The Middle Stone Age Fish Fauna from the Klasies River main site, South Africa

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ABSTRACT
The fish bone sample reported here was excavated between 1984 and 1988 from the Late Pleistocene main site at Klasies River. At least 82 species from 47 fish families were identified. The majority of the assemblage is made up of vertebrae of small fish of the size class ranging from 15 to 25 cm in total length. Some 78% of the fish identified to species or genus level are intertidal or estuarine fishes. The involvement of humans as opposed to birds or other animals in creating the fish bone accumulations in the Klasies River deposits was investigated, and the possible contribution of humans to this accumulation was found to be more significant than previously supposed.

KEY WORDS
Klasies River,
Late Pleistocene,
fish fauna,
fishing.

RÉSUMÉ
L'ichtyofaune du Paléolithique moyen du site principal de Klasies River, Afrique du Sud.
L'échantillon de restes de poissons décrit ici provient du site principal du Paléolithique moyen de Klasies River, fouillé entre 1984 et 1988. Quelque 82 espèces appartenant à 47 familles ont été identifiées. La majorité de l'assemblage est constituée de vertèbres de petits poissons de longueur totale variant de 15 à 25 cm. Environ 78 % des poissons identifiés au rang de l'espèce ou du genre sont des poissons de zone intertidale ou d'estuaire. On s'est interrogé sur l'implication des hommes, par opposition aux oiseaux ou à d'autres animaux, dans la constitution des accumulations des restes de poisson dans les dépôts de Klasies, et il apparaît que la possible contribution humaine est plus importante que ce que l'on supposait.

MOTS CLÉS
Klasies River,
Paléolithique moyen,
ichtyofaune,
pêche.

INTRODUCTION

Klasies River, situated on the Tsitsikamma coast (eastern Cape) near the modern town of Humansdorp and some 120 km west of Port Elizabeth, is one of the better-known Late Pleistocene archaeological sites in South Africa (Fig. 1). The locality includes several cave systems and the so-called "main site", approximately 0.5 km east of the mouth of the Klasies River. It is the most impressive and important (Fig. 2) in being a 20 m sequence of well-stratified deposits dating between 120 000 and 60 000 years ago. Human remains, among the oldest modern or near-modern humans, have been found there together with artefacts, animal bones and shells (Deacon & Geleijnse 1988: 5).

Singer and Wymer (1982) carried out the first archaeological excavations in 1967 and 1968. In 1984, Deacon (1995) initiated a re-investigation of the site that has continued over the subsequent years. Recent reviews of the history of the excavation, the historical importance of the site, and the literature resulting from studies there are given in Wurz (2000, 2002). In particular zoological investigations of the large mammal fauna from the older excavations can be found in Klein (1976) and Binford (1984) and from the more recent excavations in Van Pletzen (2000). Avery (1987) studied the small mammal fauna.

This paper deals with the ichthyo-archaeological remains excavated between 1984 and 1988. The aim of this investigation has been to identify the different fish species present, to establish fish sizes, to study changes in the frequencies of the various fish families or groups through time and also importantly to try to answer the question of whether the fish bones deposited in the shelters were brought there by humans or by animals.

MODERN ENVIRONMENT

The Tsitsikamma coast is noteworthy for the large variety of fish species that are found there and its many endemic forms. In the 1960s a National Park was established along part of this coast and this has aided both in the conservation of the diversity of the fish fauna and in encouraging research into the species that occur here. The shoreline of the Park and much of the coast extending eastwards to the Klasies River is exceptional in being a narrow discontinuous stripe at the base of an almost unbroken line of cliffs facing a long stretch of completely open sea. Larger and smaller rocky spurs separated by sandy beaches are found along this high-energy coast that is buffeted by strong winds and heavy seas particularly the winter. This setting contributes to the diversity of the fish fauna recorded.

Outside the confines of the Park and along the whole coast, sport fishing from the beaches and rocks is a popular and competitive pastime. The most popular angling species are galjoen, *Coracinus capensis*, kob, *Argyrosomus hololepidotus*, elf, *Pomatomus saltatrix*, White musselcracker, *Sparodon durbanensis*, hottentot, *Pachymetopon grande*, dageraad, *Chrysoblephus cristiceps*, roman, *Chrysoblephus laticeps*, Miss Lucy, *Chrysoblephus gibbiceps*, poenskop, *Cymatoceps nasutus*, copper steenbras, *Petrus rupestris*, and carpenter, *Argyrozona argyrozona* (Bruton 1988: 451). Interestingly, smaller fish, like klipfishes (Clinidae) are caught with baited hook.

The profile of the Klasies River is very steep and the river descends by a series of waterfalls from the level of the coastal platform forming the cliffs to sea level. The first waterfall on the seaward side is about 0.5 km from the coast. The river enters the sea through a narrow gorge. It is a blind river mouth, cut off from the sea by a sandbar. The river mouth is not normally open to the sea. The area of the estuary is very restricted at present sea levels but may have been more extensive under conditions of lower sea levels in the past. It is possible that in the past the estuary was even closer to the main site and that there was a lagoon at the back of a barrier dune cordon or cordons.

There are near-shore rocky outcrops or stacks forming small islands, where seabirds, mainly cormorants (Fig. 3), can rest and let their feathers dry after diving for food. During a visit to the site in August of 1989 two species of cormorants, the

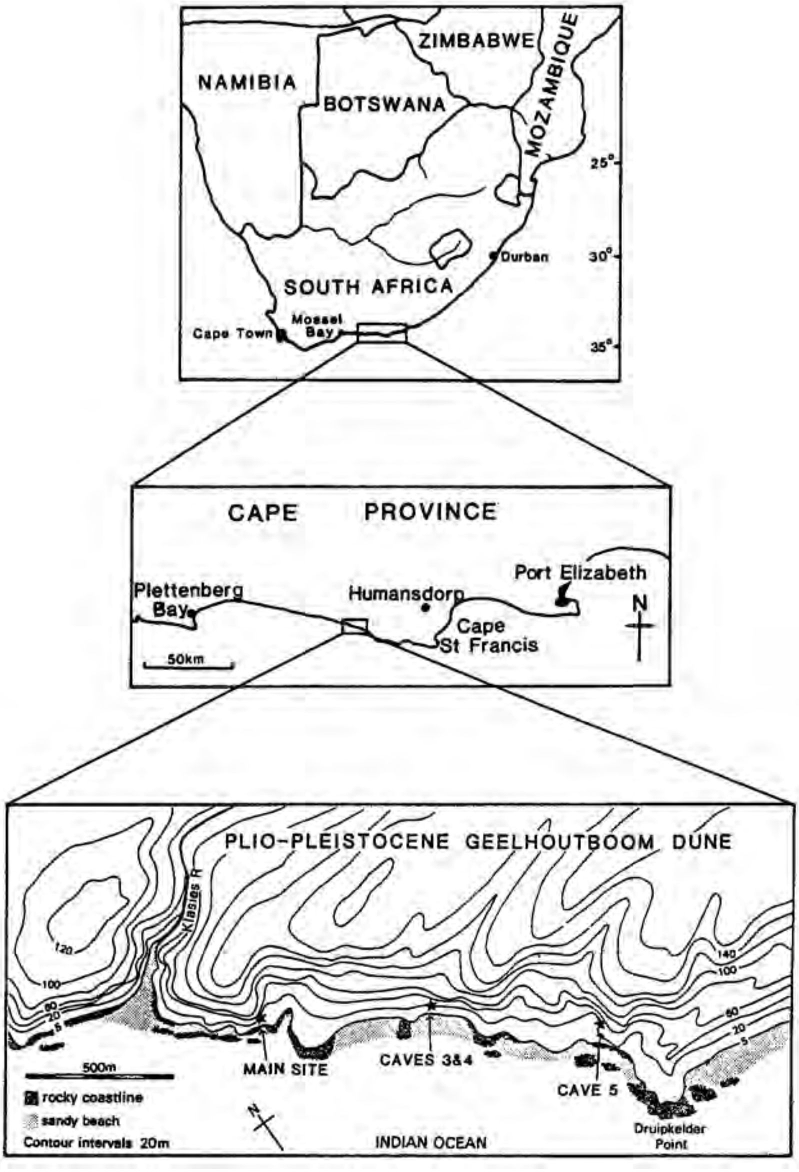

FIG. 1. – Geographic location of the Klasies River sites (Deacon & Geleijnse 1988: fig. 1).

Cape cormorant, *Phalacrocorax capensis*, and the white-breasted cormorant, *Phalacrocorax carbo,* were observed as well as the oystercatcher, *Haematopus* sp., kelp gull, *Larus dominicanus*, greyheaded gull, *Larus cirrocephalus*, and the large yellow-billed swift tern, *Sterna bergii*. During storm periods when the seas are rough, birds vacate the safe of the near-shore stacks and take shelter against the cliff above main site. The two cormorant species seem to be the only birds that regurgitate the pellets of food waste, mainly fish bone, and these pellets accumulate on the site. It was possible to collect a sample of modern pellets from the surface of main site for comparison with

FIG. 2. – General view of Klasies River main site from the south (photograph from Deacon).

materials obtained by excavation from the site (Table 1).
As can be seen from Table 1, most of the fish identified from the pellets are small, measuring less than 15 cm and often less than 10 cm in total length. Fish is the main and sometimes the only component of the cormorant's diet. From studies of the modern cormorant, it is known that the prey eaten at a particular site can comprise a large number of species, but generally opportunism leads the birds to take mainly the most abundant and available small species, and preferably slow-moving ones (Orta 1992: 331). Recent investigation of the feeding behaviour of *Phalacrocorax carbo* on the Danube revealed that the largest fish specimen caught by this bird species measured 35 cm in length (Schratter & Trauttmansdorff 1993). From South Africa it is reported that the great cormorant eats long, thin fish such as eels up to 60 cm long (Orta 1992: 332). Lengths of 60 cm and even 35 cm are certainly too large for the smaller, more common *Phalacrocorax capensis*, but individuals up to 20 cm long are said to be taken. From the fish sizes identified in the pellets (Table 1), one gains the impression that the cormorants prefer small fish which can be swallowed more easily, although there are certainly exceptions.

THE DIFFERENT SQUARES AND THEIR DATING

In Klasies River sequence three main chronological units can be distinguished (Shackleton 1982):
1. The Upper member, is the youngest deposit and dates beyond the range of radiocarbon or older than 50 000 years. The Upper member includes the layers containing the typologically distinctive artefacts of the "Howiesons Poort" and the MSA lll sub-stages. An age close to 70 000 years (Deacon 1992) is widely accepted. Recent uranium

FIG. 3. – White breasted or great cormorant, *Phalacrocorax carbo*, sitting on a rock in the surf zone of Klasies River (photograph by the author).

