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 Máñez and Irene Ring

Abstract Protection of the Eurasian otter (*Lutra lutra*) has been successful in recent years but is increasingly running into conflict due to the damage caused on the fish stock in ponds aquaculture. In this chapter we compare the conflicts in two regions with a long history of carp farming—Upper Lusatia in Saxony (Germany) and South Bohemia in the Czech Republic, teasing out the factors which amplify or attenuate the conflicts. We show that financial compensation for the damage occurred is insufficient to mitigate the conflict or stop it from becoming worse. To succeed in long term, a set of mitigation measures, both financial and non-financial, should be deployed. These measures perform best when they are spatially differentiated and tailored to the size of farms and farming practices.

J. Myšiak (✉)
Fondazione Eni Enrico Mattei and Euro-Mediterranean Center for Climate Change, Castello 5252, 30122, Venice, Italy
e-mail: jaroslav.mysiak@cmcc.it

K. Schwerdtner Máñez
Department of Social Sciences, Leibniz Center for Tropical Marine Ecology, Fahrenheitstrasse 6, 28359, Bremen, Germany
e-mail: kathleen.schwerdtner@zmt-bremen.de

I. Ring
Department of Economics, UFZ—Helmholtz Centre for Environmental Research Leipzig, Permoserstr. 15, 04318, Leipzig, Germany
e-mail: irene.ring@ufz.de

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1 Introduction

The fish-pond landscapes in Central and Eastern Europe have immense historical and cultural value, and are highly significant as a habitat for numerous endangered species. As typical examples of cultural landscapes, their maintenance depends on fish-pond farming. Although the protection of endangered piscivorous predators in these landscapes, such as the Eurasian otter (*Lutra lutra*), has been successful in recent years, it is increasingly running into conflict due to the damage caused by this species in the fish ponds.

Formerly widespread throughout Europe, the otter underwent a rapid decline in numbers during the twentieth century. For centuries otters were regarded as pest whose damage to fish populations caused high losses in aquaculture. As a result of persecution, otter populations dwindled and became endangered. Under strict species protection policies starting in the second half of the twentieth century, the persecution and killing of otters were outlawed, allowing otter populations to slowly regenerate. When the EU 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. Yet, the slow regeneration of otter populations in Central Europe was accompanied by complaints about otter damage, especially by carp farmers (Kranz 2000; Bodner 1998).

We present a comparative analysis of conflicts between otter protection and aquaculture in two regions with a long history of carp-farming—Upper Lusatia in Saxony (Germany) and South Bohemia in the Czech Republic (Fig. 1).[1] Whereas the previous two chapters go into much more detail regarding the specifics of each of the conflicts (compare Klenke et al. 2013 and Poledníková et al. 2013, in this book), the purpose of this chapter is to tease out the similarities and differences between these two cases. A critical comparison lends itself to the identification of factors which amplify or attenuate conflicts. Both areas are characterized by numerous artificial ponds for carp farming (mostly *Cyprinus carpio*), allowing for viable otter populations, spreading also into neighboring habitats. Furthermore, both areas experienced substantial structural changes, resulting in new political, economic and social conditions after the political upheaval in 1989. But this alone is not sufficient to explain the recent developments in the respective conflicts.

We first briefly introduce the two study areas in terms of their natural and socio-economic features. Secondly, the fisheries sectors are compared, after which the otter populations in the two areas are characterized. In the third step, the respective compensation schemes as a means to contribute to conflict mitigation are presented and analyzed. Combined with information on the perception of the conflict

[1] The analysis reflects the period up to 2004. More recent developments of the conflicts reported here and the attempts to cope with are not addressed in this article.

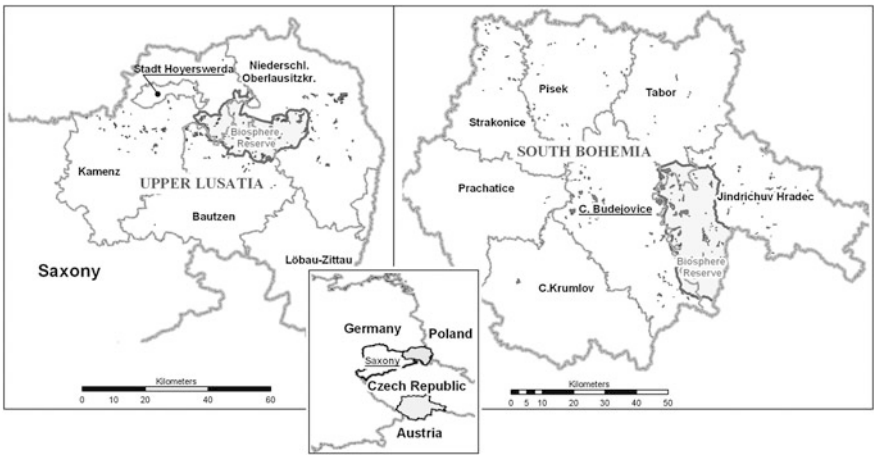

Fig. 1 Geographical overview of the study areas with major ponds: *Left*—Upper Lusatia situated in Saxony (Germany), *right*—South Bohemia (Czech Republic)

and the respective compensation schemes by relevant stakeholder groups, recommendations for the improvement of such payments are presented.

