Looking for the recent breeding grounds of Slender-billed Curlew: a habitat-based approach

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On the basis of information about habitat structure in the only area where nests of Slender-billed Curlew *Numenius tenurirostris* have ever been found (Ushakov 1912, 1916, 1925), and in the other areas where birds were recorded in summer, and presumably bred in the nineteenth century (Aksakov 1852), we analysed recent vegetation maps to select localities with similar habitat components. From historical habitat descriptions it is assumed that probable breeding sites of the species include woodland patches, shallow waters, areas of dry grasslands (including those with sedge on bogs), and restricted plots of bare ground. Such marginal areas could be found both in the forest-steppe zone and to a smaller extent in the southern taiga. A total of 16 areas in the forest-steppe and six in south-taiga bog have been identified as most likely sites on the basis of their habitat characteristics. Locating most likely breeding sites in the forest-steppe belt, especially in its southern part, depends in large part on the hydrological regime in particular years as influenced by changing climate cycles. It is suggested that in the late nineteenth to early twentieth century, Slender-billed Curlew could have been forced to breed in bogs after periods of severe droughts in steppes and forest-steppes (from 1898 to 1910). Further droughts during the twentieth century could have kept the birds out of forest-steppes also. In 1997-1998 after an increase of water supply in steppe and forest-steppe areas, the chances of finding Slender-billed Curlews in forest-steppes are larger (if they still use this zone). In the future (2000-2005), when it is predicted that there will be another cycle of droughts in the steppes and forest-steppes, there is greater likelihood of finding Slender-billed Curlews on bogs. It is recommended that each season, before the start of ground surveys, the habitat state in planned survey areas is assessed from satellite images, aerial photos and other such sources.

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INTRODUCTION

Slender-billed Curlew *Numenius tenuirostris* Vieill. is one of the rarest and most endangered birds in the world. It is now 72 years since its last nest was found (in 1924: Ushakov 1925). Nonetheless, birds are still being observed in very small numbers on migration and during wintering in the Mediterranean in particular. This means that there are still birds breeding somewhere.

Although a number of special surveys have been undertaken in the past decade to locate the current breeding areas of Slender-billed Curlew in Russia (Yurlov 1989; Gretton 1991), the areas where these birds breed remains unknown. Publications by Valentin Ushakov (1912, 1916, 1925) have remained for more than eight decades as the only, and thus widely quoted, source of information about this wader's breeding habitat requirements.

The question as to whether the only known breeding areas are actually typical of the species, as well as the reasons for the drastic population decline will certainly remain - at least until the discovery of breeding pair(s) with a nest or unfledged chicks. There are two groups of opinions concerning the location of remaining breeding areas: (1) in the vast open bogs within the southern taiga zone (*e.g.* Gretton 1991), or (2) in the remaining patches of virgin steppe of southern Russia and northern Kazakhstan (*e.g.* Belik 1994). If all opinions on the probable location of its breeding areas are taken into account it turns out that:

1) The area to be surveyed reaches approximately 2 000 000 km^2! In the west this area includes the steppes of the lower Volga if we accept Belik's (1994) hypothesis and earlier observations from the nineteenth and twentieth centuries (which have been considered as "probable breeding records" by Gretton 1991). There is no good evidence either to reject or support Kozlova's (1962, Figure 1a) suggestions as to the eastern, northern and southern limits of the potential breeding area.

2) In this vast area, even if the parts which are most populated and modified by man are excluded, the task of locating at least two birds (*i.e.* one pair) from

the few dozens that are thought to remain in the world is almost impossible (80-400 birds: Gretton 1991; 50-100 birds in Europe: Tucker & Heath 1994).

3) As high-skilled amateurs which are capable to identify the species from Curlew *N. arquata* and/or Whimbrel *N. phaeopus* are lacking in these areas, the success of surveys depends on their intensity and extent, as well as just on the 'good luck' of 20 to 50 national and international ornithologists. Moreover, only few of these Russian ornithologists have ever observed this bird in the wild.

Therefore it seems obvious that the success of efforts to locate the species breeding area depends on how target survey areas are selected.

BOGS OR STEPPES?

The only known breeding area of Slender-billed Curlew was located near Tara on the large bog adjacent to the Tara river valley: analysis of publications shows that all Ushakov's observations were made at one and the same bog but in different years (Ushakov 1912, 1916, 1925).

The most popular approach adopted by recent surveys has been to investigate confirmed breeding area(s) of this species on the bogs of southern west Siberia, and in the adjacent forest-steppe (Yurlov 1989; Gretton 1991; unpublished project reports of 1993 surveys). However until now this approach has not brought any positive results (such as, for example, observations of a territorial pair).

