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Otters vs. fishermen: Stakeholders' perceptions of otter predation and damage compensation in the Czech Republic

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ABSTRACT

Habitat destruction and extensive hunting drove the population of Eurasian otter (*Lutra lutra L.*) in Central Europe nearly to extinction. Due to conservation efforts, otters are now returning to their original habitats, including fishpond areas in the Czech Republic. As their populations grow, conflicts with fishermen arise due to significant losses of commercial fish stocks caused by otter predation. Since 2000, Czech fisheries may claim compensation for otter damages under legislative Act No. 115/2000. However, negative attitudes towards otters persist and their illegal killing remains common. In order to provide decision-support material for conflict reconciliation, we conducted a questionnaire survey among fishermen ($n = 125$) and conservationists ($n = 36$) to investigate stakeholders' perceptions of otter predation and the damage compensation scheme in the Czech Republic. Results suggest that although otter damages on fish stocks were smaller than those caused by other piscivorous predators, fishermen perceived them as a significant hardship and demanded active control of otter populations. However, only one quarter of fish farmers actively protected their ponds from otter predation and not all conservationists were able to provide advice on preventive measures. Most respondents were aware of the current compensation scheme but its actual utilisation, especially by small private fish farmers, was low due to a perceived bureaucratic burden. All stakeholders considered current compensations to be insufficient and expressed a need for additional measures. We identified deficiencies in communication between both groups of stakeholders, and a lack of knowledge and use of available damage mitigation options. Our findings show prevailing gaps in the conservation plan for *L. lutra* and suggest areas into which the effort of conservation planning, public relations, and environmental awareness campaigns should be targeted. Understanding stakeholders' attitudes towards mitigation strategies is crucial for their successful application and for future improvement of reconciliation policies focused on conflicts between human activities and protected species.

Introduction

Successful conservation efforts in Central Europe have led to the recovery of many previously endangered species, including predatory mammals such as the Eurasian otter (*Lutra lutra L.*) (Červený et al. 2001). In highly developed landscapes of Central Europe, expanding populations of recovering species compete with humans for the use of space and biological resources. The recent increase in otter numbers has resulted in a typical human–wildlife conflict due to significant damages by otters predating on commercial fish stocks, particularly at farmed fishponds (Kloskowski 2005; Kranz et al. 1998; Myšiak et al. 2004). Since extensive aquaculture is a common way of agricultural production in most European countries and the costs of damages must be carried by those whose activities overlap with otter territories (Schwerdtner & Gruber 2007), the negative attitudes towards piscivorous predators are rising among fishermen (Bodner 1998; Kranz 1994; Kučerová 1999). Understanding fish farmers' perceptions of otter predation thus represents a critical challenge for conservation managers that aim to alleviate the fundamental conflicts between human activities and protected animals (Marshall et al. 2007).

The relevancy of human–wildlife conflicts in Europe is illustrated by the existence of the Framework for Biodiversity Reconciliation Action Plans (FRAP) project. This project was specifically designed to develop a procedural framework for action plans aimed at reconciling conflicts between the conservation of large vertebrates and the use of biological resources by humans (Similä & Varjopuro 2004). As a model case, the impact of piscivorous predators on fisheries was investigated in eight European countries, including the Czech Republic (Poledníková et al. 2006). In this study,

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we expand on the FRAP framework and examine the stakeholders' perceptions of otter predation and damage compensation in the Czech Republic, in order to provide supporting material for conservation managers as part of the management program for Eurasian otter.

In the Czech Republic, there is a long tradition of conflict between otters and fisheries (Kučerová 1999). With more than 50,000 ponds, many of which date back to 14th and 15th centuries, this country is the second largest carp (*Cyprinus carpio*) producer in Europe (Rauschmayer et al. 2008). Illegal killing together with environmental pollution and habitat destruction almost drove otters to extinction in the first half of the 20th century. However, due to strict protection and active recovery management, the otter population is now steadily increasing (1600–2200 estimated individuals in 2005 up from less than 200 individuals in the 1970s) (Hlaváč et al. 1998; Poledník et al. 2009). After the political transformation in 1989 that resulted in profound changes in land-use management and privatisation of the aquacultural sector (Bičík et al. 2001; Václavík & Rogan 2009), conflicts between otters and fishermen re-emerged (Toman 1998). The annual otter damages reported by two major fishermen organisations, the Czech Fish Farmers Association (CFFA) and Czech Fishing Union (CFU), fluctuated around 150 million CZK (~€6 million) per year between 2000 and 2005 (CFU 2009b; CFFA, personal communication). As a consequence, some fishermen ignore otter conservation status and use illegal methods such as trapping and culling to protect their properties and avert undesirable damages (Kranz et al. 1998; Toman 1995). Although the Czech otter population is currently not under a direct threat of extermination, the combination of illegal killing with increasing occurrence of road kills can result in a population decline in the near future (Poledník et al. 2009). Illegal killing thus represents one of the major obstacles to otter conservation in the Czech Republic (Poledník et al. 2007) and has created an incentive for developing strategies to mitigate conflicts between fishermen and otter protection.

