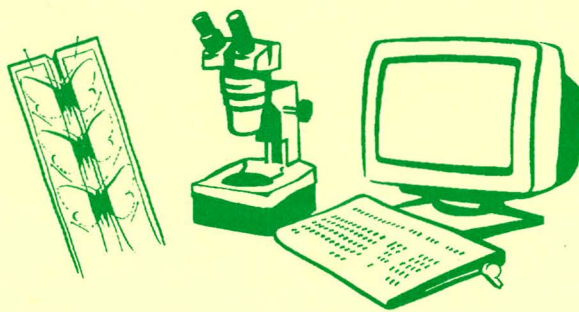


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The Biology Curators Group was founded in 1975 with the following terms of reference:

1. To facilitate the exchange of information between individuals concerned with the collection of biological specimens and records, their conservation and interpretation.
2. To present the views of biological curators to the Museum Association and other bodies.

BCG holds regular meetings, usually based on topical themes, and occasionally in association with other groups. There are usually two meetings a year, one in the Spring which incorporates the AGM, and one in the Autumn.

BCG publishes three Newsletters a year, one issue of the Journal of Biological Curation a year and a series of Special Reports and leaflets as the need arises. These are normally free to members. Write to the Editor or the Newsletter Editor for information on back issues.

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Natural history collections management in North America

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Definitions of terms

The word *museum*, first used to describe the university building at ancient Alexandria, soon came to mean “*a place for study*” (August, 1983:138). In terms of natural history collections management, this is an important distinction to make—museums are places where collections are studied. I define study broadly, to cover everything from public exhibition to scientific research, but its the use of the collection that describes a natural history museum’s function.

In North America, the courts define a museum as “a repository or a collection of natural, scientific or literary curiosities or objects of interest, or works or art” (August, 1983:139). The word *collection* means “a group of things collected and arranged” (August, 1983:140). The words *collect* and *arrange*, in turn, come from Latin words meaning “to gather up” and “to put in proper order” (August, 1983:140)—in other words, to manage. Collections management is caring for and managing collections for study.

As has been noted, collections management means different things to different people (Roberts, 1988). I will define management as meaning “to treat with care, to manipulate, to keep in order, to balance current resource demands with long-term future needs” (Manning and Simmons, 1991:46). Collections management means keeping data associated with specimens, while maintaining specimens so that they are retrievable; so that they can be used for research, education, or exhibition; and so that they can be kept in good condition for as long as possible.

Natural history collections management is a relatively new specialization. It is the direct result of the growth of collections in both size and complexity, combined with the increased research and teaching demands on the scientists who traditionally have cared for them.

Personnel

In the United States, the people who manage collections are usually called *collections manager*, or sometimes *curator*; in Canada, they are usually called *curatorial assistant* or *curator* (Cato, 1991). In Europe, the titles

curator, *keeper* and *information scientist* have all been used or proposed (Horie, 1986).

Although *curator* has been defined as a person with curatorial responsibilities (Horie, 1986), in the United States perhaps a more descriptive term for *curator* would be *scientist* or *researcher*. As Humphrey recently noted, most curators of systematics collections have research and teaching as their principal responsibilities (Humphrey, 1992). But for purposes of this paper, I will call the workers who have direct responsibility for collections care *collections managers*.

What is the role of the collections manager? First and foremost, it is to preserve the collection, and its associated data, while fulfilling the museum's ethical and legal obligations, which includes the conservation of specimens and data (Manning and Simmons, 1991). Conservation, or more precisely, preventive conservation, is rapidly becoming one of the driving forces of collections management in North America. For purposes of this paper, I will define *conservation* to mean the preservation of a specimen so as to retain as completely as possible its original condition.

A collections manager maintains and refines the collection and data; plans, arranges, and maintains storage systems; monitors the storage environment and specimen condition; monitors equipment and supplies needed to care for collections; trains and supervises other collections care staff; ensures loans are processed and visitors are appropriately accommodated; manages collection records and other data associated with the collection; maintains familiarity with the preservation and conservation literature and techniques relevant to the collections; interacts with members of the scientific community, with the other staff of the museum, and with "outer museum" (Humphrey, 1991) uses of collections; and conducts research projects relating to the care of the collection. The collections manager also assists with setting goals, planning, and other administrative aspects of collection care, helps prepare and implement policies, procedures, and long-range plans, participates in professional organizations, disseminates information to advance the museum profession and the standing of the museum in the scientific community. Obviously, the collections manager's job overlaps somewhat with that of both traditional curators (or researchers) and registrars (Cato, 1991).

But then, what is the role of the curator? The American Association of Museums (AAM) defines a curator as someone primarily in a research role with only supervisory responsibilities over the collection (Glaser, 1980), and distinguishes the collections manager as the one who "may perform the combined functions of registrar and curatorial assistant" (Glaser, 1980:31). A *registrar* primarily organizes and maintains forms, documents, files, and records.

In the United States, the title of curator is usually conferred on a PhD-level researcher, not on someone primarily engaged in collections care (Lindberg, 1989a). These PhD-level researchers have also been termed *scientist-curators* (Laub, 1985:50) and *scholar-curators* (Washburn, 1967:46).

In 1963, Walker proposed "that the term 'curator' be reserved for those who have the care of collections entrusted to them and for those who do care for collections" (Walker, 1963:295). This suggestion was not well accepted, probably because there is too much tradition associated with the title of "curator." In the United States, a natural history curator is defined to mean "scientist", but in history museums, curator is used for those involved in collections care (Washburn, 1967). Washburn saw the passing of the era of what he termed the "scholar-curator" (Washburn, 1967:46) and regretted it, fearing that some sort of "museum specialist will displace the scholar-curator, as the professional librarian has shouldered out the scholar-librarian" (Washburn, 1967:46). He failed to see that what was really happening was that the incredible growth in size, complexity of collections, research techniques and collection care are such that one person can no longer do justice to both collections management and full-time systematics research. Those areas of responsibility—research and collections care—had to be divided.

As Yamamoto wrote about the Royal Ontario Museum, "the concept [of collection management] is still evolving" (Yamamoto, 1985:276). A 1990 survey by a committee of the Society for the Preservation of Natural History Collections (SPNHC) of collection care positions drew a profile of typical collections managers in North America (Cato, 1991). These people have Master's degrees; have been working in the field for 11 years and in their present jobs for five years; 71 percent of them spend more than 40 hours a week on professional and job-related activities. They earn a salary of US\$ 25,000, and spend most of their time managing specimens or data. They are involved with professional societies and publishing in their field. Ranked in order, the frequency of job tasks are: management of specimens and data; management of personnel; general collection support and administration; public service; specimen preparation; research and publication; and teaching.

Of the people in this survey, 40 percent had the title of collections manager (all in the United States); 17 percent were curators; 11 percent were curatorial assistants (all in Canada); the remainder had a variety of other titles. Of those who had the title collections manager, 52 percent had a master's degree, 7 percent had a doctoral degree. Of those called curator, 35 percent had a master's degree, 40 percent had a doctoral degree. Eighty-five percent considered their jobs to be a professional position as opposed to a technical position, but only 58 percent of their institutions classified their jobs as professional (the institutions considered 53 percent of the collections managers professionals, but 80 percent of the curators were considered professionals).

For purposes of this paper, a *professional* is one who conforms to the standards of a profession. A *profession* requires specialized knowledge and usually intensive academic preparation. By contrast, someone in a *technical* position would be a *technician*, which can be defined as a specialist in the technical details of a subject or occupation. The difference is important—professional means specialized knowledge and intensive academic preparation; technical means merely a mastery of certain technical details.

Collections managers have also been incorrectly referred to as "paraprofessionals." The definition of a paraprofessional is someone trained to assist a professional person. This is not what collections managers do.

The survey documented that, "In practice, the care of natural history collections is handled increasingly by the growing profession of collection managers, individuals trained primarily in the care and conservation of collections" (Cato, 1988:51). What training do collections managers need? The AAM recommends that a collections manager have a degree in a discipline field and that a museum studies degree is desirable (Glaser, 1980). I believe that for natural science collections, the preferable combination is a degree in a discipline field and a graduate degree in museum studies with an emphasis in museum collections management and training in preventive conservation. Museum studies encompasses that body of knowledge that defines collections management as a professional pursuit, yet natural history collection care workers have sadly neglected museum studies literature, to their detriment.

There are 18 museum studies programs in the United States offering Master's degrees with emphasis in the management of scientific collections (Genoways, 1989). In addition, the National Institute for the Conservation of Cultural Property (NIC) has published an excellent curriculum for an intensive, four-week course on collections care and maintenance (NIC, 1991).

Historical development of collections management in North America

Natural History museum work is rich in tradition. There is a long tradition of on-the-job training (Stansfield, 1980), a tradition of the autonomy of curators over their collections, and the oral tradition of procedures and techniques being handed down from curator to student.

The body of knowledge contained in this oral tradition has rarely been codified. Robert Boyle, writing in 1666 about the then-new technique of preserving specimens in alcohol, stated that because he was writing in haste, "...I must content my self to have mention'd that, which is Essential, leaving divers other things, which a little practise may teach the Curious, unmentioned..." (Boyle, 1666:200). Unfortunately, few people since Boyle's time have bothered to write down what they have learned, either.

These oral traditions, autonomy, and on-the-job training are responsible, in part, for a crisis in natural history museums today—a crisis of too many specimens for the staff to care for, of not enough training available for the staff, and specimens deteriorating because of inadequate environmental conditions and a lack of knowledge about how to deal with many problems.

Historic attitudes towards museum work

A paper published in 1748 on preserving birds stated that "There is no great skill required for putting one or several [specimens] into a Vessel full of Spirit of Wine, or very strong brandy" (Reamur, 1748:307). This idea that "no great skill" is required for museum work has persisted.

In 1931, the American biologist and museum builder Alexander Ruthven, of the University of Michigan Museum of Zoology, wrote that "Museum work cannot properly be considered a profession for it is only incidental to the recognized disciplines. It is simply a technique, or more generally a group of techniques, which must be determined, guided, and used by those skilled in the several fields of knowledge best cultivated in these institutions" (Ruthven, 1931:26). He went on to say that "Directors and curators should be scholars, not technologists, if the museums are to be real 'nurseries of living thoughts'" (Ruthven, 1931:29). Yet, Ruthven also wrote that "As a technique, museum work is too important to be neglected" (Ruthven, 1931:26).

Clearly, attitudes have changed somewhat since 1931. The most important change has been a recent recognition that collections have simply outgrown their traditional curators—most systematic collections are too large and complex to be managed by someone who is also expected to be a full-time researcher and often a teacher as well; and the size, complexity, and age of collections demand that those caring for them have a greater knowledge of collections care than was thought necessary in the past. Add to this the fact that our knowledge of collection care has greatly increased in recent years.

A 1963 paper on curation stated that "The custodial part of the curator's job has a much broader and more important significance than many people seem to realize today" (Walker, 1963:292). The author worried that "Having decided that research is their most important function, many curators are tending to concentrate their entire attention to this one activity" (Walker, 1963:292). In a 1985 paper on natural history curators, Laub defined a curator as a scientist "first and foremost" (Laub, 1985:48) and further explained that "Commonly, the cataloguing and placement of specimens in storage cases is done by persons other than the curator" (Laub, 1985:49). Despite this admission that curators do not actually care for collections, Laub thought little of collections managers. He wrote that "The argument has been advanced that curators should have responsibilities for research and higher education only, while collection managers (who are not professional scientists) should be responsible for the maintenance and increase of collections... I feel that the value of the scientist-curator's training, activities, and experience are of such importance to the development and care of a collection that it is unwise to 'divorce' the scientist from interest in and ultimate responsibility for the collection" (Laub, 1985:50). This is a very curious viewpoint. I believe that Laub has missed something important—a collections manager does not 'divorce' the scientist from the collection at all—instead, the collections manager enables the scientist to make better use of the collection.

But shouldn't the researchers using the collections know best how to care for them? After all, have they not inherited the mantle of curator through their academic lineage? This is actually part of the problem. Researchers (or scholar-curators) are not taught modern collections care. They learn the oral tradition, but they are taught nothing about preventive conservation, management, or the wealth of information available in the museum studies literature. They were only taught how to run a collection so that it could be used—they were not taught how to manage complex collections as I have

defined collections management. In the edition available from 1969 to 1991 of one of the most widely used texts on systematics (Mayr, 1969), the section dealing with "Curating of Collections" was very short—just five and a half pages out of a total of 428 pages in the book. To add irony to insult, the single photograph in the "Curating of Collections" section (of some bird specimens in trays in a case) was printed sideways. In the current edition (Mayr and Ashlock, 1991), "Curating of Collections" is still five and a half pages long, although the text has grown to 475 pages. Another recent systematics text (Wiley, 1981) devotes six pages to curation of a total of 439 pages. All three of these texts address the importance of curation, but clearly they can impart very little knowledge of the subject in just five or six pages.

In university museums, where most scholar-curators are trained, the problem is particularly acute. As one scholar-curator pointed out, "Except in the well-endowed academic museums, support staffing seldom includes museum professionals. Instead, graduate students, research and laboratory assistants are delegated responsibilities as collections managers, technicians and museum assistants. And because many of these persons are transient in the academic setting, continuity and stability of care and expertise fluctuate greatly from year to year," (Lindberg, 1989a:8). Several scholar-curators have suggested that collections care should be formally taught in graduate systematic biology programs (Humphrey, 1989; Lindberg, 1989b), but no universities are doing this yet.

Although scholar-curators should be better educated about collections management, it would be inappropriate to try to train PhD students in systematics to be collections managers. A PhD in systematics is not needed to manage collections—but a degree in museum studies is very important. Collections management is a specialization in and of itself. The roles of research and collections care have some overlap, but they are complimentary professions in the museum field.

Many traditional scholar-curators have been reluctant to delegate the authority for the collections care part of their jobs, even though both they and their collections would benefit if they did (Murdoch, 1992). There are two main causes for this. First, because of their lack of training in collections management and preventive conservation, many PhD researchers do not really understand the complexity of day-to-day modern collections management. Secondly, the scholar-curators are deeply steeped in the oral traditions of curation. As a group, they have been unwilling or unable to establish curatorial standards for what they do now, much less look for better ways to care for specimens. An example of this can be found in the attempts of the Association of Systematics Collections (ASC) to address collections management.

The ASC is an institutional membership organization for systematic collections. The officers, committee memberships, and councils of the ASC are made up chiefly of PhD researchers and administrators. At the 1989 annual meeting in Lincoln, Nebraska, the ASC held workshops on "Educating Systematists/Curators" and "Collections Management and Preservation." Among the ideas expressed by some of these scholar-curators was that their

graduate students were well-trained in collections management because each student had the opportunity to work in the collection, during which time "they do all the things that a curator or collections manager does," such as prepare loans, supervise undergraduate preparators, and assist visitors. Note that these activities are all related to *using* the collection, not to *caring for* the collection. In a subsequent publication, one scholar-curator admitted that "the lack of formal course work in contemporary collection conservation and preparation allows for the passing on of 'bad habits' from curatorial generation to curatorial generation" (Lindberg, 1989b:65). This is a serious problem—the people in charge of the collections in North America are, for the most part, PhD scholar-curators who received their training in collections care only through an inadequate oral tradition.

With a few notable exceptions, neither the scholar-curators nor ASC have done much about collections management. In 1973, the ASC announced the formation of the "Council on Standards for Systematics Collections" as part of the development of a major report on systematics collections (Anon., 1973). This council was supposed to develop standards for "physical facilities, collection storage, preservation, specimen and data acquisition and documentation, collection growth, and interinstitutional loans" (Anon., 1973:12), all of which are collections management issues. The council also intended to look at the broader issues of the nature of systematics collections and electronic data processing. The council formed two subcommittees, one on preservation, the other on data standards (Anon., 1974a). The preservation subcommittee then set out to collect information (Anon., 1974b).

The following year the preservation subcommittee, in attempting "the determination of specific standards of preservation related to individual disciplines", reported that "a series of preliminary and necessarily more general standards has been written" (Anon., 1975:3). However, the report cautioned that "Much remains to be done toward the delineation of specific standards that can be used by collection managers, staff, users, and students associated with systematics collections" (Anon., 1975:3). The recommendations listed in the report were very general, for example, "Collections and specimens must be housed in buildings and storage facilities that provide adequate protection from fire, water, dust, excessive heat or light, and other physical and biological hazards" (Anon., 1975:4). The vast majority of the recommendations concerned access to the collection, which is to say, collection use rather than collection preservation. Nothing more was reported by this committee in the ASC Newsletter until 1980.

By 1980, the Council on Standards had been changed to the Council on Curatorial Methods and was "reactivated" (Lee, 1980a). But the Council again ran up against the unyielding forces of tradition and autonomy. Its report stated that "Each discipline in Systematics has some generally agreed upon practices relative to curatorial procedures and data documentation, etc., but there is virtually no unity of approval on even a regional basis, let alone a national scale. In truth, very few, if any *standards* exist" (Lee, 1980a:9). The article goes on to discuss the negative reaction by the systematics community at large to the idea of curatorial standards, saying that "There are few words

which can stir up misgivings, doubts, fears and even anger as quickly in practising systematists as the term *standards*" (Lee, 1980a:9). A suggestion came to the council that "Rather than 'curatorial standards,' how about a venture into 'curatorial ideals'?" (Roth, 1980:43), but even this appears to have met resistance. Eventually, the Council settled for "the development of interdisciplinary guidelines for the management of voucher specimens" (Lee, 1980b:57; Lee, 1980c; Bell, 1981). The Council established a working group to "insure a minimal level of preparation that will maximize future use of voucher specimens" (Van Syoc, 1981). This effort resulted in a publication (Lee, 1982; Lee et al. 1982) useful in many ways, but the recommendations were still very general. For example, "If long term storage and use are to be guaranteed, application of correct procedures is highly critical. This is accomplished best through work done under the direction of trained biologists" (Lee et al., 1982:13). There is no attempt to define what "correct procedures" are, nor what training the "trained biologists" should have. It was apparently assumed that traditional preparation and management procedures did not need to be examined. Despite good leadership and a willing group of committed scientists, collections management issues were not seriously addressed.

After this, the Council planned to turn its attention to the less controversial area of specimen records and record management (Sutton, 1980).

A recent report from the "ASC Workshop on Collections Resources for the 1990s," funded by the National Science Foundation of the United States (NSF), has again called for the establishment of standards for collection storage and collections management and manuals on preservation and conservation of specimens (Hoagland and Mabee, 1988). Clearly some of the scholar-curators know there are problems, but not enough of them are yet willing to make changes.

In 1984, the ASC reported on a survey designed to project priorities for the systematics community for the next decade (Anon., 1984). This report mentions funding needed for the curation of collections and the development of "new curatorial techniques" (Anon., 1984:38), but "support staff" (Anon., 1984:38) are only mentioned in the context of being needed "to process the backlog and the growing volume of new materials being added to systematics collections" (Anon., 1984:38). No mention was made of the need for more trained staff to better manage and care for what is already in collections.

The present situation

How should natural history collections be managed? In North America, there is a growing emphasis on the conservation of specimens and data and the stability of the collections storage environment (Shepard, 1988). The emphasis is on preventive conservation instead of treatment of individual specimens (there are very few conservators working in natural history (Hawks, 1990), and it is unlikely that there are going to be many more in the near future). Both good collections management and good conservation practices start with the prevention of problems.

