

# *WHERE'S THE MANAGEMENT IN COLLECTIONS MANAGEMENT?*

## *Planning for Improved Care, Greater Use, and Growth of Collections*

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### *RESUMEN*

¿DONDE ESTA LA GESTION EN LA ADMINISTRACION DE LAS COLECCIONES? La necesidad urgente de documentar y proteger la diversidad biótica, en un momento en el que los hábitats se encuentran cada vez más amenazados, es lo que se entiende generalmente por Crisis de la Biodiversidad. A menudo se pasa por alto la *segunda* crisis de la biodiversidad: es decir, el impacto asociado que produce la primera en los museos de Historia Natural. Estos museos se están saturando de ejemplares procedentes de prospecciones bióticas, al mismo tiempo que la mayoría de sus presupuestos están siendo recortados. Para una mejor utilización de los recursos limitados, los museos tendrán que mejorar la gestión de las actividades relacionadas con las colecciones. Se debe poner un mayor énfasis en la planificación de mejoras en el cuidado, aumento del uso y desarrollo de las colecciones. El Departamento de Entomología del National Museum of Natural History (Estados Unidos) y agencias afiliadas están desarrollando una serie de enfoques innovadores acerca de la gestión de colecciones, que se presentan en este trabajo, e incluyen: 1) desarrollo de modelos de gestión y de un sistema asociado de perfiles de colecciones; 2) establecimiento de un índice de salud de la colección; 3) creación de un Programa Externo para Desarrollo de las Colecciones; 4) desarrollo de un nuevo método de medir la calidad de las colecciones; y 5) uso de los informes de impacto de colecciones. Se discuten también el reparto de recursos, prioridades de investigación y actividades de gestión de colecciones.

### *ABSTRACT*

The urgent need to document and protect biotic diversity in an era when habitats are increasingly threatened, is what is generally understood to be the Biodiversity Crisis. Often overlooked is the *second* biodiversity crisis: the associated impact on natural history museums. These museums are being inundated with specimens from biotic surveys at the same time that most museum budgets are being cut. In order to make the best use of their limited resources, museums will have to demonstrate improved management in their collection activities. Emphasis should be on planning for improved care, greater use, and growth of collections. The Department of Entomology at the National Museum of Natural History (United States), and affiliated agencies are developing a number of innovative approaches to collection

management that are presented in this contribution. They include: 1) development of curation standards and an associated collection profiling system; 2) establishment of a collection health index (CHI); 3) creation of an off-site Collection Enhancement Program; 4) development of a new way to measure collection quality, and 5) use of collection impact statements. Resource allocation priorities for research and collection management activities are also discussed.

### INTRODUCTION

Collections management can be defined narrowly ". . . to mean the organization, documentation and tracking of collection materials, and by improved techniques for handling and preserving specimens" (Danks, 1991) or more broadly to include acquisition, disposal and collections policy development (Waddington, 1989). The primary concern of this paper is not so much the scope of activities included under this term, but rather the rigor in which the word *management* is applied. Webster's Third (1971) International Dictionary defines management as "the more or less skilled handling of something." In an era of dwindling museum budgets and ever increasing demands on collections, the "more or less" is critical and dependent upon sound management at all levels of the museum organization. Sound management means: 1) clarification of goals and priorities, 2) associated strategic planning, 3) development of necessary monitoring systems, and 4) leadership.

Most museum workers are highly trained individuals who are skilled at handling materials in their immediate areas of interest - such collections tend to be well-cared for. Beyond this localized level of individual expertise (that is, departments and museums), collections management too often breaks down to a system of "collections ad-hocing," that is, dealing with problems and opportunities as they become apparent and seem important at the time. A fundamental reason for this is, as Griffin (1987) points out, few museum workers see themselves as being part of an organization. Accordingly, in such an environment, it is rare to see collections management systems developed that allow for meaningful overview of collection problems at the departmental and/or museum levels. Collection status summaries usually emphasize quantitative aspects such as size of collections, number of specimens accessioned, and so forth. Qualitative aspects (collection health) tend to be summarized by non-numerical, anecdotal reviews. However, numbers in management are important, as Sloma (1981) emphasizes: "Basically, the need for numbers stems from the need for measurement. With numerical goals, you can not only measure the degree of achievement, but also keep track of interim progress." The lack of numerical qualitative systems for collection assessment is a fundamental flaw in most collections management programs.

The Collections Committee of the Department of Entomology at the National Museum of Natural History (NMNH), United States, is composed of representatives from the Smithsonian Institution, Systematic Entomology

Laboratory (SEL)/United States Department Agriculture (USDA) and the Army's Walter Reed Biological Unit. In 1985, at the suggestion of F. Christian Thompson (SEL/USDA), the Committee initiated the development of curation standards that are described herein. From this starting point, the group coordinated the development of other policies and practices that will hopefully lead to: 1) improved care of the NMNH Entomology Collection, 2) its greater use, as well as 3) better planning for its growth. Below are summarized some of these activities that should be of interest to the broader natural history community.

## *IMPROVED COLLECTIONS CARE*

### *Curation standards*

How healthy is a particular collection? What are the problems, how do we describe them, and how do they compare to other collections? How do we set collection improvement priorities and wisely allocate limited resources (that is, money and people)? These are the concerns behind the development of what is commonly referred to in the entomological community as the Smithsonian Curation Standards and Profiling System. This is nothing more than a numerical coding system that identifies the curation status of the individual storage units commonly used in insect collections: insect drawers, alcohol jars, and slide boxes. The standards are concerned with those issues common to all natural history collections: materials conservation (LEVEL 1); specimen accessibility (LEVELS 2-4); physical organization (LEVELS 5-6); data capture (LEVELS 7-9); and scientific voucher material (LEVEL 10). These levels are defined as follows: (Department of Entomology Collections Management Policy, revised May 18, 1992):

#### LEVEL 1. CONSERVATION PROBLEM (Fig. 1):

Specimens deteriorating, potentially cullable, or unprepared. Collection unit in need of immediate attention: museum pests, rusting pins, crystallizing slide media, unringed Hoyer's media, evaporated alcohol, fading labels, broken cover slip or slide, etc. Primary types mixed in general collection. LEVEL 1 storage units (drawers, slide boxes, alcoholic jars) shall be conspicuously marked when first discovered. This marking also will be done by the curator-in-charge after each collection inventory and will be used as an "identifier" so that LEVEL 1 units may be easily found and corrected on a priority basis.

NOTE: In some groups, long series of unprepared specimens are placed in the collection adjacent to pinned specimens. When it is obvious that an appropriate number of specimens in the series have been prepared, and the unprepared specimens are in suitable containers for their protection, the storage unit may be scored at an appropriate higher level. [Horie, 1987, proposed a qualitative coding system to document the conservation status of

mounted vertebrate specimens; Fitzgerald (1988) presented documentation guidelines for the preparation and paleontological and geological conservation of specimens, and Garrett (1989) did the same for biological specimens].

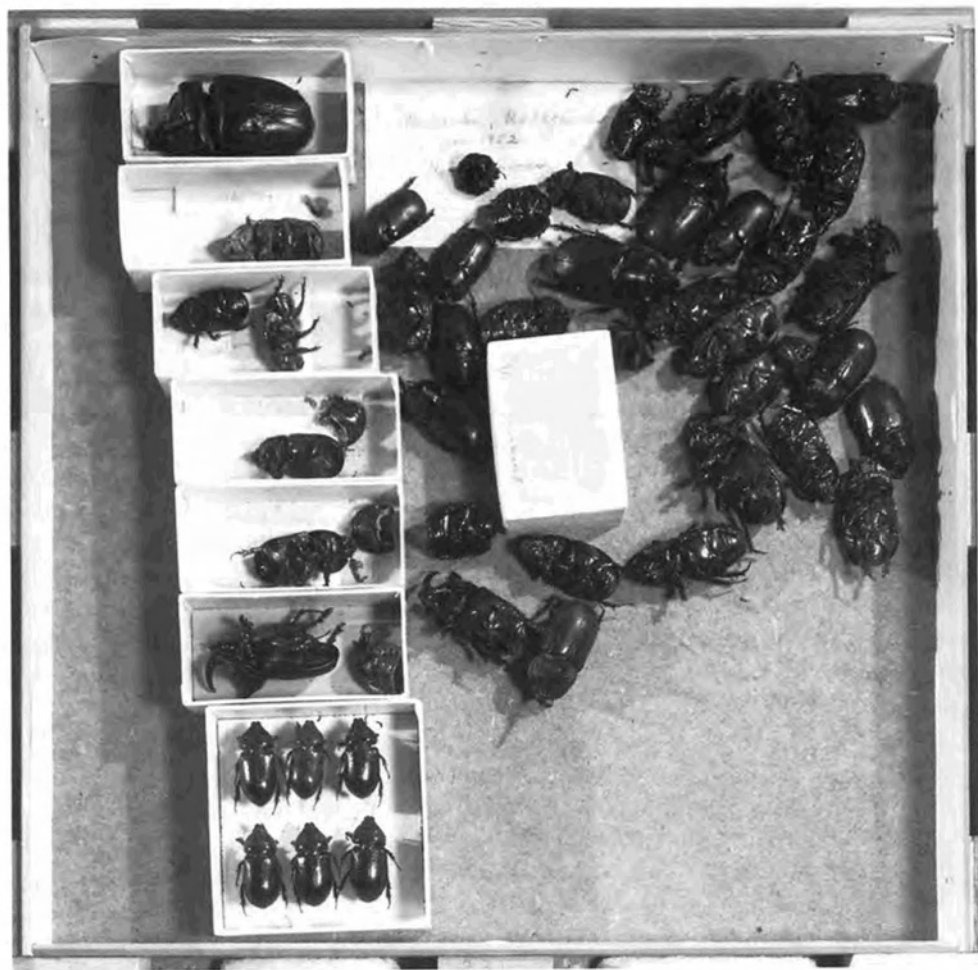


Figure 1. Curation LEVEL 1: conservation problem. Loose, unprepared scarabaeid beetles from Madagascar represent an obvious materials conservation problem.

**LEVEL 2. SPECIMENS UNIDENTIFIED, INACCESSIBLE (Fig. 2):**

Material properly prepared but not sorted or only rough-sorted; not readily available to specialists.

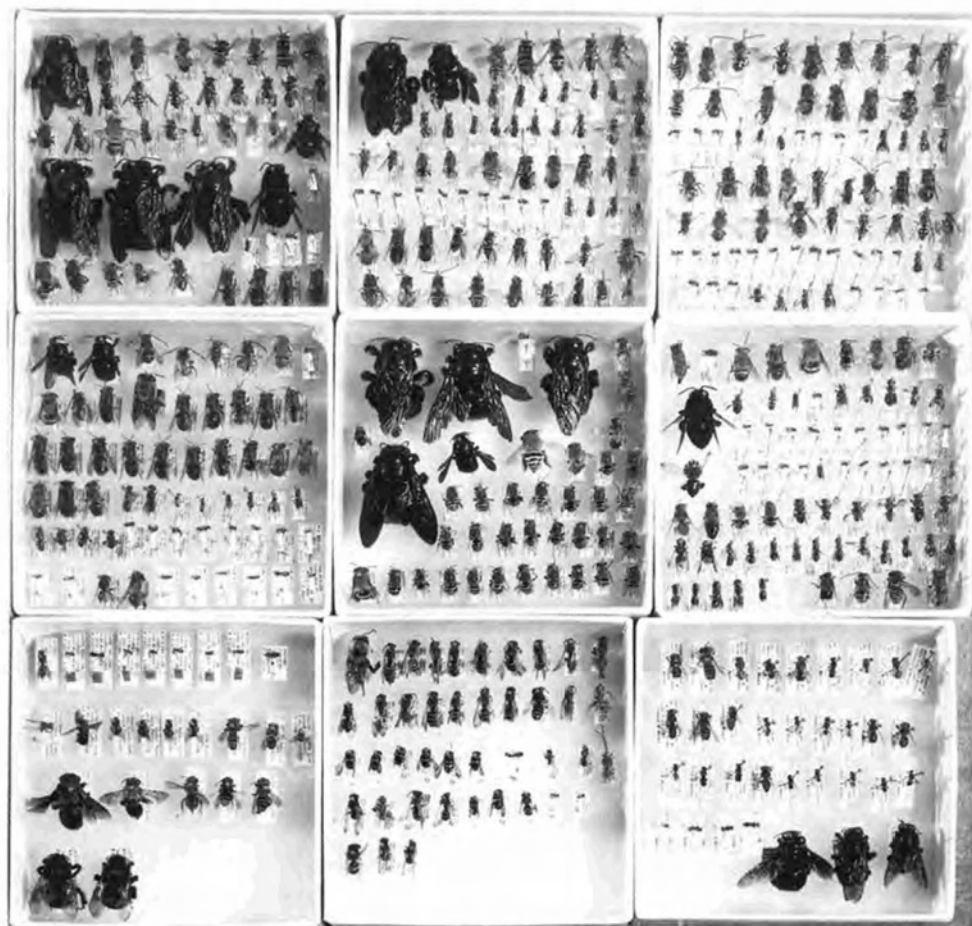


Figure 2. Curation LEVEL 2: inaccessible specimens. Miscellaneous, unsorted bees.

**LEVEL 3. SPECIMENS UNIDENTIFIED, ACCESSIBLE (Fig. 3):**

Specimens sorted to a level necessary to be efficiently accessible to research specialists for study. All specimens in soft-bottom trays, shell vials in jars, or slide boxes, with appropriate labels denoting pertinent taxonomic information. Taxonomic category may vary among different taxa.

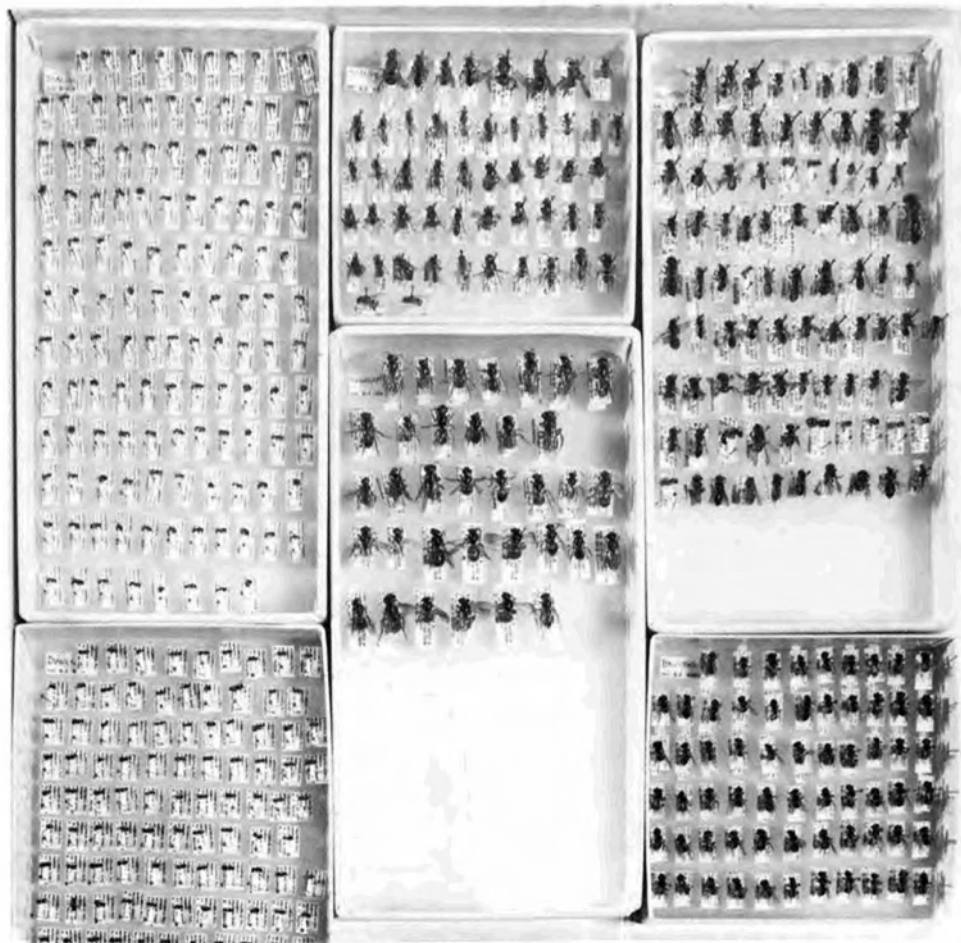


Figure 3. Curation LEVEL 3: rough-sorted material. Halictid bees identified to genera.

LEVEL 4. SPECIMENS IDENTIFIED BUT NOT INTEGRATED INTO COLLECTION (Fig. 4): Valuable material that has been identified to the species level but not yet put away - effectively inaccessible.

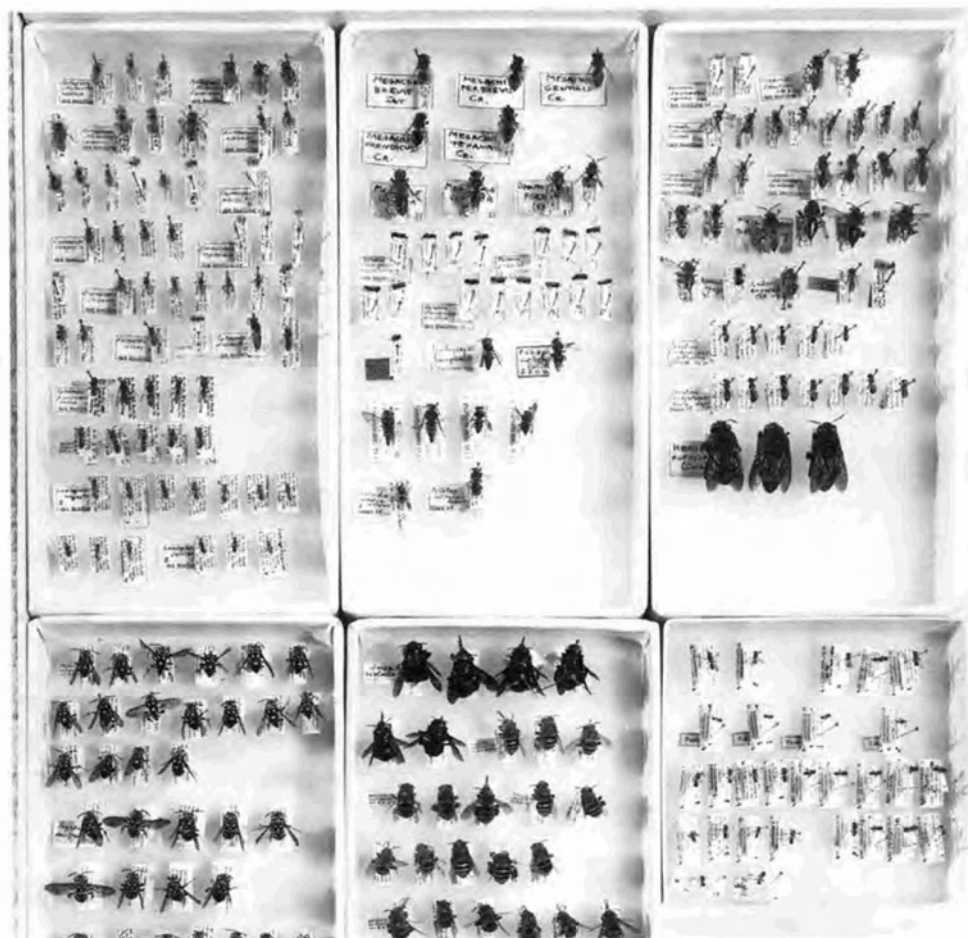


Figure 4. Curation LEVEL 4: identified material, not integrated into general collection. Miscellaneous bees identified to species.

LEVEL 5. SPECIMENS IDENTIFIED BUT CURATION INCOMPLETE (Fig. 5): All specimens identified and integrated. However, this collection unit needs upgrading, e.g., names checked, header labels for unit trays prepared, transfer to soft-bottom trays, etc., box header labels checked against slides. Alcoholic collection with individual exposed vials, jar labels misleading or without detail, overall format heterogenous.



Figure 5. Curation LEVEL 5: identified, curated material but not meeting departmental standards. Megachilid bees in hard-bottom trays; names not recently validated.



LEVEL 6. SPECIMENS IDENTIFIED AND PROPERLY CURATED IN ACCORDANCE WITH DEPARTMENTAL COLLECTION STANDARDS (Fig. 6): All specimens in soft-bottom unit trays; all unit-tray header labels, drawer or box, and cabinet labels completed; space left for expansion. When a collection reaches LEVEL 6, the names(s) of who did the curation, the date of curation and listing of catalogues or monographs on which the names are based should be entered in the Smithsonian Collection Inventory File (CIF) computerized files. Vial within jar system established, labels complete and accurately typed, expansion space allocated, and alcohol levels adequate. NOTE: Specimens from the same sample (identical locality data) may be stored in bulk containers (suitable according to taxon), if an appropriate series is properly pinned or pointed and labeled.

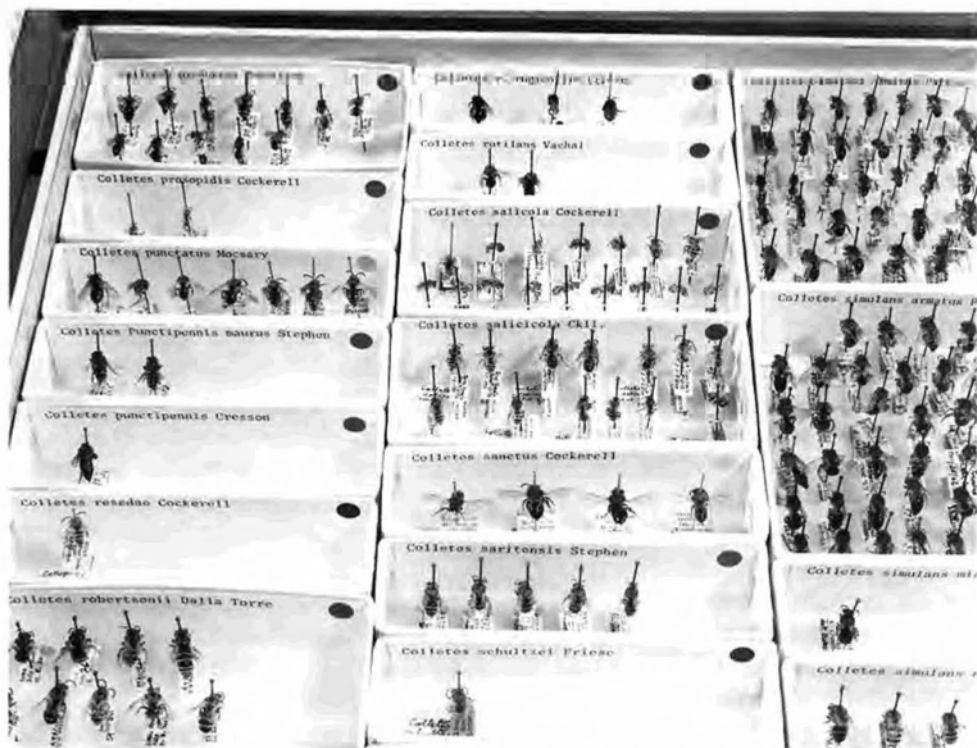


Figure 6. Curation LEVEL 6: identified material curated to departmental standards. Colletid bees in soft-bottom trays, names recently validated and on tray labels.

**LEVEL 7. DATA CAPTURE: SPECIES LEVEL INVENTORY:**

Species inventory with header or box label generation completed. Alcoholic collection with taxa listed on jar labels and in database. As in LEVEL 6, plus species-level inventory.

**LEVEL 8. DATA CAPTURE: SPECIMEN LABEL DATA CAPTURE:**

Label data are recorded for systematic, biogeography or natural history studies. The data elements recorded will vary by group, however, a standard core set includes the following: a) country/province/place/latitude-longitude; b) date of collection; c) collector(s); d) miscellaneous (for example, elevation, host). Miscellaneous voucher specimens, including types, from various studies are also ranked at this level.

**LEVEL 9. DATA CAPTURE: RESEARCH DATA CAPTURE:**

Measurements, graphics, or other pertinent (descriptions) of specimens are captured in a database.

**LEVEL 10. SCIENTIFIC VOUCHER MATERIAL:**

Groups of specimens included in published monographic, synthetic, or revisionary works, including primary type collection if storage is at LEVEL 7 or higher. When groups of specimens serve to voucher published scientific collection-based studies and have undergone conservation and accession requirements of at least LEVEL 7.

### *Data Gathering*

Collection information for pinned specimens is recorded on standardized data sheets, with one form for each insect cabinet representing the matrix of insect drawers by curation levels (Fig. 7). Individual drawers will often contain unit trays at mixed levels of curation, for example, LEVEL 2 and 3 materials. The level representing the majority of included specimens is the one recorded. Where majority representation is not obvious, the most useful (usually lower) level is recorded; in this example, identification of LEVEL 2 materials in need of sorting is more useful information for collections management than estimates of LEVEL 3 materials. A drawer with any materials conservation problem is scored entirely at LEVEL 1. These data are summarized at the family level and then entered into a dBASE-IV database.

Common questions are 1) "Isn't it prohibitively time consuming to collect the initial data?" and 2) "Isn't it too much trouble to continually update the database?" The answer to both is yes if not carefully considered. The efficient method of gathering data, especially for large collections, is to organize groups of individuals, make sure all are clear as to what the standards are, and then simply blitz the collection. For example, in August 1988, the Smithsonian

Initials of Recorder: PMG Page 1 of 4 Pages  
 Date of Record: APRIL 7, 1992  
 Insect Order: HYMENOPTERA Family: COLETTIDAE  
 Cabinet #: 3783  
 Circle one: Old Steel    Wooden Frame    New Steel

		CURATION LEVEL													
		LEFT							RIGHT						
		1	2	3	4	5	6	7	1	2	3	4	5	6	7
DRAWER #	1														
	2														
	3														

		CURATION LEVEL						
		1	2	3	4	5	6	7
DRAWER #	1							✓
	2							✓
	3							✓
	4							✓
	5							✓
	6			✓				
	7		✓					

Figure 7. Standardized data capture forms for recording curation levels of insect drawers; actual data for colletid bee cabinet.

Hymenoptera Collection of 5,152 drawers was reviewed by ten hymenopterists and associated personnel in approximately three hours. Updates are performed only upon completion of significant curation projects.

### Collection Profiling

Curation standards data allow one to profile an entire collection (Fig. 8), compare the status of various taxa (Fig. 9) and track collection improvements through time (Fig. 10). Collections in different museums can also be compared (something of interest to funding agencies such as the National Science Foundation). For example, Figure 11 shows 1988 data for the Hymenoptera collections at the Canadian National Collection (Biological Research Center, Ottawa), Bishop Museum, and the Smithsonian Institution. The profiles of these collections were entirely different, reflecting their different histories, problems, and needs.

The CNC profile was excellent with a bimodal distribution peaking at LEVELS 3 and 6, signifying fully accessible unidentified specimens and fully curated identified specimens. However, the CNC profile identified an apparent lack of collection data capture (LEVEL 7 or higher) and a continuing need for visiting specialists to help sort LEVEL 2 material (935 drawers). The need for visiting specialists was clearly documented in the Bishop Museum profile where there were 559 drawers of unsorted material and no resident staff hymenopterist. The Smithsonian profile was one that might be expected of an old and very large

collection - the problems being primarily an inordinate amount of now obsolete curation (LEVEL 5) and significant LEVEL 4 problems (that is, 388 drawers of identified specimens that needed to be integrated into the general collection).

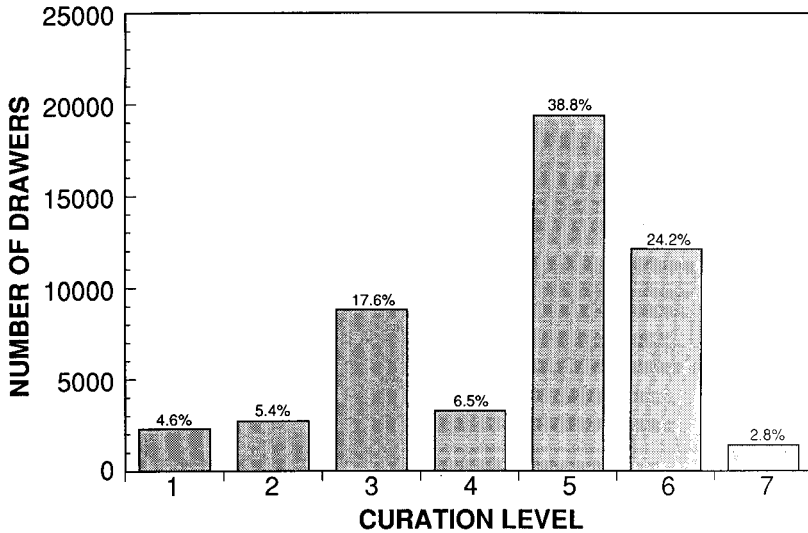


Figure 8. Curation profile of NMNH Entomology Collection, April 7, 1992; Collection Health Index (CHI) is 0.45 (see text, p. 321 for explanation).

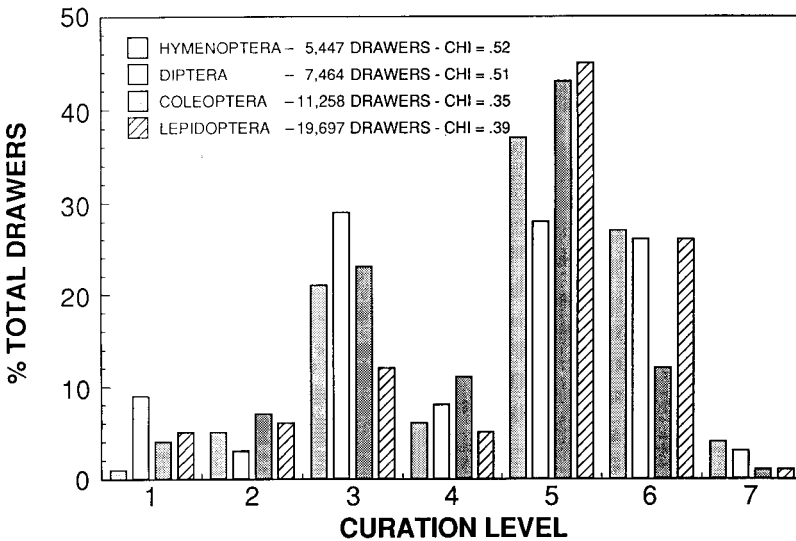


Figure 9. Curation profile comparison of four major orders in NMNH Entomology Collection, April 7, 1992; CHI is Collection Health Index.

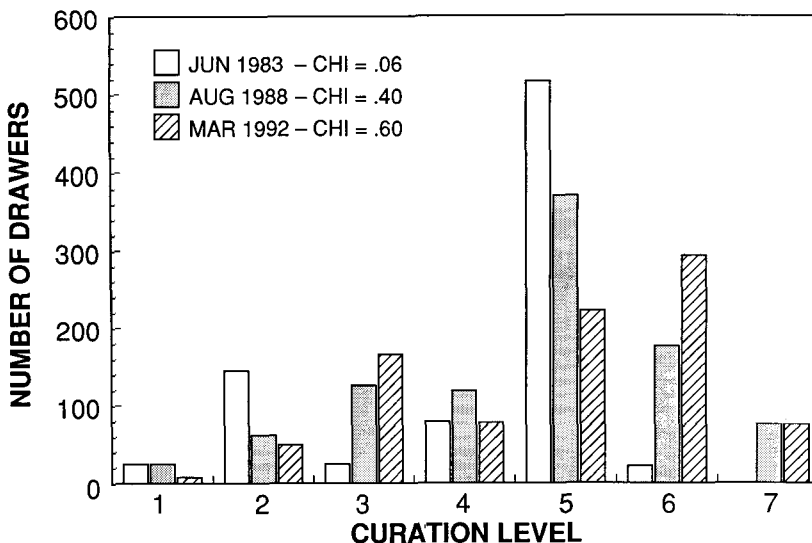


Figure 10. Curation profiles of NMNH bee collection in 1983, 1988 and 1992; CHI is Collection Health Index.

### *Collection Health Index (CHI)*

What should the optimal collection profile look like? The quick answer might be all LEVEL 6 or higher. While desirable, such a profile would most likely be associated with a dead, static collection. A dynamic, active collection might optimally look like the hypothetical one depicted in Figure 12, where the majority of the main collection is maintained at LEVEL 7 (or higher) but includes incoming material in need of sorting (LEVEL 2) which results in specimens readily accessible to specialists (LEVEL 3), and hopefully only a trace of material identified to species and in need of integration (LEVEL 4). This would suggest that a healthy collection profile would be bimodal, peaking at LEVEL 3 and LEVELS 6-10.

It follows that a Collection Health Index (CHI) can be calculated as the sum of LEVELS 3 + 6-10 divided by the total number of storage units. Referring to Figure 8, an optimist might say that the NMNH Entomology Collection is 45% well - a pessimist would see it as being 55% sick. The CHI is a succinct collection descriptor that can help summarize collection improvements through time (Fig. 10) or facilitate collection comparisons (Fig. 11).

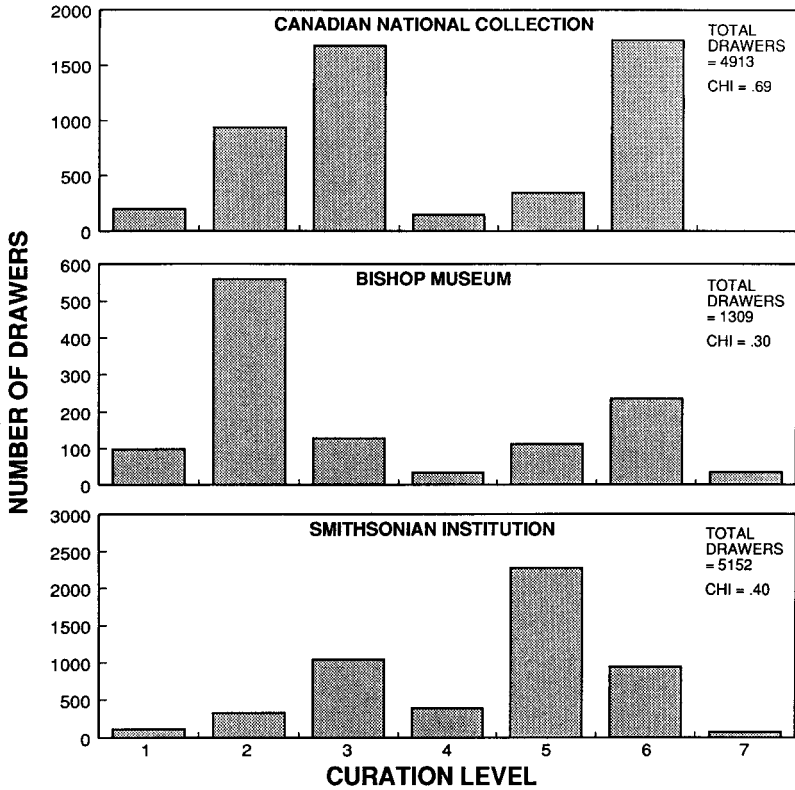


Figure 11. Curation profiles of three Hymenoptera collections based on 1988 inventories; CHI is Collection Health Index.

### *Collection Management Priorities*

Systematic collections are built and maintained primarily to support basic research, secondarily to support associated service functions such as specimen identification, education and exhibition. The enormous diversity of insects and modern methods of mass collecting (canopy fogging, Malaise traps, and so forth) present a significant challenge to museum resources (Danks, 1991; Mound, 1992). These collections need to be well-managed, but not over-managed. Limited budgets mandate the development of a realistic collection management agenda for Entomology.

In May 1991, twenty-four department heads and curators from major entomology collections in Australia, Canada, the United Kingdom and the

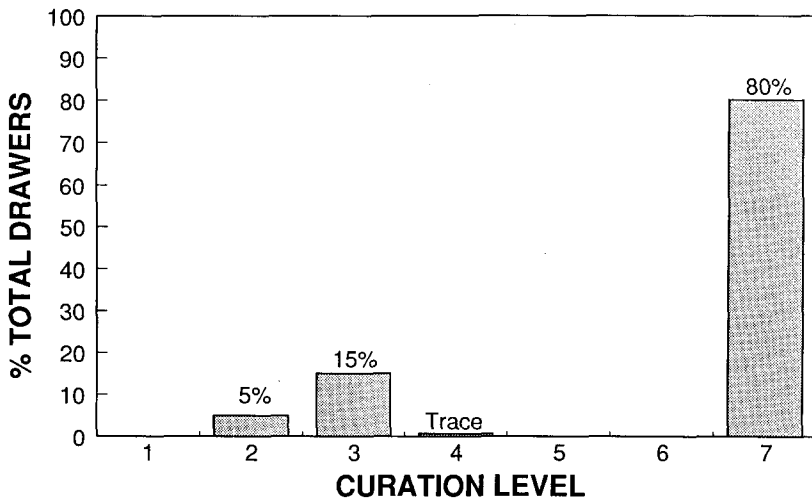


Figure 12. