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# A C T A Z O O L O G I C A C R A C O V I E N S I A

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# Nesting of Black-headed Gull Larus ridibundus L.

(3 text-figs., pls. VI-XII)

Gnieżdżenie się mewy śmieszki Larus ridibundus L.

Гнездование озёрной чайки Larus ridibundus L.

#### INTRODUCTION

The objective of the study presented in this paper was to investigate the nesting of the Black-headed Gull *Larus ridibundus* L., especially the adaptive abilities of this bird as regards both the choice of nesting colony site and the situation and building of particular nests. The further purpose of the study was to find out the common features of the nests built under various conditions, the features that might be assumed as characteristic of this species of birds.

The Black-headed Gull is a species widely distributed over the Palaearctic region, and as results from recent observations it has been extending its range northwards. It seems that this expansion is not stimulated by climatic changes but caused by a considerable, general, biologic dynamics of this species. One of the sources of this dynamics and tendency towards expansion may be a marked adaptive ability of the Black-headed Gull so far as nesting is concerned.

I wish to express my hearty gratitude to Prof. K. Starmach, Director of the Institute of Water Biology of the Polish Academy of Sciences, for enabling me to collect material in the pond area under the administration of the Institute. I also owe thanks to Mr. J. Noskiewicz, custodian of the West-Pomorze Museum in Szczecin, who enabled me to visit the colony of Black-headed Gulls in the vicinity of Szczecin.

#### LOCALITIES

The material for this study consists of the observations made at several colonies of Black-headed Gulls situated on the ponds at Gołysz, on the artificial water reservoir at Goczałkowice, both in Silesia, as well as on the sedimen-

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tation basin of the Szczecin Foundry and in a floating islet of Lake Bolkowskie in the neighbourhood of Szczecin.

On the fish-ponds at Golysz gulls nested in the years 1954—1960, several dozen pairs each year (Bocheński, 1958, 1960a). The colonies changed their situation from year to year, moving from one pond to another. They were always in an area embraced in dikes, either in the shallow parts of the ponds overgrown by water plants, or as floating nests directly on deeper water. In the years 1955 and 1958 Black-headed Gulls inhabited the deeper ponds, and so all the nests were floating ones. In the years 1956 and 1957 the colonies under study were situated on the shallow ponds with a rich vegetation, where prevailed the nests built on tufts and the floating nests touched the bottom of the pond.

Lake Goczałkowickie, being a dam with considerable fluctuations of water level in the annual cycle, produced quite different conditions for Black-headed Gulls inhabiting there. In 1959 the largest of the several colonies existing on the lake numbered 350 nests. It was situated on a flooded wood clearing at the mouth of the Stream Bajerka, off the south shore of the lake (Phot. 1). The nest-sites indicated the two-phase formation of the colony. The older nests were built when the water level was higher and only the tops of tree-stumps projected above the surface. At that time the nests were built of a large amount of material and rested on the bottom of the reservoir, which was shallow in this place, close to the stumps, roots, etc. In the second phase, when the water level had dropped, the gulls nested on the denuded bottom. These nests were made of a much smaller amount of material. On 30 May, at the time of my visit to the colony, most clutches in the nests of the first phase were at the last stage of incubation and those in the nests built in the second phase were at an early stage of incubation, which proves that the interval between the two phases of nest-building was about 2 to 3 weeks. In 1960 the state of the colony did not undergo any major changes, however in 1961 the colony evidently decreased in number, its main part numbering 150-200 nests. The other colonies, of some dozens of nests each, were on the islets several hundred metres distant. I noticed a fact, hitherto unreported, that Black-headed Gulls made use of the nests left by Great Crested Grebes Podiceps cristatus (L.) and laid eggs in them (Phot. 10). The colony of Great Crested Grebes consisting of about 20 nests must have been founded about mid-April, when the water level in the reservoir was high. Owing to the drop of water level the colony of Great Crested Grebes found itself on the dry ground several dozen metres from the shore, and the birds left it. On 10 May 1961 I found eggs of Black-headed Gulls, 1-3 in number, beside mostly full clutches of the Grebes (chilled, but at the initial stage of incubation) in more than ten nests left by the latter birds. Thus, in some cases the Black-headed Gulls were still laying eggs. The remaining nests were built on the ground like the nests made in the second phase of formation of the colony in 1959, or on the tree-stumps.

In addition to the colony described above there were several smaller colonies on the shallows and islets of Lake Goczałkowickie every year, and so the

joint number of Black-headed Gulls amounted for this lake to about 1000 pairs. The conditions for colony formation on the shallows near the shore were analogous to those described above in the colony at the mouth of the Bajerka. On the islets formed from the old dikes of the River Vistula and in flooded farm-steads Black-headed Gulls always nested on the dry ground and even in the ruins of the pulled-down houses. Most nests of these colonies were built of a small amount of material. The number and site of the colonies change from year to year considerably, as some islets emerge and submerge owing to the differences in the water level of the reservoir.

The next colony examined by me was on the north-west of Poland, on the sedimentation basin of the Szczecin Foundry. Consisting of nearly 1000 nests, it occupied an area with a thick growth of sweet flag. The neighbourhood of the big and noisy works did not prevent the gulls from forming this colony and keeping it for several years (Phot. 2). At the time of my visit, at the beginning of June 1960, most nests were already empty. In few nests only there were eggs at the last stage of incubation and the young that had just hatched. The majority of fledglings, aged from a few days to about three weeks had already left the nests. The nests were built in sweet-flag tufts. On the day of my visit the substratum for the vegetation was thick mud, the external crust of which was strong enough to bear fledglings as well as adult birds. There was only little water in the basin, but the River Odra flows at no great distance from the place. No doubt a few weeks earlier, when the gulls were building their nests, there was more water in the sedimentation basins. The appearance and character of the environment as well as the situation of the nests indicated this fact.

