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How effective can be the national law in protecting birds? A case study from the Czech Republic

Dedicated to Professor Karel Hudec in honour of his 80th birthday

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A b s t r a c t . An effect of the Czech nature conservation law on a conservation status of bird species was examined using data on population size from two Atlases of breeding bird distribution in the Czech Republic (1985–1989 and 2001–2003). On average, species with the highest level of legal protection did better than other species. This pattern was probably driven by marked population increase of the species which were already increasing before the law came into the effect. Negative trends of declining species were not reversed after the law was accepted and it appears that the law failed to protect common bird species. Positive trends of protected species in the Czech Republic seem to mimic the trends in Europe and in neighbouring countries. Available official assessment of species conservation actions together with mixed message of our analysis suggest that the law could bring more positive results if implemented properly.

Key words: monitoring, legal protection, protected species, trends

Introduction

Effective modern nature conservation requires financial and human resources. However, such resources are always limited. Therefore, an evaluation of the effectiveness of conservation actions is needed to achieve the best outputs and to minimize ineffective expenditures. However, such assessments are still lacking in many conservation projects at least at national level (F e r r a r o & P a t t a n a y a k 2006). Moreover, even if an assessment is performed, mixed or negligible effect of conservation actions is sometimes found (e.g. K l e i j n et al. 2001, 2006). Other studies, although mostly at international level, have shown that conservation effort or conservation legislation brings positive outputs (B u t c h a r d et al. 2006, D o n a l d et al. 2007). Positive examples of such evaluation can be found e.g. in USA (M a l e & B e a n 2005) or UK (B r a d b u r y & A l l e n 2003), but generally studies of this type are rather rare at national level.

In the Czech Republic, there is only one official evaluation of selected conservation projects available on a limited number of species (K u m s t á t o v á et al. 2005). An overall assessment of the effectiveness of national conservation legislation on bird species is currently completely lacking.

The principal piece of nature conservation legislation in the Czech Republic is the Act on the Nature and Landscape Protection No. 114/1992 Coll. (the Act hereinafter), which entered into force in 1992. The Act poses several general restrictions on all species, for instance ban on persecution and deliberate killing of any species. Furthermore, the Act defines three categories of so called specially protected plants and animals. These are classified as so called (i) critically endangered species, (ii) highly endangered species and (iii) endangered species, former having the highest level of protection and latter the lowest. A list of specially protected species was published by the Ministry of Environment in 1992 and in case of birds no change to list of specially protected species has occurred since then (A n o n y m 2004).

The Act has been changed several times since 1992, but the main change occurred in 2004 when the Czech Republic entered the European Union and EU directives had to be implemented into the Czech law. Since 2004, the Czech law has been compatible with EU legislation and its main tool, the Birds Directive (Council Directive 79/409/EEC) has been under implementation. The Czech Republic is also a signatory to all major international nature conservation treaties (CITES, Convention on Biological Diversity, Bonn Convention, Bern Convention), although they are less legally binding than the Birds Directive.

The implementation of the Birds Directive poses significant change to the Czech nature conservation law. Thus, the period between the adoption of the Act in 1992 and introduction of EU legislation into Czech law in 2003 provides a good opportunity to test whether the existing legal provisions were effective in protecting bird species. Such a period should be appropriate for the evaluation as experience from USA shows that a law is most effective in the period 12–13 years after the listing of a species as being endangered (M a l e & B e a n 2005).

Neither the Act itself nor other governmental documents on specially protected species provide sufficiently specific and measurable targets. Since vaguely specified and not measurable targets of the Act do not allow proper testing, we need to use indirect evidence for the assessment. Establishing the criteria for such an assessment is rather subjective process, however, in the absence of the official targets this provides us with the only viable option. Therefore, we use common sense to formulate hypothesis for the evaluation.

