Trends in numbers of the Coot (*Fulica atra*) in the Czech Republic in 1988-2000

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1. Introduction

Common Coot *Fulica atra* is one of the commonest waterbird species in the Czech Republic. The total size of the breeding population was estimated between 1985 and 1989 as 30 000 to 60 000 bp (breeding pairs) (Šťastný *et al.* 1996). In the 20th century, up to the late 1970s, breeding population numbers increased during most decades (*e.g.* Fiala 1978, Řepa 1987, 1989). During the 1980s and 1990s, a remarkable decline in Coot numbers was recorded (Musil 1995, 1999, Musil *et al.* 2001). However, our present knowledge about the population dynamics of this species is very poor, circumstances that provided the main stimulus for the initiation of an intensive study of Coot ecology and breeding biology, including the annual monitoring of breeding population size. This short paper is aimed at an analysis of the regional pattern in trends in Coot breeding population numbers.

2. Study area

Fishpond characteristics

In the Czech Republic, artificial lakes and fishponds represent the most suitable breeding habitat for Coots and many other water birds (*e.g.* grebes, geese, and ducks). Fishpond development began in Czech lands mainly during the 14th century. During the 20th century, fishpond ecosystems have changed markedly in term of fish production, biodiversity and water quality, the most remarkable changes in fishpond management being recorded from the 1950s onwards. The documented evidence shows heavy increases of nutrient flow both from the surrounding landscape and from direct fertilization of the waterbodies. The consequence has been that fishponds have changed from being oligotrophic and mesotrophic waterbodies to become eutrophic and hypertrophic in the 1980s and 1990s. In these two decades, the mass of fish stocks has also increased greatly for many decades (from 50 kg/ha in the 1900s to over 500 kg/ha).

The enormous scale of the grazing effect of fish recently seems to be the most important factor affecting benthic and plankton communities, the extent of littoral vegetation and consequently also many other limnological parameters, such as water transparency and chemistry (Pokorný *et al*. 1994, Pokorný & Pechar 2000). The above massive eutrophication also led to the intensive development of littoral vegetation in fishponds. Consequently, water surface area has declined in many fishponds since the 1950s. To counter this

Fig. 1. Location of investigated fishponds regions in the Czech Republic: 1. Plzeň, Tachov. 2. České Budějovice. 3. Třeboň. 4. Jindřichův Hradec. 5. Central Bohemia. 6. East Bohemia. 7. North Moravia. 8. Břeclav.

effect, the commercial fish breeders have carried out large-scale removal of sediment and littoral vegetation.

3. Methods

The programme 'Monitoring Waterbird Breeding Populations in the Czech Republic' started in 1988 (Musil 1995, 2000). Annually, volunteers collect data from 460-710 water bodies in some 20-40 varied regions of the country. Data from the 8 most important fishpond regions (České Budějovice, Jindřichův Hradec, Třeboň, Tachov and Plzeň of Central Bohemia, and Břeclav, Central and North Moravia, East Bohemia) were analysed for this paper (see Fig. 1).

Since 1993, the results have been published in annual reports in a bulletin, CSO (Czech Society for Ornithology) News (*e.g.* Musil 1997, 2000). All ponds under study are checked twice during each breeding season, in the second half of May and in the second half of June. In case of Coot, as a territorial species, the higher of the two values was used to express the species abundance (see Musil 1996 for details). Relative changes in breeding population size were expressed by population index calculated as a percentage of the base-year (1988) population size. The statistical importance of the population trends was assessed using the linear correlation coefficient. Principal Component Analysis (PCA) was used for comparison of population trends in fishpond regions (Fig. 3).

