

## Factors Determining Number Fluctuations and Variation of the Breeding Success of an Urban Population of the Black-headed Gull *Larus ridibundus* (N-Poland)

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Accepted November 4, 2005

INDYKIEWICZ P. 2005. Factors determining number fluctuations and variation of the breeding success of an urban population of the Black-headed Gull *Larus ridibundus* (N-Poland). Folia biol. (Kraków) 53 (Suppl.): 165-169.

In this paper a study conducted on a breeding colony of the Black-headed Gull *Larus ridibundus* between 1998-2004 is presented. The colony is located on an island on a small (4.6 ha area) artificial lake situated in the most abundantly visited recreational area of Bydgoszcz (53°07'N, 18°03'E). The island has an area of 0.9 ha and in some parts there are 25-30 year old *Pinus silvestris*; the banks are overgrown by *Phragmites communis*, *Typha latifolia* and *Salix* sp., and the remaining part of the island is covered by grasses and perennial plants. During seven breeding seasons remarkable fluctuations in colony size were noted (from 1877 pairs in 2000 to 998 pairs in 2003). Most, i.e. 71% of females started breeding between the 15<sup>th</sup> and 25<sup>th</sup> of April. In subsequent seasons they laid 2.2-2.8 eggs (mean 2.5 eggs). Egg losses during incubation varied between 9.7% and 17.6% (mean 13.7%). Mortality of chicks during the first three weeks of life was at an average level of 15.2% and varied in subsequent seasons from 5.6% to 29.4%. In consequence, breeding success of the studied population was at a level of 72.6%, and each pair raised on average 1.81 offspring. The collected data on numbers, phenology, dynamics of broods and selected parameters of reproduction (i.e. size of broods, egg losses and chick mortality) indicate that in the studied population – despite its specific location and several years of existence – there are no changes that would give evidence to the progressing process of synurbisation.

Key words: Black-headed Gull *Larus ridibundus*, breeding success, urban population.

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The Black-headed Gull breeds in Poland in moderate numbers. The Polish population of this species is estimated at 110-120 thousand breeding pairs (TOMIAŁOJĆ & STAWARCZYK 2003). In Wielkopolska, a region neighbouring the Kujawsko-Pomorskie voivodship, during the last decades of the previous century (1980-1996), 101 colonies were described, concentrated mainly in the eastern part of the region, north of the town of Leszno, in the region of Poznań and Piła and in the Noteć river valley, and the population size was estimated at ca 20-25 thousand breeding pairs (BEDNORZ *et al.* 2000).

The described colony is exceptional at the scale of the country by its location within administrative borders of a town of almost 400 thousand population and is the largest colony of the Black-headed Gull in the Kujawsko-Pomorskie voivodship.

### Material and Methods

The data presented in this paper are an effect of studies and observations of the breeding colony of

the Black-headed Gull *Larus ridibundus* conducted during seven subsequent breeding seasons, i.e. between the years 1998-2004, on the island at Myślęcinek Lake in Bydgoszcz (Fig. 1).

The studies consisted mainly of recording phenology of all important moments in the breeding period, collecting all data needed to define breeding success, measuring eggs and in selected and individually marked nests – following the history of broods. The collected material was analysed by standard statistical methods.

The studied colony is located on an island of Myślęcinek Lake, which is a small (area 4.6 ha) artificial lake of 0.7-1.3 m depth, located at the edge of the largest and the most numerous visited recreational area of the town of Bydgoszcz, i.e. in the Forest Park of Culture and Recreation in Myślęcinek (53°07'N, 18°03'E). This lake and the island were created entirely by human activity in 1983. The island has an area of nearly 0.9 ha and is covered in some parts by trees (mainly 25-30 year old *Pinus silvestris*), and the banks are overgrown by *Phragmites communis*, *Typha latifolia* and willows



