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EFFECTS OF A POWER GENERATING STATION ON THE OCCURRENCE AND DISTRIBUTION OF WINTERING WATERBIRDS (MaB - ÖKOSYSTEMSTUDIE ALTENWÖRTH, AUSTRIA)

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ABSTRACT

Data of regular waterbird counts on the river Danube were used to compare the habitat situation for communities of wintering waterbirds prior and after the building of the hydroelectric power plant station Altenwörth. Counts were carried out along a 20 km long river section. Due to the dam construction the following effects could be observed: a significant increase in the total number of wintering waterbirds, a change in the species composition and abundance of various species, and changes in the distribution of waterbirds within the impoundment area.

INTRODUCTION

Besides the dammed parts of the Inn river and the Rhine delta at Lake Constance, the stream system of the river Danube serves as an important resting area for migrating and wintering waterbirds in Austria. An average of 30% of all waterbirds registered during mid-winter counts were recorded on the Danube during the last years (Aubrecht and Böck, 1985). As a result of the industrial development many large rivers have been dramatically changed by stream regulations for power generation. Waterbird communities react very quickly to such new environmental habitat situations and are good indicators for the evaluation of the ecological situation of a freshwater eco-system (Reichholf and Reichholf-Riehm 1982; Rüger

et al. 1987). The objective of the interdisciplinary Man and Biosphere (MaB) research project "Ecosystem Study Altenwörth" was to investigate the impacts of a big hydro-power plant station located at the river Danube on the environment, taking into account biological factors as well as social and economical aspects. Eight research groups were involved in this programme: limnology, hydrology, fish biology, climatology, zoology, botany, forestry and socio-economics (Hary and Nachtnebel, 1989). One part of the zoological research team investigated to which extent numbers and communities of waterbirds were and are influenced by the construction and the operation of the power plant station.

METHODS

Regular waterbird counts were carried out along the 20 km long impoundment area between stream km 1980 (location of the power plant barrage) upstream to km 2000 (city of Krems) during the winter season (months September until April) in the years 1984/85 - 1987/88 (**Figure 1**). Following data were noted: day, time, species, numbers, male-female ratio, position of the birds on the river (stream-km, north / south bank, middle of the river), activity of the birds and possible human impacts like traffic on the river and on the roads on the dams. All observations were made from the riverbank. The frequency of complete counts varied between 4 to 6 counts per month, depending on the seasonal occurrence of the species and the actual climatic conditions. Additional observations were made occasionally in the remaining part of the original old river, below the barrage downstream and along several water bodies in the adjacent riverine forests. Data of waterbird counts for the same river section before the building of the power plant station were available to compare the former and actual situation.

RESULTS AND DISCUSSION

The data material obtained was analyzed in different levels ranging from coarse to fine grained resolution. Analyses with coarse resolution were used for the comparison of waterbird counts prior to and after the building of the dam, to discuss the development of waterbird

