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Maya Crocodilians: Intersections of Myth and the Natural World at Early Nixtun-Ch'ich', Petén, Guatemala

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Abstract This essay pursues a four-pronged, interdisciplinary approach in considering the possibility that the unusual layout of the lowland Maya site of Nixtun-Ch'ich' in the lakes region of central Petén, Guatemala, might have been modeled on the scaly back of a crocodile. Part 1 summarizes the biological characteristics of crocodilians, particularly *Crocodylus moreletii*, and their habitats in lowland Mesoamerica. Part 2 reviews interpretations of these reptiles in myth and art, and exploitation of the creature in the lakes area. Third, the ceremonial core of Nixtun-Ch'ich', established in the Middle Preclassic (800–400 BCE) period, is discussed. It exhibits an unusual grid of corridors creating a landscape resembling the bony plates of a crocodilian's back, and a natural cenote-like *fosa* is proposed to relate to a mythical "Starry Deer Crocodile." Part 4 discusses probable social and political characteristics of early community leaders who planned this site's atypical layout, viewed through selectionist theories of cooperation and costly signaling. Designed to mimic the mythical crocodile of creation, Nixtun-Ch'ich' illustrates the role of ideological power in the development of complex societies.

Keywords Crocodile · Gridded layout · Myth · Lowland Maya · Middle Preclassic · Selectionist theory · Costly signaling

Then arises

The great Itzam Cab Ain.

The ending of the word,

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The fold of the katun:

That is a flood

Which will be the ending of the word of the katun.

. . .

And then will be cut

The throat of Itzam Cab Ain.

Who bears the country

On his back.

–(Edmonson 1982: lines 761–772)

How and why do creatures of the natural world permeate the minds of ancient peoples, to play starring roles in their myths and ontologies? Scholarly studies of these creatures tend to preserve disciplinary boundaries of method, theory, and subject matter: biologists, for example, investigate physical traits and habitats; art historians address form, medium, and style. But what if the artificiality of disciplinary boundaries is jettisoned and these divergent perspectives are inter-related through a multi- or interdisciplinary approach?

This essay began as a semi-pareidolian thought experiment: The lowland Maya site of Nixtun-Ch'ich', covering approximately 2 km^2 on the western edge of Lake Petén Itzá in the Department of Petén, northern Guatemala, displays a highly atypical gridded plan. What was the inspiration for this unusual Middle Preclassic site plan? Might the layout have been modeled on the back of a crocodile? The site grid was established by multiple corridors—six east-west and seven north-south—that created quadrilateral blocks or sectors of residential and civic-ceremonial construction. Radiocarbon dates from the earliest corridor modifications above bedrock in the central areas suggest the grid was established in the Middle Preclassic period, 800–400 BCE (Pugh and Rice 2017, Table 1). Gridded layouts are highly unconventional for the Maya lowlands and rare in Mesoamerica as a whole (major

Table 1 Living members of the order Crocodilia in Mesoamerica

Family	Subfamily	Genus	Species	Comment
Crocodylidae	Crocodylinae	*Crocodylus*	*acutus*	Lives along Atlantic, gulf coasts; prefers saltwater
			moreletii	Smaller; prefers freshwater habitats but tolerates saltwater
Alligatoridae	Caimaninae	*Caiman*	*crocodilus* or *sclerops*	Pacific coast (not Maya lowlands); tolerates saltwater

exceptions being Classic Teotihuacan and the Postclassic Aztec capital of Tenochtitlan in the highland Basin of Mexico).

I believe an argument can be made for the scaly back of a crocodilian—specifically *Crocodylus moreletii*—as the inspiration. Here, I explore this possibility from four distinct positions. First, I summarize the current biological and ethological traits of crocodilians and the ecological characteristics of their habitats in the culture area known as Mesoamerica (Mexico, Guatemala, Belize), with special attention to *C. moreletii* in the central Petén lakes district. Next, I review ancient Maya interpretations of crocodilians as they can be discerned from their language, artistic programs, belief systems, and cosmogony, as well as physical evidence of exploitation of this faunal resource. Third, I turn to the site of Nixtun-Ch'ich' itself, considering the likelihood that the early (Middle Preclassic; *ca.* 800–400 BCE) gridded construction plan at this lakeside city was designed to emulate the regular arrangement of armor-like scutes on a crocodile's dorsal surface. This unusual site layout demands attention to those who conceived and imposed it on a community, and thus the fourth section envisions, through the lens of selectionist theories of cooperation and costly signaling, the social and political qualities of such early leaders and planners. In the concluding section, I reflect on how multidisciplinary perspectives (from archaeology plus zoology, conservation biology, art history, ethnography, and historical documentation) illuminate the environmental foundations of Mesoamerican world views and cosmology. Those foundations were uppermost in the minds of the ancient designers and builders of Nixtun-Ch'ich', who commanded a substantial labor force to build a sacred landscape of, and a permanent monument to, Creation.

Crocodilians in Mesoamerica: Biology and Ecology

Crocodiles and alligators inhabit tropical and semi-tropical areas throughout the world, especially in the southern hemisphere, and they flourish in lowland Mesoamerica (see http://www.crocodilian.com; www.reptile-database.org). Crocodilians are primarily aquatic creatures occupying well-vegetated freshwater and saline/brackish habitats, but they are also ambulatory on land. Opportunistic feeders, they are mainly carnivorous, consuming fish, turtles, birds, varied hard-shelled invertebrates, and small and large mammals. Their commercially valuable hides are characterized by rows of keratinous scales or plates known as scutes, which are prominently raised or keeled on the animal's dorsal surface. In some species, these scutes are underlain by bony plates called osteoderms, which form a dermal exoskeleton. Crocodilians' hulking armored bodies and powerful toothy jaws make these apex predators fearsome denizens of the lowland environment.

Taxonomically, crocodilians are members of the order Crocodilia in the class Reptilia, with two families in Mesoamerica: Crocodylidae and Alligatoridae (Table 1). The widest ranging of the Crocodylidae is the American crocodile, *Crocodylus acutus*, occupying the Atlantic and Pacific coastal regions (Fig. 1), and extending throughout lower Central America, the Caribbean, and northern South America (Thorbjarnarson 2010). *C. acutus* has been heavily hunted for its hides and may have been extirpated or nearly so from the southern Gulf coast of Mexico (see Wing 1980, p. 107; also Pacheco-Sierra et al. 2016) and the northern coast of Honduras (Healy 1983, p. 47) before protections were put in place. Similarly, *acutus* was thought to be almost extinct on the south coast of Guatemala, although it has been found in lower elevations of Huehuetenango (Acevedo 2006, pp. 493,

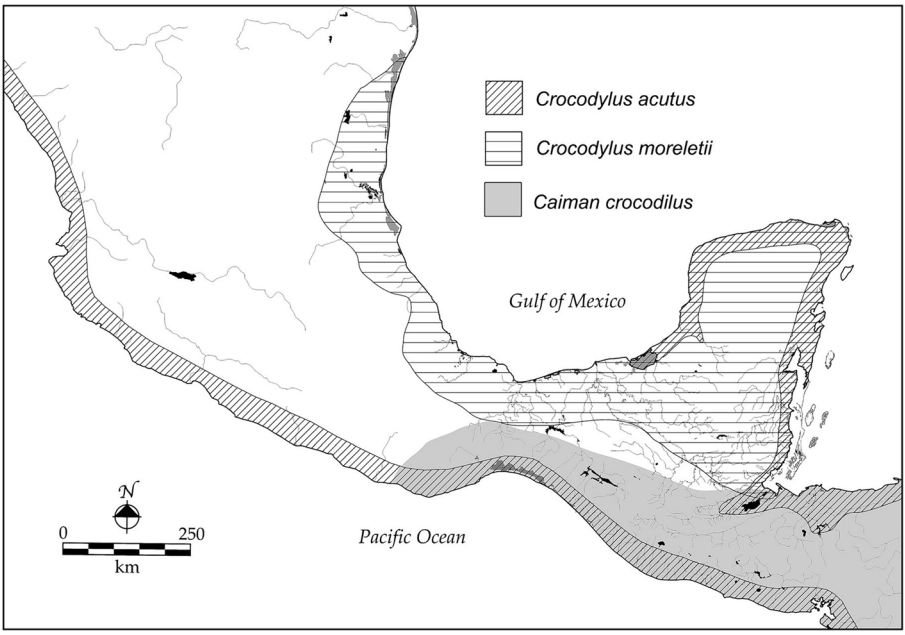

Fig. 1 Mesoamerica, showing the ranges of three crocodilians. Map by Don Rice

518). The smaller Morelet's crocodile, *C. moreletii* (Fig. 2a) has a more restricted range: the Maya lowlands of the Yucatán Peninsula (including Belize and Petén; also northern Alta Verapaz [Acevedo 2006, p. 518]) and along the Gulf coast of Mexico north into Tamaulipas. Today, these crocodiles are farmed at numerous places in their range.

The Alligatoridae are represented in Mesoamerica by the spectacled caiman, *Caiman crocodilus* (or *C. sclerops*; sometimes as subspecies *chiapasius*), its common name derived from a bony ridge between the eyes. Caimans occupy the Pacific region of southern Chiapas and Oaxaca (Mexico), southern Guatemala, and throughout lower Central America. They reportedly were found along the southern Veracruz Gulf coast in the 1930s (Wing 1980, p. 107). Caimans do not presently occupy the Maya lowlands of the Yucatán Peninsula.

The precise natural ranges of these lowland reptiles in Mesoamerica are poorly known—or, better said, poorly illustrated by on-line maps of the International Union for Conservation of Nature (IUCN) Redlist of threatened species. For example, these maps indicate all three species in the mountainous highlands, but crocodilians are lowland animals, rarely inhabiting elevations above 1000 m. They rely on warm ambient temperatures for thermoregulation,[1] although they can survive brief freezes.

Distinguishing Mesoamerican crocodilians by their external appearance can be difficult (see Britton n.d.; Platt and Rainwater 2005). Primary criteria are head shape and snout morphology. Head shape is described by a ratio of length (nostrils to eyes) to maximum width. Alligatorids have broader, U-shaped snouts than crocodylids, although within the latter *C. moreletii* is notably shorter and more broad, blunt, and deep than the narrow, pointed or V-shaped jaws of *acutus* (Fig. 2b). Snout breadth may increase with age and be

[1] One study incorporating mtDNA analysis found a genetically pure strain of these reptiles in a branch of the Macal River in the Maya Mountains of central Belize at approximately 450 m a.s.l., perhaps the "highest known elevational records" for the species (Stafford et al. 2003, pp. 18–19).