Fig. 1. Island on Myślęcinek Lake where the breeding colony of the Black-headed Gull *Larus ridibundus* was located from 1998. Top left (A) – the island in 1984; below (B) – a view of the island from the northern side in 2004; right (C) – a sketch of the island, where: A – submerged vegetation (mainly reed and reed-mace), B – coastline covered by 16 species of trees and bushes (mainly by common birch, grey willow and common osier), C – grey willow thickets, D – 25-30 year old pine woodland, E – various species of grasses and perennial plants (mainly mugwort).

of the *Salix* genus. The remaining part of the island is covered by 6 species of grasses and 25 species of perennial plants. This island is located at a distance of 4.5 km to 15.6 km from potential foraging areas for gulls, such as the lake complex in Kusowo, waters of the Vistula river (outlet of the Brda river) and the Brda river (in Oplawiec and Pisaki) and the municipal garbage dump in Wypaleniska. A detailed description of Myślęcinek and the island where the studied colony is located was presented in an earlier paper (INDYKIEWICZ 2001).

## Results and Discussion

The first nesting attempts of Black-headed Gulls on the island on Myślęcinek Lake were recorded on the 3<sup>rd</sup> of April 1998. Over the following ten years 1437 pairs started to build nests, and in the whole season 1673 pairs raised broods.

Formation of a colony in such an “untypical” site, i.e. within the recreational area of a large city is probably a consequence of the loss of favourable breeding places for gulls at the Vistula river (located at a distance of ca 7.7 km) as an effect of high and very high water levels between 1995-1997 (floods). It should be added that several years earlier (1988-1993) on the Middle Vistula course, a gradual tendency for breeding on “high” islands rather than on adjacent sandbars was observed for this species. In the case of the Black-headed Gull and Common Tern (which often form mixed colonies) BUKACIŃSKI and BUKACIŃSKA (1994) noted an increase of the number of nests on “stable” islands, respectively: from 19% to 50% and from 39% to 92% (BUKACIŃSKI & BUKACIŃSKA 1994).

After two further breeding seasons (1999-2000) during which a decisive increase in numbers was noted for the Myślęcinek colony (up to 1758 pairs,

i.e. 5.1%; and 1877 pairs, i.e. 6.8%) a rapid decrease of its size occurred. In 2001 the colony comprised only 1297 pairs, i.e. 30.9% less than in the earlier season, while in the subsequent three years the number of breeding pairs was respectively: 1203, 998 and 1051. In 2005, 1677 pairs bred on the island, i.e. as much as 59.6% more than the year before, and almost exactly the same as in the first breeding season.

The recorded fluctuations of the population in Myślęcinek were very similar in character to changes observed by BUKACIŃSKI and BUKACIŃSKA (1994) in Black-headed Gulls breeding on islands on the Vistula course. During six years they noted a five-fold increase of the size of the colony of this gull, followed by a twenty-fold decrease of its size and further increase in the next two years (BUKACIŃSKI & BUKACIŃSKA 1994).

In Myślęcinek Black-headed Gulls usually effectively used ca 74% of the island area for breeding sites. Most pairs starting broods the earliest in a given season located their nests usually in the eastern bank zone, which is characterised by e.g. the presence of vegetation which shelters chicks. In the second phase of settlement Black-headed Gulls occupied places in the central part of the island most numerous. These places are covered by grass and perennial plants, by they are not shaded by high vegetation. However, at the last stage of breeding attempts the opposite edge of the island was settled, covered with relatively high trees. Mean density of nests on the island during the first three breeding seasons was 0.43 nests/m<sup>2</sup>, but in certain parts of the island it ranged from 0.06-0.08 nest/m<sup>2</sup> to 0.81 nest/m<sup>2</sup>.

The earliest breeding attempts in Black-headed Gulls were noted on the 3<sup>rd</sup> of April and the latest nest on the 15<sup>th</sup> of May, while the largest number of pairs, i.e. 70.9%, started laying eggs between the 15<sup>th</sup> and 25<sup>th</sup> of April. Between 2001-2004, i.e. in the period of the decrease in colony size, a “delay”

of the peak of egg laying for one or two pentads was recorded in comparison with years 1998-2000. In the first case – between the 15<sup>th</sup> and 25<sup>th</sup> of April 90.0% of females laid eggs, while in the second case – between the 10<sup>th</sup> and 20<sup>th</sup> of April 88.2% of females started to breed.

