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Of Megalodons and Men: Reassessing the 'Modern Survival' of *Otodus Megalodon*

Tyler Greenfield
tgreenfield999@gmail.com
orcid.org/0000-0002-1721-0798

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HIGHLIGHTS

Critical analysis suggests that presumed sightings of the gigantic, prehistoric-era shark called megalodon represent hoaxes or misidentifications of modern species.

ABSTRACT

The megalodon, *Otodus megalodon*, is arguably the most renowned ancient shark because of its extreme size and carnivorous nature. Paleontologists overwhelmingly agree that it went extinct towards the end of the Pliocene. However, some cryptozoologists have proposed that it never died out. Their evidence for its modern survival consists of alleged post-Pliocene teeth and sightings of unknown sharks. The sightings were compiled and critically reviewed via a study-specific scoring system that assessed physical and contextual characteristics. Prior research showed that the teeth were inadequately dated and are of conventional age. Consistent with this finding, the coding results of the eyewitness reports strongly suggested that they involved hoaxes or misidentifications of known sharks. Altogether, there is no compelling evidence for extant *O. megalodon* and ample proof of its extinction. The progression of the notion of its survival and the relationship to cryptozoological biases and popular culture are accordingly discussed.

KEYWORDS

Megalodon, sharks, prehistoric survivors, cryptozoology, paleontology, marine biology.

INTRODUCTION

Otodus megalodon[1], colloquially known as the 'megalodon' or 'megatooth', was the largest predatory shark that ever lived. Recent estimates suggest it reached a maximum total length[2] of 18–20 meters (59.1–65.6 feet) (Pimiento & Balk, 2015; Perez et al., 2021). Its body form was likely similar to sharks of the family Lamnidae, which include great whites (*Carcharodon carcharias*), makos (*Isurus* spp.), and porbeagles and salmon sharks (*Lamna* spp.) (Cooper et al., 2020; 2022). While *O. megalodon* is classified in the separate family Otodontidae, lamnids are still its nearest living relatives (Greenfield, 2022a; b). Like them, it was a very active predator, being partially endothermic and capable of burst speeds up to 37.2 kilometers per hour (23.1 miles per hour) (Ferrón, 2017). It had an estimated bite force 10–20 times higher than a great white's and potentially the highest of any animal (Wroe et al., 2008; Rice et. al., 2016). Bite marks on bones and teeth show that it preyed on seals and smaller whales (Collareta et al., 2017; Godfrey et al., 2018; 2021). Although teeth are the most common remains of *O. megalodon*, skeletal elements like vertebrae, jaw fragments, and possible rostral nodes are also known (Greenfield, 2022a; b). Its fossils are found in most ocean basins and on all continents except Antarctica (Pimiento et al., 2016).

O. megalodon appeared in the early Miocene around 23 million years ago (Pimiento et al., 2016) and went extinct in the late Pliocene between 3.6–2.6 million years ago (Pimiento & Clements, 2014; Boessenecker et al., 2019). The emerging consensus is that its extinction was caused by interconnected environmental and ecological factors. These include loss of coastal habitat due to falling sea levels (Pimiento et al., 2017; Herraiz et al., 2020), decrease in prey diversity and quantity (Pimiento et al., 2016; Collareta et al., 2017), and competition with great whites (Boessenecker et al., 2019; McCormack et al., 2022). Despite the conclusive evidence for its extinction, there is speculation about the survival of *O. megalodon* into the modern day. This idea has a relatively recent origin, incorporating paleontology, cryptozoology, and popular culture.[3] Two main claims are used to support it: teeth dated to the Pleistocene–Holocene and sightings of giant sharks. This paper reexamines and refutes these arguments for modern survival while tracking the evolution of the concept over time. The last major, skeptical review of this topic was 25 years ago (Roesch, 1998), and the need to address it has only increased since then.

Cryptozoology and the Prehistoric Survivor Paradigm (PSP)

The modern survival of *O. megalodon* is most often viewed through the lens of cryptozoology. Thus, it is first important to understand cryptozoological terminology and methodology. Cryptozoology is the study of animals that are reported to exist but have not been confirmed according to scientific standards (Heuvelmans, 1982).[4] It is divided into subfields by taxonomic group; for pertinent example, the one for fishes is 'cryptoichthyology' (Berzas, 1998). These animals are called 'cryptids' (Wall, 1983), and their anecdotal status is referred to as being 'ethnoknown' (Greenwell, 1985). Cryptids are frequently interpreted as species traditionally thought extinct, a phenomenon termed the 'prehistoric survivor paradigm' (PSP) (Naish, 2010; 2016).[5] The identification system of the PSP relies heavily on popularity. The more famous an extinct taxon is, the more likely it is to be associated with a cryptid, even if this association is contradicted by the available evidence. Paleontological discoveries and hypotheses have a significant influence on the PSP, but the osmosis of information is slow. As a result, cryptozoologists' conceptions of ancient animals are usually based on obsolete science (Naish, 2001; Paxton & Naish, 2019). Pop culture has an equal influence, with the subgenre of 'cryptofiction' commonly featuring prehistoric survivors (Bosky, 2014; Mullis, 2019). These depictions are inaccurate and exacerbate the spread of misinformation within the field. Overall, the PSP is a critically flawed model that is not scientifically viable for analyzing cryptids.

Nonetheless, *O. megalodon*'s continued existence is widely discussed in the literature (Stead, 1963; Heuvelmans, 1965/1968; Matthiessen, 1971; Brown, 1973; Dennis, 1975; Housby, 1976; Goss, 1987; Raynal, 1987; Bright, 1989; Ellis & McCosker, 1991; Shuker, 1991; 1995; Roesch, 1998; Coleman & Clark, 1999; Eberhart, 2002; Renz, 2002; Coleman & Huyghe, 2003; Coudray, 2009/2016; Kriwet et al., 2009; Newton, 2009; Emmer, 2010; Conway et al., 2013; Marshall, 2018; Fuchs, 2020; Guimont, 2021; Hawthorne, 2021).[6] As is normal for cryptids, it has been given alternate names such as 'giant shark' (Coleman & Huyghe, 2003), 'great shark' (Marshall, 2018), 'lord of the deep,'[7] and the tongue-in-cheek scientific epithet *Carcharocles* '*modernicus*' (Conway et al., 2013). Unlike other cryptids, though, interest in extant *O. megalodon* is inversely proportional to the amount of its support. Similarly well-known cryptids like sasquatch and the Loch Ness monster have hundreds or thousands of encounters with dozens of additional pieces of evidence (e.g., footprints, hairs, DNA, photographs, videos, audio recordings). In contrast, only a couple of teeth and a handful of sightings are attributed to living *O. megalodon*. For the latter, little connects them aside from involving huge sharks. This weak evidential basis, summarized below in two sets, demonstrates the power of the PSP in linking cryptids with extinct taxa. The superlative characteristics of *O. megalodon* and its corresponding fame are enough to fuel the idea of it being alive.