4. Results

Coot was the most frequently recorded water bird species, occurring on more than

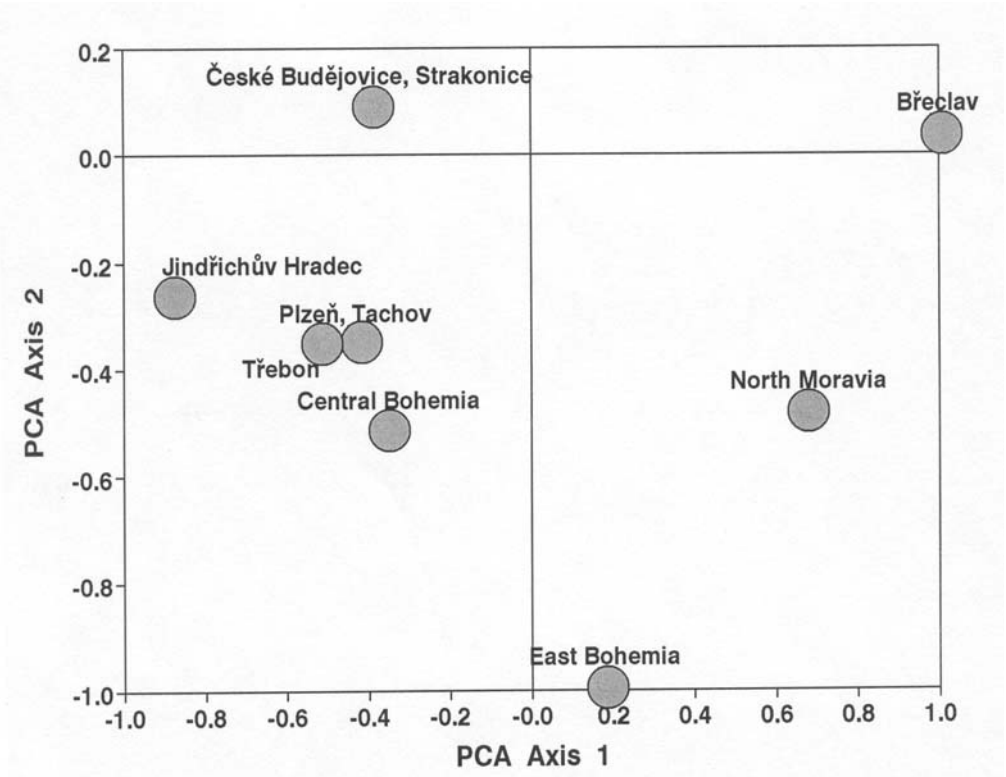

Fig. 3. Principal Component Analysis of inter-region similarity in trends in numbers of breeding population of Coot.

63% of studied water bodies. Since 1989, a significant decrease in Coot numbers has been recorded in most of the fishpond areas (see Fig. 2). The most significant decrease was recorded in South Bohemia, including the regions of České Budějovice ($r=-0.870$, $P<0.001$, $n=13$), Jindřichův Hradec ($r=-0.944$, $P<0.0001$, $n=13$) and Třeboň ($r=-0.873$, $P<0.001$, $n=13$). Moreover, rapid decreases in Coot breeding population numbers were found in Southwest (Tachov and Plzeň) ($r=-0.767$, $P<0.01$, $n=13$) and Central Bohemia ($r=-0.709$, $P<0.01$, $n=13$). Significant increases since were recorded in Břeclav region and in Central and North Moravia. Fluctuations in Coot numbers were recorded in East Bohemia ($r=0.078$, n.s., $n=13$).

The similarity of the population trends in particular fishpond regions (PCA, see Fig. 3) reflects the geographical location of these regions. There is a very visible difference between trends in the west (most Bohemian regions) and in the east of the country (Moravia).

5. Discussion

The Coot breeding population increasing in many decades of the 20th century but declined very rapidly in the 1980s (Šťastný *et al.* 1996, Musil 1999). These population changes do not correspond with the general population trends recorded in the Western Palearctic (*e.g.* see

Gorban & Stanevičius 1997, Delany *et al.* 1999). Many possible causes of this aberrant decline have been discussed. The following factors are often strongly connected with the intensification of fishpond management, which has affected the entire fishpond plant and animal communities since the 1980s.

1. *Cutting, destruction or degradation of the littoral vegetation*. The littoral veg-

