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===SHORT COMMUNICATION===

The morphometric analysis of Eurasian coot eggs (*Fulica atra*) under the local conditions from Câmpeneşti, North-Western Romania

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Abstract. The aim of the present paper was to analyze the measurements of the Eurasian Coot (*Fulica atra*) eggs in order to evaluate if the local conditions, presented here, differ in some way from older data found in references dating to 1955 in Romania. The data were collected from the Eurasian Coot nests identified (N=8) at Câmpeneşti fishponds, located in North-Western Romania, in May 2018. The clutch size was 7.5 ±1.6, ranging from 5 to 10 eggs. The mean egg length was 50.81 mm, and the mean egg breadth was 34.5 mm with higher variability in case of the first measurement. The mean egg volume was 31.3 cm^3 which is much smaller than reported in the Romanian references (36.13 cm^3). Regarding intra-clutch variance, we found that some clutches manifest a higher length, breadth and volume variance than others which can be a result of the intraspecific nest parasitism or environmental variances. The results brought some extensions of egg length and egg breadth limits and also may reflect a decrease in egg size over time.

Keywords: egg length, egg breadth, egg volume, intraspecific variation

Introduction

The present paper aims to analyze the Eurasian coot (*Fulica atra*) egg morphometry and to compare our data with similar findings from the literature dating to 1955 from Romania and also from Poland (Polak, 2010). In birds, the

genotype, laying date, laying order, and ambient temperature just before laying may influence the egg size variation (Custer and Frederick, 1990; Polak 2010). Clutch size and egg characteristics also vary among and within bird species (Figuerola and Green, 2005). Intraspecific and intraclutch variation may give a hint about the nestling hatching and its survival (Blackburn, 1991; Profus *et al*., 2004). It is known that larger eggs contain more nutrients, thus hatchlings from larger eggs are more sizeable, grow faster, and also show a higher survival rate than those from smaller eggs (Mitrus and Rogala, 2001). The egg size variation can also provide information about intraspecific brood parasitism (Cheng *et al*., 2016). Regarding the clutch size, the larger the clutch the lower the survival rate of the offspring due to an increased possibility of being detected by predators (David *et al*., 2018). The Eurasian coot is a sexually monomorphic, monogamous water bird of the family Rallidae (Cramp and Simmons, 1980; Samraoui and Samraoui, 2007). It breeds in inland wetlands where emergent vegetation is present. In this species, a pair's breeding success each season is positively related to the abundance of submerged vegetation (Nieoczym and Kloskowski, 2018) because emergent vegetation presumably provides nesting habitats and protection against aerial predators (Salathé, 1986). Coots are generally nesting on wet vegetation stands with rich food (plant or animal) resources (Glutz *et al*., 1981).

Egg size varies in relation to a lot of factors such as the age of the females, some anatomical and physiological features of the females or the mass of the oviduct and endogen proteins (Christians, 2002). The size of the clutch is influenced by the distance from shore of the nest emplacement and the weight of the egg is also dependent on this parameter (Uzun *et al*., 2010). The Carp population may also influence the clutch and egg measurements (Nieoczym and Kloskowski, 2018). In this context, our samples may seem insufficient (N=60 measured eggs can be interpreted as insufficient) but this number can reflect the situation found at Câmpeneşti and can reflect the general values that can be identified in the local conditions of those wetlands. The interpretation of data does not involve correlation in order to insist and isolate one parameter. Moreover, our results obtained through measurement, not calculation or statistical interpretation, bring novelty in relation to the existing data in the bibliography.

Materials and methods

Câmpeneşti fishing complex is in the North-Western Transylvania, Romania (46°50'01.60"N, 23°43'12.92"E). Seven fishponds are found at Câmpeneşti fishing complex, each of them having different ecological particularities (Kiss and Pripon, 2019a, b). In this study, we chose two of those ponds based on observations

indicating they the highest number of breeding pairs of coots. The distance between the two ponds where the nests were identified was 1.36 km. The data was collected between 8 and 9 May 2018. For the nest searching, we used the line transect method (Gregory *et al*., 2004). We measured the length and the breadth of the egg with a digital caliper. The volume was determined after Hoyt's formula: $V = k\ x\ L\ x\ B^2/1000$ where k = 0.51 (Hoyt, 1979), L = length and B = breadth. Standard deviation was calculated using standard statistical equations, as square root of the variance.

