DOI: 10.17242/MVvK_3.19

WATERFOWL NUMBERS ON SOUTH BOHEMIAN FISHPONDS IN RELATION TO FISHPOND MANAGEMENT

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ABSTRACT

In the period 1990 - 1994 point counts of waterfowl were conducted on 88 fishponds of different size (1 - 394 ha) in monthly intervals. Data on the numbers of waterfowl were compared with the data on management of the fishponds counted (total fish biomass, age class of the fishes). Highest densities of waterfowl in the breeding season (*Aythya fuligula, Aythya ferina, Anas strepera, Anas platyrhynchos*) were observed on the fishponds with the lowest fish stock (mainly fry fishponds). The competition for protein-rich food between fishes and waterfowl is supposed to be responsible for this pattern. In opposite, the highest densities of waterfowl in autumn (mainly *Anas platyrhynchos and Anser anser*) were observed on big ponds, irrespectively of the fish biomass. However, Mallards and Grey Lag Geese are feeding outside of the fishponds at this time. Main factor affecting distribution of waterfowl in the autumn seems to be safety from hunting and other disturbance.

INTRODUCTION

In the second half of 1970's and in the beginning of 1980's sharp decline of the waterfowl numbers was observed on South Bohemian fishponds (Czech Republic). Various species of ducks - Mallard, Tufted Duck, Pochard - and Coot were most affected (Hudec *et al.*, 1994; Musil and Fuchs, 1994). Several factors were proposed to be responsible for this

decline - eutrophication of fishponds connected with botulism and liquidation of littoral vegetation by heavy machinery were quoted most often (Hudec *et al.*, l.c., Musil, 1987)

Because the period of the decline of waterfowl occurred at the same time as the period of greatest intensification of fishery on these fishponds, I examined possible influence of fishpond management (mainly mass of fish stock) on the waterfowl numbers.

STUDY AREA AND METHODS

South Bohemian fishponds are shallow artificial water bodies of different size (from 1 to ca 500 ha), constructed mainly in the 15th and 16th centuries for the purposes of fishery (mainly carp rearing). Number of the fishponds in South Bohemian region is ca 6000, total area approximately 25.000 ha. Most of the fishponds are eutrophic or hypertrophic currently, due to intensification of fishery in the 20th century (mean total N ca 2-3 mg per liter, mean total P ca 300-500 mg/l, mean chlorophyll-a 100-150 mg/l). Average production of fish was ca 50 kg per hectare in 1950's (after the Second Word War), however at present average fish production is more than 500 kg per hectare (Korinek *et al.*, 1987).

The fish stock of the ponds is formed mainly by carp (ca 90%), additional fish species are tench, grass carp, pike, common whitefish etc. The carps are artificially fed in the ponds mainly by grain and pellets. Natural food is responsible for ca 30% of fish production, artificial food for remaining ca 70% of production. Separate age classes of carp are kept in fishponds separately, i.e. - fry fishponds, ponds with 1 year old carp (referred to as K1, ponds with 2 or 3 year old carp - K2, K3. In the autumn fishes are taken from the ponds and sold or put to anther pond. Fertilizers are also used to increase production (organic - manure, synthetic - nitrates, phosphates).

In the period 1990 - 1994 I made regular counts of aquatic birds on a set of 88 fishponds of different size (total area ca 2700 ha). Each fishpond was controlled in a monthly intervals by point count method (largest ponds were counted from 2 or 3 points) and all visible waterbirds were counted. Data on the fishpond management were gathered from the fishery enterprises (i.e. data on a mass of fish stock in a given pond in a given year, data on species and age class of fishes in the pond etc.).

I calculated average seasonal mass of fish stock for a given pond and given year as an average value of fish mass put to the pond in the spring and fish mass taken from the pond in the autumn respectively. Average seasonal mass of fish stock was used as a measure of feeding pressure exerted by fish stock in the pond.

RESULTS

Data on seasonal dynamics of average densities of most common waterfowl species on the fishponds with different age classes of carp are shown on **Figure 1**. Average seasonal mass of fish stock was lowest on fry fishponds (183 kg per ha) and highest on fishponds with the oldest carp K3 (1100 kg per ha), intermediate on K1 (374 kg per ha) and K2 (618 kg per ha). Densities of waterfowl in the breeding season were highest on fry fishponds and lowest on K3 fishponds. [Note that fry fishponds are in the spring (March April) usually without water, therefore average densities of waterfowl are very low there in that period].

