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# New Evidence for Fish Processing in the Ancient Eastern Mediterranean: Formalised *Epinephelus* Butchery in Fifth Century BC Kinet Höyük, Turkey<sup>†</sup>

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**ABSTRACT** Archaeological evidence for fish preparation in the Eastern Mediterranean is scarce. A Late fifth century deposit at Kinet Höyük provides tangible evidence for the systematic butchering of large individuals of *Epinephelus* (groupers), and possibly of Mugilidae (mullets), and *Clarias gariepinus* (African catfish). Butchery marks on head and proximal trunk regions of groupers follow a consistent pattern, indicating the processing of large fish heads for, apparently, local redistribution and consumption at the settlement. Although elements of the vertebral column remaining between the atlas and the ultimate vertebra are virtually absent in the assemblage associated with these butchered fish remains, this differential representation of elements does not appear to be an unequivocal reflection of fish processing techniques and subsequent trade. The insufficiency of research on ancient fisheries and fishing in the Eastern Mediterranean poses an obstacle to contextualise this deposit within a general historical and archaeological framework. Copyright © 2013 John Wiley & Sons, Ltd.

**Key words:** zooarchaeology; butchery; *Epinephelus*; fifth century BC; trade; Mediterranean

## Introduction

Fish processing is a frequently visited subject in both archaeological and historical studies concerning the ancient Eastern Mediterranean. A large corpus of textual evidence enables a critical analysis of fish processing practices in the Greek world (Mylona, 2008). Detailed pictorial representations depicting fish preparation methods provide a wealth of information for ancient Egypt (Ikram, 1995, pp. 62, 73, 148–149, Van Elsbergen, 1997). Archaeological remains of fish species found outside their historical zoogeographic distribution not only provide ample evidence for cross-regional trade but also indicate the existence of established traditions of commercial fish processing at the producer end (Van Neer *et al.*, 2004; Saidel *et al.*, 2006). Unmediated archaeozoological evidence for fish

processing in the Eastern Mediterranean, however, is virtually non-existent.

In ichthyoarchaeology, body part frequency and differential distribution of elements have been the primary tools for interpreting fish processing traditions. For example, both underrepresentation and overrepresentation of vertebral elements have been interpreted as evidence for carcass processing for immediate and delayed consumption (Morales, 1993; Zohar *et al.*, 2001; Mylona, 2003). Techniques of fish pickling and sauce (e.g. Garum) production have been reconstructed from careful analyses of fish bone concentrations recovered in closed contexts, such as floors of storerooms (Van Neer & Depaetere, 2005) and storage vessels (Van Neer & Parker, 2005).

In zooarchaeology at large, butchery marks on bone remains constitute the most tangible archaeological tool to reconstruct methods of carcass processing (Binford, 1981) for all types of meat. Despite the fact that fish remains are a common component of archaeological sites located near substantial bodies of water, as well as in other contexts, butchery traces on archaeological fish remains are rarely reported. This is in

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marked contrast with the abundance of butchery marks on mammalian remains. One of the few examples of butchery marks on fish bones comes from third millennium BC Pakistan. The site of Balakot has yielded butchery marks on 1% of the ichthyoarchaeological assemblage from the site (Belcher, 2005), in keeping with the traces of butchery found on modern fish, resulting from their processing by contemporary fishermen and fishmongers.

Several explanations have been proposed for the scarcity of butchery marks on archaeological fish remains, one of the most important being that both small and large fish can be processed for immediate or belated consumption without leaving traces of butchery (Wheeler & Jones, 1989, p. 68). In a recent paper, Willis *et al.* (2008) questioned this scarcity of butchery marks on archaeological fish remains and conducted a series of butchering experiments on modern fish using stone and metal tools. The paper concluded that butchering fish with methods provided in ethnographic accounts and by modern fish processors can indeed leave marks on fish bones, especially on the elements of the axial skeleton. As a result, the authors suggested that the scarcity of butchering marks on archaeological fish bone may be due to modern researchers overlooking cut marks, taphonomic factors that obscure cut marks or ancient butchers' specific methods that leave no marks. The explanation suggesting a fault from the side of ichthyoarchaeologists seem least likely, for studying fish remains generally entails an intricate quest for details in osteological morphology. For the Eastern Mediterranean, at least, the most significant factor in yielding direct evidence of fish butchery practices is probably related to the scarcity of systematically recovered faunal remains and the general lack of ichthyoarchaeological research in the region.

However, a recently excavated faunal assemblage from Kinet Höyük (Hatay, Turkey), with a high frequency of butchered fish bones, provides a remarkably unusual case in this scientific context. This study describes various aspects of this fish assemblage and attempts to reconstruct the methods and purpose of the fish butchering process it represents. Results reopen discussions about the role of fish consumption in the Classical Eastern Mediterranean world.

