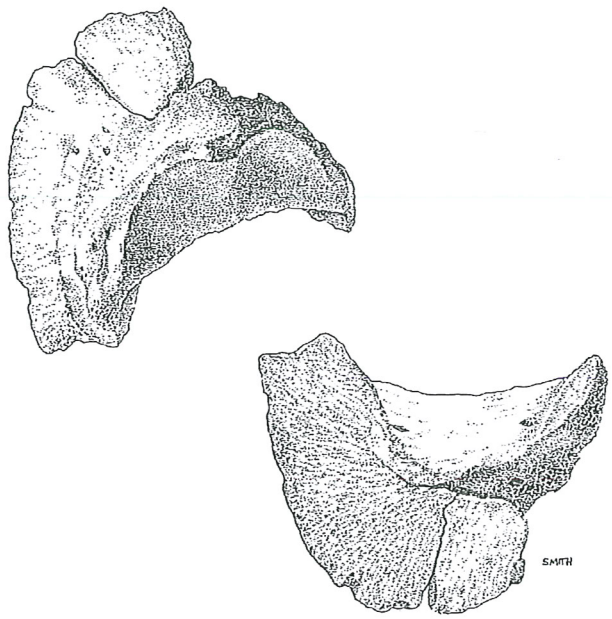
ARCHAEOZOOLOGY OF THE NEAR EAST III

Proceedings of the third international symposium on the archaeozoology of southwestern Asia and adjacent areas

edited by

H. Buitenhuis, L. Bartosiewicz and A.M. Choyke



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Cover illustration: Dorsal and palmar aspects of a
Bronze Age horse phalanx from Arslantepe, Turkey,
identified by Sándor Bökönyi.
Courtesy by the artist, Patricia Smith (Reduction: 64%).

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Preface

This publication is the result of the third international symposium on archaeozoology of southwestern Asia and adjacent areas, held in Budapest, Hungary from 2 - 5 September 1996. The editors would like to thank all colleagues of the Working Group who helped with the translation of abstracts. Financial support for the publication was given by the Acker Stratingh Stichting, Groningen, The Netherlands.

Participants of the 3rd ASWA Conference, Budapest 1996
(Photo: Péter Komjáthy, Aquincum Museum)

Standing, left to right: B. De Cupere (Belgium), G. Bar Oz (Israel), H. Buitenhuis (The Netherlands), R. Rabinovich (Israel), L. Leblanc (New Zealand), N. Benecke (Germany), H. Hongo (Japan), N. Russell (USA), J. Speth (USA), A. Patel (India), E. Stephan (Germany), C. Cavallo (The Netherlands), W. Van Neer (Belgium), A.T. Clason (The Netherlands), T. Dayan (Israel), L. Van Es (The Netherlands), C. Becker (Germany), R. Meadow (USA), M. Mashkour (France), F. Poplin (France), E. Vila (France), Mrs. Poplin (France), L. Bartosiewicz (Hungary), E. Pellé (France), P. Ducos (France).
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Participants not shown in picture: D. Carruthers (Great Britain), D. MacHugh (Ireland), S. Whitcher (Great Britain).

Contents

FISH REMAINS FROM THE NEW EXCAVATIONS AT TROY

Wim Van Neer[1] and Margarethe Uerpmann[2]

Resumé

Des restes de poissons trouvés lors des nouvelles fouilles à Troie ont été décrits et comparés à ceux des fouilles précédentes. Le lieu et la saison de capture des poissons sont discutés, ainsi que l'importance paléo-économique du poissons par rapport aux autres sources alimentaires. On observe des changements diachroniques dans la composition de l'ichthyofaune qui peuvent être mis en rapport avec l'évolution de l'environnement hydrographique.

Introduction

The fish bones dealt with in this paper are from the new excavations at Troy directed by M. Korfmann, University of Tübingen. Since 1988, yearly excavations have taken place in various parts of the ancient settlement of Troy, Ilion, or Hisarlik (the Turkish name of the site) covering nearly all previously known phases. Human presence at Troy is attested since the Early Bronze Age (ca 2900 BC) and continued until Roman and Byzantine times. Phases I, II and III belong to the Early Bronze Age, phases IV and V are Middle Bronze Age, and phases VI and VII Late Bronze Age. No animal remains have yet been studied from phase V and from the so-called Dark Ages of Troy, which separated the end of Troy VII from the Hellenistic period designated as Troy VIII. The Roman period is called Troy IX, while Troy X corresponds to the Byzantine phase. Preliminary results of the new excavations are regularly published in the journal *Studia Troica*.

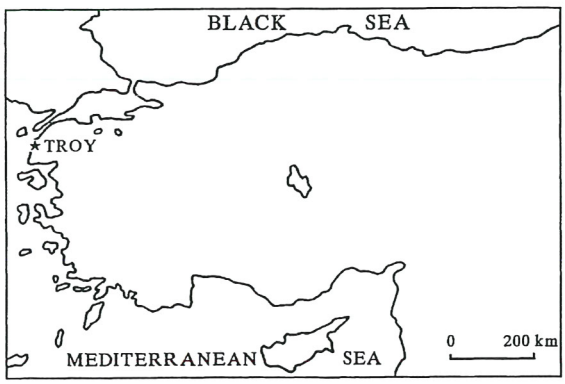

Figure 1. Location of Troy.