TABLE 1. – Fish and other animal groups present in the regurgitated pellets of cormorants collected in 1989 at Klasies River main site.

Sample	Fish taxa identified	Others	% vertebrae	Remarks	Fish size (length in cm)
1	Serranidae Cheilodactylidae Gobiesociedae	Molluscs Sea urchin	60	heavily digested	all less than 15, most less than 10
2	*Galeichthys feliceps* (1) Clinidae (several)		59,5	slightly digested	1 = 20, rest less than 12
3	*Acanthistius sebastoides* (4 Ind.)		49	heavily digested	all less than 15
4	Serranidae Clinidae (several Ind.)	Crustacea	52	heavily digested	15, less than 10
5	Serranidae (1 Ind.) Clinidae	Crustacea Sea urchin	60	heavily digested	mostly less than 10
6	Clinidae (several Ind.)	Crustacea	62,5	digested	less than 12, some under 5
7	*Galeichthys feliceps* (1) Clinidae	Molluscs	65,8	digested	18, less than 10
8	Serranidae Mullidae Gobiesocidae	Crustacea	53,5	heavily digested	less than 15, most less than 10
9	*Acanthistius seba- stoides* (1 Ind.)	Crustacea	54,8	digested	less than 15, most less than 10
10	Serranidae, *Spondyliosoma emarginatum* (1 Ind.)		36,2	heavily digested	18, rest less than 10

TABLE 2. – Statistical data on the fish bone material.

Square	Member	Osteichthyes	Chondrichthyes	Vertebrae	Non-Vertebrae	Identified	Unidentified	Total
E50	Upper	2545	312	2799	58	1548	1309	**2857**
%		*89.1*	*10.9*	*98.0*	*2.0*	*54.2*	*45.8*	*100*
H51	Upper	1294	243	1505	32	820	717	**1537**
%		*84.2*	*15.8*	*97.9*	*2.1*	*53.4*	*46.6*	*100*
J51	Upper	1250	155	1283	122	909	496	**1405**
%		*89.0*	*11.0*	*91.3*	*8.7*	*64.7*	*35.3*	*100*
O50	SAS up.	303	38	309	32	191	150	**341**
%		*88.9*	*11.1*	*90.6*	*9.4*	*56.0*	*44.0*	*100*
T50	SAS up.	44	3	36	11	32	15	**47**
%		*93.6*	*6.4*	*76.5*	*23.4*	*68.1*	*31.9*	*100*
T51	SAS up.	322	10	312	20	196	136	**332**
%		*97.0*	*3.0*	*94.0*	*6.0*	*59.0*	*41.0*	*100*
J48/K48	SAS up.	19	1	19	1	19	1	**20**
%		*95.0*	*5.0*	*95.0*	*5.0*	*95.0*	*5.0*	*100*
T50	SAS lo.	16	3	15	4	17	2	**19**
%		*84.2*	*15.8*	*78.9*	*21.1*	*89.5*	*10.5*	*100*
Z44	SAS lo.	54	3	55	2	19	38	**57**
%		*94.7*	*5.3*	*96.5*	*3.5*	*33.3*	*66.7*	*100*
Y45	SAS lo.	273	24	232	65	129	168	**297**
%		*91.9*	*8.1*	*78.1*	*21.9*	*34.4*	*56.6*	*100*
PP38	SAS	789	34	687	136	391	432	**823**
%		*95.9*	*4.1*	*83.5*	*16.5*	*47.5*	*52.5*	*100*
M50	SAS	1183	179	1333	29	921	441	**1362**
%	*Test c.*	*86.9*	*13.1*	*97.9*	*2.1*	*67.6*	*32.4*	*100*
N51	SAS	499	28	486	41	276	251	**527**
%	*Test c.*	*94.7*	*5.3*	*92.2*	*7.8*	*52.4*	*47.6*	*100*
Q52	SAS	132	15	77	70	119	28	**147**
%	*Test c.*	*89.8*	*10.2*	*52.4*	*47.6*	*81.0*	*19.0*	*100*
Z44	LBS	599	10	485	124	308	301	**609**
%		*98.4*	*1.6*	*79.6*	*20.4*	*50.6*	*49.4*	*100*
AA43	LBS	763	11	649	125	306	468	**774**
%		*98.6*	*1.4*	*83.9*	*16.1*	*39.5*	*60.5*	*100*
PP38	LBS	2272	324	2234	362	1249	1347	**2596**
%		*87.5*	*12.5*	*86.1*	*13.9*	*48.1*	*51.9*	*100*

series dates give an estimate of 65 000 years (Vogel 2001), which is somewhat younger than estimates based on the epimerization of the amino acid isoleucine (Van Pletzen 2000: 30). Ages in this range would place the Upper member in a period of sea level regression. The Upper member is represented by the squares E50, H51, and J51, from which the largest numbers of fish remains (5 799 specimens: Table 2) come. The lower units of Square E50 (under layer YS4) and those of H51 have produced thick carbonized layers of the Howiesons Poort, and the bones in those layers were burnt after deposition when the original plant-rich deposit was ignited.

2. Underlying the Upper member is a series of shell and artefact-rich units grouped into the "SAS member" corresponding to the Middle Stone Age ll (MSA ll). The total thickness of the SAS member is more than 10 m. Uranium dating by Vogel (2001) suggests that sedimentation was slow and that the member spans a time range of some 25 000 years, between ca. 100 000 years and less than 78 000 years BP. Isotope stratigraphy (Deacon *et al.* 1988) suggests an age range between ca. 103 000 and ca. 90 000 years ago. Fish remains have been sampled in caves 1A and 1 from squares J48, K48 , O50, T50, and T51, representing the later layers of the SAS member

and from test cuttings M50, N51, and Q52, which are directly below the cliff where most of the modern cormorant pellets fall. Parts of square T50 and the squares Y 44, Y45, Z44, and Z45 belong to the lower layers of the SAS member. L51 (upper layers of SAS member) has yielded only 4 fish bones, which were not included in the statistical data listed in Table 2. In addition, fish bones are available from square PP38 in Cave 1B, which also dates to the SAS member. From the SAS member a total of 3 972 fish bones has been recorded (Table 2).

3. The lowest stratigraphic division in the main site sequence is the LBS member, which is equivalent to the Middle Stone Age I (MSA I) and is securely dated. According to isotope stratigraphy these deposits can be placed in MIS 5d dating to about 110 000 years BP. MIS 5d would correspond to a period of sea level regression. The LBS member has yielded a sample of 3 979 fish bones and fragments.

METHODS OF INVESTIGATION

Identification of fish bones

The identification of the fish bones was carried out by directly comparing the morphology of the bones with fish skeletons of known species and size in the reference collection of the *Staatssammlung für Anthropologie und Palaeoanatomie, München*. Many of the South African fish species were collected and prepared by the author herself who was generously supported by several institutions and private persons (see acknowledgements). Otoliths were identified either by directly comparing them with specimens in the modern collection or by reference to the *Otolith Atlas of Southern African Marine Fishes* (Smale *et al.* 1995). The level of identification of fish bone fragments varies according not only to the state of preservation of the material, but also to the morphology of the family, genus, or species. In the case of the fish bone assemblage from Klasies River main site, it is often not possible to identify material beyond the level of family (see below) and thus only sometimes to genus and occasionally to species. Although there exist more recent species nomenclatures for fishes (*e.g.* Eschmeyer 1998), in this contribution taxonomic nomenclature follows Smith & Heemstra (1986), a work which is best known in Southern Africa.

For *Arius thalassinus* from the Arabian Gulf (a very close relative of the South African species *Galeichthys feliceps*), Samuel *et al.* (1987: 260) report that incremental structures in the large spherical otoliths, if unburned, are easy to read in cross section with transmitted light in order to establish seasonality. Unfortunately, most otoliths of *Galeichthys feliceps* (N = 52 in the whole sample) have been polished through erosion by natural processes, so that the outer annual increments are missing. Any attempt to read them would lead to misinterpretations about the age of the fish at death.

At the same time that the identification was made, the approximate size (total length) of the fish was estimated, either through direct comparison or through the measurement of the bones. An attempt was also made to classify the unidentified vertebrae fragments into size groups. Because most of the bone material is very fragmented, the reconstructed fish lengths could only be estimated in size intervals of 5 cm (see Fig. 11). In the case of Klasies River the size classes are: < 10 cm = very small fish; 10 to 25 cm = small fish; 25 to 40 cm = medium-sized fish; > 45 cm to 80 = large fish, and 80 to 100 cm = very large fish.

Since the bones came from sieving, they include numerous fragments too small to be identified with the naked eye. Their identification to anatomical element and fish species or, better said, to fish families was carried out using a binocular microscope with a magnification of 6.7X up to (if necessary) 40X. Elements of the fish skull can more reliably be identified to species level than can vertebrae, ribs, and spines. These are chiefly the bones of the viscerocranium, such as the *praemaxillare*, *maxillare*, *palatinum*, *dentale*, *articulare*, *quadratum*, *hyomandibulare,* etc., but also include some characteristic parts of the neurocranium *(e.g.*, *otoliths*, *basioccipitale,* and *vomer)*, the bones covering the

TABLE 3. – Some robust skull elements (Praemaxillare, Maxillare, Palatinum, Dentale, Articulare) of Sparidae present in the total assemblage.

Square	Member	N Sparidae	Skull elements
E50	Upper	101	De
H51	Upper	70	2 molariform teeth
J51	Upper	134	2 De; molariform tooth
O50	SAS up.	22	2 Pr; 2 De
T50	SAS up.	11	molariform tooth
T51	SAS up.	39	2 molariform teeth
J48/K48	SAS up.	3	–
T50	SAS lo.	10	Pr
Z44	SAS lo.	4	–
Y45	SAS lo.	20	Pr ; 2 Pa ; Ar
M50	SAS	99	Pr
N51	SAS	46	Pa ; 6 De
Q52	SAS	13	Pr ; De ; molariform teeth
PP38	SAS	67	3 Pr ; De ; 5 Ar
Z44	LBS	34	2 Pr ; Ar ; mol. tooth
AA43	LBS	82	3 Pr; 4 De; Ar; 4 mol. teeth
PP38	LBS	164	5 Pr ; Ma ; Pa ; 4 De ; 4 Ar ; 2 mol. teeth

gills *(operculare* and *praeoperculare)*, and the bones of the shoulder girdle *(e.g. cleithrum)*. If these bone elements are present, one has a good chance of identifying them to species level, even when dealing with a fish family comprising many members, which is the case, for example, with the families Sparidae and Clinidae. Unfortunately, the skeletal parts mentioned above are very scarce in the ichthyofaunal material of the Klasies River main site (Tables 2 and 3).