The colony on a floating island in Lake Bolkowskie near Szczecin, visited by me in June 1960, was small and comprised about 30 nests of Black-headed Gulls and some dozen nests of Common Terns Sterna hirundo L. The nests lay chiefly among tufts of sweet flags, on a wet and soaking but relatively hard substratum. The lake, being about 2 sq. km. in area, with the shores densely covered with vegetation, was inhabited by warious species of marsh-water birds (among others by different species of ducks, swans and cranes). Black-headed Gulls, however, nested only in the islet.

Apart from the colonies described above, in two cases I found single nests of Black-headed Gulls several hundred metres distant from colonies. The first one was found at Golysz in 1958. It was situated in a sweet-flag bed on a shallow about 250 m. from the colony on the adjacent pond. The other nest lay on an islet (previously a dike of the Vistula) in Lake Goczałkowickie among the nests, above ten in number, of a colony of Common Terns in 1959. It was built of very scanty material on the ground in the grass, more than a half-kilometre from the nearest colony of Black-headed Gulls.

The above-cited observations point out a considerable adaptive ability in the Black-headed Gull regarding the choice of a site for colony formation. Colonies situated on shallows in generally small fresh-water reservoirs predominate. In the case of a larger water reservoir the colony lies on the shore, islets or shallows. Most of my material derives from artificial reservoirs, chiefly from fish-ponds. It may be supposed that these shallow, usually rather small water reservoirs provide particularly good conditions for the Black-headed Gull to nest. The fact that the fish-ponds are situated mostly in the neighbourhood of fields, a chief foraging ground of Black-headed Gulls in spring and summer, is not insignificant.

The colonies on Lake Goczałkowickie represent colonies on an artifical dam reservoir and that on Lake Bolkowskie exemplifies colonies on natural lakes.

STADIE (1929), discussing the occurrence of Black-headed Gulls in Silesia, writes about some colonies of these birds on the fish-ponds in the Upper Vistula valley. In Lower Silesia the colonies on fish-ponds occur above all in the primeval valley of the River Barycz (Szarski, 1950). Zimmermann (1925, 1927) reports that Black-headed Gulls nest on fish-ponds in Łużyce and Saxony, and Hudec (1955), Kux, Svoboda and Hudec (1955) state the same for Moravia.

The data regarding the colonies on natural lakes are given by Karczewski (1953) for North Poland, Noll (1924) and Schinz (1952, 1954) for Switzerland, Svärdson (1958) for Sweden and Ytreberg (1956) for Norway. The last author records the nesting of Black-headed Gulls on rocky islets in fiords, which has been also described by Fredrikson from Finland (1940). Niethammer (1942) however, emphasizes the fact that the nesting of these gulls on the sea is a rarity.

The size of Black-headed Gulls' colonies is very variable. In the areas under study it fluctuates from 10 to about 1000 pairs. The number of nests in a particular colony also shows some fluctuations from one breeding season to another.

As may be seen from Table 1, made up on the base of my own observations and the data presented by ZIMMERMANN (1927) from Saxony and Łużyce, WITHERBY et al. (1941) from England and Wales and SVÄRDSON (1958) and YTREBERG (1956) from the Scandinavian Peninsula, the colonies of some dozens to several hundreds of nesting pairs are most frequent. My previous observations (Bocheński, 1962) indicate that such colonies provide optimum conditions for surviving. Noll (1931) believes that big colonies present better conditions for defending the nests against enemies, however, in such big colonies the gulls often start fights which result in the destruction of eggs, hurting and killing of nestlings and even adults (Makowski, 1950). This occurrence of fights in the colonies numbering several hundred nests or more can undo the advantages resulting from easier defence against enemies to a high degree.

Single nests of Black-headed Gulls, lying lonely far from the colonies, have not been described hitherto, and Makatsh (1952) states such facts are unknown

Table 1

Size of colonies of Black-headed Gulls

		Total		24	87	_	0	0/		10	1
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	Total no. of	colonies in columns 1.—5		0	14	6	5	67	ಣ	67	0
		Pax (after I Karsch, 19	7	2	12	_	-	ñ .		1	1
	46	Witherby (1941)	9	22	19		,	24		7	1
	( <sub>1</sub> N	ZIММЕНМАМ (1927)	10		00	ಣ	1	67	1	61	1
		Хтвевеве (1956)	4		1	5	2	1	1	1	1
		хоздяйуг (8591)	33	-	1	1	1	1	1	1	1
Sources of data	Author's observations	Others: Szczecin Foundry, Lake Bolkowskie, fish-ponds at Golysz and Zator	2		60	1	1	-	1	-	
	Author's o	Colonies on Lake Go- czałkowickie acc. to observations in 1961	1	1	67	ಣ			-	-	
		Size of colony (No. of nests)	Column	1—10	10—100	100-250	250—500	500-750	750—1000	1000—10000	10000 and onwards

1) The counts presented are the highest, since, giving the figures, Zimmermann emphasizes the fact that the colonies decrease owing to despoiling practices of egg-collecting. Part of these data can be repeated after Pax,

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to him. Thus, the two single nests described above (p. 3) are rare phenomena, and their finding is an interesting supplement to the knowledge of the nesting biology of Black-headed Gulls.

The qualitative composition of the colonies of Black-headed Gulls may be various; there are homogenous colonies as well as mixed ones, in which the proportion of Black-headed Gulls to their co-inhabitants differs considerably. In the mixed colonies, Common Terns Sterna hirundo L. are the commonest co-inhabitants of the Black-headed Gull. I saw common colonies of Blackheaded Gulls and Common Terns on Lake Bolkowskie and on Lake Goczałkowickie, where they were represented by two of many small colonies in the islets. As I have already reported (Bocheński, 1960a), in 1958 I realized the presence of a group of Black-necked Grebes Podiceps nigricollis (C. L. Brehm) within a colony of Black-headed Gulls at Golysz. In the grounds of the same colony I found also single nests of the Coot Fulica atra L. Also in the previous years, when the colony of Black-headed Gulls was situated on the shallow ponds with a rich vegetation, I found single nests of the Black-tailed Godwit Limosa limosa (L.), Moorhen Gallinula chloropus (L.) and Pochard Nyroca ferina (L.) within its range (Bocheński, 1958). In 1961 I watched a small colony of Blackheaded Gulls and Black Terns Chlidonias nigra (L.) at Zator. It is also worth to mention that in 1961 at Pecice near Warsaw I saw the nesting of 2-3 pairs of Red-necked Grebes Podiceps griseigena (Bodd.) in the neighbourhood of a small colony of Black-headed Gulls, the nests of which, less than twenty in number, were widely dispersed over a bed of sparsely growing sweet flag. It is the more interesting because Makatsch (1952) stressed that Red-necked Grebes and Great Crested Grebes do not nest together with Black-headed Gulls.

