

Migration of water-and-marsh birds in the Valley of the Middle San (South-eastern Poland)

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Abstract. In 1982-1990 passages of 101 species of water-and-marsh birds were observed in the valley of the Middle San, mainly on the ponds at Starzawa and sedimentation basins at Siedliska. The migration route was found to extend along the San valley, through the Przemyska Brama (Przemyśl Gate) into the valley of the River Dniester. In autumn on the ponds at Starzawa the number of birds on passage averaged 10 000 per inspection (max. 40 000), among which *Anas platyrhynchos*, *Fulica atra*, *Vanellus vanellus*, *Larus ridibundus* and *Aythya ferina* were dominant, forming 95% of the group. In spring approx. 1500 birds were counted during each inspection (max. 5000); here, *Anas platyrhynchos*, *Vanellus vanellus*, *Larus ridibundus*, *Aythya ferina*, *A. fuligula* and *Philomachus pugnax* predominated and formed 80% of the group.

Key words: Water-and-marsh birds, migrations, spring passage, autumn passage, River San, south-eastern Poland.

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I. INTRODUCTION

The south-eastern part of Poland is crossed by one of the important inland routes of migratory birds, called the Black Sea-Egypt route. The region of the middle San valley and especially the area of the Przemyśl Gate form a peculiar "stage" used by migrating birds, which find suitable conditions here to rest and take food.

The main purpose of this paper is to present the specific composition and quantitative relations of migrating birds (Non-Passeriformes) and to compare their passage dynamics with that in other regions of the country.

Migrations of water-and-marsh birds were investigated in Poland by many authors, most of whom, however, dealt with incomplete materials and studies conducted for too short

a period or only in one season of the year. That is why with regard to some species (e. g. Lapwing) it was impossible to make comparisons with other water bodies.

Literature concerning the migrations of birds in south-eastern Poland is very scanty. In the study area only JÓZEFIK (1961) analysed the passages of some species on the basis of his observations made on an old river-bed at Hurko. Some species are besides mentioned by NOWICKI (1866), DZIEDUSZYCKI (1880, 1895), GODYŃ (1937, 1939), CAIS (1965), KUREK (1973, 1977, 1979) and KUREK & KUNYSZ (1984). Some of their data were utilized in a general way in the study Ptaki Ziemi Przemyskiej (Birds of the Przemyśl region) (HORDOWSKI & KUNYSZ 1991). At present we take up a detailed analysis of the migrations of water-and-marsh birds in the valley of the middle San.

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II. STUDY AREA

The San valley is formed by an erosional depression stretched about 200 m a. s. l. between the edge of the Carpathian Mts. and the Sandomierz Lowland in the southern part of the Sandomierz Basin (KONDRACKI 1978). The main bulk of material was gathered during an investigation carried out between Przemyśl and Jarosław and, above all, on fishponds at Starzawa and sewage sedimentation basins at Siedliska (Fig. 1).

The fishponds at Starzawa, about 750 ha in area, are surrounded by wide pastures and cultivated fields. In the south-east they border upon a carr several tens of hectares in area. The ponds are 120-140 cm deep, the pH of the water being 7-7.4; the mineral sediment on sandy substratum is 20-30 cm thick (PIÓRECKI 1980). The emerged plants are mainly those of the communities belonging to the *Phragmitetea*; they form a several-hectare patch in the south, while in the remaining parts they grow close to the dikes. The submerged vegetation occurs in the central parts of the ponds and forms communities from the *Potamogetonetea*. Regular fish farming is run in the ponds, carp being the main species reared. The ponds are emptied every year towards the end of September or at the beginning of October and filled in mid-May.

The sewage sedimentation basins are situated about 7 km east of Przemyśl, in the vicinity of Siedliska. They occupy an area of about 25 ha, consisting of 9 diked ponds. Two of them are void of water and their silty bottoms are exposed (both together about 3-4 ha in area). The remaining ponds have more or less defiled water. The sedimentation basins are situated amidst meadows and fields. In 1989 the silty areas underwent a reduction because of rapid eutrophization. The basins are not subjected to any treatments except for the pumping-out of water on to the surrounding meadows (in some years).

III. METHODS

Observations were conducted on the fishponds at Starzawa in 1982-1989. At the beginning, from May 1982 throughout 1983 they were not systematic; nevertheless, they

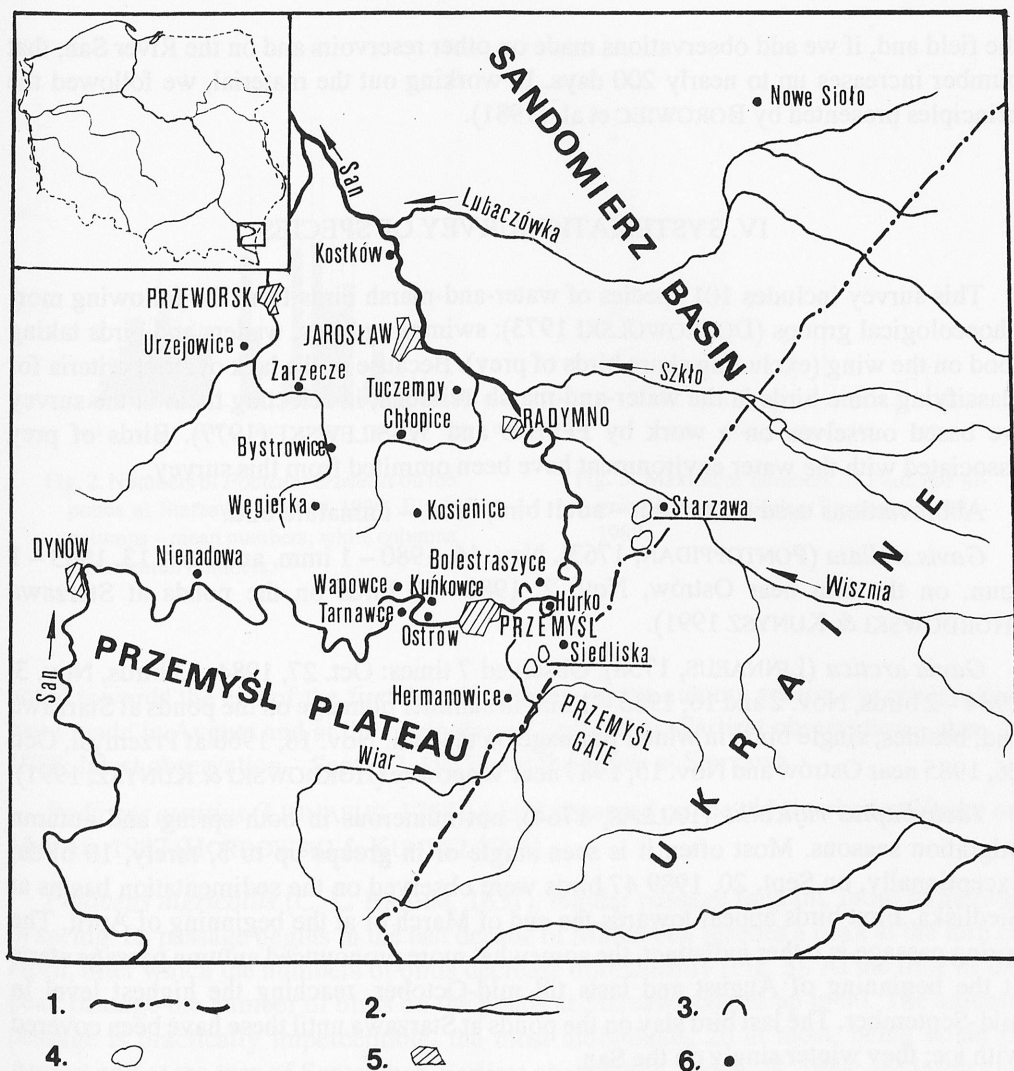


Fig. 1. A map of the study area. 1 – state frontier, 2 – rivers, 3 – old riverbeds, 4 – ponds and sedimentation basins, 5 – towns, 6 – villages mentioned in the text.

enabled us to get acquainted with the area and to work out the methods of counting; the bulk of material was gathered in 1984-1989. A total of 108 counts were made during our rounds of the whole complex of ponds from 8 A. M. to 2 P. M. From the dikes we noted all the species of birds, giving special attention to those moving from pond to pond. As we did not flush the birds away from among the reeds, the numbers of species hard to discover were underestimated (Bittern, Little Bittern and Night Heron) and some of them were not noted at all (e. g. Spotted Crane).

Observations on the sedimentation basins at Siedliska were carried out from 1987 to 1989 using the same methods as on the ponds at Starzawa. They took us 78 days spent in

the field and, if we add observations made on other reservoirs and on the River San, that number increases up to nearly 200 days. In working out the material, we followed the principles presented by BOROWIEC et al. (1981).

IV. SYSTEMATIC SURVEY OF SPECIES

This survey includes 101 species of water-and-marsh birds from the following morphoecological groups (DOBROWOLSKI 1973): swimming birds, waders and birds taking food on the wing (excluding shore birds of prey). Because of the lack of strict criteria for classifying some birds in the water-and-marsh avifauna, in selecting them in the survey we based ourselves on a work by FERENS and WASILEWSKI (1977). Birds of prey associated with the water environment have been omitted from this survey.

Abbreviations used in text: ad. – adult bird, imm. – immature bird.

Gavis stellata (PONTOPPIDAN, 1763). Nov. 16, 1980 – 1 imm. and Nov. 13, 1983 – 1 imm. on the San near Ostrów, Nov. 2, 1985 – 3 birds on the ponds at Starzawa (HORDOWSKI & KUNYSZ 1991).

Gavia arctica (LINNAEUS, 1758). Observed 7 times: Oct. 27, 1984 – 3 birds, Nov. 3, 1984 – 2 birds, Nov. 2 and 16, 1985 – 1 bird in summer plumage on the ponds at Starzawa and, besides, single birds in winter plumage on the San: Nov. 18, 1968 at Przemyśl, Oct. 26, 1985 near Ostrów and Nov. 15, 1987 near Wapowce (HORDOWSKI & KUNYSZ, 1991).

Tachybaptus ruficollis (PALLAS, 1764), not numerous in both spring and autumn migration seasons. Most often it is seen single or in groups up to 5, rarely, 10 birds; exceptionally, on Sept. 20, 1989 47 birds were observed on the sedimentation basins at Siedliska. First birds appear towards the end of March or at the beginning of April. The spring passage is rather indistinct, the somewhat more pronounced autumn passage starts at the beginning of August and lasts till mid-October, reaching the highest level in mid-September. The last bird stay on the ponds at Starzawa until these have been covered with ice; they winter singly on the San.

Podiceps cristatus (LINNAEUS, 1758), observed regularly, is more numerous in autumn (Fig. 2). The spring passage begins in mid-March, the numbers of birds increasing gradually to attain a peak in the first decade of April. Another peak occurs at the beginning of the third decade of April. The autumn migration is characterized by its many-peak dynamics. At the beginning of August the abundance of birds on the ponds at Starzawa is connected with the presence of breeding birds. After their departure it decreases and next peaks again in the first decade of September (380 birds). While the total number of birds decreases constantly, yet it shows two other minor rises at the outset of the third decade of September and towards the end of October. Earliest observation – Mar. 17, 1984; latest observation – Dec. 2, 1984.