### *Kinet Höyük and the archaeological context of the studied assemblage*

Kinet Höyük is located in Turkey on the eastern shore of the Iskenderun Gulf at the northeastern corner of the Mediterranean (Figure 1). The settlement mound

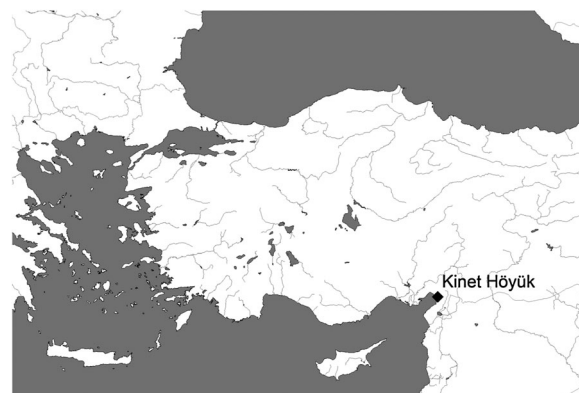


Figure 1. Location of Kinet Höyük.

is situated on the narrow coastal Erzin Plain, defined by the Amanus Mountains to the east and by the Mediterranean shore to the west. The geomorphology of this plain is characterised by thick layers of alluvial sediments underlain by a pre-Holocene alluvial fan (Gates & Özgen, 1993; Beach & Beach, 2008). Although the mound lies about 400 m from the coastline today, geomorphological investigations around the site, as well as its orientation towards the sea, suggest that the settlement was originally positioned on a promontory flanked by an estuary to the south and controlling a natural bay to the north, both filled with alluvial sediments by the Hellenistic Period (Ozener *et al.*, 1993; Beach & Beach, 2008). Broad and heavy gravel deposits show that the River Deliçay, now flowing 2.5 km south of Kinet, supplied the water for Kinet's estuary until that time (Beach & Beach, 2008).

The primary aim of the excavations at Kinet (1992–2011) was to investigate the subsistence strategies of a small Eastern Mediterranean harbour over a long chronological perspective. Indeed, Kinet, as the largest settlement mound in Eastern Cilicia (Gates, 1994), proved to be the perfect candidate to achieve this goal, with 6000 years of occupational debris. Cultural deposition at the mound begins in the Ceramic Neolithic and continues throughout the Late Hellenistic Period in an uninterrupted stratigraphic sequence. Although Roman and Early Islamic architectural remains were discovered in the fields around the mound (Gates, 2009), the mound proper stayed devoid of habitation for 12 centuries following the Late Hellenistic Period. The site was reinvested sometime during the late 12th century AD to become a port town during the Crusaders' era (Redford *et al.*, 2001). This last occupational phase lasted until the early 14th century.

The fish bone assemblage discussed in this paper was recovered in Operation (Op.) U, a 6 m E-W × 18 m N-S excavation area located on the southwestern edge

of the mound (Figure 2). Because of the mound's steep slope, Op. U was excavated as a step-trench, covering a long stratigraphy from the medieval levels on top down to the Early Iron Age (Gates, 2009). The fish remains from Op. U were scattered among the fill and debris of an architectural layer corresponding to Kinet's local Period 4, dated to the late fifth century BC (Figure 2, Gates, 2009). The Period 4 deposits in Op. U were later disturbed by pits filled with amphorae dating to the fourth to second centuries BC. No fish remains came from these pits.

Period 4 architecture in Op. U consists of a single large room (Loci 83 and 107) defined by stone walls to the south and west (Figure 2). Most of the fish remains in question come from the disuse fill within this room. On the outside, this room adjoined flimsy enclosures, resembling garden installations (Gates, 2009). Butchered bones were found immediately outside the western wall, as well as among the debris surrounding these rudimentary units. Room 83/107 was furnished with a low bench (Locus 92) encasing a deep circular depression probably intended to hold an amphora for storage (Figure 2). A similar installation was found inside the architectural remains of Period 4 on the

western side of the mound (Gates, 1999b). No clear floor level was identified in this room during the excavations. Below the shallow Period 4 fill and architecture was a massive structure belonging to the local Period 5 (late sixth to early fifth century), represented by sunken foundations over 2 m deep, 1.10–1.40 m wide and filled with gravel (Gates, 2009). According to Gates (2009), this imposing building may have served a military purpose, a remnant of Achaemenid Persian interests in Cilicia (for the Achaemenid period at Kinet, see also C. Gates, 1999). The gravel foundation layer belonging to Period 5 had no overlying deposit associated with it. Among the significant finds of the fill of this room are fragments of black-glazed imported vessels from Greece, typical of the Period 4 at Kinet, indicating the site's consistent and intense contact with the Aegean during the fifth century BC (Gates, 2009).

All the fish remains come from the debris above the Period 5 architectural remains. They clearly belong to the time when this Period 4 building was no longer in use.

## Methods

The faunal assemblage from Op. U was collected using hand retrieval methods in 2007. Both the species spectrum and the range of represented size classes are likely to have been strongly affected by this decision, particularly the fish. Several studies have shown that a more complete recovery of fish remains is only possible through the employment of dry and wet sieving techniques (Clason & Prummel, 1977; Rose, 1994, p. 388; Van Neer *et al.*, 2005), as has also been noted at Kinet. However, because much of the deposit was fill, the excavators decided not to sieve the matrix.

The fish assemblage forms part of a larger archaeozoological assemblage recovered in Op. U. Although the non-piscian portion of the faunal remains awaits more detailed study, it is clear that the fauna from Periods 5 and 4 is dominated by common Mediterranean domestic mammals followed by medium-to-large game species such as fallow deer (*Dama dama*) and wild boar (*Sus scrofa*). This pattern conforms to the results from other periods and areas of Kinet Höyük (Redford *et al.*, 2001; Çakırlar, 2003; Ikram, 2003).

Taxonomic identifications of the fish specimens are based on their skeletal morphological agreement with modern skeletons. Taxonomic identifications in ichthyoarchaeology are affected by several factors, including fragmentation, availability of modern comparative skeletons, intra-taxon morphological variability, funding constraints and researcher's decisions



Figure 2. Period 4 architecture, Op. U (view from the north). Photo by M.-H. Gates. This figure is available in colour online at [wileyonlinelibrary.com/journal/oa](http://wileyonlinelibrary.com/journal/oa).