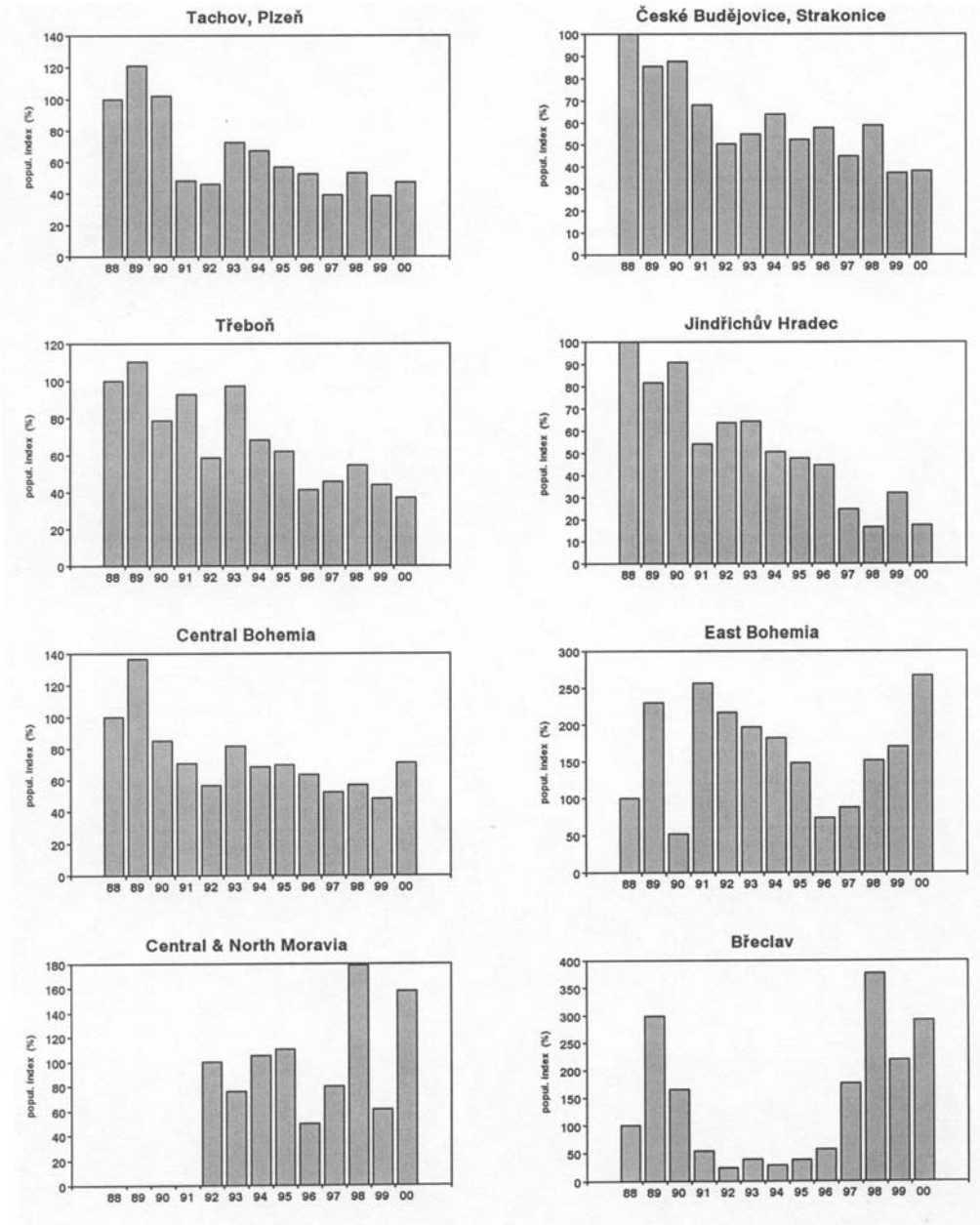

Fig. 2. Breeding population changes of Coot in various regions of the Czech Republic in 1988-2000.

etation mostly comprises *Typha*, *Phragmites* and *Glyceria*, and damage to it causes loss of nest habitat. Because the Coot is territorial, when breeding habitat is in short supply, the weaker pairs often nest in unsuitable habitat or fail to breed. The loss of nest habitat exacerbates the predator pressure on nests and chicks, because so many nests are badly hidden (Corvidae, Marsh Harrier *Circus aeruginosus* and Grey Heron *Ardea cinerea* benefit most).

2. *Overstocking of fish in fishponds*. The dominant fish species is the omnivorous carp *Cyprinus carpio*, and excessively large fish stocks cause food competition between the fish and birds in the brood feeding period (newly hatched chicks are fed invertebrates). Moreover, the presence of large carp has had a negative effect on littoral vegetation quality.
3. *Direct fertilization of water bodies and artificial feeding of fish stocks*. The high nutrient input from the presence of fertilizer (including run-off from agriculture) and the degradation of the fish food (the consequence continuous supply of fish excreta) cause phytoplankton (algae, cyanophytes) to develop, thus decreasing water transparency. The conditions that have caused the reduced food supply for birds are more likely to allow the development of anaerobic bacteria such as *Clostridium botulinum* that infect birds with botulism, thus increasing bird mortality rates.

Although Coot numbers show a decreasing trend in most Czech fishpond regions, increases in numbers were recorded in several regions after 1995, where newly established roosting sites hosted large post-breeding and non-breeding Coot aggregations, especially in Moravia. Improved management of several larger fishponds (protected as part of the National Nature Reserves) could affect this trend, particularly if the actions include diminishing the fish stocks and lowering the water level. The consequences of introducing such management practices would have a positive effect on the development of submerged water vegetation.

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