

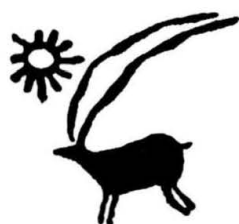
A Comparative Analysis of Fish Remains from some Mexica Offerings

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ABSTRACT: Archaeological excavations at the Templo Mayor of Tenochtitlan in downtown México City, México, have recovered a large number of offerings containing animal remains, including fish bones. A previous comprehensive study grouped the offerings according to the kind of gifts or elements they contained, but did not involve a detailed specification of the fish. This paper presents a qualitative comparative analysis of the fish species in five offerings, with a view to understanding in the future the symbolic meaning behind the oblations. Offerings 20, 23, 60, 61 and 88 were presumably laid down to commemorate one enlargement of the main ceremonial structure at the site. Fifty fish species were recorded from the five offerings. The richest diversity was found in Offering 23, with 32 species, and the poorest in Offering 20, with only three species. Cartilaginous fishes were an invariable element of all five offerings and each one had sawfish, shark and ray. Bony fishes were absent in Offering 20, while the other four shared the presence of *Tylosurus* spp., *Hyporhamphus* sp., *Pomacanthus paru* and *Diodon hystrix*. Some elements were unique and appeared in only one offering. Phenetical analysis indicates that Offerings 20 and 23 are the least similar in the entire group, with their dissimilarity accounted for respectively by poor and rich diversity. Overall, the number of shared fishes is minimal. Perhaps most fish were included in the offerings as a general type of object, with little or no regard for the particular species used. Differences in fish diversity among the various offerings suggest a possible link between this factor and the location of each offering with respect to the building.

KEY WORDS: FISH, MÉXICO, MEXICA, OFFERINGS

RESUMEN: Las excavaciones arqueológicas del Templo Mayor de Tenochtitlan realizadas en el centro de la Ciudad de México, en México, han recuperado un gran número de ofrendas que contienen restos animales, entre ellos peces. Un estudio previo agrupó estas ofrendas según el tipo de dones que contenían, pero no incluyó el registro detallado de los peces. Este trabajo presenta un análisis comparativo cualitativo de las especies de peces de cinco ofrendas, con objeto de entender en un futuro el significado simbólico detrás de la oblación. Las ofrendas 20, 23, 60, 61 y 88 se depositaron probablemente, junto con seis otras ofrendas, para conmemorar una de las ampliaciones constructivas del edificio ceremonial principal. En las ofrendas se registraron un total de cincuenta especies de peces. La ofrenda más diversa fue la número 23, con 32 especies, y la más pobre la número 20, con sólo tres especies. Los peces cartilaginosos estuvieron siempre presentes en las cinco ofrendas: cada una tenía pez sierra, tiburón y raya. Los peces óseos estuvieron ausentes en la Ofrenda 20, mientras las otras cuatro compartieron la presencia de *Tylosurus* spp., *Hyporhamphus* sp., *Pomacanthus paru* y *Diodon hystrix*. Algunos taxa tuvieron un registro único por aparecer en sólo una de las ofrendas. Los análisis fenéticos aplicados indican que las Ofrendas 20 y 23 son los menos similares de las cinco, dada su baja y alta diversidad, respectivamente. En conjunto, el número de especies compartidas es mínimo. Quizás la mayoría de ellas fueron incluidas en las ofrendas como un tipo general de objeto, sin importar cual era usada. Las diferencias en la diversidad íctica entre las ofrendas podría estar relacionada con la situación de cada ofrenda respecto del edificio.

PALABRAS CLAVE: PECES, MÉXICO, MEXICA, OFRENDAS

The Templo Mayor of Tenochtitlan was the political and religious center of Mexica culture, one of the foremost Mesoamerican societies at the time of the Spanish contact. The Templo Mayor, or Great Temple, is a pyramidal structure crowned by two oratories facing west. The building comprises two halves (Figure 1): the northern half and oratory were dedicated to Tláloc, god of rain and agriculture, while the southern half and oratory commemorated Huitzilopochtli, god of war and patron deity of the Mexica. The building itself appears to recreate certain myths, such as the death of Coyolxauhqui, goddess of the Moon and sister of Huitzilopochtli. Thrown down from Coatepec Hill (the southern half of the structure) by her own brother (represented by the corresponding oratory), she arrived in pieces at the foot of the hill (the basal platform surrounding the southern half of the temple).

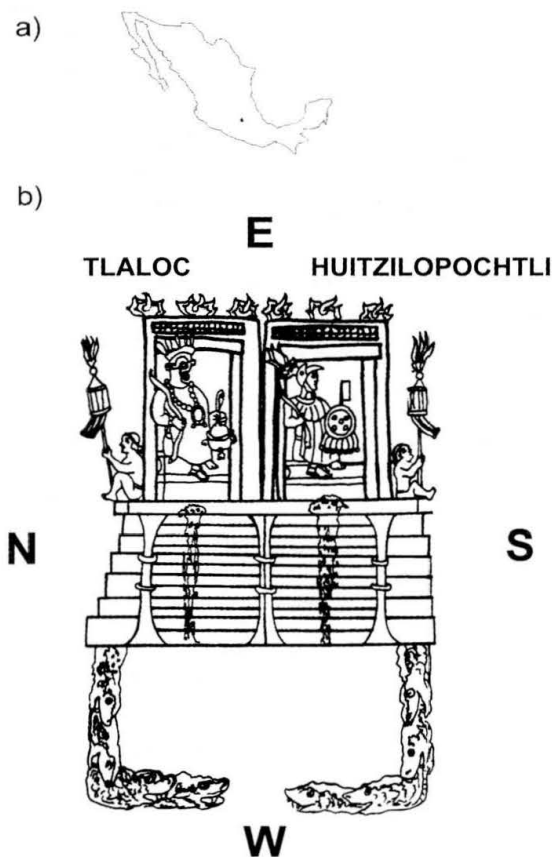


FIGURE 1

(a) Location of the Templo Mayor of Tenochtitlan in Mexico.
(b) The Templo Mayor according to Durán (taken from López Luján, 1993).

