Summary

1. Previous research on the White Stork in Poland

Until 1974, no complete census of the White Stork nests had been carried out in the territory of Poland.

The first attempt at counting Storks in a relatively wide area was made by Eugeniusz Janota who obtained data from the region of former Galicia (Janota 1876) in 1876. Data concerning former East Prussia were recorded in early 20th (Braun 1906, Lühe 1912).

Later, and more particularly in the thirties, these studies were considerably intensified. A great number of quantitative data from 1934 were provided by the First International Census of the White Stork Nests initiated by Ernst Schüz. The results were presented as follows: for former East Prussia — in papers by Schüz (1933, 1936) and Tischler (1941), for the region of the lower course of the Vistula river and East Pomerania — by Lüttschwager (1932, 1936) and Pax (1932), for West Pomerania — by Dreyfeldt (1939), Gaedtke (1934) and Holzfuss (1934, 1935), for the Lusatian Region — by Gruhl (1929), Frase (1934, 1936), Pfüzenreiter (1932, 1933), for Wielkopolska — by Ołtuszewski (1937) and Szczepski (1935), for Silesia — by Brinkmann (1930, 1933, 1934, 1935), Czudek (1935), Ecke (1936), Pax (1923, (1925), Riegel (1937, and Wodzicki (1934), and for Malopolska — by Wodzicki (1933, 1935). For the region of East Prussia the quantitative investigations on the White Stork were summarized in the work of Tischler (1941). For Silesia the same was dane by Pax (1925). Absence of data from Mazowsze and Central-East Poland is noticeable.

In the post-war period long-term investigations on breeding effectivity of the White Stork were carried out by Mrugasiewicz (1959, 1972) in the valley of the Barycz river. Though Poland took part in the Second International Census of the White Stork Nests, the results published by Szczepski (1968) were considerably lowered and deficient as regards methodics. The results of censuses of the White Stork nests for the different regions of Poland were presented in the following papers: Agapow (1979), Bogucki (1967), Drzeżdżon (1980, Goc and Niepiekło (1980), Górski et al. (1977, 1980), Indyk et al. (1979), Kaźmierski (1969), Markowski et al. (1981), Mazaraki (1969, 1973, 1979), Noskiewicz (1969), Profus (1979), Profus and Mielczarek (1981), Radkiewicz (1971), Tomiałojć (1972), and Wojciechowski and Ogrodowczyk (1978). There are also some papers (Bajor 1975, 1979, Mierzwiński 1958, Panfil 1961, Piórecki 1970) presenting material not fit for comparison collected with disregard of generally accepted methodics; nevertheless Mrugasiewicz (1971) published the basic methodical principles for investigation on the White Stork. All the above-cited papers published after 1975 are the effect of the Third International Census of the White Stork Nests which in Poland was carried out by the Department for Nature Protection at the Polish Academy of Sciences in Kraków. The preliminary results of this census were published by Jakubiec (1978), and Profus and Jakubiec (1980).

The above papers show that in the post-war period studies on the White Stork were almost exclusively carried out in the west regions, whereas there were still no data from the central and east parts of the country.

Apart from papers on the number and breeding effectivity papers were also published about other aspects of the biology of this species. Age structure of population was discussed by Hornberger (1954), Mainz (1961), Mrugasiewicz (1972), and Creutz (1974). Numerous data on breeding biology were given by Braun (1906), Hoffman (1935), Lüttschwager (1936a), Mrugasiewicz (1972), Siewert

