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Studies on the Squacco Heron, *Ardeola ralloides* (SCOP.). Part II. Secular changes in the numbers and distribution in the palearctic range

Studia nad czaplą modronosą, *Ardeola ralloides* (SCOP.). Część II. Sekularne zmiany liczebności i rozmieszczenia w palearktycznej części zasięgu

Исследования по желтой цапле, *Ardeola ralloides* (SCOP.). Часть II. Вековые изменения численности и распределения вида в палеарктической части ареала

[with 5 tables, 24 diagrams, and 11 maps in the text]

INTRODUCTION

The aim of the present paper is to survey changes in the distribution and numbers of the Squacco Heron, *Ardeola ralloides* (SCOPOLI) in the palearctic part of the range in the course of the last two centuries. Under the pressure of the rapidly developing civilization, particularly in the last 100 years, the

species in question found itself in a considerable danger. The range of the palearctic part of its area, and even more significantly its numbers, underwent in the period mentioned considerable changes. And so the reasons justifying the taking up of the subject are as follows: a) numerical and spacial presentation of quantitative changes of *A. ralloides*, b) an attempt to explain scientifically this phenomenon, c) working out of methodological bases for a planned control of the species investigated, d) working out of a basis for an investigation on the spacial structure of the breeding area. This last item will be elaborated later and included in an ensuing publication of the series devoted to *A. ralloides*.

This paper is published at the time when the IWRB has initiated a far-reaching international plan, called MAR, and this provides necessary ground for the realization of temporary activities with the intention to protect this species, one of the rare and threatened among the water fowl and wading birds of Europe.

Methodological bases of this type of zoogeographical research have been formulated earlier by Fisher (1954). The history of investigations on the Squacco Heron, including also the problem of the zoogeographical research, was given in the first part (Józefik, 1969).

The subject undertaken will be developed as follows: a short description of the history of each of the breeding sites will be followed by a general analysis of the abundance of the species investigated, and all the changes in the number of both breeding sites and breeding pairs (the abundance of the species in the first period of the breeding season) will be taken into account. A cross-section and regional analysis of secular changes in the abundance will yield material for conclusions concerned with the spacial character of this phenomenon. The causes of such changes will be discussed in a separate chapter. In the presentation below the problem of the causes of secular changes will be considered only as far as it is affected by the antropogenical factor. Changes caused by climatic and biocenotic factors, and those being the result of the spacial distribution of the species will be discussed in the relevant parts of the series.

METHODS

Materials which have been used for the purposes of the present investigation come from the following sources: a) collected by the author in various parts of the breeding area, b) collected with the help of various questionnaires, c) derived from the ornithologial literature on the subject. In all the cases the aim was to determine the following data concerning individual breeding sites of *A. ralloides*: a) character of nesting in the case of each breeding site (regular, sporadic), b) determination of chronological data and history of each of the breeding sites.

The detailed distribution of field studies and their respective positions have already been published (Józefik, 1969). An important point of the field studies was the working out and application of suitable methods dealing with quantitative research a) in the breeding period, b) in the post-breeding period.

Breeding period. No universal method has been so far worked out, that is such a method which would enable to determine, quickly and easily, the number of herons nesting in a given colony. The method suggested by

ROMASHEVA (1938), trial areas in each of the colonies investigated, may yield positive results only in large, and nowadays so rare, ribbon-like colonies, while it is useless in the case of an island-like pattern of colony distribution, e. g. the Danube Delta, the Dniester Delta, etc. Moreover, as it was stated by SYROYETSCHKOVSKIY (1958), the method of ROMASHEVA, even in the conditions of the Astrakhan Reserve, can lead to a number of serious errors, and besides, is so complicated that it has been abandoned for several years.

The method used by KOENIG (1960), LUGOVOY (1959 1961a) and VINOKUROV (1959) consisting in a calculation with the help of an airplane or hovocraft, can give good results only in the case of species which are clearly discernible (*Egretta alba* (L.), *E. garzetta* (L.), *Platalea leucordia* (L.), and partly *Plegadis falcinellus* (L.)), while it is useless when applied for *Ardeola ralloides* and *Nycticorax nycticorax* (L.). And consequently the majority of authors gives either their estimates, or data based on the total calculation of all the nests in a colony.

In my practice I have used, beside the total calculation of all the nests during a periodical survey of the colony, a new, quite simple and technically easy method of indirect calculations. This method is based on the following premises: 1) the indices of return flights of adult birds coming back to the colony from their feeding places were calculated in relation to one nest in the course of one hour in various stages of the breeding cycle. It is obvious that this index can have different values for individual species. In the case of Squacco Heron its value, calculated on the basis of materials from the Dniester Delta, for morning hours (from 6^{00} to 9^{00} a. m.) changes from 0.7 to 1.6 in various stages of the breeding period (diagram 1). 2) When we know the num-

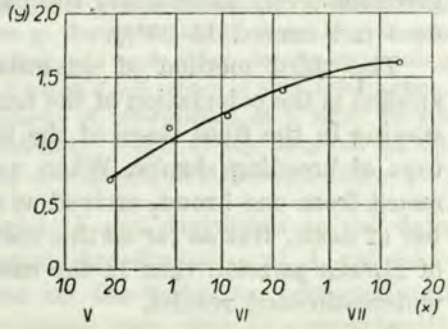


Diagram 1. Average frequency of flights of adult *A. ralloides* (SCOP.) individuals to breeding colonies in the Dniester Delta in various phases of the breeding period (number of flights per hour to a single nest between 6 a. m. and 9 a. m. East European Time); x — phenological period, y — number of flights per hour (value of index b).

ber of individuals returning in the course of one hour (taken from diagram 1), we can look up the value of the index of return flights against the respective date, and according to the formula suggested:

$$x = \frac{a}{bh} \tag{1}$$

we can calculate the number of breeding pairs in the colony (x — the number of breeding pairs, a — the number recorded of individuals flying back to the colony, b — the value of the index looked up in diagram 1 against the respective date, h — the time of observation expressed in hours).

The asset of this method is undoubtedly the fact that we can easily carry out the necessary observations even with the help of a spyglass at a distance of 1–1.5 km from the colony (e. g. putting up the spyglass in a sufficiently tall tree). This seems to be particularly important when we want to determine the number of colonies which are not accessible and dispersed in a large area of reeds. Good results can be obtained when the following conditions are observed: a) the entire colony must be seen by the observer, b) the area within the radius of at least 100 metres around the colony must be also controlled by the observer, c) the observations should be carried out in the hours mentioned above, when the weather is sunny and there is no wind (the index of return flights was calculated only for such conditions), d) the observer should conclude whether the breeding cycle of the colony, investigated from a distance, is delayed or interrupted. A good pointer can be here, as an indicator from the distance, the voice of the Night Heron (the intensity and character of the voices of adult birds and nestlings), which can be heard in the morning even at a distance of several hundred metres, as well as the appearance of young Little Egrets and Glossy Ibises on the tops of breeding shrubs — as they are those species with which the Squacco Heron can almost always be found. And so the method can be used in the case of island-pattern colonies, but not exceeding 400–500 nests of all the species living in the colony (when the colonies are larger it is impossible to manage to count so quickly). As I concluded in 1955 in the case of island colonies the "method of the index of return flights" gives relatively satisfactory results, the error slightly tending to underestimate does not exceed 15–20%.

The third method of quantitative investigations, which the author has applied is the calculation of the number of young birds, from a certain distance, staying in the final stage of the breeding period, late in the afternoon, in the tops of breeding shrubs. When we know the average number of young birds raised from one brood, arrived at empirically, we can calculate the total number of nests. But as far as this method is excellent for calculating the numbers of *Egretta garzetta*, then in the case of the species investigated it usually gives underestimated results.

The post-breeding period. In this period the quantitative investigation included only large breeding areas (e. g. the Danube Delta) and were based on the method consisting in the determination of the numbers of young birds remaining, as a rule, in the course of August and the first ten days of September within their own breeding areas. The most important point here was to determine the degree of dispersion of young birds outside the breeding area.

Hence in the initial stage it was necessary to calculate in the course of 4–5 days, and always within the same trial areas, including the feeding biotops, the density of young birds. When the density on each of the successive days is not differed, it proved that their nomadic movements had not started yet. The next stage was to determine the density of *A. ralloides*, along the routes 10–50 kilometres long, in the four main types of water bodies (main tributaries of the delta, canals of medium size, old river beds, lakes). In the period of the highest activity of feeding (8.^{00}–12.^{00} a. m.) the necessary counts were carried out from a cutter or a boat, obtaining in such a way the index of density for 1 km of the coastline. And then calculating on the bassis of a map (1:100 000) the length of the coastline of each type of the water bodies it was possible to find the total number of young individuals nesting in the entire delta. Having this index of the number of young birds leaving one nest, and after taking into account the mortality from the moment when the nest was left to the time of the calculations, the next step was to calculate the data enabling to determine the number of breeding pairs in the delta in the given breeding season. This method is applicable in the case of large breeding areas and must be based on the counting of young individuals. When the breeding period is over, adult individuals, as a rule, start immediately their nomadic movements characterized by a long range.

The questionnaire materials collected in seven countries between 1957 and 1962 were supplied by 22 scientific centers. These materials completed the missing links on the actual state of the numbers of the species investigated. The majority of forms contained information concerining several breeding sites in a specified region of the area (e. g. information supplied by the Institute of Geography, the Soviet Academy of Sciences, in Moscow, and it included all the sites in the northern part of the Caspian region).

Materials selected from the literature on the subject supplied the bulk of the information (c. 90%). It was gathered from 470, mainly faunistic, works. The oldest of them were written in the middle of the XVIIIth century (e. g. Brisson, 1760). Accepting as one information unit the abundance of a single breeding site and other details concerning only this particular breeding season, I have collected about 2,000 pieces of such information. A number of papers contained only one or a few pieces of information at a time. In all, together with the questionnaire and my own materials, I had at my disposal, on the average, 10 pieces of information per one breeding site (in all, 211 breeding sites).

The material collected should not give rise to any suspicions as the data obtained include all, or nearly all, the Palearctic breeding sites of *A. ralloides*. The representativeness of the data is based on the following premises and facts: a) *A. ralloides* is rare in nearly the entire area, and so consequently it presents considerable interest for the majority of faunist-ornithologists; b) it nests exclusively in colonies of other rare species (*Egretta garzetta* (L.), *Egretta alba* (L.), *Ardeola ibis* (L.), *Nycticorax nycticorax* (L.), *Platalea leucorodia* (L.), *Plegadis falcinellus* (L.), *Phalacrocorax pygmaeus* (Pall.) and others), which form one of the undoubtedly most attractive objects of ornithological investigations; c) the presence of *A. ralloides*, as well as all the other species

mentioned above, is easily detectable within any marshy area (even if their breeding colonies have difficult access); d) the territory of the almost entire breeding area in the last 100 years was covered with relatively satisfactory faunistic investigations; e) *A. ralloides* has a characteristic silhouette and can be easily spotted in the breeding season and the possibilty of mistaking it for any other palearctic species, even by an unexperienced amateur ornithologist, can be excluded.

In view of the circumstances mentioned the Squacco Heron can be included into the small group of palearctic species about which we have such copious materials that their distribution and numbers can be relatively easy and completely controlled.

The most laborious moment in the initial preparation of the material was the determination of the level of abundance for each of the breeding sites in separate half-centuries or twenty-years periods, taken as a basis for the purposes of the present paper. Although quite a number of breeding sites had been analysed from this point of view, I had in many cases to apply the indirect method, e. g. when estimating the numbers of *A. ralloides* according to the number of Night Herons or Little Egrets for the given breeding sites (proportions in mixed colonies where these species nested in a specified geographical region are usually the same), or to determine the numbers on the basis of a larger group of features described for the given breeding site (e. g. proportions of species ringed in a given colony, the frequency of flights to feeding places in the vicinity of the colony, etc.).

When I wanted to determine the length of time separate breeding sites existed (such data are usually quite satisfactorily dealt with in the literature on the subject) I used the following criterium: when there has been no mention of the site for the last twenty years, I have treated it as extinct; but when the given breeding site was mentioned for the first time in the period 1920–1960, it was placed in the respective decade of this period. When the existence of a site was mentioned for the first time before 1920, then I assumed, on certain grounds, that it might have also existed in the second half of the XIXth century. In the areas relatively less investigated (e. g. Mesopotamia) this limit was extended to 1930. I have to stress, however, that in view of the imperfection of the methods mentioned, dealing with the classification of historical material, there is a number of other shortcomings beside the fact of using a longer period of time, which can level many errors. The prevailing tendency is to underestimate the real level of the abundance of breeding pairs, the picture of the dynamics in terms of several years long cycles (cyclic fluctuations) is blurred, the effect of catastrophic factors (epidemics, droughts, etc.) is not reflected. The margin of possibilities is limited to the analysis of secular changes.

The method of cross-section analyses in relation to changes in the numbers of the species within the breeding area, consisting in treating these changes as average differences for separate classes of latitude in the meridian cross-section, and separate classes of longitude in the parallel cross-section of the area, has been introduced by the author to zoogeographic investigations as novum. This method is particularly useful in the case of areas elongated from E to W.

The dynamics of abundance is analysed here exclusively from the point of view of secular changes. In the analysis of the total abundance of the species

in the XIXth century it is usually given as an average for the second half of that century. For the XXth century I have used average values calculated for separate periods of twenty years. In the cross-section and regional analysis the average values were calculated only for the second half of the previous century, the first half of the present century, and for the present state, i. e. for the period including the years 1950–1962/3.

The methods to express quantitatively the material for the purposes of the present paper have been adapted to the possibility of developing the subject also from the point of view of general biological investigations. Specifically they are studies on the spacial distribution of the species and its structure. This problem includes such items as the concentration of the species, the zones of the range, the mechanism of the range changes and the formation of disjunctions, the minimum-limit values of the micropopulation, the whole group of problems connected with the internal isolation of the species and mechanisms of the genetical exchange, etc., will be taken as a basis for the successive parts of the series. However they will be based on materials presented in the traditional form of a zoogeographical research.

Here are a few comments on the terminology used and certain other methodological propositions. The concept "range of the species" is used to indicate the area of its occurrence in the full annual cycle. The range can be divided into a breeding area, migration area, and wintering area. I have taken the breeding site as the basic unit when investigating the area. This must not be mixed up with either the breeding territory or the breeding colony. I have treated as breeding territories, areas containing a specified, proper to the given species, group of biotops, within which the species investigated nested, is nesting, or can, potentially, nest there. Breeding territories occur in a mosaic-like pattern within the area, characteristic for the species. The breeding site usually covers a small part of the breeding area, and is usually called after the nearest administrative unit, and it can contain a few, and more often one or two, breeding colonies. Very often, particularly in the case of small, or medium size, bodies of water and swamps (most frequently lakes) nested by *A. ralloides*, the breeding site coincides with the given breeding territory. The breeding site is habitated by a micropopulation. And so it forms the basic type in which the species is grouped. The two concepts, "the size of the site" and "the size of the micropopulation", are used in the text in the same meaning, because in each case we are concerned either with the number of breeding pairs nesting in the site or making up the micropopulation.

The character of the species occurrence in separate sites, beside the quantitative aspect, shows significant differences. Because of that I have divided the sites into two main categories — regular and sporadic. But we may treat as a third category all those sites whose character is unclear, or which are doubtful in a given period or region (e. g. sites in the area of the Persian Gulf). Such sites are specially marked on the detailed maps, and they approach in their character sporadic sites. When there is good ground for it they are treated in the analysis as sporadic.

Regular sites are permanently nested by the species during at least 5–10 years within the area described as its site. This does not mean, however, that the species nests permanently in the same breeding colonies. Quite often they move about from year to year and such changes are not taken into consideration, providing they do not exceed

the limits of the site. But it was very difficult to sustain, for the whole area, the same proportions of site changes with the result of the Squacco Heron moving to the other, sometimes neighbouring, area (e. g. at the end of the previous century herons were recorded changing their sites at the mouth of the Theiss or the Drave, but those changes were insignificant, as far as distance was concerned, in relation to site changes within the Volga Delta, or the Amu Darya Delta).

Regular sites, particularly at the edges of the area, in the course of years were transformed into sporadic ones, and vice versa (e. g. sites. 63, 93, 109).

Sporadic sites can be divided into ephemeral and moderately stabilized. The ephemeral ones are usually situated outside the breeding area proper (e. g. sites. 17, 66, 67), while the moderately stabilized sites usually occur at the edges of the area.

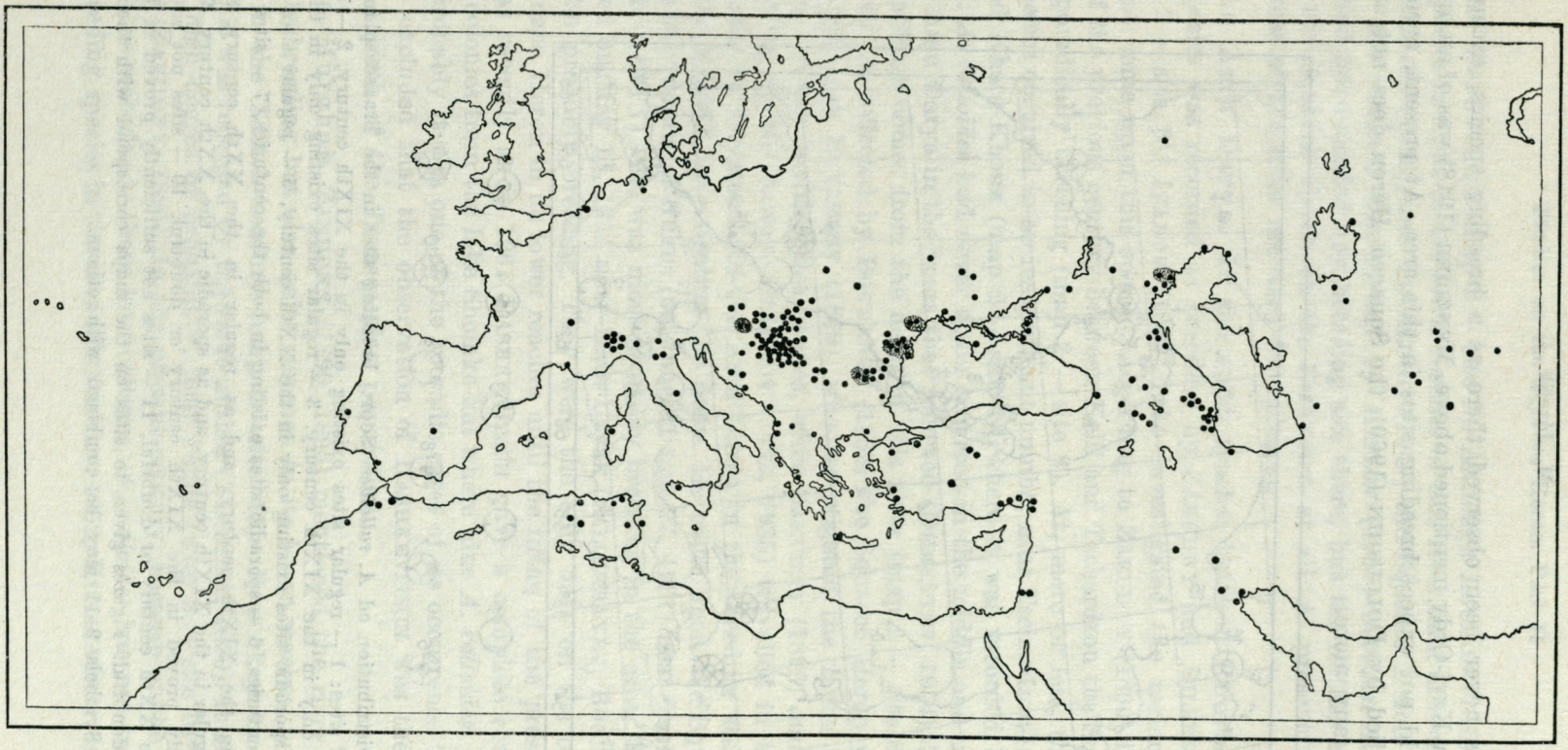
All the materials analysed in the paper are concerned exclusively with the numbers of breeding individuals, and so they do not represent the real size of separate micropopulations, or the general population. This problem will be discussed in the successive publications devoted to the dynamics of *A. ralloides* abundance in the annual cycle, mortality, and age structure of this species.

REVIEW OF THE BREEDING SITES

An introduction of the general review of the sites recorded in the XIXth and XXth centuries will help us to accept an opinion on the general biological situation of the palearctic part of the species which will be necessary for delving more deeply into the problems of secular changes in the abundance and distribution of *A. ralloides*. The review will also supply information on the history of some of the sites and will enable us to estimate the effect of certain factors influencing their fate. Map 1 illustrates the sites recorded in the last two centuries. In spite of an apparent dispersion they are grouped in a few centers. I have divided them into groups not according to their natural clumping with vague limits, but according to their position in separate sea catchement areas and tributaries. This has no particular zoogeographical significance, it simplifies the task of looking the sites up in the maps. The majority of materials, not mentioned in the review, was used in the statistical analysis.

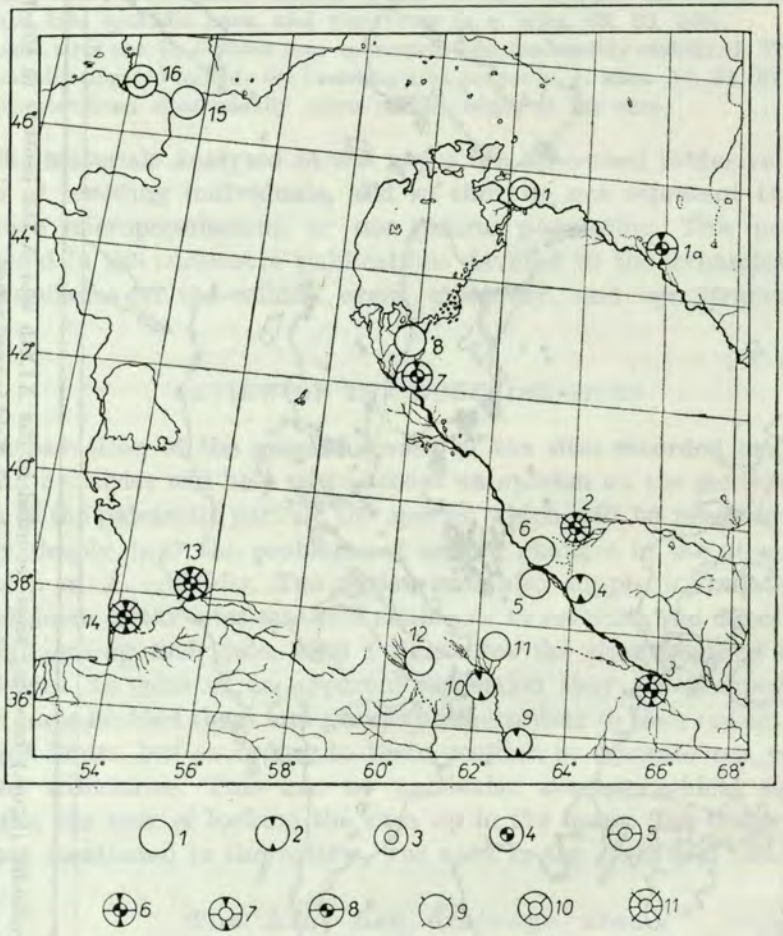
The Aral Sea drainage area

The Syr Darya (map 2 — sites 1, 1a). This river formed in the XIXth century the eastern frontier of the range. Specimen ♀ belogs to the earliest data. It was recorded in the delta by N. A. Severtzov. As it was concluded by Spangenberg and Feygin (1937) *A. ralloides* belongs to rare breeding species in the area between the delta and the locality Pulkovo. They found the breeding site for this river — they found four nests on May 28, 1925 on the lake Ayak-kul near Kzyl-Ordy. This historical breeding site has now zoogeographical significance, the more so that although Zarudny (1916) mentioned that the species nested on the Syr Darya sporadically and with long



Map 1. General distribution of *A. ralloides* (Scop.) breeding sites recorded in the XIXth and XXth century in the palearctic part of range; ● — breeding site, dotted areas indicate sites where the author carried out field investigation.

breaks, it has never been observed there as a breeding species, except the recording near Kzyl-Ordy mentioned above. MENZBIER (1918) was of an opinion that we should not expect breeding sites in this area. At present, according to data supplied by DOLGUSHIN (1960), the Squacco Heron does not appear on this river any more.



Map 2. Distribution od *A. ralloides* (SCOP.) breeding sites in the Transcaspian region. Indications of sites: 1 — regular sites existing only in the XIXth century, 2 — sporadic sites existing only in the XIXth century, 3 — regular sites existing only in the XXth century, 4 — sporadic sites existing only in the XXth century, 5 — regular sites existing in both the centuries, 6 — sporadic sites existing in both the centuries, 7 — sites existing as sporadic in the XIXth century, and as regular in the XXth century, 8 — sites existing as regular in the XIXth century, and as sporadic in the XXth century, 9 — sites not sufficiently proved in the XIXth century or doubtful, 10 — sites not sufficiently proved in the XXth century or doubtful, 11 — sites not sufficiently proved in both the centuries or doubtful. Figures given to sites on the maps correspond with their figures in the text. Symbols 9–11 may be combined with others.

The Zeravshan (map 2 — site 2). Although LOUDON (1910) came upon this species in April in the lower reaches of this river, and although, according to MENZBIER (1918), and TUGARINOV (1947) the Squacco Heron was breeding there, the research carried out by MASLOV (1957) between 1929–1949 not only had not recorded any breeding site there, but the author had not come upon the Squacco Heron on the Zeravshan at all. At present all the water resources of the river are used for cultures.

The Amu Darya. In the upper reaches between Kirovbad and Kelif the species was recorded as breeding by ZARUDNY and BILKEVITSCH (1918) (map 2 — site 3). IVANOV (1940), who investigated the region afterwards, did not come upon this species. According to ZARUDNY (1890) in the second half of the previous century between Kelif and Tschardzou the Squacco Heron was sporadically breeding (map 2 — site 4). At, more or less, the same time the species occurred in an insignificant number near Tschardzou (map 2 — site 5), and Khara-Khouz (map 2 — site 6), where it was recorded by ZARUDNY (1896). *A. ralloides* had never again occurred in the middle and upper reaches of the Amu Darya in the years that followed (DEMENTEV, 1954). The majority of recordings comes from the delta of this river (map 2 — site 8). According to materials collected by BOGDANOV (1882) the Squacco Heron was breeding there, although BUTLEROV (1879), who investigated the fauna of the delta in 1874, did not mention this species, while ZARUDNY (1896) quoted only the data given by BOGDANOV. GLADKOV (1932, 1935) travelled in a boat along the Nukus to the mouth of the Amu Darya in the breeding season of 1931, and also in 1933, investigating the delta. He came upon the Squacco Heron only in the vicinity of Nukus (on June 21 and 27, 1931) near Turkmen-Aralyk (map 2 — site 7) — it was most probably breeding in the area. The specimen recorded on May 13, 1944 near Kara-Uzyak (SALIKHBAYEV, BOGDANOV, 1961) was also probably breeding. They were the only data on the occurrence of the Squaco Heron in its lower reaches until the fifties of the present century. Only as recently as in 1961 RASHKEVITSCH gave a complete content of one of the colonies from the lake Shomke-kul where nine *A. ralloides* pairs nested. Most probably it was one of the sporadic cases of its occurrence there. It can not be excluded that the observation of RASHKEVITSCH was the first signal of the rebirth of the Transcaspian population.

The Murghab. ZARUDNY (1890, 1896) mentioned the river that it was not only breeding but also quite common in its lower reaches, near the oasis Merv, in the XIXth century (map 2—site 11). Near Yopotan (map 2 — site 10) it was recorded by the same author (ZARUDNY, 1896). It also occurred, with a high degree of probability, near Pende (map 2 — site 9) in its upper reaches (ZARUDNY, 1896). In the present century, because of the transformation of the waterlands there into cultures, *A. ralloides* has not been recorded as a breeding species in the area (DEMENTEV, 1952; KOKSHAYSKY, in litt. 1960).

The Tedzhen. The first recorded breeding site comes from 1887, and it was between the localities Tedzhen and Khara-bend in the lower reaches of this river (map 2 — site 12). It was recorded by RADDE and WALTER (1889). According to ZARUDNY (1896) *A. ralloides* was common in the region mentioned. In the XXth century, beside the occurrence of birds of passage, the Squacco Heron has never been recorded along the Tedzhen (DEMENTEV, 1952). This disappearance was connected, as in the previous cases, with land-reclamation.

The Caspian Sea drainage area

The Sumbar. According to the data presented by DEMENTEV (1952) and SHESTOPEROV (1937) *A. ralloides* nested, most probably, in the first few decades of the present century in the valley of this river (map 2 — site 13).

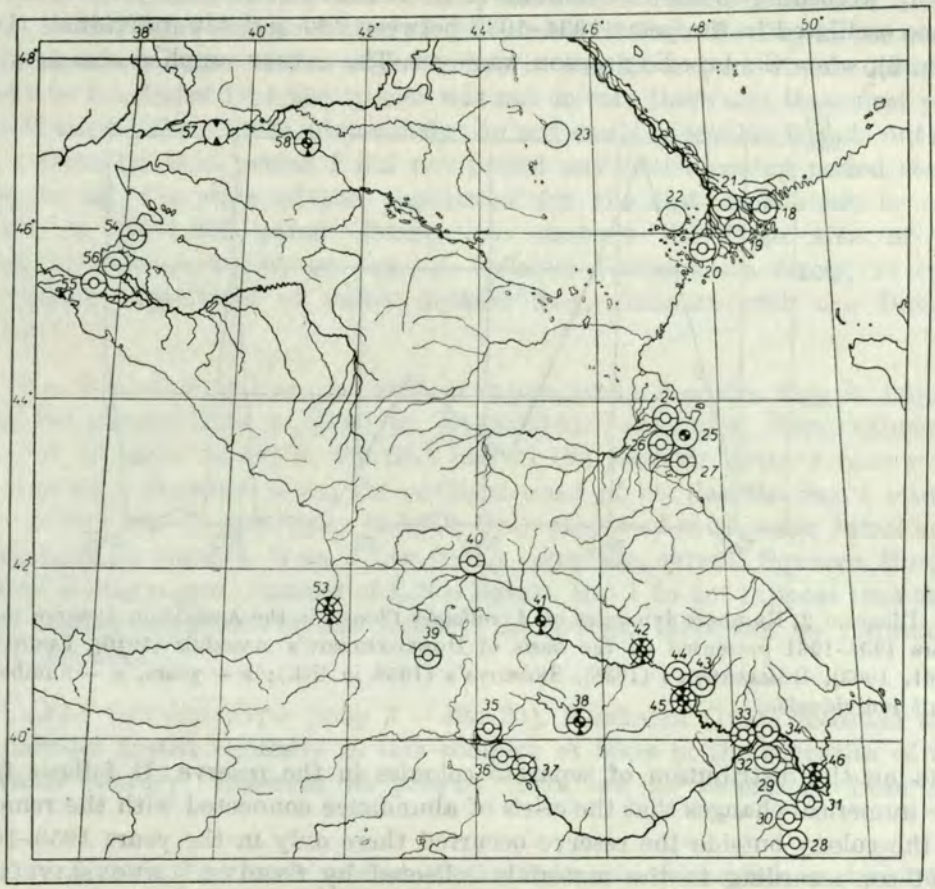
The Artek. There are no confirmed data from this river as well. DEMENTEV (1952) supposed that it nested in its lower reaches, and based his supposition probably on the recording of SHESTOPEROV (1937). ISAKOV and VOROBEV (1941), although they came upon a few individuals in the lower reaches of this river in May 1936, concluded that the Squacco Heron was not breeding there (map 2 — site 14). And so the problem of its nesting there is debatable.

Prorvinian Islands (map 2 — site 15). In the middle of the XIXth century *A. ralloides* nested on these coastal islands. Because of the lowering of the sea level the islands became connected with the land. Squacco Herons have ceased nesting there (DOLGUSHIN, 1960).

The Ural river (map 2 — site 16). 100 years ago the species occurred there commonly as breeding species. It follows from the data supplied by G. S. KARELIN (cited according to SYROYETSCHKOVSKIY 1955) that already in the seventies of the previous century its abundance decreased considerably. In the first decade of the present century BOSTANZHOGLO (1911) recorded a complete disappearance of the Squacco Heron. Although DOLGUSHIN (1960) supposed that it could go on occurring in a small number, a very detailed investigation carried out by SYROETSCHKOVSKIY (1955, in litt. 1958) proved a complete lack of its sites in the Ural Delta. According to the data obtained by the author mentioned this disappeareance occurred already in the twenties. It follows from the observations carried out by POSLAVSKIY (1963), and concerned with the return to the delta of *E. garzetta* and *N. nycticorax*, that the Squacco Heron will also return to the area which it had already occupied.

The Samara river. As it was recorded by ZARUDNY (1897), *A. ralloides* nested in the upper reaches of this river in the previous century. It was one of the few and exceptional sites situated to the north of the 50° northern latitude (the site not marked in the map).

The Volga Delta (map 3 — sites 18, 19, 20, 21). The first recorded breeding site of *A. ralloides* in the delta was given by EVERSMANN (1866 — cited after BOSTANZHOGLO, 1911). BOGDANOV (1871) stressed that in the first decades of the XIXth century this species was particularly common along the tributary Turinov and in the region of Siniy Moretz. Also YAKOVLEV (1872 — cited after SYROYETSCHKOVSKIY, 1955) supported this and related that in 1871 a person known to him collected more than 1,000 eggs of the Squacco Heron to be con-



Map 3. Distribution of *A. ralloides* (SCOP.) breeding sites in the western parts of the Caspian Sea drainage area and in the eastern parts of the Black Sea drainage area (signs as on map 2).

sumed in the vicinity of Astrakhan. Already at the end of the XIXth century in view of the fact that egrets were currently the vogue, the numbers suddenly decreased, although MENZBIER (1895) still stressed that it commonly occurred in this area. BOSTANZHOGLO (1911) pointed out that the observations of G. S. KARELIN from the seventies indicated a decrease in the numbers of

the species investigated. According to BOSTANZHOGLO in the years 1904–1907 the Squacco Heron belonged to very rare species in the entire area of the delta. The further situation in the delta was related by VOROBYEV (1936). After the Astrakhan Reserve had been set up in 1919, the numbers of *A. ralloides* increased again in the thirties — thes pecies started nesting in the Obzhorovskaya (map 3 — site 18), Trekhizbinskaya (map 3 — site 19), and Damtschitskaya (map 3 — site 18) parts of the reseve. This fact was also stressed by DOBROKHOTOV (1940). According to the calculations of ROMASHEVA (1938) the level of abundance oscillated in the years 1934–1935 between 400 and 430 individuals (Diagram 2), when the breeding season was over. The author supplied also detailed

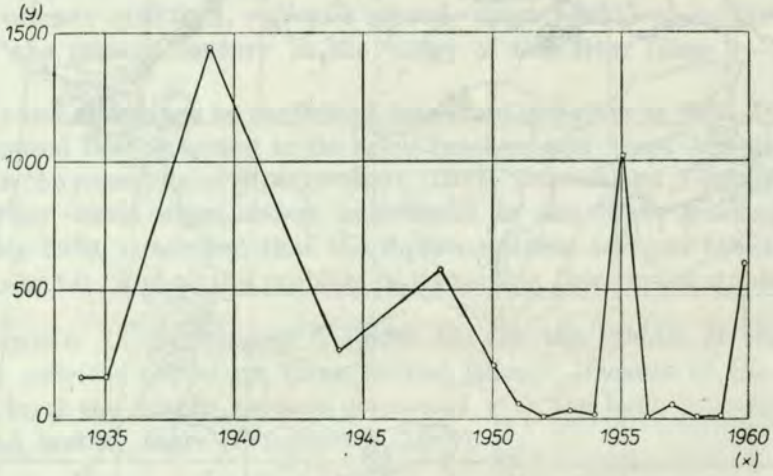


Diagram 2. Numbers dynamics of *A. ralloides* (SCOP.) in the Astrakhan Reserve in the years 1934–1961 presented on the basis of DOBROKHOTOV's materials (1940), LUGOVOY's (1961, 1963), ROMASHEVA's (1938), SKOKOVA's (1958 in litt.); x — years, y — number of adult individuals.

data on the distribution of separate colonies in the reserve. It follows from the numerical changes that the crisis of abundance connected with the removal of the colony outside the reserve occurred there only in the years 1950–1954. And so, according to the materials collected by SYROYETSCHKOVSKIY (1958 in litt.), the population of *A. ralloides* included in 1953 in the entire delta more than 800 adult individuals, and out of this number only 60–80 nested within the reserve. The rest nested in the colonies of the avandelta, on the newly formed islands. SKOKOVA (1958, in litt.) also pointed out that there occurred considerable oscillations in the numbers of this species in separate years. Detailed data on the distribution of *A. ralloides* in separate parts of the reserve were given by KOKSHAYSKIY (1958 in litt.). In the eastern Obzhorovskaya part *A. ralloides* did really stop nesting. However it was more numerous in the western Damtschitskaya part of the reserve. At the easternmost end of the delta it was

recorded near Ganiushkino village (DOLGUSHIN, 1960), although it was not mentioned by GALKIN (1961) when he was writing about other Heron species in this part of the delta. LUGOVOY (1963) estimated the occurrence of the Squacco Heron in the delta as frequent, although he stressed that the species was changeable in its quantitative dynamics.

In the first half of September, 1959, I wandered all over the eastern part of the delta including certain lakes in the steppes and I searched the breeding colonies, abandoned at this time of the year. I could record no nests of *A. ralloides*, but as there was a relatively high number of flocks feeding in the avandelta and near some of the water bodies in the lower part of the delta, it might be concluded that the species was not so rare there and that most proably it nested there quite numerously on not easily accessible islands outside the reserve (in that period I did not record any post-breeding period removals. In all, the state of the population for the last decade can be estimated at 500–1,000 pairs. Taking into account the large area of the delta, more than 14,000 sq. km., *A. ralloides* occurs there rarely, in spite of various suggestions of many authors (e. g. compare with the Danube Delta).

The Caspian lakes in the steppes (map 3 — site 22). It follows from the general data supplied by EVERSMANN (cited after BOSTANZHOGLO, 1911) *A. ralloides* nested in the first half of the previous century near some of these lakes dispersed along the northern coast of the Caspian Sea. I visited some of the lakes in the region in 1959. Only on one of them, near Astrakhan, I managed to observe, from a low flying aeroplane, several Squacco Herons feeding among a great number of Little Egrets. But I do not suppose that they were nesting anywhere in the vicinity. At present there are no recordings from this area.

Lakes Sarpinskiye (map 3 — site 23). MENZBIER (1918) recorded that *A. ralloides* nested regularly in this complex of lakes in the seventies of the previous century. However at present there are no recordings from the area.

The Terek. The lower reaches of this river can be treated as one of the less known permanent breeding sites. Although SEEBOHM (1883a), investigating in the eighties the ornitofauna of the Caucasus, recorded a common occurrence of *A. ralloides* along the Caucasian part of the Caspian coastline, he did not mention eggs from the Terek among other herons. Probably *A. ralloides* disappeared there very early as they were trading in heron feathers along the Terek particularly intensively. Materials collected by L. B. BEME (SYROYETSCHKOVSKIY, 1955) showed that the species did not nest frequently there in the years 1920–1930. SPANGENBERG and others (1951) supposed that it was breeding in the vicinity of Kizliar. SYROYETSCHKOVSKIY (1955), who searched thoroughly

the mouth of the Terek, found there in 1954 a small colony with six nests at Lake Olgino (map 3 – site 24). According to this author, *A. ralloides* may also nest on the Talovka, a tributary of the delta, as a small number of individuals were recorded there in the breeding period.

The Aktash (map 3 — site 26), the Sulak (map 3 — site 25). These rivers, forming a common drainage area in their lower reaches, contained breeding sites of the species investigated as late as 1925, according to the data presented by FORMOZOV (SYROYETSCHKOVSKIY, 1958). In the delta of the Sulak river *A. ralloides*, although not very numerous, occurred there as a common species. S. S. TUROV and D. B. KRASOVSKIY, who investigated birds of the "Oleniy Prisulakskiy" reserve situated in this region, did not mention the Squacco Heron at all (SYROYETSCHKOVSKIY, 1955). It follows from the interviews carried out among the inhabitants of the area that until the years 1930–1935 the Squacco Heron nested numerously in the delta of the Sulak river on Lakes Eki-Terekskoye and Mektebskoye (map 3 — site 27), as well as at the mouth of the Aktash river (SYROYETSCHKOVSKIY, 1958). Now it has not been recorded in these areas.

The Lenkoran Plain. This area covers the coastal belt from the mouth of the Kura river to the Iranian border. SEEBOHM (1884), who searched all over Lenkorania in the eighties, pointed out in connection with his discussion with de FILIPPI that *A. ralloides* was quite common there. RADDE (1885), the well-known investigator of the Caucasian ornitofauna, recorded large colonies of herons at the mouth of the Akusha rivulet (map 3 — site 29) where the Squacco Heron was numerously represented. It seems the more surprising that KESSLER (1878), who had earlier visited a part of these areas (e. g. "Bozhiy Promysel" at the mouth of the Kura river) did not mention the Squacco Heron at all. SATUNIN (1907) recorded a large number of Squacco Herons, particularly after the Araks had shifted to its new mouth across the Mugan Steppes to the bay of Kyzyl-Agatsch in 1894 (map 3 — site 31). The period at the turn of the century and the first two decades of the XXth century also in this distant part of the Transcaucasian region had its effect on the decrease in the numbers of herons. After the setting up of the "Kyzyl-Agatsch" reserve in 1929 the numbers of *A. ralloides* considerably increased although larger colonies were still outside it. According to TUGARINOV (1947) it was very common in the area. SPANGENBERG (1950), who was an expert in the fauna of Lenkorania, described colonies with large contingents of Squacco Herons. As it was recorded by this author (SPANGENBERG and others, 1951) the species was found on the marshy land along the Kura river down to the Iranian border. But although the literature on the breeding birds of Lankorania is relatively scarce, probably *A. ralloides* was not a numerous species there after the IInd World War. IVANOV (1952), who carried out observations in spring in the region of

the Vilazh-Tschay river (map 3 — site 30) was sceptical about the numerical state of this species. OGANESOV (1960), describing the colonies of the reserve, pointed out that the numbers of Herons started increasing as late as in the years 1952–1954. As reported by GREKOV (1965) this increase intensified considerably in the last 10 years. It follows from the materials presented by this author that more than 100 thousand pairs of Squacco Herons nested in the reserve in 1958. But when confronted with the data provided by OGANESOV (1960), TSCHERNIAVSKAYA (cited after GREKOV, 1965), and KOKSHAYSKIY (1958, in litt.) the numbers of the colony given by GREKOV seem to have been considerably exaggerated.

The Araks river (lower reaches, map 3 — site 34), the Mugan Steppes (map 3 — site 32). In the lower reaches of the Araks river *A. ralloides* was breeding but in an insignificant number. Only in the spring of 1894 the river which had been a tributary of the Kura, changed its course and started flowing across the Mugan Steppes and formed large inundation areas, marshes and lakes in a considerable area. And, as recorded by SHELKOVNIKOV (1909), it began occurring there numerously. This was also pointed out by SATUNIN (1907, 1912). In the last few decades, after the land had been reclaimed and the Araks had returned to its old bed, the species has been occurring there in a limited number — there is no information from the area at present. The species most probably occurs as well on Lake Sary-su (map 3–33) in the forks of the Araks and Kura rivers (DEBRIN, 1951).

The Araks river (upper reaches), lakes of Armenia and northern Turkey. According to SUSHKIN (1914) in Armenia, at the beginning of the XXth century, the Squacco Heron occurred frequently in the inundation areas and canals of Aralyk and Etschmiadzin (map 3 — site 35). At the same time it was breeding on the Kara-su river (map 3 — site 36) — a right-hand side tributary of the Araks river in the region of the Ararat mountains (BOBRINSKIY, 1915, 1916), where this author managed to collect a few specimens in the breeding period. DAL (1954) wrote about nesting along the Araks river (map 3 — site 37). According to the same author (DAL, 1954) the species nested irregularly on the Lake Sevan (map 3–38), which had been earlier recorded by RADDE (1885), but as he pointed out no breeing sites were found. LIAYSTER and SOSNIN (1942 — cited after SPANGENBERG and others, 1951) mentioned it also as breeding on the Lake Gilli. At the beginning of the XXth century a small number of Squacco Herons nested on the Lake Tschaldyr-gel (northern Turkey) where it was recorded by NESTEROV (1911) (map 3 — site 39).

The Kura. Along the Kura river and some of its tributaries an insignificant number of Squacco Herons occur mainly sporadically. In the twenties it nested in the lower part of Osetia (map 3 — site 40) (BEME, 1926 — cited after SPAN-

GENBERG and others, 1951). At more or less the same time it also occurred probably in the region of the Gardabani river (map 3 — site 41) as suggested by specimens shot there in the breeding period (JORDANIA, 1961). As supposed by KUTUBIDZE (1958 — in litt.) the species also nested in the valley of the Alazani river (map 3 — site 43). In the region of Agdash near the village Karadagly-Padar (map 3 — site 43) the Squacco Heron nested in a large colony in the first decade of the present century, which was abandoned by herons in 1912, and a new one was set up in the vicinity of the village Kasil (map 3 — site 44). This colony probably existed till the twenties as it was mentioned by MENZBIER (1918) in 1918. As pointed out by KUTUBIDZE (1958 — in litt.) *A. ralloides* did not nest in Georgia (except most prabably the valley of the river Alazani). However he did not exclude the possibility of its occurrence in the middle reaches of the Kura river (map 3 — site 45), and the view was supported by SPANGENBERG and others (1951). The same can be said about the lower reaches of the Kura river (map 3 — site 46).

Lake Mordab (map 9 — site 47). *A. ralloides* nests probably in the southern part of the Caspian Sea coast on Lake Mordab, where it was recorded by PASSBURG (1959). However there are no recent recordings supporting this view (GENENGER, 1968; SCHÜZ, 1959).

The Persian Gulf drainage area

The Tigris and Euphrates rivers. Large marshes cover the area between Al Kut and the mouth of the Tigris river, and the occurrence of *A. ralloides* there has not been sufficiently cleared up. According to TICEHURST, BUXTON, and CHEESMAN (1922) an individual with developed gonads was shot on the Lake Hammar on May, 19 (!). The Arab inhabitants firmly believed that the species did not nest there. On the other hand we have to take into account that the development of gonads takes place only when a community, such as a breeding colony, affects the individual. And so we might conclude that there is some possibility of *A. ralloides* nesting there (map 9 — site 48). Quite a number of young Squacco Herons were observed near Amara as early as June, 5 (!!) (map 9 — site 49) (TICEHURST, BUXTON, CHEESMAN, 1922). ALLOUSE (1953), however, did not mention the Squacco Heron when discussing the herons of this region. The two facts mentioned above decided that in spite of the lack of a direct proof that *A. ralloides* nested there, I have treated this region as a breeding area, the more so that *Ardeola grayii* (SYKES), which could substitute, potentially, the species investigated in this area of vast marshes, was not recorded there. Both CHAPMAN and MCGEOCH (1962) and MARCHANT (1962) supplied only copious information on the migrations of *A. ralloides*, although when we take into account the observations carried out on May 5 in the area of marshes near Baghdad and supplied by the latter, we could have good grounds for holding on to the view that it was sporadically breeding

there as well (map 9 — site 50). Except the observations carried out by NESTEROV (1911) there are no concrete data from the area up the Euphrates starting from the Lake Hammar. This author recorded *A. ralloides* in the region at the end of July, 1910 — and so they could have been those individuals which flew from the Transcaucasian region. According to TICEHURST, BUXTON, and CHEESMAN (1922), as well as MEINERTZHAGEN (1954), the species probably nested near Fao (map 9 — site 51), and in the area of marshes in Kuweit (map 9 — site 52).