After the Spanish conquest, the building was virtually destroyed and lay buried under later colonial and modern structures; it remained lost until

1978, when the monolithic carving representing the dead Coyolxauhqui was accidentally unearthed. This find settled once and for all the precise location of the Templo Mayor and marked an end to the period of random discoveries at the site. Subsequent systematic study of the Templo Mayor and its surrounding area (Matos Moctezuma, 1990) yielded numerous ritual offerings containing objects intentionally arrayed in a set order that is assumed to convey a symbolic language or code of communication (López Luján, 1993). The offerings also revealed an intensive use of animals as ritual elements, whose meaning could perhaps be deciphered through a detailed study of each and every specimen, its position within the offering, and the location of the corresponding offering with respect to the building (Polaco, 1991a, b).

As a result of various archaeozoological studies on animal remains from the Templo Mayor, more than 250 species belonging to 11 faunal groups have been identified to date (Blanco Padilla, 1978; Alvarez *et al.*, 1982; Díaz-Pardo, 1982; Villanueva, 1987; Carramiñana, 1988; Polaco *et al.*, 1989; Alvarez & Ocaña, 1991; Díaz-Pardo & Teniente-Nivón, 1991; Jiménez Badillo, 1991; López Luján & Polaco, 1991; López Luján, 1991; Polaco, 1991c; Polaco & Guzmán, 1994; Guzmán & Polaco, 2000). Prior to 1978, a few studies of animal remains from the Templo Mayor were done in connection with occasional search and salvage operations at the site (e.g., Batres, 1990; Estrada Balmori, 1990; Herrera, 1990; León & Gama, 1990).

Fish stand out as the second most diverse animal group recovered from the Templo Mayor (Polaco & Guzmán, 1994). Since ritual use of fish is poorly documented in ethnohistorical sources (Guzmán & Polaco, 2000), these findings should improve our knowledge of the types of fish used in the offerings, their function, and the relative importance of the various fishes involved. To achieve these ends, we defined several research steps, one of which consists in a faunal comparison among the offerings.

López Luján (1993) published a comprehensive comparative analysis of all Templo Mayor offerings based on numerical taxonomy. It included all objects recovered from each offering: stone, pottery, human, animal and plant remains, etc. Fish remains were sorted into three basic categories: shark, sawfish, and bony fish. Each of these categories, however, comprises a great variety of species, some quite different from others, so that such demarcation might not be sufficient to characteri-

ze the offerings. There is also a phenetical analysis based on isolated samples of fish remains (Díaz-Pardo & Teniente-Nivón, 1991), but since not all the fish material in any one offering was available to the authors for examination and identification, its results are partial and not useful for comparison with our own.

In view of this, our study aims to test several hypotheses arising from López Luján's comprehensive analysis, by means of a qualitative comparison of the total fish contents from the first five offerings available for examination.

BACKGROUND AND STUDY AREA

The five offerings in our study are known as numbers 20, 23, 60, 61, and 88. They are part of a group of 11 offerings, called Complex A, which were placed beneath the basal platform on all four sides of the Templo Mayor (Figure 2). They were

Moteczuzoma (A.D. 1440-1469) or Axayácatl (A.D. 1469-1481) (López Luján, 1993). Offerings 23, 61 and 88 were in the northern half of the structure: number 23 was placed before the main facade, in front of the stairway leading to the Tláloc oratory. Offering 88 was in the back of the building, directly opposite to number 23, while Offering 61 was on the northern side of the structure. Offering 60 was found in the southeast corner, towards the back of the building, on the side dedicated to Huitzilopochtli. Offering 20 was also in the back of the structure, but on the main axis dividing the building into two halves. All the offerings were placed in ashlar masonry boxes except for number 20, which was laid down directly in construction fill.

Clustering of Complex A has been validated by numerical analysis (Figure 3; López Luján, 1993): Offerings 23, 60, 61 and 88 belong to one of the two subsets of Complex A, while Offering 20 forms part of the other subset. Eight offerings in Complex A also clustered as pairs in López Luján's study: 7-61, 11-20, 13-17 and 23-60. Besides resembling each other, offerings in each of these pairs were found on opposite sides of the structure, exhibiting a clear bilateral symmetry (López Luján, 1993), except for the pair formed by numbers 23 and 60 which does not conform to this pattern (Figure 2).

MATERIALS AND METHODS

The offerings were recovered between 1979 and 1982. Animal remains have since been kept in two places: the Laboratorio de Paleozoología and the Museo del Templo Mayor, both part of the Instituto Nacional de Antropología e Historia. For this study, the entire contents of each offering were checked for fish remains, which were then set aside for examination.

