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A moving experience: The redevelopment of the University Museum of Zoology, Cambridge

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Abstract

A plan to redevelop the University Museum of Zoology, Cambridge (UMZC) and the David Attenborough Building in which it is housed began to take shape in 2010. Beginning in June 2013, three million specimens housed in five storerooms and a gallery had to be safely moved to newly-designed stores with limited time, money, and staffing levels. Advocacy amongst key partners played a crucial role in maximising resources, and an ambitious plan to recruit collection volunteers was developed. Teaching and researcher access had to be maintained throughout the redevelopment.

This paper serves as an introduction to the first half of the project, from 2010 up until early 2015, which covers collections-related aspects of the planning, initial packing and moving phase. Larkin (2016a,b) discusses methods used to pack and move the largest gallery specimens.

Keywords: Natural History, Collections, Advocacy, Volunteers, Packing, Conservation, David Attenborough Building

Introduction

The University Museum of Zoology, Cambridge (UMZC) was founded in 1865 (Willis and Clark, 1886) and can trace its origins to the Harwood Collection of Comparative Anatomy (1814) and the Cambridge Philosophical Society collections (1819). Built on the former site of the University Botanic Gardens (Parker, 2006), the collections were housed in an overcrowded Victorian gallery (Figure 1) until a major redevelopment of the site in the late 1960s (Calder, 2008), reopening in 1971 in the Arup tower (now renamed The David Attenborough Building).

With over three million zoological specimens housed in five storerooms and a public gallery, the collections

are accessible for undergraduate teaching, research, and public engagement. Over 100 researchers from around the world use the collections every year for research across the disciplines.

In 2010, the Museum was presented with an ambitious vision to redevelop the Arup Building to take advantage of the departure of the adjacent Material Sciences Department, bringing together university academics and a consortium of biodiversity conservation organisations and practitioners housed in the Cambridge Conservation Initiative (CCI).

The project planners initially considered a six-month period to pack and relocate the collections with



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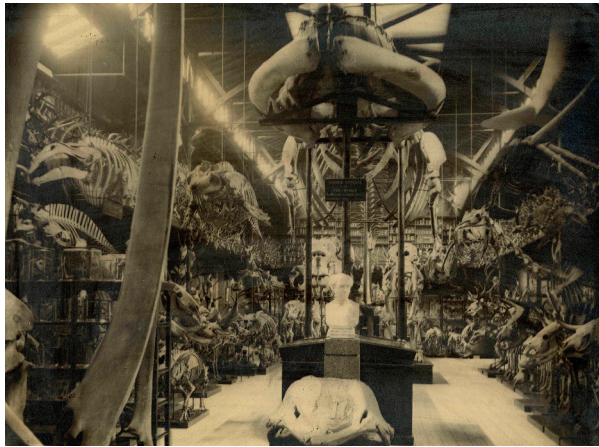


Figure 1. The museum gallery, circa 1896, showing the need for increased storage capacity. Image: UMZC.

existing staff levels but by early 2013, just months before the Museum was due to close, had reassessed the situation after both external and internal consultation. The building design itself, as discussed in the Methods section, changed to reflect the results of this consultation. The Museum closed in June 2013 with the aim to pack the collections within 14 months. An added - but much welcome - complication that altered plans was the awarding of a Heritage Lottery Fund (HLF) grant in early 2014, by which time much of the initial planning and packing phase had already occurred.

The requirement to continue teaching during the collections move was a particular challenge, as we simply could not run a reduced service. Specimens required for teaching were isolated at the very start of the move, and for four years teaching itself was relocated to the nearby Austin Building. Practical sessions had to be set up by the collections staff as normal, and specimens tracked for subsequent sessions.

Similarly, research access had to be maintained. Researchers were encouraged to use nearby collections if the nature of their enquiry did not require a unique UMZC specimen, but not refused access. Collections access was only temporarily denied in the weeks before and during the physical move itself. However, word of the Museum redevelopment appears to have temporarily depressed researcher access requests.

Finally, but not discussed in this paper, hanging outside the Museum's entrance was a 21-metre fin whale (*Balaenoptera physalus* (Linnaeus, 1758)) which, in order to provide café space, had to be dismantled

from its external podium and relocated to a new purpose-built entrance foyer.

