

Comment on “Shark fisheries during the second millennium BC in Gramalote, north coast of Peru”

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Abstract

In reporting on prehistoric specialized shark fisheries at the Initial Period site of Gramalote (~1500–1200 cal BCE) on the north coast of Peru, Prieto suggests that substantial quantities of sharks were captured by using shell rattles to attract and fiber nooses to capture them from small reed boats. Although his research has made a significant contribution to our understanding of prehistoric fishing industries, based on data from early sites along the Andean Pacific Ocean, on past and present ecological conditions, and on ethnographic information in the study area, we believe that most sharks were caught opportunistically by netting, clubbing and/or spearing them in littoral wetlands intermittently connected to the sea by high tides and storm surges.

Key words: sharks, prehistoric fishing, boats, fishing technology, Peru

Resumen

Al informar sobre las pesquerías prehistóricas especializadas de tiburones en el sitio del Período Inicial de Gramalote (~ 1500-1200 cal BCE) en la costa norte de Perú, Prieto sugiere que se capturaron cantidades sustanciales de tiburones mediante el uso de cascabeles de concha para atraer y lazos de fibra para capturarlos desde pequeñas embarcaciones de caña. Aunque su investigación ha hecho una contribución significativa a nuestra comprensión de las industrias pesqueras prehistóricas, basada en datos de sitios tempranos a lo largo del océano Pacífico andino, en condiciones ecológicas pasadas y presentes, y en información etnográfica en el área de estudio, creemos que la mayoría de los tiburones fueron capturados de manera oportunista al pescarlos con redes, aporrear y / o arponearlos en humedales litorales conectados intermitentemente al mar por mareas altas y marejadas ciclónicas.

Palabras clave: tiburones, pesca prehistórica, embarcaciones, tecnología pesquera, Perú.

Introduction

Prieto presents invaluable information on and insightful consideration of diverse datasets related to the prehistoric capture of sharks on the north coast of Peru, focusing primarily on the Initial Period site of Gramalote (~1500–1200 cal BCE; Prieto 2015, 2021). Based on moderate quantities of faunal remains at the site, he proposes that sharks were procured at sea by using shell rattlers to attract and fiber nooses to catch them from small reed boats (*caballitos de totora*). Since there is no hard evidence for harpoons, spears, and strong, resistant nets and fishhooks to catch medium- to large-sized fish during this period, it is possible that consistent numbers of sharks were caught by the rattle-noose technique during the Preceramic and Initial periods (~12,000-1500 BCE). It also is likely that sharks were captured in other ways, such as opportunistically netting, clubbing and/or spearing them in shallow, ~1-2 m deep backwater estuaries near shorelines where these and other fish occasionally entered during high tides and/or were washed in during storm surges, events that regularly occur today along the north coast (Dillehay et al, 2012; Vásquez et al, 2017a; Fig. 1).

Sharks occupy the highest level in the marine trophic chain, which is important to consider when studying their remains in archaeological contexts. It also is important to examine the character of their specific habitats and wider ecosystems, as well as their population fluctuations due to climatic-oceanographic cycles that have occurred in the last several millennia, and to apply the appropriate ichthyo-archaeological methodology to infer how, when and where they were caught. In the early Miocene ~19 million years ago, an extinction of sharks occurred that caused significant changes in the abundance and diversity of these elasmobranchs, decreasing their population by approximately 90%, an event from which they never fully recovered in most areas of the world (Sibert and Rubin, 2021). Continuous changes in the frequency of archaeological shark remains are recorded over a long period at coastal sites in Peru from the early Preceramic to the Late Intermediate periods (~14,000 BCE-500 CE).

An important group for observing changes in shark populations are the Carcharhinidae family, which reveal significant numbers in early archaeological records on the north coast of Peru, possibly due to the intermittent occurrence of major ENSO events and to the formation of backwater estuaries and lagoons in late Pleistocene and particularly in early to middle Holocene times, where several amphidromes species of this family were and are capable of inhabiting brackish or fresh waters for lengthy periods of time due to their euryhaline capacity. This hyperosmoregulatory capacity of sharks developed through the integrative

functions of multiple organs (i.e., rectal gland, kidney, liver and gills) and through their environmental physiology (Compagno, 1984). The *Carcharhinus leucas* shark is best known for this integrative physiology (Shoji et al, 2019), and has been identified in the faunal remains of the Preceramic sites of Cruz Verde and Huaca Prieta sites, located about 25 and 20 km, respectively, north of the Gramalote site. Carcharhinidae and species of the genus *Sphyrna* also have the euryhaline capacity. Both Huaca Prieta and Cruz Verde, in addition to sharing the same taxa of sharks, are littoral sites characterized by adjacent wetland environments where both brackish and fresh water periodically accumulates in times of inland flooding (as occurs during ENSO events) and during high tides and storm surges. *Carcharhinus leucas*, *Sphyrna tiburo*, *Sphyrna mokarran* (Compagno 1984) and other species were likely caught in these habitats.



Figure 1.- Fisherfolks in a backwater estuary near Malabrigo, Peru, netting fish after a nightly storm.