Podiceps grisegena (BODDAERT, 1783), represented by very small numbers both in spring and in autumn; single birds were met with, rarely their pairs and exceptionally, on Aug. 21, 1956, 5 birds were seen on the old riverbed at Hurko (JÓZEFIK, 1961). In spring the first individuals arrive at the beginning of April and the last birds on passage were

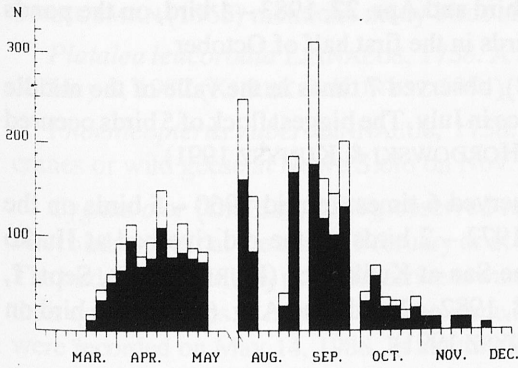


Fig. 2. Numbers of *Podiceps cristatus* on the ponds at Starzawa in 1984-1989. Black columns – mean numbers; white columns – maximum numbers.

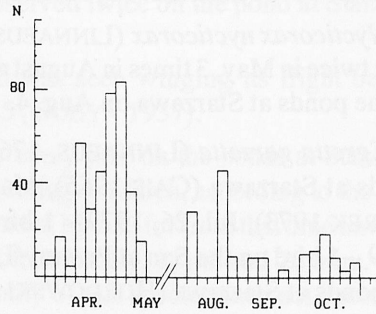


Fig. 3. Maximum numbers of *Podiceps nigricollis* on the ponds at Starzawa in 1984-1989.

noted towards the end of the first decade of May. In the autumn season six observations were made in August and at the beginning of September. Earliest observation – Apr. 1, 1988; latest observation – Sept. 12, 1987 – on the ponds at Starzawa.

Podiceps auritus (LINNAEUS, 1758), 1 bird observed on the old riverbed at Hurko on May 10, 1987 (HORDOWSKI & KUNYSZ 1991).

Podiceps nigricollis (C. L. BREHM, 1831), regular passage migrant, more numerous in spring. Its passage begins in the last decade of March and reaches a peak at the turn of April, after which the numbers of birds decrease dramatically (Fig. 3). At the time of the peak passage the number of birds on the ponds at Starzawa comes up to 80. The autumn passage is practically imperceptible, the most individuals, 20 at most, being noted in August and at the turn of September. Earliest observation – Mar. 28, 1988; the latest one – Oct. 20, 1987, on the ponds at Starzawa.

Phalacrocorax carbo (LINNAEUS, 1758), not numerous passage migrant, observed 5-6 times yearly; encountered, above all, on the ponds at Starzawa, most often in August and September. The earliest appearance – Apr. 3, 1989, the latest – Sept. 12, 1987, the biggest flock – Aug. 4, 1986 – 8 birds. From year to year this species is met with more and more frequently, which is connected with a rise in the size of this population in this country (PRZYBYSZ et al. 1985).

Pelecanus onocrotalus LINNAEUS, 1758. One White Pelican was shot at Laszki on Oct. 19, 1878. One bird stayed on the ponds at Starzawa on Jun. 27-29, 1987. We failed to identify it to specific level (HORDOWSKI & KUNYSZ 1991).

Botaurus stellaris (LINNAEUS, 1758) was observed only three times on the ponds at Starzawa in migration seasons: Apr. 27, 1986 – 1 bird, Sept. 13, 1987 – 2 birds and Oct. 3, 1987 – 1 bird; one bird was besides found dead at Hermanowice on Mar. 23, 1962 (CAIS 1965).

Ixobrychus minutus (LINNAEUS, 1766). In course of investigation it was seen only twice on spring passage: Apr. 10, 1982 – 1 bird and Apr. 22, 1983 – 1 bird, on the ponds at Starzawa. JÓZEFIK (1961) noted single birds in the first half of October.

Nycticorax nycticorax (LINNAEUS, 1758), observed 7 times in the valle of the middle San: twice in May, 3 times in August and twice in July. The biggest flock of 5 birds occurred on the ponds at Starzawa on Aug. 4, 1988 (HORDOWSKI & KUNYSZ 1991).

Egretta garzetta (LINNAEUS, 1766), observed 6 times: in mid-1960 – 5 birds on the ponds at Starzawa (CAIS 1965), May 15, 1972 – 2 birds on the old riverbed at Hurko (KUREK 1973), Jul. 26, 1977 – 1 bird on the San at Kuńkowce (KUREK 1979), Sept. 1, 1979 – 1 bird on the San at Przemyśl, May 8, 1982 – 2 birds and Aug. 6, 1983 – 1 bird on the ponds at Starzawa (HORDOWSKI & KUNYSZ 1991).

Egretta alba (LINNAEUS, 1758). A regular visitor, observed once to three times a year; all together seen 12 times on the ponds at Starzawa in 1984-1988. The most numerous appearance – 10 birds on Oct. 17, 1987. The latest observation – Nov. 16, 1985 – 1 bird; most often encountered in October (HORDOWSKI & KUNYSZ 1991).

Ardea cinerea LINNAEUS, 1758, observed regularly only on the ponds at Starzawa from the beginning of March to mid-December, reaching the largest numbers at the beginning of April (up to 136 birds). Later their quantity keeps more or less at the same level (20-40 birds) till the beginning of August. Towards the end of August their number decreases to rise again at the beginning of October. On the other water reservoirs and on the San this species appears in small groups numbering up to 10 birds.

Ardea purpurea LINNAEUS, 1766. Six birds were observed: one, probably juvenile, on the old riverbed at Hurko on Jul. 21, 1956 (JÓZEFIK 1961), 1 juv. or imm. on the old riverbed at Buszkowice on Aug. 17, 1974 (KUREK 1977), 2 adults on Apr. 27, 1986, one bird on the ponds at Starzawa on Aug. 7, 1989 and one in a gravel-pit at Hurko on Aug. 29, 1988 (HORDOWSKI & KUNYSZ 1991). Moreover, one bird was shot down on the ponds at Starzawa at the beginning of the sixties.

Ciconia nigra (LINNAEUS, 1758). Birds on passage were observed only in spring, in April and May; the most observations come from the ponds at Starzawa. The arrivals of birds occur towards the end of April (Apr. 24, 1983 – 6 individuals) and go on till the third decade of May.

Ciconia ciconia (LINNAEUS, 1758). The first migrants appear in the third decade of March. Passage is almost wanting, although small concentrations were observed at that time, e. g. Apr. 19, 1987 – 60 birds at Starzawa (they may have been non-breeding birds). Every year up to 50 non-breeders can be seen all through May and June. From the beginning of August the Storks begin to lead nomadic ways of life and to flock together. At that time their concentrations attain 600 individuals (Aug. 24, 1989, near Siedliska). The departure occurs very regularly at the close of August. Exceptionally, single birds remain and are observed throughout September.

Plegadis falcinellus (LINNAEUS, 1766), noted three times along the San valley: a bird was shot near Jarosław in 1860 (NOWICKI 1866), a female was shot at Urzejowice on May 19, 1876 and a bird was seen on the ponds of Starzawa on Oct. 17, 1987. Towards

the end of the 19th century this species probably visited this region more often, for STRAUTMAN (1963) mentions many birds shot in the Lvov region.

Platalea leucorodia LINNAEUS, 1758. A bird observed twice on the pond at Starzawa on May 8, 1982 (KUREK & KUNYSZ 1984).

Phoenicopterus ruber LINNAEUS, 1758. A bird was seen winging its flight behind cranes or wild geese at Nowe Sioło on Nov. 8, 1935 (GODYŃ 1937).

Cygnus olor (GMELIN, 1789), observed regularly every year on the ponds at Starzawa. First birds appear at the end of February or at the beginning of March, according to the year. The birds coming to stay probably arrive towards the end of March, for from that time onwards their quantity keeps at more or less the same level. Exceptionally, 14 ad. and 25 imm. birds were recorded on May 14, 1988. In autumn the quantity of this species does not exceed 30 individuals at particular inspections; last birds were observed on Nov. 17, 1983 (3 ad.).

Cygnus cygnus (LINNAEUS, 1758). Apr. 24, 1983 – 1 bird and in October 1984 – 1 bird on the ponds at Starzawa (HORDOWSKI & KUNYSZ 1991).

Anser fabalis (LATHAM, 1787), observed every year, at the time of autumn passages much more numerous (Fig. 4). In spring it appears in the first days of March, with a peak of passage in mid-March (max. 97 birds at Starzawa) and last birds seen at the beginning of the second decade of April. The autumn passage starts towards the end of September, reaching a peak at the close of October. Concentrations then observed on the ponds at Starzawa approximate 1200 birds (Oct. 22, 1986). Last birds were noted on Nov. 17, 1983.

Anser albifrons (SCOPOLI, 1769), observed mainly in autumn on the ponds at Starzawa and sedimentation basins at Siedliska. The hardly perceptible passage of birds starts at the beginning of October and lasts till the first decade of November. Flocks up to 25 birds appear then. On Sep. 18, 1854, and so exceptionally earlier, one bird was shot at Zarzecze (DZIEDUSZYCKI 1880). In spring it was observed three times – 1, 15 and 36 birds – in the last days of March and at the beginning of April.

Anser erythropus (LINNAEUS, 1758). Nov. 3, 1983 – 1 bird on the ponds at Starzawa and March 30, 1988 – 3 birds on the sedimentation basins at Siedliska (HORDOWSKI & KUNYSZ 1991).

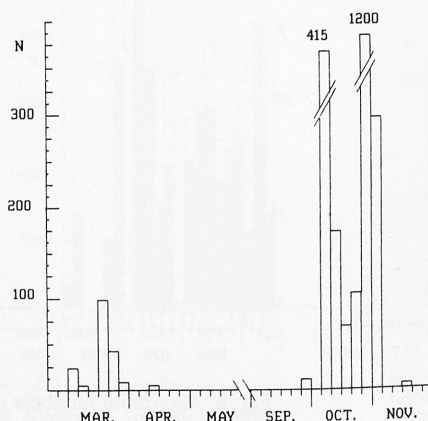


Fig. 4. Maximum numbers of *Anser fabalis* on the ponds at Starzawa in 1984-1989.

Anser anser (LINNAEUS, 1758). Not numerous passage migrant, especially in spring, occurring in very small numbers in autumn. The arrival takes place in the first days of March and various numbers of birds (2-17) are observed chiefly on the ponds at Starzawa to the end of the first decade of May. In autumn it was noted only 5 times in flocks up to 8 birds from the beginning of October to the beginning of November. Against these data the passage of three flocks of this species, numbering 150, 80 and 75 on Mar. 14, 1983 (HORDOWSKI & KUNYSZ 1991) seems to be exceptional. LUNIAK (1971) thinks that such a situation occurs when the spring is belated.

Branta bernicla (LINNAEUS, 1758). A female was shot at Chłopice on Aug. 13, 1896 (STRAUTMAN 1963).

