



New species and subspecies descriptions do not and should not always require a dead type specimen

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Abstract

Dubois & Nemésio (2007) recently considered that the present International Code for Zoological Nomenclature (“Code”) could reasonably be interpreted as requiring the deposition of dead vouchers for new species and subspecies descriptions. They considered that, to the extent that there is lack of clarity, the Code should be amended so as to require the deposition of a dead voucher. They doubted the utility of photographs and other materials for descriptions and suggested that ethical or moral concerns about the taking of dead type specimens were poorly supported. Dubois & Nemésio (2007)’s preferred interpretations of the current Code are not supported by members of the Commission. Possible reasons why the collection of a dead type specimen might not be necessary or recommended include the setting of a good example to communities in whose hands conservation action lies, government permit issues and the description of new taxa on the brink of extinction where collecting may impact populations. The Code should be liberal in relation to the nature of type specimens to enable taxonomists, who are the persons best placed to take decisions, to make appropriate judgments for particular descriptions.

Key words: Nomenclatural availability, vouchers, collections, type specimen, illustrations, samples, ethics, DNA sequences, *Code*, Commission

Introduction

Dubois & Nemésio (2007) recently discussed whether dead voucher specimens are or should be required to be deposited in order for a new species or subspecies description to be valid for purposes of the Code. Although alternative views were alluded to and discussed — and I paraphrase here — the overall thrust of Dubois & Nemésio (2007)’s paper is that the Code can reasonably be interpreted as requiring the deposition of a complete, dead voucher for a species or subspecies description; and that so it should do.

The references to ‘dead’ type specimens herein are not intended to be inflammatory, but are used to compare the situation where an individual is released, with a DNA sample (e.g. blood sample) or other part of the specimen (e.g. feathers, hair clippings, scales) removed and deposited as a voucher; or where a description is based solely upon illustrations (e.g. photography) without any sample. Dubois & Nemésio (2007) do not discuss in detail the application of the Code to these rather different situations. I do not deal here with taxa described through ‘phylogenetic definitions’, which are a rather separate issue in relation to which I sympathise with Dubois & Nemésio (2007)’s concerns.

There is a considerable amount of literature on the topic of collecting generally, including in relation to new species descriptions. Various papers concerning collecting in ornithology have interesting perspectives on the topic but some were not cited by Dubois & Nemésio (2007). I mention the following publications here for purposes of including a more complete literature review in this exchange of papers: American Bird Con-

servancy (2007), Banks *et al.* (2003), Bekoff & Elzanowski (1997), Collar (1998, 1999, 2000), Cuervo *et al.* (2006), Donegan (2000), Griffiths & Bates (2002), Hughes (1992a, 1992b), Le Croy & Vuilleumier (1992), Lever (1992), Loftin (1992), Peterson & Lanyon (1992), Peterson *et al.* (1998), Remsen (1995, 1997), Rojas-Soto *et al.* (2002), Stiles (1983), Vuilleumier (1998, 2000) and Winker *et al.* (1991, 1996). A further example exists of a bird species being described without a dead holotype (Athreya 2006) and of a live bird specimen and blood sample being used as a paratype for a new bird subspecies (Donegan & Huertas 2006).

Dubois & Nemésio (2007) make various points in their discussion with which I am in complete agreement. However, during their discussion, those who are alleged to have raised certain arguments in the context of the collection of type specimens are referred to as an ‘ethically correct tyranny’ (p. 16) who peddle ‘a hypocrisy and a lie’ (p. 15) and choose ‘ignorance in the name of conservation’ (p. 16). Whilst I do not hold all of the views so treated, these comments beg a response. Three broad issues are discussed: (i) what the Code currently requires in the way of type specimens; (ii) a rationale for a liberal approach to the nature of type specimens; and (iii) aspects of the Code that could helpfully be amended. Although Dubois & Nemésio (2007) address ‘favorable arguments’ relevant to recent descriptions without a dead type specimen, relatively short shrift is given to such arguments compared with their preferred ‘unfavorable arguments’. This article aims to address this imbalance but seeks not to recapitulate points well made by Dubois & Nemésio (2007).

At the outset, I should note that the various new species and subspecies descriptions of neotropical birds which I am an author or co-author have all utilised a dead holotype and, in some cases, a type series including new, dead specimens (Cuervo *et al.* 2001; Salaman *et al.* 2003; Donegan & Huertas 2006; Donegan 2007; Donegan & Avendaño in press). The author of this paper understands the importance of type specimens but is sympathetic to descriptions using other techniques where this is appropriate.

