“Habitat preferences and nesting success of the Common Sandpiper *Actitis hypoleucos* in the Middle Vistula River Valley”

Marek Elas M.Sc.

The Common Sandpiper (Actitis hypoleucos) is a widely distributed species from the family Scolopacidae, inhabiting the temperate climate zone of the Palearctic from western Europe to eastern Asia. The world population is estimated to 2.6-3.2 million individuals. The breeding, migration and wintering are associated with the aquatic environment. The breeding habitat includes rivers, lakes or other water bodies. Nests are located on the ground usually up to 50 meters from water. Birds prefer gravel or sandy rivers with natural hydromorphology. The Common Sandpiper is a territorial, socially monogamous species. Both partners incubate eggs, with male-biased parental care. Precocial chicks leave the nest just a few to several hours after hatching. Over the past 30 years, the breeding population in Europe has been declining, in some countries by as much as 30-40%. The reasons for the decline in numbers are not clearly defined, but it is very likely that habitat changes, primarily regulation of natural river sections, are the important factor. My dissertation examined elements of the biology and reproductive ecology of the Common Sandpiper nesting in the middle section of the Vistula River - a large, lowland, semi-natural river. Undisturbed, channel-forming processes of erosion and sedimentation ensure the persistence of habitats in various stages of succession with the widespread occurrence of sandy bars, islets or initial plant communities. The Common Sandpipers nested in the surveyed section of the river in high numbers reaching 3.5 pairs/km of river. During the survey, I found an unreported previously high density on one of the islands in the riverbed, where 6 nests were simultaneously active at an average distance of 14.1 m from each other, with a minimum distance of 2 m between adjacent nests. When analyzing the distribution of nesting territories along a 100 km stretch of the middle Vistula, I showed that the factors positively influencing the occurrence of birds are the presence of islands in the riverbed and the natural, complex shoreline. Existing hydrotechnical structures (groynes) and bank reinforcements (ripraps) are factors that reduce the number of birds, and such sections of the river are avoided by the Common Sandpipers. The negative impact of the regulation of the river is evident even tens of years after the works, despite the progressive degradation of the 6 technical condition of the structures and plant succession proceeding on the previously regulated banks.

The Vistula has a nival-pluvial regime with irregular floods during the breeding season. Consequently, inundation and predation are an important factor limiting nesting success which was 27% in 2014-2024. Flooding was the more common cause of losses in the first part of the breeding season when average hatching losses due to flooding were 92% in late April and early May. Subsequently, the importance of floods declined, with losses due to inundation dropping to 8%. Predation, on the other hand, was a less important cause of losses at the beginning of the breeding season, when average breeding losses in the first pentad of May due to predation were 33%. The importance of predation increased as the breeding season progressed, when on average as many as 86% of nests were predated. High water levels causing nest submergence were more common in the first part of the breeding season, causing significant nest losses. In the second part of the season, when fewer nests were inundated, the availability of nests to predators increased, and this cause of loss became more important during this period.

The average daily nest survival rate for nests located under shrubs was 0.98, corresponding to a nest success rate of 65%, while for nests placed in grass, it was 0.95, corresponding to a nest success rate of 34%. Also, the location of the nest close to water increased the probability of nest survival. Important was not the proximity to the river itself, but proximity to any watercourse or waterbody, such as an oxbow lake or a side branch of the river. The Common Sandpipers do not actively defend their nests during incubation, and their predation avoidance strategy is based on proper hiding of the nest and eggs and discreetly leaving the nest before the arrival of a predator. The method of hiding the nest under

bushes has proven to be an effective form of response to the threat of predators, which in the study area are represented by both diurnal (birds and mammals) and nocturnal (mammals) predators. The proximity of the nest to the water may be related to the possibility of a nesting individual leaving unnoticed, but may also be related to the proximity of feeding grounds. This may result in easier and more frequent observation of the nest surroundings by the other individual in the pair and alerting the incubating bird to danger. However, the exact mechanism of this relationship is not known.

I studied the response of the Common Sandpipers to the floods occurring during the breeding season over 36 years. Locating the nest at an appropriate height above the water level avoided losses due to flooding and significantly increased the chance of nest survival. Average nest survival rates throughout the period ranged from 16.6% for the lowest to 98.5% for the highest nests. The relative height of nests above the reference water level was highly variable, ranging from 0.64 m to 4.58 m, with 70% of nests located at a height that provided an 80% probability of avoiding flooding. This indicates that the selection of nesting heights above the water level is not random, but is a response to the threat from water.

In summary - both predation and flooding are factors determining the reproductive strategies of the Common Sandpiper nesting along the large, lowland, semi-natural river in terms of nest location and concealment. Compared to the literature data on nesting success, floods are an important additional factor limiting nesting success, which the birds have to take into account when they start breeding. Despite the existence of such a strong limiting factor, birds still choose the middle section of the Vistula River, as evidenced by the very high densities of the Common Sandpiper nests and territories in the studied section of the river. The obtained results present unexplored aspects of the Common Sandpiper's biology and reproductive ecology, which can serve as a basis for further research on this species and can serve to better understand the factors limiting its abundance and help in designing conservation measures.