The Black Sea drainage area

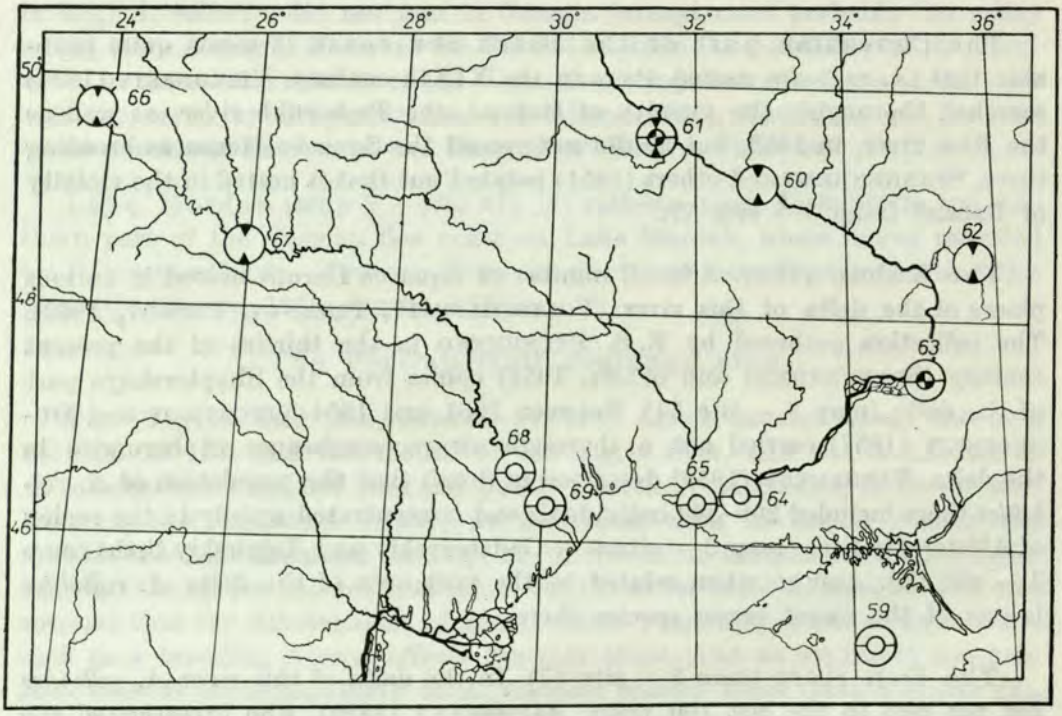
The Caucasian part of the Black Sea coast. It seems quite probable that *A. ralloides* nested there in the XIXth century. VILKONSKIY (1894) searched thoroughly the vicinity of Batumi, the Tschorukh river, as well as the Rion river, in 1893, but he did not record the Squacco Heron as breeding there. SPANGENBERG and others (1951) pointed out that it nested in the vicinity of Batumi (map 3 — site 53).

The Kuban river. A small number of Squacco Herons nested in various places of the delta of this river (VOLTSCHANSKIY, PUZANOV, PETROV, 1962). The collection gathered by E. S. PTUSHENKO in the thirties of the present century (SPANGENBERG and others, 1951) comes from the Shapterskaya part of the delta (map 3 — site 54). Between 1951 and 1954 VINOKUROV and DUBROVSKIY (1957) carried out a thorough air reconnaissance of heronries in the delta. VINOKUROV (1959) described in detail that the population of *A. ralloides* there included 200–300 individuals and concentrated mainly in the region of Akhtarskiy firth (map 3 — site 55), Gadzhievskiy and Talgirskiy firths (map 3 — site 56). And so when related to the vast area of the delta *A. ralloides* is one of the rarest heron species there.

The Don river (map 3 — site 57). In the delta of this river *A. ralloides* did not nest in the last 100 years. ALPHERAKY (1910), who investigated the area for a long time, had not recorded the Squacco Heron there before 1900, although he did not discard the possibility of its nesting there in the first half of the previous century.

The Manytsch (map 3 — site 58). In the vast drainage area of the river *A. ralloides* nests only sporadically. According to the data presented by OLEYNIKOV (1953) in 1948 the species nested on Lakes: Maloye Presnoye, Shnurovatoye, and Shakhayevskoye. As in the next two years the reeds there were burnt out and these reservoirs were emptied, the species was not recorded at the breeding sites. Only as late as 1952–1954 it started nesting again, but not very numerously, while in the years 1955–1956 its numbers considerably increased (OLEYNIKOV, 1958 — in litt.).

The Crimea (map 4 — site 59). The first information was recorded in the middle of the XIXth century by RADDE (1854), who pointed out that the Squacco Heron was quite rare there. MENZBIER (1895) recorded that it occurred in the mountainous part of the Crimea. *A. ralloides* appeared in the steppes only in the course of its flights. MOLTSCHANOV supplied more detailed data (1906), and he recorded breeding sites in orchards near Simpheropol in the northern highlands. PUZANOV (1931) reported sporadic nesting in the region of the Crimean reserve. In his next publication (PUZANOV, 1933) he included the species into the group of birds nesting not only in the area of



Map 4. Distribution of *A. ralloides* (SCOP.) breeding sites in the north-western regions of the Black Sea drainage area (signs as on map 2).

highlands but also in the steppes of the peninsula. SPANGENBERG and others (1951) stressed that the species occurred along the rivers flowing down the northern slopes, e. g. on the Salgir river. According to the recent data presented by KISTIAKOVSKIY (1958 — in litt.) *A. ralloidesis* not nesting in the steppes, while there are no data from the highlands.

The Dnieper. Along the Dnieper the Squacco Heron reached the northern regions of the Kiev district in the seventies (map 4 — site 60) (PORTENKO, 1950), and even higher as young Squacco Herons were recorded near

Kaniev (map 4 — site 61) (SPANGENBERG and others, 1951; TUGARINOV, 1947). According to BOROVIKOV (1907) the species nested sporadically, and its numbers varied, in the vicinity of Pavlograd (map 4 — site 62), while according to VALKH (1911) an insignificant number of Squacco Herons occurred in the southern, eastern, and western parts of the former Yekaterinoslavskaya province (Dniepropetrovsk). However, the earliest data, those supplied by KESSLER (1860), did not mention the occurrence of the Squacco Heron in the region of Kiev, although, as recorded by the author mentioned, it nested in large numbers in the lower reaches of the Dnieper. In the area between Zaporozhye and Nikopol, the so called "Konskiye Plavni" (map 4 — site 63), the species was breeding, in an insignificant number, in the last few dacades (PETROV, 1954). This author wrote in a letter (PETROV, 1958 in litt.) that *A. ralloides* was one of the rarest heron species in the area between 1947–1952. When the Kakhovskiy reservoir was set up and "Konskiye Plavni" covered with water, *A. ralloides* stopped occurring there, and according to KISTIAKOVSKIY (1958 in litt.) it has not been nesting anywhere further north, outside the delta.

The Dnieper Delta was a permanent breeding area (map 4 — site 64). Already KESSLER (1860) and MENZBIER (1895) pointed out that in the second half of the XIXth century *A. ralloides* occurred there numerously. According to the material collected by VELIKANOV (1936) the species was very often recorded in the thirties, but it was not one of common species. Most probably the population had not yet come to its own after its destruction in the first two decades of the present century. In the forties its numbers noticeably increased and, as it follows from the material presented by KLIMENKO (1950), it was as numerous as the Purple Heron. It nested not only in the delta but also in the Dnieper firth (map 4 — site 65). According to the material collected by ARDAMATSKAYA (1958 in litt.) *A. ralloides* was quite numerous there, as well as in the delta. Until recently it was not recorded in the vicinity of breeding sites in the Black Sea reserve. At present it nests on "Sokolinyi Ostrov" (GIZENKO, 1963). VOINSTVENSKIY (1962 in litt.) described the present state of its abundance as low, and recorded that it nested below Kherson.

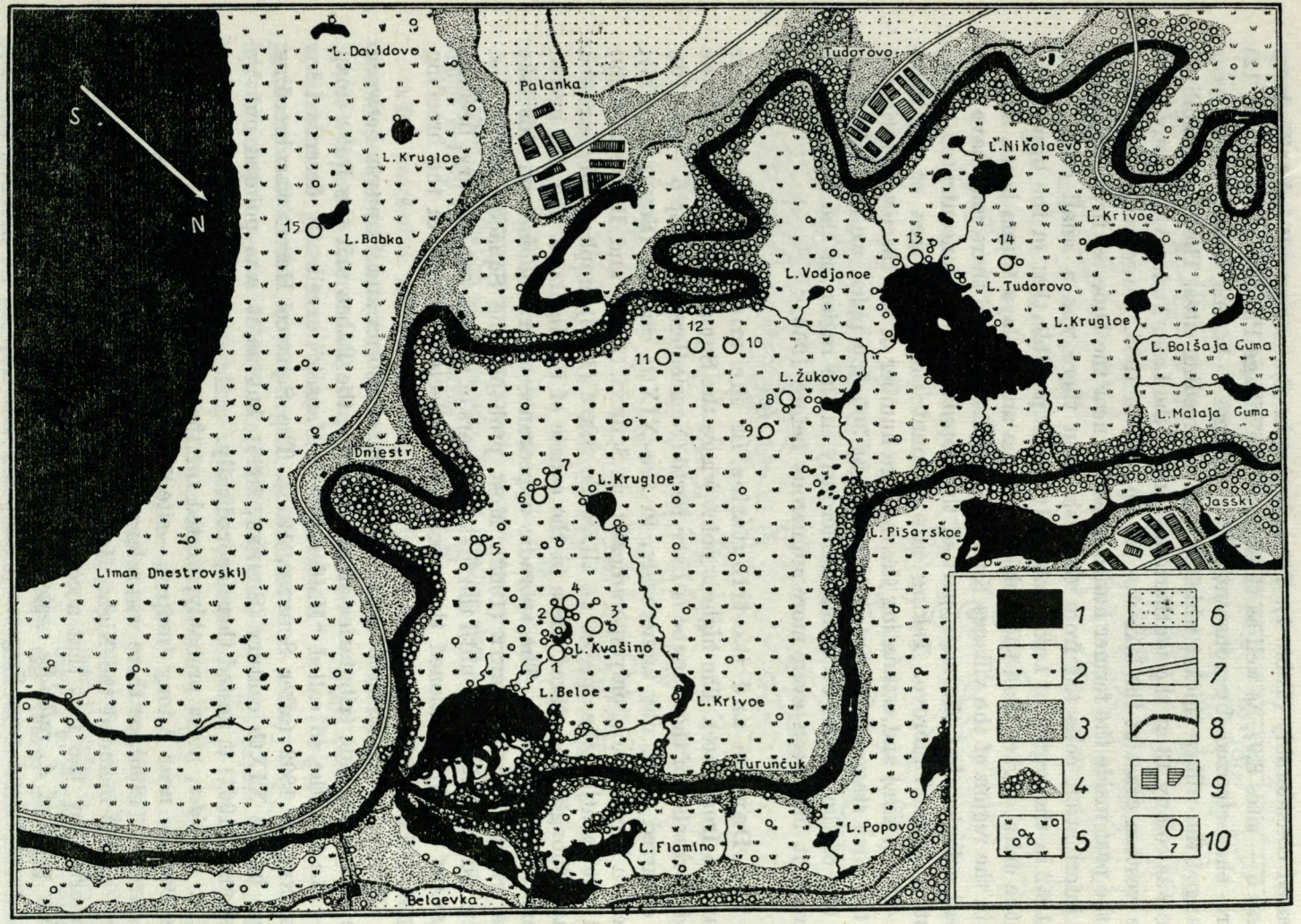
The Dniester. The lower reaches of the Dniester have always been one of the most optimal breeding areas for the species investigated. *A. ralloides* was recorded as breeding in the nineties by PRAŽAK (1898) in the upper reaches of this river on ponds near Gorodok. PRAŽAK seemed to find there 3 broods (map 4 — site 66). The other, exceptional and almost unknown in the literature, breeding site was Zaleszczyki (map 4 — site 67), and there in 1884 Squacco Heron nestlings were collected and stuffed. They were stored in the Dzieduszyccy Museum in Lvov, and given the following numbers: 1734, 1735, 1736 (DZIEDUSZYCKI, 1907). In the middle of the XIXth century the Squacco Heron occurred frequently in the lower reaches of the Dniester (map 4 — site 68),

which was recorded by KESSLER (1860). It was still very numerous at the end of the previous century (MENZBIER, 1895). As the species was universally destroyed, its numbers decreased also in the area of the Dniester (PATSCHOSKIY 1909, BRAUNER, 1912, 1916), and it became even rare (OSTERMAN, 1912a, b). Between the World Wars, when the frontier ran along the Dniester, the population considerably increased (SMOGORZHEVSKIY, 1953). It follows from the reports of the old inhabitants, whom I interviewed, that *A. ralloides* was more numerous in that period than between 1952 and 1955. According to the post-war reports (NAZARENKO, 1953, 1957; JÓZEFIK, 1954, 1957, 1960; NAZARENKO, JÓZEFIK, 1957) its numbers were relatively large. I am quoting below my own material concerned with the numbers and distribution (map 4 — site 69, map 5) of separate breeding colonies in the period 1952–1955. In this period colonies were mainly concentrated in the delta area between the Dniester and its tributary Turuntschuk. The largest community was in the region of Lake Kvashino (map 5 — sites 1, 2, 3, 4) where 4 main colonies were concen-

Table 1. Numbers of adult *A. ralloides* individuals in the Dniester Delta in the years 1952–1955.

Colonies (1)	Years (2)			
	1952	1953	1954	1955
(3) Lake Kvashino (nr 1, 2, 3, 10)	124	354	136	180
(4) "At the Dniester" (nr 4, 5, 6)	—	60	140	306
(5) Lake Zhukovo (nr 7, 13, 14)	200	140	160	70
(6) near Palanka village (nr 11, 12)	100	50	70	102
(7) Lake Tudorovo (nr 8, 15)	60	86	56	122
(8) Dniester Firth (nr 9)	30	—	—	—
Total (9)	514	690	562	780

trated, but it was variously occupied in successive years. Eastern colony 1, including a few subcolonies, was the largest one. Colony 2 increased considerably in the years 1954–1955. Colony 4 was completely destroyed by the fishermen at the beginning of May, 1952. Colony 3 was set up only in 1954. Oscillations in the numbers of Squacco Herons in the Dniester Delta are presented in Table 1. The complex of colonies, the so called "At the Dniester" (map 5 — sites 5,7) was set up in 1953. In the course of three years these colonies in-



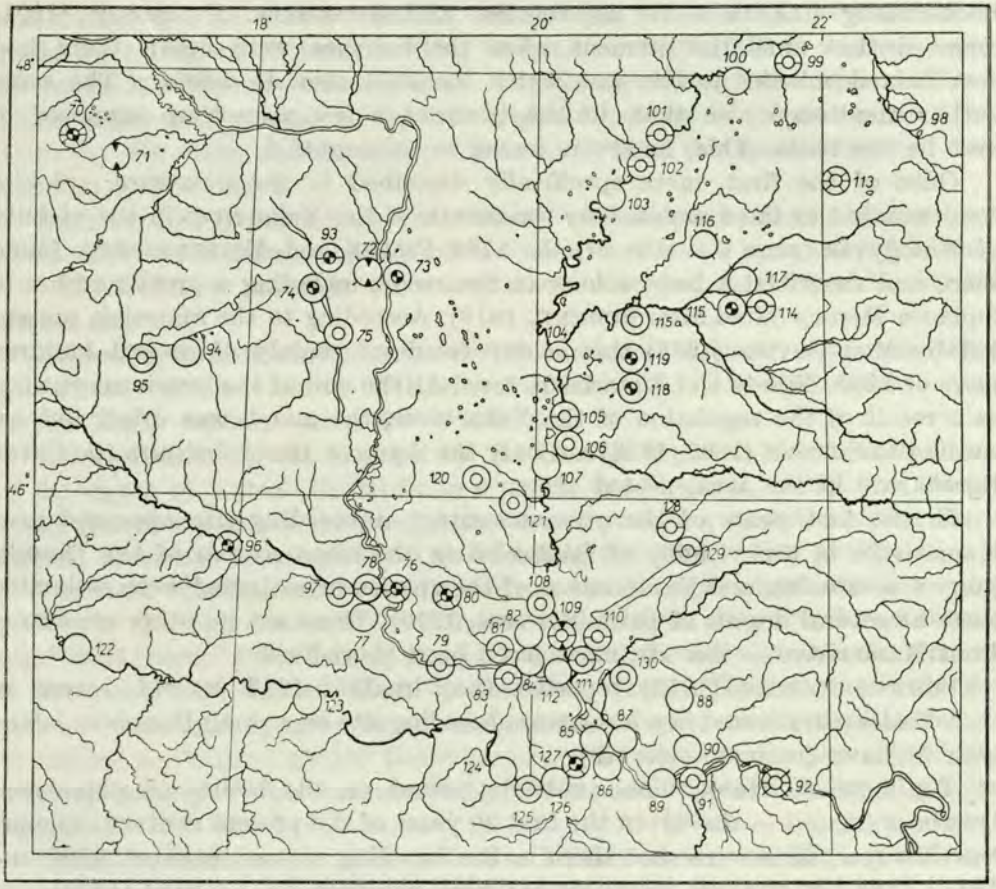
Map 5. Distribution of *A. ralloides* (Scop.) breeding colonies in the Dniester Delta; 1 — bodies of water, rivers, 2 — areas overgrown with reeds, 3 — meadows, 4 — forests, 5 — clumps of hamous willows among reeds, 6 — steppe, 7 — roads, 8 — banks of river terraces, 9 — settlements, buildings, 10 — breeding colonies of herons.

creased considerably (Table 1). The colonies in the region of Lake Zhukovo (map 5 — sites 8,9), as well as those near the village Palanka (sites 10, 11, 12) were characterized by constant place changes — herons nearly every year changed the willow thicket which served as breeding sites. The most stabilized one was colony 13 at the southernmost end of the Lake Tudorovo. Colony 14 at the western coast of the lake was set up only in 1955. Large heronries existed in the past inside the former hunting reserve near the Dniester firth. According to information collected from the fishermen there was a small colony still in 1952 in the region of Lake Babka. It seems possible that in the upper part of the delta, higher than the Bolshaya Guma and Malaya Guma lakes, as well as in the region of the villages Kopanka and Tschobrutsi there may have been small colonies, but the main part of the population was concentrated to the east of Lake Tudorovo. Taking into account the small area of the delta (c. 450 sq. km.) and estimating the average number of the species investigated in the first stage of the breeding period at 300–350 pairs, we can take it to be one of the species occurring numerously in the region of the Dniester, although it had been even more numerous before 1950.

The Danube and its tributaries in the middle reaches (higher than the Iron Gate). The highest point where the Squacco Heron nests in the middle reaches of the Danube is Lake Fertö (Neusiedlersee — map 6 — site 70). It occurred here, not numerously, in the XIXth century (Schenk, 1896); later on it could nest only sporadically, as Schenk (1918) and Breuer (1929) did not mention the species at all, while Seitz (1935) emphatically stressed that although it appeared there in the course of its flights, it had not nested there for a long time. The sporadic appearance of *A. ralloides* on this lake was recorded by Sterbetz (1962). Most probably the Squacco Heron had occurred there regularly until the first few years of the present century, because Vasvári (1939) mentioned the speciemens collected in 1901 in the breeding period.

There is a similar situation in the region of Csorna and Kapuvár between the right-hand side tributaries of the Danube, the Rábca and the Raba (map 6 — site 71), the so called "Maiden Marsh Hanság" excellently described by Chernel in 1892 (after Schenk, 1918). The Squacco Heron was breeding there in the XIXth century (Schenk, 1896), but as it was pointed out by Sterbetz (1961) it nested there sporadically.

A. ralloides, most probably, nested on the so called "Heron Island" on the Danube near Adony (map 6 — site 72), although it was not mentioned by Schenk (1896), as there was a large mixed colony there in the XIXth century, and it included the Night Heron and the Little Egret. It seems to be supported by the fact that according to Keve's information (1958 in litt.) a few pairs of *A. ralloides* nested in 1957 in the same section of the Danube on Csepel Island near Szigetcsép (map 6 — site 73).



Map 6. Distribution of *A. ralloides* (Scop.) breeding sites in the drainage area of the middle reaches of the Danube (signs as on map 2).

A few pairs of *A. ralloides* nested, according to Sterbetz (1962), in fish-ponds near Soponya on the canal Sárviz in 1958 (map 6 — site 74).

The Squacco Heron has been nesting for several tens of years in a colony on the artificial pond near Rétszilas in the region of Székesfehérvár (map 6 — site 75) (Pátkai, 1955; Štollmann, 1957 in litt.). According to Szijj (1954) 40 pairs were recorded there in 1951. In 1957, as reported by Keve (1958 in litt.), a small number of Squacco Herons occurred there, while Sterbetz (1962) provided data on the numbers of the species in the years 1949–1958 (diagram 3).

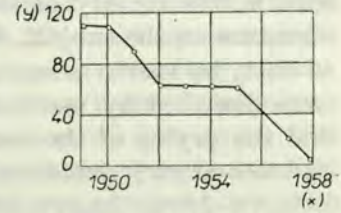


Diagram 3. Numbers dynamics of *A. ralloides* (Scop.) near Rétszilas — Hungary (according to Sterbetz's materials (1962)); x — years, y — number of adult individuals.

Down the Danube the next known breeding site was situated on the marshes near Szond —

Bács-Bodrog (map 6 — site 76) in the XIXth century. FERNBACH (1921) reported that until the moment when the marshes were dried, there had been mixed colonies in the area which included also *A. ralloides*. The same author mentioned also that in the twenties a few pairs were supposed to nest in the reeds. This, however, seems to us doubtful.

Ones of the first, more specifically described in the literature, colonies were situated in the marshes near the mouth of the Vuka river in the vicinity of Kologyvar (map 6 — site 77). In 1782 PILLER and MITTERPACHER found there and described a large colony in the reeds, including a great number of Squacco Herons (cited after SCHENK, 1918). According to the materials presented by MOJSISOVICS (1885) this colony consisted mainly of several hundred pairs of Little Egrets and Squacco Herons. At the end of the previous century, as a result of the regulation of the Vuka river, the marsh was dried, but according to SCHENK (1896, 1918) not only the Squacco Heron but also the Cattle Egret, rare in the area, nested there.

In the first years of the present century a breeding site appeared near Kamaristye in the vicinity of Bácsordas in the same section of the Danube (map 6 — site 78), and the numbers of the species investigated were estimated there at several dozens of pairs (SCHENK, 1910). There are no other recordings from Kamaristye — the site must have been short-lived.

SCHWEPPENBURG (1915) reported that in 1912–1913 several dozens of *A. ralloides* pairs nested in a less known breeding site on a small Danubian island near Mohovo (map 6 — site 79).

The Squacco Heron most probably nested on the bodies of water near Overbász (map 6 — site 80) in the first 30 years of the present century, as more than 20 specimens were shot there in the breeding seasons between 1907 and 1934 — the list of these materials has been provided by VASVÁRI (1939).

Old river beds, drainage areas and marshes near Ujvidék (Neusatz, presently called Novi Sad) (map 6 — site 81) belonged to a vast complex of marshes stretching along the Danube as far as the mouth of the Theiss and further east to the mouth of the Temes river. That is why, when investigating breeding sites in the vicinity of this town on the basis of the data derived from the literature on the subject, I could not always find their exact position, the more so that the nearby sites, e. g. near Zsablya, Kabol, or Karlovci, or even Titel, were discribed by many authors jointly. Until the regulation of the Danube and the drying of the marshes at the end of the XIXth century *A. ralloides* had nested very numerously and in many colonies near Ujvidék (BERGE, 1902; SCHENK, 1896; SZLÁVY, 1908). According to the latter, about 500 pairs of the Squacco Heron were recorded there in 1897, while in 1901 BERGE (1902) found only 150–200 pairs. Later on the numbers rapidly decreased. A new and very large colony, in which *A. ralloides* numbered about 200 pairs and was dominating (SCHENK, 1911), appeared only in 1911 owing to the setting up of the so called "Kátyi Rét", a new body of water in the vicinity of Káty. Until

and during the Ist World War the colony went on existing but its numbers gradually decreased (SCHENK, 1912a, b; SZLÁVY, 1919). But it was not recorded when the heronry ceased to exist. At present, although the Squacco Heron is not infrequently found on the left-hand side of the Danube near Novi Sad (CSORNAI, SZLIVKA, ANTAL, 1959; TERRASSE, 1961), the species has not been recorded in the region.

SCHENK (1896) mentioned the vicinity of Zsablya in the neighbourhood of the previous breeding site as a place where there was a permanent site (map 6 — site 82). Most probably the colonies were situated on the marshes on the Theiss side*.

According to SCHWEPPENBURG (1915) there was a small colony including *A. ralloides* in the vicinity of Karlovci (Karlócza) in the first several years of the XXth century (map 6 — site 83).

Before reclaiming the marshes by the Danube Squacco Herons also nested in the region of Kabol (Kovil) (map 6 — site 84) (SCHENK, 1896), but already in the first few years of the present century *A. ralloides*, as well as other heron species, were not recorded there as breeding (SCHENK, 1908, 1918).

The next breeding site was situated on the Danube islands in the region of Semlin (Zemun, Zimony) — on the so called "Gém Sziget" (Heron Island) and "Hadi Sziget" (War Island) (map 6 — site 85). It was visited in the autumn of 1835, and later on described, by NAUMANN (1837). However he could not find out the exact specific composition of herons only on the basis of nests. According to SCHENK (1918) these heronries did not survive the end of the previous century — this was caused by the harmful effect of the nearby town (Zimony).

Similarly, there was a heronry in the XIXth century on Huja island between Zimony and Pancsova (Pancévo) (map 6 — site 86), but as it was described by SCHENK (1918) on the basis of a relation by the inhabitants of Pancsova the heronry was desroyed at the end of the century by traders in feathers.

At the mouth of the Temes river near Pancsova *A. ralloides* nested on such islands on the Danube as Ovčanac, Vorkuntumez, Stefanac, and Čakljanac (map 6 — site 87). This information, as it was stressed by SCHENK (1918), was supplied by trustworthy hunters from Pancsova. The vast marshes situated of the left-hand side of the Danube were used by herons as feeding grounds. This breeding site, as well as the one mentioned above, were destroyed by poachers in the last few decades of the XIXth century. As late as in 1907 SCHENK (1908b), during his voyage down the Danube, observed a great variety of herons in this region but he did not record any colonies on the islands. Also NAGY (1921) stressed that although *A. ralloides* was recorded from time to

* Also in the XIXth century the species investigated may have nested, with a high degree of probability, on the marshes near Csurog upon the Theiss, where other heron species also occurred (SCHENK, 1918). This possible breeding site has not been marked on map 6.

time in the region of Pancsova, no breeding sites were found there. GÉROUDET (1958) visited this region in 1957. He described the destruction suffered by the biotops which had been so numeously populated by herons in the past.

A very interesting breeding site near Alibunár (map 6 — site 88) was described by ZERGÉNYI (1924). At the beginning of the XVIIIth century pelicans, as well as many heron species, were nesting there. At the end of the XVIIIth century the marshes were dried, but herons went on nesting there until the sixties of the previous century. In the twenties of the present century, as it was related by ZERGÉNYI, *A. ralloides* appeared on the remains of the marshes only in the course of its migrations.

In the region of Temeskubin (Kevevára) (map 6 — site 89) *A. ralloides* nested all through the XIXth century (SCHENK, 1896). Colonies had existed there until 1895, and this information was supplied by SCHENK (1918) who based it on the observations of MENESDORFER. The colonies were destroyed by the inhabitants of the neighbouring area, who cut down the trees together with the nests. Already in 1908 SCHENK (1908) did not find any breeding sites there.

All through the previous century the species investigated nested in the region of the mouth of the Morava river. It was quite numerous there and nested in many colonies in the section of the Danube between Temeskubin and Dubovácz (Dubravica) (map 6 — site 90). According to the data presented by an observer from Temeskubin, and quoted by SCHENK (1908b), a breeding site in the region of Mramorak, the so called "Mramoraki-Okna", was known at the end of the XIXth century. In the upper part of these marshes 10–12 pairs nested, while 80–100 pairs nested in the lower part, that is in the so called "Kör-Okna". From several to a few dozens of Squacco Heron pairs nested in the next breeding site including a few colonies (map 6 — site 91) such as, "Bella", "Bratkovácz", and "Belo blato". The Squacco Heron occurred also numerously in the colony "Gájai erdo". The colonies mentioned were being robbed systematically in the breeding season by traders in feathers, and their numbers rapidly decreased. This was also intensified by the cutting down of breeding treestands. *A. ralloides* still occurred in 1902 in the colonies "Kör--Okna" and "Gájai erdo", but as the last trees were cut down in 1907, SCHENK who visited the area a year later did not record any Squacco Herons (SCHENK, 1908).

The last breeding site before the Iron Gate is the one near Moldova (map 6 — site 92). *A. ralloides* was recorded there in 1912 by LINȚIA (1913).

Lake Velencze (map 6 — site 93). *A. ralloides* had been nesting on this lake all through the previous century (SCHENK, 1896). In the first few decades of the present century the species nested there most probably only sporadically, as for example in the spring of 1934 RADETZKY (1934) recorded there quite a number of them, but later in the summer months did not find any

nests. The specimens collected on Lake Velencze and described by VASVÁRI (1939) come from the same period. SCHENK (1942) supplied data on the colony near Dinnyés in the region of this lake, where *A. ralloides* nested as late as in the nineties, and the species occurred there in the fourties of the present century. Of the more recent data I want to mention the observations from the years 1940–1958 carried out by FODOR and KEVE, and described by STERBETZ (1962).

Lake Balaton. *A. ralloides* nested there near Fonyód on the marshes called "Nagyberek" (map 6 — site 94) (SCHENK, 1896). After the marshes had been reclaimed at the turn of the century, the Squacco Heron, together with other species, abandoned this site (SCHENK, 1918; STERBETZ, 1962).

The reserve Kisbalaton (map 6 — site 95) is one of the best investigated breeding sites. It is situated at the south-western end of Lake Balaton, forms an oldmarsh, which still preserved a relatively large area in spite of all efforts in land-reclamation. Heron colonies have existed there probably for centuries, but they aroused interest only in the last few decades of the previous century. Kisbalaton and its heronries were mentioned for the first time in 1886 by SZIKLA, while in 1891, when the colonies were visited and described by TSCHUSI (cited after SCHENK, 1918) and a few other eminent orni-

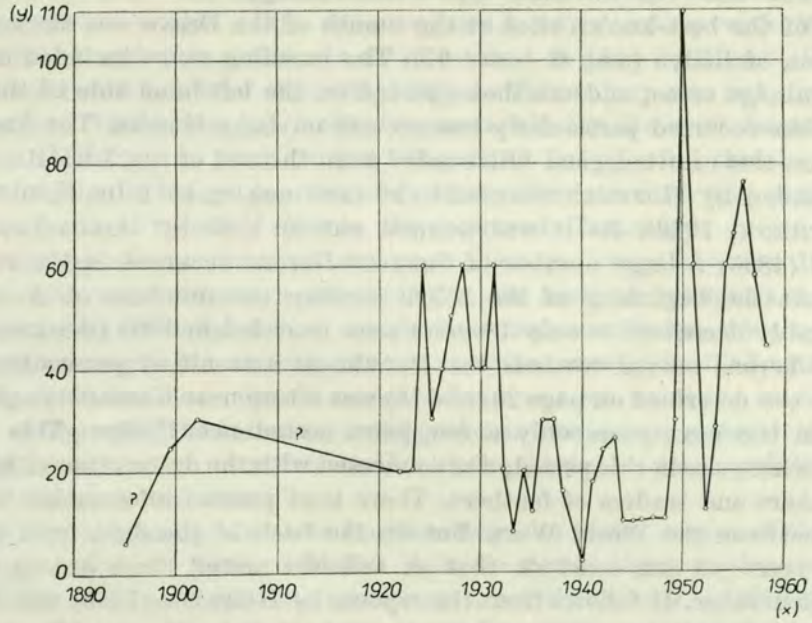


Diagram 4. Numbers dynamics of *A. ralloides* (SCOP.) on Kisbalaton (Hungary) in the years 1895–1960 presented on the basis of SCHENK's materials (1909), STEFFEL's (1959), SZIJJ's (1954), WARGA's (1954); x — years, y — number of adult individuals.

thologists, it found itself in the centre of interest. According to the data presented by SCHENK (1896) *A. ralloides* occurred there in the XIXth century regularly, although not very numerously. In the last few years of that century only a few pairs nested there; the beginning of the XXth century was a period of a severe crisis caused by traders in feathers (SCHENK, 1918). Nonetheless 36 Squacco Heron nestlings were ringed there in 1909 (SCHENK, 1909). Just before the Ist World War its numbers increased, and in the twenties there was a marked improvement. Since then the numbers of herons have been recorded every year (Diagram 4); however the numbers have never exceeded 30 pairs (SCHENK, 1924; WARGA, 1954). *A. ralloides* has been there one of the least numerous species (FÖLDVÁRY, 1929; SCHENK, 1925; WARGA, 1929). The period 1932–1949 was characterized by a general decrease in the numbers (WARGA, 1938, 1954). In the last ten years the numbers have reached the highest level so far, as 55 pairs nested there in 1950, 33 pairs in 1955, 38 pairs in 1956 (STEFFEL, 1959; STERBETZ, 1962; SZIJJ, 1954; VERTSE, 1950; WARGA, 1954).

The Drave river. As it was pointed out by SZIJJ (1954) the colony near Nemetpalkonya (map 6 — site 96), the highest of those presented so far, is a doubtful site. The permanent symbiont of the Squacco Heron, the Night Heron, has not been recorded there; on the other hand the Gray Heron was found. The site was included here conditionally.

One of the best known sites at the mouth of the Drave was the colony in the region of Béllye (map 6 — site 97). The breeding range included old river beds, drainage areas, and marshes situated on the left-hand side of this river. *A. ralloides* occurred particularly numerously on Lake Kopács. The first information on this ornithological "Eldorado" from the end of the XVIIIth century was recorded by HOFFMANNSEG, and the next one in 1871 by HODEK (cited after SCHENK, 1918). As it was pointed out in 1885 by DALLA-TORRE and TSCHUSI (1885) a large number of Squacco Herons occurred in the region of Béllye. At the beginning of the XXth century the numbers of *A. ralloides* considerably decreased — only 18 pairs were recorded in 1908 (SCHENK, 1909). In 1910 herons moved towards the Danube as a result of persecutions, and then the site described on page 26 (site 78) was set up near Kamaristye (SCHENK, 1910). In the next years only a few pairs nested near Béllye. This decline, as everywhere else in this period, was connected with the destruction of heronries by poachers and traders of feathers. There is of precise information from the period between the World Wars. But on the basis of the data from the last several years we can conclude that *A. ralloides* nested there but in an insignificant number. It follows from the reports by HORVÁTH (1955) and RUCNER (1962) that breeding conditions in the region of Lake Kopács (Kopačko) remained unaltered; recently hundreds of pairs of Squacco Herons nested there, and this species was dominating among the herons.

The Theiss. This river is one of the few tributaries of the Danube with breeding sites distributed almost along its entire length. The review here is started from those situated in the upper reaches.

The vast marshes "Ecsedi láp" (Ecsed) (map 6 — site 98) were the highest, situated at a certain distance from the valley, breeding site. Quite a large number of Squacco Herons nested there in the XIXth century (LOVASSY, 1931; SCHENK, 1918; VASVÁRI, 1939). This site most probably ceased to exist before 1930 (STERBETZ, 1962).

The species also nested near Kémecse (map 6 — site 99) until the thirties, according to the materials of L. NAGY quoted by VASVÁRI (1939).

It follows from the data collected by SCHENK (1918) on *Egretta alba*, that *A. ralloides* may have occurred near Tiszalok in the last few decades of the previous century (map 6 — site 100).

According to the observations carried out by SZOMJAS (1918) a small number of Squacco Herons (e. g. 6 pairs in 1915) nested on an island on the Theiss near Hortobágy (Tiszakisfalud) (map 6 — site 101) in the first two decades of the XXth century.

According to the data presented by SCHENK (1918) and concerned with *E. garzetta*, colonies including *A. ralloides* nesting there probably existed in the XIXth century in the region of Bihar Sárret as far as Hortobágy (map 6 — site 102). These breeding sites, not situated more precisely by SCHENK, can be described as "the region of Hortobágy". The colony near Tiszakisfalud mentioned above is also in the same region. A mixed colony with 300 pairs of *A. ralloides* and *N. nycticorax* was discovered in 1946 by NAGY (1950) on an old river bed 5 km from the village Egyek. This colony was not mentioned by UDVARDY (1960) who was collecting materials for the ornitofauna of the region of Hortobágy in 1943. On the other hand he supposed that 3 (?) pairs may have nested in this region. It follows from the data cited that *A. ralloides* has no permanent breeding sites in the region of Hortobágy.

The history of the breeding site near Tiszaigar (map 6 — site 103) was quite precisely related by SCHENK (1918) on the basis of SZOMJAS's materials. This colony may have existed on an old river bed even before 1864 when the Theiss bed was regulated. In 1876 the old river bed was again filled with water. And already in the next year a mixed colony was set up there, and a large number of Squacco Herons were nesting there. The colony existed till 1885, that is till the moment when this section of the Theiss became regulated again and the old river bed dried up.

There are not many data on the breeding site in the region of Csongrád. According to SCHENK (1896, 1918) *A. ralloides* nested there in the seventies and eighties. Most probably the species occurred there until the fifties of the present century, and it follows from the information collected by STERBETZ (1962) that a few pairs began nesting there in the years 1952–1956 (map 6 — site 104).

A. ralloides nested at the end of the previous century near Hódmezövásarhely (map 6 — site 105) (SCHENK, 1918), however there is a complete lack of more detailed data. It can be supposed that the species was breeding near Hódmezövásarhely-Barcirét also in the first years of the XXth century, as well as later near Szunyogos (STERBETZ, 1962).

A. ralloides nests relatively regularly near the previous site in the Sasér reserve on an island on the Theiss (map 6 — site 106). Detailed data have been recorded since 1948 (CZIGÁNY, 1955; FESTETICS, 1959a, b; STERBETZ, 1950, 1954, 1957, 1958, 1960). According to the data presented by the authors mentioned, as well as the materials sent by STERBETZ (1962 in litt.) the numbers of the Squacco Heron (Diagram 5) oscillated between 10–100 adult individuals. An increase in the numbers occurred more or less regularly in the course of 5–6 years, and then during one year there was a sudden decrease. In the colony at Sasér there was an interesting regularity — two very similar cycles in the numbers dynamics occurred in the course of 14 years. According to the data presented by STERBETZ (1962 in litt.) a new colony was set up on the island of Labodar in the region of Sasér in 1959. 10 pairs of *A. ralloides* were there in 1960, while in the next year there was only one pair (?!).

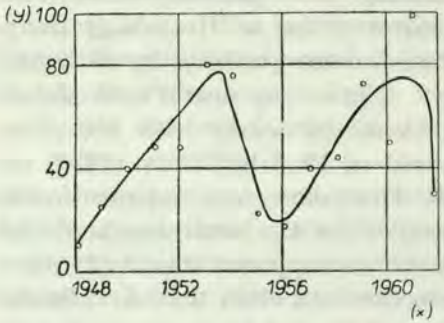


Diagram 5. Numbers dynamics of *A. ralloides* (SCOP.) in the Sasér reserve (Hungary) in the years 1948–1962 (according to FESTETICS's materials (1959), STERBETZ's (1962, in litt.); x — years, y — number of adult individuals.

The site near Szeged (Fehérto) (map 6 — site 107) has been known since the middle of the XIXth century. LAKATOS mentioned it in 1884 (cited after SCHENK, 1918), and later on SCHENK (1896). At the beginning of the XXth century *A. ralloides* was probably not nesting there, and appeared only in the course of its migrations (BERETZK, 1943, 1950; SEBESS, 1934). It has returned to nest there in recent years (BERETZK, 1964).

In the lower reaches of the Theiss, already outside Hungary, the following breeding sites were recorded: the species nested near Bačko Gradište in the thirties of the present century (map 6 — site 108), and it was ringed there (MAŠTROVIČ, 1947).

On Lake Féher-tó near Lucácsfalva (map 6 — site 109) *A. ralloides* occurred probably sporadically and in a limited number at the beginning of the XXth century, because SCHENK did not mention it at all there, although he mentioned the species in the case of the site situated 6 km more to the south, i. e. near

Fehér mocsár. And so it is difficult to decide when *A. ralloides* started nesting at the site mentioned. About 150 pairs were nesting there in 1955 (Csornai, Szlivka, Antal, 1959).

In the middle of the XIXth century the area covering Fehér-tó, Carska Bara, Feféŕ mocsár, and marshes near Titel, were visited and described by Baldamus (1851, 1852). According to him the Squacco Heron nested numerously in this area. But it is not known whether it did not nest at Carska Bara (map 6 — site 110). Schenk (1896) in his faunistic work also did not mention Carska Bara as a breeding site, while 20 years later (Schenk, 1918) he stressed that there had been no earlier data from this area. The same was pointed out by Szlivka (1958). It follows from the recent data that a large number of Squacco Herons nest at Carska Bara. After the IInd World War there were favourable breeding conditions there, and e. g. in 1956 about 200 pairs were recorded (Csornai, 1959; Csornai, Szlivka, Antal, 1959; Kroneisl-Rucner, 1958 in litt., 1962; Popovič, 1960). The setting up of a reserve at Carska Bara contributed to the preservation of this site, which was in danger in the first several years of the present century (Schenk, 1918; Szlivka, 1959).

As it was already mentioned when discussing Carska Bara, *A. ralloides* occurred in the XIXth century on Fehér mocsár, that is the so called "White Marsh" (map 6 — site 111) situated in the vicinity of Perlasz (Perlez) (Schenk, 1896) also called Perleska Bara. It is difficult to determine the numbers of *A. ralloides* there until 1950, because as it was pointed out by Popovič (1960) the colonies were constantly on the move within the larger area on the left-hand side of the Theiss, which was called in the past "Dugo Blato". The present site near Perlez goes on prospering which was related by Géroudet (1958) and Goetz (1959).

On the right-hand side of the Theiss, more or less from the town of Titel as far as the Danube, the so called "Belo Blato" — the famous "Hungarian Nile" (not to be mixed with the so called "White Marsh" (Fehér mocsár) on the left-hand side) — stretched over a large area. It was particularly famous in the XIXth century or even earlier. It is almost impossible to situate separate colonies there as even before the reclamation of "Belo Blato" it joined vast marshy areas along the Danube as far as Ujvidek (Novi Sad) (Schenk, 1918). I have decided to call the areas along the Theiss Titel breeding site (map 6 — site 112). It follows from rare descriptions provided by the ornithologists of the time (Baldamus 1851, 1852; Marsili and others (cited after Schenk, 1918); Schenk, 1896, 1908b) that the Squacco Heron nested there in tens of large colonies. In the years 1860–1870 the marshes near Titel were reclaimed, but even at the end of the XIXth century there were preserved large remains. Unfortunately there are no sources that could give us an idea of the richness of herons near Titel. At the turn of the century the Squacco Heron, as well as the Little Egret and Greater Egret were killed by traders in feathers with great fervour.

Tributaries of the Theiss. According to the report of ANDRÁSSY (1957) *A. ralloides* nested in colonies of other species at the beginning of the XXth century in the drainage area of the Ér river in the region of Étmihályfalva (map 6 — site 113). It follows from STERBETZ's description (1962) that the site is prospering at present.

According to the data presented by STERBETZ (1962) 10 pairs of Squacco Heron nested in 1958 in the drainage area of the Körös river near Biharugra (map 6 — site 114).

3 pairs of *A. ralloides* nested in 1951 in the region more to the west in the neighbourhood of Zsadány (map 6 — site 115) (SZIJJ, 1954). Earlier the two sites mentioned had not been occupied by the species investigated.

A new site consisting of 3 colonies, of which in the colony Aranyos *A. ralloides* occurs most numerously, was set up in recent years in the valley of the Körös river in the region of Halásztelek (map 6 — site 115a). A project has been put forward to put the site under protection (RÉTHY, 1964).

In the XIXth century there were also in this region vast marshy areas, the so called Bihar Sárret, divided into Nagy Sárret (map 6 — site 116) and Kis Sárret (map 6 — site 117). Although there can be no complete certainty whether the Squacco Heron was breeding there, it seems quite probable on the basis of SCHENK's data (1918) concerned with *E. alba* and *E. egretta*, that it may have nested there. Land reclamation was carried out in Bihar Sárret in the seventies, but some of the Herons still nested there in the eighties. It is possible that they changed their breeding sites and that the present site near Zsadany, Biharrugra, and Halásztelek is a continuation of the old ones.

STERBETZ (1962) pointed out that a small number of Squacco Herons nested in the years 1939–1943 in the region of Orosháza and Nagyszénás (map 6 — site 118, 119).

On the right-hand side of the Theiss in the region of the town of Subotice (Szabadka) *A. ralloides* had been nesting probably for a short period of time on marshy areas and Lake Palič (map 6 — site 120). Quite a large number of Squacco Herons were observed in the breeding period of 1958 by MIKUŠKA (1962). However he did not mention any breeding colonies. RAFAJLOVIČ (1962) found there a small colony two years later.

The Squacco Heron also nested in 1960 in two colonies on Lake Ludaško where a reserve was set up (SZLIVKA, 1959) 12 km from the town of Subotice (map 6 — site 121). In all, 40 pairs were recorded there.

The Save river. The colony near Klobaš in the so called Piplica Bara (map 6 — site 122) was the highest breeding site on this river. According to REISER (1939) 30 pairs of *A. ralloides* nested there in 1900.

SCHENK (1918), when citing the data collected by KALBERMATTEN, mentioned a colony near Šamac where "Herons of all the species" were nesting

at the end of the previous century. There is no other information on this site (map 6 — site 123).

LINTIA (1917) quoted information on the site near Zasavica (map 6 — site 124) where a full brood was collected there in 1894. According to STRESEMANN (1920) nearly 300 paires nested there.