What the Code currently requires in the way of type specimens

Dubois & Nemésio (2007) discussed and cited various provisions of the Code relevant to the nature of type specimens. As proposed previously by Banks *et al.* (1993) and Timm *et al.* (2005), they consider that the current drafting of the Code is ambiguous. They consider it to be a reasonable interpretation of the Code that a dead type specimen is required for species and subspecies descriptions. Present and past members of the Commission’s secretariat have recognised certain ambiguities within the Code but have rejected such interpretations (Wakeham-Dawson *et al.* 2002; Polaszek *et al.* 2005).

In summary (and as noted by Dubois & Nemésio 2007), the rationale for illustrated individuals or samples being acceptable as a type specimen is that Recommendation 16C (which recommends that authors should deposit type specimens in an institution that maintains a research collection) is a non-binding recommendation, not a requirement. Articles 72.5.6 and 73.1.4 contemplate descriptions based on illustrations (such as photographs) rather than voucher specimens. Article 72.5.6 states that: ‘*In the case of a nominal species-group taxon based on an illustration or description, or on a bibliographic reference to an illustration or description, the name-bearing type is the specimen or specimens illustrated or described (and not the illustration or description itself).*’ Article 73.1.4 states that: ‘*Designation of an illustration of a single specimen as a holotype is to be treated as designation of the specimen illustrated; the fact that the specimen no longer exists or cannot be traced does not of itself invalidate the designation.*’ These provisions should be given their ordinary and natural meaning.

Article 16.4.1 requires ‘*the explicit fixation of a holotype, or syntypes*’ for species and subspecies descriptions after 1999. Dubois & Nemésio (2007) consider that, if live type specimens are permissible, this would ‘*allow nomina to be created entirely within language, without objective reference to specimens*’ (p. 8); and, later, that ‘*the only way to be sure that an animal does not exist only in the mind of a person is to be able to examine a specimen*’ (p. 11). However, where a live specimen is documented through photography or deposit of a sample, the *nomen* is objectively fixed. The *nomen* is also verifiable — by inspection of the photograph or

a physical sample; or sequencing of a DNA sample; and often by repeating field research. Sequencing or inspection of a sample will not always enable identification of an individual to the required taxonomic level but at least provides a basis for verification of an individual's relations. A dead, full specimen is in many cases a better basis for objective verification than a sample, but to say that there is *only* one way to define a taxon objectively is an exaggeration.

Article 16.4.2 provides that '*Where the holotype or syntypes are extant specimens, [the description must be accompanied by] a statement of intent that they will be (or are) deposited in a collection and a statement indicating the name and location of that collection ...*'. Ambiguity and difficulties of interpretation result from this clumsy wording, as discussed by Dubois & Nemésio (2007) and other authors. The term 'holotype' is defined as '*The single specimen ... designated or otherwise fixed as the name-bearing type of a nominal species or subspecies when the nominal taxon is established*'. The term 'syntype' is also defined with reference to the term 'specimen'. The term 'specimen' is in turn defined as '*An example of an animal, or a fossil or work of an animal, or of a part of these*'. There is no requirement that a 'specimen' or 'holotype' (as defined in the Code) be alive or dead; nor is there any *de minimis* standard for what might amount to a 'part' of an animal in the context of samples.

Articles 16.4 or 72.10 are capable of full operation and meaning for descriptions where a sample (an example of a part of an animal) is deposited; and should be read in the context of Articles 72.5.6 and 73.1.4 for descriptions based on illustrations. The change brought about in the 1999 version of the Code was not to require the deposition of a type specimen that must be *dead* (as suggested by Dubois & Nemésio 2007), but merely to require the designation of an individual specimen as a type specimen, to which the name of a taxon is fixed.