Despite efforts to unify conservation strategies in the European Union, individual European countries adopted different approaches to reconcile otter–fishermen conflicts. While some countries (e.g., Poland, Portugal) have not yet undertaken any mitigation measures (Freitas et al. 2007; Kloskowski 2005), several countries (e.g., Austria, Germany) have developed damage compensation schemes to cover some of the costs associated with otter predation on commercial fisheries (Bodner 1995; Similä et al. 2005). In the Czech Republic, ex-post compensation for damages caused by selected, specially protected species has been in force since 2000, under the legislative Act No. 115/2000. Under this Act, affected fishermen can claim reimbursement for otter-induced damages on commercial fish in ponds and rivers within six months after (ex-post) the damage has occurred. An expert assessment of otter presence and damage appraisal based on a methodology recommended by the Ministry of Environment are required for claims to be successfully processed by county administrations that pay the total amount of compensations within four months after submission. Although the Act allows fishermen to get reimbursed for their economic losses caused by otter depredation, this compensation scheme has been the subject of criticism for several reasons. First, the quantification of losses caused by otters and distinguishing them from losses due to other predators, diseases, or poor cultivation practices is a complex and unreliable process. Second, only costs associated with primary damages (i.e., fish eaten by otters) are being reimbursed, while secondary damages (e.g., stress and injury on fish stock) are not taken into account. Third, the application for compensations may be considered a significant bureaucratic burden for those that suffer the costs of damage. Since the perception of conservation strategies affects their successful application (Herzon & Mikk 2007; Junge et al. 2009), investigating the attitudes of relevant stakeholders towards current compensation tools is crucially needed for development of future reconciliation policies (Marshall et al. 2007).

In this study, we conducted an extensive questionnaire survey that was focused on stakeholders' perceptions of conflicts between fisheries and otter conservation in the Czech Republic. Although mutual understanding and acceptance of conservation strategies by all parties involved in human–wildlife conflicts is recognised to be essential for reconciliation, to date, few studies have examined the way this conflict is truly perceived (Kranz 2000; Moravcová 2002). We empirically investigated stakeholders' attitudes towards otter predation and current compensation schemes, and examined the actual utilisation and cost-effectiveness of the legislative tool. Fishermen as well as representatives of government conservation agencies were interviewed to collect and analyse information from both major parties involved in the problem. In particular, we addressed the following research questions: (1) How do stakeholders (fishermen and conservationists) perceive otter predation pressure on commercial fish stocks and what are their attitudes towards current mitigation policies? (2) How frequently used and how effective is the compensation scheme implemented by legislative Act No. 115/2000? (3) If proved ineffective, what are the key problems that hinder the success of reconciliation strategies in the Czech Republic?

Materials and methods

We chose a semi-structured interview as our research methodology to collect data on stakeholders' perceptions of otter predation and damage compensation. The extensive questionnaire survey took place over three years (2004–2006), focusing on two groups of stakeholders, fishermen ($n = 125$) and local government officials ($n = 36$), that were individually interviewed via personal visits or exceptionally via phone calls. Similar surveys from recent years revealed in-person interviews to be more effective than mailed questionnaires, since those generally have low response rates and do not allow researchers to add clarifying questions (Moravcová 2002; Skáren 1990; Trindade 1991). We identified four separate groups of respondents within the main fishermen group: (1) managers of large commercial fisheries for whom fish farming represents a major source of income ($n = 21$); (2) smaller fish farmers and hobby pond owners not depending on fish farming as their primary source of income ($n = 30$); (3) official representatives of individual CFU units (anglers' organisation with more than 250,000 members; $n = 40$); and (4) recreational anglers (both members and non-members of CFU, $n = 34$). The sample of fishermen was randomly selected from Czech-Moravian Highlands and Moravia, two major regions in the Czech Republic in which otters are abundant. The individual respondents were located using the CFU registry, local municipal records, internet directories, and field interviews. The surveyed local government officials included: (1) zoologists from national parks (NPs) and protected landscape areas (PLAs) that are responsible for collecting evidence of otter damage necessary for compensation claims ($n = 25$); and (2) representatives from individual counties that are responsible for the administration of compensations at a county level ($n = 11$). From the entire country, we interviewed all local government officials from PLAs and NPs and 11 out of 14 county representatives.

Throughout the study, one assigned person interviewed all stakeholders in order to prevent potential bias in data collection. Fishermen were asked in a standard way to identify the extent of predator-induced damage to fish stocks at their farms/sites over the past five years, and specify piscivorous predators occurring at their farms/sites. To investigate the awareness about the legislative Act No. 115/2000, we asked a series of questions to assess fishermen knowledge of the compensation scheme, their previous experience

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with claims, and their general attitude towards efforts focusing on the mitigation of otter–fishermen conflict. We also asked respondents to specify those aspects of current compensation measures that they liked and disliked, and to suggest specific changes that would make the legislative tool more effective. In addition, respondents were asked to describe the types of preventive measures they know and actively use to avert otter damages on their properties. Finally, we collected information on the characteristics of each visited fish farm: number of owned fishponds; total area of farmed waters; and sources of primary income. Only fishponds that were actively farmed were taken into account, which allowed close linking of respondents' views and awareness to fish farming practices.

