

Classical Natural History: the importance of volunteers in collection management and research

JELLE REUMER¹, KLAAS POST²

SUMMARY: *As a result of increasing budget constraints and decreasing interest in classical natural history, the work effort of volunteer researchers and the need for private funding are of growing importance. A brief historical background is provided, showing the decreasing interest in the subject shown by governments and university authorities. Here, we illustrate how to tackle this deplorable phenomenon with some examples from the Rotterdam Natural History Museum, notably in the curation of the collections, the organization of fieldwork, and the digitalization of the collections through databases and the internet.*

Key words: Biodiversity, Collections, Museum, Natural History, Rio Conference, Scientific Research, Volunteers.

RIASSUNTO: A causa dell'acuirsi dei problemi di budget e del calo di interesse nella storia naturale intesa in senso classico, assumono una importanza crescente sia lo sforzo svolto da ricercatori volontari che la ricerca di finanziamenti privati. Attraverso un breve excursus storico è possibile mostrare la progressiva diminuzione nell'interesse in queste problematiche da parte delle istituzioni governative e delle università. In questo lavoro illustriamo in che modo si può contrastare questo deplorabile fenomeno portando alcuni esempi dal Museo di Storia naturale di Rotterdam tra i quali sono particolarmente degni di interesse i casi relativi alla cura delle collezioni, all'organizzazione del lavoro sul campo e alla digitalizzazione delle collezioni attraverso database e internet.

Parole chiave: Biodiversità, Collezioni, Conferenza di Rio, Museo, Storia Naturale, Ricerca Scientifica, Volontari.

Introduction

The habits of collecting objects and performing research in natural history are as old as mankind. Knowledge of nature, its workings and its produce was essential for survival in hunter-gatherer societies, and a common understanding of the species encountered was normal. It is still important in several non-western populations. In classical times and after the introduction of writing, naturalists started to document their observations of nature and natural history. Aristotle (384-322 BC) and Pliny (23-79 AD) were among the first to publish their observations, and those of others (see Jahn, 2000). These early writers, philosophers and scientists made no use of modern scientific methodologies, such as deduction,

induction, trial-and-error, or falsification. As a result, accuracy was not guaranteed (leading, for example, to the description of mythical creatures), but on the whole they can be considered the founding fathers of biology and natural history.

During the Renaissance, natural history got a stimulus through the seafarers and discoverers, who not only discovered new territories, but the flora and fauna of these new lands at the same time. God's Creation proved to be much larger and more complex than what Europeans originally thought. This period, the 16th and 17th centuries, saw a proliferation of books and illustrations of objects from nature: plants, animals, aboriginal people, minerals and fossils. Accuracy was still not guaranteed, and thus descriptions of unicorns, mermaids and giants

1. Natural History Museum Rotterdam, P.O. Box 23452, 3001 KL Rotterdam, The Netherlands. E-mail: reumer@nmr.nl

2. Natural History Museum Rotterdam, P.O. Box 23452, 3001 KL Rotterdam, The Netherlands. E-mail: klaaspost@fishcon.nl



Fig. 1 - The oval room: one of the oldest parts of Teylers Museum in Haarlem, the country's oldest, still active, natural history museum.

Fig. 1 - La stanza ovale: una delle parti più antiche del Teylers Museum ad Haarlem, il più antico e ancora attivo museo di storia naturale olandese.

were still being published. The habit of forming collections started, and soon the first cabinets were founded, a phenomenon that bloomed during the 18th century (*The Enlightenment*). The Netherlands were no exception, and collections were abundant. Some of these still exist, either as remnants within other collections, or as separate institutions.

The first institution that we are now inclined to call a natural history museum was established in the Netherlands as early as 1784; it still exists today: the Teylers Museum in Haarlem (Fig. 1). It is unique in not being the result of a royal or noble collection such as the French Jardin des Plantes. Instead it was formed through a financial legacy left by a rich private person, Mr. Pieter Teyler van der Hulst, who earned his fortune in the cloth and silk business (Sliggers, 1996). Other institutions followed during the 19th century, sometimes focusing around a collection of living animals, sometimes as a separate natural history museum. The National Museum of Natural History (presently called NCBNaturalis after several mergers with the National Museum of Geology and Mineralogy, the Amsterdam Zoological Museum and the National Herbarium) was founded in 1820 (Holthuis, 1995). Its Belgian counterpart, the Royal Belgian Institute for Natural Sciences, was established in 1846 – after Belgium had separated and became independent from the Netherlands in 1831 (Vivé, Versailles, 1996).