Identification of fish remains was made by comparison with recent skeletal material, and was supplemented by a review of the relevant literature (e.g., Gregory, 1959; Rojo, 1991). We used the comparative collection belonging to the Laboratorio de Paleozoología, which currently houses in its fish section 1,117 specimens belonging to 337 species, 180 genera, 87 families, 27 orders and 2 classes, and includes both freshwater and marine specimens. This stage of the study included verification of earlier identifications by Díaz-

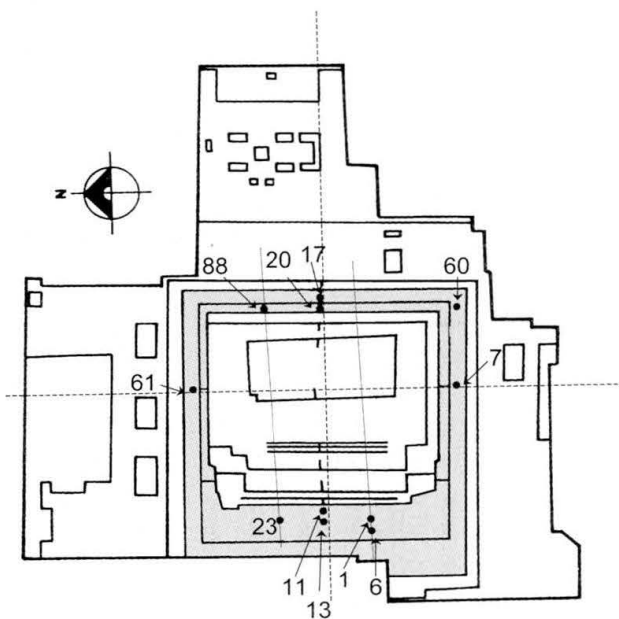


FIGURE 2

Sketch of the Templo Mayor (taken from López Luján, 1993). Black circles represent the location of Complex A offerings. The shaded area corresponds to the basal platform and the dotted lines represent hypothetical axes of symmetry.

all probably laid down concurrently, during the dedication of one of the stages of construction of the building (IVb), at some point in the reign of

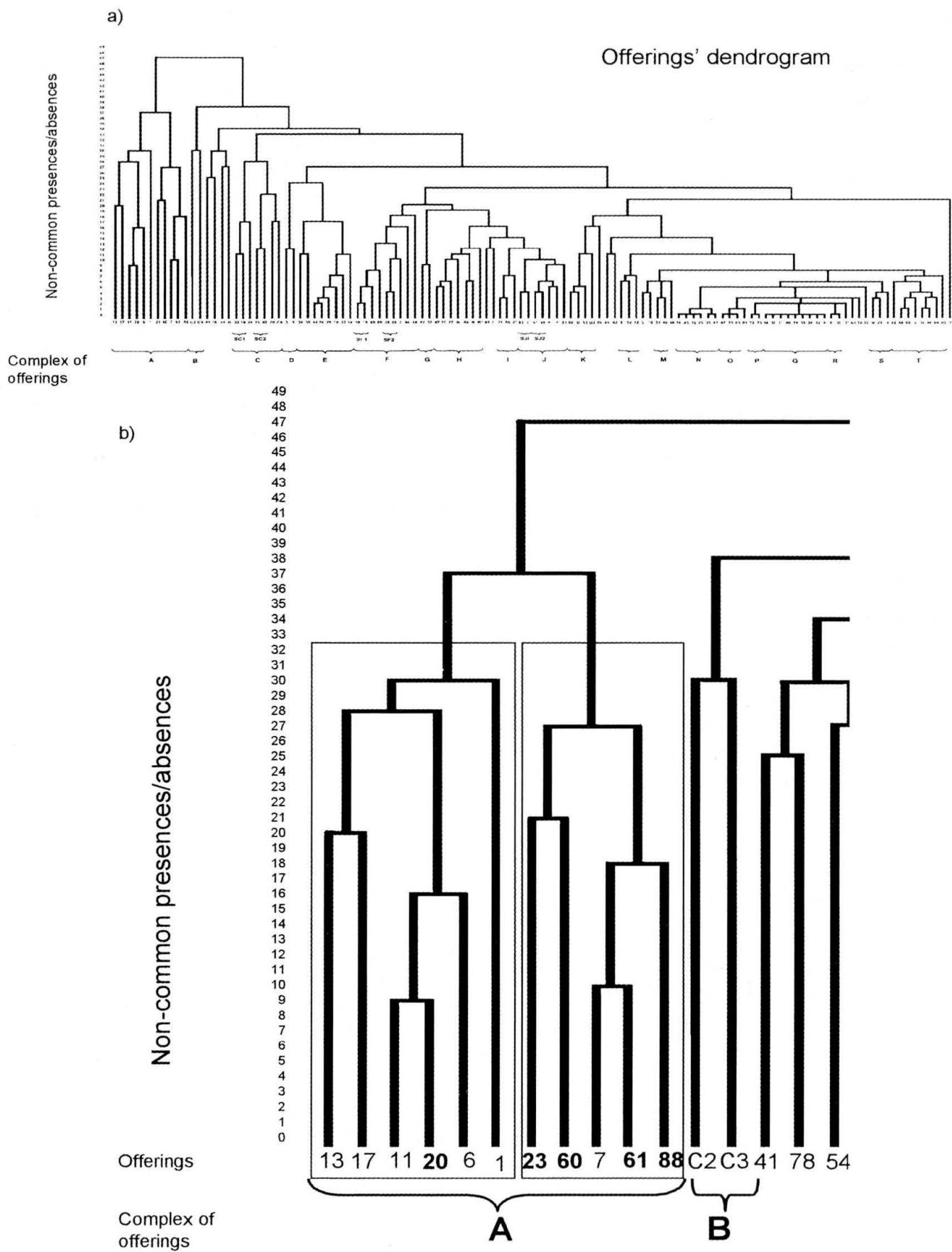


FIGURE 3

(a) Relationships among the Templo Mayor offerings based on numerical taxonomy (taken from López Luján, 1993). (b) Detail of relationships of Complex A offerings.

Pardo & Teniente-Nivón (1991). Some new identifications have been published elsewhere (Schulze, 1997; Guzmán & Polaco, 2000).

Our comparative analysis is based on an absence/presence matrix with the five offerings as OTUS or entities, and the identified species as attributes. Two different correlation coefficients were used to estimate similarity between each pair of offerings: simple matching and Jaccard's coefficient. The former considers both shared presences and shared absences of attributes as elements of similarity, while the latter disregards any matching absences.

