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Identification of fish bones - how certain is it?

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ABSTRACT: This paper emphasizes the need for any archaeozoological specimen to be identified not only as a function of its origin but also in relation to the degree of certainty in its assignment. It is argued that only in this way one can eventually reach an objective framework for intra- and interspecific sample comparisons of subfossil bone assemblages. A system of numerical codes is proposed whose feasability and advantages are discussed with the help of several fish bone assemblages from Israel.

KEYWORDS: FISH, OSTEOLOGY, IDENTIFICATION, ARCHAEOLOGY

RESUMEN: Este trabajo enfatiza la necesidad de que cualquier resto arqueozoológico pueda ser identificado no sólo en función de su origen sino también del grado de certeza implícito en su clasificación. Sólo de este modo resulta posible alcanzar algún marco de referencia objetivo para llevar a cabo comparaciones intra e intermuestrales en yacimientos. Se propone, en concreto, un sistema de códigos numéricos, de fácil aplicación, cuyas ventajas se valoran sobre la base de una serie de huesos de peces procedentes de yacimientos israelitas.

PALABRAS CLAVE: PECES, OSTEOLOGÍA, IDENTIFICACIÓN, ARQUEOLOGÍA

INTRODUCTION

Fish bone identification is a difficult exercise in pattern recognition fraught with pitfalls. Factors which affect it include the state of preservation of the bones, the range of the comparative collection and the experience of the investigator, as well as several non-osteological considerations (Driver, 1992). There are three basic questions, or steps, in the process of identification of a specific bone or fragment thereof: 1) is it a bone of a fish? 2) which skeletal element is it? 3) which taxonomic group is it? The purpose of this paper is to suggest a practice for reporting identifications of fish remains, with an *explicit* reference to the confidence of the investigator in his or her answers to these questions. A structured and well-defined code which describes the conviction in the identification might add to the quality of the report.

WHICH SKELETAL ELEMENT IS IT?

The decision whether a subfossil bone belongs to fish might at times be difficult. This question is usually resolved by identifying the skeletal element. The number of bones of a fish is much larger than it is in higher vertebrates. Moreover, there is great variation in the morphology of homologous elements among different fish families. It follows that mere recognition of the skeletal element is difficult so that every assemblage of subfossil fishbones contains a number of fragments lacking enough features to accomplish even this. Sometimes there are well preserved bones with typical features, and yet one cannot identify the element. The richer the sampled environment is in terms of different species of fish, the more one would expect to be challenged with such bones. The proportion of these hard to identify bones in the assemblage should be reported and commented upon.

WHICH TAXONOMIC GROUP IS IT?

An «ideal» taxonomic identification is detailed to the level of the species. This might be possible for certain kinds of fish and/or certain skeletal elements. At times such precise identification is important, e.g. when one might expect several genera of the same family to appear in a sample, each with different interactions with the inhabitants of the excavated site. Other situations call for identification of the family only, with no additional meaning gained by the extra effort put into a more detailed diagnosis. These kinds of methodological considerations should also be reported.

CERTAINTY TOKENS

An identification should always be accompanied by a critical question: «how certain is it?» I suggest to indicate this certainty in an explicit manner, as a «certainty token» (CT) attached to each identified bone. The suggested CT is a two-digit number. The first digit indicates the degree of certainty in the identification of the *family*. The second stands for the *genus* or the *species*. «2» means «certain» (full confidence). «1» means «compatible with» (limited confidence). Identifications with lower degrees of certainty should probably not be reported.

Relevant certainty tokens are:

- «22» for a certain identification of family and genus-or-species.
- «21» for a certain identification of the family, and a diagnosis of the genus-or-species which is «compatible with...».
- «20» for a certain diagnosis of the family, with no further identification.
- «10» for a limited-confidence identification of the family only.

A *certain* identification of the genus or species implies a *certain* identification of the family (CT=22). In other words, CT=12 or 02 is meaningless. This will usually also be true for a limited-confidence diagnosis of the genus or species (CT=21 and only rarely CT=11). Non-osteological considerations may also affect the degree of certainty of a taxonomic identification. These relate for instance to the distribution of certain kinds of fish, as will be shown below.

REPORTING CERTAINTY TOKENS

One may report certainty tokens for individual identifications or for summaries of studied assemblages. The following examples may be illustrative.

Examples for reporting individual bones:

1. Right dentary of Sparidae, *Sparus aurata* (*CT=22*). This complete, well preserved bone was found in Rosh-Zayit, a small site in northern Israel (Iron II). It showed a perfect fit with a recent specimen.

2. First dorsal spine of Balistidae, *Balistes carolinensis* (*CT=22*) from Atlit-Yam, a submerged early Neolithic village off the Mediterranean coast of northern Israel. The specimen comprises a small burned fragment of the spine.

Comment: Bones of the family Balistidae have unique shapes which are easy to recognize. There is only one species of this family in the Mediterranean and several in the Red Sea. Import of fish from the Red Sea to the Mediterranean coast in early Neolithic times is quite improbable. Therefore in this case, a reliable identification of the family, which was relatively easy even with a fragmented bone, carried with it an «automatic» identification of the species. This is an example of how non-osteologic considerations endow certainty to an identification.

3. Left maxillary of Serranidae, *Epinephelus sp.* (*CT=21*) from Tel Mikne (Iron I) situated close to the Mediterranean. A withered fragment.