Nowadays the Netherlands count a dozen important public natural history museums or

museums with a natural history department (in Leiden, The Hague, Haarlem, Rotterdam, Utrecht, Tilburg, Maastricht, Leeuwarden, Enschede, Nijmegen) and several dozen smaller ones. During the last two centuries, most of these museums were endowed with material from private collectors, who either donated their collections during their lifetime, or bequeathed the museums in their will. Private collections have thus been the 'condensation nucleus' for materials that finally are deposited in our museum collections (see, *e.g.*, Engel, 1986). Private activities are still important, not only in the assembly of collections, but also in curation and research. We will return to this subject.

The abandonment of classical research

If we try to reconstruct the history of proper natural history research, we observe a continuous line leading from Renaissance naturalists (such as Leonhard Fuchs, Conrad Gessner, Carolus Clusius), via 18th century's Carolus Linnaeus and George-Louis de Buffon, to early 19th century researchers like Georges Cuvier and Jean-Baptiste Lamarck, then to Victorian-age naturalists such as Charles Darwin, Charles Lyell, Joseph Hooker, and also Gregor Mendel, to 1900 *fin-de siècle* scientists like Hugo de Vries, to the founders of the New Synthesis (R.A. Fisher, J.B.S. Haldane, Sewall Wright, G.G. Simpson, Th. Dobzhansky, etc.), and finally to the discovery of the structure of DNA in 1953 by James Watson, Francis Crick and Rosalind Franklin. Here, classical natural history research met its unexpected and undesired Waterloo.

That year, 1953, marks the transition from 'classical' natural history research to 'modern' research such as genetics and genomics, molecular biology, and proteomics. In other words, as far as biological 'organisation levels' are concerned, the focus shifted from the population level and the organismal level to the cellular and sub-cellular and even molecular level. Thus, the last half century witnessed a steady and continuous decline in taxonomy, biogeography and other specimen-based research in the museum, in favour of substance-based research in the laboratory. This transition from specimen-based to substance-based research is reflected in the interest of funding agencies, whether gover-

nmental or non-governmental. We can conclude that the decline of classical natural history research started with the onset of molecular biology and molecular genetics from the 1950s onward. Funding agencies preferred to support research into questions about the molecular workings (the 'how' of biology), instead of questions about systematics and biogeography (the 'what' and 'where' of organisms).

The Rio conference

A potential turning point came in 1992, when the United Nations Conference on Environment and Development (UNCED) took place in Rio de Janeiro, Brazil, from 3 to 14 June 1992 (CBD, 1992). The representatives gathered in Rio formulated a number of objectives to be reached. These can be summarized as:

- 1 - National survey of floras and faunas
- 2 - Establishments of parks and reserves
- 3 - Protection of endangered species

It is immediately clear that the three biological disciplines that are needed for reaching results are taxonomy (corresponding to objective 1), biogeography (objectives 1 and 2) and ecology (objectives 2 and 3). These are exactly the disciplines of classical natural history research that witnessed a continuous decline for several decades. This provides us with an interesting but undesirable paradox, as the research that is needed for the implementation of the Rio objectives is in a state of permanent decline. So, the question to be answered is: how can these disciplines (taxonomy, biogeography, ecology) be restored to a workable level.

Reappraisal of the natural history museum

Taxonomy is a specimen-based science. Each taxon is described in a printed scientific publication according to the regulations of the Codes of Zoological and Botanical Nomenclature (ICZN, 1999; IAPT, 2006). For each taxon, a voucher specimen, the holotype, must be permanently stored in a public institution, either a museum, a herbarium, or a university institute. It must be accessible for scientific study upon request. These provisions give a scientific importance to natural history museums. But now we encounter our paradox. Taxonomical and biogeographical

research – specialities of natural history museums – are important for laying the foundations of biology, for implementing the objectives of the Rio meeting, but they are not valued by funding agencies: National Science Foundations, Academies of Science, various NGOs, and the many governments themselves.

The money funding biological research flows to areas where quick and easy profit is to be expected. It goes to biomedical research, genomics, proteomics, but not to taxonomy or biogeography, and only incidentally to ecological research, the latter preferably when having an agrobusiness value. Universities seem not interested.