We questioned local government representatives that officially administer legislative Act No. 115/2000 to understand the perspectives of stakeholders on the conservation side of the otter–fishermen conflict. All representatives were asked to provide expert opinion on the compensation measure and its operation. To examine their eligibility to facilitate reconciliation of otter–fishermen conflicts, a series of questions addressed their knowledge of preventive measures aimed at averting otter damage. In addition to information gained via questionnaire, county representatives provided official data on the number of compensation claims, approvals, and total amounts reimbursed for each year since 2000. Similarly, two national fishermen organisations, the CFU and the CFFA (professional association of commercial fisheries, covering 85–90% of the total Czech fish production) provided country-wide data on annual losses of fish stocks caused by all piscivorous predators, including otters.

To analyse collected data, we applied primarily quantitative methods because they are more suitable to reduce the complexity of results, allow hypothesis testing and statistical comparisons, and are easier to communicate to natural scientists and conservation managers (Marshall et al. 2007). The qualitative data collected via open-ended questions in the questionnaire or during discussions with interviewees were used exclusively to interpret our quantitative findings and elucidate the reasons behind results. We used statistical analyses coupled with basic GIS analyses to investigate factors affecting stakeholders' perceptions of the conflict. Likelihood Ratio Chi-square Tests (LRCTs) were applied to examine whether factors such as predator's long-term presence in the region, fishermen's primary source of income, membership in some type of interest group, or total area of farmed fishponds influence fishermen's awareness of the compensation measure. Similarly, we used LRCT to test the effect of these factors on the actual use of the legislative tool as well as on the active use of preventive anti-predator measures. We also used LRCT to test the relationship between fishermen's previous experiences with damage reimbursement and their current attitude towards the compensation program. Finally, we investigated factors affecting the total number of compensation claims and the total amount of reimbursement in individual counties, using ordinary least square (OLS) regression and the following explanatory variables: relative total area of habitat (%) occupied by otters in each county (geographic range); and total area of fishponds in each county. We log-transformed all variables to offset the effect of outliers and meet the assumption of normally distributed residuals. We measured the amount of spatial autocorrelation in the residuals using Moran's I and performed a sensitivity analysis by running the OLS model with and without outliers to assess their effect on our results. All statistical analyses were performed in SAS JMP 7.0.1 (SAS Institute Inc., Cary, NC); GIS computation of spatial features was performed in ArcGIS 9.1 (ESRI Inc., Redlands, CA), using data obtained from TG Masaryk Water Research Institute and the Agency for Nature Conservation and Landscape Protection of the Czech Republic.

Since the project methodology meets the criteria of Human Subject Research, we recognise the moral issues potentially associated with our data collection and presentation. Although our institution did not require formal ethics approval at the time of the study and the character of the data posed minimal risk to researched subjects, we strived to fully respect participants' rights to undertake our research in an ethical manner.

Results

Conflict perception by fishermen

According to 81% of interviewed fishermen, total fish losses have been continually growing in the last five years (Fig. 1). These respondents perceived the unacceptably high number of piscivorous predators as the major reason for losses of fish, believed these animals no longer met criteria for legal protection, and demanded active control of their populations. Piscivorous predators most frequently associated with damage on fish were great cormorant (*Phalacrocorax carbo*), grey heron (*Ardea cinerea*), and Eurasian otter (Fig. 2). The average proportion of otter damages for individual groups of fishermen varied between 7% and 17%. Otter predation rarely caused more than 50% of total damages and over 35% of fishermen experienced no damages by otters at all. Fish farmers with no damage by otters reported that their ponds were not being visited by otters frequently, they use effective preventive measures, or their losses of fish caused by otters are insignificant in comparison with other predators. Although predators were believed to cause the majority of damage in fishponds and rivers, a few other factors were mentioned as severe, including diseases and poaching. Some of the CFU representatives and recreational anglers also emphasised the poor quality of fish habitat, caused in particular by former channelisation of rivers and streams.

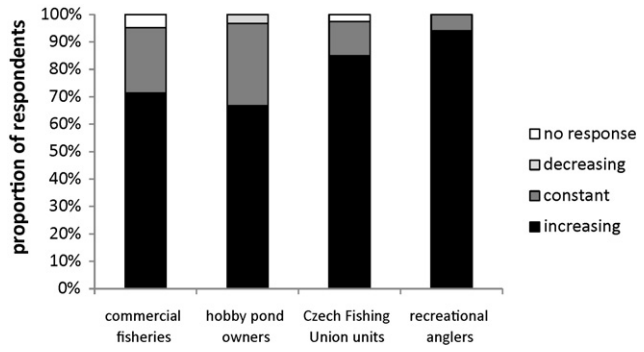

Fig. 1. Trend in total losses of fish stocks between 2000 and 2006 as perceived by four groups of surveyed fishermen.

