Morphometric Studies on Anodonta Anatine Bivalve Population from the Dognecea Lake

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Abstract
In the Dognecea Lake, near town Bocsa in Caras-Severin county a strong bivalve population has been discovered from the duck mussel specie (*Anodonta anatina*). Harvested individuals were transported to the Aquaculture laboratory where measurements and correct identification was made. This specie is considered endangered but in Banat area, especially in the Dognecea Lake it is well represented, having an ecological importance, but the bivalve can have an economical importance too, due to the high percentage of edible part of 56.5%.

Keywords: Anodonta anatina, Dognecea Lake, biometry

1. Introduction

Because the duck mussel is a relatively insufficient studied and known bivalve specie in our country, we consider that a throughout morphometric study on its characters is welcomed. As first view, this specie has an important economic value, thanks to its biomass [1,2,3,4,5]. By determining correlations between morphologic parameters, it can be estimated the profitability of a mussel culture in the future when higher emphasis is put on aquaculture, the branch of animal husbandry with strong sustainability [6-12].
Moreover, this bivalve must be studied also from the ecological point of view, being very well known its role in natural equilibriums in the wetlands [13-16]

2. Materials and methods

The duck mussels (*Anodonta anatina*) were harvested from the Dognecea accumulation near town Bocsa. The mussles were found only on the north side of the lake, in sandy areas of benthos. Few individuals were found in muddy benthos on the same north shore of the lake, but only where mud was not exceeding 10 cm in depth.
The individuals were harvested using the square method from ecology. In total 26 mussels were harvested. At harvesting, all mussels were stuck with the anterior part in the substrate at an approximately perpendicular position of the antero-posterior axle on the horizon line. Also the gregarious behavior of this specie was recorded, where nucleus of 4-6 individuals were noticed.
Immediately after harvesting, the mussels where put into a plastic bucket and quickly transported to the aquaculture laboratory of the Faculty of Animal Sciences and Biotechnologies in Timisoara. Here they were put into a 60 liters aquarium equipped with strong aeration devices.
Due to the abnormal shape of this animals, a own method for measurement was developed (fugure 1). The measured distances were as follows:

- Shell's antero-posterior length (CD);
- Shell's height at umbone (AB);
- Shell's width;
- Ligament's visible length (AE);
- Length from umbone to center of brachial siphon (AC);

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- Length from umbone to shell's anterior extremity (AD);

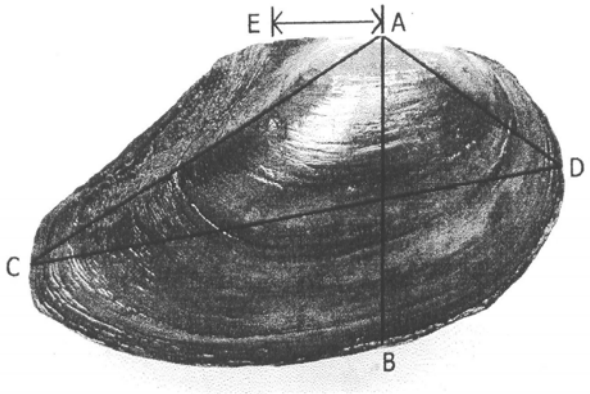

Figure 1. *Anodonta anatina*. Measurements: Shell's antero-posterior length (CD); Shell's height at umbone (AB); Shell's width; Ligament's visible length (AE); Length from umbone to center of brachial siphon (AC); Length from umbone to shell's anterior extremity (AD)

At these distances were added the weight for:

- Wet bivalves weight: of the live animal weighted 10 minutes after the removal from water (for excess water flowing)
- Bivalve's weight after water flowing by cutting the adductor muscles, and forcing the water to drain out;
- Bivalve's visceral mass, by detaching the meat from the shell;
- Shell's weight without the soft tissues.

3. Results and discussion

In table 1 is presented the average and dispersion indexes of biometric measurements for *Anodonta anatina*.

The 26 individuals had an average shell's length of 119.3±1.46 mm. the shell's length variated from a minimum of 102 mm to a maximum of 134 mm. in the studied group a low variability exists (CV=6.24%) for the length of shell. Average safety index (1.22%) shows a satisfactory precision ($S\overline{X}$ %<5%).