(Wheeler, 1978). The fish assemblage in question here was studied with the aid of the comparative fish skeleton collection housed in the Royal Science Institute of Belgium in Brussels. Although the collection includes over 5000 individuals representing more than 900 taxa, it nonetheless entails some limitations for the study of fish assemblages from the Mediterranean. For example, out of the five frequently occurring members of the genus *Epinephelus* in the Eastern Mediterranean (Bauchot, 1987), the collection contained only two species at the time of the study: the white grouper (*E. aeneus*) and the golden grouper (*E. alexandrinus*). For this reason, the identification of the groupers in the assemblage to the species level was not attempted. Identifications at the genus level are not ideal, but because *Epinephelus* species share their habitats and biology, the effect on interpretations can be considered limited (Desse & Desse-Berset, 1999).

The drawback of genus level identifications can be compensated to a large extent by estimating individual body sizes. Size distributions can provide valuable insights about fishing grounds, capturing techniques, the intensity of exploitation and the mode of consumption (Wheeler & Jones, 1989, pp. 139–147). The allometric relationship between skeletal element size and body length is well defined and comparable among several species of groupers (Desse & Desse-Berset, 1996). The body size classes of the groupers were estimated by direct comparison with 22 modern specimens that varied between 12 and 82 cm in standard length (SL, the distance between the tip of the snout and the end of the caudal peduncle). When possible, measurements following the study of Desse & Desse-Berset (1996) were applied. Size classes of other species represented in the assemblage were estimated in a similar manner, by direct comparison with individuals of known length in the Brussels collection.

The relationship between body length and wet weight in fish is not linear but exponential, usually expressed as  $\text{Weight} = a \times \text{Length}^b$ , where  $a$  and  $b$  are determined on the basis of observations on modern fisheries. Because the understanding of the dietary value and biomass of fish is enhanced by considering their weight as well as their length, weight ranges of the groupers represented in the assemblage were estimated by taking the recently published weight–length relationships observed for the individuals of *E. aeneus*, the most commonly encountered grouper in the Eastern Mediterranean, at three stations in southern Turkey (Can et al., 2002; Akyol et al., 2007; Özbek et al., 2013). The tail length of most groupers are about 1/5 of the total length, so the total length was calculated from SL values with the arbitrary linear equation of total length =  $\text{SL} \times 1.2$ . None of these calculations should be taken as more than estimations.

Butchery marks were easily recognisable, detected without the help of any magnifying equipment. In this paper, a convention is made to describe butchery marks for the sake of clarity. 'Cut marks' define knife marks that did not separate the bone into two parts, whereas 'chop marks' are traces that were produced when the cutting implement went through the element (or even several elements at once), severing them into two parts.

In this study, a 'specimen' may refer to an isolated bone fragment, a complete skeletal element, a complete or partial articulated skeleton or fresh and old broken bone fragments that join together. Specimens form the basis of number of identified specimens counts. The minimum number of individuals (MNI) represented by the specimens was estimated only for the *Epinephelus* sp. in order to add another dimension to the understanding of this data type. It is important to highlight, however, that the studied assemblage comes from mixed, open contexts that represent a small slice of the archaeological deposits at Kinet Höyük, and therefore MNI counts are of limited use. The MNI, as used here, is based on the specimen count of the most frequent symmetrical skeletal element divided by two, plus the number of partial skeletons.

## Results

### Species composition

A total number of identified specimens of 341 fish specimens were recovered among the Period 4 debris in Op. U (Table 1). Of the 15 taxa represented, there is only one freshwater species, the North African catfish, *Clarias gariepinus*. The majority of the specimens belong to marine species with only three specimens belonging to cartilaginous fish. Two Carcharhinid (requiem sharks) vertebrae were recovered from the same locus in Op. U, probably representing the same individual. The specimens measure ~13.9 mm in diameter. The morphology of another vertebral centrum agreed well with the *Isurus* sp. (mako shark) specimens in the Brussels collection.

At 257 specimens, the proportion (75%) of groupers in the assemblage is overwhelming. Were the indices of abundance reformulated in MNI (which would be 16 for the *Epinephelus*), they could imply that the sample is small. Here, it should be remembered that this assemblage represents less than 2–3% of the archaeological deposits recovered from Period 4 Kinet Höyük. The high proportion of groupers is in fact evident even in terms of MNI calculations. The predominance of *Epinephelus* over other species has been observed for other chronological periods at Kinet Höyük (Çakırlar, 2003),

Table 1. The fish assemblage from the Period 4 occupational debris recovered in Op. U: species and body part representation

Body part	Taxa Element (number of identified specimens)	CRN	LMN	SCI	ARG	EPI	DIC	SPA	SPAU	SPP	DTX	DIP	MUG	SCO	BAL	CAL	UNDET
Neurocranium	Infraorbitalia					1							2				
	Vomer					1											
	Basioccipitale					4											
	Parasphenoidium					3											
Oromandibular region	Neurocranium fragments					14		1	2						1		
	Articulare					8											
	Dentale					14											
	Ectopterygoideum					3											
	Maxillare					12											
	Palatinum					20		4									
	Praemaxillare					7		2			1						
	Quadratum					8			3								
	Branchiostegalia					19											4
	Ceratohyale					7									1		
Hyoid region	Epinyale					7											
	Hyomandibulare					19				1							
	Interoperculare			1		7											
	Operculare					8						1	5				
	Preoperculare					19											
	Suboperculare					1			1								
	Cleithrum					24									1	2	
	Postcleithrale					6											
	Posttemporale					3											
	Scapula					1											
Pectoral/pelvic girdle	Supracleithrale					5											
	Vertebrae praecaudales					15	2	17	1				3		2	1	
	Vertebrae caudales				2	9							2				1
Vertebral column	Vertebrae praecaud/caudales		2	1		5									1	5	
	Anal/dorsal spine					3									1	8	
	Modified scale																
	Partial skeleton					4											
Total		2	1	1	2	257	2	24	7	1	1	1	13	1	6	4	18
Grand total						341											