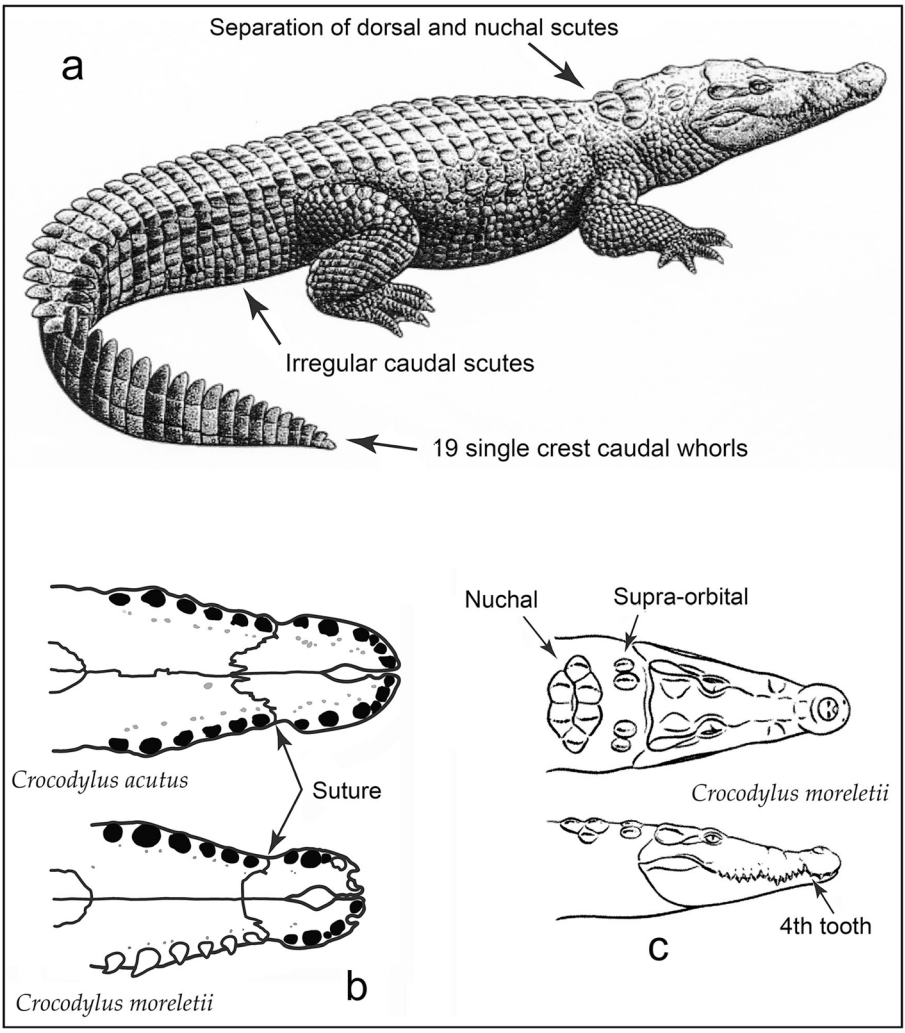

Fig. 2 *Crocodylus moreletii*. **a** Key features (CITES Identification Guide—Crocodilians 1995, p. Yellow 8). **b** Premaxillary-maxillary sutures of *Crocodylus acutus* (left) and *C. moreletii* (right) (after Thurston 2011, Fig. 4.1). **c** Plan and profile views of the head, showing nuchal scutes (CITES Identification Guide—Crocodilians 1995, p. Yellow 8)

accompanied by different feeding strategies: broader jaws are better adapted to a diet heavy in large prey and hard-shelled turtles, snails, and mollusks, rather than solely fish. Dentition is also telling: alligator maxillae slightly overlap the mandible, meaning that when the jaws of alligators and caimans are closed, usually only the upper teeth are visible. In crocodiles, by contrast, both upper and lower dentition—especially the fourth lower tooth, which protrudes outside the maxilla—are visible in the closed mouths.

Another criterion is body size, allowing for sexual dimorphism. Caimans vary from 1.2 to 3 m in length. Male American crocodiles are typically 4 m long although they may be much larger in South America, with some up to 7 m (Thorbjarnarson 2010, p. 46). Morelet's crocodile averages about 3 m but may attain 4.5 m (Platt et al. 2010, p. 79).

The extremities also exhibit some differences. The crocodilians' forefeet or "hands" have five digits, while the back feet have four plus a rudimentary fifth. The hind feet of *C. moreletii* are more heavily webbed than those of *acutus*.

Additional criteria relate to the scales or scutes. The dorsal scutes of Morelet's crocodile usually occur in a "very regular rectilinear array" (Ross, personal communication, 2/13/17), whereas those of the American crocodile are reduced and irregular, often with broken, incomplete, or unequal rows. Other differences among genera and species can be seen in nuchal scutes, the raised plates at the "neck" or base of the head (Fig. 2c), in ventral scutes, and in those on the sides and underside of the base of the tail (Ross and Ross 1974). For example, the ventral scales of some crocodiles have tiny holes near the edge, one per scale, that are pressure-sensitive sensory pores (integumentary sense organs, ISOs); alligators lack these pores except in the head. Finally, the sizes and shapes of the webbed umbilical scars on the ventral surface differ, those of alligators being larger and often "star"-shaped, while those of crocodiles are linear.

Crocodylidae in the Maya Lowlands

Two species of *Crocodylus* inhabit the Maya lowlands, *C. acutus* and *C. moreletii*. The American crocodile, *C. acutus*, is principally a coastal dweller in brackish or saline waters, especially mangrove wetlands, but may travel inland along streams and river courses. One study identified *acutus* in the Rio Usumacinta (Lee 1996), and an "isolated population" is found in the Rio Grijalva, where they occupy reservoirs and riverine habitats (Thorbjarnarson 2010, p. 48). *C. acutus* typically nests in holes dug into soft earth or sand on the banks of creeks or coastal swamps.

C. moreletii was first captured and described in 1857 by the French naturalist Pierre Marie Arthur Morelet (1871) on the basis of a specimen from Lake Petén Itzá (Lara López 1990, p. 4).[2] Also known as the swamp or Mexican crocodile, Morelet's crocodile is territorial and primarily a freshwater dweller, preferring standing or slow-moving waters of closed environments—lakes, ponds, and swamps—to the open environments of faster-moving rivers. Most scientific studies of Morelet's crocodile have been carried out in Mexico and Belize, principally in northern Belize.

The two species are sympatric in vegetated brackish-saline coastal lagoons and mangrove swamps throughout the Gulf coast and Caribbean coast of Mexico and Belize (Cedeño-Vázquez et al. 2006). Although the interior northern Yucatán Peninsula lacks the abundant surface waters of the southern lowlands, crocodiles are found in some of the small freshwater ponds associated with villages and archaeological sites, such as Lago Cobá and possibly in nearby Punta Laguna in the northeast (A. P. Andrews, personal communication, 3/8/17; see also Götz 2008).[3] Recent genetic studies of crocodiles in the Quintana Roo/Belize area have

[2] Osorio Sánchez (2014, p. 45) published Morelet's account of the horrific death of the > 3-m-long crocodile, which was brought to him by some fishermen on the lake. Wanting to preserve it intact to take it back to a museum in Paris, he and his helpers tried unsuccessfully to kill it by poisoning, then hanged it from the rafters of the structure they were staying in.

[3] Joann Andrews (personal communication, 3/8/17), long-time resident of Merida, saw villagers in Campeche around 1970–71 carrying a live crocodile, mouth bound, from their pond to another village that had lost the crocodile inhabiting its pond, which had silted up. The new reptile, they said, would loosen the mud at the base of the pond to deepen it, a valued crocodilian activity.

revealed that the two species hybridize and probably have been doing so for millennia (Cedeño-Vázquez et al. 2008, pp. 662, 666; Pacheco-Sierra et al. 2016; Platt et al. 2010).

Crocodilidae have long been hunted not so much for food (tail meat) but for their hides. Used for clothing, shoes, purses, wallets, and the like, the skin of *C. moreletii* is exceptionally valued because it is soft, has uniform scales and weakly developed osteoderms, and is relatively broad for its length (Lara López 1990, p. 5; Ross, personal communication 2/13/17). The heyday of hunting throughout its range was between the 1950s and 1970s, but since then poaching has diminished, in part due to regulations in place in Mexico and Belize. Continued pursuit is evidenced by the age structures of recently studied populations, showing larger numbers of sub-adults and fewer adults—those with the largest hides to be sold, but necessary to maintain reproduction. Some studies suggest that crocodiles of different sexes and ages (hatchlings, juveniles, sub-adults, adults) may have different habitat preferences, although this might be a consequence of sampling strategies affecting encounter rates (see, *e.g.*, Cedeño-Vázquez et al. 2006, pp. 60–62).

C. moreletii in Petén

Comparatively, few recent studies of crocodilians have been undertaken in Guatemala, deterred at least partly by the country's long civil war. As elsewhere, recent investigations by non-governmental organizations focus on the reptile's conservation status (Castañeda Moya 1998, 2000; Castañeda Moya et al. 2000; García 2014; Lara López 1990). Emphasizing population size/density and age structure, they outline plans for protection and management of the species, balanced with sustainability for harvesting hides (and possible medical uses). All reports highlight the reptiles' threatened status, largely stemming from hunting and habitat degradation but also entanglement in fishing nets and other causes. In Petén, degradation includes encroaching settlement, pollution, and development from explosive population growth, as well as destruction of adults' favored marshy habitats (Castañeda Moya et al. 2000, p. 63, Table 7.1). In these areas (*sibales*, *cibales*, *civales*) dominated by sawgrass (*Cladium jamaicense*), the crocodilians' thick skin protects them from the sharp-toothed edges of the leaves of these large, semi-aquatic grasses.[4]

The long lack of protective regulation of crocodilians in Petén meant that hunting proceeded unchecked and hides were sold over the porous borders, especially to Mexico (Castañeda Moya 1998, p. 31; Lara López 1990, p. 28). Crocodile-hunter (*lagartero*) informants estimated that more than 1000 skins were taken from the central lakes area around 1972 and sold to Mexico (Lara López 1990, p. 28). Hunting takes place on moonless nights, primarily using firearms or a harpoon (*fisga*) made of cane and fixed with four to five hooked steel points; this device can also be used against turtles and large fish (Castañeda Moya 1998, p. 31; Lara López 1990, p. 29).[5]

The mating season of *C. moreletii* in Petén begins toward the late dry season (March or April), when the lake waters have thermally re-stratified or "turned over" (surface water

[4] In 1697 Franciscan father Andrés de Avendaño y Loyola (1987, pp. 56–57) and his party became lost after being forced to flee the Itza capital and wandered—starving and barefoot—for thirteen days through northeastern Petén. He reported "a kind of square grass which, if it caught . . . our face, hands, or legs it cut them like a small saw," along with "many alligator holes."

[5] Sixteenth-century Bishop of Yucatán Diego de Landa (in Tozzer 1941, p. 192) described villagers hunting down a human-eating crocodile: a small dog was impaled on a stick with a rope tied to it, then tossed into the water. When the crocodile swallowed the dog, the stick pierced the reptile's body and it was hauled onto land.

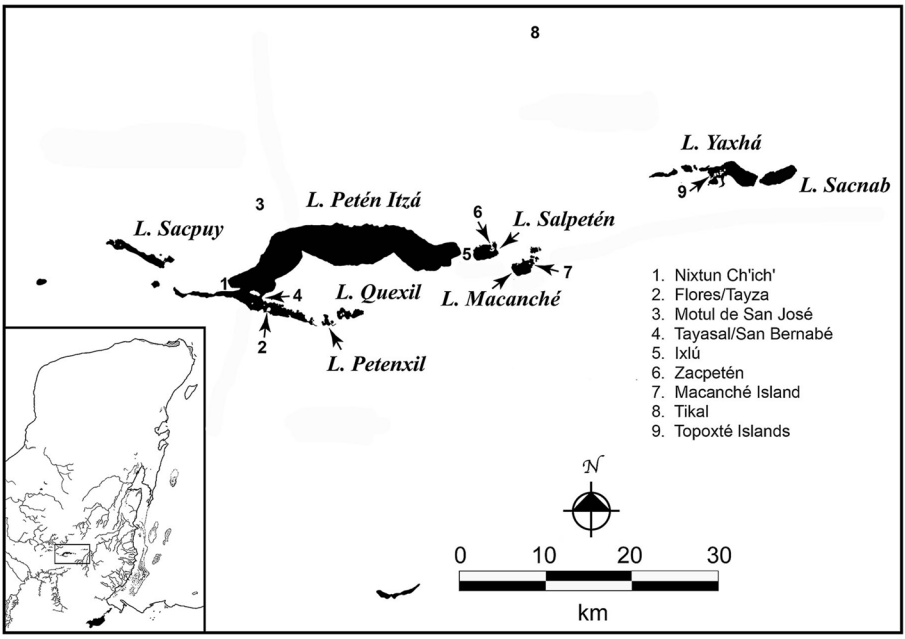

Fig. 3 The central lakes region of Petén, Guatemala, with important sites. Map by Don Rice

warms and cooler water sinks). Copulation takes place in open water and eggs are laid by the beginning of the rainy season, typically by June. The nests, mounds of mud and fresh and decomposing vegetation, measure 90–130 cm in diameter and 32–80 cm high (Castañeda Moya 2000, p. 13; Lara López 1990, pp. 39–40). Hatching occurs around 80 days later, generally in August and September after the rainy season is well under way and food is widely available.