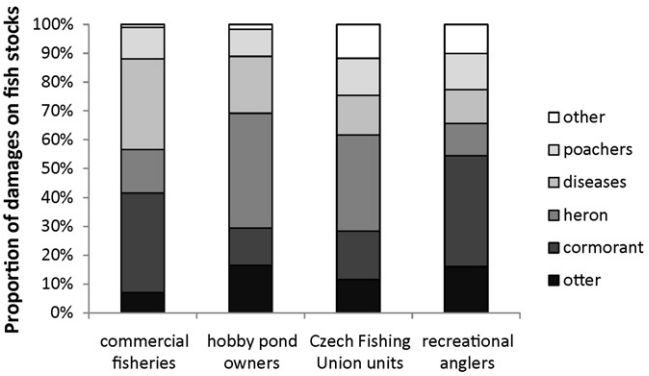

Fig. 2. Major factors causing losses of fish stocks between 2000 and 2006 summarised for four groups of surveyed fishermen.

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Managers of large commercial fisheries were shown to have better knowledge of legislative Act No. 115/2000 than other groups of fishermen. All representatives of large fisheries were familiar with the law and the process of compensation claims. About 95% of CFU representatives and 82% of anglers were aware of the damage compensation plan compared to 73% of smaller fish farmers and hobby pond owners, most of whom had only a vague idea of how the compensation process operates. Fishermen's awareness of otter presence at a fishpond site, based on distinct signs of otter activity (e.g., spraints, tracks, partly eaten fish or actual sighting of otter), had a significant positive effect on fishermen's awareness of the compensation scheme (Likelihood Ratio Chi-square Test (LRCT), $\chi^2 = 5.226$, $p = 0.0223$, $n = 125$). Moreover, fishermen that exhibited significantly better knowledge of the Act were those who were organised in some type of interest group, such as the CFU or the Czech Hunting Association (LRCT, $\chi^2 = 14.231$, $p = 0.0002$, $n = 125$), or owned a fishpond larger than one hectare (LRCT, $\chi^2 = 8.527$, $p = 0.0035$, $n = 84$).

Awareness of the legislative tool for damage compensation did not necessarily mean that fish farmers were actually using it. Of all fish farmers affected by otter and/or cormorant predation, 72% of large fish companies, 24% of CFU units, and only 10% of small fish farmers and hobby pond owners have applied for compensation. Survey participants considered the bureaucracy associated with compensation claims to be a financially demanding and time consuming process that makes conflict mitigation ineffective. Statistical comparison of participants with damages on fish stocks caused by one or more piscivorous predators showed that the presence of cormorant at a fish farm is a significant factor leading to compensation claims (LRCT, $\chi^2 = 5.953$, $p = 0.0147$, $n = 91$), whereas the presence of otter is not a significant factor (LRCT, $\chi^2 = 0.094$, $p = 0.7594$, $n = 91$).

The majority of fishermen (63%) perceived the compensation measure as an incomplete solution to the otter–fishermen conflict that needs to be accompanied by culling or live trapping. Whether fishermen claimed damage reimbursement in the past did not significantly influence their current attitude towards the law (LRCT, $\chi^2 = 1.338$, $p = 0.5123$, $n = 91$). Regardless of past experience with claims, one third of surveyed participants considered the Act to be an entirely ineffective means of conflict mitigation. Fishermen's discontent was not caused primarily by insufficient financial compensations but the fact that they are hindered in the production of their commodity. Especially for small fish farmers and hobby pond owners the motivation for fish farming was not driven by profit but by their personal satisfaction of well accomplished work. They considered reimbursement for damages to be insufficient because they wanted to produce fish, rather than to make profit.

Participants had similarly negative attitudes towards preventive measures. Only 26% of respondents farming in an area where otters were present were using some type of preventive measure to avert otter predation. Most fishermen considered the suggested measures (regular or electric fence, diversion ponds with non-commercial species, removable grid on inflows and outflows, noise and light emitters) to be ineffective and costly.

Conflict perception by local government conservation agencies

About 60% of zoologists from NPs and PLAs were convinced that the trend in losses of fish stock over the last five years was stagnant, while only 32% thought it was increasing. The county officials were relatively better informed as 82% were aware of the increasing trend. Nearly 70% of county representatives and 50% of zoologists from NPs and PLAs had previous experience with compensation claims for otter damages under Act No. 115/2000. Except for one respondent, who refused to answer, no participants from local government perceived the current legislature as a fully effective mitigation measure for the resolution of fishermen–predator conflict and expressed the need for a more holistic approach.

To determine respondents' eligibility in advising fish farmers on how to avert otter predation, we examined their knowledge of preventive measures. Of the interviewed county representatives, 73% were able to recommend at least one preventive measure. The most frequent responses included regular or electric fencing, removable grid on inflows and outflows, and noise emitters. Zoologists exhibited better knowledge of preventive measures, as 88% suggested at least one type of prevention. Their most frequent responses included regular and electric fencing together with diversity of fish stocks (combination of non-commercial fish with commercial species). Our assumption that all government officials working in regions where otters are present ($n = 30$) would be familiar with preventive measures was not confirmed. Four officials were unable to recommend any method for protecting fishponds from otter predation.

