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Robert FRANCE



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From folkloric belief to fishery bycatch: contrasting cryptozoological and euhemeristic interpretations of Australian sea serpents

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ABSTRACT

Inclusion of historical perspectives is considered necessary for the comprehensive assessment and management of complex social-ecological systems. Marine conservation biologists have increasingly recognized the value of non-traditional sources such as historical anecdotes as a way to estimate pre-anthropogenic baseline conditions in wildlife populations. The present study demonstrates that examination of eyewitness sightings of unidentified marine objects (UMOs), that were thought at the time to have been sea serpents of the “many-humped” or “string-of-buoys” typology, reveals that Australian marine fauna may have been victims of entanglement in fishing gear for a much longer period than is generally assumed. If this illation is correct, the onset of entanglement in Australia predates by many decades the advent and use of plastic in fisheries and other maritime operations in the later half of the twentieth century. Additionally, given the alarming global promulgation of pseudo-scientific rhetoric, the present study offers a pedagogical opportunity in which to contrast alternative explanations of folklore and cryptozoology versus those of euhemerism and scientific parsimony.

KEY WORDS

Australia,
fishing gear,
entanglement,
cryptozoology.

RÉSUMÉ

De la croyance folklorique aux prises accessoires de la pêche: interprétations cryptozoologiques et euhéméristiques contrastées des serpents marins australiens.

L'inclusion de perspectives historiques est considérée comme nécessaire pour l'évaluation et la gestion complètes de systèmes socio-écologiques complexes. Les biologistes de la conservation marine ont de plus en plus reconnu la valeur des sources non traditionnelles telles que les anecdotes historiques comme moyen d'estimer les conditions de base pré-anthropiques dans les populations d'animaux sauvages. La présente étude démontre que l'examen d'observations par des témoins oculaires d'objets marins non identifiés (OMNI), que l'on pensait à l'époque avoir été des serpents de mer de la typologie « à plusieurs bosses » ou « chaîne de bouées », révèle que la faune marine australienne peut avoir été victime d'enchevêtrements dans des engins de pêche pendant une période beaucoup plus longue qu'on ne le suppose généralement. Si cette illation est correcte, le début de l'enchevêtrement en Australie est antérieur de plusieurs décennies à l'avènement et à l'utilisation du plastique dans les pêcheries et autres activités maritimes de la seconde moitié du xx^e siècle. De plus, étant donné la promulgation mondiale alarmante de la rhétorique pseudoscientifique, la présente étude offre une opportunité pédagogique pour comparer les explications alternatives du folklore et de la cryptozoologie à celles de l'euhémérisme et de la parcimonie scientifique.

KEY WORDS

Australie,
serpent de mer,
outils de pêche,
enchevêtrement,
cryptozoologie.

INTRODUCTION

The study of natural history during the nineteenth century combined proto-scientific accuracy and rigid factualism with a sense of wonder and celebration of theological benevolence (Barber 1980; Berger 1983). The discipline, as practiced by both amateurs and professionals alike, had little to do with the ecological study of the inner workings of nature. Instead, the focus was the competitive pursuit involved with the discovery, description, and formal classification of species (Evans 1993). Often the emphasis was on the strange and exotic, with naturalists scouring the globe in their search for curiosities and anomalies (Stearns 1970). And of course there was nowhere that offered questing European naturalists the promise of “curiouser and curiouser” fauna in a similar vein to the “Beast Glatissant”, than Australia (Griffiths 1996; Moore 2017). If “snarks” *per se* could not be found, there were certainly no shortage of other odd and chimera-like animals, as for example, the platypus, a creature whose very existence seemed to defy basic zoological logic (Ritvo 1997; Moyal 2001). Who knew what other type of animals, as yet unknown to natural history, might inhabit the forests, deserts, and waters of that continent? And there was no creature that was sought for more doggedly by naturalists anywhere than the mysterious and frustratingly elusive sea serpent. Interest in Antipodean mystery animals persisted throughout the twentieth century in a cross-cultural fusion of imported and Indigenous folklore (Whitley 1940; Jon 1998; Hawkins 2006; Musharbash & Presterudstuen 2014). As a result, more than a dozen mystery animals are still thought to exist in Australia (e.g., Smith 1996; Clark 2017; Opit 2017; Cornes & Cunningham 2019; Falson 2020).

Back in the Victorian Era, dozens of articles about sea serpents published by prominent scientists in the world’s most prestigious journals led these “denizens of the deep” to play a significant role in discussions about natural history and the development of zoological and evolutionary science (Westrum 1979; Barber 1980; Lyons 2009; Regal 2012; France 2019a; Paxton & Naish 2019). More recently, biologists and physicists have offered scientifically defensible explanations for much of the panoply of sightings of unidentified marine objects (UMOs) which at one time were thought to have been sea monsters (Brongersma 1968; Lehn & Schroeder 1981, 2004; Paxton & Holland 2005; Woodley *et al.* 2011; Nigg 2013; Galbreath 2015; Paxton *et al.* 2005; France 2019a, 2021a). Despite this, a continual fascination with sea monsters among the general public has led to a continual deluge of books, many self-published –including a handful within the last few years alone– by cryptozoologists who continue to believe in the existence of such creatures. It is one such book, *Australian Sea Serpents*, by Malcom Smith (2020), upon which the present paper is based. For this book came to press simultaneous to the publication of a peer-reviewed paper that offered a different, scientifically-sound explanation for UMO sightings in Australia and elsewhere in the Western Pacific (France 2020a; Fig. 1). As such, a convenient opportunity was created in which to examine the contrasting interpretations provided by cryptozoology and conservation biology through comparing the two approaches taken.

Cryptozoology is the study of “hidden animals” that are undescribed by traditional zoology in consequence of their alleged existence being unsupported by sufficient anecdotal or physical evidence (Arment 2004). As Rossi (2016) found in his review of the field, fascination and belief in the existence of sea serpents and lake monsters are of particular interest. Cryptozoology frequently operates by assembling evidence from newspaper reports of eyewitness encounters as a way of proving the existence of folkloric creatures (Heuvelmans 1988). Cryptids are therefore considered to be ethno-known animals for which concrete evidence “does not yet exist” (Arment 2004: 20). For many critics, it is the insertion of that single word of assumed predetermination, “yet”, that sidetracks the entire process from being objective, orthodox science into the realm of subjective, pseudoscience (France 2019a).

Conservation biology benefits from including historical perspectives (Meine 1999; Szabo & Hedl 2011), and just as for cryptozoology, it too can be based on reviewing anecdotal evidence from non-traditional sources. These can include explorer’s reports, travelers’ diaries, naturalists’ journals, fishers’ observations, ethno-historical records, and museum documents (e.g., Pauly 1995; Saenez-Arroyo *et al.* 2005; Al-Abdulrazzak *et al.* 2012; Maschner *et al.* 2014). Such sources are of particular use in detecting the onset of deleterious change (Dearing *et al.* 2015; Kittinger *et al.* 2015; Engelhard *et al.* 2016) in relation to the “shifting baseline syndrome” (McClenachan *et al.* 2012; Novaglio *et al.* 2019), wherein successive generations come to accept a progressively depauperate biodiversity as being normal (Pauly 1995).

The present exercise in historical environmental detection (*sensu* McClenachan 2015) offers a parsimonious counterpoint, rooted in conservation biology, to the pseudoscientific postulations of cryptozoology. In doing so, this investigation challenges concepts of when Australian marine wildlife may have actually begun to experience one particular form of anthropogenic stress: entanglement in fishing gear or maritime debris. Entanglement in actively deployed or abandoned fishing equipment and other discarded anthropogenic material is acknowledged to be a major conservation problem experienced on a global scale affecting hundreds of species (Laist 1997; NOAA 2014), and one whose onset may need to be shifted earlier than what is commonly believed (France 2019a, 2020a, b, 2021b).

ANECDOTAL PROVENANCE

The long-established methodology in cryptozoology (e.g., Oudemans 2007; Heuvelmans 1968) is to compile reported sightings from disparate sources, none being more important in this regard than newspaper reportage (Heuvelmans 1988). Smith (2020) based his research on “Trove”, the innovative undertaking by the National Library of Australia to digitize the complete corpus of newspaper archives from across the country and over time. This allowed him to find almost ninety sightings of mysterious sea creatures spanning slightly more than a century, from 1870 to 1978. Significantly, more

than half of these had never before been published in book form, and many of the rest had hitherto been known in the literature from only severely paraphrased accounts. Maps are included to show the location of the sightings. In most cases, Smith lets the voices of the eyewitnesses stand alone, although in some circumstances he offers interpretations or expresses his own puzzlement in regard to what was described.

The eyewitness accounts compiled by Smith (2020) were carefully parsed using the standard qualitative procedure of directed content analysis (Hsieth & Shannon 2005), with preassigned codes as textual anchors to search for pertinent content through grounded theory (Charmaz 2000). The particular coded words or phrases employed were those based on five anatomical attributes (narrow and sinuous body shape, body composed of segments, body displaying protrusions, presence of scales, presence of mane) and five behavioral attributes (vertical undulating movement, notable water disturbance, floating motionless or swaying in waves, observed near or draped over the shore, oblivious to surroundings or physical disturbance) that had previously been specifically identified for the Gloucester UMO, the most sighted and studied “sea serpent” in history (France 2019a).

DESCRIPTION OF THE UNIDENTIFIED MARINE OBJECTS

Smith considered that 60 of the 87 reports he compiled were of sufficient detail to be “worthy of consideration” (Smith 2020: 138). My targeted search based on the 10 attributes characteristic of the Gloucester UMO generated a subsample of 39 anecdotes to examine.

In toto, a notable anatomical attribute of the Australian UMOs (Table 1; Fig. 2) is their elongated and narrow serpentine body shape (12 anecdotes), likened, in three cases, to a “sewage pipe”, a “huge armoured hose”, or a “large rope drifting about”. The bulk of the body lengths of certain UMOs were composed of a series of components parts (eight anecdotes), described variably as “arches”, “humps”, “loops”, or a “series of interconnecting plates”. Bodies sometimes sported a sequence of small protrusions along their lengths (11 anecdotes), referred to as smallish “fins”, dorsal “spikes” or “spines”, or other serrations. Six anecdotes mentioned the presence of “scales” of various colouration, whereas four anecdotes described strands of bushy material in the form of “hair” or a “beard”.

A notable behavioral attribute of the Australian UMOs (Table 2) is that they moved via vertical undulations (four anecdotes) which were often accompanied by considerable water disturbance (10 anecdotes). UMOs were sometimes observed floating motionless on the water or gently swaying in the waves (six anecdotes). Portions of UMOs that were observed above the surface seemed oblivious to the surroundings, coming right up to a boat in several cases and adjacent to the shore in another. In one anecdote, the UMO was actually observed draped over a beach, and in another, the UMO was unresponsive after being struck by a plank of timber.

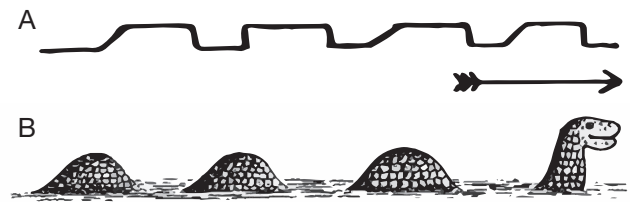


Fig. 1. — Unidentified marine objects (UMOs) representing the “many-humped” or “string-of-buoys” typology of “sea serpents” observed in **A**, Géographe Bay, Australia, in 1879; **B**, the Great Barrier Reef, Australia, in 1934. Further details of these sightings and illustrations of other UMOs from the nearby Western Pacific are presented in France (2020a).