(1932), Schüz (1954) and others. The food taken by the White Stork was analysed by Stammer (1937), and Drescher (1936), this problem having been also discussed by Profus and Mielczarek (1981), and Sokołowski (1932, 1959). Phenology of flights and returns of the White Stork has been an object of interest for a long time. The first data concerning this subject were given by Wodzicki (1877), and further information published in papers by Lühe (1959), Śliwiński (1938), Tischler (1941), and Zabłocka (1959). Problems of migrations of the White Stork from Poland were discussed by Deyfeldt (1939), Mrugasiewicz (1972), Stadie (1939), Szczepski (1976), and Zabłocka (1959a). Wodzicki et al. (1938) were interested in their spatial orientation and speed of flight. The parasites of the White Stork were studied by Gudłach (1969), Sulgustowska (1964), and Złotorzycka (1959). Special attention was paid to the problems of the White Stork protection, seen, e. g., in the works by Czudek (1935), Ferens (1973), Ołtuszewski (1937), Rossendeutscher (1939), Sendek (1965), Wodzicki (1934), and others. We would like to point out that the generally expressed opinion that in Poland this species was declining in number seems unjustifiable. Simply, conclusions drawn from numerous papers concerning West Europe were uncritically extended to the area of Poland or else these views were based on the results of incomplete quantitative data (Szczepski 1968).

2. Methods

When research on the distribution and number of the White Stork in Poland was planned it was decided that a relatively uniform material from the whole area of the country might be only furnished through inquiry data. On the other hand it was indispensable to carry out detailed field censuses in order to obtain data on breeding effectivity and credibility of the inquiry data.

About 40,000 questionnaires were sent to all offices of village administrators through bailiffs. A typical letter to the administrators with enclosed questionnaire is cited in the text (Figs 1 and 2). The first decade of July was fixed as time-limit for returning the questionnaires. For the prevailing part of Poland this is considered to be the time when young Storks leave their nests, and thus are easiest to observe.

The questionnaire contained the following alternative answers: "No nest", "Nest vacant this year", "Nest with young", "Nest occupied by old Storks without young". In the first three cases the answers were univocal, only in the last case the answer might signify: nests occupied by the White Stork pairs where clutches or broods were destroyed, nests only visited by pairs of Storks which did not lay eggs, and finally — nests occupied by single birds. This vagueness was fairly often cleared up in the "Remarks" column.

Detailed field censuses were carried out with the aid of a group of helpers. Among them there were pupils of secondary schools, students and scientists. All helpers were supplied with an instruction which on the one hand was to help them in organizing the studies, and on the other was a to secure uniformity of the obtained material. This instruction was based on Schüz methods (1952) and the recommendations of the International Council for Bird Preservation (ICBP 1972).

Controllers were supposed to detect all Stork nests in a given area and to determine:
— how a nest was occupied (for the scheme see Table I),
— where it was situated,
— what was the distance from the nest to inhabited buildings,
and to furnish additional information such as: phenology of the breeding period, the number of unhatched, thrown-away eggs, dead chicks, food, frequency and the manner of nest occupation in previous years, age of nest, and human attitude towards Storks. The scope of such information largely depended on the personal ability and concern of the investigators.

Data on each nest should had to be written down separately, and after beeing summed up, the following indices had to be calculated: IZG, IZa, IZm and StD. Every helper had to send the control results (list of localities and results of the nest census) together with a short report) a few typewritten pages and standard tables) to the Department.

Apart from the standard symbols introduced by Schüz (1952) other indices were employed by some authors to determine certain parameters of the population under investigation.

In the report from the Poznań administrative district the following indices were used:
SBm — average number of pairs with young (HPm) per 100 km² *;
SBp — average number of fledgelings (IZG) per 100 km² *;
Pog — percentage of nests established with human aidsin relation to total number of nests occupied;
Poz — percentage of nests established with previous human aid to total number of nests occupied.

In the reports from the Rybnik and Wodzisław districts (51) and the Upper Silesia Industrial Region (52) the following indices were applied:
JZStB — number of young raised per 100 km² of meadows and pastures,
V — sum of eggs thrown out and unfertilized and dead chicks.

While working on the data as a whole, an additional difficulty has emerged on comparing the indices of breeding effectivity (JZa and JZm) on account of the different percentages of nests for which it was impossible to established the manner of nest occupation by a pair (HPx) or a number of young in a nest (HPmx). To diminish these differences as much as possible, the supposed total number of young (JZG) was calculated with the following formula:

$$(JZG) = JZG + (HPmx \cdot JZm) + \frac{(HPm - HPmx)(HPx \cdot JZm)}{(HPm - HPmx) + HPo}$$

The JZa index was computed taking into account the JZG value.