Three studies have investigated populations of *C. moreletii* in six of the eight lakes forming an east-west chain in central Petén, although without attention to the morphometry of these watersheds or the geochemistry of their waters. The lakes formed in a fault line in the underlying limestone (interbedded with dolomite, gypsum, and marl) around 17° N latitude (Fig. 3). They all exhibit steep terrain on their northern shores, gentle slopes

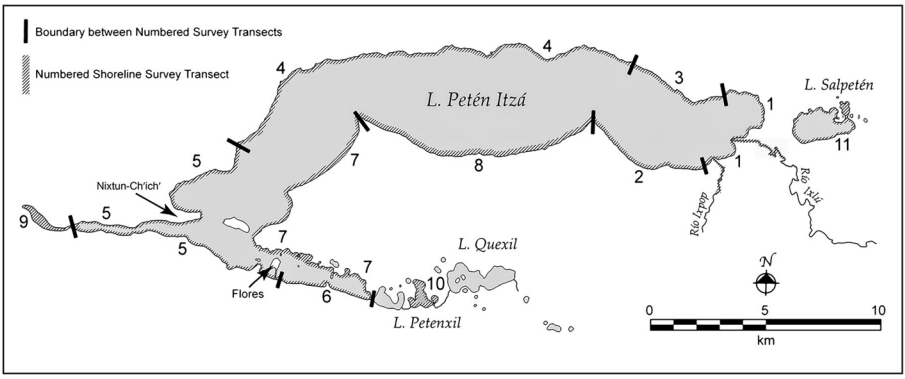

Fig. 4 Lake Petén Itzá, showing Oscar Lara López's nine shoreline survey transects, plus Transect 10 around Lake Petenxil. Map by Don Rice (after Lara Lopez 1990, Fig. 3)

and shallow waters on their south shores, and lack external drainage. Most have slightly brackish waters that can be characterized geochemically as bicarbonate systems (Sacpuy, Petenxil, Quexil) or sulfate systems (Petén Itzá, Salpetén, Macanché) (Brenner 2018). The waters of Lakes Sacnab, Salpetén, and Macanché—the last effectively Epsom salts, a laxative—are not potable. All the lakes are notorious for their unpredictably fluctuating stages, which can rise and fall as much as 4–5 m over a few years.

Oscar Lara López's (1990) study of the Lake Petén Itzá basin, undertaken at a time of high lake stage, involved nine shoreline transect surveys around the 95 km of lake margins. No crocodiles were seen in five transects (T) around the large, open, main body: two (T4 and T5) on the north shore and three (T2, T7, T8) on the south shore (Fig. 4). This is unsurprising, considering that the waters are frequently choppy with whitecaps, particularly in the west (T5) and during the rainy season. Moreover, the north shore has steep slopes with few shallow littoral habitats for these reptiles or for the submerged eel grass, *Vallisneria americana*, favored by their fish prey. Crocodiles were evident at the eastern end of the lake (T1), the area of Ixlú and its two small streams (Ixlú and Ixpop), and the shoreline just to its northwest (T3); in the small, shallow southeastern "thumb" of the lake, east of Flores (T6); and especially in the small, isolated tip of the western finger (T9; Lara López 1990, Fig. 3, cuadro 3). This last was, at the time, difficult of access and not exploited, and Lara López (1990, p. 45) suggested that it was probably the only part of the region with a natural crocodilian population structure and density.

Lake Petenxil or Petenchel, Lara López's Transect 10, is located on privately owned land developed for tourism and ecological preservation. Because hunting is not allowed, this tiny (area 0.56 km^2) lake east of Lake Petén Itzá's eastern thumb is home to a small population of crocodiles. Archaeological surveys in the watershed noted traces of ancient raised or ditched fields in the southeast portion of the lake and a canal joining the southwestern shore and the eastern thumb of Lake Petén (D. Rice 1996). These *chinampa*-like fields are another favored habitat of crocodiles because of their varied food resources (Puleston 1977). The area of Lakes Petenxil and Quexil (and perhaps farther east) was called Alain or Yalain (*ain*/*ayin*/*ayiin*/*ahiin* 'crocodilian')[6] by the seventeenth-century Itzas (Rice and Rice 2018). Alain/Yalain "place of young crocodiles" (Hofling and Tesucún 1997, p. 154) may have been a breeding ground, possibly managed by the Itzas. Its location was long unclear to the Spaniards, doubtless undisclosed because of the "heathen" beliefs connected to these animals.

Lake Salpetén is a small lake (2.9 km^2) ~ 1 km east of the eastern edge of Lake Petén Itzá. Little settlement existed in the basin until recently, when a small hotel was established on its peninsula—encroaching on the Postclassic site of Zacpetén. Lara López's Transect 11 covered the lake and he reported a high level of hunting at the time, with a low population of juveniles (1990, cuadro 4).

Lake Macanché (2.5 km^2) has considerable modern population and cattle-raising activity on its shores. Of the two tiny *lagunetas*—perched sinkholes known locally as *juleques*—to its north investigated by Francisco Castañeda Moya (2000), one was on property developed and protected for ecotourism. The other, closer to the main lake, evidenced a lower proportion of adult crocodiles, probably a consequence of hunting.

[6] Another crocodile-named site, Lamanai on the New River lagoon in northern Belize, was probably originally *lama'anayin* "submerged crocodile." An early Late Preclassic "stylized crocodile effigy bowl" from an elite burial may be the earliest crocodilian imagery at the site (Powis 2004, p. 59, Fig. 3.3a).

Eastern Lakes Yaxhá and Sacnab lie in a protected area, Parque Nacional Yaxhá-Nakum-Naranjo, established in 2003, where hunting of wildlife is now forbidden. In the 1970s and 1980s, crocodiles were hunted by members of the Kaibiles, Guatemala's elite anti-guerilla military squad which had a training base near the lakes, for "exotic" meat to serve at graduation festivities (Lara López 1990, pp. 13, 29). Valerie Andrea Corado García investigated crocodiles in southern Lake Petén Itzá, the north shore of Lake Yaxhá, and Lake Sacnab, and two other Petén lakes. She (García 2014, p. 45) found that the *moreletii* crocodiles in Lake Sacnab consisted primarily (72%) of adults, reflecting the lack of hunting and suggesting little threat to the population.

Crocodilians in Ancient Mesoamerica: Myth, Art, and Archaeology

Crocodilians played prominent roles in the cosmovision of Mesoamerican peoples, and they may be part of an ancient belief system found widely among agricultural societies in Mesoamerica and South America (Grove 1993, p. 91, citing D. Lathrap).[7] These creatures' fearsomeness was indelibly inscribed in Mesoamerican thought, but equally salient was their liminality: their amphibious ability to occupy both—or to transition between—watery and terrestrial habitats. According to much Mesoamerican ontology, including that of central Mexico and the Mayas, the world and its creatures (including pre-humans) were created, destroyed by varied cataclysms (flood, earthquake, volcanic eruption), and then re-created multiple times. In the sixteenth century, central Mexicans told Spanish interlocutors they were in the fifth such creation; the Mayas of Yucatán claimed to be in the fourth. The earth was considered animate, its surface conceived as the back of a giant crocodilian (sometimes a fish or a turtle) floating in a primordial lake or sea (Thompson 1970, pp. 216–217; see also Puleston 1977, p. 459; Stone and Zender 2011, p. 183).

Mesoamericans' early preoccupation with crocodilians is seen in long-lived day names: the name of the first of the 20 days in many highland central Mexican 260-day "calendars" (sacred divinatory almanacs), including that of the Aztecs, is Cipactli (Fig. 5a). Cipactli is generally translated as "alligator" or "he who has quills or spines" (Rodríguez Galicia and Valadez Azúa 2013, p. 66), and in Postclassic central Mexico it may reference a fish or shark (Order Carcharhiniformes; see Arnold 2005, p. 14). The first day of the Maya almanac, Imix ("waterlily"), references the characteristic freshwater vegetation of crocodilian-occupied habitats. The main sign of the Imix glyph may be a logogram for water, and one variant features a reptilian head below (Doyle 2012, p. 132). These crocodile-water associations are allegories of creation, and support inferences of the probable lowland origins of the day names in the almanacs (Edmonson 1988; Rice 2007, pp. 46–47; Thompson 1966).

Preclassic/Formative Representations

Crocodilians began to appear in Mesoamerican iconography in the Late Early Formative period (*ca.* 1600–900 BCE) in the Gulf lowland Olmec region and related areas

[7] Similarly, in North America a crocodile-like "Underwater Panther" is a powerful water "monster" that guards lakes and is associated with rain. It has the head and paws of a feline, a scaly body, upright spikes on its back, and a long tail; it may also have antlers or feathers. This description recalls the Maya "Starry-Deer Crocodile" and Aztec Cipactli (see text). A central Ohio effigy mound is called "Alligator Mound" (Lepper and Frolking 2003).

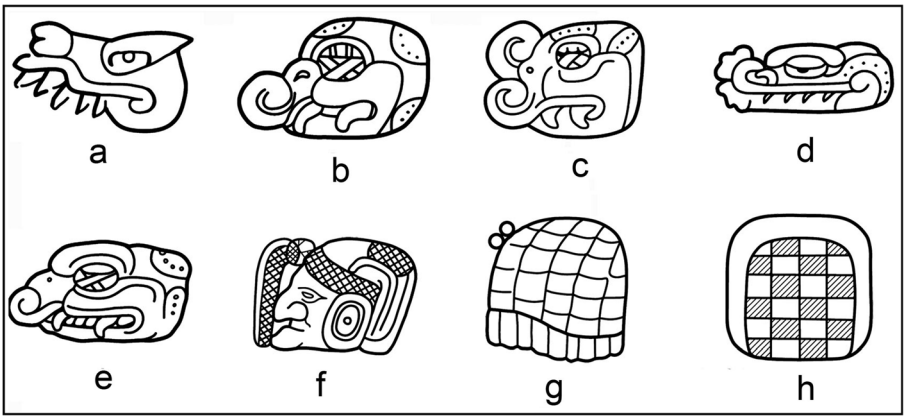

Fig. 5 Crocodile logographs and possible uses of skins. **a** Cipactli (Nahuatl) day glyph (after Edmonson 1988, p. 220). **b–d** Classic Maya (after Macri and Looper 2003, p. 64). **e** In Tikal ruler Yax Nuun Ayiin's nominal (after Martin and Grube 2008, p. 32). Note crossed bands in eye. **f** *Pawahtun* (old god) (T1014; PT4; Macri and Looper 2003, p. 147). **g** Helmet or "drum major" headdress (T678; ZD5; Macri and Looper 2003, p. 221). **h** Shield (*pakal*) (T594; XD2; Macri and Looper 2003, p. 179)

(see Stocker et al. 1980). Unfortunately, most of these depictions can only be dated by general style. Through time, these and other supernatural beings came to be endowed with attributes of other animals: snakes, lizards, birds, felines, and even deer. Small wonder, then, that these fantastic creatures are often dubbed "dragons" or "monsters" by archaeologists and art historians.