Evidence Set A: 'Recent' *O. megalodon* Teeth

O. megalodon teeth dated after its accepted extinction in the Pliocene are typically cited as indicating its survival. In particular, two teeth analyzed by zoologist Wladimir Tschernezky in 1959 (Tschernezky, 1959) are referenced. They were originally dredged from seafloor red clay by the British naval ship H.M.S. *Challenger* during its pioneering expedition in 1875. They were discovered 2,385 fathoms (4,361.7 meters/14,310 feet) deep at 'Station 281' in the South Pacific Ocean north of the Austral Islands (Murray & Renard, 1891). Both are housed in the Ocean Bottom Deposits Collection at the Natural History Museum in London, United Kingdom (Figure 1). Tschernezky measured the surface coatings of manganese dioxide (MnO_2) on these teeth, finding maximum thicknesses of 1.7 millimeters on the larger one (NHMUK M 481) and 3.64 milli-

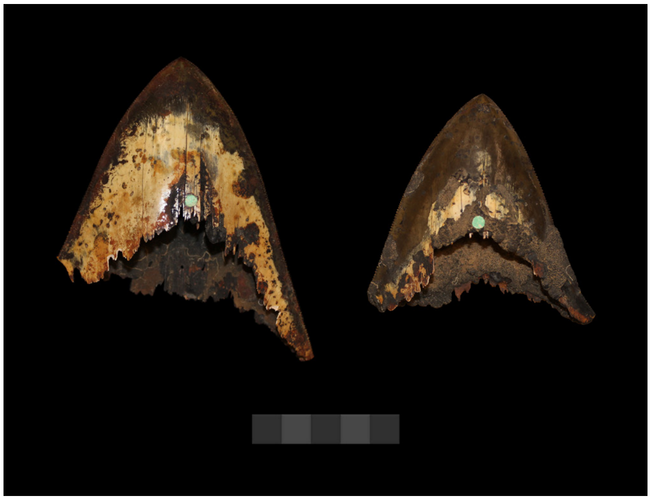

Figure 1. The two *O. megalodon* teeth unearthed by the H.M.S. *Challenger* and tested by Wladimir Tschernezky. Left: NHMUK M 481, the same as Murray & Renard (1891: pl. V, fig. 1) and Tschernezky (1959: fig. 2). Right: NHMUK M 482, the same as Murray & Renard (1891: pl. V, fig. 2) and Tschernezky (1959: fig. 1). The photographs were taken by Emma Bernard and are reproduced here with permission. The scale bar is 5 centimeters.

meters on the smaller one (NHMUK M 482). He then used the minimum MnO_2 accumulation rate of 0.15 millimeters per 1,000 years, which had been calculated by Pettersson (1955) through radium dating of oceanic manganese nodules. This resulted in estimated ages of 24,267 years[8] (late Pleistocene) for the smaller tooth and 11,333 years (early Holocene) for the larger tooth. Tschernezky did not explicitly propose that *O. megalodon* is extant based on his findings, but that was likely his intended conclusion. He was also a cryptozoologist who studied the yeti and related it to the extinct ape *Gigantopithecus*, thereby advocating for the PSP (Tschernezky, 1960; Tschernezky & Cooke, 1975).[9]

Subsequent authors who employed the same dating technique (Gipp & Kuznetsov, 1961; Roux & Geistdoerfer, 1988) have not been mentioned in the cryptozoological literature. More importantly, a 1970 rebuttal by marine biologist Georgii M. Belyaev and paleontologist Leonid S. Glickman (Belyaev & Glickman, 1970b) has likewise gone unnoticed. They pointed out several factors which completely disprove Tschernezky's methods and results. First, Belyaev and Glickman noted that radium dating of manganese nodules is inaccurate and leads to calculated accumulation rates 20–30 times faster (and ages 20–30 times younger) than more accurate ionium-thorium dating. Second, they observed that the dentine roots and cores of the *Challenger* teeth had entirely decayed, leaving only the enameloid crowns, before the deposition of MnO_2 began. Third, they recognized the spotty coverage and varying thicknesses of MnO_2 on each tooth, which shows that deposition stopped and resumed multiple times. These features are seen in other fossilized shark teeth recovered from the ocean bottom, like those collected by the Russian RV *Vityaz* expeditions that were examined by Belyaev and Glickman (Belyaev & Glickman, 1970a). Ultimately, even if an improved accumulation rate is utilized, MnO_2 is still worthless for dating because deposition started long after the teeth landed on the seabed and occurred at inconstant intervals.

The age of the *Challenger* teeth must be determined with alternative approaches. Belyaev and Glickman found that *O. megalodon* teeth are regularly accompanied by two other species of extinct sharks, the ancestral great white *Carcharodon hastalis* and the hooked megatooth *Parotodus benedenii*.[10] They were restricted to the Miocene–Pliocene between 23–2.6 million years ago (Cappetta, 2012) and serve as index fossils in this case. The shark teeth gathered by the *Challenger* that are described and illustrated in its official report (Murray & Renard, 1891) contain *C. hastalis* and *P. benedenii*.[11] They were obtained at Station 281 and surrounding sites in the South Pacific, confirming that these localities are Mio-Pliocene.[12] Further confirmation comes from two *O. megalodon* teeth which were dredged by the German research ship RV *Sonne* in 2007 in the same region (Kriwet et al., 2009). These were dated to 18 million (early Miocene) and 6 million years ago (late Miocene) using strontium dating. Finally, the fact that all confidently-dated *O. megalodon* teeth are Mio-Pliocene should erase any doubt about the age of the *Challenger* specimens. Ironically, even if Tschernezky was correct and they were Pleisto-Holocene, they would not be proof of modern survival. Many animals went extinct throughout the Holocene before the present day (e.g., woolly mammoths; Vartanyan et al., 2008); theoretically, *O. megalodon* could have done so too.

Evidence Set B: Collection of Sightings

The reputed *O. megalodon* sightings that are most often talked about have been selected through a review of the literature. The list is largely the same as those covered by Roesch (1998), with the main difference being that the Great Barrier Reef sighting is here revealed to be plagiarized from J.S. Elkington's sighting (see below). They are presented in chronological order by the date they were first published, except for Loren Grey's, which is grouped with his father's. This collection has additional sources and information that have not been addressed before by cryptozoologists or skeptics, which were turned up by extensive searching. After the sightings are explained and interpreted, they are further scrutinized with a scoring system that compares them to *O. megalodon* and living sharks. On top of that, aspects that could denote dishonesty and coinciding motivations are enumerated. This is the first collation of the sightings with in-depth breakdowns of all their characteristics and contexts. Previous authors have credulously accepted or too quickly dismissed the data without proper rigor.