2 Natural and Socio-Economic Characteristics of Upper Lusatia and South Bohemia

2.1 Location, History, and Land Use

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 Bohemian 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 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 their unique cultural and landscape value, parts of both regions have been declared as biosphere reserves.

In Saxony, the biosphere reserve "Upper Lusatia Heath and Pond Landscape" was designated in 1994, whereas the biosphere reserve "Třeboň Basin" in South Bohemia has existed since 1977. The name "Lusatia" (originally "Łuža") means marshland or swampland and was given to the region by the Slavic settlers because

Table 1 Selected socio-economic descriptors of the compared regions (2002)

	South Bohemia	Czech Republic total	Upper Lusatia	Saxony	Germany total
Total area (km^2)	10,056	78,868	4,400	18,413	357,027[a]
Numbers of inhabitants	625,000	10,206,000	607,000	4,345,000	83,000,000
Changes between 1990 and 2002	+2,200	−155,600	−78,000	−381,900[b]	+2,823,000[b]
Population density (persons/km^2)	62	129	137	236	231
Share of agricultural/ forestry land use (%)	52/30	54/33	47/34	56/27	55/30
Number of employees in agriculture, forestry, and fisheries	26,900	194,000	8,600	52,560	929,000
Unemployment (%)	6.65	9.81	22.5[c]	19.2	10
GDP per capita (EUR)	5,852	6,195	14,300	16,900	25,400

Sources: Data from Czech Republic—Český Statistický Úřad (2003), from Germany—Usbeck et al. (2004), and [a] Statistisches Bundesamt Deutschland (2004), [b] Data available only up to 2000, [c] data from 2001

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 Landscape 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 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 (Table 1). South Bohemia encompasses seven districts (České Budějovice, Český Krumlov, Jindřichův Hradec, Písek, Prachatice, Strakonice, Tábor) and 623 municipalities. Nevertheless, the two areas 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.

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 are 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 cooperatives 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 (Table 1). 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 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.[2]

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 some 11 % of total agricultural output is produced here. The political and economical changes after 1989 did not affect the population, which by 2002 had slightly increased. The average gross wage in 2001 was ca. 443 €[3] per inhabitant, 88.5 % of the Czech average. While in other sectors the average gross wage is lower than the national average, it is slightly higher for the primary 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, converted to GDP per inhabitant (5,852 €), it amounts to just 87.8 % of the national average and ranks fourth in the Czech Republic.

2.2 Carp Pond Farming

Both study areas have a long tradition of carp-pond farming going back to the thirteenth century. Driven by the continuing land settlement and high population growth, fish-pond construction boomed in the fourteenth and fifteenth century. At that time the total pond area in both countries was as much as twice that nowadays. The high popularity of fish-pond farming was due to the higher profitability of fish ponds compared to cropping on low fertility soil (Hartstock 2000). The 30 Years' War (1618–1648) precipitated a decline from which fish-pond farming in Central and Eastern Europe never completely recovered. Since the eighteenth and nineteenth centuries many ponds have been transformed into fields and in many places were replaced by sugar beet plants. Towards the end of the nineteenth century, the systematic use of additional feeding (Benecke 1885 in Thiem 2002; Vogel 1928 in

[2] For the German case study, socio-economic 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.

[3] We adopted the exchange rate of 1 Euro (EUR) = 0.85797 US Dollar (USD) and 31.68 Czech Krone (CZK) as of 02.01.2002.

Table 2 Comparison of main production characteristics of the two fish-pond areas

	South Bohemia	Czech Republic total	Upper Lusatia	Saxony	Germany total
Total fish production (tons)	>10,000[a]	~20,000	n.a.	2,931[g]	~36,000[e]
carp (tons)	~9,000[a]	~18,000	n.a.	2,620[g]	~11,000[e]
Fish-pond 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

Sources: [a] Český Statistický Úřad (2003); [b] CFFA (2003), [c] Bureš (2000), Faina (2000), Kranz and Knolleisen (1998), [d] Usbeck et al. (2004), [e] FEAP (2004), [f] Wedekind et al. (2001), [g] SLfL (2002), [h] StaLa Sachsen (1995), [i] Thiem (2002) and [j] SMUL (2004)

Thiem 2002) and fertilizers (Demoll 1925 in Thiem 2002) allowed increased pond productivity. This marked the beginning of intensification and mechanization in aquaculture (Thiem 2002, Table 2).