Most of the remains are vertebrae, which can only be identified to the level of family or of genus. An exception to the latter statement can be made when there is only one representative within a family, *e.g.*, *Coracinus capensis*.

Usually for ichthyo-archaeological material, the minimum number of individuals (MNI) is calculated. MNI calculations are generally based on skull elements and commonly are carried out taking the greatest of the left or right values for a particular element within each context with no correction for pairs. The MNI can be significant as an indicator of the relative frequencies of the various fish species represented in a sample but for the material from Klasies River, the application of this method does not provide any greater understanding because of the high numbers of vertebrae in the assemblages (Table 2).

TAPHONOMY – SOME STATISTICAL DATA

The distribution by square of the 13,750 fish bones examined is given in Table 2. The fish bones are distributed in different percentages in the various squares. E50 from the Upper member, being the thickest sequence of the deposit excavated at main site, contributed the greatest number of fish remains to the overall assemblage. A similar sized sample comes from PP38, dating to the LBS member. H51 and J51, both containing exclusively material from the Upper member, and M50, a test cutting in the SAS member, yielded more than 1 000 bones each. All other squares produced less material, as can be seen in Table 2.

The majority of the material consists of complete and broken centra (*corpora*) of vertebrae (including extremely small fragments) from very small to middle-sized fishes. The small fishes (15 to 25 cm) were most frequently represented. Remains from some large to very large specimens are present in all squares (Fig. 11). The frequency of skeletal parts other than vertebrae varies by square and according to the quality of preservation of the material (Table 2 and Fig. 4). Non-vertebrae are relatively few in the deposits of the Upper member (E50, H51, J51) and somewhat greater in most squares of the SAS and LBS

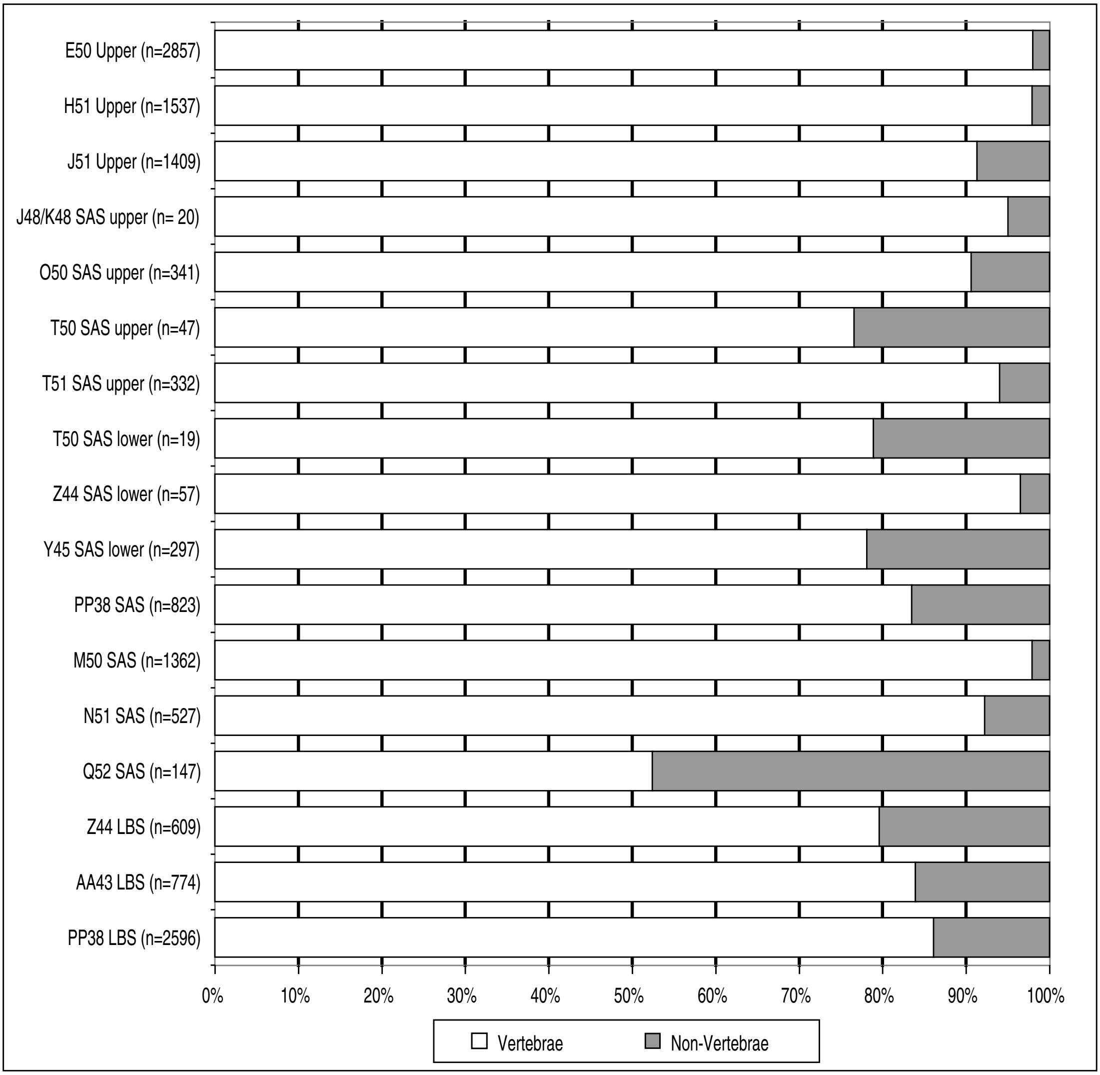

FIG. 4. – Ratio of vertebrae and other skeletal elements in the different squares.

members. However, there is no real regularity to be seen in this distribution. Most squares yielded 20% or fewer skeletal parts that are non-vertebrae. When compared with the percentage of vertebrae present in the modern pellets from cormorants (Table 1), it becomes clear that the pellets contain more skull elements and other bones than vertebrae.

Table 3 presents the numbers of robust skull elements of Sparidae in comparison to the total number of bones identified from this fish family. It demonstrates that even these robust skeletal elements which in fish samples of the holocene period usually make up the most prominent group of sparid bones are heavily under-represented.

In our analysis of the fish bones from a kitchen midden at al Markh/Bahrein on the Arabian Gulf dating to the 5^{th} millennium BC, we found that 50% were vertebrae and 50% other than

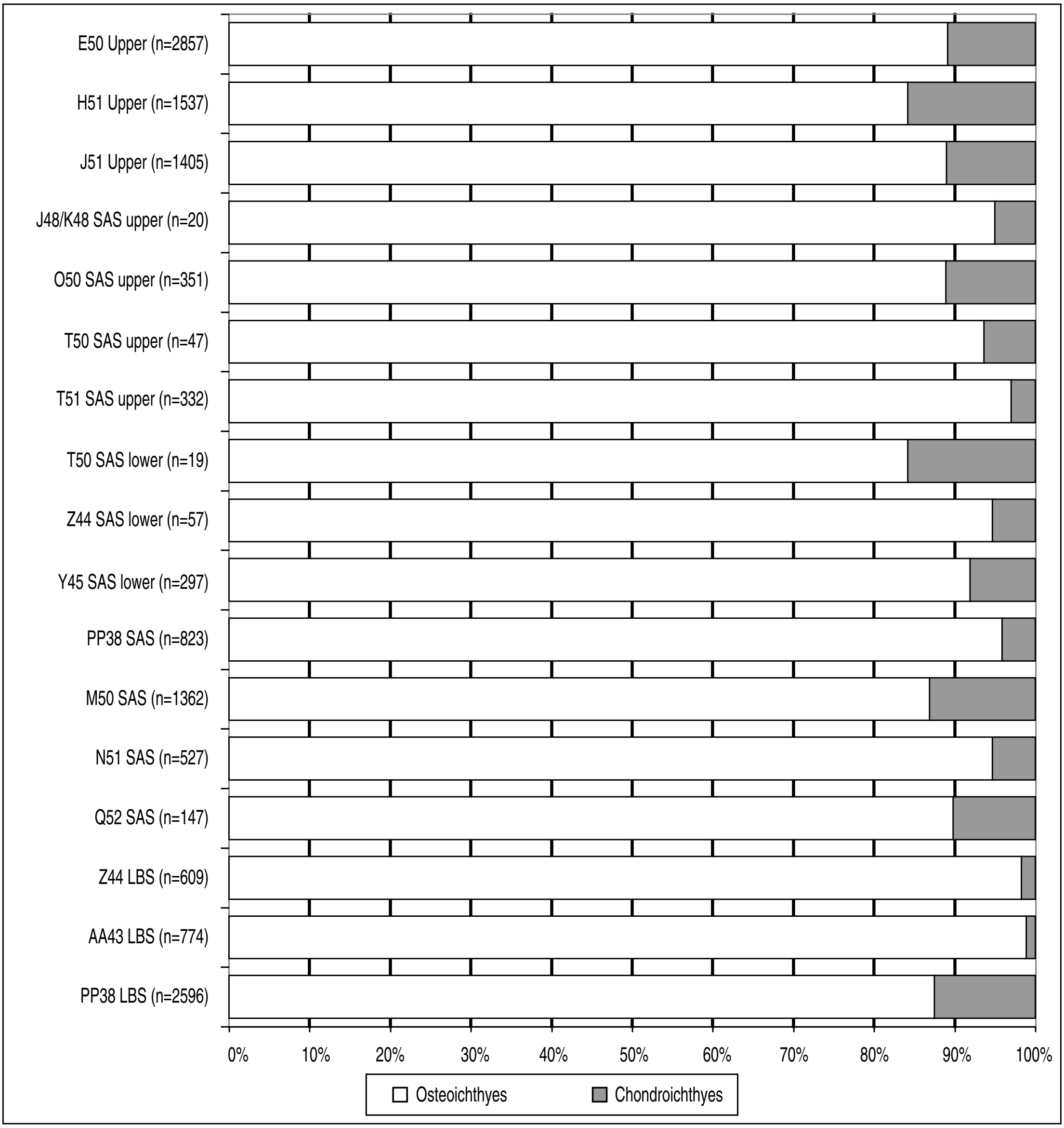

FIG. 5. – Ratio of remains of bony fish and cartilaginous fish in the different squares.

vertebrae from perciform fishes (von den Driesch & Manhart 2000: table 4). This indicates that the fishes caught were consumed on the site and does not provide evidence for the preparation of fish to be exported elsewhere. In contrast to this situation, investigations of the fish bone material from several Late Pleistocene caves in Southern Germany, dating from the Aurignacian to the Magdalenian (Torke 1978: 58), yielded a very high percentage of vertebrae. From these two examples one can conclude that the relative frequency of fish vertebrae in an archaeological sample depends largely on the geological age of the material, especially when