Smith also includes several sightings from nearby Papua New Guinea, one of which reads similar to those from Australia: “The latter consisted of four grey-green loops about 10 feet apart without any space between the loops, and there was a ‘frill’ along its back. They did not see any head, but did notice a vertical, segmented tail about two feet long” (Smith 2020: 135; Fig. 2D), to which he includes mention that its length was about 15 metres and that the loops were observed to be “rolling along” the surface of the water.

CONTRASTING PSEUDOSCIENTIFIC AND PARSIMONIOUS INTERPRETATIONS

CRYPTOZOOLOGY PERSPECTIVE

Almost invariably, based on the information contained in the anecdotes, eyewitnesses of the UMO sightings believed that they had observed some form of mysterious creature which they construed to be the elusive sea serpent. Smith (2020), from the perspective of time and his experience in examining accounts of mystery animals, opines on 13 of the anecdotes, as reviewed below.

The 1894 sighting (anecdote 13) described what seemed to be a whale or shark being chased by a sea serpent. Later, the UMO was determined to have “a serpentine head with a brownish-colored back and silvery belly” that was raised out of the water. Smith admits to being unable to “know what to make of this” since it “does not sound like any sea creature known to science” (Smith 2020: 35). He does, however, state that the sighting is similar to another “encounter between a sea serpent and a whale” (Smith 2020: 35) that was reported elsewhere in Australia. With regard to the 1900 sighting (anecdote 19; Fig. 2A), Smith writes: “If you ever flicked a rope and watched the waves move down the length, you will get an idea of what they saw. Essentially, it was a very long, thin creature which was progressing by great waves passing down its body, each arch extending so high out of the water that they could easily see the space underneath” (Smith 2020: 42). He outright dismisses the account as being an invented “load of arrant nonsense” since it is “physically and biologically impossible” given that “it is beyond the laws of physics for a living tube just over a metre thick to lift itself into arches five metres above the water. Nothing with a backbone could flex its spine in such a manner, and its is hard to see how anything

TABLE 1. — Descriptions by eyewitnesses and Smith (2020) of five anatomical attributes of unidentified marine objects (UMOs), believed to be sea serpents, observed between 1870 and 1978 in Australian waters. Symbol: #, anecdote numbers from Smith (2020), where further details of the particular sightings can be found.

Attribute	Date of observation, anecdote	Description
Narrow, sinuous body shape (snake/eel-like)	1870: #3	“As nearly as I could judge, it must have been thirty or forty feet. It was of a reddish colour, and about a foot or eighteen inches in diameter.”
	1897: #15	“It was estimated to be 30 to 40 feet long, as thick as a man’s thigh in the middle, tapering to a tail, with a head twice the width of a large human hand.”
	1901: #20	“[...] as resembling a snake in appearance, with no fins on the back, which was out of the water.”
	1908: #25	“[...] when he saw what he supposed was a large rope drifting about [...] it was estimated to be over 500 ft. long and 2 ft. in diameter.”
	1924: #32	“With a diameter of about 15 inches [...] the whole body must have been of great length. It was assuredly a member of the serpent order.”
	1925: #35	“At the same time there rose out of the water, several feet away [from the long head], a sort of tail, much thinner than the front part [...] the body, sticking out obliquely, which was about 1 ½ metres thick and was more or less cylindrical.”
	1930: #39	“It appeared to be between 50 and 60 feet long, and probably a foot thick. I could not see any fins.”
	1930: #40	“About 10ft. down the body was a small dorsal fin, very much like that of a shark, but which seemed absurdly small, considering the bulk of the body.”
	1934: #48	“[...] stated that it was long and sinuous, as sea serpents are supposed to be.”
	1934: #51	“Twenty-five feet long, a snake-like head with [...] a tail more like an eel than a snake, the body about 12 inches in diameter.”
	1934: #55	“It appeared to be about 30 feet in length. It had a head like a large turtle, and a body like a huge armoured hose.”
	1978: #72	“The thin neck was about 8 or 10 feet long, but possessed a vertical S-bend like a sewage pipe, held close to the surface rather than towering upright. He did not notice any features on the head.”
	Body composed of segmented components (humps, arches, etc.)	1900: #19
1927: #36		“It appeared to be six to eight arches which seemed to undulate.”
1930: #42		“It was essentially a long undulating thing 10 metres long, consisting of four humps, with a series of regular spikes or fins 90 cm high.”
1934: #66		“[...] and with 5 or 6 large parts of its body in a straight line with a division between each of them, reaching in all about 40 feet.”
1939: #67		“It appeared in three half loops thus, 10 feet out of the water from loop to loop. The body as thick as a man’s. Thus, the visible parts alone would have been 90 feet [...] as long as the largest whale. He [the eyewitness] could discern neither tail, fins, nor limbs, or any means of propulsion, and the loops maintained the same relative position throughout, without moving.” (Fig. 2C)
1960: #76		“The head is round [...] with a flat nose and sort of semi-detached to the body [...] [which] is about 25 ft. long.”
1960?: #82		“It was a slim, serpentine animal consisting of a series of humps, but with no fins. He thought there were three humps, protruding a couple of feet out of the water, with a total length of well over 20 feet. He could not remember seeing any head or tail. He distinctly remembered three humps, and possibly four, and they were quite distinct despite the very rough water. They were at least a foot in diameter, the distance along the tops of each hump being about 5 or 6 feet, and the space between the humps 3 or 4 feet, making a total of 20 to 30 feet.”
1983?: #70	“The body appeared to be made up of a series of interconnecting plates much like a Moreton Bay bug [i.e. a type of lobster with notable segmentations] or a series of overlapping turtle shells.”	
Sequence of body protrusions (spikes, fins, etc.)	1902: #22	“[...] a serpent of immense size [9-11 m] [...] which possessed a double row of vertical, triangular fins [...] [which] were angular.”
	1930: #40	“About 10 ft. down the body was a small dorsal fin, very much like that of a shark, but which seemed absurdly small, considering the bulk of the body.”
	1930: #44	“About 100 feet of its back was exposed. There were five or six spikes along its back, the three near to the head being about two feet long.”
	1934: #49	“When emptying crayfish [i.e. lobster] pots [...] the ropes of three were entangled round a huge fish [...] There were five distinct spines showing down the back.”
	1934: #53	“The tail appeared serrated and covered with large spikes.”
	1935: #59	“The body had a dorsal fin and a wide tail, something like that of a whale, with serrations on the end, and slaty grey stripes along it.”
	1972: #71	“The creature’s head, if it could be called that, was in fact in three sections, almost similar to the sections on a three-bladed propeller with all parts being centrally attached to the body.”
	1978: #72	“The body displayed no obvious humps, but it did possess three (not two) rows of triangular fins not unlike those of a crocodile except that they were floppy. Had they been erect, they might have been 6 inches high.”
	1960: #76	“[...] appeared to have a body about 2 ft. across and a queer-looking fin 18 ft. from the head.”
	1960: #76	“The ‘fins’ were positioned on the body i.e. behind the neck, at the sides, but higher than the centre line. He thought they were a foot long and wide, and somewhat rounded.”
1980: #74	“It was a dark object about 15 m long with a series of dorsal fins [...] [He] counted five fins at one stage, but they were far too close together to belong to a series of dolphins. Instead, it appeared to be a single eel-like object.”	

TABLE 1. — Continuation.

Attribute	Date of observation, anecdote	Description
Presence of scales	1893: #12	“The portion of the body out of the water was covered by large scales of a dirty brown and white colour.”
	1897: #15	“It was multicoloured and seemed to be covered with scales.”
	1930: #40	“From the head there was at least 20 feet of scaly monster above the water.”
	1934: #52	“[...] two great curves of a mighty animal, each about 10 feet long, practically as round as 40 gallon drums [...] with scales as big as his hand.”
	1939: #67	“The body [...] marked exactly like a giraffe, pale blue, green, yellow patched.”
	1972: #71	“[...] and there appeared to be glistening sections as the sun was being reflected from incredibly large metallic-looking scales.”
Presence of mane	1908: #25	“The head seemed very hairy, underneath bushy and long.”
	1913: #28	“[It had] an appendage hanging from its chin like a goatee beard.” (Fig. 2B)
	1931: #46	“[...] and behind the head were what looked like two floppy arms.”
	1960: #81	“He described the monster as having a long, finned neck.”

without a backbone could reach such a size or flex itself in such a manner, even without lifting itself so high out of the water” (Smith 2020: 43). For another Victorian era sighting (anecdote 20), Smith, employing the standard cryptozoology approach of confirmation bias to explain away inconvenient evidence, disregards the snakelike appearance and absence of a fin, believing instead that the eyewitnesses got it wrong since it was dark at the time of the sighting. He goes on to wonder if the UMO could have been “some sort of fish, or even a seal” (Smith 2020: 44).

Concerning the 1913 (anecdote 28; Fig. 2B) sighting of a sinuous and seemingly bearded UMO, Smith speculates whether the serrations on the neck and fore part of the back “were the mane sometimes reported for the long necked sea serpent” (Smith 2020: 51). He immediately follows this by mentioning that this trait would fit with the commonly accepted belief “that sea serpents are elongated whales”. This allows him to dismiss the possibility that the UMO was a giant squid, as the latter are found on the surface only when they are dead or in a moribund state.

The 1929 sighting of an UMO sprawled on a beach (anecdote 33) elicits the confession from Smith “to being baffled” because, in his mind, should any sea serpent find itself so stranded on a shore then “their shape probably allows them to wriggle out of the shallows where a whale or dolphin would flounder” (Smith 2020: 59). Concerning another sighting from the same year (anecdote 5) of a long, cylindrical UMO which sported a single erect and white “fin” (the eyewitness’ use of italics) partway down the length of the body, Smith states that “this ‘fin’ bothers me” given “that anything would possess a pectoral fin or flipper half the length of its body seems unlikely”. His slight-of-hand explanation via confirmatory bias is that it must be “a typographical error” (Smith 2020: 62).