Tadorna ferruginea (PALLAS, 1764). A female was shot on the old riverbed at Hurko at the beginning of October 1887 (DZIEDUSZYCKI 1895) and a female stayed on the ponds at Starzawa in May 4-9, 1985 (HORDOWSKI & KUNYSZ 1991).

Tadorna tadorna (LINNAEUS, 1758). Apr. 23, 1988 – 1 bird on the ponds at Starzawa (HORDOWSKI & KUNYSZ 1991); Feb. 25, 1989 – a male also at Starzawa.

Anas penelope (LINNAEUS, 1758). It occurs regularly on passage in spring (Fig. 5), being noted only several times in autumn. In spring it appears at the end of February and at the beginning of March, reaching a maximum number, according to the year, towards the end of March or at the beginning of April. In the spring migration season the birds attain their maximum quantities of 50 individuals on the ponds at Starzawa and 35 on the sedimentation basins.

Anas strepera LINNAEUS, 1758, observed 16 times on the ponds at Starzawa and sedimentation basins at Siedliska. Most of the observations were made in autumn, from August throughout October; four spring observations come from April. This species most frequently occurred in pairs or small groups up to 7 birds.

Anas crecca LINNAEUS, 1758. Regular though not numerous passage migrants, less frequent in spring when they are not noted at each inspection, more numerous in autumn, but occurring periodically (Fig. 6). First birds are observed towards the end of February or

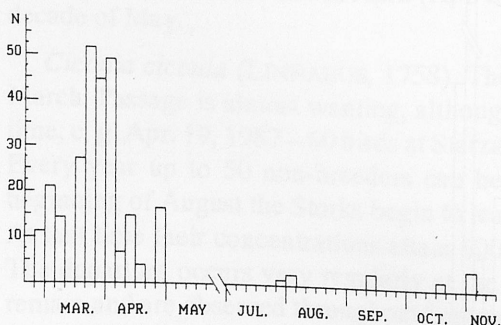


Fig. 5. Maximum numbers of *Anas penelope* in spring on the ponds at Starzawa in 1984-1989.

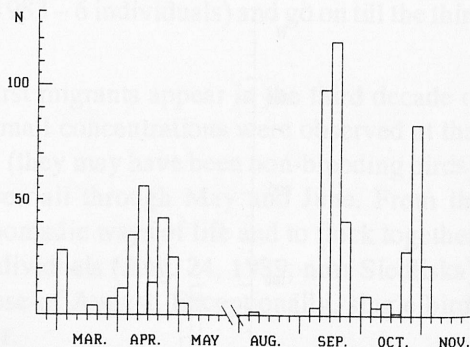


Fig. 6. Maximum numbers of *Anas crecca* on the ponds at Starzawa in 1984-1989.

at the beginning of March, but the passage proper starts in the middle of this month and the maximum numbers fall in mid-April. All the birds leave by mid-May. Single non-breeding individuals were seen in June. In autumn the first birds on passage appear at the end of the first decade of September and are most numerous in mid-September; then they fly away to reappear starting from the beginning of October; their number reaches a maximum at the close of the month. Both in spring and in autumn they occur on passage in small flocks, averaging 20 birds ($N_{\text{flocks}} = 32$), and rarely singly. The largest flocks of 120 birds were observed on the ponds at Starzawa on Sept. 18, 1988 and of 100 birds on the sedimentation basins at Siedliska on Sept. 12, 1989. Earliest observation – Feb. 28, 1989 at Starzawa, the latest – Nov. 17, 1979 on the River San (HORDOWSKI & KUNYSZ 1991).

Anas platyrhynchos LINNAEUS, 1758. This is the most numerous species all the year round, less numerous in spring and at the same time less stable in the total number of appearing birds. Its first individuals arrive after the melting away of the ice, at the latest in mid-March. Fig. 7 shows many years' mean change in the numbers of birds on the ponds at Starzawa. The shape of the histogram has been decidedly affected by the findings obtained in the spring of 1989, when 4500 Mallards stayed on these ponds, whereas in preceding years their number did not exceed 2500 individuals. They seem to be birds wintering somewhere near, which have not as yet flown off to their breeding grounds, as if waiting for the weather to become stable. When it has got distinctly warmer, their number decreases rapidly and at the end of March only the breeding birds remain. The autumnal passage is stretched in time and lasts from mid-August to mid-November. A very pronounced peak occurs at the turn of August (up to 20 000 birds at Starzawa), followed by a gradual departure of birds. Nearly all of them disappear by mid-November, when the only birds present are those remaining to winter on unfrozen waters.

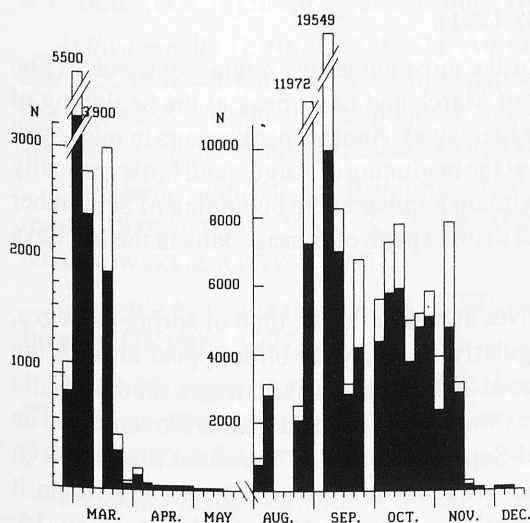


Fig. 7. Numbers of *Anas platyrhynchos* on the ponds at Starzawa in 1984-1989. Black columns – mean numbers; white columns – maximum numbers.

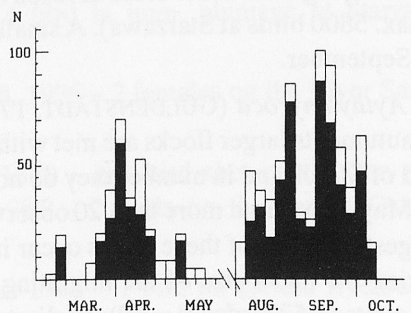


Fig. 8. Numbers of *Anas querquedula* on the sewage sedimentation basins at Siedliska in 1987-1989. Black columns – mean numbers; white columns – maximum numbers.

Anas acuta LINNAEUS, 1758. A total of 15 observations were made on the ponds at Starzawa and sedimentation basins at Siedliska in 1982-1989. The most observations come from the end of March and from April, when flocks numbering up to 22 birds were seen as Starzawa. Single birds were observed four times in autumn: on the ponds at Starzawa on Aug. 30, 1986 and Nov. 16, 1987 and on the sedimentation basins at Siedliska on Sept. 11, 1986 and Oct. 6, 1987.

Anas querquedula LINNAEUS, 1758. Fig. 8 shows changes in the numbers of Garganeys on the sedimentation basins. The birds appear at the beginning of March and reach a quantitative peak at the beginning of April. At the height of migration the maximum numbers do not exceed 70 birds on the ponds at Starzawa or on the basins at Siedliska. The autumnal passages have a many-peaked course. The first peak occurs at the close of the first decade of August on the sewage sedimentation basins and at the turn of July on the ponds at Starzawa (max. 173 birds). This species attains the highest numbers in mid-September, when concentrations reaching 100 birds were observed at Siedliska and, exceptionally, those of about 2000 birds at Starzawa (Sept. 12, 1986). The last birds were noted in mid-October. The average size of flocks encountered in autumn was 26 birds ($N_{\text{flocks}} = 45$).

Anas clypeata LINNAEUS, 1758, observed on spring passage every year. Its migration is poorly perceptible and short: the birds appear in the third decade of March and their flocks, up to 20 individuals, are observed at Starzawa and Siedliska throughout April. The mean size of flocks is 11 birds ($N = 37$). From the beginning of May their numbers decrease and the last birds depart in mid-May. In autumn observed twice at Starzawa: 5 birds on Sept. 27, 1987 and 50 on Oct. 22, 1989.

Netta rufina (PALLAS, 1773). Nov. 16, 1936 – 2 birds shot at Hermanowice (GODYŃ 1939), Apr. 19, 1984 – 2 males and a female and from May 4 to 20, 1985 – 1 bird on the ponds at Starzawa (HORDOWSKI & KUNYSZ 1991).

Aythya ferina (LINNAEUS, 1758). One of the most numerous migratory species (Fig. 9). The spring passage begins at the outset of March and has a peak at the beginning of the third decade of March (max. 422 birds at Starzawa). Another peak occurs in mid-April (max. 200 birds). The autumn passage starts at the beginning of August and birds gradually come flying from other areas to reach a maximum number at the beginning of September (max. 5800 birds at Starzawa). A smaller but distinct peak of passage falls in the last days of September.

Aythya nyroca (GÜLDENSTÄDT, 1770). Not numerous at the time of spring passages, in autumn its larger flocks are met with irregularly. In spring the birds appear towards the end of March and in number they do not exceed 25 individuals at Starzawa till the middle of May. In autumn more than 20 observations were made from August to November. The largest numbers of these ducks occur in mid-September (max. 270 birds at Starzawa). In spring the mean size of the migrating flocks ($N = 41$) is 9 birds, whereas in autumn it amounts to 52 birds ($N = 19$). Earliest observation – Mar. 25, 1989, the latest – Nov. 16, 1985 on the ponds at Starzawa.

Aythya fuligula (LINNAEUS, 1758). This regularly migrating species (Fig. 10) appears in spring from the beginning of March and has its first quantitative peak at the end of

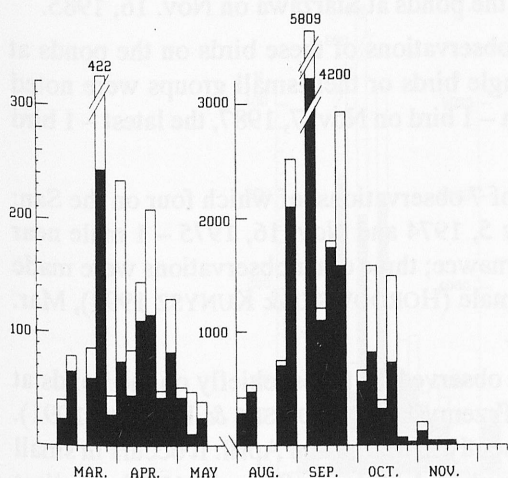


Fig. 9. Numbers of *Aythya ferina* on the ponds at Starzawa in 1984-1989. Black columns – mean numbers; white columns – maximum numbers.

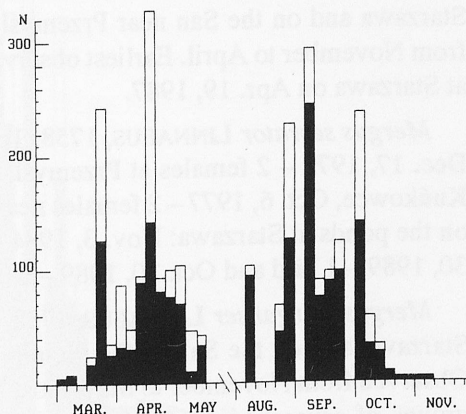


Fig. 10. Numbers of *Aythya fuligula* on the ponds at Starzawa in 1984-1989. Black columns – mean numbers; white columns – maximum numbers.