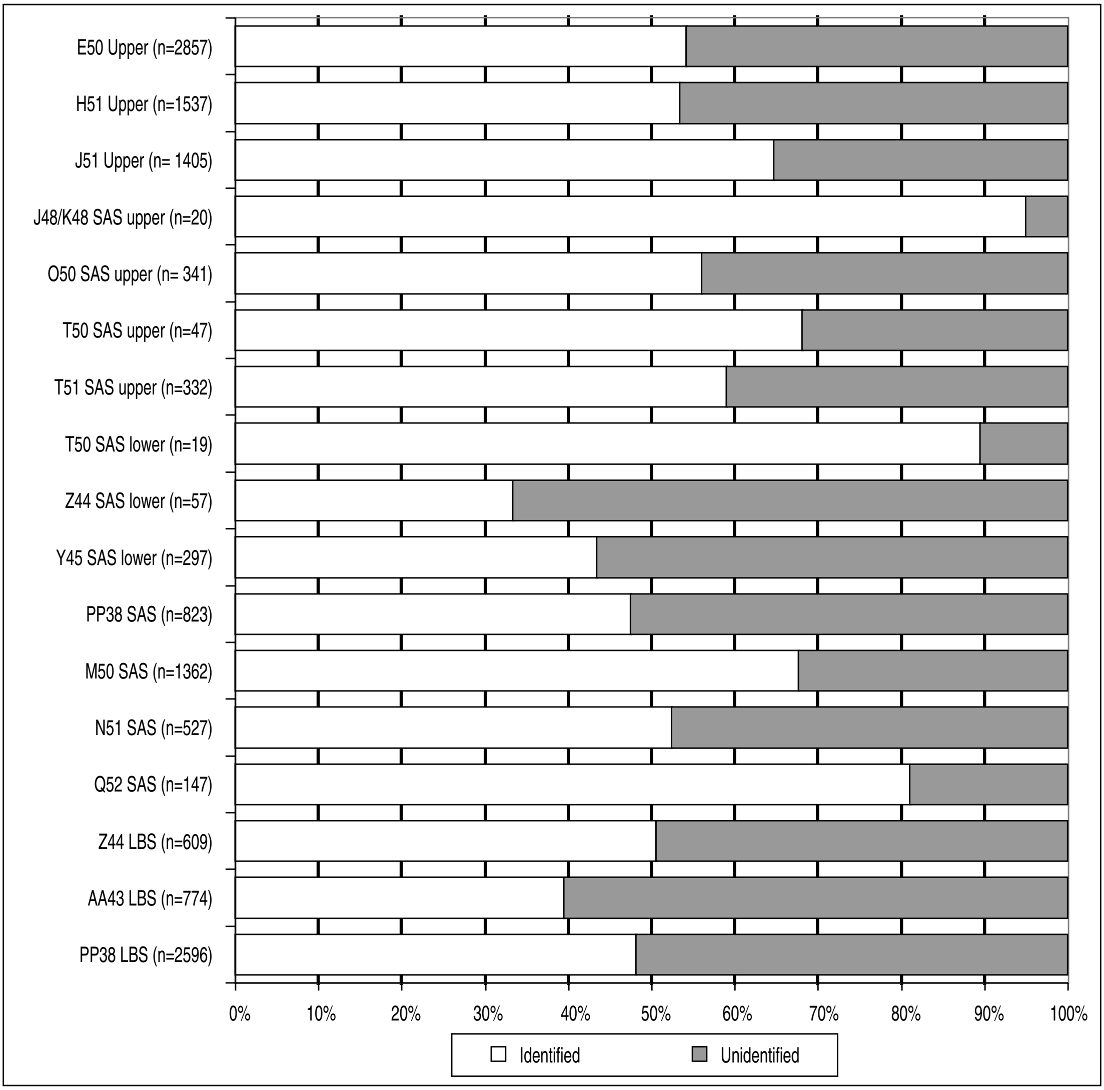

FIG. 6. – Ratio of identified and unidentified fishbones in the different squares.

the fish specimens were small. With other words: vertebrae are more robust and preserve better. Unfortunately, from South Africa no comparative material is available.

In each unit from Klasies River, remains of cartilaginous fish were found. These are chiefly the calcified centra of the vertebrae which, besides the teeth, are the only bony parts of the skeleton of Chondrichthyes (Fig. 5). Shark and ray teeth occur only occasionally. The various samples contained large, medium, and very small vertebrae of sharks and rays. In most cases it was not possible to reconstruct fish size because within the vertebral column of a cartilaginous fish the vertebrae become smaller toward the tail of the fish, which means that a small vertebra can derive just as well from a large as well as from a small individual. Considering only those squares that yielded more than 1000 identified specimens the highest counts of remains of cartilaginous fishes

come from squares H51 (15.8%), M50 (13.1%), and PP38 (12.5%) (Table 2).
Due to the fragmentation of the material, the percentage of unidentified fish bones is extremely high. By square the proportion varies from just over 30% to over 60% of a sample (Fig. 6).

RESULTS

Taxon diversity

Buxton & Smale (1984) recorded 65 fish species representing 29 families in a survey of the marine ichthyofauna of the Tsitsikamma Coastal National Park. The count was based on a survey of almost two years and did certainly not register all fish species living in the waters of this coastal zone. Our analysis has identified at least 82 species or genera deriving from 47 fish families (Table 4).
Most of the 82 species/genera are represented by only a few skeletal elements be they teeth (sharks and rays), parts of the *splanchnocranium* or other elements such as otoliths (*e.g. Galeichthys feliceps*, Serranidae, Sparidae, *Chirodactylus brachydactylus*, etc.) or very characteristic vertebrae (*e.g.*, *Liza richardsoni, Chorisochismus dentex, Spondyliosoma emarginatum*, etc.). As noted, we are dealing chiefly with vertebrae and thus the majority of the material was only identified to the level of the family. Some taxa are represented only in one particular square, others are recorded in almost all squares. Noteworthy is the presence of a freshwater fish species *(Tilapia)*, which was identified in squares E50, O50 and Y54. As *Tilapia* tolerates salty water, this fish must have been caught at the mouth of the Klasies River.
Apart from some rare exceptions, all fish species recorded in Table 3 still occur today in the waters of the Tsitsikamma coast.
The majority of the fish families identified (seen from the number of bones counted) belong to the group of intertidal fishes. Butler (1988: 90) distinguishes four categories of intertidal fishes according to their periods of residence in that zone:
1. True intertidal residents, exemplified by the banded goby, *Caffrogobius caffer*.
2. Part-time residents adapted to life in the intertidal zone but with their distribution extending into deeper water as well. This group contains common fish such as the super klipfisch, *Clinus superciliosus*, and the commafin goby, *Caffrogobius saldanha*.
3. Tidal visitors or species that occupy the intertidal zone mainly, or only, during high tide. Included in this group are adult blacktail, *Diplodus sargus*, and the strepie, *Sarpa salpa.*
4. Seasonal visitors. These include fish that are local species, for example, blacktail and mullets, Mugilidae, and that inhabit the intertidal zone as juveniles. Species of this group include also tropical and semi-tropical forms that are brought down the coast by warm oceanic currents and are usually found during summer and early autumn. These tropical and subtropical species do not survive the winter in this area.

Following Butler (1988: 93 ff), intertidal fish species recognised from Klasies River main site are: Cape conger, *Conger (wilsoni)*; sea catfish, *Galeichthys feliceps*; rocksucker, *Chorisochismus dentex*; koester, *Acanthistius sebastoides*; yellowbelly rockcod, *Epinephelus (guaza)*; zebra, *Diplodus cervinus*; blacktail, *Diplodus sargus*; Cape stumpnose, *Rhabdosargus holubi*; white musselcracker, *Sparodon durbanensis*; redfingers, *Cheilodactylus fasciatus*; twotone fingerfin, *Chirodactylus brachydactylus*; horned blenny, *Parablennius (cornutus)*; super klipfish, *Clinus (superciliosus)*; grass klipfish, *Pavoclinus (graminis)*; banded goby, *Caffrogobius caffer*; and evileyed blaasop, *Amblyrhynchotes honckenii*.
Most intertidal fishes are small, which allows them to move into crevices and under rocks to avoid currents.
A number of fish taxa found in Klasies River main site represent fish that can be classified as subtidal fishes. According to their particular adaptations to the environment, they prefer pelagic, reef, or sandy habitats (Smale 1988, fig. 8:1). In these types of environment all the larger fish species identified in the Klasies River sample lived, such as most of the sharks and rays, Cape yellowtail, *Seriola lalandi*; elf, *Pomatomus saltatrix*; galjoen, *Coracinus capensis*; leervis,

TABLE 4. – Species or genera identified in the total ichthyofauna of Klasies River main site.

CHONDRICHTHYES

Hexanchidae	Scyliorhinidae	Triakidae	Rajidae
- *Notorynchus cepedianus*	- *Haploblepharus* spp.	-*Triakis megalopterus*	- *Raja alba*
Squalidae	- *Halaelurus natalensis*	Sphyrnidae	Dasyatidae
- *Squalus megalops*	- *Poroderma pantherinum*	- *Sphyrna zygaena*	- *Dasyatis* spp.
Lamnidae	Carcharhinidae	Rhinobatidae	Myliobatidae
- *Carcharodon carcharias*	- *Galeorhinus galeus*	- *Rhynchobatus djiddensis*	- *Myliobatis aquila*
Odontaspididae	- *Mustelus* spp.	- *Rhinobatos annulatus*	- *Aetobatus narinari*
- *Carcharias taurus*	- *Carcharhinus* spp.		