The largest, best known, and most stabilized, colony on the Save river is the one situated on an old river bed between Obrež and Kupinovo, the so called Obedska Bara (map 6 — site 125). SCHENK (1908a, 1918) mentioned that herons had been nesting in Obedska Bara since days long past out of mind. There is quite a copious literature concerned with this colony. It was visited in 1835 by NAUMANN. 3 years later LANDBECK (1843) published an exhaustive description of this site. Obedska Bara was visited in the middle of the XIXth century by a number of ornithologists and hunters. LÖBENSTEIN (1851) gave a matter-of-fact description of its state at that time. According to the data left by ETTINGER (cited after SCHENK, 1908a), the chief forester from Kupinovo, the numbers of *A. ralloides* started decreasing even before the seventies as a result of unpunished poaching (e. g. one of the poachers collected 5,000 eggs in 1871). HODEK visited the colonies quite frequently between 1869 and 1880 and he supplied us with the majority of data on the numbers of herons in Obedska Bara (HODEK, 1877b). Owing to his efforts the colony was included into a reserve in 1874, and this improved its state considerably. SCHENK (1908a) set up the numbers of separate heron species in a table. The data on *A. ralloides* (Diagram 6) were as follows: the species was exceptionally numerous (more than 1,000 pairs) in the period 1840–1855,

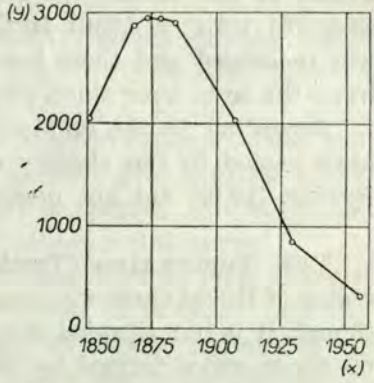


Diagram 6. Numbers dynamics of *A. ralloides* (SCOP.) in the Obedska Bara reserve (Yugoslavia) in the years 1858–1960 (according to the data presented by SCHENK (1908a), STEINMETZ (1931), SZLIVKA (1959), TERRASSE (1961)); x — years, y — number of adult individuals.

later its numbers increased even more — in 1877 there were more than 1,500 pairs. At the turn of the century there followed, as everywhere in Europe, a sudden crises connected with the fact that egrets were the vogue — in 1908 its numbers came down to about 1,000 pairs (SCHENK, 1908a). In 1883 the colony was searched over by CLARKE (1884). Accerding to this author the Squacco Heron was the dominating heron species there. Of the other informa-

tion on the question in point SZIKLA's (1897) description deserves attention. SCHENK (1908a) initiated observations in Obedska Bara in 1908. He noticed at that time that the reason for the decrease in the numbers of *A. ralloides*, besides the intensive poaching, was the land-reclamation of its feeding habitat in the region. In the next years RÖSSLER (1911) and SCHENK (1912) were interested in the numbers of the Squacco Heron. In the period of the Ist World War Obedska Bara, as well as a long section of the Save river, were protected by the order of the military goverment in Belgrade, and this helped the colony to survive the war time in a relatively good condition (SCHENK, 1918). STEINMETZ (1931) took up his investigation there in 1930. He estimated the numbers of *A. ralloides* there at 400 pairs. The same number was given by VASVÁRI (1939). After the IInd World War the Squacco Heron has nested in Obedska Bara quite numerously, although it has not achieved the level attained in the first few years of the XXth century (Diagram 6). MATVEJEV (1950) mentioned it as common compared with other heron species. GÉROUDET (1958) gave the situation of the site after the destruction of the reserve during the war. SZLIVKA (1957) estimated the numbers of *A. ralloides* in the fifties at about 150 pairs, while for both Obedska Bara and Carska Bara at 350 pairs (SZLIVKA, 1959a, b). In 1957, according to the counts of CSORNAI, SZLIVKA, ANTAL (1959), the situation improved and the Squacco Heron was very common among hundreds of herons from other species. The same was stated by TERRASSE (1961), who considered *A. ralloides*, together with the Night Heron, to be the most numerous species in the reserve.

In the XIXth century *A. ralloides* nested on a marshy old river bed near Fenék in the vicinity of Boljevci (the so called Fenecka Bara) (map 6 — site 126) (SCHENK, 1896). In the second half of the previous century the marsh was reclaimed and there has been no information on the species investigated from the area ever since (SCHENK, 1918).

According to the opinion expressed by LINTIA (1917) *A. ralloides* was to have nested in the vicinity of Korvova near Smederevo (map 6 — site 127). REISER (1939) did not mention the species as breeding there.

The Temes river (Tamiš). In the reserve near Satchinez (Knéz) in the region of Banat there was one of the older breeding sites (map 6 — site 128). Although it is not situated directly in the drainage area of the Temes river but on the marshes formed by the Timişul and Begheiul rivulets, I have included it in the sites belonging to the area of the Temes. NADRA (1962) reported that the colony was frequently destroyed in the past, the herons moved the venue of the site, and in some years they ceased nesting there altogether. 30 pairs of *A. ralloides* were recorded there in 1939 (PASCOVSCHI, 1941, 1942). The colonies existed also during the war, as LINTIA (1944) collected there in 1943 museum pieces. The specimens collected at Satchinez by LINTIA (1950) are referred to 1948. After the setting up of the reserve the numbers of *A. ralloides*

started increasing (1957 — 10–15 pairs, 1958 — 30–35 pairs, 1959 — 50–55 pairs (NADRA, 1962)).

The XIXth century breeding site near the village of Kisbecskerek (Becicherecul), and mentioned for the first time by SCHENK (1896) should be treated together with the breeding sites in the vicinity of Satchinez (map 6 — site 129), as the two localities are not far from each other. The majority of Squacco Heron specimens were collected in this particular area by LINTIA in the breeding period in the thirties (1944).

In the lower reaches of the Temes river near Ozora (Uzdin) there was quite a large colony in the thirties of the present century, and 150–200 pairs of *A. ralloides* were recorded as nesting there (map 6 — site 130) (VASVÁRI, 1942). It can not be excluded that the colony situated about 20 km to the west of the one discussed above, in the complex of marshes "Dugo Blato" on the lower Theiss, existed for a short period of time and included herons which moved from the sites on the Theiss.

The lower reaches of the Danube (below the Iron Gate). The earliest information, as pointed out by CATUNEANU (1958) was very vague but also very characteristic. A large number of colonies were stretched in 1835 along the almost entire reaches of the Danube as far as the district of Banat. The area was habitated by hundreds of thousands of herons. Thousands of pairs were nesting there 60 years later.

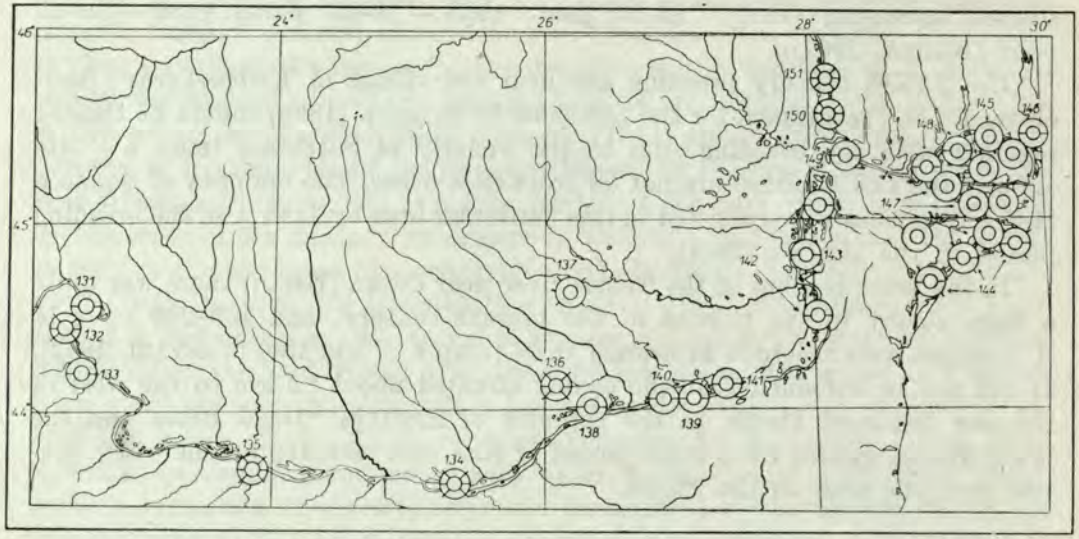
Starting from the cataract at the Iron Gate the first breeding site recorded at the beginning of the XXth century was a small colony near Bastazi in the region of Vrbica (map 7 — site 131) (REISER, 1939).

LINTIA (1917) mentioned in his discussion with REISER another colony to the south of Brza Palanka near Michajlovač (map 7 — site 132). However their is no more information on these breeding sites.

Also in the area of marshes in the vicinity of Negotin (map 7 — site 133), where even at the end of the XIXth century, according to REISER (1939), were "places fit for nesting", and LINTIA (1917) supported this suggestion several years later, a small number of Squacco Herons did occur.

There is not much information on the next breeding sites as well. Although HARRISON (1933) did not record herons in the vicinity of Svishtov and Orechovo, he observed a large number of Squacco Herons on the Danube in the region of these localities. Taking this and many other circumstances into account (e. g. the occurrence in the region of large numbers of Night Herons — the symbiont of the Squacco Heron) I have come to the conclusion that there must have been Squacco Heron in this area. The numbers of the species investigated in the other section of the Danube, according to HARRISON, were uncomparably lower (map 7 — sites 134, 135).

I recorded a large number of Squacco Herons which did not show any tendency to nomadic movements in August, 1962 on the reservoir near Comana



Map 7. Distribution of *A. ralloides* (Scop.) breeding sites in the drainage area of the lower reaches of the Danube (signs as on map 2).

on the Neajlov river (map 7 — site 136). Taking into account the fact that the biotops there favoured nesting in the region, I suppose that the species was breeding there. Radakoff (1879), when he was writing that *A. ralloides* nested near Bucharest, might have thought about these areas.

A large lake Greaca (map 7 — site 138) and the neighbouring marshy area near Prundu on the left-hand side of the Danube, which I searched over a little later, are most probably the present breeding site of the Squacco Heron. Its numbers on this lake near the Danube were quite significant. A few specimens collected in May and June between 1908 and 1961, and deposited in the museum "Gr. Antipa" in Bucharest, come from the area near Prundu. The ornithological expert of these areas Dr A. Papadopol is also of the same opinion. It can not be excluded that the species in question nests on the lakes near Giurgiu.

On the left-hand side of the Danube on Lake Sreberna, where a reserve was set up in 1948 (map 7 — site 139), the Squacco Heron nested as early as in the time of Hodek and Reiser's investigation (the period 1870–1890) (Paspaleva-Antonova, 1961). Since then, as a result of land-reclamation and connected with it deterioration of the hydrological regime of the lake, the breeding conditions have deteriorated as well. However *A. ralloides* went on nesting there (Paspaleva-Antonova, 1961). In 1961 the reserve was visited by Geissler (1962), and he concluded that *A. ralloides* was quite numerous there, while the opinion of Moutfort and Ferguson-Lees (1961), who carried out there detailed observations, was that the Squacco Heron population there was relatively large and showed a tendency to increase its numbers. A sudden increase in the numbers occurred only in recent years (Taniu, 1963).

Also on the neighbouring Lake Popino, on the Bulgarian side as well (map 7 — site 140) the species has been quite common recently (MOUNTFORT, FERGUSON-LEES, 1961b; DONČEV, 1960 in litt.). Earlier MAKATSCH (1950) and later BALÁT (1962) visited the Danubian regions of Bulgaria, and they concluded that *A. ralloides* was frequently recorded there. They pointed out that there occurred a noticeable increase in the numbers of this species.

One of the permanent sites are marches and lakes in the region of Călarasi (map 7 — site 141) where SEEBOHM collected zoological materials at the end of the previous century (OATES, 1902). According to the oral information of Dr A. PAPADOPOL, *A. ralloides* is also breeding there at present.

On the section of the Danube along Dobrudzha *A. ralloides* has been nesting since the earliest days. RADAKOFF (1879) mentioned the species as numerous there. ALLÉON (1886) described the species in Dobrudzha as very numerous. But already at the beginning of the XXth century its numbers decreased considerably, as LINTIA (1909) travelling all over Dobrudzha in 1905, e.g. the section of the Danube between Černavoda and Tulcea, did not mention it at all although he was very much interested in herons. HEINRICH (1927) mentioned that *A. ralloides* was rarer in this area than other heron species. At present the numbers considerably increased, as I could find out myself when moving across the Danube valley from Fetesti to Černavoda in August, 1962. In spite of the drought at the time *A. ralloides* was quite numerously represented among a relatively large number of herons and cormorants on inundation areas still preserved in places. As none of the authours gave the exact positions of the sites I marked them on map 7 (site 142) with two points showing their approximate positions.

The eggs collected by SEEBOHM (OATES, 1902) came from the region of Hirsova (map 7 — site 143). At present there is no precise information from this site.

The Danube Delta has copious literature concerned with birds nesting in colonies but the amount of information on the species investigated is small. In the IInd half of the XIXth century mixed colonies, which included Squacco Herons nesting there, were relatively numerous in the entire delta (MUNTEANU, 1960; RADAKOFF, 1879; SEEBOHM, 1883b). As it was stressed by NORDMANN (1890), *A. ralloides* occurred particularly numerously in the section between Izmail and Kilia. In the first few decades of the present century the species was considerably depleted in the delta (LINTIA, 1909), although DOMBROWSKI (1912) wrote that "many hundreds of pairs still nest there", while OSTERMAN (1912) that "it is rarely met there". SWANN (1925) and SCHNELL (1933) reported that *A. ralloides* was relatively numerous in the period between the two World Wars but observed only in its feeding places (colonies were situated in very inaccessible places). The history of the colonies after 1930 was described in an exhaustive way by CĂTUNEANU (1958) and MUNTEANU (1960). According to the latter, colonies with *A. ralloides* in 1935 were situated in 7 points

of the delta, in 1936 — in 9 points, in 1939 — in 8 points, in 1940 — in 9 points, in 1950 according to the data obtained with the help of an air reconnaissance they were only in 5 points, in 1955 — 9. They were all colonies varying in size from 200 to 3,000 pairs (the percentage of Squacco Herons was not fixed). In the years 1935–1940 the majority of the colonies were concentrated in the upper part of the delta; in the subsequent years, particularly after the terrible action of the total destruction of the so called ichtyophagous initiated in 1949 by the Roumanian Ministry of Alimentary Industry, Squacco Herons were left in 1955 in a few inaccessible places of the middle part of the delta. In 1955 as a result of the pressure of organizers of the protection of nature and public opinion the action was abandoned. *A. ralloides* improved its numbers in a relatively short period of time, and they were improved considerably in recent years (CĂTUNEANU, 1958; MUNTEANU, 1960).

At the end of August and in the first ten days of September, 1962 I carried out a detailed quantitative investigation on the Danube population of *A. ralloides* in the upper and middle part of the delta. The results are presented

Table 2. Numbers of young *A. ralloides* individuals in the Roumanian part of the Danube Delta in the last ten days of August and in the first ten days of September, 1962.

Character of the body of water	Index of frequency (number of indiv. per 1 km of the coastline)	Kilometres	Number of ind.	Comments
(1)	(2)	(3)	(4)	(5)
main tributaries of the delta (6)	0.9	497	447	banks not overgrown with floating plants (13)
canals of medium width (7)	11.0	363	3,993	banks overgrown with floating plants (14)
old river beds (8)	25.9	54	1,350	overgrown completely or partially (15)
lakes (9)	7.0	435	3,045	ditto (16)
firths (10)	—	—	c. 100	without floating plants (17)
small bodies of water (11)	—	—	c. 600	overgrown with floating plants (18)
total (12)	—	—	9,535	(9,500)

in Table 2. In all, 11,500 young individuals habitated in the entire delta in the first ten days of September (including here the Soviet part of the delta — cf. pages 4, 5). After the necessary calculation I estimated the size of the Danubian population of the Squacco Heron in the first stage of the breeding

period at about 4,200 pairs. Thus it is quite a common species in the delta, and is dominating among the other Heron species there. Quite a number of colonies in the delta is not known at all, as, roughly speaking, such a considerable number of Squacco Herons should nest in at least 15–20 large colonies including 700–1,000 nests of all the species of birds living in colonies. In the Soviet part of the delta such large colonies are already known in certain points (KISTIAKOVSKIY, 1954), while the majority of colonies in the Roumanian part was not systematically investigated, and they are situated in very inaccessible parts of the delta. Taking as a basis the materials collected by CĂTUNEANU (1958) I marked the distribution of the colonies on map 7 as sites 144–149.

The Pruth river (map 7 — sites 150, 151). Inundation areas and lakes in the lower reaches of this river remain the least investigated breeding area of *A. ralloides*. There is practically no information except one remark by RADAKOFF (1879) that the species nested in the previous century along the lower reaches of the Pruth. Most probably it is still nesting there, the more so that the "obligatory protection" in the conditions of the border area is favourable to the local ornitofauna (cf. the Dniester in the period between the two World Wars).

Bulgarian section of the Black Sea coast. The problem of nesting in the region of Burgas (map 8 — site 152) has not been cleared up yet. *A. ralloides* was recorded there quite a number of times (BALÁT, 1962; BOEFF, 1962; DONČEV, 1963; MOUNTFORT, FERGUSON-LEES, 1961). According to the opinion expressed by DONČEV, it started nesting there a short time ago and only on Lake Mandra, while it appears only on feeding grounds of Lakes Atanasovo and Burgas. The numbers of *A. ralloides* in these areas increase every year (MOUNTFORT, FERGUSON-LEES, 1961b; MOUNTFORT, 1962). The discovery of new breeding sites there is now only the problem of time.

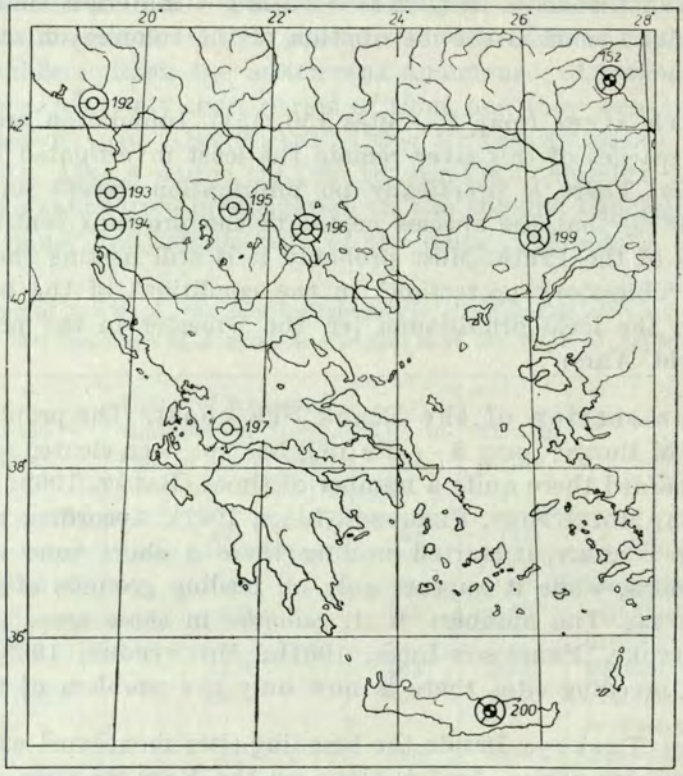
Northern Turkey. Beside the breeding sites mentioned when discussing the Transcaucasian region, that is those on the Kara-Su river at the foot of the Ararat mountains, and on Lake Tschaldyr-gel (page 17) we have also information on other breeding sites in the Black Sea drainage area. KUMERLOEVE and NIETHAMMER (1935) recorded *A. ralloides* in the vicinity of Ankara (map 9 — site 153) in nearly breeding conditions. Also on Lake Mohan Gölü (map 9 — site 154), according to WADLEY (1951) the Squacco Heron was observed in similar circumstances. But they are very doubtful breeding sites. They are both mentioned here marked on the map only conditionally.

The Mediterranean Sea drainage area

Lake Iznik Gölü (map 9 — site 155). According to the data presented by VADER and GÉROUDET, and cited by KUMERLOEVE (1964), the Squacco

Heron nested on this lake in the years 1959 and 1963 in a colony including about 50 pairs together with *N. nycticorax* and *E. garzetta*.

Lake Manyas Gölü (map 9 — site 157). A few interesting recordings were made in this region. In 1938 the breeding site on Lake Manyas Gölü was discovered by Kosswig (1956). About 150 pairs of *A. ralloides* were nesting there at the time. According to the data collected by Coiffait (1955) the

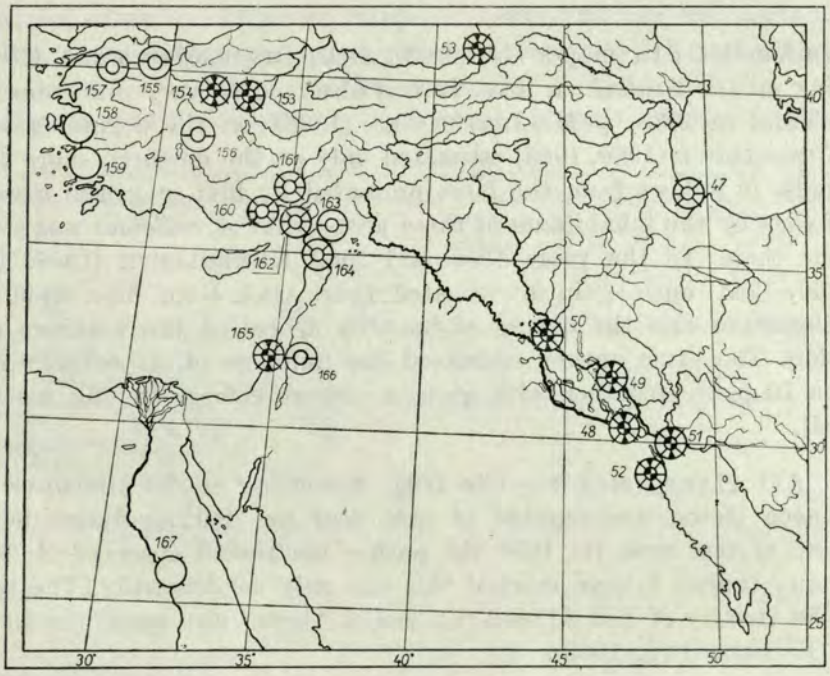


Map 8. Distribution of *A. ralloides* (Scop.) breeding sites in the Balkans (signs as on map 2).

Squacco Heron was there less numerous in the fifties than for example the Gray Heron whose numbers were estimated at 500 pairs in 1954. Kumerloeve (1955, 1960) estimated the numbers of *A. ralloides* at 100–150 pairs. In this next paper he estimated the numbers at 50–70 pairs (Kumerloeve, 1964).

The region of Izmir (Smyrna) (map 9 — site 158). Braun (1908) mentioned *A. ralloides* as breeding in the vicinity of this town at the begin-

ning of the XXth century. According to GONZENBACH (cited after KUMERLOEVE, 1960) the species was shot and known in the area even earlier than that.



Map 9. Distribution of *A. ralloides* (SCOP.) breeding sites in the region of the Persian Gulf and in the eastern regions of the Mediterranean Sea (signs as on map 2).

The Menderes river (Meander) (map 9 — site 159). The first information from the mouth of this river was supplied by SELOUS (1900) who collected eggs of the species investigated on one of the lakes there (most probably Lake Bafa Gölü). As it follows from the data he presented *A. ralloides* was not very numerous there. At present, according to KUMERLOEVE (1964) it occurs on Lake Bafa Gölü only as an accident species.

Lake Aksehir Gölü (map 9 — site 156). On this slightly salty lake KUMERLOEVE (1963, 1964) estimated the numbers of *A. ralloides* at about 200–300 pairs.

The vicinity of Mersin (map 9 — site 160). It follows from the data presented by KUMERLOEVE (1960) that the species nested there in suitable biotops.

The Sehyan river, the Ceyhan river (map 9 — sites 161, 162). *A. ralloides* was breeding, most probably, on marshy areas and parts adjoining the mouths of these rivers (KUMERLOEVE, 1960). At present it only appears over some of the southern bodies of water in the course of its flights (KUMERLOEVE, 1964).

Lake Amik Gölü (map 9 — site 163). AHARONI (1930) recorded *A. ralloides* as nesting on the Antiochian lake. It was observed as very numerous in two large colonies in 1933 by MEINERTZHAGEN (1935). At the beginning of May, 1953, KUMERLOEVE (1960, 1963) estimated only on the northern shore 200–300 individuals. It follows from the facts presented by him (e. g. the mass collection of eggs by the inhabitants of these areas) that *A. ralloides* was still very numerous there. In the years 1956 and 1962 KUMERLOEVE (1957, 1958 in litt., 1960, 1963) once again investigated Lake Amik Gölü. The rapid rate of land-reclamation and the drying of marshes decreased the numbers of that population. The same author estimated the numbers of *A. ralloides* in 1962 at about 70 pairs (together with quite a distant colony on the marshes of Göl Basi).

The Asi river (map 9 — site 164). According to KUMERLOEVE (1960) the Squacco Heron was reputed to nest near the Turkish-Syrian border in the valley of this river (in 1956 the author mentioned observed *A. ralloides* there many times). I have marked this site only conditionally. The breeding site in the vicinity of Tell Abbiad (Et Tell el Abyad) also seems not to be stabilized (KUMERLOEVE, 1963).

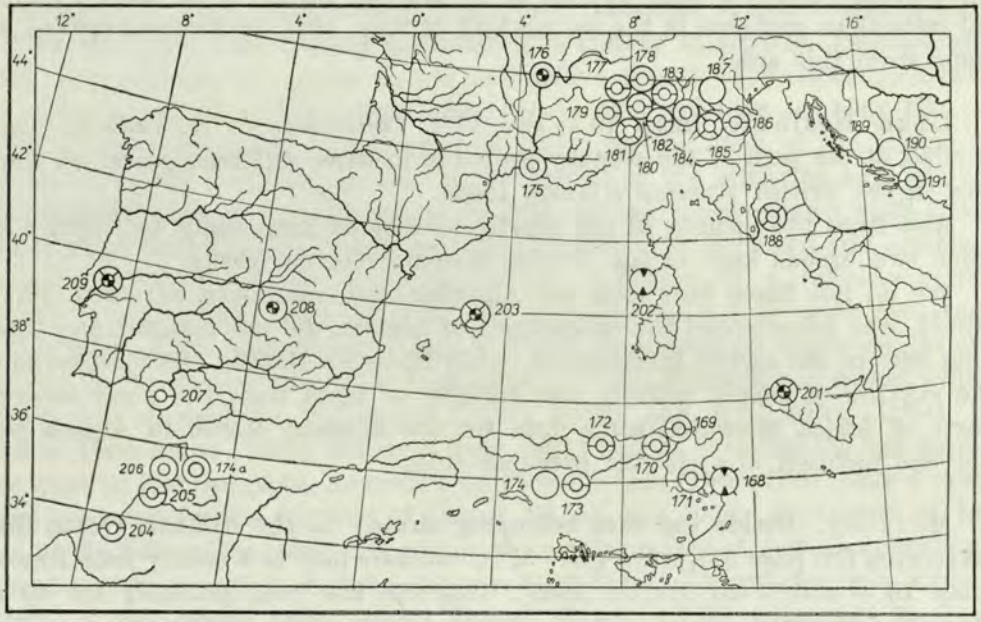
The eastern coast of the Mediterranean Sea. From Israel ROTTER (1952) mentioned *A. ralloides* as nesting irregularly near Tel-Aviv (map 9 — site 165). However this site seems to be doubtful. According to BODENHEIMER (cited after KUMERLOEVE, 1960) *A. ralloides* nested in the thirties of the present century on the marshes near Lake Huleh (map 9 — site 166). KUMERLOEVE (1960) supposed that the species might return to its old breeding site as a reserve had been set up on these biblical marshes.

The data of KUMERLOEVE (1961, 1962) come from the Lebanon. This author when citing the collection of Squacco Herons kept at the American University of Beirut mentioned also a specimen killed on May, 8. It seems doubtful whether it could be a breeding individual.

Northern Africa, the Nile. In the last two centuries the Squacco Heron has most probably never nested in the delta and generally in the lower reaches (LOAT, 1906; MEINERTZHAGEN, 1930). KOENIG's (1928) observations from the end of the previous century carried out near Dendera (map 9 — site 167) have never been supported by other investigators although it might follow from his observations that the species was breeding there. This breeding site

has been included only conditionally. Most probably *A. ralloides* was breeding in the upper reaches of the Nile, e. g. near Bahr-el-Ghazal, where it was also observed by KOENIG (1928), but this area is already outside the Palearctic. VOOUS (1960) included the lower reaches of the Nile into the breeding area.

Tunisia. Curiat Islands (map 10 — site 168). In the northern parts of Tunisia *A. ralloides* was quite a common species at the end of the XIXth century (WHITAKER, 1895). At the same time it most probably nested on Curiat Islands, and one specimen in breeding plumage obtained in the middle



Map 10. Distribution of *A. ralloides* (SCOP.) breeding sites in the western regions of the Mediterranean Sea (signs as on map 2).

of May, 1890, and one egg marked as *A. ralloides*, comes from this area (KOENIG, 1893). However these facts can give rise to doubts, as those small islands, almost without reservoirs of standing water, do not provide elementary breeding conditions.

Lake Achkel (map 10 — site 169). *A. ralloides* has been nesting for a long time on this lake near Bizerta (MILLET-HORSIN, 1912). In May, 1920 MOURGUE (1920) observed the species on soaked-up areas among the grazing buffalos. In the years 1943–1944 RAYN (1948) did not record *A. ralloides* as breeding there — only a few individuals were observed on the lake in this period. The same can be applied to the remark of GOUTTENNOIRE (1955).

The L'Oued Sedjenan (map 10 — site 170). At the beginning of the XXth century *A. ralloides* was nesting and was common along this river and in the region of the town Mateur (Millet-Horsin, 1912).

Lake Kelbia (map 10 — site 171). The species is probably nesting there at present which follows from the data presented by Guttennoire (1955). Heim de Balsac (1952), probably on this authority, mentioned it as breeding at present in Tunesia.

Algeria. Lake Fetzara (map 10 — site 172). Until the twenties of the present century a large number of *A. ralloides* nested in the area. Zoological collections gathered in the second half of May, 1913 by Zedlitz (1914a, b) come from this area.

Lake Halloula (map 10 — site 173). Collections of *A. ralloides* eggs, secured at the turn of the century probably in three different years, are kept now in the British Museum (Oates, 1902).

Also from the vicinity of the nearby locality of Zana (map 10 — site 174) come two broods kept in the British Museum (Oates, 1902).

We do not know how long the Algerian sites mentioned survived. Payn (1948), who investigated the ornitofauna of Algeria, did not mention any breeding sites of the species investigated, while Heim de Balsac (1952), discussing the rhythm of sexual activity and fertility of birds from the north-western parts of Africa presented some data for the Squacco Heron in Algeria but did not mention any specific breeding sites.

Morocco. Beside the sites belonging already to the Atlantic Ocean drainage area (cf. page 52), a few pairs of *A. ralloides* nest in a colony near Rincon (map 10 — site 174a) (Smith, 1965). This site has been probably set up in the last few years.

The northern coast of the Mediterranean Sea. The Rhône — Camargue (map 10 — site 175). The delta of the Rhône is one of the most stabilized breeding sites of *A. ralloides* in France. But it is difficult to determine how long it has been nesting there. Clarke (1898), who carried out observations at Camargue in May and June, 1895, did not mention the Squacco Heron at all. A few breeding pairs were observed in 1928 (Galet, 1931; Glegg, 1931). The low level of abundance (single nests) remained also in the years that followed (Glegg, 1932). 3 pairs were recorded in the second half of May in the years 1931 and 1932 in the colony on Ile des Pilotes (Oordt, Tjitte, 1933). In the same period only a few individuals were observed on the Grand Rhône (Alexander, Harrison, Pease, Tucker, 1933). Hugues (1937) reported a small increase in the numbers starting from 1930. In 1936 the Squacco Heron was already not infrequent, but it was still the least nume-

rous as compared with other related species. It is conspicious that *A. ralloides* was not numerous even in the post-breeding period (in the thirties — MEIKLEJOHN, 1935). According to the detailed observations reported by GLEGG (1941) the numbers of *A. ralloides* in various colonies distributed along the Grand Rhône and in Petite Camargue remained at a low level until the end of the thirties, e. g. in the colonies of the Grand Rhône 6 nests were recorded in 1936, while only 4 in 1937. In the period of the Hitlerite occupation the colonies change their places (the treestands were cut down), and the numbers were very low indeed (YEATES, 1946, 1948). In the postwar period *A. ralloides* nested only in a very small number of colonies (e. g. in the period from May 2 to May 11, 1951, HINLOOPEN, PEAR, and RESOORT (1954) recorded only 3 individuals on their feeding grounds). The history of separate colonies and their composition was given in the exhaustive report of VALVERDE (1955). *A. ralloides* nested in the years 1930–1955 in such colonies as: near Mas de l'Armeilliére (this colony survived until 1931); on the bank of the Rhône to the north of Sambuc (disappeared in the period of the Hitlerite occupation); on the right bank of the Old Rhône (Vieille Rhône) which existed until 1937; the colonies near Sablons in a pine forest discovered in 1934 and still existing; colonies on Iles de Pilotes, Paby, and others. 7–8 pairs of *A. ralloides* nested in 1954 in Camargue. VALVERDE (1955) supposed that it is more numerous in the delta of the Rhône than it was recorded by individual observers. As the interest in the Squacco Heron in Camargue has been increasing in recent years, which was stressed by PRIESTLEY (1947), PETIT and SCHACHTER (1954), as well as DRECHSLER (1957), we can expect that the data covering the last period are more or less complete. According to PENOT's data (1960, 1962) only 6 nests were recorded in the colonies of Grand Rhône and Petite Camargue at the end of the fifties. The same author was of an opinion that *A. ralloides* displayed a tendency to disappear. A few nests were recorded by DRECHSLER and MEYER (1964) in the colony near Aigues Mortes. GRAFE (1961) estimated its state at that time at about 10–20 pairs. According to the data presented by HOFFMANN (1962 in litt.) about 40 pairs were nesting in 1962 in the entire area of Camargue, but a large number of nests and individuals were destroyed by poachers.

Dombes (map 10 — site 176). *A. ralloides* appeared for the first time in the vast complex of fish ponds in Dombes only in the course of its flights (the thirties of the present century). The history of the habitation of this site is a classical example of the gradual occupation of new breeding territories and the expansion outside the breeding range. Thus 2 individuals were observed in June, 1932 on the pond near Villars (OORDT, 1934; PAILLERETS, 1937). Also in June in the years 1933 and 1936 single individuals were observed in Dombes (MAYAUD, 1938). Next 3 individuals were recorded in June, 1936 — the search for nests did not give any result (MEYLAN, 1938). In the ensuing years

in spite of a thorough search of Night Heron colonies the result was the same (Berthet, 1938, 1941–45). The first recording of *A. ralloides* nests occurred in 1947 (Cabanne, Ferry, 1951; Pochelon, Pibet, 1950). Vaucher (1954) precisely related separate facts: the first two broods were recorded in May, 1947 in the colony on Lake Sud de Montcroissont. Later single pairs were recorded there in the years 1949, 1950, 1953. On the marshes near Echets also single pairs nested in the years 1952 and 1953. On Lake de Vavres single individuals were observed in June, 1953. The next observation was recorded by Boutinot (1955) who found one nest in the region of Birieux in 1955. In the next year Boutinot (1957) carried out a special observation over this nest. According to Hoffmann (1962 in litt.) the Squacco Heron has been nesting in recent years in Dombes, but still irregularly. The number of breeding pairs did not exceed three. As it follows from Lebreton's data (1964) the site in Dombes showed signs of stabilization. When the planned reserve is set up there the numbers of *A. ralloides* will probably increase considerably.

Italy. The survey of Italian sites will be presented here in the order accepted by Moltoni (1936, 1938), as well as Warncke (1960).

Balocco and Formigliana (map 10 — site 177). In a large colony situated on the right-hand side of the Cervo river near Cascina Grazziana several pairs of *A. ralloides* (together with *E. garzetta* 30 pairs) nested until 1931. The two specimens mentioned by Moltoni (1936) were collected there. After the destruction of the colony by a storm, a part of the birds joined the colony in the region of Balocco situated at a distance of 3 km. In 1933 after cutting down the poplars near Formigliana the rest of the birds moved to Balocco. But again here the trees were cut down in connection with the road-building schemes and the birds moved once more. However A. *ralloides* went on nesting near Balocco, as was shown by the collection of 12 specimens there in the years 1931–1935 (Moltoni, 1936, 1938). As reported by Warncke (1960) another colony was set up 20 years later 6 km to the south-east of the previous one, but no Squacco Herons were recorded there.

Greggio (Vercelli) (map 10 — site 178). *A. ralloides* nested in a large mixed colony at a distance of 6 km from Greggio, but only a small number of them were recorded. The 21 specimens collected by Moltoni (1936) in the years 1927–1936 come from this area. This author gave also the first record of this colony (Moltoni, 1927). At the end of the twenties the numbers of the colony started decreasing rapidly (devastated by the inhabitants) (Moltoni, 1930, 1936, 1938). A reserve was set up there in 1938, and *A. ralloides* went on nesting there. In 1953 a violent storm destroyed the heronry and the Squacco Herons moved in the same breeding period outside the area of the reserve (Frugis, 1955). In 1960, although the colony was still very large, *A. ralloides* was not recorded there at all (Warncke, 1960).

Badia di Lucedio and Ronsecco (map 10 — site 179). *A. ralloides* nested in a colony situated between these two places until 1930. Later on the venue was moved (cutting down of the trees) (MOLTONI, 1936, 1938). In 1960 WARNCKE (1960) pointed out that the colony consisting of two subcolonies increased considerably and its numbers reached several thousands of pairs of herons, while the number of Squacco Herons increased to 15 pairs.

Candia Lomellina (Pavia) (map 10 — site 180). In 1930 the Squacco Heron occurred in this colony situated on the left-hand side of the Sesia river (Malinverni, Riserve Bergamasco). Several pairs were recorded. In 1931 the birds moved to the island of Tenuta dei Mezzi, their original site before moving to the region of Candia Lomellina in 1930 (MOLTONI, 1936, 1938).

The island of Tenuta dei Mezzi (Casale Monteferrato) (map 10 — site 181). This island on the Po river in the region of Casale Monferrato has been habitated by herons since 1925. A few pairs of *A. ralloides* were recorded there in 1930. As they abandoned the island in 1930 and started nesting near Candia Lomellina (see above), and as *A. ralloides* was recorded there, the species must have nested on the island of Tenuta even earlier (i. e. before 1930). In the years 1932–1933 only a few pairs occurred among thousands of Night Herons (MOLTONI, 1936, 1938). WARNCKE (1960) is of an opinion, on the basis of observations on herons flying in the vicinity of this region, that the colony is still existing. But we do not know whether the species investigated is still breeding there.

Torreberetti (Alessandria) (map 10 — site 182). *A. ralloides* seemed to nest permanently at the site in the region of Torreberetti (reserve). MOLTONI (1936, 1938) recorded there several fledgelings. WARNCKE (1960) did not mention any Squacco Herons from Torreberetti; he pointed out, however, that *N. nycticorax* and *E. garzetta* stopped nesting there.

Zelata di Bereguardo (Pavia) (map 10 — site 183). *A. ralloides* nested in the colony situated on the left bank of the Ticino river, with breaks, in the years 1923–1932. 11 specimens were collected there in the years 1933–1936 (MOLTONI, 1936, 1938). According to the data presented by WARNCKE (1960) there were 50 pairs of *A. ralloides* in 1936. The same author found out in 1960 that the colony shifted 3 km to the south, but no Squacco Herons were recorded in the colony.

Villa Diana, Bosco del Mezzano (Cremona) (map 10 — site 184). 2 km higher than the mouth of the Serio river to the Adda river (on the latter's right-hand side) a colony was situated where a large number of Squacco Herons were nesting among hundreds of Night Herons. In the next year the colony was functioning normally (MOLTONI, 1936, 1938). Also in this colony WARNCKE (1960) did not find any Squacco Herons in 1960.

The province of Modena (map 10 — site 185). According to the data presented by TEDESCHI (1962) *A. ralloides* was frequently observed in the province of Modena (the site was not specified more precisely) in May in the breeding plumage in flocks of 3–4 individuals. This author mentioned the species as breeding and in support of his statement gave the fact of collecting a nest with nestlings in this region.

The province of Bologna (map 10 — site 186). The earliest recordings (1592) of Italian herons published by ALDROVANDI (cited after MOLTONI, 1936) come from the vicinity of Bologna. SEVESI (1935) gave a thorough description of a mixed colony from the area of Malalbergo which included *A. ralloides*. This colony has disappeared (MOLTONI, 1936; SEVESI, 1935). According to ALTINI's data (1943) the Squacco Heron nested in the thirties and fourties in the so called "Basso Bolognese" near Marmorta, probably only a limited number. As pointed out by the author the colonies of this region were mentioned in the XVIIth century, at the turn of the XIXth century, as well as in the thirties of the present century. I have joined all these colonies in one site.

Grezzano (Verona) (map 10 — site 187). According to the data presented by ARRIGONI (1898) a mixed colony existed near Grezzano, and *A. ralloides* was also represented there.

The province of Sabina (map 10 — site 188). In the region of reservoirs such as Lago Lungo, Lago di Riposottile, Lago di Piediluco, and others, *A. ralloides* was recorded several times in the fifties, and according to CARLO's observations (1960) it is still nesting in this region. However CARLO pointed out that its numbers decreased, but he did not give any data on the nesting of the Squacco Heron symbionts. This may seem to indicate that the existence of this southernmost Italian site is somewhat doubtful.

The Adriatic coast. REISER's report (1939) on the site at Ždralovac Blato, where in 1888 40 pairs of *A. ralloides* were recorded as nesting, comes from Herzegovina (map 10 — site 189).

A. ralloides nested in the previous century in the so called "Livansko Polye" in the vicinity of Livno (map 10 — site 190). According to REISER (1891), there were 4 specimens in the collection of the Museum of Natural History at Sarajevo among which there was one nestling found on 28 May 1888. This very little known breeding place probably disappeared at the end of the previous century.

Also in the XIXth century *A. ralloides* occurred as a breeding species in the lower reaches of the Naretva in the so called "Utovo (Hutovo) Blato" (map 10 — site 191). For the last time in the XIXth century this colony was recorded in 1889 (REISER, 1891, 1939). About a dozen years later (years 1902, 1906, 1908) the species was recorded there in the breeding season in small

groups but not as a breeding species. Two individuals were still observed there in 1914 (REISER, 1939). According to RUCNER's data (1954) *A. ralloides* until recently was only an accident species in the valley of the Neretva. The latest reports of SAGE (1964) and GÉROUDET (1965) informed that it was breeding on the marshes called "Hutovo Blato" and occurred there very numerously. That the species returned to habitate there again can be attributed to the setting up of the National Park in the region.

Lake Skadarsko (Scutari) (map 8 — site 192). *A. ralloides* was quite common on this frontier lake in the twenties and thirties, particularly in the region of Plavnica, and most probably it was nesting there. (TICEHURST, WHISTLER, 1929, 1932). It was mentioned as a breeding species by MAKATSCH (1950). The latest data of TERRASSE (1961), although they were recorded at the beginning of August, indicated clearly that the species was nesting there and was numerous on the lake. As compared with the data for the thirties its numbers increased.

Albanian lakes. The nesting of *A. ralloides* on Albanian lakes is very problematic. Except Lake Skadarsko (taking into account the Albanian part) it was frequently recorded in the breeding period on Lake Durazzo (map 8 — site 193) and on Lake Terbuf (map 8 — site 194) (TICEHURST, WHISTLER, 1932). It is possible that it also occurs on marshes and lakes along the western coast.

The Wardar river. *A. ralloides* has been nesting for a very long time as a common species on the right-hand side tributary of the Wardar, in the valley of the Crna river (Krna) in Macedonia in the region of old marshes near the town of Bitola (map 8 — site 195). According to MAKATSCH (1950) an ILIČ found there a considerable collection of eggs in 1930. MICHOLITSCH (1959) mentioned the species as most frequently recorded there. In 1959 this site was visited by TERRASSE (1961) in the course of intensive land-reclamation there. He could record as many as more than 200 *A. ralloides* individuals. At present we must treat this site as extinct.

According to SLADEN (1918) *A. ralloides* was quite numerous on a small overgrown lake called Artzam in the valley of the Wardar (map 8 — site 196). MAKATSCH (1950) did not mention this site 30 years later.

Lake Vrachori (Trikhonis) (map 8 — site 197). Both REISER (1905) and STRESEMANN (1920) stressed that *A. ralloides* was in Greece only an accidental species. However, PARROT (1905) was of an opinion that it was breeding at the beginning of the XXth century on this Greek lake.

The Marica river (Évros) (map 8 — site 199). According to RAINES (1962) the species probably nests at the mouth of this river.

The Mediterranean islands, Crete (map 8 — site 200). PEASE (1940), when carrying out observations on Crete in the summer period of 1937, recorded a few points from May and June in the vicinity of the Candia river, and they gave him grounds for supposing that *A. ralloides* was breeding there. But as no other heron species were found to breed ther, that is those which are the symbionts of the Squacco Heron, this statement seems to be doubtful. *A. ralloides* was recorded by other ornithologists also in June (e. g. WHITE, 1939) but always as a migrant.

Sicily (map 10 — site 201). MOLTONI (1936) mentioned in passing that *A. ralloides* might be nesting on the marshes near Mondello (the region of Palermo). PETERSON and others (1959) in the latest revised edition of "A field guide to the birds of Britain and Europe" included Sicily in the breeding area.

Sardinia (map 10 — site 202). The data from Sardinia are also not sufficiently well proved as far the nesting of *A. ralloides* on this island is concerned, although according to MARTORELLI (1960) the species nested near Sorso (Sassari) in 1883 and the specimen from Cagliari found in June 1923 (MOLTONI, 1936) can not be treated as a convincing proof of the species nesting there.

Baleares — Mallorca (map 10 — site 203). JORDANS (1924) stated that *A. ralloides* was breeding on Mallorca near Albufera, but it does not seems very convincing. This author treated it as a breeding species on the basis of ethological observations carried out in the last ten days of May (which, nota bene, did not indicate necessarily that the species was nesting there — M. J.). However, the presence of Night Herons in the colony might add weight to JORDANS's statement, as in such a colony *A. ralloides* might be nesting. BERNIS, DIEZ, TATO (1958) mentioned *A. ralloides* as an accidental species and also express their doubts as to JORDANS's opinion.

The Atlantic Ocean drainage area

The Moroccan coast. VAUCHER H. and VAUCHER A. (1915), who investigated the ornitofauna of French Morocco quite thoroughly in the years 1884–1914, mentioned *A. ralloides* as a breeding species and that it occurred quite frequently near Boucharen (map 10 — site 204).

The data of VALVERDE (1956) come from Spanish Morocco. According to him a large colony including *A. ralloides* existed in 1913 in the region of Alcazarquivir (Sidi Selama in the valley of the Lucus river (Loukhos)) (map 10 — site 205). In 1953 10 pairs nested in the valley of the Lucus in the region of Sidi-Embarek (map 10 — site 206) in the colony of other heron species consisting of 700–800 pairs in all (cf. also page 46 — site 174a).

Thus the population of *A. ralloides* in the north-western parts of Africa is very small, and according to VALVERDE's estimate (1959) it was the least numerous one in relation to the rest of its area, and also when compared with other species of water fowl and wading birds. To prove this point I have added a diagram showing the distribution of *A. ralloides* numbers in the entire palearctic range (Diagram 22).

The Guadalquivir (Coto Doñana) (map 10 — site 207). The population of *A. ralloides* at the mouth of this river, although stabilized for years, has never been very numerous. The main colony at Coto Doñana near Algaida, one of the largest in Europe (at the end of the breeding period it includes, on the average, about 30,000 birds) has been known for tens of years, and although it has often underwent positional changes, the site has always been the breeding base for *A. ralloides* on the Iberian Peninsula. All through the XIXth century and until 1920 a large colony existed on Lake El Taraje, situated in the same area but somewhat nearer to the coast (VALVERDE, 1958). The colony on Lake Santa Olalla was also known at the beginning of the present century (MOUNTFORT, FERGUSON-LEES, 1961a). According to NOBLE (1902), *A. ralloides* was the least numerous heron species at the turn of the century — its numbers did not exceed several pairs. The situation has undergone only slight changes in the last 50 years. It follows from the data quoted by various authors that the numbers of *A. ralloides* remained until the fifties on a relatively low level (RIDDEL, 1944; YEATES, 1946). An increase followed only in the last twenty years (BERNIS, VALVERDE, 1952, 1954). Thus for example in 1952 only a few individuals were recorded in Coto Doñana (MOUNTFORT, FERGUSON-LEES, 1961a), while in 1955 already 75 nestlings were ringed (at least nests) (MALUQUER MALUQUER, 1956). In 1956 60–90 (and more precisely 65) nests were occupied (HOFFMANN, 1960; MOUNTFORT, FERGUSON-LEES, 1961a; MOUNTFORT, 1956, 1958). This increase in the numbers of *A. ralloides* coincided with the general increase of the colony. FLACH (1957) estimated the numbers in 1956 at 100 pairs. In the next years, although the other species went on increasing their numbers (BERNIS, 1961), *A. ralloides* most probably reached the "state of saturation" (BERNIS, 1961; VALVERDE, 1961). The general estimate of the state of the Squacco Heron population in Spain (including the site mentioned above) supplied by VALVERDE, an expert in this problem (1959), was that the numbers did not exceed 100 pairs, which put the species as one of the rarest heron species in the western regions of the Mediterranean Sea.