One such composite zoomorph, an earth monster, was among "three fundamental themes" in Olmec iconography (Pohorilenko 1996, p. 124). This creature's attributes are variable, but usually it has a reptilian/saurian body (sometimes more feline or piscine), serrated or cleft ("flame") brows, and maxillary dentition, but lacks a mandible. In pottery decoration, the creature is often referenced through isolated (pars pro toto) incised motifs of the head (commonly the flame brow) and the "hand-paw-wing" motif, likely a crocodile's forefoot with five digits (Stocker et al. 1980, p. 743). The frequent absence of a mandible suggests conflation with an early shark or "fish monster" supernatural, which also has a reduced lower jaw; its body is marked by crossed bands (Arnold 2005; Joralemon 1996, p. 55). At La Venta, a tomb from construction phase 4 featured a sandstone sarcophagus (Monument 6) carved to represent an earth-crocodilian, which "floats" above the primordial sea symbolized by the greenstone pavement of Massive Offering No. 2 (Reilly 1989, pp. 4–6).

In the highlands, crocodilians play a role in poorly preserved but stylistically Early Formative low-relief sculptures at Chalcatzingo, Morelos. Monument 5 shows a composite reptilian-shark with crossed bands on the back and an open, toothy mouth swallowing an anthropomorphic figure by its left leg (Angulo 1987, pp. 147–148). Monument 8 shows a creature with four short legs and a long, erect, branching, tree-like tail (Angulo 1987, pp. 133–134). Also in Morelos, a terracotta figurine from Atlihuayán, 29.5 cm high, depicts a seated individual wearing the skin of a crocodilian over its back (Fig. 6a; Clark 2008, p. 163, Figs. 7 and 8). A diamond shape in the center of the skin may be an umbilical scar, raising the possibility that it is from an imported caiman (alligatorid; from the Pacific coast?), rather than a crocodile. Crocodilians do not typically occupy these Morelos areas' elevations of around 1000–1200 m above sea

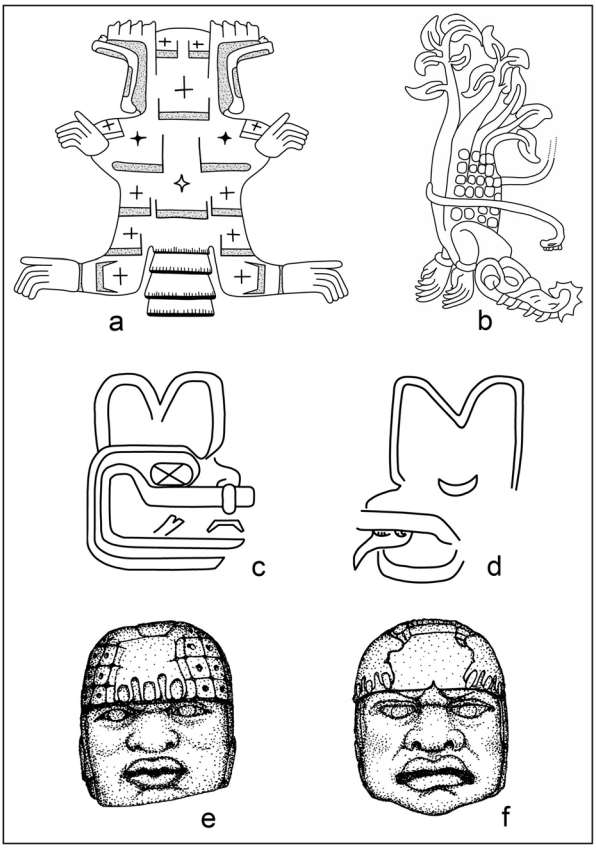

Fig. 6 Crocodilians in Mesoamerican art, iconography, and texts. **a** Crocodile skin on the back of the Atlihuayán (Morelos) figure (redrawn after Clark 2008, Fig. 8e. In some earlier published drawings, the diamond in the center of the back was shown open, as here). **b** Crocodile tree on Izapa Stela 25 (after Norman 1976, Plate 42).**c**, **d** Masks on the Señor de Las Limas sculpture: **c** crocodilian, right knee; shark, left knee (after Benson and de la Fuente 1996, Cat. No. 9). **e**, **f** "Colossal heads" from San Lorenzo: **e** Head 10 (after Cyphers 1995, p. 43); **f** Monument 5 (after Coe and Diehl 1980, Fig. 428)

level, thus these images support the existence of an early and widespread mythology involving lowland crocodilian creatures and trade in their skins, teeth, and other power regalia (Stocker et al. 1980, p. 749).

Another early sculpture is the "Señor de Las Limas" from southern Veracruz, a seated figure with four tattoo-like profile masks on the upper arms/shoulders and lower legs/knees. The mask on the right knee differs from the others in having a square eye with crossed bands and a curving, cleft fang pointing upward from the lower jaw (Fig. 6c). This mask has been interpreted as a serpent (Grove 2000) and linked to Quetzalcoatl and an earth monster (Clark 2008, Figs. 11 and 13). More likely, the up-turned fang is the prominent fourth tooth of the crocodile mandible, and crossed bands in the eye characterize earth crocodiles or creatures with watery Underworld connections. The head of the early shark monster appears on the sculpture's left knee (Fig. 6d; Arnold 2005, p. 10).

Crocodilians also play key roles in the iconography of Late Preclassic/Formative Izapa, Chiapas (*ca.* 400 BCE–200 CE), where several carved monuments depict these reptiles. Stelae 2, 5, 25, and 27 depict a crocodilian as a tree or the roots of a tree (see

Garber and Awe 2009, p. 155). On Stela 25, the toothy snout is embedded in the earth and leafy branches emerge from the raised hind end in place of legs and tail (Fig. 6b); on Stela 5, a similar crocodile is a World Tree with the head and forelimbs forming the roots. Stela 11, with a solar deity emerging from the gaping jaws of a crocodilian, portrays the birth of the sun from the earth monster. All images can be related to episodes in the *Popol Vuh* (see Rice 2007, pp. 117–125).

In the Maya lowlands, crocodilians appear on two probable Middle Preclassic carvings in the Mirador basin of Petén. La Isla Stela 1, an irregular boulder reset in later times with an altar, has an incised profile crocodile head, snout pointing up and right, with a "bifurcated flame eyebrow. .. shark-like maxillary teeth" (Hansen 2016, p. 374), and an eye resembling that in later Maya representations. Altar-like Nakbe Monument 8 features an eroded bicephalic saurian with a skyband-like body, heads pointing downward and emanating cloud scrolls (Hansen 2016, p. 377).

Classic and Postclassic Maya Art and Mythology

Crocodilians in nature occupy two habitats, terrestrial, and aquatic, and they came to embody essential dualities in Mesoamerican cosmovision. They were potent symbols of cosmic order because they represented "both the earth's surface when in a horizontal position and, in a vertical position, the axis of the universe, much like a World Tree" (Stone and Zender 2011, p. 183). In Maya art and mythology, crocodilians have celestial and telluric manifestations, and they are often depicted as bicephalic, with heads in front and rear. The two heads symbolize their distinct habitats and the structural oppositions of the empyrean versus chthonic realms: sunlit upper world versus the dark, watery Underworld. Maya supernaturals are conceptualized not only in dualistic terms but also as having quadripartite aspects (*e.g.*, the Chaaks, rain gods).

The classic logograph for a crocodilian[8] (Fig. 5b–e; T844; AL6 in Macri and Looper 2003, p. 64; Stone and Zender 2011, p. 183) is a profiled, left-facing head with a curled snout, a thick curving element over the cross-banded eyes, and prominent maxillary dentition. Herpetologist James Perran Ross (personal communication, 2/13/17) explains that the ridge over the eye is a characteristic of crocodilian skulls, attaining prominence in large, old males when it "may even project up and back behind the head" like a horn (and like the early flame eyebrow). A curled snout is not a natural trait but may occur in crocodiles kept in captivity in small enclosures. Alternatively, it might be a subtle allusion to the nose of the Olmec shark monster, with the crossed bands of the latter's body transferred to the eye. Or, this snout may be merely an artistic convention and adaptation to the confines of glyph cartouches.

Crocodiles in Creation Myth

Crocodilians play key roles in Maya creation myths surviving in various sources: Classic (200–900 CE) texts (*e.g,* at Palenque, Chiapas); late indigenous Yucatecan "books" of the *chilam b'alam* (especially the *Chumayel*: see Edmonson 1986;

[8] The sign occurs in the nominal of Tikal's late fourth century ruler Yax Nuun Ahiin I (Blue-Green Knot Crocodile) (Martin and Grube 2008, p. 32). His name alludes to the axis mundi or world center, and cosmic order (Stone and Zender 2011, p. 183). An articulated crocodile skeleton was found in his tomb (Burial 10; see Coe 1990, pp. 480–486).

Knowlton 2010, pp. 72–75; Roys 1967); the highland K'iche' *Popol Vuh* (Christenson 2003; Tedlock 1996); the four surviving codices; and other accounts (*e.g.*, Thompson 1970, pp. 330–348; Tozzer 1941, p. 136 n633). These creatures are usually composites, and include those dubbed an Earth Monster, a Celestial or Cosmic Monster, a Celestial Crocodile, and a Cosmic Caiman (see Martin 2015, pp. 192–196). In some analyses, the Celestial or Cosmic Monster has been considered a representation of the Milky Way stretching across the sky (Freidel et al. 1993, pp. 87–91; Stuart 2005, p. 72), its "dark rift" the crocodile's mouth (Jenkins 2010, p. 8).

