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The new zoology storage at Manchester Museum : an opportunity for a new curatorial strategy.

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Recently Manchester Museum has completed a new store for the non-Avian Vertebrata collection and has created a new Invertebrata Resource Centre. The vertebrate collections have been rehoused but the massive task of rehousing the non-entomological invertebrate collections is still in progress; it is hoped to have all the material safely into the new store by summer 1989, and a ten year programme has started to re-curate the major collections to the highest standard possible within the constraints of available finance and curatorial time. This paper outlines the problems which gave rise to the need for the new storage, how the storage was planned and executed and also gives details of the curatorial strategy which is being implemented for the large Mollusca collection.

The new storage

The problem

At Manchester Museum until recently most of the zoology collections other than birds and insects were stored on the galleries, either on display or in drawers below the display cases. These mahogany drawers were large, very heavy, often too deep, difficult to work with in situ or to transport elsewhere, and a major security headache; all in all they could be said to fall well short of modern standards for the storage of museum specimens. Space was already at a premium when I arrived in Manchester in 1968 and recently acquired material had to be stored as and where one could. At the worst point prior to the completion of the new resource centre, the mollusc collection, for example, was stored at seven different sites around the Museum.

The computer helps out

During the years 1978-1984 when I managed large Manpower Services Commission (MSC) funded teams cataloguing the Museum's collections (Pettitt, 1981), I had the label information of the entire molluscan collection entered into a database on the University mainframe computer (7). Although the information on many of the labels, and therefore in the database, is far from perfect, the database has already proved a boon, enabling me in response to enquiries, to find material that otherwise would have remained buried. For example, recently I received a request for sinistral *Cepaea*; I knew of one lot in the Stratton collection but a computer search indicated two more lots existed. Armed with the computer listing, all three lots, which happened to be housed on three different floors of the Museum, were located within thirty minutes. Thus during this period the computer database compensated in some measure for the overcrowded, piecemeal storage conditions. Computer databases were compiled also for the Acari, Bryozoa and Arachnida collections; input sheets have been prepared for the Foraminifera but not yet entered into the computer.

The crises

The displacement of material by the redevelopment of the bird gallery in 1980-81 produced the first crisis. Fortunately other changes at the Museum allowed the old botany gallery to be allocated for zoology storage, albeit only using the old display cases with similar drawers to those on the bird and invertebrate galleries. Some of the molluscs were brought down from the public gallery but there was insufficient storage for the whole collection, and even that part which was rehoused often had to be stored in two or three layers within a drawer. A second crisis occurred in 1985 with the start of the mammal gallery redevelopment, which displaced the remaining bone collection and also some large mammal mounts. At this point it became imperative that something radical was done to safeguard the long-term security and availability of the zoology collections at risk. Fig 1 gives an idea of conditions in the store at their worst.

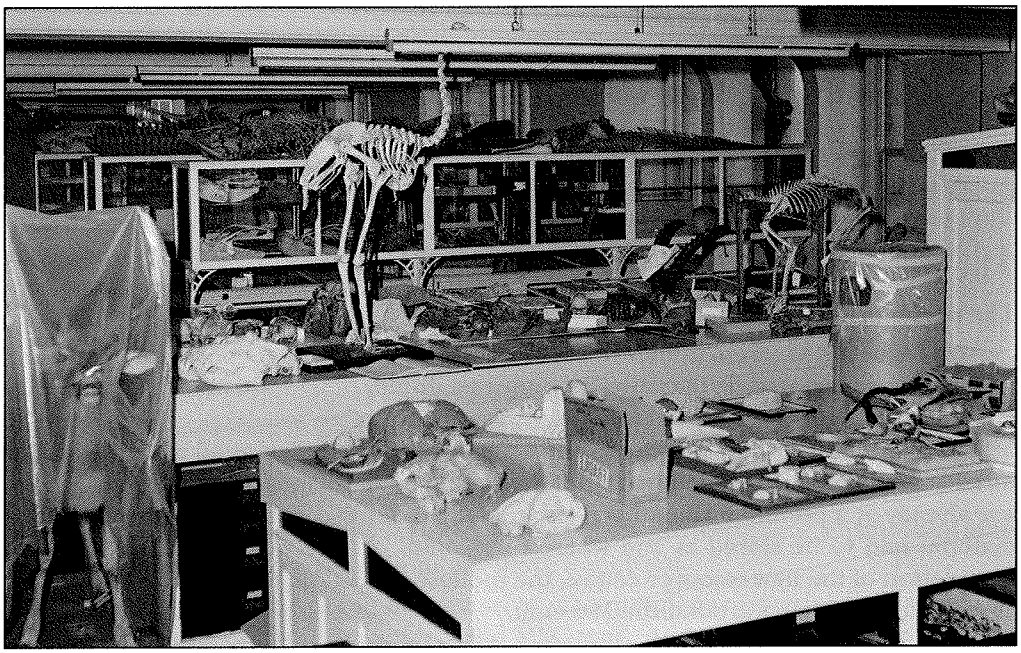

Fig 1. A view of the storage area before modernisation.

The solution

As luck would have it the Greater Manchester Archaeological Unit, which had for some years occupied an area of the museum annex, was given new accommodation elsewhere on the campus and the Museum Director reallocated the space thus released for additional zoology storage. At the same time, in view of the pressing need, he earmarked the Museum's annual capital budget for the University financial year from August 1987 for the new storage project; we were also fortunate in obtaining a grant of £4,500 from the Museums and Galleries Commission towards the work. Thus at last adequate storage for the collections could be provided; the total cost of the new bone store and the Resource Centre was £35,000.

The vertebrate material

The bird skins, mounts and eggs were already well housed in the museum annex, so it was decided to move the rest of the vertebrate material to the annex also. The new store is immediately adjacent to the conservation laboratories and since, on the whole, more conservation work tends to be needed on the vertebrate specimens than on invertebrate material, this move made sense.

Although a substantial sum had been made available, the budget was still tight and so a minimum was done to the new bone store: a flooring paint was applied to the cement floor, to reduce dust; the existing electrical fittings were retained, with some re-siting; and new double doors fitted across the end of the access corridor to improve security and environmental control. Dr Hounsome decided to use standard steel office storage cabinets, 1m wide, 0.5m deep and 1.8m high, to house the smaller specimens, and he was able conveniently to fit 36 cabinets into the available space. These have proved a most satisfactory and - with bulk purchase - a most economical solution for the efficient storage of bulky, dry vertebrate specimens.

The invertebrate material

The removal of the vertebrate material from the old botany gallery initially left an area of 8m by 20m for the storage of the non-entomological invertebrates. At the same time the run-down of the computer cataloguing unit made it appropriate for me to move my office nearer to the collections in my charge. At first I was going to return to my old office, off the mammal gallery and on the floor below the new store. However, a further grant of £10,000 from Book Club Associates allowed us to establish an audio-visual theatre in my old office; it is currently showing a 14 minute slide presentation on 'The World of Nature', as an introduction to the natural history galleries.

It was therefore decided that the old botany gallery should be converted into an *en suite* store, workroom, office and library; thus was the Invertebrate Resource Centre born, the aim of which is to bring together all the Museum's dry collections of invertebrates into adequate storage for the first time. Unfortunately, because of fire regulations, the wet, or 'spirit', collections still have to be housed in the Museum annex next door. The new Centre can accommodate the resident Keeper plus at least three visiting workers; the working space will be invaluable during the planned redisplay of the invertebrate gallery. Because of the added pressure on space caused by these improved facilities, it was decided that the main storage would have to be in the form of a compact storage unit; the final floor plan is shown in fig 2.