March; next the number of birds decreases and again its most abundant flight (up to 320 birds at Starzawa) was noted in mid-April. The autumn passage is also characterized by two peaks; the first one, higher (up to 300 birds at Starzawa) occurs at the beginning of September and the second at the beginning of October. The mean size of flocks observed is 15 birds ($N = 76$) in spring and 30 birds ($N = 57$) in autumn.

Aythya marila (LINNAEUS, 1761). All together observed 6 times: Jan. 10, 1985 and Sept. 23, 1988 – 1 male on the sedimentation basins at Siedliska, May 8, 1982 – 1 male, Oct. 22, 1983 – 1 male on the ponds at Starzawa (HORDOWSKI & KUNYSZ 1991), Sept. 12, 1989 – 2 pairs of birds at Siedliska and Oct. 22, 1989 – a female at Starzawa.

Somateria mollissima (LINNAEUS, 1758). Sept. 4, 1904 – one bird shot in the Przemyśl region (STRAUTMAN 1963), Sept. 18, 1988 – 1 bird in imm. plumage at Starzawa (HORDOWSKI & KUNYSZ 1991).

Clangula hyemalis (LINNAEUS, 1758). Jan. 18, 1976 – 2 females on the River San at Przemyśl (KUREK 1977a).

Melanitta nigra (LINNAEUS, 1758). Jun. 6, 1870 – one bird shot on the San near Nienadowa (DZIEDUSZYCKI 1880); Nov. 17, 1985 – 2 birds on the San at Ostrów (HORDOWSKI & KUNYSZ 1991).

Melanitta fusca (LINNAEUS, 1758). In August 1983 – 1 bird on the old riverbed at Hurko, Nov. 4, 1979 – 2 males on the San at Ostrów, Nov. 27, 1985 – 6 birds on the San near Tarnawce (HORDOWSKI & KUNYSZ 1991).

Bucephala clangula (LINNAEUS, 1758). Total of 15 observations of birds on spring and autumn passages at Starzawa, Siedliska and on the San. In spring the birds were

observed in March and April and in autumn from September to November. The biggest flock – 6 males and 7 females – was seen on the ponds at Starzawa on Nov. 16, 1985.

Mergus albellus LINNAEUS, 1758. Nine observations of these birds on the ponds at Starzawa and on the San near Przemyśl. Single birds or their small groups were noted from November to April. Earliest observation – 1 bird on Nov. 7, 1987, the latest – 1 bird at Starzawa on Apr. 19, 1987.

Mergus serrator LINNAEUS, 1758. Total of 7 observations, of which four on the San: Dec. 17, 1979 – 2 females at Przemyśl, May 5, 1974 and Nov. 16, 1975 – 1 male near Kuńkowce, Oct. 6, 1977 – 2 females near Tarnawce; three other observations were made on the ponds at Starzawa: Nov. 3, 1984 – 1 male (HORDOWSKI & KUNYSZ 1991), Mar. 30, 1989 – 1 bird and Oct. 20, 1989 – 2 birds.

Mergus merganser LINNAEUS, 1758, was observed 16 times, chiefly on the ponds at Starzawa and on the San in the vicinity of Przemyśl (HORDOWSKI & KUNYSZ 1991). Observed from November to May, most frequently in March and April. It occurs in small groups of several birds; the largest flock numbered 19 birds (Mar. 2, 1989). Earliest observation – Nov. 7, 1985, the latest – May 18, 1985.

Oxyura leucocephala (SCOPOLI, 1768). A bird was shot on the ponds at Starzawa on Sept. 15, 1936 (GODYŃ 1939).

Rallus aquaticus LINNAEUS, 1758. Its passages have not been recorded owing to its secret ways of life. The first birds appear in the breeding places from the end of March to the beginning of April.

Gallinula chloropus (LINNAEUS, 1758). This species was regularly observed each year, but always in very small numbers. In spring it starts appearing at the beginning of April and it leaves this area from mid-August throughout September. Earliest observation – 2 birds at Starzawa on Apr. 1, 1988, the latest – on the San on Nov. 25, 1989.

Fulica atra LINNAEUS, 1758. It is one of the most numerous occurring species, especially in the season of autumn migrations (Fig. 11). The quantitative peaks follow one another at short intervals from the end of March to mid-April. The autumn passage also runs in three waves, but it is more protracted in time. The first peak occurs at the beginning of September, the second towards the end of September and the third towards the end of the first decade of October. In the spring season the numbers of Coots on the ponds at Starzawa do not exceed 670 birds, whereas in autumn the groupings may number nearly 13 000 individuals (Sep. 22, 1986).

Grus grus (LINNAEUS, 1758). In spring its passage begins in mid-March and peaks at the beginning of April, the last birds being still met with at the beginning of May. The autumn passage lasts from the end of September to the middle of November, reaching a peak in mid-October. The size of migrating flocks ranges from several to 440 individuals, with a mean of 92 birds ($N = 41$).

Haematopus ostralegus (LINNAEUS, 1758). Mar. 30, 1991 – 1 bird on the ponds at Starzawa and Apr. 6, 1991 – 1 bird by the River San at Hurko.

Himantopus himantopus (LINNAEUS, 1758). A female was shot on the now non-existing ponds at Węgierka on Apr. 19, 1852 (DZIEDUSZYCKI 1880).

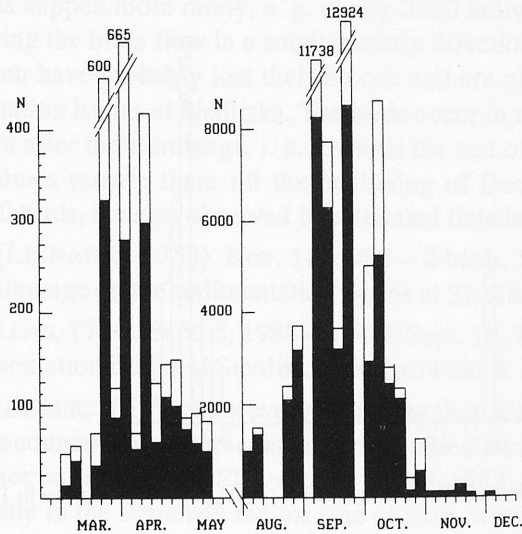


Fig. 11. Numbers of *Fulica atra* on the ponds at Starzawa in 1984-1989. Black columns – mean numbers; white columns – maximum numbers.

Recurvirostra avosetta LINNAEUS, 1758. Two birds stayed on the sedimentation basins at Siedliska from 20 to 25 Apr. 1989.

Charadrius dubius SCOPOLI, 1786. Not numerous migratory birds on spring and autumn passages. In spring they appear in small groups up to 10 birds from the end of March till mid-May, exceptionally a flock of 18 birds was seen at Siedliska on Apr. 7, 1988. They reappear in similar numbers from the beginning of July to October (max. 25 birds at Starzawa on Oct. 3, 1987).

Charadrius hiaticula LINNAEUS, 1758. In the course of observations carried out 2.5 years it was encountered 35 times on the sedimentation basins at Siedliska and only 2 birds were seen on the ponds at Starzawa (May 2, 1987). In spring single birds were observed four times from the end of March to the first days of May. In autumn it appears from August to mid-October. The passage peak occurs at the beginning of the third decade of September. It is formed by groups of 2-10 birds, with a maximum of 24 birds on Sept. 20, 1987. It seems an interesting fact that no birds of this species were observed on the ponds at Starzawa, although the draining of the ponds was started towards the end of September and areas of muddy bottoms were exposed.

Pluvialis apricaria (LINNAEUS, 1758). It was observed on autumn passage each year, whereas in spring only four times, mainly on the ponds (Fig. 12). The autumn passage starts at the beginning of October, with a peak in mid-October (max. 348 birds at Starzawa on Oct. 17, 1987). The mean size of flocks in the autumn season is 38 birds ($N = 53$).

Pluvialis squatarola (LINNAEUS, 1758). It was observed each year from the beginning of October to the beginning of November. The passage peak occurs at the end of October (max. 168 birds at Starzawa on Oct. 27, 1983). Single birds were seen on the San (JÓZEFIK

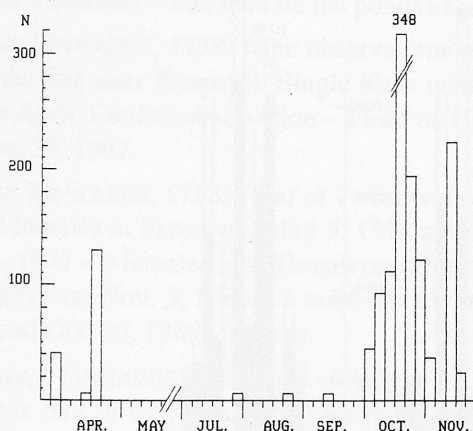


Fig. 12. Maximum numbers of *Pluvialis apricaria* on the ponds at Starzawa in 1984-1989.

1961; authors' own data), on the sedimentation basins at Siedliska and on the old riverbed at Hurko. The mean size of flocks is 25 birds ($N = 48$).

Vanellus vanellus (LINNAEUS, 1758) was observed at all inspections, distinctly more numerous in autumn, when it was outnumbered only by Mallards and Coots (Fig. 13 and 14). In spring it appears most frequently at the beginning of March and more rarely towards the end of February. Maximum numbers are reached at the turn of the second decade of March; in some years, when the spring is belated, this peak is shifted to the end of March. The birds fly in flocks of several to 150 birds, on the average 31 birds ($N = 192$ flocks).

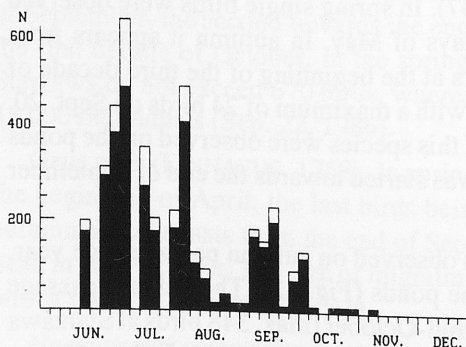


Fig. 13. Numbers of *Vanellus vanellus* on the sewage sedimentation basins at Siedliska in 1987-1989. Black columns – mean numbers; white columns – maximum numbers.

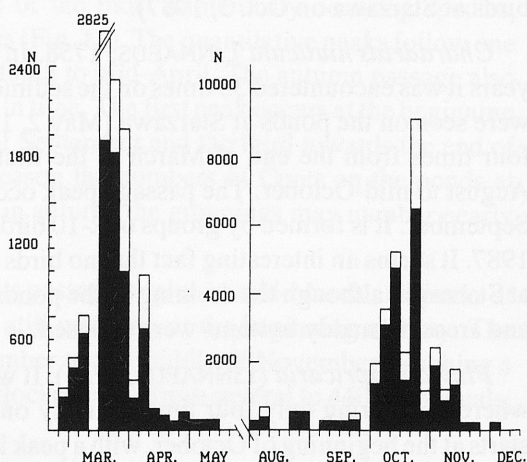


Fig. 14. Numbers of *Vanellus vanellus* on the ponds at Starzawa in 1984-1989. Black columns – mean numbers; white columns – maximum numbers.