Only descriptions based solely on illustrations present interpretative issues under Article 16.4.2. In such cases, the relevant specimen designated as a type (which, as above, may be a live individual) may or may not be extant at the time of description. In many cases, the author will not know. If the specimen is in fact extant, the requirement to deposit (or include a statement of intention to deposit) an '*animal ... or part of an animal*' would, on a literal interpretation, fall unsatisfied. There are two interpretations of Article 16.4.2 for descriptions based on illustrations where the specimen is extant, unless the individual is in captivity and deposit of its remains is sufficiently predictable. As noted by Dubois & Nemésio (2007), application to the Commission under Article 10.1 for disapplication of this requirement could be regarded as necessary. Under this interpretation, Articles 72.5.6 and 73.1.4 would only apply after a successful application had been made. Intriguingly, if a specimen originally studied as a live individual is, at the time of publication, known to be dead and its body no longer extant, the description would be valid. Such a distinction, depending upon the uncontrollable fate of a live specimen, would have no logical basis. Alternatively, more purposive interpretation could be applied pursuant to which the requirement should best be regarded as inapplicable to descriptions based on illustrations. The latter interpretation is the one supported by the Commission (Wakeham-Dawson *et al.* 2002; Polaszek *et al.* 2005).

Dubois & Nemésio (2007) suggest strongly (although this is not stated explicitly) that the published viewpoint of Commissioners in relation to the issue of dead vouchers and possible purposive interpretations ought better be ignored. These suggestions are grounded on a debatable assertion of jurisprudence ('*when juridical texts like the Code are concerned, the intention of the draftsmen is of little importance, what counts is the final text*', p. 8).¹ The Code is silent as to whether a literal or purposive approach is to be adopted. However, the Introduction to the current edition of the Code states that: '*Because of the extent to which the provisions of the Code are interdependent, contradictory provisions and different wordings leading to conflicting interpretations can arise easily*', suggesting that a purposive interpretation is sometimes necessary. The intention and published opinions of the Commissioners are likely to be matters relevant to purposive interpretations. If the Commissioners were to hear a case in relation to the validity of a description using a live type, the outcome of that case would be determinative in relation to its subject matter.

Separately, Dubois & Nemésio (2007) consider it a plausible interpretation that the requirement for type specimens to be ‘held in trust for science by the persons responsible for their safe keeping’ (Article 72.10) conflicts with Articles 72.5.6 and 73.1.4. Again, there should be no issue in relation to type specimens based upon deposited samples. For type specimens based only on illustrations, a better interpretation is that there is no person responsible for the safe keeping of the type to whom this obligation could apply. The wording of this provision is clumsy and could be improved, as will be discussed further below.

Samples were taken and deposited of the holotypes of *Laniarius liberatus*, *Avahi cleesei* and *Liocichla bugunorum* and a paratype of *Atlapetes latinuchus yariguierum* (Smith *et al.* 1991; Thalman & Geissmann 2005; Athreya 2006; Donegan & Huertas 2006). Such designations are therefore valid on any reasonable interpretation of the Code. Of the various recent live type specimens of terrestrial species discussed in this exchange of papers, only those of *Lophocebus kipunji* and *Cebus queirozi* were based solely on illustrations (Jones *et al.* 2005; Mendes Pontes *et al.* 2006) and could potentially be affected by certain of Dubois & Nemésio (2007)’s interpretations of the Code. If Messrs. Dubois and Nemésio consider that these descriptions are not valid nomenclatural acts, they should submit a case for consideration by the Commission. An alternative, more constructive, approach for those concerned about ‘phantom nomina’ would be to propose neotypification of *Lophocebus kipunji*, as a dead specimen has subsequently become available (Davenport *et al.* 2006). The issues relating to illustrations discussed in this exchange of papers could therefore as a practical matter amount to no more than a discussion of the validity of *Cebus queirozi*.

Discussion: the need for a liberal approach

Dubois & Nemésio (2007) distinguish the utility of names to taxonomists, biologists and the public from the narrow issue of the fixation of words to specimens. As they note, the Code deals with matters of nomenclature but not taxonomy or biology. Type specimens have an important role as a reference point for species and subspecies names. However, species and subspecies names have no meaning absent a biological context and are of no practical use to society other than historians (treated as synonyms) unless they refer to biologically meaningful units. Wider policy issues are therefore relevant to the question of the nature of type specimens.