It is also still unclear whether the hypothesis of V.P. Belik (1994) about the recent location of breeding areas in the steppe zone (based on the analysis of data from the nineteenth and twentieth centuries, and a review of landscape changes) is correct. At least the Slender-billed Curlew surveys by the RBCU team carried in 1996 summer season, with essential support from BirdLife/Vogelbescherming Nederland, did not give positive results (V.V. Morozov & V.P. Belik, pers. comms.).

Given this, it seems obvious that not only have all the new ideas and approaches to be thought over and checked, but also the surveys conducted by specialists have to become more targeted to restricted areas. These target areas, however, can hardly be revealed through mass and rapid involvement of the general public; the risk of causing another threat to the birds through the attention of too many people (including game-hunters) is rather high.

Thus the only possible way to make surveys more efficient lies through the co-operation of specialists from different scientific fields to identify more specifically the target areas for ground surveys. The first need is to bring together the efforts of ornithologists and geographers, as specialists in the assessment and analysis of wildlife environment. Unfortunately, surveys for Slender-billed Curlew in possible breeding areas have remained the sole privilege of professional bird specialists.

The approach outlined below for concentrating search efforts for Slender-billed Curlew within the probable breeding range (Figure 1a) is based on an analysis of all known data concerning the species' breeding habitat requirements.

WHAT BREEDING HABITATS DO SLENDER-BILLED CURLEWS PROBABLY NEED?

From the descriptions of the only breeding locality given for more than one year (Ushakov 1912, 1916, 1925; all papers describe the same bog!), the breeding habitat requirements of Slender-billed Curlew are as follows:

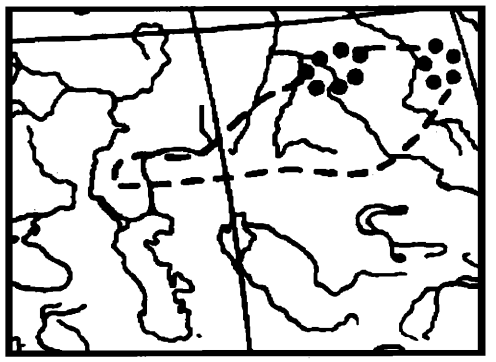
1. Open mire with dense vegetation cover of sedge with admixture of *Equisetum* sp., and with small ridges or islands of bare ground (peat called "black soil") overgrown with sparse low willows or birches. At the edges of that bog there were sparse forest-bog, birch wood, and - although far on the horizon - even a human settlement (detailed 1912 description).
2. In all cases nests were located on rather dry elevated ridges either at the edge of the bog (as described in 1916), or on "islands" within the bog (in 1924, as described in 1925). The territorial pair in 1912 was observed also at/over such an elevated ridge. In all cases the vicinity of trees was mentioned.
3. Nests were made in the dense sedge at a dry place (photo in Ushakov 1916), either on the sedge litter of previous years or on the 'ground' (moss layer).
4. It was mentioned also that in 1912 "when the bog was filled with water" only one or two pairs of Slender-billed Curlews were seen and they probably did not breed (Ushakov 1912).

If one is restricted to the mire theory of species breeding localities, then the surveys could be made more effective by means of vegetation succession analysis, through evaluation of the hydrological regime of certain areas with a combination of all the above features. After our analysis of recent maps (below) we propose to search six of the most promising areas for locating breeding birds.

However, we suggest consideration of information on habitat requirements in a more general way, taking also into account opinions about the marginal position of the breeding localities located by Ushakov.

In this respect the breeding habitat requirements of Slender-billed Curlew can be defined as:

> "Open, locally wet area with dense sedge or grass vegetation, with patches of bare ground, relief which is not flat (moderate elevations and depressions), and with adjacent shrubs or woodland patches formed mostly by deciduous trees or/and pines."