OSTEICHTHYES

Clupeidae	- *Lichia amia*	- *Pagellus natalensis*	- *Chirodactylus*
- *Sardinops ocellatus*	- *Caranx sexfasciatus*	- *Lithognathus lithognatus*	*brachydactylus*
Engraulidae	- *Trachurus trachurus*	- *Gymnocrotaphus*	Gobiesocidae
- *Engraulis* cf. *japonicus*	- *Decapterus* spp.	*curvidens*	- *Chorisochismus dentex*
Plotosidae	Pomatomidae	- *Boops salpa*	Muraenidae
- *Plotosus* cf. *nkunga*	- *Pomatomus saltatrix*	- *Spondyliosoma*	- *Echidna* spp.
Ariidae	Sciaenidae	*emarginatum*	- *Lycodontis undulatus*
- *Galeichthys feliceps*	- *Argyrosomus*	- *Polysteganus* spp.	Congridae
Belonidae	*hololepidotus*	Scombridae	- *Conger* spp.
- *Ablennes hians*	- *Atractoscion aequidens*	- *Scomber japonicus*	Anguillidae
- *Tylosurus crocodilus*	Mullidae	Gempylidae	- *Anguilla* spp.
Merlucciidae	- *Parupeneus* spp.	- *Thyrsites atun*	Muraenesocidae
- *Merluccius capensis*	Coracinidae	Mugilidae	- *Muraenesox cinereus*
Teraponidae	- *Coracinus capensis*	- *Liza richardsoni*	Ostraciidae
- *Terapon jarbua*	Pomadasyidae	- *Mugil* cf. *cephalus*	- *Ostracion* spp.
Malacanthidae	- *Pomadasys* spp.	Gobiidae	Diodontidae
- *Branchiostegus doliatus*	Sparidae	- *Caffrogobius caffer*	- *Diodon holocanthus*
Serranidae	- *Acanthopagrus berda*	Blenniidae	Tetraodontidae
- *Epinephelus* spp.	- *Rhabdosargus holubi*	- *Parablennius pilicornis*	- *Amblyrhynchotes*
- *Serranus* spp.	- *Sparodon durbanensis*	- *Chalaroderma capito*	*honckenii*
- *Acanthistius sebastoides*	- *Diplodus sargus*	Clinidae	- *Arothron hispidus*
Scorpaenidae	- *Diplodus cervinus*	- *Clinus* spp.	FRESH WATER FISH
- *Helicolenus dactylopterus*	- *Pterogymnus lanarius*	- *Pavoclinus* spp.	Cichlidae
Oplegnathidae	- *Cymatoceps nasutus*	Bythitidae	- *Oreochromis*
- *Oplegnathus conwayi*	- *Chrysoblephus gibbiceps*	- *Bidenichthys capensis*	- *mossambicus*
Carangidae	- *Chrysoblephus cristiceps*	Cheilodactylidae	
- *Seriola lalandi*	- *Pachymetopon aeneum*	- *Cheilodactylus* spp.	

Lichia amia; Cape knifejaw, *Oplegnathus conwayi*; and others (Table 4).

A third group of fish preferring a distinct habitat are the estuarine fishes (Bok 1988: 153 ff). Depending on salinity conditions, this group comprises either fish species that spend their entire life cycle in estuaries or fish species that enter estuaries only seasonally and breed at the sea. In estuaries one can find different species of mullets, Mugilidae, sparids, elf, kob, and the lesser guitarfish, *Rhinobatos annulatus*, which is often recorded in the bone assemblage of Klasies River main site as well as the eagle ray, *Myliobatis aquila*. Euryhaline freshwater species for which the degree of penetration into estuaries is determined by salinity tolerance include species that breed in both freshwater and estuaries as, for example, the Mozambique tilapia (Bok 1988: fig. 12:1).

From the biology and habitat requirements of the different species recorded at Klasies River main site, one can state that the overwhelming majority occur in coastal waters in diverse habitats or visit the coastal zone occasionally (see Smith & Heemstra 1986; Bok 1988; Butler 1988; Smale 1988). There are only very few fish species that are exclusively dwellers of the open and/or deep sea.

FREQUENCIES

As can be seen from Figs. 6 to 9, there are roughly five families that compete to be the most frequent: Clinidae, Sparidae, Gobiesocidae, Mugilidae, and Ariidae. This composition is valid for squares E50 and H51 dating to the Upper member (Fig. 7) and for the test cutting M50 (Fig. 8). J51 (Upper member) contained more finds of Gobiidae than of Ariidae (Fig. 6). In other units of the SAS member, Serranidae and/or Cheilodactylidae are included within the most frequent families instead of Gobiesocidae and/or Ariidae (Figs 8-9). Serranidae are chiefly represented by the intertidal living koester, *Acanthistius sebastoides*, and one or more species of *Epinephelus*, also confined to this type of environment.
A remarkable change in the distribution of the fish frequencies can be observed in the material from the squares of the LBS member, where Carangidae and occasionally Engraulidae and Teraponidae are included within the five most frequent families together with Clinidae, Sparidae and Mugilidae (Fig. 10).
In most instances the family Clinidae followed either by Gobiesocidae or by Sparidae is the most prominent fish group. In some excavated squares remains of Ariidae have been accumulated in large numbers (Figs 7-8).

FISH SIZES

The percentages of fish in the different size classes in four chronological divisions are presented in Fig. 11. The majority fall in the size class 15 to 20 cm, followed by the size class 20 to 25 cm, with the exception of the sample from the lower SAS member. In each chronological unit approximately 20% or less of the material is made up by fish measuring less than 15 cm, again with the exception of the lower SAS member. In the latter, almost 35% of the bone sample comprises very small fishes of under 15 cm. The high representation of very small fishes in the lower SAS member is caused by the abundance of tiny vertebrae, which for the greater part were not identifiable. Fishes with lengths from 15 to 25 cm are just those sizes preferred by cormorants although this does not rule out other agents of accumulation.
Size classes of 25 to 30 and 30 to 40 cm occur in fairly high percentages (Fig. 11), and fish sizes of over 40 cm are scarcely represented. But it has to be emphasised that in all chronological units specimens of bony fish 60, 70, and even 80 cm long occur (Table 5). Consequently, Henshilwood & Sealy (1997: 892) are incorrect when saying that "large fish are notably absent from MSA levels at all coastal southern African sites, including Klasies River Mouth main site". The authors mention large fish from Blombos Cave, southern Cape, which include *Cymatoceps nasutus, Aries* [sic!] *felicep*s and *Liza richardsoni* and give no indication of the frequency or size of the specimens recorded.
Although the reconstruction of the size of cartilaginous fish, can be problematic, some large vertebra centra permit estimation of fish size. Many of the sharks, such as the broadnose sevengill shark, *Notorynchus cepedianus*; the great white shark, *Carcharodon carcharias*; the soupfin shark, *Galeorhinus galeus*; the spotted gully shark, *Triakis megalopterus*; and the smooth hammerhead, *Sphyrna zygaena,* represent large fish presumably measuring 80 to 100 cm and more. Others were smaller (50-70 cm), such as the bluntnose spiny dogfish, *Squalus megalops*; the striped catshark, *Poroderma pantherinum*; the whitespotted smooth-hound, *Mustelus* spp.; and others are still smaller, such as the spearnose kate, *Raja alba*; the lesser guitarfish, *Rhinobatos annulatus*; and other ray species.

HUMANS OR ANIMALS?

There has been debate on whether the ichthyofauna from Klasies River main site represents a *taphocoenosis* or is cultural debris.

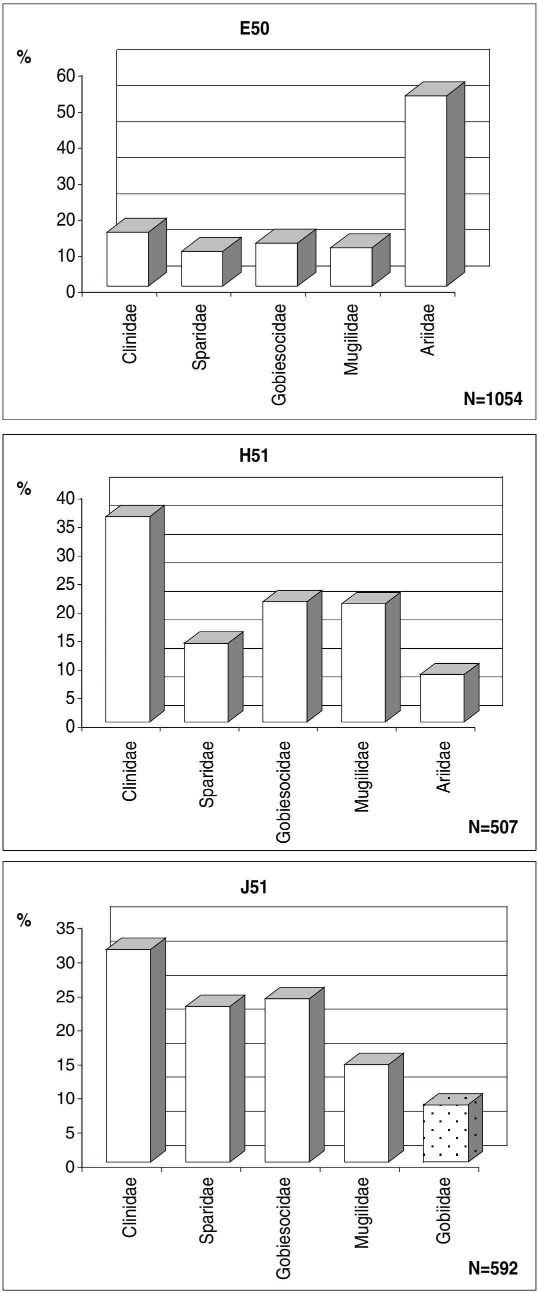

FIG. 7. – Frequencies of the 5 most abundant fish families in units of the Upper member.

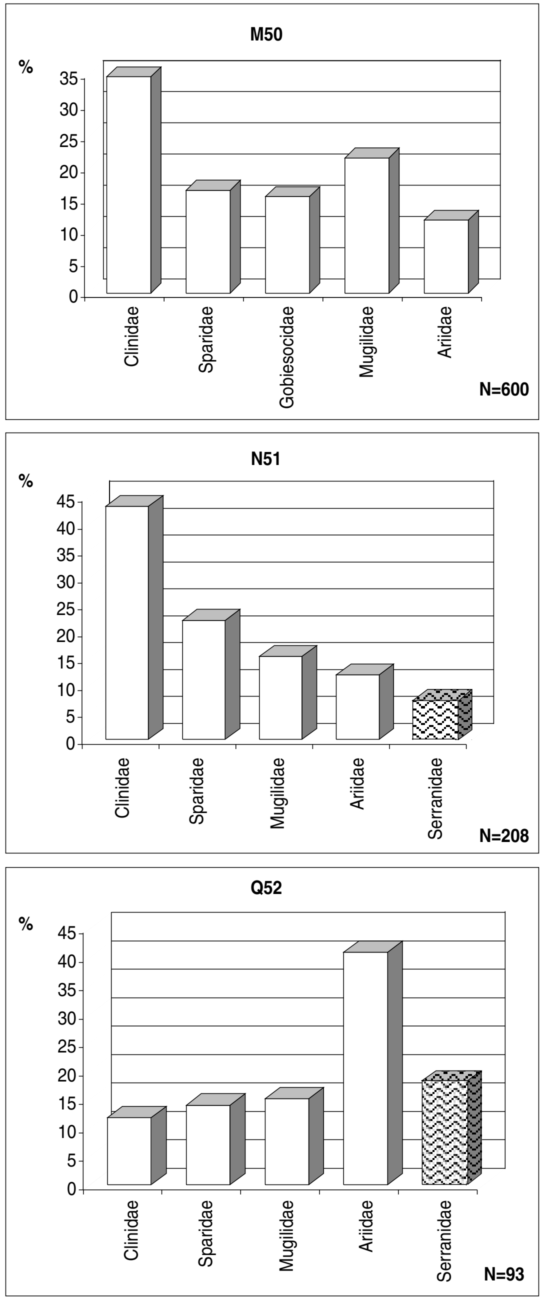

FIG. 8. – Frequencies of the 5 most abundant fish families in units of the “test cuttings” (SAS member).