The district was a basic administrative unit accepted in the first phase of the research. The basic change in the administrative system of the country which took place in 1975 brought about the liquidation of districts and made it necessary to readjust the results. To avoid inconveniences connected with reference made to any administrative units the grid of squares based on geographic coordinates was accepted as the most useful to plot the results on. This grid is shown in Fig. 3 and will serve as basis for working out the census results in the second part of this work.

3. Results of detailed censuses on the White Stork population in selected regions of Poland

The distribution of the areas directly controlled was presented in the map (Fig. 3), the numbers given there corresponding to the sequence of reports contained in Chapter II.

One district, or sometimes more than one, was the basic territorial unit for the census. Only as far as the regions of Mrągowo and Sorkwity (12), Czerwin and Troszyn (14), Mońki (15), The Białowieża Forest (17), Warszawa (34), and Siedlce (37) were concerned, smaller areas were used. The reports listed in the present volume were based on long-term observations only in the case of the Białowieża Forest (17), Poznań (23), Rybnik and Wodzisław (51), and the Upper Silesia Industrial Region (57). The reports from Września (29), and Lubaczów (56) were based on observations from before 1974. Other reports were based on material from 1974 or 1975.

In each report the results of censuses were presented in three standard tables: "Results of the White Stork nests census in...", "Nest location of the White Stork in ...", and "Distance of the White Stork nests to the nearest occupied house in ...". If all nests were situated close to human settlements the latter table was excluded.

Apart from the standard data, a number of reports contain other information on the White Stork in the area investigated. The distribution of the White Stork nests was discussed in reports from the following districts: Strzelce Krajeńskie (3), Sulęcin (19), Międzyrzecz (20), Poznań (23), Kościan (24), Leszno (25), Śrem (26), Gostyń (27), Rawicz (28), Września (29), Ostrów Wielkopolski (30), Łęczyca (31), Sokołów Podlaski (36), Siedlce and Łosice (37), Białobrzegi (42), Lublin (44), Tomaszów Lubelski (46), Milicz, Oleśnica and Trzebnica (48), Brzeg (49), Opole (50), Bochnia (53), Dąbrowa Tarnowska (55), Leżajsk and Nisko, Krosno and Strzyżów (57). In over a dozen cases the distribution of the White Stork nests

* The whole area under investigation was taking into account.

was presented in maps. The predominant majority of authors found the nests concentrated along water-courses which was generally connected with larger areas of meadows and pastures. On the district scale they were sometimes even streams or small rivers. The concentration of nests close to larger complexes of meadows and pastures deprived of water-courses was sporadically mentioned. The occurrence of the White Stork "colonies" in 21 villages was reported from the following districts: Strzelce Krajeńskie (3), Kętrzyn (11), Słubice (18), Sulęcin (19), Leszno (25), Rawicz (28), Łowicz (32), Lublin (44), Zamość (45), Tomaszów Lubelski (46), and Leżajsk (57). In most cases these were concentrations of over a dozen nests, only in Lwowiec (Kętrzyn) there were 36 nests, in Kłopocie (Słubice) — 26, in Oleśniczki (Lublin) — 23. Information on several pairs nesting on one building or within one complex of buildings was given from Strzelce Krajeńskie (3), Kętrzyn (11), the Białowieża Forest (17), Rawicz (28) and Włoszczowa (41). The distance between such nests was only several meters, yet the young were successfully reared.

An interesting piece of information came from the Białowieża Forest (17) about 25 White Stork pairs nested for many years in the closed Białowieża Clearing of 14·3 m^2 superficy; thus, density amounted to 177 pairs per 100 km^2. This is the highest value of local density of the White Stork in Poland.