The logistics of the building operations were not simple, as all the material already moved to the old botany gallery had temporarily to be rehoused to leave a completely clear space for a new floor to be laid after the existing display cabinets had been removed. However, this had the advantage that all the material could be sealed against the inevitable dust caused by building works. 'Colour Matching' fluorescent tubes were specified for the overhead lighting in the store and working area (5), since when working with molluscan shells, in particular, colour is very important for discrimination and identification.

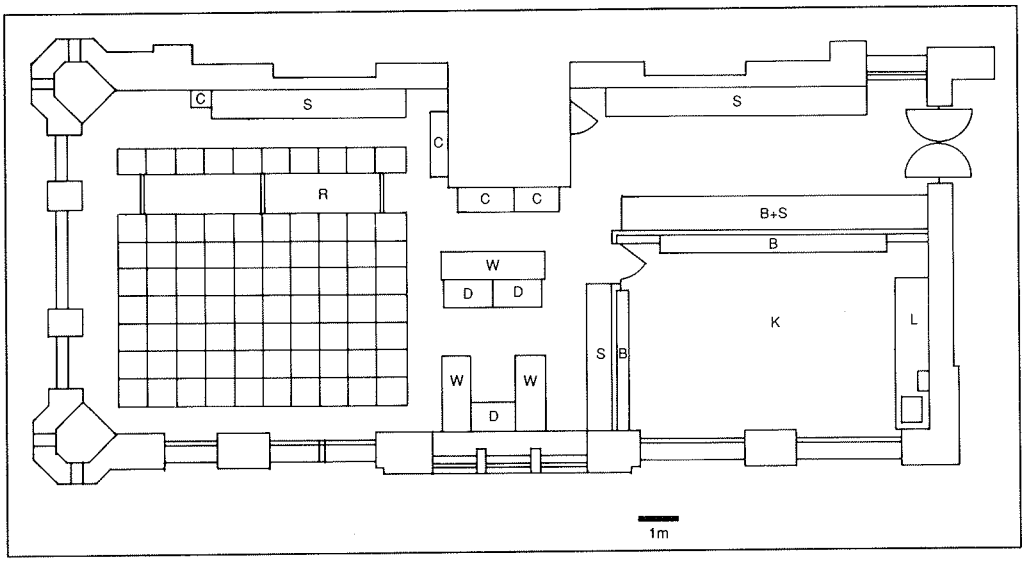

Fig 2. Sketch Plan of new Invertebrata Resource Centre at Manchester Museum. Key: B = bookcases; C = separate cabinets; D = desks for visiting workers; K = Keeper's office; L = laboratory bench; R = rolling compact storage unit; S = other storage; W = workbenches 1m high, with storage under.

The compact storage unit

It was decided that a compact storage unit, consisting of one fixed and four mobile sections, should comprise the main storage; the fixed section, and the outer mobile, are single sided, and the other three are double sided (fig 2). The sections are 6.8m long and 2m high, and each usable side has 10 vertical stacks holding a maximum of 21 drawers, giving a capacity of 8 x 10 x 21 = 1600 drawers. Only 1200 drawers have been purchased in the first instance, however, as larger specimens have to be accommodated by leaving out the drawer above, and also some of the space is being used to store small cabinets. The drawer runners are presently fixed at 9.0cm centres but can be adjusted at 4.5cm centres if required. The unit was supplied and erected by BEL Industries (now part of the APEX Group) (1), general views of the new store are shown in figs 3 and 4. The whole area, apart from the Keeper's office which is carpeted, has been laid with resilient vinyl flooring (6) and this flooring is continued under the compact storage unit, the tracks of which have been set flush to allow trolley access without jolting the specimens.

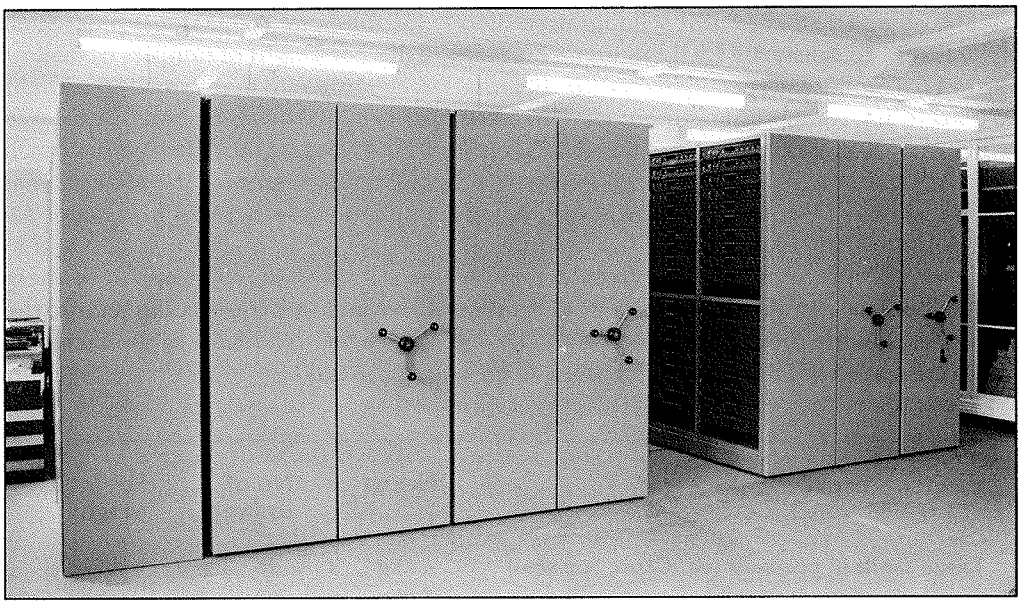

Fig 3. The new compact storage unit.

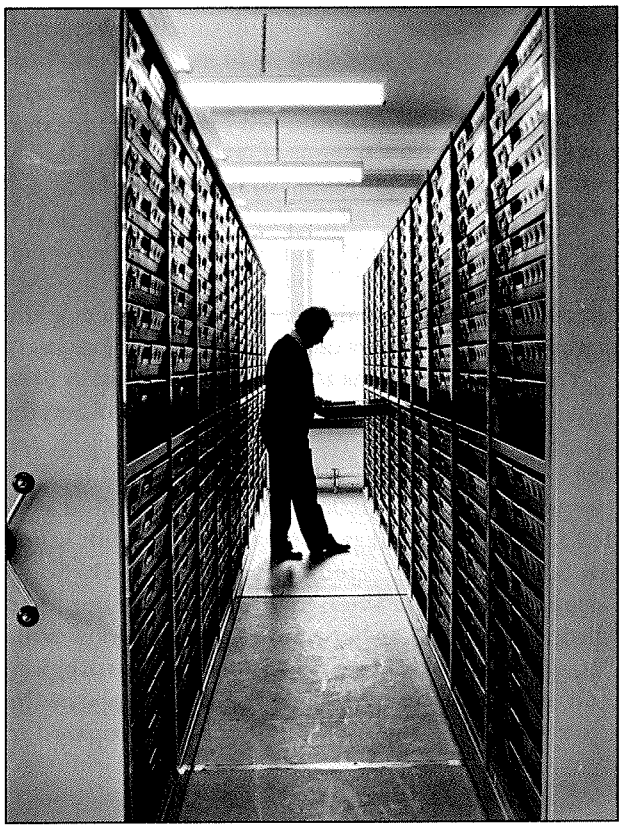

Fig 4. The new compact storage unit in use.