An ancient and widespread Mesoamerican mythology of cosmogenesis relates that a "primordial water creature is killed in order to create the surface of the world" (Stuart 2007, p. 215). This sacrifice established the beginning of time and space (Houston et al. 2006, p. 93). Of particular interest is a carved text on the south face of a platform in Palenque Temple XIX (Stuart 2003, 2005, pp. 60–77). It relates that a crocodilian was decapitated (*ch'ak* 'chopped') in a time before time, before the start of the current Maya era in 3114 BCE. The creature is identified in the Palenque text by two glyphic collocations as "hole-backed" and "painted-backed" (Fig. 7a). The circular sign read "hole" represents a "cavity within the earth, such as a cave or cenote"; the reading of "painted, written, inscribed" or even "spotted" has the root *tz'ib*, to write (Stuart 2005, p. 73). After the decapitation, fire is drilled (perhaps in the hole in the back?) and something (unclear) is formed. This creature, depicted elsewhere, has been given the moniker "Starry Deer Crocodile" (hereafter SDC). It

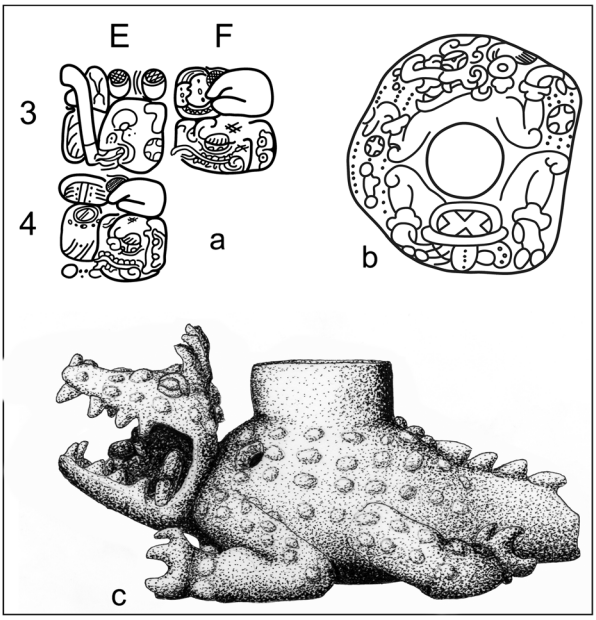

Fig. 7 The Maya "hole-backed" crocodile. **a** Partial text from the inscription on the south side of the Palenque Temple XIX Platform: "Chopped [E3] is the head of the 'Hole'-backed Starry-Deer Crocodile [F3] (and) the Inscribed-back Starry Deer Crocodile [E4]" (after Stuart 2005, Fig. 41a, prose translation p. 197). Note Venus/star glyph in ears. **b** Unprovenienced jade earflare incised with a Starry-Deer Crocodile (after Stuart 2005, Fig. 47a). Note star eye, antler(?) behind eye, hooves, forefeet "scattering" blood or rain, and the "*k'in* bowl" with stingray spine perforator and shell between its hind legs. **c** Ceramic figurine from Santa Rita, showing crocodile with an opening in the back, antlers, and an anthropomorphic head in the maw (drawn from photograph kindly supplied by National Museums Liverpool)

has deer hooves, antlers, ears with an infixed star or Venus glyph (*ek'*), and an eye with a star as the pupil. The vertical lines on the eyelid (Stuart's "long lashes") resemble both an inverted trefoil and the lower part of an "Imix" glyph.[9]

The SDC appears to be one aspect of the complex Celestial Crocodilian or Monster, and may appear in an early form as the reptiles on Izapa Stelae 25 and 27 (with a hole in the back) (Stuart 2005, p. 75). In some depictions, the creature is bicephalic, its left head and side decorated with watery vegetation and a star glyph, and the right head and back displaying a bowl holding sacrificial implements (Vail and Hernández 2013, p. 165; see also Carlson 2015, p. 209; Carrasco 2010, p. 604; Stuart 2003, 2005, pp. 70–73; Velásquez García 2006). The left side of the crocodilian relates to rainfall and the right side to blood sacrifice. Its eyes may have the star glyph of the SDC or crossed bands.

Because of the importance of crocodilians in Maya ideology, their heads and bodies are often modeled in pottery or carved in bone, stone (including greenstone/jade) (Fig. 7b), or even chipped eccentric flints,[10] as thousands of museum pieces attest. Late Classic polychrome pottery depicts a veritable bestiary of tropical creatures in palace and mythical settings, but large herpetofauna—crocodiles, alligators, caimans, lizards, and so on—are extremely rare (*cf.* K9149; Kerr n.d.). These elegant vessels also often show the Classic Maya creator deity Itzamna as a divine ruler on a throne in the sky or in a mountain cave (Stone and Zender 2011, p. 47).

An important Postclassic (*ca.* 950/1000–1525 CE) deity is Itzam Kab Ain (*kab* "earth"; *ain* "crocodilian"), the earth aspect of Itzamna (Knowlton 2010, pp. 74–75; Taube 1989; Vail and Hernández 2013, p. 76). Itzam Kab Ain (hereafter IKA) is frequently shown with vegetation, particularly corn and waterlilies, adorning its body. A common Postclassic pottery cache vessel in the eastern Yucatán Peninsula (including Belize) is a small modeled crocodilian (IKA?) with a human head (ancestor?) emerging from its jaws. One such figure from Lamanai retains venerable features of the SDC: a fish-like tail and "bumpy antlers" (Pendergast 1985, p. 3, cited in Thurston 2011, p. 120). Another, from Santa Rita, has antlers and a hole in the back (Fig. 7c; Stuart 2005, Fig. 47b).

Post-conquest Maya texts reveal the longevity of crocodilian legends. In the *Chilam Balam of Tizimin*, IKA is born, ascends to the sky, and brings forth a deluge (see epigram). Like the SDC, the beast's throat is slit (or the head cut off, Stuart 2007, p. 230 n6) by creator deities, it dies, and its body, sprinkled or "painted" with its blood, forms the surface of the earth (Knowlton 2010, p. 75; Vail and Hernández 2013, pp. 51–52). Another ancient creation-myth variant is told in the *Popol Vuh* (2003; Tedlock 1996), penned by sixteenth-century highland K'iche's but with possible lowland origins. Here, two primordial crocodilian/saurian brothers are earthly rather than celestial dyads: Zipacna (≈ Cipactli) makes mountains and Cabracan destroys them with earthquakes.[11] At their deaths, Zipacna turns to stone and Cabracan's limbs are bound and he is interred in the earth. Both tales can be related to a central Mexican

[9] On Quirigua Altar M, the eye of a blunt-snouted reptile (snake or crocodile) is an upside-down "crosshatched *imix,*" with the parallel lines in the eyelid over the eyeball and the crosshatching at the top (Looper 2003, p. 61).

[10] Two unprovenienced Late Classic Maya eccentrics at the Dallas Museum of Art, possibly found together, were chipped into the shape of an earth-crocodilian canoe with vegetation on the underside, one ferrying the Hero Twins into the Underworld.

[11] Tedlock (1996, pp. 211, 240) suggests the bicephalic Celestial Monster and IKA represent the brothers Zipacna and Earthquake. Both Zipacna/Cipactli and Earthquake are Aztec day names.

myth in which the gods Quetzalcoatl and Tezcatlipoca engage Cipactli, the primeval fish/shark monster, tearing off its mandible[12] which becomes the earth's surface (Arnold 2005, pp. 13–14). Cipactli in turn removes the lower leg of Tezcatlipoca, harking back to the scene on Chalcatzingo Monument 5.

The Sun and the Rain

The bicephalic Cosmic Monster can be seen as a metaphor for the sun's journey. Step III of Yaxchilan Hieroglyphic Stairway 3 shows the creature with the head of the Sun God in a large cartouche in place of its body (Acuña 2015, p. 177). The SDC may be a "starry, nocturnal aspect" of the cosmic monster: its left head swallows the setting sun, which travels through its belly—the Underworld—during the night and is reborn from the maw of the right head (Stuart 2005, p. 72; Vail and Hernández 2013, pp. 51–52). Similarly at Copan, the bicephalic monster above the doorway to the inner room of Structure 22 may represent the path of the sun on the winter solstice (Bassie-Sweet 1996, p. 50).

Saurian creatures, including lizards/iguanids[13] and crocodilians, are generally associated with rain in Maya art and mythology (Tozzer and Allen 1910, p. 319; also Arias Ortiz 2007, pp. 110–111; García 2014, p. 5). More specifically, they announce the coming of the annual rains, an association probably related to crocodilians' mating season. In various species—notably the northern-dwelling American alligator (not found in Mesoamerica)—mating season begins with loud vocalizations or bellows. *C. acutus* bellows, but not as loudly as the northern alligator, and *C. moreletii* is quieter still. These thunder-like vocalizations can be viewed as communication with the rain gods in their watery abode, thereby summoning the seasonal precipitation. June and July rains sweep over Petén from the east, the storms building energy as they absorb heat and moisture from the warm waters of Lake Petén Itzá. By the time the towering cumulonimbus clouds reach its western shore, they pound the area with torrents of rain, violent straight-line winds, and even historically recorded tornadoes. Unsurprisingly, the toponym of a Classic site (Motul de San José) on the northwestern lake shore is Ik'a' "windy water" (Tokovinine and Zender 2012, p. 35). Crocodilians' associations with deluges or floods may also relate to the reptiles' greater visibility, as changing water conditions can prompt them to move many kilometers into new foraging areas (Ross, personal communication, 2/13/17).

On page 74 of the Postclassic Dresden Codex, the upper register shows IKA having ascended into the sky, head to the left and facing down. His body comprises the hieroglyphic segments of a skyband,[14] from which dangle eclipse glyphs; on other

[12] The missing mandible in these myths may help explain a long-standing Mesoamerican ritual practice of removing mandibles of human enemies as trophies. The mouth—a source of powerful voice and speech—is a particular target of monument destruction, and its removal symbolically silences that voice and terminates its power.

[13] Lasting confusion has resulted from early Spanish "*lagarto*" referring to reptiles now identified taxonomically as lizards (order Squamata) and crocodilians (alligators and crocodiles) (Osorio Sánchez 2014).

[14] Two images from the deer-hunting and -trapping almanacs in the Madrid Codex (pages 40C and 47A) depict a small deer reclining on a skyband. Although this image may have astronomical significance, perhaps referencing a deer constellation (Vail 1997, p. 92; von Nagy 1997, p. 53), it may reference the SDC and the Celestial Monster.

pages his back is painted (Vail and Hernández 2013, p. 48). The water pouring out of IKA's mouth, a deluge related to Maya versions of nearly universal world-destroying flood myths, is a contentious element. John Carlson (2015, p. 216) claims that nothing in the Dresden 74 text or in other Maya codices illustrates or mentions floods, although they are present in central Mexican sources. He (Carlson 2015, pp. 197–198) suggests that such references in the *chilam b'alam* books and elsewhere (*e.g.*, Landa in Tozzer 1941, p. 136) were influenced by Christian teachings and Biblical sources, such as Noah's flood. The liquid spilling from the mouths of snakes or crocodilians, or from overturned water jars, depict the start of the annual rains to "ensure the cyclical regeneration" of life, not to inundate it (Carlson 2015, p. 219; see Thompson 1972, pp. 88–89).

Which Crocodilian?

The complex concepts and mythic associations of crocodilians in Classic and Postclassic Maya depictions have made it difficult if not impossible to identify which family (crocodilidae, alligatoridae) or species is featured. Scholars who have considered crocodilian ethology along with Maya art have largely avoided questions of genus/species identifications (*e.g.*, Arias Ortiz 2007; Osorio Sánchez 2014). Two studies of IKA identified this creature in Postclassic Yucatán as a caiman (Taube 1989; Velásquez García 2006). However, as we have already seen, true caimans are not found—at least today—in the Yucatán Peninsula. IKA, then, is more likely based on either *Crodocylus acutus* or *C. moreletii*. On Late Classic Altar T at Copan, Honduras, a splayed crocodilian carved on its upper surface has a toothy maxilla, possible crossed bands in the eye, fish nibbling water lilies at the wrists and ankles, and a bifurcated, fish-like tail, hinting at a common ancestry with the Formative shark monster. On Copan Altar D' the left head of the bicephalic creature has teeth in both jaws and a crossed band in the eye (Vail and Hernández 2013, Fig. 3.4). Given Copan's location, these crocodilians could be *C. acutus* or *moreletii*, or caimans.

Crocodilians in Archaeological Contexts

Zooarchaeological research reveals that crocodilians were hunted by the Mayas and by Mesoamericans in general. Species identifications of their remains from archaeological contexts are difficult, however: The animals are little distinguished skeletally, osseous remains are fragmentary, and differences are primarily apparent in soft tissue or are age and sex related. One small clue is the premaxillary-maxillary suture of the skull: it is transverse in *moreletii*, but in the form of a "W" or a "V" in *acutus* (Fig. 2b; Castañeda Moya 1998, p. 25, citing Ross 1987). Recent studies of hybridization between *C. acutus* and *C. moreletii* suggest this is an "ancient process" occurring over thousands of years (Pacheco-Sierra et al. 2016, pp. 3491, 3494), although possible effects of hybridization on skeletal morphology have not been investigated. Zooarchaeologists thus typically report elements at the level of the family or genus, rather than by species.

