

## The Study of Fish Remains from the Late Roman Era from Argamum, Tulcea County

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**Abstract.** *The studied fish remains come from the excavations carried out by the Ștefan Honcu archaeologist between 2017 and 2020 within the Argamum archaeological site. The study methodology consisted mainly of anatomical and taxonomic identifications based on archaeozoological atlases, quantification of the data, taphonomical evaluation, osteometry, size and weight estimation, and energy yield estimation. The archaeozoological material represents food waste. The only osteological remains registered with butchering marks was a fragment of a caudal vertebra from *Silurus glanis* (catfish). The studied material consists of 72 fish remains coming from carp – 28 fragments, catfish – 19 remains and the rest of 25 fragments couldn't be identified up to species level. The faunal material is dated as follows: second half of the V century level – 9 remains, 4 remains from carp, a fragment from catfish and 4 fragments from unidentifiable fish; first half of the VI century – 17 osteological remains coming from carp – 7 remains, catfish – 8 remains and two unidentified fragments; second half of the VI century were discovered the most fish remains – 41 osteological fragments; late VI – early VII century – 5 fragments, 2 remains coming from carp and 3 remains from catfish. Most of the carp individuals range between 60-80 cm and 80-100 cm. For catfish, most of the individuals have sizes between 220 -240 cm. Based on the estimated amount of meat for each species, the energy yield (kcal) was calculated, the assemblages dated to the VI century being the richest.*

**Rezumat.** *Resturile de pește studiate provin din săpăturile efectuate de arheologul Ștefan Honcu între anii 2017 și 2020 în cadrul sitului arheologic Argamum. Metodologia de studiu a constat în principal în identificări anatomice și taxonomice bazate pe atlase arheozoologice de specialitate, cuantificarea datelor, evaluarea tafonomică, osteometrie, estimare a taliei și greutateii indivizilor de pește și estimarea puterii energetice. Materialul arheozoologic reprezintă deșeuri alimentare. Singurele rămășițe osteologice înregistrate cu semne de tranșare a fost un fragment de vertebră caudală provenită de la *Silurus glanis* (somon). Materialul studiat este alcătuit din 72 de resturi de pește provenind de la crap – 28 fragmente, somn – 19 fragmente, iar restul de 25 de fragmente nu au putut fi identificate până la nivel specific. Materialul faunistic este datat după cum urmează: a doua jumătate a secolului V – 9 resturi, 4 resturi de crap, un fragment de somn și 4 fragmente de pește neidentificabile; prima jumătate a secolului VI – 17 resturi osteologice provenite de la crap – 7 resturi, somn – 8 resturi și două fragmente neidentificate specific; a doua jumătate a secolului VI au fost descoperite cele mai multe resturi de pește – 41 de fragmente osteologice; sfârșitul secolului VI – începutul secolului VII – 5 fragmente, 2 resturi provenite de la crap și 3 resturi de la somn. Majoritatea indivizilor crap variază între 60-80 cm și 80-100 cm. Pentru somn, majoritatea indivizilor au dimensiuni cuprinse între 220 -240 cm. Pe baza cantității estimate de carne pentru fiecare specie s-a calculat randamentul energetic (kcal), eșantioanele datate în secolul VI fiind cele mai bogate.*

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## Introduction

The fortification of Argamum is located at Cape Dolojman, on a rocky promontory on the shores of Lake Razelm, Jurilovca commune, Tulcea County (Figure 1). In ancient times the settlement had direct access to the Black Sea, because the current lagoon was a former gulf. The urban settlement was founded by Greek colonists from Miletus, the toponym associated with it being Orgame, which in Roman times is Latinised into Argamum<sup>2</sup>.

