggest that the damage caused by otters is overestimated. The conflict seems to be worse in the Czech-Moravian Highlands due to the suboptimum climatic (e.g. long snowy winters, cold water) and geological (acid soil) conditions (Kranz et al., 1998b). The low-nutrient ponds predominating here are also smaller than those in lowland areas around the Třeboň, and are owned by small farmers. Therefore, the otter causes higher relative damage up to the complete depletion of the fish stock (Toman, 1998b).

In Saxony there is evidence that since 1990 some 5–6 otters have been killed in the district of Kamenz, although the real figure is thought to be up to three times higher (Wilson et al., 2004). At present, there is no monitoring programme dedicated to otters in Saxony. Between 1993 and 1995, a

survey of the otter population in the administrative district Dresden[13] resulted in an assessment of population size as reported by Klenke (1996) between 100 and 400 individuals. An additional survey was carried out in Sächsische Schweiz National Park (Krekemeyer & Reuther 2002) which is rather close, although not part of the study area defined in this paper. For the NAK support programme (see Section 5), agreement has been reached between lower conservation authorities, local fishermen and the Department of Fisheries as to the number of otters in the region. The agreed size of the population is 250, a figure that has not changed since. Although the damage caused by otters has not been investigated in detail, it is acknowledged as being significant by Reuther et al. (2002). A more precise assessment of damage is not available due to the absence of a monitoring programme for the otter population. Therefore, the compensation scheme for environmentally sound fish farming practices lacks a scientific basis (Wilson et al., 2004). For the damage compensation scheme in cases of hardship (see Section 5), the damage is estimated as the difference between the expected and actual fish production reduced by 30% due to natural mortality and predation by other species. This approach is unable to distinguish between damage caused by diseases, natural mortality or by predation by other (unprotected) species such as the grey heron (*ardea cinerea*). Compensation is only paid if the presumed otter damage exceeds €1,000. This is especially problematic in the district of Löbau-Zittau. The district is situated in the highlands with all the ponds being rather small and fish farming is pursued as a secondary occupation. In these cases, the lower conservation authority voluntarily compensates for part of the damage with live carp (Wilson et al., 2004).

A survey by Kranz (2000) revealed that unlike the situation in South Bohemia, otter damage caused by the consumption of carp is perceived as being more important in Upper Lusatia than surplus killing and secondary losses. Only 21% of the respondents suggested that the reduction of the otter population was the best measure to prevent damage. Whereas in the late 1990s the otter was regarded as the predator causing the greatest damage (Kranz, 2000), recently cormorants and grey herons have outweighed the other species in the perceptions of fishing personnel (Sächsische Landesanstalt für Landwirtschaft, 2002; Wilson et al., 2004).

6.2 Analysis of the conflict dynamics

The dynamics of conflict may be well important when trying to mitigate a conflict. The dynamics directly relate to the ecological, economic and social indicators as they develop over time. Conflict dynamics mean that the conflict may increase/decrease in time depending on changes in the underlying factors. For example (Kranz et al., 1998) argue that the conflict may intensify (i) if the otter population increases, (ii) if fish prices fall following fierce market competition, (iii) if the number of small fish farms increases where the relative damage is higher; (iv) if differences in the perception of levels and causes of damage between conservationists and fishpond farmers grow; and (v) if the carp is increasingly considered a pet rather than a commercial product. As these

[13] The administrative region Dresden encompasses several districts including the Saxon study area and corresponds to the NUTS 2 level.

factors' importance rises, the conflict is intensified, the compound rate of the conflict's increase depending on the acceptance of otters by the stakeholders concerned. After having reached a significant dimension, the conflict may escalate, something which is often manifested by the widespread illegal killing of otters. Hafellner (1998) describes the conflict dynamics using the example of a fish farm in lower Austria, where damage compensation payments reportedly rose from small (negligible) levels in 1991 to ca. 600,000 ATS in 1995. Besides the increasing population of the otter, market pressure resulting from increased competition (especially from Czech firms) is blamed for the exacerbation of the conflict.