Physical setting of the site

Troy is situated in the northwestern part of Turkey at 5 km south of the Dardanelles and at 5 km east of the Aegean coast (Fig. 1). The settlement was founded on the western end of a spur which is part of a plateau of tertiary lime- and sandstone. West of the site, a large alluvial plain extends from the mesozoic limestone hills in the south northward to the Dardanelles. On its western side, the alluvial plain is separated from the Aegean shore by a low ridge of tertiary sandstones. Three to four kilometers north of the settlement, the rivers Karamenderes Cayi and Dümrek Cayi - *Scamander* and *Simois* in classical literature - form a delta before flowing into the sea at the western end of the Dardanelles. Dams have been built on both rivers in recent times. This, and a net of drainage ditches, have altered the marshy conditions of the alluvial plain which still existed in the first half of this century. Important natural changes in the landscape occurred as well over the last ten thousand years. Sedimentation of river alluvium and of some slope colluvium into the ancient embayment caused a northward movement of the shoreline

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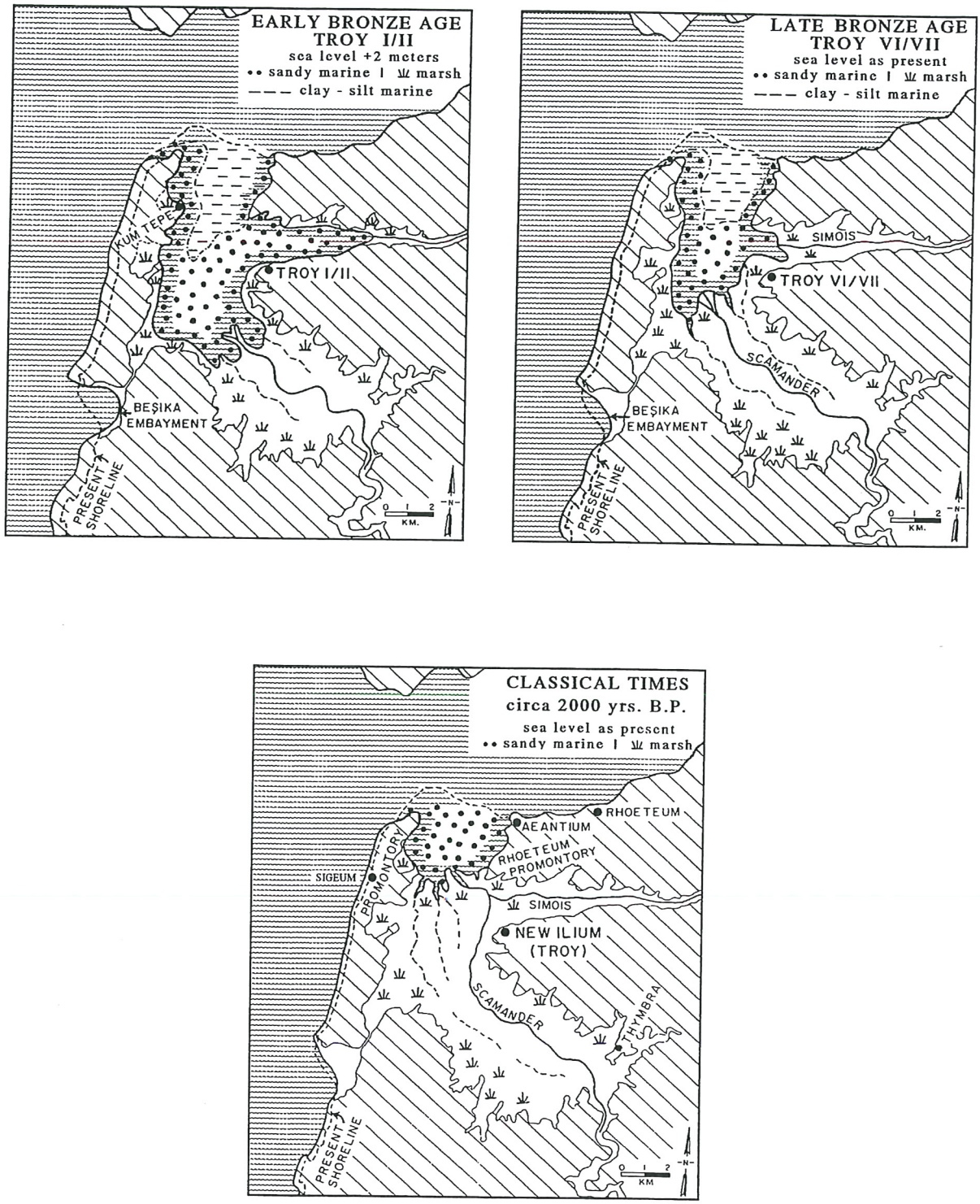