Comment: The bone had definitive characteristic features of Serranidae and it seemed to be compatible with the genus *Epinephelus* which has several species along the Mediterranean coast. They occupy similar habitats and are caught with the same fishing gear.

4. Left lower pharyngeal bone of Cyprinidae (*CT=20*) from Gamla in the Golan Heights (Roman). A fragment.

Comment: Cyprinidae have characteristic, easily recognizable, lower pharyngeal bones. This fragment carried enough information to make the identification of the family certain. Fresh water bodies in the northern part of Israel today support 8

indigenous species of this family, but further identification was not achieved.

Examples for reporting assemblages (detailed reports of these assemblages are forthcoming):

1. Bir Mazar (Northern Sinai). A Roman-Byzantine settlement site on the main road leading from Egypt to Israel along the Mediterranean coast (Via Mare).

Number of fish bones examined	409
Identification of the skeletal element:	
Unidentified splinters	64
Unidentified but well preserved bones	1
Identified skeletal elements	344 (84.1%)
Taxonomic identification	154 (37.6%)

	CERTAINTY TOKENS				
	22	21	20	10	TOTAL
Serranidae				2	3
Epinephelus fasciatus		1			
Moronidae					1
Dicentrarchus labrax		1			
Sparidae				66	110
Sparus aurata		44			
Sciaenidae				3	12
Argyrosomus regius		9			
Cichlidae				4	1
Tilapia sp.		1			
Mugilidae			3	14	23
Mugil sp.		3			
Liza sp.		3			
TOTAL		62 40%	3 2,5%	89 57.5%	154

TABLE 1
Bir Mazar - Identified fish bones.

Comment: Taxonomic identification was achieved in a relatively small percentage of cases. A certain identification of the family was accomplished for about 42%. There were no certain identifications to genus or species. This is a small assemblage of bones dominated by sparids. The general state of preservation of the bones was poor, which accounts for the large proportion of low-confidence identifications. Sparid jaw bones are especially robust and retain enough features to allow identification down to species. The same is true for some bones of Mugilidae and of Sciaenidae.

This assemblage was almost exclusively made up of marine fish from the Mediterranean. The limited degree of confidence in the identifications seems sufficient for this conclusion which seems to be in agreement with the location of the settlement. However, the large proportion of unidentified bones (190 out of 344) leaves the possibility of unrecognized freshwater fish remains among them open.

2. Tel-el-Heir (Northern Sinai). A fortress dated to the Persian-Hellenistic period, adjacent to the ancient artificial «Eastern Canal» arising in the Nile.

Number of fish bones examined	766
Identification of the skeletal element:	
Unidentified splinters	174
Unidentified but well preserved bones.	4
Identified skeletal elements:.....	588 (76.8%)
Taxonomic identification	476 (62.1%)

Comment: This is a larger assemblage of fish remains with a much higher ratio of high-confidence identifications (92% for the family and 44% for genus or species). There is a good explanation for that. Catfish account for about 80% of the findings. These include species of *Clarias* which are found in fresh water bodies in Israel and Egypt, and of *Synodontis* which are found in the Nile. Bones of *Clarias* were mostly pectoral spines (114) and skull fragments (83). Bones of *Synodontis* were mostly pectoral spines (129) and cleithra (29). These elements are tough, durable, and easy to identify. They also share a common characteristic, namely that fishermen were inclined to remove them shortly after the fish were caught. Reasons for doing so were different for these two kinds of fish: clarid heads were removed because they were heavy and useless for marketing. *Synodontis* pectoral spines were removed because they were (wrongly!) thought to be poisonous as they tended to produce lacerations which became easily infected and healed slowly.

The assemblage is therefore typical of a primary handling of fish near their location. The relatively high degree of certainty in the identifications endows high confidence in this conclusion which should help to elucidate the nature of the site.

	CERTAINTY TOKENS								
	22		21		20		10		TOTAL
Clariidae *Clarias sp.*	204								204
Mochokidae *Synodontis sp.* *Synodontis schall*	8		113 50				6		177
Sparidae							4		4
Cichlidae *Tilapia sp.*			56		4		18		78
Mugil sp. *Liza sp.*			3				10		13
TOTAL	212	44.5%	222	46.6%	4	0.8%	38	8.0%	476

TABLE 2
Tel-el-Heir - Identified fish bones.

DISCUSSION

Identification of fish bones is difficult. It is the groundwork for speculations and conclusions concerning the role of fish in an archaeological site. It is suggested that each identified subfossil bone be labeled with a «certainty token» which expresses the confidence of the investigator in his or her diagnosis. Several factors influence this certainty and if they are explicitly addressed they may often contribute to a better understanding of the samples.

Vague expressions related to an identification such as: «uncertain», «quite certain», «likely», «questionable», «doubtful», «?», etc. are of little

value. An accepted alternative uses the following format: «Serranidae, *Epinephelus cf. aeneus*». The equivalent certainty token would be «Serranidae, *Epinephelus aeneus* (CT=21)» as in the above example. I am not aware of a similar notation for an identification with a limited-certainty of the genus or family. Another advantage of the certainty tokens is the simple transition from the individual tokens to the summary report of the assemblage.

Routine estimations of the «Certainty Token» make the investigator more careful and critical. They often integrate purely osteological factors with non-osteological considerations. These estimations may at times lead to meaningful discussions and conclusions. A report which includes data about the unidentified bones and about the confidence of the investigator in his or her identifications may be easier to evaluate and may lead to better communication and cooperation among colleagues.

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