Lake (lagoon) del Taray — Toledo (map 10 — site 208). This colony was set up in 1957 and was made up of Night Herons. Several years later Little Egrets started nesting there, while in 1961 the first Squacco Herons appeared there (Club "ALCYON", 1961). The first data on the number of broods, nestlings, etc., come from 1963 (Club "ALCYON", 1963).

Portugal, Gollegã (map 10 — site 209). This problematic site in the valley of the Tagus river in the reserve near Gollegã was mentioned by Coverley (1932). According to him one *A. ralloides* individual was observed in May 1931 on the marshes of the reserve mentioned in a nearly breeding situation. Coverley, who was intrigued by this fact, carried out a series of interviews with the local fishermen — the Squacco Heron nested there in some years, and the number was estimated at a few pairs.

Holland (the vicinity of Rotterdam). According to Voous (1960) the species was reputed to nest there until the previous century.

Germany (the vicinity of Bremen). As mentioned by Brehm (1911) the Squacco Heron probably nested for a short period of time in the vicinity of Bremen. Both the sites, for various reasons should be treated as doubtful.

Closing this survey of breeding sites I have to point out that a certain number of them have never been recorded and included in the literature on the subject. And it seems to me that we should take into account the possibility that there existed, particularly in the XIXth century, undiscovered breeding sites on some lakes in the northern parts of Africa, the Balkan Peninsula, in Turkey and the Transcaucasian region, and also in the Aral Sea drainage area. It can not also be excluded that for various technical reasons I did not discover reports published in nonornithological periodicals (popular-scientific, hunting) while collecting material concerned with the distribution of *A. ralloides*. However they could make up only a very negligible percentage of the total number of sites discussed in this part.

GENERAL ANALYSIS OF QUANTITATIVE CHANGES

Secular changes in the number of breeding sites

I have accepted 20-years' periods as basic time units in the general analysis of quantitative changes recorded in the last 100 years. Only exceptionally when dealing with the XIXth century I have taken into account the averages covering the periods of 50 years, and this course was adopted only because of the character of materials concerned with the XIXth century. Thus the effect of short-term factors on the results have been eliminated, at least partially, as well as the effect of the natural several years long cycles in the numerical changes. Oscillations in the numbers of breeding sites, although they do not give such a clear picture of secular numerical changes occurring in the area, as for example fluctuations in the number of breeding pairs, they can give however a good idea of processes connected with an increase or decrease in its real range.

It follows from diagram 7, where the course of the curve expresses the percentage ratio of breeding sites in separate 20 years' periods of the XXth century to the state in the second half of the previous century, that there was a sudden drop in the number of breeding sites in the first 20-years' period

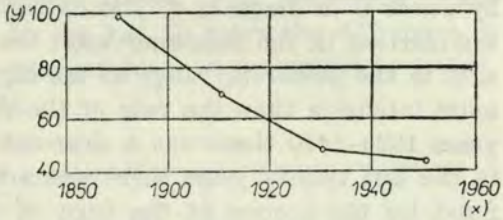


Diagram 7. Secular changes in the number of breeding sites in the palearctic range (state for the second half of the XIXth century = 100%); x — years, y — number of sites expressed in per cent.

(about 30%), which reached 50% in the years 1920–1940 of the state recorded in the second half of the XIXth century. A stabilization followed in the last 20-years. Thus in 100 years the number of breeding sites generally decreased by 57%, but in the last 20 years this decrease amounted only to 6%. In all, the disappearance of 147 breeding sites was recorded in the last 100

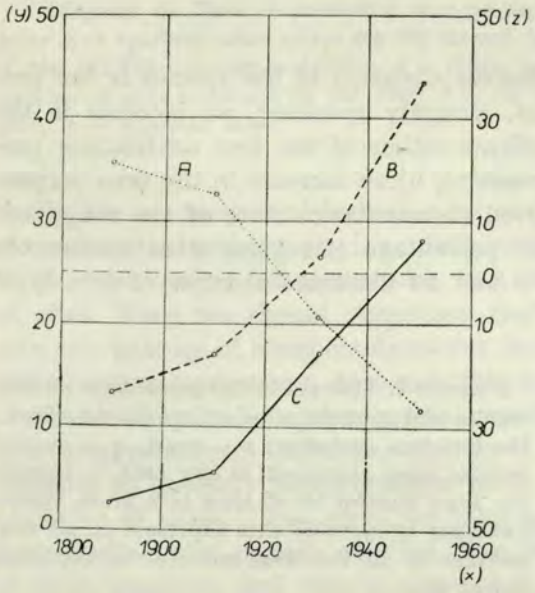


Diagram 8. Dynamics of vanishing and setting up of *A. ralloides* (Scop.) breeding sites; x — years, y — number of sites expressed in per cent in relation to each of the categories separately (scale for curves A, B), z — number of sites in absolute figures (scale for curve C), A — curve presenting vanishing of sites, B — curve presenting setting up of new sites, C — curve presenting the balance between vanishing and new sites (below 0 the balance is negative).

years. 53 new sites were set up in the same period. Diagram 8 illustrates the character of these changes. The course of curve A expressing the percentage distribution of the breeding sites disappearance and its relation to curve B giving the idea of the distribution of the new sites are very characteristic. It becomes obvious at once that the species investigated reached a severe crisis in the years 1900–1920. Out of the total number, 107, of the breeding sites lost in the period under consideration, 37% disappeared in the course

of the previous century and only 2.5% came into being, while in the first two decades of the present century 32% of the breeding sites ceased to exist, and only 5% of new sites were set up.

The situation improved in the period between the World Wars, but even then more sites disappeared than came into being. This balance is illustrated by curve *C* in diagram 8. The data presented in this diagram can be briefly summarised in the following way: the disappearance of *A. ralloides* breeding sites in the palearctic range at the turn of the century until the twenties was more intensive than the rate of the setting up of new breeding sites. In the years 1920–1940 there was a clear-cut tendency to level off this balance, and in the last twenty years there was a tendency to make up for the losses suffered by the species at the turn of the century. It should be added that a sudden increase in the numbers of *A. ralloides* followed after 1960 (which was not taken into account when drawing the diagrams included in this paper).

Changes in the proportion of regular and sporadic breeding sites

One of the exponents of the biological situation of the species is the proportion of regular and sporadic sites. Roughly speaking, an increase in the percentage of sporadic sites may indicate either of the two contrasting processes: a) a decrease in the area (regression), b) an increase in the area (expansion of the species). With the stabilized (homeostatic) state of the range and minimal pulsations of its borders the percentage of regular sites reaches the relatively highest values. Diagrams 9 and 10 illustrate changes of this type.

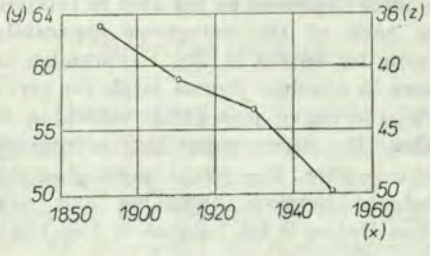


Diagram 9. Changes in the percentage relation of regular and sporadic sites of *A. ralloides* (Scop.) in the last two centuries; x — years, y — number of regular sites expressed in per cent in relation to the total number of all sites in a given period, z — number of sporadic sites expressed in per cent in relation to all the sites recorded in the given period of time.

It follows from diagram 9 that the percentage of regular sites reaches the highest level in the course of the XIXth century — 63%, in the next double decades it fell at a different rate, so that in the years 1940–1960 the difference amounted to 13%.

The character of the changes is set off in diagram 10 where the rate of the changes was taken into consideration. Providing we take the state of the pro-

portion of regular to sporadic sites in the period 1850–1900 as 100, then the difference in the rate of decrease in the period 1900–1920 will amount to almost 12% (i. e. the number of regular sites decreased more rapidly than that of sporadic sites).

In the next period the difference reached 13.5% as compared with the years 1850–1900, and only 1.5% in relation to the years 1900–1920. Thus the rate of decrease nearly levelled off. In the last 20 years the difference in the rate of decrease once again became considerable — it amounted to 10.5% (the number of sporadic sites increased).

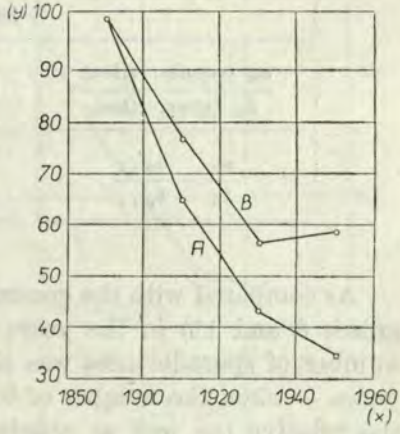


Diagram 10. Rate of numerical changes in regular and sporadic sites (state for the second half of the XIXth century = 100%; x — years, y — number of sites expressed in per cent, A — regular sites, B — sporadic sites.

So far we have analysed changes in the proportion between regular and sporadic sites without paying much attention to the significant differences in the mechanism of appearance and disappearance of the two categories of sites. Thus we should remember that the changes discussed here reflect only the balance of numbers dynamics in respect of separate categories of sites. This relative comparison does not give us the real picture in as much as the character of sporadic sites suggests a more rapid rate of their both appearance and disappearance. Unfortunately, as it was shown on page 6, it was impossible to quantify these changes when taking the decade as a unit in the majority of cases. Thus when we take into account that regular sites in the course of shorter periods of time than 20 years suffered smaller fluctuations in their numbers, and that in spite of it the general rate of these changes in the periods 1900–1920 and 1940–1960 was quicker, it becomes obvious that the category of sporadic sites in these periods must have been more numerous than it was shown by the reconstruction on the basis of historical materials. Another reason of the apparently smaller rate of numerical changes in sporadical sites may be the transformation of regular sites into sporadic in these periods. Both the analysis of diagram 10 and the reasons presented boil down to this conclusion: a considerable relative increase in the numbers of sporadic

sites followed in the years 1900–1920 and 1940–1960. When they are expressed (even without taking into account factors causing underestimation) in the form of differences in the proportion of sporadic and regular sites in separate periods then they are twice as large as in the years 1920–1940 (Table 3).

Table 3. Changes in the proportions of *A. ralloides* breeding sites

Proportions (1)	Period (2)			
	1850–1900	1901–1920	1921–1940	1941–1960
$\frac{a_n \text{ (regular sites)}}{b_n \text{ (spor. sites)}}$	1.70	1.43	1.29	1.00
$\frac{a_n}{b_n} - \frac{a_{n+1}}{b_{n+1}}$	—	0.27	0.14	0.29

As compared with the general decrease in the numbers of the species (cf. diagrams 8 and 11) in the years 1900–1920, the relatively high increase in the number of sporadic sites was caused by the regression of the species, and vice versa — when the number of breeding pairs increased in the period 1940–1960, the relative (as well as absolute — see diagram 10) increase in the number of sporadic sites showed a marked tendency to the expansion of the species.

Secular changes in the species numbers

Diagram 11 illustrates the situation of the species investigated in the part of the range discussed in the last 100 years taking into account the numbers dynamics of breeding pairs in separate periods of time, and changes in the proportion of breeding pairs to the number of breeding sites in particular. Let us consider first changes in the number of breeding pairs presented as average values for separate periods (diagram 11 — curve *C*). Thus the course of the curve, presenting the average numbers of breeding pairs, even more clearly displays the crisis of the species in the years 1900–1920. The comparison between the rate of decrease in the number of breeding sites and the rate of decrease in the number of pairs, presented in diagram 11 by curves *A* and *B*, gives us not only an idea of the dynamics of the phenomenon, but also it shows the mechanism of the regression itself.

The state before 1900 was taken for both the curves as 100. In the first 20 years the rate of decrease in the number of pairs was much quicker than the rate of the other process. The difference reached the highest point in the years 1900–1920, disregarding here the intensity of the process, and it was

the critical point. In the next 20 years this difference decreased. At the end of the fourties the species exceeded the initial state of the proportion between the number of breeding sites and the number of breeding pairs characteristic for the second half of the XIXth century. In the years 1940–1960, when there occurred only an insignificant decrease in the number of sites, the increase in the number of pairs was very intensive.

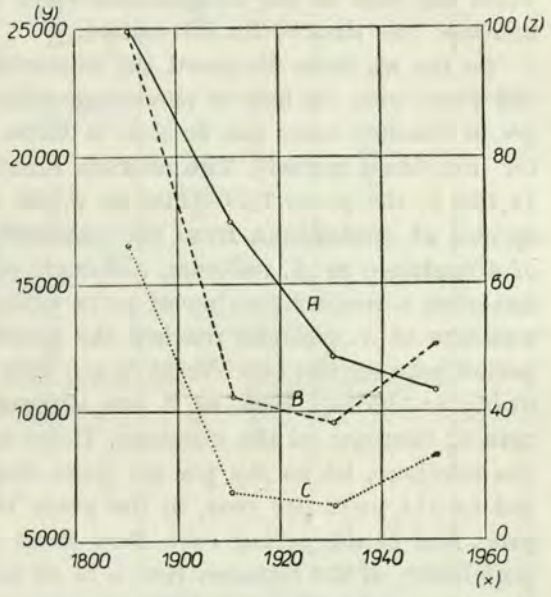


Diagram 11. Rate of numerical changes in breeding pairs and breeding sites of *A. ralloides* (Scop.) in the palearctic part of the area; x — years, y — number of breeding pairs in absolute units (scale for curve C), z — percentage scale for curves A, B; A — curve presenting number of breeding sites (state for the second half of the XIXth century = 100%), B — curve presenting the proportion of breeding pairs numbers (state for the 2nd half of the XIXth century = 100%), C — average numerical level of the species in absolute units.

The arrangement of the curves, A and B, shows the mechanism of changes occurring there. Taking as the state of balance the initial point of the two curves, we can conclude that the crisis, which became more severe at the turn of the century, occurred mainly not because the breeding biotopes became devastated, but because the population itself was detroyed. The decrease in the number of pairs exceeded by 28.2% the rate of decrease in the number of sites. Thus the disappearance of sites was only a secondary phenomenon. This is a very important conclusion — it will be discussed in greater detail in the other part of the paper.

Although the subsequent changes in the period 1920–1940 followed gradually they had a completely different character. If we take the state for the period 1900–1920 as 100 (analogously as previously), then in the next 20 years the number of pairs decreased by 7.4%, and the number of sites by 30.5%, the rate of the disappearance of sites exceeded here the decrease in the number of pairs by 23% (Table 4). Hence we can conclude: the decrease in the numbers of the palearctic *A. ralloides* population occurred in the period 1920–1940 as a secondary phenomenon, accompanying the disappearance of sites.

This was still an unfavourable period for the species, but at the same time it showed that the period of direct reduction was over. On the other hand the reduction of breeding areas was intensified (intensive land-reclamation in the period between the two World Wars).

In the last 20 years the situation consecutively improved and presented a very different picture from that of the first 20 years of the present century. The number of pairs increased by 30.1% as compared with the previous period, while the rate of site disappearance fell by 11.3% (Table 4). After 1960 this increase was drastically intensified.

So far we have discussed the numerical changes of *A. ralloides* in the last 100 years with the help of percentage ralations. The presentation of these changes in absolute units can be seen in Table 4. They are naturally average values for individual periods. The average number of breeding pairs oscillated from 16,400 in the years 1850–1900 to 6,300 in the period 1920–1940. Only a few species of ornitofauna from the palearctic area survived at such a low level of abundance as *A. ralloides*, although among *Ardeidae*, *E. alba*, for example, has even a smaller number of pairs within the palearctic range. Although the numbers of *A. ralloides* reached the lowest level of abundance recorded in the period between the two World Wars, this period can not be treated as critical owing to the fact that, as it was stressed above, the deciding factor was the rate of decrease in the numbers. If we accept an average rate of decrease in the numbers, let us say per one year, then in the period 1875–1910 it amounted to 274 pairs per year, in the years 1910–1930 it fell down to 25 pairs per year, and in the period 1930–1950 there occurred an increase in the palearctic population of the Squacco Heron at an average rate of 95 pairs per year. Thus the years 1920–1940 (or 1930 as a middle year) can be characterized as the turning point of the crisis and the beginning of the numerical restitution of the species. The palearctic population of *A. ralloides* was affected by the same factors as a considerable number of European species which started increasing their numbers and expand territorially after 1930 (Józefik, 1960; Kalela, 1949, 1950; Lack, 1954).

Secular oscillations in the numbers have been treated so far as average values for separate periods. Differences between them (cf. Table 4) although very considerable, did not reflect the maximal amplitudes of oscillation. If we accept the difference between the highest numbers at the beginning of the second half of the XIXth century amounting to 25,000 pairs and the smallest numbers at the end of the twenties in the present century — 4,000 pairs, as our starting point, then we can see that the numbers of *A. ralloides* in the course of 50–70 years decreased by 84% (!). With such considerable secular oscillations and a parmanet tendency to a decrease, differences in the numbers expressed in per cent or in absolute units suffice to give a complete picture. But once we start estimating secular changes as 1) a deviation from the state, due to some reasons or other, of the species treated as homeostatic,

Table 4. Secular changes in the numbers of *A. ralloides* in the period 1850–1960 in the palearctic part of the range.

Character of the changes (1)		Period (2)				
		1850	1900	1920	1940	1960
		(1875)	(1910)	(1930)	(1950)	
Number of breeding pairs (y_n) (3)	(a) (absolute units)	16,400	6,800	6,300	8,200	
	(b) (in percentage relations of individual periods)		100.0 → 41.5	100.0 → 92.6	100.0 → 130.1	
	(c) (in percentage relation to the period 1850–1900)	100.0	41.5	38.4	50.0	
Number of breeding sites (x_n) (4)	(a) (absolute units)	165	115	80	71	
	(b) (in percentage relations of individual periods)		100.0 → 69.7	100.0 → 69.5	100.0 → 88.7	
	(c) (in percentage relations to the period 1850–1900)	100.0	69.7	48.5	43.0	
Rate of numerical changes (in percentage relations of individual periods) (5)	(y_n)		58.5 (in −)	7.4 (in −)	30.1 (in +)	
	(x_n)		30.3 (in −)	30.5 (in −)	11.3 (in −)	
Index of secular oscilations of numbers of the species (6)	$Q_{os} = \frac{1}{\frac{y_n}{y_{n+1}}\sqrt{\frac{x_n}{x_{n+1}}}}$		0.35	0.77	1.22	

or when 2) we compare secular oscillations of several species, or when 3) we estimate the biological situation of the species not only from the point of view of numerical changes, but also from the point of view of the number of breeding sites occupied, and indirectly of the area occupied, it seems reasonable to introduce a unified index of secular oscillations in the numbers.

Thus I have introduced such an index to the investigation on secular changes in the numbers of *A. ralloides* (Q_{os} = index of secular oscillation of numbers of the species), and its construction has been based on the following assumptions:

a) I have accepted as the state of homeostasis of the numbers the lack of any difference in its value in at least two succesive double decades. Denoting the numbers in the first period as y_n, in the ensuing period as y_{n+1}, ratio $\frac{y_n}{y_{n+1}} = 1$;

b) index Q_{os} should reflect numerical changes of breeding pairs and breeding sites, which follows from the assumption discussed in point 3. Hence we can determine the proportion between changes in the number of pairs ($y_1, y_2, \ldots\ldots, y_n$) and oscillations in the number of sites ($x_1, x_2, \ldots\ldots x_n$). In case there is a functional linear relationship between them assuming the maximal value in the form of, for example, the co-efficient of correlation (i. e. $r_{xy} = 1.0$), then we could neglect the oscillations in the number of sites when constructing Q_{os}, as any changes in y would coincide with proportional changes in x. However, the correlation between y (the number of breeding pairs) and x (the number of breeding sites) although high ($r_{xy} = +0.83$), would not indicate the complete functional relationship. And consequently the secular oscillations in the number of breeding sites are, to a certain (rather insignificant) extent, dependent on factors of a different type than those which affect the numbers of the species. Hence the value of ratio $\frac{x_n}{x_{n+1}}$, when taken into account in the final formula Q_{os}, should be levelled off in as much as the effect of factors deciding simultaneously the oscillations in x and y is common. The calculation of the co-efficient levelling off value $\frac{x_n}{x_{n+1}}$ is most complicated, so the most reasonable way is to substitute formula $\frac{x_n}{x_{n+1}}$ and express it as $\sqrt{\frac{x_n}{x_{n+1}}}$.

c) In the state of homeostasis not only $\frac{y_n}{y_{n+1}} = 1$, but also $\sqrt{\frac{x_n}{x_{n+1}}} = 1$, and besides the product of the two formulas will equal 1, i. e. $\frac{y_n}{y_{n+1}} \sqrt{\frac{x_n}{x_{n+1}}} = 1$.

d) When y and x decrease (regression of the species), the product mentioned above will be larger than 1, and vice versa — in the case of the expansion of the species this product will be smaller than 1.

e) Accepting Q_{os} as the inversion of the product discussed, i. e.

$$Q_{os} = \left(\frac{y_n}{y_{n+1}} \sqrt{\frac{x_n}{x_{n+1}}}\right)^{-1} \qquad (2)$$

we shall have the following features of index Q_{os}:

1) $Q_{os} < 1$ — the species was in the state of regression,
2) $Q_{os} = 1$ — the species was in the state of homeostasis,
3) $Q_{os} > 1$ — the species displayed expansiveness.

f) The oscillation index of the secular numbers assumes its final form as:

$$Q_{os} = \frac{1}{\frac{y_n}{y_{n+1}}\sqrt{\frac{x_n}{x_{n+1}}}} \tag{3}$$

and it can serve as quite a good exponent of the biological situation of the species estimated from the point of view of several tens or hundreds years.

In Table 4 (page 61) are presented values of Q_{os} for separate periods. In the years 1875–1910 Q_{os} (= 0.35) reached its lowest value. And that was the most critical period for the species. The years 1910–1930 were characterized by a moderate regression ($Q_{os} = 0.77$), while the last period (1930–1950), as compared with the years 1910–1930, was expansive ($Q_{os} = 1.22$), although, as a matter of fact, it should be termed, from the point of view of the last two centuries, the period of numerical restitution.

Estimating the situation of the numerical changes of *A. ralloides* in the last 100 years we shall use the average value of Q_{os}. It amounts to 0.78, and so the general regression of the species can not be denied.

Beside the estimate of the situation of the species in the past, we can also obtain useful exponents with the view of protection when we transform equation (3).

Let us make an abstract assumption that we want the numbers of *A. ralloides* to ramain in the years 1960–1980 on the same level as in the period 1940–1960 in the situation of a considerable increase in the entire range, i. e. in the situation corresponding to e. g. $Q_{os} = 1.5$. We have at our disposal data from the period of the last 20 years ($y_n = 8{,}200$, $x_n = 71$). We also assume that the number of breeding sites in the period planned will not be higher than 65. Then:

$$y_{n+1} = Q_{os} y_n \sqrt{\frac{x_n}{x_{n+1}}} \tag{4}$$

Substituting the data to equation (4), we shall have: $y_{n+1} = 13{,}400$.

It is obvious that as the number of breeding sites is to decrease, the raising of the numerical level to 13,000 will be fairly expensive, and may even turn out to be impossible. So let us assume that we shall retain the previous state of the breeding sites ($x_n = 71$, $x_{n+1} = 71$), then we shall obtain $y_{n+1} = 12{,}300$ pairs. Also in this case there will be difficulties in the realization of the undertaking. We shall have to limit ourselves to the retention of the numbers at Q_{os} only marginally higher than 1, e. g. $Q_{os} = 1.05$. Then as we do not want to allow the number to decrease according to the transformed formula (3), we calculate x_{n+1}, i. e. the number of sites that is to be retained in the 20 years planned, thus:

$$x_{n+1} = Q_{os}^2 \cdot x_n. \tag{5}$$

Substituting the data we shall have: $x_{n+1} = 78.3$, i. e. 8 new sites should be restituted in the range, which will be the easiest part of our task. This will be the more effective as y_{n+1}, i. e. the numbers in the period 1960–1980, will also simultaneously go up, after a time. Other combinations can also be introduced here. However, the most important is the

fulfilment of the following condition, for a longer period and at a level accepted by the specialists as relatively optimal (taking into account our considerably limites resources):

$$\frac{\sum Q_{os}}{n} \approx 1 \qquad (6)$$

when $\sum Q_{os}$ is the sum of the values of this index for the periods investigated, n = number of periods investigated. In the case of *A. ralloides* for the last 100 years $\frac{\sum Q_{os}}{n} = 0.78$. Also an important condition for using Q_{os} with the view of protection is the permanent level of the proportions of site size in relation to the entire range. This problem will be discussed in greater detail in one of the ensuing publications, when analysing the concentration curve of the Squacco Heron.

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* *

Summing-up it should be pointed out that *A. ralloides* is not a numerous species in the palearctic range, although it is common in the case of some of the breeding sites. Both the number of breeding sites and the numbers of the species suffered considerable secular oscillations in the last two centuries. The decrease in the number of breeding sites was mostly noticeable in the period 1920–1940, while the decrease in the number of pairs was most intensive in the years 1900–1920. The most severe crisis of the species investigated occurred at the turn of the century (years 1890–1910). The crisis was overcome after 1930, i. e. at the time when a considerable number of European species started increasing numerically, extendining simultaneously their ranges. It was determined, when comparing the rate of decrease in the number of breeding sites and breeding pairs, that the main cause of regression in the last few decades of the XIXth century and until 1920 in the entire part of the area discussed was the intensive reduction of the species carried out by man. The continuing, but not as intensive as before 1920, regression in the period 1920–1940 was the result of the reduction of breeding habitats (land-reclamation, transformation of marshland habitats). A stabilization followed in the years 1940–1960, and then an increase in the numbers of the species connected with the restitution of certain sites which disappeared some time ago and the appearance of new sites. The balance of appearance and disappearance of sites was favourable only in recent years. The proportions of regular and sporadic sites reflect changes in the numbers of the species. The relative increase in the number of sporadic sites can be connected either with regression, or with the expansion of the species. When the state or the breeding area is homeostatic the per cent of regular sites is highest. Both at the turn of the century and in the period 1940–1960 there occurred a relative increase in the number of sporadic sites.

According to index Q_{os} *A. ralloides* suffered the most severe crisis in the years 1875–1910. In the next period until 1930 the regression was moderate. A stabilization with a tendency to expansiveness followed after 1930.

In the course of 100 years 2 periods of secular changes can be discerned on the basis of the effect of the antropogenical factor: 1) Period of regression (1850–1940), which included the successive stages: a) stage of direct reduction of the species which extended until 1920 with the peak of intensity in the years 1890–1910, b) stage of indirect reduction of the species (reduction of the habitat resources) which extended until 1940. 2) Period of numerical stabilization with a tendency to expansion initiated after 1930 and particularly favouring the increase in the numbers after 1960.

CROSS-SECTION AND REGIONAL ANALYSIS OF NUMERICAL CHANGES

Analysis in the parallel cross-section

The palearctic part of the range habitated by *A. ralloides* extends from east to west, when considered in its largest variant, along the 80° line of longitude (on the average 6,500 km), and from south to north along the 20° line of latitude (2,200 km). The analysis of secular numerical oscillations in the parallel cross-section will help us to present the spacial picture of changes in the numerical distribution of breeding sites and in the numbers of the species. In the case of the parallel cross-section I have used average values for each of the sectors of the range including the area between the 4° line of longitude (in all 20 sectors). These average values were calculated separately for the second half of the XIXth century, the first half of the XXth century, and the situation including the years 1950–1960.

Generally speaking, the distribution of sites in the parallel cross-section assumes quite a regular character — the numbers reach the highest values in the centre of the area, and then they decrease gradually (Diagram 12). Separate centres of site grouping are clearly discernible, but they should not be connected, at the present stage, with the geographical differentiation of individual populations. This will become possible only after the analysis of the ecological materials from the respective regions of the area.

The following centres of site grouping can be discerned: 1) Ibero-Maroccan centre (12°–0° of western longitude), 2) north-Italian (8°–12° of eastern longitude), 3) middle-Danubian (16°–24° of eastern longitude), 4) north of the Black Sea (28°–40° of eastern longitude), 5) Caucasian-Caspian (44°–52° of eastern longitude), 6) Turkmenian (60°–64° of eastern longitude).

Diagram 12 presents, beside the numerical distribution of sites in the XIXth and XXth centuries, their differentiation into regular and sporadic sites. These differences are shown in diagram 13 in percentage relation to classes of longitude, while diagram 14 illustrates the results of changes in the distribution and number of sites given in absolute units, which occurred in the last 100 years.

It is characteristic that a) the percentage of sporadic sites increased towards the regions distant from the centre and that the number of sites of this cate-

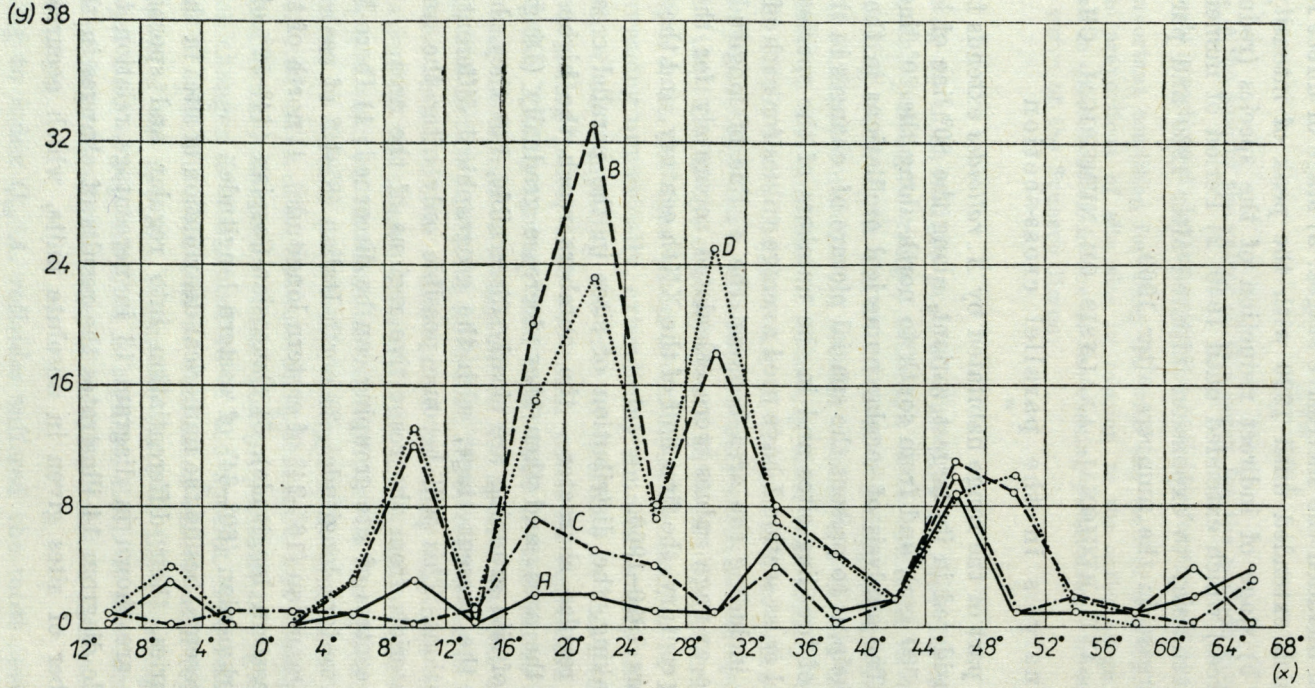

Diagram 12. Secular changes in the numbers and distribution of *A. ralloides* (Scop.) breeding sites in the parallel cross-section; x — longitude, y — number of sites, A — sporadic sites in the 2nd half of the XIXth century, B — regular sites (as before), C — sporadic sites in the XXth century, D — regular sites (as before).

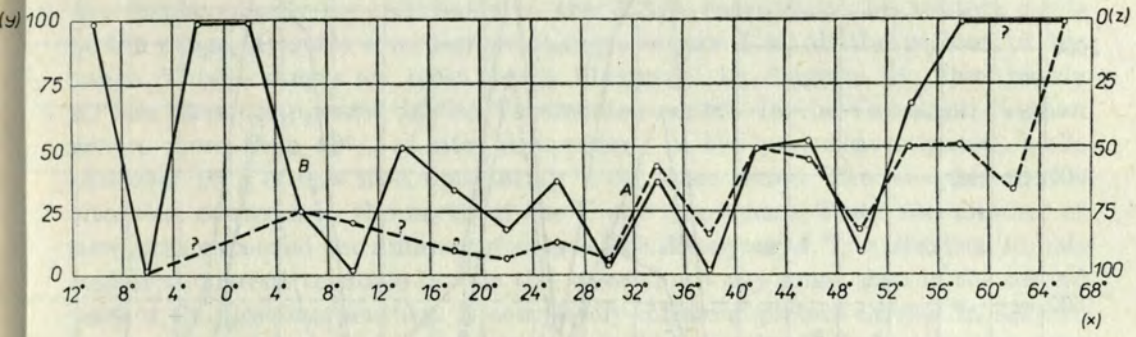

Diagram 13. Secular changes in the numbers and distribution of breeding sites in per cent within each of the classes of longitude; x — longitude, y — per cent of sporadic sites, z — per cent of regular sites, A — in the XIXth century, B — in the XXth century.

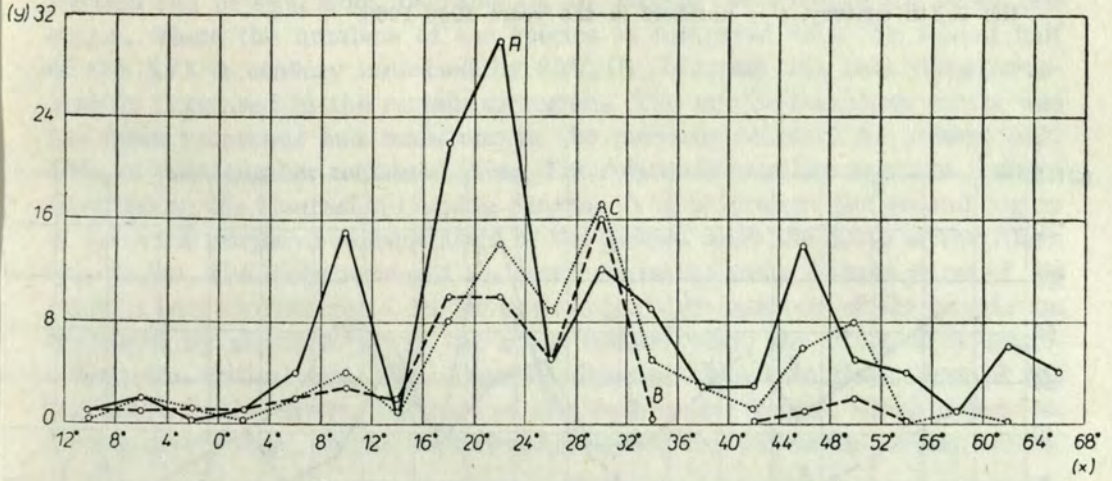

Diagram 14. Numerical changes in vanished, new, and existing sites in the years 1950–1960, along the parallel axis of the range; x — longitude, y — number of sites, A — vanished sites, B — new sites, C — sites existing in the years 1950–1960.

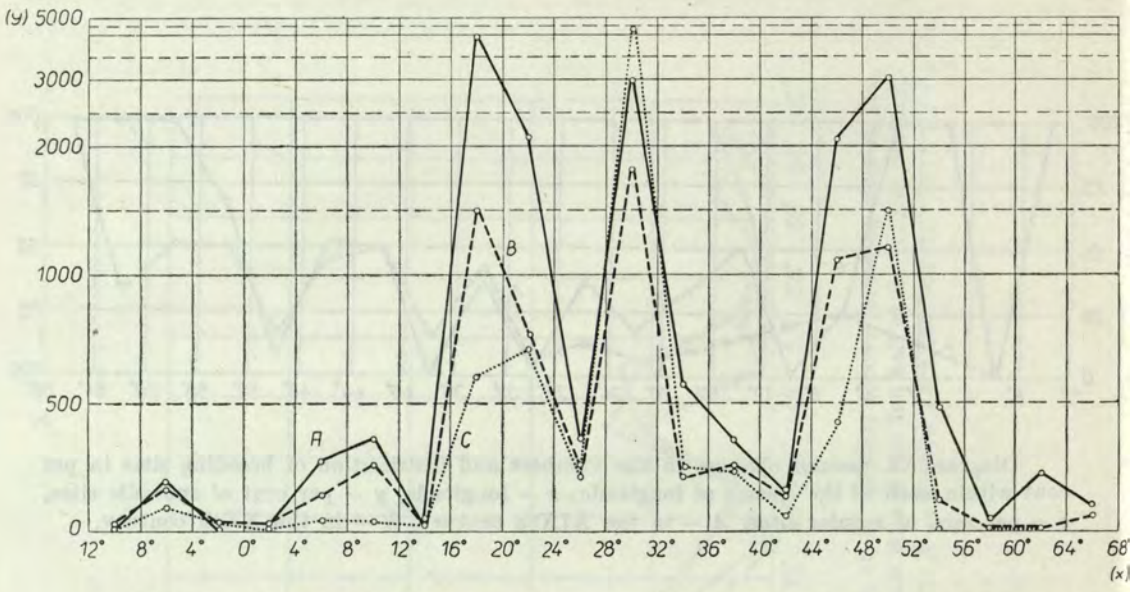

Diagram 15. Secular changes in the numbers of *A. ralloides* (Scop.) in the parallel cross-section of the range; x — longitude, y — numbers of the species in breeding pairs, A — numbers in the second half of the XIXth century, B — numbers in the first half of the XXth century, C — numbers in the years 1950–1960.

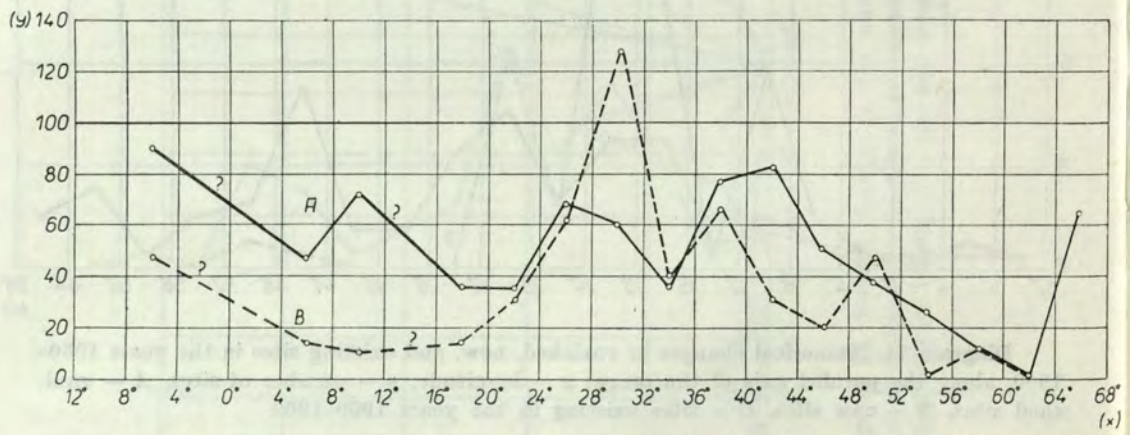

Diagram 16. Secular changes in the numbers of *A. ralloides* (Scop.) in the parallel cross-section related, in per cent, to the state for the second half of the XIXth century (state for the second half of the XIXth century = 100%); x — longitude, y — numbers of the species expressed in per cent in relation to its state in the XIXth century within individual classes of longitude, A — changes in the first half of the XXth century, B — changes after 1950.

gory increased in the XXth century, b) the situation in the XIXth century was not very stabilized, and in the XXth century the species partially disappeared in the eastern parts of the range, c) the expansiveness of the species was displayed only insignificantly in the XXth century in the western parts of the range, d) quite considerable changes occurred in all the regions of the range. These changes are most clearly illustrated by diagram 14. Thus nearly all the sites disappeared in the Turkmenian centre. In the Caucasian-Caspian centre more than 60% of sites disappeared in the period investigated, while just over 10% of new sites were set up in the same period. The most favourable situation occurred in the north of the Black Sea centre. There the number of new sites exceeded the number of sites which disappeared. The situation in this region at present seemst o favour the species, anyway more than in the second part of the previous century. A completely different picture existed in the two westernmost centres, i. e. in the middle-Danubian and north-Italian. The number of sites was cut there by more than half. In the Ibero-Maroccan centre (and more precisely Spain and France) the number of sites increased in the XXth century. The most dynamic changes occurred in the central and western parts of the range. In its eastern parts these changes went along the same line — th e regression of the species.

The dynamics of the numerical changes of the species in the parallel cross-section can be seen from diagrams 15, 16. Except the north of the Black Sea centre, where the numbers of the species as compared with the second half of the XIXth century increased by 30% (!) (Diagram 16), this value considerably decreased in the remaining regions. The middle-Danubian centre was the most numerous and main one in the previous century. At present only 15% of that number remained there. The relatively smallest negative changes occurred in the Caucasian-Caspian centres. It is at present the second region of the most intensive concentration of the species, after the north of the Black Sea centre. The distribution of the numbers in the more distant parts of the range is very characteristic. In the western parts the numbers of the population decreased by about 50%. In the north-Italian centre the situation is approaching the critical one. The diagrams discussed illustrate the course of the regression in the easernmost part of the Turkmenian centre, which depended, among other things, on the numerical changes in the Caucasian-Caspian centre.

Analysis in the meridian cross-section

In the meridian cross-section the numerical distribution of the sites was right-handed asymmetrical, as compared with the parallel cross-section (diagram 17). And so in the narrow belt beween the 44° and 48° lines of northern latitude practically 63% of the palearctic sites were concentrated (average for the last two centuries).

The mode of arrangement of curves *A* and *B* in diagram 18 shows the percentage relation of regular and sporadic sites in each of the classes of latitude.

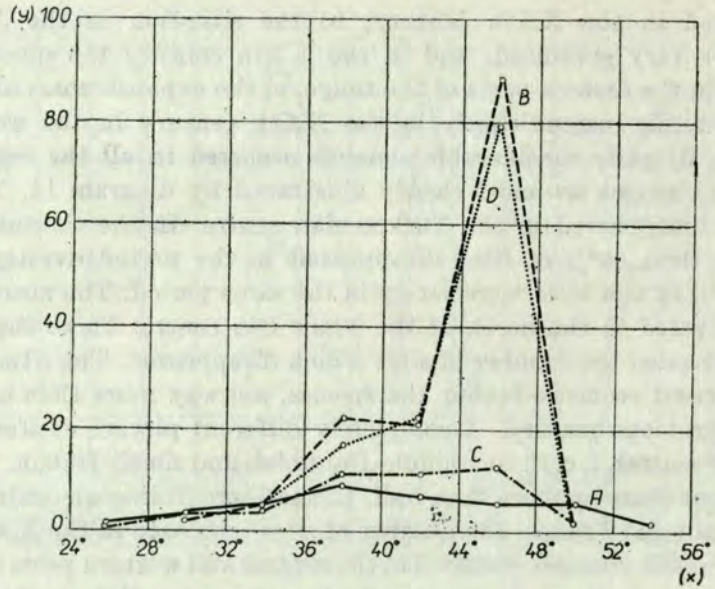

Diagram 17. Secular changes in the numbers and distribution of *A. ralloides* (Scop. breeding sites in the meridian cross-section; x — latitude, y — number of sites, A — spo radic sites in the second half of the XIXth century, B — regular sites (as before), C — spo radic sites in the XXth century, D — regular sites in the XXth century.

A general decrease in the number of sites in the XXth century was followed by the meridian shrinking of the range, and this occurred mainly at the cost of sporadic sites. An increase in this category of sites was also observed in the belt of the most intensive concentration of the species (between the 44° and 48° lines of northern latitude). Diagram 19 presents the changes considered in the meridian cross-section which occurred in the last 100 years. Both disappearance and setting up of new sites cover, more or less proportionally to the number of sites, the range in the belt of the most intensive concentration of the species. In the region of southern and northern borders sites only disappeared, while starting from the 40° line of northern latitude and further to the south the proportions of changes become less and less favourable for the sites newly established. It is not difficult to imagine that the meridian narrowing of the range (as well as the parallel one) is the result of a decrease in the number of sites in its central parts (increase in isolation, when the species exceeds the maximal degree of dispersion). This increase in the disproportion between the number of sites which vanished and the sites newly established in the southern regions can be connected with the more intensive land-reclamation and the reduction, rare as they are, of marshland biotops in the Mediterranean region.

The numerical distribution of the species is also right-handed asymmetrical — the concentration of the numbers both in the XIXth century and

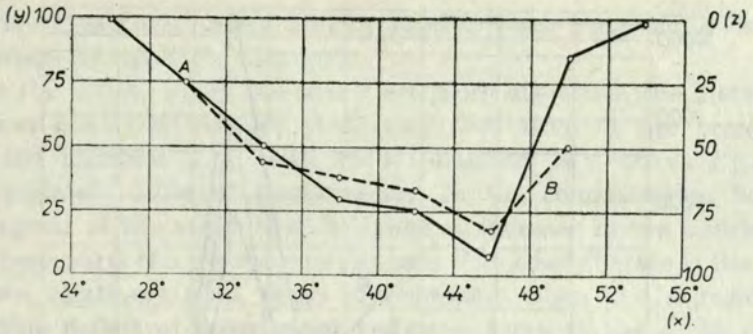

Diagram 18. Number of breeding sites in per cent within each class of latitude; x — latitude, y — number of sporadic sites in per cent, z — number of regular sites in per cent, A — XIXth century, B — XXth century.

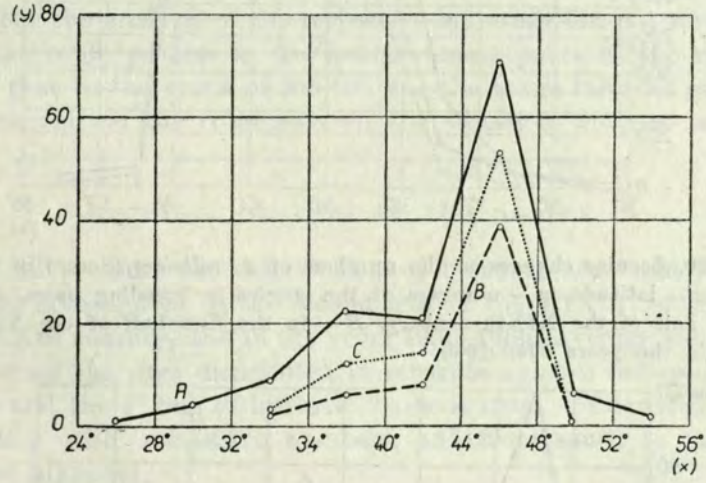

Diagram 19. Number of vanished, newly formed, and existing in the years 1950–1960 breeding sites in the meridian cros-section; x — latitude, y — number of sites, A — vanished sites, B — newly formed sites, C — sites existing in the years 1950–1960.

at present occurred between the 44° and 48° lines of northern latitude (Diagram 20). Accepting the state from the second half of the XIXth century as 100, all the numerical changes which occurred in separate sectors of northern latitude in the XXth century are most characteristic for separate periods of the regression of the species (Diagram 21). Thus the period of direct numerical reduction is reflected in the course of curve A. In the first half of the present century the relatively highest decrease in the number of breeding pairs occurred in the belt of the most intensive concentration. Undoubtedly it is a clear-cut reflection of the direct reduction carried out particularly intensively

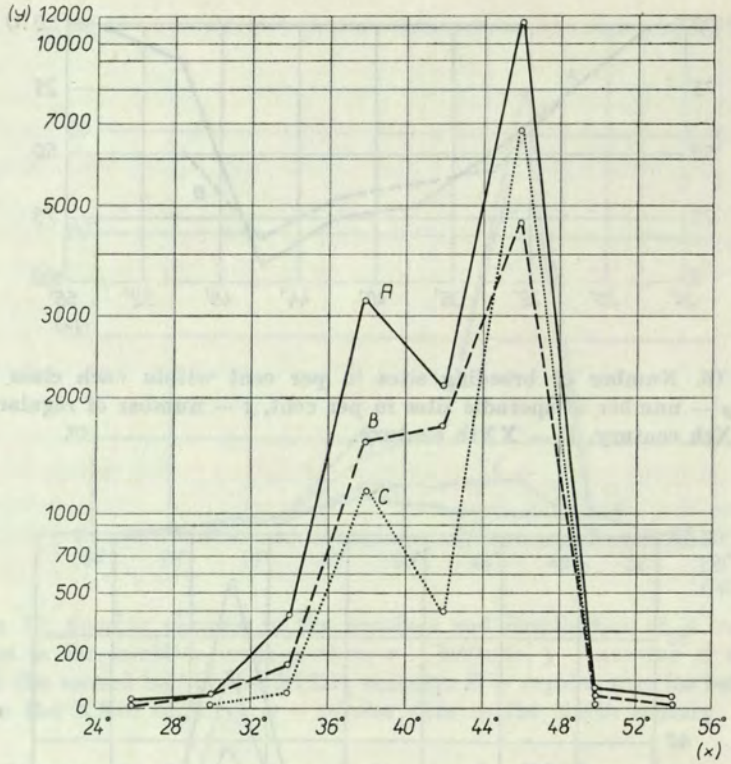

Diagram 20. Secular changes in the numbers of *A. ralloides* (Scop.) in the meridian cross-section; x — latitude, y — numbers of the species in breeding pairs, A — numbers in the second half of the XIXth century, B — in the first half of the XXth century, C — numbers in the years 1950–1960.