The presented phenology and dynamics of breeding attempts in Myślęcinek was very similar to that observed in the Middle Vistula course by BUKACIŃSKI & BUKACIŃSKA (1994). According to their data, Black-headed Gulls laid eggs on an island on the Vistula between the 15<sup>th</sup> of April and 25<sup>th</sup> of May, and the highest intensity of egg laying was between 21<sup>st</sup> of April and 10<sup>th</sup> of May (BUKACIŃSKI & BUKACIŃSKA 1994).

Based on controls of 4976 nests, the Black-headed Gulls from the island at Myślęcinek Lake laid from 1 to 4 eggs in a brood. In all years of studies broods most often included 3 eggs. These clutches were on average 65.5% of all laid eggs, but their participation in the following seasons varied from 42.1% do 83.1%. Clutches formed by 2 eggs were on average 18.8%, while 1-egg ones were on average 13.4% of the total number of recorded broods. A comparison of the participation of broods with 1, 2, 3 and 4-eggs in subsequent pentads of the breeding period did not reveal statistically significant departures from the general many-year tendency described above.

The mean brood size of Black-headed Gulls in Myślęcinek between the years 1998-2004 was 2.49 and varied in subsequent seasons from 2.2 (in 2003) to 2.8 eggs (2000).

Based on measurements of 5874 eggs laid in five breeding seasons, the length of Black-headed Gull's eggs varied within the range of 24.26-59.70 mm, reaching a mean value of 50.71 mm, while the average width was 35.86 mm. The mean mass of eggs was 32.78 g and ranged from 20.0 g to 48.0 g (Table 1).

Table 1

Intra-population variation in the length, width and mass of eggs of the Black-headed Gull *Larus ridibundus* between years 1998-2004

Year of studies	Number of eggs	Mean size of egg											
		Length (mm)				Width (mm)				Mass (g)			
		mean	max.	min.	SD	mean	max.	min.	SD	mean	max.	min.	SD
1998	810	50.96	57.16	24.26	2.66	36.27	40.32	31.22	1.15	33.9	46.0	20.5	3.83
1999	1393	51.23	59.24	41.20	2.47	36.12	40.72	31.40	1.26	33.4	48.0	23.5	3.36
2000	826	50.90	59.70	35.50	4.32	35.80	38.90	31.10	2.88	32.8	42.0	22.2	3.55
2002	1843	50.51	58.15	42.13	2.20	35.34	39.12	30.54	1.30	32.3	41.0	23.0	2.80
2004	1843	49.97	56.10	41.13	2.25	35.77	46.30	32.10	1.12	31.6	41.0	20.0	3.06
1998-2004	5874	50.71	59.70	24.26	2.78	35.86	46.30	30.54	1.54	32.8	48.0	20.0	3.32



Moreover, the length, width and mass of eggs laid in subsequent seasons differed in their mean values, but these discrepancies did not prove statistically significant. The size of eggs depends significantly on the time they were laid. Eggs laid at the beginning of the breeding season (i.e. during the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> pentads of April), as well as at the end (i.e. in pentads 7-9) were significantly smaller than eggs laid in the middle of the season (i.e. in the 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> pentads).

The mean duration of incubation varied from 17 to 24 days and was on average 19.8 days (SD=0.70). In this period egg losses of Black-headed Gulls varied in subsequent breeding seasons from 9.7% (1998) to 17.6% (1999), which means that in the analysed period these losses were on an average level of 13.73% (Table 2).