Unweighted average linkage (UPGMA) cluster analysis was performed for each coefficient on the new matrices thus obtained (Crisci & López Armengol, 1983). A final consensual analysis was performed on the results of these tests. This same procedure was repeated using as attributes: (1) the identified genera, and (2) the identified families. When more than one tree (i.e., more than one possible relationship) was obtained using the same method (same coefficient and same taxonomic level), strict consensus was applied in order to arrive at a single cluster.

The comparative part of this study was supplemented with minimum numbers of individuals (MNI), determined by means of numerical representation and relative bone size, as indicated by archaeozoological standards (e.g., Klein & Cruz-Urbe, 1984).

RESULTS AND DISCUSSION

The following results are based on more than 21,000 fish remains, 85% of which were taxonomically identified.

The Fish in the Offerings

The five offerings include a minimum of 50 marine species belonging to 2 classes, 9 orders, 30 families and 43 genera (Table 1). Of these, 34 taxa (68%) were identified to species level (five of them tentatively), 15 (30%) to genus level (two tentatively), and one more taxon (2%) to family level only. The high percentage of taxa identified to species and genus levels (98%) means we now have a good knowledge of the types of fish involved.

Remains recorded as *Pristis* sp., *Hemirhamphus* sp., and *Prionotus* sp. were not taken into account in the analysis because they might belong to the species already recorded (*Pristis pectinatus*, *Hemirhamphus brasiliensis*, and *Prionotus tribulus*). Remains identified as *Diodon* sp. were also excluded as they belong to either of the two species existing in Mexico (*Diodon hystrix* and *D. holacanthus*), both of which already appear on our list.

A total of 15 species from Offerings 60, 61 and 88 (marked with an asterisk in Table 1) were identified and recorded for the first time from these offerings. These are in addition to the 26 new records from Offering 23 described by Guzmán & Polaco (2000) (marked with a circle in Table 1) and Polaco (in Schulze, 1997) (Table 1, with a plus sign). Only one of these 41 new records is known to be present in other offerings from the Templo Mayor: *Arothron* sp., in Offering L (Díaz-Pardo & Teniente-Nivón, 1991). The remaining nine taxa out of the total 50 were already known from other offerings: *Galeocerdo cuvieri*, *Pristis pectinatus*, *Tylosurus crocodilus*, *Fistularia* sp., *Selene* sp., *Lutjanus* sp., *Pomacanthus paru*, *Sphyræna barracuda*, and *Trichiurus lepturus*.

All told, 57 different fish species are currently known from the Templo Mayor: 50 from the five offerings in this study and seven more recorded in other offerings.

Differences and Similarities among the Five Offerings

Offering 23 is the most diverse, with 32 species, followed by Offerings 61 (19 taxa), 60 (18 taxa), 88 (15 taxa), and 20 with only three taxa (Table 2). Offering 23 also has the highest number of unique species, i.e., it includes 13 not found in any other offering. Number 20, on the other hand, has the least unique species' list (1 taxa). Both trends, diversity and uniqueness, remain constant at genus and family levels: Offering 23 has the richest diversity and a larger number of unique taxa, while the opposite occurs in the other offerings, particularly so in number 20 (Table 2).

The degree of richness of the offerings might be related to their location with respect to the structure. The richest offering, number 23, was placed before the main facade. Offerings 60, 61 and 88 were on the side or the back of the structure and

Class	Order	Family	Species	Common name			
Chondrichthyes	Carcharhiniformes	Carcharhinidae	° <i>Carcharhinus leucas</i>	Bull shark			
			* <i>Carcharhinus limbatus</i>	Blacktip shark			
			<i>Galeocerdo cuvieri</i>	Tiger shark			
			° <i>Negaprion fronto</i>	Lemon shark			
			° <i>Negaprion</i> sp.	Lemon shark			
		Rajiformes	*Sphyrnidae	* <i>Sphyrna mokarran</i>	Great hammerhead		
			Pristidae	<i>Pristis pectinatus</i>	Sawfish		
				<i>Pristis</i> sp.	Sawfish		
			Dasyatidae	* <i>Dasyatis</i> sp.	Stingray		
				° <i>Himantura</i> sp.	Stingray		
Actinopterygii	*	Batrachoidiformes	*Myliobatidae	+ <i>Aetobatus narinari</i>	Spotted eagle ray		
			Batrachoididae	° <i>Opsanus</i> sp.	Toadfish		
		Lophiiformes	*Ogcocephalidae	*Ogcocephalidae cf. <i>Ogcocephalus</i> sp.	Batfish		
		Beloniformes	Belonidae	* <i>Strongylura</i> sp.	Needlefish		
				<i>Tylosurus crocodilus</i>	Houndfish		
			Hemirhamphidae	* <i>Hemirhamphus brasiliensis</i>	Ballyhoo		
				<i>Hemirhamphus</i> sp.	Halfbeak		
				° <i>Hyporhamphus</i> sp.	Halfbeak		
				Gasterosteiformes	Fistulariidae	<i>Fistularia</i> sp.	Cornetfish
			Scorpaeniformes	*Dactylopteridae	* <i>Dactylopterus volitans</i>	Flying gurnard	
				Triglidae	° <i>Prionotus tribulus</i>	Bighead searobin	
					<i>Prionotus</i> sp.	Searobin	
			Perciformes	Serranidae	° <i>Epinephelus</i> cf. <i>E. adscensionis</i>	Rock hind	
		Carangidae		* <i>Caranx hippos</i>	Crevalle jack		
				<i>Selene</i> sp.	Lookdown		
				Lutjanidae	° <i>Lutjanus</i> ca. <i>L. argentiventris</i>	Yellow snapper	
					* <i>Lutjanus</i> cf. <i>L. griseus</i>	Gray snapper	
				<i>Lutjanus</i> sp. (especie 3)	Snapper		
			Haemulidae	° <i>Anisotremus surinamensis</i>	Black margate		
				° <i>Anisotremus virginicus</i>	Porkfish		
				° <i>Haemulon flavolineatum</i>	French grunt		
			Pomacanthidae	<i>Pomacanthus paru</i>	French angelfish		
			*Kyphosidae	* <i>Kyphosus</i> sp.	Chub		
			°Pomacentridae	° <i>Microspathodon</i> sp.	Yellowtail damselfish		
			Labridae	° <i>Bodianus</i> cf. <i>B. rufus</i>	Spanish hogfish		
				° <i>Halichoeres radiatus</i>	Puddingwife		
			Scaridae	* <i>Scarus perrico</i>	Bumphead parrotfish		
				<i>Sparisoma</i> cf. <i>S. aurofrenatum</i>	Redband parrotfish		
						<i>Sparisoma rubripinne</i>	Redfin parrotfish
						<i>Sparisoma viride</i>	Stoplight parrotfish
						* <i>Chaetodipterus faber</i>	Spadefish
					°Acanthuridae	° <i>Acanthurus</i> sp.	Surgeonfish
						° <i>Prionurus punctatus</i>	Yellowtail surgeonfish
					Sphyrnaenidae	<i>Sphyrna barracuda</i>	Great barracuda
					Trichiuridae	<i>Trichiurus lepturus</i>	Cutlassfish
		Balistidae			° Balistidae cf. <i>Canthidermis</i> sp.	Triggerfish	
					°Monacanthidae	° Monacanthidae gen. et sp. indet.	Filefish
		Ostraciidae			* <i>Acanthostracion</i> sp.	Cowfish	
					° <i>Lactophrys triqueter</i>	Smooth trunkfish	
					Tetraodontidae	° <i>Arothron</i> sp.	Puffer
	* <i>Sphoeroides annulatus</i>			Bullseye puffer			
Diodontidae	° <i>Chilomycterus schoepfi</i>			Striped burrfish			
	° <i>Diodon holacanthus</i>			Balloonfish			
	° <i>Diodon hystrix</i>			Porcupinefish			
	<i>Diodon</i> sp.			Porcupinefish			