CRN, Carcharhinidae; LMN, Lamnidae; SCI, Sciaenidae; ARG, *Argyrosomus regius*; EPI, Epinephelidae; DIC, *Dicentrarchus* sp.; SPA, Sparidae; SPAU, *Sparus aurata*; SPP, *Sparus pagrus*; DTX, *Dentex* sp.; DIP, *Diplodus* sp.; MUG, Mugilidae; SCO, Scopthalmidae; BAL, *Balistes carolinensis*; CAL, *Clarias gariepinus*; UNDET, undetermined species.

yet it should also be noted that preliminary results of an ongoing study on sieved samples from Kinet provide different proportions for the represented taxa and a more diverse size frequency. The proportion of *C. gariepinus* increases drastically in the sieved assemblages, whereas the number of smaller individuals, of both the *C. gariepinus* and of other species, becomes much higher.

Sparidae (breams and porgies) and Mugilidae (mullets) are also fairly common (9% and 4%, respectively) in the Op. U assemblage, followed by *Balistes carolinensis* (six specimens) and *C. gariepinus* (four specimens). The scarcity of *C. gariepinus* is noteworthy; this species makes up more than 24% of the hand-collected assemblages from the Periods 6 and 7 layers of the mound (Çakırlar, 2003) and 20% of the wet-sieved contexts from various assemblages across the stratigraphic sequence of the site (ongoing study). Other bony marine species in the Period 4 deposits of Op. U consist of Sciaenidae (meagre), with two specimens identified securely to *Argyrosomus regius* (common meagre), *Dicentrarchus* sp. (seabass) and Scophthalmidae (flatfish); the latter represented by a single modified scale.

### Skeletal element distribution

The *Epinephelus* specimens were found mainly as fragmentary and disarticulated bones. Four *Epinephelus* specimens represent, however, articulated partial skeletons, consisting mainly of head bones including the suspensorium. Two of these, containing both head bones and precaudal vertebrae, were recovered from the same context (Locus 107). The bones of these articulated skeletons did not bear any traces of butchery.

Disregarding the partial articulated skeletons, the body part representation of the Op. U *Epinephelus* appears to display a skewed distribution. Bones of the

head, except for the neurocranial bones (Table 1) and bones closely associated with the head, including those covering the gill arches and those supporting the pectoral and pelvic fins, are represented more frequently than the elements of the axial body (Figure 4). The diagnostic elements of the axial body, namely the vertebrae, make up a mere 12% of the identified specimens, with only 10 out of 24 *Epinephelus* vertebrae belonging to caudal specimens. Because *Epinephelus* vertebrae are readily recognisable and are as robust as the bony elements of the rest of the skeleton, the underrepresentation of vertebral specimens cannot be attributed to differential preservation or identification bias. One possibility is that it may be a consequence of sampling techniques. The representation of elements in the *Epinephelus* assemblages from the Period 7 and 6 deposits at the mound, which were also retrieved by hand-collection, where only a single-butchered specimen was found (Çakırlar, 2003, pp. 62, Figure 19), is surprisingly similar to that described for Op. U ( $\chi^2 = 2,25$ ;  $P = 0,68$ ; Figure 3).

### Length and weight estimations

The estimated size of the *Epinephelus* individuals ranges between ~30 cm and +82 cm in SL (Figure 4). Although there are a few specimens in the assemblage that belong to individuals that were clearly considerably larger than the largest individual of 82 cm SL in the comparative collection in Brussels, because of the lack of good measurable dimensions, it is impossible to reconstruct their size more accurately. Whereas individuals between ~30 and 40 cm SL are rare, individuals measuring between 40 and 50 cm SL are altogether absent. An overwhelming majority of the *Epinephelus* specimens (87%) represent individuals larger than 60 cm in SL. These would have been

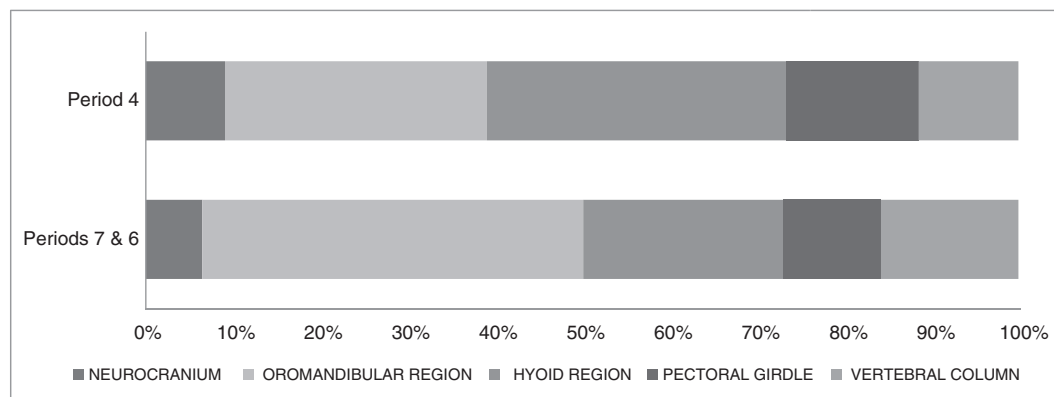


Figure 3. Body part distribution of *Epinephelus* from Iron Age Kinet: Op. U, Period 4 versus Ops. A All and EH, Periods 7 and 6.