Figure 2. Changes in the hydrographic environment of Troy (after Kraft *et al.*, 1982).

and a reduction of the Scamander bay (Kraft *et al.*, 1982). The gradual changes during the different occupation phases of Troy are of major interest with regard to the localisation of the ancient harbour of Troy, as dealt with in Homer's Iliad (Fig. 2). Moreover, these data are useful for the interpretation of the former fishing grounds. The ancient Scamander bay provided a large area favourable for lagoon fishing, whereas to the north the bay provided access to the Dardanelles, close to the outlet to the Aegean Sea. Inshore coastal fishing was possible in those areas but the Trojans had also easy access to the more open parts of the Aegean. The Scamander bay reached as far inland as the site during the Early Bronze Age but the shoreline moved farther north later on. During Roman times, the walking distance to the shore of the bay increased to about 3 or 4 kilometers. Access to the site via the Scamander and Simois rivers may have remained possible with small boats. As the shoreline of the bay moved north, the rivers came into easier reach. Another favourable fishing ground may have been formed by the Besik embayment at the Aegean coast. The inner part of the Besik embayment was separated from the Aegean sea by a coastal bar which created a lagoon and a shallow marine environment. The lagoon must have been at its widest between 6500 and 5000 BP but as a result of subsequent lowering of the sea levels, it became gradually smaller later on (Kayan, 1991).

Material

Archaeozoological studies in Troy have been directed since 1990 by H-P. Uerpmann. Thus far, a first general report (Uerpmann et al., 1992), a preliminary report on the classical city (Fabiš, 1995) and a study on bird bones (Krönneck, 1995, 1996) have been published. The fish bones presented in this paper come from faunal assemblages treated between 1990 and 1995. These include contexts that were studied completely but also some assemblages which were only looked through for unusual finds, such as fish bones, because they came from locations with insecure stratigraphy. All the fish bones studied here represent hand-picked finds. Animal remains found during the processing of botanical samples could not yet be included in this report.

The total amount of fish bones dealt with here is 218, not including 20 vertebrae and other elements from a partial tuna skeleton found in anatomical position on top of the destruction layer of Troy VII in quadrant D9 (unit 901). The finds considered here come from all phases of the ancient settlement, except phases V and X, which have not yet been studied for their archaeozoology. Since the number of fish bones is small and the archaeological context of many finds extends over two or more phases, the specimens had to be assigned to fairly large spatial and chronological units. Grouping the fish bones according to features - houses, rooms, yards etc. - does not seem to be reasonable at this stage in the research, because there are hardly any complete units available. This is due to the fact that the earlier excavations, starting with those of Schliemann (1881, 1884) more than a hundred years ago, have already emptied many contexts. The new excavations started from the earlier trenches and have only recently exposed larger undisturbed areas from which more substantial bodies of material could be selected for future research. The small amount of fish bones prevents most subdivisions of the material because statistical evaluation of the finds becomes meaningless with only a handful of specimens from an individual context. An exception may be the quadrant E4/5, where the earth heap ('pinnacle') left by the excavations of Schliemann and Dörpfeld (Mansfeld, 1993) in the *megaron*-area has yielded a total of 55 fish remains, mainly from contexts of the phases Troy II and III with some Troy IV.

Table 1 gives an overview of the studied fish remains which were lumped according to the following broad archaeological units: Troy I-IV (Early and Middle Bronze Age, ca 2900-2000 BC), Troy VI and VII (Late Bronze Age, ca 1700-1000 BC), Troy VIII and IX (Classical Period, ca 350 BC - AD 500). Some additional bones, derived from a Roman destruction layer, comprise mixed material from phases VI to IX. In the following paragraphs the identified remains are described and some details are given on the distribution and habits of the species. This information is mainly compiled from Bauchot and Pras (1980) and Whitehead *et al.* (1984, 1986).

	I-IV	VI & VII	VIII & IX	VI-IX
shortfin mako (*Isurus oxyrinchus*)	-	1	-	-
angelshark (*Squatina squatina*)	4	1	-	-
unidentified sharks	8	-	2	1
rays (Rajidae)	-	1	-	-
eagle rays (Myliobatidae)	-	1	-	-
cownose ray (*Rhinoptera marginata*)	1	-	-	-
seabass (*Dicentrarchus* sp.)	-	3	2	-
horse-mackerel (*Trachurus* sp.)	-	-	1	-
meagre (*Argyrosomus regius*)	1	-	-	-
gilthead sea bream (*Sparus aurata*)	26	14	4	7
dentex (*Dentex* sp.)	-	-	1	-
Pagellus sp.	-	1	-	-
Sparidae indet.	3	3	-	-
parrotfish (*Sparisoma cretense*)	1	-	-	-
little tunny (*Euthynnus alletteratus*)	1	1	-	1
tuna (*Thunnus thynnus*)	16	18	5	37
unidentified thunnids (Thunninae)	1	2	-	-
mullets (Mugilidae)	13	8	-	2
scorpion fishes (Scorpaenidae)	-	1	-	-
gurnards (Triglidae)	1	-	-	-
wild carp (*Cyprinus carpio*)	-	1	-	-
asp (*Aspius aspius*)	-	-	1	-
Rutilus sp.	-	-	1	1
Leuciscus sp.	1	-	-	-
unidentified cyprinids (Cyprinidae)	-	2	4	-
European catfish (*Silurus glanis*)	-	-	1	-
total identified	77	58	22	49
unidentified bony fish (Osteichthyes indet.)	6	3	2	1