Shell's height at umbone had an average of 62.42±0.58 mm and the individual extreme limits varied from 58 mm and 70 mm. Reported to the shell's length its height to the umbone was 52.32%. The average safety index is satisfactory as precision fro shell's height at umbone ($S\overline{X}$ ≈0.92%). This indicator shows a small variability (CV=4.75%) inside the studied group.

Shell's width measured with the calipers between the most lateral limits had an average of 44.81±0.82 mm. the extreme values for this character were between 38 and 57 mm. the width of shell represents 71.78% from the height at umbone and 37.56% from shell's length. Inside the studied group a low variability was noticed (CV=9.35%) for the shell's width and the average satisfies us as precision ($S\overline{X}$ %=1.82%).

Table 1. The average and dispersion indexes of biometric measurements for *Anodonta anatina*

Specification	Shell's length mm	Shell's height at umbone mm	Shell's width mm	Visible ligament's length mm	Distance between umbone and center of brachial siphon mm	Distance between umbone and shell's anterior extremity mm	Weight (grams)			
							Wet	After water drain	Visceral mass	Shell
n	26	26	26	26	26	26	26	26	26	26
$\overline{X}$	119.30	62.42	44.81	32.23	92.65	44.35	162.42	95.50	54.04	41.46
$S\overline{X}$	1.46	0.58	0.82	0.70	1.08	0.50	5.38	3.19	1.73	1.64
S	7.44	2,96	4.19	3.94	5.49	2.79	27.44	16.28	8.83	16,35
CV	6.24	4.75	9.35	12.24	5.93	6.28	16.90	17.05	16.35	20.14
$S\overline{X}$%	1.22	0.92	1.82	2.17	1.16	1.12	3.31	3.34	3.20	3.95
Minimum limit	102	58	38	25	82	40	111	66	36	26
Maximum limit	134	70	57	39	102	51	238	132	71	61

Table 2. Simple correlations between studied characters for *Anodonta anatina*

Specification	Shell's length	Shell's height at umbone	Shell's width	Visible ligament's length	Distance between umbone and center of brachial siphon	Distance between umbone and shell's anterior extremity	Wet mass	Weight after water drain	Visceral mass	Shell's weight
Shell's weight	0.83	0.56	0.74	0.46	0.77	0.73	0.91	0.94	0.79	
Visceral mass	0.79	0.57	0.69	0.56	0.66	0.58	0.83	0.95		
Weight after water drain	0.86	0.59	0.76	0.54	0.76	0.69	0.92			
Wet mass	0.93	0.51	0.86	0.64	0.84	0.67				
Distance between umbone and shell's anterior extremity	0.70	0.66	0.41	0.27	0.57					
Distance between umbone and center of brachial siphon	0.88	0.49	0.63	0.61						
Visible ligament's length	0.65	0.28	0.64							
Shell's width	0.77	0.18								
Shell's height at umbone	0.50									
Shell's length										

The visible ligament's length had an average 32.23±0.7 mm with individual extremes between 25 and 39 mm. This character represents 27.02% of shell's length and has an average variability (CV=12.24%). The average is satisfactory as precision ($S_{\bar{x}}$%=2.17%).

The distance between umbone and the center of brachial siphon was 92.65±1.08 mm with limits between 82 and 102 mm. This character represented 77.66 % from shell's length and had a low variability (CV=5.93%) and the average was satisfactory ($S_{\bar{x}}$%=1.16%).

The distance between umbone and anterior extremity had an average of 44.35±0.5mm. this character represented 37.17%from shell's length. A low variability was determined (CV=6.28%) and the average satisfied us as precision ($S_{\bar{x}}$%=1.12%).

At all 26 individuals of *Anodonta anatina* was determined the wet mass, the mass after water draining, the visceral mass and the shell's mass. The mussels wet mass after removal from aquarium was in average 162.42±5.38 g with individual limits between 111 and 238 g. A medium variability was recorded (CV=16.9%) and the calculated average satisfied us as precision since $S_{\bar{x}}$%=3,31%.

The mass after water draining was in average 95.5±3.19 g, and individual extreme limits were between 66 and 132 g. A medium variability was recorded (CV=17.05%) and the calculated average satisfied us as precision ($S_{\bar{x}}$%=3,34%). Making the difference between wet and drained mass it results that in the paleal cavity was 66.92 grams of water which is 41.2% of the wet mass.

