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# Chapter 26
# A Review of Cryptozoology: Towards a Scientific Approach to the Study of "Hidden Animals"

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## Introduction

"Cryptozoology" is a term that defines a branch of zoology that is generally considered a pseudoscience (Simpson 1984; Prothero 2007; Dubois and Nemésio 2007; Loxton and Prothero 2013) devoted to the study of animal species whose existence is not supported by empirical evidence, but rather hypothesized via indirect and uncertain information, including oral traditions, eyewitness accounts, and inconclusive physical evidence. Since its first appearance in the literature (Blancou 1959), both the word "cryptozoology" and its meaning have been the subject of heated discussions, so that hitherto a commonly accepted definition has yet to be found, and several authors have proposed a very personal vision of this discipline (Paxton 2002). The first person to use this term in a paper, with the aim to establish a new subdiscipline in the study of animal biology, was French-Belgian zoologist Bernard Heuvelmans (1965), universally known as the "Father of Cryptozoology". However, the first formal attempts to define cryptozoology and its methodology were only published several years later, between 1982 and 1998, in the peer-reviewed journal *Cryptozoology*, which, despite meeting all the requirements of a formal publication, suffered from low circulation. Several papers by Heuvelmans were also published in non-technical or non-English journals (e.g. Heuvelmans 1987a, b, 1997) and likely were little known not only to the majority of the academic world, but also within the small circle of the so-called "cryptozoological community". Although cryptozoology is considered a pseudoscience by several authors, other researchers argue against this interpretation, remarking on some aspects of this discipline (Raynal 1989; Naish 2001; Paxton 2002; Woodley et al. 2008; Rossi 2012). However, in this debate, little reference has been made to the existing scientific

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literature on cryptozoology (e.g. Simpson 1984); and furthermore, not all the critics are adequately knowledgeable of it (Conway et al. 2013). The purpose of this chapter is to review the available literature in order to determine the history, definition, aims, and methodology of cryptozoology according to Heuvelmans' ideas, as well as the main criticisms of it. The epistemological aspects of cryptozoology will also be addressed in order to suggest how it may be included among the scientific disciplines, in addition to if and how cryptozoology could actually contribute to the discovery of new animal species and to biodiversity conservation.

## Material and Methods

Reviewing the literature was not an easy process: a great deal of interesting information was found in "unorthodox sources" (e.g. magazines, blogs, grey literature, etc.) rather than in technical and scientific papers due to the fact that cryptozoology is, at best, a controversial topic. While perusing such sources is usually strongly discouraged by scientific journals, in this situation it becomes necessary due to the unique nature of the subject covered in this chapter. Furthermore, some significant criticisms have been published outside the peer-reviewed literature. In order to provide a synthesis of the status of cryptozoology as understood by Heuvelmans, and be both coherent and easily understandable, sources do not always appear in chronological order. In fact, Heuvelmans' writings cover a period of about sixty years, during which the author changed his views on cryptozoology and integrated several new ideas. The criticisms of cryptozoology have been subdivided into categories, and special attention has been given to how coherent they are with Heuvelmans' ideas.

## Results

### *History, Beginnings, and Current Status of Cryptozoology*

Even though several zoologists and biologists have, in years past, worked on so-called "mysterious animals" (e.g. Oudemans 1892; Krumbiegel 1950), the birth of modern cryptozoology is attributed to Scottish-born American naturalist Ivan T. Sanderson (1911–1973) and to French-Belgian zoologist Bernard Heuvelmans (1916–2001), who independently invented the term "cryptozoology" (Heuvelmans 1968). Sanderson became quite famous in the USA thanks to a series of radio and TV shows, and to several books and magazine articles devoted to zoology, but also to bizarre subjects such as UFOs and paranormal phenomena (Heuvelmans 1997; Conway et al. 2013). Reading one of these odd papers on the alleged survival of dinosaurs in Africa (Sanderson 1948) inspired Heuvelmans to dedicate his life to collecting information on animals that could potentially be discovered (Heuvelmans 1984). Heuvelmans undertook to tackle these alleged zoological mysteries in six books, originally only published in French (Heuvelmans 1955, 1958a, 1965, 1978, 1980; Heuvelmans and Porchnev 1974), raising a variety of diverging opinions from within the academic world (e.g. Johnson 1959; Reed 1959; Hedgpeth 1968). In particular, two of these books (Heuvelmans 1955, 1965) achieved great commercial success and were translated into several languages (e.g. Heuvelmans 1958b, c, 1968). Thus, cryptozoology enjoyed worldwide fame.