In the South Bohemia fishpond region, the conflict intensified again especially after the privatisation of the former state-owned fisheries in the early 1990s (Toman, 1998a; Roche, 2003; Samek and Dušek, 2003; Kučerová, 2000) when the damage was no longer accepted as part of naturally occurring fish losses. Thanks to improved water quality, the otter population gradually grew and reoccupied areas from which it had been eliminated since the 1950s. The production intensity in the fishponds remained stable or even increased in some areas. The conflict seems to have escalated in the late 1990s when more than 100 otters a year were thought to be being killed (Kranz et al., 1998). The negative trend in both market prices for carp and the demand for carp[14] may also have contributed to the growing conflict. The damage compensation measure implemented in 2000 after an intensive seven-year debate satisfied (at least partly) the large fishpond enterprises. However, the owners of small fishponds complain about the difficult application procedure. Although between 2000 and 2003 exponential growth was reported in the number of applications (Roche et al., 2003), in relative terms the owners of small fishponds are less represented. Later, the compensation rules were changed for the damage caused by cormorants and managing the claims has become more centralised in the course of the administrative reform.[15] The conflict seems to be escalating again in 2004 with the implementation of the NATURA 2000 programme. Under this programme, special areas have been dedicated to protected species (including the otter) listed in Annex II of the FFH Directive. At many places this requires the restriction of production intensity in fishponds. To tackle this new aspect of a potential conflict between fish farmers and nature conservation, a new compensation scheme is anticipated (Blahník, 2003; Samek and Dušek, 2003), compensating farmers for ecological services (economic benefits forgone due to reduced production intensities). Since the anglers have been left out of the damage compensation scheme, the South Bohemian Anglers' Association sued the Czech government to be considered for damage compensation in future. Although the case has not been settled, the claim has been recognised as justified in lower court hearings.

In Saxony, many fishponds have been leased rather than sold to private persons. Shortly after the political changes, the production intensity declined because of the changed economic conditions,

[14] Carp prices dropped (after constant growth until 1997) in the period 1997–2000 by 30%,stabilising at ca. 83% of the 1997 price level (MZE, 2003).

[15] In the course of EU accession, an administrative reform was enacted in the Czech Republic in 2003 under which the former administrative districts were split into smaller units, viz municipalities with extended competence.

including lower demand for fish. As explained in Section 3, more extensive carp production was also supported by early subsidies and support programmes for environmentally sound management practices. From 1992 until 2000/2001, pond fisheries were supported by a conservation contracting programme, complemented as of 1993 by the first Saxon agro-environmental programme. The UL programme (environmentally sound agriculture) based on EU regulation 2078/92 was substituted in 1999 by the recent UL programme now based on EU regulation 1257/1999. As part of its sub-programme NAK, the latter includes several measures to support environmentally sound aquaculture. Although some 90% of the fish farmers participate in the NAK programme, the number of claims under the scheme for the hardship regulation increased similar to Austria and the Czech Republic. From 1995 until 2001, the number of claims rose from 6 to 21 and the damage compensation payments applied for increased from ca. €30,000 to nearly €130,000.

7 Conclusions

The protection of the otter has been reported as a success story throughout Europe (Kruuk, 2002). The return of otters to their previous habitats, however, is accompanied by conflicts due to the increased damage to fish stocks in fishponds and water courses. The acceptance of the otter by fish farmers also declines with factors such as (i) growing market pressure (resulting in low carp prices), (ii) the increasing siltation of the ponds, and (iii) growing pressure of other pescivore predators (e.g. cormorant), to name but a few. In addition, the recent EU enlargement is suspected by fish farmers of increasing the market pressures and restricting fish production to comply with European legislation (e.g. FFH Directive).