Were crocodilians hunted in pre-Columbian times for their meat, their hides, their mytho-medical significance, or for all these reasons and others? Much of their flesh has a gamy taste, except for the "white meat" of the tail, which is a delicacy today. If the tail meat were preferentially consumed by ancient Mesoamericans, one would expect large

numbers of caudal (tail) vertebrae at archaeological sites, but such is not the case (Thurston 2011, p. 174). Instead, a review of faunal remains of crocodilians from Maya sites shows that a substantial proportion of the identifiable bones represent the cranium (Thurston 2011, pp. 58–96, Appendix A). In Preclassic northern Belize, crocodiles were seemingly "ignored as a food source" (Masson 2004, p. 110). At early Paso de la Amada, Chiapas, "virtually all" of the 19 recovered crocodilian osseous elements, some "rather large," appeared to have been heated or charred (Wake 2004, pp. 216–217). This may suggest roasting, but no other information, such as specific bones, is provided. Perhaps the burning might relate to ritual fire drilling after the decapitation of the hole-backed SDC.

Ethnography provides some analogies and suggests dietary, medical, and hide-selling motivations. Morelet's crocodiles are commonly hunted today in Tabasco in the Gulf lowlands of Mexico. Hunts are community activities and begin with a ritual of offerings to and seeking permission from the supernatural patrons of the animal (Arias Ortiz 2007, p. 113). Cooks prepare crocodile meat in many ways, "*en adobo, en mole, en tamal, en seco, en caldo, en achiote, en empanadas, en barbacoa, frito y, por qué no, en sandwich*" (Arias Ortiz 2007, p. 113).[15] In addition, various parts of the beasts have medical uses (see Ross 1992). The fat is used in Tabasco and elsewhere to cure respiratory illness and heal wounds, and is rubbed on a pregnant woman's abdomen to protect the baby during birth (Arias Ortiz 2007, p. 118). In southern Veracruz, crocodile excrement was thought to relieve certain coughs in children (Wing 1980, p. 107). The late eighteenth-century Yucatecan *Ritual of the Bacabs* includes incantations to IKA to protect the placenta, heal asthma, and alleviate travelers' illnesses involving diarrhea and fever (Roys 1965, p. 8). In Colonial highland Guatemala, it was believed that crocodiles' heads held a small stone that was prophylactic against malaria (Acevedo 2006, p. 494). The Lacandon Mayas believed that a crocodile tooth's enamel, taken with water, cured a headache (Stocker et al. 1980, p. 747, citing Baer and Merrifield 1971, p. 235). Recent research suggests that crocodile blood may have an inherent antibiotic effect (Ross, personal communication, 2/13/17).

Crocodile hides may have been used more commonly in garments than indicated by artistic representations or osseous remains. The Preclassic Atlihuayán statue is a rare image of a human wearing a crocodile skin over its back (Fig. 6a). Two "colossal head" sculptures from San Lorenzo, Head 10 and Monument 5, feature clawed animal "paws" and what appear to be tight-fitting woven caps (Fig. 6e, f). However, the paws could be crocodilian forefeet and the helmet-like caps could be made of the scaly skin. On Head 10 the individual scales display holes that may be the ISOs, the sensory pores of crocodylids (absent in alligatorids, *i.e.*, caimans). At Classic Teotihuacan, 30 osteoderms, perhaps from Morelet's crocodile,[16] were recovered in the Teopancazco quarter (Rodríguez Galicia and Valadez Azúa 2013, pp. 60–61, 65–66). This was a barrio of workers who made garments, headdresses, and similar attire for elites, and the plates were probably from a crocodile hide tanned at the site. Today, Tabasqueños cure

[15] One hundred grams of "semi-dried alligator" meat provides 232 cal, 45–46 g protein, 4–11 g fat, and 0 g carbohydrates (in Moholy-Nagy 1978, Table 4; also http://www.menshealth.com.sg/ weight-loss-nutrition/crocodile-meat-mean-lean-and-full-protein).

[16] The investigators concluded that the reptile was from coastal Veracruz, but an isolated population of Morelet's crocodile exists today in eastern San Luis Potosí, approximately 150 km inland from the Gulf (Escobedo-Galván et al. 2011).

crocodile hides primarily with salt, but sometimes with lime (*cal*) (Arias Ortiz 2007, p. 117). In the early twentieth-century, the Lacandons in Chiapas hunted crocodiles and tanned the hides with the bark of the mahogany tree (*Swietenia macrophylla*) (Duby and Blom 1969, p. 285).

It is unclear how or if crocodile hides might have been important to the ancient lowland Mayas as elements of costuming or royal regalia. In Classic iconography and hieroglyphs, the reticulated headdresses or bands seen in head glyphs, especially those of *itza'ats* ('sage, artist, scribe') and *pawahtuns* (Fig. 5f) or the helmet or "drum major" headdress (Fig. 5g), might have been made of crocodile skin. Similarly, the "checkerboard" pattern of the Classic *pakal* "shield" logograph (Fig. 5h) could conceivably depict a covering of crocodile hide. Perhaps skins and other parts, such as teeth and mandibles, were used for accessories such as pendants, masks, and headdresses: a drilled, ground, and polished left mandible of a crocodile was recovered at Altar de Sacrificios (Pohl 1983, p. 81). It is difficult to determine usage given the poor preservation of organic material in the humid, tropical lowlands.

Crocodilians in Central Petén

Crocodilian bones and teeth are uncommon in archaeological contexts in the Maya lowlands (see Thurston 2011, pp. 67–94). At Cahal Pech, Belize, crocodilian cranial elements were recovered from a Terminal Early Preclassic cache, and representations carved of slate and conch shell were also found in early contexts (Garber and Awe 2009, p. 155). Crocodiles played an important ritual role at Early Classic Tikal, with complete skeletons recovered in a tomb (note 8) and in three elaborate structure-caches that also included turtles, freshwater snails, snakes, and small birds (Coe 1990, pp. 324, 366, 426; Moholy-Nagy 2003, pp. 64, 69).

Marilyn Masson (2004, pp. 110, 121) makes two observations about crocodiles in her overview of faunal use in northern Belize: Not only were they not a Preclassic food source at two sites she examined but, in general, "consumption of crocodiles . . . was largely avoided prior to the Postclassic period." This also appears to be true in Petén, despite the fact that many sites are located in or near lacustrine and swamp habitats (Table 2).

In the Petén lakes region, crocodylids were recovered primarily, albeit in small numbers, from Postclassic contexts. (This is a sampling effect: much recent archaeological research around the lakes focused on Postclassic occupation.) The relative lack of crocodilians from the extensive excavations at Classic-period Motul de San José and Trinidad de Nosotros might be partially explained by their location on the north shore of the lake, which offers little habitat attractive to these reptiles. Varied crocodile remains (femur, tooth, vertebrae) from Zacpéten Structure 719, a conquest-era council house or *popol nah*, may be from a ritual deposit (Rice et al. in press).

On the whole, evidence for crocodile exploitation in the Petén lakes region, whether for food or other uses, seems to follow that in northern Belize: overall scarce, absent in the Preclassic period, occasional in the Classic, and more widespread in the Postclassic. It is unknown if similar patterns can be found elsewhere in the lowlands. What can explain this? It is clear that lacustrine resources were amply exploited, as turtle remains and shells of freshwater snails, especially the apple snail *Pomacea flagellata* and also *Pachychilus* spp., were abundant in Preclassic and later deposits in the central lakes area and other Petén locales (see Freiwald 2013). There may have been a host of

Table 2 *Crocodylus* (presumably *moreletii*) remains recovered at some sites/areas in Petén[a]

Lake/site	MNI		Comment	Source
	No.	Percentage		
Petexbatun		0.63		Emery 2004, Table 6.1
Tikal	9		Early Classic	Moholy-Nagy 1978, 68–70, 2003, 64, 69
Topoxté Is.	?		Only in Postclassic contexts	Hermes 2000, 247
Macanché Is.	3	0.02	Terminal Classic and Postclassic; identified by Mary Pohl	Rice 1987, Table 18
Zacpetén	6		Postclassic structure 719	Rice et al. 2017
Motul de San José	3		Late Classic from rank 1 households	Emery 2012, Tables 11.2, 11.3
Trinidad	1			Thornton 2012, Table 12.1
Tayasal	0			Freiwald 2013, Table 2

[a] Faunal analyses have not yet been completed on excavated contexts at Nixtun-Ch'ich'

practical reasons for shunning crocodilians—aversion to the taste, preference for terrestrial game, difficulty of capture, unfamiliarity with medical uses, complex rules governing human/social and animal categorization (as among the African Lele; Douglas 1957)—but I suspect the reasons are more allegorical. If we are to believe the antiquity of myths in which these reptiles play key roles, particularly illustrated by the sculptures of Izapa, during the Preclassic period crocodilians were supernatural beings embodying the primordium and the cosmos. They were the axis mundi, forming the very earth and bringing life-giving rains from the skies. Surviving myths in Postclassic and Colonial-period texts seem to subtly highlight the creatures' earthly rather than celestial roles. If so, it may be that such a transition made a difference in Postclassic hunting practice.

Nixtun-Ch'ich': A City as a Crocodile

The site of Nixtun-Ch'ich' occupies the western mainland of the Lake Petén Itzá basin and stretches eastward over the adjacent Candelaria Peninsula (Pugh and Rice 2017). Archaeological surveys and excavations have revealed occupation and construction dating from the Terminal Early Preclassic period (*ca.* 1100–900/800 BCE) into the early eighteenth century (Rice 2009). The site has a highly unusual gridded plan established by multiple cardinally oriented corridors: six east-west "streets" and seven north-south "avenues" (Fig. 8a). Thus far, 12 units (trenches and test pits) excavated in the corridors have revealed their origins as carved or scraped bedrock surfaces in the Middle Preclassic period. These corridors established the perimeters of more than 50 constructional blocks or sectors, primarily large raised platforms with multiple buildings atop. The civic-ceremonial nucleus of the city occupies the east-central mainland and comprises four blocks labeled (west to east) Y, Z, AA, and BB. BB and AA, a Triadic Structure Group and a possible E-Group, respectively, constitute a common

Middle-to-Late Preclassic ritual architectural template (*e.g.*, Estrada-Belli 2011; Hansen 2000; papers in Freidel et al. 2017).[17] Structure Z1 to the west is a tall pyramid, the second highest structure at the site (after BB), and Sector Y is an E-Group. These edifices and complexes establish the city's *axis urbis*, which continues to the west and is oriented 94° 7′ clockwise of true North.

In comparing this urban landscape to the back of a crocodile, it can be noted that the dorsal surface of *C. moreletii* is crossed by 15 to 17 transverse rows of scutes (Lara 1990, p. 14), each row made up of four to nine protuberances (Fig. 8b). Similarly, the east-west central axis of mainland Nixtun-Ch'ich' spans an alignment of 15 or more elevated structures or structural blocks (≈ scutes) and two reservoirs, with six to eight structures in each row, perpendicular to that axis. Structures and blocks decrease in size from the central axis to the peripheries of the site, as do the scales of the crocodile. The two arrangements are not exact duplicates: On *C. moreletii*, the regular distribution of the scales is bisected by a longitudinal line along the back, whereas at the site the central axis cuts *across* the main structures, bisecting them.