On January 8–9, 1982, the International Society of Cryptozoology (ISC) was founded in Washington, DC, at a meeting in the Department of Vertebrate Zoology, National Museum of Natural History, Smithsonian Institution, thanks to the vision of biochemist Roy P. Mackal (1925–2013) from the University of Chicago and agronomist J. Richard Greenwell (1942–2005) from the University of Arizona. The ISC aimed to reach the scientists who were interested in cryptozoology, yet had some reservations due to its controversial nature. Moreover, the ISC promoted cryptozoology as a subdiscipline of zoology and animal biology (Greenwell 1982). For this reason, the ISC published a peer-reviewed yearly journal (*Cryptozoology, The Interdisciplinary Journal of the International Society of Cryptozoology*) with papers, field reports and news, and a quarterly bulletin (*The ISC Newsletter*). Although the Society and its journal received a rather lukewarm response from the academic community (e.g. May 1984; Simpson 1984; Heuvelmans 1997), the journal continued to be published until 1998, when the ISC ceased its activities due to internal dispute and financial problems. One of the main sources of internal dispute was how the public perceived cryptozoology as a discipline. In fact, as pointed out by Arment (2004), in the 1970s and 1980s, several so-called "paranormal investigators" started to collect and publish numerous reports of mysterious animals whose apparently strange nature and features were explained with the supernatural. Heuvelmans (1997) proposed to separate these two different currents into cryptozoology (the "science of the hidden animals", which he conceived of as a branch of zoology) and "crypto-zoology" (meant to be a "hidden" or esoteric zoology not concerned with real, "flesh and blood" animals). Yet, over the years, the latter became the most common interpretation of cryptozoology among the general public, mostly thanks to the publication of commercially successful books on supernatural zoology (e.g. Clark and Coleman 1978; Keel 1970). On the other hand, hardly any further attempts were made to promote a more scientific approach to this field. As a matter of fact, aside from *Cryptozoology*, only three peer-reviewed journals have been devoted to this discipline: *The Cryptozoology Review* (1996–2004), *Kraken: Archives de Cryptozoologie* (2008–2011), and *The Journal of Cryptozoology* (2012–present). Therefore, cryptozoology has been given very little recognition by the academic world and is not considered a scientific discipline (e.g. Carroll 2003).

## *Cryptozoology According to Bernard Heuvelmans*

Heuvelmans (1982) coined the term "cryptozoology" using three Greek words as roots: "Kryptos" (Κρυπτος) (hidden), "Zoon" (Ζoν) (animal), and "Logòs" (Λόγος) (discussion, i.e. science), hence defining it as the "science of hidden animals". According to Heuvelmans, these "hidden animals" are animals whose existence is unknown to science but not to the local people with whom they share a geographical area or animals about which we have some indirect knowledge (such as local stories, sightings, footprints, etc.), which is, however, insufficient to demonstrate their existence (Heuvelmans 1982). Heuvelmans defined and subdivided this indirect knowledge into "circumstantial evidence" and "witness evidence", borrowing these terms from the legal jargon of the forensic sciences (Wigmore 1935). Thus, in cryptozoology, a fundamental requirement is the existence of indirect evidence concerning an alleged, still-unknown to science, animal species that is defined as "ethnoknown" (Greenwell 1985).