The year 1930 was a popular one for Australian UMO sightings. In regard to one encounter (anecdote 39), Smith mentions another sighting shortly thereafter in which a “wriggling” UMO that was observed moving through the water turned out to be nothing more than a long barnacle-covered log with protruding branches. The impression is that this could also be the explanation for the preceding

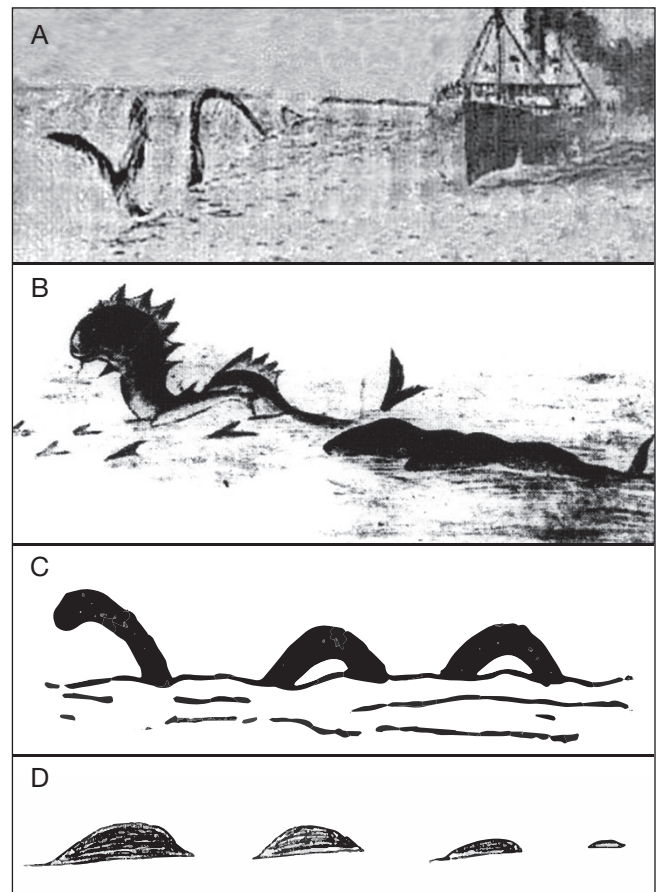


FIG. 2. — Unidentified marine objects seen in waters around Australia in **A**, 1900 (anecdote 19, *Wide World Magazine*); **B**, 1913 (anecdote 28, *Sunday Times*); **C**, 1939 (anecdote 67, *Cryptozoology*); **D**, 1981 (Papua New Guinea waters; Smith 2020). The illustration of the New Guinea UMO depicts the classic many-humped, string-of-buoys “sea serpent” seen repeatedly around the world, which could, as has been suggested for other regions, be an actual string of entangled buoys from a fishing net. The 1913 Australian UMO was observed to sport a beard and dorsal crest, both traits which have been suggested to indicate presence of entangled fishing gear for other UMOs. Clearly the coils or loops elevated above the surface of the water that were observed for the 1900 and 1939 UMOs are biologically impossible and consequently represent a train of anthropogenic material.

sighting. Concerning another sighting (anecdote 40) of a scale-covered UMO with a small dorsal fin, Smith states that his initial response is to label it as a hoax. However, upon further reflection, he posits it to have been a humpback whale (*Megaptera novaeangliae* (Borowski, 1781)), a species which has “an absurdly small dorsal fin” and which can often display clusters of barnacles that resemble scales (Smith 2020: 67). For another UMO (anecdote 42), the fact that four humps were always seen in a straight row for a duration of more than twenty minutes rightly indicates that “it could not have been a group of porpoises (or a giant squid or shark!)” (Smith 2020: 69). Because the UMO could not be so explained, the impression is left that it is a likely candidate for having been a sea serpent. Based on the estimated thirty-metre length for another UMO (anecdote 44), Smith concludes that it must have been a blue whale (*Balaenoptera musculus* Linnaeus, 1758) but is at a loss to explain the presence of the “five or six spikes”. Again the impression is that, as this is unlike any known cetacean, the UMO must have been some type of unrecognized sea serpent.

About the 1931 sighting of a pig-headed UMO trailing “two floppy arms” (anecdote 46), Smith is confident that it was a pinniped. But he is flummoxed by another sighting three years later (anecdote 49) wherein the UMO’s multiple spines became entangled in lobster pot ropes followed by the animal not responding to being struck by a plank: “The ‘five distinct spines’ suggests a fin but, although I am no ichthyologist, and am aware that there are a lot of bizarre-looking fish out there, I find it difficult to imagine a fish with a neck and a swollen body” (Smith 2020: 75). His solution to resolving the conundrum is to use the cryptozoology stratagem of explaining away non-confirmatory evidence through simply declaring that “on balance, I think this was a hoax”. The enigma of an UMO seen in 1960 (anecdote 76) is also easily explained away by rewriting history: “If the body was 25 feet long, he [the eyewitness] would hardly have described the fin as [being] 18 feet from the head; 18 inches [46 cm] was almost certainly intended” (Smith 2020: 106). For the 1980 sighting (anecdote 74), of an UMO with a series of dorsal fins, Smith notes “that there still seems to be no obvious identification” (Smith 2020: 100).

Smith offers opinions about other Australian UMOs that were not part of my selected subsample. About one, he states it to have been “some unknown species of outsized eel” (Smith 2020: 76). Of another, he offers the following paracryptozoological explanation: “Personally, I think that all the discussion about huge rays is a red herring distracting us from what Carter and Slaggert [the eyewitnesses] actually saw [...] We must take into consideration [...] [the] description of the object at the time and, of course, the green light – which also appeared four years before. In my opinion, this was not a sea monster at all, but something even stranger: a UFO!” (Smith 2020: 95). Concerning another sighting, Smith remarks that “no matter how much we pare it with Occam’s razor, we are still left with something very big, elongated, and undulating” (Smith 2020: 128). He continues: “No fish sticks out as meeting the description. Sea snakes are much,

much smaller. And, if her [the eyewitness] memory is correct that the undulations were vertical, this could only refer to a mammal” (Smith 2020: 128).

Smith, despite having a Bachelor of science and Master of science in zoology, and conducting research on the behavior of koalas for the latter, is a self-acknowledged cryptozoologist. He has published a paper in the defunct journal *Cryptozoology* and runs – as do many like-minded individuals – his own cryptozoology website/blog. He has self-published a novel about alien visitations and a book on sea serpents from other locations, in addition to two others about mysterious Australian creatures, including the “bunyip”, a folkloric man-eating swamp monster, and the “yowie”, which is apparently “Australia’s answer to bigfoot”, as he states in the present book (Smith 2020: 131). As such, it is no surprise that Smith believes in the existence of sea serpents, as enunciated in the final wrap-up chapter: “So What Are They?”

Smith begins promisingly enough by stating that whereas it is important to be sceptical, one should not simply dismiss any thesis on principle. He defends anecdotal evidence as it is used in court trials and is an important element in scientific fields of wildlife zoology, meteorology, and astronomy. All true. He correctly states that the large body sizes of UMOs, often with exhibited humps and vertical undulations, precludes sea snakes as suspects. Oudemans’ (2007) long-necked paleo-seal possibility as a one-size-fits-all explanation for sea serpents is deliberated on before being discounted based on the absence of Australian evidence since “it is pushing the limits of probability a bit too far for my liking” (Smith 2020: 143). Thereafter, the discussion veers into the murky waters of cryptozoology fable.

Although Smith considers it theoretically possible for several species of plesiosaurs to have survived for millions of years (although no evidence is provided for such a supposition), the physical traits described for Australian sea serpents are not, in his opinion, supportive of the contention. The observed sizes of the UMOs, being comparable to whales, together with their elongated and fusiform shapes and presence of rows of humps, thereby indicating that they swim by vertical undulations, can only be one thing to Smith: they must be mammals. He notes that prehistoric whales were serpentine in shape and concludes that primitive whales, archaeocetes, including Basilosaurids, are really not extinct given that they “seem the most likely solution” (Smith 2020: 144). As he explains, “on the balance of probabilities, I would guess the majority [of sea serpents] represent separate evolutions from the basal whale lineage” (Smith 2020: 145). Smith, however, goes on to contend that there are probably more than one type of sea serpent existing in Australian waters. “There are probably also exceptionally large eels and/or sea snakes”, he notes (Smith 2020: 145). “Although we don’t know what sea serpents may be”, he writes, he is emphatic that “they certainly exist” (Smith 2020: 146). From this, Smith spirals off into cryptozoological fantasy by stating that Australian sea serpents are rare and solitary, and because they are serpentine in shape, this enables them to wiggle out of shallows so that they never become stranded like other marine mammals. Similarly, as

TABLE 2. — Descriptions by eyewitnesses and Smith (2020) of behavioral attributes of unidentified marine objects (UMOs), believed to be sea serpents, observed between 1870 and 1978 in Australian waters. Symbol: #, anecdote numbers from Smith (2020), where further details of the particular sightings can be found.

Attribute	Date of observation, anecdote	Description
Vertical undulating movement of body segments	1930: #39	“I could see the undulations it formed moving through the water, but the head was not visible.”
	1960: #76	“I thought, could this be a giant eel, the daddy of them all? But an eel swims with a sideways motion, and this fellow was undulating up and down [...] He felt that the undulations – five or six at the most – were each as long as a man’s arm and about 30 cm out of the water, but there were definitely no humps.”
	1960?: #82	“They all agreed it moved by vertical undulations. The body itself did not move up and down i.e. there were no coils, but the humps moved with a fluid motion.”
	1983?: #70	“One witness described the swimming motion as being like a tractor tyre rolling along the top of the water, tread up.”
Obvious water disturbance	1893: #12	“As it rose it caused a great commotion [...] it commenced swinging its head about after the manner of the giants in a pantomime.”
	1894: #13	“An object was seen repeatedly rising and coming down with great force and lots of splashing.”
	1900: #19	“Resembling a serpent 200 feet 60 m long, it moved rapidly over the sea [...] at the same time continually lashing the water with a very flexible fin 30 feet 9 m long. Soon [...] the tentacle began to beat the waters and the head to move more violently.”
	1901: #20	“It lashed the sea into a foam.”
	1904: #24	“It moved in a leisurely fashion, occasionally throwing portions of its body out of the water like a porpoise.”
	1909: #26	“First appeared the head like that of a conger eel, which was raised in the air and brought down with tremendous force, churning the water into foam.”
	1925: #35	“We were suddenly aware of a violent disturbance in the water [...] A little later a long black body, estimated at 8 metres long, emerged at an angle of 45°, then fell back into the water with a loud splash, making the sort of waves we had already seen.”
	1930: #41	“The swishing of the tail caused a great commotion in the water, resembling that caused by the propellers of a vessel.”
	1935: #59 1972: #71	“They noted that great masses of spray were thrown up as the tail thumped the water.” “It was first noticed as a wide area of boiling frothing water followed by sections of the animal appearing above the disturbance [...] the disturbance caused by the creature’s thrashing about.”
Floating, sometimes motionless, or gently swaying the waves	1870: #3	“[...] and there it was, a veritable Sea Serpent [...] When first seen, I suppose it must have been asleep, for its head was lying flat on the surface of the sea, and its body coiled up.”
	1877: #5	“The head of the object appeared to be sunk down out of sight, while a good part of the body and tail was to be seen quite plainly [...] .and did not appear to have any motion at the time.”
	1897: #15	“[...] something like huge snake coiled in a figure 8 shape close to the boat, apparently asleep [...] It uncoiled itself and moved away.”
	1900: #19	“The creature had reared its head high above the waters, and was gently swaying it backwards, forwards, and round about, as if its body were composed of innumerable ball-joints. A huge fin or flap now showed out from behind the head, and circling in the air threw itself over the head and then back at right angles to the still vertical neck! An instant later and it shaped itself into all sorts of fantastic forms, the under part being almost a pure white in colour.” (Fig. 2A)
	1934: #53 1934: #58	“Then it remained motionless for about 20 minutes, before it moved seaward.” “It had a peculiarly-shaped head on the end of a long and thin neck, which at intervals was raised above the water in a sideways sweeping motion.”
Observed near or on shore	1929: #33	“He had been walking on the beach [...] when he saw, rolled up on the sand [...] a creature about 30 feet long and as thick as motor tyre [...] Then, much to his surprise, it began to wriggle and disappeared behind some rocks [...]”
	1934: #58	“[...] they watched it swim around in large circles at high speed, sometimes so close to the shore they thought it might beach itself.”
Oblivious of surroundings or impervious to physical disturbance	1934: #49	“One of the fishermen struck several blows on the monster’s head with the tiller, but the timber bounded off without making an impression.”
	1960: #76	“There he was, curving and gliding calmly beside the boat and only about 8 ft. away.”

another explanation for why bodies never show up, he offers that sea serpents “probably use echolocation, like whales and dolphins, and so avoid our fishing nets” (Smith 2020: 146). The book ends with guidance for what and where to report on future sightings of Australian sea serpents. The author suggests that recent reductions in sightings compared to a century ago might indicate a sensitivity of the animals to noisy ship traffic as well as a public reticence to report such sightings.

