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# Study on gonadal development and gonosomatic ratio in a population of *Cyprinus carpio* from Ariniş fishery complex, Maramureş area

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**Abstract**. Carp ovogenesis occurs through successive phases when oogonia appear and it turns into oocytes and then into mature oocytes; it is strongly influenced by the ambient temperature and water. The whole process of gametogenesis is under endocrine control as well as it is under the influence of environmental factors that interact and influence the oviposition. Because the variability aspects of maturity and gonadal development is extremely high we proposed a study on two carp varieties from Ariniş fishery complex, Maramureş area. In the climatic conditions of the Ariniş Fishery Complex the highest growth and maturation of the gonads takes place after middle of May, when analyzed specimens regardless the age, gonadal weight is higher, the body weight/gonadal weight ratio is lower and the maturation coefficient (gonosomatic ratio) is big. We recommend that the selection of reproduction males and females in the selection nucleus must take into account not only the phenotypical and health aspects, but also the gonadal development and maturation coefficient, which are very important criteria especially in artificial reproduction by reproduction milking practice.
**Key Words**: ovogenesis, carp, environmental factors, indices.

**Introduction**. Fish is a primary source of protein for more than one billion people around the world. The carp, *Cyprinus carpio* belongs to Cyprinidae family and it is one of the most economically important and valuable telostei (Mohammad Nejad Shamoushak et al 2012). In Romania it is one of the most important aquacultured fish species (Grozea et al 2002). In its ornamental form, it is kept in aquaria and ponds for many years (Petrescu-Mag et al 2013).

Carp overall maturity depends on many factors, such as: climate, soil, natural and artificial food type, the water quality, the breeding age and water content in organic matters, stocking density etc. (Horvath et al 2002; Arteni & Roşca 2010; Taati et al 2010; Enache et al 2011). Carp ovogenesis occurs through successive phases when oogonia appear and it turns into oocytes and then into mature oocytes; it is strongly influenced by the ambient temperature and water, estimating a required 1000 g days or an average temperature of 20°C for 60 days (Billard 1999)

Spermatogenesis in carp males produces an impressive number of sperm estimated by Bilard (1999) to more than 2000 billion/cycle/kg body weight. In carp males the sperm is formed in the previous autumn and remains stored and quartered in the testicles until the spring breeding season when it is expelled outside (Grozea et al 2004). The whole process of gametogenesis is under endocrine control as well as it is under the influence of environmental factors that interact and influence the oviposition (Enache et al 2011; Taati et al 2010).

Ariniş fishery complex has an area of 100 hectares water surfaces with nine pools containing between 3 and 30 hectares. In carp farmed there are two populations belonging to Lausitz and Galician varieties. Because of the variability of the aspects of maturity and gonadal development is extremely high we proposed a study on two carp varieties from Ariniş fishery complex, Maramureş area.

**Material and Method**. The biological material was represented by a number of 50 carp females $C_1+$, 50 individuals $C_2+$, 15 individuals $C_R$ autumn and 15 individuals $C_R$ spring. We followed: body weight, gonadal weight, body weight/gonads weight ratio and gonosomatic ratio (gonadal weight x 100/body weight) at the three categories of fish studied. For category noted $C_R$ for the reproduction carp nucleus older than three summers we have followed separatelly issues concerned the spring and autumn seasons. We observed and studied in each category the number of eggs/gram and the weight using the gravimeter method. Analysis of results was performed by estimating the average and dispersion indices.

**Results and Discussion**. The average weight in $C_1$ + carps was on average 652 g and the average weight of the gonads at this age was 18.9 g. The $C_2+$ carps average weight in the middle of May was 1311 g and the gonads 41.5 g. In the 15 $C_{Ra}$ specimens weighed and slaughtered in November, the average weight resulted was 2509 g, causing a gonadal weight of 130.7 g (Table 1)

Table 1

The average and dispersion indices for gonads weight at carp from Ariniş Fishery Complex

| *Age* | *n* | $X \pm sx$ | *s* | *V* | *Average weight* |
|---|---|---|---|---|---|
| $C_{1+}$ | 50 | $18.9 \pm 1.2$ | 8.3 | 44 | 652 |
| $C_{2+}$ | 50 | $41.5 \pm 2.2$ | 15.3 | 37 | 1311 |
| $C_{Ra}$ | 15 | $130.7 \pm 6.4$ | 24.8 | 19 | 2509 |
| $C_{Rs}$ | 15 | $386.9 \pm 6.8$ | 26.4 | 7 | 3598 |

The individuals $C_{Rs}$ analyzed in the middle of May in the following year represented by individuals of the same age with those slaughtered in November reached an average weight of 3598 g after additional feeding and gonadal development that had an average weight of 386.9 g (Table 2).

Table 2

The average and dispersion indices for the body weight/gonadal weight ratio of carp populations from Ariniş Fishery Complex (%)

| *Age* | *n* | $X \pm sx$ | *s* | *V* | *Average weight* |
|---|---|---|---|---|---|
| $C_{1+}$ | 50 | $34.5 \pm 1.7$ | 12.1 | 35 | 652 |
| $C_{2+}$ | 50 | $31.6 \pm 1.5$ | 10.8 | 34 | 1311 |
| $C_{Ra}$ | 15 | $19.2 \pm 2.27$ | 8.8 | 46 | 2509 |
| $C_{Rs}$ | 15 | $9.3 \pm 0.93$ | 3.6 | 39 | 3598 |

Gonadal development in terms of body weight/gonadal weight ratio shows an increasing percentage of their share from 34.5% at $C_1+$ carp age to 9.3% at $C_{Rs}$ during spring carp reproduction. The gonosomatic ratio increases in percentage from 2.9% at $C_1+$ carp to 10.8% at $C_{Rs}$ carp. Both ratios analysis show a strong correlation among age, weight and season for the two carp populations analyzed, confirming that there is great variability in the farms for the traits because of the weak selection process in reproduction nucleus target (Table 3).

Table 3

The average and dispersion indices for populations of carp gonosomatic ratio from Ariniş Fishery Complex (%)

| *Age* | *n* | $X \pm sx$ | *s* | *V* | *Average weight* |
|---|---|---|---|---|---|
| $C_{1+}$ | 50 | $2.9 \pm 0.2$ | 1.2 | 41 | 652 |
| $C_{2+}$ | 50 | $3.2 \pm 0.2$ | 1.4 | 44 | 1311 |
| $C_{Ra}$ | 15 | $5.2 \pm 0.6$ | 2.2 | 42 | 2509 |
| $C_{Rs}$ | 15 | $10.8 \pm 0.8$ | 3.1 | 29 | 3598 |

**Conclusions**. In the climatic conditions of the Ariniş Fishery Complex the highest growth and maturation of the gonads takes place after middle of May, when analyzed specimens regardless the age, gonadal weight is higher, the body weight/gonadal weight ratio is lower and the maturation coefficient (gonosomatic ratio) is big.
Dispersion indices show a high variability of all matters observed confirming that although there are two distinct populations of carp, they are heterogeneous due to incorrect individual selection process, based on performance, not intuition.

We recommend that the selection of reproduction males and females in the selection nucleus must take into account not only the phenotypical and health aspects, but also the gonadal development and maturation coefficient, which are very important criteria especially in artificial reproduction by reproduction milking practice.

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