Heuvelmans preferred to refer to the animals studied by cryptozoology as "hidden" rather than "unknown" because, in his opinion, this label included not only potential taxa that were not yet formally described, but also belonging to species considered extinct whose survival is hitherto unknown (Heuvelmans 1982). Later, he extended this definition to include populations of animals already known to science, but living in areas where their distribution has yet to be documented (Greenwell 1984; Heuvelmans 1988). Cryptozoology's main contribution to scientific research is to accelerate the completion of the planet's biodiversity inventory allowing new species, which could potentially already be endangered, to receive prompt legal protection as soon as possible (Heuvelmans 1982, 1988). In order to achieve this, once any information about an apparently still unknown animal has been obtained, the cryptozoologist must acquire as much information as possible about this taxon by thoroughly examining a broad range of sources (such as myth, folklore, history, and archaeology), collecting witness statements and analysing all the alleged indirect evidence of its existence (e.g. footprints, skin fragments, hair tufts, pictures, films, and so on) (Heuvelmans 1988). Any thus collected information must then be carefully screened and evaluated in order to discard any unreliable report or non-zoological explanations of the phenomenon. Subsequently, a sort of identikit of the animal is compiled to situate it in its correct taxonomic position with as much accuracy as is possible in order to increase the likelihood of discovering it in nature and, therefore, formally describing it (Heuvelmans 1982, 1988). According to Heuvelmans (1984), the necessity of cryptozoology is demonstrated by the fact that, in the history of zoological discovery, many animals—even large ones—would have been discovered earlier if a cryptozoological approach had been applied. For instance, the giant panda (*Ailuropoda melanoleuca*), formally discovered in 1890, had been described as *bei-shung* (white bear) in Chinese manuscripts as early as 621 A.D. (Morris and Morris 1966), and the West Indian or African coelacanth (*Latimeria chalumnae*), formally discovered in 1938, was already well-known as *kombessa* among the natives of the Comoros Islands (Smith 1953, 1956). When screening resources, Heuvelmans emphasizes the great importance of myths and legends because usually the rarest and lesser-known animals tend to become myths, thereby making it easier to transform them into something quite different from their original zoological status in oral and written tradition (Heuvelmans 1987b, 1990). For instance, some Chinese natural history treatises from the II century A.D. described the *fen-chu* a gigantic hairy rodent weighing about 600 kg and armed with two huge pickaxe-shaped teeth that lived in the area north of China (Siberia). This legendary beast was later identified as mammoths (*Mammuthus primigenius*). Their bodies had been exquisitely preserved in the permafrost and were occasionally found by indigenous Siberian hunters who traded commercially with the Chinese and contributed to creating this legend (Heuvelmans 2007). Another mysterious animal of Chinese folklore, the *mé*, was described as a cross between a bear, an elephant, and a rhinoceros, and proved to be an extreme mythification of the Malayan tapir (*Tapirus indicus*), discovered by Western scientists in 1816 (Heuvelmans 2007). Strong mythification may lead zoologists to believe that some evidence is nothing more than unsubstantiated legend; therefore, cryptozoology should also de-mythify this information by elaborating accurate scientific theories (Heuvelmans 1982). Furthermore, Heuvelmans points out that the possibility of scientifically describing a species even before the capture or collection of a specimen and the depositing of a holotype (in the form of a dead specimen) should be cryptozoology's long-term objective. This is why Heuvelmans hoped that the International Commission on Zoological Nomenclature would come to accept a separate naming system, such as the "parataxa" proposed in paleontology by Moore and Sylvester-Bradley (1957) for paleoichnological systematics, as traces are difficult to attribute to a given species. Finally, after the "hidden animal" is described, it would pass from cryptozoology into zoology proper (Heuvelmans 1982, 1984, 1997).

## *Criticism*

### Animals Studied in Cryptozoology Are not Scientifically Plausible

One of the first problems that the newly born ISC had to tackle was the application of a specific technical term that would be used in place of the vague and often out of context "hidden animal", or the all too misleading and decidedly inadequate "monster" (Greenwell 1983). Wall (1983), therefore, proposed to adopt the word "cryptid", which is still universally used today in cryptozoology. Heuvelmans (1986) compiled a first systematic checklist of cryptids (yet without using this term, referring instead to *apparently unknown animals with which cryptozoology is concerned*). On this list, which had 138 entries, he included all the alleged animal forms that appeared in his books, plus others he had learned of from other texts, newspapers, personal communications, and field studies from over more than 35 years of activity. One of the major criticisms of this checklist was that cryptozoology emphasized the search for large animals, to the detriment of the small ones, which does not make much sense in the natural sciences, given that animals with low body mass constitute the vast majority of the species in any ecosystem (van Valen 1983). Groves (1984) and Simpson (1984) argued that the checklist included mainly large terrestrial mammals, judging new species of large mammals very unlikely to be discovered. Later, Loxton and Prothero (2013) emphasized, according to the proposed checklist and several works from "authorities" in the field (e.g. Krantz 1999; Mackal 1976, 1980, 1987), cryptozoology seems to focus almost exclusively on very unlikely creatures from a biological perspective, such as Bigfoot, the Yeti, the Monster of Loch Ness, the Mokele Mbembe, and so on, notwithstanding the fact that any search for unconfirmed animals should by definition belong to cryptozoology itself. Yet, another problem concerning cryptozoological entities is their alleged range of distribution: according to Loxton and Prothero (2013) and Groves (1984), it is in fact entirely possible that future discoveries will and must come from either very scarcely populated areas or museum collections, while some of the most famous cryptids seem to live in areas where human presence is quite strong. Hence, if they were real, then they should have been discovered long before.