Although the situation is improving, there are still problems in the understanding of collections management by collection users. A recent plea for "Collection Needs" in the ASC Newsletter (Funk, 1989) made two main points: (1) more systematists need to be trained to use collections; (2) funding is needed to make more collections and process more specimens so that "they are usable" (Funk, 1989:22) by systematists. This plea, however, did not mention what collections management techniques should be used, what training collections care personnel should have, that preparation methods must be analyzed for conservation soundness, or that greater use of collections and increased collection growth make these "collection needs" even more urgent (Simmons, 1989). The scholar-curator still sees collections management first in terms of access to specimens, not in terms of collection care and conservation. Perhaps this is natural, but it puts the collections manager in the role of mediating between the use of collections and preservation of collections (Cato, 1991), although the collections manager is not often given the authority to fulfil this role. As stated by Hoagland and Mabee (1988:4), "Without the political muscle of tenured faculty, the collections managers find themselves unable to defend the collections against more powerful competing interests."

In many cases, collections managers in North America are expected to take responsibility for collection care without being given the authority needed to carry out this responsibility. Most North American natural history collections are under the charge of scholar-curators, researchers, or scientists. Collections care personnel—usually without a PhD and without tenure, lack the authority and prestige that comes with research positions. This means they rank very low in the hierarchical structure of academia. A recently published pamphlet on "Careers in Biological Systematics" does not even mention collection care jobs (Cato, 1988), it only discusses research and teaching positions.

Some researchers feel that collection use should take precedence over collections care (Conrad, 1990), failing to realize that when collection use comes before preservation, the users will soon be out of business as they will end up with a useless collection. They argue from the position that "...museums understand that the desire to take care of collections derives from the need to use them" (Conrad, 1990:1), and make this argument in opposition to the AAM for their insistence that care of collections is the primary responsibility of all museums. The argument is illogical—collections cannot be used if they don't exist, and they won't exist unless their care is the *primary* responsibility of the institution which houses them. The use of collections should not mean that they can't be properly cared for, nor should caring for collections proscribe their use. Several other authors have evaluated the museum missions of education, exhibition and research and have more rationally concluded that "...we must acknowledge that we owe support to collections..." (Novacek, 1990:356).

The necessity for research to be conducted with museum specimens, even though this complicates the mission of preserving them, cannot be overstated. Collections not used for research risk becoming irrelevant (Foster, 1982).

However, research needs cannot be allowed to completely dictate collections management policy. Use of specimens must be very carefully evaluated by both the researcher and the collections manager in terms of specimens available, effect of the research on the specimens, and expected use of the resulting data (Manning and Simmons, 1992).

Collections management positions have evolved rapidly over the last fifteen years (Cato, 1991). Survey data "emphasize the importance of collection manager-type positions to overall collection care goals in an institution" (Cato, 1991:92). Collections managers are involved in the development of policy and procedures (Simmons, 1991), and all aspects of specimen care from collection and preservation through identification, organization and storage, use, research, and dissemination of information (Cato, 1991). Through all these tasks, the collections manager has a particular responsibility to the collection users to make the collection accessible, and a particular responsibility to the collection to care for it (Simmons, 1986).

I am using the term *collections management* in a very broad sense, such that *curation* describes a subset of collection management activities. Collection management subsumes a broad definition of curation, as in "The term 'curation' implies management functions regarding collections, i.e., processing, cataloging, accessioning, conserving, storing, maintaining, and making collections and their documentation available for research" (Marquardt et al., 1982:409).

What does it mean to have a "curated" collection? Traditional scholar-curators define it as a collection that is organized so that specimens can be retrieved (Steffan, 1977). However, a well-curated collection should also mean that specimens are stored under the best possible environmental conditions, that handling and use are closely monitored, and that steps are taken to improve the longevity of the specimens.

In a recent essay (McGinley, 1990) a scholar-curator at the Smithsonian Institution suggested that "instead of collection management, we tend to practice a system of 'ad hoc management' that is, dealing with problems as they become apparent and seem important at the time" (McGinley, 1990:30). The writer recommends that each collection should (1) develop a mission statement; (2) based on that statement, establish priorities for collection growth; and (3) identify problems with the collection. From this framework, he developed a "Collections Standards and Profiling System" which rates the "health" of a collection using a numerical coding system to identify the curation status of basic storage units (drawers, boxes, or other units). These categories describe conservation problems, identification problems, labelling, placement of specimens in units, and status of data recapture. Using this system, a profile of the collection can be produced to show clearly where problems are and how they can be addressed. This system has great potential as a collections management tool, particularly in a very large collection.

At the 1989 ASC meeting session on "Collections Management and Preservation," Kimball Garrett of the Los Angeles County Museum of Natural History, summarized the chief impediments to proper collection management faced in North America:

1. Inadequate staffing and funding for collections.
2. A lack of basic research in collection care materials and procedures.
3. The inadequacy and inconsistency in the basic training of collections managers.
4. Lack of recognition by many curators of the functions and responsibilities of collections managers. Collections managers should not be used merely as research assistants.
5. The tendency of many curators to choose collection growth over collection care.
6. Some curators are out of touch with progressive collection care techniques and needs. They would rather continue using improper techniques for collection care because it is perceived to be easier or cheaper than comprehensive collections management.
7. Lack of recognition on the part of many administrators of the role of collections managers. Collections managers are often treated like second-class citizens.

The future of natural history collections management

There are two distinct components to collections management (Cato, 1990). One of these includes cataloguing, tracking, identification, and physical location of specimens, which all falls under the general heading of *registration and documentation*. The second component is that involved with the physical existence of the specimens, the prevention of their *deterioration*. The greatest growth and improvement in collections management has definitely been with *registration and documentation*, especially the advances made in electronic data management. By contrast, the physical safety of the specimens "has really taken a back seat in the realm of collection management" (Cato, 1990:12).

The advances made in electronic data processing do have a downside—they can obscure the more important tasks of collections management. There is a real danger of collections management being made synonymous with computerization in the minds of many collections users (Cato, 1990).

The growth in size and complexity of collections has created a demand for new management techniques and policies (Cato and Schmidly, 1991; MacBeath and Gooding, 1969). Even very small museums benefit greatly from the development of a collections care program (Kopeck, 1991; Silvy and Cato, 1991). Long-range planning is lacking in most life science collections. Cato (1991) reported that only 42.2 percent had long-range growth and development plans; a mere 29.4 percent had plans for improving collections management, and just 31.4 percent had long-range collection conservation plans.

Long-range planning is important for good collections management. Preparing a plan should involve three types of specialists—conservators, scholar-curators, and collections managers (Cato, 1990). Conservators are trained to look at the collection environment and evaluate the longevity of the specimen. Scholar-curators bring the perspective of the use of the collection and directions for growth. Collections managers work from the perspective of both collection use and preservation. “The combined evaluations of all three specialists are essential to the development of a workable long-range plan for a collection” (Cato, 1990:13). This is recognized by the Code of Ethics proposed by the AAM which calls for curators to “work in cooperation with the registrar, collections manager, conservator and other staff to ensure that the collections and related documentation are well maintained” (Lester, 1983:38).

Policy statements are important for carrying out the mission of the museum (Sledge, 1988). They serve both as a guide and “a public statement of the museum’s professional standards regarding objects left in its care” (Malaro, 1979:57). Collections managers should play a key role in preparing policy and procedural statements. Of natural history collections surveyed in North America, 78.9 percent had loan policy and preparation plans, but only 59.6 percent had written acquisition/field preparation plans; 56.1 percent had general management policies and procedures; and a mere 21.1 percent had conservation treatment plans (Cato, 1991).

As Cato (1990) stated, “A systematic questioning of procedures and techniques should be an integral part of a collection manager’s job. The collection manager...should function...as a type of systems analyst to pull apart the management system that is currently in place and to analyze it.” In doing this, the collections manager will discover problem areas where research is needed, and can then coordinate working with specialists to address these problems. In this regard, an important initiative has been undertaken by the NIC with the collaboration of ASC and SPNHC. The project is designed “to explore the conservation and preservation needs of the natural science specimens...that repose in museum, university and other institutional collections” (NIC news release, 1992). Funded by the NSF, the project convened working groups to gather and analyze three types of information:

1. Basic problems affecting the overall general care of natural science collections.
2. Specific conservation problems in need of research (both collection specific and common to several disciplines).
3. Collections care and conservation training and information resources that are currently available and those that are needed for the future.

These working groups brought together collections managers, scholar-curators, material scientists, conservators, administrators, and other collections care workers and users of collections. One preliminary observation from this project is that the answers to many of the conservation questions already exist in the materials science literature. The problem is one of communication and access to information. The collections manager is in an ideal position to coordinate information from materials scientists,

conservators, and other collections care workers, to work with conservators to establish preventive conservation measures, and to identify areas where research is needed (Rose, 1991). Thus, the professional collections manager must remain current with professional museum standards, with the research needs in the appropriate scientific disciplines, and with conservation standards for the collection (Cato, 1990).

New strategies for collections management

Increasingly, there are calls for changes in “management structure, roles and responsibilities for...collections management function” (Tyler, 1990:7) in museums, and a movement “to look critically at roles and responsibilities of research scientists, curators, collections managers, support units, and administrators—the collection management team” (Tyler, 1990:7).

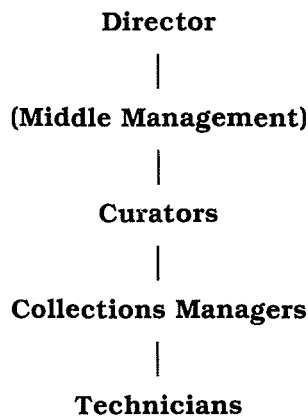


Fig 1. The traditional power structure in natural history museums in North America.

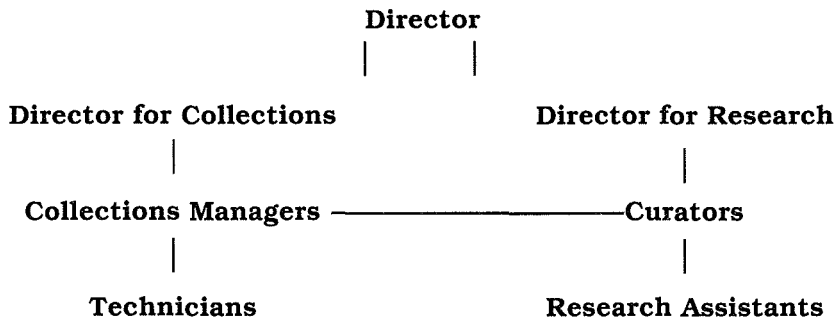


Fig 2. The power structure that has evolved to reflect the changed relationship between collections management and research.

The traditional power structure in natural history museums in North America is one of linear descent from director to collections manager (Fig. 1). But several institutions have changed to systems which reflect how the relationship between collections management and research has evolved (Fig. 2).

The Royal Ontario Museum in Toronto has implemented a collections management system headed by a Coordinator of Collection Management whose job is "to develop, implement, and coordinate collection management related plans, schedules and activities" (Yamamoto, 1985:276). The Coordinator of Collection Management reports directly to the Associate Director Curatorial, who oversees the science departments (Waddington, 1989). The Coordinator of Collection Management manages pest control, risk management projects, facilitates safety concerns, and chairs the Collection Management Committee. This committee "helps coordinate the physical and human resources for collection management" (Waddington, 1989:29) and coordinates electronic documentation records. This system "provides a workable balance of departmental independence and institutional accountability" (Waddington, 1989:30).

The Canadian Museum of Nature in Ottawa has created completely separate divisions of Research and Collections to enable scholar-curators to focus on research and collections care personnel to focus on collections management (Anon, 1992).

At the University of Kansas Museum of Natural History, which is in large part bound by the traditional constraints of an academic hierarchy, there is now a Collections Managers Committee, appointed by the Director. This committee meets monthly to discuss common problems and work on common projects. The committee has produced the museum policies for collections management, pest control, and chemical hygiene.

Summary

The professionalization of collections managers, the recognition of their particular knowledge and skills, and the realization of how their role facilitates carrying out the mission of natural history collections reflect the evolution of natural history collections management in North America. With the growing emphasis in collections management on preventive conservation, the role of collections manager as mediator between the use and preservation of the collections is becoming ever more important. Continued professionalization of collections managers positions will result in better care of collections and enhanced access to collections

Acknowledgments

The genesis of this paper was an invitation to address the annual meeting of the Biology Curator's Group (UK) in 1992. I thank the Biology Curator's Group and the Museums and Galleries Commission for making that possible. A special acknowledgement goes to Steve Garland for making my visit to England extraordinarily enjoyable and productive.

I also want to thank Paisley S. Cato and Frank M.P. Howie for their helpful comments and suggestions on an earlier draft of this paper, although I take full responsibility for the opinions expressed.

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REVIEW: The Moths and Butterflies of Great Britain and Ireland. Volume 7 Part 2.

Editors A. Mattland Emmet and John Heath.

Published by Harley Books.

Price £55 (hardback).

How could the **Lasiocampidae**, **Saturniidae**, **Endromidae**, **Drepanidae** and **Thyatiridae** fill a whole book? The answer is that they do not! The last sixty pages cover the identification, distribution and life history of each species to the same high standard as that achieved in other volumes. The colour plates, so often criticised in early volumes in this series, now seem to have achieved a consistent high standard.

The rest of the book contains three other sections. First is a summary of the classification of the Lepidoptera. The relationships between families and superfamilies and the history of these divisions is discussed. It is set in a worldwide context with useful notes explaining the characteristics of each division.

The second chapter discusses the resting postures of Lepidoptera. Unfortunately, many families of **Microlepidoptera** are omitted from the excellent colour photographs depicting moths at rest. I remember well how long it took me to 'get my eye in' to the extent that I could reorganise moth families by their resting poses. Many people complain that it would be much simpler to identify moths if the books did not at all show them in set poses!

The bulk of this volume contains an extensive series of life history charts for all species of Lepidoptera recorded in Britain and Ireland. Details of the annual life cycles are provided showing which stages of development each species will have reached for each month. General distributional notes and habitat preferences are given and note of the flight time (as in 'Afternoon' or 'Sunrise') are listed. This section is fully indexed to species and foodplants. Abbreviations are used extensively, but an excellent laminated reference key avoided repeated flicking back to find the main key. The level of information provided is not as detailed as that of Emmet's *A Field guide to the Smaller British Lepidoptera*, but provides a useful checklist with plenty of room for annotations! It is extremely useful to have a full index to the foodplants of all species of British Lepidoptera.

Another classic volume in the series.

Steve Garland

Bird Egg Collections: Report of a one-day seminar at Tring Museum, 15 February 1990

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Introduction

This paper is a summary of the proceedings of the one-day seminar organised by the Biology Curator's Group and held at Tring Museum on 15th February 1990. The Seminar was arranged with the principal aim of trying to clarify some of the 'grey areas' of the current legislation relating to bird egg collections, with special reference to the position of museums. The morning session examined egg thefts, the laws relating to eggs and the curation and use of collections. The afternoon session consisted of an open discussion forum, followed by a tour of Tring's egg collections.

Egg Thefts

The morning session started with some case-histories of egg-thefts. Clem Fisher spoke about an egg theft by two youths at Liverpool Museum in 1977. In this case, suspicions had been aroused when the youths visited a museum in Southport and the alert curator had been able to take their photographs. These were then circulated to other museums in the area. They later visited Liverpool and after asking to see the egg collections were subsequently caught with schedule 1 eggs in their pockets; the police were then called in.

Steve Garland related how the egg collections at Sheffield Museum were regularly shown to members of the public. Precautions were taken (the drawers were always taken to another room and people were never left unattended); however photography was permitted and coats and bags were allowed into the room. The theft was not noticed until the RSPB visited regarding a prosecution. Photographs were found in the collection of an egg thief, which appeared to be of a museum's collection. It was then realised that three Golden eagle eggs had been removed and substituted by painted goose eggs. The thief had visited the museum, taken photographs of the eggs and come back a second time to photograph the same eggs, after explaining that the film had not come out. It was during the second visit that the eggs had been switched. One conclusion from this particular case is that all eggs should be kept turned over so that set marks cannot be seen and therefore copied.

Derek Whiteley told of a more recent case from Sheffield about a man who was prosecuted for having a collection containing 1302 eggs, two bats and bits of birds. The museum was approached by the police who were keen that

the collection should not be destroyed, and asked to accept the collection. The collection is an excellent one, well preserved with good local data collected in the mid 1980s. It could not be obtained by 'normal' means. The museum eventually agreed to accept the egg collection and the two bats and obtained a licence from DOE. The pieces of birds were destroyed. The collector is very knowledgeable and has since visited the museum to give additional information about the collection.

History of Egg Collecting

Peter Robinson, the RSPB's Senior Investigations Officer, gave his views about the history and legal aspects of bird egg collections. He explained how egg collecting was an 'English' problem, tending to be concentrated in ex-colonial countries; especially in Victorian times, when it was almost a science, was legal and socially acceptable. Data with eggs was normally valid, reliable and often meticulous. Collecting used to be common in the USA, but it has almost entirely died out there as a result of sensible wildlife laws in force for about 100 years. There is now little justification in collecting as most research work can be done by photography, measuring etc. Limited collecting may still be necessary (under licence) as we may not be able to foresee the future uses of the collections (e.g. shell thinning).

The RSPB know of 500-600 present-day collectors, most of whom were discovered during the 1970s and 1980s, by seizure of notebooks etc. Although most of these people are known, it does not mean that egg-collecting is decreasing. Organisations like the YOC may have reduced it, but there is a natural tendency for youngsters to collect eggs.

Collectors come from all ages and backgrounds (even policemen!). It tends to be a male-dominated problem. There are very few dealers today. Scotland was less accessible in the last century, so dealers such as Dunbar Brothers supplied many eggs to English collectors. There are still a few dealers and there is still a lot of exchanging going on (which under the law is a sale). In a recent case a collection of 26,000 eggs were discovered at Dartford, Kent, including South African eggs. These had been exchanged with a collector in Zambia; the World Wide Fund for Nature funded an investigation and he was subsequently prosecuted.

Most egg collectors have acute, but limited knowledge. They can find nests but often don't know bird calls etc. They often have a bias for 'strange' clutches, or abnormally coloured eggs. The police used to find it difficult to detect eggs which were hidden in thermos flasks, spare tyres etc. Some cars are specially modified to hold eggs. Dummy eggs are often put into a nest, so that it is not obvious that the real eggs have been taken. Data cards are very important (to mount a prosecution) and for this reason collectors often keep them separately from the eggs.

Two successful prosecutions were described: in Sheffield a Mark Whittaker was found with a collection and some photographs of a collection from a well-kept museum. He claimed the eggs had been his grandfather's. It was in fact a 'Whittaker Collection', but the eggs turned out to have been stolen from Sheffield Museum.

The Passmore Edwards Museum had a visitor who wanted to see a Guillemot egg. He then returned and took it. Later, similar events happened elsewhere. The Royal Scottish Museum, Gilbert White Museum and Inverness Museum were all tricked into sending eggs by Red Star to London. Then out of the blue, the RSPB got to see a letter sent to Madrid from somebody requesting a Black Vulture's egg for study. Nobody had heard of the person concerned. They got a description of the person who had collected the Gilbert White Museum's eggs and then 'staked-out' the address on the letter for three days. They also went through the Red Star receipts for the other eggs. All were signed 'PHT' but used different names, (of actual people). The police got a theft case and a search warrant and found the eggs, with RSPB assistance and advice. The thief received a 6 month sentence. He had been an egg collector as a child and had renewed his interest.

The rarer the bird is, the more likely it is for its eggs to be taken. Birds of prey, Divers, Dotterel, Red-backed Shrike, Little Ringed Plover are most at risk. The Kentish Plover is down to only a few breeding pairs in Britain. Egg collecting may finish it off!

Bird Eggs and the Law

In Britain, legislation concerning birds started in 1869 with the Sea birds Bird Protection Act. The Protection of Birds Act 1880, sought to protect wild birds (but not eggs) listed on a schedule. About 1887 it was decided to protect the eggs as well on a local basis, which became unenforceable.