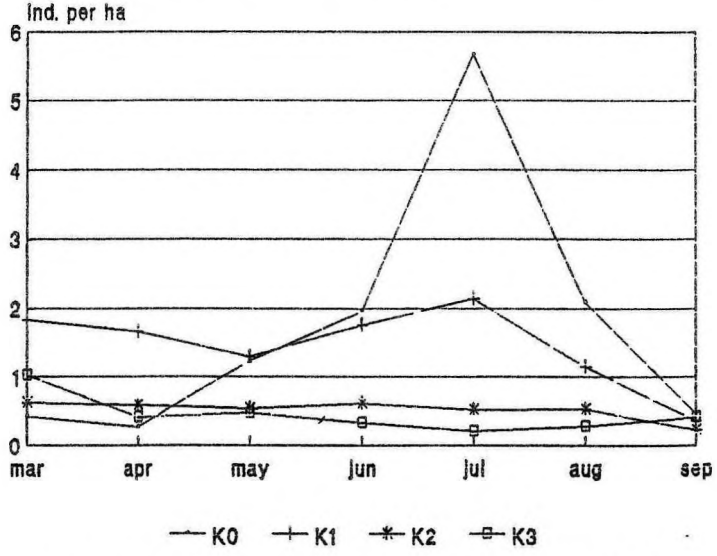

Figure 1: Seasonal dynamics of average densities of most common waterfowl species (Tufted Duck, Pochard, Mallard, Gadwall, Teal amd Coot) on the fishponds with different age classes of carp. K0 - fry fishpond, K1 - one-year-old carp, K2 - two-year-old carp K3 - three-year -old carp

Same trend is obvious if diving ducks (Pochard and Tufted Duck) are treated separately (**Figure 2**). On the contrary, fish stock in the ponds was not an important factor for waterfowl numbers since September onwards, when Mallard and Grey Lag Goose were prevailing species. Both these species are feeding mainly outside the fishponds in the fields (geese) and in oak woods and alleys (Mallards), just roosting on the fishponds. At this time of the year they therefore choose largest fishponds (K2 and K3), where they are relatively safe from hunting and predation. This situation is illustrated by seasonal dynamics of Mallard shown on **Figure 3**.

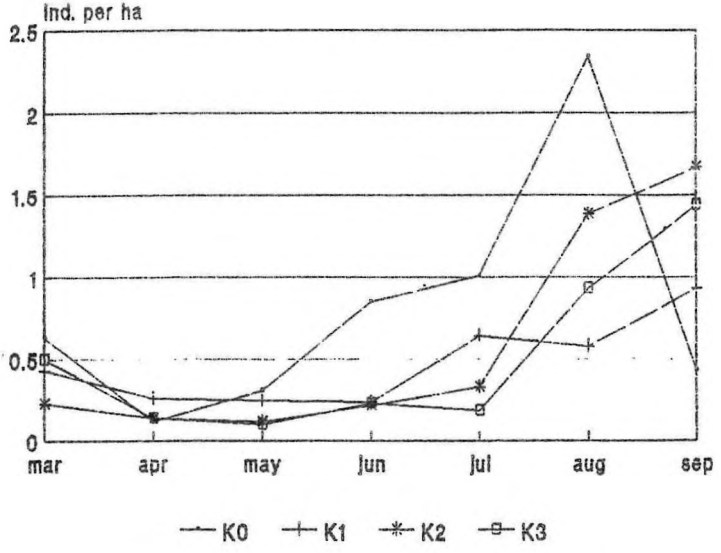

Figure 2: Seasonal dynamics of average densities of diving ducks (Tufted Duck, Pochard) on the fishponds with different age classes of carp. For other explanations see Fig. 1.

Relation between mass of fish stock per hectare (irrespective of age class of fish) and density of aquatic birds in July, i.e. at the end of breeding season, is shown on **Figure 4**. It can be seen clear negative relation between these two variables. Higher densities of aquatic birds were observed only on the ponds with average mass of fish stock less than 400-500 kg per hectare. Densities of birds on fishponds with average fish stock higher than ca 1000 kg per hectare are always low. Same trend is apparent if diving ducks (Pochard and Tufted Duck) are

treated separately (**Figure 5**). Therefore diving ducks, that are easily observable on fishponds, can be used as a suitable model species.