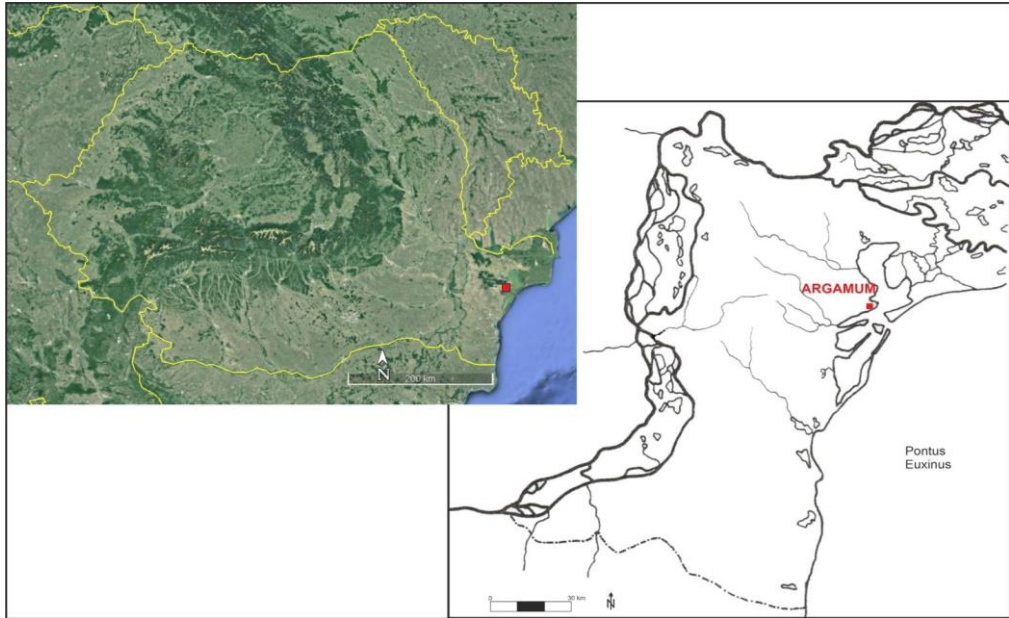


Figure 1. Localization of the Argamum archaeological site. Source: HONCU, 2023.

The studied fish remains come from the excavations carried out by the Ștefan Honcu archaeologist between 2017 and 2020 within the Argamum archaeological site. The remains are dated to the Late Roman Era as follows: second half of the V century, first half of the VI century, second half of the VI century and late VI century – early VII century<sup>3</sup>. The archaeozoological material represents food waste. The only osteological remains registered with butchering marks was a fragment of a caudal vertebra from *Silurus glanis* (catfish) (Figure 2). In the second half of the VI century level was discovered an edifice (noted E1), from which were identified 7 remains coming from carp (*Cyprinus carpio*), one fragment of a posttemporal of catfish and 11 remains from Teleostei fish.

<sup>2</sup> MĂNUCU-ADAMEȘTEANU 1992, 2001; HONCU 2023.

<sup>3</sup> HONCU 2016, 2023; HONCU *et al.*, 2021.



Figure 2. Catfish vertebra with butchering mark.



Figure 3. Common carp skeletal remains (from left to right: vertebra, ossa pharyngea and dentale).

## Methods

The study methodology consisted mainly of anatomical and taxonomic identifications based on archaeozoological atlases<sup>4</sup>, quantification of the data (NISP – number of identified specimens and MNI – minimum number of individuals), taphonomical evaluation, osteometry, size and weight estimation<sup>5</sup>, estimation of energy yield<sup>6</sup> and statistical analysis.

### Results and discussion

The studied material consists of 72 fish remains coming from carp – 28 fragments, catfish – 19 remains and the rest of 25 fragments couldn't be identified up to species level (Figure 4). Regarding the minimum number of individuals (MNI), the carp sums up a minimum of 14 individuals and the catfish adds up to 11 individuals. Starting in chronological order with the second half of the V century level, the fish remains counts to 9, 4 remains from carp, a fragment of cleithrum from catfish and 4 fragments from unidentifiable fish. As MNI, for carp was estimated to have a minimum of three individuals and one individual for catfish. From the first half of the VI century were discovered 17 osteological remains coming from carp – 7 remains, catfish – 8 remains and two unidentified fragments. For both, carp, and catfish, were identified two minimum individuals each. In the second half of the VI century were discovered the most fish remains – 41 osteological fragments. The unidentifiable remains are prevalent in this assemblage – 19 remains, being followed by the carp remains – 15 and catfish remains – 7 fragments. Carp presents a minimum number of 5 individuals and catfish presents only 3 estimated individuals. Lastly, in the late VI – early VII century were excavated only 5 fragments, 2 remains coming from carp and 3 remains from catfish. Catfish are more numerous as MNI too, being estimated 3 individuals, while for carp were estimated 2 individuals (Table 1).