Methods

Advocacy and external consultation

The tentative six-month estimate to pack and relocate the collection made by the project planners (including external contractors and University of Cambridge employees) was a first attempt to gauge the scale of the problem. When decision-makers are not fully informed as to the challenging nature of such collections, advocacy is crucial (Viscardi, 2013). Although not natural historians themselves, many of the architects, builders, and project planners were enthralled by the collections and, through a programme of tours, greater understanding was gained. Once introduced to iconic specimens such as the dodo (*Raphus cucullatus* (Linnaeus, 1758); UMZC. 415.K) and our fin whale (UMZC.C.13), the delicate nature of the collections and the importance of their care were made clear. Above all, the unique problems associated with moving a museum collection and the timescales required were repeatedly emphasised.

The University had already contacted a freelance conservator, Nigel Larkin, to report on the feasibility of moving the fin whale skeleton. Based on this, and

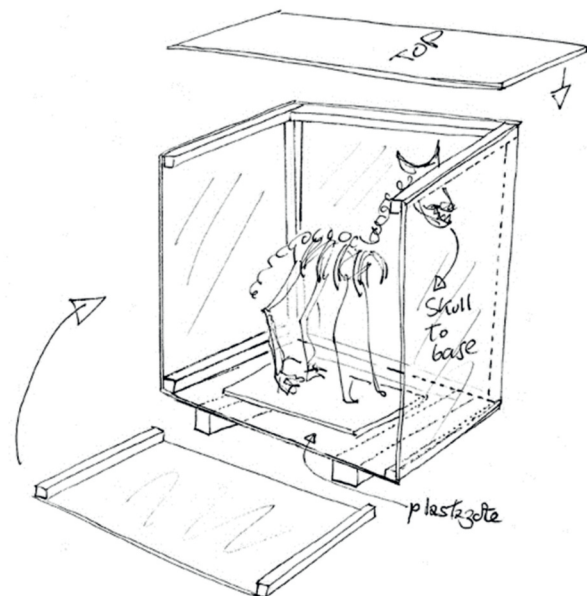


Figure 2. Sketches with the Packing and Moving Report, even if they were not eventually used, provided a useful guide for planning. Image: N. Larkin.

wishing for an independent opinion, Mr. Larkin was further commissioned to produce a detailed time and motion study coupled with an estimate of material usage and associated cost.

The resulting Packing and Moving Report laid out clear person/hour timescales that all parties understood. Packing techniques were suggested with materials fully costed and summarised (Figures 2 and 3). Through this, both the Museum and project planners more thoroughly understood the challenges faced, and a more realistic timescale of 14 months and an adequate budget for materials and staffing was provided.

Additionally, the report altered the very design of the building and the approach to packing and moving the collections. The original plan to move the collections offsite proved more costly than altering the building and project schedule. Thus, it was decided to divide the Arup Building redevelopment into two phases by first creating new stores in parts of the building unoccupied by the Museum, whilst the

collections were packed in the old stores and gallery (Phase One). After completion of Phase One, which was to take 14-months, there was to be a 14-week period to move the collections from the old to the new stores. With the collections safely moved, the Museum gallery and old stores would be handed over to the building contractors for Phase Two and completion.

The report provided a framework (although as the dynamics of the project changed, it was altered) that allowed a project Gantt chart to be created and implemented by the Project and Collections Managers, giving the collections team and volunteers clear aims and objectives.

Bulk purchasing

An additional benefit of the Packing and Moving Report was increased confidence in the estimated volume of materials required. Discussions with conservation equipment suppliers were made from a position of strength when negotiating bulk discounts.