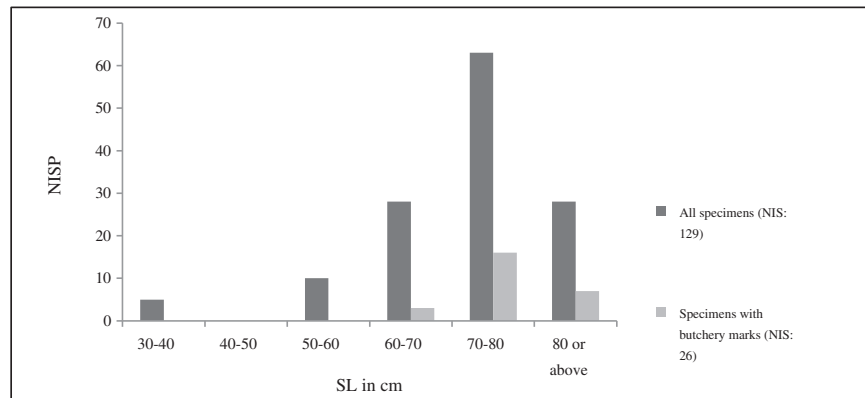


Figure 4. Estimated length range of *Epinephelus* from Period 4, Op. U.

sexually mature individuals. But these results are mostly likely skewed because of the mode of retrieval (hand-collection) during excavation. Size could be estimated for 26 of the specimens with butchery marks, all of which belonged to large individuals falling within the 60 cm or above SL range. The three partial articulated skeletons fall within the 60 cm SL or above category. The majority represents individuals between 70 and 80 cm in SL (Figure 4).

Weight estimations based on weight-length calculations indicate that the individual groupers in the assemblage span a considerable range: from a kilogramme to possibly 15 kg or more (Figure 5). The majority of the butchered specimens represent an estimated weight range between 5.5 and 8.3 kg. With individuals of such large weight, heads alone must account for more than 1 kg each. Mediterranean groupers can weigh up to 60 kg, but nowadays, catches heavier than 10 kg are extremely rare.

### Butchery marks

The butchery marks on the *Epinephelus* bones from Op. U Period 4 are notably frequent, as stated earlier. In this study, 34 specimens (13% of the *Epinephelus* specimens) in total bear butchery marks. Some of the bones may belong to the same individuals, but no butchered bone was found in skeletal articulation with another bone.

Butchery marks concentrate around the anterior skeleton: on the head, suspensorium, branchial skeleton and in the area of the pectoral and pelvic skeleton (Table 2). About 18% of all identified *Epinephelus*, head bones showed clear chop or cut marks. Of the elements belonging to the suspensorium and the branchial skeleton, about 9% of the specimens showed traces of butchering. Butchery marks were most frequent on the elements of the pectoral and pelvic skeleton, with 25% of the specimens bearing

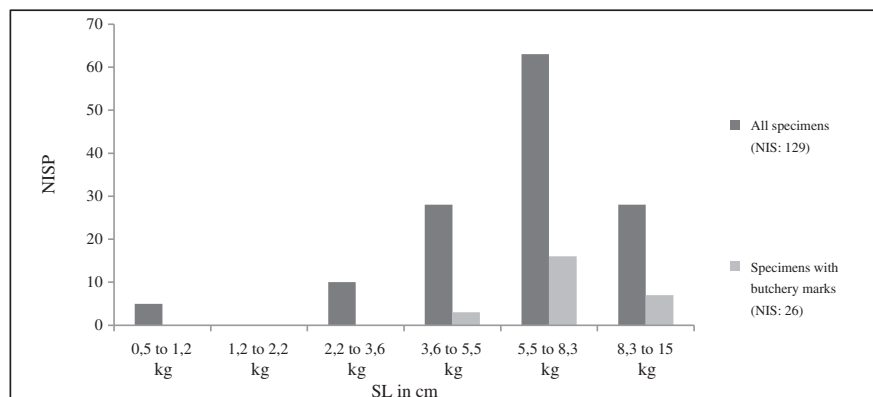


Figure 5. Estimated weight range of *Epinephelus* from Period 4, Op. U.

butchery marks, whereas 14% of the precaudal vertebral fragments showed traces of the butchering process.