The Broughton Island Sighting

The most notable sighting claimed to be *O. megalodon* was recounted by marine biologist David G. Stead in his posthumous 1963 book *Sharks and Rays of Australian Seas* (Stead, 1963). It happened in 1918 near Broughton Island off the coast of New South Wales (NSW), Australia. Stead and his colleague Ebenezer J. Paton were told this story at Port Stephens by fishermen who trapped rock lobsters around the island.[13] They allegedly witnessed an enormous shark, which they conflictingly guessed to be either 115 or 300 feet long (35.1 or 91.4 meters). Besides its size and uniformly white coloration, no other physical attributes were specified. The shark seized many of the fishermen's lobster pots, which were 3.5 feet (1.1 meters) wide and contained a few dozen lobsters each, and took their mooring lines with them. Although unconvinced of the extreme lengths, Stead believed the account to be otherwise true and the shark to be an *O. megalodon*.[14] His opinion was informed by outdated length estimates of 80–90 feet (24.4–27.4 meters) for this species, along with his mistaken assumption that teeth he personally saw were unfossilized. Furthermore, his earlier theorization that sea serpents could be gigantic sharks (Anon., 1912) might have contributed to his belief.[15]

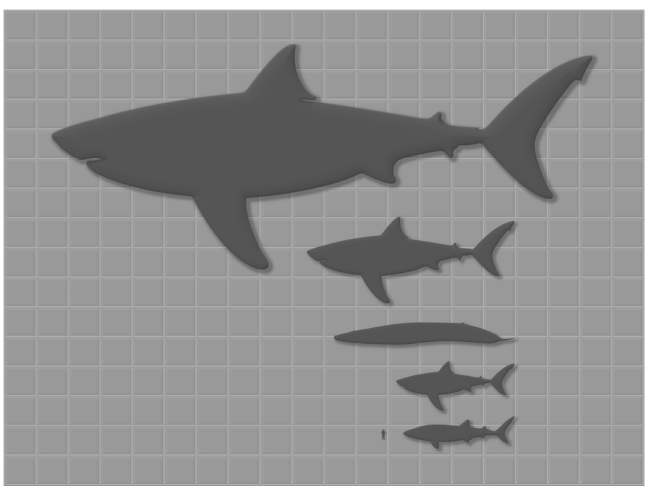

Figure 2. From top to bottom: the upper (91.4 meters) and lower (35.1 meters) sizes for the Broughton Island shark, a blue whale (30.5 meters), *O. megalodon* (20 meters), whale shark (18.8 meters), and human (1.8 meters). The *O. megalodon* silhouette is redrawn from Oliver Demuth's reconstruction in Cooper et al. (2020) (CC BY 4.0), the blue whale silhouette is modified from Scott Hartman's (PhyloPic, CC BY 3.0), the whale shark silhouette is modified from Christoph Schomburg's (PhyloPic, CC0 1.0), and the human silhouette is the author's own work. See end of article for full links.

This version of the incident has been ubiquitously repeated in the cryptozoological literature, but a contemporary newspaper article quoting Stead (Anon., 1918a) has been overlooked. It is consistent with the former yet reveals key details that were omitted. It was published in the January 30 issue of the Sydney *Evening News*, with the sighting implied to have transpired in the preceding days. There was a severe, monsoonal storm in the area that morning, and Stead and Paton were initially inquiring about damages suffered. An article regarding the storm was printed later in the same issue (Anon., 1918b). The fishermen, while remaining anonymous, were disclosed to be Greek immigrants.[16] The shark supposedly appeared over the course of multiple days, ate the lobster pots and their contents whole, and on one occasion took a bite out of one of their 'launches.' This would have been a small, motor or steam-powered boat holding two to four men, according to another description of NSW lobster fishermen (Gruvel, 1911). Like Stead, the article writer matched the encounter with *O. megalodon* because of inflated size estimates and rumored unfossilized teeth,[17] being the first ever source to postulate its modern survival.

The connection of the Broughton Island sighting with *O. megalodon* is tenuous at best. The reported sizes are almost twice as long as the largest *O. megalodon* at minimum and over four times at maximum (Figure 2). Even presuming that the lengths were greatly exaggerated,[18] there are no identifying characters (e.g., the morphology of the teeth, head, body, or fins) that are shared between them. A more reasonable candidate is a whale shark (*Rhincodon typus*), which was posited by Hawthorne (2021). It is the largest living shark, reaching a total length up to 18.8 meters (61.7 feet) (McClain et al., 2015), and is closest in dimensions to the sighting (albeit still significantly shorter). An albino or leucistic individual has been seen (Anon., 2008), so an all-white color is possible. Additionally, the fishermen would have been unfamiliar with whale sharks. The species was not recorded in NSW until 1936 (Whitley, 1965)[19] and in the fishermen's native Mediterranean Sea until 2021 (Turan et al., 2021). On the other hand, the reported behaviors do not line up. Whale sharks are filter feeders that eat pelagic organisms like zooplankton and small fishes (Rohner & Prebble, 2021), not large, benthic crustaceans like lobsters. They have minute, vestigial teeth (White, 1930), which are incapable of crushing lobster pots or biting chunks out of boats.[20] Their esophagus has a mere diameter of ~4 inches (~10.2 centimeters) (Gudger, 1940), so the pots could not be swallowed whole.

Another candidate that better fits the behaviors is a great white shark. Crustaceans are not a main component of their diet, but they have consumed large crabs in rare instances (LeMier, 1951). Great whites can bite and crush crab traps and bite or ram other fishing gear and boats (Collier et al., 1996). In an extraordinary event, one smashed a hole into a small boat carrying two lobster fishermen and capsized it (Anon., 1953; Day & Fisher, 1954). Albino (Smale & Heemstra, 1997) and leucistic (Kabasakal, 2020) individuals have also been documented. However, great whites attain a top total length of approximately 7 meters (~23 feet) (Mollet et al., 1996), only about a third of that of whale sharks. A study of untrained witnesses found average errors under 0.5 meters (1.6 feet) when visually assessing the lengths of great whites (May et al., 2019). The species was already present in NSW well before 1918 (Whitley, 1939), so the fishermen were surely familiar with it. These factors make it less conceivable to be misidentified and exaggerated than a whale shark, especially at the close distance when the shark attacked the boat. It would also be an unlikely combination of unusual circumstances for an albino/leucistic great white to destroy lobster pots, eat lobsters, and bite a boat.