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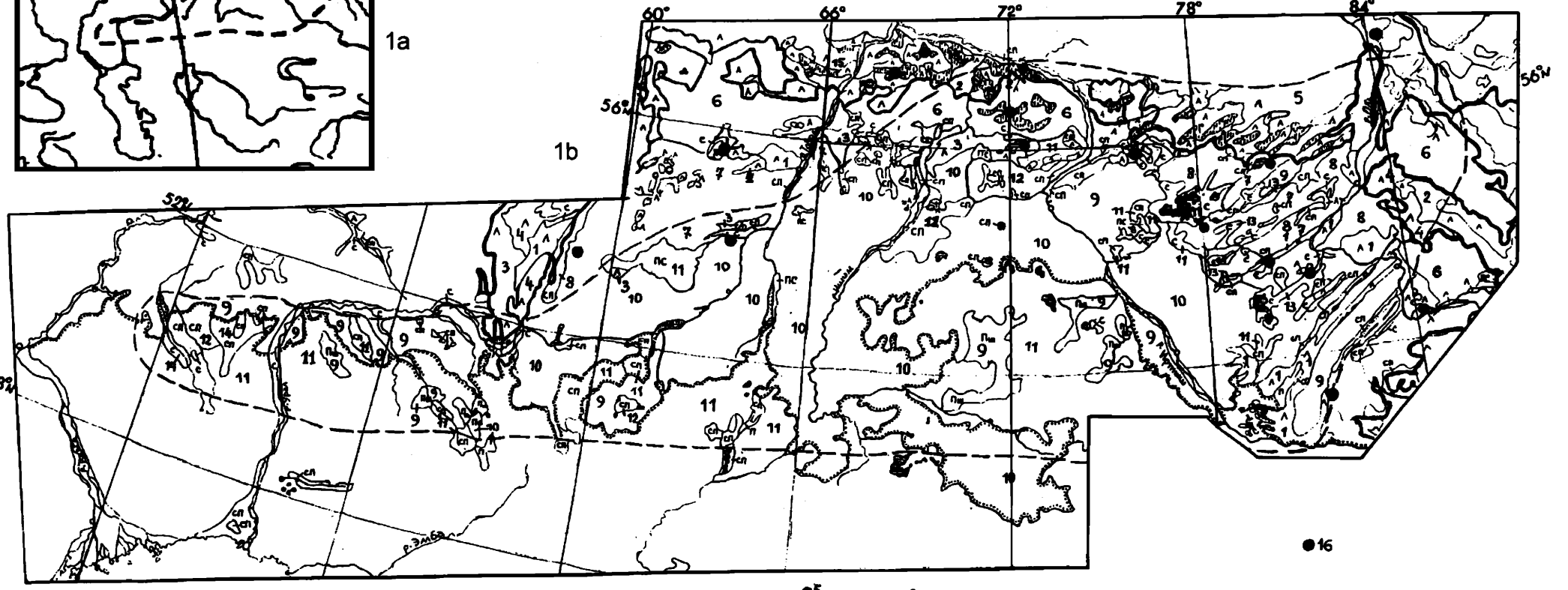
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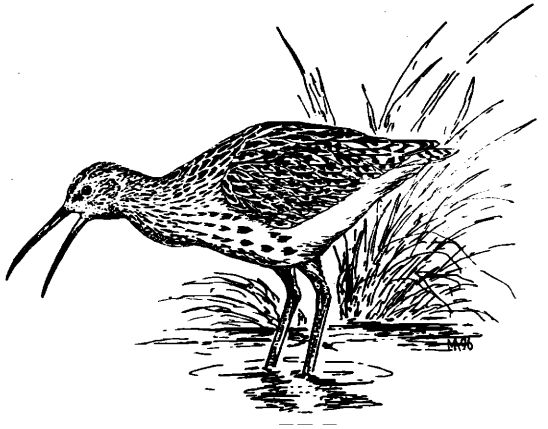


Figure 1. Prevailing type of habitats and habitat-use in the areas considered by E. Kozlova as the possible breeding range.

1a - boundaries of breeding range from Kozlova, 1962 (dashed line - boundary; dotted - breeding areas (?) described by Ushakov)

1b - recent state of habitats & land-use:
^ - forestry: 1 - Pine woodlands; 2 - Spruce and Spruce/*Abies*; 3 - broad-leaved; 4 - small-leaved decidious forests; 5 - complex forest-bog habitats;

IIIII - arable agriculture: 6 - arable lands mixed with small-size woodland patches (up to 15% of the area) and meadow patches of different type; 7 - arable lands with admixture of woodland islands (5-10%) and protective man-made forest-stripes; 8 - arable lands with patches (up to 5% of total area) of virgin or dry steppes under different stages of degradation; 9 - arable lands with patches of steppes (up to 10% of total area); 10 - pure arable lands;

CII, IIC - hay-based and pastoral agriculture (with prevalence of one of these types): 11 - areas of virgin steppes at diferent stages of pastoral degradation with meadow patches of different types (up to 5%) and arable lands (up to 5%); 12 - meadows-saline communities in depressions combined with different types of steppes over the slopes; 13 - solonetz-saline complexes in steppes along coastal and flood-plain lowlands;

C - hay-based agriculture: 14 - saline (grass and herb) meadows in steppe depressions combined with reedbeds at the bottoms of depressions and galophytous complexes on saline lands and solonets areas;

b-bogs: 15 - bogs with ridges and ponds, and bogs with ridges and lakes with sedge and *Sphagnum* vegetation and with fragments of woodlands and shrubs;

16 - selected localities (see also Table 1 for description).