Some examples from The Netherlands: Utrecht University closed its Institute for Zoological Taxonomy in the 1980s. It decided to close the world-famous Herbarium and the department of Plant Taxonomy in 2008. The herbarium was saved from oblivion by a quick action in Leiden, where the National Herbarium and (then) Naturalis provided space for the collections. The Zoological Museum of Utrecht University also closed in the 1980s; the collections were scattered and ended up in private collections and several other museums. The Rotterdam Natural History Museum could at that time acquire a fish collection from Utrecht, some of the fishes being pickled in 18th century jars which had great value. The University of Amsterdam will close its zoological facilities - including a research institute and a museum - in the years 2010-2011; the collections will be transferred to Leiden. At the same time, Leiden University decided to close its department of Animal Ecology in 2009; this will be effectuated in 2010.

There are some positive developments, fortunately. The minister of Education, Culture and Science decided in 2009 that (a) the National Museum of Natural History Naturalis, (b) the Amsterdam Zoological Museum (which was being closed by the university that owns it), and (c) the National Herbarium (with three branches: one in Leiden, the branch in Utrecht that was being closed, and a branch in Wageningen that is also on the brink of closure) will all merge into a new and national institute: the so-called Netherlands Centre for Biodiversity (NCB). This NCB will be based in Leiden. Substantial sums are allocated for storage, collection management and even collection-based research. So, there is



Fig. 2 - The Rotterdam Natural History Museum: the building was constructed in 1850 as the mansion of a wealthy family of ship-brokers.

Fig. 2 - Il Museo di Storia Naturale di Rotterdam: l'edificio è stato costruito nel 1850 come villa di una benestante famiglia di intermediatori navali.

hope. But even in the NCB much of the research will be done by volunteers: students, amateur biologists, and retired professionals.

Volunteers: the case of the Rotterdam museum

The Natural History Museum in Rotterdam (Fig. 2) has a paid staff of 20 (from the director to the wardens), in addition to which 23 volunteers work exclusively on the collections. The volunteers are overseen by two members of the staff: the curator and the registrator. They work in six departments: (1) Vertebrates, (2) Entomology, (3) Malacology, (4) other Invertebrates, (5) Botany, and (6) Mineralogy. There is no separate department of paleontology as the fossil representatives of certain groups are curated by the same volunteers as the recent taxa (e.g., the department of Vertebrates includes the collections of fossil mammals and birds). Members of each department have appointed one of the volunteers as their head; this *primus inter pares* reports directly to the curator and the director of the museum.

The volunteers are recruited from amateur scientists living in the greater Rotterdam region. They can either be trained biologists that are often working as schoolteachers, or amateur scientists trained in other professions but with a shown considerable skill in their respective field (malacology, entomology, etc.). Often they have a private collection. This might be a potential problem, as both professional museum ethics and the ICOM *Code of ethics for museums* (ICOM, 2006)

do not allow private collectors to be involved in museum practice. (The *Code of ethics* states the following in article 8.16 about private collecting: 'Members of the museum profession should not compete with their institution either in the acquisition of objects or in any personal collecting activity. An agreement between the museum professional and the governing body concerning any private collecting must be formulated and scrupulously followed.')

This evidently relates to the risks that conflict of interest might arise, in which case a collector/volunteer might put unacceptable prevalence on his (or her) private collection.

So far such problems have not occurred. In our case, we have made proper agreements with the volunteers. It has to be understood that their experience and their skills arise from their collecting and handling of specimens, often from a very young age onwards. Without this experience they would not be able to cope with the daily routine in a natural history museum, and thus be of no value to the museum. Therefore, the board of directors of the museum has decided that the most important factor in the mutual cooperation between the museum and the volunteers is trust. Of course the volunteers are screened by a committee before being admitted to the collections, and they must have a working experience, they must be trustworthy and preferably they have the ability to publish the results of their scientific or curatorial work in the form of (scientific or popular) articles. But the major factor in their relationship with the museum is trust. The museum trusts the volunteers, and they in return can profit from facilities offered by the museum, such as a working address, access to the library, postal and copying facilities, and a network of colleagues in the country and abroad.

The museum started a scientific journal in 1994 (Deinsea, ISSN 0923-9308; see http://www.nmr.nl/nmr/locale/select.do?scope=ui&localeid=en_GB) for publishing scientific results of the volunteers' work and the fixed staff's research alike. As a result of this policy some of the volunteers have an engagement with the museum of over twenty-five years and yet are still enthusiastic about their work. Volunteers helped prepare the museum's sperm whale skeleton that was beached in January 1995, during a 5-day defleshing operation on the beach



Fig. 3 - The Rotterdam sperm whale (*Physeter macrocephalus*) as seen from outside: mostly prepared by volunteers.