Under the communist system installed in both countries, fish-pond farms were nationalized and merged to form large state-owned enterprises. Fish production was carried out intensively, often involving high additional feeding, fertilizing and stocking rates. Following the political changes in 1989 the fish ponds were returned to their previous owners or privatized. While in Saxony the carp production has diminished ever since (from 6,686 tons in 1989 to 2,620 tons in 2002; SLfL 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 programs has led to a generally more extensive production scheme (Thiem 2002). Due to private data protection and the lack of periodical statistical surveys, only little statistical information about current fish-pond 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 (SLfL 2002). Annual fish production varied between 3,351 tons in 2001 and 2,931 tons in 2002 (BfLuE 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.[4] 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).

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 (*Tinca tinca*), and whitefish, having 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 (ČSÚ 2003). In terms of company size, 124 of the 131 companies have fewer than 10 employees; most of them work on a part-time basis (ČSÚ 2003). By contrast, only nine companies have more than 10 employees, and just one has over 100 employees. A small number of companies owns most of the fish ponds. One single company operates on ca. 400 fish ponds mostly located in the Třeboň Basin Biosphere Reserve. The total area of these ponds amounts to 7,000 ha fish ponds (~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 tons of fish annually—about the same as the total production of Saxony. According to the CFFA (2003), average production in fish ponds 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 et al. 1996).

2.3 The Otter Populations in Saxony and South Bohemia

The Eurasian otter is naturally distributed among inland waters all over Europe, its populations stretching from the Iberian Peninsula to Northern Siberia and from Scandinavia to South India. 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 fish ponds played a crucial role as refuges for otter populations from which, having been protected, they then spread to neighboring states. There are numerous references to the severe persecution of otters in the past. In Saxony, one of the central aims of the Saxon Fishery Association after its foundation in 1884 was the persecution of the otter. Due to intensive hunting, the population collapsed in 1903 (Fiedler 1996).

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. 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

[4] Data gathered from the Saxon State Office for Agriculture, Department of Fisheries in 2004, own calculations.

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 vital otter population in the East of Germany (Saxony, Brandenburg, Mecklenburg-Western Pomerania) is of special importance for the conservation and spread of the species into adjacent areas of Germany (Lower Saxony, Schleswig-Holstein, Saxony-Anhalt, Thuringia) and for connectivity with populations in Bohemia and Bavaria (Reuther 1999). Until the end of the nineteenth century, otters were present on all suitable inland waters and wetlands in Germany. By the mid-twentieth century, however, the species had disappeared in most areas in western and central Germany. Since the early 1980s, there have been clear indications that otters have started to recolonize their former habitats. Nowadays, approximately 20 % of German territory is populated by otters again (Reuther 1999). The German study area Upper Lusatia hosts one of the most abundant otter populations in central Europe (Ansorge and Striese 1993). However, there is high uncertainty about otter numbers. Ansorge et al. (1997) estimate 400 adult animals for the area, Klenke (1996) mentions a population size of 200 (−100, +200) for the Upper Lusatia and East Saxony. Densities may vary considerable: from 3–6 otters per 100 km^2 (Ansorge and Striese 1993) to 30 animals per 100 km^2 (Grohmann and Klenke 1996).

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). Recent mapping of otter distribution suggests a continuous spread and increase in numbers mainly in 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 program in 1989 (Toman 1998a; Kučerová 2000). The study area contains the largest and most stable otter population in the Czech Republic, which extends across the South Bohemian fish ponds (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 .

3 Compensation Schemes as a Means to Conflict Mitigation

3.1 Rationale for Compensation Schemes in Biodiversity Conservation

From an economic perspective, biodiversity (or the services it provides) represents a public good. It does not have the characteristics of private, marketable goods. Therefore, it is the state that has to create adequate framework conditions for

sufficient biodiversity conservation. The conservation of protected species is considered to be a responsibility that must be shared by the whole society, since the entire society may benefit from it (Fourli 1999; Hampicke 2005). Conservation measures, such as species protection or the establishment of nature reserves, are often associated with additional costs for land users, who are restricted in their management choices. Depending on property and use rights of the country concerned, at least part of these costs should be compensated (Bromley and Hodge 1990; Hanley et al. 1998; Ring 2004).

In our case, fish farmers may be restricted in production methods especially when located in a protected area. If they adopt environmentally sound land-use practices, these practices usually involve less intensive production methods and thus, less economic profit. Costs are also caused by protected species that feed on commercial fish. Due to the protection status of species, fish farmers are limited in their possibilities to avoid such damage. This holds even more for fish farms located in protected areas, where the use of technical mitigation measures can be restricted or forbidden.