Figure 2. State of habitats and land-use in the south-west of Russia (including forest-steppe areas where Slender-billed Curlew was observed probably on breeding by Aksakov).

AREAS UNSUITABLE FOR BREEDING

FORESTS: 1 - Pine, 2 - Spruce/*Abies*, 3 - small-leaved, 4 - broad-leaved;
RIVERINE: 5 - shrub & forests;
STEPPES: 6 - with *Spirea*, karagan, *Astragalus etc.*, grasses combined with solonetz and saline lands;
ARABLE: 7 - arable lands with addition (up to 5%) of rural landscapes and (up to 10%) forest-stripes;
BOGS: 8 - *Sphagnum* upland bogs with ridges and lakes mixed with pine-shrub-*Sphagnum* bogs

AREAS PROBABLY SUITABLE FOR BREEDING

Unfavourable:
STEPPES: 9 - northern dry with grass tussocks; 10 - southern dry with grass tussocks and herbs of dry types; 11 - with *Spirea* and karagan shrubs and grass tussocks, with saline patches and solonetz; 12 - xeromesophytous with grasses and herbs and shrubs over dry slopes;
FOREST-FIELD: 13 - combination of arable lands with small-size woodlands (up to 20%) and meadow paches of different types on flat lowlands; 14 - arable lands with forest-stripes and admixture of birch forest islands (5-10%) on flat lowlands between the rivers;
MEADOW: 15 - riverine combinations of reedbeds with galophytous grass meadows and galophytous communities on saline soils;

Moderately favourable
FIELD: 16 - combination of arable areas with patches of steppe communities and steppe-like herb and grass meadows used for hay or pasture (European part); with saline and solonetz complexes and forest islands (up to 5%) east of the Urals;
MEADOW: 17 - meadow-solonetz communities combined with patches of degraded steppes of northern type in flat depressions; 18 - low-grass and herb, as well as grass salinic meadows in steppe depressions, and along rivers and lakes;
RIVER VALLEY: 19 - shrubs and meadows with steppe patches of different type;
BOGS: 20 - reed and sedge fens mixed with pine woodlands and very wet fens with birch and pine;

Favourable:
FOREST-FIELD: 21 - mixture of arable lands with forest islands, herb and grass steppes at different stages of pastoral degradation, wet hay meadows and wet mire depressions in a hillocky landscape;
STEPPE: 22 - steppes of northern type along rivers and lakes, under different stages of pastoral degradation, with addition of low-grass saline meadows and steppe shrubs;
BOGS: 23 - grass and *Gypnum*/sedge fens with ridges, restricted areas of open water and low birch growths on ridges;

24 - potential breeding localities, positioned by latitude.

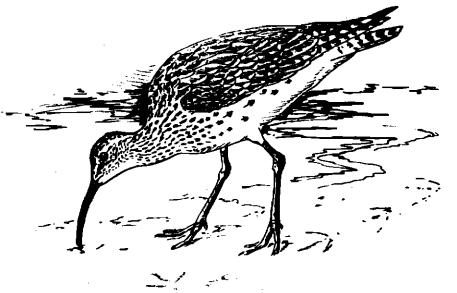
Given this definition it is possible to consider the probability of finding breeding sites also in the forest-steppe belt. The majority of confirmed or probable observations of Slender-billed Curlews during breeding season have been seen exactly in the forest-steppe (Gretton 1991: p. 24). It was also the forest-steppe areas which Gretton described as a "target" survey zone. However, even the forest-steppe belt to be surveyed extends to a total area of 200 000-400 000 km^2.

FOREST-STEPPE AS PRIMARY BREEDING AREA

As possible confirmation that the original breeding grounds were located in forest-steppe we can consider the observations of S.T. Aksakov, the famous Russian writer, field naturalist and game-hunter, which were made in the first half of the nineteenth century (the first year he refers to is 1811: Aksakov 1852 - latest reprint was 1987).

As we failed to find any (!) reference to this information in recent publications on Slender-billed Curlew, and also taking into account the fact that Aksakov's information had been accepted and partly cited by one of the most acknowledged founders of Russian ornithological science M.A. Menzbier (1900-12), we consider it useful to discuss some aspects of Aksakovs' observations.