In 1954 the Protection of Birds Act gave total protection to all wild birds and their eggs (except pests) and prohibited sale and exchange. The possession of eggs was not controlled. The penalties were pretty small - £25 for a serious offence, £5 for a lesser offence, although serious offenders could be imprisoned for up to three months. Search warrants were available for police officers to use where specially protected species were involved or the sale of specimens were suspected. The wilful Disturbance of Specially Protected Birds offence came in via the Protection of Birds Act, 1967 (an amending act).

In 1981 the Wildlife and Countryside Act was passed. This current legislation came into effect from September 1982. It prohibited the taking and sale and exchange of wild bird's eggs and extended the issuing of warrants. It is not only an offence to take, but also to be in possession of bird eggs. It controls the possession of wild birds eggs, however, it lets a possessor off the hook if he can show the eggs were taken before September 1982.

Part 1, sub-section 2(a) of the Act states:"...if any person has in his possession or control - any live or dead wild bird or any part of, or anything derived from, such a bird ... he shall be guilty of an offence". This acts retrospectively for birds, but not for eggs, as you cannot tell with certainty when an egg was taken. The draft for the Act included registration of egg collections, but this was probably taken out of the final Act, due to the amount of work required for the initial registration of collections. There are provisions for licences to be granted (eg for the sale of eggs), but with provisos

that they are for scientific or educational purposes. In Northern Ireland, the Act was implemented by the 1985 Wildlife Order which does require registration of collections in Northern Ireland. The UK Government may currently contravene the EEC 1979 Wild Bird Directive, by not having a register,

Under the 1897 Police Property Act, if the police in the course of their duties come across 'property', they have the right to seize it and return it to its rightful owner. It is up to the person it has been seized from, to take action to get it back. It is arguable that the "State is the rightful owner" of eggs etc. (eg. NHM, RMS, NMW). The courts have so far upheld this. If an egg thief is convicted, other things involved can be confiscated, such as cars or other equipment. 'Possession' is an on-going offence. The onus is on the possessor to show an egg has been legally obtained.

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Import and Export Act 1972 prohibit the import into the UK of certain species, except under licence. Animal Health Controls include hatching eggs.

The 1985 Endangered Species Import and Export (Enforcement) Regulations and the EEC Regulation 3626/82 prohibit the public display of anything on the Schedules (Museums are exempt). It is a little understood and under-publicised regulation.

How do the regulations effect Museums? If ANY person has a bird or egg in his possession it is up to him to prove he has it legally (this has been tested several times in the High Court). For example in c.1983 a 'breeder' of birds of prey was found to have four Goshawk eggs which could not be accounted for through his breeding records. They proved to be German, not Finnish as was claimed. The resulting birds were marked by the DOE and went to a dealer. He was caught with the birds and couldn't prove he had them legally. The High Court ruled that "Yes, that is what the Act said". It is therefore up to the person having a collection to come up with the data.

Section 6 of the Wildlife & Countryside Act relates to the sale of eggs. You cannot sell wild birds' eggs without a licence. It is also an offence to publish an advert which suggests a person buys or sells eggs. Section 18 of the Act states that it is an offence to attempt to commit an offence and it is an offence to have equipment to commit an offence. Gamekeepers and taxidermists must prove a specimen was taken legally. Commercial taxidermists must be registered and keep records.

If an egg collection is offered to a museum; are you able to satisfy yourself that if you were challenged over them, that the eggs were legally obtained? Where some future proof might be needed that no eggs have been added to any collection since it was acquired, it might be advisable to record any data etc and lodge it with a solicitor. The person concerned has then done everything within his power. It cannot remove the possibility of future prosecution - this was a point at the centre of a big High Court appeal (Kirkland v Robinson). What it may do is show that you acted in good faith (mitigation), and lessen any penalty a court might impose. You can then go to

the DOE to say that the eggs are in your possession and ask for a licence to cover the collection. (The RSPB/RSPCA both have blanket cover to possess collections in prosecutions). A licence from DOE does not remove the possibility of prosecution in the case of a collection of unknown history. The ideal situation is to register all collections with the DOE. The DOE are however probably not the best people to run a registration scheme. Museums would probably be the best people to do it (with a grant from the DOE/EEC) as a one-off exercise, in conjunction with the RSPB.

Curation of egg Collections

Bob McGowan described how bird eggs are kept in the Royal Museum of Scotland in Edinburgh. The eggs are stored in glass-topped or acetate-topped boxes (i.e. dust-free) containing foam (not necessarily a good idea) or cotton wool. Stickers on each box indicate the area of origin (e.g. S=Scotland). The eggs are kept in an air-conditioned room at 58% RH. The detailed recording sheets used by the RMS were described and it was pointed out that any treatment done to the eggs (e.g. for mould) should be carefully noted, as this may affect future analyses. Although a lot of work has already been done on the collection, it will take about another 12 years to finish curating it!

Uses of Egg Collections

Michael Walters (Tring Museum) described the various uses of eggs using the Tring collections; a paper based on his talk will be published separately.

Discussion Session

The afternoon session of the seminar consisted of a discussion open to all present. It was recorded on tape and the main points are summarised here:

The Department of the Environment's Views

It had been hoped that a representation from the Department of the Environment would have been present at the meeting. Unfortunately nobody was available. Instead a letter from F O'Laughlin was read out from them giving their "informal views". It was not to be taken as a binding or authoritative interpretation of the law, as that is a matter for the courts. The letter stated:

"Section 1 of the Wildlife & Countryside Act 1981 makes it an offence for any person to take an egg of a wild bird in his possession or control unless he can show it was not taken in contravention of the Act or had been legally sold whether to him or another person under a licence issued by the Department. In any prosecution the onus is on the possessor of the egg to be able to show that it had been taken or sold otherwise than in contravention of the Act.

The possession of an egg collected prior to 1981 is legal whatever its origin. The 1981 Act applies only to the eggs of species which are normally resident in or are visitors to Great Britain in the wild state. Museums should therefore be able to show that eggs of British birds

collected after 1981 are held lawfully. If they are unable to do so, it is open to them to apply to the Department for a licence to legitimise the keeping of their specimens.

The display for commercial purposes of the eggs of species which are subject to control under EC Regulation 3626/82 which implements within the EC the Convention on International Trade in Endangered species requires an exemption from the Department. However we have issued a general exemption (GEXI9) which authorises the display of all such specimens by any museum. All museums can take advantage of this exemption without the need to apply individually.

An exemption under EC Regulation 3626/82 is also required to sell or to offer, transport or keep for sale any egg of a controlled species. The sale or advertising of eggs of British species which are not covered by EC regulations requires a licence under the 1981 Wildlife & Countryside Act. No general exemption or licence has been issued for the sale of eggs. An individual application to the Department must be made by a museum wishing to sell specimens. All applications are considered on their merits, but the Department's normal policy is to allow the sale of eggs only to another reputable museum or Scientific Institution.

Should museums wish to buy eggs they should ensure that the vendor has a valid exemption licence to sell otherwise the vendor will be committing an offence. A licence is not required to give a collection of eggs to a museum without charge; but any museum willing to accept eggs offered to them this way should make sure that the eggs are accompanied by evidence to show that they were not collected in contravention of the 1981 Act. The Department cannot offer definite advice on the form this evidence should take, but it could include detailed records showing when and where each-specimen was collected, or a sworn affidavit that the eggs were collected prior to 1981 or acquired legally since then.

A licence under the 1981 Act is required to destroy eggs of British species.

There is no statutory requirement to register egg collections. I am not aware of any proposals to introduce such a system nor of any other proposals which would be likely to affect the keeping of egg collections."

The reference to a licence being required to destroy eggs was presumably referring to eggs in a nest in the wild, rather than to museum specimens (eg game rearers destroying peregrine eggs). Peter Robinson did not believe any court in the land would take it as referring to the destruction of a 'shoe-box' collection in a museum situation. It does however still require clarification.

Acquisition of Egg Collections

Everybody agreed that 'Shoe-box Collections' were a big problem. There is no thoroughly satisfactory answer. It is necessary to satisfy the law that the

collections were legally acquired. This may be relatively easy when the collection is being given by old Mrs Bloggs, who found them in her attic, but difficult with a well documented collection from somebody in his 30s! It is vital that such collections are taken out of public circulation as they may encourage others to collect. Peter Robinson suggested that we should all jump on shoe box collections which have no data! It was agreed that specimens with data should not be destroyed and that many specimens without data may be useful for other purposes.

If it is not possible to prove a collection was legally taken you can apply to the DOE for a licence to legitimise the collection. Peter Robinson suggested that we should not ask for such exemptions for any old shoe-box collection. The DOE might start giving out lots of licences without considering the merits and that would undermine the whole point of licensing.

Should museums be actively collecting birds eggs? Steve Garland gave the example of how a nest in Sheffield was being observed and the birds deserted it. A licence was applied for and granted allowing the eggs to be collected and deposited in the museum.

Jan Dawes asked who is collecting legally today and made the point that we do need *current* egg collections. Andrew Kitchener said that the NCC have been doing some work on Choughs on Islay. A licence was applied for to collect eggs which were then passed on to the Royal Museum of Scotland. Bob MacGowan suggested that museums should get in touch with the Institute of Terrestrial Ecology. They look at carcasses and eggs for pesticide analyses etc. Museums should offer to get the eggs properly blown for them. The museum could then keep the eggs and ITE would still have the contents for analysis. We don't know what might be wanted in 20-30 years time. If we are not careful there will be major gaps in our collections.

Alan Knox pointed out the situation of the Collared Dove which only colonised Britain in the early 1950s. The National collection has only 1 clutch of British eggs and 1 skin. We have nothing to show what has happened to the species in evolutionary terms, colonising an island! Perhaps we need to continue sampling on a more systematic basis than was done in the past.

Licences were issued in the 1960s and 1970s under the 1954 Act to collect eggs. Unfortunately massive fiddling and falsification of records took place and other eggs were taken. The Home Office decided they couldn't trust 'these people' and the government have not entertained licences for collecting eggs. The scientific community feel that egg collecting gets you into areas of great concern and lowers your credibility and so nobody wants to know! It was agreed that the stigma has attached to nest/egg research as a result of the activities of illegal collectors, and that this situation might improve if the collectors could be controlled.

Registration of Birds Eggs

Any voluntary registration scheme would not be legally binding, but any person who is holding a collection legally would be likely to come forward and register. A person holding a collection illegally would be unlikely to register. If

that person then appeared in court it could be pointed out that there is a well-publicised voluntary registration scheme and this person has chosen not to register. It would then be up to the court to decide why the person didn't register. As well as having direct conservation benefits, a national registration scheme would be useful to researchers, NCC etc, if detailed enough.

Peter Robinson suggested that the DOE would not be the best people to set up such a scheme. The ringing of captive passerine species required a registration scheme under section 7 of the 1981 Wildlife & Countryside Act. The DOE made the British Bird Keepers the registered operators of the ringing scheme. If a ringed bird is the subject of an investigation, they generally refuse to give the information required, as they do not want their members persecuted by the RSPB or RSPCA. The DOE might ask the Jourdain Society to run a registration scheme for eggs! It would be necessary to register individual eggs rather than just collections, so that it would be obvious if any new eggs had been added.

How should we go about setting up a scheme? Initially we might be talking of the salary of one person for one year to set up the scheme nationally, but each individual museum would probably need additional curatorial help on top of that to get the work done. Museums would need to register that they have an egg collection, but large museums would then have say 5-10 years to come up with a catalogue. Smaller museums with for example less than 15,000 eggs would have to do it sooner. It is a big job for the curators. It is essentially an audit but extra resources are needed to carry it out. It must be remembered that the scheme would not be aimed at putting unnecessary restrictions on museums, but to catch illegal collectors. It will be necessary to look for resources to get the necessary work done; Extra funds would need to be found specifically for the documentation of egg collections.

The basic problem is the bad legislation. The government should be encouraged to set the legislation right. The RSPB would like it to be illegal for anyone outside a museum or similar institution to hold an egg collection.

Richard Sutcliffe pointed out that Lloyd Kiff in USA is compiling a World Inventory of birds eggs. He is looking for the number of clutches of each species (with data) in each museum. Museums which had not yet responded still had time to do so. Steve Garland mentioned the idea of a "Bird Egg Amnesty". There are probably a large number of people with bird egg collections, who don't really want them, and would be happy to get rid of them, but who are unable to prove their legality. At present if somebody comes to a museum with a collection, what can they do? The museum cannot accept them legally, and so either they are dumped by the person or are kept in circulation. In other cases people leave their eggs at museums and never come back for them.

Mike Bishop gave the example of a large writing cabinet in an auction at Plymouth, where the auctioneer had bought the cabinet in good faith, but the drawers had been locked. When they were unlocked they were found to contain a large egg collection. The auctioneer managed to get a DOE licence to sell the cabinet plus the eggs. The details were circulated around museums

throughout the UK, but in the end the owner decided to keep them and gave them to his son.

Steve Garland was concerned about the wording of the licence, which said "it would be available for purchase by museums or other scientific establishments". It was felt this was too vague a description. He had suggested to the DOE that when Museum Registration was completed throughout the country that should be the criteria they should base it on, but it should possibly be even tighter than that, and depend on the presence or absence of a biological curator. Peter Robinson suggested that the right way for the DOE to do it is to tell the vendor to find a buyer who meets the requirements and that the DOE will then give a licence. They should licence the advert for sale, which should read, "For sale for educational or scientific purposes; an egg collection". Having hooked a buyer through the advertisement, the DOE should then consider granting a licence for the sale.

Peter Robinson pointed out one danger with licences. If he had a bird of prey and registers it with the DOE, it does not make it legal, it just identifies that it is present. If somebody later shows that it was acquired illegally, he is not prevented from being prosecuted just because the fact the bird is registered. The same thing applies to eggs. The fact you have a licence cannot take away the liability to be prosecuted later for possession.

Very basic registration would be relatively easy to achieve (ie do you have an egg collection or not?) and would give some credibility. In the case of a lot of small collections, good colour photographs would establish that you have collections at that time. Any scheme must be tied in with a lot of publicity and taken to a wider community.

If there was a bird egg amnesty many museums might be swamped with unwanted eggs. Should there be a central egg repository? They would probably need to be channelled to particular museums. Otherwise they would end up in museums which have no biological curator and who don't want them. There would be extra expense for museums who did accept such eggs in providing specialised housing for them. It was suggested that there would be no point in the amnesty if it simply meant changing illegal holding of collections from private hands to public institutions. There would need to be pressure put on the DOE or legislation passed to give museums some sort of immunity from prosecution for holding these collections. Peter Robinson stated that it was better to get small collections out of circulation, by bringing them to your local museum and getting the DOE to grant licences to accept these eggs under this particular situation (a one-off exercise).

Jumping on eggs with no data was suggested, but what would people's reaction be if they later discovered you had jumped on Grandpa's egg collection? Many people are probably scared to death, thinking they have illegal collections; an amnesty would let them give them away.

Display and Interpretation

David Glue said that the function of a museum is to collect, hold, display and educate. He felt that so long as labels are written properly, then we

should display eggs. There are some aspects of bird biology which cannot be done properly without showing eggs. There is an important distinction between displaying eggs in context rather than just as an object. Unfortunately the public don't always see it that way! Peter Robinson made the point that an ICCP resolution was approved at a meeting in Greece in c.1968 which agreed that it was no longer necessary to use eggs and skins in the educational context in this day and age when so many photographic aids were available.

Andrew Welsh (who runs an Environmental Interpretation Centre) deals with young children. Photographs are all well and good, but an actual egg will be remembered by a child whereas a photograph will not. Eggs should be available to educate people - "If you hadn't taken this egg it would have been a bird". Some of the people who are now most fanatical about stopping egg collecting, started off by collecting eggs themselves. They then realised and thought about what they were doing and now try to prevent collecting. We must educate youngsters about what an egg is and what they will develop into and change the whole way of looking at things.

Alan Knox commented that many of today's ornithologists started out as 'egggers', collecting anything from one or two to even a few hundred eggs. Collecting is part of the learning process and in most cases has done very little harm. Today's youngsters are encouraged to collect sea shells, bits of plants etc., whilst learning about the environment. These are going to be the next generation of conservationists.

Steve Woolfall drew attention to a recent article about a biology teacher who discovered his pupils were egg collecting and managed to steer them into nest recording instead. Ann Hollowell suggested that the appeal of recording nests may be more useful than looking at what eggs look like (the ecological rather than the oological approach). Derek Whiteley admitted that we have all hidden our eggs away because that is what conservationists have been telling us to do for the last 20 years. Joan Round felt that hiding eggs away is actually doing harm. We should put them on display with the relevant information and highlight extinctions etc.

Security

Ken Joycey asked if there was a mechanism for keeping an eye on those people who have already been convicted for egg thefts. The RSPB no longer issue black lists. The list was getting very long, there were severe legal problems (eg. the Data Protection Act) and people would be lulled into a false sense of security. Repeat offenders are common. If you think someone is acting suspiciously act on it! Thieves are very clever. When the 'Red Star' thief phoned one museum to ask them to lend eggs, he gave the name and address of Shell. The museum phoned Shell back and discovered the person existed (but had left 3 months earlier). It turned out he had lost his credit card! The egg thief had later used it to establish a false identity.

LEEDS CITY MUSEUM - its Natural History Collections.

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Abstract

The following is a brief history of the Leeds City Museums, with special reference to the role of the natural history collections in the development of the museum. The paper also attempts to give an insight into the scope of the collections and some of the complex thinking and negotiations which have taken place in the past over the acquisition of material. The paper also includes the first part of a detailed account of the natural history holdings of the Leeds City Museum.

The Museum's origins

The Leeds City Museum was founded by the Leeds Philosophical and Literary Society at a meeting held on May 7th 1819. At this meeting a building committee was appointed which decided that land should be purchased and a suitable building erected. The building was ready for occupation in April 1821, at a total cost of £6,150 (Brears, 1989). One of the earliest of the literary society museums in Britain, Leeds was founded after Spalding 1710, Plymouth 1812, and Truro 1818 but before such well known society museums as Manchester 1821, Whitby 1823 and York 1823 (Brears, 1984).

The Society, founded on November 11th 1818, was formed to discuss and expand the knowledge of its members in 'all the Branches of Natural Knowledge and Literature, but excluding all topics of Religion, Politics, and Ethics'. (Kitson Clark, 1924). The building of a museum was a natural priority for the founding members, but there were few other museums at the time and no obvious model for a purpose-built museum existed. The result was that by 1825 the museum had already become uncomfortable and overcrowded, being 'neither sufficiently commodious nor in any respect eligible for the purpose of an increasing and valuable collection'. The Society doubled the size of the museum in 1861-2 by creating a new Lecture hall, and "a vast zoology gallery, library and kitchens, etc." (Brears, 1989).

The Victorian attitude - Science v. Brass

Since the very inception of the museum, natural history material was actively collected in the field, as well as being acquired by purchase and by donation. The quantity of material collected for, and on behalf of, the museum in the 19th century would be considered excessive by today's standards but is

typical of museums and collectors of the period. For example, letters in the archives of the museum indicate that between 1860 and 1895 Mr. M.A.B. Gellibrand of Cleveland, Tasmania and Mr. George Noble of Leeds sold or gave to the museum 20 specimens of the Tasmanian Wolf (Norris, 1985a). It is little wonder that this and many other animals and birds, became extinct when collecting on this scale took place. Gellibrand is also known to have supplied Tasmanian Wolves to other museums and institutions throughout Britain.