To justify public expenditure for conservation projects, non-marketable benefits of biodiversity conservation are frequently estimated in terms of the public's willingness to pay (WTP). The WTP for conservation programs targeted at threatened and endangered species, investigated by contingent valuation studies, expresses the perceived use (or usefulness) of the protection of these species (Loomis and White 1996; MacMillan et al. 2004). There are few studies quantifying the WTP for otters and none of them applies 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. A similar study exists for the sea otter (*Enhydra lutris*) carried out by Hageman (1985) in which the WTP amounted to US$29. Albeit the problems related to the transferability, these data give a certain evidence on the society's willingness to pay for otter protection. In any case for Germany, the estimated willingness to pay for national species protection programs was found to be substantially higher than their actual costs (Hampicke et al. 1991) and biodiversity conservation is notoriously undersupplied, receiving too low financial resources (BfN 2002).

Especially the primary sector including agriculture, forestry, and fisheries is of outstanding importance for the overall success of biodiversity policies. In the Central European cultural landscape, many species depend on secondary habitats created by human land uses. Much of the biodiversity-rich land in the EU depends on low-intensity farming and other traditionally extensive land uses (Wiseman and Hopkins 2001). Although not competitive under present economic constraints, the extensive production methods are indispensable for the success of biodiversity conservation.

Theoretically, compensation to fish farmers may be paid in two forms: Either as payments for ecological services, often on the basis of agri-environmental schemes (Wätzold and Schwerdtner 2005) or as damage compensation for losses due to predation by protected species. As shown in the following section, their practical implementation may be less distinctive due to the large uncertainties associated with the estimation of damage caused on carp ponds by otter predation.

3.2 Compensation Payments in the Otter-Aquaculture Conflict

The compensation payments in both study areas differ considerably in the instruments applied, assumptions made, and associated transaction costs.[5]

4 Damage Compensation

In Saxony compensation for damage caused by wild animals that are not part of the hunting law is paid under a program for "cases of hardship".[6] The program is based on §38 of the Saxon Nature Conservation Act and in place since 1995. It also compensates for otter damage on a voluntary basis, as otters are part of the hunting law. In aquaculture, the total financial loss must exceed 1,000 € per year. Damage is calculated by subtracting a standard loss from the expected fish production. The standard loss differs among age classes of fish and between summer and winter ponds. It varies between 12 and 50 %, with an average of 28 %. The standard loss is supposed to cover all natural losses due to fish mortality, diseases, and a certain extent of predation (Langner, personal communication). If losses exceed the standard loss, fish farmers can claim a hardship and ask for compensation. The compensation is bound to concrete evidence of the damage but real inspections rarely take place. Compensation is paid on the base of expert reports from fishery and conservation authorities. This makes the damage assessment to differ from real damage. Very likely, predation by other species such as cormorants or herons, poor water quality or improper management practices lead to losses which are indistinguishable from damage caused by otter. On the other side, the advantage of the calculation methods is that it partly covers the secondary damage, such as serious injuries caused by otters.

From 1998–2003, fish farmers in Upper Lusatia received an average damage compensation of about 58,000 € per year. There is no legal entitlement to such payments—compensation is paid as long as public funds are available. Otter damage is usually compensated to 60–80 %, depending on the time of loss (summer or winter) and the age class of fish. However, especially small-scale fish farmers often fail to reach the minimum loss of 1,000 € per year. To overcome this problem and to raise the acceptance of the otter, local authorities in two districts initiated an additional damage compensation scheme and provided living fish for those farmers. Ever since the latter schemes were stopped, attempts have been made to include small-scale farmers in the program for "cases of hardship".

[5] Compare Klenke et al. (2013) and Poledníková et al. (2013) for further information on the respective programs.

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

In the Czech Republic compensation for damage caused by protected species is imposed by the Law 115 (and its later revisions) and is in place since 2000. The species, whose damage is compensated are explicitly listed in §3 and include otter, the great cormorant (*Phalocrocorax carbo sinensis*), brown bear (*Ursus arctos*), wolf (*Canis lupus*), moose (*Alces alces*), beaver (*Castor fiber*), and Eurasian lynx (*Lynx lynx*). Regarding protected piscivorous species, only damage caused to artificial fish ponds is compensated; the damage in streams and rivers is not object of the compensation. To compensate the damage caused by otter, a proof of otter presence in the pond is required. The affected fish farmers have to report the damage (within 48 h) to the responsible local authority, which inspects the fish pond and confirms the damage. Applications for damage compensation are submitted in 6 months cycles and must be complemented by an independent expert report assessing the number of otters visiting the pond and damage arisen.