Larger concentrations happen more rarely, e. g. nearly 3000 individuals at Starzawa on Feb. 17, 1989. In spring the birds flew in a south-easterly direction. From the middle of May some birds which have probably lost their broods and are of local origin begin to flock on the sedimentation basins at Siedliska. The birds occur in maximum numbers on the ponds at Starzawa after their drainage, i. e. towards the end of October (up to 9000 birds). Single individuals remain there till the beginning of December. Large flocks, numbering up to 1000 birds, are also observed in cultivated fields in October.

Calidris canutus (LINNAEUS, 1758). Nov. 11, 1987 – 2 birds, Sept. 5, 1988 – 1 bird partially in summer plumage on the sedimentation basins at Siedliska.

Calidris alba (PALLAS, 1764). Sept. 5, 1988 – 1 bird, Sept. 18, 1988 – 2 birds in imm. plumage on the sedimentation basins at Siedliska (HORDOWSKI & KUNYSZ 1991).

Calidris minuta (LEISLER, 1812) occurs every year at the time of autumn passages (Fig. 15). In spring it was encountered only three times: twice at Siedliska at the turn of the first decade of May and once on the ponds at Starzawa on May 8, 1983 – 40 birds. In June two observations were made in the Przemyśl region, one of them was of a flock of 20 birds (Jun. 26, 1976 – TOMIAŁOJC 1990). The autumn peak of migration was noted at the turn of August. Small flocks of 5-15, exceptionally 40 birds are usually met with.

Calidris temminckii (LEISLER, 1812) was observed four times: Aug. 30, 1987 – 1 bird in summer plumage, Sept. 11 and 20, 1987 – 1 and 5 birds at Siedliska and May 12, 1983 – 3 birds on the ponds at Starzawa (HORDOWSKI & KUNYSZ 1991).

Calidris ferruginea (PONTOPPIDAN, 1763). From the end of August till mid-October it is seen in small groups of 2-15 birds on the sedimentation basins at Siedliska. From August 1987 to October 1989 the birds of this species were observed 42 times. They appear most numerous and most frequently at the beginning of September, maximally 60 birds

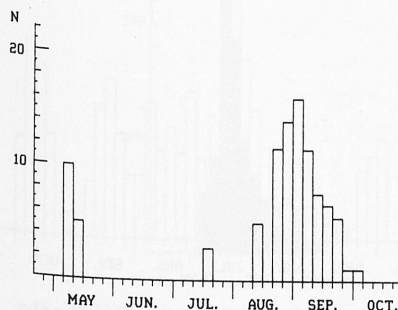


Fig. 15. Maximum numbers of *Calidris minuta* on the sewage sedimentation basins at Siedliska in 1987-1989.

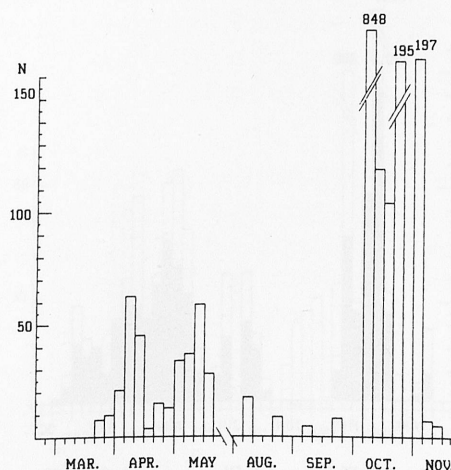


Fig. 16. Maximum numbers of *Calidris alpina* on the ponds at Starzawa in 1984-1989.

on Sept. 10, 1989. On the ponds at Starzawa they were noted four times, including one observation of 4 birds in spring (Apr. 20, 1985).

Calidris alpina (LINNAEUS, 1758) is the most abundant small wader in the study area (Fig. 16). In spring it is rare (max. 62 birds at Starzawa). First birds appear towards the end of March and the first peak takes place towards the end of the first decade of April, followed by another more or less in mid-May. The autumn passage begins approximately in August and small numbers of birds stop here till September. The peak of migration falls in the first decade of October.

Limicola falcinellus (PONTOPPIDAN, 1763). Aug. 12, 1956 – 1 juv. on the old riverbed at Hurko (JÓZEFIK 1961) and Aug. 3, 1987 – 2 on the sedimentation basins at Siedliska (HORDOWSKI & KUNYSZ 1991).

Philomachus pugnax (LINNAEUS, 1758) occurs every year from the end of March to mid-October but reaches highest numbers in the season of spring passages. The birds usually arrive in the third decade of March, exceptionally in 1989 they appeared in mid-March. After the arrival of the first birds their number increases rapidly and at the turn of March it reaches a peak (max. 700 birds at Starzawa). In the middle of April nearly all the birds disappear, which is followed by another wave of passage with a peak at the end of April and the beginning of May, considerably higher at Starzawa (max. 550 birds) than at Siedliska (max. 250 birds – Fig. 17). The Ruffs reappear in mid-June, with a peak in the first decade of July (max. 65 birds at Siedliska); another peak occurs at the turn of the first decade of August (max. 110 birds).

Lymnocyptes minimus (BRÜNNICH, 1764). Sept. 18, 1988 – 1 bird observed on the sedimentation basins at Siedliska (HORDOWSKI & KUNYSZ 1991).

Gallinago gallinago (LINNAEUS, 1758). Regular passage migrant; met with on most water reservoirs, wet meadows or floodplains every year (Fig. 18). The spring passage is

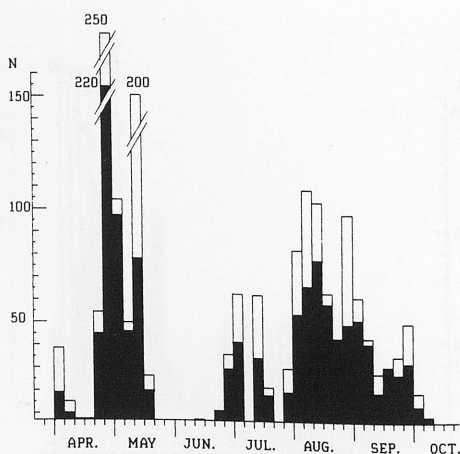


Fig. 17. Numbers of *Philomachus pugnax* on the sewage sedimentation basins at Siedliska in 1987-1989. Black columns – mean numbers; white columns – maximum numbers.

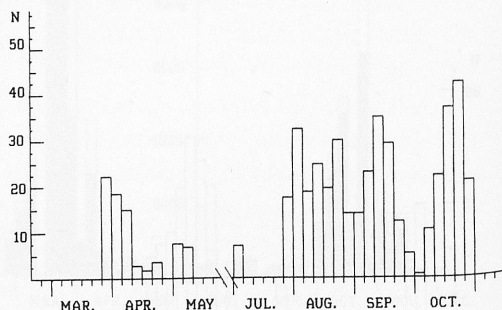


Fig. 18. Maximum numbers of *Gallinago gallinago* on the sewage sedimentation basins at Siedliska in 1987-1989.

poorly marked; in the last days of March the birds appear at once in their highest number (max. 23 individuals at Siedliska). The autumn passage, starting at the beginning of July, is characterized by three peaks. The first of them occurs more or less at the beginning of August, the second in mid-September and the third at the end of October. The maximum number of birds on the sedimentation basins at Siedliska does not exceed 45 birds. Earliest observation – Mar. 24, 1983, the latest – Nov. 16, 1985.

Gallinago media (LATHAM, 1787), observed four times: in mid-May 1984 – 4 birds on the old riverbed at Hurko, Nov. 3, 1983 – 3 birds on the ponds at Starzawa, Aug. 3, 1987 – 4 birds and Jul. 23, 1989 – 2 birds at Siedliska.

Limosa limosa (LINNAEUS, 1758). Most of the observations were made in the season of spring migration (Fig. 19). The arrival takes place in mid-March and the number of Black-tailed Godwits reaches a peak at the turn of March (max. 670 birds at Starzawa). In autumn they are seen irregularly, mainly in groups up to 15 birds on the sewage sedimentation basins from the end of July to September. earliest observation – Mar. 17, 1989, last birds were noted on Oct. 27, 1984.

Limosa lapponica (LINNAEUS, 1758). One bird was observed on the sedimentation basins at Siedliska on Mar. 20, 1989 (HORDOWSKI & KUNYSZ 1991).

Numenius phaeopus (LINNAEUS, 1758). Jul. 8, 1980 – a bird seen over Przemyśl (HORDOWSKI & KUNYSZ 1991).

Numenius arquata (LINNAEUS, 1758). It was observed 25 times on the ponds at Starzawa and on the sedimentation basins at Siedliska. In spring it appears from the end of March to the middle of May; in autumn, single individuals or small groups up to 7 birds can be seen from July to the end of September. Birds of this species are besides come across also far from water reservoirs, e. g. at Bolestraszyce, Kosienice, Bystrowice or

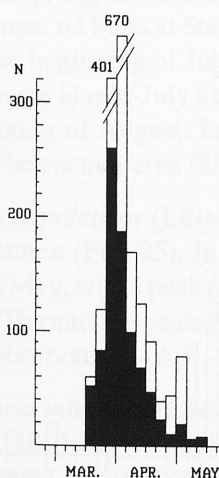


Fig. 19. Numbers of *Limosa limosa* on the ponds at Starzawa in 1984-1989. Black columns – mean numbers; white columns – maximum numbers.

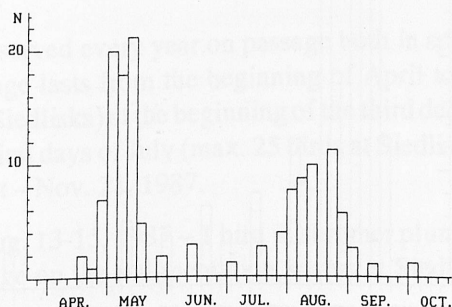


Fig. 20. Maximum numbers of *Tringa erythropus* on the sewage sedimentation basins at Siedliska in 1987-1989.

Przemyśl, mainly in August. Earliest observation – Mar. 28, 1989, the latest – Sept. 22, 1987.

Tringa erythropus (PALLAS, 1764), every year observed on spring and autumn passages, but in very small numbers (Fig. 20). The arrival falls in mid-April and the passage peaks in the first days of May (max. 21 birds at Siedliska). The return passage begins towards the end of July and reaches a peak at the beginning of the third decade of August. Only single birds were observed later, the last of them on Oct. 30, 1987.

Tringa totanus (LINNAEUS, 1758). Observed regularly only in spring (Fig. 21). The birds arrive in mid-March (exceptionally, as early as Mar. 2 in 1989) and they gradually increase in number to reach a peak at the beginning of April (max. 76 birds at Starzawa). Their number grows again towards the end of April and nearly all the birds fly away by mid-May. Later, this species was observed 12 times in small groups of several to 20 birds. Latest observation – Oct. 5, 1984.

Tringa stagnatilis (BECHSTEIN, 1803). Six observations: Apr. 21, 1984 – 1 ad., Apr. 28, 1984 – 2 ad., Apr. 16, 1988 – 2 ad. on the ponds at Starzawa (HORDOWSKI & KUNYSZ 1991) and Apr. 26, 1989 – 3 ad. on the sedimentation basins at Siedliska; one adult bird was noted at Starzawa late in autumn, on Oct. 22, 1989. In the light of the findings published by TOMIAŁOJCZAK (1990) this is one of the latest observations of this bird in Poland.