Section/specimens		Internal depth cm	Time to pack (hrs)
Man's ancestry			
primate skulls and mandibles	1 x Euro small 1 x Euro small Tissue & plastazote	22 13.9	1
Rodents			
Townsend's ground squirrel, northern palm squirrel, least chipmunk, Californian ground squirrel, grey squirrel, harvest mouse with upright straw. Greater Egyptian gerboa, hazel dormouse, Mongolian 5-toed gerboa, Ord's kangaroo rat, meadow jumping mouse, field vole, European water vole, Norway lemming, wood rat, striped hamster, pygmy gerbil, wood mouse or long tailed field mouse, brown common or Norway rat, black house or ship rat, grey hamster, short tailed pouched rat, lead pipe, Mongolian Tsaganomys sp and gnawed wood.	2 x Euro small Tissue & plastazote dividers etc	22	1.5
Red giant flying squirrel, red squirrel on branch, crested rat on branch, scaly-tailed flying squirrel	Euro large1 Tissue & Plastazote dividers etc	30	1
Primates			
Potto, Aye aye on branch, Spot-nosed guenon, Slender Loris, Black-eared marmoset	1 x Large euro	20	1.5
Diana Monkey, Humboldts woolly monkey, Martins Guenon, Bushbaby	Wooden crate 75x50 x 55		3
Ruffed lemur, ring tailed lemur, Chimpanzee, Spectral tarsier	1 x Large euro	40	1
Abyssinian colobus x 2, Proboscis monkey	Wooden crate 120 x 90 x 55		5
Giant lemur skull: Lay down in a crate with its plinth	1 x small euro	22	-5

Figure 3. A snapshot of one of many tables from the Packing and Moving Report, detailing the number and dimensions of crates required and the estimated time taken to pack. Image: N. Larkin.

For example, the cost of acid-free paper sheets was reduced from £24 per 500 sheet pack to £16 per pack, providing 100 packs were ordered at a time. Similar discount rates were agreed for Tyvek and acid-free paper rolls.

The biggest cost saving involved 1500 Eurocrates, detailed in Mr. Larkin's report and ordered together (but delivered in batches). In contrast, had small batches (50 – 100 units) been ordered at a time, the cost would have been £10,000 higher.

Bulk ordering also resulted in additional savings in terms of staff time spent processing orders. Large bulk orders took less processing time than multiple small orders and supplies were not lacking when needed, resulting in less interruption when packing specimens.

Volunteer training

The University Museum of Zoology did not have a substantial record of volunteering before the redevelopment began, with most volunteers being University students or people otherwise affiliated with the Department of Zoology. An ambitious plan was put in place in the spring of 2013, with the help of University of Cambridge Museums Conservators and Volunteer Coordinators, to recruit over 30 volunteers in three batches and train them in 2-4-day packing sessions. Targets for the number of volunteer hours had also been set by HLF.

Once the Museum's general volunteer documentation (Agreements, Induction Forms, and Expression of Interest) was brought up to date, role descriptions were created and advertised in local volunteer forums, Friends groups, and the University website. The training days were advertised in advance and it was made clear that attendance was compulsory. Applications were shortlisted and, with the aim of training 12-15 people in each batch, up to 20 people at a time were invited to the Museum for a taster session.

As soon as the Museum closed in June 2013, the first potential recruits were invited in. Each taster session involved a behind-the-scenes tour of the Museum and an informal presentation as to the nature of the project and the challenges faced. At the end of the session, the applicants were told to reconsider their interest and get in touch if they were still interested in pursuing their application further. This allowed people to retreat honourably if they felt that the project was not as they expected, and also provided

Museum staff with the opportunity to meet the applicants without any firm commitments being made.

15 people out of those who reconfirmed after the first taster session were selected to attend two two-day training sessions, held a week apart. The potential volunteers were briefly trained in basic handling skills, pest identification, conservation materials, and the risks associated with zoological collections. Manual handling training was provided by the University's training office.

Perhaps the most important skill gained involved packing techniques and box-making. Second-hand shop crockery was presented to the trainees with the instructions to build a box and to pack the object with the materials provided (Figure 4). Upon completion, the boxes were dropped (often enthusiastically) down a staircase, after which boxes were exchanged and anonymous group critique of the results was exchanged.



Figure 4. Packing sacrificial crockery on our first volunteer training session. Image: UMZC.

By the end of the first training session, all 15 volunteers were deemed adequately trained and a rota began, which consisted of morning and afternoon sessions on Tuesdays to Thursdays.