TABLE 1

Fish identified in offerings 20, 23, 60, 61 y 88, of the Templo Mayor of Tenochtitlan.

* = new records determined in this study; ° = new records published by Guzmán y Polaco (2000); + = new records by Polaco (in Schulze, 1997).

Taxonomical level	Number of taxa					TOTAL
	Offerings					
	20	23	60	61	88	
Species	3 (1)	32 (13)	18 (7)	19 (6)	15 (2)	50
Genera	3 (1)	29 (10)	17 (7)	18 (3)	14 (2)	43
Families	3 (1)	23 (5)	13 (2)	15 (2)	13 (2)	30
Orders	2	7	7 (1)	6 (1)	7	9
Classes	1	2	2	2	2	2
MNI	4	88	39	40	39	210

TABLE 2

Number of taxa per offering and taxonomic level. Figures in parentheses indicate the number of unique taxa at each level.

		Offerings					
		20	23	60	61	88	Total
		MNI					
Carcharhinidae	<i>Galeocerdo cuvieri</i>			1			1
Sphyrnidae	<i>Sphyrna mokarran</i>					1	1
Myliobatidae	<i>Aetobatus narinari</i>	1					1
Ogcocephalidae	Ogcocephalidae cf. <i>Ogcocephalus</i> sp.			3			3
Belonidae	<i>Strongylura</i> sp.			3			3
Fistulariidae	<i>Fistularia</i> sp.				1		1
Dactylopteridae	<i>Dactylopterus volitans</i>					1	1
Serranidae	<i>Epinephelus</i> cf. <i>E. adscensionis</i>		4				4
Carangidae	<i>Caranx hippos</i>				2		2
	<i>Selene</i> sp.		2				2
Lutjanidae	<i>Lutjanus</i> ca. <i>L. argentiventris</i>		2				2
	<i>Lutjanus</i> cf. <i>L. griseus</i>				2		2
	<i>Lutjanus</i> sp. (especie 3)				1		1
Haemulidae	<i>Anisotremus surinamensis</i>		1				1
Kyphosidae	<i>Kyphosus</i> sp.				1		1
Pomacentridae	<i>Microspathodon</i> sp.		1				1
Scaridae	<i>Scarus perrico</i>			1			1
	<i>Sparisoma</i> cf. <i>S. aurofrenatum</i>				1		1
	<i>Sparisoma rubripinne</i>		2				2
	<i>Sparisoma viride</i>		1				1
Ephippidae	<i>Chaetodipterus faber</i>			1			1
Acanthuridae	<i>Prionurus punctatus</i>		1				1
Sphyraenidae	<i>Sphyraena barracuda</i>		4				4
Trichiuridae	<i>Trichiurus lepturus</i>		1				1
Monacanthidae	Monacanthidae gen. et sp. indet.		1				1
Ostraciidae	<i>Acanthostracion</i> sp.			1			1
	<i>Lactophrys triqueter</i>		1				1
Tetraodontidae	<i>Arothron</i> sp.		1				1
	<i>Sphoeroides annulatus</i>			1			1
TOTAL		1	22	11	8	2	44

TABLE 3

Unique taxa recorded in each offering.

had, approximately, half the number of species in Offering 23. Offering 20 had the lowest number of taxa even though it was placed on the main axis of the building, but offerings laid in construction fill might be expected to contain fewer gifts than those in ashlar masonry boxes. Future study of the other six Complex A offerings should clarify this point.