In this paper we analysed these conflicts emerging between otter protection and fish farming in two study areas – Upper Lusatia (Germany) and South Bohemia (Czech Republic). The study areas compared are characterised by similar conditions: (i) they both have a long history of fish farming in ponds going back to the 13th century, (ii) they have comparable geographical, hydrological and geological conditions; and at least partly (iii) they underwent (at least partly) similar political and societal developments after the Second World War. Both regions are rural with low population density and fish farming is a traditional form of land use there. However, whereas the Upper Lusatia study region suffered substantial population decline due to migration to the rest of Germany, South Bohemia was spared this loss.

Little information is available about the growth of the otter population in recent years in Upper Lusatia. In South Bohemia, otters have reoccupied territories (e.g. the Czech-Moravian Highlands) from which they disappeared in the past due to severe persecution and the poor water quality. In Upper Lusatia, the formerly intensive carp production was transformed into for instance extensive farming management thanks to the agro-environmental measures adopted early on aimed at more environmentally sound pond management. This transformation caused total carp production in Saxony to drop from 6,890 tonnes in 1989 to 2,620 tonnes in 2002. By contrast, in South Bohemia fish stocks remained at their rather high level, tending to exacerbate the conflict.

In both study areas, compensation is paid for damage caused by otters. The two compensation schemes, compensation in the case of ‘hardship’ in Saxony and damage compensation pursuant to

Act no. 115/2000 in the Czech Republic, apply different methodologies to assess the damage and exercise different rules for compensation. Under the Saxon scheme applicants are not automatically entitled to damage compensation and the budget available for compensation is limited. Compensation can be applied for if the actual yields are more than 30% below that expected. Any difference up to 30% is considered a natural loss. Thus the scheme also allows to some extent for compensation for secondary damage due to injury or stress suffered by fish. In the Czech Republic, compensation is guaranteed by a law which also defines the conditions and the rules of its application. This compensation is calculated according to daily consumption by the otter and does not cover secondary damage.

When comparing the conflicts and the compensation schemes existing in both study areas, it may be concluded that designing economic instruments aimed at conflict mitigation is no easy task for several reasons:

(i) Firstly, because of the difficulty of assessing the actual damage (and thus satisfying the parties affected). Indeed, the conflicts are characterised by serious disagreements about the facts (population size, daily consumption, behaviour of the otter e.g. surplus killing, etc.). The disagreements are also rooted in the uncertainty surrounding the reliable estimation of this information. In this regard, the Saxon system does not seek the cause of damage and no proof is demanded that damage was actually caused by otter predation. Consequently, the compensation payments may be too high and the limited budget for compensation payments is not optimally allocated. The Czech system addresses this problem by requiring substantiation from a specialist. This makes the application procedure difficult for the owners of small ponds, creating distrust and preventing farmers from applying for damage compensation.

(ii) Secondly, because of the limited ability of financial compensation to solve the conflict. Monetary benefit is not the exclusive reason for fishpond farming, especially in small ponds. Instead, people often breed fish as pets, as a pastime or to share a good meal with friends – things that can hardly be compensated for in monetary terms. In such a case, material compensation with fish losses being substituted by replacement fish, as already informally carried out in some districts in Upper Lusatia, is likely to be more successful.

A proper set of mitigation measures should aim to change the attitude of all or at least the most affected actors and mitigate the conflict or at least stop it from becoming more serious. The financial compensation of damage, if not supported by other mitigation measures, is unlikely to mitigate the conflict in the long term. In order to be successful, a set of mitigation measures has to (i) address ecological, economic and social aspects of the conflict; (ii) be spatially differentiated, considering for example the differences between fish farming conditions in lowlands and in highlands; (iii) be differentiated regarding the size and ownership of the fishponds; (iv) acknowledge the social needs of the various stakeholder groups involved; and (v) be composed by a number of measures, both financial and non-financial, which besides compensating for the damage help 1) to increase the acceptance of the endangered and threatened pescivore predators, and 2) to prevent higher damages.