Another two rounds of recruitment and training sessions were held and, between June 2013 and December 2014, over 800 hours of volunteer time were given. It is important to note, however, that the volunteers required constant supervision and projects needed to be planned in advance, taking up considerable time for the Conservators and Collection Manager. Such time commitments should be factored into any future packing and moving project plans.

Packing up the gallery

The gallery drawers containing large mammal osteological specimens were considered an entry-level starting point for our new volunteers. Drawers were laid out on large desks within the gallery, alongside benches of clearly labelled packing supplies. Each drawer contained a list of specimens printed from the database, which the volunteers audited before they began packing. Any discrepancies were reported, corrected on the database if appropriate, and signed off. A photograph of the contents prior to packing was included in the finished drawer.

Drawers were lined with either Plastazote or Jiffy foam, and specimens packed within drawers using a combination of acid-free tissue puffs and Plastazote straps pinned together with toothpicks (Figure 5).

One time-saving method we discovered was to ask our departmental receptionist to make tissue puffs during quiet moments. We estimate that, for the packing of the spirit collections alone, our receptionist made somewhere in the region of 25-30,000 puffs. Boxes of acid-free paper and instructions were also made available to the

department with requests for help. Pre-made supplies such as these meant less interruption when working on the specimens themselves.

Whilst drawers from the gallery (and eventually stores) were packed by volunteers, the Museum staff focused on the more complex display specimens. Larger mounted specimens, for example our African elephant (*Loxodonta africana* (Blumenbach, 1797); UMZC. H.4451), giant sloth (*Megatherium americanum* Cuvier, 1796; UMZC.E.261), and giraffe (*Giraffa camelopardalis* (Linnaeus, 1758); UMZC.H.20381) were partially dismantled by Mr. Larkin, who first removed and separately packed the limbs and skulls. The vertebral columns, ribcages, and armatures were wrapped in situ on their plinths and placed in large wheeled crates (Larkin, 2016a). Similar crates were made for our orangutan (*Pongo pygmaeus* (Linnaeus, 1760); UMZC.E.7107.H) (Larkin, 2016b) and large model bird diorama. Being too large to remove from the gallery, these crates were sealed and left in the Museum during the building works (Figure 6).

Similarly, the Museum has five whale skeletons hanging in the gallery (excluding the fin whale) 10 meters above the floor. As discussed in Larkin (2016a),



Figure 5. A before-and-after image of a tapir (*Tapirus indicus* Desmarest, 1819; UMZC.H.7323) packed by our volunteer team. Image: UMZC.



Figure 6. The Museum upon handover to Phase Two. Note the whales wrapped and hanging from the ceiling and the larger specimens on wheeled, sealed crates. Image: UMZC.

it was considered an unacceptable health and safety risk to totally dismantle and remove these skeletons at such a height, and thus only the skulls and limbs were removed. The skeletons were then wrapped with layers of acid-free paper, bubble-wrap, and Tyvek, and remained hanging in-situ in the gallery during the building works (Figure 6).

The remaining 5,000 display specimens were packed by staff and volunteers upon completion of the drawer packing. Eurocrates and Really Useful Boxes were used for most of the smaller specimens. For specimens being removed that were too large for Eurocrates, bespoke frames made with lengths of 50mm x 50mm planed all round (PAR) wood and a solid wooden base were made easily and quickly in-house. Our volunteers then took the completed frames and clad them with corrugated plastic (Corex) using screws and washers. The Corex crates were significantly lighter than equivalent solid wooden crates whilst remaining strong enough to protect the specimens (Figure 7).

The mounted bird taxidermy, both in the gallery and bird room, had small magnets fitted to their wooden bases and were packed into Eurocrates with steel sheet inserts, in the same fashion as the Norwich Castle Museum redevelopment (Irwin, 2002). This allowed for the specimens to be moved, even tilted, without falling over or the need to use potentially damaging packing techniques.