If the Act is effective, we can expect: (i) the proportion of species with increasing population size should be greater in the group of specially protected species compared to those species that are specially not protected; (ii) the change in population status of specially protected species is more positive than the change in status of species not specially protected after the Act came into effect, the logic here being that the specially protected species should benefit from stricter protection and the active conservation actions promoted by the Act; (iii) the specially protected species, which were declining prior to 1992, should decline to lesser extent thereafter, or to be stable or increasing; (iv) the population status of specially protected species, whose numbers prior to the adoption of the Act were increasing did not worsen after its introduction in 1992.

The status of a local population of a species can be seriously affected by population dynamics of the species in a wider area due to the effects of metapopulation structure (F r e c k l e t o n et al. 2005) or source-sink dynamics (B r a w n & R o b i n s o n 1996). Therefore, a species can improve its status in the Czech Republic because its populations are improving elsewhere in Europe or in neighbouring countries irrespective to the effect of the Act. Thus, if the positive trends of specially protected species after 1992 are correlated with trends in Europe and/or in neighbouring countries, we can not rule out a possibility that positive trends of species are not linked to the effect of the Act but to the improving state of the species elsewhere.

Material and Methods

Data

We used data from last two atlases of the breeding bird distribution in the Czech Republic (Atlases hereafter) covering period 1985–1989 (Šťastný et al. 1996) and 2001–2003 (Šťastný et al. 2006). Data from the first Atlas come from a time period before the Act was accepted while the second Atlas describes the situation when potential effects of the Act could already be detected. Data was collected in a unified network of squares of 10´ longitude and 6´ latitude (roughly 12 by 11.1 km). The method of field work was the same in both Atlases. Each co-worker was requested to survey all habitats in the selected square, while it was recommended to start with the most frequented habitats (fields, woods, towns, ponds, etc.) and then to move onto rarer ones (sandpits, swamps, streams, etc.) and then finally to carry out a targeted search for individual species in appropriate environment or at an appropriate time – e.g. at dusk in case of the owls, crakes, nightingales etc.

The fieldwork was done by volunteer co-workers, mostly members of the Czech Society for Ornithology. In total 750 and. 532 resp. co-workers took part in two Atlases. The co-workers selected squares for their surveys and their field observations of all bird species were recorded using 16 numerical codes according to standards used in Europe (Hagemeijer & Blair 1997). Occasional observations, as long as they fulfilled criteria, were also used.

A total of 198 breeding species were registered in the Atlas 1985–89 and 199 species in the Atlas 2001–03 (not including introduced species and species escaped from captivity). The co-workers estimated the number of breeding pairs (or other relevant information on population size, e.g. number of calling males) in their squares on a geometric scale: 0–5, 6–25, 26–125, 126–625, 626–3125 and more than 3125 pairs per square. Estimates per squares were compiled at a central coordination level and then extrapolated into population estimates for the whole country.

For each species, the population estimate is expressed as the minimal and maximal population size in the Atlases and a geometric mean was calculated from these values. We obtained one figure representing the 1985–1989 population estimates and another one representing the 2001–2003 population estimates. All species were sorted into two groups depending whether the population size was higher in the first (i.e. declining species), or in the latter time interval (i.e. increasing species). In the case of declining species, their population change between 1985–1989 and 2001–2003 was calculated using the formula

$$I = -(N_t / N_{t+1} - 1) \qquad \text{(eq. 1)}$$

where I is the index of population change (hereinafter Atlas index), N_t is the 1985–1989 population estimate and N_{t+1} is the 2001–2003 population estimate. In the case of increasing species, we modified the eq. 1 as follows

$$I = N_{t+1} / N_t - 1 \qquad \text{(eq. 2)}$$

This approach was necessary because expressing population change in percentage terms would produce highly asymmetric results for increasing and declining species, thus preventing inter-species comparisons (see Lemoine et al. 2007 for further explanation). Using our

approach we obtained an index of population change with symmetric values around zero. The positive value of the Atlas index indicates a population increase, while a negative one indicates a decline. Species with an Atlas index of zero have the same population estimates for both time intervals and thus they underwent no change at all. We used data on species where positive values of population estimates were available from both Atlases, thus species with zero population estimate in one of the Atlases were excluded from the analysis.