The problem of changes in the White Stork numbers in the particular regions of Poland has been engaging a good deal of attention; however, in view of the scarce number of data from the previous years they were just individual speculations or opinions expressed by the local population. The considerable decrease in the White Stork number as compared with the data from the early thirties of our century was recorded in the following districts: Nowy Dwór Gdański (7), Kościan (24), Leszno (25), Oleśnica (48), amounting, respectively, to c. 70%, 30%, 40%, and 16.5%. A smaller decrease, not exceeding 10%, was found to occur in the following districts: Choszczno (2), Kartuzy (4), Września (29), Milicz and Trzebnica (48), and Łowicz (32). There was also information about the decrease in number from Małopolska, in the Dąbrowa Tarnowska (55), and Leżajsk and Nisko (57) districts but the comparison with data the given by Wodzicki (1935) was difficult because of different methods applied and considerable underestimation of the results of these previous investigations proved by Czudek (1935). The stabilization of the White Stork number as compared with the data from before 40 years was demonstrated for the districts: Kętrzyn (11), Mrągowo (12), Poznań (23), Bochnia (53), and Nowy Sącz (54). The increase in the White Stork number was evidenced in the following districts: Szczecin (2), Legnica (47), Brzeg (49), Opole (50), Rybnik and Wodzisław (51), Lubaczów (56), Krosno and Strzyżów (57), and in the Upper Silesia Industrial Region (52). The increase in number always exceeded 20% sometimes even reaching 250%.

Local factors such as land reclamation or scarcity of place for nesting, which was connected with changes in roof covers, e. g. in the Nowy Dwór Gdański (7), Leżajsk and Nisko (57) districts, were considered to be the reasons of the decrease in number. This last factor seems to be less essential, though many authors mention it, beacuse according to the data from the Kętrzyn (11), and Bochnia (63) districts and from Silesia (Mrugasiewicz 1972, Profus and Mielczarek 1981), where a process of this kind was over a long time ago, Storks put up their nests in threes or on hard roofs as an aplty found substitute for the disappearing thatches. Another factor favoring the establishing of new nests was aid provided by local population as mentioned in reports from the following districts: Szczecin (2), Słubice (18), Sulęcin (19), Nowy Tomyśl (22), Poznań (23), Leszno (25), Gostyń (27), Rawicz (28), Ryki (35), Radzyń Podlaski (38), Wieluń (39), Brzeg (49), and Dąbrowa Tarnowska (55). This sort of aid as a common phenomenon and assumes various formes, as establishing supports for nests on roofs cutting trees short, and sometimes raising special free-standing constructions.

The process of replacing roofs thatched roofs by fire-proof covers has been considerably spreading in Poland. In many regions this constitutes a serious threat to many nests within a relatively short time. Information on this subject was given from the following districts: Wolin (1), Kartuzy (4), Żuromin (13), Mońki (15), Siemiatycze (16), Poznań (23), Śrem (26), Sochaczew (33), Włoszczowa (41), and Opole Lubelskie (43). The age of the White Stork nests was discussed in reports from the following districts: Szczecin and Choszczno (2), Kartuzy (4), Bochnia (53), Nowy Tomyśl (22), and Opole (50). From these two last districts the recorded stories of 90 and 100 years old nests were given. This species displayed a particularly strong conservatism. This manifested itself by persistent returns to nests situated in untypical or unfavourable places. For instance, there were reports from the Sulęcin (19) and Brzegi (49) districts on nests situated up on working industrial chimneys. The chicks were completely smoky, and black, in the first case they even choked. Yet the old birds, though shied off every year and despite

the fact that their nests used to be thrown down, always returned to the place once chosen and started on rebuilting their nensts.