### Cryptozoological Nomenclature Is not Applicable

van Valen (1983) criticized the possibility of describing a species only on theoretical grounds because the holotype, as Valen pointed out, is the only objective data that can demonstrate the real existence of any organism. Happel (1983) also criticized this point, stating that the possibility of describing a species before it is actually discovered is absolutely irrelevant to the scope of cryptozoology. According to Pauwels and Chérot (1997), cryptozoology was born of a misunderstanding by Heuvelmans: he believed that the International Code of Zoological Nomenclature necessarily called for the registration of the more or less complete remains of an animal in order to make it possible to arrive at a scientific description; but there are no clear rules for this (e.g. Wakeham-Dawson et al. 2002; Polaszek et al. 2005; Donegan 2008). Dubois and Nemésio (2007) indicate that, while the ICZN does not require holotypes, in the form of a preserved specimen of the species in question (onomatophores) to be registered, it also categorically rules out all "hypothetical concepts", i.e. all those animals whose existence—past or present—is formally known only to the mind of the author, whether it is a prediction or not. According to these authors, cryptids are a perfect example of "hypothetical concepts" and add that if registering a holotype as an onomatophore was clearly one of the ICZN's rules, then Latin names proposed only through eyewitness descriptions, footprints, or pictures to describe cryptozoological animals would cease to present any philosophical problems regarding their validity.

### Other Pseudo-scientific Aspects

According to Loxton and Prothero (2013), cryptozoology should be considered a pseudo-science because it promotes statements that seem scientific but are not actually guided by the scientific method of verification and falsification of hypothesis. Furthermore, often the so-called cryptozoologists tend to hold on to their ideas even when there is strong evidence against their case and attempt to use ad hoc hypotheses to avoid admitting their errors. Conway et al. (2013) point out that the majority of cryptozoological hypotheses and evaluations have been published in popular literature, thus avoiding peer-review, and that so far there is still no convincing evidence as to the existence of the most famous cryptids. These authors also criticize the excessively literal interpretations used by cryptozoologists when working on cryptids identified mainly in folklore (e.g. lake monsters, African dinosaurs, etc.). As a matter of fact, in many cases the interdisciplinary approach seems to be exclusively used to credit zoological interpretations of a given phenomenon, ignoring other possible causes (Meurger and Gagnon 1998). Even Groves (1984) supports this view, suggesting that cryptozoologists should first ask themselves if a given cryptid could truly exist rather than first asking from which animal a given legend could stem. Yet another criticism shared by several authors is that cryptozoology largely uses eyewitness accounts that, due to their inherent unreliability, cannot be considered valid data (Loxton and Prothero 2013; Shermer 1997, 2003). According to Mckinney (2013), standard zoology already searches for new animal species, thus there is no need to create a separate discipline. Nor can cryptozoology be classified as a scientific discipline because it does not address problems that have not already been dealt with by other known disciplines. Therefore, it is unnecessary and for this reason should be considered a pseudo-science. Even Loxton and Prothero (2013) highlight that the discovery of species such as the coelacanth, okapi (*Okapia johnstoni*), and Komodo monitor lizard (*Varanus komodoensis*), often offered by cryptozoologists as examples of the validity of cryptozoology, actually have no value at all as they all belong to the field of standard zoology. Finally, according to Naish (2007), the overlapping of cryptozoology and zoology is so broad that one wonders if cryptozoology actually exists at all.