Aksakov more or less definitely distinguished all three *Numenius* species, which occur in the area:



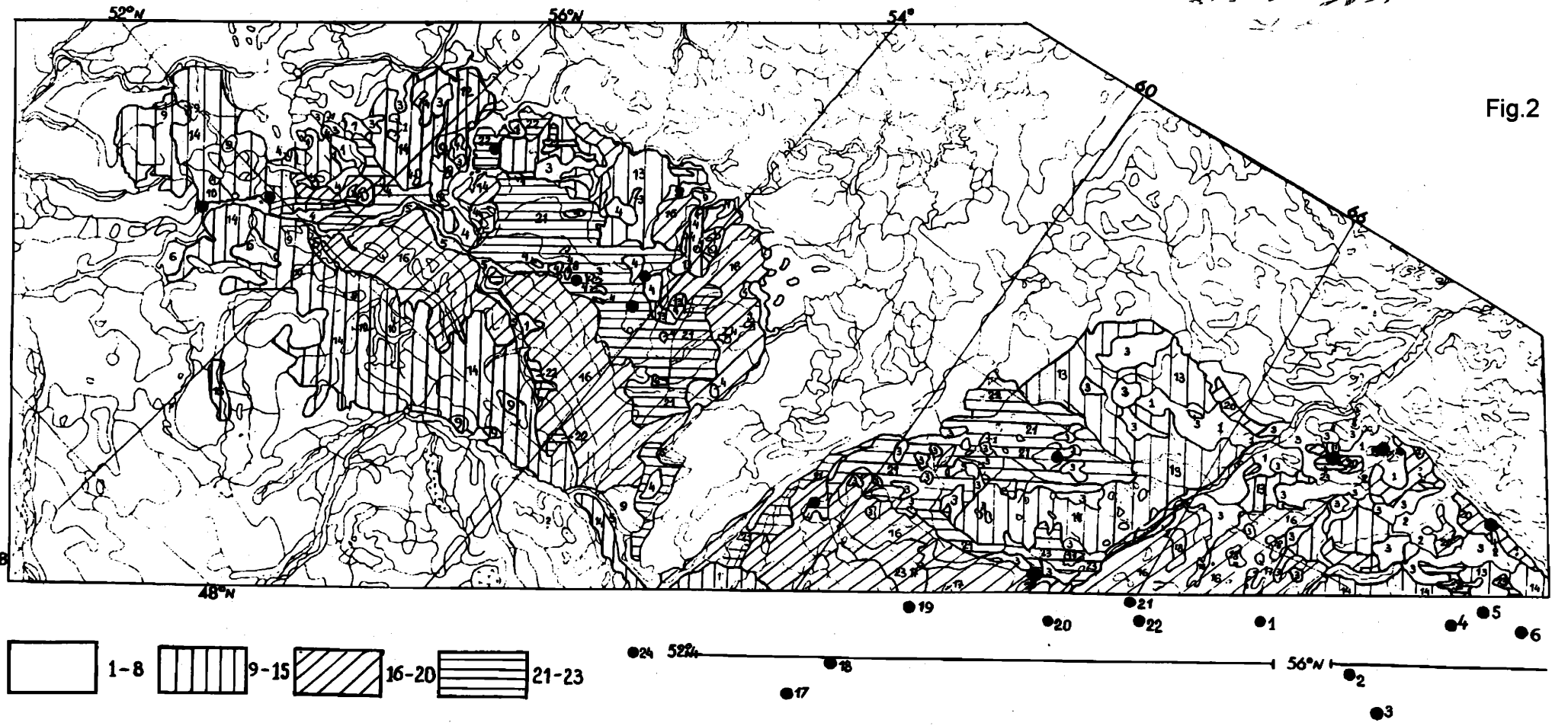

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Fig.2

"Besides larger size, curlew of the first kind [*i.e. Curlew*] has more dark-brown feathers and short hoarse call; it sometimes breeds on dry bogs and at wet forest edges with large tussocks, moss, shrubs and trees, adjacent to fields or steppe places; sometimes he is joined by *Middle Curlew*, but never by *Lesser Curlew*, which always lives in steppes, and which is much paler in colour, and with finer stripes [*here it still may be possible that Aksakov could have mixed N. tenuirostris and N. phaeopus alboaxillaris*]; its' voice is much more clear and piercing than in *Middle Curlew*..."..... "size of eggs depends on the size of curlews: in *Curlew* they can be larger than chicken eggs, while in *Lesser Curlew* - are not larger than small guineafowl eggs but just a bit longer; colour of the eggs is greenish-grey, they are covered with smaller and larger spots, which are larger and more dark at the obtuse end"...

Thus we can see from the last phrase that Aksakov actually saw at least one nest of Slender-billed Curlew as he distinguished even the smaller size of eggs (although no measurements were given).