The compact storage unit is being used mainly for the large (60,000 lots plus) shell collection. To satisfy the Civil Engineer, I measured the net weight of samples of various drawers of molluscan specimens of differing natures, eg some with many small specimens in glass tubes, some with medium sized material mainly in glass topped boxes and some with just a few large and heavy specimens (Table 1). I then assessed the proportion of each of these drawer types in the collection to arrive at a total net weight for the collection as a whole; adding the tare weight of the compact storage unit gave a point loading of 4.0 Kilonewtons (Kn) on each wheel of the unit. It was sobering to realise that one had to move nearly 4 tons of molluscs from the old to the new storage! The result of these calculations caused the Civil Engineer to insist on additional steel joists being set into the floor beneath the three rails; one day was allowed for this but the quality of the Victorian concrete was so good that it took a week to complete the task!

Contents of drawer	Net wt		No of drawers		Subtotal weight
Large shells in polybags (eg. *Cassis, Strombus*)	4.2kg	x	25	=	105kg
Small metal glass-topped boxes	4.2kg	x	40	=	168kg
Small shells in card glass-topped boxes	3.5Kg	x	500	=	1750kg
Small to medium shells, in glass-topped pill-boxes and in glass tubes stacked in card trays	2.3kg	x	875	=	2012kg
Estimated total weight of collection				=	ca. 4000kg

Table 1. Mean net weights of the contents of 0.6m x 0.6m drawers of molluscan shells, inclusive of their immediate containers, the estimated number of each type in the Manchester Museum collection and the total net weight of the collection.

The unit was delivered in prefabricated parts and erection took less than a week; the external cladding is sheet steel covered with sage green coloured 'Plastisol', giving a pleasant, 'leatherette', appearance. The moving sections roll smoothly and with little effort, even when full, and the unit can be fastened and locked in the closed position for security. The 60cm x 60cm drawers are made of high density polyethylene, which our Keeper of Conservation has declared both chemically inert, and stable for at least 20 years. They are formed over a rectangular lip-frame of 8.0mm diameter polished steel rod and have cut-outs in the plastic to provide a front pull, together with side lifting handles for safe carrying when full; a label holder is riveted to the front (fig 5). Some 'bellying' of the plastic floor of the drawer takes place when loaded; on the other hand their cheapness and low weight are distinct advantages when compared to drawers made of more conventional materials. The weight factor was critical with our installation; wooden or chipboard drawers could well have pushed the total weight above the maximum floor loading of 4.8 Kn. per wheel that the Civil Engineer was prepared to tolerate, even with the steel joists.

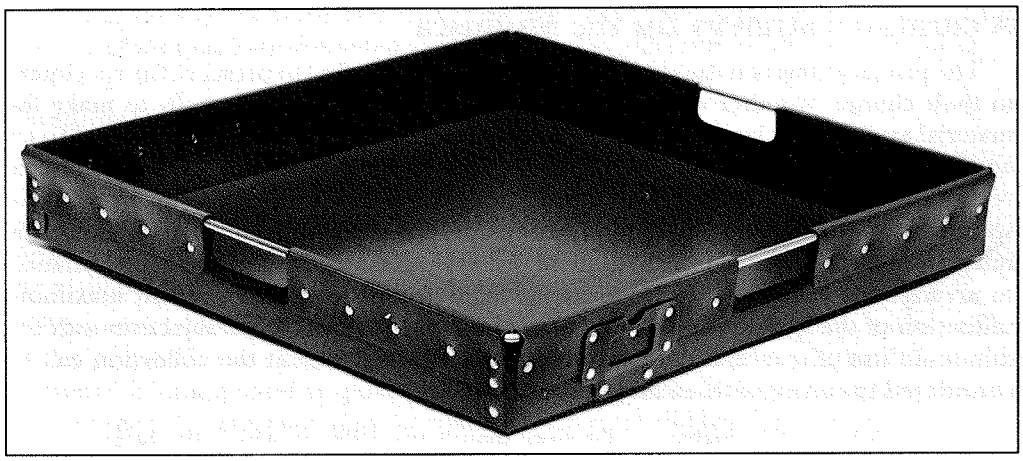

Fig 5. One of the plastic drawers from the compact unit, showing method of construction.

Dust proofing of the mobile store was not thought to be practicable, so we have concentrated on the reduction of the ingress of dust, or dust prevention; the measures adopted can be considered as nested to a depth of three. First, it is hoped progressively to install secondary glazing to the external windows of the store, to reduce ingress of dust (and of pests) into the general storage area. At the same time, as far as possible, all cracks and crevices have been sealed and the general environment designed to minimise the generation, or harbouring, of dust. Next, all the gaps between the enamelled steel panels forming the top of the unit have been sealed with an electrical insulation tape, which should have a life of 10-20 years (2). A rubber-based moulding (3) is fitted to the front edges of the sections so that when closed the gaps between the sections are sealed; again, the design life of the material is a minimum of 20 years. APEX Ltd. can supply a lockable tambour roller shutter fitted to each vertical bay, which would have given even better dust prevention and added security. Unfortunately these shutters were too expensive for our budget, although they can be fitted retrospectively if required. Finally, inside the unit all the specimens will be kept in either boxes with lids, glass tubes plugged with cotton wool (8), or in resealable polythene bags.

The Halkyard Foraminifera, the Waters Bryozoa, the Britten Acari and the Mackie/ Freston Arachnida collections are already adequately housed in suitable cabinets, which have now been sited conveniently within the new resource centre. The other groups, such as the corals, echinoderms, and arthropods will be accommodated in new storage converted from pre-existing old botany gallery wall cases which have been left in position and also in some good cabinets freed as the large shell collection is recurated as explained below. Measures are also in hand to improve the dust prevention characteristics of these wall cases and of those freestanding cabinets which will remain in use. Some smaller cabinets - such as the Jelly Bryozoa slide cases - have been installed within the fixed section of the new compact storage unit.

A curatorial strategy for the Mollusca

The primary aims of natural history curators should be first to preserve the specimens in their charge, together with any associated information, and secondly to make the material available for legitimate use, when this does not conflict with the first aim. To try and achieve these aims, a curatorial strategy has been planned for the major task of recurating the shell collection, with the following objectives: to minimise the handling of specimens (both now and during any future expansion of the collection), to maintain the integrity of any associated information, to preserve all material evidence of provenance, to arrange for specimens to be located readily when needed, to permit maximum utilisation of the specimen information, and, finally, to reach these objectives with the minimum use of scarce, finite curatorial resources. At present the collection can be considered to consist of three main parts:

1. **The 'old' or 'Darbishire' collection**; mainly pre-1930, of which the large bequest from RD Darbishire forms the basis.
2. **The 'special collections'**; a number of disparate collections, principally distinguished by being from restricted geographical locations; examples are the Haddon (Torres Straights), Hadfield (Lifu), and Townsend (Persian Gulf) collections, and other unnamed ones such as the 'Falklands', or the 'Tierra del Fuego', collections.
3. **Some general collections**; mostly acquired post-1945, which are still stored in their original cabinets, or which, because of the pressure on space, are either stacked in the boxes in which they arrived at the museum, or else have had to be packed inaccessibly several layers deep within some of the original storage drawers.