Of notable significance in terms of being germane to the present reappraisal of Australian UMO sightings and the illation advanced regarding what they represent from a conservation biology perspective, is that Smith states that a good number of the Australian sightings fall into the category of the so-called “many-humped” or “string-of-buoys” typology of sea serpent. This is the same body form that has frequently been noted by previous cryptozoologists (e.g., Heuvelmans

TABLE 3. — Descriptions by eyewitnesses of the unidentified marine object (UMO), imagined to be a sea serpent, observed between 1815 and 1824 in Gloucester Harbour and elsewhere in New England and New York, and clearly indicative of a marine animal that was non-lethally entangled in fishing gear or other maritime debris. Abbreviation: **FRS**, final report summary by the Linnaean Society of New England, 1817. Symbol: #, anecdote number from (France 2019a), where further details of the particular sightings can be found.

Date of observation, anecdote	Description
1815: #1	"[...] his appearance in this situation was like a string of buoys. I saw perhaps thirty or forty of those protuberances and bunches, which were about the size of a barrel."
1817: #6	"[...] looked like the buoys of a seine."
1817: #17	"[...] with a good glass [I saw what] seemed like gallon kegs tied together."
1817: #48	"His body when out of the water looks like the buoys of a net, or a row of kegs, or a row of large casks."
1817: #35	"[...] of the size of a barrel about the body, which [...] are so prominent, that they resembled buoys attached to each other."
1817: #36	"[The body] appears in joints like wooden buoys on a net rope almost as large as a barrel, that the musket balls appear to have no effect on it, that it appears like a string of gallon kegs."
1817: #36	"[...] as he moved he looked like a row of casks following in a right line."
1817: #38	"He appears to be full of joints and resembles a string of buoys on a net rope, as is set in the water to catch herring. Others describe him as like a string of water casks [...] Two [musket] balls were thought to hit his head, but without effect."
1817: #9	"[...] resembled the link of a chain."
1819: #65	"The first view I had of him appeared like a string of empty barrels tied together, rising over what little swell of the sea there was."
1819: #66	"The back was composed of bunches about the size of a flour barrel, which were apparently about three feet apart [...] and looked like a string of casks or barrels tied together."
1817: #35	"The body, which is formed into parallel rings, which –when he is on the top of the water– are so prominent, that they resembled buoys attached to each other."
1817: FRS	"[...] and to seem jointed, or like a number of buoys or casks following each other in a line."
1817: FRS	"[...] the curvature and bunches on his back. To some he appeared jointed, or like a string of kegs or buoys connected on a rope."
1819: #71	"[...] giving the appearance of a long moving string of corks."

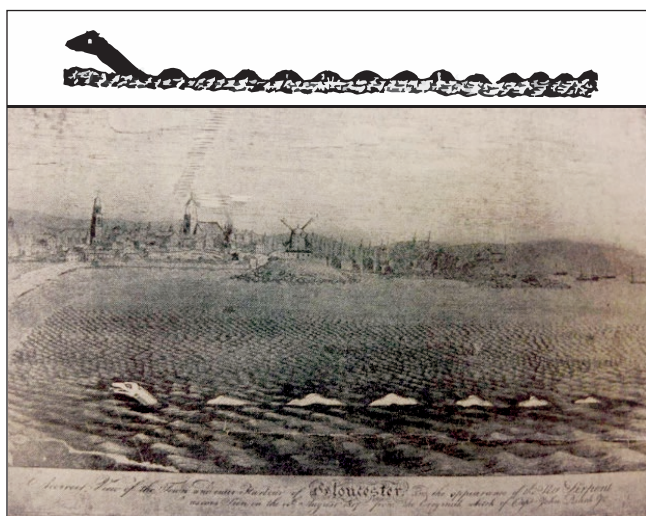


FIG. 3. — Illustrations of the many-humped, string-of-buoys Gloucester Sea Serpent observed by hundreds over a period of weeks in Massachusetts in the nineteenth century. Further details of these sightings as well as other illustrations are presented in France (2019a, b).

1968), and which at one time was “particularly common off the shores of New England in the U.S.A.” (Smith 2020: 145). In point of fact, and in an intriguing twist of pan-global environmental history, it was actually a cataclysmic event that took place just several thousand kilometres from Australia in 1815 that gave birth to the many-humped, string-of-buoys “sea serpent” observed on the other side of the world, and therefore helped to fuel, as few comparable sightings ever did, the widespread folkloric belief in the existence of such sea monsters during the nineteenth century.

CONSERVATION BIOLOGY PERSPECTIVE

The 1815 eruption of Mount Tambora ejected enough ash into the stratosphere to cause repercussions felt around the world (Wood 2014). And just as the effects of the Indonesian volcano famously led to the creation of Shelley’s *Frankenstein* “Creature” or monster (Higgins 2016), so too did the consequent “Frankenstein weather” (*sensu* Wood 2016) lead to the creation of history’s most observed and investigated sea monster, the “Gloucester Sea Serpent” (France 2019b), a creature whose influence on nineteenth-century natural science and popular culture was profound (Brown 1990; Burns 2014; France 2019a). The ensuing climatic upheaval –commonly referred to as “the year without a summer”– dropped global temperatures by several degrees and completely reconfigured the social-ecological system (SES) of New England. Slaughter of livestock due to absence of fodder and a collapse of the anadromous fishery due to spawning failures necessitated an *in extremis* shift to mackerel. The result of this emergency alteration in regional resource use was the sudden and massive deployment of fishing gear in coastal waters as never before (Alexander *et al.* 2017). This in turn caused the nonlethal entanglement of a large marine animal, probably a large fish (France 2019a), leading thousands of eyewitnesses to believe that the train of fishing nets and floats that they spied bouncing up and down over the surface of the water for many months was a bona fide sea serpent (France 2019b; Table 3; Fig. 3).

Fishing gear has been set in waters around Australia for millennia (Fagan 2017), and since the nineteenth century, purse seines, long-lines, trawls, and driftnets and the like have been deployed (e.g., Klaer 2001; Tilzey & Rowling 2001; Thurstan *et al.* 2014; Novaglio *et al.* 2019). The enormous

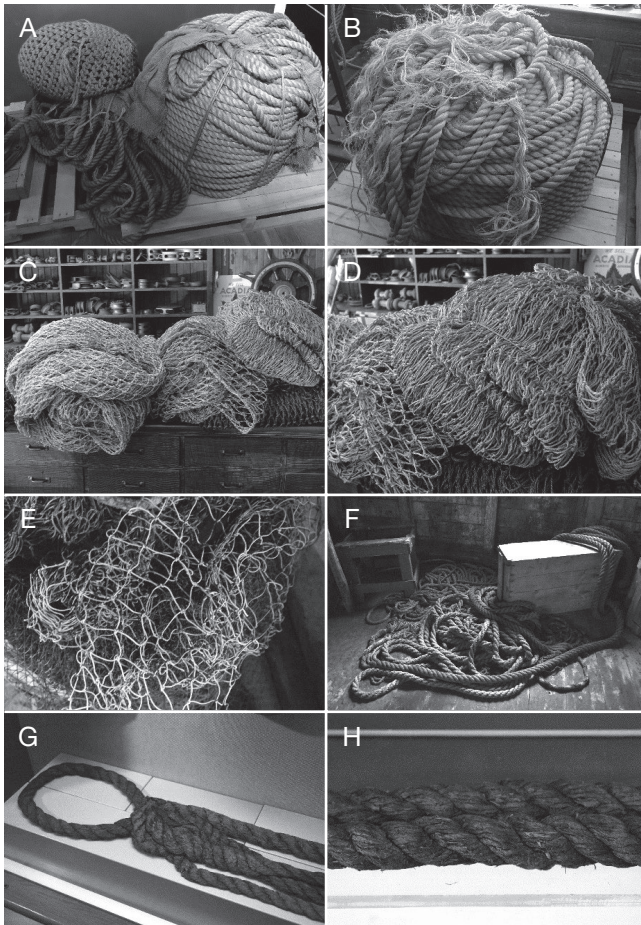


Fig. 4. — Pre-plastic maritime equipment forming the backbone of the long tails of putative sea serpents. **A–F**, early to mid twentieth-century fishing ropes and nets constructed of natural fibre (hemp); **G, H**, remarkably preserved hemp ropes retrieved from a 400 year-old sunken Basque whaling ship. Photo credits: R. France (taken at the Fisheries Museum of the Atlantic, Lunenburg, Nova Scotia [**A, B**]); the Maritime Museum of the Atlantic, Halifax, Nova Scotia [**C, D**]); Battle Harbour National Historic District, Battle Harbour, Newfoundland and Labrador [**E, F**] [see France 2019a for other, similar photos as well as nineteenth-century illustrations of the same]); Red Bay National Historic Site & UNESCO World Heritage Site, Red Bay, Newfoundland and Labrador (**G, H**).

threat posed to contemporary Australian marine biota by becoming entangled or succumbing as bycatch in active or abandoned fishing gear is well documented (e.g., Groom & Coughran 2012; Wilcox *et al.* 2014; Edyvane & Penny 2017; Tulloch *et al.* 2019). It is my contention that the most parsimonious (i.e. Occam's Razor) and indeed, the only, explanation for the attributes described by eyewitnesses for the UMOs in the anecdotes (Tables 1, 2), including those which the compiler, Smith (2020), admits to finding perplexing, is that they derive from animals having the misfortune of being nonlethally entangled in fishing equipment or other maritime debris. But before justifying this illation, it is first necessary to correct a misconception commonly held by many marine conservation biologists concerning the threat of entanglement.