With the exception of a few cut marks, one on the centrum of an anterior precaudal vertebra and one on a postcleithrum, all butchery marks resulted from chopping through the bone with a sharp implement (Figures 6–8). The implement was probably made of metal. Most chop marks are clear and regular: a few, such as one that separated the posterior portion of a posterior abdominal vertebra from its anterior portion by chopping through the centrum, are rather irregular, as if made with difficulty (Table 2). The locations of the butchery marks show that the strokes came both from the medial and lateral sides. Some dissect the bone obliquely, such as the one on an articulare and several found on cleithrae. This might be due to the awkward shape and location of the bone. Marks that recurrently appear on the same element are consistently identical. Marks on maxillae and premaxillae (Figure 7(a) and 7(b)) must have been part of the same chop stroke, which came from the medial side on a medio-lateral axis. Chop strokes on the lower jaw again seems to have hit two elements at the same time, namely, the dentary and the articulare, but these came from the lateral side of the face. Chop marks on the preopercular and opercular bones (Figure 8(a) and 8(b)) are located almost exclusively

on the same spot, cutting through the bones on a cranial-caudal axis (Table 2). In this case, the direction which the chop strokes came from is indeterminable. Both the cut and chop marks on the ceratohyal bones are on the dorsal-ventral axis, located on the anterior or mid sector of the bone. Butchery marks occur most frequently and uniformly on cleithrae (eight specimens in total; Table 2). Chops marked these bones through the crista externa or interna, the thickest section of the bone, on a roughly cranio-caudal axis. In the axial skeleton, the butchering process seems to have affected the anterior abdominal vertebrae only. On two occasions, the ventral costae were separated from one or two precaudal vertebra(e) at others; the strokes targeted the vertebral centra.

Not all specimens bearing butchery marks in the assemblage belong to groupers. There are two additional specimens, one belonging to a mugilid (probably *Mugil cephalus*) and the other to a *C. gariepinus*. The mugilid specimen is a precaudal vertebral centrum recovered in articulated state with three other vertebrae (represented as a partial skeleton in Table 1). The specimen displays a light knife mark that cuts the centrum in the middle on a medio-lateral axis. This partial skeleton would belong to an individual of ~30–40 cm in SL. Apart from this partial skeleton, Mugilidae are represented by the most robust elements of the head area and a few vertebrae (Table 1).

Table 2. Description of butchery marks on *Epinephelus* specimens

Body part	Element (number of identified specimens)	Number of identified specimens	Description
Neurocranium	Neurocranium	1	Medio-lateral chop transversing the epiotic and pterotic bones near the posttemporal.
Oromandibular region	Articulare	1	Irregular chop from the lateral side (probably more than a single stroke) on the costa inferior externa, where the articulare joins the dentary.
	Dentale	1	Strong lateral cut on the anterior corpus.
	Maxillare	4	Oblique chops from the medial side, from the anterior towards the posterior, near mid or anterior corpus.
Hyoid region	Premaxillare	2	Cut and chop marks from the medial side about mid corpus.
	Ceratohyale	3	Cut from the lateral side on pedunculus keratohyalis. Chop from medial side through corpus above branchials. All on dorsal-ventral axis.
	Operculare	4	Transverse and oblique chops on mid sector of bone facies, on a cranial-caudal axis.
	Preoperculare	4	Chops (direction not clear) on a cranial-caudal axis on angulus superior or slightly below on cristo hyomandibularis.
Pectoral/pelvic girdle	Cleithrum	8	Chops through the crista externa or interna on a roughly cranial-caudal axis.
	Posttemporale	1	Medial cult from anterior towards posterior.
	Postcleithrale	1	Chop on mid facies.
Vertebral column	Vertebrae	4	Second vertebra; from dorsal towards ventral, two strokes, both of which did not chop through the centrum, one of which is on the anterior face of centrum.
	praecaudales		Chop from anterior side, probably with some difficulty. Costae chopped off from centrum.
Total		34	

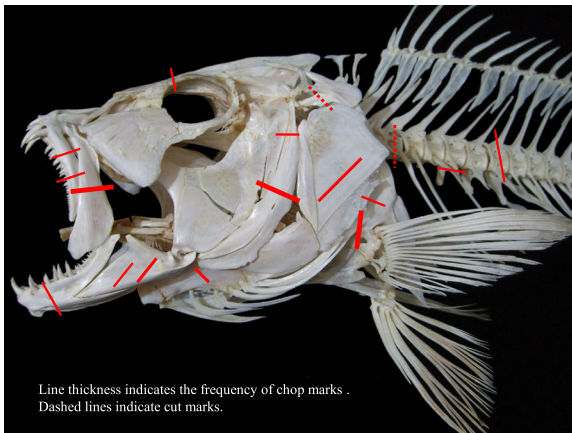


Figure 6. Location of butchery marks. This figure is available in colour online at [wileyonlinelibrary.com/journal/oa](http://wileyonlinelibrary.com/journal/oa).

The chop mark on the *Clarias* specimen is remarkably similar to the chop marks on the *Epinephelus* cleithrae described earlier (Table 2), sharply dissecting the bone obliquely through its crista interna. The *Clarias* specimen in question represents an individual of ~50–60 cm in SL. As shown in Table 1, it is one of several *Clarias* specimens in the assemblage. They include two cleithrae, a precaudal vertebral centrum, and—especially—a hypohyal-ceratohyal-epihyal complex, that is, almost the entire branchial skeleton, comparable in size with that of a modern 110 cm SL *C. gariepinus*. This specimen represents the largest *Clarias* individual found at Kinet Höyük so far.

Curiously, none of the other taxa found in this assemblage bore butchery marks.

## Discussion

As intriguing as Kinet's Period 4 fish bone assemblage may be, its cultural-historical significance poses an interpretive challenge. Groupers constitute common elements of Mediterranean fish bone assemblages (Van Neer *et al.*, 2005), but this assemblage stands out as a unique case in the ichthyoarchaeological record of the Eastern Mediterranean because of the record it provides about butchering practices. The assemblage also differs from other fish bone assemblages from Kinet studied to date.