The methodology applied to assess the damage extent was developed by Czech Otter Foundation and the Environmental Protection Agency (Roche 2003). It distinguishes between detailed assessments techniques, applied only exceptionally, and simplified techniques, applied more commonly. The detailed assessment bases on regular monitoring of water quality in the pond, climate factors, fish diseases, and population of other piscivorous predators. It has not yet been applied due to its high costs. The simplified techniques base on assumptions and available evidence about the daily consumption of otter, number of otters visiting the pond and their visiting frequency, and the market price of the farmed fish. In case of a single pond or a small complex of ponds, the pond area is considered. The damage is assumed higher in small ponds. Therefore, the estimated damage is increased by 20 % for ponds smaller than 2 ha and decreased by 20 % for ponds larger than 5 ha. Damage assessment covers the direct damage (fish actually eaten by the otter), since secondary damage (caused by injuring or stressing the fish in winter) is not regulated. The methodology does not consider damage caused by other piscivorous species such as cormorants or grey herons (*Ardea cinerea*), or by low water quality.

Scant information is available about the actual payment at the national and regional level. Šilhavý (2003) reports that in 2002 ca. 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 fish-pond area in the Czech Republic. According to Roche (2003), by September 2003 the Czech Otter Foundation, the institution which examines approximately 90 % of all compensation claims for otter damage in South Bohemia, had registered 160 claims amounting approximately 205,180 €.

5 Compensation for Ecological Services

In Saxony, incentives for extensive fish farming are paid under the "NAK"[7] program based on Council Regulation (EC) No. 1257/99. It is partly designed to support environmentally sound aquaculture and to maintain the historical pond landscape.

Taking the form of voluntary contracts for a duration of 5 years, fish farmers can choose from various measures besides the general maintenance of ponds such as extensive production with no additional feeding, no additional stocking or the support of wild fish stocks. There are also payments for an extra stocking to create feeding habitats for endangered species, which are mostly used for otters and unofficially called "otter bonus". In 2003, 99.8 % of Saxony's pond area was supported under the NAK program (SMUL 2004). In Upper Lusatia, 53 % of the pond area cultivated under NAK is also used for the "otter bonus" and supported with 103 € per ha and year. In 2003, some 280,000 € have been paid as "otter bonus" in this area.

In addition, there is an aquaculture program supporting the protection of fishing stocks against piscivorous predators by technical mitigation measures such as fencing and wires, under which 25,500 € were spent in 2001–2002 for pond fencing in Upper Lusatia.

In Czech Republic the agri-environmental schemes (AES) alongside with subsidies for less favored areas (LFA) were introduced by the Horizontal Plan of Rural Area Development, based on the Council Regulation (EC) No. 1257/99. They are available only since 2004. The only measure applicable in our context is construction of bio-corridors, which, if planted along the water courses, may improve the habitat for both fish and otter populations. The LFA measures compensating farmers for the restriction due to imposed extensive management regimes in protected areas generally do not apply to fish ponds.

More relevant measures for the otter-fish farming conflict have been introduced by the program Rural Development and Multifunctional Agriculture, also supported by the EU structural funds. Fish farming represents one of the main areas addressed by the program, including measures for fish processing, aquaculture (especially increasing production capacity and modernization of existing facilities) and consultation activities. These measures are generally not associated with obligation to pursue environmentally friendly production techniques but their provision can be made depending on compliance with environmental legislation.

In 2003, a compensation program (up to 32/ha €) from national sources was introduced, which rewards protection of littoral zones, reduction of fish feeding, fertilization of the fish-pond bottom, and other measures aimed at environmental protection in ponds larger than 5 ha. Tolerating protected piscivorous species is

[7] NAK stands for "Naturschutz und Erhalt der Kulturlandschaft" – nature protection and conservation of cultural landscapes and is part of the general program for environmentally sound agriculture.

not addressed by the program. An additional subsidy program is aimed at supporting fish farmers to tackle the increasing siltation of fish ponds.

5.1 Conflict Development, Perception of Conflict and Compensation Schemes

The compensation schemes as described in the previous section have a different ability to mitigate conflicts between the involved actors, such as fish farmers and anglers, nature conservationists, and hunters, to name but a few. A conflict is a social construct characterized by disagreement, interference, and negative emotion (Barki and Hartwick 2004). Rooted in divergence of values, needs, interests, opinions or goals, existence of conflicts, and the strategies employed to mitigate them may significantly influence the success of compensation schemes and subsequently the protection of threatened and endangered species, such as the otter. Therefore, we have analyzed the recent conflict evolution in both study areas, and especially, how suitable the different compensation schemes are to mitigate the conflicts at hand.

Before the compensation payments were introduced in 2000, the conflicts seemed to escalate in South Bohemia. As a result more than 100 otters a year were thought to be illegally killed (Kranz et al. 1998). This was because the previously state-owned ponds were privatized and the damage was no longer accepted as part of naturally occurring fish losses (Toman 1998a; Roche 2003; Samek and Dušek 2003; Kučerová 2000). Unlike Saxony, the production intensity in the fish ponds remained stable or even increased in some areas. The negative trend in both market prices for carp and the demand for carp[8] may also have contributed to the growing conflict. Additionally, thanks to improved water quality, the otter population gradually grew and reoccupied areas from which it had been eliminated since the 1950s.