Table 2

The size of the Black-headed Gull *Larus ridibundus* breeding colony and breeding parameters between years 1998-2004

Year of studies	No of breeding pairs	No of eggs in clutch	Egg losses (%)	Chick mortality %	No of reared chicks
1998	1673	2.7	9.7	6.7	2.28
1999	1758	2.4	17.6	5.6	1.87
2000	1877	2.8	10.1	29.4	1.78
2001	1297	2.7	12.0	19.8	1.91
2002	1205	2.3	16.1	21.8	1.43
2003	998	2.2	14.6	12.8	1.64
2004	1051	2.3	16.0	10.3	1.73
1998-2004	9859	2.5	13.7	15.2	1.81

The smallest egg losses were noted in 3-egg clutches, as only 26.6% of pairs with such clutches lost at least one egg, while in 1-egg clutches losses were recorded in 34.1% nests, and in 2-egg broods in as much as 57.7% nests. The main reasons of egg loss in the Black-headed Gulls were: (a) nest abandonment, (b) mechanical damage of an egg or its accidental displacement outside a nest – as a consequence of birds' take-off directly from the nest in effect of fights, (c) disturbance to the rhythm of egg incubation, and in consequence from chilling or overheating leading to inhibition of the development of embryos, (d) destruction or damage of an egg by a predator, (e) infertile eggs.

Egg loss in the Mysłęcinek population does not depart from the average for this species. In the colony studied by FLEGG and COX (1975), consisting of ca 2 thousand breeding pairs, egg losses varied

during three subsequent years from 1.5% to 13.0%. These authors also noted that one of reasons of high egg loss (i.e. infertile eggs and eggs with dead embryos) could be an increased aggressiveness of birds caused by an increase in the size of the breeding colony, or as suggested by GLUTZ and BAUER (1982), high humidity caused by heavy rainfall, hail and temporary changes of the water level in the reservoir (which sometimes even led to the displacement of the colony).

The level of chick hatching on the island of Mysłęcinek Lake in subsequent breeding seasons varied from 82.4% (1999) to 89.9% (2000), on average 86.27%. However, chick mortality in the first three weeks of life was on average 15.2% and ranged in subsequent seasons from 5.6-6.7% (1999 & 1998) to 19.8-29.4% (2001 & 2000).

Analysing data from seasons 2000-2002, in which chick mortality was the highest (mean 23.7%), the most numerous group among dead offspring (26.6-39.5%) were chicks dead or fatally injured by adult birds or by much older offspring from adjacent nests. The next group (8.6-12.7%) were 1-3 day chicks which died as a consequence of underfeeding or starvation. Acts of predation were noted relatively rarely (0.4-1.7%). However, it should be added that in the subsequent two years such cases were more frequent and at this time the Raccoon Dog *Nyctereutes procyonoides* was a direct cause of chick loss at a level 4.2-5.8%.

In contrast, in 2000 the most important reasons of chick mortality during the first three weeks of life was the mass occurrence of *Simullidae* dipterans and very high temperatures (with a complete lack of rain) in May. It was determined that both factors were direct or indirect causes of the death of 47.3% of chicks.

The presence of a large number of small haematophags caused exceptional disturbance and increased activity of adult birds and in consequence – more often and longer abandonment of nests without care and food. Chicks attacked by dipterans either left nests, which exposed them to attacks from neighbouring gulls, or stayed in the nests which caused their hyperthermy as an effect of prolonged insolation.

Further evidence supporting that *Simullidae* cause such serious chick loss is data on the breeding success of the Common Gulls *Larus canus*. BUKACIŃSKI and BUKACIŃSKA (2000) showed that the haematophagous dipterans caused an increase in the average mortality of chicks in their first week of life, in subsequent colonies from 6.4% to 48.5% and from 12.5% to 75.0%, and that they were the reason of abandonment of 30.3-50.6% of broods (BUKACIŃSKI & BUKACIŃSKA 2000).

It should also be added that literature data show that mammal predators in small colonies in one season can lead to a complete extermination of chicks. An example can be the American mink *Mustela vison*, which according to data of CRAIK (1997, 1998) and RAE (1999), was a direct reason of the death of 32.0-94.4% of Black-headed Gull chicks in colonies they studied.