One reason for the distinctions may stem from its context, a fill in a limited area of the settlement; another reason may be a heavy bias towards large specimens, because deposits from Op. U were not dry-sieved or wet-sieved in 2007. Moreover, no other group of piscian remains reported from the Eastern Mediterranean (and probably elsewhere) has features analogous to the assemblage in question, and thus there are no appropriate comparanda that would facilitate its interpretation. Despite these obstacles, one can propose to reconstruct the butchery method that this assemblage illustrates and suggest a few plausible interpretations regarding the assemblage and its historical/archaeological context.



Figure 7. (a) Maxillae and (b) premaxillae with butchery marks. This figure is available in colour online at [wileyonlinelibrary.com/journal/oa](http://wileyonlinelibrary.com/journal/oa).



Figure 8. (a) Opercular and (b) preopercular with butchery marks. This figure is available in colour online at [wileyonlinelibrary.com/journal/oa](http://wileyonlinelibrary.com/journal/oa).

### *Fishing grounds and possible procurement methods*

With the exception of its cartilaginous fish, the species spectrum of Op. U Period 4 reflects coastal and continental fisheries. Given the scarcity of specimens belonging to cartilaginous fish, their remains can reasonably be considered the products of chance catches or finds, rather than systematic and frequent exploitation. The other marine taxa variously live on shallow sandy bottoms (sea breams) and near rocky littorals (groupers and triggerfish), sometimes penetrating lagoons and estuaries (mulletts). All of these types of fish could be captured using rudimentary techniques involving a hook and a line or nets thrown from small boats. Today, solitary and slow fish such as the groupers are caught by recreational fishers using harpoons. Catfish occupy the lower, soft-bottomed and slower river courses, and like most of the marine fish represented in the assemblage, they can be captured using a hook and a line or using nets; in season, populations are so dense that they can easily be captured by hand.

### *Taphonomy and butchery*

Today, one of the most common methods of butchering large fish in the Mediterranean involves removing the head and the fins and preparing boneless fillets or small

cuts from the rest of the body. Medium-sized fish, on the other hand, are gutted and sold without the removal of the head from the body and commonly served whole. Several features in the assemblage from the Period 4 deposits of Op. U at Kinet indicate that the head bones were not discarded prior to the consumption of the flesh around them but that they were prepared further for the consumption of the meat-bearing parts.

Firstly, the butchery marks are distributed across the entire head region, from the lips to the gills and from the 'throat' to the pectoral fins. If the monger/butcher had aimed only at removing the head for immediate disposal, no marks would be expected around the lip area. Secondly, the butchery strokes appear to have come from both the medial and the lateral sides of the bones, indicating a procedure beyond dismantling the anterior body from the posterior. The medial strokes on the upper jaw (maxillae and premaxillae), lateral strokes on the lower jaw (dentary and articulare) and cuts on the gill area along a cranial-caudal axis all suggest an interest in the meat-bearing parts around these bones. Joining portions of chopped specimens from same loci confirm this idea. If the bones were fragmented to keep a certain portion and to get rid of the rest, one would expect them to be found in different refuse locations.

The presence of partial skeletons consisting largely of head elements without butchery marks in close association with disarticulated bones bearing butchery

marks also points to the food use of these parts. In addition, although the scarcity of neurocranial bones may result from their relatively fibrous texture, chopping the neurocrania into small pieces prior to consumption would certainly have accelerated the adverse effects of chemical and physical post-depositional processes on discarded bones. Zohar and Cooke's observations on fish processing among contemporary fish mongers in Panama indicate that neurocranial elements can be particularly prone to loss when certain techniques of fish processing for delayed consumption are applied (Zohar & Cooke, 1997). At Kinet, it seems that the anterior body, including the head, was chopped into small pieces and prepared as part of a single culinary item on the menu, sometimes including the flesh in the trunk region. In contemporary fishing villages in Pakistan, Belcher (2005) observed that fish larger than 25 cm are consumed in small pieces, but all parts are used in the same dish, in which case the cranial elements occasionally bear butchery marks.

Grouper meat is considered a delicacy in the Mediterranean, and like other popular seafood, its many parts can be prepared in numerous ways. The delicacy status of grouper meat in modern Mediterranean kitchen does not seem to stem from rarity of the individuals today because of overfishing but has a longer tradition based on its tastiness and size. According to textual sources, large solitary fish that live in rocky coastal waters were highly prized by the ancient Greeks, particularly the heads (Wilkins, 2000, pp. 18, 302). Davidson (1972, pp. 353) cites several recipes for grouper meat, including a fish soup from Bodrum (Turkey), preferably prepared with grouper heads. Again, Belcher (1998) provides an ethnographic analogy from Pakistan, where heads of large fish reserved normally for the commercial market are occasionally kept by the fisher family for special feasts. Today, heads and skeletons of imported salmon are traded in the Eminönü fish market in Istanbul to be used in soup (personal observation). A better analogy is provided by the cod, a staple component of North Atlantic cuisines. Before the development of modern food industries and the internationalisation of European cuisine, Northern Atlantic cookery exploited all parts of the cod, including the cheeks, the roe, the 'tongue' and even the bones, whether in dried, salted or fresh form (Kurlansky, 1997, pp. 238–256).