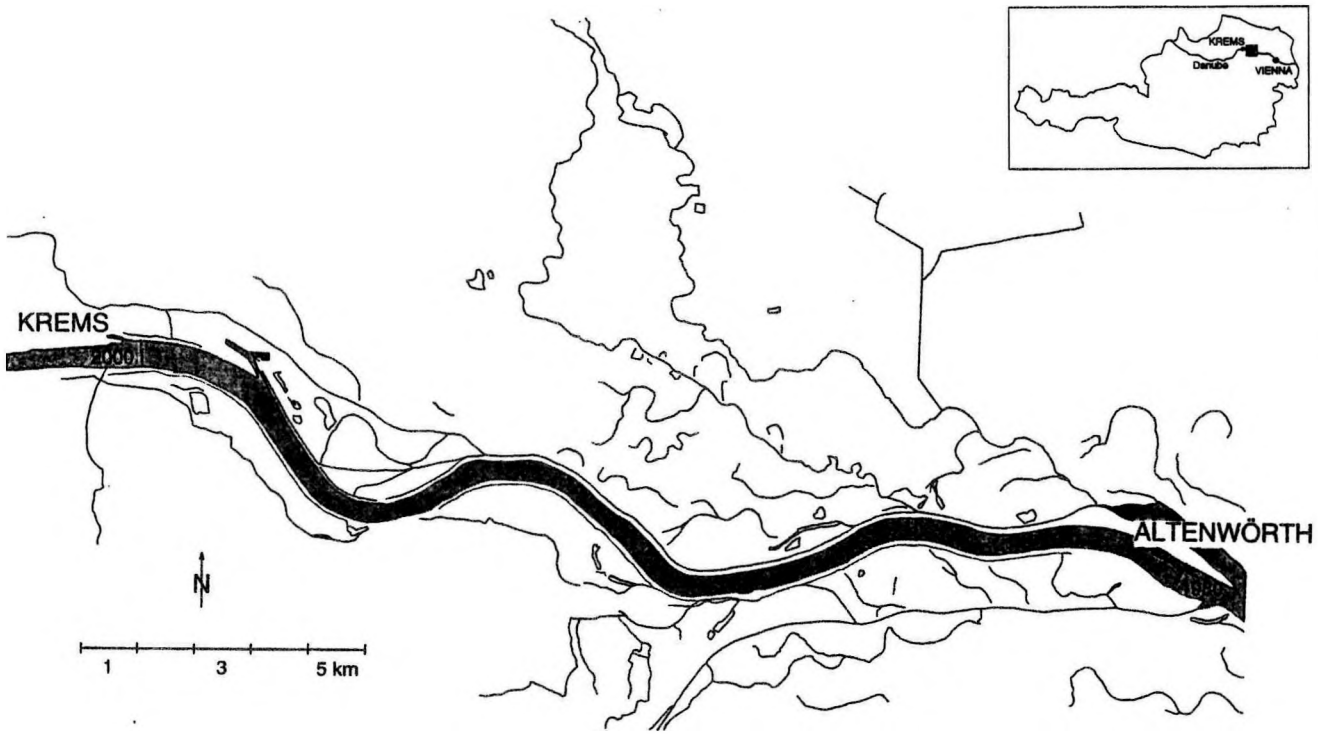

Figure 1: Backwater area Altenwörth between stream-km 1980-2000, tributaries and the network of surface waters in the riverine forests

numbers over the years, the seasonal occurrence of different species and the actual spatial allocation of various species to river areas. More detailed analyses on a fine grained resolution could be used to demonstrate the species and sex-specific differences in the utilization of the dammed river section as a feeding or resting area and the effects of single or regular human disturbances (Parz-Gollner, 1989a).

Due to the dam construction the following general effects were observed:

- a significant increase in the total number of migratory waterbirds
- a change in the species composition
- changes in the occurrence and the distribution of various species within the impoundment area.

Numbers and species composition

During the study period 22 waterbird species were observed regularly in very different quantities, 12 additional species visited the backwater area only occasionally in very low numbers, only one to five individuals during one observation day (**Table 1**). An average of 7000 - 8000 birds were the daily maximum registered in December or January during the years 1984/85 - 1987/88 (**Figure 2**). Comparing the available data for the years 1965 to 1988 the average number of waterbirds per count increased from 1332 birds to 4813 birds in January. Because of the reduced flow velocity, the danger of a total icing in the impoundment area in cold winters has increased. A solid ice cover in the dammed section of the river, reaching over 20 km for several weeks, was observed in January 1985 and in January 1987. Such events may cause a sudden loss of already limited habitat suited as a resting and feeding area for wintering waterbirds under severe winter conditions within a few hours. Diving duck species were leaving the area completely, their numbers in the following spring time were much lower than during moderate winter periods. During winters with icing periods a conspicuous migration peak of several species like the Smew or the Goosander could be registered in March, when these birds were flying back to their northern breeding grounds.

Table 1: Migrating waterbirds registered on the stream and the Danube riverbanks between stream-km 1980 and km 2000 in the months September until April in the years 1984-1988.

Regular migrants	Rare migrants (all years N =< 40)
Great Crested Gereb (*Podiceps cristatus*)	Black-throated Diver (*Gavia arctica*)
Little Grebe (*Tachybaptus ruficollis*)	Red-throated Diver (*Gavia stellata*)
Cormorant (*Phalacrocorax carbo*)	Red-necked Grebe (*Podiceps grisegena*)
Heron (*Ardea cinerea*)	Slavonian Gereb (*Podiceps auritus*)
Mute Swan (*Cygnus olor*)	Black-necked Grebe (*Podiceps nigricollis*)
Bean Goose (*Anser fabalis*)	Great White Egret (*Casmerodius albus*)
Mallard (*Anas platyrhynchos*)	Grey-lag Goose (*Anser anser*)
Teal (*Anas crecca*)	Pintail (*Anas acuta*)
Garganey (*Anas querqudula*)	Shoveler (*Anas clypeata*)
Gadwall (*Anas strepera*)	White-eyed Pochard (*Aythya nyroca*)
Widgeon (*Anas penelope*)	Common Scoter (*Melanitta nigra*)
Red-crested Pochard (*Netta rufina*)	Eider (*Somateria mollissima*)
Scaup (*Aythya marila*)	
Tufted Duck (*Aythya fuligula*)	
Pochard (*Aythya ferina*)	
Goldeneye (*Bucephala clangula*)	
Long-tailed Duck (*Clangula hyemalis*)	
Velvet Scoter (*Melanitta fusca*)	
Smew (*Mergus albellus*)	
Red-brested Merganser (*Mergus serrator*)	
Goosander (*Mergus merganser*)	
Coot (*Fulica atra*)	

Reviewing the actual species composition in the backwater area with the former free flowing river, one had to take into account, that during the study period much more counts were made and also better trained research teams were involved. As a result, also usually rare waterbird species were registered more frequently. So in a first step only January mid-winter counts were taken as a basis for comparison.