The areas he described as "Orenburg steppe" were a combination of flat lands with steppe lakes and river flood-plains, forest patches, and hillocky areas. Thus the description given reflects the appearance of forest-steppe, rather than southern dry steppe.

THE NINETEENTH CENTURY: WHAT COULD HAVE MOVED SLENDER-BILLED CURLEWS FROM FOREST-STEPPES?

Detailed information by Aksakov about extensive steppe fires as the main threat to birds, first of all to curlews, at the start of breeding and particularly in early dry and warm springs, are another reason to suppose that Slender-billed Curlews had moved to breed in bogs as a result of habitat changes in forest-steppes. Aksakov wrote:

"...in dark nights... either walls, or rivers, or streams of fire are climbing along steep slopes, move down to the valleys, and spread as the flaming sea over lowland plains. All this is accompanied by noise, cracks, and by alarm calls of steppe birds... It is good that steppe areas are never burnt totally, otherwise there would be no place for meadow birds. Wet depressions and ravines, forest patches and forest edges with still remaining snow, and finally the rivers... stop the fire if there are no dry places nearby... If spring is late and wet then fire cannot spread everywhere, does not spread far into the steppe, and birds are saved; but in early dry spring flow of flame stretches over enormous steppe area and kills not only all nests and eggs but sometimes even birds... If the fires happen late (which is sometimes the case) and steppe waders loose already incubated clutches or are even wounded themselves during fire, especially at nights, then waders do not renew nests but remain this year non-breeding and stay near the areas where their nests were burnt. I used to find and shoot such non-breeding curlews.... in some birds I even found slightly burnt feathers".

NINETEENTH AND TWENTIETH CENTURY: DROUGHTS IN STEPPES AND FOREST-STEPPES AS ADDITIONAL LIMITING FACTOR?

It is known that climatic conditions of forest-steppe are characterised by pronounced variability: several wet years are followed by a dry period, even with droughts. This makes the forest-steppe environment largely unfavourable for breeding of birds that need wet or coastal habitats.

In the nineteenth century extremely severe droughts in southern areas occurred in the 1860s-1870s; a similar very dry period was observed in 1930s (Krivenko 1987). At water bodies in northern Kazakhstan droughts with a noticeable lowering of lake water levels was observed in 1892-1910, 1930-1941, 1950-1959, 1960-1964, 1965-1968, 1973-1980 (Krivenko 1991). From data in the Figure in Krivenko (1991) it is obvious that at Chany Lake low water levels were recorded during the periods 1896-1902, 1925-1945 and 1960-1985.

In these dry periods soils in the forest-steppe areas become more saline, meadow vegetation over large areas are replaced by halophytous plants. Boggy and marshy areas noticeably reduce in size, and lose their importance as breeding areas for many birds (Krivenko 1991).

It is thus possible that 'normal' breeding habitats of Slender-billed Curlew in forest-steppe could become unsuitable, and as a result birds moved for breeding to more northern bogs within southern taiga belt. At least for waterfowl it was confirmed, that after droughts at the beginning of the twentieth century (which lasted until 1910) populations of waterbirds and shorebirds started to recover in steppes only in the 1920s (Krivenko 1991).

Combining all the above knowledge has led to our conclusion that the forest-steppe zone is the most likely *historical* breeding area of Slender-billed Curlew. However, this does not mean that we insist that the *recent* breeding distribution lies exclusively in the forest-steppe.

Periods of droughts, which make conditions in steppes and forest-steppes unfavourable to birds, occur in more or less regular cycles. These differ, however between areas. We thus consider it most possible that this process influences the irregular breeding of Slender-billed Curlew as also for example with Asian Dowitcher *Limnodromus semipalmatus.*

WHERE COULD THEY BE NOW? - ANALYSIS OF RECENT MAPS

The final aim of our study was the identification of localities on a recent map where, judging from our knowledge of published sources about breeding Slender-billed Curlew habitat requirements, we consider it most possible to find them breeding today.

Using detailed vegetation maps (Sochava & Ilyina 1975; Atlas of the Altaisky Kray 1978; Belov *et al.* 1990) of the whole area of potential breeding range and also in adjacent forest-steppes, which were not considered earlier, we have identified localities where a combination of the following habitats can be found recently on areas with moderately hillocky relief:

- areas of fresh shallow waters and relatively wet lowland meadows (*i.e.* areas at the lake shores);
- mires (mostly fens);
- woodlands patches of deciduous trees (or combination of deciduous trees and pines); and
- restricted areas of bare ground (including arable lands).