Assuming that an adequate type specimen is designated, types are but one of many facets of a strong new taxon description. The existence of a species, subspecies or population (or its presence at a particular place or time) can be demonstrated in many ways. Descriptions based on one specimen with no behavioural, locality, biogeographic, ecological, molecular or other data or analyses presented are subject to scepticism and are often not recognised by the authors of textbooks, checklists and the like. On the contrary, a description including: photographs and biometrics of a number of live individuals examined in the hand and observed by a number of independent persons; various archived photographs; blood, feather, hair and/or skin samples referable to archived photographs of marked individuals; sound recordings deposited in an online or museum library with vocalisation analysis; biogeographic analysis; molecular sequences archived in public databases; a molecular phylogeny; colorimetry data; x-ray or CT scan for osteological data; and ecological information -

1. Statutory interpretation has been a great topic of debate amongst jurists given its significance in the legal field. Some legal systems tend to favour a literal approach to statutory interpretation (e.g. England: Cross *et al.* 1995; Bennion 2002). In contrast, most civilian law systems (such as France and Brazil), some international systems (e.g. the European Union and public international law) and even some common law based systems (e.g. federal law of the United States) have a purposive or ‘teleological’ approach to interpretation, pursuant to which the intention of the drafters and *travaux préparatoires* are of importance (Bennion 2002; Germain 2003; Eskridge *et al.* 2006; articles 31 and 32 of the Vienna Convention on the Law of Treaties 1969). Even in countries where literal interpretation is preferred, judges interpret the law and sometimes adopt a purposive approach in particular legal fields (for examples in ‘literal’ English law: criminal law, tax law and the implementation of European Union laws). Thus, one can only at best speak of tendencies in statutory construction (towards a literal or purposive approach) in any given jurisdiction, time period or discipline.

but without a single (dead) type specimen — would be stronger than a single-dead-specimen-only description. A description also including a dead type specimen may improve the documentation of the latter hypothetical description; a description with a series of specimens may improve the description further. In either case, a single individual must be documented properly and designated as a type specimen. If cogent evidence can be presented and published of a new species and the characters of individuals designated as type specimens can be described and appropriately documented otherwise, dead type specimens should not be required by the Code.

Concerns about certain collecting activities being undertaken for spurious reasons (e.g. museum enrichment, record documentation) are a rather separate matter from the targeted collection of a single individual for purposes of designating a type specimen. Indeed, it is always preferable to have a complete dead type specimen for the reasons discussed by Dubois & Nemésio (2007). However, the Code and taxonomists should recognise that, in some instances, the collection of a dead type specimen may not be regarded as justifiable. The Code should be liberal in relation to the nature of type specimens to enable taxonomists to take appropriate decisions in respect of particular descriptions.

In this section, I discuss reasons why a taxonomist might wish to describe a new taxon without taking a dead type specimen. Some of these reasons, and others relating to marine organisms not repeated here, were discussed by Dubois & Nemésio (2007). Additional concerns relating to dead type specimens and overlooked rationale relevant to some of the points raised by Dubois & Nemésio (2007) are discussed below.

(1) The adequacy of photographic and other non-specimen evidence

Dubois & Nemésio (2007) doubt the value of photographic evidence, noting that unvouchered photographs may be inaccurate, of bad quality or tainted by fraud. They cite various examples. Specimens, similarly, are not infallible. Specimen-based research can also be tainted by fraud or be based on inaccurate, ambiguous or incomplete label data. Furthermore, specimens can be lost or destroyed; colours may become faded or foxed; and (at least in birds) no data on bare part, skin, mass or eye colour is objectively verifiable from a specimen. Dubois & Nemésio (2007)'s suggestion that fraudulent use of photography might further a taxonomist's career is interesting — as one would normally assume quite the opposite effect. The various recent mammal and bird descriptions not using dead specimens and based largely on photography are generally regarded as having documented instances of previously undescribed taxa and have been published in peer reviewed scientific journals.

Dubois & Nemésio (2007)'s comments in relation to the (lack of) utility of photography in taxonomic studies are exaggerated. Photographs indeed have some advantages over specimens in documenting bare part coloration and being easily published and reproduced. A published photograph, particularly if it is made available online, is likely to be inspected by more persons than a dead specimen in a museum tray. Although it is difficult to relocate a particular individual used as a type specimen, photographic evidence can usually be corroborated through other researchers repeating field research. Archived series of photographs of captured live individuals at close range (e.g. in the hand) alongside standardised colour charts (e.g. Munsell Color 1977, 2000) and rulers are of broadly similar value to dead specimens, at least as regards external coloration. In the same way that innovative preservation techniques may be used in cases where collecting is difficult, little-explored innovative techniques can be used to study features of live animals (e.g. X-Rays, computerised tomography (CT) scans, colorimetry, induced vomiting for stomach contents and molecular analysis of blood samples).