Tringa nebularia (GUNNERUS, 1767), observed every year, chiefly in spring (Fig. 22). The passage starts at the beginning of April and has a peak (max. 50 birds at Siedliska) at the end of April or at the beginning of May. The species was observed regularly over the River San.

Tringa ochropus LINNAEUS, 1758, occurred in very small numbers (Fig. 23). The spring passage begins in the first days of April and the most birds (max. 16 at Siedliska) were noted towards the end of the first decade of this month. The passage declines towards the end of the first decade of May. The return passage starts at the close of July, with a

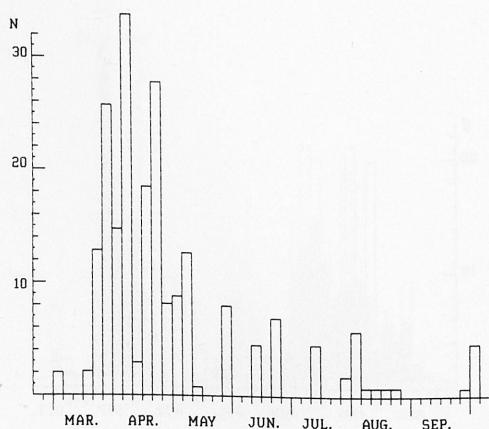


Fig. 21. Maximum numbers of *Tringa totanus* on the sewage sedimentation basins at Siedliska in 1987-1989.

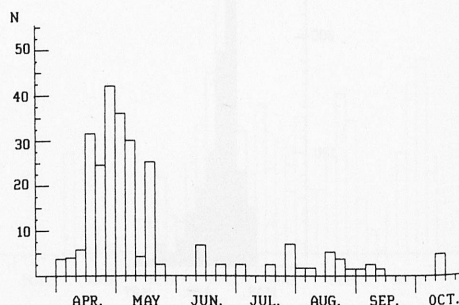


Fig. 22. Maximum numbers of *Tringa nebularia* on the sewage sedimentation basins at Siedliska in 1987-1989.

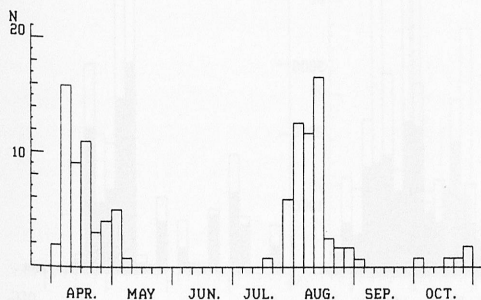


Fig. 23. Maximum numbers of *Tringa ochropus* on the sewage sedimentation basins at Siedliska in 1987-1989.

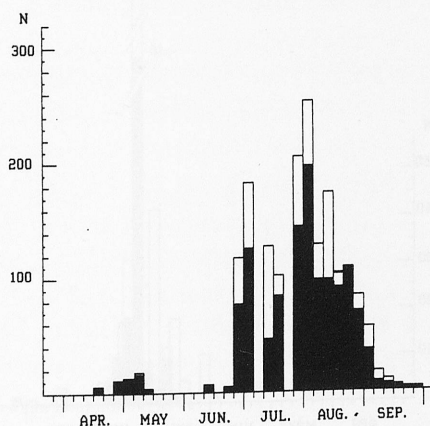


Fig. 24. Numbers of *Tringa glareola* on the sewage sedimentation basins at Siedliska in 1987-1989. Black columns – mean numbers; white columns – maximum numbers.

peak in mid-August (max. 18 birds). The birds are only exceptionally seen in September and appear somewhat more frequently again towards the end of October. Earliest observation – Mar. 28, 1989, the latest – Nov. 2, 1985 at Starzawa.

Tringa glareola LINNAEUS, 1758. The most abundant species of the waders on the sedimentation basins at Siedliska and ponds at Starzawa (Fig. 24). Relatively few birds are seen in spring, the most of them appearing towards the end of April or at the beginning of May (max. 63 birds at Starzawa). The passage is resumed in mid-June to reach the first peak at the beginning of July (max. 190 birds on the sedimentation basins). The second wave appears in mid-July and has a peak (max. 250 birds on the sedimentation basins) at the beginning of August. Later, the number of birds gradually decreases and the latest birds can be encountered till mid-September.

Actitis hypoleucos (LINNAEUS, 1758), observed every year on passage both in spring and in autumn (Fig. 25). In spring the passage lasts from the beginning of April to the middle of May, with a peak (max. 25 birds at Siedliska) at the beginning of the third decade of April. The autumn passage begins on the first days of July (max. 25 birds at Siedliska). Earliest observation – Apr. 4, 1985, the latest – Nov. 21, 1987.

Arenaria interpres (LINNAEUS, 1758). Aug. 13-15, 1987 – 1 bird in summer plumage and Sept. 18, 1988 – 1 bird in winter plumage on the sedimentation basins at Siedliska (HORDOWSKI & KUNYSZ 1991).

Phalaropus lobatus (LINNAEUS, 1758). Jun. 1, 1985 – 1 bird on the ponds at Starzawa and Aug. 9-21, 1987 – 1 bird on the sedimentation basins at Siedliska (HORDOWSKI & KUNYSZ 1991).

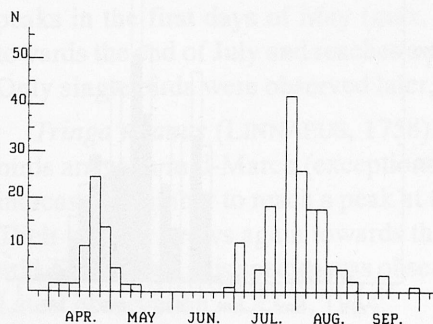


Fig. 25. Maximum numbers of *Actitis hypoleucos* on the sewage sedimentation basins at Siedliska in 1987-1989.

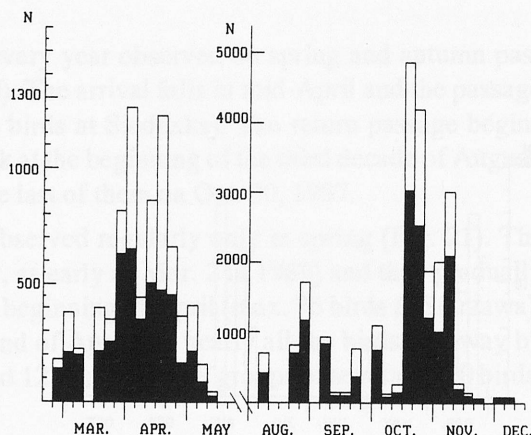


Fig. 26. Numbers of *Larus ridibundus* on the ponds at Starzawa in 1984-1989. Black columns – mean numbers; white columns – maximum numbers.

Larus melanocephalus TEMMINCK, 1820. A bird in the second year of life was seen on the ponds at Starzawa on Oct. 17, 1987 (HORDOWSKI & KUNYSZ 1991).

Larus minutus PALLAS, 1776. It is met with on spring and autumn passages every year. More numerous in spring, it is observed from the beginning of the second decade of April to mid-May (max. 108 individuals at Starzawa and 80 on the sedimentation basins at Siedliska). It is less frequent in autumn; single birds or rarely groups up to 10 individuals are observed from the beginning of July to mid-September.

Larus ridibundus LINNAEUS, 1766. One of the most abundant species, observed regularly in spring and autumn (Fig. 26). The spring passage starts at the beginning of March or, exceptionally, at the close of February and the first peak of quantity occurs at the beginning of April (up to 1300 birds at Starzawa) or as early as the end of March (max. 3000 birds at Przemyśl); another, lower, peak falls in mid-April. The autumn passage is more abundant, the nomadic birds begin to appear towards the end of July, the greatest concentrations occurring in mid-October (up to 5000 birds). In mid-November the passage comes distinctly to an end and only a few wintering individuals remain.

Larus canus LINNAEUS, 1758. It appears regularly in spring and autumn (Fig. 27), most often in small groups up to 15 birds or singly. In spring the first birds appear in mid-March, the main peak of passage taking place at the end of April (up to 30 birds at Starzawa). The birds reappear towards the end of the first decade of October, reaching a peak at the beginning of the third decade of that month (max. 79 individuals at Starzawa). Single birds are observed till mid-November.

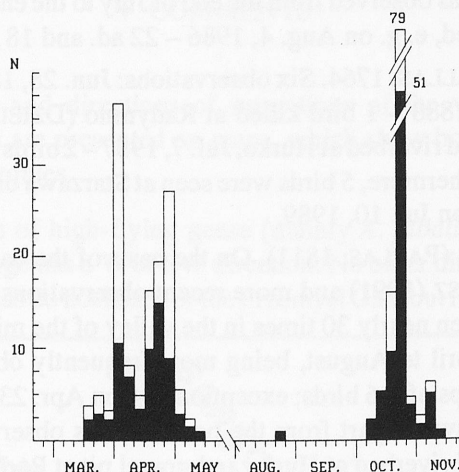


Fig. 27. Numbers of *Larus canus* on the ponds at Starzawa in 1984-1989. Black columns – mean numbers; white columns – maximum numbers.

Larus fuscus LINNAEUS, 1758. Mar. 5, 1954 – a dead individual found in the region of Przemyśl (SZCZEPSKI 1970), May 13, 1983 – 1 bird observed at Kosienice (HORDOWSKI & KUNYSZ 1991), Jun. 21, 1976 – 1 ad. over the San near Sieniawa (TOMIAŁOJC 1990).

Larus argentatus PONTOPPIDAN, 1763. In 1981-1988 it was observed only six times (HORDOWSKI & KUNYSZ 1991), whereas at the beginning of 1989 and in April that year it was seen at each inspection on the ponds at Starzawa (up to 8 birds).

Larus cachinnans PALLAS, 1811. In 1989 and 1990 a pair of birds with olive yellow legs was observed regularly in spring. In 1989 these birds were seen breeding amidst the colony of Black-headed Gulls on the ponds at Starzawa. In the light of a publication by BUKACIŃSKI et al. (1989) this is the second nesting area of this species in Poland.

Larus marinus LINNAEUS, 1758. Apr. 8, 1984 – 2 ad. and 3 imm. observed on the ponds at Starzawa (HORDOWSKI & KUNYSZ 1991).

Rissa tridactyla (LINNAEUS, 1758). A bird was found on the San near Kostków in April 1894 (DZIEDUSZYCKI 1895).

Sterna caspia PALLAS, 1770, observed four times: Aug. 27, 1983 – 2 ad., Apr. 18, 1984 – 1 ad., Apr. 28, 1987 – 1 ad. on the ponds at Starzawa and Oct. 2, 1973 – 1 bird on the San at Przemyśl (HORDOWSKI & KUNYSZ 1991).

Sterna hirundo LINNAEUS, 1758. In the season of spring migration it appears starting from the third decade of April and its passage lasts till mid-May. Single birds or their small groups up to 5 individuals were seen at that time. Flocks up to 60 birds were observed on the sedimentation basins at Siedliska, but they were probably birds which nested there.