The Sector Y E-Group is of particular interest. It features the complex's two archetypal main structures, Y1/1 in the east and Y1/2 in the west, long thought to have functioned in early horizon-based solar astronomy (Freidel et al. 2017). Immediately east of Structure Y1/1, on the central axis, lies a large depression or *fosa* that we call Fosa Y. We initially thought Fosa Y was a reservoir or perhaps a limestone quarry or modern *aguada* (water hole), but three deep excavation units in its center never reached a bedrock floor, suggesting instead that it may have been a sinkhole. Thick soil deposits incorporate generally low quantities of Terminal Early Preclassic and Middle Preclassic pottery. By the end of the Middle Preclassic period the ~20 m-wide center was ringed with amphitheater-like stone tiers and it accommodated a massive feast evidenced by a 30–50-cm-thick midden deposit (Rice and Pugh 2017).

Fosa Y is an especially compelling component of the proposition that this Middle Preclassic site grid mimics a crocodile's back. If the grid is imagined from a mythical-crocodilian model, Fosa Y is a hole in the crocodile's back.[18] As we have seen, the SDC (Starry Deer Crocodile) is described in the Palenque Temple XIX creation text as "hole-backed" and "painted-backed" (Fig. 7a). We do not know if Fosa Y or the surrounding structures were painted, as was the back of the SDC, but traces of plaster were noted on the stone terraces surrounding the mouth of the *fosa* (perhaps plastering can be considered "paint"). Nor do we have evidence for fire drilling, but note that in one excavation unit in the *fosa* a large red-slipped platter was found at 6 m b.d. with evidence of interior burning; it held pieces of charcoal and a human temporal bone fragment. Turtle bone lay around the platter, which appeared to have been emplaced *in situ*.

[17] Maya archeology boasts an extensive literature on the role of cosmology and astronomy in site planning and sacred landscapes, too large to review here (for a debate on the issues, see Ashmore and Sabloff 2002 and M. E. Smith 2003a). Discussions pertain principally to the Late Preclassic and Classic periods, and do not refer to layouts mimicking particular animals.

[18] Fosa Y and the mark on the Atlihuayán figurine hide (Fig. 6a) might represent either ventral umbilical scars or dorsal holes. If the latter, the figurine constitutes a very early manifestation of the hole-backed crocodile myth. Or, perhaps the Mayas conflated these surficial perforations, dorsal hole and ventral umbilicus, as openings to a dark place from which are born natural and supernatural creatures ranging from baby crocodiles to ancestors, the rain gods, and the sun.

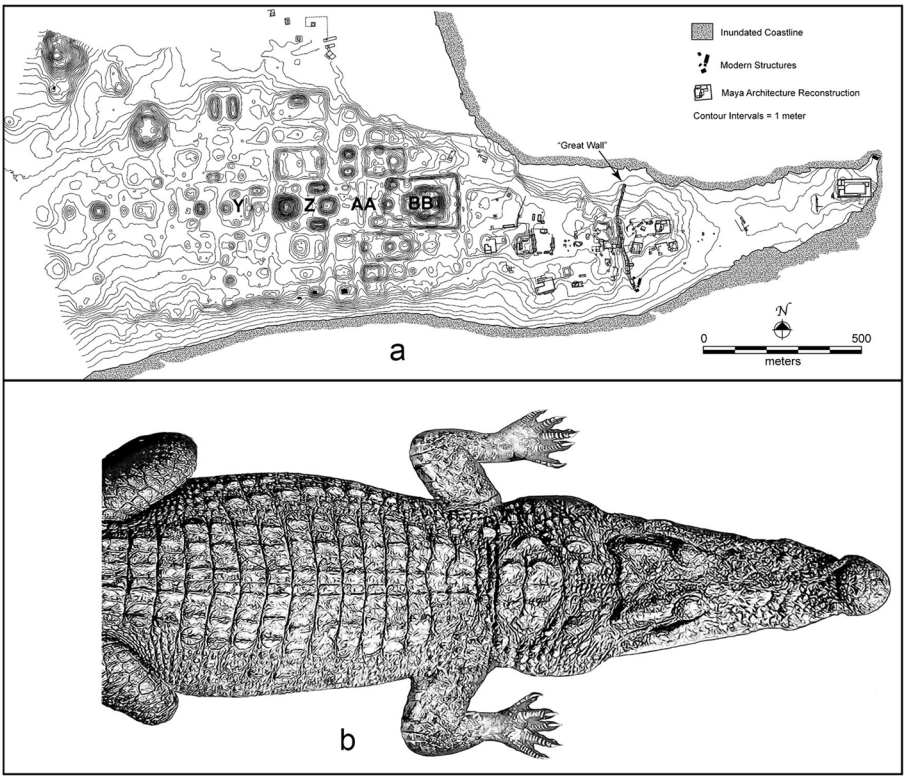

Fig. 8 **a** The site of Nixtun-Ch'ich', on the western edge of Lake Petén Itzá, with labeled sectors of the civic-ceremonial core. Constructions and contours on the Candelaria Peninsula, east of the "Great Wall," constitute the head of the crocodile (mapped by Marc Wolf). The mainland part of the site represents the body of the crocodile (contour map by Timothy Pugh). Contour intervals 1 m. Composite map conjoining the two by Don Rice. **b** Dorsal view of *C. moreletii*, showing regular array of rows of scutes

Another component of Nixtun-Ch'ich', Structure XX4, the "Great Wall" wall-and-ditch fortification (Fig. 8a), also can be incorporated into the SDC model. This complex, 355 m long north-south, with the ditch west of the wall, lies east of the civic-ceremonial core at the base of the Candelaria Peninsula. Clearing of the profile of a modern road-cut through the wall revealed that its initial construction began with two superimposed low Middle Preclassic structures on the western edge of a large Middle Preclassic platform (Structure XX1) that extended eastward some 250+ m (Rice 2009, p. 403, Figs. 1 and 2). A test unit in this platform proceeded through 2.48 m of fills to smoothed, leveled bedrock. Two Middle Preclassic plaster surfaces, 8–10 cm thick, were encountered in the lowest 50 cm of this unit. In the crocodilian model of the site layout, the ditch of the fortification is the cut that severed the head of the SDC, represented by peninsula and the Structure XX1 platform to the east; the body of the reptile occupies the mainland.

Elsewhere (Rice and Pugh 2017), we present an interpretation of Nixtun-Ch'ich' as a sacred Creation landscape. Mesoamerican mounded constructions are artificial mountains (Vogt 1964, p. 194) and certain architectural assemblages, such as E-Groups and Triadic Groups, assume the role of the cosmic House of Creation (*e.g.*, Looper 2003, p.

15). From this perspective, the Sector Y E-Group and Structure Z1 represent Creation Mountains. And in this landscape Fosa Y, a natural feature flanked by early construction, is not only a cave-like portal to the watery Underworld but also the "hole" in the back of the mythical SDC.

In sum, the built landscape of Nixtun-Ch'ich' emerges from Lake Petén Itzá as the back of the earth crocodilian floating in the primordial sea at the moment of cosmogenesis. The site proclaims itself the chimerical Cosmic Monster, more specifically the nocturnal-celestial aspect of the SDC (Stuart 2005, pp. 70–75): the night sun enters the Underworld—the belly of the monster—through the western *fosa* on the centerline and travels through this dark watery domain to be born again in the east. This rebirth occurred as a hierophany: the sun appearing to rise out of Fosa Y (or behind Structure Z1) on the centerline at the autumn equinox (Rice and Pugh 2017).[19] The Fosa Y cavity or cenote was the centering point of this numinous landscape and a pivotal nexus in time and space for the early Mayas. This evocative setting would have been a prime location for commemorative calendrical rituals and visual "rhetoric of re-enactment" of the moment of Creation (see Connerton 1989, p. 65).

Crocodiles, Cooperation, and Costly Signaling

The elephant (or crocodile)-in-the-room question that follows from the preceding discussion is, Who was responsible for the gridded plan at Nixtun-Ch'ich'? There are no contemporaneous sites in Mesoamerica—indeed, in the New World—with a fully gridded layout to have provided some well-traveled, early Maya town father with inspiration. Who envisioned building a city on the model of the "very regular rectilinear array" of scales on the back of the Morelet crocodile? Who persuaded or coerced the community's residents (and others) to commit to the heavy labor of clearing bedrock and laying the foundations of the streets and structures? Why was the layout not copied at other Maya sites? We cannot definitively answer these questions, but we can suggest some plausible possibilities.

Nixtun-Ch'ich' is not alone as an effigy construction, and it may not be the earliest one in Mesoamerica. The massive earthen platform underlying the Late Early Formative Olmec site of San Lorenzo in southern Veracruz was once proposed, to considerable skepticism, to be an effigy of a bird, wings outstretched, flying eastward (Coe 1989, p. 80; Coe and Diehl 1980, p. 28). A "fortress-like" Terminal Middle Formative complex at Edzna, Campeche, is shaped like a Creation-turtle's rounded back and surrounded by water-holding canals (Williams-Beck, personal communication, 8/12/17). In the eastern and midwestern USA, hundreds of large earthen mounds were modeled on animals, including birds, felines, serpents, bear, deer, and an alligator (note 7) as well as geometric shapes (*e.g.*, Bernardini 2004; Herrmann et al. 2014). The sacred landscapes of these mounds and of Nixtun-Ch'ich' were, in Henri Lefebvre's (1991, pp. 38–39) tripartite schema, "conceived" spaces: planned and built to resemble a natural or mythological creature. As a "lived" space, however, Nixtun-Ch'ich' in its entirety may not have been directly "perceived" by its inhabitants as representational, except

[19] Through time, with later construction, the sunrise likely appeared out of Lake Petén Itzá over structures farther east on the Candelaria Peninsula.

for the hole in its back. The site, like the eastern U.S. Hopewell mounds (Bernardini 2004, p. 333), was probably created by pooled regional labor in the service of pan-regional ceremonial systems (here based on crocodilians). But who directed the labor?[20]

Early City and State Organization

As a very early urban center in the Maya lowlands, Middle Preclassic Nixtun-Ch'ich' was probably occupied by groups representing a range of social ranks, and through time it would have attracted immigrants from surrounding areas. Cities rarely come into being by leadership fiat alone: They are formed by "negotiated consensus," often prolonged, between multiple constituencies including earliest families, migrants, varied specialists, kin, and "all those who live in the urban core as well as its hinterlands" (M. L. Smith 2003b, pp. 2, 7; see also Yoffee 2015). Urban centers are defined by, and successful because of, their social roles, building relations in the face of competing interests, and accumulating and disseminating political, social, and economic information (M. L. Smith 2003b, pp. 7–9).

Middle Preclassic Petén was a crucible of developing societal complexity, with some emergent aspects of state-level political organization. Such organization, ancient and modern, has long been the subject of intensive study in varied scholarly disciplines (as has urbanization), giving rise to a literature far too voluminous to review here. Although the relations between cities and states are no longer viewed as necessarily dependent (Smith 2003, b, pp. 11–16), the key defining criteria for both are not physical or demographic size but rather socio-politico-economic relations: increased social complexity and centralized political power. A recent Maya-focused overview of states identifies them as "non kin-based organizations possessing coercive power that integrated society under centralized authority" (Sharer and Traxler 2016, pp. 17, 26). These essential characteristics of complexity and power, evidenced archaeologically by mobilization of labor and interregional interactions, can begin to be identified in the small and highly variable "states"—better termed incipient states—of the Middle Preclassic Maya lowlands, such as in the Mirador Basin (Hansen 2016). Larger, more highly centralized states appeared, along with kingship and hieroglyphic writing (and other traditional state-defining characteristics, such as site-size hierarchies, palaces, administrative institutions, *etc.*), by the early Late Preclassic, around 400–200 BCE.