In all, 29 different fishes (58% of the total) are present in only one offering, and several families are represented by a single species (Table 3). Most of these unique species are represented by a single individual, and none by more than four (1.5 on average). A total of 44 individuals (20.9%) are involved. This group accounts for most of the differences among the offerings.

On the other hand, the most evident common factor is the presence of cartilaginous fishes in all five offerings (Table 4): each offering has one or more sawfish (*Pristis*), sharks belonging to different species, genera or families, and a single stingray belonging to different genera or families. At least nine species (18%) and 34 individuals (16.2%) are represented in this group, including three unique taxa comprising three individuals.

Offering 20 has no bony fish, a fact setting it apart from the others. The remaining four offer-

ings, placed in ashlar masonry boxes, all contained the following four taxa, represented by 76 individuals (Table 5): houndfish (Belontiidae: *Tylosurus crocodilus*), halfbeak (Hyporhamphidae: *Hyporhamphus* sp.), French angelfish (Pomacanthidae: *Pomacanthus paru*) and porcupinefish (Diodontidae: *Diodon hystrix*). In addition, several other recorded species belonging to these same families are so similar in morphology and coloration to the four taxa just mentioned that they might be considered equivalent to the latter for oblation purposes, even though they are not present in all the offerings. This last group comprises at least a further four taxa and 24 individuals (including one taxon with three individuals falling under the group of unique fishes) (Table 5). If this final group is considered valid, eight bony fish taxa (16%), involving 100 individuals (47.6%), appear as common elements in offering construction.

The remaining eight bony fish species (16%) have a scattered distribution quite unlike the consistent pattern displayed by the previous groups. They comprise 38 individuals, or 18.1% of the total (Table 6).

All this suggests that certain fishes were essential elements in the symbolic language of

	Offerings					TOTAL
	20 MNI	23	60	61	88	
Carcharhinidae						
<i>Carcharhinus leucas</i>		2	7		1	10
<i>Carcharhinus limbatus</i>				1	1	2
<i>Galeocerdo cuvieri</i>			1			1
<i>Negaprion fronto</i>		1				1
<i>Negaprion</i> sp.	1					1
Sphyrnidae						
<i>Sphyrna mokarran</i>					1	1
Pristidae						
<i>Pristis pectinatus</i>		1		2	5	8
<i>Pristis</i> cf. <i>P. pectinatus</i>	2					2
<i>Pristis</i> sp.			3			3
Dasyatidae						
<i>Dasyatis</i> sp.				1	1	2
<i>Himantura</i> sp.		1	1			2
Myliobatidae						
<i>Aetobatus narinari</i>	1					1
TOTAL	4	5	12	4	9	34

TABLE 4
Cartilaginous fishes recorded in each offering.

	Offerings					TOTAL
	20 MNI	23	60	61	88	
Belonidae						
<i>Strongylura</i> sp.			3			3
<i>Tylosurus crocodilus</i>		9	1	12	6	28
Hemirhamphidae						
<i>Hemirhamphus</i>			1	2	3	6
<i>brasiliensis</i>						
<i>Hemirhamphus</i> sp.		4				4
<i>Hyporhamphus</i> sp.		3	3	2	10	18
Pomacanthidae						
<i>Pomacanthus paru</i>		6	1	3	4	14
Diodontidae						
<i>Chilomycterus schoepfi</i>		2	1			3
<i>Diodon holacanthus</i>		2	3			5
<i>Diodon hystrix</i>		6	6	2	2	16
<i>Diodon</i> sp.		3	*			3
TOTAL		35	19	21	25	100

TABLE 5
Families of bony fishes shared by the offerings.

	Offerings					TOTAL
	20 MNI	23	60	61	88	
Batrachoididae						
<i>Opsanus</i> sp.		1			1	2
Triglidae						
<i>Prionotus tribulus</i>		4				4
<i>Prionotus</i> sp.			1			1
Haemulidae						
<i>Anisotremus virginicus</i>		4		1		5
<i>Haemulon lavolineatum</i>		1		1		2
Labridae						
<i>Bodianus</i> cf. <i>B. rufus</i>		11		2	1	14
<i>Halichoeres radiatus</i>		3		1		4
Acanthuridae						
<i>Acanthurus</i> sp.		1			1	2
Balistidae						
Balistidae cf. <i>Canthidermis</i> sp.		1		2	1	4
TOTAL		26	1	7	4	38

TABLE 6
Families of bony fish not shared by all offerings.

oblation: three kinds of cartilaginous fish (stingray, sawfish and shark) present in all five offerings, as well as fish of the families Belonidae, Hemirhamphidae, Pomacanthidae and Diodontidae, in the case of the four ashlar masonry box offerings. This essential fish group comprises

only 17 species (34%) but includes a large number of individuals (134, or 63.8%). Conversely, the large number of unshared species, each represented by a few individuals, suggests these other types were probably used as more general objects of oblation.

Cluster analysis

I. Simple matching coefficient (SM): At species and genus levels, relationships between the five offerings are much the same (Figure 4). Offerings 61 and 88 are the most similar pair, which is then successively related to Offerings 20, 60 and 23, with the latter being the most dissimilar. These relationships may be accounted for by the fact that Offerings 61 and 88 share a large number of presences and absences, and they both also have very few unique elements. Offering 23, on the other hand, is the most diverse of all and its many unique taxa imply fewer shared absences with the other offerings. At family level, Offerings 61 and 88 are still the most similar pair, and number 23 the most dissimilar, but Offerings 20 and 60 now have the same degree of similarity with respect to the other three offerings.