The most plausible explanation for the Broughton Island sighting is that it was a hoax perpetrated by the fishermen. This was mooted by Heim in Renz (2002), who speculated that they devised the shark story to cover up the loss of their equipment for a different reason. Now, with knowledge of the newspaper articles, that reason becomes clear: the storm. The gale force winds, heavy rainfall and consequent flooding, and turbulent waves all could have caused the lost pots and damaged boat. Neither were probably owned by the fishermen, instead being leased from a senior person or company since they were poor immigrant workers. They would have been liable if the situation was due to their own negligence, like if they improperly stored the materials or operated them out in the storm. To add to their financial woes, the years 1916–1918 experienced a marked decline in rock lobster catches in NSW as an effect of World War I (Montgomery, 1995). Considering their vulnerable socioeconomic status in this stressful time, the fishermen had a strong incentive to hide their fault and avoid reimbursement. A hoax of desperation accounts for the hyperbolic sizes and other inconsistencies with real sharks, which are doubtful to be honest errors.

Zane and Loren Grey's Sightings

The next sightings are one by novelist and sport fisherman Zane Grey and another by his son Loren. Zane's was presented in his 1931 book *Tales of Tahitian Waters* (Grey, 1931). It happened in June 1928[21] in the vicinity of Rangiroa atoll in the South Pacific and was watched by him and his entourage of several boats and crewmen. As they were reeling in yellowfin tuna, a big shark approached the surface towards them. It ignored the tuna and passed under the boats, then dove down and disappeared after a few seconds. It was yellowish-green colored with a few white spots and had a square head and large pectoral fins. The last third of its body and tail was noticeably thinner than its broad head and anterior body. Zane judged it to be 8 feet wide (2.4 meters) and at least 35–40 feet long (10.7–12.2 meters). Loren recalled his sighting in the 1976 book *Shark: The Killer of the Deep* (Grey & Grey, 1976). It occurred in 1933[22], around 100 miles (160.9 kilometers) northwest of Rangiroa, while he was on the steamer S.S. *Maunganui* with his father. Loren spied the shark emerging from the ocean and alerted Zane and fellow passengers, who also saw it. It was yellowish-brown in color with hundreds of white spots, which were actually barnacles upon closer inspection and not patterning. It had a large tail that protruded out of the water, a round head 10–12 feet wide (3–3.7 meters), and it was 40–50 feet long (12.2–15.2 meters).

Neither of the Greys ascribed their sightings to *O. megalodon*, as opposed to the cryptozoological literature. They did not determine the species, but both were adamant that it was not a whale shark, regardless of the similarities. Indeed, Roesch (1998) contended that it was, in fact, a whale shark because of the resemblance. Zane's description is the closest match overall. The length is within the range of whale sharks, and the rectangular head wider than the posterior body[23], and prominent pectoral fins align too (Tomita et al., 2021). Zane indicated a low amount of white spotting, which is seemingly at odds with the numerous spots on whale sharks. Yet, nonoptimal lighting and water clarity can reduce the number of visible spots (Pianin, 2020). The yellowish-green coloration is not typical, but the aforementioned conditions could also cause the standard shades of blue, grey, or brown to look differently. Zane had previously seen a whale shark and perceived it as being green at first, then changing to blue (Grey, 1925).[24] The behavior of disregarding the hooked tuna is congruent with whale sharks, which do not eat fish of that size. Some of these aspects are contradictory to *O. megalodon.* Rostral nodes belonging either to it or its relative *Parotodus* are most alike porbeagles and salmon sharks (Greenfield, 2022a; b), suggesting that it had a pointed snout and tapering head.[25] It would have been solidly dark colored, not spotted, on its dorsal side as a function of its ecology (Cooper et al., 2020). The behavior is abnormal for any predatory sharks, which tend to depredate fish caught on lines (Mitchell et al., 2018).

Loren's sighting parallels whale sharks in some details, though others are incompatible. The length and color are again within possibility, and whale shark heads could be construed as rounded since they have blunt corners. The infestation of barnacles is where the narrative deviates from known anatomy. All sharks have dermal denticles (a.k.a., placoid scales) covering their skin; whale sharks (Becerril-García et al., 2021) and *O. megalodon* (Nishimoto et al., 1992) are no exceptions. The hard, ribbed exteriors of these denticles, which are composed of enameloid like teeth, prevent barnacles from attaching to the epidermis (Bixler & Bhushan, 2013).[26] Whales are hosts for a variety of barnacles (Fertl & Newman, 2018), but Loren was positive that the animal was a shark and not a whale when seeing its tail. Whales and sharks have horizontally and vertically oriented caudal fins, respectively (Fish, 2023), so it would be difficult to conflate them. This paradox is a sign that the story was a hoax. Also suspicious is that Zane never attested to it, despite purportedly being a bystander, and that Loren waited until long after his father's death in 1939 to tell it. Loren may have concocted a more sensational tale in an attempt to beat Zane's, which would explain why his shark was somewhat longer and wider as well.[27]

J.S. Elkington's Sighting

David Stead wrote about a further sighting in *Sharks and Rays of Australian Seas*. It was communicated to him in a 1939 letter from ship captain J.S. Elkington, who said it unfolded in 1894 off Townsville, Queensland, Australia. When Elkington was sitting in a 35 foot (10.7 meter) launch that had broken down, a shark came and laid within 10 feet (3 meters) of the boat for a half hour. It extended a few feet past each end of the boat and was yellowish-white in color. He was certain that it was a great white and ruled out a basking shark. Strangely, this anecdote was plagiarized by marine biologist Theo W. Brown in his 1973 book *Sharks: The Silent Savages* (Brown, 1973). Brown changed some parts: the source to an anonymous captain who told him, the date to 1963,[28] and the launch to 85 feet (25.9 meters). The location off Townsville (now specified to the Great Barrier Reef), the boat being stalled, and the shark being as long or longer than the boat and white colored were retained. Though Brown's has been referred to as a separate sighting, it is obviously a hoax that was lifted from Elkington's.[29]

Contrary to Elkington's conviction, the size of his shark agrees with a basking or whale shark and not a great white. The peaceful disposition and potential albinism/leucism also conform to both of the filter feeders. Basking sharks are more comparable in body plan to great whites than whale sharks are to either (Ebert et al., 2021), so they are more plausible to be confused. His view may have been biased by a reputed 36.5 foot (11.1 meters) great white captured off Port Fairy, Victoria, Australia (Günther, 1870), which was eventually reevaluated to be ~17.7 feet (~5.4 meters) (Randall, 1973). A dubious detail is that Elkington implied the shark sat still by his unmoving boat for the duration. Big pelagic sharks are ram ventilators, meaning they swim practically continuously to keep water flowing through their gills to breathe (Dolce & Wilga, 2013).[30] Whales can be motionless for over an hour while resting due to their air-breathing (Lyamin et al., 2001), and their carcasses can float (Moore et al., 2020), but it would be hard to mistake a whale for a shark as already elaborated. Once again, a hoax is most probable in light of this discrepancy. There is no corroborating evidence that it preceded all other sightings, as Elkington asserted. Therefore, his shark's coloration could have been copied from the Broughton Island sighting, with the length approximating the Port Fairy great white or Zane's sighting to make it more believable.