Breeding effectivity and the reasons for the losses were discussed at lenght. Weather conditions were factors decisive for breeding effectivity in 1974, especially in Eastern and South-Eastern Poland. June brought a longer period of markedly cold weather together with intense rains which caused mass mortality among the young either as a result of soddening and cold or because of absence of food. In many regions of the country the mortality of the young exceeded 30%, and under specific conditions it was even higher than 70%. A disastrous effect of weather conditions on the White Stork broods was reported from the regions of Czerwin and Troszyn (14), Mońki (15), Siemiatycze (16), Słubice (18), Radzyń Podlaski (38), Włoszczowa (41), Białobrzegi (42), Opole Lubelskie (43), Lublin (44). Bochnia (53), Dąbrowa Tarnowska (55), Leżajsk and Nisko, Krosno and Strzyżowo (57). Struggles for nests were relatively often mentioned reasons of broody destructions as was found when censusing the following districts: Kętrzyn (11), Sulęcin (19), Kościan (24), Leszno (25), Śrem (26), Gostyń (27), Włoszczowa (41), Białobrzegi (42), Brzeg (49), and Opole (50). Losses in broods caused by brood destructions due to fights for nests amounted as a rule to a few per cent. Of the other reasons inducing in broods, of minor consequence only, the following were reckoned: trees broken, nests thrown down, by the wind, young or adult bird poisoning, predation, the young stung to death by swarming bees, nests with eggs or broods thrown down during repair works on buildings or electric lines. The report from the Białowieża Forest (17) gives the dependence of breeding effectivity on the total precipitation in May and June for 23 years (Tab. LI). In the report from the Poznań district (23) the effect of food base on breeding effectivity was discussed, whereas in the reports from the Wodzisław and Rybnik districts (51) the production of the young for 1925—1934 was compared with that for 1972—1980 and the dependence of breeding effectivity on the departure time of the young from nests was determined. The same problem was discussed in the report from the Upper Silesia Industrial Region (52). In both cases the thesis was confirmed that with the delayed beginning of broods (the latter being designated by the time of the young leaving their nests) breeding effectivity decreases. It is worth emphasising that in the reports from Września (29), Milicz, Oleśnica and Trzebnica (48), Leżajsk and Nisko, Krosno and Strzyżowo (57) the authors made an attempt at referring the results obtained to the natural physiographic units, such as mesoregions and have found differences in breeding effectivity between neighbouring mesoregions. Hence, it seems that infuture such natural units ought to be censused. It would allow for more univocal interpretation of the results obtained.

Information on causes inducing adult birds mortality is another point discussed in the reports from the following districts: Ostróda (10), Włoszczowa (41), Brzeg (49), Opole (50), Dąbrowa Tarnowska (55). The most often mentioned reason was knocking against live wires — 8 incidents, and among other reasons: herbicide poisoning — 3, exhaustion and hurts as a result of fights for nests — 2, knocking by a train — 1. It is alarming that most reasons inducing adult birds mortality is due to human activity.

Almost all reports comment on the attitude of humans to the White Stork, and the authors agree that this species evokes friendly feelings and comes under protection. However, there are obviously some exceptions to the rule and even occasional incidents of vandalism occur.

4. Tentative assesment of credibility of questionnaire data in confrontation with results of direct field censuses

Of the 39,041 questionnaires sent 31,815 were returned this amounting to 81.5%. When one takes additionally into account a number of collective answers usually informing about the absence of White Stork nests in many villages of a given community, the percentage of replies obtained will exceed 85. This is a very good result as compared with other investigations on the subject (Bednorz 1974, Bogucki 1967, Dyrcz 1966, Olłuszewski 1937, Szczepski 1968).

Only two out of 317 districts did not answer (Łask and Miechów). To determine the supposed number of pairs in their area the method of interpolation was applied: the mean density of the White Stork in the adjacent areas was calculated and its value referred to the given district; then, the supposed number

of pairs was estimated. The density for the Łask district calculated while applying this method appeared to be a little lower in comparison with the data for 1970 (Markowski, Trenda, Wojciechowski 1981).

The comparison of the inquiry data with the results of direct censuses was reduced to estimating the degree of credibility of basic parameters characteristic of the White Stork population: density of breeding pairs, breeding effectivity, percentage of pairs without broods or those which did not complete their broods. The Comparison was made by listing and comparing all nests and breeding pairs found in the area of a given district. Three categories were distinguished: nests or pairs found by both the inquiry and the census, nests or pairs reported only by the inquiry, and nests or pairs detected only by the census. On this base the supposed maximum number of nests and breeding pairs was calculated together with the percentage of nests found by the inquiry and the census. The results obtained were surprising because for 28 districts out of 72 which had been compared the census gave results lower than the inquiry.