Taxonomists using different techniques should trust one another as a starting point, whether specimens, photography, molecular studies or all of them are used. The distinction between descriptions of a 'hypothetical concept' and valid species is vexed in the field of cryptozoology and requires discussion as a topic relevant to the nature of type specimens. However, the peer review process should weed out poorly-supported descriptions from scientific journals; and fantastical descriptions are not recognised in serious scientific publications. The Loch Ness Monster and Yeti do not bear comparison with the recent mammal and bird descriptions discussed in this paper.

(2) Moral considerations

I am aware that many of the issues and points of view expressed in this paper run contrary to the ‘mainstream’ in taxonomy and zoology. Taxonomists are often more comfortable discussing issues relating to dead specimens in a moral vacuum (or following *reductio ad absurdum* of moral concerns, which amounts to the same thing). The question of the utility of taking a specimen over use of other materials then has an obvious answer. Challenging of some of the more flimsy of the moral arguments allegedly raised by ghost critics against collection (e.g. ‘mawkishness’) is worthwhile. However, the views of those opposed to collecting specimens, whether type specimens or otherwise, are often honestly held and considered and often amount to more than merely hypocritical discomfort. Different views should be tolerated and discussed appropriately.

Ethics and philosophy, which include the study of animal and environmental rights, are fields of academic study. Experts in such fields have an important contribution to make to discussions about collecting. Philosophers are often not concerned with determining what or who is wrong and right, who is absurd or which ethical tyranny should prevail. Rather, they frequently discuss possible frameworks for the taking of decisions. Loftin (1992) elucidated 10 criteria for ethical and responsible scientific collecting from a utilitarian or consequentialist perspective. As I am no expert in matters of ethics, much of the discussion below draws from ideas and concepts in Loftin’s paper, which is a helpful starting point for discussions.

Although the focus of conservation at the individual level has its critics, individual animals are generally regarded as having at least a soft or inchoate ‘right’ to life and freedom from ill-treatment (e.g. Agar 1995). In the same way that it is generally ‘better’ if a valued work of art or building is not burnt, defaced or destroyed, it is generally ‘better’ if an organism is not killed. To kill a sentient organism gratuitously at least causes aesthetic damage and reflects poorly on the perpetrator. Killing non-human organisms is a subject on which followers of various world religions have perspectives. Various political movements and NGOs have as their central purpose the protection or welfare of individual animals (e.g. Royal Society for the Prevention of Cruelty to Animals, Vegetarian Society, International Fund for Animal Welfare, abandoned pet homes). Moral considerations relevant to the taking of dead vouchers — and the welfare of live individuals subject to biological study — are thus considered of relevance and interest by members of the public and should not be brushed aside, derided or insulted lightly by the scientific community. A robust rationale considering ethical issues in favour of responsible and necessary scientific collecting of type specimens would be of value in convincing a sceptical public of its importance.

I ignore for analytical purposes those that would deny or permit the killing of animals on any grounds whatsoever. Such views are often (but not always) based on religious or quasi-religious beliefs, handed down from God or another supernatural being or may be the result of arrogance. Although persons with absolutist views are fully entitled to them, it is difficult to form any objective basis for collecting type specimens (beyond that you either should never or always do so in certain circumstances). The following discussion therefore considers collection only in a utilitarian context.

(a) Utilitarian perspectives:

A philosophical chestnut of millennia vintage is whether a relatively small moral transgression can be justified by a greater good. Put simply, the most widely practiced moral code dealing with this issue in western society can be encapsulated in the maxim ‘the ends must justify the means’. The ‘means’ must be the only or best available way of attaining the ‘ends’ and the ‘ends’ must be of greater benefit than the damage caused by the ‘means’. The ‘means’ of relevance here are of course the killing of an individual animal for use as a type specimen. The ‘ends’ are the greater purpose or good which is achieved by a having a dead specimen, in this case stronger documentation of a description compared to use of other techniques, the expeditious publication of a valid description and the testing of hypotheses relevant to a new species or subspecies description.

In order for collecting to be justified from a utilitarian perspective, the killing must be *necessary* to consider the hypothesis or achieve the other objective being pursued; and the benefits from collecting must out-

weigh the damage done (Loftin 1992). Different people have different perspectives on the value attributed to the life of non-human organisms (and their populations, species and habitats). Some economists, businesspersons, politicians and religious fanatics would value non-humans (and even species and habitats) as of virtually no worth compared to people, votes or money. At another extreme, an animal rights campaigner might value an individual of a critically threatened primate as of broadly equivalent to a human life. Some religions extend this analysis to all organisms. Separately, different people have different perspectives on the importance of achieving a stronger or more permanent level of documentation for a type specimen, compliance with particular interpretations of the Code or the testing of hypotheses. Finally, the consequences that would result from the collecting 'means' must be balanced against the 'ends' to see whether the 'means' are justified. This is a subjective consideration. Researchers and taxonomists are better placed than many other people to make such determinations.