In the present literature we can find the data concerning the nesting of the following birds with Black-headed Gulls: Common Tern Sterna hirundo L. (among others Fredrikson, 1940, and Stricker, 1952), Black-necked Grebe Podiceps nigricollis (C. L. Brehm), Black Tern Chlidonias nigra (L.), Little Gull Larus minutus Pall., Common Gull Larus canus L., Sandwich Tern Sterna sandvicensis Lath., Oystercatcher Haematopus ostralegus L., Ringed Plover Charadrius hiaticula L. and Redshank Tringa totanus L. To the list of birds nesting in the colonies of Black-headed Gulls, Schinz (1954) added Little Grebe Podiceps ruficollis (Pall.) and Spotted Crake Porzana porzana (L.). As results from the photographic illustrations of a popular book by Puchalski (1956), besides Common Terns the Black-headed Gull is accompanied in its colonies by Mute Swans Cygnus olor (Gm.) as well. According to Koskimies (1957) various species of diving ducks, among others Tufted Ducks Nyroca fuligula (L.), frequently inhabit the colonies of Black-headed Gulls.

As the aforegoing data indicate, the list of the co-inhabitants in the mixed colonies of Black-headed Gulls is long, and presumably it might be still lengthened in the result of further observations. The above-mentioned species can be distinguished into two groups. The first group includes all the *Laridae*, and so different species of gulls and terns. They form compact colonies with

Black-headed Gulls, treating each other as inhabitants of one common colony, defending it all together, etc. The numerical proportions of Black-headed Gulls and other species of the Laridae vary in such mixed colonies considerably. In some of them Black-headed Gulls prevail, in others their number may be smaller. Excluding the Laridae, all the remaining species of marsh-water birds found in the mixed, multispecies colonies are in distinct minority as compared with Black-headed Gulls and may be counted in the second of the mentioned groups. These species do not ally closely with gulls and do not form a uniform society of the colony with them, but even, as Makatsch (1952) noticed in the case of Black-necked Grebes, form their own colony within the colony of Blackheaded Gulls. Grebes, diving ducks and coots are the commonest birds of the second group. Koskimies (1957) inquired into the factors that make ducks and grebes nest in the colonies of gulls and terns. He believes that the association of ducks and grebes with gulls is due to their recognition of the environment that secures their better surviving and has been acquired by imprinting in the local populations. It seems that the presence of the remaining species of the marsh-water birds belonging to the second group in the colonies of Blackheaded Gulls may be interpreted in a similar way on the principle of an analogous mechanism.

#### NEST SITES

On the basis of the material described in this paper three main types of site can be distinguished, covering the vast majority of the nests of Blackheaded Gulls. The three types embrace the nests built:

- 1. on the hard ground, including both completely denuded spots and those covered with grass and other herbage (among these we must count the nests built, for instance, on floating islets, where hard, densely entangled rhizomes of sweet flag, etc. constitute the substratum (Phots. 3—4),
- 2. on detached tufts of sweet flags, irises and other marsh-water vegetation (Phot. 5), and
- 3. on deeper water (up to a depth of 1 m.) searcely grown over with sedge and rushes, as floating (Phots. 6—7).

These three types of nest site are also known to other authors (Makatsch, 1952; Niethammer, 1942; Noll, 1924; Svärdson, 1958; Ytreberg, 1956 and others). It can be stated on the basis of my material and the findings of the aforenamed authors that the first two types of nest site are much more frequent than the third one. It also turns out that the colonies with nests belonging to one of the three mentioned types are predominant, whereas those composed of several types of nests are rare.

The three types of nest site mentioned show a number of variations depending upon local circumstances. Thus, the first type comprises the nests from small islets in Lake Goczałkowickie and a part of the nests of the colony on the flooded clearing at the mouth of the Stream Bajerka on the same lake, namely,

the nests that were built in the second phase of the formation of the colony in 1959 and almost all in 1961. Also the nests of the colony in the floating islet, providing Black-headed Gulls with a hard substratum for building, in Lake Bolkowskie may be included here. The nests of this type are lying mostly at some distance from water, but generally the distance does not exceed several metres. A large distance may sometimes result from the fall in water level.

The second type of nests, i. e. those built in the tufts of marsh-water plants, is as frequent as the first one. The colonies with this type of nests are, as a rule, situated on shallow parts of water reservoirs, overgrown with vegetation. The vegetation generally consists here of sweet flags, irises and rushes; sedge tufts can also serve as bases for nests. The nests in tufts of plants occur most frequently on fish-ponds and similar reservoirs. All the nests of the colony on the sedimentation basins of the Szczecin Foundry and the majority of the nests on the ponds at Golysz represent this type.

Black-headed Gulls build floating nests on deeper parts of reservoirs, with a water depth up to 1 m. and a sparse vegetation. These nests are situated chiefly in the neighbourhood of small tufts or in a thin growth of water plants. The location among plants serves as anchorage and prevents the nests from drifting off. If such a nest is built on shallow water, its bottom part may rest on the bottom of the reservoir. I watched the nests of this type on the ponds at Golysz and Zator. Also a part of the nests of the colony on the flooded clearing on Lake Goczalkowickie, built in the first phase of the formation of the colony in 1959 belongs in this group. Stumps and sticks projecting above the surface of the shallow water could be used to anchor the floating nests.

The existence of three different types of nest sites indicates a great adaptive ability in the Black-headed Gull. None of the nest types described above is more characteristic of this bird than the others. A further evidence of the plasticity in nest siting is provided by occasionally occurring nests that cannot be classified in any of the given types (Phots. 8—9). These are exemplified by above ten nests on stumps found in the colony on Lake Goczałkowickie near the mouth of the Stream Bajerka. Another evidence is presented by a nest placed in a fishing net lying on the ground on an islet in Lake Goczałkowickie.