Analysis of official data for the Czech Republic

The official data collected from individual county offices showed that over the period 2000–2006 local government approved 654 compensation claims and paid fish farmers more than 30 million CZK (∼€1.2 million) for damages caused by otter predation. This is an underestimate since data for 14 claims approved between 2000 and 2002 in Vysocina County were missing. Of all compensations awarded since the Act was adopted in 2000, 70% were submitted in Jihocesky County, 25% in Vysocina County, and the remaining 5% in six other counties with large otter populations (Fig. 3). Although there is no legal obligation for county administrations to keep evidence of rejected claims, county officials reported that only 5% of the claims were declined between 2000 and 2006. Statistical analyses indicate that the number of compensation claims (OLS, adjusted $R^2 = 0.84$, $n = 13$) as well as the total amount paid to fish farmers (OLS, adjusted $R^2 = 0.79$, $n = 13$) in each county is positively affected by (i) the total relative area of habitat occupied by otters ($p < 0.01$ for both models) and (ii) the total area of fishponds ($p < 0.01$ for both models). The relationships remained significant even after we performed sensitivity analysis and ran OLS without two outliers represented by Jihocesky and Vysocina Counties. Analysis of residuals revealed an insignificant amount of negative spatial autocorrelation in both models as measured by Moran's I ($I = -0.23$ with p-value = 0.49 and $I = -0.26$ with p-value = 0.21 respectively).

To gain insight into the actual effectiveness of the compensation scheme, we acquired estimates of economic losses caused by otter and other piscivorous predators from the CFFA and CFU. Comparison of estimated losses to the actual amounts reimbursed to fishermen shows that only 2–5% of estimated losses caused by otter predation were compensated between 2000 and 2005 (Fig. 4). In this period, the government spent 23 million CZK (∼€920,000) on otter damage compensations, while the damages reported by the CFFA and CFU exceeded 875 million CZK (∼€35 million). However, these amounts represent only a fraction of the total losses caused by piscivorous predators (particularly cormorants) in the Czech Republic, estimated by the CFFA (Fig. 5a) and CFU (Fig. 5b).

Discussion

In this study, we analysed stakeholders' perceptions of otter predation and the damage compensation scheme in the Czech Republic to gain a better understanding of the otter–fishermen conflict and thus facilitate its successful reconciliation. Results indicate that fishermen perceive otter damages as significant, although not as severe as the damages caused by cormorants and herons. Generally, fishermen demanded the regulation of all piscivorous predators

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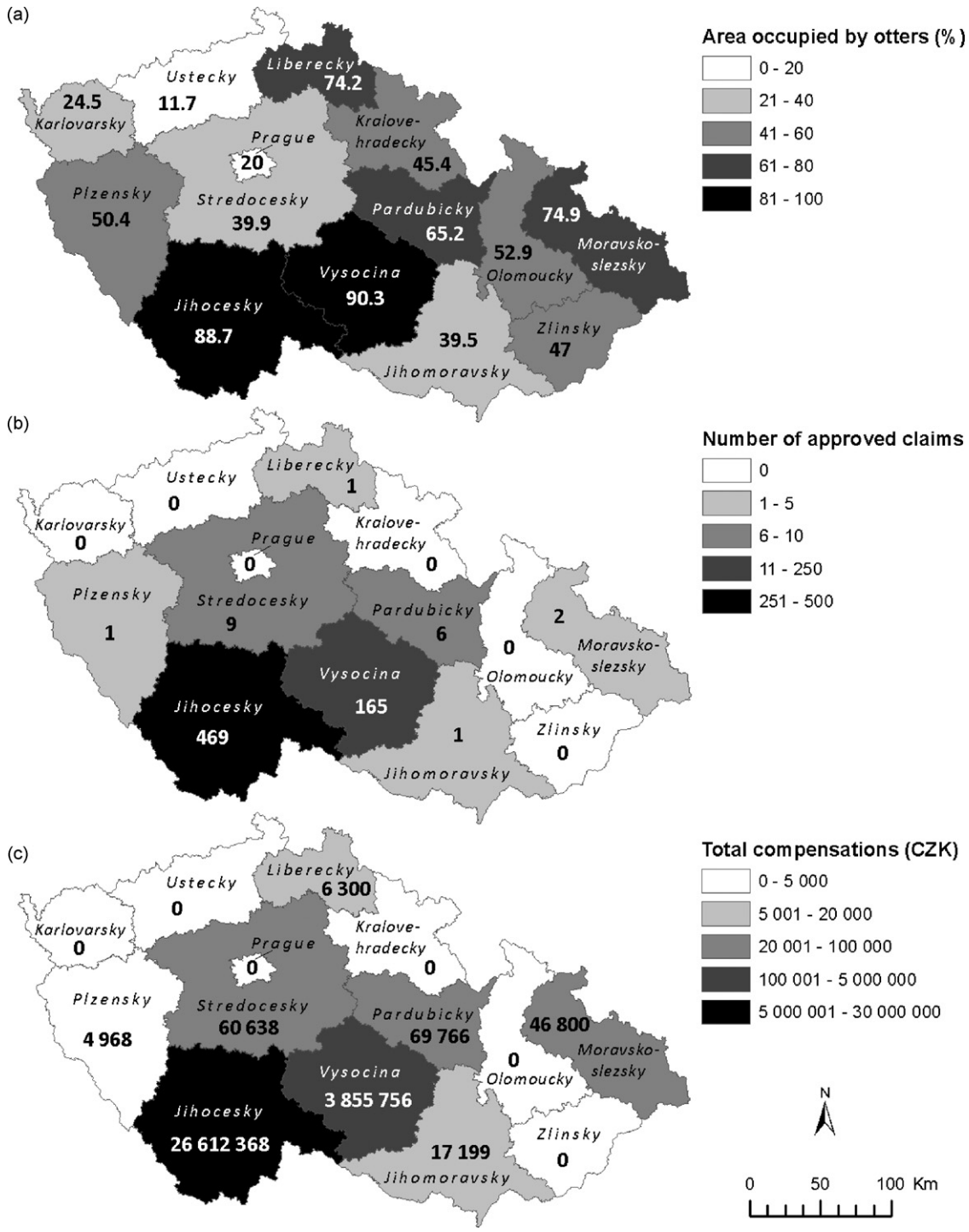