I have decided to incorporate the vast majority of this material into one series, arranged according to the currently accepted taxonomy. The only exceptions will be type material, already housed separately in a secure cabinet, and, for the time being, the Townsend collection, which appears still to have considerable potential for further research. The superfamily will be the main division used.

Curatorial strategy: phase one

The 'old' collection is currently being rehoused in the compact storage unit, superfamily by superfamily. Since the old collection is arranged largely according to the taxonomy of Theile (1937), several of the present groupings are having to be split between two or more of the modern superfamilies; the nomenclature on the existing labels is often out of date, which complicates the task of reassignment. Fortunately, however, with the aid of some of the MSC funded staff, I had previously compiled a computerised data dictionary of generic level molluscan names. From this I have prepared an alphabetical listing of genera and subgenera, together with their current superfamily assignment and an indication whether the name is current or a synonym. This dictionary of genera has already saved many hours of curatorial time; it is constantly being updated as new names or changes in the position or validity of existing names, come to my notice.

I am leaving the same number of drawers empty at the end of each superfamily as are occupied by specimens from the old collection, on the assumption that the proportion of material in each superfamily will be similar in the remaining smaller collections to the proportion present in the old collection. One extra block of empty drawers is being left

halfway along and one at the end of each section of the compact store, to reduce the the amount of reorganisation needed as, hopefully, the collection continues to expand.

Curatorial strategy: phase two

Once all the old material is rehoused, then work will begin on incorporating the remaining collections one by one; the initial objective is just to assemble all the specimens of a given superfamily together into one place, without any attempt at this stage to order the material within the superfamily. For this work both the data dictionary of genera, and the main database of molluscan specimen information, will be pressed into service.

When the database of label information was compiled by the MSC team, each sample, or 'lot', of shells was assigned a running serial catalogue number; each of these 'lot numbers' is unique and is quite unrelated to any previous accession or registration numbers already associated with the specimens. A small slip bearing this lot number was included with every sample; during the cataloguing these slips helped to prevent mistakes such as lots - or even whole drawers - being missed, or catalogued twice. In the five years since, the collection has been moved around and new material has been acquired, so now the slips are invaluable for confirming what has, and what has not, been computer catalogued. During the years I have been using the database to help trace material, I have found that when hunting through a drawer it is the lot number which is most easily recognised; it is much easier to spot than the often semi-legible names on the original labels. Unfortunately these lot number slips were printed on a dot matrix printer with a fabric ribbon and the ink used is proving light fugitive. However, provided care is taken not to leave the samples in strong sunlight - not good curatorial practice anyway - the numbers should remain legible until new, more permanent, labels are produced under phase 3 of the strategy (see below). Throughout the remainder of the paper I will use the term 'lot' to indicate a sample of one or more specimens from a single field collection event, stored in one container; one computer entry was generated for each lot. For each collection in turn the relevant entries will be retrieved from the database so that various sorted listings and indexes can be formed from them, to assist the curation.

Using the dictionary of genera, a three figure 'biocode' will be added to each entry, where this has not already been done; this biocode identifies the superfamily to which the specimen is now allocated. The biocodes used at Manchester are identical to those prepared and used in the natural history departments of the National Museums of Scotland and I am grateful to David Heppell of the NMS for providing the codes and giving advice on their application (Heppell, 1989). The importance here of the biocode is that it allows the entries to be sorted and listed in taxonomic order and working from the sorted listing all the material of a given superfamily can quickly be picked from the various drawers of the small collection being dealt with, and moved en bloc to its correct place in the new storage. Trials have shown that this method is far quicker than working through the small collection specimen by specimen; it also reduces the amount of handling the specimens receive during this operation, lessening the risk of damage. Also the overall utility of the database will be increased as the biocoding is completed, section by section, making future searches more efficient.

As each smaller collection is broken up in this way, all the specimens will have an extra label added recording its source collection. These labels are being produced in house by word processing the collection name repetitively to fill a master A4 sheet, and then reproducing this xerographically using archival quality A4 paper (4). Recently HMSO,

at our request, has examined the problem of producing archival quality documents and labels using word processors and they have recommended the above method. Best results are achieved using a daisywheel printer for the master sheet but a reasonable dot-matrix printer (particularly a 24-pin one) used in 'NLQ' mode, gives acceptable results. By using a photocopier with reduction facilities, it is possible to make the print smaller than the usual 11-12 point typeface produced by most printers. I rejected this idea because the resultant small labels were not only more difficult (and time consuming) to manipulate but also became hidden more easily by the specimens.

Curatorial strategy: phase three

Once all the small collections have been incorporated, then phase 3 will begin, with each superfamily being dealt with as a unit. Once more the entries covering the block of material will be extracted from the database and globally edited to add the biocode where it is still missing. Then, again with the aid of specially prepared listings and indexes, the entries will receive a locality code if this is missing. Adding a hierarchical locality code in this way allows the information to be indexed, sorted, or retrieved, efficiently by locality. Coding is a great deal more economical of curatorial time than laboriously editing the full locality field to concord the information, and also the coding approach maintains the integrity of the original information, which I consider should be sacrosanct; for further discussion of the philosophy and application of sort/search codes to museum databases, see Pettitt (1989).

At this stage it is intended to subdivide any superfamily that contains a large number of lots, to simplify future usage of the collection. Thus for some large superfamilies the formal groupings could be at the level of family, subfamily or even of a single genus. In the chitons, scaphopods and cephalopods, which are more sparsely represented in the dry collection than the other classes, suitable taxonomic levels above superfamily will be used, again with the objective of providing 'pigeon-holes' that contain a useful but not excessive, amount of material. Initially 500 lots will be used as the 'break point', although this may be reduced in the light of experience. When a superfamily is subdivided, the relevant biocodes will also be extended in the database, to reflect the subdivision. Finally, each of the resulting grouping of lots will be rearranged into lot number order within its drawers, rather than in the more usual alphabetical-under-taxon order. A fresh, distinct, archival quality label giving the lot number and the biocode will be computer produced and added to each lot as it is sorted, replacing the present, fading, lot number slips. Using an arbitrary numerical order means that fresh lots are just added at the end of the series within the relevant grouping, thus avoiding unnecessary handling of the existing material shuffling everything around to make room for the latest additions.

As should be clear by now, our molluscan collection is an amalgam of material from many sources and not unnaturally individual lots are held in a wide variety of containers, such as open card or folded paper trays, card, wooden or metal glass topped boxes, glass tubes, pill boxes (with or without glass tops), and, for the larger specimens, resealable polythene bags. This heterogeneous assemblage of containers has to be lived with for two reasons:

1. The time and money needed to change a collection of this size over to a standard set of containers is just not available and even if these resources were available I believe they could be more usefully employed on researching the specimens to enhance their scientific and historical value.

2. While any original labels are always preserved, in many cases some of the provenance of the specimens resides in the precise type of container used, and/or in the handwriting or format of the information written directly on a container; in some cases even the colour or quality of the cotton wool used is characteristic of a particular collector. Should the destruction of an original container become necessary, for example because of pest infestation or water damage, then all written information on the container is captured by photocopying, and added to the information stored with the specimens, together with a full description of the container.