At this point in our nascent investigations of early Nixtun-Ch'ich', we are reluctant to apply evolutionary labels such as "state" because we lack information on leadership, governing institutions, and socioeconomic differentiation. If we accept the Sharer and Traxler (2016) position, Middle Preclassic Nixtun-Ch'ich', with its gridded layout, may have been an incipient state. Regardless, what is clear is that this site literally embodies the principle that "'ideological power' was a fundamental aspect" underlying the evolution of complex societies (Yoffee 2004, pp. 173–174). In Maya ideology, Nixtun-Ch'ich' was the earth crocodilian floating in Lake Petén Itzá, the nocturnal-celestial Starry Deer Crocodile, the landscape of cosmogenesis where the sun rises from the Underworld.

[20] Takeshi Inomata et al. (2015) have argued that early structures at Seibal and other sites might have been built by the seasonal labor of semi-mobile groups in the absence of central leadership.

Leadership: Selectionist and Signaling Theory

But who was the leader(s) of early Nixtun-Ch'ich', responsible for the crocodile layout? As Monica Smith 2003 p. 14) observes, "it is difficult to ascertain political actions at the inception of the city form, when leadership roles may have been multiple and overlapping, and when overt signs of leadership may not be apparent except as they are manifested in communal activities.. .. many archaeologically derived examples of social complexity show that individualizing leadership develops only after a period of group-based interaction." In the transformative milieu of early Middle Preclassic Petén, we can postulate that the "architect(s)" or "engineer(s)," so to speak, of the Nixtun-Ch'ich' grid probably commanded the kind of "ideological power" referred to above. The leader was likely a respected individual or kin unit possessing intimate knowledge of ancient mythic histories and astro-calendrics, and boasting privileged access to the gods and the ancestors. S/he/they may have gained initial standing through descent from a founder or other kin ties, or power may have been based on achievement, managerial competence, and maintaining cooperative social and economic relations. This last, maintenance of cooperative relations within a collectivity, is key to success: "failure to keep people cooperating results in political collapse" (Stanish 2013, p. 87).

The importance of cooperation in groups has been explored in various social and biological science fields in which selectionist theory, Darwinian evolutionary biology, and game theory play salient roles. Cooperation, in humans and in animals, can be defined as "costly behavior performed by one individual that increases the payoff of others"; that "payoff" is usually delayed (Boyd and Richerson 2009, p. 3282). Non-cooperators, or those who do not participate in collective actions, are called free-riders, slackers, or defectors and are shunned. The highly evolved human behaviors of conditional cooperation are predicated on the "four Rs"—reputation, reciprocity, retaliation/retribution, and reward (see Apicella et al. 2012, p. 497; Boyd and Richerson 2009; Carballo et al. 2014, p. 107)—along with related attributes of fairness, generosity, altruism, and responsibility. Application of these principles and theories to "intermediate societies"—complex hunter-gatherers and simple chiefdoms (*e.g.*, in the Andes: Stanish 2013; Stanish and Haley 2004)—lends insight into the origins of more complex society. In these relatively simple societies, goal-oriented, charismatic, entrepreneurial individuals ("aggrandizers," "big-men") can attract followers through generosity (material wealth underwriting sponsorship of games, hunts, or feasts), through wisdom (knowledge of the natural world, problem-solving, healing, group lore), or both.

Much of the current understanding of prosocial cooperative behavior among humans comes from signaling theory. Signaling refers to species' methods of communicating or signaling information or intentions, for example about food, predators, mating, and the like (*e.g.*, Bliege Bird and Smith 2005; Gintis et al. 2001; Smith and Bliege Bird 2000). Human aggrandizers exhibit "costly signaling," their signals often including generous provision of high-quality, rare/exotic, or "expensive" foods and goods at community-wide feasts, for example (Dietler and Hayden 2001; Smith 2015). Feasts are rituals, often commemorative, that "demonstrate or enforce inequalities. .. [or are] for political gain, prestige, ritual fulfillment, the demonstration of power and authority, and/or the elicitation of labor commitments" (Smith 2015, p. 1216). They may entail community-wide contributions to build social integration and ease tensions (Smith 2015, p. 1217). These investments in foods and display goods—that is, in the costly

signals—are made and sent in expectation of delayed reciprocity: social, economic, physical, or political support and cooperation from the group.

Belief Systems and Ritual

Costly signals may also relate to belief systems. In selectionist theory, belief systems or religions are means for institutionalizing cooperation because they require commitment to a set of expectations and often burdensome obligations or prohibitions—commitments signaled by dress, diet, behavior—that convey and uphold collective identity (*e.g.*, Bliege Bird and Smith 2005, p. 231; Irons 2001; Norenzayan and Shariff 2008; Sosis 2004; Steadman and Palmer 2008). From an evolutionary perspective, belief systems, attendant rituals, and related behaviors help make communication more trustworthy, monitor problems caused by free-riders, and provide sanctions on the latter (Norenzayan 2013; Rappaport 1979, p. 229; Sosis 2004, p. 169; Watanabe and Smuts 1999). Rituals provide critical sanctification for participation in corporate labor organized to build the architecture for celebrating the supernatural entities at the core of the religion. Although lacking the "moralizing high god" overseers of world religions today, early Mesoamerican belief systems involved supernaturals and animate forces that monitored the reputations of leaders beyond the social in terms of their ritual efficacy, scrupulous offerings, perspicacious divinations, and so on.

For Terminal Early and Middle Formative Mesoamericans, cooperation, wisdom, and knowledge—particularly knowledge related to ritual, time-reckoning, and scheduling as it pertained to cosmic forces—were especially salient determinants of authority. Leaders possessing these attributes in Middle Preclassic Nixtun-Ch'ich' were able to create and maintain supra-household cooperation in community labor organization to build E-Groups and other edifices, along with the city's grid system. We can speculate that they were either endowed with architectural or engineering skills themselves or recognized these talents among others. And these leaders were intent on sending costly signals about commitment to the beliefs and behaviors represented by the Cosmic Crocodile and related cosmogonic "theory." We do not know the details of those early myth-based beliefs; we can only draw upon hints supplied by later laconic textual and iconographic manifestations. Nor do we know much to date about the site-specific intersections of myth and physical environment: Did the leaders of Nixtun-Ch'ich' design the city based on an early myth about Creation and crocodiles, or was the myth informed by the city's sacred landscape? Or both?

We do know that the Nixtun-Ch'ich' Fosa Y hole-in-the-back-of-the-deer-crocodile was a portal to the Underworld that periodically received Terminal Early and Middle Preclassic offerings. Its usage culminated in a huge feast involving beautiful slipped and decorated pottery, and doubtless desirable foods such as cacao and maize (Rice and Pugh 2017). Large, community-wide feasts are excellent opportunities for leaders or would-be leaders to flaunt not only their generosity but also their managerial skills and ritual authority (Smith 2015, pp. 1218–1226). The foods and the smashing or killing of the pottery vessels at Fosa Y were costly signals sent by the leader(s) of the early city as displays of (surplus) wealth and power, perhaps in reward for cooperative communal labor investment in impressive civic architecture. Simultaneously, this event proclaimed the leader(s)' knowledge of sacred creation myths, esoteric beliefs and traditions, and solar cycling, and their privileged access to supernatural authority. The

labor investment was dedicated to creation of a "public good": continuing access to the beneficence of that supernatural power. Nixtun-Ch'ich' exemplifies urban historian Lewis Mumford's (1961, pp. 48–49) comment that "the city was nothing less than the home of a powerful god. .. . To be a resident of the city was to have a place in man's true home, the great cosmos itself."

Concluding Thoughts

"In Mesoamerican cosmologies, world views [are] based on the surrounding ecology, landscape, and weather patterns," writes Miguel Angel Astor-Aguilera (2010, pp. 28–29). The preceding four-part exegesis has described just such a cosmology. It is based on lowland Maya crocodilians and their role in Preclassic/Formative and later art and mythology. Discussions integrated data and perspectives from zoology, conservation biology, historical documentation, ethnography, art history, and evolutionary biology with archaeological findings to provide a cross- or multidisciplinary picture of this unusual city and its temporal setting. Selectionist and signaling theories are applied to approach the difficult questions of how early city leaders might have engaged community labor to construct it, while exploiting these beliefs and related rituals to unite a growing and diversified population in pursuit of larger goals.

From these data and perspectives, it is evident that the early Mayas thoroughly internalized their tropical environment and shared, with their Mesoamerican neighbors, a complex belief system centered on one of its most powerful and enigmatic creatures, a crocodile. Their observations of the reptile's behavior in its watery surroundings established the foundation of a body of cosmogonic myths having at their core a mammoth aquatic crocodilian creature (or creatures, including a fish/shark) central to cosmogenesis. The creature(s) created the world and destroyed it, then created it again by forming the surface of the earth and ascending to the sky, sending the rains. Linkages between rains and crocodilians persisted into the Colonial period among the Mayas.

One variant of this long-lived creation myth was given early material expression, I propose, at the central Petén lacustrine site of Nixtun-Ch'ich'. This Middle Preclassic city was constructed as the literal embodiment of the cosmic creator crocodile, who became the surface of the earth floating in an ancient sea. Nixtun-Ch'ich' is characterized by a gridded site plan, an unusual layout not seen elsewhere in the Maya area and rare in Mesoamerica as a whole. This urban grid was never copied at other sites, and thus it might be judged a failed experiment in urban planning. On the other hand, a landscape modeled on a powerful earthly-celestial-cosmic supernatural crocodilian creature might have been deemed a singularity too sacred/dangerous to be copied.[21] The features of the city that mimic the "Starry-Deer-Crocodile" of Classic and Postclassic Maya myth include not just the regular arrangement of elevated structures, recalling the pattern of scutes on the reptile's back, but also Fosa Y, the "hole" in the

[21] Elsewhere (Rice 2018), I discuss the likelihood that, during the Terminal Classic or Postclassic, the western basin of Lake Petén Itzá became, for the Mayas, a *chak'an putun*, a mythical place of dynastic legitimization analogous to the paradigmatic cities known as *tollans* in many areas of Mesoamerica. Nixtun-Ch'ich' and similar early sites may be precursors of the late concept of *altepetl* ("water-mountain")—hill surrounded by water—central to, for example, Mexica/Aztec migrations (Boone 1991, pp. 133–143).

back of the crocodile, and the deep ditch of the defensive complex, representing the mythological creature's sacrificial beheading. Although many Maya and Mesoamerican centers and architectural complexes have been seen as sacred landscapes with celestial-cosmological referents to Creation, these primarily date to the Classic period. Middle Preclassic Nixtun-Ch'ich' is an unusually early and vivid example.

The site's distinctive grid was established in the Middle Preclassic by scraping and cutting bedrock in the corridors and beneath buildings and platforms. We currently know little about the political leadership of the early city, or specifics of the organization of a regional labor force for construction. However, perspectives from selectionist theory, cooperation, ritual, and costly signaling shed light on the effective use of leaders' power in creating corporate architecture. The Preclassic grid at Nixtun-Ch'ich' was maintained through succeeding settlement in the Classic, Postclassic, and Contact periods, and still guides the movements of cattle over the landscape of this twenty-first-century ranch. The city's millennia-long life highlights its role as a "mnemotope": something that "manifests the presence of the past, the conscious or unconscious memory traces of a more or less distant period in the life of a culture" (Purdy 2002). In the case of Nixtun-Ch'ich', the grid memorializes the deep, primeval period of cosmic Creation. With a visionary managerial elite leading by popular acclaim and skill—and precocious arrogation of divine approbation—the Middle Preclassic Mayas at Nixtun-Ch'ich' orchestrated a terrestrial landscape as a sacred monument to the Cosmic Crocodile and all it embodied.

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