It is difficult to ascertain whether the Leeds Philosophical and Literary Society had a specific collecting policy or not, with regard to the acquisition of natural history material and/or collections; it is most probable, however, that only cost dictated the acquisitions policy. Either way the museum, unlike similar institutions, did not finance collecting trips either in Britain or overseas. Material acquired by the museum was nearly always by means of donation, and as a result of personal contact by dealers or members and friends of the Society offering material for the collections. Even when specific collections were purchased it often took many months or even years before a purchase price was agreed. Typical of this is the correspondence relating to the purchase of a collection of British and Continental birds which were on loan to the Society from Sir William Mordaunt Edward Milner (1848-1880) the 6th Baronet of Nun Appleton. Sir William succeeded to the estate and titles at the age of 18, and the estate soon ran up enormous debts largely it was asserted, by his brother Sir Frederick who, it is said, had been led astray 'by the falsest of friends'. Sir William died in Cairo whilst a member of the British Army, and the family estates, including his collection of birds became the property of Sir Frederick.

The collection was offered for sale to the museum in 1893 and was valued on behalf of the society by Canon H.B. Tristram. The following is an extract from a letter dated 9 May 1893:

"Gentlemen,

At your request I have carefully gone through the Milner collection of British Birds, with a view to obtain a correct estimate of its market value.

The collection contains 616 specimens of 355 reputed British species of birds. The specimens are by no means all British-taken. In fact, with four exceptions, the examples of rare stragglers or accidental visitors, have been procured from abroad.

The gem of the collection is a fine though badly mounted specimen of the Great Auk, now extinct. This example has no history beyond the fact that it was purchased by the late Sir Wm. Milner in 1856 for £25. Judging by the prices fetched at recent sales, viz £200 & £210, I cannot estimate this specimen at less than £225.

[Note: 1. The specimen was described in a paper published in 1897 (Grieve, 1897), as "one of the finest skins in existence". 2. The details of the specimen as published in the sixty-first report of the Leeds Philosophical & Literary Society, 1881 are as follows; "Great Auk (*Alca impennis*). - Orkney. Bought in 1856 from the Rev. R. Buddicom, of Smethcote, Shrewsbury, for £28". This specimen is thought to be the specimen purchased by Mr. A.D.

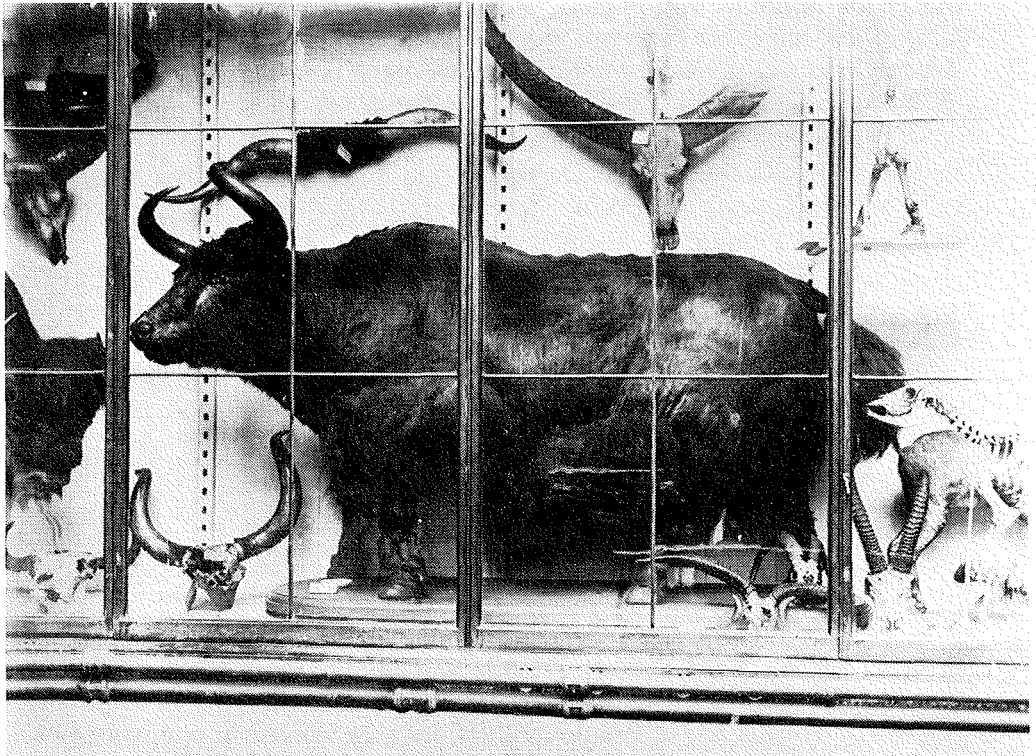


Plate 1. Yak, *Bos grunniens*, Acc. No. LEEDM-C-46-1862, circa 1900. Shot on the shores of the sacred lake of Manasarover in Tibet in 1860 by Capt. Edmund Smyth (1823-1911) and the Hon. Robert Drummond who violated not only British and Indian laws of the time but also the Tibetan religion at one of its most sacred shrines.

Capt. Edmund Smyth was a pioneer of hunting and mountaineering in the Garhwal Himalayas, and was immortalised as Crab Jones in 'Tom Brown's Schooldays'. The Hon. Robert Drummond was a younger son of the Eighth Viscount Strathallan, and the younger brother of the Lieutenant-Governor of the newly-formed North-Western Province.

Bartlett as a 'Northern Diver', and sold to Shaw of Shrewsbury in September 1844. (Hahn, 1963)].

The rest of the collection I do not value at more than £160.

*There are two birds in the catalogue which might be supposed to be of considerable value. One of these, labelled *Aestrelata lasitata* "The Capped Petrel" if the specimen were what it professes to be I should have valued at a high figure. But it is not "The Capped Petrel" at all, but an allied Pacific species, which is not uncommon, while the "Capped Petrel" is believed extinct. I have valued it at £1. Had it been the genuine bird it might have been worth £20.*

*Another bird, *Rhodostethia rosea* Ross's Ivory Gull, or the Wedgetailed Gull, is interesting, as being the solitary specimen on which is based its claim to be inserted in the list of British Birds. Only*

two other instances of its being taken in Europe are on record - one on the Faroe Islands, the other at Heligoland. This arctic bird is in the winter very different from the much prized summer plumage. ——— I have valued it at £8 only. In summer plumage it might be worth £20. ——— I estimate £385 to be the outside sum the collection would fetch at an auction”.

This valuation was in Sir Frederick's opinion “simply absurd”. In a letter from his London home, 22 Pont Street dated Nov. 26 1893 Sir Frederick writes:

I have now completed my correspondence with Professor Newton and Mr. Cordeaux and other experts, and I am quite satisfied that I have every chance of realizing at least £1,000 by the sale of my collection of birds. When I tell you that I have now two offers of £300 for the Great Auk, and one of £70 for the Cuneate tailed gull, you will see how absurdly inadequate was the offer made by your Society. For the sake of keeping the collection in Leeds I would make some sacrifice, but I could not consider any offer of less than £800”.

In July 1894 this sum was reduced to £700. In August 1894 the Great Auk was withdrawn from the collection and forwarded to Stevens Auction Rooms where it was sold on the 22-23 April 1895 (Chalmers-Hunt, 1976). The bird was, in fact, bought in as it did not reach its reserve price believed to be 360 guineas (Hahn, 1963). The Great Auk was almost immediately sold to the Edinburgh Museum (now the National Museums of Scotland), for the sum of £350, (NMSZ 1895.71). The main collection was finally purchased by the museum in May 1922 for the sum of £250. The purchase of this collection had taken nearly 30 years of correspondence before an agreement was reached on the price to be paid.

The natural history archives also contain details of collections about which such agreements as to the purchase price were not reached, with the result that these collections were never purchased.

Civic Pride - Mayoral and other gifts

Membership of the Leeds Philosophical and Literary Society was a social “must” if one had ambitions of a political or business nature in Leeds. It is not surprising, therefore, that most members of the Leeds City Council were also members of the Society. A good number of the Mayors of Leeds used their office to acquire material for the collections, either as personal gifts or by persuading others to donate material. The material presented as Mayoral gifts varied according to circumstances. In 1854-5, for example, the museum acquired a fine Crane shot in Scotland from the then Mayor Joseph Richardson, in 1857-8 Peter Fairburn presented five quadrupeds from Australia, in 1870-1 John Barron donated an adult female orang-utan and skeleton of the same, in 1875-6 Alderman Croft gave a Collection of British birds, and in 1891-2 Alderman Boothroyd presented a collection of birds' eggs.

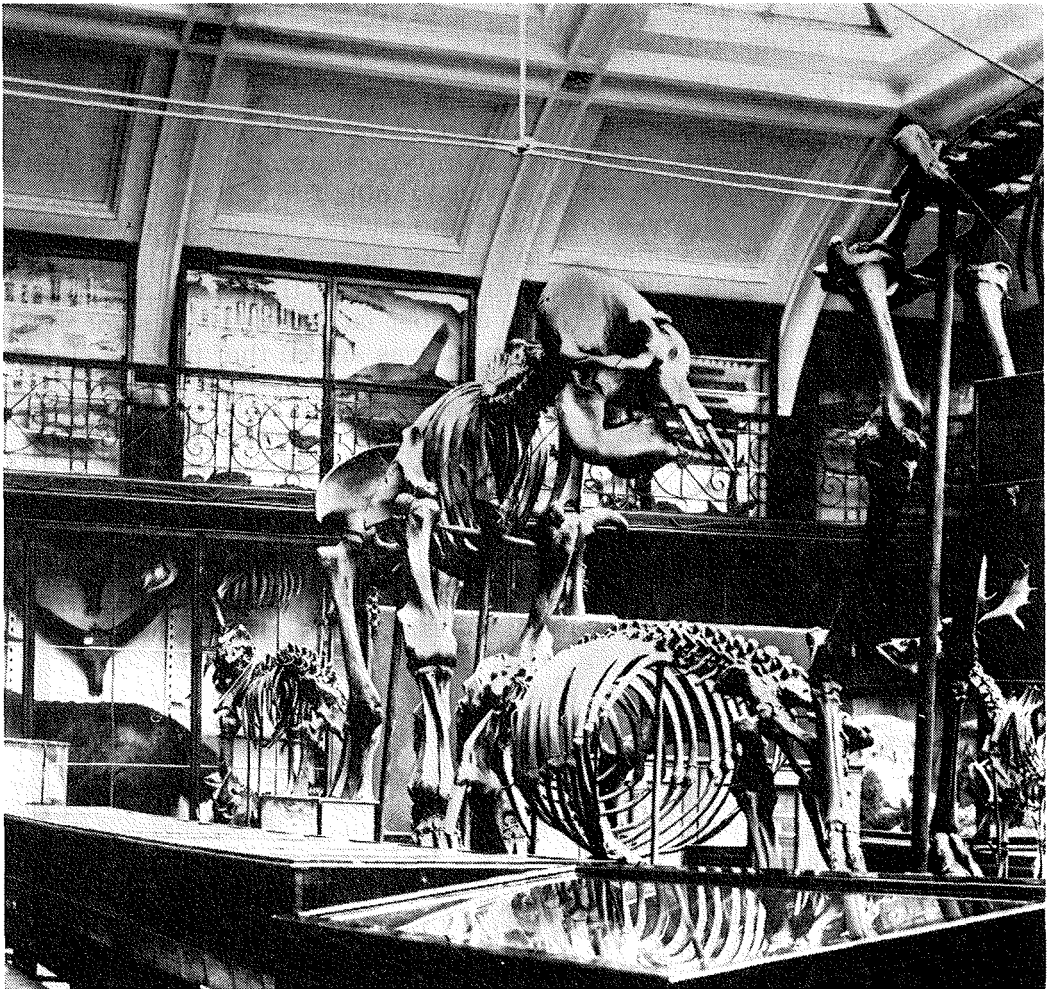


Plate 2. Part of the zoology gallery as displayed circa 1900, showing part of the study collection of skeletons including elephant, walrus and part of the Irish Elk collected in 1847 from Lough Gur in County Limerick. The skeleton of the elk is still on display today at the City Museum. Most of the other large skeletons suffered as a result of the aftermath of bombing in 1941, and have either been lost or dismantled.

In the single year 1858-9 the Society received donations from George Lane Fox of Bramham Park; His Grace the Archbishop of York; J. Spencer Stanhope, Cannon Hall; T.W.V. Wentworth, Wentworth Castle; Daniel Gaskell, Lupset Hall; Joseph Dent, Ripston Hall, The Lord Bishop of Ripon; Sir J.V.B. Johnstone Bart, Hackness Hall; John Wilson, Seacroft Hall; J.C.F. Gascoigne, Parlington Hall; Sir J.H. Lowther, Swillington Hall; Sir Thomas Becket, bart, Somerby Park; Lord Viscount Palmerston, Lord Wharnccliffe, Wortley Hall; The Earl of Effingham; The Earl of Carlisle; Lord Faversham, Duncombe Park; The Earl of Dartmouth, Sandwell Park; Earl Fitzwilliam, Wentworth Park; and Lord Londesborough of Grimston Park. These gifts ranged from a collection of

shells donated by the Earl of Dartmouth to an entire skeleton of a Reindeer from the earl of Carlisle. This social rollcall shows the status of the museum and the reflected civic pride it gave to the City of Leeds.

The Leeds City Council

In 1904 the Society reviewed the progress of the museum and came to the conclusion that unless it was moved into larger premises it could never achieve its full potential (Brears & Davies, 1989). The University of Leeds offered a suitable site on Woodhouse Lane and a joint committee of University and Society members was proposed to run the museum as a joint University Museum. However, before any action could take place, the Leeds City Council expressed its interest in the museum as a public facility. In 1918, some years later, the University finally pulled out and it was agreed that the city should take over the museum and its collections. This officially took place on July 18th 1921.

In 1937 a design was commissioned for a new combined library and arts building which was to occupy a 90,000 sq. ft. site adjacent to the Town Hall. The outbreak of war in 1939, however, brought the whole project to a halt.

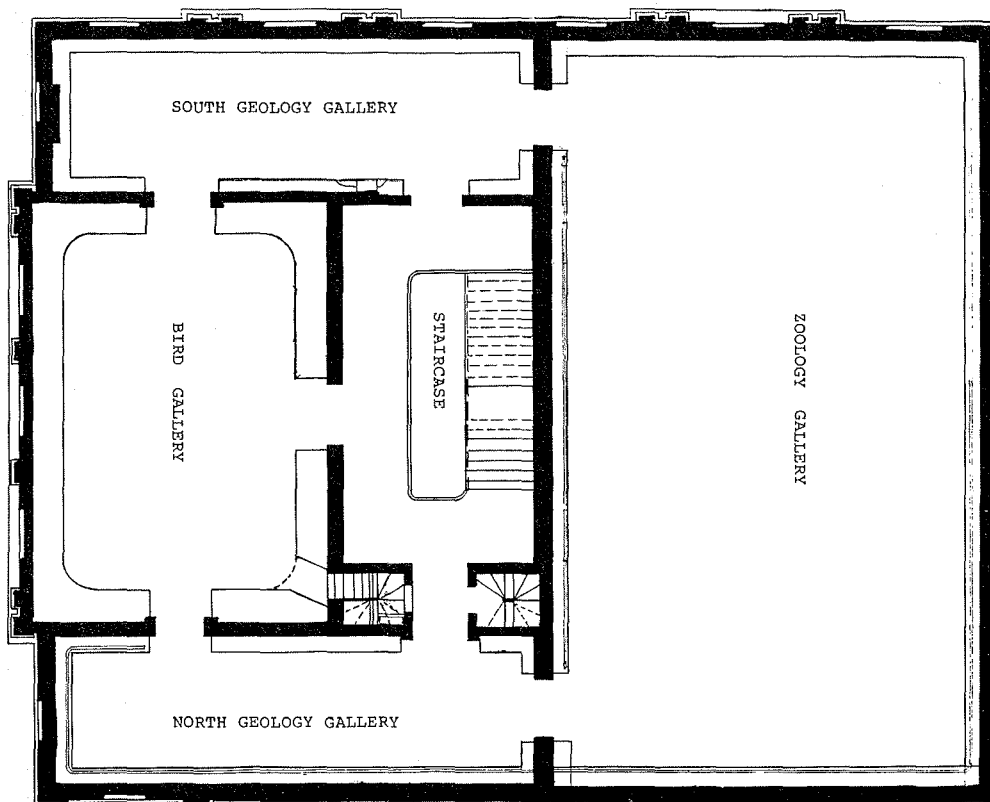


Plate 3. In 1961-2 the architects Dobson and Chorley created a new lecture theatre and a huge new zoology gallery as part of the remodelling of the museum building. This plan shows the scale of the project and the relationship of the bird gallery to the new zoology gallery. The bird gallery was totally destroyed by the 1941 bomb.

The Second World War and its aftermath

At 3 a.m. on the morning of Saturday 15th March 1941 disaster struck; the museum received a direct hit. A bomb crashed through the roof of the bird room, destroying the front half of the building. When the museum re-opened on 23rd June 1942 only the 1860s extension remained. The bombing of the museum resulted in the loss of many rare and valuable items, including most of the mounted skeletal material and a quarter of the museum's bird collection. By the early 1960s it was realised that the museum would have to be demolished, as the foundations had been severely damaged by the bombing and the wall of the building had started to move outwards. These structural defects finally forced the museum to close to the public in January 1966.

A temporary solution

The former Police Department Offices in the Municipal Buildings had become vacant and plans were made to move the museum into this temporary accommodation. The site of the old museum was far too small to redevelop as a museum and, being centrally situated, was a valuable asset. Thus the old museum was sold, demolished and the site was redeveloped as a bank. A new museum was opened by H.R.H. The Princess Margaret, Countess of Snowdon on 6th November 1969. The original intention was that the museum would be housed in this temporary accommodation for a maximum of 10 years - over 20 years later the museum is still there, with less display space than was available in the 1860s.

The gathering in

In the late 1940s an appeal was made by the Leeds Museum for birds to replace the 1,000 or more lost because of war damage. This resulted in several hundred specimens from other museums and institutions being transferred to Leeds. In 1950 alone, Leeds received 58 cases of birds from Scarborough, 70 cases from West Hartlepool, 4 cases from Winchester Museum, 50 cases from Northampton as well as an unknown number purchased from Whitby Museum and sundry gifts from other institutions and private individuals. In recent years large quantities of material have come into the collections as a result of other museums and institutions rationalising of their holdings. In 1977 the museum acquired the bulk of the bird collections from Swindon Museum and large sections of the herbarium from Leeds University in 1980 plant collections from the Wellcome Institute, in 1982 foreign zoological material from Salford, in 1985 the zoological collections of Wakefield Museum, in 1987 botanical and spirit collections from Malham Tarn Field Centre, and in 1990 the natural science collections of the Bankfield Museum in Halifax.

Present holdings

The present holdings of the natural history department are in excess of 300,000 specimens, 74,232 of which have come into the museum's collections

between 1980 and the end of 1991. The count for 1992 is, at the time of going to press, in excess of 8,000 specimens.

The Leeds City Museum is fortunate in being able to provide for the general public such an extensive and important resource, with material from all parts of the world available for study. The local authority should be congratulated for holding on to this material during periods when other institutions held such items in poor regard, and disposed of their collections. In particular, the large quantity of foreign material currently held by the Leeds City Museum is now exceptional within provincial museums.

Past curators

Over the 173 years of the museum's existence there have been many outstanding curators, whose special interests were in the field of the natural sciences: John Atkinson, Curator 1820-1828, Henry Denny 1825-1871, Prof. L.C. Miall 1871-1891, Edgar Waite 1891-1893, Henry Crowther 1893-1928, and David Owen 1947-1957. Departmental Keepers have also included John Armitage 1952-1970. These, and many other outstanding naturalists, have helped with the collection, identification, documentation and storage of the collections as staff, volunteers and donors.

The Collections : I. Vertebrates

Mammals

The mammal collections are small in numerical terms, but they take up nearly half the total storage and display space within the museum. The collection includes such large mounted items as tigers, yak, bison, polar bear, Brown, Himalayan and Black Bears, hippopotamus, Arabian Oryx, zebra, gnu, wild boar, several seals and sealions, and even a Giant Panda.