In turning specifically to Prieto's (2021) proposal for a shark fishery at Gramalote and for attracting and noosing sharks from boats, we are not fully convinced that this technique accounts for the majority of shark remains in early sites. Our reasoning and brief assessment of shark capture follows:

1. We agree with Prieto that fishhooks are unlikely implements to catch medium- to large-sized sharks. Prieto (2015, 2021) indicates that he has recovered four fishhooks made of sea lion bone (Otariidae), with an average size of 4.5 cm in length (Prieto 2015: 610, Table 6.14). Research on similar types of fishhooks and on the ocean depth of fishing with them in the Pacific Ocean of coastal Mexico shows that they are ineffective for capturing elasmobranchs (Galeana et al, 2008).

Moreover, along the north coast of Chile, archaeologists have recovered larger, composite, and technologically more resistant and sophisticated fishhooks at several Preceramic (or Archaic) sites (e.g., Alcalde and Flores, 2020) than those documented for the north coast of Peru. In general, few shark remains are reported at Chilean sites, and it is unlikely that fishhooks were used to catch them. As noted by Béarez and colleagues at the middle Holocene site of Zapatero, even large, composite and more resistant fishhooks probably were ineffective for offshore fishing of large pelagic fish such as sharks:

To catch such large fish [billfish and sharks] with a hook and line appears to be unlikely, since most recognized hooks in Zapatero were small in size and made from shell. They would probably not have had enough resistance for the traction exerted by large billfish. Moreover, the presence at Zapatero of sharks, like the mako, which would rapidly cut through any fiber line, suggests that a hook and line was not appropriate for fishing large pelagics sharks. Because, several kinds of spearheads are known from the archaic archaeological sites in the area (Llagostera, 1989), including Zapatero, harpooning seems to be the most likely fishing practice employed for billfishing (Béarez et al, 2016:192).

To the best of our knowledge, no harpoons or spearheads have been found at Preceramic or Initial Period sites on the north coast of Peru and the few shell and/or bone fishhooks retrieved from them are too small and fragile to function as primary instruments to procure large pelagic fish. (Somewhat confusing in Prieto's 2021 article is that he advocates the rattle/noose technique for capturing sharks, yet in Table 4 he lists spearing and netting as techniques used in prehistoric times on the north coast of Peru (Prieto 2021: 17)).

2. Although there is iconographic and ethnohistorical evidence, respectively, of fishing from boats for the late Early Intermediate Period to the Late Horizon (~200-1500 CE), there is no hard evidence of boats for the earlier Preceramic and Initial periods. We do not deny their presence during these periods, but it is difficult to evaluate their technological use as offshore vessels without knowledge of their size and durability. On a minor point, in Prieto's Table 8.1 of NISP values for botanical remains, reference to the raw material for the manufacture of *caballitos de totora* (Prieto, 2015), *Scirpus californicus* "totora" and *Schoenoplectus* sp., is taxonomically ambivalent. That is, remains of cattails at Gramalote were assigned to two synonymous taxa, *Scirpus californicus*, which is the prior name for cattails, and *Schoenoplectus* sp., which is the new scientific name. Since a specific

species was not assigned to these remains, which is a technical oversight at the taxonomic level, it is not clear whether one or two different taxa might have been used for boat building. There also is no hard evidence of ropes of “cabuya” (*Furcraea occidentalis*), which is required to make reed vessels (Rondón et al, 2003). Nine specimens of this fiber are referenced by Prieto (2015: 228, Table 8.1), but their specific characteristics are not described at the microscopic level, which is necessary to make proper species identification.

3. Another technology that might have been used for offshore shark fishing is cotton nets (Prieto, 2015: 607). However, the small number of net fragments recovered at Gramalote and the thinness and probable weakness and fragility of their threads would not have facilitated shark capture, as Prieto also states. Béarez et al, 2016: 192 note that sharks of any size could easily cut through cotton lines and release themselves. Moreover, it seems unlikely that one-to-two persons in small reed boats could capture and hold even moderate-sized sharks for transport to beaches for butchering.
4. Prieto (2021:3-4) mentions that the most important source of marine protein at Huaca Prieta and Paredones was sharks. Except for the late Pleistocene and perhaps the early Holocene periods at Huaca Prieta, various species of bony fish and sea lions constituted the main sources of marine food, not sharks. Prieto (2021:2) also states that the earliest known shark exploitation along the Peruvian coast is in the early Holocene or Archaic period. Prieto does not cite our 2012 and 2017 publications (Dillehay et al, 2012; Vásquez et al, 2017b), presenting preliminary evidence of culturally procured and modified shark bones in the late Pleistocene and early Holocene levels below the artificial mound at Huaca Prieta. Cut and burned bone remains of recovered species are *Galeorhinus* sp., *Alopias vulpinus*, and Carcharhinidae. For this period, we do not know if these species were netted, speared, hooked and/or clubbed near the shoreline from small vessels or captured in backwater estuaries, although we favor the latter technique.