The damage compensation schemes implemented in 2000 and subsequently reformed in 2002 and 2003 satisfied (at least to some extent) the large fish-pond enterprises. However, the owners of small fish ponds complain about high transaction costs associated with the compensation claim. Especially in the Czech-Moravian Highlands with suboptimum climatic (e.g., long snowy winters, cold water) and geological (acid soil) conditions for carp farming (Kranz et al. 1998) the conflict seems to persist. The low-nutrient ponds predominating here are also smaller than those in lowland areas around the Třeboň and are owned by small-scale farmers. Therefore, the otter causes higher relative damage up to the complete depletion of the fish stock (Toman 1998b). Although between 2000 and 2003 exponential growth was reported in the number of applications for damage

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

compensation (Roche 2003), in relative terms the owners of small fish ponds are less represented. Another interest group left out of the compensation schemes are the (hobby) anglers utilizing water courses. The South Bohemian Anglers' Association sued the Czech government to be considered for damage compensation in future.

The conflict seemed to be escalating again in 2004 with the implementation of the NATURA 2000 program. Under this program, special areas have been dedicated to protected species (including the otter) listed in Annex II of the Habitats Directive. At many places, this requires the restriction of production intensity in fish ponds.

Although the otter population in the Czech Republic and South Bohemia is well documented, the estimated population size differs considerably among the conflicting parties (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 program established by the Nature Protection Agency and the Czech Otter Foundation assesses the population size at approximately 800–1,000 individuals (Roche 2003). Strong disagreement also exists about the damage caused by otters due to (1) the different assessment of the population size and (2) different assumptions about daily consumption and secondary damage. Assessments of otter consumption per day vary between approximately 0.5 kg/day (Toman 1998b; Kranz et al. 2004) and more than 1 kg/day (e.g., Sýkorová 2003). 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 4.16 millions € (Sýkorová 2003). The corresponding assessment (based on the daily consumption of 0.75 kg/otter and a fish price of 1.6 €) by fish farmers amounts to 694,444 € for 2002 (Šilhavý 2003).

In Saxony, conflicts raised again with the increasing otter population in the 1960 and 1970s. Several applications for killing permits (possible until 1984, when the otter became totally protected under the conservation law of the former GDR) were made but mostly not accepted. This resulted in some illegal killings which were strictly punished (Kubasch 1996, compare also Klenke et al. 2013 in this book). In 1978, a fish farm management plan for the district of Dresden was agreed upon. Intensive carp production was restricted to a third of the pond area, while leaving the rest to traditional extensive or semi-extensive management. Otters were tolerated by the fish farmers who also bore the costs for technical mitigation measures. An information campaign started in 1986 raising the acceptance for otter protection even more (Kubasch 1996).

The political changes in 1989 and the following privatization of pond farms raised the conflict again. Fishers were no longer state paid and depended on fish production. Otters were again perceived as a problem species that endangered an

effective production (Kubasch 1996). The early introduction of agri-environmental schemes combined with a decreasing demand for carp had very positive influences on the conflict development. By being paid for ecological services, fishers do less depend on production. Most measures under the NAK program for pond farming effectively support habitat quality for otters (Schwerdtner and Ring 2005).

The Department of Fisheries of the Saxon State Office for Agriculture assumes that each otter causes an annual damage of 500 € (Langner, personal communication). Using estimated number of 400 adult otters in the area (Ansorge et al. 1997), annual damage of about 200,000 € would occur. Summing payments for damage compensation and the otter bonus for the year 2003 in the Upper Lusatia, results in total compensation payments of 364,000 €. This exceeds by far the estimated financial damage to pond farmers. This indicates that either otter numbers are underestimated, requiring an update by an otter monitoring program, or overall compensation payments are too high, demanding an improvement of the single schemes respectively a better coordination of both compensation schemes.[9]

All Saxon stakeholders agree that one of the main reasons for the absence of a conflict is the existence of the compensation payments (Zwirner and Wittmer 2004). Though, slight disagreements exist whether payments are adequate. Whereas fishers consider them as adequate, authorities criticized payments being used as compensation for losses not connected to otter predation and for providing an additional (alternative) income.

In combination, agri-environmental schemes and compensation payments for otter-related costs mitigate the conflict about otters to a great extent. They are no longer considered as a problem species but perceived as part of the landscape (Zwirner and Wittmer 2004). Additionally, damage by cormorants and grey herons have outweighed the otter in the negative perceptions of fishing personnel (SLfL 2002; Zwirner and Wittmer 2004).