From literature we know such facts as a nest on a post one and a half metres high in Norway (YTREBERG, 1956) and others in trees at a height of 4—8 m. in England (NIETHAMMER, 1942) or on house roofs (WITHERBY et al., 1941).

#### NEST MATERIAL

The amount of material used by the Black-headed Gull to build the nest is various. It is closely correlated with the size and shape of the nest, and so will be discussed in the next chapter devoted to this question. Now I confine myself only to the qualitative analysis of the nest material.

I have carried out my investigations concerning this problem chiefly in the area of the fish-ponds at Golysz and on Lake Goczałkowickie, and only to a low.

degree on Lake Bolkowskie and the sedimentation basins of the Szczecin Foundry. Material used for nest building has been registered for 119 nests and the results of these observations are given in Table 2. It may be seen from this table that the material most often used for building are sedges. It was employed for most of the nests constructed of homogeneous material. Sticks come in second so far as the occurrence rate is concerned, but they rarely appear to be the only material of a nest. Sticks being hard, Black-headed Gulls generally line the nests that are for the most part built of sticks with a soft material, e. g. small roots, couch-grass or duck-weed.

 ${\it Table~2}$  Qualitative analysis of material used to build 119 mests of Black-headed Gulls

Ser. No.	Material	No. of nests in which was found	% of total nests	No. of nests built only of this material	% of total nests
1.	Marsh and water plants: stems and leaves of reed,				
	sweet flag, reed-mace, etc.	64	53.77	40	33.61
2.	Sticks	57	47.81	7	33.61
3.	Fine material: among others small roots, couch-grass, bast,			2.3	
	etc.	34	28.57	2	1.68
4.	Grass blades	31	10.92	5	4.20
5.	Dry stems and perennials	11	9.24		
6.	Rush	9	7.48	5	4.20
7.	Duck-weed	3	2.52		
8.	Bramble	1	0.84		
9.	Pieces of wood	1	0.84	_ 1	
	Total	119	100.00%	59	49.57%

No. of groups	No. of nests	% of total nests
1	59	49.58
2	48	40.34
3	10	8.40
4	1	0.84
5	1	0.84
Total	119	100.00%

The records published so far indicate the use of nest materials similar to those ascertained for Black-headed Gulls during the present study (Noll, 1924; Makatsch, 1952; Ytreberg, 1956 and others). However, the figures given in Table 2 render it possible to establish the quantitative relations characterizing the use of diverse materials for nest building.

Table 3 shows to what extent particular pairs of Black-headed Gulls use uniform material for nest building. The first column of table the presents the number of material groups employed for the building of given nests (it refers to the kinds of building materials specified in Table 2). Table 3 covers the same material as has been analysed in Table 2. It reveals that nearly a half of nests are built of uniform material.

The gathering of nest material in the vicinity of the colony and the gathering of the material most available in the region of the colony cause that at least a majority of the nests in the colony are built, as a rule, of the same one or two groups of building materials. And so, for instance, sedges are predominant as nest material in the colony at Golysz and in 1959 sticks and delicate lining material prevailed at the colony on the flooded clearing near the mouth of the Stream Bajerka on Lake Goczałkowickie. The use of the material being readily available in the closest neighbourhood of the nest is possible only thanks to great adaptive abilities of Black-headed Gulls. It is owing to these abilities that, when the material being in common use (sedges) is lacking, the birds can also use sticks or even couch-grass or hay gathered in the adjacent mown meadows (Макатsch, 1952).

A great diversity of the materials used and a high percentage of the nests built of such materials of various properties as sedges and sticks make it impossible to distinguish a typical, characteristic material, found in all or at least in the vast majority of nests of Black-headed Gulls. The materials can be only arranged according to their being more or less frequently used and this sequence can be established on the basis of the data given in Table 2. Sedges under various form take the top place in the list. It is followed by sticks, different delicate roots, couch-grass rhizomes, bast, grass blades, rushes and others. Although these conclusions have been made on the basis of a limited number of nests belonging to a small number of colonies, the data obtained from literature admit the supposition that the sequence of various kinds of nest materials arranged according to the frequency of their being used is such as has been offered above.

#### SHAPE AND SIZE OF NESTS

During my investigations I collected the following data characterizing the shape and size of nests: inner diameter of the nest cup and outer diameter. The measurements of both diameters were taken twice, and where the shape of the nest was elliptical, the shortest and the longest diameter were measured. The values given in the tables are the arithmetic means of both measurements.

The height of nests above the ground or water level and the depth of cups were also measured. It was sometimes difficult to measure the height of nests precisely, and it was particularly so in the case of floating nests. Here not only the part projecting above water but also the underwater part should be measured, which, however, is difficult and exposes the nest to a danger of destruction. It is also often difficult to distinguish how much of the nest was built by birds and what part was material accumulated by wind and waves, on which the Black-headed Gulls started to build their nest. Because of these difficulties the outer diameter of the nest was assumed to be the measure of the amount of the material used.

The graph in Fig. 1 shows the dispersion of the outer-diameter lengths for 119 nests of Black-headed Gulls. As will be seen from it the range of these di-

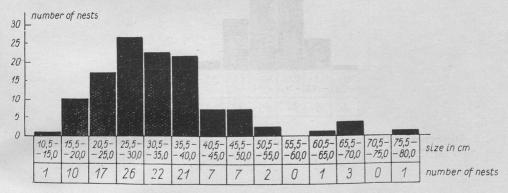


Fig. 1. Dispersion of outer diameters for 119 nests of Black-headed Gulls. Arithmetic means of two measurements are used for particular nests

mensions is considerable, but for most nests they lie within limits of 15.5 cm.—50 cm.