The *Rachel Cohen* Incident

In his 1969 book *Des Poissons si Grands*, pilot and sport fisherman Pierre Clostermann documented an attack by a gargantuan great white[31] (Clostermann, 1969). The ship *Rachel Cohen* was traveling off Timor in March 1954 when it was rocked by an unseen collision on a stormy night. Upon returning to dry dock in Adelaide, South Australia (SA) for repairs, the culprit of the crash was exposed by 17 teeth lodged in the wooden keel. Their average crown height was 10 centimeters (3.9 inches), and base width was 8 centimeters (3.1 inches). They were arranged in an arc with a roughly 1 meter (3.3 feet) radius near the propeller shaft, which was bent from the force. Clostermann stated that unnamed ichthyologists had ascertained a length of 24 meters (78.7 feet) from the bite. After consulting historical materials, this narrative is divulged to be a mixture of truth, confusion, and embellishment. There was an Australian ship christened *Rachel Cohen*, but it was destroyed in a fire in 1924 (Anon., 1924). The *Rachel Cohen* was professed to have been the victim of a shark attack, but that was a mistake.

In 1897, the ship *Eclipse* was docked for refitting at Birkenhead, SA (a suburb of Adelaide) when shark teeth were removed from the copper plating on its hull (Anon., 1897). How many teeth, their measurements, and what species they belonged to were not declared. This event was reiterated in a 1926 article with alterations: the date was left out, and the *Eclipse* was switched for the *Rachel Cohen* (Saunders, 1926). The latter ship's immolation two years prior was probably fresher in the writer's memory, causing an accidental substitution. The modified retelling was then included in Victor Coppleson's 1958 book *Shark Attack* (Coppleson, 1958). Clostermann plausibly could have pulled the vessel's name and port and the general scenario from Coppleson. The features of the teeth might have been drawn from a different interaction. In 1950, a fishing boat in Streaky Bay, SA, was assailed by a 17 foot (5.2 meter) great white[32] (Anon., 1950). Its head projected over 3 feet (0.9 meters) out of the water when it moved alongside the boat. The shark was soon caught and three of its teeth were extracted from the planking. Perhaps Clostermann misinterpreted the particulars, with the 17 feet changed to 17 teeth, three teeth to three-inch-wide teeth, and three-foot-high head to three-foot bite radius. The 1954 date, contact off Timor, mangled propeller, and length estimate all seem to be fabrications by Clostermann.

Scoring the Sightings Collection

Comparative analysis with a scoring system has been utilized in some cryptozoological research. For instance, Woodley et al. (2011) used this process for comparing a baby sea serpent to other animals. They were dealing with an intricate account and sketch with 29 traits and 14 candidates.[33] Unfortunately, the sightings here are all far less detailed and lack drawings, and have a more limited pool of candidates. Four of them were included, with the Great Barrier Reef sighting and *Rachel Cohen* incident eliminated since they are definite hoaxes. They have been sorted into a simpler tabulation with six categories of characteristics and four species (Table 1). *O. megalodon* was chosen because of its correlation with these sightings by cryptozoologists. Basking, great white, and whale sharks were chosen because they are the biggest sharks that both inhabit the South Pacific and often come to the surface. Whales were excluded because they are unlikely to be mistaken for sharks at short distances by experienced seamen. Each characteristic was considered at face value and independently of the others. If it matches a species, then one point was added to that species' score; if not, then zero points were added. Characteristics that pertain to all species (e.g., swimming, large pectoral and caudal fins) were not scored, while those that contradict all species were.[34] The species with the most points has the greatest similarity to the sighting, although it is not necessarily the best explanation.

Zane Grey's sighting is the only one in which all characteristics fit a single species, whale sharks. It is also the only one without a characteristic that contradicts all species. Great whites scored highest for the Broughton Island sighting, whale sharks for Loren Grey's, and basking sharks for J.S. Elkington's. These three had one contradicting characteristic each. Any characteristics that correspond to *O. megalodon* are shared with other species. It never garnered more than half of the available points for a sighting. Altogether, this system suggests that misidentified extant sharks were responsible and not *O. megalodon*. That being said, the scoring cannot fully resolve if hoaxing was involved or not. It encompasses questionable parts within the sightings but not information from elsewhere. The poor quality and quantity of the sample further restrict the applicability of this type of analysis. These shortcomings emphasize that additional context, rather than the base descriptions alone, is essential for

Table 1. The scoring system for sightings with the characteristics on top and the points for species on bottom.

Sighting	Length	Width	Head shape	Coloration	Behavior	Other characteristics
Broughton Island	115-300 feet[X]			White[B,G,W]	Swimming, attacking boats and traps to eat lobsters[G]	
Zane Grey's	35-40 feet[B,M,W]	8 feet across body[M,W]	Square[W]	Green and yellow with white spots[W]	Swimming, ignoring hooked tuna[B,W]	Large pectoral fins, last 1/3 of body narrower than head[W]
Loren Grey's	40-50 feet[B,M,W]	10-12 feet across head[M,W]	Round[W]	Brown and yellow[B,W]	Swimming	Large caudal fin, covering of barnacles[X]
J.S. Elkington's	>35 feet[B,M,W]			White and yellow[B,G,W]	Stationary[X]	Similar in appearance to great whites[B,G,M]

Sighting	(B) Basking shark	(G) Great white shark	(M) *O. megalodon*	(W) Whale shark	(X) Contradicts all
Broughton Island	1/3	2/3	0/3	1/3	1/3
Zane Grey's	2/6	0/6	2/6	6/6	0/6
Loren Grey's	2/5	0/5	2/5	4/5	1/5
J.S. Elkington's	3/4	2/4	2/4	2/4	1/4

Table 2. The final appraisal of the sightings supplementing the scoring system with context.