Many of these large animals could easily have been lost to the museum, due to neglect, poor documentation and inadequate storage. Fortunately, staff were able to justify the retention of this part of the collections (Norris, 1988), and a programme of cleaning and restoration has revitalised much of the material. The collection is also very strong in the number of primates it contains, this includes several chimpanzees, orangutans, gorilla and many other smaller species from all parts of the world. A travelling exhibition called "Monkey Business" was recently produced by the Yorkshire and Humberside Museums Council based entirely on the Leeds collection.

Accession registers have often proved to be unreliable, with single line entries being common. A great deal of research has been undertaken in recent years to fill in the background information on specific animals and collectors. This research is still in progress and the author would be pleased to know of the whereabouts of the veterinary records from Belle View Zoo, Manchester, as well as any information which might be available about a travelling exhibition which was staged by the Canadian Government and toured Britain and Europe just prior to the second world war.

The mammal collection mainly comprises single, or small groups of specimens and numbers about 250 items. The bulk of the skeletal collection

was destroyed by the bomb in 1941. The only collections as such are: the collection of mounted heads put together by Mr. A. Hailwood of the Manchester Creamery, Broughton which was acquired by the Royal Museum and Libraries, Peel Park, Salford in 1908 and subsequently transferred to Leeds when the Buile Hill Museum, Salford disposed of its mounted animals in 1982, and the Whittaker collection of Yorkshire Bats. Detailed research has been undertaken on a number of the larger exotic mammals and short notes published on the following: The Giant Panda (Norris, 1981), Mok the gorilla (Norris, 1984), the Leeds Tiger (Norris, 1985b), The Hippopotamus (Norris, 1985c) and the Yak (Norris, 1986).

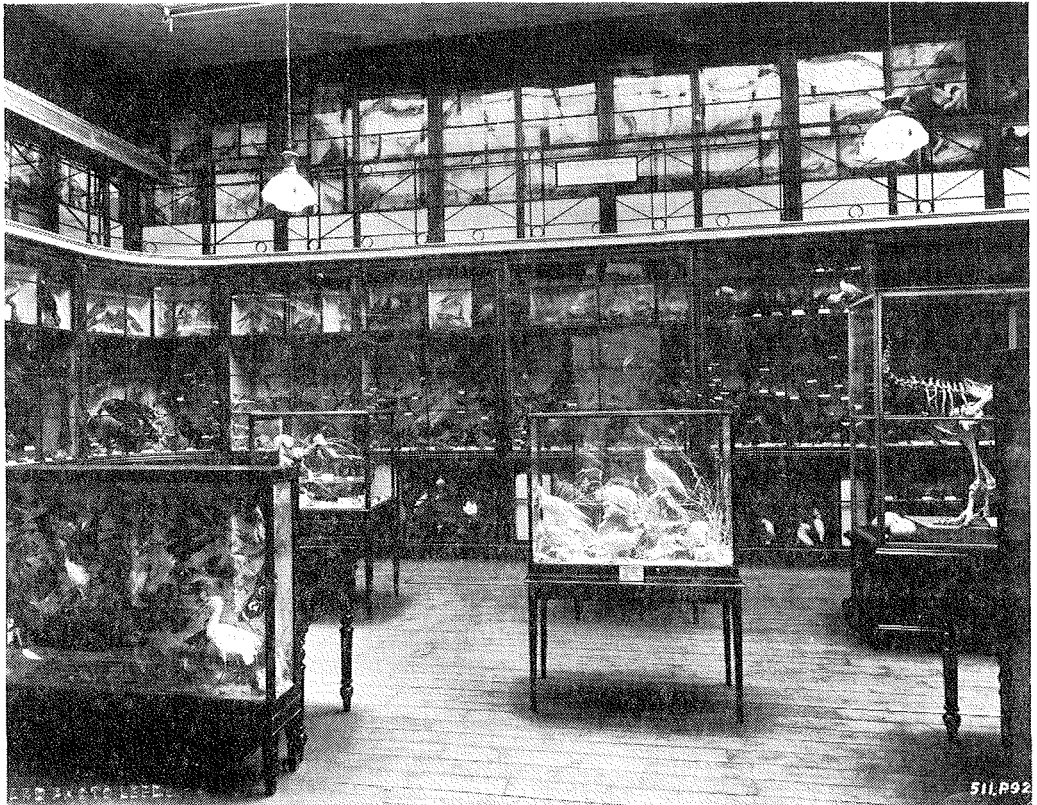


Plate 4. The bird gallery, as remodelled by Watson and Pritchell of York, who added the mezzanine gallery in 1926. The photograph dates from circa 1900, and shows part of the large collection of birds on display at this period. The mezzanine gallery holds the Sir William Milner collection of British Birds.

Birds

Like the skeletal material, the bird collections took the brunt of the damage when the museum was bombed, resulting in the loss of over 1,000 mounts and skins. Many of the salvaged birds also proved to have lost their documentation and it is difficult, in many cases, to state categorically whether

or not Leeds has a particular specimen. A typical example of this is the specimen of Ross's Gull purchased by the museum as part of Sir William Milner's collection. It was previously thought that this specimen had been on display in the bird gallery when it was bombed in 1941. Recent research into a Ross's Gull found in the collections of Wakefield Museum, however, suggests that it is probably the Leeds specimen (Densley, 1988). It may be impossible to prove beyond all doubt, but the specimen was probably on loan to Wakefield from Leeds. Very little documentation on loans in or out of the Leeds collections survived the aftermath of the bombing.

At present, the collection contains some 3,935 skins and mounts and over 10,000 birds' eggs. The collection includes material from the following collectors:

Mounts and skins.

Hirst, J.C., 216 mounted birds from all parts of the world, including many rare and extinct species such as the Passenger Pigeon and a pair of Huia's from New Zealand; Mountain, C., 120 mounted birds; Milner, Sir William, Bart., 100 skins and mounts are still extant out of the original 615 purchased in 1922 and these include some extinct species such as the Carolina Parakeet and the Eskimo Curlew; Todd, J., (?), 64 mounted birds.

Eggs

The extant egg collections are comprised mainly from the material collected by 8 egg collectors, as listed below. The bulk of this material came into the museums collections as a result, directly or indirectly, of the restrictive legislation regarding the collecting of birds eggs which became law on the early 1950s. Most of the pre-war egg collections did not survive the 1941 direct hit, the shock waves shattering the eggs. For example the collection of Mr. W.T. Crampton of Roundhay Leeds, donated in the year 1903-4, was reduced by the bomb from over 1,700 eggs to just over 100 today. A great deal more research is required into these collectors, and their collections, to bring these into line with other aspects of the museums collections.

Arundel, Maj. W.B., fl.1895-1907, 132 clutches, 469 eggs; Booth, H.B., (1866-1941) 221 mainly single eggs. U.S.A. & Australia; Caley, George C., (1891-1968), 114 clutches, 509 eggs; Campton, W.T., fl.1897-1951, 42 clutches, 107 eggs; Rhodes, C.E., fl.1884-1942, 369 clutches, 1673 eggs; Roper, J.G., fl.1901-1937, 221 clutches, 991 eggs; Schluter, W., fl.1886-1909, 139 clutches, 575 eggs; Woodhouse, F.H., fl.1889-1959, 42 clutches, 197 eggs; and many other smaller collections.

Fish and lower vertebrates

The Leeds collection contains only small numbers of lower vertebrates and very few mounted fish. However, some interesting material is contained in these holdings. This includes a Ganoid Fish from Africa which appears to be the same specimen that was on display in the Calvert Museum in Leeds (an

early private museum c. 1825-1874), a description of which appeared in *A companion to the Leeds Museum of Natural Curiosities, Antiquities, works of Art &c.* printed by Edward Baines and published in 1826. Other interesting and useful parts of this collection include a small collection of some 43 packets of otoliths presented to the museum by Dr. Adrian Rundle.

The spirit collection also contains over 150 samples of British freshwater fish collected as part of a study into the allozyme variation and phylogenetic relationships of Asian, North American and European populations by Dr. Robin Lawson of the California Academy of Sciences.

The collection of reptiles and amphibians is mainly limited to mounts of tropical lizards. The museum did hold a sizeable collection of reptiles and amphibians in spirit, but these were lost in the bombing.

Invertebrate Collections.

The invertebrate collections comprise, in numerical terms, the largest part of the Leeds City Museums Natural History Collections. This part of the collection also contains some of the most important material held by the department, both historically and scientifically. In the next paper I will be discussing these collections and the many people involved, in both the collecting of material and the gathering together of these collections.

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REVIEW: The Scientific Names of the British Lepidoptera - their History and Meaning

by A. Maitland Emmet.

Published by Harley Books.

Price £49.95 (hardback); £24.95 (paperback).

This is not an easy book to review. It has entries for every scientific name, both genera and species, of all British **Lepidoptera**. Each word has been extensively researched to provide an explanation of its meaning. At first glance, this list of names seemed very indigestible and was difficult to enthuse about. However, the book sat by my desk for several weeks and became well thumbed as I repeatedly referred to it. Various scientific names would spring to mind and beg to be explained; it can become addictive! Some are obvious; *albicolon* causes no problems, but how many people know that *Ephestia* means 'of the hearth', a reference to its occurrence in domestic situations.

It is fascinating to see how some names were obviously chosen after much thought. Others, such as many of Walker's were given little thought or have no real meaning. There are also fascinating insights into misspellings, misidentifications and other errors now irreversibly accepted by the ICZN. Others have stories associated with them. *Euclementia woodiella* was named by Curtis after R Wood, who supplied him with a specimen for figuring. Unfortunately this failed to acknowledge the discoverer, a Mr. Cribb, who was not impressed!

The bulk of the book consists of the definitions; names being in updated Kloet and Hincks order with Bradley and Fletcher's 'Log Book' numbers. A thorough index is provided as well as lists of those names derived from peoples' names and geographical names. There is also a table listing errors identified in definitions given by Macleod in his 1959 book *Key to the Names of British Butterflies and Moths*.

The introductory chapters provide a useful explanation of the history of scientific nomenclature and a very straightforward explanation of modern rules of nomenclature, Law of Priority, Homonymy and other problems. If *sensu auctt.* in a checklist means nothing to you, read this chapter.

Finally, Colonel Emmet has not been completely successful. Appendix 3 lists thirty-five names for which he has found no satisfactory explanation. A strangely large number of these are generic names, but if you like a real challenge . . .

Steve Garland

Museum pests from pigeon nests

E. Geoffrey Hancock

Art Gallery and Museum, Kelvingrove, Glasgow, G3 8AG, Scotland

There is now quite a voluminous literature on museum pests and their control and prevention. Birds' nests are generally known to be the natural habitat of several native insects that have subsequently taken advantage of human activity and become distinctly synanthropic. Those which feed on hair or feather, the keratin digesting clothes moths, are amongst the most familiar in this category. In addition introduced species use nests in appropriate situations. This note describes the contents of pigeon nests in relation to a museum situation. The pigeons are the town or feral strains of the rock-dove (*Columba livia*)

In advance of several events in Glasgow, the Garden Festival (1988) and the European City of Culture (1990) celebrations, investment in the city environment became more of a priority. One of these included the external renovation of the main museum building. Stone cleaning, stone replacement where necessary, and roof and rooflight repairs were carried out. For a few years previously windows in the turrets had not been replaced when broken and pigeons nested in these areas. These turrets and associated baroque embellishments (the building is officially described as French renaissance with Hispanic interior) only have access for maintenance purposes so the situation had apparently been tolerated or ignored. Many of the nests had signs of generations of occupation, being very thick and having layers of sticks, droppings and other debris spilling over a considerable area. Feathers and the remains of dead squabs elevated the range of organic nutrients.

The contents of one nest were quantified in June 1987. Three other nests were examined also for insects, from which no additional species were seen. The nests were sealed in polythene bags within the roof space before taking to the laboratory. The details of the contents of the one are as follows:

Lepidoptera

<i>Hofmannophila pseudospretella</i> (White shouldered house moth)	10
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Coleoptera

<i>Niptus hololeucus</i> (Spider beetle)	43
<i>Dermestes peruvianus</i> (Larder beetle)	15

There were also a variety of mites and some spiders, staphylinid beetles

and several carrion feeding blowflies. The opportunity to examine more nests was prevented by their removal by contractors working on the building renovation programme.

Dermestes peruvianus is the most frequently identified member of the genus brought into the museum as enquiries from the Glasgow district. Prior to examination of the pigeon nests this beetle was also being found alive within the main hall of the museum wherein a coffee bar is managed. No trace or source of infestation could be located there or elsewhere but a regular trickle of specimens were being brought to the Natural History Department by shop and security staff. It was only subsequently that I realised the source was from above, in the roof space. The hall has a ceiling some 80 feet high and in order to maintain the chandeliers winding mechanisms are located within the roof space above. In this area pigeon nests were common and the beetles had clearly fallen through the chain holes which allowed the lights to be lowered.

In this space alone over twenty nests were occupied or had been in use in the previous season. The potential numbers of insect museum pests therefore would be in the order of thousands of individuals actually living within the fabric of the building at the time. A secondary effect was the nuisance factor which was reported from offices which were immediately below some of the turrets. Blowflies were common, particularly so in warm weather when the windows were open, presumably attracted to or originating from the nesting areas above. Dead birds were found in the spaces immediately above these offices.

Discussion

This account of some insects in pigeon nests formerly in Glasgow Museums is given as a specific example of a pest problem in a museum context. Whereas the phenomenon is well known in general terms there appears to have been few documented instances of such occurrences actually in any one museum. Although there were occasions when beetles were found in the public areas of the building, ascribed to the existence of nests in the roof space, no actual damage to the collections has been identified as a result. An outbreak of moth, in this case *Tinea pellionella*, was found in the fur of a Red Squirrel on display at the time but could not be traced to any particular origin. (That species was not found as a component of the pigeon nest fauna.)

No complacency should result from any unproven associations as some of the more severe museum pests are particularly fond of birds' nests, especially *Anthrenus* spp. (Armes, 1984). *Anthrenus sarnicus* is specifically mentioned as feeding as larvae on the carcase of a dead pigeon in a domestic situation (Woodroffe, 1967). It is not that there is something inherently attractive in pigeons but that it is a common bird and has a habit of living and dying in urban areas. This makes it available as a prime source of food for certain insects. The message would appear to be that museum buildings should be carefully screened for the pigeon problem. Preferably, building design should minimise this risk but high Victorian architecture does exactly the opposite so

that Kelvingrove and The Natural History Museum in London, for example, need to have particularly vigilant building maintenance teams.

It has generally been considered that some species of pests are not present or as widespread in the north of Britain. However, this assumption has recently had doubt cast upon it by the circumstances of the discovery of two hitherto 'southern newcomers' within the premises of the Royal Museum of Scotland in Edinburgh (Shaw, 1991).

Nevertheless, the above list of potential pests actually reared from the nests is impressive enough in numerical terms if not species variety in this particular instance.

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An Anonymous Catalogue of British Birds dated 1832

Fred Woodward,

Art Gallery and Museum, Kelvingrove, Glasgow G3 8AG.

Description

An apparently unknown ornithological publication listing British Birds recently acquired by me has prompted the present note. The work consists of seven pages plus two pages of Patrons in the form of an octavo pamphlet.

The title page and the introduction are reproduced as figure 1. The next five pages (3-7) consist of a systematic Catalogue of British Birds divided into *I Land Birds* pages 3-5 and *II Water Birds* pages 5-7. The list includes a total of 275 species as being British, 209 of which are indicated as being represented in the Museum Collection.

The seventh page includes:

Postscript - *In the execution of a Catalogue like the preceding, deficiencies and errors are inevitable. The Author will be satisfied if they are not found very numerous or glaring. So much confusion and discrepancy exist, even in the best writers, with respect to the Gull Genus, that great difficulty has been experienced in forming the present imperfect arrangement of it.*

The following Species have been excluded from the Anas Genus: as, although naturalised or domesticated, and described by Bewick, they are confessedly not of British, nor even of European origin: A. Cygnoides, Swan Goose; A. Canadensis, Cravat G; A. Gambensis, Spur-winged G; A. Ægyptiaca, Gambo G; and A. Moschata, Musk Duck.

The Catalogue, such as it is, will serve as the Index to a little "Manual for the Student of British Ornithology"; which will shortly be published for the benefit of the Proprietor, at the Birmingham Museum of Natural History. Temple-Row July 4th 1832.'

Pages 9-10 consist of a 'list of patronesses, patrons, and subscribers. There then follows on this and the succeeding page a list of a further one hundred and forty-two subscribers (see figure 2) including:

[**Corrie, Mrs.**, Woodville (wife of the Rev. Corrie, President of the Birmingham Philosophical Society. She was a keen conchologist and possessed perhaps the finest collection of freshwater bivalves (Unionidae) in Europe. Dr. Isaac Lea, the american authority on the groups named *Unio corrianus* in 1834 in her honour.)

Hope, Rev. F.W., F.L.S. London (Frederic William, (1797-1862) the eminent entomologist)

Vigors, N.A. Esq., F.R.S., F.L.S. (Nicholas Aylward, (1785-1840) the entomologist, the bulk of his collection including that of the coleopterist, S. Wilkins, was transferred from the Zoological Society's Museum to the British Museum in 1859)

Withering, W. Esq. (William, Junior (-1832) Botanist)

A contemporary review

This work was reviewed in J.C. Loudon's Magazine of Natural History Vol. 6 for 1833 page 136 as follows:

'Anon: *A Systematic Catalogue of British Birds; intended as a Guide to the Ornithological Department of the Birmingham Museum of Natural History*. 8vo July, 1832. We notice this pamphlet of seven pages for the sake of stating that it shows the rare species in the museum to be, of land birds, the osprey (*Falco Haliae'etus*), Tengmalm's owl (*Strix Tengmalmi*), golden oriole (*Oriolus Galbula*), rose-coloured pastor (*Pastor roseus*), bee-eater (*Merops Apiaster*), wood shrike (*Lanius rufus*), pine grosbeak (*Pyrrhula enucleator*), and the great bustard (*O'tis tarda*). Of the water birds, the rarest in the collection are the ibis (*I'bis falcinellus*), the roseate tern (*Sterna Dougalli*), the burgomaster (*Larus glaucus*), and the little auk (*U'ria Alle*). The catalogue "is arranged on the plan of M. Temminck's valuable *Manuel d'Ornithologie*, with the improvements suggested by Mr. Selby in his *Illustrations of British Ornithology*".'

Possible authors of the Pamphlet

There is no indication of the author of the pamphlet but the publication may be attributed to Richard Weaver, the owner of the Birmingham Museum of Natural History. Richard Weaver commenced upon the study of entomology about 1814, as evidenced by his 1847 note on *Sphinx convolvuli*:

'In August, 1814, I was reaping wheat in a field, in the Parish of Tibberton, Worcestershire, about five miles from Worcester, and on that part of the field, there was growing with the wheat a quantity of the plant *Convolvulus arvensis*, amongst which I found two of the caterpillars of *S. convolvuli*, full-grown.'

His enthusiastic collecting resulted in the accumulation of some five thousand species of British insects. These were displayed to the public.

Such was his success that he obtained premises in New Street, Birmingham, with a view of forming a Museum of Natural History. During his residence there, he turned his attention to ornithology with considerable success preserving some two hundred species of British birds as well as foreign birds and insects. As his collection increased the New Street premises became too small, so Weaver moved to the Institution Rooms in Temple Row.

If Richard Weaver was not responsible for the Catalogue another possibility is N.A. Vigors. He was not only an annual subscriber to the Museum but played a major part in negotiations with the Zoological Society of London which resulted in the gift of twenty-four rare birds to the Museum, thus enriching its collections and at the same time, enhancing its reputation.