A persistent problem is the fish loss of small-scale farmers and hobby producers. Adequate compensation is necessary for those farmers whose losses may cover a considerable amount of their production. Damage compensation is important in this respect to raise the acceptance of otters in the area, especially in the case of isolated ponds that play an important role for the distribution of the species (Rothmann, personal communication).

In terms of stakeholder participation, the importance of the fisheries council has to be highlighted, which is legally based in the Saxon Fisheries Act. In this council, various stakeholder groups such as scientists, conservationists, fisheries and angling associations meet to discuss fisheries related problems such as damage by fish-eating species. Furthermore, there is a working group pond farming that is assembled at times when coordination is required specifically related to pond

[9] Compare Klenke et al. (2013, in this book) for a damage assessment based on otter numbers and daily food uptake resulting in approximately 17,000 € annual damage to fish farms. Although the rule-of-thumb assessment by the Department of Fisheries leads to slightly higher annual damage estimates, both approaches finally lead to the same conclusion regarding a potential overcompensation of damage, if both compensation schemes are considered together.

farming. These two stakeholder forums are relevant for regular communication among different stakeholder groups and for consensus-driven decision-making. The long tradition of communication between stakeholders since GDR times has led to the opinion of most stakeholders that conflicts are solved cooperatively (Zwirner and Wittmer 2004).

6 Comparative Analysis of Conflicts in Relation to Compensation Schemes

In the previous sections we analyzed factors governing the conflicts, either directly or through their manifold interactions, in the examined regions. The problem complexity increases if the broader context is considered in which the conflicts take place: the decline or improvement of water quality, insufficient availability of natural prey, the changes to river morphology and the subsequent loss of riverine habitats, and humankind-driven changes of fish populations in water courses. Each conflict is unique in terms of its perception (conceptualization), related drivers, and their relevance. That makes it difficult to generalize experience gained from analyzing different cases, which is of crucial importance for designing sustainable mitigation strategies.

The study areas compared bear important similarities: (1) they both have a long history of fish farming in ponds going back to the thirteenth century, (2) they have comparable geographical, hydrological, and geological conditions; and at least partly (3) they underwent similar political and societal developments after the Second World War. Despite these substantial similarities, there are also important differences. Since the political changes in the 1990s, Upper Lusatia suffered substantial population decline due to migration to the rest of Germany, whereas the political changes and economic reforms in South Bohemia were applied in a different context and similar migration did not take place. Unemployment rates are significantly higher in Upper Lusatia, both in comparison to the national average and to South Bohemia. Perhaps most importantly, the transformations regarding the pond fisheries were very different in both study areas, favoring transition to an extensive farming management in Upper Lusatia while encouraging stable or even higher fish stocks in South Bohemia.

An important limitation for designing mitigation measures is the lack of consensus, shared among the parties involved in the conflict, about the population size of species in question and about the actual damage caused. Even if monitoring campaigns are put in place, the confidence intervals of their results allow interpretations, which may equally sustain different positions. In our case, expert assessments point out that on average otter density in Upper Lusatia might be higher than in South Bohemia (Andreas Kranz, Reinhard Klenke; personal communications). Local densities can of course vary considerably, especially taking into account different geomorphologic conditions and pond number and average

size in both study areas. While in Upper Lusatia the medium-sized ponds prevail, in South Bohemia very large pond complexes stand for a significant proportion of total pond area. Numerous small ponds with higher pressure by otter are located in territories (e.g., the Czech-Moravian Highlands) from which otters disappeared in the past due to severe persecution and poor water quality and which are now progressively reoccupied.

Despite less favorable economic conditions and a high otter pressure, the conflict between otter protection and pond farming in Upper Lusatia seems to be more relaxed than in South Bohemia. Although otters feed on commercial fish resources, concerned stakeholder groups do not perceive the otter as creating a real conflict with fish farming. The conflict potential seems to have been paid high attention early enough in order to avoid conflict escalation as known from South Bohemia. In the early 1990s, Saxony implemented voluntary compensation schemes as part of the agri-environmental program for less intensive production methods. The reduction in market demand for carp, experienced in that period, was mitigated by these schemes as well. Later, these early measures evolved to the current schemes. Using compensation as an incentive for more extensive farming methods, better suitable for the preservation of a historically valuable cultural landscape, is the key feature of the mitigation measures in Saxony.

To the contrary, in South Bohemia, the problematic perception of otter persists among various stakeholder groups despite the damage compensation scheme introduced in 2000. The mitigation measure has been introduced late, only after the extent of illegal killing already achieved considerable level. Lower confidence in the measure, especially among small farmers, and high uncertainty about how long the compensations will go on may be a lasting consequence of it. How fragile the mitigation measures are has been demonstrated during the designation of NATURA 2000 sites. In addition, the damage compensation scheme does not relate to other support schemes aimed at conserving unique landscape or pursuing more environmentally sound production techniques.