Due to the assumption that ropes and nets made from natural fibres will “lose their resilience in usage and if lost or discarded at sea [will] tend to disintegrate quickly” (Gregory 2009), there

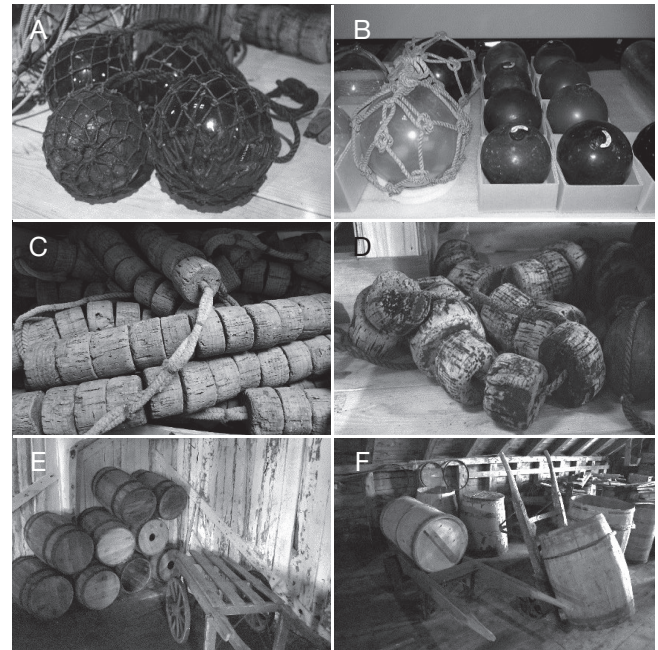


Fig. 5. — Pre-plastic maritime material forming the humps of the long tails of putative sea serpents. **A, B**, blown-glass balls used as floats from the nineteenth-century; **C, D**, nineteenth-century cork floats; **E, F**, wooden casks of the type often used as floats on fishing nets. Photos credits: R. France (taken at the Fisheries Museum of the Atlantic, Lunenburg, Nova Scotia [**A, D**]); the Battle Harbour National Historic District, Battle Harbour, Newfoundland and Labrador [**E, F**]); the Mystic Seaport Museum Archive and Collections, Mystic, Connecticut (**B, C**).

is widespread belief that entanglement is a modern phenomenon restricted to use of plastic since the middle of the twentieth century (Nelms *et al.* 2015), with little or no occurrence before that time (NOAA 2014). And it is for this reason that it was only in the mid-1980s when wildlife biologists began to recognize the severity of the problem and to publish papers on the topic (Vegter *et al.* 2014). In point of fact, although it is undeniably true that hemp, flax, and cotton ropes and nets (Fig. 4), as well as wooden cask, cork, and glass floats (Fig. 5) would have deteriorated more rapidly than their modern-day equivalents, it would be wrong to suppose that this would have occurred to such an extent as to preclude their ubiquitous use in maritime activities, or at a rate to mitigate the omnipresent threat that their presence would have posed to susceptible marine life. Hemp actually becomes stronger when wetted (McCaskill 2009), and if treated with tar or soaked in tanning solution made from ash or oak bark, has a longevity exceeding a year (Aiken & Purser 1936; Hodgson 1957; Bekker-Nielsen & Casola 2010). This is more than enough time that should an otherwise unknowing eyewitness observe an animal pulling a train of ropes, nets, and floats bouncing atop the water, that a conclusion might be reached of having seen a many-humped or string-of-buoys type of sea serpent. Photographs and illustrations of nineteenth-century fishing equipment deployed in the sea display just how easy the deception would have been (Fig. 6). This would especially be the case if the anthropogenic material was festooned with accumulations of seaweed and other bric-a-brac, giving the impression of solidarity to the presumed

body (one can find many online photographs of such with respect to entangled animals today). The sea serpent literature is rife with examples of mariners thinking they have spotted the elusive creature until such time as they realize that they have been deceived by logs, nets, and seaweed. Occasionally the deception is so convincing that it is not until the “sea serpent” was actually captured and taken aboard the ship that they realized their mistake (see one such incident described in France 2018). Moreover, because natural fibre nets are not as strong or as elastic as today’s made of synthetic material, it is likely that a much higher proportion of animals would have managed to elude capture, pulling along the entangled material as a legacy of their near-fatal encounter. Once again, the sea serpent literature is filled with accounts of fishermen frustrated at their nets being ruined or carried off by all manner of marine megafauna, some recognized, others, however, not, and therefore given the appellation “monster” (France 2020b).

Many of the Australian UMOs compiled by Smith (2020) are described by eyewitnesses as being of considerable size. Yet, as there are no known megafauna with such serpentine body shapes (McClain *et al.* 2015; Mazzoldi 2019) that can be advanced as suitable candidates, clearly something unnatural must be going on. As described for UMOs from North America, the British Isles, Africa, and the Western Pacific (France 2019b, 2020a, b, 2021b), those observed in Australia also have body components that imply entangled debris. The fact that a rigid form of humps or loops, separated by interstitial water and elevated above the water, and often sporting a sequence of strange protrusions or scales and plates, could be maintained, regardless of whether the animals were moving or, most significantly, at rest, indicates that these structures could not be biological in nature. The parsimonious explanation is that they represent a train of entangled fishing gear. Furthermore, descriptions of strands of draping filaments that were thought to be hair or a beard of monsters no doubt simply reflect the presence of entangled fishing nets.

Eyewitness descriptions of Australian UMOs note their rapid rate of movement (Smith 2020). As the case for UMOs from elsewhere in the world (France 2020b, 2021b), those observed in Australia achieved this through vertical undulations, something which, given the absence of large fins or tail, is simply impossible for a snake-shaped animal to accomplish (Van Weerden *et al.* 2013). Obviously the agent for propulsion must originate elsewhere, such as an entangled animal at the front end of the debris train that is invisible due to being either temporarily or permanently submerged. The fact that often considerable water disturbance was associated with the swimming of Australian UMOs is antithetical to evolution which has designed body shapes to reduce drag as much as possible. Moreover, all sea snakes, eels, and fishes rely upon horizontal (side-to-side) flexure for propulsion (Graham *et al.* 1987; Tytell & Lauder 2004), and although sea mammals do move through vertical undulations, none presently exist having serpentine body shapes such as those described. Therefore, no strictly biological explanation can be advanced for what was observed. Once again, the parsimonious explanation is one of an animal pulling a string of buoys. Further evidence that the observed elongated “bodies” of

Australian UMOs were inanimate objects is that—as found for UMOs in other regions (France 2020b, 2021b)—they seemed oblivious to their surroundings, including even one that was sprawled over a beach, and most remarkably, another that was unresponsive to direct physical assault.

DISCUSSION

HISTORICAL ECOLOGY

Bolster (2012: 91), in his comprehensive history of North American fishing, claimed that “no marine environmental historian worth his or her salt can afford to ignore [...] nineteenth-century sea serpents”. The present study shows that the careful parsing of words contained within historical anecdotes of UMOs, purported at the time to have been sea serpents, supports Parsons’ (2004) contention that such information can also be germane to conservation biology concerns.

Extensive compilations of what were imagined to be sightings of sea serpents by cryptozoologists reveal that the many-humped or string-of-buoys form is a prevalent body type observed around the world (e.g., Heuvelmans 1968; O’Neill 1999; Harrison 2001; Leblond *et al.* 2014). The present work shows that Australia is no different in this regard. Because the Gloucester Sea Serpent was repeatedly observed by thousands of people for extended periods over a duration of many months (France 2019a), it is often touted by cryptozoologists for providing “by far the best-documented evidence that sea-serpents exist” (Bauer 2013). The irony is that the UMO does the exact opposite and has become the standard through which to compare other sightings of what were almost certainly animals pulling trains of entangled fishing gear or other maritime debris (e.g., France 2020a, b, 2021b). For, as Loxton Prothero (2015: 233) correctly state: “The problem, of course, is that such sightings are by their nature ambiguous: a humungous serpentine animal might resemble a string of buoys, but a group of smaller individual objects (say, an actual string of buoys) might also resemble a string of buoys.” The examination herein of Smith’s (2020) recent compilation of the totality of Australian sightings of UMOs, which hitherto had been known only from local newspaper reports, supports interpretations made earlier with regard to the “Moha-Moha” (France 2017) and to a dozen other, lesser known, UMO sightings from the region (France 2020a), all of which suggest that Australian marine fauna have been susceptible to entanglement in fishing gear since before the advent and use of plastic in the latter half of the twentieth century. This conclusion supports the contention of Alverson *et al.* (1994) and a senior NOAA scientist interviewed by Deedy (2017) that bycatch and nonlethal entanglement have probably existed ever since fishing began and humans first deployed nets in the water.

The present work supports the research of others (e.g., Thurstan *et al.* 2014; Giglio *et al.* 2016) in demonstrating the utility of historical eyewitness accounts in providing insight concerning the historical influence of marine fisheries. In particular, it is important in suggesting that historic fishing pressure is not only experienced by species that are being di-

rectly exploited but also probably by those species which are the collateral victims of bycatch and nonlethal entanglement. Concepts, therefore, of a destructive modernity as contrasted to an imagined halcyon past represent a false dichotomization of the complexity of the historical impacts of fishing during the Anthropocene (France 2021b).

ETHNOZOOLOGY

Sea serpents are mental constructs existing in the liminal space between traditional folklore (Meurger & Gagnon 1988) and popular culture (Hackett & Harrington 2018). Meurger & Gagnon 1988 consider cryptozoologists to display a naturalistic naivety when they transform fables into zoological speculations in order to purvey a sense of historical verisimilitude to present-day observations. Folklorist belief, they caution, should not be so naturalized, for doing so creates an illusion of facticity. Taking traditional folklore and using it out of context in the form of newly invented narratives—a favorite strategy employed in cryptozoological imaginings—is what is variably referred to as “folkloresque”, “folklorism”, or, if particularly censorious, “fakelore” (Foster 1998; Yolen 2014; Foster & Tolbert 2016; James in press).

The appropriate vehicle in which to situate studies of sea serpents is the interdisciplinary field of ethnozoology—the study of people, animals, and the environment—subsuming as it does, elements from anthropology, conservation biology, folklore, archaeology, psychology, folkloresque, and environmental and social history, in addition to its foundational roots in anthrozoology and ethnology (France 2019a, c, 2021a). In this regard, the present investigation joins previous studies, as for example books by Lyons (2009), Bartholomew (2012), Nigg (2013), Williams (2015), and Hayward (2017), theses by Burns (2014) and Cheezum (2007), special issues of the journals *Anthropologica* (Jacquemard *et al.* 2018) and *Shima* (Hayward 2018), as well as numerous papers (e.g., Brown 1990; Papadopoulos & Ruscillo 2002; Jaffe 2013; Szabo 2018; Paxton & Naish 2019; James, in press), in highlighting the importance of giving as much attention to history (social, cultural, environmental, scientific) as to zoology in the comprehensive investigation of what Naish (2011) calls aquatic “mystery animal research”.

CRYPTOZOOLOGY

Differences in the illations proposed to explain the existence of Australian “sea serpents” between the perspective of euhemeristic conservation biology (France 2020a; this paper) and that of pseudoscientific cryptozoology (Smith 2020) derive from whether the Law of Parsimony is adhered to or ignored. In “good” science, it is necessary to first consider the simplest explanation first, and only then, if that seems insufficient, to progress to alternative hypotheses of increasing complexity. The systematic methodology of Occam’s Razor functions to symbolically “shave away at the ambiguous metaphysical concepts that either cause confusion or misunderstanding in people” (Konar 2009), thereby pruning away theories of unnecessary embellishments (Das 2009). In contrast, cryptozoologists immediately jump to conclusions about the existence of new or mythical creatures that are unwarranted by the nature of the