The visceral mass determined by removing the soft tissues weighted in average 54.04±1.73g and individuals had between 36 and 71 g of visceral mass. A medium variability was determined inside the group (CV=16.35%) and the calculated average satisfied us as precision ($S_{\bar{x}}$%=3,2%).

The shell's weight without the soft tissues had in average 41.46±1.64 g, and individual extreme limits were between 26 and 61 g. A high variability was recorded (CV=20.14%) and the calculated average satisfied us as precision ($S_{\bar{x}}$%=3,95%).

From the wet mass of mussels, the water from paleal cavity was 41.2%, the meat content

(visceral mass) was 33.27% and the shell weighted 25.53%.
From the mussel's mass after draining water from paleal cavity, the meat represented 56.58% and the shell 43.42%.
Table 2 shows simple correlations calculated between studied biometric characters.
Correlation among most economically important characters such as *wet mass* and *visceral mass* or *wet mass* and *mass after water draining* had very strong positive values r=0.83 and 0.92 respectively indicating the positive correlation.
Almost absolute positive correlation was determined between *ass after water draining* and *visceral mass* (r=0.95), *mass after water draining* and shell's mass (r=0.94), *wet mass* and *shell's length* (r=0.93).
Positive correlations but with distinct significant values were identified for *shell's width* and *visceral mass* (r=0.69) and *shell's length* and *visceral mass* (r=0.79).
Positive weak correlations were determined also between *height at umbone* and *ligament's length* (r=0.27) and between height at umbone and shell's width (r=0.18).

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4. Conclusions

Our studies revealed the following conclusions:

1. The duck mussel *Anodonta anatina* is well represented in Banat's waters and should be further studied under economical and ecological aspects.
2. The duck mussels from Dognecea lake weigh in average 162.42±5.38 g and measure a length of 119.30±1.46 mm. the biometry revealed a strong homeostasis of the genotype.
3. Among all studied parameters positive correlation were determined. Between *wet mass* and *visceral mass* exists a strong positive correlation (r=0.83). *Wet mass* and *mass after water draining* are strongly positive correlated characters (r=0.92). between *mass after water draining* and *visceral mass* a positive closo to absolute correlation was determined (r=0.95).
4. The meat percentage from the live mussel's weight is 33.2% and after water draining is 56.5%.

References

1. Bura, M., 2002, Acvacultură specială; Ed. Orizonturi Universitare, Timişoara.
2. Bura, M., Muscalu R., Grozea A., i Dumitrescu Gab, Lazu, D., Heveşi Camelia, 2003, Studiu anatomo-histologic asupra piciorului, branhiilor şi a palpilor labiali la specia Anodonta anatina L., Analele Universitatii Dunarea de Jos, Galati
3. Fira Valeria, Năstăsescu Maria, 1977, Zoologia nevertebratelor; Editura Didactică şi Pedagogică, Bucureşti.
4. Grosu, Al., 1962, Mollusca, vol. III, fasc. 3. Bivalvia (scoici) din colecţia Fauna republicii Populare România, Acad. R.P. România.
5. Radu, Gh., Radu V., 1967, Zoologia nevertebratelor, Vol. 2, Editura Didactică şi Pedagogică, Bucureşti.
6. http://en.wikipedia.org/wiki/Bivalvia
7. http://www.bio.uib.no/evofish/papers/Englund_1994_Valve_movement_of_fresh water.pdf
8. http://www.animalbase.uni-goettingen.de /zooweb/servlet/AnimalBase/home/
9. http://olteniastudii.3x.ro/cont/22/E04-Cioboiu.pdf
10 http://www.csuchico.edu/~mmarchetti/FRI/ bivalva/bivalva.html
11. http://encyclopedia2.thefreedictionary.com/ Bivalva
12. http://www.tpwd.state.tx.us/huntwild/wild/ species/giantfloater/
13. http://pubs.acs.org/doi/abs/10.1021
14. http://www.animalbase.uni-goettingen.de /zooweb/servlet/AnimalBase/home/species ?id=2117
15. http://www.iucnredlist.org/apps/redlist/ details/22736/0
16. http://www.mendeley.com/research/ thickshelled-river-mussel-unio-crassus-sweden-distribution-ecology-status-threats-conservation-18/