Fig. 2. presents the dispersion of the inner-diameter lengths for the nests examined. Here the fluctuation is markedly smaller: the diameter oscillates between 11.1 cm. and 17.0 cm., but in nearly 90 per cent of the nests it is between 13.1 cm. and 16.0 cm. and in 58 per cent of the nests comes to be in the group 14.1 cm.—15.0 cm. Thus the graph evidently indicates the stability of the inner diameter in the nests of Black-headed Gulls.

Different conditions existing in the colonies under study permit us to analyse the dependence of the out diameter upon the nest site. The nests built in atypical conditions, difficult to classify in any of the three groups distinguished (floating nests, nests built on tufts of vegetation and those placed on the hard ground) have been left out of account. The graph in Fig. 3 shows the number of the nests of each type in particular groups of size represented by the outer diameters. As may be seen from this graph, the floating nests are the largest ones, the nests on tufts are smaller and those on the hard ground the smallest.

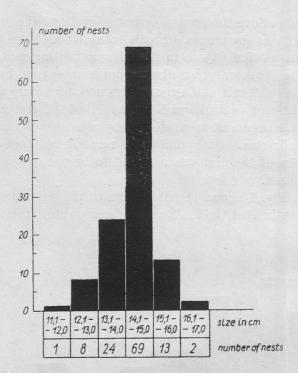


Fig. 2. Dispersion of the inner diameters of the nest cups for 117 nests of Black-headed Gulls.

Arithmetic means of two measurements are used for particular nests

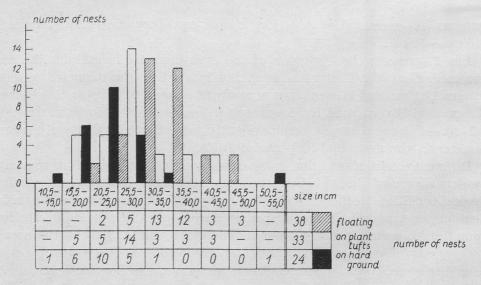


Fig. 3. Dispersion of the arithmetic means calculated from two measurements of the outer diameters of the nests of Black-headed Gulls in relation to the type of nest siting

Correlation between outer diameter of nests and inner diameter of nest cups in Black-headed Gulls

							Outer diam	eter (Gre	oup interva	al = 5 cm						1	e	-0	$e^2l$	$K_1$
		10,1–15,0	15,1-20,0	20,1-25,0	25,1-30,0	30,1-35,0	$0   \left  35,1-40,0 \right $	40,1-45,0	0 45,1-50,0	50,1-55,0	55,1-60,0	60,1-65,0	0 65,1-70,0	70,1–75,0	75,1-80,0	1	e	e-	e <sup>z</sup> t	A <sub>1</sub>
	11,1–12,0		1 (9)													1	-3	9	9	
er : 1 cm)	12,1–13,0	1 (8)	3 (18)	3 (12)	1 (2)											8	-2	4	32	115
ner diameter interval $= 1$	13,1–14,0		2 (6)	8 (16)	5 (5)	2	3 (-3)			2 (-8)			1 (-7)			23	-1	1	23	107
ner int	14,1–15,0		3	4	16	16	14	7	5			1	2		1	69	0	0	0	84
Inr (Group	15,1–16,0		1 (-3)	2 (-4)	2 (-2)	2	5 (5)		1 (3)							13	1	1	13	15
	16,1–17,0			8	2 (-4)											2	2	4	8	2
	1	1	10	17	26	20	22	7	6	2		1	3		. 1	$\begin{vmatrix} 116 \\ = n \end{vmatrix}$			$ 85 $ $ = \Sigma e^2 l $	$\begin{vmatrix} 323 \\ = \Sigma K_1 \end{vmatrix}$
	e	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9					
	$e^2$	16	9	4	1	0	1	4	9	16	25	36	49	64	81					
	$e^2l$	16	90	68	26	0	22	28	54	32	0	36	147	0	81	600 =	$=\Sigma e^{2}$	21		
	$K_1$		115	105	88	62	42	20	13	7		5	4		1	462 =	$=\Sigma K$	7,		
						M														

The following formulae were used for calculation: arithmetic mean  $M_1 = x_0 + \frac{\lambda \Sigma K_1}{n}$ ; standard deviation  $\sigma = \lambda \sqrt{\frac{\sum e^2 l}{n}} - (M - M_1)^2$ ; coefficient of corelation  $r = \frac{\sum e_y e_z}{n \cdot \sigma_y \sigma_z}$ 

Results: For the outer diameter of nest:  $M_1 = 34.91 \text{ cm}$ ; = 11.35 cm,

For the inner diameter of nest cup:  $M_1 = 14.78 \text{ cm}, = 0.82 \text{ cm},$ 

The coefficient of correlation between outer and inner diameters r = 0.052.

(Bracketed figures in the Table are used to calculate "sums of squares"  $= \sum e_y e_z$ )

Similar facts were observed previously by Dementiev et al. (1951), Ma-KATSCH (1952), YTREBERG (1956) and FREDRIKSON (1940). However, the data given above, collected in our localities, render the quantitative presentment of this phenomenon possible. Table 4 offers a trial to establish the correlation between the outer and the inner diameter of the nest. It shows that the correlation coefficient is very low for the 116 nests under investigation, which indicates the lack of interdependance between these two dimensions.

Table 5 is to show the correlation between the inner diameter of the nest cup and the number of eggs in the nest. The correlation coefficient is here somewhat larger (0.266), which indicates some small interdependence between the cluth size and the inner diameter of the nest cup.

The dependence of the nest cup dimensions upon the number of eggs is

 ${\it Table~5}$  Correlation between inner diameter of nest cup and clutch size in Black-headed Gull

No.			er diamet roup inte			200 - EUO	$egin{array}{ c c c c c c c c c c c c c c c c c c c$					
eggs	12.0— —11.1	12.1— —13.0			15.1— —16.0	16.1— —17.0					$\mathbf{n}_1$	
1		1 (4)	5 (10)	10			16	_2	4	64		
2	1 (3)	2 (4)	10 (10)	20	4 (4)		. 37	1	1	37	97	
3		5	6	35	6	2	54	0	0	0	60	М
4			1 (1)	1	1 (1)		3	1	1	3	6	<i>‡</i>
5			1 (2)	1			2	2	4	8	3	
6			1 (3)	· ·			1	3	9	9	1	
· l	1	8	24	67	11	2	$\begin{vmatrix} 113 \\ = n \end{vmatrix}$			$egin{array}{c} 121 \ = \varSigma e^2 l \end{array}$	$ \begin{array}{c} 167 \\ = \Sigma K_1 \end{array} $	
e	3	2	-1	0	1	2						
$e^2$	9	4	1	0 .	1	4						
$e^2l$	9	32	24	0	11	8	84 =	$= \Sigma e$	2l			
$K_1$		112	104	80	13	2	311 =	- ΣΙ	$\zeta_1$			
				M								

The Formulae applied are the same as in Table 4.