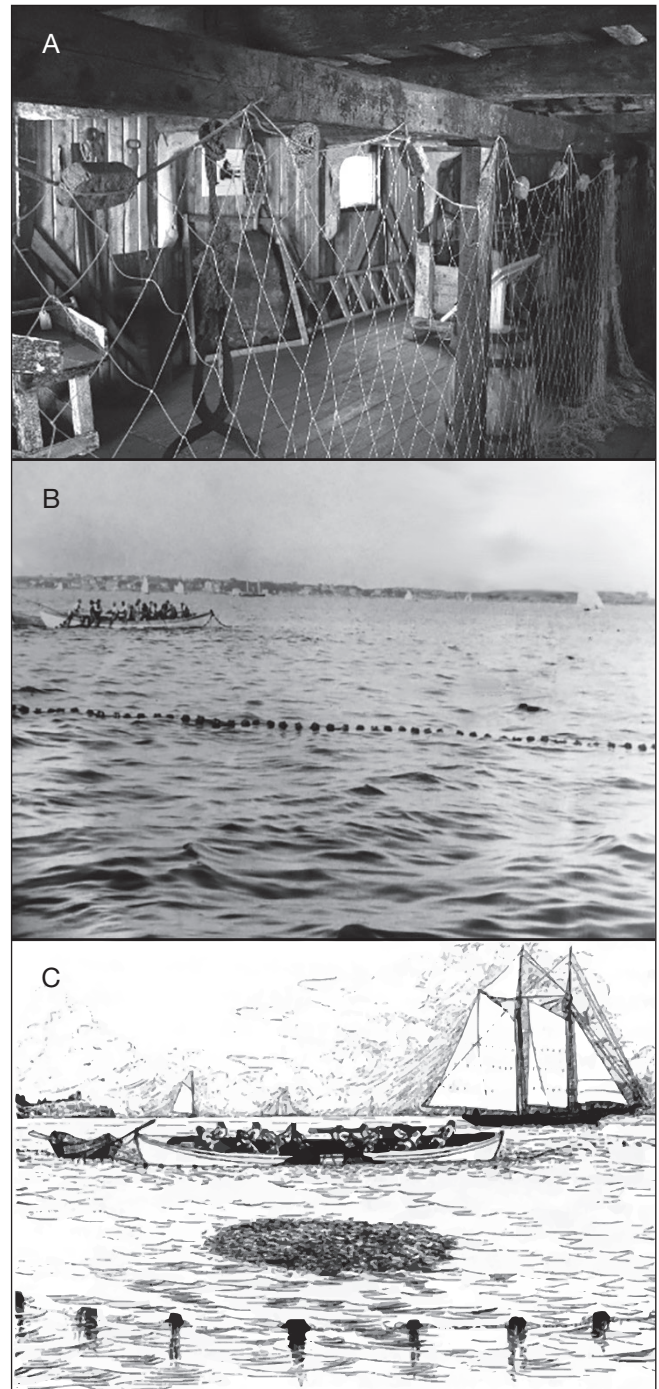


FIG. 6. — String of **A**, fishing-net floats, which, if nonlethally entangled around an actively swimming animal and bobbing up and down on the water surface might be misinterpreted as the long tail of a presumed sea serpent, especially if the UMO was also pulling a “mane” of intertwined fishing-net and accumulations of seaweed or other natural or anthropogenic debris; **B**, cork pieces used to buoy a gillnet; **C**, wooden casks used to suspend a purse-seine. Photo credits: R. France (taken at Battle Harbour National Historic District, Battle Harbour, Newfoundland and Labrador [**A**]; Cape Ann Museum, Massachusetts [**B**]); nineteenth-century illustration reproduced from France 2019a [**C**].

data obtained. As Konar (2009) states, the motivation of cryptozoologists like Smith “to discover these purported creatures is so strong that they will create complex, hypothetical situations stating that this alleged creature is alive and researchable

[...] [while ignoring] the crucial details that might negate their findings or contradict their theories”. According to Hill (2011), cryptozoologists like Smith exhibit confirmation bias right from the start by assuming a mystery creature exists somewhere waiting for them to find. They begin by asking the wrong question; i.e. rather than inquiring “What is that?” they ask “Is that a cryptid?” and by so doing they consequently narrow the range of possible and parsimonious interpretations.

In *Abominable Science*, a book that is as well-received by scientists (Hoch 2014) as it is dismissed by pseudoscientists (Bauer 2013), Loxton & Prothero (2015) state that most cryptozoologists are amateur enthusiasts ignorant of the rules of science and do not possess advanced degrees or relevant training in appropriate biological disciplines. But for the present case of Smith (2020), however, it is worth noting that having a university degree in biology, as he does, and as also for example, do Leblond & Bousfield (1995), Thomas (2011), and Woodley (2008), unfortunately does not preclude embarrassing forays into cryptozoological fantasy. Smith should have really known better given that it was not as if he was unaware of the existence of entanglement. Indeed, in the second paragraph of first chapter, he remarks that the megamouth shark (*Megachasma pelagios* Taylor, Compagno & Struhsaker, 1983) was first discovered when a specimen became entangled in a sea anchor in Hawaii in 1976, and he later mentions that in Australia, in 1918, an immense shark tore up and made off with a line of “pots, mooring lines and all” (Smith 2020: 7). Furthermore, no less personage than the founder and popularizer of cryptozoology himself, Bernard Heuvelmans, the first individual to be cited by Smith (2020), believed that entanglement in fishing gear was the explanation behind at least one famous sighting (see France 2018 for a description and analysis of this particular encounter). Smith (2020) even refers to Occam’s Razor in one puzzling case upon which he deliberates.

CONCLUSION

Although it may seem unduly unfair for Smith to be pilloried in this fashion, far from being unique, his flights of cryptozoological fancy are emblematic of the growing trend of such being promulgated, unrefereed, on the Web and in self-published books. Whereas once the arm-waving of “crackpots” (*sensu* Regal 2011) might be regarded with but a knowing smile, we are increasingly living in a society of alternative facts (Cook 2017), where pseudoscience masquerading as legitimate science—as for example fantastical archaeology (Feder 1990; Williams 1991) with respect to imagined ancient alien visitations being disseminated on the so-called The History Channel—undermines truth (Bartholomew & Radford 2003). The growth of such thinking is contagious and can be perilous to the survival of both people and the planet (e.g., Fischer 2019; Bratus 2020), behooving experts, therefore, to counter such claims (Harrison & Lockett 2019). Cryptozoology is “abominable science” (*sensu* Loxton & Prothero 2015), and as a contributor to the general slide toward post-truth consciousness, it should be called out at every opportunity.

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REFERENCES

- AIKEN W. R. G. & PURSER J. 1936. — The preservation of fibre ropes for use in sea-water. *Plymouth Laboratory New Series* 20 (3): 643-654. <https://doi.org/10.1017/S0025315400058227>
- AL-ABDULRAZZAK D., NAIDOO R., PALOMARES M. L. D. & PAULY D. 2012. — Gaining perspective on what we’ve lost: the reliability of encoded anecdotes in historical ecology. *PLOS One* 7 (8): e43386. <https://doi.org/10.1371/journal.pone.0043386>
- ALEXANDER K. E., LEAVENWORTH W. B., WILLIS T. V., HALL C., MATTOCKS S., BITTNER S. M., KLEIN E., STAUDINGER M., BRYAN A., ROSSET J., CARR B. H. & JORDAAN A. 2017. — Tambora and the mackerel year: phenology and fisheries during an extreme climate event. *Science Advance* 3 (1): 1-18. <https://doi.org/10.1126/sciadv.1601635>
- ALVERSON D. L., FREEBERG M. H., MURAWSKI S. A. & POPE J. G. 1994. — A global assessment of fisheries bycatch and discards. *Fisheries and Oceans Fisheries Technical Paper* 339, 233 p.
- ARMENT C. 2004. — *Cryptozoology: Science & Speculation*. Coachwhip Publications, Darke County, 396 p.
- BARBER L. 1980. — *The Heyday of Natural History 1820-1870*. Doubleday & Company, New York, 320 p.
- BARTHOLOMEW R. E. 2012. — *The Untold Story of Champ: A Social History of America’s Loch Ness Monster*. Excelsior Editions, New York, 272 p.
- BARTHOLOMEW R. E. & RADFORD B. 2003. — *Hoaxes, Myths, and Manias: Why We Need Critical Thinking*. Prometheus Books, Buffalo, 229 p.
- BAUER H. H. 2013. — Cryptozoology and the troubles with ‘skeptics’ and mainstream pundits. *Journal of Scientific Exploration* 27 (4): 690-704.
- BEKKER-NIELSEN T. & CASOLA D. B. (eds) 2010. — *Ancient Nets and Fishing Gear*. Proceedings of the international workshop “Nets and Fishing Gear in Classical Antiquity: a First Approach”, Cádiz, November 15-17, 2007. University of Cádiz Publications; Aarhus University Press, 441 p.
- BERGER C. 1983. — *Science, God, and Nature in Victorian Canada*. University of Toronto Press, xiv + 92 p.
- BOLSTER W. J. 2012. — *The Mortal Sea: Fishing the Atlantic in the Age of Sail*. Harvard University Press, Cambridge, xi + 416 p.
- BRATUS S. 2020. — The fake news sociology of COVID-19 pandemic fear: dangerously inaccurate beliefs, emotional contagion, and conspiracy ideation. *Linguistic and Philosophical Investigations* 19: 128-134. <https://doi.org/10.22381/LPI19202010>
- BRONGERSMA L. D. 1968. — The Soay beast. *Beaufortia* 15 (184): 33-46.
- BROWN C. M. 1990. — A natural history of the Gloucester sea serpent: knowledge, power, and the culture of science in antebellum America. *American Quarterly* 42 (3): 402-436. <https://doi.org/10.2307/2712941>
- BURNS E. I. 2014. — *Monster on the Margin: The Sea Serpent Phenomenon in New England, 1817-1849*. Ph. D. Thesis, Department of History, University of Buffalo, 302 p.
- CHARMAZ K. 2000. — *Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis*. Sage Publications, Thousand Oaks, 224 p.
- CHEEZUM E. A. 2007. — *Discovering Chessie: Waterfront, Regional Identity, and the Chesapeake Bay Sea Monster, 1960-2000*. Ph. D. Thesis, University of South Carolina, 310 p.