For information on species population trends in Europe and in neighbouring countries we used information about population trends of species between 1990 and 2000 in Europe, and separately in Germany, Poland, Slovakia, Hungary and Austria, from BirdLife International (2004). For simplification, trend categories used in this book were pooled into three main classes: -1 for all categories of population decline, 0 for stable or fluctuating populations, and 1 for all categories of population increase. From this data, a population trend was calculated for each species in the countries surrounding the Czech Republic (hereafter the surrounding trend) as a mean for the trends in the neighbouring countries (Germany, Poland, Slovakia, Hungary and Austria) weighted by its population size in each of these countries. Finally, we transformed the values of the surrounding trend into a categorical scale treating values less then -0.1 as indicators of declining population and values more then 0.1 as indicators of increasing population. Values between -0.1 and 0.1 were treated as a stable population. Species with trends evaluated as "uncertain" in BirdLife International (2004) and species with missing data were not included in the analysis.

Statistical analysis

As a first step, the Atlas index between specially protected species and species specially not protected was compared using a t-test. We repeated this analysis recognizing different levels of species conservation status (i.e. species listed as critically endangered, highly endangered, endangered species and species not specially protected) using one-way ANOVA. We took into account species population changes prior to the Act by sorting the species into "previously declining" and "other" according to their trends between 1970 and 1990 in Tucker & Heath (1994). We then performed both previous analyses separately of each of these species group.

To test the effects of the species European and surrounding trend on their population changes in the Czech Republic, we compared Atlas indices between the three trend categories (i.e. declining, stable and increasing species) using one-way ANOVA. A separate analysis for European trends and for surrounding trends was also performed.

Results

Populations of 47 specially protected species increased in the interval between two breeding Atlases, thus indicating that the status of these species had improved after the Act's adoption in 1992. However, for the same period the status of 29 species specially protected by the Act had in fact worsened and their populations declined. Populations of 18 specially protected species remained at the same level between two Atlases. Some 26–32% of species in each category were in decline with the proportion very similar in all three categories as well as among the unprotected species (Table 1).

The Atlas index expressing population change between the breeding Atlases (1985–89 and 2001–03) shows that populations of specially protected species increased at average

significantly more than the breeding populations of species not specially protected, which remained at the same level at average (Fig. 1a). The effect of the legal status on a population

Table 1. Number and proportion of declining species between two Atlases according to species' legal conservation status. E - endangered, H - highly endangered, C - critically endangered, P – specially protected, N - species specially not protected.

	Declining (n. species)	Not declining (n. species)	% of declining sp.
N	26	63	29.2
P	29	71	29
C	7	16	30.4
E	9	19	32.1
H	13	36	26.5