Our excavations at several sites on the north coast have yet to produce any evidence of projectile points or spears, harpoons, fishhooks, rattles and nooses in the late Pleistocene to middle Holocene levels (Dillehay et al, 2012; Dillehay 2011, 2017). A few fishhooks are found at other Preceramic sites on the north coast, yet, as noted above, they were not designed and resistant enough to large fish.

Cotton nets were recovered from mid-Holocene levels by Junius Bird (Bird et al, 1985) and by our project at Huaca Prieta (Dillehay, 2017), yet none

were sufficiently resistant to capture small to medium-sized sharks (see Splitstoser, 2017b) and, as Prieto (2021:14) also notes, the mesh sizes are too small to capture large fish.

5. In citing part of a casual email exchange between Prieto and Dillehay in 2020, Prieto states that: “One night in 2009, Duccio Bonavia and I camped on the beach and witnessed such a [storm] surge. The waves were about 2.5 meters high and pushed at least 200 meters onto the beaches and, in low areas, beyond. Locals say they have caught a few sharks over a meter in length. These storms occur every year, at least along this portion of the coast (Tom Dillehay, personal communication by e-mail, July 2020).” Prieto did not contact Dillehay for permission to publish this quote, and if he had, Dillehay would have given him additional information on Bonavia’s and his experiences with opportunistic shark capture in brackish estuaries and freshwater lagoons.

Since the mid-1970s, we have worked in four coastal valleys of north Peru along a ~130 km strip of the Pacific shoreline and have interviewed numerous fishers, not just one. There is consensus among informants that high tides and occasional storm surges connected the sea to shallow wetlands behind low beach ridges. During these occasions, primarily mullet (*Mugil cephalus*) and catfish (*Galeichthys peruvianus*), but also neretic bony and cartilaginous fish, including small- and medium- sized sharks of the Carcharhinidae family, were washed ashore or swam into the mouths of rivers and wetlands linked to the sea, where they were captured by clubbing or netting (Fig. 1). According to informants, one or two sharks were caught infrequently during these occasions, usually measuring between ~0,6 to 1,2 m in length (Bonavia, field notes, 2009). We also note that Bernabé Cobo, a Spanish priest living in Peru in the early 17th century observed sharks in river deltas along the Peruvian coast. He states:

“There are sharks, both in the sea, as in the mouths of the rivers, where they enter, [they are] very harmful and butcherers, because they have killed and eaten many men’ (cited in Mateos 1964:309).

In referring to catching sharks in wetlands, Prieto states that: It seems unlikely, considering the current knowledge of the paleoclimate records during the Late Preceramic and the Initial Period along the coasts of the Moche and Chicama valleys, that the weather pattern was different from what it is today. Therefore, an environmental scenario wherein shark species frequent brackish waters, estuaries, or lagoons with warmer water is unlikely (Prieto, 2021:14).

First, what paleoclimatic data exists to support this statement? Prieto cites no evidence for this supposition. Second, according to our interdisciplinary paleo-ecological and archaeological studies in the area since 2006, the period between 5500-1500 cal BCE was characterized by the extensive build-up of littoral estuaries and lagoons all along the Chicama coastline and by the presence of moderately dense early to middle Holocene residential and ceremonial sites along their shorelines (Dillehay, 2017b; Goodbred et al, 2017, 2020). Unfortunately, Prieto does not cite these studies, which would have provided him with the most current paleoclimatic and environmental data for the study area. Third, in regard to the Huanchaco area today, he states that “The lack of sharks in present-day coastal waters in the Huanchaco and Huanchaquito areas, where Gramalote is located, prevents modern traditional fishers from focusing on shark fisheries. ¿So, why are there so few sharks in the area today? Is it due to climatic and environmental changes or other variables?

6. Prieto (2018, 2021) continues to note that our voluminous book on Huaca Prieta (Dillehay, 2017) did not cite his doctoral work on shark hunting at Gramalote (Prieto, 2015). He was not cited simply because the pre-published Huaca Prieta manuscript of 3500+ pages were submitted to the University of Texas Press in early 2015 before his dissertation was available for scholarly use. It took the press nearly two years to prepare and publish the 950-page Huaca Prieta book.

Prieto is to be commended for presenting new data and less known details of shark capture in ancient Peru. There is no doubt that sharks were both economically and symbolically important to ancient peoples living along the Andean Pacific littoral. It is possible but very unlikely that the sharks recovered at the Gramalote site were caught at sea from small boats. Until metal fishhooks, more resistant lines, and larger boats were developed, we believe that most sharks were captured in littoral wetlands connected to the sea. Both in the past and present, extensive littoral wetlands existed along the coastline of the Moche Valley where Gramalote is located (e.g.). Until more hard evidence is available on the technologies of the exploitation of shark and other medium -to large-sized marine species along the north coast of Peru, we cannot overly speculate and generalize too widely on the basis of data from just one or a few archaeological sites. We look forward to continuing evaluations of marine resource histories throughout the Andean Pacific region and anticipate that local histories may differ substantially based on solid empirical evidence.

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“Son los tiburones, así en la mar, como en las bocas de los ríos, donde entran, muy dañosos y carniceros, porque han muerto y comídose muchos hombres” (Cobo cited in Mateos 1964:309).

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