Results and discussion

At Câmpenești fishing ponds, the Eurasian coot is one of the most abundant species of waterbird (Kiss and Pripon, 2019a). A total of 60 eggs from 8 complete nests were identified and measured (Table 1 and Table 2) at Câmpenești. Regarding the clutch size, the mean value was 7.5 eggs/clutch with a variation similar to that found in eastern Poland in a similar habitat type in 2005 – 2008 (Polak, 2010). Regarding the minimum number of eggs per clutch, this was identical to the one mentioned by Polak (Polak, 2010) and lower than the one mentioned by Linția in 1955 (Linția, 1955). On the other hand, the maximum number of eggs per clutch was lower than the maximum number mentioned by Polak and by Linția (Table 1). We observed a negative trend regarding clutch size based on the minimum number and the maximum number of eggs mentioned 60 years ago in Romania. This trend should be studied more comprehensively for a longer period and museum collections should be also analyzed. In comparison with other studied Rallidae species (David *et al*., 2018), we found that the mean number of eggs in coot nests (7.5) is lower than in Water rails (*Rallus aquaticus*) – 8.36 and higher than in Little crakes (*Porzana parva*) – 6,22 (David *et al*., 2018).

Table 1. Clutch size characteristics in Eurasian Coot nests identified at Câmpenești in 2018 in comparison with other studies from Romania (Linția, 1955) and Poland (Polak, 2010)

	Linția (1955)	**Polak (2010)**	**This study**
Total number of clutches	-	106	8
Minimum number of eggs/clutch	7	5	5
Maximum number of eggs/clutch	12	14	10
Mean of eggs/clutch ±SD	-	7.52 ± 1.59	7.5 ±1.60

Table 2. Egg measurements from Eurasian Coot clutches identified at Câmpeneşti in 2018 in comparison with other studies from Romania (Linţia, 1955) and Poland (Polak, 2010)

		Linţia (1955)	**Polak (2010)**	**This study**
N (samples)		**100**	**797**	**60**
Length (mm)	Minimum	48.9		43.09
	Maximum	59.4		55.69
	Mean ±SD	**57.41**	**52.70 ±2.33**	**50.81 ±2.54**
Breadth (mm)	Minimum	32.1		32.22
	Maximum	39		43.38
	Mean ±SD	**35.13**	**36.52 ±1.22**	**34.55 ±1.48**
Volume (cm^3)	Minimum			24.73
	Maximum			50.3
	Mean ±SD	**36.13**	**35.72 ±3.44**	**31.3 ±3.74**

We obtained almost the same values for the egg dimensions as Polak's study (Polak, 2010 - Table 2) but in all cases, we obtained a slightly lower value and a slightly pronounced variation (Table 2). We can notice that a high difference is present between the data obtained from Câmpeneşti and those from 1955 obtained by Linţia (Linţia, 1955). Comparing the differences between the mean values, we saw an 11% decrease in length and a 13% decrease in volume. Regarding egg breadth, the difference is insignificant (1%) which shows that this dimension presents higher stability. On the other hand, we can observe that the minimum and maximum values for egg length at Câmpeneşti are considerably lower than those mentioned by Linţia (Linţia, 1955). Regarding egg breadth, we see that the minimum value is approximately identical to the one from 1955, but the maximum value is larger, meaning some eggs at Câmpeneşti are wider. If we compare our results with ones obtained for other species from the Rallidae family (David *et al*., 2018), we ascertain that the minimum egg length in the Eurasian coot is 3.5 mm larger than the maximum length of a Water rails' egg. The difference between the maximum and minimum egg length values for the Eurasian coot it is 12.6 mm, which makes the interspecific difference approximatively three times smaller than the intraspecific difference. Regarding the breadth of the little crake's eggs, some of the eggs have a bigger breadth (max: 36.93 mm (David *et al*., 2018)) than the Eurasian Coot's eggs (min: 32.22 mm – Table 2).

Concerning the egg volume, the minimum value was considerably lower compared with both Polak (Polak, 2010) and Linţia's studies (Linţia, 1955), showing a difference of 4.4 cm^3 in the first case and 4.83 cm^3 in the second

case (Table 2). The minimum value of the volume in Eurasian coot's egg at Câmpeneşti (24.73 cm^3 – Table 2) it is approximatively equal with the maximum value of the Water Rail's egg – 24.14 cm3 (David *et al*., 2018) which reflects a reduced interspecific difference regarding this parameter. Until now the discussions were focused on the intraspecific and interspecific differences regarding the clutch and the egg dimensions of the Eurasian Coot. Some interesting aspects can be observed from the variation of those parameters between clutches.