The issue of evaluating the 'means' and 'ends' in the context of collecting becomes more complex where there is no clear direct benefit referable to the killing of a specific individual (e.g. collection for general museum enrichment purposes without any hypothesis or documentation of a distinctive new vertebrate species where sufficient evidence can be presented in other ways). If it is possible to achieve the relevant objective using non-lethal methods, collection would not be justified. When an individual possibly to be collected is of a species or population on the verge of extinction, additional negative consequences should be borne in mind in assessing the consequences of taking a specimen.

Various recent examples are cited in this paper of strongly-supported species descriptions that have been published without a dead specimen. A dead specimen might be necessary to test some other hypothesis or for some other purpose. A dead specimen might have meant that a description is subjectively 'better' in the eyes of some taxonomists, that there is no doubt as to whether the Code was complied with or that additional permanent evidence of the characters of the type specimen exist. However, the means of killing an individual in these cases was not necessary for the ends of a species' documentation and description and designation of a type specimen.

The evaluation of the 'means' and the 'ends' in the context of collection may vary between taxonomic groups. For example, invertebrates and other lower trophic level consumers have typically more numerous local populations than vertebrates or higher trophic level consumers. As a result, impacts on populations of collecting vary. Large mammals and birds in groups in which external morphology are of use to taxonomy can more feasibly be studied with photography than species of smaller or duller taxonomic groups or those in which dissection reveals key morphological characters. Some vertebrates apparently show parental care, suffer distress at the death of closely related individuals or partners, have more complex communication systems and have nervous systems broadly similar to our own, resulting in such organisms arguably having a stronger right to a life than less complex organisms. In light of both practical and ethical considerations, it is therefore not surprising that photographic-based descriptions have to date involved large vertebrates.

Although not strictly relevant to the taking of type specimens, the widespread desire among zoologists for a voucher of sequenced individuals in molecular and other research provides some interesting parallels with discussions over the nature of type specimens (e.g. Griffiths & Bates 2002; Winker *et al.* 2006). Notably, anthropologists studying molecular variation in *Homo sapiens* do not usually take fresh (collected) voucher specimens – with 'mawkishness' a likely factor, criminal law implications aside. However, many ornithologists and mammalogists continue to criticise studies involving blood samples from individual animals which are not collected (e.g. some contributors to Remsen *et al.* 2008). The contrast in mainstream approaches between human and non-human molecular studies appears based on a religious or quasi-religious perspective on the value of life (e.g. recognition of the unique 'soul' of humans). Multiple studies have provided evidence for the proposition that all animals share a common ancestor. Any taxonomic line above or below which collecting is permitted will always be arbitrary. However, it is clear that many deeper morphological and molecular divisions exist within the animal kingdom than generic levels within primates. It is better that taxonomists

be allowed to take appropriate judgements in relation to different studies, taking all the facts and circumstances into account. The Code should allow such flexibility.

(b) Field researchers as an example to others at a time of mass extinction:

Various of the recently-described mammal species mentioned by Dubois & Nemésio (2007) were discovered on exploratory field research projects in remote regions. Short-term economic rights seemingly over-ride the rights of animal and plant populations to subsist in the view of many politicians, corporates and rural populations. Many field research grants now require biologists to spend a certain amount of time engaging in community conservation education. Research biologists and taxonomists are therefore among those who are at the front line of educating local communities about their effects on the environment and encouraging environmental conservation.

Those who hunt or destroy primary habitat justify their actions with reference to their prey being relatively common or widespread and individuals dying anyway through other causes, there being lots of other habitat, their own personal perceived low impact in the greater scheme of things, the fact that others hunt or destroy habitat far more than they do or the low value of animal life: essentially all the same arguments trotted out by the museum community in favour of scientific collecting and dead voucher specimens. Researchers who have described species without killing their study piece have the moral authority to encourage conservation initiatives among communities which through hunting and habitat destruction threaten populations with extinction. The discrete taking of a single type specimen with a view to a description may be capable of being distinguished and justified compared with (at another extreme) public mass collecting of vertebrates for museum enrichment. However, researchers who seek to convince poor or hungry rural communities that scientific collecting is justified, whilst hunting or animal trade should be controlled or prohibited, are likely to be regarded as inconsistent.