II. Jaccard's coefficient (J): Relationships at species and genus levels are again much the same. Offerings 61 and 88 are still the most similar pair, but are here successively related to Offerings 23, 60 and 20, i.e., in exact reverse order to that determined using the SM coefficient (Figure 4). This means that Offerings 61 and 88 still share a large number of species, while Offering 20 is in fact the most dissimilar: it contains very few shared species in comparison with the other offerings. At family level, there is a noticeable change in the relationships: Offerings 23 and 61 are the most similar pair, and are successively related to numbers 88, 60 and 20. Offering 20 is the most dissimilar of all, again due to its poverty of taxa.

III. Consensual analysis: In general, strict consensus between the SM and J analyses confirms that Offerings 61 and 88 are the most similar pair, and indicates an ambiguous relationship among the other three offerings (Figure 4).

COMPARISON WITH PREVIOUS STUDIES

I. Complex A Offerings from the Templo Mayor

The similarity established by López Luján (1993) among the eleven offerings of Complex A was determined using a Euclidean distance coefficient, equivalent to our SM coefficient. In López Luján's dendrogram (Figure 3), Offerings 23, 60, 61 and 88 cluster together with Offering 7 into one branch. This subset is itself divided into two parts:

one formed by the pair of Offerings 23 and 60, the other by the triad of Offerings 7, 61 and 88. Offering 20 is in the second subset, and directly related to Offering 11.

The correlations derived in our study (Figure 4) differ somewhat from those in López Luján (Figure 3). Our dendrograms do indicate Offerings 61 and 88 are the most similar pair, almost the same situation as in previous analysis, given Offering 7 has not yet been incorporated in our study. The main difference arises in Offerings 23 and 60. In our dendrograms they do not cluster as a pair and each one is separately linked to pair 61-88. Likewise, Offering 20 is part of the cluster, instead of being at one end of the tree, as would be expected if it formed a separate branch.

Our examination confirms, this time on the basis of detailed fish attributes, that Offerings 23 and 88 are not very similar to each other, even though they are located directly opposite on a hypothetical E-W axis. In our study, Offering 23 does not relate specifically to any other offering, probably due to its rich diversity. Although some of the relationships indicated by our results are likely to change once all Complex A offerings are incorporated in the numerical analysis, we do not expect Offerings 23 and 88 to cluster as a pair, since the rich diversity of number 23, not shared by any other offering to date, prevents its resemblance to other offerings.

II. Fish in Ethnohistorical Sources

The relevant ethnohistorical sources for fish in the Mexica microcosm were written by Francisco Hernández (1959) and Fray Bernardino de Sahagún. The writings of Sahagún are particularly interesting, since they are based on consultations with elder Mexica sages. Besides his *General History of the Things of New Spain* (Sahagún, 1992) written in Spanish, there is a complementary text in Náhuatl, with illustrations, known as the *Florentine Codex*.

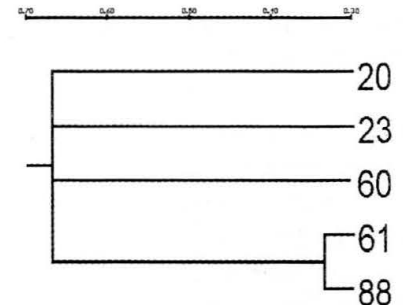
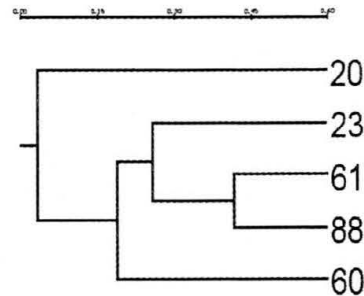
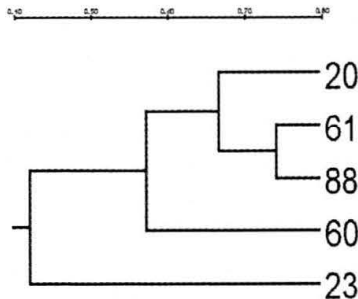
Sahagún described 18 adult fishes, 13 of which are also mentioned by Hernández (Polaco & Guzmán, 1994; Guzmán & Polaco, 2000). In Book XI of his *General History*, Sahagún recorded ten marine fishes, three of which are clearly related to four families and six species recovered in Templo Mayor offerings (Figure 5): *acipaquitli* is the sawfish (Pristidae), *uitzitzilmichi* corresponds to both the houndfish (Belonidae) and the halfbeak (Hemiramphidae), and *chimalmichi* is the French angel-

I) Simple matching
coefficient
SM

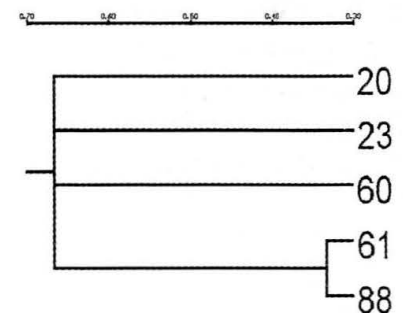
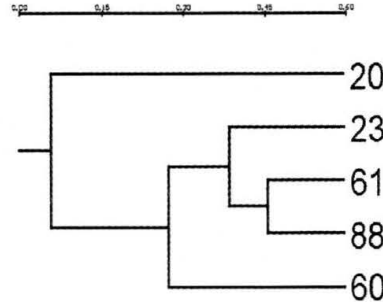
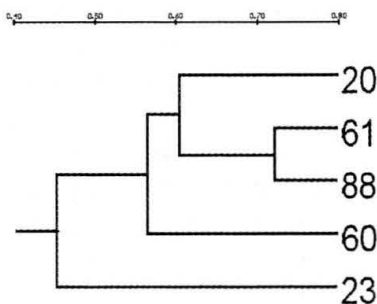
II) Jaccard's coefficient
J