In the years prior to the building of the power plant station the dominant species in the waterbird community were Mallards (76%), Goldeneye (13%), Teal (5,1%) and Goosander (4,2%). The recent situation in the impoundment area now favours the occurrence of large concentrations of mainly four waterbird species: Mallards (57%), Coots (9,1%), Pochard (15,4%) and Tufted Duck (9,3%). More than 90% of all waterbirds belonged to this group. Other species, such as the Goosander or the Goldeneye, which require higher flow velocities decreased in their abundance (**Figure 3**).

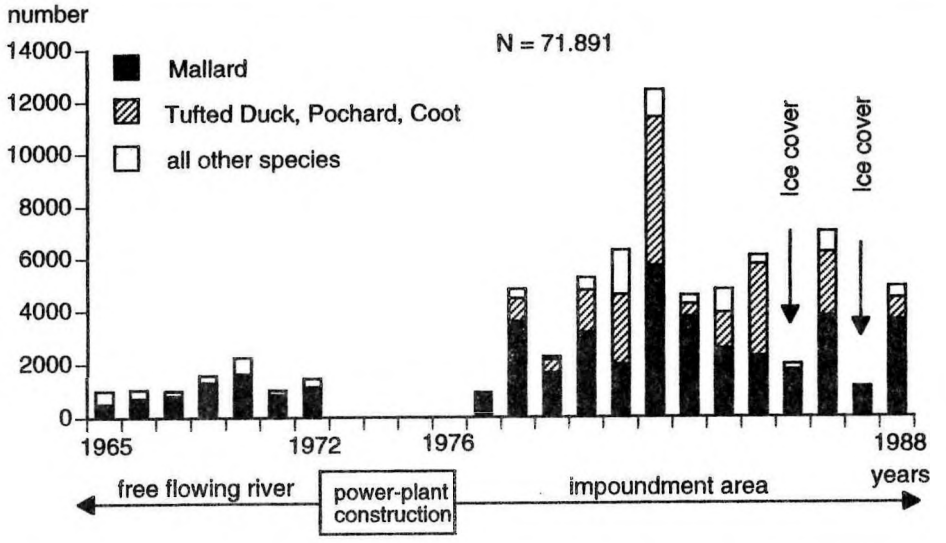

Figure 2: Number of all waterbirds counted on the river and in the corresponding impoundment area on one day in January between stream-km 1980 - 2000 before and after the building of the power plant station (mid-winter counting dates).

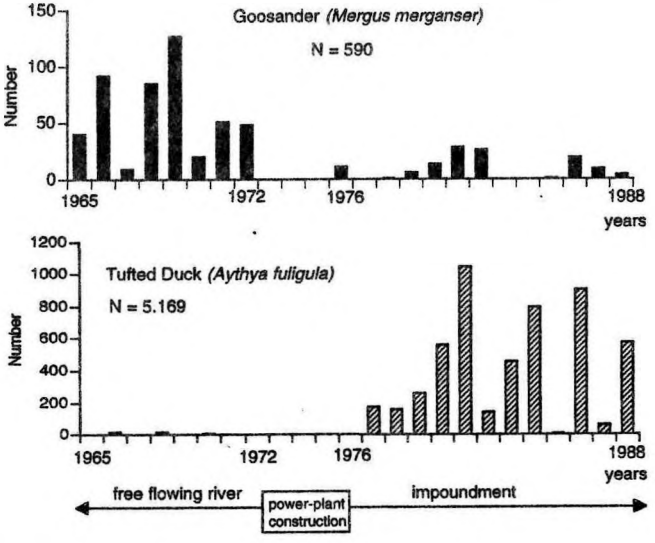

Figure 3: Numbers of Goosanders and Tufted Ducks counted on the river - respectively the corresponding impoundment area - between stream-km 1980 - 2000 before and after the building of the power plant station (January mid-winter counts).

Decreasing tendency was further noticed for the Red-breasted Merganser and the Little Grebe. More often and in slightly increasing numbers the following species were recorded: Gadwall, Smew, Velvet Scoter, Long-tailed Duck, Divers and other Grebes. No clear tendency in the development of their occurrence showed Widgeon, Pintail and Garganey. Great fluctuations in the numbers of some species - e.g. the Goldeneye - could be noticed in consecutive years. Beside the environmental habitat changes the local situation of migrating waterbirds is highly depending on the actual climatic condition in middle Europe.