Fig. 3. Otters and compensation claims in individual counties in the Czech Republic: (a) relative area of habitat with otter occurrence; (b) total number of approved claims between 2000 and 2006; and (c) total amount of paid compensations between 2000 and 2006.

and often believed that culling or translocation was the only solution to the current conflict. According to Graham et al. (2005), this attitude is prevalent among affected stakeholders in a variety of human–wildlife conflicts. Culling or translocation need to be considered with the utmost caution because these management options may create population sinks and thus be detrimental to the overall population of vulnerable predators (Beja et al. 2009). Indeed predator control to benefit game populations and allow harvesting has severely reduced the abundance and distribution of many mammalian and avian predator species in the last 200 years (Reynolds & Tapper 1996). However, the FRAP project suggests there is a need for a general shift in policies from strict conservation towards active management of endangered fish predating species (Rauschmayer et al. 2008).

Perceptions of otter predation by professional and hobby fish farmers seemed to be influenced by three major factors: (a) the relative importance of otter damage compared to other causes of damage (some fishermen consider otter a minor problem when they have severe damages caused by other piscivorous predators); (b) the level of personal involvement (hobby pond owners are often emotionally involved in the farming outcome and farm not to earn money, but for the personal satisfaction of well accomplished

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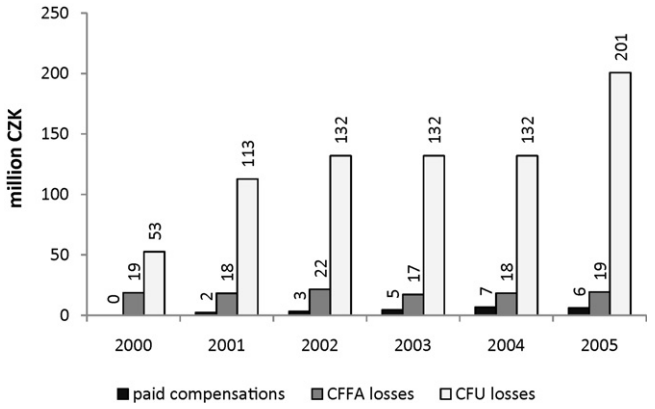

Fig. 4. Comparison of paid compensations reported by local government and losses of fish stock caused by otter predation reported by Czech Fish Farmers Association (CFFA) and Czech Fishing Union (CFU) between 2000 and 2005.

work); and (c) the size and economic situation of the farming enterprise (the same damage to fish stock can represent a small profit loss for a large commercial fishery but a total profit loss for a small fish farmer).

The perception of otters by recreational anglers was generally positive because their motivations to fish are not economic but driven by outdoor experience. These respondents generally agreed that spotting otters in their natural environment is a highly attractive part of such an experience. In addition, recreational anglers do not own the fish in the rivers and/or ponds, and predators thus cause no direct damage to them. The agreement of recreational anglers with otter protection has been repeatedly proven in socio-economic studies of angling in the Czech Republic published by the CFU (Spurný et al. 2003, 2009). In contrast with Goedeke and Rikoon (2008) who documented highly negative attitudes of anglers to otter conservation in Missouri (USA), these studies corroborate our findings and argue that positive attitudes of Czech anglers are influenced by their primary motivation for angling. Spurný et al. (2009) showed that the primary motivation for majority of anglers was either outdoor experience (56% of respondents) or spending leisure time with friends (26% of respondents). To catch fish for the purpose of consumption was the primary motivation for only 1.4% of respondents in their study.