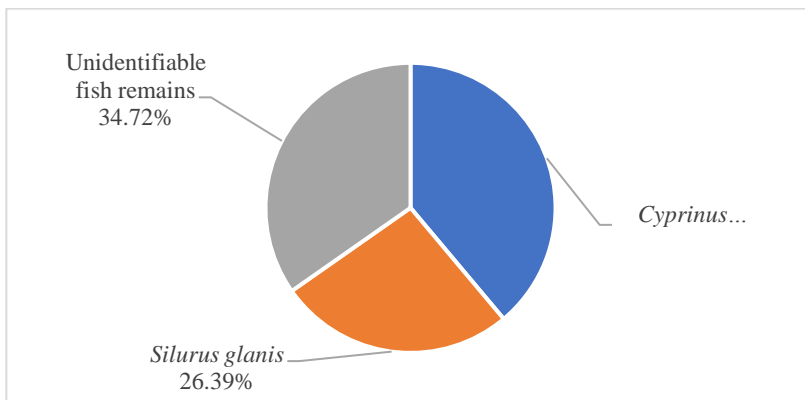


Figure 4. Proportions of fish remains from the Argamum archaeological site.

<sup>4</sup> RADU 2005.

<sup>5</sup> RADU 2011.

<sup>6</sup> BĂLĂȘESCU *et al.* 2005

Table 1. Quantification of fish remains from the studied archaeological levels from Argamum site.

Era		Second half of the V century		First half of the VI century		Second half of the VI century		Late VI century- Early VII century	
Species		NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI
<i>Cyprinus carpio</i>	Common carp	4	3	7	4	15	5	2	2
<i>Silurus glanis</i>	Catfish	1	1	8	4	7	3	3	3
Unidentifiable fish remains		4		2		19			
<b>Total sample</b>		<b>9</b>	<b>4</b>	<b>17</b>	<b>8</b>	<b>41</b>	<b>8</b>	<b>5</b>	<b>5</b>

For some of the osteological remains the size and weight were calculated based on osteometry. Thus, for the second half of the V century were measured a hyomandibular, an opercular and a vertebra of carp and estimated sizes of 866.28 mm, 475.48 mm, 802.25 mm and weights of 9599 g, 1624,59 g, respectively 7648.88 g. For catfish was measured a cleithrum with M2 = 17.7 mm, being estimated a size of 1114.2 mm and a weight of 9329.83 g.

The estimated size of carp varies from 271.33 mm to 713.7 mm in the first half of the VI century and the weight varies from 310.24 g to 5416.74 g. For catfish, the size varies from 1216.2 mm to 2271.3 mm and the weight varies from 12122.7 g to 78557.6 g.

In the second half of the VI century were measured 8 fragments of carp and 4 fragments of catfish. Thus, the size of carp varies from 592.79 mm to 904.31 and the weight from 3126 g to 10900 g. For catfish, the calculated sizes are: 1132.5 mm, 1645.49 mm, 2335.42 mm and 2367.19 mm and the estimated weights are: 16561 g, 29951 g, 85381.23 g and 88903.83 g.

In the last studied level, the size and weight of carp were estimated to be 669.5 mm and 841.6 mm, respectively 4480 g and 8813.53 g based on two caudal vertebrae with M1 of 12 mm and 15.4 mm. Based on two precaudal vertebrae and a dentary bone, the size of catfish was calculated to 912.3 mm, 1095 mm and 630.75 mm. The weight was estimated to be 5130.12 g, 8855.88 g, and 1701.38 g respectively (Table 2).

Table 2. Carp and catfish estimated sizes and weights.

Species	Size	Weight
<b>Second half of the V century</b>		
<i>Cyprinus carpio</i>	866.28	9599.06
	802.25	7648.88

	475.18	1624.59
<i>Silurus glanis</i>	1114.24	9329.83
<b>First half of the VI century</b>		
<i>Cyprinus carpio</i>	271.33	310.24
	609.64	3407.87
	713.70	5416.74
	646.11	4037.59
<i>Silurus glanis</i>	1552.41	25162.00
	1216.17	12122.70
	2271.29	78557.62
	1818.64	40402.49
	1988.10	52742.75
<b>Second half of the VI century</b>		
<i>Cyprinus carpio</i>	779.56	7026.90
	899.84	10742.26
	592.79	3125.98
	856.81	9292.23
	904.31	10899.55
	664.44	4380.64
	643.48	3984.43
	679.63	4683.43
<i>Silurus glanis</i>	2335.42	85381.23
	2367.19	88903.83
	1645.49	29951.19
<b>Late VI century-Early VII century</b>		
<i>Cyprinus carpio</i>	841.63	8813.53
	669.51	4480.09
<i>Silurus glanis</i>	1094.99	8855.88
	912.34	5130.12
	630.75	1701.38