The relatively high percentage of samples revealing better results of the inquiry is fairly understandable because a village bailiff had to furnish data concerning a small area well known to him, whereas a controler had to move in a territory unknown to him. However, it has been found that the bailiffs very often provided information derived from previous years reporting nests (sometimes even with the number of the young inside) vacant for a year or two. On the other hand, nests established in the year of investigations were very often omitted. In some cases when a nest was situated far from the settlements it was ignored or reported by several bailiffs. The percentage of nests vacant but mentioned as occupied by breeding pairs was sometimes fairly high; hence it will be more safe to accept that the inquiry data even by 10% higher than those of the census do not prove the last one to be ineffective.

When the census and inquiry results were compared, a serious difficulty was caused by different names of villages used by bailiffs and controllers which took place particularly in areas where there were many hamlets and dispersed buildings.

These and other similar difficulties caused that the differences in nest numbers were often greater than differences in indices of density, for instance, because the supposed maximum number of nests increased, this resulting in a decrease of the calculated coincidence of results by about 10—20%. This was found upon analysing in detail the data from the Bochnia district.

In the above-described case there were no reasons to accept the results of direct censuses to be related fully to the actual status of the White Stork, or to assume the inquiry data to be less reliable. Hence, it is practically impossible to establish the actual status univocally. So an attempt to estimate the degree of coincidence between the inquiry and census results was made in order to determine the degree of credibility of the inquiry results.

The efficiency of detectability of the White Stork nests was close to that of breeding pairs, depending on the method applied only slightly. In the sample analysed, on the average 71.4% of nests and 73.1% of pairs were found by the inquiry while the census revealed respectively 73.6% and 77.1%. When analysing the correlation between the percentage of nests and that of breeding pairs and the density of the White Stork, the constant trend to decrease the percentage of nests as the density increased was found to be marked (Fig. 24). A higher density was assumed as basis regardless of the source (inquiry or census) which its value derived from. On the other hand, the density influenced only slightly the percentage of credibility of results obtained with the inquiry method and by direct field censuses (Fig. 25). A particularly pronounced illustration of the degree of credibility of the inquiry data is the percentage of nests and breeding pair found in relation to the percentage of the returned inquiry questionnaires (Fig. 26). It shows that in the case when more than 60% of the questionnaires were sent back, the percentage of nests oscillated between 70% and 80%. This may be explained by the increase of proportion of negative answers in this testing group. The percentage coincidence of the density index values relating to the percentage of returned questionnaires (Fig. 27) shows that the following intervals may be distinguished: in 40% of answers — 50% of results were consistent, in 40—60% — 70% on the average, and 60% of answers — over 80%.

The listed comparison results have permitted to state that to estimate the approximate number of breeding pairs of the White Stork the following corrections should be taken into account:

— a percentage of questionnaires returned from the given district, and

— a density but with reference to an area somwehat larger than a district.

On this basis the table of corrections was constructed (Tab. CLXXIII).

The breeding effectivity expressed as an average number of young reared by a breeding pair (JZm)

was the second parameter analysed. The mean value of the breeding effectivity index obtained from the inquiry amounted to 109.2% with respect to the census data. The dependence of the percentage coincidence of the inquiry and census values of the JZm index on the values of this index calculated according to the census data was also determined (Fig. 28). The comparison showed that the inquiry tended to overestimate the low vallues and to underestimate the high ones.

The analysis of the results has proved that the breeding effectivity of the White Stork was estimated with an accuracy of +10% on the whole territory of the country; for half of the samples, however, this devitation was higher, the extreme values being mainly concerned.

The comparison of the coincidence of the percentage participation of pairs which failed to rear broods successfully (%HPo) shown by the inquiry and the census with the census data was presented in a diagram (Fig. 29). In this case the high values were also underestimated and the low ones overestimated.

5. Numbers and density of the White Stork in Poland in 1974

The White Stork occurs in the whole territory of Poland. In 1974 its presence was not reported in four districts only. They were districts including mountain areas: Nowa Ruda, Wałbrzych, Sucha Beskidzka and Limanowa. However, in this last case the first White Stork nest was established in the area in 1975 (Profus and Mielczarek 1981).

The inquiry data showed that in 1974 there were 31,802 nests in Poland of wich 27, 413 occupied by breeding pairs. 21, 858 pairs out of their total number had broods, while 5419 (19.8%) pairs failed to breed successfully. After the necessary corrections had been introduced the supposed numbers of nests and those of breeding pairs of the White Stork were estimated; they amounted to 37,389 and 32,223 respectively (Tab. CLXXXIII).