Results: For the number of eggs:  $M_1 = 2.4$ ;  $\sigma = 0.89$ 

For the inner diameter of nest:  $M_1 = 14.75 \text{ cm}$ ;  $\sigma = 0.82$ .

The coefficient of correlation r = 0.266.

variable in different species of birds. Promptov (1945) has pointed out that the manner of nest formation is fixed by heredity and characteristic of the given species, documenting his opinions by the example of some passerine birds. Hence the nest cup diameter must be somehow connected with the bird size. I have stated the same for the Spotted Flycatcher Muscicapa striata (PALL.) (BOCHEŃSKI, 1957). In the Black-necked Grebe Podiceps nigricollis (C. L. BREHM) examined by me (BOCHEŃSKI, 1961) the nest cup size increases in proportion to the clutch size, which is connected with the extension of the nest as the egg number augments. The occurrence of these two types of relations is dependant upon the elasticity of the material of which the nest has been built.

A slight dependence of the nest size upon the number of eggs in Black-headed Gulls can be explained by the fact that the material used for nest building, in spite of its being for the most part elastic, may be little resistant to the strain in some cases (e. g. couch-grass rhizome). An additional reason for this dependence may be that the number of eggs ascertained in the nest need not correspond to the full clutch. As results from the data of YTREBERG (1956), some eggs may disappear occasionally, e. g. drop out of the nest, which is more likely to happen if the nest is small. FREDRIKSON (1940) states also that the clutches of Black-headed Gulls are larger in strongly built nests than those laid on rocky islets almost without nests. These factors may play some role in the research after the reasons for a small statistical interdependence between the clutch size and the dimensions of the inner cup of the nest.

As a matter of fact, the uniformity of the inner nest cup dimensions in Black-headed Gulls, illustrated by the above-cited numerical data, is the only constant feature of the nests of this species. This characteristic has been hitherto overlooked in literature or mentioned only generally (e. g. NIETHAMMER (1942) writes only that the nest cup diameter in Black-headed Gulls amounts to 15-20 cm.). The dimension of the inner nest cup diameter, depending on the inborn manner of nest formation and the bird size, is in the case of the Black-headed Gull the most characteristic feature of the nest. The arithmetic mean of this dimension, calculated for 116 nests, comes to 14.78 cm. with the standart deviation  $\sigma$  equal to  $\pm$  0.82 cm.

To complete the picture of nest building in Black-headed Gulls a fact described by many authors must be mentioned here, namely, the presence of platforms of nest material by some floating nests of this bird (among others Noll, 1924, and Steinbacher, 1941). In the opinion of the latter author this platform is built by the birds on purpose. At any rate, it is not characteristic of the Black-headed Gull's nest, because however frequently it occurs, most nests are without it.

#### MIXED CLUTCHES

In order to obtain a full picture of the nesting of Black-headed Gulls I should touch the question of mixed clutches, constituting a rather little known phenomenon. The mixed clutches composed of eggs of one species only explain the

occurrence of 4 and more eggs in the nest of the Black-headed Gull. Table 6 gives the numbers of eggs in the nests under investigation and so makes the estimation of the number of mixed clutches possible. In my material the percentage of such clutches is higher than it was in the studies of Fredrikson (1940) and Ytreberg (1956). As will be seen from this table, the most frequent mixed clutches are those of 4 eggs. During my investigations I never met more than 6 eggs in a nest, though Dementiev et al. (1951) have recorded mixed clutches of 7 eggs.

Mixed clutches of two different species of birds constitute a separate question. I have already described a mixed clutch, where in the nest of a Black-

Table 6

Cluth size in Black-headed Gulls on the basis of author's material as compared with the data calculated on the basis of the material of Fredrikson (1940) and that obtained from table 4 of Ytreberg's study (1956)

No. of eggs	Aı	thor's ob	servations	Data	of Fredr	ikson (1940)	Data of YTREBERG (1956)				
	No. of nests	% of total number of nests	total one female and mixed of number dutabase nests nests			No. of nests	% of total number of nests	Clutches of one female and mixed clutches, in %			
1	16	13.80	1	17	14.40	)	8	1.9	,		
2	38	32.76	93.97	41	34.75	95.76	36	8.6	98.9		
3	55	47.41		55	46.61		372	88.4			
4	4	3.45	í	4	3.39	1	3	0.7	3		
5	2	1.72	6.03	1	0.85	4.24	1	0.2	1.1		
6	1	0.86		-	<u></u>		1	0.2			
Total	116	100.00	100.00	118	100.00	100.00	421	100.00	100.00		

headed Gull besides the full clutch of this bird there were also two eggs of a Coot Fulica atra L. (Bocheński, 1960b) (Phot. 6). While describing the areas of my present investigations, I mentioned that sometimes Black-headed Gulls make use of the nests left by Great Crested Grebes Podiceps cristatus (L.) and in effect incubate the mixed clutches (Phot. 10).

The observations discussed above as well as the data obtained from literature (GWINNER, 1956) indicate that Black-headed Gulls can lay eggs in the nests of other species of marsh-water birds and they can receive and incubate in their nests the eggs coming from other individuals of the same species or from birds of other species.

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STRESZCZENIE

Autor stara się zbadać dwa zagadnienia: możliwości przystosowawcze śmieszki do gnieżdżenia się w różnych warunkach oraz wynalezienie cech wspólnych charakterystycznych dla gniazd śmieszki.