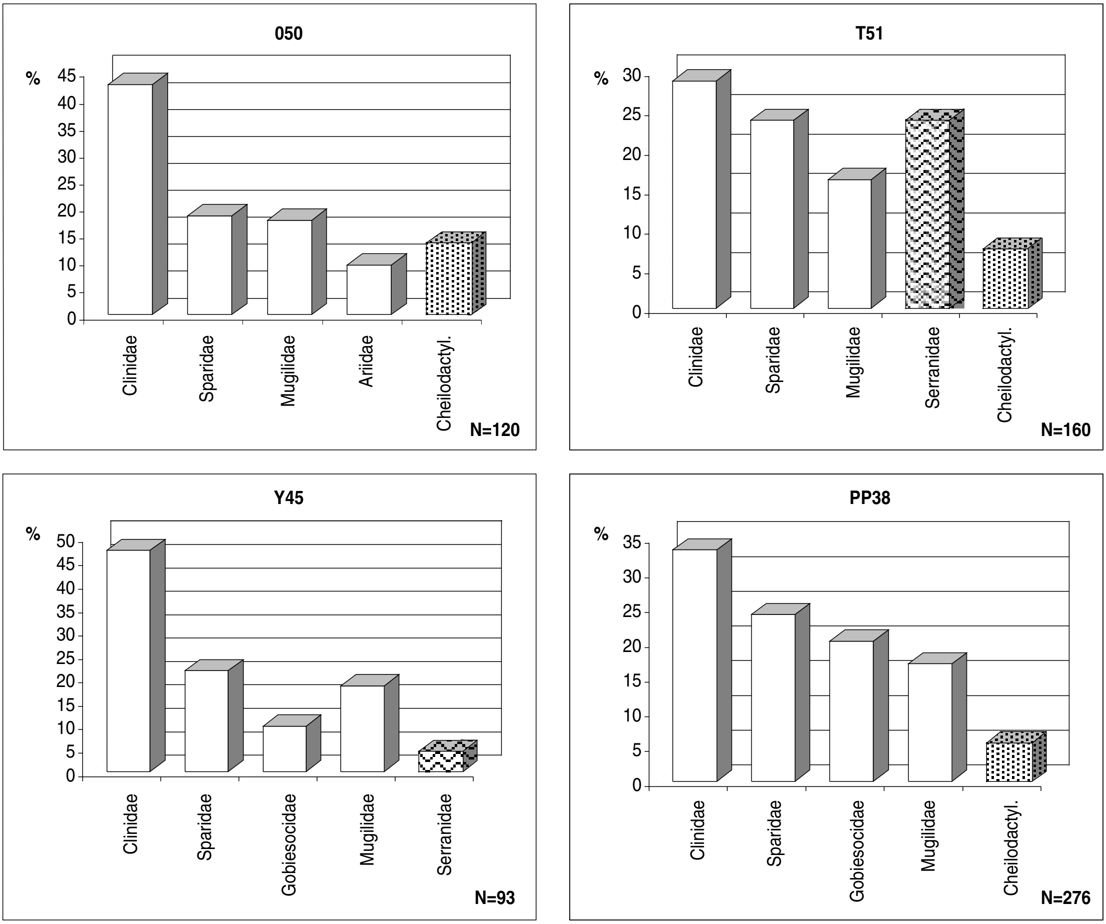

FIG. 9. – Frequencies of the 5 most abundant fish families in units of the SAS member.

ARGUMENTS IN FAVOUR OF ANIMALS HAVING CONTRIBUTED TO THE DEPOSITS

Taking into account the sizes of the fish identified and the habitats where they would have occurred, there are a number of potential agents of accumulation.

Penguins

Today two species of penguins are known to breed on the south coast of Africa: the jackass penguin, *Spheniscus demersus*, and the Magellanic penguin, *Spheniscus magellanicus*. Both species feed on pelagic school fish, predominantly *Engraulis* and *Sardinops*. The size range of their prey is given as from 2.5 up to 16 cm but with sizes up to 30 cm sometimes taken (Martínez 1992: 159). Breeding takes place all year around with the peak laying seasons in November to January and May to July. Nests are built on beaches, hills of sand or clay, in the forest or on grassy slopes. On the assumption that at times penguins would have been breeding within the confines of main site – this is suggested by the frequency of penguin bones in the deposit (Deacon 1997) – one may postulate that the remains of small pelagic species, such as pilchards, and anchovies were the result of feeding by breeding penguins.

Cormorants
The two species of cormorants expected to have been at main site during the Late Pleistocene have been mentioned: the smaller Cape cormorant, *Phalacrocorax capensis*, and the white-breasted or great cormorant, *Phalacrocorax carbo*. The latter measures 80-100 cm in body length, the former 60-64 cm (Orta 1992: 344). As both species feed in coastal waters in the surf zone and commonly sit on cliffs in order to regurgitate, most of the bone material of the smaller fishes of up to 25 cm or possibly 30 cm in length could have been regurgitated by cormorants.

Sea gulls
More than any other group of sea birds, gulls exploit a wide variety of food types and have evolved highly diversified foraging methods (Burger & Gochfeld 1992: 579 ff.). Besides the active hunting of living prey, chasing other bird predators to let their prey fall, stealing food from other adults that are feeding chicks, and further methods of piracy, gulls are known to be scavengers. They take living, moribund, or dead fish and non-vertebrates and forage the open ocean, the surf zone, intertidal mudflats, cliffs, and estuaries. At main site, it is conceivable that some of the large fish including sharks and rays that had been thrown ashore as dead were scavenged by gulls. In order not to be molested by other birds, parts of carcasses including bones may have been transported to the shelter of the cliff above the site.

Terns
Like gulls, terns also eat fish. The largest species that occur on the south coast are the Caspian tern, *Hydroprogne caspia* (52 cm), and the already mentioned swift tern, *Sterna bergii* (50 cm). Terns are more specialised foragers than gulls. They feed at sea, plunge-diving for fish (Gochfeld & Burger 1992: 630f.). Occasionally they appear inshore and in estuaries. However, it is doubtful that they would have contributed to the accumulation of fish bones in the site because they are ground breeders and do not enter caves or sit on cliffs.

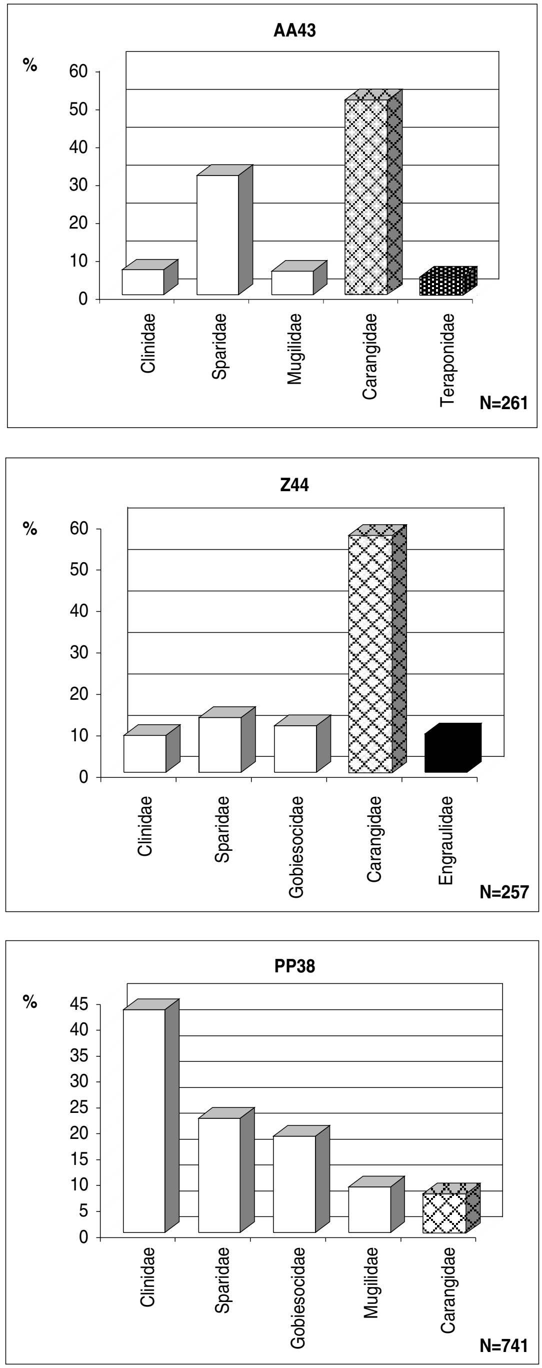

FIG. 10. – Frequencies of the 5 most abundant fish families in units of the LBS member.

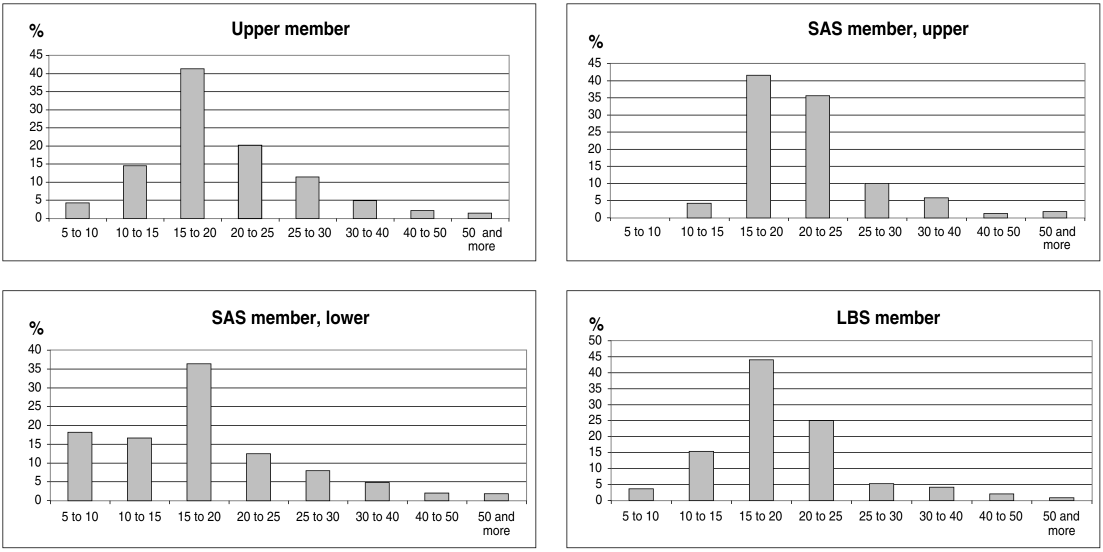

Fig. 11. – Percentages of fish size classes in cm of bony fishes in the different members.