Fig. 3 - Il capodoglio di Rotterdam (Physeter macrocephalus) visto dall'esterno: per la maggior parte è stato preparato da volontari



Fig. 4 - Volunteers do preparations (obductions) of fresh museum specimens during the 2010 Museum Night: here visitors look at the projection of the obductions on a LED-screen set on the plaza in front of the museum.

Fig. 4 - Volontari preparano reperti museali freschi durante la Notte dei Musei 2010: qui i visitatori guardano la proiezione dell'operazione su un video a LED allestito sulla piazza di fronte al museo.

near The Hague (Fig. 3). Volunteers also help during public performances, such as broadcasted preparations during Rotterdam's yearly Museum Night, in March 2010 (Fig. 4).

The primary task of the volunteers is the proper management of the collections: preparation, conservation, labelling, administration. Scientific work is encouraged but no necessity. Most volunteers work an average of one day per week, some more often, others less often. This is an important labour input. We estimate the total working effort of these collaborators to be around four full-time

equivalents. In money, given the necessary (near) academic level of these people, this work effort would be the equivalent of 4 times € 50.000 = € 200.000 (0.2 M€) per year. With a total annual municipal subsidy of only € 780.000 (0.78 M€) euros, and a total turnover of around 1.3 to 1.4 M€ (excluding the volunteer work effort), this amounts to a considerable, if not accountable, contribution to the museum.

The case of the Peruvian fossils

A special case of volunteer effort is the collaboration between the Rotterdam museum and museums abroad, most notable of which is the joint paleontological project in Perú. Some years ago, a collaboration started between the Rotterdam museum and the Natural History Museum of the Universidad Nacional Mayor San Marcos in Lima, Perú. This collaboration started quite accidentally, when one of the Rotterdam volunteers (the second author of this paper, who specialises in fossil marine mammals) joined an international team visiting the Natural History Museum in Lima and made the contact out of interest in fossil cetaceans. Since, several visits of European vertebrate paleontologists to Lima took place, resulting in common fieldwork (Fig. 5) and the retrieval of important fossils for the Lima Museum, among which several taxa that



Fig. 5 - The international excavation team in the Peruvian desert at the place where a new species of sperm whale was discovered; the left (kneeling) figure is a volunteer from the Rotterdam museum and second author of this paper, Mr. K. Post.

Fig. 5 - Il gruppo di ricerche internazionale nel deserto del Perú sul luogo della scoperta di un nuovo capodoglio; la persona sulla sinistra (in ginocchio) è un volontario del museo di Rotterdam e secondo autore di questo articolo, il Sig. K. Post.

were new to science, and a paper in *Nature* (Lambert *et al.*, 2010b).

In 2009, the directors of the museums from Rotterdam and Lima signed an agreement, in which the museums express their wish to collaborate in paleontological fieldwork, in doing research and in making exhibitions with paleontological material. Perú is rich in fossil whales (Cetaceans) dating from the Eocene to the Pliocene (c.45-2.5 million years) that are largely unstudied. The costs of fieldwork, retrieval, preparation, study and storage of the fossils exceed the Lima museum's financial capabilities. Part of the programme is now made possible through generous support from a Rotterdam volunteer who owns a firm that acts as the *mecenas*. As the first result of this effort, several scientific publications were published (e.g., Lambert *et al.*, 2009, 2010a,b,c), in addition to articles for the interested general public (Reumer, 2009, 2010). An exhibition in Lima is planned for 2011, and some material is being shown in Rotterdam in 2010.

Specimens on the website (www.nmr.nl)

Finally, a few words are needed to describe the impact of volunteer work on the growing availability of the museum collection through the internet. Two of our voluntary curators are working for several years already on documenting, labelling, registering and photographing museum specimens: notably Mollusca and Insecta. Their effort equals on average one working day per person per week, thus around 0.4 full-time equivalent. As a result of their effort, our collection is largely present on the museums web-sites *nmr.nl* and *nmr-pics.nl*; the former being the searchable collection database, the latter being the storage of thumb-nail photographs of specimens (Fig. 6). Here again, the effort of volunteers is indispensable.