Z punktu widzenia stada możliwości przystosowawcze objawiają się przede wszystkim w wyborze miejsca na założenie kolonii. Rozmaitość miejsc wybieranych jest bardzo duża. Od rzadko zarośniętych głębszych wód, przez gęsto zarośnięte płycizny, żwirowiska, do trawiastych wysepek oraz od zacisznych, z dala od ludzi położonych jeziorek, przez zagospodarowane stawy rybne do wód przemysłowych w pobliżu wielkich i hałaśliwych zakładów przemysłowych (fot. 1—2). Wielkości rozmaitych kolonii są zestawione w tabeli 1. Z punktu widzenia pary budującej gniazdo, możliwości przystosowawcze w wyborze miejsca na usytuowanie gniazda i doborze budowlanego materiału są jeszcze większe. Wachlarz miejsc wybieranych przez ptaki oraz związanych z nimi typów gniazd, gdzie obok trzech typów zasadniczych, tj. budowanych na twardym gruncie (fot. 3—4), na kępach roślinnych (fot. 5) i gniazd pływających (fot. 6), występują jeszcze inne warianty, wskazuje na bardzo dużą plastyczność instynktu gnieżdżącego się ptaka. Zupełnie podobnie przedstawia się sprawa doboru materiału do budowy gniazda (tabele 2 i 3).

Po eliminacjach rozmaitych cech gniazd śmieszki, jedynie średnica wewnętrzna czaszy gniazda wykazuje większą stabilność (fig. 2) przy dużej rozpiętości innych wymiarów, np. średnicy zewnętrznej gniazd (fig. 1) i różnorodności materiału, usytuowania itp. Wymiary średnicy wewnętrznej i zewnętrznej gniazda są od siebie niezależne (tabela 4). Średnica wewnętrzna czaszy gniazda wykazuje jedynie nieznaczną korelację z ilością jaj w gnieździe (tabela 5). Wymiar średnicy wewnętrznej czaszy gniazda, jako zależny od wrodzonego sposobu formowania gniazda i wielkości ptaka, jest w przypadku śmieszki cechą najbardziej charakterystyczną. Średnia arytmetyczna dla 116 gniazd wynosi 14,78 cm przy odchyleniu znamiennym 0,82 cm. Średnica zewnętrzna gniazda uzależniona jest od jego usytuowania (fig. 3).

Na zakończenie autor omawia występowanie u śmieszek lęgów mieszanych. Okazuje się, że lęgi takie, składające się ze zniesień dwu samic śmieszki do tego samego gniazda, stanowią kilka procent ogólnej ilości zniesień (tabela 6). Śmieszki mogą też składać jaja do gniazd innych gatunków ptaków, m. in. do porzuconych gniazd perkozów dwuczubnych z zaziębionymi jajami (fot. 10).

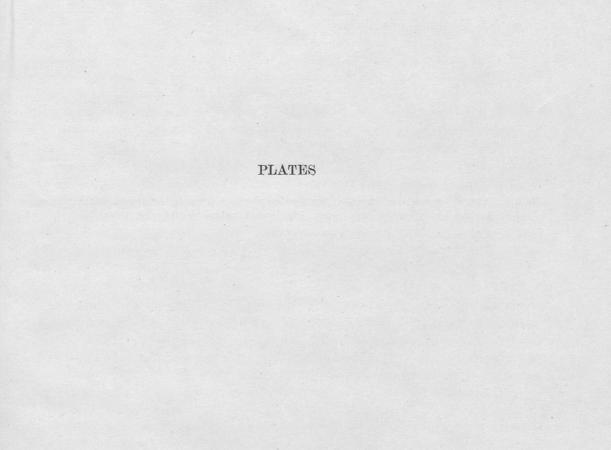
Автор старается найти ответ на два вопроса: возможности приспособления озёрной чайки к гнездованию в разных условиях, а также отыскание общих черт, характерных для гнёзд озёрной чайки.

С точки зрения стаи приспособительные возможности обнаруживаются прежде всего в выборе места для основания колонии. Разнообразие мест избираемых для колонии очень большое. Начиная от редко поросших глубоких вод и густо поросших мелководий, кучь гравия до травянистых островков; также от тихих озёр, расположенных вдали от человека, благоустроенных рыбных прудов до промышленных вод вблизи больших, шумных промышленных предприятий (фото 1—2). Величины различных колоний составлены в таблице 1. С точки зрения пары строящей гнездо — приспособительные возможности в выборе места и строительного материала для гнезда ещё больше. Многообразие мест, избираемых птицами и связанных с ними типами гнёзд, где рядом с тремя основными типами — т. е. построенными на твёрдой почве (фото 3—4), на растительных кочках (фото 5) и плавающих гнёзд (фото 6) — выступают ещё и инные варианты, указывающие на значительную пластичность инстинкта гнездящейся птицы. Совершенно сходно выглядит вопрос подбора материала для постройки гнезда (табл. 2 и 3).

При рассмотрении различных черт строения гнёзд озёрной чайки, единственно диаметр внутренней чаши гнезда обнаруживает значительную стабильность (рис. 2) при больших колебаниях иных размеров напр. внешнего диаметра (рис. 1), разнородности материала, устройства гнёзд и т. д. Размеры внутреннего и внешнего диаметра гнезда не зависят друг от друга (табл. 4).