Table 1. Overview of the studied fish remains. I-IV = Early and Middle Bronze Ages (ca 2900 - 2000 BC); VI-VII= Late Bronze Age (ca 1700 - 1000 BC); VIII-IX= Classical Period (ca 350 BC - AD 500); VI-IX= mixture from a Roman destruction layer.

Cartilagenous fish are represented by at least 5 taxa. Among the shark remains one tooth was found which could be identified as a shortfin mako (*Isurus oxyrinchus*), almost 3 meters long. This species is epipelagic but sometimes occurs close to the shore. Several large shark individuals are represented by vertebral centra. The reconstructed total lengths vary between 1 and 3 meters.

Most of the specimens closely resemble the family Carcharhinidae but it was preferred to label them simply as 'large sharks' because of the incompleteness of the reference collection. Five vertebral centra show the typical dorso-ventral depression seen in the genus *Squatina* and were attributed to *Squatina squatina* on the basis of the present-day distribution patterns of the species in the Mediterranean. All angelsharks are bottom-living species which burrow in sand and gravel. A single vertebral centrum identified as Rajidae is from a specimen of 80-100 cm total length. All the members of this family are benthic. Two large fragments of toothplates could be attributed to two different ray taxa, on the basis of the shape and the arrangement of the pavement teeth (cf. van der Elst, 1988: 60-61; Wheeler and Jones, 1989: 83). One specimen corresponds to an eagle ray (Myliobatidae) of about 1 meter disc width, the other one is from a cownose ray (*Rhinoptera marginata*) of about 1.3 meter disc width. Two species of Myliobatidae occur in the Mediterranean:

the common eagle ray (*Myliobatis aquila*) and the bull ray (*Pteromylaeus bovinus*). Both species are semipelagic in warm temperate coastal waters. They are fairly abundant in shallow waters, often seen swimming at the surface. Their food is comprised of bottom-living crustaceans and molluscs. The habitat and food requirements of the cownose ray are similar to those of the eagle rays.

Most of the finds represent bony fish. Three dentaries, a hyomandibular and a preopercular of *Dicentrarchus* were found. The corresponding individuals had a standard length (SL) of 30-35 cm (2 specimens), 40-50 cm, 50-60 cm, and 60-70 cm. The European seabass (*Dicentrarchus labrax*) occurs over the whole Mediterranean and most of the Black Sea whereas the distribution of the spotted seabass (*Dicentrarchus punctatus*) is limited to the southern Mediterranean. Present-day landings from the Aegean part of Turkey (Cerig, 1986) would only include *Dicentrarchus labrax* but *D.punctatus* presently occurs along the southern coastline of Turkey as well (Whitehead *et al.*, 1986: 795). Both species could have lived near Troy if only a small shift in the distribution of *D. punctatus* had occurred. The preserved specimens do not allow species identification and are therefore labelled as *Dicentrarchus* sp. Both species are coastal fish preferring oxygen rich areas over rocky and sandy bottoms. They also enter rivers where they sometimes reproduce.

One caudal vertebra of a horse-mackerel (*Trachurus*) was found. It was not possible on the basis of this element to distinguish between the two species occurring in the Eastern Mediterranean today. *Trachurus mediterraneus* and *T. trachurus* are primarily benthopelagic fishes; they usually live near the bottom but can also be pelagic or live near the surface. They often form large shoals. Horse-mackerels contribute significantly to the present-day landings in the Aegaen part of Turkey (Cerig, 1986).

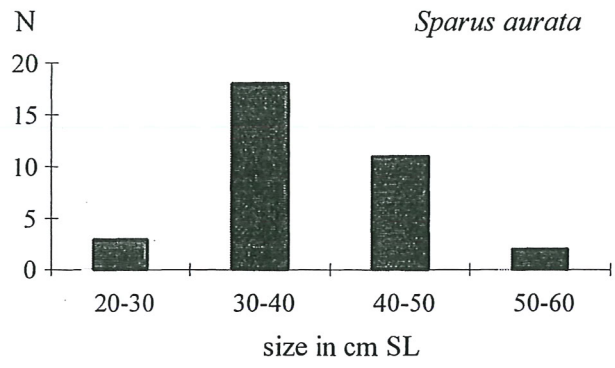

Figure 3. Size reconstructions of *Sparus aurata* based on premaxillars and dentaries.