To bring some order to the present chaos, a supply of 4.5cm deep card trays has been obtained, in a modular range of sizes to fit the new storage drawers. These trays will be used to hold the variety of smaller containers and allow them to be organised into columns within the drawers.To minimise any waste of space, sometimes more than one layer of very small containers, such as pill boxes or glass tubes, will be allowed in a tray if they form a numerical sequence but then a tray label will be added giving the range of numbers held in the tray, to aid picking and refiling. Some of the oldest material was still held in open containers, and these specimens are being secured within resealable polythene bags.

The normal method of retrieval at Manchester is to obtain a computer list of the required material, which takes only a few minutes and then to pick the lots from the drawers using this list. As was mentioned earlier, I have already found it far quicker to hunt for a number than to scan the variety of original labels for the taxon, which is often only semi-legible; having the lots arranged in regular rows in numerical sequence should make picking even quicker. Perhaps an even more important advantage is the ease with which lots can later be slotted back into their correct place. It is probably a reflection on my ability, but I tended to have some difficulty in locating the correct place when replacing returned loans in the alphbetically arranged 'old' collection. Refiling lots is a tedious task and it has a tendency to get left while more important (ie less boring) things are done; since the numerical system makes the job easier and quicker perhaps it will get done sooner, thus reducing the time that the specimens are at risk lying around out of protective storage.

Finally, every lot will have a label showing the biocode as well as the lot number and since the biocodes run sequentially through the collection, finding the correct place for a lot is simple, even for non specialist helpers, who may have little or no knowledge of the phylogenetic sequence of superfamilies, etc, and who are unfamiliar with latinized taxonomic names.

The numerical arrangement is not as easy to browse as the alphabetical-by-taxon arrangement, a disadvantage for casual visitors, but as no grouping will contain more than 500 lots, browsing would not be completely impossible. However, visitors who give notice will be encouraged, before coming to Manchester, to use computer produced listings to identify the specimens they wish to see; then when they arrive the material will already be laid out, enabling them to start work immediately and so allow them to make the best use of their - usually limited - time.

The computer listing also serves as a checklist of the material provided to a visitor; most visitors are totally trustworthy but the knowledge that the list is available and will be used to check the material at the end of the visit, may help to discourage the occasional less ethical person from attempting to 'liberate' a rare specimen or two.

Curatorial strategy: phase four

This is where the work finally becomes intellectually stimulating, for at last it will be feasible to make a full revision of a group, bringing the nomenclature up to date, and, where necessary, enhancing the database entries with additional information gleaned by the research. However, to maintain the integrity of the original information present with the specimen, that information will remain in the database unchanged and any new information, such as a revised taxon, enhanced locality, or other 'research event', will be indicated as such, for the benefit of future workers, particularly those consulting the database at a distance from the collection. Because I want to bring the whole collection up to the highest possible level as quickly as possible, a deadline will be set for each group when it enters phase 4; any problems which are still unsolved when the deadline is reached will be left for the time being and the next grouping moved to phase four. However, the remaining problem entries will be flagged in the database and also copied over to an 'inquirenda' database, so that work can continue on them as the opportunity presents. It may be, for example, that advantage can be taken later of a visit to another museum or library to solve a problem beyond my resources in Manchester, or that subsequently a visitor to Manchester can rapidly dispose of some problem that has had me puzzled. Pacing the work in this way should ensure that the whole collection is worked through in a reasonable time and that it does not come to resemble the curate's egg, with some favourite groups polished to the nth degree and others still a total muddle. However, it is envisaged that groups will not enter phases 3 and 4 in phylogenetic order, starting at the chitons and progressing steadily through to the cephalopods. Instead I will rank the groups in priority, depending on such factors as the availability of a modern monograph and the proven demand for the group from the loan record. I intend doing some small groups first, to test the strategy more thoroughly.

When the phase 4 deadline is reached, then fresh, archival quality labels will be printed out for all the lots in the group. Colour coding of labels was considered but rejected. Colour coding on class is redundant since all lots will eventually carry their biocodes giving the supra-generic classification and colour coding on locality, such as white for British, pink for European and blue for non-European is considered an unnecessary complication, since specimens can readily be retrieved separately by these geographical areas using the hierarchical locality codes in the computer database.

Finally, provided more than, say, 95% of a group has been successfully revised, at the end of phase 4 it is intended to produce a Handlist of specimen information; the medium, format and method of distribution of these Handlists to the Collection are still under discussion. However, although they would be produced in random order, they will be numbered according to the biocode, so that the series would assemble into a coherent whole. It is debatable whether the Handlists should be published in the accepted sense, as the computer database from which they are produced is likely to be updated frequently as more information becomes available or more material is added, so that any published list is likely to get out of date quite quickly. In this respect, the Handlists are akin to taxonomic catalogues, and I agree with Kohn (1983) that it is better to keep information of this nature in machine readable form and to print it out only on request. Perhaps once the revision of one of the major sections - such as the prosobranchs - has been completed, there might be a case for producing the full list in microfiche for distribution to major museums.

Summary of the curatorial strategy

Phase 1. Rehouse 'old' collection in new storage, mostly arranged by modern superfamily using dictionary of genera, leaving space for the incorporation of remaining collections.

Phase 2. Incorporate the smaller collections one by one, retrieve relevant database entries using lot number, fill in missing biocodes, add source collector label to lots, move material to new storage by new groupings.

Phase 3. Working group by group, retrieve relevant database entries, globally add missing biocodes, and fill in missing locality codes; for large groups subdivide into smaller (<500) groupings, and modify database biocodes accordingly; lastly arrange material into lot number order within each final grouping and add computer produced biocode/lot number label to each lot.

Phase 4. Fully revise each group as far as practicable in a pre-planned period, and update database entries; at end of revision period copy problem entries to inquirenda database, computer produce fresh full labels and add to lots, prepare and make available Handlist to the group.

Scheduling of work

It seems sensible to complete phase 1 before starting phase 2, and similarly it would mean some double working to try and start phase 3 before phase 2 was complete. However, it is expected that phases 3 and 4 will, to some extent, run concurrently; advantage would be taken, for example, of the presence of a visiting expert to obtain their help with a group in which they specialise, even if that group had previously held a lower priority.

Conclusions

Staff time is probably now the most precious commodity in a museum and so we must be prepared to adopt new methods of working that preserve this precious resource, even though this may make the collection less convenient for a visiting worker. Although phases 2 to 4 of the Strategy are presented in the future tense, a pilot run has been done on a small amount of material, and all the methods outlined above seem to work satisfactorily. However, part of the reason for writing this paper has been to spark some debate on how we can make more effective use of the scarce time of trained curator staff and I would welcome any constructive criticism or comment on my strategy.

Acknowledgements

I thank my colleagues Dr MV Hounsome, Keeper of Zoology and Mr V Horie, Keeper of Conservation, for their help while writing this paper. The Manchester Museum gratefully acknowledges the help of the Museum and Galleries Commission, the Estates and Services Department of Manchester University, and BEL Industries (APEX Group) in completing the storage project.

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Footnotes

1. The supplier of the Compact Storage Unit was APEX Storage Systems Ltd., Congleton, Cheshire CW12 4YA. Phone: 0260 274044.

   Two other firms who will quote for similar equipment are:

   Brynzeel Ltd., Pembroke Road, Stocklake Industrial Estate, Aylesbury, Bucks HP20 1D. Phone: 0296 395081.

   RACKLINE Ltd., River Dane Road, Eaton Bank Trading Estate, Congleton, Cheshire CW12 1UN. Phone: 0260 281010.