Thus, within the boundaries of the potential breeding range given by E.V. Kozlova (1962: Figure 1a, dashed line) we assessed the state of all the different habitat types using the latest available detailed maps of vegetation and landscape types. During this map analysis we subdivided all possible habitat types into arable areas with fragments of forests or steppes, pure arable lands, different types of bogs, forests, areas with different character of steppe vegetation *etc.* (see the detailed captions for Figure 1b and 2). Each outlined area on Figures 1b and 2 is characterised by a specific combination of habitats and by different types of land-use.

It turned out that by the end of our century relatively few localities with the combination of all mentioned habitats remained (Figures 1b and 2). In the area from the southern taiga bogs to the forest-steppe, it is possible to select only 22 sites where there are habitat mosaics similar to our understanding of that required by Slender-billed Curlew.

From the point of view of vegetation mosaics, the central and southern forest-steppe areas seem to be rather uniform - here are vast areas with a prevalence of arable lands, a mixture of hay and pastoral meadows, lake coastal lowlands, with shallow-waters and woodland patches. For this reason additional information was used to select "most promising" sites. As it is known that the majority of species records were more or less restricted to river valleys and lakes, the net of water bodies in this area was analysed as well. As southern forest-steppe and steppe within the potential breeding range of the species are characterised by low water supply (both due to natural reasons and additionally through irrigation and drainage activities) only those areas with the best developed pattern of water bodies and with a concentration of river outflows and valley complexes (which have a relatively more stable water regime) can be considered as promising areas for future surveys for breeding Slender-billed Curlew (Figures 1b and 2).

Table 1. (Numbers relate to those in Figures 1b and 2). Geographical position of selected localities for most probable recording of breeding Slender-billed Curlews.

No	Geographical position
1	Upper reaches of the Ural river 220 km to SW from Chelyabinsk
2	Area between the Techa and the Miass rivers, 110 km to the NE from Chelyabinsk (between Chelyabinsk and Shadrinsk)
3	Kurgan region: area on the left bank of Tobol river 130 km to the N from Kustanay
4	Tumen' region: area between the Tobol and the Irtysh, 90 km to S from their confluence
5	Tumen' region: area between the Tobol and the Irtysh, 70 km to SE from their confluence
6	Tumen' region: 160 km to NW from Tara town
7	Omsk region: 160 km to W from the Tara mouth
8	Boundary between Omsk and Tumen' regions: upper reaches of the Osha river, northern coast of Tenis lake
9	Omsk region: area between the Om' and the Irtysh 190 km to NE from Omsk
10	Novosibirsk region: SE shore of Maliye Chany lake 320 km to WSW from Novosibirsk
11	Novosibirsk region: NE corner of the Ubinskoye lake 180 km to NW from Novosibirsk
12	Boundary between Novosibirsk region and Altaisky Krai: the Burla valley 260 km to NW from Barnaul
13	Boundary of Novosibirsk reg. and Altaisky Krai: 150 km to NW from Barnaul, 40 km to S from Novisibirsk water reservoir
14	Altaisky Krai: area on the right bank of the Ob' 50 km from confluence of the Biya and the Katun' rivers
15	Altaisky Krai: area on the left side of the Alei river 60 km to N from Lokot' settl.
16	Tomsk region: area between the Chulym and the Ob', 40 km to SE from their confluence
17	Upper reaches of the Ilovlya river 120 km to NW from Saratov
18	Northern coast of the Volga (latitud. loop) 60 km to NE from Saratov
19	Left side of the Volga in Ulyanovsk region, 60 km to E from Ulyanovsk
20	Boundary betwen Samara, Orenburg regions and Bashkiria: right side of Bolshoy Kinel' river in its middle reaches, 140 km to NE from Samara
21	Boundary between Samara, Orenburg regions and Bashkiria: the Yia river basin, 170 km to WSW from Ufa
22	Boundary between Samara, Orenburg regions and Bashkiria: the Yia river basin, 180 km to SW from Ufa

Taking into account also the level of human influence on certain areas (population density, road patterns,

agricultural impact *etc.*) as well the extent of previous ornithological studies in these localities it becomes possible to identify those sites where it is more probable to find this species breeding.

CONCLUSIONS

Thus, we consider it most effective if those who believe in "bog theory" make surveys in six localities which we propose as most suitable (Area numbers 4, 5, 6, 7, 14, 16; Table 1 shadowed, Figures 1b and 2).

As regards the forest-steppe zone the largest chances to find Slender-billed Curlew on breeding according to our opinion are in the other sixteen localities (Table 1; Figures 1b and 2; Area numbers 1-3, 8-13, 15, 17-22).

Additionally, but only in wet years it could be worth surveying those areas of south-European Russia, where patches of thyme *Thymus* spp. steppes similar to those described by Aksakov remain in the river valleys of northern Orenburg and of Samara regions.