Distribution of waterbirds within the impoundment area

The distribution of the most abundant species within the impoundment area was analyzed and if possible compared with the former situation in the free flowing river (Parz-Gollner, 1989b). It seems obvious, that environmental factors like water depth, current velocity, structure of the river banks, sedimentation, location, type and amount of food as well as human disturbances are responsible for the distribution of the species along the riverbanks and within the impoundment area. The utilization of the new man-made habitat as a resting or feeding area depends on the morphological and physiological capacity of each species and determines the quantitative and qualitative changes of the waterbird community.

An example for the distribution of diving ducks and a fish-eating species within the backwater area is shown in **Figure 4**. The great majority of Tufted Ducks and Porchards are concentrating in the lower section closer to the barrage with slower water movement and high sedimentation. They are resting and also diving for food close to the slopes of the river banks in this part of the dammed river. In the contrary "rheophilic" species - e.g. the Smew - preferred the remaining "free-flowing" section in the uppermost part of the impoundment area.

Most of the dabbling duck species, especially Mallards, but also Gadwalls, Teals or Garganeys are using the river now mainly as a resting area. These duck species may appear in high numbers. Due to the damming the water surface area increased, the width of the water body guaranties a secure resting place for these ducks during daytime. Because of steeper banks and the depth of the water, dabbling ducks are not able to feed in this environment. There are no gravel banks or zones of shallow water in the main stream, only temporary small

macrophyte belts grow along the shoreline between a monotonous rockfall. The adjacent riverine forests with tributaries and a network of surface waters therefore serve as an important retreat area for feeding and during spring and summer time also for breeding waterbirds.

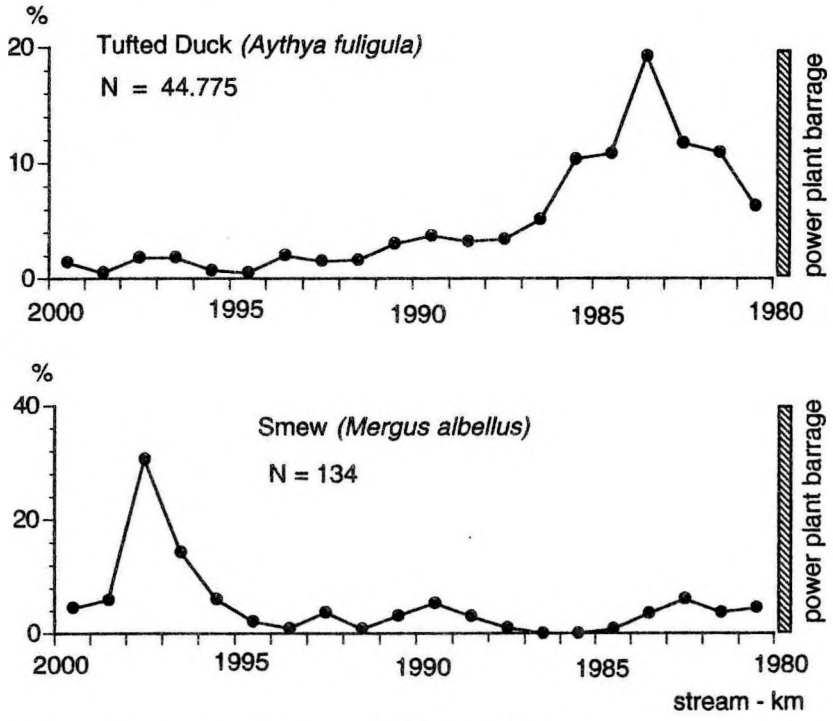

Figure 4: Distribution of Tufted Duck and Smew within the impoundment area between stream-km 1980 -2000; November, 1984 - February, 1988, 66 counts.

CONCLUSION

Due to the hydro-power plant construction the eco-system of the river in general changed from a former "rheophilic" habitat to a "limnophilic" water body. Velocity, water depth, structure of the river banks, food supply (invertebrates) - depending on grain size, location and extent of sedimentation in the river - changed basically. Rare waterbird species, characteristic for faster flowing rivers, can still be observed as migrants but in very low numbers and in places with higher current velocity. New diving duck species, typically for

standing water bodies, appear in great numbers in the new, man-made habitat. More than 90% of the observed birds belong to only four species, a result which is emphasizing the uniformity of the impoundment area. With regard to the actual climatic conditions and the differences in the migration pattern of various species, waterbirds should be registered over the whole winter season (migration period) to evaluate the local situation.

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