African Fish Eagle (Haliaeetus vocifer)
This large bird of prey which mainly feeds on living fish can be also made responsible for the one or the other fish remain from Klasies River main site. It is found at larger rivers, lakes, dams, estuaries and seashores. It takes a large variety of surface species, mainly caught within 15 cm of surface, occasionally as deep as 0.5 m below. The bird can lift fish up to 2.5 kg, but large fish of 2.5-3 kg, normally are planed along surface or dragged through water to shore and beach and eaten there (Brown *et al.* 1982: 313).

Mammals
Scavenging predators such as hyaenas or active predators like clawless otter and different cat species could have entered the shelters in order to feed or to defecate. Scats of the clawless otter, for example, may contain digested fish bones. The same is true for the faeces of hyaenas and cats. Especially hyaenas would have swallowed the whole fish including the bones or part of a carcass (sharks). The occasional presence of hyaenas in the shelters is proved by coproliths. Smaller fish may have been brought in the caves in the stomachs of seals hunted by humans.

To sum up, all fish bone material collected from the shelters of Klasies River can potentially be explained in terms of accumulations caused by different agents, in particular birds and mammals, primarily cormorants and sea gulls. There are a number of arguments against this hypothesis, however.

Arguments against fish eating animals having been the only contributor to the deposits

The state of preservation of the bone material provides evidence that is contrary to the assumption that birds like cormorants and other animals were the only accumulators of the fish remains found in the site. The study of modern cormorant pellets from the site shows that most of the bones, whether vertebrae or skull elements, are heavily degraded (Figs 12-14). It seems unlikely that such eroded skeletal elements would have survived burial for many thousands of years. In sharp contrast to the bones from modern cormorant droppings are the almost intact surfaces of most of the vertebra bodies *(corpora)* and some other elements such as dentaries and pharyngeals of the Middle Stone Age assemblage. The pecu-

Table 5. – List of larger fish specimens in the assemblage.

Square	Scientific fish name	Reconstructed length(s) in cm
E50	*Lithognathus lithognathus*	45-50
	Echidna spp.	60; 70
	Conger spp.	50-55; 80
	Squalus megalops	60-65
	Argyrosomus hololepidotus	55-60
	Pomatomus saltatrix	60
	Indet. Sparidae	55-60
H51	*Anguilla* spp.	50
	Lycodontis undulatus	65-70
	Carcharhinus spp.	80
	Thyrsites atun	55-60
J51	*Cymatoceps nasutus*	45-50
	Sphyrna zygaena	100
	Lycodontis undulatus	55-60
O50	*Galeorhinus galeus*	100
	Rhinobatos annulatus	70
	Coracinus capensis	60
	Indet. Sparidae	50
T50	*Poroderma* spp.	65-70
T51	*Galeorhinus galeus*	70-75
	Carcharhinus spp.	70-75
	Seriola lalandi	75-80
	Indet. Sparidae	60-65
	Sparodon durbanensis	60
	Anguilla spp.	45-50
	Conger spp.	65-70; 70-65
N51	*Halaelurus* spp.	70
	Rhinobatos annulatus	60; 70
	Cymatoceps nasutus	45-50
Q52	*Carcharhinus* spp.	80
	Poroderma spp.	60
Y45	Indet. Sparidae	60
Z44	*Poroderma* spp.	80
	Triakis megalopterus	80
AA 43	*Sphyrna zygaena*	large
	Indet. Serranidae	50 ; 70
	Indet. Mugilidae	50
	Sparodon durbanensis	45-50
	Cymatoceps nasutus	45
	Chrysoblephus spp.	50-55
PP38	*Poroderma* spp.	60
	Argyrosomus hololepidotus	60
	Sparodon durbanensis	75-80
	Chrysoblephus spp.	75

liar structures and specific features of the peripheral area of vertebrae are generally well preserved, although all the *processus neurales* and *haemales* as well as the *apophyses* are often broken off. There are individual bones that show evidence for some sort of digestion, but these are rare. The preservation of the otoliths of the sea cat fish has been discussed above. Admittedly, most of the bone elements are broken or compressed through the load of the overlying layers, but, to reiterate, only very few show signs of having been partially digested. In addition, the fish bones do not bear any traces of tooth marks of carnivores or rodents.

Arguments in favour of humans having contributed to the deposits

It is thought that the hunters of Klasies River main site did not fish because artefacts that can be interpreted as fishing devices, such as net weights, harpoons, hooks, rods and reels, are not present in the archaeological record (Wurz 2000). Deacon (1997) writes concerning the food remains from the caves: "As would be expected from the situation on the coast, the food remains include shellfish, penguins and seals. This is among the earliest evidence for people systematically using coastal resources. Many of the fish bones in the deposit may be from gulls and cormorants roosting on the cliff face and the people may have lacked the technology for fishing".

It is quite futile to discuss whether hunting is older than fishing or fishing older than hunting. The opinion is sometimes expressed that fishing must be younger because it is easier to catch an animal on land than to win a fish from the sea. This is not convincing. Accordingly, there are some who strongly hold the contrary opinion, namely, that fishing is earlier than the hunting of terrestrial animals because only simple tools are necessary for this practice. With other words, hunting requires the use of much better gear (von Brandt 1984: 2). The presence of such gear is verified through the artefacts of Klasies River main site, which together with the mammal bones found, give the proof for the active hunting of game of all body sizes with eland, buffalo, and an extinct giant buffalo, as well as many antelopes, prominent in the remains.

Another argument against fishing at the site may have been the idea that hunters and fishers were two differently thinking groups, because, apart from the gear, hunting needs a different kind of knowledge about the prey than does fishing. The knowledge of the "fisherman" about the behaviour of his prey was a major factor in his success. In this early stage of the evolution of human foraging methods, the separation of the two groups was certainly not so strict. For their subsistence it was necessary for humans to exploit as many resources as possible. When humans from Klasies River collected shellfish in the shallow water, they certainly were aware of aspects of fish behaviour, *e.g.*, that distinct species inhabit tidal pools and are hiding under stones or that they can be tamed. The latter is the case with those clinids that live in pools and do not move out and may be tamed by repeated visits to the same pool with food (Smith & Smith 1966: 106). Why should humans during their stay at the site in order to hunt and collect terrestrial animals not have tried to catch fish? For gathering fish, no specific fishing device is needed, only a pair (or many pairs) of hands. One can also imagine that children and women carried out this duty. Following von Brandt (1984: 6), some fishing methods need little man power and can be carried out by a child; for others even the power of a strong man is not sufficient. This is why, very often in traditional fisheries, a clear division of labour can be found. There are some fishing methods considered suitable for women (and children), *e.g.*, fishing in calm or shallow waters, while others are reserved for men only. This separation is based on the physical differences between man and women. This old practice, to divide duties between men and women, is considered as one of the earliest behaviours of humankind (Koenig 1975).

Early humans certainly learned that fish together with shellfish provided a valuable source of protein. Simultaneously humans sometimes must have had bad or even deadly experiences to learn which fish were edible and which not (*e.g.* the blaasop). From ethnological studies, different primitive fish catching methods have been recorded. To obtain these desirable and desired products of the fresh waters and of the sea, humans originally had to rely solely on their hands, occasionally using their feet. Using simple tools like stones and sticks, and trapping with plaited fences or baskets made from plant material or leather (not preserved in the archaeological record), marked a development in fishing techniques.

Tidal fish-traps built from stones are recorded along South Africa's coasts from historic times. "Tidal fish-traps consists of low wall of boulder or stone blocks constructed across gullies or other suitable localities for the purpose of catching fish.

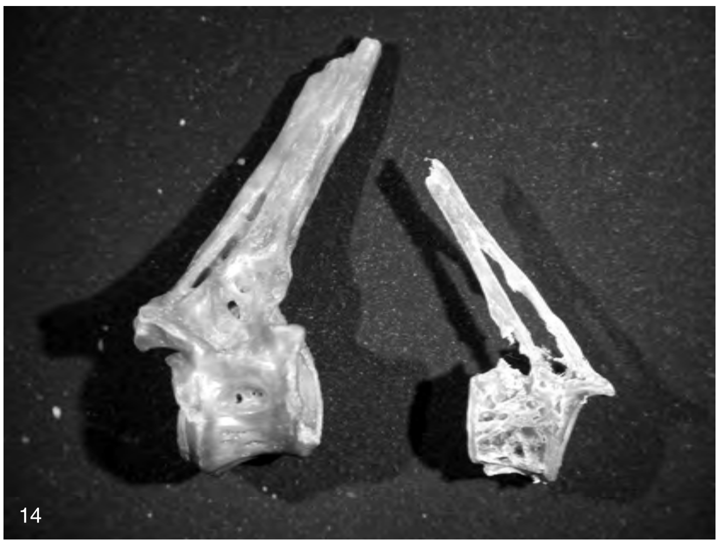

FIG. 12. – *Galeichthys feliceps*, *articularia*. Above: from E50 YS3 (L = 17 mm), below: digested *articulare* (L = 13 mm) from modern pellet no. 3 (Table 1).

FIG. 13. – Serranidae (*cf. Acanthistius sebastoides*), *dentalia*. Above: from H52 YS1 (L = 22 mm), below: disgested *dentale* (L = 15 mm) from modern pelet no. 3.

FIG. 14. – Serranidae, *vertebrae praecaudales*. Left: from E50 BSS2 (L of corpus = 4.5 mm), right: heavily digested *vertebra* (L of corpus = 3.5 mm) from modern pellet no. 3.

Situated within the intertidal zone, the walls are built to the height of the surrounding bedrock, or may form complete artificial enclosures… The traps operate on the principle that fish will swim over the walls at spring high tides in order to feed and that as the water receeds the fish do not attempt to swim back until it is too late, and are trapped within the confines of the enclosure" (Avery 1975: 105). Interestingly, Avery (1975: 110) mentions the taxa caught in such traps. Besides intertidal fish species known from Klasies River also large fishes such as *Galeorhinus galeus* and the black marlin, *Istiompax indicus*, are recorded.

The question arises whether Middle Stone Age people mentally were able to invent such tricky fish-traps, *e.g.* for the use in the mouth of the Klasies River. If so, the constructions certainly were more simple and not long-lasting at all, maybe similar to that enclosure as photographed by Goodwin (1946: plate 1) in the Slang River near Humansdorp.