In both study areas, the compensation schemes apply different methodologies to deal with or assess the damage and exercise different rules for compensation. In Saxony, payments for ecological services in the form of providing a feeding habitat for the otter are by far more important than actual damage compensation payments. Regarding the hardship regulation in Saxony, applicants are not automatically entitled to damage compensation and the budget available is limited. Since there is less stringent obligation for proving the physical extent of the damage, the scheme 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 law and its calculation requires reliable assessment of the damage provided by a recognized expert. Since it bases on assumption about the daily consumption by the otter, it does not cover secondary damage. These differences do not yet explain the effectiveness of conflict mitigation. Apparently, there is a trade-off between the transaction costs associated with the compensation measures and the level of scientific accuracy surrounding damage assessment. Although the lesson learned from comparing the study areas suggests that

successful conflict mitigation strategies require compensation schemes to address different objectives, acknowledging the scale of damage and further requirements are important.

Concerning the scale of damage, spatially differentiated and flexible schemes, able to pursue different measures for different extents of damage, are generally more likely to succeed. The extent of damage in the case of large pond farms, situated in lowlands in both Upper Lusatia and South Bohemia, are likely to exceed thresholds imposed by the compensation schemes. In Saxony, the threshold is explicitly defined by the hardship regulation, while in South Bohemia it is the perception of administrative obstacle, which is better coped with by larger companies than by small farmers. In Upper Lusatia, small and medium-sized farmers, which fail to reach the threshold, can still apply for the "otter bonus" in context of the agri-environmental program. This measure rewards the presence of the otter (as strictly protected species) as an ecological service. At the same time, the whole program provides an incentive for farmers to apply extensive forms of fish farming, reducing the potential for large-scale damage and by doing so, taking off the edge of the conflict. Small-scale damage used to be compensated in a non-monetary way with living carps. After the end of this measure, the "otter bonus" remains the only possibility for compensation. In South Bohemia, a similarly differentiated approach to damage compensation has yet to be found. The need for such an approach seems to be well justified in the light of the persistent conflict especially among the small farmers.

Even though, compensation schemes are an essential feature of conflict mitigation strategies from an economic point of view, often they are not sufficient to actually reconcile an existing conflict (Montag 2003). Apart from economic aspects, ecological and social factors are crucial in conflict mitigation. Mitigation measures formulated in a participatory process, open to relevant stakeholders, and based on trust and understanding of positions of opposing parties, are more likely to succeed. There is little information about the processes behind the design process of compensation schemes in both study areas. Indirectly, the success of such processes can be assessed by the level of agreement achieved in the compensation schemes. In this context, the interests of small-scale farmers and anglers have been marginalized in the Czech Republic.

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 fish ponds and water courses. The acceptance of the otter by fish farmers also declines with factors such as (1) growing market pressure (resulting in low carp prices), (2) the increasing siltation of the ponds, and (3) growing pressure of other piscivorous predators (e.g., great cormorant), to name but a few. In addition, the recent EU

enlargement is suspected by fish farmers to increase the market pressures and to restrict fish production to comply with European legislation (e.g., Habitats Directive).

In this chapter we analyzed conflicts emerging between otter protection and fish farming in two study areas—Upper Lusatia (Germany) and South Bohemia (Czech Republic). 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:

1. Actual damage assessment is difficult and needs to address different scales of damage (and thus satisfying the parties affected). Indeed, especially in the Czech Republic, the conflict is characterized by serious disagreement about the facts.
2. Financial compensation has limited scope to solve the conflict. Monetary benefit is not the exclusive reason for fish-pond 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 it used to be carried out in some districts in Upper Lusatia, is likely to be more successful.
3. Successful conflict mitigation strategies must involve relevant stakeholder groups in decision-making. A stakeholder forum, such as the fisheries council and the working group "pond farming" in Saxony, can effectively contribute to consensus-finding about important facts relating to the conflict and thereby mitigate it. Depending on the seriousness and extent of the conflict, it might be relevant not only to include professional fishermen, but also non-professional groups, such as anglers and their associations.

A proper set of mitigation measures should aim at changing 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 (1) address ecological, economic, and social aspects of the conflict; (2) be spatially differentiated, considering for example the differences between fish farming conditions in lowlands and in highlands; (3) be differentiated regarding the size and ownership of the fish ponds; (4) acknowledge the social needs of the various stakeholder groups involved; and (5) be composed by a number of measures, both financial and non-financial, which, besides compensating for the damage, help increasing the acceptance of the endangered and threatened piscivorous predators and preventing higher damage.

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Great cormorant (*Phalacrocorax carbo sinensis*). *Photo:* André Künzelmann