Accepting as a base the number of the White Stork pairs taken as a whole, the mean value of density (StD) calculated for the whole territory of Poland amounted to 10.2 pairs per 100 km^2. This is the very high in comparison with values from the countries situated to the west and south of Poland. The maximum density of the White Stork was found in the Bartoszyce, Braniewo and Lidzbark Warmiński districts where the StD value exceeded 40 pairs per 100 km^2. The index of density of breeding pairs per area of cultivated fields (StDSt) was also calculated. The mean value of this index calculated for the whole territory of Poland was 16.7 pairs per 100 km^2 of cultivated fields. The maximum density was found in the Goldap and Węgorzewo districts where the StDSt value exceeded 70 pairs per 100 km^2 of cultivated fields. The spatial distribution of the StD and StDSt indices presented in the maps (Figs. 30 and 31) showed that the highest densities of the White Stork occured in the area situated to the east from the Vistula river, particularly in the north-eastern part of Poland. In the western parts of Poland the densities exceeded the mean values for the country only locally.

In the area of Poland there is a distinct tendency to increase the White Stork density, from the lowest values in the south-west to the highest ones in the north-east (Fig. 32). Such a distribution is probably a result of the relatively recent territorial expansion of this species from the centre of the area situated in the south-eastern coasts of the Baltic Sea. This expansion is partly due to anthropogenic factors such as landscape transformations and changes in man's attitude towards this bird species. It may be accepted that the areas of lake districts situated along the south coasts of the Baltic Sea (in the past perhaps those of the North Sea, too) constituted the optimum part of White Stork area as regards biotope. This was the result both of environmental conditions and a low density of population. Earlier expansion might be probably prevented by the low number of the White Stork which was a result of predation and hunting. This was indicated by the following: mention made in the work of Mateusz Cygański — Bird Hunting; 1584; various advice for the different parts of the White Stork body, as well as whole birds, to be used to heal different diseases and poisons, described by Stefan Falimirz in his Herbarium from 1534; Storks used as food in hungry preharvest periods as related by Janota (1876). As some of Poland's regions had a greater density of forests, it seems that in the past the White Stork distribution was of patchy character; thus for instance, it tended to concentrate in river valleys. The White Stork nested within human settlements in the 16th century

(Knape 1975, Haverschmidt, quoted after Lack 1975). There is also information from Poland coming from the same century. In the herbarium mentioned above the detailed description of the Black Stork was given by Stefan Falimirz who stated: "... those did not nest close to human settlements but in swamps ...".

On the basis of the above it may be concluded that since the 16th century environmental transformations favourable for the White Stork were continuously intensifying in Poland coinciding with synanthropisation of this species. A considerable increase in the White Stork number was a result of these two processes. The still lasting expansion has come later. The rate and direction of this expansion is determined by the following facts: (1) not more than 100 years ago the White Stork crossed the Vistula river in its sector up of Kraków (Janota 1876, Profus and Jakubiec 1980), (2) in the course of the last 50 years the White Stork has been spreading over large areas in Lower Silesia, and (3) the White Stork continues to increase its range in the south of GDR as can be seen from the comparison of data from 1958 with those from 1974 (Schildmacker 1960, 1975). The continuation of this expansion is also evidenced by this bird's occupying intermountain valleys of the Carpathians and Sudeten (Folk et al. 1975, Profus and Mielczarek 1981, Stollman 1976, Suchanek 1965) and by the increase in number in many regions of Southern Poland, as indicated by Miczyński (1934), Profus and Mielczarek (1981), Tomiałojć (1972), and many authors of the reports included in the present volume.

Particularly significant data were given from the Legnica district investigated by Tomiałojć. He was able to demonstrate that in the course of the last 20 years a considerable degradation in the environment has been taking place there, and despite of this fact a pronounced increase in the White Stork number was observed in this area. It shows distinctly that the White Stork number remains still below the environmental capacity in a large part of southern Poland.

Translated into English by Mulgorzata Makomaska-Juchiewicz