## Discussion

### *Animals Studied in Cryptozoology Are not Scientifically Plausible*

According to Paxton (2011), even though the zoological community does not use the term "cryptid", it does not mean that it cannot be used, as it was once formally defined. Unfortunately, this is a problem with no simple solution. According to Heuvelmans, if an animal belongs to a potentially unknown species, to a surviving form of a species that is considered extinct, or to a known species living outside its recognized area of distribution, and there is indirect evidence of said animal, then this organism should be situated within the field of cryptozoology, and thus can be considered a cryptid. On the other hand, Loxton and Prothero's 2013 criticism is essentially correct: cryptozoology mainly emphasizes entities whose biology and ethology strongly clash with current scientific knowledge and whose existence is not supported at all. Upon examination of the 119 papers and field reports published in the 13 volumes of *Cryptozoology*, the manuscripts can be subdivided as follows:

- 12 Concerning technical definitions and proposals relating to cryptozoology
- 39 Concerning so-called "relict hominids" (Bigfoot, Yeti, Yowie, etc.)
- 32 Concerning lake monsters (Nessie, Champ, etc.) and sea monsters ("Caddy" and giant octopuses)
- 7 Concerning the possible survival of species considered extinct (3 of which are on Mokele Mbembe, an alleged surviving sauropod dinosaur from central Africa)

- 16 Concerning the existence of possible new, yet undiscovered, species
- 4 Concerning animals with new possible ranges
- 6 Concerning folklore and ethnozoology
- 3 Concerning subjects not necessarily connected to cryptozoology, such as the possible cloning of extinct species from their DNA

Thus, it is absolutely impossible to consider cryptozoology a science as long as it continues to concern itself with impossible creatures. However, although cryptozoological literature seems to be full of bizarre creatures, this is not because there is no valid method to distinguish between the possible and the unreal, but only because, in my opinion, this method has rarely been used—paradoxically, even by its inventor. In fact, Heuvelmans (1987a) points out that if a hitherto unclassified animal form was described by a traveller or native, this would not justify it being studied by a cryptozoologist, as a cryptozoologist must be called upon if there is a "certain implicit plausibility" and if it is "coherent with the most advanced scientific knowledge of our time". If this evaluation method was applied correctly, cryptids such as Bigfoot, lake monsters, and surviving dinosaurs would be utterly excluded from cryptozoology. As for criticisms of the size of cryptids, the majority having a large body size, Heuvelmans never considered size discriminatory. However, since cryptozoology is based on eyewitness reports and local traditions, cryptids generally should have a size that makes it possible to observe them (Heuvelmans 1983). However, small-sized species already locally known before their official discovery clearly demonstrate that testimonial and circumstantial evidence can be used to find "new" animals, notwithstanding body size. For instance, five different new species of New World monkeys whose body weight ranges from 150 to 1200 g (*Callibella humilis, Callithrix manicorensis*, *Callithrix acariensis, Callicebus bernhardi,* and *Callicebus stephennashi*) were discovered and described by zoologist Marcus van Roosmalen and his co-workers thanks to indications provided by local people, who told van Roosmalen that in different areas similar monkeys exhibited different colours (van Roosmalen et al. 1998, 2000, 2002; van Roosmalen and van Roosmalen 2002; van Roosmalen 2014). Finally, although the discovery of mid- and large-body-sized animals is statistically less likely than that of small-sized ones, and even if we narrow our scope to include only the most recently discovered terrestrial forms, we find the discovery in 2010 of the Northern Sierra Madre forest monitor (*Varanus bitatawa*), a 2-m long lizard, and in 2013, the lowland tapir (*Tapirus kobomani*), weighing 110 kg (Welton et al. 2010; Cozzuol et al. 2013). It should also be pointed out that the latter taxon had already been described by van Roosmalen (van Roosmalen and van Hooft 2013; van Roosmalen 2014) under the name *Tapirus pygmaeus* after its discovery thanks to the indications of local natives.