2. The sealing tape used is 'Rotunda' 2702 Black PVC, 0.14mm, 75mm wide, with an adhesion to steel of 2.4 N/cm and a neutral, pH 5.5-8.0, adhesive whose minimum life should be 10 years.

   Supplied by Titan Tape Technology Specialists, Whitefield Road, Bredbury, Stockport SK6 2QR. Phone. 061-494 1344.

3. The sealing moulding made of a compound called 'Levaflex', manufactured by Bayer and conforming to DIN 4102 class 2, and to the motor vehicle manufacturers standard FMVSS 302. The moulding was bought in by APEX Ltd.

4. The archival quality paper we use is 'Atlantis Copysafe'; this is wood-free cellulose fibre, acid-free, minimum pH of 7.5, buffered with calcium carbonate. Supplied by Atlantis, Gullivers Wharf, 105 Wapping Lane, London E1 9RW. Phone 01-481-3784 (NB minimum order £50).

5. Specification of 'Colour Matching' Fluorescent Tubes. We installed GEC Colour Matching tubes (CRI = 91; Colour Temperature 6,500K.). These emit substantial amounts of UV (150 micro-Watts/lumen) but this emmission is considerably reduced, to 40 micro-Watts/lumen, by the polystyrene diffusers. These tubes, or their equivalent, should be available from most electrical wholesalers.

6. Specification and Supplier of Flooring.
   'POLYFLOR XL' 2.0mm thick polyvinyl covering, all seams welded to provide jointless floor. Supplied by: James Halstead Ltd., P.O. Box 3, Radcliffe New Road, Whitefield, Manchester M25 7NR. Phone: 061-766 3781.

7. Database compiled using the FAMULUS77 database management package, running on an AMDAHL 5890-E under the VM/CMS operating system.

8. Cotton Wool. We use 'wool' that is made of pure cotton, because the high sulphur content of the viscose fibres often added to cheaper grades of 'wool' can cause damage to specimens particularly when in a small, enclosed space such as a glass tube. Also the pure cotton grade is softer and less likely to catch and damage delicate spines, hairs etc. when the specimens are removed from the container.

Summary of 'Biological Collections. UK'

Steve Garland

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Introduction

This is an attempt to summarise the main facts of this report. I hope that these notes will be of use. BCG now has a review copy which can be circulated to interested people. Copies are still available and Museums Association members can obtain them from the M.A., 34 Bloomsbury Way, London WC1A 2SF, price £35.

The full report is 600 pages long so it must be remembered that this summary is somewhat brief! Figures quoted are correct but I have obviously shortened verbal descriptions greatly. Check the original report before quoting!!

The report

Questionnaires were sent out between December 1983 and May 1984 to 672 museums. 604 (90%) were returned and were broken down as follows:

No biological collections	308
Biological collections only	232
Biological collections & full-time Natural History Curator	64

Museums with biological collections have been classified in eight groupings. Groups 5, 6 and 7 contain only museums with natural history curators, all other groups have none. They are summarised briefly as follows:

Group 1	Small museums. Little commitment to natural history. Few specimens.
Group 2	Some natural history activity. No future direction apparent for natural history. Little curation.
Group 3	Some people available to work on natural history material. Significant collection size. Often receiving new material from research or survey work.
Group 4	Special cases where, although there is no post for a full-time curator of natural history, there is a marked museum commitment to the section.
Group 5	Museums or collections with at least one full-time natural history curator but activity restricted for a variety of reasons.
Group 6	Usually more than one full-time natural history curator. Collections large. Museum undertaking a wide range of natural history activities. Providing sound service to the community.
Group 7	The most active museums. Very large collections including type specimens. Undertaking wide range of activities including sound scientific work. Providing very good service to the community.
University etc.	A group of research institutes etc. with no natural history curators. Many possess large collections with type material.

The museums

Groups 1 and 2 are ignored. Appendix XIII lists all museums in all groups.

Group 3 (16 Museums)

Tenby Museum
Angus District Museum (Montrose)
Philipps Countryside Museum
Carmarthen Museum
Falkirk Museums
Dover Museum
Luton Museum
Bournemouth Museum
Buxton Museum
Worcester City Museum
Kirleatham 'Old Hall'
Gray Art Gallery & Museum
Saffron Walden Museum
Royal Institution of Cornwall
Wood End Museum (Scarborough)
Oldham Museums

Group 4 (21 Museums)

Dorman Museum (Middlesboro')
Kendal Museum
Warrington Museum
Kirklees Museums
Rochdale Museum
Lynn Museum
Woodspring Museum
Museum of London
Powell-Cotton Museum
Oxfordshire County Museum
Linnean Society
Shropshire County Museums
Dorset County Museum
Wiltshire A & N H S Museum (Devizes)
Carlisle Museum
Swansea Museum
Torquay Museum
Manx Museum
The Educational Museum
Chelmsford & Essex Museum
Wellcome Museum of Medical Science

Group 5 (14 Museums)

Cleveland County Museums
Inverness Museum
Perth Museum
Southend Museums
Maidstone Museum
Scunthorpe Museum
Lancashire County Museums
Birmingham Museum
Somerset County Museums
Bedford Museum
Canterbury City Museums
Paisley Museum
Newport Museum
Yorkshire Museum

Group 6 (22 Museums)

Cliffe Castle, Keighley
Horniman Museum
Warwickshire Museum
Reading Museum
Rotherham Museum
St. Albans Museum
Lincoln City & County Museum
Buckinghamshire County Museums
Hampshire County Museums
Royal Albert Meml. Museum (Exeter)
Harrison Zoological Museum
Kingston upon Hull Museums
Derby Museums
Hereford City Museum
School of Animal Biology, UCNW (Bangor)
Plymouth City Museum
Bankfield Museum
Passmore Edwards Museum
Portsmouth City Museums
Oxford Univ. Museum (Zool)
Univ. Coll. London Museum (Zool etc)
Birmingham Univ. Geol. Museum

Group 7 (27 Museums)

Sunderland Museum
Univ. of Reading Herbarium
Herbert A.G. & Museum, Coventry
Leeds City Museum
Dundee Museum
Stoke on Trent City Museum
Sheffield City Museum
Ipswich Museum
North Herts Museums
Booth Museum (Brighton)
City of Bristol Museum
Doncaster Museum
Glasgow A.G. & Museum
National Museum of Wales
Hope Entom. Collns (Oxford)
Nottingham Museums
Leicester Univ. Herbarium
Leicestershire Museums
Bolton Museum
Hancock Museum (Newcastle)
Ulster Museum
Colchester & Essex Museum
Norwich Castle Museum
Royal Scottish Museum
Manchester Museum
Merseyside County Museums
Univ. Museum of Zool. (Cambridge)

Staffing

Curatorial posts

Of the 64 museums with posts: 27 have one post,
17 have two posts,
7 have three posts.

The rest have four or more posts (one has sixteen).

There are a total of 101 zoologists, 29 botanists, 10 biologists and 19 geologists. Entomology is the most popular specialist area in museums.

Pay scales are compared. The wide variety of scales is apparent and the gulf between scales in city/county museums and national/university museums is very noticeable.

Technical posts

Only 33 of the 64 museums with curatorial posts have technical staff available to work on natural history. Seventeen of the 27 Group 7 museums have access to technicians working in natural history departments.