The meagre (*Argyrosomus regius*) is represented by a first vertebra from an individual measuring 70-80 cm SL. This species prefers coastal waters and enters estuaries and coastal lagoons. It congregates inshore during the spawning season which lasts from May to August in Turkish waters.

The sparids are well represented in all the assemblages studied here. Probably as a result of the sampling techniques there is an overrepresentation of diagnostic elements such as dentaries and premaxillars. *Sparus aurata* is the most abundant species; size reconstructions based on dentaries and premaxillars are given in Figure 3. The guilt-head seabream is a littoral species living over sandy bottoms and on *Posidonia* beds; these occur in estuaries.

One *Dentex* premaxilla of an individual measuring 35-40 cm SL could not be identified beyond genus level. Four species of *Dentex* with similar habitat preferences occur in the Eastern Mediterranean; they all live in inshore waters on various bottoms. Juveniles are littoral but adults also come closer to the shore for reproduction. They are basically benthic species which can, however, pursue their prey to the surface. The genus *Pagellus* is represented by a premaxilla of an individual of 20-25 cm SL. Four species of *Pagellus* occur in the Mediterranean of which only the axillary seabream (*Pagellus acarne*) and the common pandora (*P. erythrinus*) live in the eastern part. Both species are gregarious and live in inshore waters over various bottoms.

The parrotfish (*Sparisoma cretense*) is represented by a caudal vertebra of an individual measuring 30-35 cm SL. This species, which is typical of shallow waters on rocky and sandy shores, is of little economic importance today.

Two taxa could be identified among the scombrid bones. Three caudal vertebrae belong to the little tunny (*Euthynnus alletteratus*). Two of these vertebrae were from individuals between 70-80 cm SL, and one was from a smaller specimen of 40-50 cm. The haemal arches of the little tunny differ from those of the genus *Thunnus* in that the transverse processes fuse directly under the vertebral centrum (cf. Fig. 94b in Lepiksaar, 1995). The vertebrae of *Thunnus* differ not only morphologically but are also of larger size. Using the comparative specimens of the Royal Museum of Central Africa and the University of Tübingen size reconstructions were attempted. One Troy specimen is from an individual of 70-80 cm SL but all the others are from fish larger than 1 meter. The size reconstructions of the large specimens were hampered by the absence in the reference collections of very large tuna skeletons. The largest comparative specimen at our disposal was 155 cm SL and was used as a standard. It appears that 7 specimens were a little smaller than 1.5 m, 13 were more or less 1.5 m, whereas the remaining 23 specimens were clearly larger. Some less diagnostic pieces such as pterygiophores, finrays and ribs have also been attributed to tuna on the basis of the large size. Two tuna species occur in the Mediterranean. The albacore (*Thunnus alalunga*) occurs in the northern part of the eastern Mediterranean including the Aegean but not the Black Sea, whereas the bluefin tuna (*Thunnus thynnus*) is found everywhere in the Mediterranean and in the southern part of the Black Sea. The albacore seems to be less common in the Mediterranean and fishery statistics from Turkey only mention the bluefin tuna (Cerig, 1986). Large albacore are rare in the Mediterranean; the majority of the catch is made up of individuals between 50 and 100 cm fork length (De Metrio et al., 1989; Di Natale, 1991). Since most of the tunas found at Troy are over 1 m long, it is likely that these remains mainly represent *Thunnus thynnus*. Tunas are epipelagic and mesopelagic fish which migrate over long distances. Their migrations bring them regularly close to the shore. They are gregarious especially during reproduction. The little tunny is also a schooling fish but is less migratory than larger species of tunas. It comes rather close to the shore.

Except for three hyomandibulars and one opercular, the mullets are only represented by vertebrae. Most of the specimens are derived from relatively large fish with a standard length between 30 and 50 cm. Six species of Mugilidae have been reported from the eastern Mediterranean. They are all pelagic fish which usually live in schools in coastal waters. All but one of the species enter lagoons and estuaries for feeding where they can form residential populations.

The family of the scorpionfishes (Scorpaenidae) is represented by a palatine of an individual measuring 30-40 cm SL. These bottom-living fishes occur mainly inshore around rocks, coral reefs and seaweeds but some species prefer sandy or muddy bottoms. Taking into account the present-day distribution and abundance of the different species in the eastern Mediterranean it is likely that the specimen found at Troy represents a *Scorpaena*.

A neurocranial fragment could be identified as a gurnard (Triglidae) of 20-30 cm SL. This family is represented in the eastern Mediterranean by six species which live mainly on sandy bottoms of the continental and insular shelves. Certain species such as *Trigla lucerna* can penetrate estuaries.