- CLARK I. D. 2017. — A fascination with bunyips: Brinburg, La Trobe, Wathen, and the Djab Wurrung people of Western Victoria. *Journal of the C. J. La Trobe Society* 17: 27-68.
- COOK N. A. 2017. — Posttruth, truthiness, and alternative facts: information behavior and critical information consumption for a new age. *Library Quarterly: Information, Community, Policy* 87 (3): 211-221. <https://doi.org/10.1086/692298>
- CORNES R. & CUNNINGHAM G. 2019. — *The Seal Serpent (Revised): The Search for a Long Necked Pinniped*. Independently Published, 330 p.
- DAS N. 2009. — Occam's razor and cryptozoology. *The Scientia Review, MIT*.
- DEARING J. A., ACMA B., BUB S., CHAMBERS F. M. & CHEN X. 2015. — Social-ecological systems in the Anthropocene: the need for integrating social and biophysical records at regional scales. *The Anthropocene Review* 2 (3): 220-246. <https://doi.org/10.1177/2053019615579128>
- DEEDY A. 2017. — Hark! A sea monster! (Oh, no, just a dying whale). All those strange sea monster sightings in days of yore? This may be the best explanation yet. *Hakai Magazine* February 8, 2017 [online].
- EDYVANE K. S. & PENNY S. S. 2017. — Trends in derelict fishing nets and fishing activity in northern Australia: implications for trans-boundary fisheries management in the shared Arafura and Timor Seas. *Fisheries Research* 188: 23-37. <https://doi.org/10.1016/j.fishres.2016.11.021>
- ENGELHARD G. H., THURSTON R. H., MACKENZIE B. R., ALLEWAY H. K., COLIN R., BANNISTER A., CARDINALE M., CLARKE M. W., CURRIE J. C., FORTIBUONI T., HOLM P., HOLT S. J., MAZZOLDI C., PINNEGAR J. K., RAICEVICH S., VOLCKAERT F. A. M., KLEIN E. S. & LESCRAUWAET A.-K. 2016. — ICES meets marine historical ecology: placing the history of fish and fisheries in current policy context. *ICES Journal of Marine Science* 73 (5): 1386-1403. <https://doi.org/10.1093/icesjms/fsv219>
- EVANS H. E. 1993. — *Pioneer Naturalists: The Discovery and Naming of North American Plants and Animals*. Henry Holt, New York, ix + 294 p.
- FAGAN B. 2017. — *Fishing: How the Sea Fed Civilization*. Yale University Press, New Haven, 368 p.
- FALSON S. 2020. — Hawkesbury River 'monster' sightings: Tony Healy to return to Hawkesbury for second expedition. *The Hawkesbury Gazette* June 30, 2020.
- FEDER K. L. 1990. — *Frauds, Myths, and Mysteries: Science and Pseudoscience in Archaeology*. Mayfield Publishing Company, California City, 231 p.
- FISCHER F. 2019. — Knowledge politics and post-truth in climate denial: on the social construction of alternative facts. *Critical Policy Studies* 13: 133-152. <https://doi.org/10.1080/19460171.2019.1602067>
- FOSTER M. D. 1998. — The metamorphosis of the Kappa: transformation of folklore to folklorism in Japan. *Asian Folk Studies* 57 (1): 1-24.
- FOSTER M. D. & TOLBERT J. A. 2016. — *The Folkloresque: Reframing Folklore in a Popular Culture World*. University Press of Colorado, Boulder, 272 p.
- FRANCE R. L. 2017. — Imaginary sea monsters and real environmental threats: reconsidering the famous *Osborne*, 'Moha-Moha', *Vallhalla*, and 'Soay Beast' sightings of unidentified marine objects. *International Review of Environmental History* 3 (1): 63-100. <https://doi.org/10.22459/IREH.03.01.2017.07>
- FRANCE R. L. 2018. — Illustration of an 1857 "sea serpent" sighting reinterpreted as an early depiction of cetacean entanglement in maritime debris. *Archives of Natural History* 45 (1): 111-117. <https://doi.org/10.3366/anh.2018.0486>
- FRANCE R. L. 2019a. — *Disentangled: Ethnozoology and Environmental Explanation of the Gloucester Sea Serpent*. Wageningen Academic Publishers, Wageningen, 290 p. <https://doi.org/10.3920/978-90-8686-886-5>
- FRANCE R. L. 2019b. — Extreme climatic upheaval, emergency resource adaptation, and the emergence of folkloric belief: geomythic origin of sea serpents from animals becoming entangled in fishing gear during New England's nineteenth-century social-ecological crisis. *Human Ecology* 47: 499-513. <https://doi.org/10.1007/s10745-019-00097-5>
- FRANCE R. L. 2019c. — Ethnobiology and shifting baselines: an example reinterpreting the British Isles' most detailed account of a sea serpent sighting as early evidence for pre-plastic entanglement of basking sharks. *Ethnobiology and Conservation* 8 (12): 1-31. <https://doi.org/10.15451/ec2019-10-8.12-1-31>
- FRANCE R. L. 2020a. — From cryptozoology to conservation biology: an earlier baseline for entanglement of marine fauna in the Western Pacific revealed from historic "sea serpent" sightings. *Advances in Historical Studies* 9 (2): 45-69. <https://doi.org/10.4236/ahs.2020.92005>
- FRANCE R. L. 2020b. — Historical anecdotes of fishing pressure: misconstrued "sea serpent" sighting provide evidence for antecedent entanglement of marine biota in the British Isles. *Fish and Fisheries* 22 (1): 54-71. <https://doi.org/10.1111/faf.12505>
- FRANCE R. L. 2021a. — *Ethnozoology of Egedé's "Most Dreadful Monster," the Foundational Sea Serpent*. Society of Ethnobiology (coll. Contributions in Ethnobiology), Boston, 192 p.
- FRANCE R. L. 2021b. — The monstrous Anthropocene: imaginary 'sea serpents' from the 'Dark Continent' reveal an earlier baseline for real environmental impacts to African marine life. *Anthropocenes – Human, Inhuman, Posthuman* 2 (1). <https://doi.org/10.16997/ahip.931>
- GALBREATH G. J. 2015. — The 1848 'enormous serpent' of the Daedalus identified. *The Skeptical Inquirer* 39 (5): 42-46.
- GIGLIO V. J., LUIZ O. J., REIS M. S. & GERHARDINGER L. C. 2016. — Memories of sawfish fisheries in a southwestern Atlantic estuary. *SCP Traditional Marine Resource Management and Knowledge Information Bulletin* 36: 28-37.
- GRAHAM J. B., LOWELL W. R., RUBINOFF I. & MOTTA J. 1987. — Surface and subsurface swimming of the sea snake *Pelamis platurus*. *Journal of Experimental Biology* 127 (1): 27-44. <https://doi.org/10.1242/jeb.127.1.27>
- GREGORY M. R. 2009. — Environmental implications of plastic debris in marine settings – entanglement, ingestion, smothering, hangers-on, hitch-hiking and alien invasions. *Philosophical Transactions of the Royal Society B* 364 (1526): 2013-2025. <https://doi.org/10.1098/rstb.2008.0265>
- GRIFFITHS T. 1996. — *Hunters and Collectors: The Antiquarian Imagination in Australia*. Cambridge University Press, xiv + 416 p.
- GROOM C. J. & COUGHRAN D. K. 2012. — Entanglements of baleen whales off the coast of western Australia between 1982 and 2010: patterns of occurrence, outcomes and management responses. *Pacific Conservation Biology* 18 (3): 203-214. <https://doi.org/10.1071/PC130203>
- HACKETT J. & HARRINGTON S. (eds) 2018. — *Beasts of the Deep: Sea Creatures and Popular Culture*. Indiana University Press, Bloomington; John Libbey Publishing, Barnet, 200 p. <https://doi.org/10.2307/j.ctt20krz85>
- HARRISON P. 2001. — *Sea Serpents and Lake Monsters of the British Isles*. Robert Hale, London, 256 p.
- HARRISON N. & LUCKETT K. 2019. — Experts, knowledge and criticality in the age of 'alternative facts': re-examining the contribution of higher education. *Teaching in Higher Education* 24 (3): 259-271. <https://doi.org/10.1080/13562517.2019.1578577>
- HAWKINS J. 2006. — *The Folklore of Awe: Elements and Influences Involved in the Construction of Tales Concerning Strange Creatures and Phenomena Arising in the Australian Environment and Culture*. M. A. Thesis, University of New England, Biddeford, 162 p.
- HAYWARD P. 2017. — *Making a Splash: Mermaids (and Mermen) in 20th and Early 21st Century Audiovisual Media*. Indiana University Press, Bloomington; John Libbey Publishing, Barnet, 218 p. <https://doi.org/10.2307/j.ctt200605w>

- HAYWARD P. 2018. — Introduction. Mermaids, mercultures and the aquapelagic imaginary. *Shima* 12 (2): 1-11. <https://doi.org/10.21463/shima.12.2.03>
- HEUVELMANS B. 1968. — *In the Wake of the Sea-Serpents*. Rupert Hart-Davis, London, 648 p.
- HEUVELMANS B. 1988. — The sources and method of cryptozoological research. *Cryptozoology* 7: 1-21.
- HIGGINS D. 2016. — Why a volcano, Frankenstein, and the summer of 1816 are relevant to the Anthropocene. *The Conversation* (64984).
- HILL S. 2011. — Cryptozoology and pseudoscience. *Skeptical Beliefs* 21 (3): 1-3.
- HOCH J. M. 2014. — Review of *Abominable science! The Quarterly Review of Biology* 89: 198-199.
- HODGSON W. C. 1957. — *The Herring and its Fishery*. Routledge & Kegan Paul, London, 197 p.
- HSIETH H.-F. & SHANNON S. E. 2005. — Three approaches to qualitative content analysis. *Qualitative Health Research* 15 (9): 1277-1288. <https://doi.org/10.1177/1049732305276687>
- JACQUEMARD C., GAUVIN B., LUCAS-AVENEL M. & CLAVEL B. (eds) 2018. — Animaux aquatiques et monstres des mers septentrionales (imaginer, connaître, exploiter, de l'Antiquité à 1600). *Anthropozoologica* 53 (2-15), 141 p.
- JAFFE A. 2013. — Sea monsters in antiquity: a classical and zoological investigation. *Berkeley Undergraduate Journal of Classics* 1 (2): 1-12.
- JAMES R. M. (in press). — Morgawr and the folkloresque (a study of a shopping fish tale). *Shima*.
- JON A. A. 1998. — Dugongs and mermaids, seals and selkies. *Australian Folklore* 13: 94-98.
- KITTINGER J. N., MCCLENACHAN L., GEDAN K. B. & BLIGHT L. K. (eds) 2015. — *Marine Historical Ecology in Conservation: Applying the Past to Manage for the Future*. University of California Press, Gainesville, 312 p.
- KLAER N. L. 2001. — Stream trawl catches from south-eastern Australia from 1918 to 1957: trends in catch rates and species composition. *Marine and Freshwater Research* 52 (4): 399-410. <https://doi.org/10.1071/MF00101>
- KONAR G. 2009. — Not your everyday animals: applying Occam's Razor to cryptozoology. *The Scientia Review* [online].
- LAIST D. W. 1997. — Impacts of marine debris: entanglement of marine life in marine debris including a comprehensive list of species with entanglement and ingestion records, in COE J. M. & ROGERS D. B. (eds), *Marine Debris*. Springer (coll. Springer Series on Environmental Management), New York: 99-139. https://doi.org/10.1007/978-1-4613-8486-1_10
- LEBLOND P. H. & BOUSFIELD E. L. 1995. — *Cadborosaurus, Survivor from the Deep*. Hordsal & Schubart, Salt Spring Island, 134 p.
- LEBLOND P. H., KIRK J. & WATSON J. 2014. — *Discovering Cadborosaurus*. Hancock House, Surrey, 176 p.
- LEHN W. H. & SCHROEDER I. I. 1981. — The Norse merman as an optical phenomenon. *Nature* 293: 362-366. <https://doi.org/10.1038/289362a0>
- LEHN W. H. & SCHROEDER I. I. 2004. — The *hafstramb* and *margygr* of the *King's Mirror*: an analysis. *Polar Record* 40 (2): 121-134. <https://doi.org/10.1017/S0032247403003255>
- LOXTON D. & PROTHERO D. R. 2015. — *Abominable Science! Yeti, Nessie, and Other Famous Cryptids*. Columbia University Press, New York, xviii + 411 p.
- LYONS S. L. 2009. — *Species, Serpents, Spirits, and Skulls: Science at the Margins in the Victorian Age*. State University of New York Press, 259 p.
- MASCHNER H. D. G., TRITS A. W., REEDY-MASCHNER K. L. & BRETTIS M. 2014. — The decline of Steller sea lions (*Eumetopias jubatus*) in the North Pacific: insights from indigenous people, ethnohistoric records and archaeological data. *Fish and Fisheries* 15 (4): 634-660. <https://doi.org/10.1111/faf.12038>
- MAZZOLDI C. 2019. — From sea monsters to charismatic megafauna: changes in perception and use of large marine animals. *PLOS One* 14 (12): e0226810. <https://doi.org/10.1371/journal.pone.0226810>
- MCCASKILL J. 2009. — *Conserving Waterlogged Rope: A Review of Traditional Methods and Experimental Research With Polyethylene Glycol*. MA Thesis, Texas A&M University, College Station, 133 p.
- MCCCLAIN C. R., BALK M. A., BENFIELD M. C., BRANCH T. A., CHEN C., COSGROVE J., DOVE A. D. M., GASKINS L., HELM R. R., HOCHBERG F. G., LEE F. B., MARSHALL A., MCMURRAY S. E., SCHANCHE C., STONE S. N. & THALER A. D. 2015. — Sizing ocean giants: patterns of intraspecific size variation in marine megafauna. *PeerJ* 2 (E715). <https://doi.org/10.7717/Peerj.715>
- MCCLENACHAN L. 2015. — Viewpoint from a practitioner: the detective work of historical ecology – new technologies enhance, but cannot replace archival research, in KITTINGER J. N., MCCLENACHAN L., GEDAN K. B. & BLIGHT L. K. (eds), *Marine Historical Ecology in Conservation: Applying the Past to Manage for the Future*. University of California Press, Berkeley: 312 p.
- MCCLENACHAN L., FERRETTI F. & BAUM J. K. 2012. — From archives to conservation: why historical data are needed to set baselines for marine animals and ecosystems. *Conservations Letters* 5 (5): 349-359. <https://doi.org/10.1111/j.1755-263X.2012.00253.x>
- MEINE C. 1999. — It's about time: conservation biology and history. *Conservation Biology* 13 (1): 1-3. <https://doi.org/10.1046/j.1523-1739.1999.013001001.x>
- MOORE G. 2017. — Beast, birds, fishes, and reptiles: Anthony Trollope and the Australian acclimatization debate, in MAZZENO L. W. & MORRISON R. D. (eds), *Animals in Victorian Literature and Culture*. Palgrave Macmillan, Basingstoke: 65-82. https://doi.org/10.1057/978-1-137-60219-0_4
- MOYAL A. 2001. — *Platypus: The Extraordinary Story of How a Curious Creature Baffled the World*. Smithsonian Institution Press, Washington, xiii + 226 p.
- MEURGER M. & GAGNON C. 1988. — *Lake Monster Traditions: A Cross-cultural Analysis*. Fortean Tomes, London, 320 p.
- MUSHARBASH Y. & PRESTERUDSTUEN G. H. 2014. — *Monster Anthropology in Australasia and Beyond*. Palgrave Macmillan, New York, ix + 228 p. <https://doi.org/10.1057/9781137448651>
- NAISH D. 2011. — Cryptozoology at the Zoological Society of London. Cryptozoology: time to come in from the cold? Or, cryptozoology: avoid at all costs? *Tetrapod Zoology Blog*: July 19, 2011.
- NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) 2014. — *Entanglement of Marine Species in Marine Debris with an Emphasis on Species in the United States*. National Oceanic and Atmospheric Administration (coll. NOAA Marine Debris Program Report; 2014), Silver Spring, 28 p.
- NELMS S. E., DUNCAN E. M., BRODERICK A. C., GALLOWAY T. S. & GODFREY M. H. 2015. — Plastic and marine turtles: a review and call for research. *ICES Journal of Marine Science* 73 (2): 165-181. <https://doi.org/10.1093/Icesjms/Fsv165>
- NIGG J. 2013. — *Sea Monsters: A Voyage around the World's Most Beguiling Map*. University of Chicago Press, Chicago, 186 p.
- NOVAGLIO C., SMITH A., FRUSHER S. & FERRETTI F. 2019. — Identifying historical baseline at the onset of exploitation to improve understanding of fishing impacts. *Aquatic Conservation: Marine and Freshwater Ecosystem* 30 (3): 475-485. <https://doi.org/10.1002/aqc.3264>
- O'NEILL J. P. 1999. — *The Great New England Sea Serpent: An Account of Unknown Creatures Sighted by Many Respectable Persons Between 1638 and the Present Day*. Down East Books, Camden, 256 p.
- OPIT G. 2017. — Citizen science and cryptozoology, data received from listeners during 18 years of wildlife talkback on ABC North Coast New South Wales local radio. *Australian Zoologist* 38 (3): 430-456. <https://doi.org/10.7882/AZ.2016.008>
- OUDEMANS A. C. 2007. — *The Great Sea-Serpent*. [1st edition 1892]. Coachwhip Publications, Landisville, 437 p.
- PAPADOPOULOS J. K. & RUSCILLO D. 2002. — A Ketos in early Athens: an archaeology of whales and sea monsters in the Greek World. *American Journal of Archaeology* 106 (2): 187-227. <https://doi.org/10.2307/4126243>