A size distribution was made for both carp and catfish to better see in which size classes most of the individuals are situated. Thus, most of the individuals of carp are situated between 60-80 cm and 80-100 cm (Figure 5). For catfish, most of the individuals have sizes between 220 -240 cm (three individuals) and between 100-120 cm and 180-200 cm (two individuals for each class) (Figure 6). The majority of large size individuals (adults) could indicate that most probably fishing took place during the spawning season, which occurs mainly between March and June<sup>7</sup>.

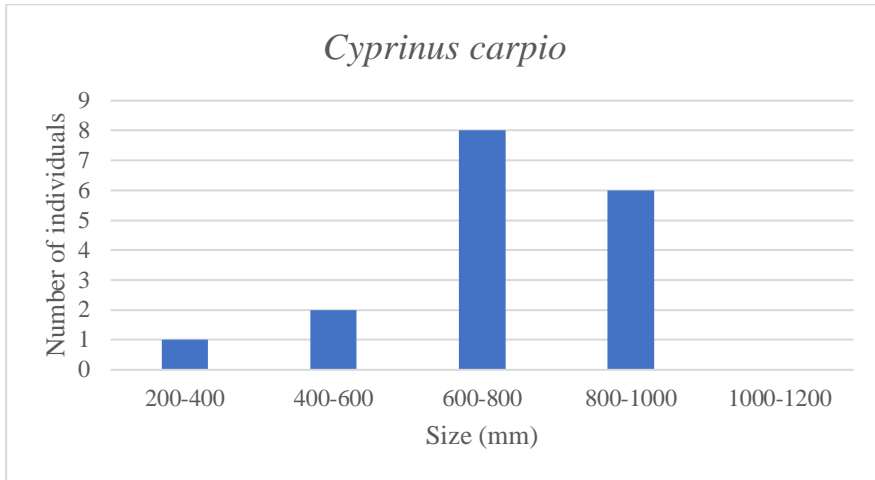


Figure 5. Carp size distribution in the Argamum archaeological site.

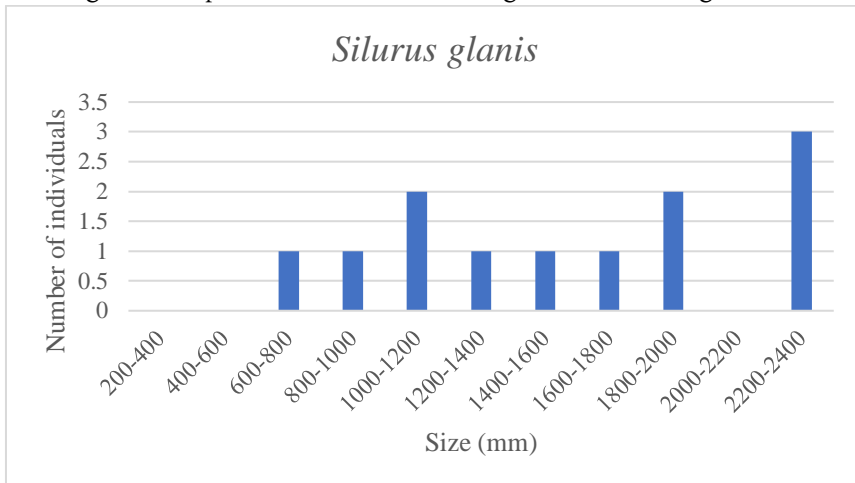


Figure 6. Catfish size distribution in the Argamum archaeological site.

<sup>7</sup> BREHARD et al. 2014.

Based on the estimated amount of meat for each species, the energy yield (kcal) was calculated. Thus, catfish, due to its larger size and higher caloric yield (244 kcal/100 g) provided in all samples the largest part of the estimated calories (54% - second half of the V century; 97% - first half of the VI century; 91% - second half of the VI century; 73% - late VI century – early VII century). Compared to catfish, carp is a less fatty fish, with a caloric yield of 104 kcal/100 g. Energy yields for carp and catfish were taken from Mincu, 1985. In the second half of the V century, carp offered 1.962.743 kcal and catfish 2.276.478 kcal. Moving to the first half of the VI century total fish resources provided 52.362.898 kcal, of which 50.992.964 kcal came from catfish. In the second half of the VI century, catfish provided 53.874.575 kcal, and carp only 5.630.083 kcal. And in the late VI century – early VII century, carp offered 1.382.536 kcal, while catfish provided 3.827.720 kcal (Table 3).