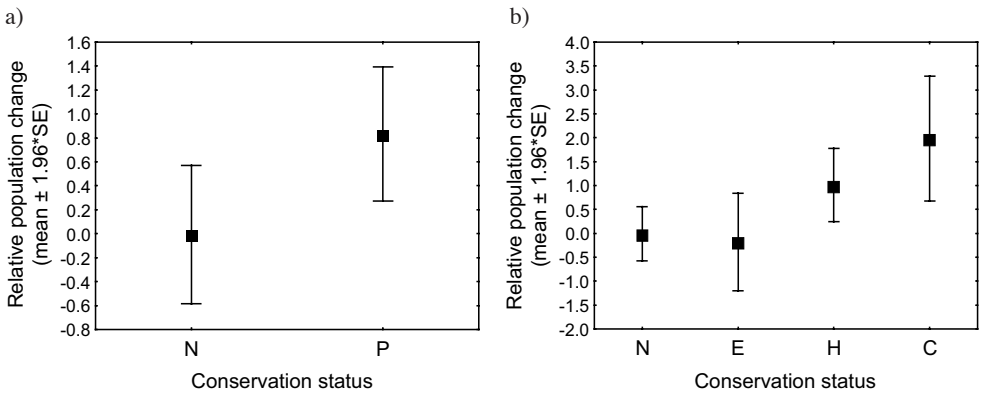

Fig. 1. Relative change in the species breeding population size between two Atlases (1985-89 and 2001-03) according to their legal conservation status categories in the Act. 1a – species specially protected (P) by the Act and species specially not protected (N). T-test, $t_{1,181} = 2.06$, p=0.041. 1b – specially protected species in separate categories (E - endangered, H - highly endangered, C - critically endangered) and species specially not protected (N). ANOVA: $F_{(3,179)} = 3.83$, p=0.011. Pairwais comparisons of means - Tukey test: p = 0.048 (difference between C and E), p = 0.029 (difference between C and N).

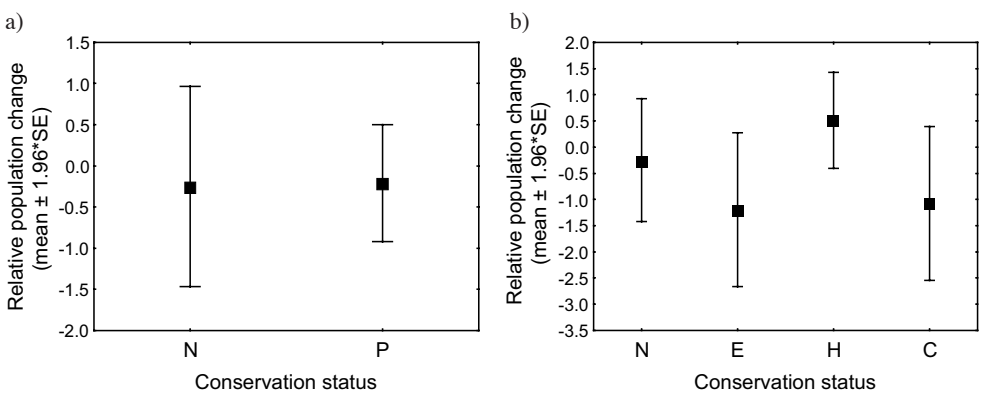

Fig. 2. Trends of species which were declining before 1992. Relative change in the species breeding population size between two Atlases (1985-89 and 2001-03) according to their legal conservation status categories in the Act. 2a - species specially protected (P) by the Act and species specially not protected (N). T-test, p=0.94049. 2b - specially protected species in separate categories (E - endangered, H - highly endangered, C - critically endangered) and species specially not protected (N). ANOVA: $F_{(3, 64)} = 1.4510$, p=0.23632.

change is significant, with numbers of those species with the highest status (critically endangered) having increased significantly more than species endangered and species not specially protected (Fig. 1b).

When species declining already before 1992 (i.e. species classified by Tucker & Heath (1994) as declining or strongly declining between 1970 and 1990) are considered only, there is no difference between average change in the population size of specially protected species and species specially not protected (Fig. 2a). All but highly endangered species which were declining prior to 1992, continued to decline after 1992 (Fig. 2b).

Species which were either stable or increasing (i.e. not declining) before 1992, were stable or increasing on average in the period thereafter. Populations of specially protected species within this group changed in positive direction while specially unprotected species