Sighting	Most likely explanation	Scoring results	Problematic context
Broughton Island	Hoax	Does not match a species in all characteristics	Only published in secondhand accounts
		One characteristic that contradicts all species	All witnesses were anonymous
		Lowest number of scored characteristics	Severe storm and negligence could have caused damaged equipment and boats
			Financial incentive to cover up damages and avoid liability
			Fishermen were already vulnerable due to being poor immigrants
			Stressful time because of a decline in the local lobster fishery
Zane Grey's	Misidentified whale shark	Matches whale sharks in all characteristics	Alleged other witnesses never confirmed they were present
		No characteristics that contradict all species	Insistence it was not a whale shark, despite describing one similarly before
		Highest number of scored characteristics	
Loren Grey's	Hoax	Does not match a species in all characteristics	First reported 43 years after it supposedly happened
		One characteristic that contradicts all species	No corroboration that it happened when claimed
		Second highest number of scored characteristics	Date changed in a later retelling
			Alleged other witnesses never confirmed they were present
			Similar to Zane's sighting, but with a larger shark
			Loren had a troubled relationship with Zane and wanted to one-up him
			Reported during a wave of public interest in sharks
J.S. Elkington's	Hoax	Does not match a species in all characteristics	Only published in a secondhand account
		One characteristic that contradicts all species	First reported 45 years after it supposedly happened
		Second lowest number of scored characteristics	No corroboration that it happened when claimed
			Similar shark coloration to the Broughton Island sighting
			Similar shark size to the Port Fairy great white and Zane's sighting

deciding the veracity of anecdotal evidence. Bearing that in mind, the sightings have been organized into a second tabulation that combines the scoring with problematic context (Table 2). The features indicative of hoaxes outnumber those in favor of misidentifications for the Broughton Island, Loren Grey's, and J.S. Elkington's sightings. The results of both comparisons should dispel the myth that *O. megalodon* has been witnessed by humans.

Evolution of the Concept and Popular Culture

The modern survival of *O. megalodon* was hypothesized as far back as 1918, yet it did not become a pervasive idea until much later. Tschernezky's and Stead's works in 1959 and 1963, respectively, were the real starting points. Even then, their contents were not immediately disseminated. An example is the 1968 *In the Wake of the Sea-Serpents*, a foundational text on marine cryptids by 'father of cryptozoology' Bernard Heuvelmans (Heuvelmans, 1965/1968). He briefly touched on extant *O. megalodon*, insinuating that their rotting corpses could have inspired legends of hairy sea monsters. However, Heuvelmans did not discuss the recent teeth or sightings and was apparently unaware of them. Peter Matthiessen's 1971 book *Blue Meridian: The Search for the Great White Shark* was the first to repeat the Broughton Island sighting (Matthiessen, 1971). He also incorrectly theorized that *O. megalodon* and great whites may be a single species, as support for its current existence.[35] This argument was parroted in Peter Benchley's famous novel *Jaws* in 1974 (Benchley, 1974). Matthiessen's and Benchley's books spurred writing on the subject among shark enthusiasts, leading to the induction of Elkington's sighting (via Brown's appropriation) into the canon (Brown, 1973; Dennis, 1975; Housby, 1976). The 1976 short story "He" by Alan Dean Foster was the earliest fiction about a live *O. megalodon* (Foster, 1976). It introduced the trope of the shark inhabiting an oceanic trench (the Tonga-Kermadec Trench in this iteration), which became a staple of ensuing crypto-fiction.[36]

This rise of interest in the 1970's was ephemeral and failed to impact the cryptozoological community. The early 1980's saw no developments aside from the first novel on the topic, Robin Brown's *Megalodon,* in 1981 (Brown, 1981). In 1986, Heuvelmans excluded *O. megalodon* from his comprehensive list of cryptids (Heuvelmans, 1986). Countering the next year, cryptozoologist Michael Goss published a magazine article favorable to its persistence (Goss, 1987). He added the Greys' sightings to the roster of evidence and referenced the *Challenger* teeth, but not Tschernezky's dates for them. Those would be brought up by Michel Raynal's addendum to Heuvelmans' list the same year (Raynal, 1987) and Michael Bright's book *There Are Giants in the Sea* in 1989 (Bright, 1989). Richard Ellis and John E. McCosker covered modern *O. megalodon* in their 1991 book *Great White Shark* (Ellis & McCosker, 1991). Cryptozoologist Karl Shuker followed suit in a 1991 magazine article and 1995 book *In Search of Prehistoric Survivors* (Shuker, 1991; 1995). Steve Alten's *Meg: A Novel of Deep Terror*, the most influential pop culture property starring *O. megalodon*, was released in 1997 (Alten, 1997).[37] All these publications prompted a resurgence in attention that endures today. In 1998, marine biologist Ben Speers-Roesch provided the initial skeptical perspective on the issue (Roesch, 1998). He deduced that the sightings were hoaxes or misidentifications and the teeth were wrongly dated. He also outlined ecological and environmental aspects that preclude survival.

While Speers-Roesch discounted living *O. megalodon* completely, his analysis did not mitigate its popularization. Various books, articles, and papers on the matter have been written in the meantime, representing a spectrum of opinions (see 'Cryptozoology and the PSP' for a list). Television shows and movies have played a more substantial role as well. A 2009 episode of the cryptozoological docuseries *MonsterQuest* focused on *O. megalodon* (Hajicek, 2009). It created a link with recollections of the 'Black Demon' shark in the Gulf of California, which were hitherto unrecorded in the literature. Two cryptofictional films were misleadingly aired as 'documentaries' on the Discovery Channel, *Megalodon: The Monster Shark Lives* in 2013 and its sequel, *The New Evidence,* the year after (Glover, 2013; 2014). These programs portrayed faked photographs and footage as genuine and used actors posing as scientists to deceive the audience. Justifiably, they faced intense backlash from academics for misinforming the public on an educational network (Fuchs, 2020). *The Meg*, a cinematic adaptation of Alten's novel, premiered in 2018 (Turteltaub, 2018). A sequel, *Meg 2: The Trench* (Wheatley, 2023), and a competitor, *The Black Demon* (Grünberg, 2023), both debuted this year. Pop culture has carried the modern survival of *O. megalodon* to new heights; what began as scant teeth and anecdotes is now the domain of multimillion-dollar blockbusters.[38]

GENERAL DISCUSSION

When subjected to scrutiny, the putative evidence for *O. megalodon* in the present day does not hold up. The *Challenger* teeth were dated with an invalid method and are Mio-Pliocene in age, not Pleisto-Holocene, based on coeval fauna and accurately-dated teeth. The Broughton Island sighting was probably a hoax invented by the fishermen to deflect blame for their missing and broken equipment, which explains the outlandish size of their shark. Zane Grey's sighting is wholly consistent with a whale shark, notwithstanding his insistence otherwise. Loren Grey's and J.S. Elkington's sightings both have elements conflicting with sharks (barnacles and motionlessness) and were likely hoaxes trying to imitate their predecessors. The *Rachel Cohen* incident was an amalgamation of garbled shark attacks and hoaxing. The false equivalencies here are especially damning; if the original claims were absolutely true, they still would not signify *O. megalodon* being alive. Teeth from the early Holocene would not demonstrate it lasting into the modern era. The sightings have no diagnostic traits of *O. megalodon* and clash with its actual anatomy (and with each other). They are only associated because of the species' notoriety and the ever-prevalent PSP in cryptozoology. In reality, *O. megalodon* is not ethnoknown and is thus not a cryptid, since there are no legitimate accounts that can be credibly tied to it.