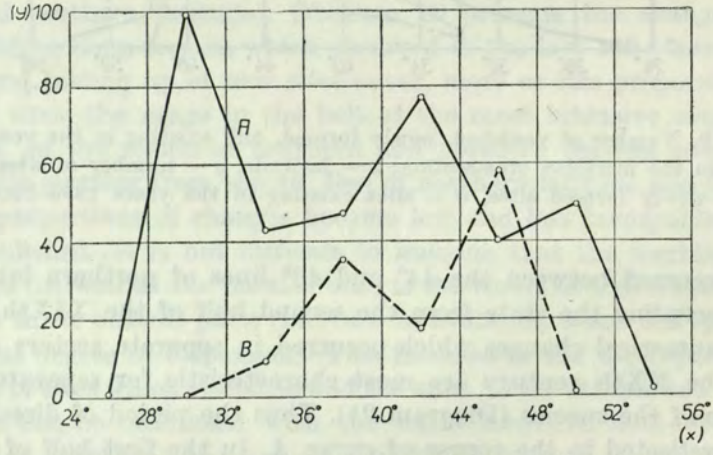

Diagram 21. Secular changes in the numbers of *A. ralloides* (Scop.) in the meridian cross-section related in per cent to the state for the second half of the XIXth century (state for the second half of the XIXth century = 100%); x — latitude, y — numbers of the species in per cent related to its state in the XIXth century within separate classes of latitude, A — changes in the first half of the XXth century, B — changes after 1950.

in the former Austria-Hungary and in Russia (these two countries were the main exporters of egrets in Europe).

More to the south, where the sites were more dispersed, the increase in the numbers was relatively smaller. Analysing the curve of the present distribution of the numbers (i. e. until 1960) (diagram 21 — curve *B*), we come upon a completely different phenomenon. In the concentration belt in the northern regions of the range there followed an increase in the numbers, while in the southern parts the reverse was the case. The present state is the reflection of the other, relatively mild, stage of regression when in the region having a considerable deficit of fresh water resources (area to the south of the 44° of northern latitude) an intensive transformation of the marshland habitats was carried out, particularly after the IInd World War. As a result, the numbers of *A. ralloides* in this belt decreased between 44° and 40° by 82%, between 40° and 36° by 65%, between 36° and 32° by 91%, and lastly between 32° and 28° the species investigated disappeared completely. This is the more disturbing that the analysis of the respective materials did not reveal any sign of the synanthropic process in the southernmost parts of the range. When we consider that to the south of the 36° line the range includes only the non-European territories, the comments on the situation will not be very optimistic.

Regional changes in the numbers

Diagram 22 presents the distribution of breeding sites and the numbers of the species investigated in the second half of the XIXth century, the first half of the XXth century, and in the years 1950–1960. Average values for these periods cover all the sites distributed in separate squares between the 4° line of longitude and the 4° line of latitude. These squares are denoted on the diagram parallely with successive numbers, and from south to north by the letters of the alphabet.

Let us consider succesively the situation and secular changes in separate regions of the range:

1) North-western Africa (squares 2–E, 5–D, 5–E, 6–D, 6–E — diagram 22). In this region 9 breeding sites and 600–700 pairs of *A. ralloides* were recorded in the XIXth century. In the first half of the present century the numbers of the north-African population decreased by more than 50% although the number of sites remained nearly at the same level. In the years 1950–1960 the state did not exceed 100 pairs. The disappearance wasconnected, in the first place, with land-reclamation, and then with lack of protection activity.

2) The Iberian Peninsula (squares 1–D, 2–D, 3–D). Only one site was known in the XIXth century (c. 20–30 pairs). Already 3 sites have been recorded in the present century, and one of them was established only recently. The Iberian population is increasing progressively — at present 60–80 pairs.

4) Southern regions of France (5–B, 5–C). Both these sites were set up in the XXth century, but the site at Dombes was started being habitated only after the IInd World

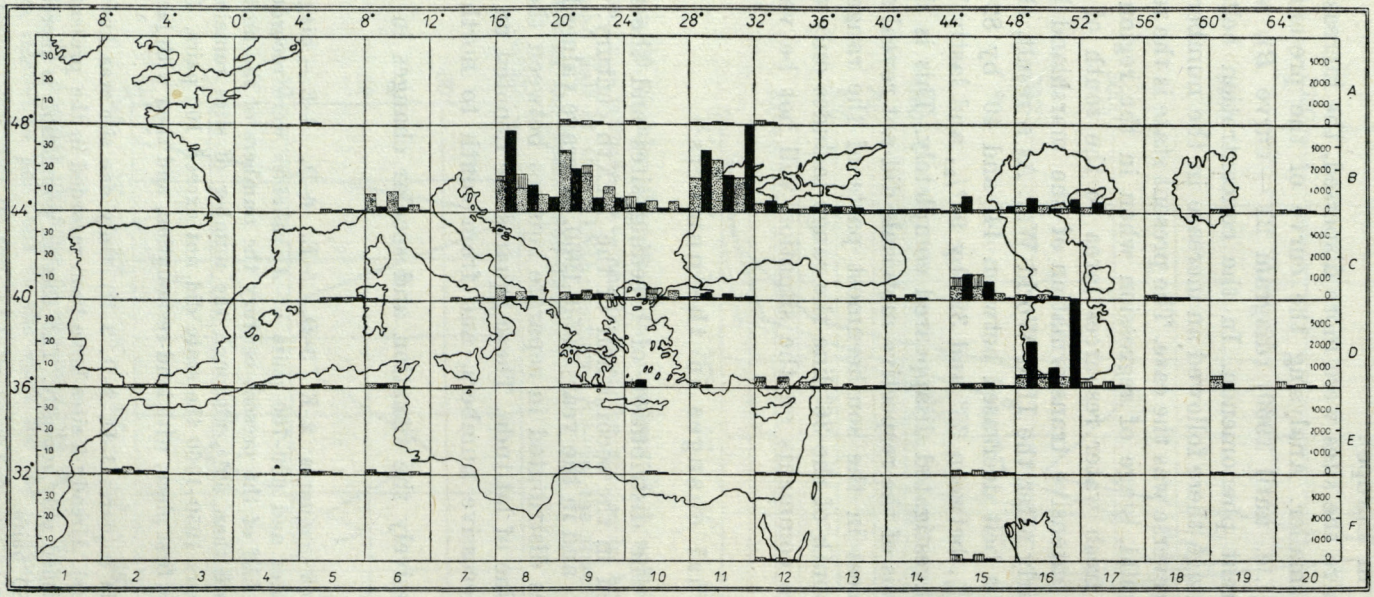

Diagram 22. Diagram presenting regional secular changes in the number of sites and the numbers of the species. On the left-hand side of the diagram the scale of site numbers is given, on the right hand side the scale for the number of breeding pairs. Dotted columns denote regular sites, columns with vertical lines — sporadic sites, blackened columns — numbers of the species in pairs. First two columns on the left in each of the squares pre- sent the situation from the second half of the XIXth century, the two middle columns — the first half of the XXth century, the last two — data ifor the years 1950–1960.

War. In all, the population from the south of France has been increasing slowly, and amounts at present to 40–50 pairs.

5) The Italian Peninsula (6–B, 7–C). In the previous century and in the first half of the XXth century 10 sites were recorded including, on average, 100–130 pairs. After 1950 4 sites were recorded, while the numbers were cut down to about 30 pairs. This decrease was connected, in the first place, with land-reclamation and insufficient protection.

6) The Balkans (8–C, 9–C, 10–C, 9–D). There were 10 sites in this region in the XIXth century and the numbers were kept at the level of 450–500 pairs. In the first half of the XXth century the numbers did not change, while the number of sites increased up to 14. In the years 1950–1960 the number of pairs was cut down to 130–150, while the number of sites was reduced to 6. The regression was the result of the transformation of the breeding habitat and insufficient protection. At present, some of the sites that had disappeared are restituted, and the numbers of the Squacco Heron increase.

7) Turkey and the eastern part of the Mediterranean Coast (11–C, 11–D, 12–D, 12–E, 12–F, 13–D). In the part of the area including the region mentioned there has been roughly speaking, a permanent decrease in the numbers. In the middle of the XIXth century 12 sites were recorded and the numbers of *A. ralloides* were estimated at 450–500 pairs. In the first half of the XXth century 10 sites were recorded there and the number of pairs amounted to 300–350 pairs. The state after 1950 was as follows: 5 sites and 200–230 pairs. The regression has been connected with the rapid rate of land-reclamation and inefficient methods of protection. In recent years there has also been in this region a numerical increase in the case of some of the sites.

8) Mesopotamia (15–E, 15–F). *A. ralloides* nested sporadically at 5 breeding sites in the region. The size of the population probably did not exceed 20–40 pairs. At present there is little probability that *A. ralloides* could still nest there.

9) Turkmenistan, Kazakhstan, Uzbekistan (17–B, 17–D, 18–C, 19–D, 19–E, 20–B, 20–D). Breeding sites of *A. ralloides* in this desert region were particularly dispersed. In the previous century 16 sites were recorded and the numbers of the population were estimated at 800–1,000 pairs. In the first few decades of the XXth century the number of sites was cut by about half, while the number of pairs, when sporadic nesting prevailed, did not exceed 150–200. In the last 30 years the Squacco Heron has been nesting intermittently in the lower reaches of the Amu-Darya, and the number was estimated at a few dozen pairs. The disappearance was mainly connected with the transformation of the habitat.

10) The Caspian Plain (15–B, 16–B). 6 sites of *A. ralloides* were recorded in the XIXth century in the region covering the Volga Delta and the Caspian lakes, the number of pairs was estimated at 1,400–1,600. The average values for the first half of the present century showed a decrease — 4 sites and 300–400 pairs were recorded. The reserve protection resulted in an increase in the numbers, already after 1930, while the number of sites remained unaltered. At present there are about 800–1,000 pairs, and a progressive tendency is evident.

11) The Caucasian (14–C, 15–C, 16–C, 15–D, 16–D). This vast region belongs to those parts of the area where the numbers of *A. ralloides* systematically decrease. Only in the last several years the numbers of the species at some of the sites (e. g. the Kyzyl-Agatsch reserve) started increasing drastically. 22 sites of *A. ralloides* were recorded there in the second half of the XIXth century (3,800–4,000 pairs). The average value for the first half of the present century amounted to 24 sites and 2,000–2,200 pairs. At present it is difficult to obtain quantitative data, as the materials presented by some of the authors are controversial (cf. GREKOV's data (1965)). Nonetheless we can accept that, e. g. in Lenkorania, the present drastic numerical increase has passed into the logarithmic phase.

12) The north of the Black Sea region (10–B, 11–B, 12–B, 13–B, 14–B). 31 breeding sites were recorded in the second half of the XIXth century, and 3,800–4,200 pairs nested

there. As a result of an intensive direct reduction the numbers of the population decreased in the first few decades of the present century down to 2,100–2,300 pairs, while the number of sites increased to 37. In the years 1950–1960 there was a particularly intensive increase in the numbers although the number of sites (land-reclamation) decreased to 26. At present there are more than 4,500–4,800 pairs with a further tendency to increase, so there are more Squacco Herons there than in the IInd half of the previous century. The numbers of *A. ralloides* increased particularly intensively in the lower reaches and in the Danube Delta, as well as in the Dnieper Delta.

13) The drainage area of the middle reaches of the Danube (8–B, 9–B). 46 breeding sites were recorded there in the second half of the XIXth century. The numbers of the population were estimated then at 5,500–6,000 pairs — thus it was the area of the most intensive concentration of the species. But here the results of numerous shooting of the Squacco Heron and the destruction of breeding colonies at the turn of the century were particularly painful. This was supported by the average values for the first half of the present century: 1,800–2,000 pairs and 40 sites. As this is a densly populated area the intensive tranformation in the ensuing stage (the years after the Ist World War) led to a decrease in the number of sites (20 sites), and a further decrease in the numbers of the species. Only 1,000–1,200 pairs were in the years 1950–1960. New sites have been set up in recent years, and a tendency to an insignificant numerical increase has been recorded.

Such regions as the Mediterranean islands and the area northwards to the 48° line of northern latitude are not discussed here. Everywhere there *A. ralloides* occurred at ephemerical sporadic sites, and nested not longer than 1–2 breeding seasons at a given site.

Table 5 presents the percentage relations of secular changes in the numbers of *A. ralloides* for separate parts of the range against the 5-degree scale estimating the effect of the anthropogenical factor. The data presented (some of them approximate) may give some idea of the relationship between the secular changes in the numbers of the species investigated and the degree of environment transformation, as well as the development of protection culture in various parts of the range (Table 5).

A direct reduction of *A. ralloides* in the XIXth century was most intensive in the eastern and central regions of the area. The indirect reduction was most intensive in the southern parts where a shortage of fresh water is coupled with overpopulation.

In the following areas the numbers of *A. ralloides*, as compared with the state in the second half of the XIXth century, were cut by 80% or more: the north-western part of Africa, Mesopotamia, the Caspian part of the range (Turkmenistan, Kazakhstan, Uzbekistan), the Italian Peninsula, and the drainage area of the middle reaches of the Danube. The numbers were cut by nearly 50% in the Balkans, the Caucasus, and Turkey. A 30% decrease occurred in the Caspian Plain. An increase in the numbers (particularly after 1960) was recorded in a number of regions in the range. The following should be mentioned here: the Iberian Peninsula, the south of France, the north of the Black Sea region, the Transcaucasian region (mainly Lenkorania). At present a tendency to the restitution of the numerical state of the species investigated can also be observed in the Balkans, the drainage area of the middle reaches of the Danube, and even in Turkey and the Caspian Plain.

Table 5. Secular changes in the numbers of *A. ralloides* in separate regions of the breeding range and the effect of the anthropogenical factor (the data include the period until 1960).

Regions of the range	Period	Secular changes in the numbers in °/₀°/₀		Effect of the anthropogenical factor		
		of breeding sites	of numbers of the species	direct reduction	indirect reduction	protection
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Northern Africa (8)	a	100	100	3	2	1
	b	89	47	4	3	2
	c	33	16	3	4	1
Iberian Peninsula (9)	a	100	100	3	2	1
	b	200	100	3	3	2
	c	300	280	1	2	4
Southern France (10)	b	100	100	3	3	2
	c	200	300	2	3	3
Italian Peninsula (11)	a	100	100	3	2	1
	b	83	80	4	2	2
	c	33	20	3	4	3
Balkans (12)	a	100	100	3	3	1
	b	140	90	4	3	2
	c	60	28	3	4	3
Turkey and the eastern coast of the Mediterranean Sea (13)	a	100	100	3	1	1
	b	83	60	3	2	1
	c	41	40	3	4	3
Mesopotamia (14)	a	100	100	3	2	1
	b	80 (?)	40 (?)	4	3	1
	c	?	?	4	3	1
Turkmenistan Kazakhstan Uzbekistan (15)	a	100	100	4	2	1
	b	44	20	3	4	2
	c	6 (?)	2 (?)	3	3	3
Caspian Plain (16)	a	100	100	4	2	1
	b	66	23	3	3	3
	c	66	60	2	3	4
Caucasian region (17)	a	100	100	3	2	1
	b	110	50	3	4	2
	c	45	30	3	3	4
North of the Black Sea region (18)	a	100	100	4	2	1
	b	120	55	3	3	2
	c	84	118	1	3	3

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Drainage area of	a	100	100	4	3	2
the middle	b	87	33	3	4	2
reaches of the						
Danube (19)	c	43	17	2	3	4

Explanations to the table: a — IInd half of the XIXth century, b — Ist half of the XXth century, c — years 1950–1960. The 5-degree scale estimating the effect of the anthropogenical factor: 1 — minimal or no effect, 2 — very moderate, insignificant, 3 — moderate, 4 — considerable, 5 — very strong.

To conclude the following points should be stressed: the secular oscillations of the Squacco Heron numbers were least intensive in the centre of the range in the region of the maximum concentration of the species. These oscillations increased towards the peripheries. The highest concentration of the species in the XIXth century occurred between the 16° and 20° of eastern longitude, while in the XXth century it was situated between the 28° and 32°, as well as between 48° and 52° line of eastern longitude. Secular oscillations in the numbers and changes in the distribution were more considerable along the parallel axis of the area. The distribution in the meridian cross-section was right-handed asymmetrical with the peak in the northern part of the area. The most intensive concentration in this type of cross-section occurred between the 44° and 48° of northern latitude, and it assumed a more permanent character as well.

FRONTIER CHANGES OF THE PALEARCTIC RANGE

Breeding sites of *A. ralloides* within the range occur in a mosaic-like pattern. The isolation between them reaches tens and hundreds of kilometres. As it was mentioned in previous chapters, they are grouped in a few basic centres, and their density is several times higher than in the remaining parts of the range. Consequently it seems reasonable, when presenting the range graphically, to mark on the maps either separate sites or areas with their specified density. The latter method seems to be more rational as it reveals the openwork (mosaic-like pattern) of the distribution characteristic for the given species. In such a case the traditional determination of the range frontiers is, to a certain degree, meaningless. So when we discuss secular frontier changes of the palearctic range of *A. ralloides*, we should treat them as border changes in areas with a specified, higher density of breeding sites. It can be mentioned that the attempts undertaken so far to present the breeding range of *A. ralloides* in faunistic or academic works (e. g. in the works of Mackworth-Preed and Grant (1957), Peterson and others (1958), Spangenberg and

others (1951), or VOOUS (1960)) have never gone beyond the traditional approach. The present paper also employs classical methods of the description of range borders, but they are understood here, after DARLINGTON (1957), as more or less wide zones of peripheral occurrence displaying considerable oscillations both in the number of breeding sites and in their size.

The mosaic-like pattern of the Squacco Heron range (Map 11), particularly in the case of its eastern and western ends, seems to be a disjunctive distribution. However they are not real disjunctives connected with a genetical isolation and a complete autonomy of the parts separated. In spite of this separation and mosaic-like pattern, the parts of the range under consideration

Map 11. Secular changes in the distribution of *A. ralloides* (SCOP.) in the palearctic range; 1 — distribution in the years 1950–1960, 2 — distribution in the middle of the XIXth century, 3 — expansion zones of the species in the last 30 years.

are structurally complete, and consequently all the numerical changes inside the range affect the oscillations of its frontiers (this problem will be thoroughly discussed in one of the ensuing publications).

Map 11 presents the occurrence of *A. ralloides* in the middle of the XIXth century and after 1950 — and so it illustrates changes in the distribution which occurred in the last 100 years. Roughly speaking *A. ralloides* disappeared in those parts of the area where its numbers in the XIXth century were low as a rule, and its breeding sites (most of them sporadic) were quite dispersed.

In the middle of the XIXth century, and probably generally in the historic times, the eastern frontier of the distribution was made up by the following rivers: the Syr-Darya, the Zaravshan, the middle reaches of the Amu-Darya, and the drainage area of the lower reaches of the Tigris and Euphrates. The earliest regression in the XIXth century occurred in the middle reaches of the Amu-Darya and the drainage area of the Tedzhen and the Murghab, i. e. the southern regions of the Turkmenistan centre. The disappearance gradually

shifted northwards and southwards (the lower reaches of the Sar-Darya and the Amu-Darya, as well as the Tigris with the Euphrates). At the turn of the century the species disappeared completely also along the eastern coast of the Caspian Sea. The regression occurred along the south-western coast of the Mediterranean Sea as well. As a result the frontier was shifted towards the north-east, on the average by about 1,200 km (!). In our times the south--eastern frontier of the range starting from the Volga Delta in the north, runs along the western coast of the Caspian Sea, then suddenly turns across Iran and Turkey towards the south-west, including also Antiochia.

In the last 40 years *A. ralloides* nested sporadically and intermittently in the lower reaches of the Syr-Darya (1 recording) and the Amu-Darya (8 recordings) — thus we are confronted here with the phenomenon of an unusually wide oscillations in the case of the eastern frontier.

In the Transcaucasian region *A. ralloides* retreated in the first few decades of the XXth century from a considerable number of sites (see map 11). In the case of the Caucasian part of the Black Sea coast the onset of the regression occurred as early as in the first half of the XIXth century, as nobody recorded the Squacco Heron in the second half of that century in e. g. the Rion Delta, and the recording from the vicinity of Batumi concerned probably the final, before the complete disappearance, cases of sporadic nesting. In Turkey *A. ralloides* is vanishing in the region of the Ararat from certain of the sites there, both in central parts of the country and in the south-west.

This decline covers in the north the lower reaches of the Syr-Darya and Amu-Darya, the Ural Delta, the Caspian steppe lakes, the Don Delta, the Crimea, the lower reaches of the Dnieper (except the Delta), the middle and the lower (partly) reaches of the Dniester (also except the Delta), the drainage area of the upper Theiss, and the region of Lake Neusiedler. In the range of Manytsch the Squacco Heron goes on nesting, but only sporadically — thus this is again an oscillating section of the range frontier.

The regression in the Hungarian Plain includes a considerable number of sites. A considerable part of the Balkan sites have already vanished. Similar changes took place in the north-Italian centre and in the northern part of Africa.

The territorial expansion of the Squacco Heron occurred in the present century in the following regions: the mouth of the Marica (Évros), the region of Burgas on the Bulgarian coast of the Black Sea, the south of France, the province of Sabina in Italy, Toledo in Spain.

*
* *

The following conclusions should be presented in the way of summary: in the last 100 years the territorial regression of *A. ralloides* occurred in the

almost entire palearctic range including, in the first place, areas with a low density of breeding sites and small numbers of the species (Map 11). As a result the range decreased more intensively than the numbers.

The most acute regression took place in the eastern and southern regions. Some territorial expansiveness of *A. ralloides* in the western regions was recorded in the XXth century, and particularly in the last two decades. When the numbers of the species were optimal and highest in the XIXth century, the most intensive oscillations were recorded in the case of the northern and southern frontiers of the range. After a considerable decrease in the numbers of the species in the first half of the present century the frontiers mentioned became stabilized, while the eastern and western frontiers started oscillating.

In the first half of the previous century the frontiers of the range ran along the southern and eastern coast of the Aral Sea, the valley of the Syr-Darya, the Zaravshan, the valley of the middle reaches of the Amu-Darya, the drainage area of the Tedzhen and the Murghab, the valley of the Artek river. Starting from the southern coast of the Caspian Sea the frontier ran along the drainage area of the lower reaches of the Tigris and Euphrates, the valley of the Jordan, across Crete, Sicily, northern parts of Tunisia, Algeria and Morocco, then across the southern parts of the Iberian Peninsula, Sardinia, northern Italy (the valley of the Po), and further north-eastwards across Lake Neusiedler, along the Danube, it crossed the upper reaches of the Theiss, the Carpathian mountains, and then along the middle reaches of the Dniester, the Dnieper near Kiev, the drainage area of the Manytsch, the north Caspian lakes, included the Volga Delta and the Ural Delta reaching the southern coast of the Aral Sea.

After over 100 years the frontiers of the range shifted considerably and at present they look as follows: to the east of the Volga Delta the frontier runs along the western coast of the Caspian Sea, then along the middle reaches of the Arax river, it turns to the west, and it includes Antiochia, then crosses the region of the Marmara Sea (Lake Manyas Gölü), the mouth of the Marica (Évros) in the Balkans, the Krna river, Lake Skadarsko, the mouth of the Neretva river. Further west the frontier runs across the central part of Italy, turns sharply to the south crossing the north-eastern part of Tunisia and the north-western part of Morocco, includes the south of the Iberian Peninsula (the mouth of the Guadalquivir, Toledo). From Camargue the frontier runs along the Rhône as far as Dombes, then along the Po approaches the Hungarian Plain from the south-west. Next it crosses Lake Balaton, the Velencze, and the Danube to the south of Budapest, and then along the middle reaches of the Theiss and Körös rivers, and returns to the Danube and along the valley of this river covering the mouth of the Pruth it reaches the coast of the Black Sea. Further east the frontier is made up of the Dniester Delta, the Dnieper, and the Kuban. It reaches the Volga Delta across Manytsch.

THE EFFECT OF THE ANTHROPOGENICAL FACTOR

The increasing effect of the civilization, from the middle of the XIXth century on the state of the European avifauna was often dealt with in numerous publications on the subject. It is beyond any doubt that the anthropogenical factor have had a considerable effect on the numbers of the majority of water fowl and wading birds in the last hundred years. Not only industrialization but also the transformation of the countryside decided the fate of rare and with difficulty synanthropizing representatives of the *Ardeidae* family. At the turn of the century the direct reduction was connected with the secessionist vogue of egrets, and generally of bird feathers for woman dresses. This situation has been discussed earlier (JÓZEFIK, 1957).

I have discerned two phases (page 65) in which the anthropogenical factor influenced upon the regression of the Squacco Heron in the entire palearctic range. Let us analyse in greater detail the character and certain mechanisms of numerical changes in the first stage of regression, and the dominating factor turns out to be the uncontrolled direct reduction of the species.

As long as the heron feathers were not in great demand on the world markets, there was never any problem of the protection of the species. The period of *Ardeidae* destruction started gathering strength in the middle of the previous century. In the years of "fin de siècle", after exterminating, in the first place, *E. alba* and *E. garzetta*, the remaining heron species were got at. Expeditions with perfectly equipped ships reached the most distant river deltas. At that time shooting herons outside breeding colonies was not so much profitable and even the most inaccessible heronries became the target and none of the species was spared. The market prices of heron feathers soared up. They are quoted, as a sort of document characterizing the effect of the secession on the situation of herons in Europe, by OGNEV (1913), ZHIDKOV (1914), SCHENK (1918), BUTURLIN and others (1940). Fortunes were made and consequently the most intricate and ingenious ways and methods were used. Heron eggs were also in great demand as they could be used in the production of delicate soaps and other cosmetics. As a foodstuff they were called "Persian eggs" and sold in the Russian markets. This period lasted until the Ist World War, but its consequences were felt much longer (e.g. cf. diagrams 7, 8, 11). The rate of decline of the Squacco Heron numbers in this period (cf. pages 60, 61) was surprisingly drastic.

The situation of *A. ralloides* until the twenties of the present century in the Amu-Darya Delta was described by MOLTSCHANOV (1912), while for the Volga Delta BOSTANZHOGLO (1911), OGNEV (1913), ZHIDKOV (1914), VOROBIEV (1936), TURGENIEV (1947), and KURAZHSKOVSKIY (1958) supplied their discriptions. The situation in the Danube Delta was recorded by OSTERMAN (1912), CĂTUNEANU (1958), MUNTEANU (1960); in the Dnieper Delta and the Dniester Delta by PATSCHOVSKIY (1911), PODUSHKIN (1912), PARAMONOV (1924, 1925). The extermination of the Turkish population was described by SELOUS (1900). The situation in the heronries of the middle reaches of the Danube was thoroughly analysed by SCHENK (1908a, 1912; 1918). HODEK (1877a, b) wrote earlier about the extermination of herons in the XIXth century in the case of some of the sites (e. g. Obedska Bara). This author had urged to a more rational exploitation of heron resources even before the egret vogue reached its peak. He contributed much to the setting up of the Obedska Bara reserve in which the herons survived relatively successfully the "madness of fin de siècle". The other distinguished organizer, though not appreciated by his contemporaries, was SCHENK (the organizer of the reserve at Kisbalaton, the moving spirit of the "Society

for the Protection of rare Egrets and Herons") (cf. SCHENK, 1908a, b, 1918, 1924, 1926, 1929).

In the period discussed the world opinion was alarmed not only by publicists, but also by special lectures, photographic exhibitions (colonies with hundreds of dead nestlings devasted by poachers, etc.) (ANFILOV, 1913). The problem of heron protection found its way even to fiction (belles-lettres). Some positive results were even achieved — the levying of higher duties of the import on heron feathers, ban on imports, etc. Fortunately the Ist World War put a stop to the seccessive fashion.

This period of direct reduction was not only connected with a sudden drop in the numbers of *A. ralloides*. The crisis suffered by a species gives rise to the mechanism of selfpreservation. Let us consider this problem.

It follows from diagram 23 that until 1920 large and very large sites vanished most rapidly. This was undoubtedly connected with wholesale shooting of

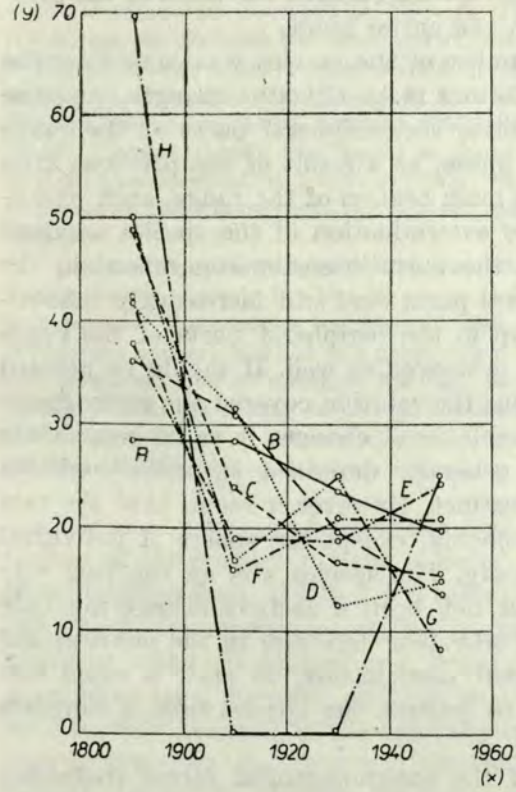

Diagram 23. Rate of numerical changes in *A. ralloides* (SCOP.) breeding sites of various size (changes expressed in per cent and related to the number of sites in each of the size categories); x — years, y — percentage scale, A — sites including up to 10 breeding pairs, B — 11–20 pairs, C — 21–50 pairs, D — 51–100 pairs, E — 101–200 pairs, F — 201–500 pairs, G — 501–1,000 pairs, H — < 1,000 pairs.

herons, the exploitation of eggs, and devastation of the largest colonies, best known and easy to detect in the given region. This systematic extermination of breeding sites carried out by man led to its total destruction. New small colonies were set up in not very suitable biotops by the remains of the micropopulations dispersed. Hence there were so many small sporadic sites. Other herons joined the existing colonies. But as the species was also exterminated in other than the breeding periods, medium and small colonies vanished as well,

although not so intensively. As it follows from diagram 23 the numbers of the smallest sites remained on, more or less, the same level. But this was only an apparent phenomenon. The analysis of materials connected with the smallest sites shows that they also vanished rapidly, but their loss was constantly compensated by the transformation of medium colonies into small ones, and the setting up of new small colonies. The mechanism of the decline of small colonies (sites) developed on different grounds and was caused by the specific gregarious conditions of the species — the exceeding of the limit of the minimal numbers by micropopulations habitating the given site. A general rotation of separate sites occurred in separate breeding areas and the largest of them became degraded in size. Due to the constant rise of small colonies together with a rapid reduction of the species numbers, there followed a delayed decrease in the numbers (cf. Diagram 11), and the species suffered the state of the greatest dispersion when considered within the entire range.

In natural conditions, when the number of the species was caused by the increasing pressure of the extremal factors (e. g. climatic changes, pressure of competitors, etc.), individuals inhabiting the peripheral parts of the range moved to its centre. Also in the first phase, as a result of the previous drop in the density of the population in the main centres of the range, such phenomenon was quite expected. But as the extermination of the species assumed a regular character in the regions of the most intensive concentration, the effect was quite reverse — the peripheral parts were still increasingly inhabited. When such larger sites were set up in the peripheral parts of the range they were easily detected by man and destroyed as well. It should be pointed out marginally that except small sections the rotation covered the entire range and from the point of view of microevolutional changes it could consolidate the complex of ethological features, generally described as anthropophobia and the weakening of the gregarious instinct. However it seems that the rate of reduction was too fast and anthropophobia, except the sphere of individual experience, could not be fixed genetically. The species was on the best way to the total destruction. If there had not been a decisive change not only in the world fashion after the Ist World War but also in the political and economical relations, no compensational mechanisms, at such a rapid rate of reduction, would have been able to protect the species from a complete extermination.

The second phase of the effect of the anthropogenical factor (reduction of the resources of the breeding habitat and its transformation), although it had existed in the pre-historic times, was particularly acute in the period between the two World Wars. This was determined by a rapid increase in the world population, and first of all by the technical and industrial development coupled with a relatively low level of protection.

The fertility of marshy habitats, particularly in valleys and river deltas was a deciding factor which affected their transformation, as well as the reali-

zation of demands for protection of nature. The transformation of the habitats of the species investigated proceeded in the following directions: 1) direct exploitation, and connected with it devastation, quite irrational in the majority of cases (cutting and burning out of reeds, turning out of animals and fowl, raising of fur-bearing animals, setting up of fish ponds), 2) carrying out of land-reclamation and adaptation for rice cultures, 3) drying up of marshes (cultures, industrial and strategic buildings), 4) flooding of river valleys (setting up of reservoirs).

A number of authors related the degree of transformation which the initial habitat of *A. ralloides* underwent in the separate regions of the range. Thus the land-reclamation in Antiochia and its effect of the numbers was described by KUMERLOEVE (1960), the problem of the Transcaucasian region was dealt with by ISAKOV (1948), the Volga Delta by VOROBYEV (1936), SYROYETSCHKOVSKIY (1955). Changes in the lower reaches and the delta of the Danube were described by BUSNICA (1956), RUDESCU (1959), PASPALEVA-ANTONOVA (1961), on the Dnieper by APHANASYEV, BILYK, and others (1952). The transformations in the Hungarian Plain were presented by CSATH (1930), STERBETZ (1957, 1958), GÉROUDET (1958), FESTETICS (1959), those in Banat by NADRA (1962), in Yugoslavia in the Voyvodina by GÉROUDET (1958), SZLIVKA (1959), in the valley of the Krna river by TERRASSE (1961), RUCNER (1965). The extent of transformations undergone by marshland habitats in Italy was described by MOLTONI (1936), FRUGIS (1955), ALTINI (1960), WARNCKE (1960), in France in the Rhône Delta by YEATES (1948), HOFFMANN (1959), in Spain by VALVERDE (1959).

It should be pointed out that the majority of the authors mentioned above discussed also habitat changes in the last 20 years. As far as the intensification of the tranformation is concerned, the analysis has showed that it was not weaker in the period 1940–1960. Differences between the last two periods were not the result of the rate of land-reclamation and transformation of marshes, but they can be presented as mainly caused by the following points: a) raising of the protection culture in the post-war period, b) effective synantropization of *A. ralloides* in certain regions of the range in the last 20–30 years. This problem will be discussed later.

The second phase of regression was characterized by the renewed concentration of the species in large colonies — in diagram 23 the curves presenting sites including from 100 to 1,000 pairs go up considerably. It should be pointed out about the mechanics of the phenomenon that the concentration of the numbers, although natural and proper for such a social species as *A. ralloides* must have been adversly affected by the activity of man. This was indicated by a further decrease in the numbers of the species, the only difference being that in this case the rate of decrease exceeded the drop in the number of breeding pairs. In diagram 23 the rate of decrease in the case of sites containing 10–100 pairs is particularly rapid and is directly connected with the drying up, land-reclamation of small and medium size, in the first place, marshes and reservoirs, giving at the prevailing level of technological development rapid economical effects. Thus two factors came to the front: on the one hand the natural process of concentration into larger colonies, and on the other hand a decrease in the area of small and medium size breeding sites.

As a consequence large sites became over-crowded, and the inter- and intraspecific competition increased. The species, in spite of the apparent onset of stabilization, was forced to adapt to the transformed environment. And the period of synanthropization, initiated in the XIXth century, was intensified. The formation of proportions between sites of various size in this period (Diagram 24) just reflected this very state of things presented above. To-

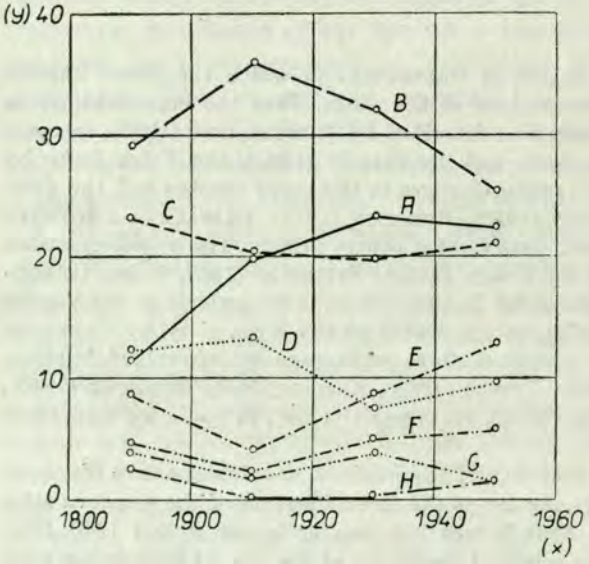

Diagram 24. Secular changes in the percentage relation of *A. ralloides* (Scop.) breeding sites of various size in separate periods of time; x — years, y — number of sites in the given period in per cent; classes of site size: A — 1–10 pairs, B — 11–20 pairs, C — 21–50 pairs, D — 51–100 pairs, E — 101–200 pairs, F — 201–500 pairs, G — 501–1,000 pairs, H — < 1,000 pairs.

gether with an increase in the percentage of large sites and a decrease in small and medium size sites, there was also unexpectedly an increase in the percentage of the smallest sites (1–10 pairs). They are in the majority sporadic sites. Thus it is not difficult to conclude that this category of sites is the pointer of overcrowding and search for new breeding areas. Most frequently they were areas with biotops differing in character (e. g. rice fields) to which the species had yet to adopt. It should not be left out of reckoning that the Squacco Heron as the mutuant of the Night Heron, had quite a limited range of possibilities (e. g. considerable differences in the feeding habitats of the two species), although the Night Heron occurs in larger numbers and consequently covers larger areas.

A number of authors reported the stabilization, and then an increase in the numbers, of *A. ralloides* in the last period (years 1940–1960). As compared with the years 1920–1940 the state of the species became stabilized in the Volga Delta (Dobrokhotov, 1961). In Lenkorania in the Kyzyl-Agatsch reserve there occurred a sharp increase (Oganesov, 1960; Grekov, 1965). In the Dniester Delta (cf. page 155), and in the Dnieper Delta the numerical state improved (Gizenko, 1963). In the Danube Delta (cf. page 173; Cătuneanu, 1958; Munteanu, 1960), as well as in the lower reaches of this river the numbers increased quite rapidly (cf. page 172; Taniu, 1963). The numbers increased also on the Bulgarian coast of the Black Sea (Mountfort, 1962; Mountfort, Ferguson-Lees, 1961 a).

A few new sites were set up in the Hungarian Plain (e. g. Rétszilas, Halásztelek, etc.). The numbers increased in Yugoslavia as well (Béllye, Obedska and Carska Bara, Hutovo Blato). New sites, distant from the previous areas, were set up in the west of Europe (Dombes, El Taray).

Only a short outline of the mechanics of changes occurring in the last period will be given here. An absolute increase was in the numbers of the species although the rate of decrease in the number of sites was 3-times slower. Diagram 23 shows the increase of sites including over 1,00 pairs (here sites of 500–1,000 pairs were re-grouped to higher categories and medium size sites). Their proportions resembled those in the second half of the XIXth century (Diagram 24), the only difference being that sites of 10–20 pairs were intensively regrouped to higher categories, while the level of the lowest category did not change. As before, they were mainly sporadic sites but expansive in their character. Paralelly with a decrease in the breeding area (land-reclamation continued), the net of reserves was strengthened and expanded. This reserve protection directly affected the increase in the numbers of *A. ralloides*. At present this species is nesting in the following reserves: Astrakhan Reserve — sites 19, 20, 21, Kyzyl-Agatsch — site 31, Black Sea reserve — site 64, Kisbalaton — site 95, Sasér — site 106, Fehér-tó — site 109, Carska Bara — site 110, Obedska Bara — site 125, Satchinez — site 128, Sreberna — site 139, Manyas Gölü — site 157, Camargue — site 175, Hutovo Blato — site 191, Coto-Doñana — site 207.

Sites within these reserves make up more than 25% of the regular sites prospering in the period 1950–1960 in the palearctic part of the range. They are all state reserves. I have not mentioned any local, periodical, or hunting reserves, which were set up in, for example, Portugal, Italy, or even the Ukraine.

Out of the countries where *A. ralloides* breeds, only Hungary have introduced the protection of the species. As a result small sites have been set in recent years in a few regions of this country. The survival of small sites in the conditions of agricultural landscape is possible only when the specific protection is realized.

The "frontier refuges" are not without significance for the survival of the species in certain parts of the range (some of the sections of the Danube, the Pruth, the Arax, Lake Scutari), where the protection of the national frontier provided peace and a relatively little devastated habitat.

The phenomenon of occupying the ecological niches of others species, and as such more attractive for hunters and consequently more depleted, was observed in some countries. For example, *A. ralloides* partly occupied the Night Heron's feeding biotops in the Danube Delta, as well as those of the Glossy Ibis and, rarely of the Little Egret.

The other fact affecting considerably the present increase in the numbers of the species investigated is, in some parts of range an advanced synan-

thropism, that is the adaptation to the habitats transformed by man. Thus in western and central regions of the range the species was observed feeding on rice cultures (e. g. Camargue, the region of Sasér, the Transcaucasian region), irrigation canals, fish ponds. The Squacco Heron adapted itself to feeding on canals and rivers with a heavy traffic of ships (e. g. the Danube Delta). In many regions (e. g. the lower reaches of the Danube) the species can frequently be observed as a commensal of swine grazing on marshes.

The control of wild predator populations by man is not without significance for any increase in the numbers of *A. ralloides*. This resulted in the lowering, particularly in the west of Europe, of the minimum size values of micropopulations, and it enabled the Squacco Heron to habitate even on small reservoirs with a low ecological capacity. This problem will be discussed in greater detail in one of the ensuing publications.

Thus as a result of an increase in the general culture of the society, and protection culture in particular, as well as due to the increased rate of synathropic processes the last 20 years provided grounds for optimism, on the condition that the further progress of civilization will retain the existing balance.

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Summing-up it should be stressed that the regression of *A. ralloides* initiated in the second half of the XIXth century and lasting until the thirties and even the fourties of the present century went successively through two stages. In the first stage, lasting until 1920, the dominating factor was the uncontrolled direct extermination and persecution of the species connected with the successive fashion of adorning women's hats and dresses with feathers. The most intensive reduction occurred in the regions of the highest concentration of the species. The rate of extermination was very rapid and the palearctic part of the species was at the threshold of a total destruction. This period was characterized by the destruction, in the first place, of largest and medium size breeding sites, and the frequent setting up of small sites and a general increase in the number of sporadic sites. The distribution of sites displayed lack of stabilization — a considerable dispersion of the species occurred in the range. The Ist World War put an end to the exploitation of heron resources which had developed into a sort of industry.

The second stage of regression was characterized by an indirect control of the numbers through reduction and the transformation of the breeding habitats. The insufficient net of reserves and the relatively low protection culture in the period between the two World Wars contributed to a moderate regression, particularly in overpopulated areas with insufficient resources of fresh water. This period witnessed the renewed concentration of the species

at large sites, an increase in their density which resulted in the occupation of transformed habitats and their synanthropization intensified.

The period of stabilization and an increase in the numbers commenced, as a matter of fact, during the IInd World War, and has intensified since then. This period was characterized by an increase in the numbers as compared with the state from the years 1920–1940, by 30%, although as a result of continued land-reclamation the number of sites decreased but only insignificantly (this is based on the data for the period until 1960). Paralelly the restitution of sites which had been destroyed earlier and the territorial expansion occurred in certain regions of the range. Stabilization and an increase in the numbers were the result of a considerable improvement in the protection culture of many European countries, and the expansion of the net of state reserves. At present sites of *A. ralloides* flourish in 14 large state reserves. The other main factor affecting an increase in the numbers is the synanthropization of the species. In many regions of the range, particularly in its central and western parts, there occurred an effective adaptation of *A. ralloides* to the transformed habitats (rice cultures, irrigation canals, fish ponds, etc.) or those with a heavy traffic (ships, mechanical vehicles). The control of wild fowl populations by man also favoured the increase in the numbers, as well as the use of ecological niches partly left by large allied species and reduced by man because of their hunting attractiveness, or destroyed as ichtiophages. The species investigated is more and more often observed as a commensal of swine grazing on marshes. Taking all this into account we can suppose that if these factors go on affecting permanently the position of the Squacco Heron in the palearctic range, it may steadily improve.

CONCLUSIONS

The basic conclusions following from the analysis presented in the previous chapters on changes in the numbers and distribution in the palearctic range can be presented thus:

A. ralloides is a relatively rare species in the part of the breeding area discussed, although it occurs quite numerously at some of the sites. Both the number of the breeding sites and the numbers of the species suffered considerable secular oscillations in the last two centuries. The decrease in the number of breeding sites was particularly evident in the period 1920–1940, while the decrease in the numbers of the species (i. e. number of breeding pairs) reached the lowest point and the highest rate in the years 1900–1920. The most acute crisis occurred at the turn of the century (years 1890–1910). This was supported by the value of the secular oscillation index Q_{os}. The crisis was overcome after 1930, i. e. at the moment when the numbers of European bird species also started increasing numerically, expanding at the same time their ranges.

Comparing the rate of decrease in the number of sites and the number of breeding pairs, we have concluded that the main cause of regression in the entire part of the area in the last decades of the XIXth century and until 1920 was a direct drastic reduction of the species numbers carried out by man. The prolonged, though not so intensive as until 1920, regression in the period 1920–1940 was caused by the reduction of breeding habitats (land-reclamation, tarnsformation of marshland habitats). A stabilization followed in the years 1940–1960, and then a considerable numerical increase of the species connected with the restitution of sites which had been destroyed and the setting up of new sites. The balance of destruction and the establishment of new sites was positive only in recent years. Thus in the course of over 100 years we can single out two periods of secular changes which depend on the effect of the anthropogenical factor: 1) period of regression (1850–1940) which had two successive phases: a) direct reduction until 1920 with a peak at the turn of the century, b) indirect reduction until 1940; 2) period of stabilization with a tendency to expansiveness initiated after 1930 and particularly favouring the numerical increase after 1960.

The dominating limiting factor in the first phase of regression was the uncontrolled direct extermination and persecution of the species connected with the seccessive fashion of adorning women's hats and dresses with feathers. The most intensive reduction occurred in the regions of the most intensive concentration of the species. The rate of decrease was considerable and the palearctic part of the species at the threshold of a total destruction. Characteristic for the period are the following facts: the destruction, in the first place, of largest and medium size sites, frequent setting up of small sites, and a general increase in the percentage of sporadic sites. The distribution of sites was lacking in stability — a considerable dispersion of the species occurred in the range.