## *Cryptozoological Nomenclature Is not Applicable*

If, on the one hand, the ICZN does not clearly state that dead type-specimens must be registered as holotypes in order to assign a scientific name to a species (Donegan 2008), attempts to describe cryptozoological species are usually extremely disappointing (Dubois and Nemésio 2007). Textbook cases are: Scott and Rines's description of the Loch Ness Monster (1976) based on alleged underwater pictures of flipper-like appendages that later were revealed to be heavily retouched (Binns 1983; Campbell 1996; Shine 2006); or the famous "Minnesota Iceman", the alleged corpse of an unknown hominid found frozen in a block of ice and exhibited in side-shows around the USA which was judged real by Heuvelmans (1969). Heuvelmans considered it real and described it as *Homo pongoides* via a visual and photographic analysis, but later it proved to be a masterfully produced mannequin (West 2011). However, perhaps the most emblematic case of the risks of describing a cryptid based solely on pictures and testimonial evidence is possibly the so-called "Cadborosaurus", the alleged sea serpent of British Columbia. Mainly based on old pictures of an apparently unusual carcass found in 1937 in the stomach of a sperm whale, LeBlond and Bousfiled (1995) and Bousfiled and LeBlond (1995) described *Cadborosaurus willsi* as a surviving form of sauropterygian plesiosaur. Using the same pictures and testimonial accounts of alleged sightings, Saggese (2009) later offered a different interpretation of the creature, making reference to a highly specialized Sirenian closely related to Steller's sea cow (*Hydrodamalis gigas*), which he named *Cadborotherium willsi*. Setting aside the highly questionable method used by these authors in their tentative description of the alleged sea serpent (see below for a further discussion of this case), it is clear that, from the same sources, two different genera belonging to two different classes are described, proving that the evidence itself is ambiguous at best and cannot be accepted as the basis of a scientific description worthy of its name. As a matter of fact, Donegan (2008) reports several cases of species that have been described without registering onomatophores, yet the quality of the indirect evidence used in these descriptions (clear pictures and observations made by scientists in the field) cannot be compared to that used in the majority of cryptozoological cases (blurred pictures, grainy video, confused descriptions made by alleged eyewitness, etc.). The debate on establishing clearer ICZN guidelines is beyond the scope of this chapter. However, if there is currently sufficient evidence to describe a species, then it can be described, and, in my opinion, a "parallel" nomenclature would only create greater confusion and the result would be void of any scientific criteria. Therefore, I believe that the description of a species on very poor evidence, or perhaps even before its actual discovery, would be none other than an exercise in style that facilitates the demonstration of the existence of certain authors to science more than the demonstration of the existence of certain species—in addition to being completely irrelevant to cryptozoology. Woodley (2011) suggests using an independent classification system in cryptozoology based on the concept of *aequivotaxa* (from the Latin "aequivocus", or ambiguous, uncertain), where "hypothetical concepts" can find a place based on given requirements, such as:

1. The "aequivotaxon" must be supported by a holotype in the form of a detailed description, pictures, images, audio recordings, biological samples, or any other evidence.
2. The description of the "aequivotaxon" must not contain attempts to deduce its biological affinities.
3. The proposed name must be different from the one used to christen the species in case of an effective future discovery of the examined cryptid

According to Woodley (2011), funding an International Commission on Aequivological Nomenclature would be the most important step towards the institution of cryptozoology as a formal discipline. Yet, I think that the application of the scientific method would be even more important so as to avoid "hypothetical concepts" and better safeguard the image of cryptozoology. Therefore, I am unable to support Woodley's unnecessary proposal. In fact, I am of the opinion that such classification, albeit well elaborate and clever, would not be used by professional zoologists and would only confine cryptozoology to a sphere of research that is cut off from the recognized biological sciences. My proposal of a method that would allow for the study of cryptids without needing to provide a possibly premature "scientific" description consists of improving on the checklist method introduced by Heuvelmans (1986). By applying the most up-to-date zoological knowledge, not to mention a good dose of common sense, such a checklist would allow to rule out unreal cryptids (such as "a 30 m long anaconda", "lacustrine plesiosaurs", and so on) and coherently and systematically group together all the reports of potential new *taxa* and sightings of species considered extinct that have been collected by field zoologists and biologists during their research. Such reports often risk suffering from limited circulation because scientific zoological journals are not generally interested in publishing material that may be solely theoretical and devoid of any results. Such a checklist could be regularly published on official media created for this specific purpose and could prove to be of great help to biodiversity conservation: the formal discovery of new species could be helped by knowing that this potentially new species has already been reported in a given area, in the event that such an animal actually existed; or researchers could find out that these reports regard a species that is already known and thus that cryptid could be struck off the list and zoologists (and their colleagues) could focus their research on more potentially interesting cases. Moreover, if such a checklist had official status, it would help circumvent ethical problems, such as in the description of the lowland tapir, encouraging any researcher who has already collected and reported evidence on the discovery of a new *taxon* to be included, or at least cited, in the description.

## *Other Pseudoscientific Aspects*

Criticism which considers cryptozoological theories pseudoscientific is certainly not without grounds. The use of ad hoc theories and data manipulation which only take into consideration that which furthers these theories, ignoring that which is contrary to the given hypothesis is, unfortunately, common practice in cryptozoology.

One remarkable example is the description of nine different species of large unknown marine animals based on the analysis of alleged sightings (Heuvelmans 1965). According to Heuvelmans, this analysis was conducted with scientific rigour and allowed him to discover how the apparently unrelated and confused reports of so-called "sea serpents" were actually obscuring a logical and coherent picture because the description of the sighted creature was strictly connected to the sighting area. Heuvelmans (1965) stated that these nine kinds of sea serpents would have occupied different ranges and niches, thus being biologically believable. However, in Magin's (1996) critical examination of his work, the author pointed out that several sightings considered valid by Heuvelmans were actually hoaxes, and that Heuvelmans himself had piloted the data in order to substantiate his theories. For instance, given that a specific ocean area was inhabited by long-necked sea serpents, any sighting coming from that area was automatically included in the category "long-necked", even though in the description, the neck of the animal was either not mentioned or reported as "not long" (e.g. Heuvelmans 1968, pp. 286, 360, 412, 580–582). Another good example comes from the already mentioned "formal" descriptions of the *Cadborosaurus*. In fact, although witnesses have often described a sort of mane along the neck of the animal, Bousfiled and LeBlond (1995) are not inclined to consider this feature in their description of the creature. On the other hand, Saggese (2009) includes the mane, yet chooses to ignore the many reports of horny projections on the head of the animal, considering them misinterpretations and oversights. Hence, both Bousfiled and LeBlond (1995) and Saggese (2009) were eager to exclude the features that would not fit into their own taxonomical hypothesis on the nature of the alleged cryptid (for a plesiosaur, a mane, and horns for a sirenian). Yet, despite the fact that many claims in cryptozoology are not scientific, this does not imply that the method itself is not scientific (Paxton 2002). In my opinion, the fundamental ideas forming the basis of cryptozoology are empirically demonstrable:

- The inventory of our planet's fauna is largely incomplete. Not only new species are discovered every year, but mathematical models have been developed to estimate the number of potential species yet to be discovered (e.g. Giam et al. 2012).
- It is possible to discover new species previously known only through circumstantial and testimonial evidence, especially those provided by the local population (e.g. Sheil and Lawrance 2004; Cozzuol et al. 2013).
- Species considered extinct may have survived and may be rediscovered. Sheffers et al. (2011) have reported 351 such cases in the last 122 years.
- Investigating circumstantial evidence may accelerate the process of discovery and description of potentially new species (Rossi 2011), as demonstrated by van Roosmalen et al. (1998, 2000, 2002).
- Some real animals may be mythified beyond recognition. For instance, while investigating bizarre legends about a monkey who sneezed on rainy days because water drops got into its nose, Geissmann et al. (2010) discovered and described a new species of the genus *Rhinopithecus* (*R. strykeri*) in Myanmar.

As for the criticism of eyewitness testimony, while it is true that this sort of evidence is the kind that is most often used in the majority of the pseudosciences (such as parapsychology, ufology, and several "alternative medicine" practices) and can be unreliable (see Polidoro 2006; Wiseman 2011), it is also true that a great deal of rare natural phenomena has initially been documented only due to eyewitness testimony (Paxton 2009). Eyewitness testimony is widely used in zoology both to assess the extinction of a species (e.g. Hume et al. 2004; Black et al. 2013) or its persistence (e.g. Boyd and Stanfield 1998) and to report new species that have yet to be formally described (e.g. Pitman et al. 1987). The main difference in cryptozoology is in the data elaboration that, differently from what happens in zoology, generally does not undergo any scientific control and refereeing. But it is interesting to note that peer-reviewed journals do not discard cryptozoological contributions a priori as long as they satisfy the criteria for scientific publication (Paxton 2011). Cryptozoology may be taken more seriously by the academic world if cryptozoologists start to apply the scientific method more consistently. However, if cryptozoology must rid itself of what public opinion deems its "symbolic animals" (Bigfoot, lake monsters, surviving dinosaurs, and so on) in order to become a scientific discipline proper, then we must ask ourselves whether—once these beings have been set aside—this field of study will become redundant with zoology. According to McKinney (2013), "each and every animal" currently known to science has been previously known only through vague description; yet this does not at all imply that the whole history of zoology should be included in cryptozoology. It is also worth noting that, according to Heuvelmans (1984), at least until the end of the eighteenth century, zoology had no need at all for cryptozoology because the systematic search for species of unknown status was the norm for naturalists of that time. Yet, strictly speaking, there appears to be no impediment to instituting cryptozoology as a science, as it is not redundant with zoology. First of all, McKinney (2013) seems to ignore that stating that "each and every animal" has been ethnoknown before its discovery and description is erroneous. Investigation to demonstrate the existence of a species is but one of the methods zoology may use to collect useful data and samples. For instance, one of the most commonly employed methods in field research uses area-specific surveys and traplines which randomly inventory species at a given location (Arment 2004). Furthermore, a new species may be unexpectedly collected purely by chance, as in the case of the megamouth shark (*Megachasma pelagios*), accidentally caught off the Hawaiian Islands in 1976 (Taylor et al. 1983). Therefore, it is entirely possible for a zoologist to encounter a new species, not previously ethnoknown, and not have any information about it before its official discovery. Arment (2004) defines cryptozoology as a "targeted-search methodology for zoological discovery"; yet even in this case one could ask what the differences are between this method and the zoological method. However, this problem ceases to exist if cryptozoology is considered a branch, or subdiscipline, of zoology. For instance, even recognized disciplines such as mammalogy, ichthyology, or herpetology, do not address problems that have not already been addressed by zoology—yet no one doubts their scientific value. Such disciplines may be considered specializations of zoology and may be further subdivided into additional subdisciplines (e.g. primatology and cetology for mammalogy ophidiology for herpetology, and so on). The point is that, if the methodology of any given discipline renders correct results, then its acceptance as a scientific subject is sanctioned by sheer conviction. For instance, only in recent years has bathrachology (the study of amphibians) been supported as a distinct discipline, yet this does not mean that before then zoology did not include the study of amphibians. Amphibians were, however, studied by herpetologists merely because of historical tradition, but in 1982 a group of French zoologists founded the first bathrachological society in the world in Paris and published *Alytes,* the first journal completely devoted to this new discipline. Mammalogy, ornithology, ichthyology, and bathrachology are specializations within zoology that are based on the precise taxonomic status of their subjects of study, while palaeontology—based on the remains and traces of extinct beings—is based on the temporal status of their subjects. Therefore, there is no reason cryptozoology should not be based on the cognitive status of the *taxa* and considered the branch of zoology that studies and researches *taxa* whose possible existence is initially based only on circumstantial and testimonial evidence. However, in my opinion, the only way to achieve this status would be if zoologists with a shared perception of this concept of "scientific cryptozoology" founded a new society and published a new journal devoted to the aforementioned topics. Given time, this would prevent anyone dabbling in "mysterious animals", such as lake monsters, chupacabras, or mothmen, from being called "cryptozoologists". Only in this way could and would cryptozoology avoid the often embarrassing "image problems" that have affected it since its birth as a field. As a matter of fact, a great deal of interesting information collected by professional zoologists risks falling into oblivion due to fear of it being associated with a pseudo-scientific discipline. For instance, in a paper dedicated to the possible recent survival of the pigmy hippopotamus and giant lemurs in Madagascar, deduced by the local people's description of animals called respectively "Kilopilopitsofy" and "Kidoky", Burney and Ramilisonina (1999) report that they have been reluctant to publish their work for fear of it being associated with cryptozoology.

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