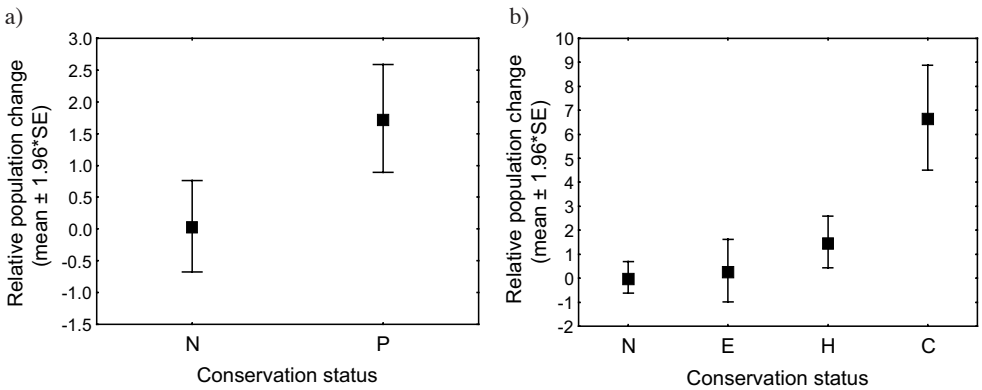

Fig. 3. Trends of species which were not declining before 1992. Relative change in the species breeding population size between two Atlases (1985-89 and 2001-03) according to their legal conservation status categories in the Act. 3a - species specially protected (P) by the Act and species specially not protected (N). T-test, p=0.00312. 3b - specially protected species in separate categories (E - endangered, H - highly endangered, C - critically endangered) and species specially not protected (N). ANOVA, $F_{(3, 111)} = 11.927$, p=0.00000. Pairwais comparisons of means - Tukey test: C different from all other groups (all $p < 0.001$).

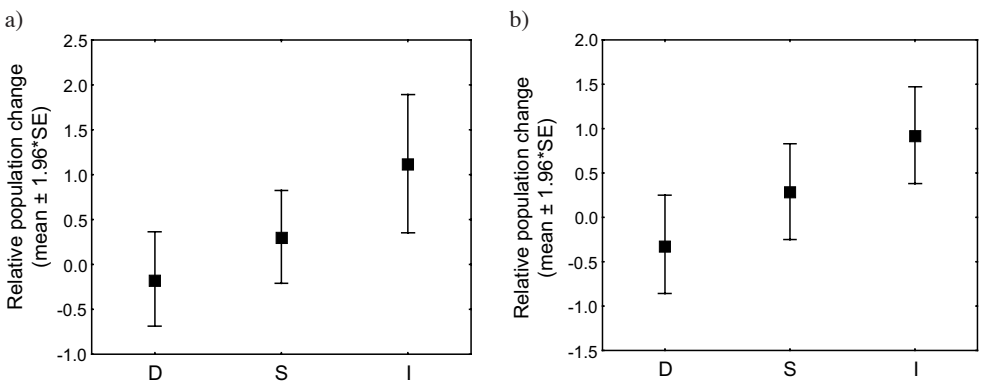

Fig 4. a - mean population change between two Czech Atlases in relation to species trends in Europe (1990-2000, BirdLife International 2004). D – declining in Europe, S – stable in Europe, I – increasing in Europe (see Material and Methods). One-way ANOVA, $F_{(2, 157)} = 3.7127$, p=0.02658. Pairwais comparisons of means - Tukey test: D different from I ($p = 0.018$). b - mean population change between two Czech Atlases in relation to species trends in neighbouring countries. National average trends are weighted by population size of species in each country (BirdLife International 2004) and classified as ‚decline' (D) – decline more than 10%, ‚stable' (S) – decline less than 10% and increase less than 10%, ‚increase' (I) – increase more than 10%. One-way ANOVA, $F_{(2, 176)} = 4.9097$, p=0.00842. D different from I ($p = 0.004$).

kept their status. Trends of specially protected species were significantly more positive than trends of species not specially protected (Fig. 3).

A comparison of species population change between the two Czech Atlases and information on species population trends in Europe (BirdLife International 2004) shows that species increasing in the Czech Republic were also on the increase in Europe (Fig. 4a). The effect is more pronounced when we compare Czech species trends with trends in neighbouring countries only (Fig. 4b).

Discussion

Better performance of specially protected species and critically endangered ones in particular (Fig. 1) suggests that the Act has had a positive effect. However, those species, whose numbers were already declining prior to the Act's introduction, do not seem to have improved their status, even after being listed as specially protected (Fig. 2). One might argue that these species could have been in severe trouble even before the Act and more time would be needed for their populations to recover. However, as shown by M a l e & B e a n (2005) a law is most effective 12 to 13 years after a species is listed. This is the same time frame used for this investigation and we assume that the positive effect of the Act on population trends of declining species should have been detectable.