Table 3. Energy yield estimated for the reconstituted fish weight.

Species	Total weight (g)	Energy yield (Kcal)	% Energy yield
<b>Second half of the V century</b>			
<i>Cyprinus carpio</i>	18872.53	1962743.12	46.30
<i>Silurus glanis</i>	9329.83	2276478.52	53.70
Total	28202.36	4239221.64	100
<b>First half of the VI century</b>			
<i>Cyprinus carpio</i>	13172.44	1369933.75	2.62
<i>Silurus glanis</i>	208987.56	50992964.64	97.38
Total	222160	52362898.39	100
<b>Second half of the VI century</b>			
<i>Cyprinus carpio</i>	54135.42	5630083.68	9.46
<i>Silurus glanis</i>	220797.44	53874575.36	90.54
Total	274932.86	59504659.04	100
<b>Late VI century-Early VII century</b>			
<i>Cyprinus carpio</i>	13293.62	1382536.48	26.53
<i>Silurus glanis</i>	15687.38	3827720.72	73.47
Total	28981	5210257.20	100



For a better understanding of the energy yield values we followed the theoretical model of Bălăşescu et al.<sup>8</sup> and we tried to estimate the number of inhabitants that could have been fed exclusively with these fish resources. We took the same mean value of the needed calorie intake of approximately 3000 kcal/day/individual depending on age, gender, weight, elders, adults, or children. Therefore, the fish resources from the second half of the V century could sustain 1413 inhabitants for a day, 47 for 30 days, 8 for 6 months and 4 for a year. In the VI century, the fish resources were richer, in the first half being fed 17454 inhabitants for a day, and up to 48 inhabitants for a year. In the second half, the amount of estimated calories could have sustained 19835 people for a day and 54 people for a year. In the late VI century – early VII century fish resources are similar to the V century and could've fed 1737 inhabitants for a day, 58 for 30 days, 10 for 6 months and 5 for a year (Table 4). According to the approximately half a century dating for each archaeological level, we tried to estimate how many people could sustain these fish resources, and only the resources coming from the VI century were rich enough to sustain two inhabitants (one for the first half and one for the second half of the century).

Table 4. The number of inhabitants sustained exclusively by the studied fish remains for each archaeological level.

	1 day	30 days	6 months	1 year	Half a century
Second half of the V century	1413	47	8	4	0.08
First half of the VI century	17454	582	96	48	1
Second half of the VI century	19835	661	109	54	1
Late VI century-Early VII century	1737	58	10	5	0.10

## Conclusions

The studied archaeozoological remains, which represent food waste, come from the Argamum archaeological site from the 2017-2020 archaeological campaigns by Ştefan Honcu. The present study focuses only on the fish resources from the Late Roman Era from the Argamum fortress. In the aforementioned archaeological campaigns were discovered 72 fish fragments coming only from two species (common carp and catfish) and being dated to the second half of the V century – 9 remains, first and second half of the VI century – 17 remains, respectively 41 remains and to late VI century – early VII century – 5 remains. The carp is prevalent as NISP and MNI in almost all the studied assemblages.

Most of the measured fish fragments came from large-size specimens, between 40 – 100 cm for carp and between 100 – 240 cm for catfish. By size distribution, it seems that most of the captured fish were adults, and it is possible that fishing took place during the spawning

<sup>8</sup> BĂLĂŞESCU et. al. 2005.

season, between March and June. The energy yield was estimated based on the reconstituted weights. Thus, catfish, due to its larger size and higher caloric yield was the main energy source in all the studied assemblages. Also, a theoretical model was made to better understand how many individuals could sustain these fish resources. The assemblages from the VI century were the richest, being able to feed 17454 inhabitants for a day, 582 for 30 days, 48 for a year and one inhabitant for 50 years in the first half of the century and 19835 inhabitants for a day, 661 for 30 days, 54 for a year and one for 50 years in the second half.

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