The results so far (situation of July 2010): we now have registered in our collection database (numbers refer to either single specimens such as a stuffed bird, or samples consisting of many specimens such as gastropods or bivalves): 3100 birds, 6500 fossil mammals, 2950 recent mammals, 1300 fishes, 57,000 mollusks, 1250 crustaceans, 53,800 insects, 450 chelicerata, 600 other invertebrates, 3500 mosses and 1950 vascular plants. This is a total of c. 130,000, i.e. about one third of the total collection.

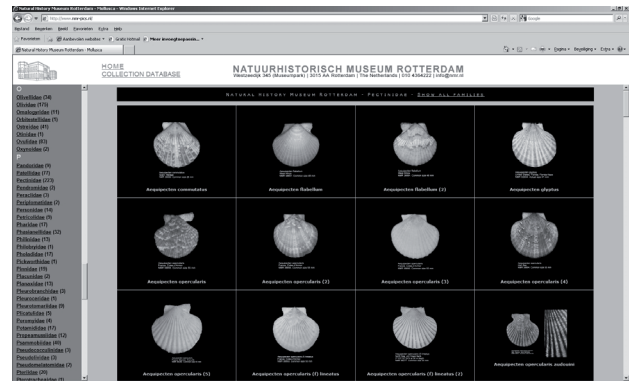


Fig. 6 - Volunteers prepare thumbnail photographs such as these ones for the museum's website; roughly 8000 taxa are thus made available (situation July 2010), a number that grows on a monthly basis.

Fig. 6 - I volontari preparano fotografie-anteprima come quelle qui mostrate per il sito web del museo; circa 8000 taxa sono resi disponibili in questo modo (situazione aggiornata al Luglio 2010), un numero che cresce di mese in mese.

Conclusion

We hope that we have been able to demonstrate a clear but unwanted paradox. While, on the one hand, there is an increasing need for knowledge about biodiversity (fauna, flora, biogeography, and trends therein), there is, on the other hand, a decreasing interest shown by governmental and university authorities and funding agencies to support academic research in these subjects. For that reason, the role of natural history museums, where the physical testimonies of the world's biodiversity are being stored, becomes more and more important. Also, because the large budget constraints seen in museums, the role of volunteers is increasing in importance. It is a necessity that (managers of) natural history museums take more effort in promoting their institutions' importance for research and society, and that they stimulate the work done by volunteers.

References

- BIANUCCI G., POST K., LAMBERT O., 2008. Beaked whale mysteries revealed by seafloor fossils trawled off South Africa. *S. Afr. J. Sci.*, 104: 140-142.
- CBD, 1992. Convention on Biological Diversity. <http://www.cbd.int/doc/handbook/cbd-hb-01-en.pdf> (Visiting year: 2010).

- ENGEL H., 1986. Hendrik Engel's Alphabetical List of Dutch Zoological Cabinets and Menageries. Rodopi b.v. (Amsterdam), 340 pp.
- HOLTHUIS L.B., 1995. 1820 - 1958 Rijksmuseum van Natuurlijke Historie. Nationaal Natuurhistorisch Museum (Leiden), 172 pp. (in Dutch)
- IAPT (International Association for Plant Taxonomy). 2006. International Code of Botanical Nomenclature (Vienna Code). <http://www.bgbm.org/iapt/nomenclature/code/> (Visiting year: 2010).
- ICZN (International Commission on Zoological Nomenclature). 1999. International Code of Zoological Nomenclature. <http://iczn.org/> (Visiting year: 2010).
- ICOM (International Council of Museums). 2006. ICOM code of ethics for museums. http://icom.museum/code2006_eng.pdf (Visiting year: 2010).
- JAHN I. (ed), 2000. Geschichte der Biologie: Theorien, Methoden, Institutionen, Kurzbio-graphien. Spektrum Akademischer Verls GmbH, Heidelberg, Berlin, 1088 pp.
- LAMBERT O., BIANUCCI G., POST K., 2009. A new beaked whale (Odontoceti, Ziphiidae) from the Middle Miocene of Peru. *J. Vert. Pal.*, 29: 910-922.
- LAMBERT O., BIANUCCI G., POST K., 2010a. Tusk-bearing beaked whales from the Miocene of Peru: sexual dimorphism in fossil ziphiids? *J. Mamm.*, 91: 19-26.
- LAMBERT O., BIANUCCI G., POST K., DE MUIZON C., SALAS-GISMONDI R., URBINA M., REUMER J., 2010b. The giant bite of a new raptorial sperm whale from the Miocene of Peru. *Nature*, 266: 105-108.
- LAMBERT O., BIANUCCI G., POST K., DE MUIZON C., SALAS-GISMONDI R., URBINA M., REUMER J., 2010b. Corrigendum. *Nature*, 266: 1134.
- REUMER J. 2009. Walvissen in de woestijn. *NWT (Natuurwetenschap en Techniek)*, 77: 62-66. (in Dutch)
- REUMER J., 2010. Monster is boven water. *NWT (Natuurwetenschap en Techniek)*, 78: 36-41. (in Dutch)
- SLIGGERS B.C. (ed.), 1996. Hoogtepunten uit Teylers museum: geschiedenis, collecties en gebouwen ('Highlights from Teylers Museum: history, collections and premises'). Teylers Museum (Haarlem), 100 pp. (in Dutch)
- VIVÉ A., VERSAILLES A., 1996. De Musée à l'Insti-