Inter-clutch analysis of the length, breadth and volume

In every clutch, the egg length varies to some degree (Fig. 1). Clutch number 8 contains 7 eggs and is the most variable clutch, while clutch numbers 1 (10 eggs) and 5 (6 eggs) are the least variables (Fig. 1). The rest of the clutches vary approximately equivalently. The egg breadth does not vary as much as egg length (Fig. 1).

For egg breadth, the most stable clutches are number 1 and number 7 and the most variable clutches are number 8 and 2 (Fig. 1). We can observe that in the case of breadth and length, clutch 8 varies considerably, reflecting that the nest may be intraspecific parasitized. The most pronounced variation regarding the egg breadth was found in clutch 2 where the egg length has an intermediary variation as shown in Figure 1.

If we compare clutch number 2 to the rest of the clutches which were influenced by the same environmental factors, we can also question the status of the clutch (if it was intraspecific parasitized or not). Regarding the volume of the eggs, we notice a similar spectrum of variance between the clutches (Fig. 1), where the eggs from clutches 2 and 8 have more variable eggs than clutches 1, 6, 5, and 7 where the egg volume is relatively constant even though clutch 1 has more eggs than the others.

Conclusions

In conclusion, we can say that the measured values for egg length, egg breadth and egg volume are similar to the eastern Poland study, but they are different from the ones in Romania in 1955, showing an evident decrease in egg length and egg volume in the latter case. A negative trend is also present in both egg dimensions, with the length of the egg being more variable and the breadth more stable. In both cases, we found high variation which goes over the limits stipulated by Linţia in 1955, stretching the limits for the maximum value of breadth by + 4.38 mm and the minimum value for length by -5.81 mm.

Regarding Eurasian coot and Water rail egg volumes, the interspecific differences are very small even though the body size difference between those species is significant. We can also say that the length, breadth and volume vary considerably between some clutches which can be a sign of intraspecific parasitism but also a result of the environmental influences during the laying period.

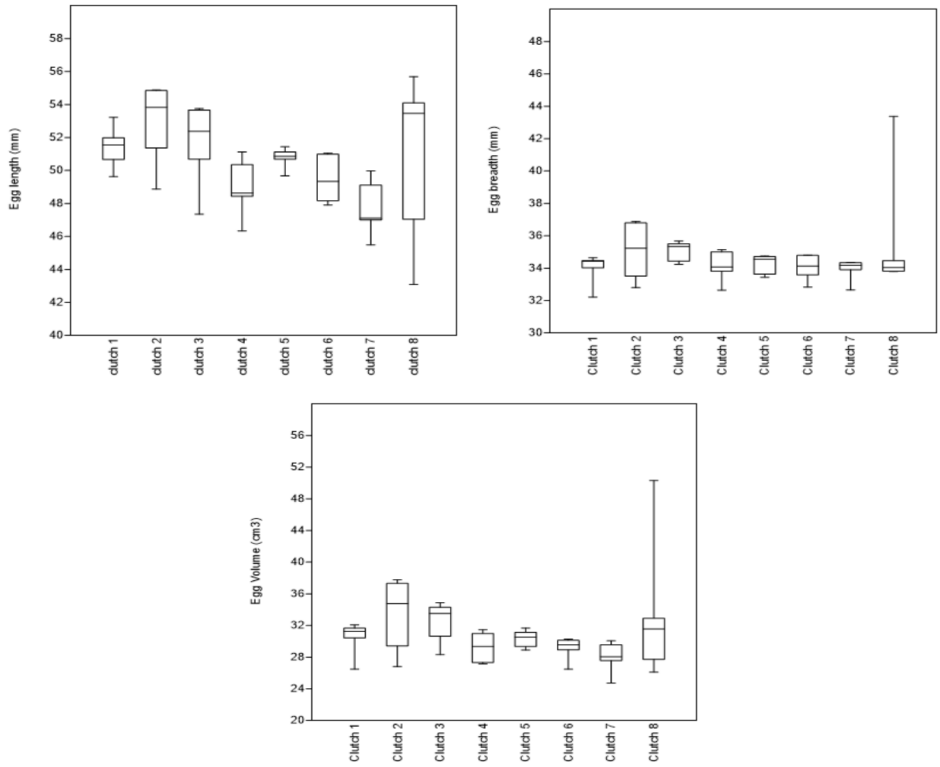

Figure 1. The variation of length (top), breadth (middle) and volume (down) of Coot (*Fulica atra*) eggs in 8 clutches identified at Câmpeneşti.