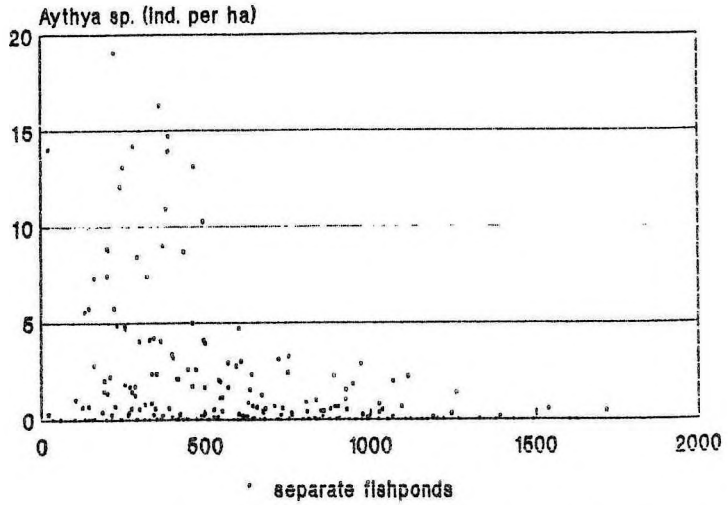

Figure 3: Seasonal dynamics of average densities of Mallard on the fishponds with different age classes of carp. For other explanation see Fig. 1.

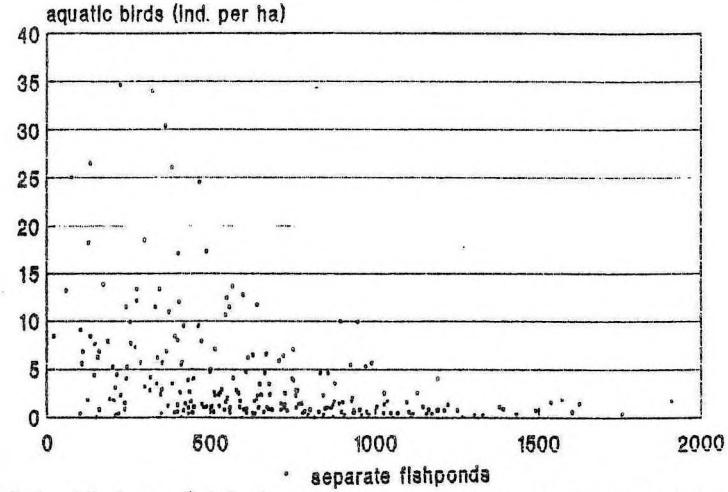

Figure 4: Relationship between July density of aquatic birds (except Black-headed Gulls) and mean fish biomass (kg per ha).

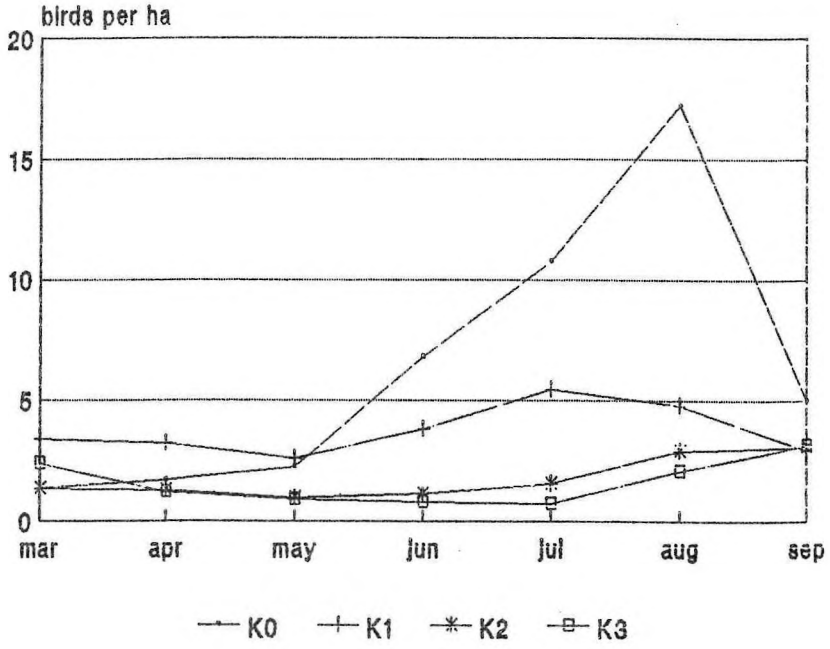

Figure 5: Relationship between July density of diving ducks (Pochard, Tufted Duck) and mean fish biomass (kg per ha).

DISCUSSION

I propose a hypothesis, based on presented data, that competition for food between waterfowl and fishes exists in these fishponds, mainly in the breeding season, when juveniles of most species of waterfowl (even primarily phytophagous species like Gadwall or Coot) are dependent on protein-rich invertebrate food (large zooplankton, zoobenthos, littoral fauna, necton). High densities (or masses) of fish consume almost all available invertebrate food in the pond or lower substantially amount of this food and cause their shortage for waterfowl.