Volunteers

It is stated that insufficient use is made of volunteer help. Natural history volunteer use is well below that in other subject areas.

MA Diploma

Twenty-two of the 64 museums have no natural history staff who hold the Diploma. No university/research collections curators hold the Diploma.

MSC Staff

From 1978 to 1983 as many natural history MSC person - years were used in museums as natural history curator - years. (What does this mean now that ET is here??)

Collections

This chapter of the report contains numerous facts and figures. I have extracted only a few. A full list (Appendix XIX) is provided of all 296 institutions' collections. The collections are categorised as 0 (none), small, medium, large and very large. The collections are listed by type - these being Insects, Molluscs, Invertebrates, Vertebrates, Non-vascular Plants and Vascular Plants. A number of museums are named in this section; especially those that have large collections but fall into lower groups than their collections warrant due to inadequate staffing or funding etc.

Of Group 1 to 3 museums Saffron Walden, Worcester City, Wood End and Darlington Museums all hold some large collections. Saffron Walden Museum is the biggest anomaly as its collections are of a size comparable with Group 6 museums, and larger than some Group 7 museums. The report suggests the appointment of a natural historian or the transfer of its collections to a museum with natural history curatorial resources.

An estimated 1 to 2.5 million biological specimens are housed in Group 1 to 3 museums and are, therefore, at risk due to lack of biological curatorial expertise.

Group 4 museums include the Museum of London, Dorset County and Carlisle Museums which all hold very large or large collections of more than one animal or plant group.

Group 5 museums include five holding large or very large natural history collections. These are Perth,, Maidstone, Yorkshire, Inverness and Birmingham Museums.

Type specimens

Three Group 2 or 3 museums hold type material. At two of the three it was impossible to distinguish the types. In addition, two Group 5 and three Group 7 museums do not clearly mark types. These museums are not fulfilling their function of safeguarding this material.

Current acquisitions

A large amount of information is included on the growth of collections. This follows the museum groupings with a few exceptions. There are no Group 1 or 2 museums acquiring significant natural history material whereas Group 7 museums are most active. There are, however, five museums with no natural history curator acquiring potentially valuable material from research and survey work.The acquisition of local, British and foreign material is discussed with tables breaking it down by museum group, collection type, etc.

Availibility of specimens in biological collections

Physical accessibility

In 12 of the Group 7 and 15 of the Group 6 museums lack of space impedes research. This obviously affects curation too. The working party judged that only 28 museums had adequate facilities for visitors to work on the collections. Of these 22 are Group 7, 4 are Group 6 and 2 are Group 5. The five inadequate Group 7 museums are two national and three local authority museums. They are Bolton, Ipswich, Glasgow, Ulster and the National Museum of Wales.

Documentation

One fifth of museums with natural history curators do not regard documentation as a priority activity. Biological recording and display work are the two main overriding priorities.

Four Group 5 and one Group 6 museum reported that none of their biological material was catalogued. No Group 7 museums have everything catalogued but all have some catalogued. However, five have no insects catalogued. Over half of these Group 7 museums take over one year before newly acquired specimens are catalogued. This is explained by inadequate staffing levels at the most active museums.

(It is interesting to note here that the conditions for Registration of Museums will require a definite commitment towards cataloguing the backlog.)

Curation, caretaking and storage

Curation

In the majority (over 90%) of institutions the curators spend less than one third of their time on curation. Museums reporting no curation were predominantly in Groups 1 and 2 with one in Group 3 and one in Group 5 (due to frozen post). Six more collections receiving no curatorial care are in university museums or similar institutions. Five of these six institutions are still receiving new material! Even though their existing collections are at risk they still acquire more!

One quarter of museums with biological collections use volunteers to help with curation. In ten institutions all curation of insects is carried out by volunteers. In eleven institutions, voluntary staff carry out all biological curation.

The report points out that where curation of natural history collections by non-qualified staff occurs, damage to the collections ensues.

Expansion space

Details are given concerning curation being impeded by lack of room for expansion. This is a frequent occurrence.

Accessions register

Forty institutions have no accessions register. All are Groups 1 to 4 except two university departments in Group 6. They are all failing to conform to professional standards as laid down by the Museums Assocation. (This will cause them severe problems when attempting to register as museums.)

The backlog

The report includes tables showing the percentages of unaccessioned material in museums of each group. Over one third of Group 5, 6 or 7 museums have major accessioning backlogs.

Storage

Inaccessibility of collections is discussed and inadequate storage units are reported as a major problem. Twenty-four of the 49 Group 6 and 7 museums do not have a large enough storage area considering their role as major centres of museum natural history.

The working party considered that a minimum of 10% expansion room should be available in dry stores. Over half of the Group 7 and nearly half of the Group 6 museums **could not meet these criteria!** In each group 10 museums had **NO** space left at all.

Two Group 6 and one Group 5 museum reported the most acute problems. These are Southend, Passmore Edwards and Hereford City Museums.

Facilities and resources

Access to fumigation chambers, freeze driers, deep freezes and cold stores is discussed. It is pointed out that if none of these four items is available then a museum has no way to treat incoming specimens efficiently.

Access to a fume cupboard is vital to comply with Health and Safety legislation when handling many everyday chemicals. One third of Group 6 and 7 museums do not have access to one.

Widespread inadequacies concerning lighting, ventilation and water and power supplies in stores, offices and laboratories is noted. Group 6 and 7 museums tend to be the better off, but many still have major problems.

Libraries

Only 13 museum natural history libraries have a fixed annual budget of over £500. Tables are included showing library facilities on a regional basis. The main fact to emerge is that many museums are unable to maintain the size of library needed for their collections.

Microscopes

The provision of microscopes is worst in Group 1 museums and best in Group 6/7 museums. Absence of a microscope will obviously preclude work or research on many collections.

Loss of collections

Two thirds report some collections have been lost through neglect and one quarter report losses due to unforeseen disaster. The report points out that the museums losing specimens through neglect are not fulfilling the most important function of a museum - to safeguard material for posterity.

Eighty per cent of institutions with natural history curators report losses of collections or specimens through neglect. The main reasons for damage by neglect were reported as (in descending order of importance):

1. **Bad storage**
2. **Neglect, bad curation, bad handling**
3. **Pest attack**
4. **Absence of qualified curators**

A depressing appendix lists reasons given for loss of collections or specimens. Below are a few details:

Lost through neglect (126 occurrences)

Ex-curator used to hold auctions

Informal, undocumented exchange went ahead in the past

Dumping of 'excess' horns and antlers in 1930s

1977, insects and birds eggs destroyed through insecure external stores entered by children (hole in roof)

Unofficial gifts and exchanges

Material has left museum by unspecified means for unspecified reasons

Some material thrown away by previous curator. No details of losses available

Disposal of some specimens by bonfire, 1950s

At risk. Council considering sale of 'surplus' specimens to finance institution

Much late 19th and 20th century material has vanished without trace

Prior to 1970 many other museums and private individuals were allowed to 'help themselves'

1960-69 unofficial gifts and sales by caretaker

Collections disposed of by bonfire in early 1960s as surplus to requirements

Fumigants

The lack of a safe, effective pest-control strategy is mentioned and concern is expressed about the effects of regular and long-term exposure of staff to naphthalene, paradichlorobenzene, dichlorvos and mercuric chloride.