The second phase of regression was characterized by an indirect reduction in the species numbers through the extermination and transformation of the breeding habitat. The insufficient net of reserves and not very high level of protection culture in the period between the two World Wars resulted in a moderate regression, particularly in overpopulated areas with insufficient fresh water resources. This period was characterized by a renewed concentration of the species at large sites, over-crowding, and this resulted in the habitation of transformed habitats and led to the intensification of synanthropic processes.

Stabilization and an increase in the numbers were helped considerably by an improvement in the protection culture of many European countries, as well as the expansion of the net of state reserves. The other main factor affecting the increase in the numbers is the species synanthropization. In many regions of the range, particularly in its central and western parts, *A. ralloides* effectively adapted itself to the use of transformed habitats, sometimes

very busy ones. The numerical increase was also favoured by the control of wild predator populations by man, and the use of ecological niches by the Squacco Heron which had been left by larger allied species.

Proportions between the number of regular and sporadic sites in the range reflect the numerical changes of the species. A relative increase in the number of sporadic sites was connected with the regression or expansion of the species. When the state of the breeding area is homeostatic the per cent of regular sites is highest. Both at the turn of the century and in the period 1940–1960 there occurred a relative increase in the number of sporadic sites.

In the period discussed the smallest oscillations of *A. ralloides* numbers were recorded in the centre of the range where the concentration of the species was most intensive. These oscillations increased towards marginal zones. Numerical oscillations and changes in the distribution were more considerable along the parallel axis of the range (i. e. in the parallel cross-section). The most intensive concentration of the species in the XIXth century occurred between the 16° and 20° lines of eastern longitude, while in the XXth century it occurred between the 28° and 32°, as well as between the 48° and 52° lines of eastern longitude.

The numerical distribution in the meridian cross-section is right-handed asymmetrical with a peak in the northern part of the range — the most intensive concentration of the species occurred in this cross-section between the 44° and 48° lines of northern latitude, and it assumed there a permanent character.

In the last 100 years the territorial regression of *A. ralloides* occurred in the almost entire palearctic range including, in the first place, areas with a low density of sites and the low numbers of the species. It was most effective in eastern and southern regions (the Turkmenistan centre, Mesopotamia, and to a lesser extent the Caucasus-Caspian centre, the Balkans, the northern part of Africa).

In the period of optimal and highest numbers of the species in the XIXth century the most important fluctuations were recorded in the case of northern and southern frontiers of the range. After a considerable drop in the numbers in the first half of the present century the frontiers mentioned became stabilized. But then the eastern frontier, and to a lesser extent the western one, started oscillating.

Secular changes in the numbers of the species occuring in one region of the range affect its numerical state and its distribution in the remaining areas.

Secular oscillations in the range frontiers depend on the numerical changes of the species. A decrease in the numbers is accompanied by the territorial regression. The territorial expansion is preceded by a certain period of an increase in the numbers. This is just a cumulative phase preceding the proper start of the species expansiveness.

REFERENCES

Aguesse P., Bigot L. 1960. Observations floristiques et faunistiques sur un étang de Moyenne Camargue: la Baisse Salée de la Tour du Valat. Vie et Milieu, Paris, **11**, 2.

Aharoni J. 1930. Brutbiologisches aus dem Antiochia-See. Beitr. Fortpfl. Biol. Vögel, Berlin, **6**, 5.

Alexander W. B., Harrisson T. H., Pease H. J. R., Tucker B. W. 1933. Some Spring observations on the Birds of the Camargue. Ibis, London, **3**, (ser. 13), 3.

Alléon A. 1886. Mémoire sur les oiseaux dans la Dobrodja et la Bulgarie. Ornis, Wien, **2**, 2–3.

Allouse B. E. 1953. The Avifauna of Iraq. Baghdad.

Alphéraky S. N. 1910. Pticy Vostočnogo Priazovja. Orn. Vestn., Moskva, **1**, 1.

Altini G. 1943. Le Garzaie nel Bolognese. Atti Soc. Ital., Milano, 82.

Andrássy E. 1957. Bird-life at the Érmellek. Aquila, Budapest, **63–64**.

Anfilov V. K. 1913. Tragedija hohlatoj capli. Pticeved. i pticevodstvo, Moskva, 1.

Anon, 1962. Conservation et aménagement des marécages, tourbières et autres milieux humides en zone tempérée. Bull. UJCN, Morges, (nouvelle série) 3.

Antipin V. M. 1959. Novye dannye po ornitofaune doliny Syr-Darji. Tez. dokl. II Vsesoj. orn. konf., Moskva, 3.

Arrigoni D. O. 1898. Eine Brutstätte des Schwarzen Milans bei Grezzano bei Verona. J. f. Orn., Leipzig, **46**, 4.

Arrigoni D. O., Moltoni E. 1930. Osservazioni fatte nelle garzaie di Greggio (Vercelli) e di Casalino (Novara). Natura, Milano, **21**, 4; **22**, 1.

Averin V. G. 1927. Ohorona ptahiv ta ptašyni zapovidnyki na Ukrajini. Ohor. pamjatok prir. na Ukr., Harkiv, 1.

Balát F. 1962. Contribution to the knowledge of the avifauna of Bulgaria. Práce Brnésk. zákl. Ceskoslov. Akad. Ved., Praha, **34**, 10.

Baldamus E. 1851. Beiträge zur Naturgeschichte einiger dem S. O. Europas angehörenden Vögel. Naumannia, Stuttgart, **1**, 1, 2, 4,

Baldamus E. 1852. Beiträge zur Naturgeschichte einiger dem S. O. Europas anghörenden Vögel. Naumannia, Stuttgart, **2**, 2.

Bannerman D. A., Bannerman W. M. 1958. Birds of Cyprus. London.

Banu A. C. 1964. Situaţia rezervaţiilor naturale din delta Dunării. Ocrot. Nat., Bucureşti, **8**, 1.

Bates G. L. 1933. Birds of the Southern Sahara and Adjoining Countries in French West Africa. Part 1. Ibis, London, **3**, (ser. 13), 4.

Bauer L. 1960. Wirtschaft und Naturschutz im Donaudelta. Urania, Leipzig/Jena, **23**, 5.

Benson S. W., Irving W. M., McDowell C., Higginbottom C., Lind P. B. 1962. Birds seen in Yugoslavia. Larus, Zagreb, 14.

Beretzk, P. 1943. Die Vögelwelt des Fehértó bei Szeged auf Grund 10-jähriger Beobachtung. Aquila, Budapest, **50**.

Beretzk P. 1950. The avifauna of the Fehértó near the town Szeged. Aquila, Budapest, 51–54.

Beretzk P. 1957. Beiträge zur Vogelwelt der Tisza. Acta Un. Szegediens., Szeged, **3**, 1–2.

Beretzk P. 1964. Ornithological data from between the Danube and Tisza. Aquila, Budapest, **69–70**.

Berge R. 1902. Die Vogelsiedlung des Neusatzer Riedes in Ungarn, J. Orn., Leipzig, **50**, 1.

Bernis F. 1954. Prontuario de la avifauna Española. Ardeola, Madrid, **1**.

Bernis F. 1961. Quatro notas sobre Garzas Españolas. Ardeola, Madrid, **7**.

Bernis F., Dies P. M., Tato J. 1958. Guion de la avifauna Balear. Ardeola, Madrid, **4**.

Bernis F., Maluquer S., Travé F. 1956. Algunas capturas interesantes del delta del Ebro y Valencia. Ardeola, Madrid, **3**, 1.

Bernis F., Valverde J. A. 1952. La Gran Colonia de Garzas del Coto de Doñana (ano 1952). Munibe, Madrid, **4**.

Bernis F., Valverde J. A. 1954. La gran colonia de garzas de Doñana en 1953. Munibe, Madrid, **1**.

Berthet G. 1938. De quelques observations récentes en Dombes. Alauda, Paris, **10**, 3–4.

Berthet G. 1941–1945. Note sur la nidificaton de l'aigrette garzette, *Egretta garzetta* (L.) en Dombes. Alauda, Paris, **13**.

Birrer E. 1960. Ornithologische Beobachtungen in Jugoslawien (Kopačevo-See). Larus, Zagreb, 12–13.

Bobrinskiy N. A. 1915. Rezultaty ornitologičeskih ekskursij v Surmalinskij i Ečmiadzinskij uezdy Erevanskoj gub. letom 1911 i 1912 gg. Izv. kavk. muz., Tiflis, **8**, 3–4.

Bobrinskiy N. A. 1916. Rezultaty ornitologičeskih ekskursij v Surmalinskij i Ečmiadzinskij uezdy Erevanskoj gub. letom 1911 i 1912 gg. II. Izv. kavk. muz., Tiflis, **10**, 2.

Bock W. J. 1956. A generic review of the Family *Ardeidae* (*Aves*). Amer. Mus. Novitates, New York, 1779.

Bodenheimer F. S. 1935. Animal life in Palestine. Jerusalem.

Boev N. 1962. Danni za liatnoto razprostranenie na niakoj vedove ptici u nas. Izv. Zool. Inst. Muz. BAN, Sofia, 9.

Boev N., Georgiev Z., Dončev St. 1964. Pticite v Trakia. Cast' 1. "Fauna na Trakia". Sofia, izd. BAN.

Bogdanov M. 1871. Pticy i zveri černomorskoj polosy Povolžja i doliny Srednej i Nižnej Volgi. Trudy Obšč. estestvoispyt. Imp. Kaz. Uniw., Kazan', **1**.

Bogdanov M. 1879. Pticy Kavkaza. Trudy Obšč. estestvoispyt. Imp. Kaz. Un-ta, Kazan', **8**, 4.

Bogdanov M. N. 1882. Očerki prirody Hivinskogo oazisa i pustyni Kyzyl-Kum. Taškent.

Borovikov G. A. 1907. Materialy dlia ornitofauny Ekaterinoslavskoj gubernii. Sborn. Stud. kružka Imp. Novoross. Univ., Odessa, 2.

Bostanzhoglo V. N. 1911. Ornitologičeskaja fauna Aralo-Kaspijskih stepej. Moskva.

Boutinot S. 1955. Nidification du Crabier et de l'Aigrette en Dombes. Ois. Rev. fr. d'Orn., Paris, **25**, 3.

Boutinot S. 1957. Nidification de l'Aigrette, du Crabier et de la Barge à queue noire en Dombes. Ois. Rev. fr. d'Orn., Paris, **21**, 1.

Braun F. 1908. Unsere Kenntnis der Ornis der Kleinasiatischen Westküste. J. Orn., Leipzig, **56**, 2.

Brauner A. 1898. Zametki o pticah Kryma. Odessa.

Brauner A. 1899. Zametki o pticah Kryma. Zap. Novorossijsk. obšč. estestvoispyt., Odessa, **23**, 1.

Brauner A. A. 1912. O vrednyh i poleznyh pticah Hersonskoj, Tavričeskoj, Bessarabskiej gubernij. Kišinev.

Brauner A. A. 1916. O gnezdovanii plavnevyh ptic. Školnye eksk. i školn. Muz., Odessa, 1.

Brehm A. 1911. Die Vögel. **1**, Leipzig — Wien.

Brehm A. 1911. Žizn' životnyh. Pticy. **6**, Peterburg.

Breuer G. 1929. Die diesjahrigen Brutkkolonien des Edelreihers am Fertösee. Kócsag, Budapest, **2**, 3–4.

Brisson M. 1760. Ornithologie ou méthode contenant la division des oiseaux en orders, sections, genres, éspeces et leurs variétes. **5**, Paris.

Brusina S. 1902. Zur Ornis Serbiens. Aquila, Budapest, **9**.

Busnita T. 1956. Delta Dunării. Bull. Inst. Cercet. Pisc., București, **15**, 3.

Butlerov M. 1879. Ornitologičeskaja fauna mestnosti Nukusa, ležaščej meždu Amu-Darjoj i Kuban'-Džapmoj. Trudy Sankt-Peterburgsk. obšč. estestvoispyt., Peterburg, **10**.
Buturlin S. A., Geptner V. G. et all. 1940. Životnyj mir SSSR. Pticy. Moskva-Leningrad.
Cabanne F., Ferry C. 1951. Quelques observations faites en Dombes au printemps 1950. Alauda, Paris, **19**, 3.
Carlo E. A. 1947. Osservazioni Ornitologiche sul Lago di Campotosto. Riv. Ital. Orn., Milano, **17**, 2.
Carlo E. A. 1960. Notizie ornitologiche dalla Sabina. Riv. Ital. Orn., Milano, **30**, 3.
Caterini F. 1941. Gli uccelli del Pisano. Riv. Ital. Orn., Milano, **11**, 4.
Cătuneanu I. I. 1939. Contributioni la cunoasterea faunei ornitologice a Deltei Dunării (Reg. Iolgani). Bull. Soc. Nat. Rom., București, **13**, 14.
Cătuneanu I. I. 1958. Coloniile de cuibarit din delta Dunării și necesitatea creării unor rezervatii ornitologice. Ocrot. Nat., București, 3.
Chapman E. A., McGeoch J. A. 1956. Recent field observation from Iraq. Ibis, London, **98**, 4.
Clarke W. E. 1884. Field-notes from Slavonia and Hungary, with an Annotated List of the Birds observed in Slavonia. Ibis, London, **5**, (ser. 5), 6.
Clarke W. E. 1898. On the ornithology of the Rhône. Ibis. London, **4**, (ser. 7), 16.
Club "Alcyon". 1961. La colonia Ardeidas de "El Taray" (Toledo). Ardeola, Madrid, **7**.
Club "Alcyon". 1963. La Garcilla Cangrejera criando en la Mancha. Ardeola, Madrid, **9**, 2.
Coiffait H. 1956. Les oiseaux du Manyas (Turquie). Bull. Soc. hist. nat., Toulouse, **90**, 1–2.
Conder P. J. 1963. Project MAR. Bird Notes, London, **30**, 7.
Congreve W. M. 1929. Some notes from South-Western Transylvania and the Banat of New Rumania. Ibis, London, **5**, (ser.12), 3.
Čornai R. 1959. Ornitološka opažanja na području Carske-bare, Obedske bare i Čantavira. Larus, Zagreb, **11**.
Coverley H. W. 1932. Nesting notes from Portugal. Ibis, London, **2** (ser. 13), 1.
Csath A. 1930. Die Vogelwelt der Grossen Ungarischen Tiefebene einst und jetzt. Kócsag, Budapest, **7**, 1–2.
Csornai R., Szlivka L., Antal. 1959. Data to the ornis of Batchka and Bánát. Aquila, Budapest, **65**.
Czigány E. 1955. Bird-life in 1954 on the island Sasér in the Lower Tisza. Aquila, Budapest, **59–62**.
Dal S. K. 1954. Životnyj mir Armianskoj SSR. Pozvonočnye životnye. **1**, Erevan.
Dal S. K., Sosnin G. V. 1947. Opredelitel' ptic Armianskoj SSR. Erevan.
Darlington Ph. J. 1957. Zoogeography: the geografical distribution of animals. New York-London.
Debrin I. I. 1951. Kuda poehat' na ohotu. Moskva.
Dekeyser P. L. 1955. Notes d'ornithologie ouest-africaine. Bull. Inst. fr. Afr. Noire, Paris, Dakar, ser. A, **17**, 4.
Dementev G. P. et al. 1951. Pticy Sovetskogo Sojuza. 2. Moskva.
Dementev G. P. 1952. Pticy Turkmenistana. Ašhabad.
Deryugin K. M. 1900. Materialy po ornitofaune Čorohskogo Kraja (jugo-zapadnoe Zakavkazje i okrestnosti Trapezoida). Ežegodn. zool. Muz. Imp. AN., Petersburg, **5**, 3.
Dobrokhotov B. P. 1961. K ekologii želtoj capli (*Ardeola ralloides* Scop.) w delte Volgi. Trudy Astrah. gos. zap., Astrahan', **5**.
Dobrokhotov V. I. 1936. Zadači naučno-issledovatelskih rabot kompleksnoj estestvenno-istoričeskoj stancii Astrahanskogo Gosudarstvennogo Zapovednika. Trudy Astrah. gos. zap., Moskva, **2**.
Dobrokhotov V. I. 1940. Astrahanskij Gosudarstvennyj Zapovednik. Moskva.

Dolgushin I. A. 1960. Pticy Kazahstana. 1, Alma-Ata.
Dombrowski R. R. 1912. Ornis Romaniae. Bukarest.
Dontschev St. 1963. Novi danni v'rhu preleta, prezimuvaneto i razprostranenieto na niakoi pticy v B'lgaria. Izv. Zool. Inst. Muz., Sofia, **14**.
Drechsler H. 1957. Wunderwelt der wilden Vögel. Leipzig — Jena.
Drechsler H., Meyer F. 1964. Camarge — Beobachtungen 1956. Beitr. z. Vogelk., Leipzig, **9**, 6.
Dubinin V. B., Dubinina M. N. 1940. Parazitofauna kolonialnyh ptic Astrahanskogo Zapovednika. Trudy Astrah. gos. zap., Moskva, **3**.
Dzieduszycki W. 1907. Przewodnik po Muzeum im. Dzieduszyckich we Lwowie. Lwów.
Dzhanashvili A. G. 1957. Materialy po izučeniu ornitofauny Sirakskoj stepi i Alazanskoj doliny. Trudy Tbilissk. un-ta, Tbilisi, **62**.
Engelhardt W. 1963. Die letzten Oasen der Tierwelt (mit Zoologen, Wildhütern und Kamerajägern in den Nationalparks der Erde). Frankfurt a. M.
Favero L. 1943. Considerazioni su alcune catture importanti. Riv. Ital. Orn., Milano, **13**, 4.
Fedorov S. 1925. Zametki o pticah nizovjev Dnepra. Ukr. Ohotn. i Rybolov, Kiev, **2**.
Fernbach K. 1921. Eine ehemalige Silberreiherkolonie. Aquila, Budapest, **28**.
Festetics A. 1957. The Egret-colony of the Sasér and its bird-movements in one day's time. Aquila, Budapest, **63–64**.
Festetics A. 1959. Data from the Rezerve Sasér near Hódmezóvásárhely from 1956. Aquila, Budapest, **65**.
Festetics A. 1959. Ökologische Untersuchungen an den Brutvögeln des Sasér. Vogelwelt, Berlin, **80**, 1.
Fisher J. 1954. A History of Birds. Boston.
Flach B. 1957. Från ett besök på Coto Doñana i Spanien. Fauna och Flora, Upsala, **52**.
Földváry M. 1929. Hungarian birds Sanctuaries. Kócsag, Budapest, **2**, 1.
Frugis S. 1953. Considerazioni ganerali sulle "Garzaie" e note sui costumi della Nitticora. Riv. Ital. Orn., Milano, **23**, 1.
Frugis S. 1955. The Distribution of Heronries in Italy and some remarks on the Night Heron behaviour. Acta XI Congr. Int. Orn. Basel-Stuttgart.
Gabriel K., Kloss K., Kreisel H. 1961. Avifaunistische Bobachtungen in Bulgarien. Beitr. z. Vogelk., Leipzig, **7**, 3/4.
Galet L. 1931. Notes sur la nidification en Camargue de l'Aigrette garzette, du bihoreau et du Crabier [*Egretta garzetta* (L.), *Nycticorax nycticorax* (L.) et *Ardeola ralloides* (Scop.)]. L'Ois. Rev. fr. d'Orn., Paris, **1**, 1–2.
Galkin D. 1961. Kaspijskie ohotnočje ugodja. Sborn. "Liubimye mesta ohoty", Moskva.
Ganiushkin M. A. 1958. Iz fenologičeskih dnevnikov. Trudy Astrah. gos. zap., Astrahan', **4**.
Gauzshtein D. M. 1955. Letnie pticy bassejna reki Dnestr v južnyh rajonah Moldavskoj SSR i Izmailskogo rajona Odesskoj oblasti USSR. Uč. Zap. Kišinevsk. gos. un-ta, Kišinev, **20**.
Gebel G. F. 1879. Ob ornitologičeskoj faune trostnikovyh bolot Umanskogo uezda. Trudy Sankt-Peterburgsk. Imp. obšč. estestvoispyt., Peterburg, **10**.
Geissler K. 1962. Ornithologische Beobachtungen im Naturschutzgebiet von Srebarna (Bulgarien). Falke, Leipzig-Jena, **9**, 10.
Géroudet P. 1958. Aperçus ornithologiques sur la Yougoslavie. II. Les marais de l'Obedska Bara et la Kupinovo. Nos Oiseaux, Neuchâtel, **24**, 8/9.
Géroudet P. 1958. Aperçus ornithologiques sur la Yougoslavie. III. Dans la plaine du Banat: la Perlezka Bara. Nos Oiseaux, Neuchâtel, **24**, 10.
Géroudet P. 1959. Garzettes, Crabiers, Echasses et Guifettes moustacs au printemps 1958 en Suisse. Nos Oiseaux, Neuchâtel, **25**, 2.
Géroudet P. 1962. Notes d'ornithologie grecque: le lac Karla. Nos Oiseaux, Neuchâtel, **26**.

Géroudet P. 1965. Aperçus ornithologiques sur la Yougoslavie VII. La basse Neretva et l'Hutovo Blato. Nos Oiseaux, Neuchâtel, **28**, 1.
Gizenko A. I. 1963. O gnezdovanii karavajki na Dnepre. Ornitologija, Moskva, **6**.
Gladkov N. A. 1932. Ornitologičeskie rezultaty poezdki na Amu-Darju letom 1931. Biull. Mosk. obšč. ispyt. prir., Moskva, **41**.
Gladkov N. A. 1935. Novye dannye po rasprostraneniju ptic v delte Amu-Darji. Biull. Sredn.-aziatsk. gos. un-ta, Taškent, **21**.
Gladkov N. A. 1941. Ekologičeskaja zametka po faune ptic delty Syr-Darji. Sborn. trudov gos. zool. muz. MGU, Moskva, **6**.
Glegg W. E. 1924. A list of the birds of Macedonia. Ibis, London, **6**, (ser. 11), 1.
Glegg W. E. 1931. The birds of "L'Ile de la Camargue et la Petite Camargue". Ibis, London, **1**, (ser. 13), 3.
Glegg W. E. 1932. Les oiseaux de l'Ile de la Camargue et de la Petite Camargue. L'Ois. Rev, fr. d'Orn., Paris, **2**, 2.
Glegg W. E. 1941. The Birds of "L'Ile de la Camargue et la Petite Camargue. Ibis, London, **5**, (ser. 14), 4.
Goetz L. 1959. (Photo-reporting from heronries of Perleska Bara in Voivodina). Larus, Zagreb, **11**.
Gouttenoire G. 1955. Inventaire des oiseaux de Tunisie. Alauda, Paris, **23**, 1.
Grafe H. 1961. Das Schutzgebiet der Camargue. Falke, Jena, **8**, 8.
Grekov V. S. 1965. Kolonii golenastyh i veslonogih ptic v Kyzyl-Agačskom zapovednike. Ornitologija, Moskva, **7**.
Grozdanic S. 1950. Obedska Bara i potreba njene zaštite. Zašt. prir., Beograd, **1**.
Harrison J. M. 1925. A contribution to the Ornithology of Macedonia and the North Aegean Area. Ibis, London, **1**, (ser. 12), 2.
Harrison J. M. 1933. A contribution to the Ornithology of Bulgaria. Ibis, London, **3**, (ser. 13), 4.
Harrison J. M., Pateff P. 1937. An Ornithological Survey of Thrace, the Islands of Samothraki, Thasos and Thasopulo in the North Aegean and Observations in the Struma Valley and the Rhodope Mountains Bulgaria. Ibis, London, **1**, (ser. 14), 3.
Heim de Balsac H. 1952. Rhythme sexuel et fécondité chez les oiseaux du Nord-Ouest de l'Afrique. Alauda, Paris, **20**, 4.
Heinrich G. 1927. Dobrudschareise 1925. J. f. Orn., Berlin, **75**, 1.
Hinloopen A. A., Peer J., Ressort W. J. 1954. Observations ornithologiques en Camargue de 2 au 11 Mai 1951. Terre et la Vie, Paris, 101, 1.
Hodek E. 1877a. Die "Obedszka-Bara". Mitt. Orn. Ver. in Wien, Wien, 1.
Hodek E. 1877b. Ornithologischer Reisebericht II. Mitt. Orn. Ver. in Wien, Wien, **1**.
Hoffmann H. 1960. Das Vogelparadies Südspaniens: Die Coto de Doñana. Kosmos, Stuttgart, **56**, 12.
Hoffmann L. 1958. An ecological sketch of the Camargue. Brit. Birds, London, **51**, 9.
Hoffmann L. 1959a. Animaux rares et ménacés de la Région Méditerranéenne Française. Compte Rendu de la Réunion Techn. d'Athenes de l'U.I.C.N., **5**.
Hoffmann L. 1959b. Esquisse écologique de la Camargue l'intention des ornithologistes. Terre et la Vie, Paris, **106**, 1.
Hollom P. A. D. 1955. A fortnight in South Turkey. Ibis, London, **97**, 1.
Hollom P. A. D. 1959. Notes from Jordan, Lebanon, Syria and Antioch. Ibis, London, **101**, 2.
Horváth L. 1955. Ornithológia megfigyelések a Béllyei Réten. Aquila, Budapest, **59–62**.
Hosking E., Ferguson-Lees I. J. 1959. Photographic studies of some less familiar birds. XCVIII. Squacco heron. Brit. Birds, London, **52**, 6.

Hughes C., Sumerfield A. R. 1959. List of Birds seen in Yugoslavia from 17th to 25th May, 1957. Larus, Zagreb, **11**.

Hugues A. 1937. Contribution à l'étude des oiseaux du Gard, de la Camargue et la Lozère, avec quelques notes additionnelles sur les oiseaux de la Corse. Alauda, Paris, **9**, 2.

Isakov Ju. A. 1951a. Astrahanskij Zapovednik. Zapovedniki SSSR. Moskva, **1**.

Isakov Ju A. 1951b. Kyzyl-Agačskij Zapovednik v zalive imeni Kirova. Zapovedniki SSSR. Moskva, **1**.

Isakov Ju. A., Vorobjev K. A. 1941. Obzor zimovok i proleta ptic na Južnom Kaspii. Trudy Vsesojuzn. Orn. zap. Gassan-Kuli, Moskva, **1**.

Ivanov A. I. Vesennie nabljudenija nad pticami na jugozapadnom poberežje Kaspija. Trudy Zool. Inst., Moskva-Leningrad, **9**, 4.

Jordania R. G. 1961. Ornitofauna Tbilisi i okolic. Acta Orn., Warszawa, **6**, 8.

Jordania R. G. 1962. Ornitofauna Malogo Kavkaza (v granicah Gruzinskoj SSR). Tbilisi.

Jordans A. 1924. Die Ergebnisse meiner zweiten Reise nach Mallorca. J. f. Orn., Berlin, **72**, 4.

Józefik M. F. 1954. Materialy po ekologii povtornogo i normalnogo gnezdovanija kvakvy i želtoj capli v nizoviah Dnestra. Trudy Odessk. gos. un-ta, Odessa, **3**.

Józefik M. 1957. Z wędrówek po czaplińcach. Warszawa, PWN.

Józefik M. 1960a. Lęgi podwójne u ibisów kasztanowatych, *Plegadis falcinellus* (L.) w delcie Dniestru. Acta Orn., Warszawa, **5**, 14.

Józefik M. 1960b. Modyfikacje południowo-zachodniej granicy zasięgu *Erythrina erythrina erythrina* (Pall.) na przestrzeni dwóch ostatnich stuleci. Acta Orn., Warszawa, **5**, 11.

Józefik M. 1961. Sezonowy mutualizm troficzny pomiędzy niektórymi gatunkami z rodziny *Ardeidae* a boleniem, *Aspius aspius* (L.) w delcie Wolgi. Acta Orn., Warszawa, **6**, 1.

Józefik M. 1969. Studies on the Squacco Heron, *Ardeola ralloides* (Scop.). Part I. History of research. Acta Orn., Warszawa, **11**, 6.

Kalela O. 1949. Changes in geographic ranges in the avifauna of northern and central Europe in relation to recent changes in climate. Bird Band., **20**.

Kalela O. 1950. Zur säkularen Rhythmik der Arealveränderungen europäischen Vögel und Säugetiere mit besonderer Berücksichtigung der Überwinterungsverhältnisse als Kausalfaktor. Orn. Fenn., Helsinkfors, **27**.

Karaman S. L. 1950. Ornitofauna Scopske Kotline. Larus, Zagreb, **3**.

Kessler K. 1960. Putešestvie s zoologičeskoj celiu k severnomu beregu Černogo morja i v Krym v 1958 godu. Kiev.

Kessler K. 1878. Putešestvie po Zakavkazskomu kraju v 1875 godu s zoologičeskoj celiu. Trudy Sankt-Peterburgsk. obšč. estestwoispyt., Peterburg, **8** (priloženie).

Kistyakovskiy A. B. 1954. Redkie ohotnic'i pticy Ukrainskoj SSR. Sborn. "Ohota na Ukraine". Charkov.

Klimenko I. I. 1950. Materialy po faune ptic Černomorskogo gosudarstvennogo zapovednika. Trudy Černomorsk. gos. zap., Moskva, **1**.

Koenig A. 1893. Zweiter Beitrag zur Avifauna von Tunis. J. Orn., Leipzig, **41**, 1.

Koenig A. 1928. Fortsetzung und Schlufs der Watvögel (*Grallatores*) Aegyptens. J. Orn., Berlin, **76** (suppl.).

Koenig O. 1960. Neue Wege zur Erforschung der Reiherkolonien des Neusiedlersees. Burgenländ. Heimatbl. **22**, 1.

Kolbe H. 1962. Ornithologische Beobachtungen in Albanien. Beitr. z. Vogelkunde, Leipzig, **8**, 3.

Kolombatovič G. 1903. Faunistische und zugsdaten aus Dalmazien. Aquila, Budapest, **10**.

Kornis K. 1931. Meine ornithologische Studienreise in die rumänische Dobrudscha im Herbst 1928. Kócsag, Budapest, **4**, 4.

Kosswig C. 1956. Das Vogelparadies am Manyassee in Westanatolien. Kosmos, Stuttgart, **52**, 11.
Kostin V. P. 1956a. Zametki po ornitofaune levoberežia nizoviev Amu-Darii i Ustiurta. Trudy Inst. zool. i paraz., Taškent, **8**.
Kostin V. P. 1956b. Materialy po faune mlekopitajuščih levoberežia nizoviev Amu-Darii i Ustiurta i očerk rasprostranenija vidov pozvonočnyh životnyh. Trudy Inst. zool. i paraz., Taškent, **8**.
Kostyutschenko A. 1925. Ornitologičeskie meloči. Ukr. ohotn. i ryb., Kiev, 12.
Kroneisl-Rucner R. 1954. Rezultati prstenovanja ptica Ornitološkag zavoda u Zagrebu u godini 1951 i 1952. Larus, Zagreb, **6–7**.
Kroneisl-Rucner. R. 1956. Prstenovanje ptica u 1953 godini. Larus, Zagreb, **8**.
Kroneisl-Rucner R. 1959. Oiseaux de Yougoslavie devenus rares ou menacés d'extinction. Terre et la Vie, Paris (suppl.).
Kroneisl-Rucner R. 1959b. Oiseaux de Yougoslavie devenus rares ou menacés d'extinction. Un. Int. Cons. Nat. et ses Ressources. 7-me Réunion techn., Athènes, **5**.
Kumerloeve H. 1955. Raupen gefährden Vogelparadies Manyas Gölü. Orion, München, **10**, 1–2.
Kumerloeve H. 1957. Kuhreiher *Ardeola* (*Bubulcus*) *ibis*, am Amik Gölü (Hatay, Türkei). Vogelwelt, Berlin-München, **78**, 2.
Kumerloeve H. 1960. O rozmieszczeniu czapli modronosej *Ardeola ralloides* (Scop.) w Azji Mniejszej. Acta Orn., Warszawa, **5**, 10.
Kumerloeve H. 1961. Bemerkenswerte Vogelbälge aus dem Libanongebiet in der "American University of Beirut". Bonn. Zool. Beitr., Bonn, **12**, 1–2.
Kumerloeve H. 1962. Notes on the Birds of the Lebanese Republic. Iraq Nat. Hist. Mus., Baghdad, 20–21.
Kumerloeve H. 1963. L'avifaune du lac d'Antioche (Amik Gölü — Gölü Başi) et de ses alentours. Alauda. Paris, **31**, 2.
Kumerloeve H. 1964a. Über die Situation des Vogelschutzes und den biologischen Schädlingsbekämpfung im Vorderen Orient (Türkei, Syrien, Libanon). Angewandte Orn., Hamburg, **2**, 1.
Kumerloeve H. 1964b. Zur Sumpf- und Wasservogelfauna der Türkei. J. Orn., Berlin, **105**, 3.
Kumerloeve H., Niethammer G. 1935. Beiträge zur Kenntnis der Avifauna Kleinasiens (Paphlagonien — Galatien). J. Orn., Berlin, **83**, 1.
Kuzyakin A. P. 1959. Materialy po biologii kolonialno gnezdiaščihsia ptic. Uč. Zap. Mosk. obl. ped. Inst. Moskva, **71**.
Lack D. 1954. The natural regulation of animal numbers. Oxford.
Lambert A. 1957. A specific check list of the Birds of Greece. Ibis, London, **99**, 1.
Landbeck L. 1843. Die Vögel Sirmiens. Ibis, Jena — Leipzig, 1.
Launic K. V. 1912. Materialy dlia ornitofauny Černomorskogo poberežia Kavkaza. Pticeved. i Pticevodstvo, Moskva, 3–4.
Lebreton Ph. 1954. Introduction écologique à l'étude de l'avifaune de la Dombes. Terre et la Vie, Paris, 1.
Lintia D. 1909. Meine ornitologische Studienexkursion in die Dobrudsche. Aquila, Budapest, **16**.
Lintia D. 1913. Nachtrag zu dem Berichter: "Eine mediterrane Oase in der Vogelwelt Südostungarns". Aquila, Budapest, **20**.
Lintia D. 1917. Materialen zur Avifauna Serbiens. Aquila, Budapest, **23**.
Lintia D. 1944. Catalogul sistematic al faunei ornitologice Romane. Timişoara.
Lintia D. 1950. Ornithological news from the Bánát. Aquila, Budapest, **51–54**.
Lintia D. 1955. Păsările din R.P.R. Bucureşti, **3**.

Lintia D., Grassu V. A. 1951. Păsări ichtiofage din fauna R.P.R. Natura, Bucureşti, **3**, 1.
Loat W. L. S. 1906. On a small Collection of Birds from the vicinity of Lake Menzalah in the delta of Egypt. Ibis, London, **6**, (ser. 8), 21.
Löbenstein B. 1851. Ornithologische Notizen, gesammelt auf einer Reise in Ungarn 1840. Naumannia, Stuttgart, **1**, 3.
Lomnt H. 1936. La Nidification des Ardéidés en Camargue. Comptes rendus Assoc. fr. pour avans. Scienc., Marseille, **60**.
Loudon H. 1910. Meine dritte Reise nach Zentral-Asien und ihre ornithologische Ausbeute. J. Orn., Leipzig, **58**, 1.
Lovassy S. 1931. Az Ecsedi-láp és madárvilége fennállása utolsé évtizedeiben. Budapest.
Lugovoy A. E. 1959. Dinamika gnezdovogo raspredelenija kolonialnyh ptic delty Volgi. Tez. dokl. II Vsesojuz. orn. konf., Moskva, 2.
Lugovoy A. E. 1961a. Dinamika gnezdovogo raspredelenija kolonialnyh ptic nizoviev delty Volgi. Trudy Astrah. gos. zap., Astrahan', **5**.
Lugovoy A. E. 1963. Pticy delty Volgi. Trudy Astrah. gos. zap., Astrahan', **8**.
McClure H. E., Yoshii M., Okada Y., Schere W. F. 1959. A method for determining age of nesting heron in Japan. Condor, Berkeley, **61**, 1.
Mackworth-Praed C. W., Grant C. H. B. 1957. Birds of Eastern and North-eastern Africa. **1**, London, New York, Toronto.
Makatsch W. 1950. Die Vogelwelt Macedoniens. Leipzig.
Makatsch W. 1959. A propos de la protection des oiseaux en Grèce et en Turquie. Terre et la Vie, Paris, (suppl.).
Maluquer Maluquer S. 1956. Campaña de anillamento de aves en el Coto de Doñana (Huelva). Iberica, Madrid, **23**, 322.
Marchant S. 1962. Iraq Bird notes — 1961. Bull. Iraq nat. Hist. Mus., Baghdad, **2**, 1.
Martorelli G. 1960. Gli ucceli d'Italia. Milano.
Maštrovič A. 1947. Rezultati prstenovanja ptica Ornitološkog zavoda u Zagrebu u razdoblju od 1940 do 1945. Larus, Zagreb, **1**.
Matvejev S. D. 1948. Ptice okolice Skopja. Larus, Zagreb, **2**.
Matvejev S. D. 1950. Razprostranene i život ptica u Srbiji. Pos. Izd. Sr. Akad. Nauk, Beograd, **159**, 3.
Mayaud N. 1938. Commentaires sur l'ornithologie française. Alauda, Paris, **10**, 3–4.
Mayaud N. 1953. Liste des oiseaux de France. Alauda, Paris, 21, **1**.
Meiklejohn M. F. M. 1935. Some autumnal notes on the Birds of the Camargue. Ibis, London, **5**, (ser. 13).
Meinertzhagen R. 1920. Notes on the Birds of Southern Palestine. Ibis, London, **2**, (ser. II), 1.
Meinertzhagen R. 1930. Nicoll's Birds of Egypt. **2**, London.
Meinertzhagen R. 1935. Ornithological results of a trip to Syria and adjacent countries in 1933. Ibis, London, **5**, (ser. 13), 1.
Meinertzhagen R. 1954. Birds of Arabia. London.
Menzbier M. A. 1895. Pticy Rossii. **1**, Moskva.
Menzbier M. A. 1904–1909. Pticy. Moskva.
Meylan O. 1938. Premiers résultats de l'exploration ornithologique de la Dombes. Alauda, Paris, **10**, 1–2.
Micholitsch A. 1959. Ornithologische Beobachtungen in Jugoslawien (Mazedonien). Larus, Zagreb, **11**.
Mikuška J. 1962. Ornithological notes from the countryside of Palics (Jugoslavia) in 1958. Aquila, Budapest, **67–68**.
Millet-Horsin D. 1912. Notes ornithologiques sur la Tunisie. Rev. fr. d'Orn., Paris, **4**, 41–42.

Mojsišovics A. 1885. Bericht über eine Reise nach Südungarn und Slavonien. Mitt. Nat. Ver., Steiermark, **1**.
Moltschanov L. A. 1906. Spisok ptic Estestvenno-Istoričeskogo Muzeja Tavričeskogo Gubernskogo Zemstva. Mat. k pozn. fauny i flory Ross. Imp., Moskva, **7**.
Moltschanov L. A. 1912. Letnjaja ornitofauna delty Amu-Darii. Orn. Vestn., Moskva, **4**.
Moltoni E. 1927. La nidificazione di *Plegadis falcinellus* (L.) e di *Ardeola ralloides* (Scopoli) in Piemonte. Atti Soc. Ital. Sci. Nat., Milano, **66**.
Moltoni E. 1933. Ulteriori notizie sulle garzaie di Greggio (Vercelli) e di Casalino (Novara). Atti Soc. Ital. Sci. Nat., Milano, **73**.
Moltoni E. 1934. The Heronries of Italy. Proc. VIII Int. Orn. Congr., Oxford.
Moltoni E. 1936. Le Garzaie in Italia. Riv. Ital. Orn., Milano, **6**, 3–4.
Moreau R. E. 1934. A Contribution to the Ornithology of the Libyan Desert. Ibis, London, **4**, (ser. 13), 3.
Mountfort G. 1956. The herons of Coto Doñana. Sphere, **226**, 2945.
Mountfort G. 1958. Portrait of a Wilderness. The story of the Coto Doñana expeditions. London.
Mountfort G., Ferguson-Lees I. J. 1961a. The birds of the Coto Doñana. Ibis, London, **103a**, 1.
Mountfort D., Ferguson-Less I. J. 1961b. Observations on the Birds of Bulgaria. Ibis, London, **103a**, 3.
Mountfort G., Hosking E. 1962. Portrait of a River. The wild life of the Danube from the Black Sea to Budapest. London.
Mourgue M. 1920. Oiseaux observés en Tunisie du 8 mai au 8 juin 1920. Rev. fr. d'Orn., Orléans, **6**.
Munn P. W. 1921. Notes on the Birds of Alcudia, Majorca. Ibis, London, **3**, (ser. 11), 4.
Munn P. W. 1926. Additional notes on the Birds of the Balearic Islands. Ibis, London, **2**, (ser. 12), 3.
Munn P. W. 1932. Furthers notes on the Birds of the Balearic Isles. Ibis, London, **2**, (ser. 13), 2.
Munteanu D. 1960. La situation de l'avifaune dans la delta du Danube. Nos Oiseaux, Paris, **25**, 269.
Nadra E. M. 1962. Rezervatia ornitologice de la Satchinez. Ocr. Nat., Bucureşti, **6**.
Nagy E. 1921. Die Vogelwelt des grossen Riedes von Pancsova. Aquila, Budapest, **28**.
Nagy L. 1950. New ornithological observations on the Hortobágy. Aquila, Budapest, **51–54**.
Naumann J. F. 1837. Ornithologische Reise nach und durch Ungarn. Arch. f. Naturg., Leipzig, **3**, 1.
Naumann J. F. 1905. Naturgeschichte der Vögel Mitteleuropas. **6**, Gera.
Nazarenko L. F. 1953a. Ekologo-faunističeskaja harakteristika ornitofauny nizoviev Dnestra i perspektivy eje hoziajstvennogo ispolzovanija. Sborn. Biol. fak. gos. un-ta im. Mečnikova, Odessa, **6**.
Nazarenko L. F. 1953b. Kolonialno gnezdjaščiesja pticy nizoviev Dnestra i ih hozjajstvennoe značenie. Sborn. rab. po Dnestr. lim. i niz. Dnestra, Odessa, **2**.
Nazarenko L. F. 1955. Materialy k izučeniju ornitologičeskoj fauny nizoviev Dnestra. Trudy Odessk. un-ta, Odessa, **145**.
Nazarenko L. F. 1957. Osnovnye čerty ekologii ptic nižnego Pridnestrovia i ih zoogeografičeskie svjazi. Naučn. ežegodn. 1956 Odessk. gos. un-ta, Odessa.
Nazarenko L. F. 1957. Kolonialno gnezdjaščiesja pticy nizoviev Dnestra, ih rasprostranenie, osobennosti ekologii i praktičeskoe značenie. Trudy II Pribalt. orn. konf., Moskva.
Nazarenko L. F. 1959. Ornitologičeskaja fauna Nižnego Pridnestrovia i eje hozjajstvennoe značenie. Avt. diss. kand. biol. n. Odessk. un-ta, Odessa.

Nazarenko L. F. 1961b. Izmenenie ornitofauny Dnestra i rezultaty hozjajstvennoj dejatelnosti čeloveka. Sborn. „Ekol. i migr. ptic Pribalt.", Riga.
Nazarenko L. F., Józefik M. F. 1957. Gnizdovannja maloho baklana (*Phalacrocorax pygmaeus* Pall.) na Dnistri. Prac. Odesk. derž. un-tu, Odessa, **147**, 8.
Nesterov P. V. 1911. Materialy po ornitofaune jugo-zapadnogo Zakavkazia i severo-vostočnoj časti Maloj Azii. Ežegodn. zool. Muz. imp. Akad. nauk, Peterburg, **16**, 3.
Nicholson E. M., Ferguson-Lees I. J., Hollom P. A. D. 1957. The Camargue and the Coto Doñana. Brit. Birds, London, **50**, 12.
Noble H. 1902. Forty-four days' nesting in Andalusia. Ibis, London, **2**, (ser. 8), 5.
Nordmann A. 1890. Observations sur la faune pontique. Voyage dans la Russie méridionale et la Crimée. Paris, **3**.
Oates E. W. 1902. Catalogue of the collection of birds' eggs in the British Museum. **2**, London.
Oganesov A. K. 1960. Pticy kolonii Kyzyl-Agača. Priroda, Moskva, 7.
Ognev S. J. 1913. Poezdka v deltu Volgi. Moskva.
Oleynikov N. S. 1953. Rybojadnye pticy i ih vlijanie na rybnoe hozjajstvo manyčskih vodohranilišč. Uč. zap. biol. počv. fak. Rost. gos. un-ta, Rostov, **19**, 3.
Oordt G. 1934. Quelques observations faites en France. Alauda, Paris, **6**, 4.
Oordt G., Tjittes A. A. 1933. Ornithological observations in the Camargue. Ardea, Leiden, **22**, 3–4.
Osterman A. I. 1912a. Objasnitelnyj katalog Zoologičeskogo Selskohozjajstvennogo i Kustarnogo Muzeja Bessarabskogo Gubernskogo Zemstva. Kišinev.
Osterman A. 1912b. Zametki o pticah Bessarabii. Trudy Bessarabsk. obšč. estestvoispyt. i ljub. prir., Kišinev, 2, 2.
Patschoskiy I. K. 1911. K ornitofaune Hersonskoj Gubernii. Orn. Vest., Moskva, 3–4.
Paillerets S. V. 1937. Remarques sur l'inventaire des oiseaux de France. Alauda, Paris, **9**, 1.
Pallas P. 1811. Zoographia Rosso-Asiatica, **2**, Petropolis.
Papadopol A. 1955. Citeva considerente asupra păsărilor ichtiofage legate de problema pescuitului și pisciculturii. Bull. Inst. Cercet. pisc., București, **14**, 2.
Papadopol A. 1956. Contributii la cunoasterea faunei ornitologice a litoralului Mării Negra și a lacurilor din lungul litoralului. Natura, București, **8**, 6.
Parrot C. 1905. Eine Reise nach Griechenland und ihre ornithologischen Ergebnisse. J. Orn., Leipzig, **53**, 4.
Pașcovschi S. 1941. O colonie de păsări interesantă. Rev. Carpați Sibiu, **9**, 4, 9.
Pașcovschi S. 1942. Cuibăritul stârcilor în jurul Timișoarei. Carpații, Sibiu, 1.
Paspaleva-Antonova M. 1961. Prinos kem ornitofaunata na rezervata Srebarna, Silistrensko. Izv. Zool. Inst. Muz. BAN, Sofia, **10**.
Passburg R. E. 1959. Birds notes from Northern Iran. Ibis, London, **101**, 2.
Patev P. 1950. Pticite v Balgaria. Sofia.
Payn W. H. 1948. Notes from Tunisia and eastern Algeria: February 1943 to April 1944. Ibis, London, **90**, 1.
Pease H. J. R. 1940. Supplementary Notes on Mr. C. M. N. White's "Contribution to the Ornithology of Crete". Ibis, London, **4**, (ser. 14), 1.
Penot J. 1957a. Rapport ornithologique pour 1956. Terre et la Vie, Paris, 2–3.
Penot J. 1957b. Rapport ornithologique pour 1957. Compte rendu Station biol. de la Tour du Valat, 4.
Penot J. 1960. Rapport ornithologique pour 1958. Terre et la Vie, Paris, 2.
Penot J. 1962. Rapport ornithologique pour 1959. Terre et la Vie, Paris, 1.
Penot J. 1963. Les marais-richesse naturelle incomparable. Vie de Bêtes, Paris, 54.