8 Acknowledgements

This research was kindly supported by the EC under contract no. HPMD-CT-2001-00117 and under the 5 FP R&D project FRAP (Development of a procedural Framework for Action Plans to Reconcile conflicts between the conservation of large vertebrates and the use of biological resources: fisheries and fish-eating vertebrates as a model case).

9 References

Anonymous, 1891. Chytání vyder. Vesmír, S. 172-174.

Adamek, Z.; Kortan, D.; Lepič, P.; Andreji, J., 2003. Impacts of otter (*Lutra lutra L.*) predation on fishponds: A study of fish remains at ponds in the Czech Republic. Aquaculture International 11, 389 - 396.

Blahník, P., 2003. Natura 2000 z hlediska ochrany zájmů rybářskeho svazu. In: Sýkorová, Z. (ed): Rybářství a predátoři. Sborník referátů z odborného semináře, Praha 18.9. 2003. Český rybářský svaz, 23-26.

Bodner, M., 1998. Damage to stock in fish ponds as a result of otter (*Lutra lutra* L.) predation. In: BOKU-Reports on Wildlife Research & Game Management, 14, 106-117.

Breitenmoser, U., 1998. Large predators in the Alps: The fall and rise of man's competitors. In: Biological Conservation, 83 (3), 279-289.

Bundesanstalt für Landwirtschaft und Ernährung, 2002. Karpfenbericht 2002. Bericht über die Marktversorgung und die Außenhandelssituation von Karpfen und anderen Süßwasserfischen in der Bundesrepublik Deutschland. www.ble.de/fisch/fiwirt_f.htm, accessed on 14.03.2004.

Bureš, J., 2000. Vývoj zonace a sítě maloplošných zvláště chránených území Třeboňska. In. Pokorný, J.; Šulcová, J.; Hátle, M.; Hlásek, J. (eds): Třeboňsko 2000: Ekologie a ekonomika Třeboňska po dvaceti letech. Sborník příspěvků ze stejnomenné conference, 40-43.

CFFA, 2003. Czech Republic: Production and utilisation of farmed fish, present and prospect. Czech Fish Farmers Association. available on internet under http://rybsdr.fishnet.cz/ryby_en.htm, accessed on 14.05.2004.

Clark, T.W.; Curlee, A.P.; Reading, R.P., 1996. Crafting effective solutions to the large carnivore conservation problem. Conservation Biology, 10, 940-948.

Council of the European Community, 1992. COUNCIL DIRECTIVE 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Brussels.

Cox, C.B.; Healey, I.N.; Moore, P.D., 1973. Biogeography: An Ecological and Evolutionary approach. Blackwell. Oxford/UK.

ČSU, 2003. Statistická ročenka Jihočeského Kraje. Český Statistický Úřad, krajská representace České Budějovice.

Economist, 2003. The promise of a blue revolution. August 7th 2003.

Eurostat, Introduction to the NUTS and the Statistical regions of Europe, available on internet under http://europa.eu.int/comm/eurostat/ramon/nuts/introduction_regions_en.html, accessed on 07.05.2004.

Faina, R., 2000. Alternativy k tradičnímu pojetí rybářské intenzifikace na rybnících v CHKO Třeboňsko a na rybničných rezervacích. In: Pokorný, J.; Šulcová, J.; Hátle, M.; Hlásek, J. (eds): Třeboňsko 2000: Ekologie a ekonomika Třeboňska po dvaceti letech. Sborník příspěvků ze stejnomenné conference, 192-196.

FEAP, 2002. European Fish Farming. Hearing on European Aquaculture held by the Fisheries Committee of the European Parliament (October 2002). Accessible on internet under http://www.feap.info/feap/presentations/EUparliament_en.asp, accessed on 14.5.2004.

Geidezis, L., 1998. What do otters (*Lutra Lutra*) feed in a carp pond area in Saxony, Eastern Germany? BOKU-Rep. Wildl. Res. & Game Management 14, 65-71.