Freshwater fish form only a small portion of the ichthyofauna identified from Troy. The wild carp (*Cyprinus carpio*) is represented by a dentary of a specimen of 30-40 cm SL. This species lives in slow-running rivers such as the Scamander (Karamenderes Çayi) and the Simois (Dümrek Çayi). It is a euryhaline species that can tolerate rather high salinities and therefore can occur close to the coast. The asp (*Aspius aspius*) is represented by a pharyngeal bone of an individual measuring 40-50 cm SL. This fish occurs mainly in the middle reaches of rivers but is also found in brackish water of estuaries (Maitland, 1978). Two pharyngeal bones were identified as *Rutilus* sp. *Rutilus rutilus* and *Rutilus rubilio* can occur in the region according to the distribution maps given by Kuru (1980). *Rutilus rutilus* is sometimes found in estuaries but no data on the salinity tolerance of the other species are available. It was not possible to identify the basioccipital fragment of a *Leuciscus* to species; *Leuciscus cephalus* but *L.borysthenicus* also occur in the region (Kuru, 1980). Like the other cyprinids found at Troy, also *Leuciscus cephalus* sometimes occurs in brackish water. The European catfish (*Silurus glanis*) is represented by a single caudal vertebra of an individual of 70-80 cm SL. This species lives in the lower reaches of large rivers and may occur in brackish water.

Discussion

The fish species and their place of capture

No detailed accounts have been given of the fish fauna found during the earlier excavations at Troy but bluefin tuna, shark, shark or ray, and small fish are mentioned (Schliemann, 1881: 360, 364). Gejvall (1938, 1939) studied the fish remains recovered during the University of Cincinnati excavations directed by Blegen. In the final site report (Blegen *et al.*, 1950-1958) fish are only briefly mentioned in the description of each deposit. Rose (1994: 380) critically revised these old data and concludes that it is best to treat the information as a partial species list, including a ray species, possibly a shark species, possibly Sparidae, and bluefin tuna. The new material that has become available could be studied with the aid of a comparative collection which is superior in number of species and number of specimens, compared to what was available at the end of last century and the first half of this century when archaeo-ichthyology was still poorly developed. Despite the small sample size, the assemblage from the new excavations allowed the identification of at least 21 taxa. Using the habitat preferences of the species an attempt could be made to reconstruct the fishing grounds that were exploited in former times.

As already mentioned in the introduction, the inhabitants of Troy had access to several good fishing grounds close to the settlement. Fishing in the estuaries of the Scamander and Simois rivers is indicated by the few finds of cyprinids and European catfish. These freshwater fish have a high salinity tolerance and may seasonally have had different distributions. The greater influx of freshwater during the winter months may have allowed them to enter the Scamander bay. This environment may, however, have been too saline during summer for carp and European catfish forcing them to migrate upstream. Besides these inland fish, it is likely that some of the marine species were also captured in the estuaries of the Scamander and Simois. The well-represented gilthead seabream and the mullets are known to regularly enter rivermouths. The seabass and meagre were possibly also captured here. The marine embayment (the Scamander bay) also must have been a favourable, more or less protected fishing area. The aforementioned, euryhaline, marine fish may have been captured in this lagoon which may have formed a suitable spawning ground. Stenohaline marine fish (not supporting low salinity) may have been more abundant here during summer when the water discharge of the rivers was lower. The Besik embayment, farther away from the site at the west, may have been another good area for lagoon fishing. Its waters were relatively shallow and also, more or less, protected from the sea. Fish remains found at the nearby settlement of Besiktepe (von den Driesch and Boessneck, 1984; Boessneck, 1986) include 17 bones of *Thunnus thynnus*, one of *Argyrosomus regius* and one of *Sparus aurata*. The latter two were most probably captured in the Besik bay, although this is impossible to prove. It is clear that it is not possible to decide whether the lagoonal species found at Hisarlik come from the Scamander lagoon or from the Besik embayment. The former being larger and located closer to the site, it is supposed that most of the lagoon species came from the Scamander bay. With boats, the Trojans had access to the Dardanelles and, at a few kilometers to the west, to the Aegean Sea. Here, inshore coastal fishing may have yielded species such as the angelshark (*Squatina squatina*), eagle rays (Myliobatidae), cownose ray (*Rhinoptera marginata*), and parrotfish (*Sparisoma cretense*). In the more open waters, large pelagic migratory fishery may also have been practised as shown by the bones from bluefin tuna, little tunny and large shark species such as *Isurus oxyrhinchus*. It should be emphasized, however, that during their seasonal migrations, schools of tuna may pass rather close to the shore (see below).