- PARSONS E. C. M. 2004. — Sea monsters and mermaids in Scottish folklore: can these tales give us information on the historic occurrence of marine animals in Scotland? *Anthrozoös* 17 (1): 73-80. <https://doi.org/10.2752/089279304786991936>
- PAULY D. 1995. — Anecdotes and the shifting baseline syndrome of fisheries. *Trends in Ecology and Evolution* 10 (10): 430. [https://doi.org/10.1016/s0169-5347\(00\)89171-5](https://doi.org/10.1016/s0169-5347(00)89171-5)
- PAXTON C. G. E. & HOLLAND R. 2005. — Was Steenstrup right? A new interpretation of the 16th century sea monk of the Oresund. *Steenstrupia* 29 (1): 39-47.
- PAXTON C. G. M. & NAISH D. 2019. — Did nineteenth century marine vertebrate fossil discoveries influence sea serpent reports? *Earth Sciences History* 38 (1): 16-27. <https://doi.org/10.17704/1944-6178-38.1.16>
- PAXTON C. G., KNATTERUD M. E. & HEDLEY S. L. 2005. — Cetaceans, sex and sea serpents: an analysis of the Egede accounts of a “most dreadful monster” seen off the coast of Greenland in 1734. *Archives of Natural History* 32 (1): 1-9. <https://doi.org/10.3366/anh.2005.32.1.1>
- REGAL B. 2011. — *Searching for Sasquatch: Crackpots, Eggheads, and Cryptozoology*. Palgrave Macmillan (coll. Palgrave Studies in the History of Science and Technology), New York, xi + 249 p. <https://doi.org/10.1057/9780230118294>
- REGAL B. 2012. — Richard Owen and the sea-serpent. *Endeavour* 36 (2): 65-68. <https://doi.org/10.1016/j.endeavour.2011.12.001>
- RITVO H. 1997. — *The Platypus and the Mermaid and Other Figures of the Classifying Imagination*. Harvard University Press, Cambridge, xiv + 288 p.
- ROSSI L. 2016. — A review of cryptozoology: towards a scientific approach to the study of “hidden animals”, in ANGELICI F. M. (ed.), *Problematic Wildlife*. Springer, Cham: 573-588. https://doi.org/10.1007/978-3-319-22246-2_26
- SAENEZ-ARROYO A., ROBERTS C. M., TORRE J. & CARINO-OLVERA M. 2005. — Using fishers’ anecdotes, naturalists’ observations and grey literature to reassess marine species at risk: the case of the gulf grouper in the Gulf of California, Mexico. *Fish and Fisheries* 6 (2): 121-133. <https://doi.org/10.1111/j.1467-2979.2005.00185.x>
- SMITH M. 1996. — *Bunyips and Bigfoots: In Search of Australia's Mystery Animals*. Millennium Books, Tampa, viii + 207 p.
- SMITH M. 2020. — *Australian Sea Serpents*. Independently published, 188 p.
- STEARNS R. P. 1970. — *Science in the British Colonies of America*. University of Illinois Press, Urbana, xx + 760 p.
- SZABO V. 2018. — Northern seas, marine monsters, and perceptions of the premodern North Atlantic in the longue durée, in JORGENSEN D. & LANGUM V. (eds), *Visions of North in Premodern Europe*. Brepols Publishers, Turnhout: 145-182.
- SZABO P. & HEDL R. 2011. — Advancing the integration of history and ecology for conservation. *Conservation Biology* 25 (4): 680-687. <https://doi.org/10.1111/j.1523-1739.2011.01710.x>
- THOMAS L. 2011. — *Weird Waters: The Lake and Sea Monsters of Scandinavia and the Baltic States*. CFZ Press, Woolfardisworthy, 148 p.
- THURSTAN R. H., HAWKINS J. P. & ROBERTS C. M. 2014. — Origins of the bottom trawling controversy in the British Isles: 19th century witness testimonies reveal evidence of early fishery declines. *Fish and Fisheries* 15 (3): 506-522. <https://doi.org/10.1111/faf.12034>
- TILZEY R. D. J. & ROWLING K. R. 2001. — History of Australia's south east fishery: a scientist's perspective. *Marine and Freshwater Research* 52 (4): 361-375. <https://doi.org/10.1071/MF99185>
- TULLOCH V., PIROTTA V., GRECH A., CROCCETTI S., DOUBLE M., HOW J., KEMPER C., MEAGER J., PEDDEMORS V., WAPLES K., WATSON M. & HARCOURT R. 2019. — Long-term trends and a risk analysis of cetacean entanglements and bycatch in fisheries gear in Australian waters. *Biodiversity and Conservation* 29: 251-282. <https://doi.org/10.1007/s10531-019-01881-x>
- TYTELL E. D. & LAUDER G. V. 2004. — The hydrodynamics of eel swimming. I, Wake structure. *Journal of Experimental Biology* 207 (11): 1825-1841. <https://doi.org/10.1242/jeb.00968>
- VAN WEERDEN J. F., REID D. A. & HEMELRIJK C. K. 2013. — A meta-analysis of steady undulatory swimming. *Fish and Fisheries* 15 (3): 397-409. <https://doi.org/10.1111/faf.12022>
- VEGTER A. C., BARLETTA M., BECK C., BORRERO J., BURTON H., CAMPBELL M. L., COSTA M. F., ERIKSEN M., ERIKSSON C., ESTRADES A., GILARDI K. V. K., HARDESTY B. D., IVAR DO SUL J. A., LAVERS J. L., LAZAR B., LEBRETON L., NICHOLS W. J., RIBIC C. A., RYAN P. G., SCHUYLER Q. A., SMITH S. D. A., TAKADA H., TOWNSEND K. A., WABNITZ C. C. C., WILCOX C., YOUNG L. C. & HAMANN M. 2014. — Global research priorities to mitigate plastic pollution impacts on marine wildlife. *Endangered Species Research* 25: 225-247. <https://doi.org/10.3354/esr00623>
- WESTRUM R. 1979. — Knowledge about sea serpents, in WALLIS R. (ed.), *On the margins of science: the social construction of rejected knowledge*. *The Sociological Review* 27 (1 Suppl.): 293-314. <https://doi.org/10.1111/j.1467-954X.1979.tb00066.x>
- WHITLEY G. 1940. — Mystery animals of Australia. *The Australian Museum Magazine* 7 (4): 132-139.
- WILCOX C., HEATHCOTE G., GOLDBERG J., GUNN R., PEEL D. & HARDESTY B. D. 2014. — Understanding the sources and effects of abandoned, lost, and discarded fishing gear on marine turtles in northern Australia. *Conservation Biology* 29: 198-206. <https://doi.org/10.1111/cobi.12355>
- WILLIAMS G. 2015. — *A Monstrous Commotion: The Mysteries of Loch Ness*. Orion, London, 400 p.
- WILLIAMS S. 1991. — *Fantastic Archaeology: The Wild Side of North American Prehistory*. University of Pennsylvania Press, Philadelphia, xi + 350 p.
- WOOD G. D. 2014. — *Tambora: The Eruption that Changed the World*. Princeton University Press, Princeton, 312 p.
- WOOD G. D. 2016. — Frankenstein, the baroness, and the climate refugees of 1816. *The Public Domain Review* June 15, 2016 [online].
- WOODLEY M. A. 2008. — *In the Wake of Bernard Heuvelmans: An Introduction to the History and Future of Sea Serpent Classification*. CFZ Press, Woolfardisworthy, 176 p.
- WOODLEY M. A., NAISH D. & MCCORMICK C. A. 2011. — A baby sea-serpent no more: reinterpreting Hagelund's juvenile ‘Cadborosaur’ report. *Journal of Scientific Exploration* 25 (3): 497-514.
- YOLEN S. 2014. — Follere vs. fakelore, the epic battle. *The Horn Book Magazine* 90: 55-57.

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