Gossow, H.; Kranz, A., 1998. Otters and fish farms: An introduction. BOKU-Rep. Wildl. Res. & Game Management 14, 1-2.

Groombridge, B.,1992. Global Biodiversity. Chapman & Hall, London.

Gutleb, A.; Kranz, A.; Henninger, W.; Loupal, G., 1998. Mortality of otters (*Lutra Lutra*) in Austria with special references to evidence for poaching. BOKU-Rep. Wildl. Res. & Game Management 14, 138-141.

Hafellner, W., 1998. Fish farming and otter damages in the Waldviertel region in lower Australia – An example: Kinsky's fish farm enterprise Heidenreichstein. BOKU-Rep. Wildl. Res. & Game Management 14, 3-5.

Hageman, R., 1985. Valuing marine mammal populations: benefit valuations in a multi-specied ecosystem. Administrative report LJ-85-22. Southwest Fisheries Center, national Marine Fisheries Service, La Jolla, Ca.

Hanzal, V.; Havránek, F., 2000. Vydra říční – škůdce, nebo klenot naší přírody?. Sborník Referátů, Predátoři v Myslivosti. 58-59.

Hartstock, E., 2000. Entstehung und Entwicklung der Oberlausitzer Teichwirtschaft. Schriftenreihe der Sächsischen Landesanstalt für Landwirtschaft. 5. Jahrgang

Horáčkova, K.; Polednik, L., 2002. Můj život s vydrou. Geografický Magazín Koktejl, XI (1), 91-97.

Kaule, G., 1996. Arten- und Biotopschutz. Verlag Eugen Ulmer, Stuttgart.

Kepr, T., 2003. Vývoj stavu rybožravých predátorů od 90. let do současnosti, prognóza vývoje stavů a jimi způsobové škody. In: Sýkorová, Z. (ed): Rybářství a predátoři. Sborník Referátů z Odborného Semináře, Praha 18.9. 2003. Český rybářský svaz, 3-6.

Klenke, R., 1996. Ergebnisse der Erfassung von Fischotternachweisen von 1993-1995. In: Sächsisches Landesamt für Umwelt und Geologie (ed.): Artenschutzprogramm Fischotter in Sachsen, 12-17.

Kranz, A.; Toman, A.; Knolleisen, M.; Prasek, V., 1996. Fish ponds in Central Europe – a rich but risky habitat for otters. Proc. VIIth International Otter Colloquium, 181-186.

Kranz, A.; Knolleisen, M., 1998a. How many otters live here? A discussion about counting otters. BOKU-Rep. Wildl. Res. & Game Management 14, 120-125.

Kranz, A.; Toman, A.; Roche, K., 1998b. Otters and fisheries in Central Europe-What is the problem. BOKU-Rep. Wildl. Res. & Game Management 14, 142-144.

Kranz, A., 2000. Otters (*Lutra lutra*) increasing in Central Europe: from the threat of extinction to locally perceived overpopulation? In: Mammalia, t. 64, No. 4, 357-368.

Kranz, A.; Polednik, L.; Polednikova, K., 2003. Fischotter im Mühlviertel, Ökologie und Management Optionen im Zusammenhang mit Reduktionsanträgen. Gutachten im Auftrag des Oberösterreichischen Landesjagdverbandes.

Kranz, A.; Polednik, L.; Toman, A., 2004. Der Fischotter in Österreich. Der Anblick, Zeitschrift für Jagd, Fischerei, Jagdhundwesen und Naturschutz 2, 12-15.

Krekemeyer, A. & Reuther, C., 2002. Das ISOS-Netzwerk beginnt zu wachsen. Otter-Post 23 (2), 2, 31-32.

Kruuk, H., 2002. Hunters and hunted – relationship between carnivores and people. Cambridge University Press, Cambridge.