Security against fire and theft

Only 15% of institutions reported inadequate theft precautions but 59% reported losses due to theft. Sixty per cent reported inadequate fire protection for their stores. Forty-one per cent of Group 7 museums have inadequate fire protection in their stores! This obviously includes massive numbers of specimens and many types.

Collection maintenance

Among the Group 6 and 7 museums there are an estimated 2 million specimens in bad condition (ie on the brink of destruction). Approximately 7 million more are in indifferent condition. However, when visiting institutions the survey investigator found that nearly all curators had underestimated their problems!

Use of collections

Details are given of the use of collections by staff for research, display and loans and by visitors and researchers. Areas of concern include large numbers of institutions that are not used by researchers at all. Groups 1 to 3 and 5 are the worst in these respects.

Many museums with no natural history curator have biological displays. The selection of items suitable for display is an obvious concern.

Suitable repositories

In response to the question 'Is the museum able and willing to be a repository for collections from universities and research institutes?', 77 replied 'Yes'. However 31 of these museums had no full-time natural history curator!? Of 25 Group 7 museums answering 'Yes' the working party considered that only 10 were really able to take such collections. Institutions causing them most concern are the Hope Entomological Collections (University Museum, Oxford), Manchester Museum, Merseyside County Museums, Castle Museum (Norwich) and Glasgow Art Gallery and Museum. Appendix XXVIII lists museums which said they were suitable but which the working party considers unsuitable - reasons are given.

Most museums were happy for a BCG representative to visit (4 refused). It was interesting to note that 85% of museums said they would welcome professional assistance from outside. This included many Group 6 and 7 museums.

Policies

Closure

The number of museums with formal arrangements for the collections if they were to close is very low. This includes 37 Group 6/7 museums.

Frozen posts

Forty museums reported frozen natural history posts and 34 had had posts removed in the last 5 years (to 1984).

Collection policies

Less than half of the institutions had collecting policies and of the 108 that did only 47 had them written down.

Code of practice for curators

Only 17% had formal guidelines for natural history staff. Only 6% had written guidelines! The working party regards the adoption of the MA Code of Conduct for Museum Curators by museums as an essential requirement for high standards of professional conduct.

Curatorial representation on committees

Curators do not attend policy meetings in most museums. The report gives examples of inefficient informal consultation arrangements and expresses concern that many museum curators do not have direct access to their trustees or committee.

Disposal of collections

Seventy-one per cent of institutions had no collection disposal policy! Even in Group 6 and 7 museums 43% had no disposal policy! Statistics concerning widespread disposal by gift, sale or exchange are listed. Unethical disposal is usually associated with the absence of a full-time natural history curator.

Summary

Under a chapter entitled 'Curators' Professional Milieu' the fundamental problems are summarised:

1. **Lack of essential resources (staff, equipment, library etc.)**
2. **Lack of space or inaccessibility of collections**
3. **Poor collection documentation**
4. **Poor communication and consultation (ie management problems)**

Five named museums have their problems listed (Manchester, Bolton, Sheffield, Birmingham and Hampshire) as do three un-named museums, all with problems caused by poor communication and consultation.

Other activities can adversely affect curation. Biological recording and display are the main causes and are a major problem in some museums where they receive overriding priority.

Appendices to the report

Many have already been mentioned but one that has not is the 'Black Mark' table. This lists museums in Groups 5 to 7 in 'Black Mark Order'. Black Marks are related to poor storage or documentation, lack of expansion space, poor access for research and curation, poor library provision and lack of important equipment.

Recommendations from the report

Recommendation 1

Peripatetic biology curators should be appointed to Area Museum Councils to offer advice and help with the care of biological collections and, where necessary, to curate them.

Each AMC should appoint at least one full-time peripatetic biology curator and the larger councils, such as the Scottish Museum Council and the Area Museum Service for South Eastern England should appoint not less than two curators. These curators should be appointed on 3 year contracts with the possibility of renewal following a review of the situation in museum natural history towards the end of the initial 3 year period. The peripatetic curators' work should be supervised by the Natural History Advisory Panels already established or yet to be established in the areas covered by AMC's in the United Kingdom.

Recommendation 2

The major museums identified as actual or potential centres of excellence in natural history should act as parent museums to the peripatetic biology curators.

The parent museums should be able to provide back up facilities for peripatetic curators and funds should be allocated from the AMC's to ensure that these museums are able to fulfil their responsibility.

Recommendation 3

Provision should be made in parent museums for the reception and storage of valuable and important biological collections discovered by peripatetic curators to be beyond the capacity of their custodians to conserve and curate. Parent museums must be given the wherewithal to provide space, modern storage units and the curatorial staff that this will require.

Although parent museums may be designated to take into their care biological collections under threat, the option remains of leaving collections where they are, provided means can be found properly to store and curate them on a long term basis. Decisions on whether a collection should be transferred to a designated museum will be based on the advice of the peripatetic biology curator and the Natural History Advisory Panels. Existing museums with commitment to local, regional natural history should be supported to improve accessibility of collections and support services.

Recommendation 4

New or additional conservation facilities consisting of a laboratory and a staff of properly trained conservation technicians should be established in the parent museums or in other central institutions including Area Museum Councils.

The conservation laboratories would attend to the great burden of conservation work already identified in broad terms and to which the peripatetic biology curators will address themselves. Staff with systematic expertise should be trained in relevant conservation techniques to deal with a wide range of biological material and its conservation. The Working Party endorses the view of Foster (1980) that natural history collections generally should be conserved by qualified scientists, with graduate curatorial staff being assisted by natural history technicians.

The new staff will supplement the work of preparators and taxidermists already in post and they may be AMC, museum or university personnel as best befits local and regional circumstances.

Recommendation 5

Area Museum Councils and the Museums Association should approach the Museums and Galleries Commission for funding derived ultimately from the Office of Arts and Libraries to support the appointment of the peripatetic biology curators and the formation of new conservation facilities as outlined in Recommendation 4.

Parent museums which are to receive and curate important collections from other museums (Recommendation 3) should be funded in the same way. However, some contribution from the parent museums' own controlling authorities, whether the museums be national or local authority institutions, should be forthcoming to bring the parent museums up to a satisfactory standard. Where important collections have been built up as a result of scientific research, the research councils should be approached for financial support. In some cases, sponsorship may be appropriate to support the care of important collections.

The pressure for financial assistance should be applied in the first instance by the Natural History Advisory Panels. This underlines the necessity that these panels should comprise senior and very senior professional and institutional members.

Recommendation 6

It is recommended that a catalogue of Biological Collections Advisory and Rescue Services (BIOCARS) be compiled by the Museums Association in conjunction with the relevant learned societies. A Secretariat should be established to consult with interested bodies and to make the compilation on which to base the catalogue.

Museums and learned societies have a reservoir of expertise and resources capable of being utilized to answer a wide range of questions and to provide co-ordinated services to other museums, governmental bodies and commercial organisations. The BIOCARS scheme would provide services paid for by clients, thus allowing museums to supplement their income.

Recommendation 7

The Museums Association, the Museums and Galleries Commission and the Research Councils should establish a steering group to co-ordinate and monitor action on the recommendations delineated here. This steering group should be responsible for recommending new action in response to changing circumstances.

The Working Party believes that long term co-ordination between the Museums and Galleries Commission and the Research Councils is an essential prerequisite to more efficient management and use of biological collections. Therefore, we recommend that the new steering group should make long term plans to ensure a continuation of its co-operative approach to the management of biological collections in the U.K.