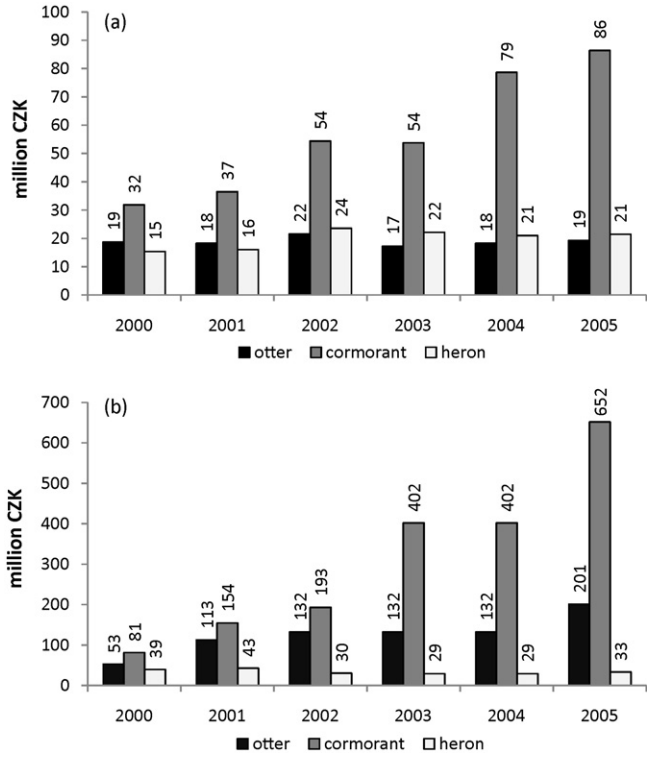

Fig. 5. Losses of fish stocks caused by piscivorous predators reported by (a) Czech Fish Farming Association and (b) Czech Fishing Union.

In contrast, the attitude of CFU officials that are responsible for individual fishing districts is highly negative, affected by the unclear interpretation of the Act No. 115/2000. Since 2006, an amendment to the Act has included compensations for otter damages not only to farmed fish, but also to fish in rivers. However, since the Ministry of Environment's interpretation of the law states that fish in rivers are *res nullius* (nobody's property) and that proprietary rights to them do not commence until the fish are caught, no compensation for fish in rivers has been paid to date. For the CFU, who stocks rivers and streams with fish in the value over 160 million CZK (~€6.4 million) every year (CFU 2009a), such interpretation is completely unacceptable and contributes to the escalation of the otter–fishermen conflict.

Overall awareness of Act No. 115/2000 among fishermen was relatively high, although a marked difference between professional and hobby fish farmers was apparent. Small, private fish farmers were less likely to utilise the compensation program, as only 10% of those with some predation damage applied for reimbursement, in contrast to almost three quarters of commercial companies. Commercial fisheries typically reserve staff and resources to deal specifically with legal issues, while small farmers and hobby pond owners have only limited capabilities to do so, and are often discouraged by the bureaucratic process and the initial financial burden associated with independent damage assessment. Moreover, quantitative analysis indicated that otter damages did not always motivate fish farmers to apply for compensation since these damages were typically less severe than those caused by migrating piscivorous birds. Unfortunately, one reason for the low number of compensation claims among small fish farmers may be the fact that the owners managing small, shallow ponds that are particularly vulnerable to otter predation (Schwerdtner & Gruber 2007) prefer to illegally trap predators rather than deal with the paperwork required for legal compensation (Poledníková et al. 2006).

The attitude of fishermen towards preventive, non-lethal measures was typically negative. Only one quarter of those fishermen whose fishponds are regularly visited by otters utilised preventive tools. Fish farmers not only considered the cost–benefit ratio of prevention to be too high, but also believed that common preventive methods are entirely ineffective. This is in sharp contrast with findings of previous experimental studies that tested the efficacy of selected preventive measures for small water bodies (<1 ha) in Europe. For example, Leblanc's (2003) study in France showed that the use of electric fences in combination with partially buried wire netting significantly reduced otter predation in studied fishponds. In Austria, Bodner's (1995) experiments at eight fishponds demonstrated that electric fences were 100% successful in keeping otters out of all studied ponds. Offering otters alternative food via installation of 'diversion ponds' also resulted in a significant shift in predators' foraging territory from high-risk sites with commercially valuable carp to low-risk sites with commercially less important species (Bodner 1995). These findings suggest that the major issue hindering the use of preventive measures by small fish farmers is not their inefficiency but the lack of public awareness and lack of knowledge among affected fish farmers.

Deficiency of appropriate and up-to-date information about the otter–fishermen conflict was also found among conservationists from local government offices. Contrary to our expectations, not all surveyed conservationists were able to recommend methods for

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protecting fish stocks from otter predation. In addition, the majority of zoologists from NPs and PLAs considered current trends in otter damages to be stagnant, although fishermen claimed losses of fish stocks were increasing. However, otter damage assessment is a complex issue and different groups of stakeholders use slightly different criteria for final estimation of fish stock losses.