Kučerová, M., 2000. Ochrana vydry říční jako příklad ochrany vlajkového druhu. In. Pokorný, J.; Šulcová, J.; Hátle, M.; Hlásek, J. (eds): Třeboňsko 2000: Ekologie a ekonomika Třeboňska po dvaceti letech. Sborník příspěvků ze stejnomenné konference.

Langner, M., Department of Fisheries. Expert interview April 2004.

Loomis, J.B.; White, D.S., 1996. Economic benefits of rare and endangered species: Summary and meta-analysis. Ecological Economics 18, 197-206.

MacMillan, D.; Hanley, N.; Daw, M., (in press). Costs and benefits of wild goose conservation in Scotland. In: Biological Conservation.

MZE, 2003. Ryby 2003: Situační a výhledová zpráva. Ministerstvo zemědělstvi České republiky. Odbor živočísné výroby.

Myšiak, J., in preparation. Perceptions analysis of the conflict between protection of the otter and fish farming in the South Bohemia.

Novotná, E., 1998. Lidé a vydra, závěrečná zpráva sociologického předvýzkumu. Jihočeská Sociologická Agentúra, Zahrádky, pp. 24.

Pearce, D.W.; Perrings, C.A., 1995. Biodiversity conservation and economic development: local and global dimensions. In: Perrings, C.A.; Mäler, K.-G.; Folke, K.; Holling, C.S.; Jansson, B.-O. (Eds.): Biodiversity conservation. Problems and policies. Kluwer, Dordrecht, 23-40.

Poledník, L.; Bičík, V., 2000. Funkce vydry říční ve vodních ekosystémech. Sborník Referátů, Predátoři v Myslivosti. Hranice, 60-65.

Poupě, J., 2003. Legislativní a ekonomické střety mezi ochranou přírody a rybářstvím. In: Sýkorová, Z. (ed): Rybářství a predátoři. Sborník Referátů z Odborného Semináře, Praha 18.9. 2003. Český rybářský svaz, 19-22.

Reuther, C., 1999. Otter 2000. Eine Vision für den Otterschutz in Deutschland. In: Reuther, C. (Ed.) Otterschutz in Deutschland. In: Habitat 7, 85-92.

Reuther, C.; Dolch, D.; Drews, A.; Ehlers, M.; Heidemann, G.; Klaus, S.; Mau, H.; Sellheim, P.; Teubner, J.; Teubner, J. and Wölfel, L., 2002. Habitat. Arbeitsberichte der Aktion Fischotterschutz e. V. Fischotterschutz in Deutschland. Grundlagen für einen nationalen Artenschutzplan.

Řeřábek, P., 2004. Hrozí přemnožení vyder?. Třeboňský Svět 2, 12

Rijsberman, F., 1999. Conflict management and consensus building for integrated coastal management in Latin America and the Caribbean. Inter-American Development Bank, accessible on internet under http://www.iadb.org/sds/publication/publication_1532_e.htm (accessed on 14.05.2004).

Roche, K., 1998. Preliminary findings on carp *Cyprinus Carpio* predation by otters *Lutra Lutra* in the Trebon biosphere reserve (Czech Republic). BOKU-Rep. Wildl. Res. & Game Management 14, 73-82.

Roche, M., 2003. Výsledky mapování výskytu vydry říční v ČR a zkušenosti s náhradami ztrát způsobených vydrou. In: Sýkorová, Z. (ed): Rybářství a predátoři. Sborník Referátů z Odborného Semináře, Praha 18.9. 2003. Český rybářský svaz, 14-18.

Sächsische Landesanstalt für Landwirtschaft, 2002. Zahlen zur Binnenfischerei im Freistaat Sachsen. Jahresbericht.

Samek, R.; Dušek, M., 2003. Problematika rybích predátorů v aktuálním pohledu ochrany přirody. In: Sýkorová, Z. (ed): Rybářství a predátoři. Sborník Referátů z Odborného Semináře, Praha 18.9. 2003. Český rybářský svaz, 10-11.