The autumn passage was observed from the end of July to the end of August; larger groups of birds were also noted, e. g. on Aug. 4, 1986 – 22 ad. and 18 imm. at Starzawa.

Sterna albifrons PALLAS, 1764. Six observations: Jun. 28, 1882 – a pair of birds killed at Tuczępy; Jul. 5, 1888 – 1 bird killed at Radymno (DZIEDUSZYCKI 1895); Jun. 17, 1979 – 2 birds on the old riverbed at Hurko, Jul. 7, 1987 – 2 birds at Starzawa (HORDOWSKI & KUNYSZ 1991); furthermore, 5 birds were seen at Starzawa on Jun. 24, 1989 and 2 birds at Sośnica on the San on Jul. 10, 1989.

Chlidonias hybrida (PALLAS, 1811). On the basis of the data published in a work by HORDOWSKI & KUNYSZ (1991) and more recent observations it can be stated that birds of this species were seen nearly 30 times in the valley of the middle San. The Whiskered Tern appears from April to August, being most frequently observed in May. It occurs singly or in small groups of 4-6 birds; exceptionally, on Apr. 23, 1989 there were 15 birds on the ponds at Starzawa. Apart from the ponds it was observed on the sedimentation basins at Siedliska, old riverbed at Hurko and gravel pit at Radymno.

Chlidonias nigra (LINNAEUS, 1758), observed in varying numbers both in spring and in autumn (Fig. 28). Its passages are characterized by regularity. The birds are most abundant at the end of April and later their number decreases gradually till the end of May (max. 130 birds at Starzawa and 81 birds at Siedliska). Single non-breeding individuals were seen throughout the breeding season. The birds appear again in larger numbers at the beginning of August (max. 40 birds at Siedliska) and the latest individuals were noted in mid-September. The Black Terns fly in flocks of 3-120 birds, on the average 25 ($N = 52$ flocks). Earliest observation – Apr. 16, 1988, the latest – Sept. 17, 1989.

Chlidonias leucoptera (TEMMINCK, 1815). On the basis of the data published in a work by HORDOWSKI & KUNYSZ (1991) and more recent observations it can be stated that birds of this species were met with 14 times in the valley of the middle San, mainly at the turn of April and only once a bird was killed at Węgierka in August (Aug. 15, 1852 – DZIEDUSZYCKI 1880). The highest number of birds (24) were observed on the ponds at Starzawa on Apr. 27, 1988.

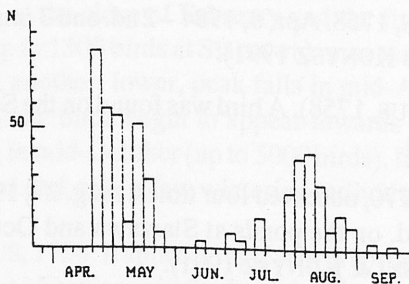


Fig. 28. Maximum numbers of *Chlidonias nigra* on the sewage sedimentation basins at Siedliska in 1987-1989.

V. COMMENTS

The important routes and directions of migrations of the water-and-marsh birds watched in the study area are presented on maps, which show both the spring (Fig. 29) and the autumn (Fig. 30) routes.

Repeated observations of high-flying geese (mainly *A. fabalis*, evidence that in the autumn season their passage has a W or SW direction. No other directions of flights were observed. And so these birds do not head for the Przemyśl Gate but fly along the Carpathian

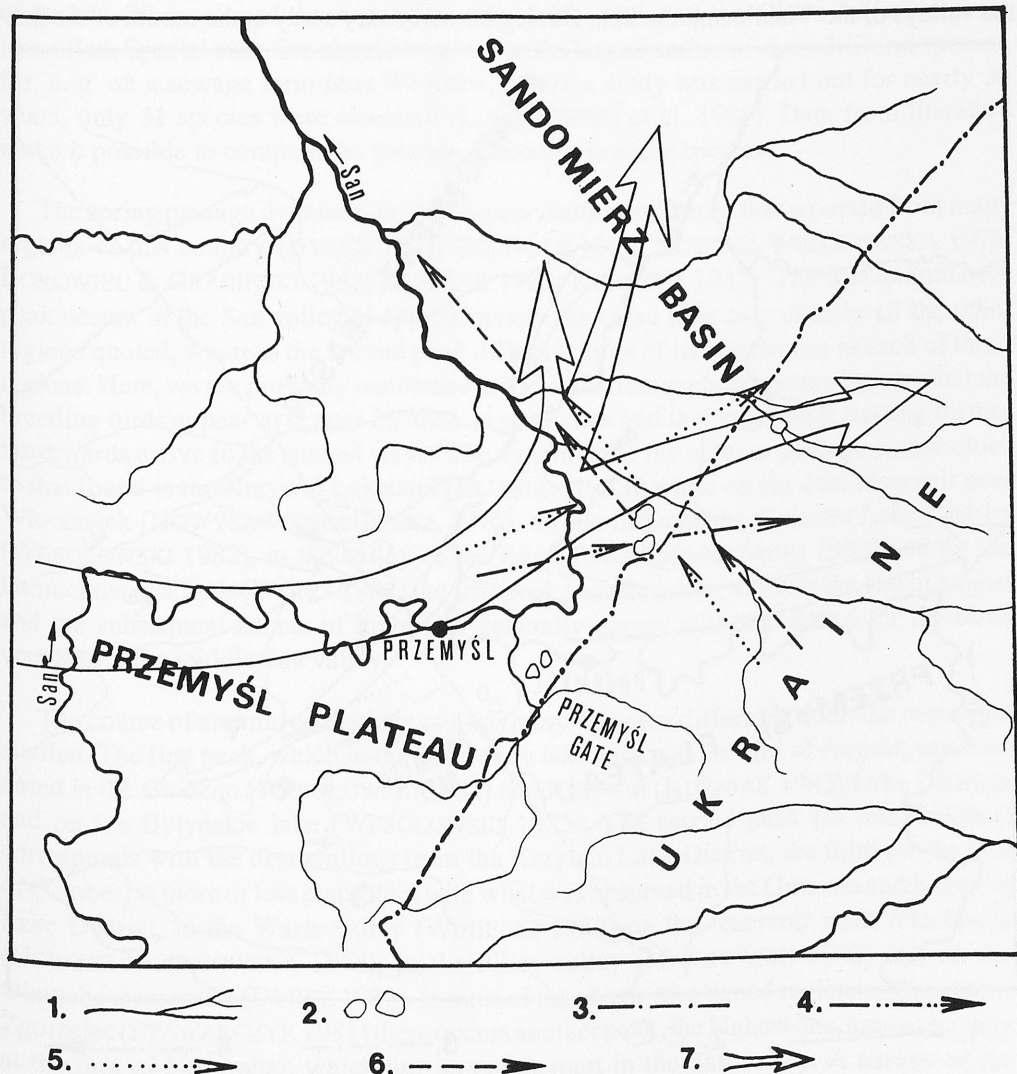


Fig. 29. A map showing main directions of spring passages in the water-and-marsh birds in the middle San valley. 1 – rivers, 2 – ponds and sedimentation basins, 3 – state frontier, 4 – passage direction of *Larus ridibundus*, *Vanellus vanellus* and other *Limicolae*, 5 – passage direction of the birds from the genera *Anas* and *Anser*, 6 – passage direction of *Grus grus*, 7 – main passage directions of most of the water-and-marsh birds.

chain to their winter quarters situated somewhere farther in Western Europe. This direction would agree with the route found by RUTSCHKE (1987) (Figs. 29 and 30).

According to SIERAKOWSKI et al. (1969), the San valley is one of the main migration routes of *Grus grus* in Poland. The present observations however suggest that the route of spring passages does not coincide with the autumn route.

In the case of the wading birds the routes of migration are somewhat differentiated but, for instance, 30 years ago JÓZEFIK (1961) writes the Grey Plover penetrates up the valley of the San and through the Użocka Pass in the Bieszczady Mts. into the valley of the River Uh.

In JÓZEFIK's (1969) opinion, one of the migration routes of *Sterna caspia* runs along the valleys of the Vistula and the San. During his stationary study at the mouth of the San

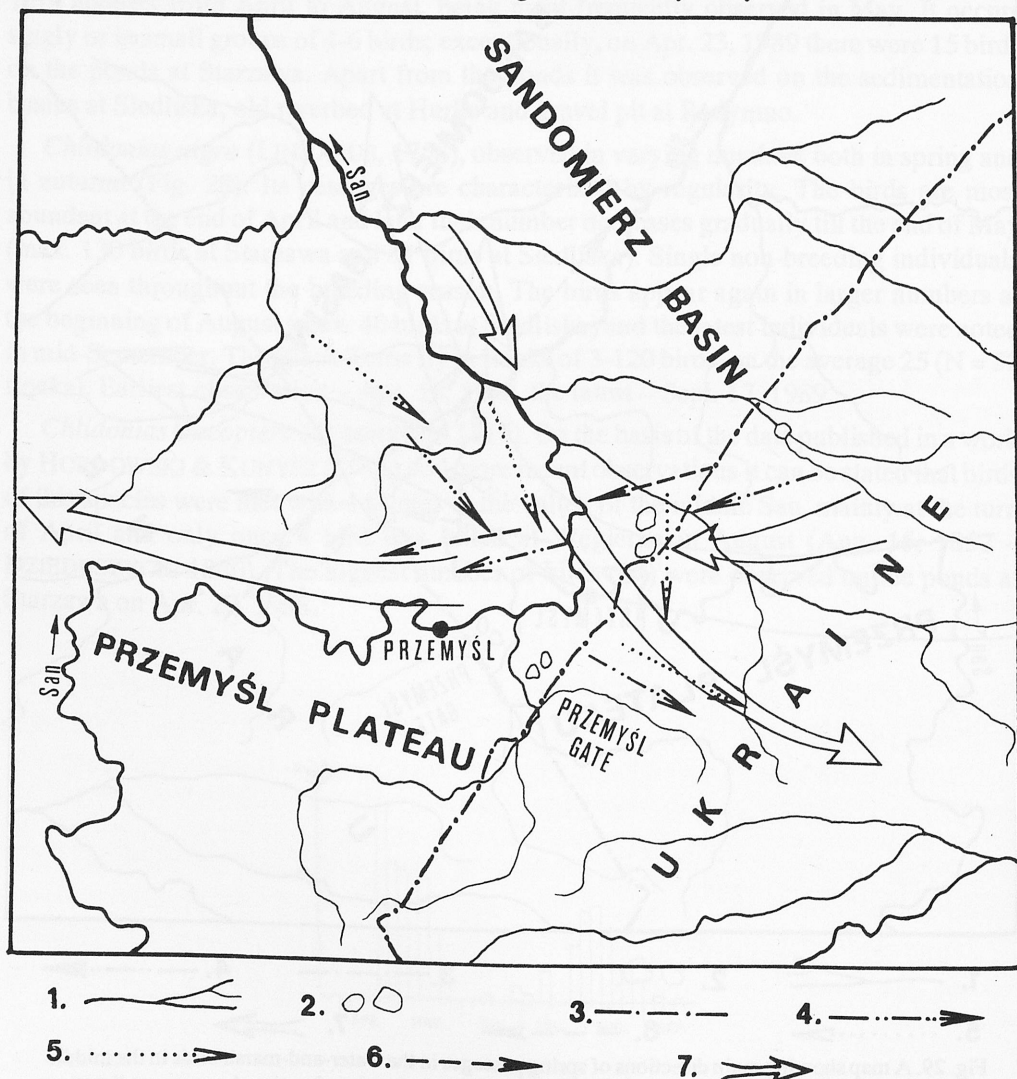


Fig. 30. A map showing main directions of autumn passages in the water-and-marsh birds in the middle San valley. 1-3 - same as for Fig. 29, 4 - passage direction of *Larus ridibundus*, *Vanellus vanellus* and other *Limicolae*, 5 - passage direction of birds of the genera *Anas* and *Anser*, 6 - passage direction of *Grus grus*, 7 - main passage directions of most of the water-and-marsh birds.

into the Vistula, LUNIAK (1971), too, found that in autumn 50% of the Caspian Terns flew up the river San, but he hardly ever noted their flights in the opposite direction. That was also true of night flights. Our observations however indicate that these terns do not fly as far as the Przemyśl region. It may well be that after flying along the lower course of the San, they move along the edge of the Roztocze Hills and reach the valley of the Dniester. The passage route may also have changed within these last twenty years.