Conversely to widespread misconceptions, it is indeed possible to prove a negative position if there is sufficient negative evidence (Pasquarello, 1984; Hales, 2005).[39] The current nonexistence of *O. megalodon* is verified by strong lines of negative evidence. There are no known teeth that are authentically post-Pliocene, whether fossilized, subfossilized, or freshly-shed. This contrasts with the sheer abundance of its teeth during the Mio-Pliocene, which establishes that they should continually be produced in vast numbers if it was not extinct.[40] There have been no strandings on shores, and none captured by fishermen as bycatch, either live or dead. Extant species of large sharks have been washed up or accidentally caught many times (Oliver et al., 2015; Wosnick et al., 2022), and *O. megalodon* should be no different. No bite marks or embedded teeth on modern marine mammals have been discovered. It would need to feed and would leave traces of predation or scavenging, as it did in the fossil record. It would also need to reproduce and rely on shallow-water nurseries to protect its young (Pimiento et al., 2010; Herraiz et al., 2020), yet no such areas or offspring are found. No photographs or videos are taken in spite of the increasing utilization of underwater ROV's and aerial drones for surveying sharks (Butcher et al., 2021). In summary, there is no conceivable way that *O. megalodon* could be living while utterly evading detection. Without any physical, visual, or testimonial backing, the burden of proof remains firmly on the proponents of its survival.

IMPLICATIONS AND APPLICATIONS

For cases mostly or entirely lacking physical evidence, a systematic content analysis of eyewitness reports is a viable technique to assess and contextualize cryptids. This approach has limitations and might not necessarily resolve the cases (or broader phenomena) under review, but it can generate or test hypotheses to certain extents. It is a more rigorous alternative to automatically designating cryptids as novel or relictual taxa. Various scoring systems have been put forward in cryptozoology (e.g., Champagne, 2001; 2007; 2016; Woodley et al., 2011), and most, including the one here, are centered on aquatic sightings. They could be expanded to incorporate more terrestrial and aerial sightings and begin to tackle larger datasets. It would be valuable to compare and refine these competing schemes to produce a standardized system that is widely adopted as the best practice tool.

ENDNOTES

1. Throughout its long history, the species *megalodon* has been placed in six genera: *Carcharias*, *Carcharocles*, *Carcharodon*, *Megaselachus*, *Otodus*, and *Procarcharodon*. This paper uses the combination *Otodus megalodon* following the argument of Shimada et al. (2017). For an opposing view advocating an assignment to *Carcharocles*, see Kent (2018).
2. Total length is measured from the tip of the rostrum to the tip of the upper lobe of the caudal fin in a straight line in life position. Lengths in the sightings investigated later in this paper are assumed to be total lengths.
3. This blending of modern science and culture was termed 'new mythology' by Guimont (2021).
4. The foremost scientific standard lacking by many cryptids is a physical type specimen (i.e., a whole body preserved in a museum). However, some species recognized by mainstream zoologists have also been described without physical types (see Krell & Marshall, 2017, for a list). The demarcation between cryptozoology and zoology can be ambiguous, and it is used here as a term of convenience.
5. The paleontological equivalent is a 'Lazarus taxon,' which reappears unexpectedly after a period of absence in the fossil record (Fara, 2001).
6. Young earth creationists have also forayed into cryptozoology, focusing on prehistoric survivors as falsifying evolution and deep time (Thunig, 2017). Tying into their ideology, some creationists have suspected the persistence of *O. megalodon* (Froede, 1995; Wieland, 2005). One pondered that it might have been the 'great fish' which ingested the Biblical Jonah (Lamb, 2006).
7. This name is supposedly taken from a Polynesian legend, but it should be regarded as apocryphal since no primary, native sources are cited. It was first mentioned by Brown (1973), who did not explicitly connect it to *O. megalodon*. That connection was made by Dennis (1975) and Housby (1976), then later revived by Shuker (1995) and Eberhart (2002). The 'box head lamnid' of the South Pacific (Champagne, 2001) might be another name intended for *O. megalodon*, owing to the similitude with the Greys' sightings, but this is unconfirmed.
8. A probable typographical error caused this to be printed as '24,206' by Tschernezky. His two figures were also unintentionally switched around relative to their captions and descriptions in the text (i.e., fig. 1 actually shows tooth 'N2' [= M 482] and not tooth 'N1' [= M 481], and vice versa).
9. Tschernezky was additionally a founding member of the International Committee for the Study of the Human-like Hairy Bipeds (Anon., 1962).
10. Like *O. megalodon*, these two species have convoluted taxonomic histories. *hastalis* has been referred to the genera *Carcharodon*, *Cosmopolitodus*, *Isurus*, and *Oxyrhina*, and *benedenii* has been referred to the genera *Anotodus*, *Isurus*, *Oxyrhina*, *Parotodus*, and *Uyenoa*. They are here assigned to *Carcharodon* and *Parotodus*, following Ehret et al. (2012) and Cappetta (1980), respectively. Early Pleistocene occurrences of both have been recorded (Ebersole et al., 2017; Boessenecker et al., 2018), but these teeth were probably reworked from older sediments.
11. The teeth in plate VI, figures 1–7 are *C. hastalis* (identified as '*Oxyrhina*'), and those in plate VI, figures 8–11 are *P. benedetti* (identified as '*Oxyrhina*' or '*Otodus*') (pers. obs.). Two of the *P. benedenii* came from Station 281, while the rest came from neighboring stations. More teeth of '*Oxyrhina*' from Station 281, presumably including *C. hastalis* and *P. benedenii*, were alluded to but not figured.
12. Another possible age constraint is a layer of volcanic ash that overlaid the red clay at Station 281, which likely fell from a terrestrial eruption on the nearest islands of Rurutu or Tubuai (Murray & Renard, 1891). This layer has not been radiometrically dated, but

the latest eruption on Rurutu was 1.17–1.12 Ma (early Pleistocene), and on Tubuai was 10.52–10.35 Ma (late Miocene) (Rose & Koppers, 2019).

13. Paton was an NSW Inspector of Fisheries, and only his surname was declared by Stead. His full name was sourced from a government notice of his retirement (Oakes, 1923). The crustaceans being caught were variously called 'crayfish' by Stead and 'lobsters' in some retellings. They were almost certainly the eastern rock lobster (*Sagmariasus verreauxi*), which are abundant and commonly fished along the NSW coast (Stead, 1910; Holthuis, 1991).

14. Stead did not use its scientific designation and instead dubbed it the 'white death type', an informal name for *Carcharodon* (which *megalodon* was placed in at that time). The newspaper article about the sighting did so too. His assessment of its length may have been influenced by the equal result of Dean (1909), who used a reconstructed dentition and jaws which were later proven to be far oversized (Applegate, 1971).