Further increase of critically endangered species, which were not declining before the Act, can be understood as positive and could be considered as a direct effect of the Act. Other protected species, which were increasing already prior to the Act, do not differ significantly from species not protected.

The proportion of declining species (ca 30%) was similar both in specially protected and unprotected species, as well as within species groups with a different conservation status. Although the analysis showed that the specially protected species revealed significantly higher population increase than unprotected species, it appears that this result was probably caused by a rapid population increase of a few critically endangered species, which were already increasing prior to the Act.

We found that 47 specially protected species improved their status, i.e. their breeding populations increased in the Czech Republic between 1985–1989 and 2001–2003. Another 18 species remained at the same population level within the same period while the numbers of 29 specially protected species declined.

We could expect that an improvement of populations of 47 species could result from targeted conservation actions triggered by the Act. Unfortunately, there is no central source of information on the conservation efforts devoted to each specially protected species. Some species are obviously subject of several projects run by governmental or non-governmental organisations with little coordination. Information on the success of conservation measures aimed at some specially protected species has been provided by an evaluation conducted by K u m s t á t o v á et al. (2005). Seven out of 47 increasing specially protected species have been involved in this evaluation and the effectiveness of conservation effort assessed. Most of conservation measures included the installation of nest boxes or nest platforms (white stork *Ciconia ciconia*, goldeneye *Bucephala clangula*, Ural owl *Strix uralensis*, Tengmalm's owl *Aegolius funereus*, kingfisher *Alcedo atthis*), the release of individuals bred in captivity (capercaillie *Tetrao urogallus*, goldeneye, Ural owl), habitat management (capercaillie), raising public awareness or protection of nests against farming activities (Montagu's harrier *Circus pygargus*). The assessment found that, on the whole, most of the conservation measures implemented were either less effective than they could have been, or not effective at all, with

nest boxes even becoming ecological traps for a species (goldeneye) (K u m s t á t o v á et al. 2005). They found positive results in two species only: the Ural owl where reintroductions led to the re-establishment of the local breeding population, and Montagu's harrier, where proper measures can significantly reduce breeding failures caused by agriculture mechanisation. Furthermore, the assessment found little coordination between numerous bodies (governmental and non-governmental) involved in conservation actions for each species, a lack of information needed for the proper evaluation and inefficient monitoring (K u m s t á t o v á et al. 2005). We might speculate that some other species could benefit from being listed as specially protected because the listing provides stronger protection against persecution, particularly among species sensitive to persecution (e.g. white tailed sea eagle *Haliaetus albicilla*, sparrowhawk *Accipiter nisus*, marsh harrier *Circus aeruginosus* or raven *Corvus corax*).

The evaluation also provides an assessment of the effectiveness of conservation measures on limited number of declining protected species. There are only two species with such an assessment, barn owl *Tyto alba* and little owl *Athene noctua* (K u m s t á t o v á et al. 2005). Conservation actions in these two species included the installation of nest boxes, raising public awareness and, to a certain extent, reintroduction. As in the case of those conservation measures targeting increasing species, actions on behalf of barn and little owl suffer from poor coordination, monitoring is inefficient or even lacking and reintroductions are evaluated rather negatively (K u m s t á t o v á et al. 2005). Information on conservation effort targeting the other 27 species is not available and we could assume that conservation action plans for these species have not been prepared and implemented at all.
Based on this rather patchy information one could infer that the effectiveness of direct conservation actions targeted at specially protected species is rather low. Unfortunately, the absence of a comprehensive assessment prevents a fuller discussion on this issue and we thus need to use further indirect evidence.

It was shown that the existence of official action plans is a good predictor of success in efforts to protect a target species (D o n a l d et al. 2007). Therefore, the number of action plans might be another indirect indicator of conservation effort and its effect. In the Czech Republic, only one official recovery (action) plan – for the capercaillie – was accepted by the government (http://www.nature.cz/index.php?id_subjekty=en), suggesting a rather low intensity of centrally coordinated conservation effort on behalf of specially protected species.