We have lumped the species found at the site into four broad categories, using their habitat preferences. The 'continental fish' comprise the cyprinids and *Silurus glanis*, the 'coastal, possibly estuarine' fish are the euryhaline species which are known to inhabit lagoons and to occasionally enter rivers. This group consists of the following species found at Troy: gilthead seabream (*Sparus aurata*), mullets (Mugilidae), seabass (*Dicentrarchus* sp.), and meagre (*Argyrosomus regius*). The former two fish taxa seem to be typical, more or less residential inhabitants of lagoons, occurring in large numbers. The 'coastal, probably not estuarine' fish comprise the following more stenohaline

species which were probably captured inshore: angelshark (*Squatina squatina*), eagle rays (Myliobatidae), cownose ray (*Rhinoptera marginata*) and parrotfish (*Sparisoma cretense*). We also included in this category the horse-mackerel (*Trachurus* sp.), the scorpionfish (Scorpaenidae), the gurnard (Triglidae) and two sparids (*Dentex* sp. and *Pagellus* sp.). These fish have been reported from lagoons as well but do not seem to occur there very frequently or in large numbers (Kiener, 1985). A final category are the 'pelagic, occasionally coastal fish' with the bluefin tuna, little tunny and large sharks. Figure 4 shows the relative importance of each group in the different chronological units. The remains from the Roman destruction phase have not been included because they constitute a mixture of Late Bronze Age and Classical material. Compared to the other assemblages, it comprises mainly tuna remains. It is not clear if this has an archaeological meaning or if it is simply an indication that sampling was less precise in this context.

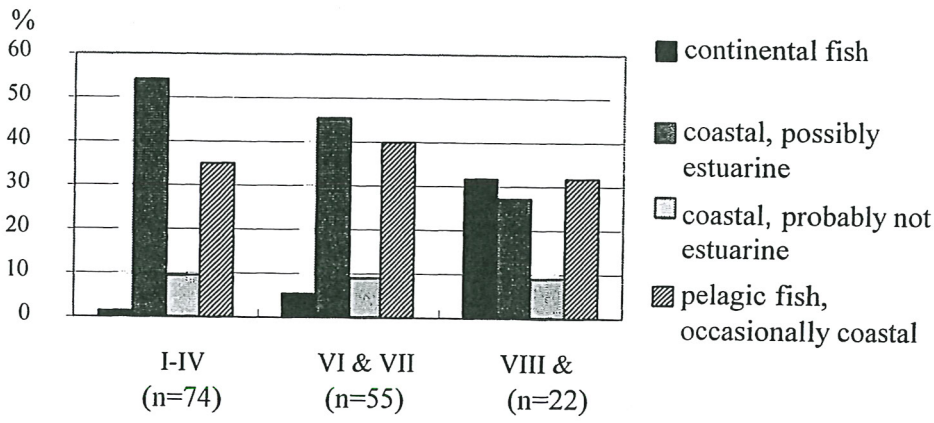

Figure 4. Relative importance of different fish groups through time

The graph (Fig. 4) shows certain trends which possibly reflect the changes through time in the physical environment. The contribution of continental fish increases with time, whereas there is a decrease in the species believed to have been captured in the lagoon. These trends are possibly related to the delta-floodplain progradation and alluviation which resulted in the lagoon becoming smaller and, at the same time, the river beds coming closer to Hisarlik. No significant changes seem to occur in the contribution of the marine coastal fishes and of the larger pelagic species. This hypothesis is based on relatively small samples and should, therefore, be further tested in the future.

Fish as a food resource at Troy

Fish bones represent a minor part of the animal remains throughout the different phases and excavation areas of Troy. Their relative abundance ranges from 0 to 1.7% of the total number of identifiable bones. The differences between phases are not significant and no correlation is seen with the changing distance of the site to the shore of the Scamander bay. Possibly, small shifts in the importance and selection of fish occurred in different areas and at different times which slightly influenced the amount of fish bones but the observed proportions may as well result from the local soil conditions and the contexts in which the bones were found. Moreover, at sites like Troy the composition of the finds can be influenced by the many different excavators, recovery techniques, available time, care and skill of the workmen and trench supervisors, and by other factors related to the excavation itself. Nevertheless, one can speculate whether the higher amount of fish bones from the 'pinnacle' (excavation area E4/5), combined with its predominance of one species (*Sparus aurata*), is a characteristic feature or an aleatory result. In any case, the 'pinnacle' is the only area

where the new excavations have come across a context that can be related to some extent with the most important remark of Schliemann concerning the occurrence of fish remains at Troy. When he writes about the 'third or the burnt city' he mentions many fish remains, especially 'accumulations of fish scales, little spines and vertebrae of percoids in hand-thick layers' (Schliemann, 1881: 360). The new excavations did not come across any such context, which would certainly not have been overlooked. It seems that concentrations of fish remains like the ones described by Schliemann are not a regular phenomenon at Troy but that they must represent special depositional contexts. These finds do not seem to represent normal kitchen refuse. The assumption that Schliemann's rich finds of fish from Troy II-III are rather an exception, is supported by remarks of Virchow (Schliemann, 1884: 355) concerning other finds of the older excavations. They refer to Troy I ('urälteste Stadt') where Virchow writes about the minor importance of fishing and hunting in the economy of the early Trojans. As long as there are no watersieved samples from Troy, we must remain in the field of speculation when dealing with the probable contribution of fish to the diet. Despite the fact that the evidence is limited to hand-picked material, it seems nevertheless reasonable to state that fishing was always of secondary importance compared to animal husbandry and agriculture. A similar conclusion was reached in a detailed survey of Bronze Age sites (including sites where sieving was practised) along the Aegean coast (Rose, 1994: 404, 415).