15. Stead suggested a form akin to the frilled shark (*Chlamydoselachus* spp.) that grew to be 80–100 feet (24.4–30.5 meters) long or more. Similar propositions of massive, serpentine sharks were made by Gill (1887) and Heuvelmans (1965/1968; 1986), the latter of whom christened this cryptid the 'snark'.

16. Stead labeled them 'outside' men in his book, perhaps hinting at them being immigrants.

17. The article purported that the unfossilized teeth were dredged in the Pacific by the American naval ship U.S.S. *Albatross*. However, the official report of fossils retrieved during its 1899–1900 expedition has no indication of such teeth (Eastman, 1903).

18. Both can be rejected considering that they exceed the longest sharks and the longest marine vertebrate, the blue whale (*Balaenoptera musculus*), which probably does not surpass 30.5 meters (100.1 feet) (McClain et al., 2015). The disproportionate gap in the lengths is unusual for eyewitnesses of the same creature, who tend to conform with each other (Paxton & Shine, 2016).

19. Incidentally, this first observation also occurred close to Broughton Island.

20. Basking sharks (*Cetorhinus maximus*) have the same problems. They can grow to 12.3 meters long (40.4 feet) (McClain et al., 2015) and can be albino (Frøiland, 1975) but are planktivores with nonfunctional teeth (Welton, 2013).

21. There is no concrete date, but Zane stated that they arrived at Tahiti on May 30 and returned there around July 1, with the excursion to Rangiroa sometime in the middle.

22. In a later version, Loren changed the date to two days after Zane's sighting in 1928 (Thomas, 1994). This is assumedly erroneous because Zane made no mention of a second encounter or Loren participating on that trip (Grey, 1931). He also added that the tail stuck out 10 feet (3 meters) above the surface, but that is disregarded here given the ambiguity of the measurement (i.e., whether it was the whole caudal fin or not) and the discrepancy in this version.

23. Basking shark heads can appear somewhat squarish or rounded while the wide mouth is open for feeding, but the pointed snout results in an ovate shape distinct from whale sharks (Crowe et al., 2018). This leads to the front of the head being narrower than the posterior body.

24. This took place in April 1925 in the Gulf of California. Zane noted that it had a wide, flattened head and large pectoral fins, like the shark he saw in 1928, which makes his denial of the latter being a whale shark particularly illogical. He instead called it "one of the man-eating monsters of the South Pacific". This determination may have been prompted by David Robbie's 1909 encounter with a 40 foot, square-headed 'shark' near Fiji. Robbie equated it to the maneating shark god Dakuwaqa (Wall, 1918), but it might have been a whale since it was said to have a flat, broad tail (horizontally-oriented?).

25. Whale sharks do not have rostral nodes and cartilages, hence their unique head shape (Denison, 1937).

26. A single species of barnacles (*Anelasma squalicola*) lives on sharks, but it is a highly specialized form that only parasitizes smaller and slow-swimming deepwater sharks (Rees et al., 2014).

27. Loren resented his father and sought to be a better writer than him (Markman, 1986). Moreover, he could have been motivated by the renewed fascination with *O. megalodon* and sharks in general in the 1970's (see 'Evolution of the Concept and Pop Culture'). He did refer to his shark as a vague 'prehistoric monster'.

28. This is a blatant reference to the publication date of *Sharks and Rays of Australian Seas*.

29. Roesch (1998) misattributed Brown's rendition to B.C. Cartmell's 1978 book *Let's Go Fossil Shark Tooth Hunting* (Cartmell, 1978; not seen by the present author).

30. Whale sharks can stay stationary in a vertical, head-up orientation when feeding, but for ~1.35 minutes or less (Montero-Quintana et al., 2021). Dead sharks are obviously immobile, but their carcasses sink because most species are negatively buoyant (Gleiss et al., 2017).

31. Clostermann labeled the shark a *Carcharodon carcharias*; it is unclear whether he thought it was a relict or just an outsized specimen. He was under the impression that great whites and *O. megalodon* were one species, like some of his contemporaries (see 'Evolution of the Concept and Pop Culture').

32. It was called a 'pointer', short for 'white pointer', vernacular for a great white.

33. Champagne (2001; 2007; 2016) created and refined another scoring system for aquatic cryptids. The present author disagrees with some of his credibility criteria (e.g., that an investigator's opinion speaks for the reliability of a sighting) and uses other criteria which he did not include (e.g., whether a sighting was first- or secondhand, how long before it was reported, if dates and other witnesses were corroborated or not). His system does not test similarity to known animals and operates under the assumption that credible accounts represent new species.

34. Published maximum widths were not found, so they were measured by scaling the 3D model of *O. megalodon* from Cooper et al. (2022) and illustrations of the other species from Ebert (2014) to their maximum lengths. Unlike size and body form, which have been scientifically reconstructed, exact colors and behaviors (e.g., whiteness caused by albinism/leucism, interactions with humans) were not scored for *O. megalodon* since they are unknown.

35. Matthiessen credited this conjecture to James F. Clark of Harvard University. Ellis & McCosker (1991) said it originated from an unpublished 1968 undergraduate paper by Clark titled "Serpents, sea creatures and giant sharks" (not seen by the present author).

36. Sharks are mostly absent in the abyssal zone (depths 4,000–6,000 meters/13,123.4–19,685 feet) and entirely absent in the trench/hadal zone (depths >6,000 meters), likely due to physiological limitations (Laxson et al., 2011; Treberg & Speers-Roesch, 2016). The deepest record of a shark is a 'dogfish' observed at 4,050 meters (13,287.4 feet) (Houot, 1954; 1958).

37. Alten relocated the shark to the Mariana Trench, which has become a cliché in internet lore (e.g., Evon, 2016). There is even a physics paper dedicated to debunking that premise (Carlisle et al., 2020). Housby (1976) spoke of a nameless scientist he met whose squid-baited steel cable was snapped while fishing above the Mariana Trench. The scientist surmised that the assailant was a sperm whale, while Housby proffered it was an *O. megalodon*. This tale was never repeated elsewhere and seems too obscure to have inspired Alten, but is noteworthy as the first to unite *O. megalodon* with that trench.

38. These media are successful, in part, because they capitalize on the mystery and fear of the deep sea among the public (Jamieson et al., 2021).

39. 'Negative evidence' is used here in the sense of Mills (2007), as inferences derived from data which should exist in a given situation but is lacking.

40. An individual *O. megalodon* would lose an estimated 34,071–38,717 teeth in its lifetime (Greenfield, 2022a). Its teeth also have a high preservation potential because of their exceptional size and the hardness of enameloid.

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