Although the Act seems to work well in the case of conservation of species with the highest extinction risk, i.e. critically endangered species, the populations of species with the lowest protection status, i.e. endangered species, experienced changes very similar to those without specific protection. Results of long-term monitoring projects report serious decline in many common bird species, particularly farmland birds (e.g. skylark *Alauda arvensis*, yellowhammer *Emberiza citrinella* or tree sparrow *Passer montanus*) in the Czech Republic (Š ť a s t n ý et al. 2004, R e i f et al. 2006) as well as in Europe (PECBMS 2007), mostly as a consequence of changes in land-use (D o n a l d et al. 2001, G r e g o r y et al. 2005). It seems that species considered to be common are often beyond the attention of targeted conservation actions and nature conservation fails to prevent population declines of species which are affected by large-scale habitat changes.

We can assume that the status of at least some out of 47 specially protected species improved as a consequence of the Act, especially those species with the highest legal status. Although some of these species were already increasing prior to the Act, their positive trends can indeed be secured by the legal protection. Positive effect of the Act on some species is also supported by the assessment by K u m s t á t o v á et al. (2005).

However, trends of species, which seem to confirm at least partly positive effect of legal protection, reflect trends in Europe and especially in neighbouring countries (Fig. 4). One might speculate that positive trends of specially protected species are driven by positive trends elsewhere in Europe rather than by direct conservation effort in the Czech Republic. A better assessment of conservation actions in the Czech Republic is therefore needed.

A comparison with the situation in other countries might help to clarify the mixed messages from this study. Unfortunately, assessments of the effectiveness of nature conservation law usually come from countries with different legal systems or have been done at international level. The study by D o n a l d et al. (2007) is an example of the latter, which has shown that the Birds Directive has indeed helped to improve the status of species listed in its Annex 1. These species also benefit from specific conservation measures including the designation of Specially Protected Areas (SPAs). A comparison is also difficult because the Birds Directive includes several specific conservation tools aimed at improving the species conservation status, which the Czech Act did not. Drawing a comparison with system in place in North America (USA) (M a l e & B e a n 2005) is also difficult because lists of protected species are updated there, species being listed or delisted, depending on their conservation status. However, the list of specially protected bird species did not change in the Czech Republic in period from 1992 to 2003.

A smaller spatial scale could also be used for examining how legal protection functions and it might help to assess the effect of the legislation at national level. An evaluation of the role of protected areas (e.g. D e v i c t o r et al. 2007) would be of particular interest in this regard. However, this is again lacking in the Czech Republic.

Our analysis did not take into account species-specific characteristics other than the legal protection status, such as habitat requirements or migratory status, which could potentially affect the results. However, we have previously shown that migratory strategy explains only a marginal proportion of interspecific variation in population trends of common birds and that groups of species with different migratory strategies have similar trends (R e i f et al. 2006). In the case of habitat requirements, R e i f et al. (2007) found a long-term increase of forest bird populations while the opposite pattern was described in farmland birds (R e i f et al. 2006). Habitat alteration or changes in habitat quality could thus affect bird populations irrespective of the legal protection status of a particular species. On the other hand, we argue that an effective conservation law should overcome these effects.

Indirect evidence and an incomplete assessment of species conservation actions can hardly be used for drawing clear conclusions on the effect of the Act. The positive message, that specially protected species improved their status, is weakened by the fact that the Act did not prevent a further decline of some protected species as well as species not protected. Also, available information on species action plans and their implementation suggests that the implementation of the Act could suffer from low efficiency. Further research is needed to clarify whether species have directly benefited from conservation measures or in fact they improved their status because their populations were increasing in rest of Europe and neighbouring countries. Setting up measurable targets by the state nature conservation authorities are necessary as well as regular updating of lists of specially protected species based on results of large-scale monitoring schemes.

A c k n o w l e d g e m e n t s

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