III) Consensus analysis
(SM-J)

a) Species



b) Genera



c) Families

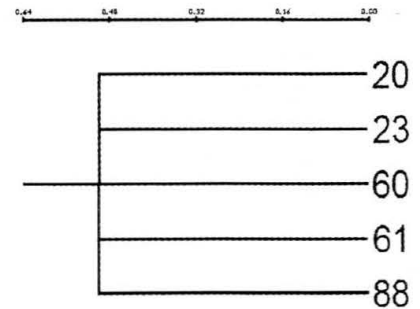
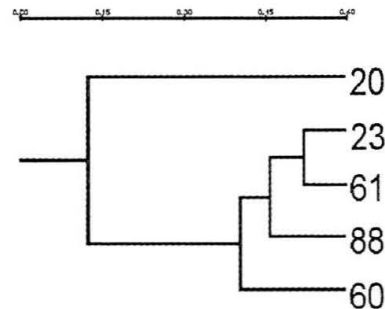
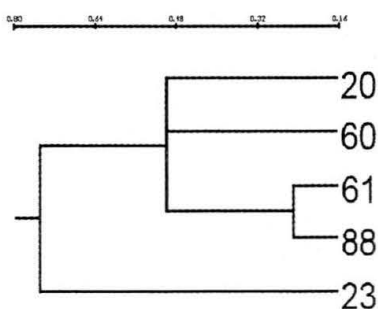


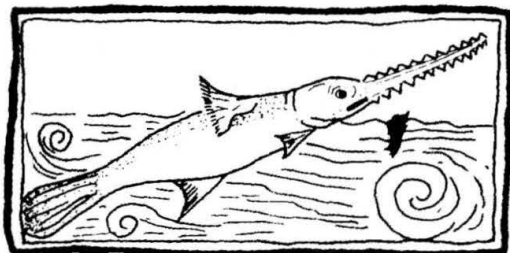
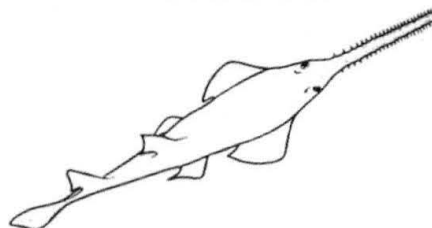
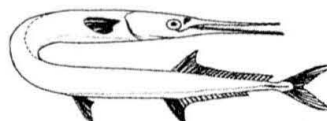
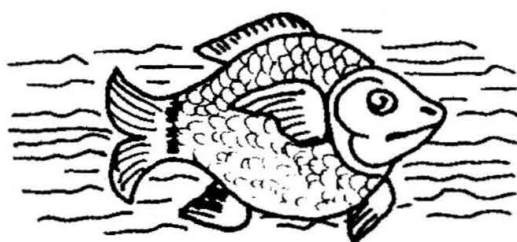
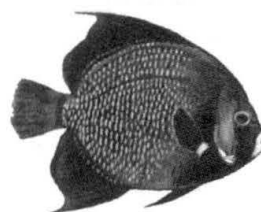
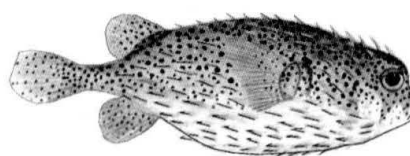
FIGURE 4

Relationships of similarity between five Complex A offerings based on two correlation coefficients and consensual analysis.

fish (Pomacanthidae) (Guzmán & Polaco, 2000). These taxa stand out as some of the most abundant and common fish in the offerings we studied.

Similarly interesting is a Mexica icon interpreted as a representation of a porcupinefish (López Austin & López Luján, 2001), another common

family (Diodontidae) in the offerings, tentatively assigned to *quauhxcouili* by Guzmán & Polaco (2000; Figure 5). Once the ichthyological record of Templo Mayor offerings is complete, we will be better able to compare, verify and corroborate this type of findings.

acipaquitli**Pristidae****uitzitzilmichi****Belonidae****Hemirhamphidae****chimalmichi****Pomacanthidae****quauhxouili****Diodontidae****FIGURE 5**

Comparison between fish illustrations from the *Florentine Codex* (taken from López Luján, 1991) and some species recorded from Templo Mayor of Tenochtitlan. The bottom illustration shows the base of a stone sculpture (taken from López Austin & López Luján, 2001).

CONCLUSIONS

Study of fish remains from five Mexica offerings reveals the presence of 50 species belonging to 30 families. Accordingly, total fish diversity recorded for the Templo Mayor now stands at 57 species.

The richest offering was number 23, with 32 species, while the rest have on average half that amount, except for Offering 20, the poorest of all with only three species. Offering 23 has the highest number of unique taxa (13). Its location before the main facade of the building, as compared to the presumably secondary locations of the other offerings on the sides or back of the structure, might account for its diversity and abundance. In contrast, Offering 20, placed in construction fill at the back of the building, was the least diverse and abundant one.

Cartilaginous fish, in particular shark, sawfish and ray, are the most common and basic elements in the language of the offerings. In the case of ashlar masonry box offerings, four bony fish families also appear to perform this function: Belonidae, Hemirhamphidae, Pomacanthidae and Diodontidae.

Two separate cluster analyses indicate Offerings 61 and 88 are the most similar pair. Offerings 23 and 20 are the most dissimilar in the study group, due to rich and poor fish diversity respectively. Offerings 88 and 23 do not cluster as a pair, despite being opposite each other on a hypothetical axis of symmetry.

Six species in the five offerings correspond to three illustrations and descriptions in Mexica ethnohistorical sources. These species were overall the most abundant and common fishes in the offerings, and allow us to presume the marine fishes mentioned by Sahagún might in fact correspond to those given in oblation at the Templo Mayor. Thus, completion of the archaeoichthyological record of the Templo Mayor is essential, since it may contribute to the interpretation and identification of other types of materials, such as texts, paintings, and stone carvings.

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