The importance of tuna at Troy

Already during the first excavations at Troy, remains of bluefin tuna (*Thunnus thynnus*) were found and identified (Schliemann, 1881: 360, 364). Tuna remains were also mentioned from the Blegen excavations at Troy (Gejvall, 1938, 1939; Blegen et al. 1950-1958) and from the work at nearby Besiktepe (von den Driesch and Boessneck, 1984; Boessneck, 1986). In all instances the bluefin tuna was a common species which led to an overestimation of its economic importance. As a result of their large size, tuna bones have better recovery chances than most other Mediterranean species. Their frequent occurrence and their preponderance in many hand-picked samples no doubt is a result of sampling bias. Moreover, differential preservation may have resulted in an overrepresentation of tuna as well. Similar high occurrences of bluefin tuna have been noted at prehistoric sites elsewhere in the Aegean (for a review see Rose, 1994) which led several authors to suggest that tuna were a major food resource for prehistoric Aegean cultures. Bintliff (1977) linked early seafaring, trade and seasonal pursuit of tuna in the Aegean, whereas Mee (1978, 1984) suggested that Late Bronze Age tuna fishing was related to Mycenaean trade and possibly to the start of the Trojan war. Troy, which is located along the narrow strait of the Dardanelles, would have been an ideal place for the seasonal capture of tuna migrating between the Aegean Sea and the Black Sea. According to Mee (1978, 1984) tuna migrate to the Black Sea in May and June, and return between 22nd September and 22nd October. The predictability of these migrations would have allowed extensive netting in the Dardanelles. The ichthyological literature does not seem to support the reliability of the migration periods and the constant trajectories that would be followed by tuna. Modern data on the migrations, distribution and abundance of tuna are rather scarce for the Northern Aegean, and especially for the Sea of Marmara and the Black Sea. This is partly due to the low market demand and the lack of suitable fishing techniques in the area, a situation which has changed only in the late 1980's by the increased Japanese export demand. Oray (1994) mentions that bluefin tuna fishing in the Turkish part of the northern Aegean starts around the end of August, whereafter the fish migrate further southwards. Migrations from the Aegean to the Black Sea would take place between April and September, whereas the return to the Aegean would occur between September and December (Atay, 1994: 92). Nowhere in the literature was an indication found, that the time or the trajectories of tuna migrations were predictable with great precision as was suggested by Mee (1978, 1984). Tuna fishing is practised in the Dardanelles today but no details on when this happens are available: the region of Çanakkale at about 20 km northeast of Troy is mentioned as a place where tuna fishing is practised with multiple hooks (Hossucu, 1991: 220).

The large size and elevated weight of adult bluefin tuna may give a false idea of the economic importance of the species. The bluefin tuna represents today only 1.5% of the total fish production of the Mediterranean and Black Sea (Stamatopoulos, 1993: 8). Inshore coastal fishing and fishing for small pelagic fish form the major part of fish production today. The first type of fishing can be practised with small boats and it is likely that also at Troy the overall yield of this kind of artisanal fishing was higher than the seasonal capture of tuna. Fishing in coastal waters of the Dardanelles may have been practised all year round and, seasonally, migrating tuna may have been captured. The evidence available thus far from Troy, seems to indicate that fishing may have been a year round activity in the rivers and in the lagoon. Cyprinids and catfish were probably of minor importance but the residential lagoonal species such as *Sparus aurata*, mullets and *Dicentrarchus* probably constituted a reliable food resource throughout the year.

A similar case of overestimation of the economic importance of tuna has been reported by Morales (1993) who recently made a survey of the tuna remains found at Iberian sites. According to the archaeological literature, bluefin tuna was supposed to have played a major role in the economy of the Iberian sites, especially those located near the Strait of Gibraltar where migrating fish would have been easily captured. The number of bones actually found in excavations is much lower than was expected from the numerous considerations in the archaeological and classical literature and tuna does not seem to have been the reason for Phoenician colonisation and the origin of the fish-processing industry in the area.

Conclusion

The small sample of hand-picked fish remains from the new excavations has allowed us to enlarge the number of fish species known to have been exploited at Troy. The view that the Trojans were mainly interested in tuna fishing had to be abandoned. The material found thus far indicates that the rivers and the Scamander lagoon were the major fishing grounds exploited by the inhabitants. Coastal fishing in the Dardanelles occurred probably to a lesser extent, and tuna fishing was a seasonal activity. No biological data are available to support the previous hypotheses that the time and the trajectories of the tuna migrations were predictable with great precision. The overall contribution of tuna, and of fish in general, to the diet at Troy was small in comparison to animal husbandry and agriculture. No changes are seen through time in the type of fish that were captured. However, a shift seems to occur in the relative abundance of river fish and species supposed to have been captured in the lagoon. Numbers of lagoonal species decrease whereas river species become more abundant in younger levels. This is probably related to the reduction of the surface of the lagoon.

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