The original pamphlet has been placed in the archival collections of the Natural History Department, Art Gallery and Museum, Kelvingrove, Glasgow and photocopies deposited in Birmingham's Museum and also their Reference Library.

A
 SYSTEMATIC CATALOGUE
 OF
BRITISH BIRDS;

INTENDED AS
 A GUIDE
 TO THE ORNITHOLOGICAL DEPARTMENT
 OF
 THE BIRMINGHAM MUSEUM
 OF
 NATURAL HISTORY.

The following CATALOGUE OF BRITISH BIRDS is intended as a Guide to the visitor of the BIRMINGHAM MUSEUM OF NATURAL HISTORY. It is arranged on the plan of Temminck's valuable *Manuel d'Ornithologie* with the improvements suggested by Selby, in his *Illustrations of British Ornithology*. It exhibits the most accurate and complete list of British Birds, yet published.

The numbers prefixed to the various Species in this Catalogue, correspond with the numbers attached to the specimens in the Museum. The divisions of several of the Genera into Sections or Sub-genera, are indicated by alphabetical characters. The cross prefixed to a Species, denotes that the bird is in the Museum. The absence of such mark shews that the Species is yet wanting; and will, we hope, attract the notice, and elicit the contributions, of country-gentlemen. Where the number is omitted and a note of interrogation follows, the existence of the bird as a distinct Species from that which precedes it, may be considered questionable. Simple omission of the number implies doubt as to the Species in question, being really British. N., R., V. R., and E., following the English name, must be understood as meaning that the Species so distinguished, is *New*, *Rare*, *Very Rare*, or has recently become *Extinct*, in the British Islands.

LIST OF
PATRONESSES, PATRONS, AND SUBSCRIBERS
to
THE BIRMINGHAM MUSEUM OF NATURAL HISTORY.

Patronesses.

Her Royal Highness the DUCHESS of KENT
Her Royal Highness the PRINCESS VICTORIA

Patrons.

The Right Hon. the EARL of DARTMOUTH
The Right Hon. the EARL of BRADFORD
The Right Hon. LORD LYTTLETON
The Right Hon. LORD C. TOWNSEND, M. P.
SIR EARDLEY EARDLEY-WILMOT, Bart.

Annual Subscribers.

The Right Hon. the Countess of Bradford
The Right Hon. the Earl of Dartmouth
Sir Thomas Winnington, Bart.
Sir Edward Dolman Scott, Bart.
Sir Eardley Eardley-Wilmot, Bart.
Sir Edward Thomason, Kt.

Abney, Mr. E., Lichfield
Amplett, Mr. Edw., Broom House
Attwood, Mr. T.
Attree, W. H.
Auster, Mr. John
Austice, Mr. J.
Baker, Mr. Charles
Barber, Mr. J. V.
Becket, Mr. H.
Bedford, Yeend John, Esq., Edgbaston
Bedington, Mr.
Becken, Mr. H.
Benson, Mr. E. W.
Bielby, Mr. Thomas
Bingham, Miss
Blyth, Mr. Thos., F. A. S.
Blythe, Mr. G.
Bolton, Mr. T.
Bolton, Miss, Soho
Bond, Mr. J.

Bond, Mr. John Fletcher
Booth, Mrs.
Bragg, Mr. G.
Bramall, Mr. Thos., Tamworth Castle
Brewin, Miss M. H., Halea Owen
Brierly, Mr. Wm.
Butler, Mr. James
Buxton, Mr. T. B.
Carr, Mr.
Chapman, Miss
Chidlaw, Mr. J.
Clarke, Mr. F.
Clarke, Mr. T., Ladywood
Clarke, Mr. T., Jun.
Cook, Mr. B.
Cooke, Rev. John
Corrie, Mrs., Woodville
Craven, Rev. Charles
Crompton, D. W.
Crompton, Mr. J. W.

Dawes Mr. J. S.
Dawson, Mr. R., Sandwell Coitage
Dee, Mr. Frederick
Dudley, Mrs.
Eckersall, Rev. C.
Fenwick, Rev. J. T.
Finn, Mr. Ford, London
Freeman, Mr., London
Galton, Mr. Tertius
Galton, Miss
Goddard, Mr. S. A.
Grey, Mr. T.
Griffin, Rev. John
Hadley, Mr. B.
Hale, Mr. George
Hanson, Mr. T., Senior
Hanson, Mr. T., Jun.
Harris, Mr.
Harris, Mr. H., Edgbaston
Harris, Mr. R.
Heywood, Mr. James
Herford, Mr. James
Hill, Messrs. T., W. and Sons, Hazlewood
Hodgetts, Mr. W.
Hodgson, Mr. J.
Holmes, Mr. George
Hope, Rev. F. W., F. L. S., London
Hunt, Mrs. H.
Hutchinson, Mr.
Jesson, Mr. Thos.
Jones, Mr. Charles
Jones, Mr. J.
Johnson, Mr. W., Horsley
Jukes, Mr. Alfred
Keeling, Mr. John
Kennedy, Dr., Ashby
Kempson, Mr. Samuel, Summer Hill.
Lane, J. N.
Lee, Thomas Esq., Edgbaston
Lee, Miss T. C.
Lee, Mrs. T. Eyre
Lloyd, Mr. James
Lucas, Mr. W.
Malé, Miss Helen, Edgbaston
Mappleback, Mr. W. B., Islington Row
Martin, Mr. William
Mason, Mr. Oliver
Matthews, Mr., Westbromwich
Messenger, Mr. Samuel
Messenger, Miss
Miller, Mr., Hagley Road

Millward, Miss
Moilliett, Mr. James
Moseley, Rev. Thos.
Moore, Mr. E., Tilsley
O'Brien, Mr. I. B.
Paine, Mrs.
Palmer, Dr. Shirley
Pershouse, Mr. H.
Perkins, Esq. S. F. S.
Phipson, Mr. W., Edgbaston
Piercey, Mr. J. E.
Power, Mr. Robt., Atherstone
Richards, Mr. C.
Rotton, Mr. Richard
Russell, Mr. James
Russell, W. C. Esq.
Russell, Miss, Bescott Hall
Russell, Mr. Ditto
Ryland, Mr. Frederick
Ryland, Mr. T.
Salt, Mr. T. C.
Sharp, Mr.
Skey, Mr. Arthur, Spring Grove
Solomon, Mr. Jas. Vose, Highfield
Stewart, Mr.
Stock, Mr. J.
Stovin, Mr. C.
Swann, Mr. W.
Taylor, Jas. Esq.
Thornley, Mr. Samuel
Timmins, _____
Turner, Mr. A., Kidderminster
Turner, Mr. W. H.
Tyndal, Mrs. T.
Underwood, Mr. T.
Vigors, N. A. Esq., F. R. S., F. L. S.
Wart, Mr. H. Van.
Warmald, Mr. Sam., Seahun Harbour
Webster, Miss
Webster, Mr. C. F.
West, Mr. W.
Wheele, Mr. S. A.
Wickenden, Mr.
Wigley, Miss, Migrey, Malvern Hall
Willmore, Mr. John
Willmore, Mr. Thos.
Winman Mr. William
Wilmot, Mr. J.
Withering, W. Esq.
Woods, Mr. T.
Wooley, Mr., Somerfield

Fig 2 List of Patronesses, Patrons, and Subscribers. Note Princess Victoria had yet to ascend the throne.

The proposed 'Manual'

I have been unable to discover whether the proposed 'Manual for the Student of British Ornithology' ever materialised. However, it would appear to be a continuation of the work reviewed in J.C. Loudon's *Magazine of Natural History* Volume 5, for 1832, page 441 thus:

'ART I. Catalogue of Works on Natural History, lately published with some Notice of those considered the most interest (sic) to British Naturalists.

ANON: Popular Lecture on the Vertebrated Animals of the British Islands. Part I. On the British Mammifera; with a tabular View of them, arranged according to Blumenbach's System; a Synopsis of all the Genera and Species; and an Appendix containing a Sketch of Extinct Animals. 8vo, pp. 96. Birmingham, 1831. Wrightson, Birmingham; Baldwin, and Longman, London.

The Writer of these Lectures plays with his subject, that is, he discussed it in an off-hand manner; and although in his successive treating of the various animals, one by one, he gives in English, the technical characteristics of each species, and those of the genus, order, etc., to which it belongs, he gives also, in relation to each either some sentimental reflection, something interesting that has to his knowledge occurred in association with it, or anecdotes and notices descriptive of the habits of the animal.. This untechnical part of the book we regard more than the technical part, because the British animals are to Britons empirically known or distinguishable; but it is, we fear, far from being the fact, that each is to every Briton a centre of amiable, intellectual, and therefore highly interesting, associations.

This is what it is most desirable they, and every object in creation, should be; and we admire the present manual, as being a cheap means of promoting so desirable an end, and heartily wish that the successful sale of this "Part I" may encourage the author to proceed with the remainder, which he proposes should consist of six parts: "Parts II., III., and IV., to be respectively devoted to the description of the land birds, the Grallae or waders, and the water birds; Part V. to the amphibious animals and cartilaginous fishes; and Part VI. to the osseous or bony fishes." We cannot state the price of this richly sorted pamphlet, or "Part I.", but it cannot be high, as it has been got up in a plain, unornamented, but nevertheless clear and neat manner.'

The origin and author to this work, which I have so far been unable to trace, again may be attributed to Richard Weaver.

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The Educational Role of Live Exhibits - Short reports from Seminar held at Townley Hall, 25 October, 1991

Introduction

There were seven talks given at this Seminar. Written versions of three of these talks, submitted by the speakers, are printed here; three other talks are being published as separate papers (see below).

What do schools want?

by Peter Garner, Educational Advisor in Biology, Lancashire County Council Education Department.

One of the main 'buzz' words at the moment is 'National Curriculum'. The National Curriculum consists of three 'core' subjects plus six 'foundation' subjects plus religious education. In addition schools have to take account of cross curricular dimensions, skills and themes. One of the themes is 'Environmental Education' which in the context of 'The Educational Role of Live Exhibits' is the most important. There is also an important role for teachers of core and foundation subjects in this context. It is obvious that in science and geography there will be opportunities to use live collections to advantage. But in English, art, technology, history at least a case can be made to enrich the curriculum by introducing children to live exhibits in relation to these subjects. In the case of science there are direct references to living things and the importance of appropriate care. In the theme of environmental education there is reference to discussion of issues of concern.

But the National Curriculum is not the school's curriculum. There are many other important facets to a child's education and what happens outside the National Curriculum is of equal importance to what happens inside it. It has always been important to take children out of school to show them the wider world. A visit to a zoo or other live animal collection is on the agenda for the vast majority of schools when planning their visits each year.

Throughout a child's education there are certain things which are highlights and visits out of school are of particular importance especially in the primary school. It is important to get away from the classroom to see the wider world and equally important to use this as a stimulus to enrich the curriculum which the children receive. This makes the classroom a much more exciting place as well as making lessons more relevant. Even without a National Curriculum these activities would go on in our schools because they are good for education.

At secondary level there seems to be more reluctance to get out of schools to see live exhibits. However field studies are regarded as important and perhaps there are opportunities through this approach to generate more interest in live collections.

I want to consider these issues at three different levels - (i) live exhibits (ii) the school estate (iii) the school and especially the classroom.

Live Exhibits

Animal exhibits include -

- Zoos - with their rich collections of exotic creatures.
- Safari Parks - offer the chance to see animals in wide open spaces.
- Farms - collections of domesticated animal species for economic reasons - links here with the theme 'Economic and Industrial Understanding'.

- Live bird collections - the Wildfowl and Wetlands Trust and the R.S.P.B. provide opportunities to see a vast variety of birds in a controlled collection or to see the naturally wild birds.
- Aquaria - fresh water and marine collections now offer a further choice for schools.

I do not think it matters particularly where children go but it is essential that when they visit these places there is a well prepared education programme with good educational materials of high quality for the teachers and the children. I also think that it is important for the children to see the animals and, if possible, to have an expert available who can explain things to them. Nowadays there are many interactive systems available which can simulate and even replace the real thing. But it seems to me that when children are taken to an exhibition of living things they should spend most of their visit looking at the real thing. There are plenty of ideas to develop - classification, movement, feeding habits, design of body, feet and beaks and of course all the issues concerned with conservation. There is also the uniqueness of the animals in the collections which can make an enormous impact on young children particularly. Remember the first time you saw a giraffe or an elephant or eagle? It can be equally exciting to see fish or other water creatures.

Nowadays children are much more aware of issues concerned with animal care and welfare and those who are responsible for collections need to be aware of this because if not they will be put on the spot by today's children. The exhibits should be well labelled and the labels should be informative for the children and their teachers and not just for the 'expert'. Work materials are vital and follow up ideas are more than welcome. Indeed I think that ideas must be included for the teachers to use when they return to school and they must relate to the National Curriculum because this takes up most of the curriculum time available. Children should be given the opportunity to visit on more than one occasion so that their knowledge and understanding can be

further enhanced. This of course is in the hands of the teachers but you can help by providing support materials and perhaps you can give the teachers ideas which would encourage them to return. A problem for schools these days is the cost of getting to a venue and with the current legislation regarding charging things are even more difficult for some schools. For this reason it is essential that the visit is worthwhile.

Plant exhibits - I have referred to animal collections up to now but I think that plant collections can stimulate plenty of interest and ideas for follow up work. I do not think that many schools visit plant collections certainly if compared to visits to animal collections. The other advantage in terms of linking the visit with work back at school is that it is much easier to keep plants for study and so direct links can be made and studies can be related to the visit. I think that field studies are very important in this context. Children should be taught to observe the environment including the plants. Most people on country walks miss so much because they have not been taught to look properly. It has to be taught in the first place and it begins at school and this can be reinforced when pupils visit a live collection.

The School Estate -

Each school should have an estate which is an exciting and stimulating place for children to be. The needs of primary and secondary schools will be different but certain elements are common to both -

There should be a 'wild' area which is planted up and provides a woodland habitat plus a wildflower meadow. Hedgerows can be planted around the estate and can be used to provide demarcation between areas of interest.

There should be a pond, if the school wants one, which will provide a focus of interest as well as a wonderful resource for lessons in all sorts of areas of the curriculum.

In a primary school an adventure playground is a worthwhile addition as well as places to hide in.

There might be a garden area and the design of this may vary but there are lots of exciting ideas for making this area of the estate interesting.

Maybe a greenhouse will provide an additional resource which will extend the possibilities for growing more exotic plants. This is only viable if there is a teacher who is prepared to take on the responsibility for organising things.

With this come the animals so that with effort 'God's Half Acre' can be created for the benefit of all the children.

I have seen some pretty boring school estates but also some which have become a part of the learning environment for the school. It has meant commitment from the headteacher and at least some of the staff but it is worth the effort. The governors and parents should also be involved.

Inside the School -

It is important that the school itself is not neglected. Schools vary but primary schools are exciting places to be and secondary schools are nowadays catching up. There are many opportunities to make the school an attractive and interesting place. This leads to respect for the fabric and enlivens what happens there. There are opportunities to keep animals as long as correct housing is available and as long as those involved plan carefully and know how to care for animals. Perhaps a starting point should be an aquarium which is easier to look after and provides a rich source of interest and ideas. You could even have a pond in the corner of the room and the aquarium could contain the same creatures as the pond so that children can see what is happening under the water.

Plants can be used in a variety of ways and used to study the conditions required for growth and maturation. They will also bring the animals associated with them sometimes useful but sometimes pests. It is all education and related to their future lives when many of them will develop interests based upon their school days.

Hatching chicks is a very exciting thing for young children and brings the animals to them. It is a vehicle for teaching about the care of living things, but requires a lot of organisation.

Keeping insects is another activity which can be carried out without too much difficulty and there are plenty of insects which can be kept successfully in classrooms.

I think that those who run zoos and other collections have a responsibility to help schools who wish to keep animals because that is where the expertise lies. You might take the lead in this by providing ideas and support for teachers.

Summary

Children should have the opportunity to visit live collections. They will learn from what they see but will benefit particularly from the expertise of the staff and the educational materials produced.

Live collections should include plants as well as animals and the education provided should demonstrate to children how the two are related.

School estates should be developed so that they are exciting and educationally interesting places. If they are then the collections of plants and animals will become an important stimulus and resource for learning.

Classrooms should also be exciting and interesting places which stimulate and enhance learning.

I think that this is what schools require and one can make a very important contribution by making visits something to remember but also by helping the teachers to develop the environment back at their schools.

[An updated and extended version of Mike Graham's talk will appear in the next issue of the *Journal*]

Of Shoals and Schools - Aquaria and the National Curriculum

by Ian Wallace and Denis Murphy, Liverpool Museum, William Brown St., L3 8EN

The talk at the meeting was to be given by Denis Murphy, Curator of the Aquarium and Vivarium for the National Museums and Galleries on Merseyside. Unfortunately, Denis fell ill shortly before the meeting and an alternative talk was given by his colleague, Ian Wallace, Curator of Zoology. This written account draws upon the talk and the notes Denis had prepared.

The present aquarium and vivarium at Liverpool Museum was opened to the public in March 1966, and has remained one of, if not the, most popular galleries in the building. The only documented time its continuance was threatened was in 1984. Following local government re-organisation and the conversion of Merseyside County Museums to the National Museums and Galleries on Merseyside, there was a staff review when all functions of the new organisation were scrutinised by an outside government team. It was suggested that the aquarium was not a core function, those being concerned with the maintenance and exploitation of collections of traditional 'dead' objects. It is indeed true to say that aquaria and vivaria are outside of the main core activities of many museums but the suggestion was rejected, and it was not just because it would have been plain stupid to remove one of the main reasons people visited the place, but also because of the educational role of the set-up.

Whilst the educational role of the aquarium was indisputable, it was also somewhat ill-defined. As with most museum displays, there was a hope that teachers would use its facilities to inspire their pupils or illustrate particular elements of their courses or projects. Most pupil visitors were young children whose courses were then not as closely defined as those of older exam takers. Then along came the National Curriculum with its specific attainment targets and set subjects.

With a little imagination aquaria can be used to demonstrate a wide range of curriculum topics, and because of the live element they are probably more attractive to teachers than other parts of museum natural history. The following lists suggests some topics which could be offered in the Science for Ages 5 - 16 area.

The Diversity of Life - why creatures are different shapes, colours and sizes.

Lets Get Moving - animals in action, buoyancy and swimming, shoaling and flying, jumping and shooting, squirming and burrowing.

Making Babies - sexual and asexual reproduction, breeding cycles and seasonal changes, courtship, territoriality and aggression. Egg laying, live bearing. Brood care, nest building.

Strange Partners - animal relationships, how and why animals and plants sometimes live closely together. Symbiosis, commensalism.

Eat or be Eaten - food and feeding mechanisms. Digestion, assimilation, excretion. Food chains. Predator - prey relationships. Growth, how old is that fish?

Homes and Habitats - local or exotic environments and how they differ. How and why we change our aquarium habitats. How creatures adapt to different environments.

Lets Clean Up - pollution and its effect. Our duty of care, how our actions affect the environment. What happens in a fish tank when things go wrong?

Check It Out - water, our most vital resource. Simple experiments showing how and why we monitor and change water quality, temperature, p.H., density. Use of simple metering and monitoring equipment to demonstrate water flow, currents, erosion, turbidity, oxygen levels, acidity, alkalinity, salinity etc.

Who's Who? - identification of creatures into simple groups through observing important features and using simple keys.