Local government officials were mostly dissatisfied with the current compensation scheme but believed that the primary reason for its under utilisation was fishermen's inadequate knowledge of Act No. 115/2000, and emphasised the need for public relation campaigns. Some officials clearly stated, however, that the state and fishermen need to collaborate on damage prevention rather than relying on ex-post compensations. Like some fishermen, conservationists suggested adoption of subsidies that would provide funding to install and maintain technical, preventive measures but also identified the need to promote extensive (as opposed to intensive) ways of farming. Such an approach has been previously recommended by the Czech FRAP project (Poledníková et al. 2006) and could serve as a supplemental policy to the current compensation scheme, similar to the programs in several neighbouring countries.

For example in Austria, the province government pays for the material to construct fences preventing otters to enter registered fishponds, while ex-post compensations are paid from 'ÖPUL' (Austrian Agri-environmental. Programme) and the 'Landscape Fund' (Similä & Varjopuro 2004). In Lower Austria, this mitigation system is not implemented via legislative tools but based on agreement among the Department for Nature Conservation of the Government in Lower Austria, hunting authorities, Organization for the Conservation of Nature (NÖNB), and World Wildlife Fund Austria (Bodner 1998). In 2002, for instance, otter damages of almost €120,000 were covered from these sources (Similä & Varjopuro 2004). In Saxony (Germany), the economic instrument entitled 'Support Program for Aquaculture' assists farmers with the adoption of technical measures for the purpose of mitigating damages caused by piscivorous predators (Similä & Varjopuro 2004). Under this program based on voluntary contracts, over €25,000 were spent in 2001–2002 to support pond fencing in Upper Lusatia (Myšiak et al. 2004). In addition, more than 90% of farmers in this region agreed to create, or make available, new feeding habitats for otters. This program exists concurrently with the 'Saxon Compensation of Hardship Regulation' which partially compensates for damages over €100/ha/year caused by protected species (Similä & Varjopuro 2004). Additional funds are also available at the European level to support environmentally sound agriculture, including fish farming (Similä & Varjopuro 2004). Poledníková et al. (2006) suggest that such funds should be used to encourage less intensive farming because the consequent decrease in stock density and the increase in diversity of prey are in accordance with the optimal foraging theory and would reduce losses of fish stocks caused by otters.

Statistical analysis of data for the entire Czech Republic confirmed our hypothesis that both the number of compensation claims and the total amounts paid to fish farmers in each county are positively influenced by the relative extent of otter geographical range and the total area of fishpond habitats in those counties. Although we suspected that the relationships may be driven by two counties (Jihocesky and Vysocina) in which the core of the Czech otter population exists (Fig. 3a), the associations remained significant even after we removed the effect of statistical outliers. This robustness of findings suggests that the actual utilisation and effectiveness of the compensation measure are influenced primarily by the amount of otters and their potential habitat in each county and unlikely to be affected by other factors (e.g., unequal criteria for application processing or damage reimbursement) that would favour or discriminate applicants for compensations among individual counties.

Finally, the comparison of official data from local governments and two major fishermen organisations showed that only a fraction of actual damages caused by otters is compensated (2–5%), while damages caused by other piscivorous predators, especially cormorants, are even higher. This situation raises questions with serious implications for future policy-making: Is it feasible and sustainable for the state budget to compensate continually growing damages? Is ex-post compensation the most appropriate approach for conflict reconciliation? Is it meaningful to pay compensations when preventive measures are under utilised and fishponds overstocked? Recent experience from Germany indicates that growing populations of piscivorous predators together with diminishing budgets for conservation issues, make compensation unsustainable as the main mitigation strategy (Rauschmayer et al. 2008). In accordance with the results of our study, these findings suggest the need for more effective collaboration among stakeholders and a shift towards preventive approaches for otter–fishermen conflict mitigation.

Conclusions

In this study, we examined stakeholders' perceptions of otter predation and current damage compensation system in the Czech Republic. We demonstrated how a social perspective can be applied to provide insights into stakeholders' attitudes towards the overall strategy and effectiveness of otter–fishermen conflict mitigation. We identified serious deficiencies in (i) the communication between fishermen and conservationists, and (ii) the knowledge and utilisation of the current damage compensation scheme, which hinder the conflict reconciliation. Our results show prevailing gaps in the conservation of *L. lutra* in the Czech Republic and suggest the areas into which the efforts of conservation planning, public relations, and environmental awareness campaigns should be targeted. Both conservationists and fishermen (especially small fish farmers) must be provided with resources and detailed information about preventive measures to effectively avert otter damages. In addition, a constructive dialogue between both groups of stakeholders needs to be initiated, in order to increase mutual trust and information exchange. Understanding stakeholders' perceptions of human–wildlife issues and involvement of stakeholders in the conservation process is essential to future development and improvement of reconciliation policies focused on conflicts between human activities and protected species.

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