Schulthess, G.; Schulthess, H., 2004. Der Otterhound, www.otterhound.de (12.05.2004).

Šilhavý, V., 2003. Problémy způsobené komerčnímu rybářství neadekvátní ochranou predátorů. In: Sýkorová, Z. (ed): Rybářství a predátoři. Sborník Referátů z Odborného Semináře, Praha 18.9. 2003. Český rybářský svaz, 7-9.

Spurný, P.; Mareš, J.; Kopp, R.; Fiala, J., 2003. Socioekonomická studie sportovního rybolovu v České republice. Český rybářský svaz.

SMUL - Sächsisches Ministerium für Umwelt und Landwirtschaft. In literature. 22.04.2004

SMUL. www.smul.sachsen.de (15.05.2004)

StaLa Sachsen – Statistisches Landesamt, 2001. www.statistik.sachsen.de

Statistisches Bundesamt Deutschland, 2004. www.destatis.de (12.05.2004)

Statistisches Landesamt des Freistaates Sachsen, 1995. Statistische Berichte. Die Teichwirtschaft im Freistaat Sachsen. Ergebnisse der Binnenfischereierhebung 1994. Kamenz.

Stubbe, M., 1990. Buch der Hege. Band 1 Haarwild. Deutscher Landwirtschaftsverlag Berlin.

Sýkorová, Z., 2003. Vpliv predačního tlaku vydry, kormorána, volavky popelavé a dalších predátorů na rybí spoločenstva vodných toků v roce 2003. Český rybářsky svaz.

Thiem, A., 2002. Naturschutzfachliche Grundsätze zur Bewirtschaftung von Karpfenteichen in Sachsen. Materialien zu Naturschutz und Landschaftspflege. Dresden

Toman, A.; Kadlečík, J., 1992. Bulletin Vydra. Vydal Český ústav ochrany přírody 3-59.

Toman, A., 1998a. Otters versus privatisation in the Czech Republic. BOKU-Rep. Wildl. Res. & Game Management 14, 6-7.

Toman, A., 1998b. Otter damage compensation in the Czech Republic. BOKU-Rep. Wildl. Res. & Game Management 14, 118-119.

Usbeck, H.; Ebert, A.; Usbeck, F.; Schwerdtner, K. & Ring, I., 2004. Socio-Economic Report of the German model region "Oberlausitz-Niederschlesien". Project report. Eu project FRAP-Framework for biodiversity reconciliation action plans. EVK 2-CT-2002-00142. Leipzig.

Vaníček, 2004. Letter from 9.1.2004 about subsidies from the programme 229210. Ministerstvo zemědelství ČR, odbor programového financování ve vodním hospodářství.

Wedekind, H.; Hilge, V.; Steffens, W., 2001. Present status, and social and economic significance of inland fisheries in Germany. In: Fisheries Management and Ecology, 8, 405-414.

White, P.C.L.; Keith, W.G.; Lindley, P.J.; Richards, G., 1997. Economic values of threatened mammals in Britain: A case study of the otter *lutra lutra* and the water vole *Arvicolea terrestris*. Biological Conservation 82, 345-354.

Wilson, D.C.; Antunes, P.; Baptista, G.; Bruckmeier, K.; Gomes, J.; Franco, N.; Ferreira dos Santos, R.; Larson, C. H.; Madruga, L.; Mateus, P.; Moretti, S.; Olesen, T.; Vasconcelos, L.; Varjopura, R.; Virtanen, S.; Wittmer, H.; Zwirner, O., 2004. Work Package Six Deliverable Five: The Social Impact Assessment Report. FRAP project report.

Zhang, L.; Wang, N., 2003. An initial study on habitat conservation of Asian elephant (*Elephas maximus*), with a focus on human elephant conflict in Simao, China. In: Biological Conservation, Vol. 112, 453-459.