Alongside the Spirit Specimen crates (see following section), the contents of all gallery boxes were

recorded on an Excel spreadsheet and were barcoded using a Wasp barcode scanner and software. The hand scanner could then be used to search through the

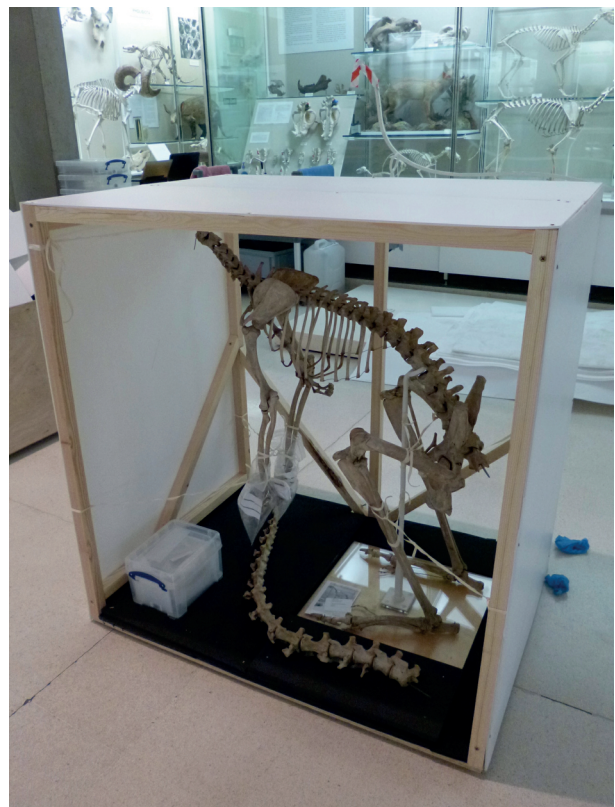


Figure 7. A wooden framed Corex box containing a partially dismantled red kangaroo skeleton (*Macropus rufus* Desmarest, 1822; UMZC.A12. 21/1), with the tail and skull removed and the main body tied down. Image: UMZC.

substantial Excel spreadsheets generated, allowing for quick auditing in temporary store areas after the collections had been moved. A battery-powered wireless printer also proved invaluable for generating barcodes and labels on the move and within the stores.

Packing the Spirit Store

Whilst the Vertebrate, Bird, Mollusc and Insect Stores were to be moved to their permanent new locations after Phase One, both the Spirit Store and gallery specimens had to be found temporary locations during Phase Two. The gallery specimens were given a temporary home near the new Museum stores in a space not required until project completion. The Spirit Store, due to fire safety, had to be refurbished but remained in the same location. During the refurbishment, however, the spirit specimens themselves had to be temporarily relocated.

With fragile glass jars, hazardous chemicals, and heavy loads, spirit collections have their own particular challenges with regards to transportation (Clark et al., 1994). We had to pack and move 20,000 jars of alcohol and formalin-preserved specimens out of the store, down a flight of stairs (ramps were demolished and lifts were decommissioned during Phase One) and across a building site car park into a purpose-built temporary spirit store located in the nearby Austin Building.

Members of the Collections team placed jars of similar height from each of the 70 bays within the Spirit Store into Plastazote-lined Eurocrates on trolleys. As discussed in Simmons (2014), a spirit collections move is an opportune time to conduct a conservation audit, and specimens assessed as requiring attention were separated to be packed together. Each Eurocrate had a blank label stuck to the side, on which the specimen catalogue numbers were written as the crates were filled. The jars within the crates were wheeled into the Museum gallery, where there was ample space for volunteers to pack them using the pre-made tissue puffs (Figure 8). All staff and volunteers were briefed with risk assessments associated with spirit specimen collections, and appropriate PPE in the form of gloves, lab coats, safety goggles, and masks was provided. Spill kits were made available in case of breakage.

Any lids considered loose, sharp, or in danger of leaking were wrapped with Parafilm, a plastic paraffin film, which acted as a temporary sealant, and the

completed crates were stacked and stored in a row. At the end of each day, the Collections Manager photographed the handwritten labels detailing the contents, typed up the data into an Excel spreadsheet, and generated a unique barcode label for each box. This allowed the Museum to quickly audit all 650 crates once placed in the temporary store, and therefore keep track of all 20,000 specimens throughout the redevelopment. This was critical for researcher/student access and for reviewing specimens for potential redisplay.



Figure 8. Packed spirit specimen crates. It took over 650 crates to pack the whole store. Image: UMZC.