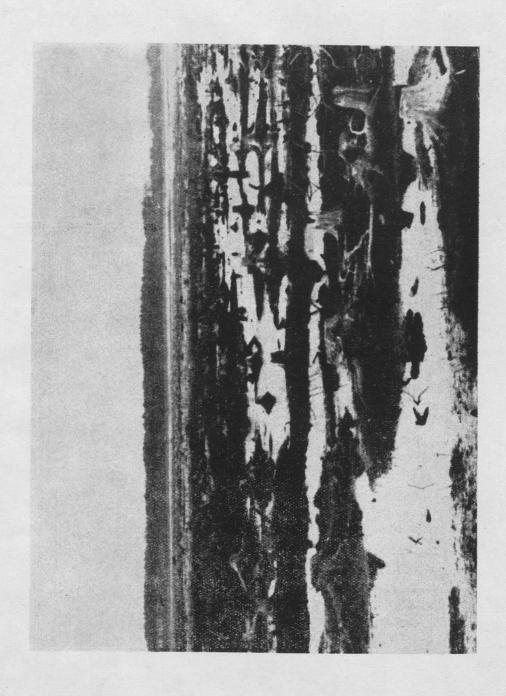
Внутренний диаметр чаши гнезда обнаруживает единственно незначительную зависимость от количества яиц в гнезде (табл. 5). Размер внутреннего диаметра чаши гнезда, зависящий от врождённого способа формирования гнезда и величины птицы, является чертой наиболее характерной для озёрной чайки. Средняя аритметическая 116 гнёзд равняется 14,78 цм при знаменательном отклонении  $\sigma = 0.82$  см. Внешний диаметр гнезда зависит от его устройства (рис. 3).

В конце работы автор обсуждает вопрос выступания у озёрной чайки смешанных выводков. Оказывается, выводки такие, состоящие из кладок двух самок в одно и то же гнездо, составляют несколько процентов общего количества кладок (табл. 6). Озёрные чайки могут откладывать яйца в гнёзда других видов птиц, между прочем, в брошенные гнёзда чомги с застуженными яйцами (фото 10).



# Plate VI

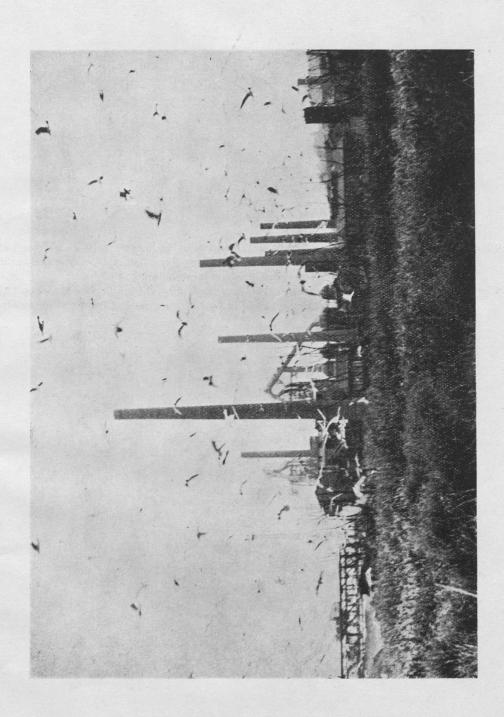
Phot. 1. General view of the colony on the flooded wood clearing at the mouth of the Stream Bajerka on Lake Goczalkowickie. Photograph taken on May 30, 1959



Auctor phot. Z. Bocheński

## Plate VII

Phot. 2. General view of a part of the colony on the sedimentation basin of the Szczecin Foundry, showing the close neighbourhood of the works



Anetor phot.

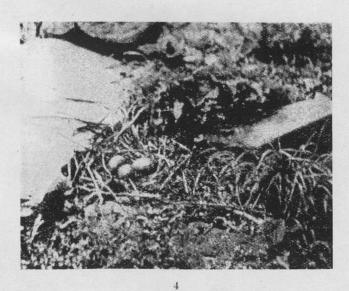
Z. Bocheński

#### Plate VIII

- Phot. 3. Nest of a Black-headed Gull built on the ground in the flooded wood clearing on Lake Goczalkowickie in the second phase of the colony formation in 1959. The photograph shows a small amount of material used for nest building
- Phot. 4. Nest built on the dry ground in rubble on an islet formed from flooded houses on Lake Goczałkowickie. Some dozen sticks and-grass rhizomes constitute material for building



3



Auctor phot. Z. Bocheński

#### Plate IX

Phot. 5. Typical nest situated in a tuft of plants (colony on the sedimentation basins of the Szczecin Foundry)

Phot. 6. Floating nest on a pond at Golysz. Besides the full clutch of the Black-headed Gull there are two eggs of a Coot in the nest (mixed clutch)



5



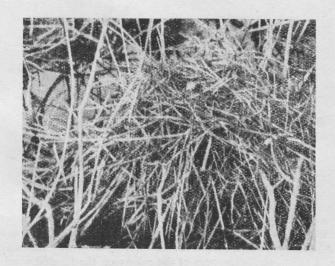
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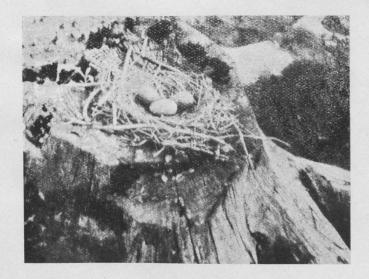
Auctor phot. Z. Bocheński

#### Plate X

Phot. 7. Nest in the colony on the flooded wood clearing at the mouth of the Stream Bajerka on Lake Goczałkowickie. The nest built of a large amount of sticks in the first phase of the colony formation in 1959 was probably a floating one originally

Phot. 8. Nest of a Black-headed Gull on a tree-stump in the colony on the flooded clearing on Lake Goczalkowickie in June 1961





8

Auctor phot. Z. Bocheński

# Plate XI

Phot. 9. Nest of a Black-headed Gull built disorderly of a very small amount of material on a bundle of reeds cut down in the previous year. Lake Bolkowskie in June 1960

Phot. 10. Append of a Black-headed Gull in the nest left by a Great Crested Grebe and beside

Phot. 10. An egg of a Black-headed Gull in the nest left by a Great Crested Grebe and beside the eggs of the latter, in the area of the colony on the flooded wood clearing at the mouth of the Stream Bajerka on Lake Goczalkowickie in 1961



9



10

 $\begin{array}{c} \text{Auctor phot.} \\ Z. \ \textit{Boche\'nski} \end{array}$ 

## Plate XII

Phot. 11. Nestling of a Black-headed Gull in the colony on the sedimentation basins of the Szczecin Foundry. The wound that can be seen in the head of the bird was caused by the fights of Black-headed Gulls within the colony



Auctor phot. Z. Bocheński

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