Only a small portion of those localities indicated on the maps have been more or less surveyed either for breeding Slender-billed Curlews specifically or during other field studies by ornithologists (Yurlov 1989; Gretton 1991; also Korshikov 1995; Yurlov *et al.* 1995; Yakimenko 1995 *etc.* all in Ryabitsev 1995). More precise selection of survey sites can be based on more detailed maps of these areas together with relevant analysis by specialists of satellite images for selected areas. The latter is especially worthwhile as local habitat changes (such as the use of water for irrigation, changes in farming practices *etc.*) can hardly be predicted for certain years.

As the water supply during ongoing cyclic changes in southern areas was increasing since 1978-1980 up to probably 1993 (the so called wet phase: Krivenko 1991), the probability of finding breeding Slender-billed Curlews in forest-steppe was the greatest in the early 1990s. As the dry and warm phase now develops (1993-2005?), the chances of finding Slender-billed Curlews in northern forest-steppe or at south-taiga bogs will increase. Although probably by that time modern transmitters for radio- or satellite-tracking will be put on birds caught in the wintering areas and recent breeding areas of Slender-billed Curlew will then become known with much more certainty.

REFERENCES

Atlas of the Altaisky Kray 1978. Moscow. GUGK.

Aksakov, S.T. 1852. [*Notes of the game-hunter from Orenburg region*]. Second edition. Moscow, University Printing House. 415 pp. In Russian.

Belik, V.P. 1994. [Where the Slender-billed Curlew (*Numenius tenuirostris*) breeds? *Inform. Materials of the Working Group on Waders* 7: 30-32. Ed. P.S.Tomkovich. Moscow. In Russian.

Belov, AV, Gribova, S.A., Karamysheva, Z.V. & Kotova, T.V. 1990. [Vegetation of the USSR.] Map for higher education institutions. Moscow: GUGK. Scale 1:4.000.000.

Dolgushin, I.A. 1962. [Lesser Curlew - *Numenius tenuirostris* Vieill.]. *In*: *Birds of Kazakhstan*. Vol. II. Ed. I.A. Dolgushin. Alma-Ata: Kazakhstan Acad. Sci. Pp.133-137. In Russian.

Gretton, A. 1991. *Conservation of the Slender-billed Curlew.* ICBP Monograph No. 6. Cambridge: International Council for Bird Preservation. 159 pp.

Kozlova, E.V., 1962. [*Numenius tenuirostris* Vieill. *In*: *Fauna of the USSR. Birds.* Vol. II. Issue 1(3). Charadriiformes. Moscow-Leningrad. USSR Acad. Sci. Pp. 299, 307-312.]. In Russian.

Krivenko, V.G. 1991. [*Waterbirds and their conservation.*] Moscow, Agropromizdat. 271 pp. In Russian.

Menzbier M.A. 1900-12 (sic). [38. Lesser Curlew. *Numenius tenuirostris*, Vieill. Habits of Curlews and Game-hunting for them.] *In*: Game and hunting birds of European Russia and the Caucasus. Vol. I. Moscow: Kushnerev & Co. Pp. 201, 204-216. In Russian.

Ryabitsev, V.K. (ed.) 1995. [Materials to distribution of birds at the Urals, the Ural region and West Siberia: information materials.] Ekaterinburg: Ural Branch of Russian Acad. Sci., 84 pp. In Russian.

Tucker, G. & Heath, M. 1994. *Birds in Europe: their conservation status.* Cambridge, UK.: BirdLife International (BirdLife Conservation Series No. 3). Slender-billed Curlew account by A. Gretton, pp. 276-277.

Sochava, V.B. & Ilyina, I.S. (eds.) 1975. [Vegetation of West-Siberian Plain.] General scientific map. GUGK: factory No. 4. Scale: 1:1 500 000.

Ushakov, V.E. 1912. [More on Slender-billed Curlew in the Tara district]. *Nasha Okhota* No 17-12: 27-32. In Russian.

Ushakov, V.E. 1916. [Nest and eggs of *Numenius tenuirostris*, Vieill.]. *Ornithol. Vestnik* 3: 185-187. In Russian.

Ushakov, V.E. 1925. [Colonial breeding of Slender-billed Curlew in the Tara district of the Omsk region. *Uralsky Okhotnik* 3: 32-35. In Russian.

Yurlov, A.K. 1989. [On the studies of Slender-billed Curlew]. *In*: *Information Materials of the Working Group on Waders* 2: 33-34. Ed. A.Ya. Kondratiev. Magadan. In Russian.