It may be expected that in such a large colony as the Myślęcinek population a serious threat to chicks, especially in the first period of their life, would be infectious diseases and ectoparasites. However, recent results of MÜLLER and co-authors (2004) show that in populations of Black-headed Gulls breeding in high densities, chicks have increased numbers of antibodies (MÜLLER *et al.* 2004).

Breeding success in the Black-headed Gull colony on the island on Myślęcinek Lake in seven subsequent seasons ranged from 62.2-84.4% and was on average at the level of 72.6%. The gulls reached their highest breeding success in the first year of the existence of the colony (1998), when each pair of birds reared on an average 2.3 chicks, while in subsequent seasons a pair raised from 1.43 (in 2002) to 1.91 chicks (in 2001), and on average 1.73 chicks (Table 2).

During seven subsequent years in total 9859 pairs of the Black-headed Gulls attempted to breed, rearing in total 17845 chicks. The breeding success reached by the population from Myślęcinek may be considered high, especially in the light of the information given by GLUTZ and BAUER (1982), that a pair of the Black-headed Gulls breeding in western and central Europe raises on average 1.6 chicks.

## Conclusion

The colony of the Black-headed Gull *Larus ridibundus* from Myślęcinek, despite its specific location (i.e. on the island of an artificial reservoir, within a town of 400 thousand population) does

not differ in characteristics from countryside populations in e.g.: number fluctuation, phenology, dynamics of broods and selected breeding parameters (i.e. the size of broods, egg loss and chick mortality). Moreover, the collected data lead to the conclusion that no changes in biology and ecology were revealed in the studied population that would unambiguously indicate the rapid process of syn-urbanisation.

## References

- BEDNORZ J., KUPCZYK M., KUŹNIAK S., WINIECKI A. 2000. Birds of the Wielkopolska region. Bogucki Wyd. Nauk. S.C., Poznań. (In Polish).
- BUKACIŃSKI D., BUKACIŃSKA B. 1994. Factors influencing changes in the abundance and distribution of Gulls, Terns and Plovers nesting on the Mid-Vistula. *Not. Orn.* **35**: 79-97. (In Polish).
- BUKACIŃSKI D., BUKACIŃSKA B. 2000. The impact of mass outbreaks of black flies (*Simuliidae*) on the parental behaviour and breeding output of colonial common gulls (*Larus canus*). *Ann. Zool. Fennici* **37**: 43-49.
- CRAIK J. C. A. 1997. Long-term effects of North American Mink *Mustela vison* on seabirds in western Scotland. *Bird Study* **44**: 303-309.
- CRAIK J. C. A. 1998. Recent mink-related declines of gulls and terns in west Scotland and the beneficial effects of mink control. *Argyll Bird Report* **14**: 98-110.
- FLEGG J. J. M., COX C. J. 1975. Mortality in the Black-headed Gull. *British Birds* **68**: 437-449.
- GLUTZ VON BLOTZHEIM U. N., BAUER K. M. 1982 *Handbuch der Vögel Mitteleuropas*. Band 8/I, Teil 3. Akademische Verlagsgesellschaft, Wiesbaden: 273-360.
- INDYKIEWICZ P. 2001. The Gulls and Terns. Ecology of the Black-headed Gull *Larus ridibundus* and Common Tern *Sterna hirundo* breeding population in the Myślęcinek. NICE, Bydgoszcz. (In Polish).
- MÜLLER W., GROOTHUIS T. G. G., DIJKSTRA C., SIITARI H., ALATALO R. V. 2004. Maternal antibody transmission and breeding densities in the black-headed gull (*Larus ridibundus*). *Functional Ecology* **18**.
- RAE S. 1999. The effect of predation by Mink on ground-nesting birds in the outer Hebrides. MESH – Mink Eradication Scheme for the Hebride. The Scottish Ornithologists' Club, Edinburgh: 1-9.
- TOMIAŁOJĆ L., STAWARCZYK T. 2003. The Avifauna of Poland. Distribution, numbers and trends. PTPP "Pro Natura", Wrocław. (In Polish).