tut: 150 ans de sciences naturelles. Institut Royal des Sciences Naturelles de Belgique, Brussels, 112 pp.

Riassunto

Nonostante la generale presa di coscienza della necessità di conoscere e conservare la biodiversità sul nostro pianeta, le principali linee di ricerca finanziate da enti governativi e dalle università vertono su temi di diverso ordine. La storia naturale intesa in senso classico ha formato e ancora forma la base delle moderne conoscenze biologiche ed ecologiche e la maggior parte dei fatti biologici che ne costituiscono le fondamenta è rappresentata da reperti prevalentemente conservati in musei di storia naturale. Eppure, l'enorme sviluppo di linee di ricerca diverse (biologia molecolare, ingegneria genetica etc.) ha messo in secondo piano lo studio naturalistico classico. D'altro canto, sia grazie alla Conferenza di Rio che grazie ad azioni specifiche di organismi sopranazionali, è ampiamente riconosciuto il fatto che la biodiversità mondiale rappresenta un patrimonio di eccezionale importanza per l'umanità, patrimonio che va conosciuto e preservato.

Il paradosso che queste osservazioni mettono in luce è di difficile soluzione data la generale scarsa disponibilità di finanziamenti per la ricerca scientifica. Tuttavia, è possibile venire a capo del problema attraverso un *modus operandi* nel quale ricercatori professionisti, strutture scientifiche e volontari ben preparati possono cooperare. Il Museo di Storia Naturale di Rotterdam, ad esempio, ha dato il via ad un vasto progetto di cooperazione tra volontari e ricercatori professionisti in cui i primi partecipano attivamente alla cura delle collezioni, allo studio dei reperti e alla loro digitalizzazione e i secondi supervisionano il loro lavoro. I volontari devono mostrare affidabilità, continuità e devono essere preparati sul piano scientifico e tecnico per eseguire lavori di elevato profilo scientifico. Inoltre, essi devono conformare il loro comportamento ad un codice etico che ne garantisca la piena affidabilità.

Normalmente, i volontari lavorano al museo alcune ore a settimana per lunghi periodi di tempo (anni). In questo modo essi possono totalizzare un gran numero di ore di lavoro che rappresentano un enorme risparmio economico per il museo (dell'ordine dei 200.000 Euro all'an-

no). In questo modo, attraverso il lavoro integrato di ricercatori professionisti e volontari il Museo di Storia Naturale di Rotterdam è stato in grado di tenere in ordine le collezioni, portare avanti le procedure di digitalizzazione, catalogazione e schedatura e lo studio scientifico di reperti significativi.

I volontari, inoltre, si sono dimostrati un elemento-chiave nella progettazione e realizzazione di progetti scientifici di grande respiro come le spedizioni di ricerca che il Museo di Storia Naturale di Rotterdam ha portato avanti nel corso degli ultimi anni e che hanno portato a scoperte paleontologiche di grande importanza pubblicate in alcune delle più prestigiose riviste scientifiche del mondo.

E' auspicabile che questa cooperazione tra volontari e ricercatori professionisti possa svilupparsi ancora di più nel prossimo futuro allo scopo di ovviare a problemi di finanziamento dello studio della storia naturale intesa in senso classico e per consentire un accesso più partecipato alla ricerca scientifica da parte di un numero sempre maggiore di persone.

How to cite this paper:

Reumer J., Post K., 2010. Classical Natural History: the importance of volunteers in collection management and reseach. In Bisconti M., Roselli A., Borzatti de Loewenstern A. (eds.), Climatic change, Biodiversity, Evolution: Natural History Museum and Scientific Research. Proceedings of the meeting. Quad. Mus. St. Nat. Livorno, 23: 23-29.