For modern humans these fishing methods are hardly comprehensible because they demand time, patience, and much skill, and they are thought to be not very efficient. Those who think that in our days, gathering by hand is only done in countries with a low level of economy are incorrect. In the 1980s in southern Spain, I observed two persons, father and son, walking very slowly upstream in a small mountain river. The father was beating from time to time with a solid stick the larger flat stones lying in the current. By doing so he put the fish that had swum under the stone when being aware of the men under a kind of daze. For the son it was then easy to reach under the stone and seize the fish. In a short time span both had caught enough fish for a dinner.

Successful fishing depends not only on the level of technological equipment at the disposal of the fisherman but also on the environmental conditions. In the kinds of rough waters with heavy winds and big breakers that occur today in the Klasies River area, especially during winter, fishing might have been difficult under the primitive conditions of the Late Pleistocene. Active involvement in fish procurement was certainly much easier in the low-lying plains adjacent to lakes or rivers subject to seasonal flooding (Inskeep 2001: 66). However, on the coast winds were not blowing intensively throughout the whole year, as Fig. 3 demonstrates it, for example. With respect to the artefacts found in Klasies River main site, Wurz (2000: 136 ff.) has argued that the stone tools reflect modern behaviour. Modern behaviour can be defined as the practice of symbolic communication that involves a unique memory or mnemonic strategy and speech. Such behaviour obviously underlies the development of more elaborated fishing techniques.

In addition, standing in the water in the tidal zone and reaching under stones to secure small fish or wading in the flat water of the estuary of the Klasies River mouth, be it in small or larger groups, and beating fish appearing under the surface with a stick or throwing a stone at such fish, another method used to obtain fish at that time might have been spearing and harpooning. Spearing might have taken place with sharpened wooden sticks or with the same weapons used to kill antelopes. Inskeep (2001: 66) has noted that no human-made weapon has a known history as long as that of the spear. Using spears would have enabled people to hunt larger fish including sharks and stingrays and would explain the presence of so many remains of cartilaginous fish in the sample. Stow (1964: 72), in his research into the native peoples of South Africa in the mid-nineteenth century, records that the Bushmen of the Vaal and Orange Rivers and their tributaries made very ingenious harpoons for taking fish, the heads of which were armed with long sharp points of bones with which they landed fish of a considerable size. It must be stated here, however, that bone tools are very rare in Klasies River main site (Wurz 2000).

Another possibility to explain the presence of large fish, especially of sharks and rays, would be to assume that people have looked along the shore for dead fish. Although Binford (1984) in his analysis of the mammal bones has argued that the smaller bovids at Klasies River sites were largely hunted and the larger bovids primarily scavenged from carnivores' kills, his interpretation appears no longer valid through more recent study of the mammal remains. As a result of his investigation on the skeletal patterns and cut and tooth marks on the bones, Van Pletzen (2000: 24) comes to the conclusion that instead of humans scavenging from carnivores it seems much more likely that the opposite was true, namely that carnivores were scavenging at the site after the humans had left. In my opinion, scavenging on dead fish thrown ashore is another thing. Humans took what they could get. Hunting does not preclude scavenging.

ARGUMENTS AGAINST HUMANS HAVING CONTRIBUTED TO THE DEPOSITS

As already noted, the Upper member includes the culture stratigraphic substages of the Howiesons Poort and MSA lll. According to Deacon & Geleijnse (1988: 9), no human remains have been recovered from this member except isolated teeth, a premolar and an uncomplete incisor, that were found during the current excavations. The deposits in cave IA are a series of human occupation units containing artefacts, faunal remains, numerous hearth features, and much carbonised material "interbedded with naturally accumulated sands with abundant fine roof clasts and chance inclusions like fish and small mammal bones, which derived from the activities of birds roosting in the overhang, indicating a slow rate of sediment accumulation". The fish remains of such culturally sterile layers have to be regarded as produced by other vertebrates than man.

CONCLUSIONS

The archaeological fish bone assemblage studied here comprises 13,750 fish remains from both cartilaginous and bony fishes. Archaeologically, the material can be grouped into three chronological sequences covering an approximate time span from 120 000 to 60 000 years ago. Analysis resulted in the identification of at least 82 species or genera belonging to 47 families. In spite of this impressive diversity, the number of taxa is not high relative to the long period of deposition and this for several reasons:

1. The fish bone material studied here was recovered during the 1984 to 1988 excavations. From 1984 onwards, excavations were on a limited scale designed to provide information on the context of the finds rather to produce large samples of material. Small excavations were made by cutting back the sections through the full stratigraphic sequence (Van Pletzen 2000: 27). Thus, the fish bone material represents only a small fraction of the total ichtyofauna.
2. The site was only occupied when sea levels were high enough for the sea to be used as a base for obtaining marine foods like *Arctocephalus pusillus*, fish, and shellfish. It is supposed that, during periods of major sea level regression, the climate was cooler and drier, rendering the main site from time to time inhabitable (Van Pletzen 2000: 31 f.). Thus one has to reckon with a much shorter time period for accumulation of fish remains in the caves but still with thousands of years.
3. As shown in Fig. 6, the percentage of unidentified fish bones is extremely high, due to poor preservation and due to the fact that the majority of the assemblage consists of vertebrae that only rarely bear distinguishing morphological features permitting their more detailed identification. Depending upon the area excavated, unidentified remains make out from about 30% up to over 60% of an assemblage. However, not only fragmentation but also the lack of some South African marine fish species in the reference collection available to us contributed to a certain extent to the high proportion of unidentified material. It is thus likely that a few additional species would be identified if preservation were better and a more complete comparative collection were available.

Because of the relative small sample size, taxonomic diversity is smaller than would have been if many more material had been analysed. This is true in an absolute sense, in that it is probably that individual specimens of additional taxa will show up, thus increasing overall diversity. But overall diversity is a poor measure of human activity,

Table 6. – Frequencies of identified fish species (families) according to their habitat.

Member	N of intertidal fishes	N of estuarine fishes	N of subtidal fishes reef	sand	pelagic
Upper Total: 3162	1649 = 52.2%	851 = 26.9%	199=6.3%	248=7.8%	215=6.8%
SAS Total: 2231	1280 = 57.4%	557 = 25.0%	106=4.8%	149=6.7%	139=6.2%
LBS Total: 1654	877 = 53.0%	283 = 17.1%	39=2.4%	114=6.9%	341=20.6%

* In case when a fish species occurs in different zones, the size or age of the fish was considered, and the numbers obtained for a species distributed to the zones respectively.

because many if not most of the poorly represented taxa are expected to have been chance pickups. It is unlikely that we will witness a major shift in the major taxa exploited, unless there were periods of significant marine environmental change that are not reflected in the present record. About four fifths of the material studied represent the remains of intertidal and estuarine fishes (Table 6). These fishes were either true residents or partial residents and seasonal visitors of intertidal zones as well as juveniles of subtidal fishes that frequented this habitat. Not only birds were preying here but also humans could have exploited this type of coastal environment.

Though true pelagic forms are scarcely represented in the samples from the Upper and the SAS members (approximately 6 to 7%), the LBS member contained 20.6% of pelagic fishes (Table 6). This is due to the presence of a fairly high number of vertebrae and scutes of the massbanker, *Trachurus trachurus*, and the Indian scad, *Decapterus russelli*, particularly frequent in AA43 and Z44. Moreover, reconstructed size classes show that, in almost all chronological units (Fig. 11), between 60% and 80% of the fish lengths reconstructed fall into the classes of 15-20 and 20-25 cm total length. When one includes the fish size classes of less than 10 cm and 10-15 cm, over 80% of the sample comes from very small and small fishes. Fishes in these size classes are those preferred by cormorants. However, Late Pleistocene people using very simple methods would have been able to catch fish in the same size classes.

There are only few differences in the frequencies in which the fish species or families occur in the various squares and chronological units. The distinctions are not clear-cut and more likely indicate differences in the exploitation of local habitats rather than major ecological or climatic changes. In the materials from the Upper member, the five most frequent families are Clinidae, Sparidae, Gobiesocidae, Mugillidae and Ariidae (Fig. 7), all of which are intertidal or estuarine fishes (Table 6). With the exception of the test cutting M50, in all units of the SAS member the frequencies in order of decreasing importance are as follows: Clinidae, Sparidae, Mugilidae, Ariidae or Serranidae or Cheilodactylidae (Fig. 8). Like the clinids, sparids and mugilids, the latter two fish families are also found in intertidal and estuarine waters.

The only marked change in the distribution of the fish frequencies is observed in the LBS member where occasionally members of the family Carangidae and/or Teraponidae/Engraulidae are among the five most frequent fish families (Fig. 10). Whereas many of the species of carangids and teraponids enter shallow water and estuaries, members of the family Engraulidae (and Clupeidae) are true pelagic fishes.

Finally, the relative importance of humans or animals to the formation of the fish bone accumulations in the Klasies River depository is not easily factored out. Many arguments can be put forward in favour of the hypothesis that the fish bones were brought in by birds and other animals. This may be true for the fish remains of the naturally accumulated sand layers of the Upper member but is not necessarily true for the majority of the fish bone accumulations in the underlying deposits. Two important points can be noted in favor of an anthropogenic accumulation. First the relatively well-preserved surface of the fish bones, especially that of the bodies *(corpora)* of the vertebrae. They do not show any traces of digestion that occur when birds swallow, partly digest and then regurgitate the remains of their prey (Figs 12-14). Second, the degree of standardisation of the artefacts produced by the people inhabiting or visiting the Klasies River cave system reflects modern behaviour. Humans from Klasies River used ochre and ochre has been suggested as indicating a capacity to communicate by the use of symbols because of the strong ethnographic evidence for the symbolic meaning of the colour red (Wurz 1999; 2000). Additionally, humans who were able to hunt large game actively such as *Syncerus caffer*, *Pelorovis antiquus*, *Hippopotamus amphibius,* or *Taurotragus oryx*, can be considered to be intelligent enough to have developed some kind of fish catching methods and one may speculate that parties of women and children were involved in both shellfish collecting and fishing.

It is supposed that hunter-gatherers made short-term visits to Klasies River main site. People probably occupied the site for only some weeks at a time and they accumulate rubbish rapidly leaving a strong signal of their visits (Deacon pers. comm.). Between these visits, the natural accumulation of debris, containing micromammals and fish bones, was very slow, so thin interbeds of non-occupation can represent a substantial time. There was ample time for the activities of various non-human agents to contribute to the deposits. This ichthyofaunal investigation has not been able to distinguish between the relative importance of the possible different taphonomic agents. However, it does serve to suggest that the contribution of people to this Late Pleistocene fish fauna may have been more important than previously assumed.

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