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References

Blackburn, T. M. (1991). An intraspecific relationship between egg size and clutch size in birds. *Auk*, 108: 209-211.

Cheng, K., Cheng, Z., Cai, T., & Ha., L. (2016). The effectiveness of egg morphology for detecting parasitized nests and eggs for common coots *(Fulica atra)* in Heilongjiang, China. *Waterbirds*, 39(3):306-311.

Christians, J., K. (2002). Avian egg size: variation within species and inflexibility within individuals Biol. Rev 77: 1–26

Cramp, S., & Simmons, K. E. L. (1980). The Birds of the Western Palearctic, Vol. 2. *Oxford University Press*, Oxford.

Custer, T. W., & Frederick, P. C. (1990). Egg size and laying order of Snowy Egrets, Great Egrets and Black-crowned Night-herons*, The Condor*, 92: 772-775.

David, A., Stermin, A. N., & Sevianu, E. (2018). Clutch size and egg repetability in three elusive bird species: Little Bittern (*Ixobrychus minutus*), Little Crake (*Zapornia parva*) and Water Rail (*Rallus aquaticus*) from north-west Romanian populations, Studia Universitatis Babeș-Bolyai Biologia, 63, 1, 81-88.

Figuerola, J., & Green A. (2005). A comparative study of egg mass and clutch size in the Anseriformes. *J. Oenithol.* 147: 57–68.

Glutz U. N., Bauer K., & Bezzel E. (1981). Handbuch der Vögel Mitteleuropas. Wiesbaden B.5: 688.

Gregory, R. D., Gibbons, D. W., & Donald, P. F. (2004). Bird census and survey techniques 1: 38-40 DOI: 10.1093/acprof:oso/9780198520863.003.0002

Hoyt, F. D. (1978). Practical methods of estimating volume and fresh weight of bird eggs. *The Auk* 96:73-77.

Kiss, V. A., & Pripon L. R. (2019a). Differences regarding habitat preferences of the Eurasian Coot (*Fulica atra* Linnaeus 1758) in the breeding and non-breeding season in local conditions of Câmpenești (Cluj, Transylvania), Conference paper: 12th congress of the European Ornithologists' Union - Cluj-Napoca.

Kiss, V. A., & Pripon, L. R. (2019b). A reevaluation of the avifauna from Câmpenești fishing complex (Cluj County – Romania) in the context of high human impact, *Brukenthal Acta Musei* XIV 3, 657-672.

Linția, D. (1955). Păsările din R.P.R. vol. III. *Editura Academiei Republicii Populare Române*, București.

Mitrus, C., & Rogala, B. (2001). Egg size variation in the Collared Flycatcher Ficedula albicollis in the Bialowieza Forest (NE Poland). *Acta Ornithologica* 36: 7-12.

Nieoczym, M., & Kloskowski, J. (2018). Habitat selection and reproductive succes of coot *Fulica atra* on ponds under different fish size and density conditions. *Hydrobiologia* 820: 267–279

Polak, M. (2010). Clutch and egg size variation in the coot *Fulica atra* breeding on fishponds in eastern Poland – test of the optimal egg dimensions hypothesis, *Acta zoologica cracoviensia,* 53A (1-2): 35-40.

Profus, P., Tryjanowski, P., Tworek, S., & Zduniak, P. (2004). Intrapopulation variation of egg size in the White Stork *(Ciconia ciconia)* in southern Poland, Polish *Journal of Ecology*, 52: 75-78.

Salathé, T. (1986). Habitat Use by Coots Nesting in a Mediterranean Wetland. Wildfowl 37: 136–171.

Samraoui, F., & Samraoui, B. (2007). The reproductive ecology of the Common Coot *(Fulica atra)* in the Hauts Plateux, Northeast Algeria, *Waterbirds* 30(1): 133-139.

Uzun, A., Uzun B., & Kopij G. (2010). The Effect of Clutch Size on Egg and Hatchling Mass and Measurements in the Common Coot *Fulica atra*, Ekoloji 19, 74:160-163.