In the course of the present study we found 101 migrating species. Having applied TOMIAŁOJC'S (1972) criteria, we distinguished 48 species appearing every year, 23 occurring irregularly and 30 sporadically or exceptionally. Among other forms, 5 species of grebes, 30 species of the *Anseriformes* and 33 species of the *Charadriiformes* were identified. Special attention should be given to the large number of charadriiform species, for, e. g. on a sewage farm near Wrocław, where a study was carried out for nearly 30 years, only 31 species were observed (LONTKOWSKI et al. 1988). Data from literature make it possible to compare the passage dynamics in some species.

The spring passage dynamics in *Podiceps cristatus* resembles that reported from many regions of this country (DYRCZ 1971; BEDNORZ 1976; NOWYSZ-WESOŁOWSKA 1976; BOROWIEC & GRABIŃSKI 1982; KUŹNIAK 1983; KUPCZYK 1987). The first quantitative peak occurs in the San valley at approximately the same time as it does in all the other regions quoted, whereas the second peak differs in time of its occurrence in each of these regions. Here, we are probably concerned with two different populations of birds: first the breeding birds appear to scatter for their nesting sites and the individuals nesting further northwards arrive in the second wave. The dynamics of the autumn passage comes close to that found in the Krzywiń Lakeland (KUŹNIAK 1983), while on the dam reservoir near Włocławek (NOWYSZ-WESOŁOWSKA 1976), on the lakes of the Gniezno Lake District (WESOŁOWSKI 1982), in the valley of the River Pilica (MARKOWSKI 1982) and on the Otmuchów reservoir (DYRCZ 1981) the first peak occurs earlier, towards the end of august and the subsequent course of migration generally agrees with that found for the birds watched in the middle San valley.

The course of autumn migrations of *Anas platyrhynchos* differs between the reservoirs studied. The first peak, which in the San valley takes place at the turn of August, was also noted in the Gniezno (WESOŁOWSKI 1982) and Krzywiń (KUŹNIAK 1983) Lake Districts and on the Bytyńskie lake (WESOŁOWSKI 1975). The second peak (in mid-October) corresponds with the observations from the Krzywiń Lake District, the third (at the turn of October) is more or less consistent with what was observed in the Gniezno and Krzywiń Lake District, in the Warta valley (WINIECKI 1982) on the reservoir near Włocławek (NOWYSZ-WESOŁOWSKA 1976), in the Pilica valley (MARKOWSKI 1982) and on the Otmuchów reservoir (DYRCZ 1981). In most of the above-mentioned regions and also near Zgorzelec (STAWARCZYK 1981) there occurs another peak, the highest one, approximately at the turn of November, which has no counterpart in the San valley. A survey of the ornithological literature of this country shows that the ponds at Starzawa are one of the places of the largest concentration of Mallards during their autumn passage (up to 20 000 birds per inspection). Similar but somewhat smaller groups were recorded from Turawskie Lake – up to 19 000 (DYRCZ 1989) and Biebrza Basin – up to 16 000 (DYRCZ et al. 1984).

Exceptionally only in the Słońsk Reserve the concentrations reach 72 000 birds (DYRCZ 1989), but this may be associated with the nature and size of that locality.

As will be seen from literature the grouping of about 2 000 *Anas querquedula* is one of the largest in the country. Many authors write that they observed up to 100 birds, only from the Biebrza Basin 1000 individuals were recorded (DYRCZ et al. 1984); KUŹNIAK (1967) saw a group of 500 birds at Rów Polski at the time of a flood, TOMIAŁOJC (1990) reports up to 630 birds from the Nyski reservoir and RIABININ (1963) mentions "enormous" flocks in Lublin Polesie.

The maximum numbers of *Aythya ferina* during its spring and autumn passages fall in different periods in different regions of the country except for the Krzywiń Lake District and Bytyńskie Lake, where the dynamics of spring passages is almost the same (WE-SOŁOWSKI 1975; KUŹNIAK 1983). The autumn concentrations of *Aythya ferina* on the ponds at Starzawa, reaching nearly 6000 individuals, belong to the greatest in this country. Greater concentrations were observed in the Słońsk Reserve – 9300 birds – and on the ponds at Przemków – 9000 (TOMIAŁOJC 1990), whereas on the other reservoirs their numbers did not generally exceed 500 birds.

In spring *Calidris ferruginea* was observed in Poland only several times (about 5 times inland) and always in May and June at that (TOMIAŁOJC 1990). According to STAWARCZYK and GRABIŃSKI (1980), concentrations of about 60 birds are rare inland not only in Poland but throughout Central Europe as well. This would point at the intensity of the passage along the middle San valley.

The course of autumn passage in *Calidris alpina* in the study area resembles that recorded from Nyski reservoir (GROMADZKA 1985), whereas two peaks were observed at the Otmuchów reservoir – towards the end of October and at the beginning of November – (DYRCZ 1981). At the height of migration, i. e. at the beginning of October, groups reaching 850 birds were observed on the ponds at Starzawa. Such concentrations are exceptional in Central Europe in autumn (GROMADZKA 1985). In inland areas of Poland there were, however, groups up to 2650 birds on the Nyski reservoir (STAWARCZYK in litt.) and 480 on the Goczałkowice reservoir (TOMIAŁOJC 1990).

In comparison with other localities in this country the spring migration of *Philomachus pugnax* in the middle San valley differs in having two peaks, whereas only one peak, at the turn of April, was observed on the Zator ponds (WASILEWSKI 1973), on the ponds near Siedlce (KOT 1986), in the Warta valley (WINIECKI 1982) and in the Pilica valley (MARKOWSKI 1982). Only the dynamics of migration found in flood meadows near Poznań (BEDNORZ 1976) resembles that observed on the San. On the other hand, an identical course of the autumn passages was found on a sewage farm near Wrocław (LONTKOWSKI et al. 1988).

The autumn passage of *Gallinago gallinago* along the San valley is ismilar in nature to that occurring near Poznań (BEDNORZ 1976) and in the valley of the middle course of the Warta (WINIECKI 1982) but quite different from that noted near Wrocław (LONTKOWSKI et al. 1988). The numbers observed in the valley of the middle San are small in relation to the numbers in other areas, for, e. g., 1100 birds were present at the same time on the Turów reservoir (DYRCZ 1989), up to 600 birds near Wrocław (LONTKOWSKI et al. 1988) and 330 on the Zator ponds (WASILEWSKI 1973).

Tringa nebularia on the San – unlike the birds of this species in other regions of the country (WASILEWSKI 1973; BEDNORZ 1976; BOROWIEC et al. 1981; LONTKOWSKI et al. 1988; TOMIAŁOJC 1990) – lacks a distinct spring passage. Single birds or their small groups are encountered in various periods.

The dynamics and size of passages on the ponds at Starzawa differ from those observed on the sewage sedimentation basins at Siedliska. In spring, as soon as the ice has melted, i. e., at the close of February or at the beginning of March, large groups of ducks, mainly Mallards, up to 3500 individuals, arrive on the ponds and scatter for their breeding grounds. The diving ducks and geese reach a maximum towards the end of March or at the beginning of April; at the same time Lapwings, Ruffs and godwits fly over in large numbers. Other waders, terns and Little Gulls appear in small numbers towards the end of April. It is also then that the Ruffs have an other quantitative peak. All the time Black-headed Gulls and Snipes fly over. In mid-May the passages come to an end. The birds reappear at the beginning of August, the Mallards and Coots being dominant. Maximum numbers of birds on the ponds (up to 40 000 at inspection) occur at the beginning of September. After some of the ponds have been drained, towards the end of September or at the beginning of October, the waders, especially Lapwings, whose numbers reach 9000 in October, start appearing. The Dunlin, Golden Plover, Grey Plover and geese are abundant. The latest passage migrants are noted towards the end of November.

The dynamics of spring passages on the sewage sedimentation basins is characterized by low numbers of birds (up to 400). Ducks are the first to appear and they go on flying over in small numbers all through the spring (except for the Garganey). Distinct passage can be seen in the Ruff, Greenshank, Redshank and Common Sandpiper, whose maximum numbers are observed towards the end of April or at the beginning of May. At that time the Black Tern and Little Gull have a peak in passage. The spring passage terminates by mid-May and only non-breeding individuals remain. However, as early as the end of May first Lapwings begin to arrive again. In the season of autumn passages the quantitative peaks (up to 1000 birds) fall in July and August. The Lapwing and Wood Sandpiper are dominant. Towards the end of September, after the drainage of the ponds at Starzawa, the passage on the sedimentation basins at Siedliska virtually comes to an end.

The main site of concentrations of birds in the middle San valley are the fishponds at Starzawa. In spring the concentrations exceed 5000 birds (on the average 1500 birds at an inspection). The Mallard, Lapwing, Black-headed Gull, Pochard, Tufted Duck and Ruff, which form 80% of the total of birds there observed, are dominant species. In autumn the concentrations reach 40 000 birds (averaging about 11 000 at an inspection). The Mallard, Coot, Lapwing, Black-headed Gull and Pochard are dominant and constitute 95% of the whole group. Both in spring and in autumn the numbers of the dominants show big fluctuations between particular years.

In accordance with the criteria presented by WESOŁOWSKI and WINIECKI (1988), the ponds at Starzawa should be protected under the scheme of the international convention Ramsar. More than 10 000 *Anseriformes* and 10 000 Coots assemble here regularly. There are only two other pond complexes in Poland, at Milicz and Przemków, which qualify for being included under conservation (WINIECKI & WESOŁOWSKI 1987).

The sewage sedimentation basins at Siedliska are of great importance to the migration of wading birds. Here they find favourable conditions for feeding and resting all year round. Their maximum concentrations occur in July and August, when the number of waders comes to 100 individuals and Lapwings and Wood Sandpipers form above 85% of the whole assemblage. LONTKOWSKI et al. (1988) number this type of environment among the localities of the greatest importance to water-and-marsh birds and, above all, to wading birds.

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