The transportation of all the crates, some weighing over 30kg, was hazardous but manageable. The contractors constructed a wooden pulley and ramp system, allowing us to winch each crate individually down the staircase to waiting trolleys with pneumatic tires outside the Museum. Trolleys were then taken across the car park site to the nearby Austin Building for storage. As the temporary storage area had a floor loading limit, each crate was individually weighed, and the weight clearly labelled on the outside of the box. This ensured that we did not exceed the weight limit of the room during storage, and evenly distributed the load.

All 14 tonnes of the spirit collections were therefore moved in late spring/summer of 2014 during good weather conditions, over a four-month period, well before the end of Phase One (Figure 9).

Packing the Mollusc, Vertebrate, Insect, and Bird Rooms

Most taxidermy, mounted skeletons, and other specimens/items not within drawers were packed into Eurocrates or bespoke boxes in the same fashion as the display specimens already described. Mounted taxidermy heads were either relocated to the Austin Building or wrapped in plastic by the volunteers and



Figure 9. Conservator Natalie Jones pushing one of the hundreds of trolley loads of volunteer-packed spirit specimens towards the temporary store. Image: N. Jones

stored alongside the gallery specimens. The remaining specimens were housed in 2,600 drawers, most of which did not need any further packaging, having been adequately packed for many years. The exceptions were highlighted and given further protection by the volunteers.

The Insect Room was unique, in that there was no plan to change the drawers or cabinets (which would have been too time consuming and costly), and in having to move twice. The original Insect Store was on the fourth floor of the Arup Building, and the collection was destined to be rehoused alongside the new stores. However, the old collections space was within the area to be handed over to the contractors at the beginning of Phase One. The insect collection therefore had to be moved early in the project into the gallery, where it remained for some months until the new Insect Room was complete at the end of Phase One.

The move itself

The Museum had its collections packed and ready for moving by the middle of October 2014 and, soon after, a passageway was created from the old Museum Bird Room into the new stores. A 14-week period was scheduled to move the collections, which included the Christmas period.

The staff were split into teams, and each team given a specific store or zone within a store. The volunteering rota was reduced, as there was a risk of having too many teams of people with trolleys blocking up corridors. The new stores were vacuumed, mopped, dusted and dry-cleaned as thoroughly as possible before specimens were transferred.

At the very beginning of the project, it was initially intended that the cabinets from the old stores would be reused in the new stores, along with their old wooden drawers. With HLF funding and the necessity to use the space more efficiently, it was decided that new metal roller-racking with metal drawers should be installed in the new stores. However, to move the collections within the 14-week window, we had to temporarily use the old wooden drawers. These were housed in the new roller racks until after the move, when we had the time to carefully transfer and organise the collections into the metal drawers.

During the stores design phase in January 2014, over 2,600 drawers had their dimensions recorded. Over-packed drawers were noted so that expansion space could be incorporated into the new stores in the required places. With the height requirements of the drawers known, as some teams transferred collections from old to new stores, other teams were in the new stores accurately installing drawer brackets in relevant bays to receive the incoming collections without a delay.

Other methods used to improve efficiency included the modification of a to-be-disposed cabinet in the Mollusc Store, which was strengthened and fitted with wheels. This allowed all 900 drawers in the old Mollusc Store to be moved the 100 metres and transferred to the pre-set brackets safely within three days.

One downside of the transfer was that the eclectic mix of drawer and cabinet sizes in the Vertebrate Store meant the order of the collections had to be disturbed when transferring to the standardised cabinets of the new store, resulting in a further project post-redevelopment.

By the middle of December 2014, the majority of the collections had been moved, with the remaining time available to move furniture and equipment, and to ensure the safety of the larger specimens left in the gallery. Perhaps the most difficult part of the transfer was the ethical disposal of the Museum's old cabinets,

especially from the Bird Room. Offers to museums regionally and nationwide had limited success (few had the space for such large cabinets), but eventually an antiques dealer was found, who took the cabinets for use in a showroom. No cabinets of monetary or historical value were sent to landfill. The mid-January 2015 deadline to move the collections was achieved with a day to spare (Figure 6), enough time to plan a celebration for all in the near-empty Museum gallery.