Preparation of these large fish for filleting can be another way of explaining the frequency of the sharp butchery marks in the area of the pectoral and pelvic skeleton, on the cleithrum and postcleithrum. Before filleting takes place, fish mongers commonly get rid of these bones and the fins attached to them, either by leaving them with the head as they behead the

carcass or by cutting them off prior to gutting (personal observation at the Istanbul fish market). In the Kinet case, the pectoral girdle seems to have been dissected in the middle, to become one of the many small pieces of flesh from the anterior body. Alternatively, both the head and the axial skeleton may have been turned into chunks of meat still containing bones, as opposed to fillets. Fillets or chunks, whatever is produced of the posterior body, may have been consumed in an entirely different culinary context from the flesh around the anterior body, which would explain the low representation of caudal vertebrae associated with the butchered bones in question.

Desse & Desse-Berset (1994) consider a ~55% elemental representation of axial body 'normal' at a Mesolithic context on Cyprus. The unusually low proportion of postcranial elements of groupers (12%) thus poses a challenge. Yet, the similarity between the body part distributions represented by the *Epinephelus* assemblages with and without butchery marks at Kinet suggests that it is not wise to build a straightforward relationship between the low proportion of the vertebrae and the abundant evidence for the butchering process.

Other species may also have been processed using the same formalised methods applied on the *Epinephelus*, although the evidence for this is scarce. The single *Clarias* cleithrum specimen bearing the same chop mark as the *Epinephelus* cleithra (see aforementioned text) suggests that medium and probably large catfish may have been disarticulated in a similar, but not identical manner. A resemblance between the chop marks on the cleithrae of *Epinephelus* and *Clarias* does not necessarily indicate that the processes involved in butchering *Clarias* matched those applied on *Epinephelus*. The cleithrae of *Epinephelus* and *Clariidae* are situated at different anatomical locations in these two taxa: the cleithrae of *Epinephelus* being positioned laterally and the cleithrae of the *Clarias* being positioned ventrally at the throat. The partial mugilid vertebral column with a butchered centrum implies that smaller fish were not excluded from the process, but a single specimen cannot determine whether the method copied the one used for large groupers. Although smaller individuals are poorly represented in the assemblage for reasons explained earlier, a deliberate preference for large fish can also be argued from the presence in this context of the largest catfish found at Kinet to date. Large fish must have been especially suited for whatever cultural activity required their butchering. Certainly, this makes sense if large numbers of individuals were to be fed, or if one fish were to be the sole source of protein for a group of people.

The mixed archaeological context of the fish assemblage does not allow any inference as to the actual location of processing or consumption. Op. U instead sampled the (preserved) edge of the settlement, where waste could be discarded inside and around decaying remnants of disused buildings. The assemblage's characteristics and find spot concur in identifying here a site of primary consumption waste deposition. On the basis of the scale and consistency of evidence for fish processing, two suggestions can be made as to the kind of consumption and discard pattern to which this waste belongs. The assemblage can record a single event or a short series of similar events related to banqueting. Alternatively, these finds may represent the communal waste for foodstuffs, including unwanted fish parts processed and redistributed by a specialised fish butcher.

Chronologically, as well as geographically, the closest ichthyoarchaeological evidence for processing is the exceptionally well-preserved fish cuts found still adhering to amphorae from a fifth century BC building in Corinth (Kaufman, 1979). Unfortunately, because detailed analysis of these fish remains from Corinth has not been conducted, not much else is known about them, apart from the fact that they are cuts from tuna and sea bream. This and other, less clear, archaeological evidence provide tangible proof for the significance of fish products and their trade in the fifth century BC Eastern Mediterranean area. In contrast, the Kinet assemblage suggests that local fish were systematically prepared and consumed on the site. The underrepresentation of grouper vertebrae is intriguing, but it does not constitute a strong challenge to this view.

## Conclusions

The find complex discussed in this paper is unique so far at Kinet and other coastal and inland settlements in the Eastern Mediterranean basin. The *Epinephelus* dominating the fifth century BC fish bone assemblage and the abundant primary evidence for the butchering of individuals larger than 60 cm in SL document a formalised method of processing fish on a large scale, either for mass consumption at a special event or for redistribution. The cultural status of these chopped pieces of fish head and trunks cannot be inferred from their context however. There is no evidence to decide, for instance, whether they supplied festive food for many consumers, whether they were considered delicacies or whether they fed the poor.

An argument for the relationship of this fish assemblage to the increasing textual and archaeological evidence for trade in fish products cannot be sustained

rightfully. Such caution may be attributed directly to the poor state of research in the region. Kinet's connection with the cultural web of the Eastern Mediterranean, including the Aegean, is well established by the second half of the sixth century BC. Textual and archaeological evidence for trade in fish products around the Mediterranean and beyond (in the Black Sea and Red Sea, e.g.) seems to increase around the fifth century BC (Mylona, 2008). At a slightly later date, for example, Kommos produced remains of imported catfish that were most likely shipped in from the Eastern Mediterranean (Rose, 2000). Within this chronological context, the circulation of influences in culinary practices could plausibly be argued, together with Kinet's direct involvement, as a coastal settlement, in the highly profitable trade in fish products. By the time of Period 4, Kinet would already have had some experience with the local production of commodities obtained from the sea, for trade not only within but also beyond the local community. Evidence for murex dye production during the seventh and the earlier half of the sixth century BC, for example, is a prominent feature of Kinet's cultural history (Gates, 1999a; Çakırlar, 2003). Yet, without the existence of substantial comparable data from contemporary coastal and inland sites, and from Kinet itself, these suggestions will have to remain speculative. In order to define the cultural-historical meaning of the fish bone assemblage from Kinet's Period 4 Op. U with accuracy, still more information is needed, both from Kinet Höyük and from other contemporary sites in the Eastern Mediterranean.

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