This hypothesis agrees well with results of limnological observations on South Bohemian fishponds. Faina (1983) ascertained ten years ago large zooplankton (2,5-5 mm) prevailing on fishponds with low fish stock (lower than 500 kg per hectare), and, on the contrary, clear prevalence of small zooplankton (lesser than 1,5 mm) on fishponds with high

fish stock of carp (higher than 800 kg per hectare). The amount of large zooplankton (mainly large cladocerans) is a representative parameter for the amount of natural food in the pond (Pokorny *et al.*, 1994).

An obvious influence of absence of fishes in the water body on numbers of waterfowl was reported by Giles (1991, 1994), which experimentally removed fishes from gravel pit in England. After the removal of fish biomass invertebrates and submerged vegetation increased substantially and number of breeding Tufted Ducks increased many times, as well. Similar results reported McNicol and Wayland (1992), that studied ducks numbers on Canadian lakes. Highest densities of ducks were observed on acidified lakes, where the fishes were absent because of low pH, their feeding pressure was eliminated and subsequently the density of invertebrates was highest. Similarly, Mallory *et al.* (1994) showed that presence or absence of fishes in the water body is the best predictor of macroinvertebrate abundance.

South Bohemian fishponds have considerable experimental advantage, ensued from the fact that it is possible to get exact information on fish stock (biomass, age composition, species composition) in any pond every year, because ponds are managed in one or two year cycle. Fishpond management creates in this way some kind of semi - natural experimental conditions.

ACKNOWLEDGEMENTS

The field work would not have been feasible without help from Jan Cempirek, Jan Cerny, Zdenek Klimes, Zdenek Krafka, Ladislav Lesak, Frantisek Nosek, Petr Pavlik, Karel Pecl, Milos Prochazka, Miroslav Salek and Petr Tomas. I thank also Richard Faina for his valuable comments in early stage of work.

REFERENCES

Faina, R. (1983): The use by natural food by carp in fishponds [in Czech]. Edice Metodik VURH Vodnany, No.8.

Giles, N. (1991): Fish-removal from lakes increases food for waterfowl. In: M.C.Finlayson and T.Larsson (eds.),Wetland management and restoration: 80-86. Swedish Environmental Protection Agency Report 3992.

Giles, N. (1994): Tufted Duck *(Aythya fuligula)* habitat use and brood survival increases after fish removal from gravel pit lakes. *In*: J. Kerekes and B. Pollard (eds.), Aquatic Birds in the Trophic Web of Lakes. (Dev. Hydrobiol. 96. 524 p.) Hydrobiol. 279/280: 387-392.

Hudec, K. *et al.* (1994): Fauna CR a SR - Ptaci I. (2nd ed.). Academia Praha.

Korinek, V., J. Fott, J. Fuksa, J. Lellak, M. Prazakova (1987): Carp ponds of central Europe. In: G. Michael (ed.), Ecosystems of the World 29. Managed Aquatic Ecosystems: 29-62. Elsevier.

Mallory, M.L., P.J. Blancher, P.J. Weatherhead, D.K. McNicol (1994): Presence or absence of fish as a cue to macroinvertebrate abundance in boreal wetlands. *In*: J. Kerekes and B. Pollard (eds.), Aquatic Birds in the Trophic Web of Lakes. (Dev. Hydrobiol. 96. 524 p.) Hydrobiol. 279/280: 345-351.

McNicol, D.K. and M. Wayland (1992): Distribution of waterfowl broods in Sudbury area lakes in relation to fish, macroinvertebrates, and water chemistry. Canad. J. Fish. Aquat. Sci. 49 (Suppl. 1): 122-133.

Musil, P. (1987): Changes in numbers of aquatic birds breeding on fishponds near Kardasova Recice in the period 1980-1985 [in Czech with German summary]. In: Avifauna jiznich Cech a jeji zmeny: 137-151.

Musil, P. and R. Fuchs (1994): Changes in abundance of water bird species in southern Bohemia (Czech Republic) in the last 10 years *In*: J. Kerekes and B. Pollard (eds.), Aquatic Birds in the Trophic Web of Lakes. (Dev. Hydrobiol. 96. 524 p.) Hydrobiol. 279/280: 511-519.

Pokorny, J., G. Schlott, K. Schlott, L. Pechar, J. Koutnikova (1994): Monitoring of changes in fishpond ecosystems. In: G. Aubrecht, G. Dick , C. Prentice (eds.): Monitoring of Ecological Change in Wetlands of Middle Europe. Stapfia 31: 37-45.