Discussion

The collections team faced an enormous challenge to achieve a safe collections move within the timeframe, but did so thanks to a time and motion study being laid out at the beginning of the project, the resources required being made clear, and an ambitious volunteer programme that provided the people needed when we needed them most.

But achieving the collections move would have been only a partial victory had it occurred without taking advantage of the situation itself. Packing the collections in their entirety creates a much better working knowledge of the collections, for the Collections Manager especially, resulting in lost specimens being relocated and even a few surprises turning up (such as a preserved thylacine stomach in a box! (Sleightholme and Campbell, 2017)).

Perhaps the greatest improvement the Museum has made as a result of the redevelopment has been a cultural change. The desire to improve our collections care and to train staff and volunteers in professional packing methods meant we could justify the employment of conservation staff on the team for the first time. This has fundamentally altered how staff care for and work with the collections. Having a conservator on-hand to advise, guide, and monitor the move and the stores, gallery, and labs has been crucial.

We took advantage of the packing (and unpacking) phase by conducting audits and conservation surveys. Although time was limited to act upon the results of this, the information generated will inform our future collections care and conservation plan. The realisation of the conservation needs of the collections, coupled with a better understanding of how a conservator role fits into the Museum, has prompted a staff restructure that caused a temporary role to be made permanent post-redevelopment.

The successful volunteering programme initiated at the Museum has continued, with half a dozen of the

first cohort of volunteers still routinely working alongside staff four years later. In fact, the Museum has not had been required to recruit new collections volunteers since March 2014, such is their dedication to the project. The volunteering programme has also attracted interest from a number of nearby museums who are also going through a collections move, and for which UMZC has been keen to provide advice.

Measuring the volume of the collections prior to the move was a necessity, but also a good opportunity to make efficient use of the new space provided, and it demonstrated the need for increased storage capacity as we move forward. This has proven prescient, as no sooner than we began moving the spirit collections back into their refurbished store, the Museum was offered a substantial donation of Lake Malawi fishes, which we simply would not have been able to acquire had we not advocated for increased storage capacity in the form of roller-racking in a previously statically-shelved storeroom. However, the rush to move the collections within the 14-week period has resulted in a certain amount of disorder in the stores, particularly the Vertebrate Store, which will require significant time to rectify. This was unfortunate, and an argument was made for more time for the moving phase, but with multiple-stake holders awaiting the beginning of Phase Two, there was no room in the schedule. The 14-week move schedule also meant we had limited opportunity to isolate and freeze the entire collections before they moved into their new locations. The most vulnerable specimens were prioritised for freezing, and some specimens were double-wrapped to be frozen later.

Working within a building site also came with significant challenges, which could easily be the subject of a further series of papers. Constant vigilance to combat the risk to collections through leaks caused by burst pipes, the use of hoses to remove dirt in floors above the Museum, and rainwater finding its way through temporary roofs slowed the project and sapped the energy of the Collections team. Over the packing period, some 62 leaks as well as other disruptive incidents (such as dust pouring into the gallery space, alarm malfunctions, and power cuts) all took their toll; thankfully, the collections came through the move relatively unscathed due to the excellent packing techniques employed by our staff and volunteers, a well-stocked and constantly restocked disaster kit, and the quick responses of the Museum team and University Security, who were always willing to conduct out-of-hours patrols.

The opportunity to share the experience of the collections move via Facebook, Twitter (@ZoologyMuseum), conferences, and local news raised the Museum's profile and encouraged us to engage more with the Zoology Department, University, and the wider museum world, culminating in hosting the 2017 conference and AGM of the Natural Sciences Collections Association (NatSCA). Indeed, one of the local news journalists covering the Museum's project was impressed enough that she has volunteered for the past three years, not only helping with the collections but also providing sound media advice.

Lastly, and as realised by countless museum professionals the world over, a move of this kind is one of the most stressful and challenging periods of one's career. It is of crucial importance for the team to pull together, to look out for one another, and celebrate as many successes as possible. A collections move of this kind is not done every day, or indeed every decade, and each one is unique – in each case, there is a lot to learn along the way, and the Author is confident that other museums have alternate and equally ingenious solutions to their particular collections move.

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