If available, demonstrators could illustrate some of the above topics using current aquarium displays. However, all of these topics and much more could be taught by combining displays with a suitably equipped and staffed teaching room or 'Living Laboratory' which would enable us to concentrate upon the huge potential of living specimens available in aquaria. The traditional public aquarium has rows of tanks with little space for labels, and once a few people are around a tank, others cannot always see what point is being illustrated. To a lesser extent that is a common problem for galleries in general. Teaching rooms solve many of the problems for normal galleries but the paraphernalia of aquaria are usually difficult to fit into the traditional teaching room. Then there is the slight problem of staff time. It is probably true to say that the typical museum aquarium assistant curator has the most diverse job of any museum person ranging from heavy duty cleaning work to skilled dissection, analysis, and engineering construction, not to mention the odd lecture, or demonstration to a group who on special appointment have been squashed into the behind the scenes area not occupied fully by tanks, tubes or tubs of gravel.

Liverpool Museum is famous for its Natural History Centre where demonstrators talk to visitors about items from the reference collections in a purpose built attractive room. The same facilities are now exploited for school groups though it is true to say that we have not had the demand for National Curriculum related courses for specific topics - a general introduction to the objects in the Centre is the usual school class.

The success of demonstrators in the Natural History Centre led to their introduction to other areas of the museum. The aquarium grasped its opportunity through the Mersey Dock Watch Aquarium whose theme is the life that is found in the Mersey Estuary and particularly its dock system - life which is increasing in abundance as the Mersey is 'cleaned up'. This display was described at a previous BCG Meeting on the Greening of Museums and in the *Museums Journal* August 1991 page 33. A team of demonstrators who

were also maintenance personnel were essential not only to help run the display aquaria but also to operate the touch tank and the close-up video camera. The *only* successful, or even ethically acceptable, touch tanks in our opinion, are those where demonstrators or explainers or technicians (the name is not important) guide visitors through the experience with minimum livestock stress. The demonstrators also had a vital role in explaining about pollution in the Mersey Estuary and its reduction, which the life in the aquaria clearly exhibited was having beneficial results. This is superficially a simple subject but the historical, commercial, and engineering side needed covering as well as the biological. In other words it was only through cross-curricular elements that the correct impression could be given of the problem and its solution.

Although mainly a school holiday show it has proved very popular with school groups during the time its opening and term time have coincided. (During the 17 weeks it was open in 1991, 56,200 visitors had seen the displays of which 1,595 were children in 99 school groups which had booked a morning activity session with a demonstrator). Regrettably money has only been made available to operate this during the summer time. The reason is that demonstrators are expensive and whilst the stock could have been maintained with only one person, four were needed to provide an adequate demonstrator presence.

In the long term can demonstrators be replaced? A selection of interactive units will replace many of the labels and provide a much improved visitor experience on the gallery but for most class-room type of activity there will be interaction between live animal and pupil, and a trained mediator is required to prevent injury to either party.

So should we end on a confident note or a pessimistic one? The considerable potential of museum aquaria to increase their institutions contribution to the National Curriculum will be frustrated unless there are sufficient funds devoted to purpose built demonstration areas and, above all, to staff to run them. The present financial climate does not lead one to be optimistic; perhaps in the long-term we can be. If we were in America we would have a selected band of volunteers who we had trained who in return for the general feeling of being part of a worthwhile team, had agreed to devote a fixed period on particular dates to acting as demonstrators. If we were a large institution we might have hundreds on the rota, but even if we were small we might have 50. They would operate under the instruction of the paid staff and be principally involved in demonstrating or with routine maintenance. These wonderful people are called docents.

We are not as rich a country, but we also have less sympathetic unemployment benefit legislation, and also a work-force worried about jobs being replaced by volunteers. We see changes on the way and British docent armies on the horizon. We fore-see few recruitment problems as requests to work in the aquarium outnumber other work experience requests to the zoology departments. In the meantime we must strive to have aquarium facilities prepared for the docent army when it comes. To fail to do so will condemn museum aquaria and vivaria to the role of mere honey-pot

attractions for the institutions that house them, rather than the multi-faceted integrated asset they have the potential to be.

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[Papers based on the talks by Gordon Reid and by Brenda Norgain appear elsewhere in the current issue. A talk was also given at this point by Mike Cotton on 'Learning through Birds'.]

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Education and Conservation

by Rod C. Haynes - Displays Manager, The Sealife Centre Ltd., Blackpool.

During the last twenty years, the display of fish in public aquaria has made considerable progress. Initially aquaria exhibited fish in practically undecorated glass cages, often containing a single species. Today, mixed species tanks with environments provided for each of the species is more usual. The creation of ecosystems in miniature is the next step, simulating environments containing everything from sunlight to predators, and being an independent, self contained microcosm. This is evident in, for example, the Great Barrier Reef Mesocosm at Townsville, Australia, a 38m x 17m aquarium simulating the Great Barrier Reef.

This progress has been facilitated by a number of pressures. Public expectations of tourist attractions have risen; tourism is now a major industry and people will no longer tolerate poor quality displays. Aquarium technology has advanced, with acrylic panels enabling the production of tunnels, large transparent panels and new tank designs. Parallel technologies such as lighting, fibreglass and glass to glass sealing have also advanced, or been applied to the area of aquarium development, contributing to the higher standards of display seen today.

A major factor in the progress of aquaria is the new-found public awareness of conservation and the environment. It is no longer sufficient for aquaria to merely show fish; they must now also be environmentally conscious, meeting educational needs and conservation pressures.

The response to any survey of the public, inviting them to comment on areas of greatest concern within the Marine Environment, will be heavily influenced by whatever is in the news currently. The public has, collectively, a very short term memory. Thus, certain items are consistently found to be areas of concern; notably, oil pollution, sewage discharge, whaling and land based pollutants. More rarely, areas of concern include overfishing, discarded nets or the plight of individual species such as turtles. There is a whole range of issues that rarely reach public awareness. One of the responsibilities of a public aquarium is to be aware of these issues, and to be able to inform the public when necessary.

Advising and educating the public is often more difficult than it at first seems. The education programme at Sea Life Centres is three pronged, dealing with three different sections of the population.

Seawatch scheme.

The first is the SeaWatch scheme, which serves a number of purposes. SeaWatch is an information and research programme. In the public eye, it manifests itself as a bulletin board within the Sea Life Centre, where press cuttings relevant to the marine environment are displayed. It is therefore a passive education tool, relying on the public approaching it and reading it! It also serves as an education tool for the people who work within the Sea Life Centre. If their duty is to inform, they themselves must be informed. Sea Life Central Office scans the media in a far more efficient manner than could the individual sites, and disseminates information to each Sea Life Centre.

The "research" side of SeaWatch encompasses a number of aspects. Basking Shark Watch is operated by the Marine Conservation Society, and partially funded by Sea Life centres. It's aim is to learn about the biology and hopefully the population of these fish and to build a database to enable the species to be conserved.

Probably the most important aspect of SeaWatch is the Seal Watch programme. This originated at the Oban Centre, with a rear and release scheme for common seal pups. Each year, the Centre has reports of up to a dozen abandoned seal pups. Either the mother has died, or the pup has been moved, or for whatever other reason, the pup is alone. Under normal circumstances it will die. With the intervention of the Oban Sea Life Centre, the pup will be hand reared and after about 6 months, be returned to the wild. Rehabilitation schemes are also in operation for Loggerhead turtles that have been beached around the shore of the U.K. These are shipped back to the Mediterranean, where they are released back into the wild. SeaWatch also encompasses research on behalf of the animals within the Sea Life Centres, looking at diet, growth rates, disease susceptibility; the full range of any animal husbandry programme.

Public talks programme.

The other two aspects of education within Sea Life Centres involve the public talks programme and our schools packages. On a daily basis, a series of public talks and demonstrations occur giving the people within the Centre an opportunity to learn about various aspects of the species on display. At the Blackpool Sea Life Centre, these include touchpool demonstrations, allowing people to experience the creatures found in rockpools, such as shore crabs, starfish and mussels. SCUBA diving kit demonstrations also take place, giving people the opportunity to breathe through a demand valve, and see through a mask. The talk on British sharks and rays allows people to feed the fish by hand. From a conservation viewpoint, the most important talk is that on tropical sharks.

The "Jaws" image has seriously damaged shark populations, especially that of the slow growing, slow to reproduce, great white. Many people come to

the Sea Life Centre expecting to see large sharks in a feeding frenzy. It is to be hoped that after seeing the display, and hopefully hearing one of the talks or watching the video, they leave with an image of sharks as creatures to be respected, but not feared and indiscriminately killed.

Schools education package.

The schools education package is another very popular aspect of Sea Life Centres. Each year the Centres invite teachers to come and look around the Sea Life Centre, and to discuss with the education officer the educational resources available. With the advent of the National Curriculum, Sea Life Centres and many other establishments, had to revise their education programme. This revision is still going on. The aims of the programme however have remained the same; to illustrate to children the diversity of marine life; to teach them to respect the creatures and the environment, and to assist the teachers in the teaching of their curriculum.

At the Blackpool site, three "standard" talks are offered; a touchpool - aimed primarily at younger children and the appropriate National Curriculum area; mainly tactile and diversity based areas. A shark talk is non-science curriculum, and, interestingly, is rarely requested. The third is a pollution demonstration, focusing on environmental matters. This is aimed at slightly older children, and again covers areas of the National Curriculum. Here, the main areas of pollution are explained, including oil and sewage, together with some of the less evident ones - pointing out why plastic bags can be dangerous to dolphins for instance.

There is a range of resources for the teacher, including a series of worksheets to be used either at the Centre or afterwards in the classroom, and teachers notes. Each Sea Life Centre has an education officer who can advise and assist teachers in all aspects of marine environmental education.

These three areas of education, SeaWatch and the public and schools education programme, all aim to put forward an environmental message. Conservation of both species and environments is important. Establishments with living creatures have an ideal opportunity to educate people, and should take full advantage of this fact.

An Aquarium for the future

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Abstract

Museums have a long and proud tradition in maintaining and developing public aquaria. However, to conform with modern requirements and with new zoo licensing regulations, they must increasingly justify their operation in terms of conservation, education and scientific study. The 'Living Waters' project at the Horniman Museum is the first public aquarium dedicated to underwater conservation. It is taken as an example of a substantial development which integrates the three aspects above, and which is strongly supported by public and private bodies and the World Wide Fund for Nature. It took four years in the planning and execution and cost about £300,000.

Introduction

Fishkeeping is an immensely popular hobby worldwide. In Britain about 3 in 21 million homes (or 14%) have fish (Andrews, 1990). In line with this, public aquaria are increasingly successful visitor attractions, as seen in the remarkable proliferation of 'Sea Life' and other similar centres. Historically, several museums incorporate aquaria and today these are invariably still among the most popular visitor draws (Reid, 1993).

London was the site for the world's first public aquaria. Fredrick Horniman, the founder of the Museum, had a lifelong interest in living creatures and, during the 1890's he organised public displays of live animals. A small Aquarium and Vivarium has existed at the Horniman since its opening as a free public Museum in 1901. It was established under the influence of Philip Henry Gosse - the man who coined the word 'aquarium' - and some of his original documents and illustrations of marine life are still held in the archives of the Museum Library. By the 1980's the Horniman's Aquarium was still popular, but the 'conservation, education and science' content was very limited and much of the structure was in urgent need of replacement. Gallery surveys indicated that it was an area that the public definitely wished to see retained but also to be considerably improved. John Toovey, the distinguished zoo architect, was commissioned in 1988 to undertake a feasibility and design study in conjunction with the Horniman team, which at that time included the author (Toovey, 1992)(5). Building began in 1990 and was completed by the end of 1991. The 'Living Waters' exhibition looks at conservation in action worldwide, including practical field projects operated by the Horniman Museum (Reid, 1989; Teugels *et al.*, 1992).

Reception

There is a reception centre at the base of the stairs leading to the new exhibition. This incorporates a dispenser system for 'sound wands' (1) which provide a conducted tour through the gallery operated by a passive infra-red radiator system. Although critical as an introduction to the exhibition, the reception centre was, in fact, one of the last areas to be installed. It is designed with a view to being operated by an attendant who would regulate the large flow of visitors through the automatic doors to the exhibition foyer. At the discretion of the attendant, the automatic doors can be closed, allowing time to retrieve sound wands deposited by visitors at a collection point by the exit to the gallery. Fold-down facilities for dispensing literature are incorporated here, as well as a small 'shop window' which advertises merchandise available in the museum shop such as mugs, t-shirts and books - all with an aquatic theme. For security reasons, a cash register was not installed at the entrance.

Overall, the reception centre works well but the attendants find that adults (more so than children) can have trouble in operating the sound wands to the best effect. For safety there is no distracting sound commentary on the steep entrance stairs, an omission which irritates a proportion of visitors. The sound wand system differs from other audio guides in being specific to zones set within the exhibition. Visitors can return to the same point as often as they wish for a repeat of the message. There are several communication channels so that non-standard tours can be incorporated to cover, say, school parties or foreign languages. There is also a sound booster for the hard of hearing.

Water resistant graphics are installed throughout the gallery. These panels were designed as 'stand-alone' interpretation rather than as a supplement to the audio guide commentary. If the audio-guide is not in operation, for whatever reason, the visitor still has sufficient information to understand the display fully. The text is laid out in 'newspaper format' with eye-catching headlines, summary introductions, short sentences and short line-lengths; an average reading age of 13 years was aimed at. While the main theme of the displays is not taxonomic, basic identification graphics are included in each panel.

Conservation centre

The 'Living Waters' project first started with the development of a back-up facility to support the display and to serve as a Conservation Centre on view to visitors. Laboratory benching was retrieved from a disused local school. Modern filtration and water purification equipment was installed with a total recirculating volume of more than 14,000 litres (or 14 metric tonnes). The floor had to be reinforced with concrete to cope with this weight. Initially, much of the labour for development was provided through a government employment scheme and the back-up and animal kitchen services became fully operational in 1989. A review of the advanced aquarium technology in use is provided by Fletcher (1992). Essentially, three different aquatic

environments are controlled in the Conservation Centre and redistributed to the gallery: tropical freshwater, tropical marine and temperate marine. A localised unit on the gallery itself caters for a small British freshwater display. More than 90 individual tanks linked to reservoir systems are in operation behind-the-scenes and these are used as quarantine and breeding spaces.

A research programme centering on captive breeding was developed in the new facility. This mainly concerns rare and endangered cichlid fishes from Lake Victoria, East Africa, threatened with extinction due to the careless introduction of the predatory Nile perch into their habitat. The captive breeding programme established at the Horniman has contributed to our knowledge of basic cichlid biology and brought several species back from the brink of extinction. The origin and scientific development of the Lake Victoria conservation programme is detailed by Reid (1990a, 1990b) and popular reviews are provided by Smith (1990) and Tudge (1990, 1991).

The Conservation Centre is really the first 'exhibit' and it represents the 'heart and lungs' of the Living Waters experience. The public are fascinated by the hi-tech life support systems and the view of staff behind a glass partition working on various breeding programmes, such as that for Water Dragons, endangered aquatic reptiles from South East Asia. The first products of breeding - the eggs and larvae of invertebrates, fish, amphibians and reptiles - are on display in a glass 'incubating' cabinet.

Main gallery

The main gallery is 21 metres long and only 2.7 metres wide and lies at the head of a long and steep flight of stairs. Otherwise unusable, the stairs were utilised to make the 'Worlds' River' - an imaginary journey upstream showing the kinds of fish populations living at different points and the adverse effects that humans can have on them. The mirrored wall opposite increases the sense of space in the narrow corridor and reflects rippling highlights. Wave-formed ceiling panels extend up the stairs and through the main gallery. The elaborate acrylic cascade which forms the 'Worlds' River' is run on a partially deionised water supply to prevent hard water calcification on the clear panels and subsequent scratching during cleaning. Fluidised sand in a large acrylic column at the head of the stairs purifies the water in the cascade and the incessantly shifting particles fascinate visitors. Special disabled access was built into the stairway and, indeed, the viewing needs of the physically handicapped public, parents with pushchairs and small children were carefully considered prior to construction. In particular the main tanks are floor to ceiling so that the smallest and tallest visitors can see equally well. Other low-level open tanks provide the sounds, movement and smells of particular habitats and so enhance the experience.

Work began in the main gallery in 1990 and all the old tanks were stripped out (some of the historical Edwardian slate tanks were found behind the gallery facade). New all-glass tanks were manufactured in Germany by the Laging company and supplied in Britain through Aquamagic (2). On delivery, the tanks had to be hoisted into the building using a large crane. They were

then set into place in a specially designed fibre glass tray which would contain any leaks. Once the tanks were installed, an elaborate wave-form facade was fabricated around them. The tanks were, for safety, filled up under test by the local fire brigade. The largest tanks hold 1000 litres (or 1 metric tonne) and so the glass is triple laminated and 6 centimetres thick. Computer simulations of the pressure characteristics of the new tanks were conducted by consulting engineers who found the tanks to be fourteen times within safety limits. Even so, in the two metre deep tanks serious problems did arise with the silicone rubber adhesive holding the glass panels together and one tank leaked. An improved two-part formula adhesive has now been substituted in the critical tanks.

The first main exhibit concerns the Horniman Museum expedition field project in Korup rainforest, Cameroon. The scientific results of the expedition are discussed by Reid (1989) and Teugels, *et al.* (1992). A modest attempt was made, with the help of Kew Gardens, to re-create a jungle pool in the gallery. An oscilloscope display screen was used to track the electrolocation signals given out by elephant fish (mormyrids), typical of gloomy jungle streams. The relationship between fishes and forests is picked up in other exhibits in the same module : 'the hidden world of blind cave fish', 'piranha threatened' and 'monster lake, monster problem'. The latter deals with the Lake Victoria problem. All of the cichlid fish on view are extinct or near extinct in nature and were bred in the Conservation Centre.

The next module in sequence concerns 'coastal conservation ... local shore life and fisheries under threat'. Here, in the 'relating to rockpools' tank, are common inshore fishes and invertebrates that are becoming rarer due to pollution and overfishing. The cliff face backdrop was modelled in fibreglass from a real rockface on the south coast. High and low tides are simulated using a valve system fed from behind-the-scenes by a reservoir chilled to the appropriate temperature with a titanium coil. Wave effects are created by a simple dump bucket flushing down a tube. This system and others in the aquarium were developed by Philip Mayfield, aquacultural engineer (4). Some realistic seaweed models made in California by Carl Gage were used (6). There has been some success in maintaining real seaweeds in this section, and snakelocks sea anemones also do particularly well under special lighting conditions which favour the symbiotic algae that lives in their tissues.

The next exhibition module of five tanks concerns 'Coral in Crisis'. Digital readouts from the electronic systems monitoring critical water quality are on display in a perspex box. These systems supplied by New Technology (3) are linked to a computer for data logging. 'Vanishing variety' is the first tank in the sequence showing the colourful diversity of reef fishes and threats posed by destruction of coral reefs and global warming.

A detailed look at reef symbiosis is provided in 'Partners in trouble' - a 'desk top' tank which can be viewed from above. Cleaner shrimps which pick parasites off fishes can, for example, be viewed in great detail at their 'station'. A plankton tank and a seahorse tank, illustrate the close link between primary production on a reef and specialised feeders - a fragile relationship easily disrupted by pollution. The final showpiece is a 'Living Reef' tank

formed around a suspended acrylic plate using a special non-toxic polyurethane foam, kindly donated by New Technology. Living corals are embedded in the foam and gradually colonise it. Reef currents are simulated by oscillating pumps and sunlight by a special sealed-beam unit incorporating high intensity metal halide and actinic blue luminaires. The unit has a built-in timer control so that day length can be varied. In the evening, just before the visitors leave, a 'moonlight' function switches on revealing nocturnal activity on the reef.

The last section brings the visitor back home to look at our disappearing waterlife. London has lost 90% of its ponds since Victorian times with more lost every year. A small open pond display highlights the diversity which still exists in a few places and which needs conservation. Medicinal leeches are used as an unusual example of a medically important animal now extinct in most parts of Britain. Crayfish in the adjacent display represent the most threatened freshwater animal species in southern England: displaced in nature by introduced foreign crayfish and an associated disease. The last tank in the exhibition is 'Pure Rubbish', established to contrast the beauty of living waters with man made pollution.

Altogether, more than thirty contractors were involved in the construction of Living Waters, with most of the main framework being provided by Carlton Beck. The problems of working within a Grade 2 listed building were considerable. Also, to conform with new Museums and Galleries Commission Standards (Reid, 1992), the entire exhibition was designed as a discrete air-conditioned unit more-or-less separate from and not seriously impinging on atmospheric control in the rest of the museum.

Living Waters has gained several favourable reviews (Januarius, 1991; Fletcher, 1992; Newmark, 1992; Wheatcroft, 1992) and, indeed, has been described by the Horniman's Director (Boston, 1992) as: 'the best example of what we have achieved so far under independence ... it has received high praise and an influx of visitors, with queues at the weekends.'

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Footnotes

- (1) Sennheiser UK Ltd (sound wands), B2 Knaves, Beech Business Centre, Londwater, High Wycombe, Buckinghamshire, HP10 9QY Tel.0628 850958
- (2) Aquamagic Ltd (tanks), Marine House, Market St., Watford, Hertfordshire, WD1 7AN Tel. 0923 39637
- (3) New Technology (N T Laboratories Ltd) (aquarium systems). Unit 3, Branbridge Industrial Estate, East Peckham, Kent, TN12 5HS Tel. 0622 871387
- (4) Philip Mayfield & Co. Ltd (aquacultural engineering), 7 Harefield Rd., Rickmansworth, Hertfordshire, WD2 1LY Tel. 09237 75272
- (5) John Toovey (zoo architecture), Toovey Lane Consultants, Ashcroft, Ashley Green, Chesham, Buckinghamshire, HP5 3RB Tel. 0442 864202
- (6) Carl Gage Biological Models (seaweed models), 198 North Lima Street, Sierramadre, CA 91024, USA Tel. 0101 818 355 4680

The Educational Role of the Live Exhibits in a Zoo Collection

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Introduction

Along with Education staff at most zoos, the Education Staff at Chester Zoo believe that there is a very important role for live exhibits in the education of all of our visitors. However, for reasons of space, this article confines itself to their use by pupils and students within the formal education system - from pre-school to undergraduate level.

Our visitors - Up to 90 000 students/pupils from schools, colleges, and universities visit Chester Zoo each year. This is about 10% of our total number of visitors.

Using what is in the Zoo

The prime aim of a good zoo must be conservation. It therefore follows that the selection and range of animals kept will be determined by conservation needs and breeding programme requirements. Species which may well be extremely useful for education purposes may well not be kept at all, or may well not be replaced if movement to another zoo as part of a breeding programme is necessary. The need to maintain appropriate groups for breeding purposes means that, unless the size and finances of a zoo increase, there will be a trend towards keeping more specimens of the same species and fewer species.

For example, at Chester at present we have no common hippopotamuses and will not be keeping this species for the foreseeable future. We have no gorillas because we sent our two males to other zoos in the hope that they would then contribute to breeding programmes. The number of Primate species has been reduced giving a much better potential for long term breeding programmes with the species retained.

Meeting the animals' needs for privacy and security may well mean it is extremely difficult to see particular animals and certainly impossible to guarantee viewing. Avoiding petting and taming inevitably leads to a no-handling or minimum handling policy.

I most certainly subscribe to conservation being the prime aim of a good zoo, but it is important for the Education Division to use what is in the collection at any given time and to accept that it will have little influence on the collection. Nevertheless, there is still a vast range of animals and,

therefore, of opportunities and, indeed, there is a bonus. Chester Zoo is dependent on income from visitors. The visitors themselves and the ways in which their needs are met become part of the zoo and can be included in appropriate ways in the educational use of the zoo.

Using the Zoo appropriately

The Education Division has a basic philosophy which guides us and serves as a check list against which we decide whether or not to implement any ideas. There are seven major points in this philosophy.

1. **Anything to do with the zoo visit must fit into the curriculum.** The zoo visit may be a start point, an end point or in the middle, but must be part of the school work and enrich it.
2. **The visit must focus on the animals.** There is no point in coming to the zoo unless this is so - it's the sight of the live, the size, the smell, the sounds - no television programme can compare! Yet it can be easy to lose sight of this focus. I have seen children taken into a darkened classroom and shown a slide of a whale (which they would not be going to see) and a slide of a giraffe, when the real giraffe was 50 yards away. I have seen children brought to the zoo and given work which has merely encouraged label reading and 'head down' working.
3. **Work must be appropriate for the age and ability of the pupils/students.** This requires skilled professional judgements about teaching methods, vocabulary, concentration spans, concept levels, etc.
4. **Time in the zoo must NOT include work/activities which would be better done back at school or college.** Here we do use a little discretion to provide a change of activity (such as watching a puppet theatre show or listening to 'Storytime') as long as it is linked to the theme being studied and for very limited periods of time. Why should schools pay to come in and see a slide show - could not the time be better spent studying the real animals and the slides loaned or sold to the schools?
5. **Work must encourage first hand observation of the animals,** and, where recording of data is an integral part of the work, must be practicable in an outdoor situation.
6. **Visits should offer the opportunity to explore many aspects of the curriculum,** and not just be confined to biological areas.
7. **Anything offered must obviously have been thought through and prepared by an expert in that area,** whether in the age range or in the subject specialism.

Some examples

I now propose to look at examples of the ways in which we use the animals in the zoo. I deliberately flit from area to area and age range to age range for I am merely trying to indicate the available scope.

Mathematics - There is a lot of mathematics in the zoo. Work in other subject areas can lead into mathematics work or mathematics work can lead into other areas. Take 'Animals and their food': well designed data collection sheets can develop direct observation, careful recording, collation of results and presentation of data. The results obtained can lead into an understanding of biological aspects of carnivores/herbivores and the theme can be developed into the time spent eating, food values etc. It is vital to have quick recording methods (See figure 1 for part of a suggested data collection sheet for junior pupils - simple counting and mapping).

<u>ANIMALS AND THEIR FOOD</u>		<u>J.M.I.</u>
As you go round to look at the animals in turn, do TWO things.		
1) Draw a line from the name of the animal to the type of food which it eats. You may have to look carefully to see remains of food about.		
2) In the column headed "Is it eating or not" put a ✓ if it is and a 'x' if it is not for EVERY SINGLE ANIMAL YOU CAN SEE IN THE ENCLOSURE.		
<u>Is it eating or not?</u> ✓ or 'x'.	<u>Animal</u>	Food
	Giraffes 2	(Grass or hay)
	Zebras 3	
	One lot of monkeys in the Monkey House 4	
	Any cat, including tigers, where you can see food. 5	(Fruit, vegetables or seeds)
	Rhinoceroses 6	
	Elephants 7	
	Lions 8	
	Sea-lions 9	(Meat or fish)
	Penguins 10	
	Any cage of parrots 11	
	Any tortoise 1	
	Any of your choice: Name:	

Fig 1. Example data collection sheet for junior pupils - simple counting and mapping.

Or 'How popular are different animals?': again, appropriate data collection sheets can develop observation, recording and presentation of data.

A suggested data sheet could be as shown in figure 2.

HOW POPULAR ARE DIFFERENT ANIMALS?						J.M.2.	
<p>You are going to count the number of people entering various animal houses or looking at particular animals over a set period of time. Go to the place your teacher gives you, look at your watch and then record the number of people entering your house or viewing the particular animals over 5 minutes.</p> <p>One of the group should carefully watch the time, another should put a mark for each person - adult or child - in the correct place on this worksheet, another should quietly tell the recorder 'adult' or 'child' as each person enters or is seen looking at the animals.</p> <p style="text-align: center;"><u>DO NOT BLOCK THE ENTRANCES OR MAKE A NOISE</u></p>							
House or Enclosure	Tick where you are going	Time of start	Time of finish	Adults		Children	
Example:-	✓	2.03	2.08	llll	llll	llll	llll
				Total at end	9		10
Aquarium					□		□
Bird House					□		□
Tropical House					□		□
Monkey House					□		□
Bison					□		□
Wallabies					□		□
Ostriches					□		□
Parrot House					□		□

Fig 2 Example data collection sheet - to encourage observation, recording and presentation of data.

Mathematical skills can be developed into exercises such as *devising* ways of testing popularity where there is no straightforward entrance/exit, one place etc., different times, different people - a host of more difficult situations. Overall, mathematical skills can include counting, estimation, numbers, distances, timing, tallying, mapping, recording methods, presentation methods, and the work is easily adapted for lower primary to older secondary.

Conservation - Take a topic such as *conservation* - a popular and often 'half-baked' approach is used. It is a complex topic. Much is better done in the classroom, BUT the sheer *enjoyment* of the animals can foster the wish to preserve them and the *role* of the zoo can be studied in the zoo.

Smaller children, given suitable preparation, can be asked to look out for and record in an easy way which of the animals have babies/young and this can lead to an indication of breeding successes, at an appropriate level of language and understanding, *and* a consequent discussion of how difficult it is to tell some young from adults. Older children can follow the same theme but extend it by looking for breeding awards, looking at numbers of young, linking what they see to rates of development, breeding groups and balance of sexes and even debating the question of surplus males.

This on-the-spot study (obviously associated with other points as well) is vastly superior to book work and even computer simulations! The visit to the zoo is a *real* situation - and easy to fit in to pre- and post-visit work of a wide range cutting across so many subject areas including biology, geography, ethics and morality (PSE, social responsibility or RE - call it what you will.)

Design/Technology/Art - At a Higher Education level we recently put a design project to a group of students for a highly durable, costed, interpretative item which involved the public in some physical activity. Design is central but so is the animal chosen, the particular aspect of interpretation, the execution, the evaluation. Another project we set was a shadow puppet project - this involved close observation of locomotion and then all that goes into the project up to the final stage, i.e. design, choice, costs, manufacturing, evaluation.

Art - We have many visits from art colleges just because the zoo is a unique resource for Higher Education students, but the zoo is an excellent resource at a simpler level: drawing, models, ceramics.

I liked the Infant group brought for drawing and modelling whose teacher said it had been worth the visit for a variety of reasons, but still would have been worthwhile for just one - the eventual dawning that an elephant's legs are 'under' the body or the elephant collapses!

The zoo provides splendid opportunities to stress the need for accurate observation, e.g. do a drawing before you come; take it and look at the real animal; observe; go away and do it again.

Language work/English - An unbelievably rich field:

- the popular Roald Dahl Enormous Crocodile is great - but see real crocodile.
- imaginative writing/poetry is greatly stimulated by a zoo visit.
- and what about **Communication?**

I was inspired by the C13 carving of an elephant on one of the choir stalls of Chester Cathedral (obviously done by someone who had probably never seen an elephant for it has horse's legs!). It led me to realise that the zoo is a superb place for observation, description and vocabulary extension. Could you describe an animal to someone? What would their interpretation be?

Obviously, you don't *need* a living animal to do this, *but* include movement, noises, smells and it is much more attractive and more likely to be accurate. Link to symbolism - watch the lions etc. - are they used wisely in heraldry etc?

Information technology - Another area of activity which the zoo Education Division wishes to develop is I.T. At undergraduate level, recently, we had a student measuring breathing rates of mammals with a camcorder - then, back at university, the classic link with body size. The write up of that has now appeared in a scientific periodical (Worthington, *et al*, 1991). Recently we worked with a group of teachers on devising an I.T. project on the same theme but, interestingly, they did not ask the right questions and mixed Mammals and Reptiles etc. - this indicates a need for teamwork between teachers and zoo educators - a point I will return to later.

Undoubtedly observation and data collection in the zoo, together with reference book work outside, can provide fascinating data for use and therefore the development of skills in this area.

Animal movement is not only a useful biological study, but is so easily linked to **Dance, Drama, Music**.

Business Studies - with a rich field for observation - this time of layouts of the zoo, people's behaviour etc.

Architects - and the design of animal houses.

Geography - linked with fauna, which is so important in many parts of the world, is an obvious example, but there are many other aspects.

Psychology - and the devising and carrying out of observational studies - with all the consequent learning curves for the students!

Home Economics - and mass catering when you do not know how many will come!

Modern Languages - a variety of approaches and certainly a vocabulary helper!

I have left till last most areas of **Science** - but not just Biology.

There is a lot of **Physics** in animal studies.

Biology, I believe, needs little explanation:

- A study of *diversity of life*, from infant to secondary level, enjoyable and easy in the zoo.
- Locomotion. What a range - and it *can* be seen actually happening.
- Feeding, food chains, food webs and you can *see* the food and eating methods
- Five senses - and you can see *ears* moving
- Communication - and you can *see* it happening
- Size and shape
- Classification (diversity of life) - at any age level and ability level and, as in other examples, we take the guide lines of:

Observe; Record; Collate; Interpret;

as fundamental steps.

Figures 3a and 3b show a partly completed data collection sheet and a completed collation sheet showing the approach and the way the data can be collated. There are, of course, other approaches, particularly at the 'Designing how to tackle an investigation' level.

HERBIVORES (Plant eaters) Data Collection Sheet A **ANSWERS**

NAME _____






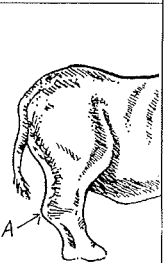
	GIRAFFE	ZEBRA	BLACK RHINOCEROS
Look carefully at the animals. Then draw in the: 1) mouth 2) eyes 3) ears			
Put a tick in the space if you see the ears moving in different directions from one another.	✓	✓	✓
What are they eating or what food can you see?	tree leaves or hay.	grass or hay.	tree leaves or hay.
Count the total number of animals.	_____ total	_____ total	_____ total
How many are feeding?	_____ feeding	_____ feeding	_____ feeding
If the body covering is patterned, draw part of it.	(see below)	(see below)	—
Describe the colour of the animal.	fawn and brownish	black and white (sometimes brownish)	grey.
Look at the back limbs, then on these diagrams, put an 'A' where the ankle is.			
How many toes are there on each foot?	2	1	3
What else can you see at the end of each toe, a claw, a nail or a hoof?	hoof	hoof	nail
What else have you noticed about <u>any</u> of these animals?			

Fig 3a Example data collection sheet - to encourage observation, recording and interpretation of biological information (see text).

	Giraffe	Zebra	Rhino	Cheetah	Lion	Eagle owl	Ostrich	Condor
Ears moved in different directions								
Ears not visible or not moving								
Eyes at side of head								?
Eyes at front of head								?
Ankle positioned about half way up leg						?		?
Ankle positioned much nearer ground				✓	✓	?		?
One, two or three toes								
Four or five toes								
Claws at end of toes								
No claws at end of toes								
Patterned body covering							?	?
No pattern on body covering							?	?
Numbers of animals	2	10	4	3	4	2	2	2
TOTAL of animals bracketed	16			9				
Number feeding	2	8	3	0	0	0	2	0
TOTAL of animals bracketed	13			0				
Half, or more than half, of totals feeding								
Less than half of total feeding								

Fig 3b Example data collation sheet - to encourage observation, recording and interpretation of biological information (see text).

Enough examples - I could go on. I believe that they *together* will develop skills, knowledge and understanding in most areas of the curriculum.

Primary schools tend to cut across 'subject areas' naturally. Secondary schools are more varied, but I was encouraged recently by a visit from twelve teachers from one school who came to discuss work programmes which would interlock - Mathematics, Biology, Art, Technology, Home Economics, Information Technology, Business Studies, Modern Languages. We did it! This has led me neatly into - it is fine to say all this can be done - but HOW?

How can this be achieved?

Best by a partnership

The children's teachers:

know the children

|

know what the children know

|

know how they want the work to progress after the visit

|

have certain facilities in school which the zoo cannot provide

|

BUT

|

do not usually know much about the zoo, its animals, what could/will work and what will not.

The Zoo Education Staff:

know the schools (all have many years of experience in schools)

|

know their own subject areas.

|

know the zoo

|

know what is likely to work and what is not feasible

|

BUT

|

do not know those particular children and their pattern of work.

So add together the expertise within the partnership through:

1. Joint Working Parties and the publishing of the results for others to use.
2. Teacher's Courses on using the zoo - especially on particular themes.
3. Discussions during pre-visits with individual teachers.
4. Provide tested materials in published form - information, ideas, worked out schemes on particular topics for particular age groups. In fact, set up complete 'Do-it-yourself' programmes. We call them 'Teachers Packs'. They include suggested pre- and post-visit work and detailed work for use in the zoo.

These approaches are our main areas of work, but we do do some teaching ourselves and I believe this is vital as it is so easy to 'get out of touch'.

Conclusion

Of course - it sounds easy and it is not.

- We have tried teaching 'locomotion' on a hot day when all the animals are asleep! - and then tried to find ways round the problem so that we can help other teachers.

- We have had to overcome the heart-break of just publishing a full Teachers' Pack on the savannah - and the day it went to print the zoo went out of vultures!
- We try to accept that the zoo is a conservation agent and therefore the welfare of animals and the long term are the main themes, despite the limitations these place on the work we do.
- We try to juggle a small department to cover all the subject and age level expertise that is needed and we are going some way to achieve this by appointing one year staff with expertise in specific areas of the curriculum (for example, this year we have a physicist).
- BUT despite all the problems it is fun trying even if we do not always succeed AND we are not alone. Closer links with other zoos, museums and other out-of-school education centres all help for we are NOT competing. We are complementing each other for, in the end, it is what the children get out of any visit out-of-school which is important.

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- Worthington, J., Young, J.S. and Altrincham, J.D. (1991). The scaling of respiration frequency and energy uptake with mass. *J. exper. Biol.* **161** : 533-536

Instructions to Authors

Manuscripts should be submitted to: Charles Pettitt, Keeper of Invertebrates, Manchester Museum, Manchester University, Manchester M13 9PL, England.

Tel: 061-275 2666 FAX: 061-275 2676

Preference will be given to papers in the following subject areas:

- collection management
- documentation, particularly advances in computer based systems
- natural history interpretation, particularly display planning, execution and evaluation
- biological recording; collection, storage and dissemination of data
- curatorial techniques in the preparation and conservation of biological material
- experimental investigation into the permanence of stored collections
- description of collections and institutional holdings, from the UK and abroad

This list is not meant to be exhaustive or exclusive. Papers on related subjects will also be considered, but the products of purely systematic research will not be accepted unless they throw significant light on any of the subject areas listed above.

All papers submitted will be expertly refereed using a double-blind protocol, so the author's name and address should be given on a separate sheet and not repeated on each page of the manuscript. Authors should refer to previous issues of the *Journal* for a guide to format; headings should be labelled [A] [B] or [C] to indicate the desired hierarchy. Authors are reminded of the high cost of printing, and are therefore expected to write concisely and to make maximum use of the available page area when designing art-work and tables.

The typescript should be on A4 paper, single sided, double spaced and with a wide margin. It will speed publication if material is submitted in machine readable form: such material can be accepted on IBM format 3½" (720k or 1.44Mb.) or 5¼" (370k or 720k) disks, preferably as WordPerfect, WordStar or ASCII files. Illustrations should be black ink on white paper or card. Photographs should be black and white glossy prints.

Full scientific names, including authority, should be given for all organisms on first mention. Subsequently the generic name should be abbreviated to an initial. Scientific names should be underlined in the typescript. Measurements should be in metric units, and should follow the Institute of Biology publication *Biological Nomenclature: recommendations on terms, units and symbols* (1989). Dates should be written in full: 31 June 1989.

References should be in the form:

Jeffreys, J.G. (1858). *Gleanings*. *Ann. Mag. Nat. Hist.* **2**, 130

Babington, C.C. (1839). *Primitiae Florae Sanniceae*. Longman, London.

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