(3) Collecting permits

I understand that the type for the bird *Laniarius liberatus* (Smith *et al.* 1991) was not collected among other reasons because the researchers had no collecting permit. At the time, their country of study was in civil war and the government had priorities other than the granting of collecting permits to researchers. Scientists should not be required by the dogma of others or stretched interpretations of the Code to take a specimen without the necessary permit, even in a lawless society. Most museums do not permit the accession of new specimens without permits.

(4) Extreme cases of threatened species

As Dubois & Nemésio (2007) rightly state, taxonomists are not a significant cause of extinctions. Indeed a good taxonomic basis is fundamental for conservation assessments and many leading conservationists are also leading taxonomists (and *vice versa*). Polarisation of the debate on type specimens into an issue of taxonomists *vs.* conservationists is unhelpful and confrontational.

Dubois & Nemésio (2007)'s assertion (based on Patterson 2002) that scientific collecting has never imperilled or caused the extinction of any species is not certain. In 1900, R. Beck collected 9 of 11 individuals he observed of a large bird species endemic to a small island off the Coast of Mexico: *Polyborus lutosus*. Although there may have been other causes for this extinction and the species was already very rare, no-one has reported this taxon in life subsequently. It is now considered extinct probably at least in part due to 'scientific' collecting (Loftin 1992; Fuller 2000). Collar (2000) discussed various other cases where collecting has been alleged to have contributed to bird extinctions or unduly to impact upon threatened populations. For example, the apparently extinct woodpecker *Campephilus principalis* was subject to local extinctions caused by collecting (Fitzpatrick *et al.* 2005), some of which was museum-related – and several hundred museum specimens of this species exist. The recent collection of individuals of the threatened bird species *Clyctotantes*

alixii in Colombia and *Grallaria ridgelyi* in Peru, each apparently for purposes of museum enrichment and record documentation, have been subject to heated debate among the ornithological community (e.g. American Bird Conservancy 2007¹).

Dubois & Nemésio (2007) note that if a newly discovered species is known from just one individual, it may be better to take a dead type specimen than risk taxonomists never having a voucher. The species would effectively already be extinct by this stage. Although this proposition is controversial (what if another individual is subsequently found?), a more difficult issue is presented by new species with tiny populations. For example, the bird species *Pterodroma magentae*, *Cyanoramphus cookii* and *Psittacula eques* were all known from less than five pairs globally in the last ten years but all still survive today, some in greater numbers; and the bird species *Petroica traversi* was reduced to a population of five individuals including only two females in 1980 but now has a wild population of 200–300 individuals (Butchart *et al.* 2006). In the descriptions of *Liocichla bugunorum* (known population: 3 pairs) and *Laniarius liberatus* (known population: 1 individual, one hopes there are more), the authors felt that conservation concerns were of sufficient import not to take a dead type specimen. In each case, a type specimen was designated and described in some detail, with published photographs and samples were deposited in reference collections. The extinction of a species is generally regarded as among the most heinous forms of environmental damage. Although a so-minded taxonomist may choose to collect a type specimen of an undescribed species of tiny population, the Code should not require taxonomists to be implicated in extinctions or increase the risk of an extinction occurring. The alternative suggestion of obtaining Commission approval for descriptions based on a live specimen could delay conservation action being taken. Commission cases typically take around 2 years to consider and sometimes longer.

Aspects of the Code that could helpfully be amended

Dubois & Nemésio (2007) portray themselves as victims of an ‘ethically correct tyranny’ (p. 16) in being required to suffer new taxon descriptions without dead vouchers. However, their proposed solution — that the Code should be amended so as generally not to allow descriptions based on vouchers other than dead specimens - involves imposition of their own ‘tyranny’. I contend that, for the reasons set out above, if there is to be any amendment, the Code should make it clear beyond doubt that type specimens can include properly documented and illustrated live individuals or, at very least, samples of live individuals so documented. The Code should allow flexibility and recognise the plurality of views among the public and scientific / taxonomic communities in relation to the nature of type specimens. Differences in procedures by different taxonomists should be due to different choices within what is allowed by a flexible but unambiguous Code, rather than different interpretations of the Code. In any event, the Code should not be amended with retroactive effect (as per some of Dubois & Nemésio’s possible proposed amendments) as to do so could invalidate recent mammal descriptions and result in nomenclatural instability.

As foreshadowed above, the Code does not deal as clearly as it could do with the status of an individual which is depicted but released when a sample is taken. Similar issues are raised in the context of descriptions based on dead specimens. Most bird specimens in museums are just a skin. The muscle tissue, brain, eyes, digestive and corollary systems and (more often than not) skeleton are often simply tossed away, often with a small tissue sample taken (e.g. Salaman *et al.* 2003). Article 72.5.1 states that a type is an animal or part of an animal; or when an illustration is used, the specimen or specimens illustrated. Where a sample is deposited, the sample (being a part of an animal) is the type. The Code would benefit from dealing in greater detail with a definition of “part of an animal”. For example, it could be made explicit that any body parts or samples that have been disposed of and cannot reasonably be traced should not be regarded as part of the type specimen.

1. Part of this debate revolved around certain factual inaccuracies in the reference cited.

The Code currently allows for the designation of a neotype where a type specimen has been lost and it is necessary to define the nominal taxon objectively (Article 75). The designation of a neotype is currently not recommended for a species whose identity is not in doubt and which is not involved in any complex zoological problem (Article 75.2, Example). Those amending the Code should consider whether recent species descriptions based on samples and/or illustrations could better be made subject to less stringent conditions for neotypification if a full specimen subsequently becomes available (e.g. Davenport *et al.* 2006). The Code could, for completeness, also deal with the possible situation where one of various samples forming part of the type specimen does not refer to the same individual as other samples (for example, due to an error or sample contamination).

Consideration is required of whether some *de minimis* sample of a type specimen should be required by the Code as quality control against fantastical or far-fetched descriptions. This is a point not strictly relevant to the fixation of words to specimens, but is an important policy issue. Although the provisions of the Code relating to 'hypothetical concepts' are relevant here, the traditional use of a dead voucher specimen necessarily involves close inspection and enables additional verification by third parties of the biological basis for a description. A requirement for a minimum of a blood or other sample from which molecular analysis could be conducted would enable at least the relations of a purported new taxon to be verified at the time of description or subsequently and would require close inspection in order for the sample to be extracted. Such an approach may cause difficulties for those describing certain marine organisms but would result in cryptozoological descriptions being invalid.

Materials other than dead specimens and illustrations should be considered in greater detail in a modern Code. Photographs, other illustrations, ecological data, biogeographical analysis, spectrograms and molecular analysis relevant to new species should be published in articles describing them where possible. Sound recordings, particularly if they are of a type specimen, should be deposited in publicly available sound archives. Molecular samples of a type specimen should where possible be deposited in reference tissue banks; and, if they are sequenced prior to a description, details of sequences should be published in publicly accessible databases. Pyle *et al.* (2008) showed how multiple data relating to a new taxon description can be made available in publicly accessible sources. It is probably only for historical reasons that the Code focuses on type specimens. Recommendation 73C could helpfully be expanded to cover documentation of other aspects of a new species' biology and characters.

The nub of the ambiguities and discussions concerning the meaning of the current Code concern Articles 16.4 and 72.10. Dubois & Nemésio (2007) have already proposed various possible amendments, depending on the preferred approach. Article 72.10 requires further re-consideration. The requirement for type specimens to be held '*in trust for science*' refers to an ownership or charity law concept not recognised in many countries. Many museums are not established as a charitable trust and declarations of trust are typically not made when specimens are deposited with a museum. On another interpretation, the trustworthiness of institutions or curators is not within the control of taxonomists. Article 72.10 is duplicative in practical effect to Recommendation 16C but uses different words. This reflects a generic shortcoming with the current draft of the Code, due to overlap of concepts and practical scope of Chapters 4 and 16. The wording of these and other overlapping Chapters could helpfully be converged where similar concepts are referred to, in order to reduce the risk of ambiguities arising. Simply, a type specimen, if it is or includes an animal, a part of an animal or a sample, should be deposited in a publicly accessible reference collection. Finally, Article 1.2 includes a non-exhaustive list of examples of matters falling within the scope of the Code. A reference here to names based on parts or samples of animals and names based on animals which are illustrated would amount to helpful clarification.

Acknowledgements

Four anonymous reviewers provided constructive comments; three anonymous reviewers provided comments on a similar manuscript that was submitted to another journal. I would like to thank and commend Alain Dubois, editor of the Theory and Methodology section of this journal and co-author of the paper to which this is a response, for administering an efficient and unbiased peer review process.

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