Peterson R., Mountfort G., Hollom P. 1961. A field guide to the birds of Britain and Europe. London.
Petit G., Schachter D. 1954. La Camargu. Etude écologique et faunistique. Année biol., Paris, 30, 5–6.
Petrov V. S. 1954. K ornitofaune pojmy Dnepra. Uč. zap. Harkovsk. un-ta, Charkov, 52.
Pochelon G., Bibet J. 1950. Nidification du Héron Crabier en Dombes. Nos Oiseaux, Neuchâtel, 213.
Poduhskin D. A. 1913. Zametki o pereletah i gnezdovanii ptic v okrestnostjah Dneprovskogo limana. Zap. Krymsk. obšč. estestvoispyt., Semfiropol, 2.
Popović J. 1960. Formirovanie ptičjih kolonija na Obedskoj bari i Vojtinoj Mlaki (Carska bara). Zašt. Prir., Beograd, 17.
Portenko L. A. 1950. Životnyj mir SSSR. Pticy — Aves. 3, Moskva.
Poslavskiy A. N. 1963. Novye dannye o faune ptic Severnogo Prikaspija. Trudy Inst. zool. AN Kazahsk. SSR, Alma-ata, 20.
Prázák J. P. 1898. Materialen zu einer Ornis Ost-Galiziens. J. Orn., Leipzig, 46, 2.
Priestley M. 1947. The Camarque Reserve. Ibis, London, 89, 2.
Puzanov I. I. 1931. Predvaritelnye itogi izučenija fauny pozvonočnyh Krymskogo Zapovednika. Sborn. rab. po izuč. fauny Krymsk. gos. zap., Moskva.
Puzanov I. I. 1933. Opyt revizii krymskoj ornitofauny. Bjull. Mosk. obšč. ispyt. prir., Moskva, 42.
Puzanov I. I. 1949. Zoogeografija. Kiev.
Puzanov I. I. 1953. Fiziko-geografičeskij očerk Dnestra, ego pojmennyh vodoemov i limanov. Sborn. rab. po Dnestrovsk. lim. i nizov. Dnestra, Kiev, 2.
Puzanov I. I. 1962. Faunističeskij očerk Odesskoj oblasti, Trudy Odessk. gos. un-ta, Odessa, 152, 10.
Radakoff W. N. 1879. Ornithologische Bemerkungen über Bessarabien, Moldau, Walachei, Bulgarien und Ostrumenien. Bull. Soc. Nat., Moscou, 54.
Radde G. 1854. Beiträge zur Ornithologie Süd-Russlands, insbesondere die Vögel Tauriens betreffend. Bull. soc. Imp. nat. Mosc., Moscou, 27, 3.
Radde G. 1885. Ornitologičeskaja fauna Kavkaza (Ornis Caucasica), Tiflis.
Radde G., Walter A. 1889. Die Vögel Transcaspiens. Ornis, Wien, 5, 1.
Radetzky D. 1934. Das Jahr der Vogelwarte Graf Kuno Klebelsberg am Velenceer-see. Kócsag, Budapest, 7, I — 4.
Rafajlović A. 1962. Mešovita kolonijà čaplji na Paliču i na Ludaškom jezeru. Larus, Zagreb, 14.
Raines R. J. 1962. The distribution of birds in Northeast Greece in summer. Ibis, London, 104, 4.
Rashkevitsch N. A. 1961. V nizoviah Amu-Darii. Priroda, Moskva, 10.
Reichenow A. 1900–1901. Die Vögel Africas. I, Neudamm.
Reiser O. 1891. Vogelsammlung des Bosnisch-Herzegovinischen Landesmuseum in Sarajevo. II Int. Orn. Congr., Budapest.
Reiser O. 1894. Materialen zu einer Ornis Balcanica, II, Bulgarien. Wien.
Reiser O. 1905. Materialen zu einer Ornis Balcanica. III. Griechenland und die griechischen Inseln (mit Ausnahme von Kreta). Wien.
Reiser O. 1939. Materialen zu einer Ornis Balcanica. I. Bosnien und Herzegowina nebst Teilen von Serbien und Dalmatien. Wien.
Réthy Z. 1964. Little Egret colonies along the Triple-Körös. Aquila, Budapest, 69–70.
Romasheva A. G. 1938. Količestvennoe izučenie gnezdovyh kolonij Astrahanskogo Zapovednika. Trudy Astrah. gos. zap., Moskva, 2.
Romasheva A. G. 1940. Biocenotičeskie vzaimootnošenija kolonialnyh caplevyh. Trudy Astrah. gos. zap., Asrahan', 3.

Rössler E. 1908. Des Riedmuseum von Béllye. Aquila, Budapest, **15**.
Rössler E. 1911. Über das Vogelleben im Sumpfe „Obedska Bara". Verhandl. V Int. Orn. Congr., Berlin.
Rotter P. 1952. Prilog poznavanju ptica Palestine. Larus, Zagreb, **4–5**.
Rucner D. 1954. Ptice doline Neretve. Larus, Zagreb, **6–7**.
Rucner D. 1959. Novi podaci za poznavanje ornitofaune Donje Neretve. Larus, Zagreb, **11**.
Rucner D. 1962. Prilog poznavanju ornitofaune Kopačkog rita i okolice u Baranji. Larus, Zagreb, **14**.
Rudescu L. 1950. Necesitates unei staţiuni ornitologice in Delta Dunării. Vinătorul, Bucureşti, **2**, 1.
Rudescu L. 1959. Die wirtschaftliche Nutrung des Donaudeltas und die Erhaltung seiner Flora und Fauna. Falke, Jena, **6**, 6.
Rustamov A. K. 1945. Biocenotičeskie gruppirovki i geografičeskoe raspredelenie ptic pojmy Amu-Darii. Izv. Turkm. fil. AN SSSR, Ašhabad, **2**.
Sage B. L. 1964. Notes on the birds of the Lower Neretwa valley, Jugoslavia. Ardea, Leiden, **52**, 3–4.
Sagitov A. K. 1957. Ornitologičeskie issledovanija v Zeravšanskoj doline. Trudy Uzb. un-ta, Samarkand, **76**.
Salikhbayev H. S. 1950. Ohotničie-promyslovye životnye delty Amu-Darii i mery ih racionalnogo ispolzovanija. Moskva.
Salikhbayev H. S., Bogdanov A. N. 1961. Fauna Uzbekskoj SSR. Pticy. 2, 3. Taškent.
Salvadori T. 1865. Katalog der Vögel Sardiniens mit Noten und Beobachtungen. J. Orn., Leipzig, **13**, 4.
Satunin K. A. 1907a. Letnjaja poezdka v Gelskuju kotlovinu. Tiflis.
Satunin K. A. 1907b. Materialy k poznaniju ptic Kavkazskogo kraja. Tiflis.
Satunin K. A. 1912. Muganskaja Step'. Priroda i naselenie. Životnyj mir Mugani, **3**, Tiflis.
Schenk J. 1896. Fauna Regni Hungariae. Aves. Budapest.
Schenk J. 1908a. Die Reiherkolonie der Obedszka-Bara in der Gegenwart. Aquila, Budapest, **15**.
Schenk J. 1908b. Ornithologische Skizzen von der unteren Donau in Ungarn. Aquila, Budapest, **15**.
Schenk J. 1908c. Bericht über die Vogelmarkierungen im Jahre 1908. Aquila, Budapest, **15**.
Schenk J. 1909. Bericht über die Vogelmarkierungen im Jahre 1909. Aquila, Budapest, **16**.
Schek J. 1910. Bericht über die Vogelmarkierungen im Jahre 1910. Aquila, Budapest, **17**.
Schenk J. 1911. Bericht über die Vogelmarkierungen im Jahre 1911. Aquila, Budapest, **18**.
Schenk J. 1912. Bericht über die Vogelmarkierungen der Königl. Ung. Ornith. Zentrale im Jahre 1912. Aquila, Budapest, **19**.
Schenk J. 1913. Bericht über die Vogelmarkierungen der Königl. Ungar. Ornithologischen Centrale im Jahre 1913. Aquila, Budapest, **20**.
Schenk J. 1916. Die Vogelmarkierungen der Königlich Ungarischen Ornithologischen Zentrale in den Jahren 1914 und 1915. Aquila, Budapest, **22**.
Schenk J. 1918. Die Einstigen und Gegenwärtigen Brutkolonien der Edelreiher in Ungarn. Aquila, Budapest, **25** (suppl.).
Schenk J. 1919. Bericht über die ungarischen Vogelberingungen in den Jahren 1916–1919. Aquila, Budapest, **24**.
Schenk J. 1922. Raport about the Hungarien bird banding work in the years 1920–1922. Aquila, Budapest, **29**.
Schenk J. 1924a. Bericht über die ungarischen Vogelberingungen im Jahre 1923. Aquila, Budapest, **30–31**.

Schenk J. 1924b. Edelreiher — und Naturschutz. Aquila, Budapest, **30–31**.
Schenk J. 1926a. Bericht über die Vogelberingungen in Ungarn in den Jahren 1924 und 1925. Aquila, Budapest, **32–33**.
Schenk J. 1926b. Die Reiherkolonie im Kisbalaton. Arch. Balatonicum, Budapest.
Schenk J. 1929a. Über die Zukunft der Silberreiher-Kolonie im Kisbalaton-Sumpf in Ungarn. Aquila, Budapest, **34–35**.
Schenk 1929b. Die Vogelberingungen in Ungarn in den Jahren 1926–27. Aquila, Budapest, **34–35**.
Schenk J. 1929c. Die Siedlungsverhältnisse einiger Vögel der palaearktischen Fauna. Aquila, Budapest, **34–35**.
Schenk J. 1929d. Edelreiher — und Naturschutz. Aquila, Budapest, **34–35**.
Schenk J. 1930. Die Vogelberingengen des Kgl. Ung. Ornith. Institutes in den Jahren 1928–30. Aquila, Budapest, **36–37**.
Schenk J. 1934. Die Vogelberingungen des Kgl. Ungarischen Ornithologischen Institutes in den Jahren 1931–1932. Aquila, Budapest, **38–41**.
(Schenk) Vönöczky J. 1942. Nisten des Silberreihers (*Egretta alba alba* L.) in Dinnyés. Aquila, Budapest, **46–49**.
Schnidt E., Sterbetz I. 1962. Cattle Egret in the Sasér Bird Sanctuary. Aquila, Budapest, **67–68**.
Schnell H. 1933. Colonii de păsări in Delta. Rev. Vinat., Bucureşti, **11**.
Schouteden H. 1953. La héron crabier du Madagascar (*Ardeola idae*) au Congo Belge. Rev. zool. bot. afric., **48**, 3–4.
Schouteden H. 1954. Faune du Congo Belge et du Ruanda-Urundi. III. Oiseaux non-Passereaux. Ann. Mus. royal du Congo Belge, Tervuren, **29**, 8.
Schüz E. 1957. Vogelkunde am Manyas-See (Türkei). Vogelwarte, Stuttgart, **19**, 1.
Schweppenburg H. F. G. 1915. Ornithologische Beobachtungen in Komitat Syrmien. J. Orn., Leipzig, **63**, 1.
Sebess G. 1934. Ornithofaunistische Daten aus der Gegend von Szeged. Aquila, Budapest, **38–41**.
Seebohm H. 1883a. Notes on the Birds of the Caucasus. Ibis, London, **1**, (ser. 5) 1.
Seebohm H. 1883b. Excursions to the Dobrutscha, Ibis, London, **1**, (ser. 5), 3.
Seebohm H. 1884. Notes on the Collection of Birds from Lenkoran. Ibis, London, **2**, (ser. 5), 8.
Seitz A. 1935. Ornithologisches vom Neusiedlersee. Kócsag, Budapest, **8**, 1–4.
Shelkovnikov A. B. 1909. *Nelumbo nucifera* Gaertn. na razlivah Araksa na Mugani. Izv. Kavk. Muz., Tiflis, **4**, 3.
Selous F. C. 1900. A Fortnight's Egg-collecting in Asia Minor. Ibis, London, **6**, (ser. 7), 23.
Sevesi A. 1935. La Garzaia di Malabergo (Bologna) secondo la descrizione di Ulisse Aldrovandi. Riv. Ital. Orn., Milano, **5**, 4.
Skokova N. N. 1960. Piščevye otnošenija u ptic, gnezdjaščihsja kolonijami v drevesnyh zarosljah delty Volgi. Trudy Probl. i temat. soveščˇ. Zool. Inst. AN SSSR, Moskva, **9**.
Sladen A. G. L. 1918. Further notes on the Birds of Macedonia. Ibis, London, **6**, (ser. 10), 2.
Sladen A. G. L. 1919. Notes on the Birds observed in Palestine. Ibis, London, **1**, (ser. 11), 2.
Smirnov K. A. 1915. O zakavkazskoj ryžegolovoj čepure. Izv. Kavk. Muz., Tiflis, **9**, 2.
Smith K. D. 1965. On the birds of Morocco. Ibis, London, **107**, 4.
Somov N. N. 1897. Ornitologočeskaja fauna Harkovskoj gubernii. Harkov.
Spangenberg E. 1950. Zapiski naturalista. Moskva.
Spangenberg E. P., Fejgin G. A. 1937. Pticy nižnej Syr-Darii i prileža̧ščih rajonov. Sborn. trudov Gos. zool. muz. pri MGU, Moskva, **3**.

Steffel G. 1959. Stock of the characteristic birds of Lake Kisbalaton in the years 1952–1957. Aquila, Budapest, **65**.

Stiegman B. K. 1938. Osnovy ornitogeografičeskogo delenija Palearktiki. Fauna SSSR. Pticy, Moskva —Leningrad, **1**, 2.

Steinbacher J. 1955. Sull'ecologia e distribuzione degli uccelli in Sicilia. Riv. Ital. Orn., Milano, **25**, 1.

Steinmetz H. 1931. Das Vogelleben in der Obedska Bara. J. Orn., Berlin, **79**, 4.

Sterbetz S. 1950. Data to the breeding of the Little Egret and Squacco Heron at Algyö. Aquila, Budapest, **51–54**.

Sterbetz J. 1954. The "Sasér" heronry in 1949. Aquila, Budapest, **55–58**.

Sterbetz J. 1957. The bird-life of the Sasér — Bird Sanctuary of Hódmezövásárhely, according to observations from 1948 till 1954. Aquila, Budapest, **63–64**.

Sterbetz J. 1959a. The birds of the sodaic areas in the surroundings of Hódmezövásárhely. Aquila, Budapest, **65**.

Sterbetz J. 1959b. Data from 1955–56–57 about Avifauna of Hódmezövásárhely. Aquila, Budapest, **65**.

Sterbetz J. 1960. Recent data on bird-life in the Sasér-Rezerve and on the Fehértó near Hódmezövásárhely. Aquila, Budapest, **66**.

Sterbetz J. 1961. Der Seidenreiher. Die Neue Brehm Bücherei. Wittenberg.

Sterbetz J. 1962. The Squacco Heron in the "Sasér" Bird-Sanctuary. Aquila, Budapest, **67–68**.

Stresemann E. 1920. Avifauna Macedoniae. München.

Suchantke A. 1960. Herbstlicher Reiherzug an der Camargue-Küste. Vogelwelt, Berlin — München, **81**, 2.

Sushkin P. P. 1914. Zametki o kavkazskih pticah. Orn. Vestn., Moskva, **5**, 1.

Swann H. K. 1925. Two ornithologists on the Lower Danube. London.

Syroyetschkovskiy E. E. 1955. Geografičeskoe raspredelenie rybojadnyh ptic Severnogo Kaspija. Avtoref. dissert. kand. geogr. n. Inst. Geogr. AN SSSR, Moskva.

Syroyetschkovskiy E. E. 1958. K metodike količestvennogo učeta ptic gnezdjaščihsja kolonijami v drevesnyh zarosljah. Trudy Astrahansk. gos. zap., Astrahan', **4**.

Székessy V. 1958. Fauna Hungariae. Aves Madarak. **21**, Budapest.

Szijj J. 1954. Gémtelepek Magyarországon 1951-ben. Aquila, Budapest, **55–58**.

Szikla G. 1897. Ein interessanter Brief aus der Sabe-Gegend. Aquila, Budapest, **4**.

Szlávy K. 1908. Die Vogelwelt des grossen Riedes in Ujvidék. Aquila, Budapest, **15**.

Szlávy K. 1919. Die Reiher-Kolonie bei Ujvidék. Aquila, Budapest, **26**.

Szlivka L. 1957. Ornitološka opažanja na Carskoj Bari u Vojvodini. Larus, Zagreb, **9–10**.

Szlivka L. 1959a. Data on the Reserves of Ornithological Interest of the Vojvodina. Aquila, Budapest, **65**.

Szlivka L. 1959b. Nešto o ptičem svijetu Vojvodine. Larus, Zagreb, **11**.

Szomjas G. 1918. Ornithologische Notizen von der Hortobágyer Heide aus den Jahren 1916 und 1917. Aquila, Budapest, **24**.

Taniu M. 1963. Čaplita na Srebarna. Priroda, Sofia, **12**, 5.

Tedeschi G. M. 1962. Note sugli uccelli aquatici del Modenese. Riv. Ital. Orn., Milano, **32**, 1

Terrasse J. F., Terrasse M. 1961. Impressions ornithologiques en Yougoslavie (1960). Ois. Rev. fr. d'Orn., Paris, **31**, 1.

Terrasse J. F., Terrasse M. 1961. Impressions ornithologiques en Yougoslavie (1959). Ois. Rev. fr. d'Orn., Paris, **31**, 2.

Thorpe W. H., Cotton P. T., Holmes P. F. 1936. Notes on the birds of Lakes Ohrid, Malik and Prespa and adjacent parts of Yugoslavia, Albania and Greece. Ibis, London, **6**, (ser. 13), 3.

Ticehurst C. B., Buxton P. A., Cheesman R. E. 1922. The Birds of Mesopotamia. Part 3. J. Bombay Nat. Hist. Soc., Bombay, **28**, 3.
Ticehurst C. B., Whistler H. 1929. A spring tour through Yugoslavia. Ibis, London, **5** (ser. 12), 4.
Ticehurst C. B., Whistler H. 1932. On the Ornithology of Albania. Ibis, London, (ser. 13), 1. **2**.
Tobias B. 1842. Der Sumpf Obeda bei Kupinovo im Sirmischen Militär Grenzlande. Abhandl. nat. Gesellsch. Görl., Görlitz, **3**, 2.
Tugarinov A. Ja. 1947. Veslonogie, aistoobraznye, flamingo. Fauna SSSR. Ptiсy. **1**, 3, Moskva-Leningrad.
Tugarinov A. Ja. 1951. Aistoobraznye. Ptiсy SSSR. **1**, Moskva.
Udvardy M. 1960. Supplement to the bird fauna of the Hortobágy. Aquila, Budapest, **66**.
Valh B. S. 1911. Materialy dlja ornithologii Ekaterinoslavskoj gubernii. Orn. Vestn., Moskva, **3–4**.
Valverde J. A. 1953. Description du poussin *d'Ardeola ralloides*. Alauda, Paris, **21**, 4.
Valverde J. A. 1955, 1956. Essai sur l'aigrette garzette (*Egretta g. garzetta*) en France. Alauda, Paris, **23**, 3, 4 (1955); **24** 1 (1956).
Valverde J. A. 1965a. Les aves de Marruecos Español en julio. Ardeola, Madrid, **2**, 2.
Valverde J. A. 1956b. La colonia de Garzes de la Algaida (Doñana) en 1956. Munibe, Madrid, 2.
Valverde J. A. 1957. La "Spanish expedition 1957" en el Coto Doñana. Ardeola, Madrid, **3**, 2.
Valverde J. A. 1958. An ecological sketch of the Coto Doñana. Brit. Birds, London, **51**, 1.
Valverde J. A. 1959. La protection de la faune en Espagne. Terre et la Vie, Paris (suppl.).
Velverde J. A. 1961. Vertebratos de las Marismas del Gualdaquivir (Introduccion a su estudio ecológico). Arch. Inst. Aclimat. Almeria, **9**.
Valverde J. A. Weickert P. 1956. Sobre la migración de varias garzas españolas (Primeros datos de anillamiento en Doñana). Munibe, Madrid, 1.
Vasvári M. 1938. Die wichtigsten Ergebnisse meiner Untersuchungen ueber die Ernährungsoekologie der Reihervögel (*Ardeidae*). 9 Congr. Orn. Int., Rouen.
Vasvári M. 1939. Die Ernährungsoekologie das Nachtreihers und Rallenreihers. Aquila, Budapest, **42–45**.
Vasvári M. 1942. Auf Bäumen nistende Seidenreiher. Aquila, Budapest, **46–49**.
Vasvári M. 1955. Measurements of Hungarian Birds. Aquila, Budapest, **59–62**.
Vaucher Ch. 1954. Contribution à l'étude ornithologique de la Dombes. Alauda, Paris, **22**, 2.
Vaucher H., Vaucher A. 1915. Liste des oiseaux observés au Maroc de 1884 à 1914. Rev. fr. d'Orn., Orleans, **7**, 76, 77.
Velikanov V. L. 1936. Prolet i gnezdowanie capel' v nizoviah Dnepra. Priroda, Moskva, **10**.
Vertse A. 1950. For welcome. Aquila, Budapest, **51–54**.
Vertse A. 1959. Vogelschutzbericht (1952–57). Aquila, Budapest, **65**.
Vilkonskiy F. V. 1894. Otčet ob ornitologičeskih issledovanijah Kutaisskoj gub. v 1893 g. Bull. soc. Imp. Nat. Mosk., Moscou, **7**.
Vinogradov V. V. 1959. V Kyzyl-Agačskom zapovednike. Ohota i ohotn. hoz., Moskva, **10**.
Vinokurov A. A. 1959. Raspredelenie i čislennost' golenastyh ptic v Priazovskih limanah. Zool. Žurn., Moskva, **38**, 6.
Vinokurov A. A., Dubrovskij E. B. 1957. O značenii nekotoryh rybojadnyh ptic v rybnom hozjajstvie jugo-vostočnogo Priazovia. Vopr. ihtiol., Moskva, **8**.
Voinstvenskiy M. A. 1950. Ptiсy plavnej delty r. Dunaja. Naučn. Zap. Kievsk. gos. un-ta, Kiev, **12**, 3.

Voistvenskiy M. A. 1954. V plavnjah Dunaja. Sborn. „Ohota na Ukraine", Harkov.
Voistvenskiy M. A. 1960. Pticy stepnoj polosy evropejskoj časti SSSR. Kiev.
Voltschanetskiy I. B., Puzanov I. I., Petrov V. S. 1962. Materialy po ornitofaune severo-zapadnogo Kavkaza. Trudy naučn. issl. In-ta biol. fak. Harkovsk. gos. un-ta, Harkov, **32**.
Voous K. H. 1960. Atlas of European Birds. Nelson.
Vorobyev K. A. 1936. Materialy k ornitologičeskoj faune delty Volgi i prileżaščih stepej. Trudy Astrah. gos. zap., Moskva, **1**, 1.
Wadley N. J. P. 1951. Notes on the birds of Central Anatolia. Ibis, London, **93**, 1.
Warga K. 1929. Nisten des Seidenreihers am Kisbalaton. Aquila, Budapest, **34–35**.
Warga K. 1934. Neueres Nisten von *Egretta garzetta* L. auf dem Kisbalaton. Aquila, Budapest, **38–41**.
Warga K. 1938. Neueres Nisten von *Egretta g. garzetta* (L.) in dem Kisbalaton, Ungarn. Proc. VIII Int. Orn. Congr., Oxford.
Warga K. 1954. Voranzeige über die Erforschung der Vogelwelt des Kisbalaton. Aquila, Budapest, **55–58**.
Warga K. 1955. XVIth Report on Bird-Banding in Hungary. Aquila Budapest, **59–62**.
Warga K. 1959. A Kis-Balaton madarainak fészkelö közösségei. Allatt. Közl., **47**, 1–2.
Warncke K. 1960. Die Norditalienischen Reiherkolonien 1960. Vogelwelt, Berlin, **81**, 5.
Weigold H. 1913. Zwischen Zug und Brut aus Mäander. J. Orn., Leipzig, **61**, 4.
Westerskov K. 1958. Altersbestimmung und Schlüpfreitdatierung mit Hilfe der Handschwingen europäischer Hühnervögel. Zeitschr. Jadwiss., **4**, 3.
Whistler H. 1936. Further Observations from Albania. Ibis, London, **6**, (ser. 13), 2.
Whitaker J. I. S. 1895. Additional notes on Tunisian Birds. Ibis, London, **1**, (ser. 7), 1.
White C. M. H. 1939. A contribution to the Ornithology of Crete. Ibis, London, **3**, (ser. 14), 1.
Worobiew K. A. 1932. Das staatliche Naturschutzgebiet im Wolga-Delta bei Astrachan. Kócsag, Budapest, **5**, 1–2.
Yeates G. K. 1946. Bird life in two deltas being the diaries a bird photographer in the estuaries of the Guadalquivir and the Rhône and their neighbourhoods. London.
Yeates G. K. 1948. Some supplementary notes on the Birds of the Rhône delta. Ibis, London, **90**, 3.
Zahavi A. 1957. The breeding birds of the Huleh swamp and lake (Northern Israel). Ibis, London, **99**, 4.
Zaroudnoi N. 1885. Oiseaux de la Contrée Trans-Caspienne. Bull. Soc. Imp. Nat. Mosc., Moscou, **2**.
Zaroudnoi N. 1890. Recherches zoologiques dans la Contrée Trans-Caspienne. Bull. Soc. Imp. Nat. Mosc., Moscou, 1, 2.
Zarudnoy N. 1890. Ornitologičeskaja fauna oblasti Amu-Darii meždu gg. Čaržuem i Kelifom. Bjull. obšč. ispyt. prir., Moskva, **1**.
Zarudnyj N. 1896. Ornitologičeskja fauna Zakaspijskogo Kraja. Mat. k pozn. fauny i flory Ross. Imp. Otd. zool., Moskva, **2**.
Zarudnyj N. 1897. Dopolnenija k „Ornitologičeskoj faune Orenburgskogo Kraja". Mat. k pozn. fauny i flory Ross. Imp., Moskva, **3**.
Zarudnyj N. A., Bilkevitsch S. I. 1918. Spisok ptic Zakaspijskoj oblasti i raspredelenie ih po zoologičeskim učastkam. Moskva.
Zedlitz O. 1910. Meine ornithologische Ausbeute in Nordost-Afrika. J. Orn., Leipzig, **58**, 2.
Zedlitz O. 1914a. Ornithologische Reisebilder aus Nord-Algerien. J. Orn., Leipzig, **62**, 1.

Zedlitz O. 1914b. Zusammenstellung der im April–Juni 1913 in Algerien von mir gemachten nidologischen Beobachtungen. J. Orn., Leipzig, **62**, 1.
Zergényi A. 1924. Fragmentarische Notizen über die Vogelwelt des Alibunárer Sumpfes. Aquila, Budapest, **30–31**.
Zbitkov B. M. 1914. O promysle i ohrane ptic v delte Volgi. Mat. k pozn. russk. ohotn. dela. Peterburg, **4**.

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STRESZCZENIE

Celem pracy jest analiza zmian sekularnych liczebności i rozmieszczenia czapli modronosej, *Ardeola ralloides* (Scop.) w Palearktyce na przestrzeni dwóch ostatnich stuleci. Przyczyny tych zmian autor rozpatruje w aspekcie oddziaływania czynnika ludzkiego.

Materiały, które posłużyły do opracowania, pochodzą z kilku źródeł: jedne zostały zebrane przez autora w różnych punktach zasięgu, inne autor otrzymał drogą ankietową, inne wreszcie wyselekcjonował z piśmiennictwa.

Własne materiały autor zbierał w latach 1952–1962 w deltach Wołgi, Dniestru, Dunaju, w różnych punktach dolnego biegu tej rzeki, oraz na jez. Balaton. W badaniach terenowych, prócz znanych powszechnie metod ustalania liczebności par lęgowych w poszczególnych koloniach, autor stosował opracowane przez siebie metody pośrednich badań ilościowych:

1. Metoda „wskaźnika przylotów" polega na pośrednim obliczaniu liczby par lęgowych x na podstawie zaobserwowanej z określonego dystansu od danej kolonii w określonym czasie h w godzinach porannych liczby osobników dorosłych a przylatujących z żerowisk do kolonii. Podstawiając do wyrażenia

$$x = \frac{a}{bh},$$

zebrane podczas obserwacji wartości a, h oraz odnajdując z wykresu 1 pod odpowiednią datą wartość b (ustaloną poprzednio przez autora empirycznie), można — nie penetrując samej kolonii — obliczyć liczbę par lęgowych x.

2. Kolejna metoda pośrednich badań ilościowych opiera się na obliczaniu w ostatniej fazie okresu lęgowego liczby osobników młodocianych, które w godzinach popołudniowych przebywają na wierzchołkach zarośli kolonii lęgowej. Znając poprzednio empirycznie ustalony wskaźnik wylotu młodych z jednego gniazda, oblicza się liczbę par lęgowych w kolonii.

3. W okresie polęgowym obliczanie liczby par opierało się na: a) ustaleniu stopnia zaawansowania koczowisk polęgowych osobników młodych, b) o ile

nie stwierdzono jeszcze koczowisk — na frekwencji ptaków młodych na próbnych obszarach wszystkich rodzajów biotopów żerowiskowych (liczba osobników na 1 km linii brzegowej), c) na obliczeniu długości linii brzegowej poszczególnych typów zbiorników na podstawie map 1 : 100 000, d) na obliczeniu ogólnej liczby osobników na danym obszarze, e) posługując się wskaźnikiem wylotu młodych z jednego gniazda, po wprowadzeniu poprawki na śmiertelność w okresie od opuszczenia kolonii do momentu badań ilościowych (dane z obrączkowania) — na obliczaniu liczby par lęgowych. W pracy są omówione zalety, wady oraz warunki stosowania powyższych metod.

Kolejna część danych, na których opiera się praca, pochodzi z materiałów ankietowych — dane te otrzymano z 22 ośrodków naukowych z 7 krajów europejskich.

Podstawowa część materiałów (około 90%) została wyselekcjonowana z piśmiennictwa (470 prac) pochodzącego z lat 1760–1964. Uzyskano około 2000 informacji o liczebności i innych szczegółach, dotyczących poszczególnych stanowisk lęgowych w danym sezonie lęgowym. W połączeniu z materiałem własnym oraz ankietowym otrzymano przeciętnie 10 informacji dotyczących każdego stanowiska.

W dalszej części pracy autor omawia reprezentatywność, statystyczną porównywalność, stopień dokładności oraz metody klasyfikacji zebranych materiałów. Z powodzeniem można je wyzyskiwać jedynie do badań zmian sekularnych.

Stosowana przez autora metoda totalnego badania rozmieszczenia gatunku i zmian sekularnych w zasięgu jest pierwszą próbą pełnych tego typu badań, chociaż metodologiczne przesłanki zostały ogólnie sformułowane wcześniej. Jako nowość autor stosuje profilową analizę zmian sekularnych (w przekroju równoleżnikowym i południkowym zasięgu). Metody ilościowego opracowania danych są dostosowane do możliwości rozwinięcia tematu w płaszczyźnie badań nad strukturą rozmieszczenia przestrzennego gatunku.

Kolejny (III) rozdział poświęcono przeglądowi stanowisk lęgowych *A. ralloides* (Scop.), jakie w XIX i XX w. stwierdzono w Palearktyce (mapy 1–10). W sumie omówiono występowanie gatunku w 211 stanowiskach regularnych i sporadycznych, naświetlając historię wielu z nich, podając dynamikę liczebności niektórych (wykresy 2–6), poruszając wpływ czynników decydujących o ich losach. Przegląd dostarcza kompletnego materiału do faunistyki palearktycznej, dotyczącego jednego z rzadszych i mało zbadanych gatunków. W przeglądzie są publikowane po raz pierwszy materiały zebrane w terenie przez autora.

Rozdział IV dokonuje ogólnej analizy zmian sekularnych liczebności i rozmieszczenia (tabela 4, wykresy 7–11). Stwierdzono, że zarówno liczba stanowisk, jak i liczba par lęgowych badanego gatunku w ostatnich dwóch stuleciach podlegała znacznym wahaniom sekularnym, z ogólną tendencją do obniżania się. Spadek liczby stanowisk najwyraźniej zaznaczył się w okresie 1920–1940,

a najniższy stan liczebności, przy równoczesnym szybkim tempie jej obniżania się, stwierdzono dla lat 1900–1920. Najostrzejszy kryzys badanego gatunku (brano pod uwagę tempo zmian) zaznaczył się na przełomie stuleci (lata 1890–1910). Ogólny przełom tego kryzysu następuje po r. 1930, tj. w momencie, w którym znaczna liczba europejskich gatunków zaczęła wzrastać, rozszerzając równocześnie granice swych zasięgów.

Porównując tempo obniżania się liczby stanowisk i liczebności gatunku, ustalono, że w ostatnich dziesięcioleciach XIX w. i do r. 1920 główną przyczyną regresji w całej rozpatrywanej części zasięgu była prowadzona przez człowieka bezpośrednia, gwałtowna redukcja liczebności gatunku. Przedłużająca się, lecz nie tak intensywna jak do r. 1920, regresja w okresie 1920–1940 uwarunkowana była redukcją środowisk lęgowych (melioracje, przekształcanie środowisk wodno-błotnych). W latach 1940–1960 nastąpiła stabilizacja, a następnie dość szybki wzrost liczebności gatunku, połączony z restytucją niektórych zanikłych przed laty stanowisk i powstawaniem nowych. Bilans zaniku i powstawania stanowisk jedynie w ostatnich kilkunastu latach był dodatni (wykres 8). Proporcje stanowisk regularnych i sporadycznych są odbiciem zmian liczebności gatunku. Względny wzrost liczby stanowisk sporadycznych wiąże się z regresją bądź ekspansją gatunku. Przy homeostatycznym stanie zasięgu odsetek stanowisk regularnych osiąga wartości względnie najwyższe. Stwierdzono, że zarówno na przełomie stuleci, jak w okresie 1940–1960 zaznaczył się względny wzrost stanowisk sporadycznych.

Do badania zmian sekularnych liczebności (będących w pewnym sensie wykładnikiem sytuacji biologicznej) gatunku wprowadzono wskaźnik sekularnej oscylacji liczebności Q_{os}, opierający się na średnich, obliczanych dla okresów 20–50-letnich:

$$Q_{os} = \frac{1}{\frac{y_n}{y_{n+1}} \sqrt{\frac{x_n}{x_{n+1}}}},$$

gdzie y_n — liczba par lęgowych w pierwszym okresie, y_{n+1} — liczba par lęgowych w okresie następnym, x_n — liczba stanowisk w okresie pierwszym, x_{n+1} — liczba stanowisk w okresie następnym. Wskaźnik posiada następujące właściwości:

$Q_{os} < 1$ — gatunek znajdował się w stanie regresji,
$Q_{os} = 1$ — gatunek znajdował się w stanie homeostazy,
$Q_{os} > 1$ — gatunek przejawiał ekspansywność.

Wzór wskaźnika wyprowadzono, wychodząc ze stwierdzonych poprzednio faktów, że czynniki wpływające na liczebność par lęgowych i stanowisk w pewnym stopniu są zróżnicowane (korelacja dość wysoka, $r_{xy} = +0{,}83$). Wskaźnik Q_{os} może służyć jako czuły wykładnik sytuacji biologicznej gatunku, rozpatrywanej w aspekcie porównawczym dwóch lub większej liczby okresów 20-

i 50-letnich. Według wskazań Q_{os}, *A. ralloides* (Scop.) w latach 1875–1910 przechodziła najgłębszy kryzys liczebności (Q_{os} = 0,35). Po r. 1930 nastąpiła stabilizacja z tendencją do ekspansywności.

Odpowiednio przekształcając równanie Q_{os} (p. wyrażenie 4 i 5 na str. 197), można je wykorzystać do planowania zabiegów ochronnych w skali całego zasięgu. Warunkiem utrzymania gatunku w zasięgu z gwarancją jego dalszej egzystencji (np. przy planowaniu większych przeobrażeń przyrody na skalę międzynarodową) jest, aby średnia Q_{os} z kilku kolejnych okresów n nie obniżała się poniżej 1,0, tj. by

$$\frac{\sum Q_{os}}{n} \approx 1.$$

Średnia ta dla *A. ralloides* (Scop.) za ostatnie 100 lat wynosi 0,73.

W ostatnich dwóch stuleciach, zależnie od działania czynnika ludzkiego, wydzielić należy 2 okresy zmian sekularnych: 1) okres regresji (1850–1940), w którym wyróżniają się kolejno: a) faza bezpośredniej redukcji gatunku, trwająca do 1920 r. z najintensywniejszym szczytem w latach 1890–1910, b) faza pośredniej redukcji gatunku (redukcja zasobów środowiskowych) trwająca do 1940 r.; 2) okres stabilizacji liczebności z tendencją do ekspansywności, zapoczątkowany po 1930 r. i szczególnie sprzyjający wzrastaniu liczebności po 1960 r.

W profilowej analizie zasięgu (wykresy 12–22) rozpatrywane są zmiany liczebności jako średnie obliczone dla II połowy XIX w., I połowy XX w. oraz dla stanu w latach 1950–1960 dla obszarów zasięgu zawartych między 4° długości geograficznej w profilu równoleżnikowym (łącznie 20 sektorów po 4° dł. geogr. każdy — dłuższa oś zasięgu = 6500 km) oraz dla obszarów zawartych między 4° szerokości geograficznej w profilu południkowym (łącznie 6 sektorów — krótsza oś = 2200 km). W profilu równoleżnikowym wyróżniono następujące centra ugrupowań stanowisk: 1) centrum iberyjsko-marokańskie (12–0° dł. zach.), 2) północnowłoskie (8–12° dł. wsch.), 3) środkowonaddunajskie (16–24° dł. wsch.), 4) północnoczarnomorskie (28–40° dł. wsch.), 5) kaukasko–nadkaspijskie (44–52° dł. wsch.), 6) turkmeńskie (60–64° dł. wsch.).

Autor stwierdza, że najmniejszym względnym wahaniom sekularnym podlegała liczebność *A. ralloides* (Scop.) w centrum zasięgu na obszarze maksymalnej koncentracji gatunku. Ku peryferiom wahania te wzrastają, jak również zwiększa się odsetek stanowisk sporadycznych. W profilu równoleżnikowym rozmieszczenie liczebności przyjmuje charakter rozkładu ze szczytem w centrum zasięgu. Maksymalna koncentracja gatunku w XIX w. wystąpiła między 16 a 20° dł. wsch., w XX w. uplasowała się ona między 28 a 32° oraz 48 a 52° dł. wsch.

Sekularne wahania liczebności i zmiany rozmieszczenia są bardziej znaczne wzdłuż równoleżnikowej osi zasięgu. Rozmieszczenie w profilu południkowym jest prawostronnie asymetryczne ze szczytem w północnej części zasięgu.

Maksymalna w tym profilu koncentracja gatunku wystąpiła między 44 a 48° szer. pn., przyjmuje też ona bardziej stały charakter.

Regionalne zmiany liczebności przedstawiono również jako średnie dla II połowy XIX w., I połowy XX w. i dla stanu w latach 1950–1960 dla regionów zasięgu w kwadratach obejmujących po 4° długości i szerokości geograficznej (tabela 5). Dane z poszczególnych kwadratów, zależnie od wielkości regionu, są omawiane łącznie (wykres 22). Skonstatowano, że w XIX w. obszarem maksymalnej koncentracji było centrum środkowonaddunajskie. W ciągu 100 lat ubyło tam ponad 50% stanowisk i ponad 80% liczebności gatunku. Obszarem obecnie maksymalnej koncentracji jest centrum północnoczarnomorskie oraz region Zakaukazia.

Do obszarów, gdzie liczebność *A. ralloides* (Scop.) w porównaniu z II połową XIX w. obniżyła się o 80% lub więcej, należą: północno-zachodnia część Afryki, Mezopotamia, zakaspijska część zasięgu (Turkmenia, Kazachstan, Uzbekistan), Półwysep Apeniński oraz dorzecza środkowego Dunaju. Poniżej 50% spadła liczebność na Bałkanach, na Kaukazie, w Turcji. Poniżej 30% obniżenie nastąpiło na Nizinie Nadkaspijskiej.

Wzrost liczebności zanotowano na Półwyspie Iberyjskim, na południu Francji, w centrum północnoczarnomorskim i w Zakaukaziu (Lenkoran).

W rozdziale VI, dotyczącym zmian granic zasięgu, autor omawia charakter rozmieszczenia stanowisk, dając krytykę dotychczasowych sposobów graficznego przedstawiania zasięgów geograficznych. Proponuje, by ażurowość (mozaikowość) zasięgu (mapa 11) przedstawiać, zaznaczając jedynie regiony o określonym zagęszczeniu stanowisk.

Mozaikowość zasięgu czapli modronosej, zwłaszcza jeśli idzie o wschodnie i zachodnie jego krańce, sprawia wrażenie rozmieszczenia dysjunktywnego. Nie są to jednak dysjunkcje rzeczywiste, połączone z genetyczną izolacją i pełną autonomią rozerwanych części. Mimo rozczłonkowania i mozaikowatości, palearktyczna część zasięgu strukturalnie stanowi dość zwartą całość, stąd wszelkie zmiany ilościowe w głębi wpływają na oscylację jego ogólnych granic.

Analizując zmiany sekularne rozmieszczenia, autor stwierdza, że w ciągu ostatnich 100 lat regresja terytorialna badanego gatunku zaznaczyła się w całym niemal palearktycznym zasięgu, obejmując przede wszystkim obszary o nieznacznym zagęszczeniu stanowisk i niskiej liczebności gatunku (mapa 11). W rezultacie powierzchnia zasięgu zmalała znacznie bardziej niż liczebność gatunku. Najgłębiej regresja terytorialna zaznaczyła się w regionach wschodnich i południowych.

W okresie optymalnego i najwyższego stanu liczebności w XIX w. największym oscylacjom podlegały granice północna i południowa zasięgu. Po znacznym obniżeniu się liczebności w I połowie XX w. wspomniane granice uległy stabilizacji, oscylować natomiast zaczęły granice wschodnia i zachodnia.

W I połowie XIX w. granice zasięgu przebiegały przez południowe i wschodnie wybrzeża Morza Aralskiego, doliną Syr-Darii, Zerawszanu, doliną środko-

wego biegu Amu-Darii, przez dorzecze Tedżenu i Murgabu, doliną rzeki Artek. Od południowych wybrzeży Morza Kaspijskiego granica przechodziła przez rozlewiska dolnego biegu Tygrysu i Eufratu, doliną Jordanu, przez Kretę, Sycylię, północną część Tunezji, Algierii i Maroka, następnie przez południowe części Półwyspu Iberyjskiego, Sardynię, północne Włochy (dolina Padu), stąd dalej ku północnemu wschodowi przesuwała się przez jez. Neusiedler, wzdłuż Dunaju, przecinała górny bieg Cisy, pasmo Karpat, przebiegała przez środkowy bieg Dniestru, Dniepr pod Kijowem, rozlewiska Manycza, północnonadkaspijskie jeziora, obejmowała deltę Wołgi i Uralu, dochodząc do południowych wybrzeży Morza Aralskiego.

Po upływie 100 z górą lat granice zasięgu uległy poważniejszym przesunięciom i w latach 1950–1960 kształtowały się jak następuje: na wschodzie od delty Wołgi granica przebiega wzdłuż zachodnich wybrzeży Morza Kaspijskiego, następnie wzdłuż środkowego Araksu zmierza ku zachodowi, na południu obejmuje Antiochię, przechodzi w rejon morza Marmara, na Bałkanach obejmuje ujęcie Maricy (Évros), rzekę Krna, jez. Skadarsko. Dalej na zachód granica przebiega przez środkowe Włochy, ostro skręca na południe, przebiegając przez północno-wschodnią część Tunezji oraz północno-zachodnią część Maroka, obejmuje południe Półwyspu Iberyjskiego (ujście Guadalquivir, Toledo). Od Camargue przebiega wzdłuż Rodanu po Dombes, następnie wzdłuż Padu, zmierza na północny wschód ku Nizinie Węgierskiej. Tu przebiega przez jeziora Balaton i Velencze, na południe od Budapesztu przecina Dunaj, obejmuje dorzecza środkowych biegów rzek Cisy i Körös, znów powraca do Dunaju i doliną tej rzeki, ogarniając ujście Prutu, dochodzi do wybrzeży czarnomorskich. Dalej na wschód granicę stanowią delty Dniestru, Dniepru i Kubania. Poprzez Manycz granica dochodzi do delty Wołgi.

Obecnie *A. ralloides* (Scop.) jako regularnie lęgowe występuje w delcie Wołgi, na Nizinie Lenkorańskiej, w środkowym biegu Araksa, w deltach Kubania, Dniepru, Dniestru i Dunaju, w licznych stanowiskach dolnego biegu Dunaju, na południu zaś w Turcji, w Antiochii i w Anatolii, na Bałkanach w ujściu Maricy, na jez. Skodarsko, na rzece Krna (tylko do ostatnich lat) oraz w ujściu Neretwy, we Włoszech w dorzeczu Padu (3–4 stanowiska) oraz w prowincji Sabina, w deltach Rodanu, Gualdaquivir, w Maroku na rzece Lucus oraz w Tunezji na jez. Kelbia.

Sporadycznie czapla modronosa występuje w delcie Amu-Darii, w ujściu Tereka, w Zakaukaziu w środkowym i dolnym biegu Kury oraz na rzece Alazani, na rozlewiskach Manycza, na bułgarskim wybrzeżu pod Burgas, na Nizinie Nadkaspijskiej, na zachodzie Europy w Dombes i na jez. Laguna del Taray. W związku z ogólnym wzrastaniem liczebności w ostatnich latach gatunku w Palearktyce liczba stanowisk sporadycznych stale zwiększa się.

W ostatnim rozdziale (VII) jest rozpatrywany wpływ cywilizacji i znacznego wzrastania zaludnienia w ostatnich 100 latach na kształtowanie się liczebności, rozmieszczenia i zmian biologii badanego gatunku. Autor dochodzi

do wniosku, że w pierwszej fazie regresji (do 1920 r.) dominującym czynnikiem ograniczającym było niekontrolowane bezpośrednie tępienie i prześladowanie gatunku w związku z secesyjną modą przystrajania ubiorów damskich piórami. Najintensywniej redukcja przebiegała w regionach maksymalnej koncentracji gatunku. Tempo zaniku było nadzwyczaj gwałtowne, w związku z czym palearktyczna część gatunku znalazła się u progu totalnej zagłady. Dla tego okresu charakterystyczne jest zanikanie przede wszystkim stanowisk największych i średnich, częste powstawanie stanowisk małych oraz ogólne zwiększenie się odsetka stanowisk sporadycznych. W usytuowaniu stanowisk daje się zauważyć brak stabilizacji — w zasięgu następuje znaczne rozproszenie gatunku. Wraz z I wojną światową ustaje rozwinięta na skalę „przemysłową" eksploatacja zasobów czaplowatych.

Druga faza regresji cechuje się pośrednim ograniczeniem liczebności gatunku przez redukcję i przekształcanie środowiska lęgowego. Przy niedostatecznie rozbudowanej jeszcze sieci rezerwatów i niezbyt wysokiej kulturze ochronnej okresu międzywojennego obserwuje się umiarkowaną regresję, zwłaszcza na obszarach o znacznym zaludnieniu i deficycie zasobów słodkowodnych. W okresie tym widać ponowną koncentrację gatunku w dużych stanowiskach, wzmaganie się w nich przegęszczenia, w związku z czym zaczyna się zasiedlanie stanowisk przekształconych oraz wzrasta synantropizacja.

Okres stabilności i wzrostu liczebności rozpoczyna się faktycznie podczas II wojny światowej i trwa również obecnie, co jest konsekwencją znacznego polepszenia się kultury ochrony przyrody w wielu krajach Europy, rozbudowy sieci rezerwatów państwowych. Obecnie stanowiska *A. ralloides* (Scop.) utrzymują się w 14 dużych rezerwatach.

Drugim głównym czynnikiem decydującym o zwiększeniu się liczebności jest synantropizacja gatunku. W wielu regionach zasięgu, zwłaszcza w jego centralnych i zachodnich częściach, nastąpiło efektywne przystosowanie się *A. ralloides* (Scop.) do wykorzystywania środowisk przekształconych (uprawy ryżu, kanały nawadniające, stawy rybne itd.) oraz o dużym nasileniu ruchu (statki, pogłębiarki, pojazdy mechaniczne).

Wzrastaniu liczebności sprzyja też ograniczenie przez człowieka populacji ptaków drapieżnych, wykorzystywanie przez czaplę modronosą nisz ekologicznych częściowo zwolnionych przez większe gatunki pokrewne, ograniczane przez człowieka ze względu na ich atrakcyjność łowiecką, bądź tępionych jako ichtiofagi. Coraz częściej obserwuje się badany gatunek w roli komensala wypasanej na błotach nierogacizny.

Praca kończy się akcentem optymistycznym. Autor jest przekonany, że o ile spodziewać się można trwałego charakteru czynników działających obecnie na stan liczebności badanego gatunku (wyższy poziom kultury społeczeństwa, koordynacja międzynarodowych poczynań ochronnych — akcja MAR, nasilenie procesów synantropizacji itd.), o tyle prognozowanie przyszłości tego gatunku w Palearktyce w znacznej mierze może być pozytywne.

Objaśnienia do wykresów, tabel i map:

Wykres 1. Przeciętna częstotliwość przylotów osobników dorosłych *A. ralloides* (Scop.) do kolonii lęgowych w delcie Dniestru w różnych fazach okresu lęgowego (liczba przylotów w ciągu 1 godz. do pojedynczego gniazda między 6°° a 9°° czasu wschodnioeuropejskiego); x — okres fenologiczny, y — liczba przylotów w ciągu 1 godz. (wartość wskaźnika b).

Wykres 2. Dynamika liczebności *A. ralloides* (Scop.) w Rezerwacie Astrachańskim w latach 1934–1961, na podstawie materiałów Dobrokhova (1940), Lugovoya (1961, 1963), Romashevoj (1938) i Skokovej (1958 in litt.); x — lata, y — liczba osobników dorosłych.

Wykres 3. Dynamika liczebności *A. ralloides* (Scop.) pod Rétszilas (Węgry), według materiałów Sterbetza (1962); x — lata, y — liczba osobników dorosłych.

Wykres 4. Dynamika liczebności *A. ralloides* (Scop.) w rezerwacie Kisbalaton (Węgry) w latach 1895–1960, według materiałów Schenka (1909), Steffela (1959), Szijj (1954), Warga (1954); x — lata, y — liczba osobników dorosłych.

Wykres 5. Dynamika liczebności *A. ralloides* (Scop.) w rezerwacie Sasér (Węgry) w latach 1948–1962, według materiałów Festetics (1959), Sterbetz (1962, in lit.); x — lata, y — liczba osobników dorosłych.

Wykres 6. Dynamika liczebności *A. ralloides* (Scop.) w rezerwacie Obedska Bara (Jugosławia) w latach 1858–1960, według danych Schenka (1908a), Steinmetza (1931), Szlivka (1959), Terrasse'a (1961); x — lata, y — liczebność osobników dorosłych.

Wykres 7. Zmiany sekularne liczebności stanowisk lęgowych w palearktycznej części zasięgu (stan z II połowy XIX w. = 100%); x — lata, y — liczba stanowisk w procentach.

Wykres 8. Dynamika zanikania i powstawania stanowisk lęgowych *A. ralloides* (Scop.); x — lata, y — liczba stanowisk w procentach każdej kategorii z osobna (skala dla krzywych A i B), z — liczba stanowisk w liczbach bezwzględnych (skala dla krzywej C), A — krzywa zaniku stanowisk, B — krzywa powstania nowych stanowisk, C — krzywa bilansu między zanikającymi a powstającymi stanowiskami (poniżej 0 bilans jest ujemny).

Wykres 9. Zmiany stosunku procentowego stanowisk regularnych i sporadycznych *A. ralloides* (Scop.) w ostatnich dwóch stuleciach; x — lata, y — liczba stanowisk regularnych w procentach do ogólnej liczby wszystkich stanowisk w danym okresie, z — liczba stanowisk sporadycznych w procentach do wszystkich notowanych w danym okresie stanowisk.

Wykres 10. Tempo zmian liczebności stanowisk regularnych i sporadycznych (stan z II połowy XIX w. = 100%); x — lata, y — liczba stanowisk w procentach, A — stanowiska regularne, B — stanowiska sporadyczne.

Wykres 11. Tempo zmian liczebności par lęgowych i stanowisk lęgowych *A. ralloides* (Scop.) w palearktycznej części zasięgu; x — lata, y — liczba par lęgowych w jednostkach bezwzględnych (skala dla krzywej C), z — skala procentowa dla krzywych A i B, A — krzywa liczebności stanowisk lęgowych (stan z II połowy XIX w. = 100%), B — krzywa procentowego stosunku liczebności par lęgowych (stan z II połowy XIX w. = 100%), C — przeciętny poziom liczebności gatunku w jednostkach bezwzględnych.

Wykres 12. Zmiany sekularne liczebności i rozmieszczenia stanowisk lęgowych *A. ralloides* (Scop.) w profilu równoleżnikowym; x — długość geograficzna, y — liczba stanowisk, A — stanowiska sporadyczne w II połowie XIX w,. B — stanowiska regularne (jak poprzednio), C — stanowiska sporadyczne w XX w., D — stanowiska regularne (jak poprzednio).

Wykres 13. Zmiany sekularne liczebności i rozmieszczenia stanowisk lęgowych w ujęciu procentowym w obrębie każdego z przedziałów długości geograficznej; x — długość geograficzna, y — odsetek stanowisk sporadycznych, z — odsetek stanowisk regularnych, A — w XIX w., B — w XX w.

Wykres 14. Zmiany liczebności stanowisk zanikłych, nowo powstałych i istniejących w latach 1950–1960 wzdłuż równoleżnikowej osi zasięgu; x — długość geograficzna, y —

liczba stanowisk, *A* — stanowiska zanikłe, *B* — nowo powstałe, *C* — istniejące w latach 1950–1960.

Wykres 15. Zmiany sekularne liczebności *A. ralloides* (Scop.) w profilu równoleżnikowym zasięgu; *x* — długość geograficzna, *y* — liczebność gatunku w parach lęgowych, *A* — liczebność w II połowie XIX w., *B* — liczebność w I połowie XX w., *C* — liczebność w latach 1950–1960.

Wykres 16. Zmiany sekularne liczebności *A. ralloides* (Scop.) w profilu równoleżnikowym w procentach stanu z II połowy XIX w. (stan z II połowy XIX w. = 100%); *x* — długość geograficzna, *y* — liczebność gatunku w procentach stanu z XIX w. w obrębie poszczególnych przedziałów długości geograficznej, *A* — zmiany w I połowie XX w., *B* — zmiany po r. 1950.

Wykres 17. Zmiany sekularne liczebności i rozmieszczenia stanowisk lęgowych *A. ralloides* (Scop.) w profilu południkowym; *x* — szerokość geograficzna, *y* — liczba stanowisk, *A* — stanowiska sporadyczne w II połowie XIX w., *B* — stanowiska regularne (jak poprzednio), *C* — stanowiska sporadyczne w XX w., *D* — stanowiska regularne w XX w.

Wykres 18. Liczebność stanowisk lęgowych w procentach w obrębie każdego z przedziałów szerokości geograficznej; *x* — szerokość geograficzna, *y* — odsetek stanowisk sporadycznych, *z* — odsetek stanowisk regularnych, *A* — XIX w., *B* — XX w.

Wykres 19. Liczebność stanowisk zanikłych, nowo powstałych i istniejących w latach 1950–1960 w profilu południkowym; *x* — szerokość geograficzna, *y* — liczba stanowisk, *A* — stanowiska zanikłe, *B* — stanowiska nowo powstałe, *C* — stanowiska istniejące w latach 1950–1960.

Wykres 20. Zmiany sekularne liczebności *A. ralloides* (Scop.) w profilu południkowym zasięgu; *x* — szerokość geograficzna, *y* — liczebność gatunku w parach lęgowych, *A* — liczebność w II połowie XIX w., *B* — w I połowie XX w., *C* — w latach 1950–1960.

Wykres 21. Zmiany sekularne liczebności *A. ralloides* (Scop.) w profilu południkowym w procentach stanu z II połowy XIX w. (stan z II połowy XIX w. = 100%); *x* — szerokość geograficzna, *y* — liczebność gatunku w procentach stanu z XIX w. w obrębie poszczególnych przedziałów szerokości geograficznej, *A* — zmiany w I połowie XX w., *B* — zmiany po r. 1950.

Wykres 22. Kartogram regionalnych zmian sekularnych liczby stanowisk i liczebności gatunku. Z lewej strony kartogramu podano skalę liczebności stanowisk, z prawej — skalę liczebności par lęgowych gatunku. Kolumny zakropkowane oznaczają stanowiska regularne, kreskowane pionowo — stanowiska sporadyczne, całkowicie zaczernione — liczebność gatunku w parach. Pierwsze kolumny od lewej w każdym z kwadratów dotyczą II połowy XIX w., środkowe dwie — I połowy XX w., dwie ostatnie — danych z lat 1950–1960.

Wykres 23. Tempo zmian liczebności różnej wielkości stanowisk lęgowych *A. ralloides* (Scop.) w procentach ogólnej liczby stanowisk każdej kategorii wielkości; *x* — lata, *y* — skala procentowa, *A* — stanowiska do 10 par lęgowych, *B* — 10–20 par, *C* — 21–50 par, *D* — 51–100 par, *E* — 101–200 par, *F* — 201–500 par, *G* — 501–1000 par, *H* — ponad 1000 par.

Wykres 24. Zmiany sekularne stosunku procentowego różnych klas wielkości stanowisk lęgowych *A. ralloides* (Scop.) w poszczególnych okresach; *x* — lata, *y* — liczebność stanowisk w danym okresie w procentach; klasy wielkości stanowisk — jak na wykresie 23.

Mapa 1. Ogólne rozmieszczenie notowanych w XIX i XX w. stanowisk lęgowych *A. ralloides* (Scop.) w palearktycznej części zasięgu. ● — stanowiska lęgowe; obszary zakropkowane obejmują stanowiska, w których autor prowadził badania terenowe.

Mapa 2. Rozmieszczenie stanowisk lęgowych *A. ralloides* (Scop.) w regionie zakaspijskim. Stanowiska: *1* — regularne istniejące tylko w XIX w., *2* — sporadyczne istniejące tylko w XIX w., *3* — regularne istniejące tylko w XX w., *4* — sporadyczne istniejące tylko w XX w., *5* — regularne istniejące w XIX i XX w., *6* — sporadyczne istniejące w XIX

i XX w., *7* — w XIX w. istniejące jako sporadyczne, w XX w. jako regularne, *8* — w XIX w. istniejące jako regularne, w XX w. jako sporadyczne, *9* — nie posiadające z XIX w. dostatecznej dokumentacji bądź wątpliwe, *10* — nie posiadające w XX w. dostatecznej dokumentacji bądź wątpliwe, *11* — nie posiadające dostatecznej dokumentacji ani w XIX, ani w XX w. bądź wątpliwe. Numeracja stanowisk na mapach odpowiada ich numeracji w tekście. Symbole 9–11 mogą być kombinowane z innymi.

Mapa 3. Rozmieszczenie stanowisk lęgowych *A. ralloides* (Scop.) w zachodnich częściach zlewiska Morza Kaspijskiego i wschodnich częściach zlewiska czarnomorskiego (oznaczenia jak na mapie 2).

Mapa 4. Rozmieszczenie stanowisk lęgowych *A. ralloides* (Scop.) w północno-zachodnich regionach zlewiska czarnomorskiego (oznaczenia jak na mapie 2).

Mapa 5. Rozmieszczenie kolonii lęgowych *A. ralloides* (Scop.) w delcie Dniestru. *1* — zbiorniki wodne, *2* — obszary porośnięte trzciną, *3* — łąki łęgowe, *4* — lasy łęgowe, *5* — kępy wierzby niskorosłej wśród trzcin, *6* — step, *7* — drogi, *8* — krawędzie tarasów rzecznych, *9* — osiedla, zabudowania, *10* — kolonie lęgowe czaplowatych.

Mapa 6. Rozmieszczenie stanowisk lęgowych *A. ralloides* (Scop.) w dorzeczu środkowego biegu Dunaju (oznaczenia jak na mapie 2).

Mapa 7. Rozmieszczenie stanowisk lęgowych *A. ralloides* (Scop.) w dorzeczu dolnego biegu Dunaju (oznaczenia jak na mapie 2).

Mapa 8. Rozmieszczenie stanowisk lęgowych *A. ralloides* (Scop.) na Bałkanach (oznaczenia jak na mapie 2).

Mapa 9. Rozmieszczenie stanowisk lęgowych *A. ralloides* (Scop.) w rejonie Zatoki Perskiej i w regionach wschodnio-śródziemnomorskich (oznaczenia jak na mapie 2).

Mapa 10. Rozmieszczenie stanowisk lęgowych *A. ralloides* (Scop.) w zachodnich regionach śródziemnomorskich (oznaczenia jak na mapie 2).

Mapa 11. Zmiany sekularne rozmieszczenia *A. ralloides* (Scop.) w palearktycznej. części zasięgu; 1 — rozmieszczenie w latach 1950–1960, 2 — rozmieszczenie w połowie XIX w., 3 — strefy ekspansji gatunku w ostatnich 30 latach.

Tabela 1. Liczebność osobników dorosłych *A. ralloides* (Scop.) w delcie Dniestru w latach 1952–1955. (1) — kolonie, (2) — lata, (3) — jez. Kvašino, (4) — „Przy Dniestrze", (5) — jez. Žukovo, (6) — pod wsią Palanka, (7) — jez. Tudorovo, (8) — Liman Dniestrzański, (9) — razem.

Tabela 2. Liczebność osobników młodocianych *A. ralloides* (Scop.) w rumuńskiej części delty Dunaju w III dekadzie sierpnia i I dekadzie września 1962 r. (1) — charakter zbiornika wodnego, (2) — wskaźnik frekwencji (liczba osobników na 1 km linii brzegowej), (3) — kilometraż, (4) — liczba osobników, (5) — uwagi, (6) — główne odnogi delty, (7) — kanały średniej szerokości, (8) — starorzecza, (9) — jeziora, (10) — limany, (11) — drobne zbiorniczki wodne, (12) — razem, (13) — brzegi nie porośnięte roślinnością pływającą, (14) — brzegi porośnięte roślinnością pływającą, (15) — zarośnięte całkowicie lub częściowo, (16) — jak wyżej, (17) — bez roślin pływających, (18) — zarośnięte roślinnością pływającą.

Tabela 3. Zmiany w proporcjach stanowisk lęgowych *A. ralloides* (Scop.). (1) — proporcje, (2) — okres.

Tabela 4. Zmiany sekularne liczebności *A. ralloides* (Scop.) w okresie 1850–1960 w palearktycznej części zasięgu. (1) — charakter zmian, (2) — okres, (3) — liczebność par lęgowych (y_n), (4) — liczebność stanowisk lęgowych (x_n), (5) — tempo zmian liczebności (w stosunku procentowym poszczególnych okresów), (6) — wskaźnik oscylacji sekularnej liczebności gatunku Q_{os}, (a) — w jednostkach bezwzględnych, (b) — w stosunku procentowym poszczególnych okresów, (c) — w stosunku procentowym do stanu w 1850–1900.

Tabela 5. Zmiany sekularne liczebności *A. ralloides* (Scop.) w poszczególnych regionach zasięgu na tle wpływu czynnika antropogenicznego. (1) — regiony zasięgu, (2) — okres, (3) — zmiany sekularne liczby stanowisk lęgowych w % (4) — zmiany sekularne liczebności gatunku w %, (5) — oddziaływanie czynnika ludzkiego — redukcja bezpośrednia, (6) — redukcja pośrednia, (7) — ochrona, (8) — północna Afryka, (9) — Półwysep Iberyjski, (10) — południowa Francja, (11) — Półwysep Apeniński, (12) — Bałkany, (13) — Turcja i wschodnie wybrzeża śródziemnomorskie, (14) — Mezopotamia, (15) — Turkmenia, Kazachstan, Uzbekistan, (16) — Nizina Nadkaspijska, (17) — Kaukaz, (18) — region północnoczarnomorski, (19) — dorzecze środkowego biegu Dunaju, a — II połowa XIX w., b — I połowa XX w., c — okres 1950–1960; 5-stopniowa skala oceny oddziaływania czynnika antropogenicznego: 1 — oddziaływanie minimalne lub żadne, 2 — bardzo umiarkowane, 3 — umiarkowane, 4 — znaczne, 5 — bardzo silne.

РЕЗЮМЕ

Целью настоящей работы является анализ вековых изменений численности и распространения желтой цапли, *Ardeola ralloides* (Scop.) в Палеарктике на протяжение двух последних столетий. Причинность этих изменений рассматривается в аспекте воздействия антропогенного фактора.

Автор воспользовался следующего рода материалами: собранными им лично в различных пунктах гнездового ареала, полученными путем анкетного опроса, выбранными из орнитологической литературы.

Собственные материалы собирались автором в дельтах Волги, Днестра, Дуная в различных местах нижнего течения этой реки а также на озере Балатон в период 1952–1962 гг. В полевых исследованиях, кроме общеизвестных методов оценки численности гнездовых пар в соответственных колониях, автор пользовался собственно им розработанной методикой посредственных подсчетов:

1) Метод „коэффициента прилетов" основывается на посредственном подсчете гнездовых пар (x) при использовании производимых на определенном расстоянии от гнездовой колонии наблюдений прилета взрослых особей (a), которые в ранние часы в определенном промежутке времени (h) прилетели на гнездовье. Подставляя данные в формулу:

$$x = \frac{a}{hb}$$

и из графика 1 под соответственной датой находя величину b (эмпирически вычисленную автором), не просматривая самой колонии, можно вычислить искомую численность гнездовых пар (x).

2) Следующий метод посредственных подсчетов состоит в том, что в последних стадиях гнездового периода подсчитывается количество молодых птиц, которые в предвечерние часы собираются на верхушках гнездовой рощи. Зная до того эмпирически вычисленный коэффициент вылета молодых из одного гнезда, можно вычислить общее количество гнездовых пар в данной колонии.

3) В послегнездовом периоде количественная оценка гнездовых пар основывалась на следующих положениях: а) устанавливалась степень интенсивности послегнездовых кочевок молодых птиц, б) если кочевки еще не начались, вычислялась встречаемость молодых птиц на пробных площадях основных видов биотопов (количество особей/1 км береговой линии), в) на картах 1 : 100000 подсчитывалась общая длина береговой линии отдельных водоемов, г) высчитывалась численность молодняка на всей исследуемой территории, д) пользуясь коэффициентом вылета из одного гнезда в среднем, учитывая смертность от момента вылета из колонии до времени производимого подсчета (данные кольцевания), можно вычислить общую численность гнездовой популяции. Автором рассматриваются положительные и отрицательные моменты, а также условия применения указанной методики.

Анкетные материалы были получены из 22 научных учреждений из 7 европейских стран.

Основная часть материала (ок. 90%) была выбрана из орнитологической литературы (свыше 470 публикации) охватывающей период 1760–1964. Получено ок. 2000 сведений о численности и других подробностях касающихся отдельных мест гнездовок в данном гнездовом периоде. Вместе с выше упомянутыми материалами, в среднем получено 10 сведений касающихся каждого из мест гнездовок.

В дальнейшей части работы автором рассматриваются вопросы статистической сравнимости и достоверности данных, а также принципы классификации мерериалов. Такого рода материалы успешно можно использовать лишь для выявления общих вековых изменений численности и распространения.

Применяемый автором метод тотального исследования количественных вековых изменений численности вида в пределах ареала является одной из первых попыток наиболее полной разработки этой проблемы, хотя методологические предпосылки в общих чертах были изложены раньше. В качестве научной новинки, автором применяется профильный анализ вековых изменений (в широтном и меридиональном разрезе ареала). Методика количественной обработки данных была уставленная таким образом, чтобы дать возможность развернуть тему в аспекте исследований пространственной структуры рапределения вида внутри ареала.

В последующей главе автором дается просмотр всех палеарктических мест гнездовок желтой цапли, какие на протяжении XIX и XX столетий были обнаружены и описаны (карта 1). В общем констатировано 211 мест регулярных и спорадических гнездовок. Автором дается история многих из них, а а также динамика численности некоторых (графики 2–6), влияние факторов решающих их судьбу и т. д. Просмотр доставляет богатый материал для палеарктической фаунистики по отношению к одному из менее изученных видов. В упомянутой главе впервые печатаются собранные автором данные.

Четвертая глава посвящена общему анализу вековых изменений численности и распространения (таб. 4, графики 7–11). Автор приходит к выводу, что как численность мест гнездовок, так и гнездовых пар на протяжении двух последних столетий подвергалась значительным вековым колебаниям с общей тенденцией к падению численности. Снижение числа мест гнездовок наиболее сильно отмечалось в период

1920–1940 гг., в то время как наиболее низкая численность гнездовых пар, при одновременно очень быстром темпе ее снижения, отмечена в 1900–1920 гг. Наиболее острый кризис имел место в период 1890–1910 гг. (принимается тут во внимание темп изменений). Переломный момент наступает после 1930 года, т. е. в то время, когда значительное число европейских видов птиц начало увеличивать свою численность, расширяя одновременно свои ареалы. Сравнивая темпы снижения числа мест гнездовок и численности гнездовых пар, автор приходит к выводу, что в последних десятилетиях XIX столетия, вплоть до 1920 года, основной причиной регресса в пределах рассматриваемой части ареала было непосредственное изничтожение человеком поголовья желтой цапли. Продолжающийся количественный регресс в период 1920–1940 гг., однако уже не столь стремительный и не так интенсивный, обуславливался посредственной редукцией вида, т. е. мелиорациями и преобразованием болотных биотопов. В период 1940–1960 гг. отмечается стабилизация и затем очень бурный подъем численности вида и одновременное восстановление раньше исчезнувших мест гнездовок, а также возникновение новых. Баланс исчезновения и возникания гнездовий единственно в течение двух последних десятилетий был положительный (граф. 8). Пропорции численности мест регулярных гнездовок и спорадических гнездовий отображают общую картину количественных колебаний вида. Относительное возрастание числа спорадических гнездовок следует связывать или с регрессом, или с экспансивностью вида. При гомеостатическом состоянии ареала процент регулярных гнездовок достигает максимальной величины.

Автор констатировал, что как на переломе столетий, так и в период 1940–1960 гг. наступило заметное относительное возрастание числа спорадических мест гнездования.

С целью изучения вековых колебаний численности (являющихся в известной мере показателем общебиологической ситуации вида), автором был введен индекс вековых колебаний численности (Q_{os}) основывающийся на средних из 20–50-тилетних отрезков времени:

$$Q_{os} = \frac{1}{\frac{y_n}{y_{n+1}} \sqrt{\frac{x_n}{x_{n+1}}}},$$

где y_n = число гнездовых пар в течение первого периода, y_{n+1} = число пар в течение последующего периода, x_n = число мест гнездования в первом периоде, x_{n+1} = во второй период. Индекс характеризуется следующими особенностьями:

$Q_{os} < 1$ — вид в состояние количественного регресса,

$Q_{os} = 1$ — вид в состояние количественного равновесия (гомеостаз),

$Q_{os} > 1$ — вид проявляет экспансивность.

Формула индекса основывается на таких фактах, как дифференцированная степень влияния факторов определяющих численность самого вида и число его мест гнездования (корреляция между этими параметрами $r_{xy} = +0{,}83$). Индексом Q_{os} воспользоваться можно в качестве чувствительного показателя биологической ситуации

вида, рассматриваемой с перспективы сравнимости двух, или больше 20–50-тилетних отрезков времени. Судя по показаниям Q_{os}, желтая цапля в течение 1875–1910 гг. проходила наиболее глубокий кризис численности ($Q_{os} = 0{,}35$). После 1930 года отмечается стабилизация вида с тенденциями к экспансивности.

Соответственно преобразовывая уравнение Q_{os} (см. стр. 197 — формула (4), (5)), можно его использовать для планирования мероприятий по охране вида по отношению ко всей площади ареала. Необходимым условием надежного сохранения вида в будущем является такое положение, чтобы Q_{os} из нескольких последующих периодов (n) в среднем было не меньше 1,0, т. е. чтобы:

$$\frac{\sum Q_{os}}{n} \approx 1.$$

За последних 100 лет средняя величина Q_{os} для желтой цапли = 0,73.

На протяжении двух последних столетий, в зависимости от характера воздействия антропогенного фактора, автором были выделены два разных периода вековых изменений: 1) Период регресса (1850–1940), который подразделяется еще на две фазы: а) непосредственной редукции численности вида — эта фаза продолжалась по 1920 год с наиболее интенсивной редукцией в 1890–1910 гг., б) фаза посредственной редукции (мелиорация и преобразовывание болотных биотопов), продолжающаяся по 1940 год; 2) Период стабилизации численности с тенденциями к экспансивности, особенно после 1960 года.

В главе, посвященной профильному анализу ареала, изменения численности рассматриваются как средние величины, отдельно вычисленные для II половины XIX столетия, I половины XX столетия и для состояния видя в период 1950–1960 гг., по отношению к секторам ареала ограничиваемым 4° географической долготы в широтном разрезе (в сумме 20 секторов — более длинная ось ареала = 6500 км) и по отношению к секторам, каждый в пределах 4° географической широты, в меридиональном разрезе (в сумме 6 секторов — более короткая ось ареала = 2200 км). В широтном разрезе автором были выделены следующие главные группировки мест гнездовок желтой цапли: 1) Пиренейско-мароканский центр (12–0° зап. долг.), 2) северо-итальянский центр (8–12° вост. долг.), 3) средне-придунайский центр (16–24° вост. долг.), северо-черноморский центр (28–40° вост. долг.), 5) кавказско-прикаспийский центр (44–52° вост. долг.), 6) туркменский центр (60–64° вост. долг.).

Наиболее незначительным относительным вековым колебаниям подвергалась численность желтой цапли в центральных районах ареала, т. е. в пределах максимальной концентрации вида. По направлению к перифериям эти колебания усиливаются, а также возрастает процент мест спорадических гнездовок. В широтном профильном разрезе распределение численности характеризуется апогеем в центральных частях ареала. В XIX столетие максимальная концентрация численности имела место между 16 а 20° вост. долг., в XX столетие она локализировалась между 28 а 32° вост. долг. и особенно между 48 а 52° вост. долг.

Как констатировал автор, более значительные вековые колебания численности и распределения происходят вдоль широтной оси ареала. Распределение вдоль меридиональной оси является правосторонне асиметричным с апогеем в северной части ареала. Максимальная, в меридиональном разрезе, концентрация вида отмечается между 44 а 48° сев. шир., где принимает она более постоянный характер.

Региональные изменения численности, приведенные тут как средние величины, характеризуют II половину XIX столетия, I половину нашего столетия и период 1950–1960 гг., и были вычислены автором для прямоугольников о боках состоящих из 4° в широтном и 4° в долготном направлениях (таб. 5). В зависимости от величины данного региона ареала, данные из нескольких прямоугольников анализируются совместно (граф. 22). В XIX столетие районом максимальной концентрации численности желтой цапли был средне-придунайский центр. За 100 лет уменьшилось там на свыше 50% количество мест гнездовок и на свыше 80% численность вида. Районами максимального сосредоточения в настоящее время являются центры северо-черноморский и особенно закавказский (Ленкорань).

К районам, в пределах которых численность желтой цапли, по сравнению с II половиной XIX века, снизилась на 80% или больше, следует причислить северо-западные части Африки, Месопотамию, закаспийскую часть ареала, Апенинский п-в а также бассейн среднего течения Дуная. Падение ниже 50% отмечается на Балканском п-ве, на Кавказе, в Турции. Ниже 30% наступило снижение на Прикаспийской низменности.

Увеличение численности наблюдается на Пиренейском п-ве, на юге Франции, в центре северо-черноморском и особенно в пределах Закавказья.

В главе посвященной изменениям границ ареала, автором рассматривается характер распределения мест гнездования, дается критика способов графического изображения географических ареалов. Автор предлагает мозаику (кружево или ажурность) ареала представлять на картах исходя из определенной густоты мест гнездовок.

Ажурность ареала желтой цапли (карта 11), особенно на его восточных и западных окраинах, дает впечатление разорванного ареала, что однако не ведет за собой генетической изоляции и автономности разъединенных частей. Палеарктическая часть ареала в структурном отношении составляет целое. Отсюда всякие колебания численности в центральных частях ареала сказываются на осцилляции его общих границ.

В дальнейшей части работы автором констатируется, что за последних 100 лет имел место территориальный регресс желтой цапли, наблюдаемый почти повсюду в палеарктической части ареала, и в первую очередь в районах незначительной плотности заселения вида (карта 11). В результате поверхность ареала уменьшилась в более значительной степени, чем пропорционально численность вида. Наиболее значительное отступление вида отмечается в восточных и южных частьях ареала.

В период оптимального и наиболее высокого уровня численности в XIX веке наиболее значительным осцилляциям подвергались северные и южные границы

ареала. После снижения численности вида в I половине нашего столетия они стали более стабильными, а стали осциллировать в то время границы западная и особенно восточная.

В первой половине прошлого столетия границы проходили через южные и восточные побережья Аральского моря, долиной Сыр-Дарьи, Зеравшана, вдоль среднего течения Аму-Дарьи, через бассейны Теджена и Мургаба, долиной Артека. С юга Каспийского моря граница пробегала через плавни в нижнем течение рек Тигра и Евфрата, вдоль реки Иордан, затем через острова Крит, Сицилию, северные части Туниса, Алжира, Марокка, южные части Пиренейского п-ва, Сардинию, северную Италию (долиной реки По), отсюда поворочивала к северо-востоку к озеру Нейзидлер-Зе, проходила вдоль Дуная, пересекала Тиссу в верхнем течение, переходила на северную сторону Карпат, вдоль среднего течения Днестра, пересекала Днепр под Киевом, охватывала плавни Маныча, прикаспийские степные озера, дельту Волги, реки Урала и отсюда поворачивала к южным берегам Аральского моря.

После 100 с лишним лет границы ареала подверглись значительным изменениям. В 1950–1960 гг. они пробегали следующим образом: на востоке, начиная от дельты Волги, граница пробегает вдоль западных побережьи Каспийского моря, вдоль Аракса, поворочивая к югу охватывает Антьокию, затем переходит в район Мраморного моря, на Балканском п-ве охватывает дельту Марицы, реку Црна, Скадарское озеро, проходит через центральные районы Апенинского п-ва, резко поворачивает на юг, проходит через Тунис, северо-западные части Марокка, охватывает южную половину Пиренейского п-ва (дельта Гвадальквивир, Толедо), на юге Франции Камарг, вдоль Роны доходит до Домб, в Италии вдоль реки По, через Югославию пробегает к Венгерской низменности, где охватывает озера Балатон, Веленце, к югу от Будапешта пересекает Дунай, охватывает средние течения рек Тиссы, Кереш, опять поворачивает к Дунаю и долиной этой реки, охватывая нижнее течение Прута, доходит к черноморскому побережью. Далее к востоку границей ареала являются делты рек Днестра, Днепра Кубани. Через плавни Маныча доходит она на востоке до дельты Волги.

В настоящее время желтая цапля в качестве регулярно гнездящейся отмечается в дельте Волги, на Ленкоранской низменности, в среднем течение Аракса, в дельтах рек Кубани, Днепра, Днестра, Дуная, во многочисленных местах вдоль нижнего и среднего течения этой реки, в Турции в Антьокии и Анатолии, на Балканском п-ве в устье Марицы, на Скадарском озере, на реке Црна (единственно до последних лет), в устье реки Неретвы, в Италии в бассейне реки По (в 3-х – 4-х местах) и в провинции Сабина, в дельтах рек: Роны, Гвадальквивир, в Марокко на реке Лукус, а в Тунисе на озере Келибия.

Спорадически желтая цапля появляется на гнездовьях в дельте Аму-Дарьи, на Теджене, в устье Терека, в Закавказье в среднем и нижнем течение Куры, на реке Алазани, в плавнях Маныча, на болгарском побережье Черного моря, на Венгерской низменности, на западе Европы в Домб и на озере Лагуна дель Тарай. В связи с общим, все более усиливающимся возрастанием численности желтой цапли в по-

следнее время в Палеарктике, число мест спорадических гнездовок постоянно возрастает.

В последней главе анализируется влияние антропогенного фактора и значительного увеличения за последних 100 лет человеческой популяции на состояние численности, распространение и изменения биологии изучаемого вида. Автор приходит к выводу, что в первой фазе регресса (до 1920 года) господствующим ограничивающим фактором было неконтролируемое непосредственное изничтожание вида в связи с модой в стиле сецессион на райеры и эгретки. Наиболее интенсивный отстрел имел место в районах максимального сосредоточения вида. Темпы исчезновения вида были настолько стремительны, что палеарктическая его часть оказалась накануне полной гибели. Для этого периода характерно исчезание в первую очередь гнездовий крупных и средней величины, возникновение гнездовий небольших, а также относительное увеличение процента спорадических гнездовок. Места гнездовок непостоянны, часто они меняются — по всему ареалу наблюдается значительное рассеивание вида. С момента окончания I Мировой войны затихает производимое в „промышленных" маштабах истребление цаплевых.

Вторая фаза регресса характеризуется посредственным ограничиванием численности желтой цапли (преобразование болотных биотопов). При недостаточном количестве заповедников и низкой все еще культуре охраны природы в межвоенном периоде отмечается умеренное снижение численности, особенно в районах перенаселенных с недостатком ресурсов пресной воды. Констатируется концентрацию численности в пределах крупных гнездовий, где возрастает перенаселение желтой цапли, в связи с чем переселяется она на новые места гнездовок в преобразованных биотопах и подвергается процессам синантропизации.

Период стабилизации и возрастания численности фактически начинается во время Второй мировой войны и продолжается в настоящее время. Причинность этого явления кроется в подъеме культуры охранного дела на более высокий уровень, в создании обширной сети государственных заповедников во многих странах Европы. В настоящее время желтая цапля гнездится в 14 больших заповедниках, из которых Кызыл-Агачский играет первостепенную роль.

Другого рода основным фактором решающим о возрастании численности является синантропизация. Во многих районах ареала, особенно центральных и западных, желтая цапля с успехом приспособилась к культурным биотопам (посевы риса, мелиоративные канавы, рыбные пруды и т. д.), появляется в местах с большим движением (пароходы, моторные лодки, дночерпательные устройства, а даже автомобили и поезда). Возрастанию численности способствует ограничивание популяции хищников, использование желтой цаплей экологических ниш частично оставленных более крупными видами цаплевых, которые ввиду своей привлекательности для охотников, или из-за ихтиофагии, истребляются более интенсивно. Все чаще можно наблюдать желтую цаплю в качестве коменсала выпасаемого не болотах нерогатого скота.

Автор заканчивает работу оптимистическими акцентом — если ожидать, что воздействующие на количественный уровень исследуемого вида факторы примут

более постоянный характер (более высокий уровень культуры охранного дела, согласованность международных мероприятий — кампания МАР, усиление процессов синантропизации и т. д.), предсказания по отношению к будущему желтой цапли в Палеарктике можно будет считать благоприятными.

Объяснения к графикам, картам и таблицам:

График 1. Частота прилетов взрослых желтых цапель до гнездовых колонии в дельте Днестра, в среднем, на различных стадиях гнездового периода (число прилетов к одинарному гнезду в течение одного часа между 6^{00} а 9^{00} часами восточноевропейского времени); h — фенологический период, y — число прилетов в течение одного часа (величина показателя b).

График 2. Динамика численности желтой цапли в Астраханском госзаповеднике в период 1934–1961 гг. на основании данных: Доброхотова (1940), Лугового (1961, 1963), Ромашевой (1938), Сковой (1958, in litt.); x — годы, y — численность взрослых особей.

График 3. Динамика численности желтой цапли в районе Ретсиляш (Венгрия) на основании данных Штербеца (Sterbetz, 1962); x — годы, y — численность взрослых особей.

График 4. Динамика численности желтой цапли в заповеднике Кишбалатон (Венгрия) в период 1895–1960 гг. на основании данных: Schenk (1909), Steffel (1959), Szijj (1954), Warga (1954); x — годы, y — численность взрослых особей.

График 5. Динамика численности желтой цапли в заповеднике Шашер (Венгрия) в период 1948–1962 гг. на основании материалов: Festetics (1959), Sterbetz (1962, in litt.); x — годы, y — численность взрослых особей.

График 6. Динамика численности желтой цапли в заповеднике Обедская Бара (Югославия) в период 1858–1960 гг. на основании материалов: Schenk (1908a); Steinmetz (1931), Szlivka (1959), Terrasse (1961); x — годы, y — численность взрослых особей.

График 7. Вековые изменения численности мест гнездовок в палеарктической части ареала (состояние из II половины XIX века = 100%); x — годы, y — число мест гнездовок выраженное в %%).

График 8. Динамика исчезновения и возникновения мест гнездовок желтой цапли; x — годы, y — число мест гнездовок в %% по отношению к каждой их категории отдельно (шкала для кривых A, B), z — число мест гнездовок в абсолютных единицах (шкала для C), A — исчезание мест гнездования, B — возникание новых мест гнездовок, C — кривая баланса исчезновения и возникновения гнездовий (ниже О баланс отрицательный).

График 9. Изменения процентных соотношений регулярных и спорадических мест гнездовок желтой цапли на протяжение двух последних столетий; x — годы, y — численность регулярных гнездовок выражена в процентном соотношении к общему числу всех гнездовок в определенном отрезке времени, z — численность спорадических мест гнездования в процентном соотношении ко всем отмеченным в определенном отрезке времени местам гнездовок.

График 10. Темпы изменений численности регулярных и спорадических мест гнездования (состояние во II половине XIX столетия = 100%); x — годы, y — численность мест гнездовок в %%, A — регулярные гнездовья, B — спорадические гнездовья.

График 11. Темпы изменений численности гнездовых пар и мест гнездования желтой цапли в палеарктической части ареала; x — годы, y — численность гнездовых пар в абсолютных единицах (шкала для C), z — процентная шкала для кривых A, B; A — численность мест гнездования (состояние со II половины XIX столетия = 100%), B — процентные соотношения численности гнездовых пар (численность во II половине XIX столетия = 100%), C — численный уровень вида в абсолютных единицах в среднем.

График 12. Вековые изменения численности и распространения мест гнездования желтой цапли в широтном (параллельном) разрезе; x — географическая долгота, y — численность мест гнездования, A — места спорадических гнездовок со II половины XIX столетия, B — места регулярных гнездовок (как выше), C — места спорадических гнездовок в XX веке, D — места регулярных гнездовок (как выше).

График 13. Вековые изменения численности и распространения мест гнездовок в процентных соотношениях в пределах каждого сектора географической долготы; *x* — географическая долгота, *y* — процент спорадических гнездовок, *z* — процент регулярных гнездовок, *A* — в XIX веке, *B* — в XX веке.

График 14. Изменения численности исчезнувших, вновь возникших и существующих в период 1950–1960 гг. мест гнездовок вдоль параллельной оси ареала; *x* — географическая долгота, *y* — численность мест гнездовок, *A* — исчезнувшие гнездовья, *B* — вновь возникшие, *C* — существующие в период 1950–1960 гг.

График 15. Вековые изменения численности желтой цапли в широтном разрезе ареала, *x* — географическая долгота, *y* — число гнездовых пар, *A* — численность во II половине XIX столетия, *B* — в I половине XX столетия, *C* — в период 1950–1960 гг.

График 16. Вековые изменения численности желтой цапли в широтном разрезе ареала в процентном соотношении к численности со II половины XIX столетия (численность во II половине XIX столетия = 100%); *x* — географическая долгота, *y* — численность вида в пределах соответственных секторов географической долготы, *A* — изменения в I половине XX века, *B* — после 1950 года.

График 17. Вековые изменения численности и распространения мест гнездовок желтой цапли в меридиональном разрезе; *x* — географическая широта, *y* — число — мест гнездовок, *A* — спорадические места гнездовок во II половине XIX века, *B* — регулярные места гнездовок (как выше), *C* — спорадические места гнездовок в XX веке, *D* — регулярные (как выше).

График 18. Численность мест гнездовок в процентном соотношении в пределах каждого сектора географической широты; *x* — географическая широта, *y* — число мест гнездовок спорадических в %%, *z* — число регулярных мест гнездовок в %%, *A* — XIX столетие, *B* — XX столетие.

График 19. Численность исчезнувших, вновь возникших и существующих в период 1950–1960 гг. мест гнездования в меридиональном разрезе ареала; *x* — географическая широта, *y* — число мест гнездовок, *A* — исчезнувшие места гнездовок, *B* — вновь возникшие, *C* — существующие в период 1950–1960 гг.

График 20. Вековые изменения численности желтой цапли в меридиональном разрезе ареала; *x* — географическая широта, *y* — число гнездовых пар, *A* — численность во II половине XIX столетия, *B* — в I половине XX века, *C* — в период 1950–1960 гг.

График 21. Вековые изменения численности желтой цапли в меридиональном разрезе ареала в процентном соотношении к состоянию во II половине XIX столетия (численность из этого времени = 100%); *x* — географическая широта, *y* — численность в пределах соответственных секторов географической широты, *A* — изменения в I половине XX века, *B* — изменения после 1950 года.

График 22. Картограмма региональных вековых изменений численности мест гнездовок и численности вида. С левой стороны картограммы подана шкала численности мест гнездовок, с правой — гнездовых пар. Столбики зачерченные пунктиром обозначают регулярные места гнездовок, зачерченные вертикальной штриховкой — спорадические места гнездовок, сплошь черные — численность вида поданная в гнездовых парах. Первых два столбика с левой стороны в каждом из прямоугольников касаются II половины XIX столетия, два столбика посередине — I половина XX столетия, два столбика с правой стороны касаются периода 1950–1960 гг.

График 23. Темпы изменений численности различной величины мест гнездовок желтой цапли (в процентном соотношении к общему числу мест гнездовок в пределах каждой категории по величине); *x* — годы, *y* — процентная шкала, *A* — места гнездовок величиной до 10 пар, *B* — 11–20 пар, *C* — 21–50 пар, *D* — 51–100 пар, *E* — 101–200 пар, *F* — 201–500 пар, *G* — 501–1000 пар, *H* — <1000 пар.

График 24. Вековые изменения процентных соотношений разных по величине классов мест гнездовок желтой цапли в отдельных отрезках времени; *x* — годы, *y* — число мест гнездовок в процентах в данном отрезке времени, *A* — 1–10 пар, *B* — 11–20 пар, *C* — 21–50 пар, *D* — 51–100 пар, *E* — 101–200 пар, *F* — 201–500 пар, *G* — 501–1000 пар, *H* — <1000 пар.

Карта 1. Общее распределение отмеченных в XIX и XX столетиях мест гнездовок желтой цапли в палеарктической части ареала; ● — места гнездовок, районы заштрихованные пунктиром охватывают гнездовки, в которых автором производились полевые исследования.

Карта 2. Распределение мест гнездования желтой цапли в закаспийской части ареала.

Обозначения мест гнездования: 1 — регулярные, существующие единственно в XIX веке, 2 — спорадические места гнездовок, существующие единственно в XIX веке, 3 — регулярные, единственно в XX веке, 4 — спорадические в XX веке, 5 — регулярные в XIX и XX столетиях, 6 — спорадические в XIX и XX столетиях, 7 — в XIX веке спорадические, в XX регулярные, 8 — в XIX веке регулярные, в XX веке спорадические, 9 — места гнездовок в XIX веке лишенные достаточно полной документации или сомнительные, 10 — в XX веке лишенные достаточно полной документации или сомнительные, 11 — места гнездовок не имеющие достаточно полной документации в обоих столетиях, или сомнительные. Обозначения 9–11 могут быть комбинированы с другими. Номера мест гнездовок на картах соответствуют нумерации в тексте.

Карта 3. Распределение мест гнездовок желтой цапли в западных частях каспийского бассейна и восточных частях черноморского бассейна (обозначения — как на карте 2).

Карта 4. Распределение мест гнездования желтой цапли в северозападных районах черноморского бассейна (обозначения — как на карте 2).

Карта 5. Распределение гнездовых колонии желтой цапли в дельте Днестра. Обозначения: 1 — водоемы, реки, 2 — территории поросшие тростником, 3 — пойменные луга, 4 — пойменные леса, 5 — островки кустарниковой вербы среди тростников, 6 — степь, 7 — дороги, 8 — речные террасы, 9 — жилые поселки, постройки, 10 — гнездовые колонии цаплевых.

Карта 6. Распределение мест гнездовок желтой цапли в бассейне среднего течения Дуная (обозначения — как на карте 2).

Карта 7. Распределение мест гнездовок желтой цапли в бассейне нижнего течения Дуная (обозначения — как на карте 2).

Карта 8. Распределение мест гнездовок желтой цапли на Балканском п-ве (обозначения — как на карте 2).

Карта 9. Распределение мест гнездовок желтой цапли в районе Персидского залива и в восточно-средиземноморском регионе (обозначения — как на карте 2).

Карта 10. Распределение мест гнездовок желтой цапли в западных районах средиземноморского бассейна (обозначения — как на карте 2).

Карта 11. Вековые изменения распространения желтой цапли в палеарктической части ареала; 1 — распространение в период 1950–1960 гг., 2 — в половине XIX столетия, 3 — районы экспансии вида в течение последних 30 лет.

Таблица 1. Численность взрослых особей желтой цапли в дельте Днестра в период 1952–1955 гд (1) — колонии, (2) — годы, (3) — оз. Квашино, (4) — „при Днестре", (5) — оз. Жуково, (6) — пог Паланкой, (7) — оз. Тудорово, (8) — Днестровский лиман, (9) — итого.

Таблица 2. Численность молодых особей желтой цапли в румынской части дельты Дуная в III декаде августа и I декаде сентября 1962 г. (1) — характер водоема, (2) — коэффициент встречаемости (число особей /1 км береговой линии), (3) — километраж, (4) — число особей, (5) — замечания, (6) — основные рукава дельты, (7) — каналы средней ширины, (8) — стороречья, (9) — озера, (10) — лиманы, (11) — мелкие водоемы и пруды, (12) — итого, (13) — берега не окаймленные плавающей растительностью, (14) — берега окаймленные плавающей растительностью, (15) — сплошь или частично поросшие, (16) — как выше, (17) — без плавающих растений, (18) — поросшие плавающими растениями.

Таблица 3. Изменения в пропорциях мест гнездовок желтой цапли. (1) — пропорции, (2) — период.

Таблица 4. Вековые изменения численности желтой цапли в период 1850–1960 гг. в палеарктической части ареала. (1) — характер изменений, (2) — период, (3) — численность гнездовых пар (x_n), (5) — темпы изменений численности (в процентном соотношении соответственных промежутков времени), (6) — коэффициент вековых осцилляций численности вида Q_{os}, (a) — в абсолют-

ных единицах, (*b*) — в процентном соотношении соответственных промежутков времени, (*c*) — в процентном соотношении к численности в период 1850–1900 гг.

Таблица 5. Вековые изменения численности желтой цапли в отдельных частях ареала в сопоставлении с влиянием антропогенного фактора. (1) — отдельные районы ареала, (2) — период, (3) — вековые изменения числа мест гнездовок в %%, (4) — вековые изменения численности вида в %%, (5) — влияние антропогенного фактора — непосредственная редукция, (6) — посредственная редукция, (7) — охрана вида, (8) — северная Африка, (9) — Пиренейский п-в, (10) — южная Франция, (11) — Апенинский п-в, (12) — Балканский п-в, (13) — Турция и восточные побережья Средиземного моря, (14) — Месопотамия, (15) — Туркмения, Казахстан, Узбекистан, (16), — Прикаспийская низменность, (17) — Кавказ, (18) — северо-черноморский район, (19) — бассейн среднего течения Дуная, *a* — II половина XIX века, *b* — I половина XX века, *c* — период 1950–1960 гг.; 5-ти бальная шкала оценки влияния человеческого фактора; 1 — минимальное влияние или нет его вовсе, 2 — очень умеренное, 3 — умеренное, 4 — значительное, 5 — очень сильное.

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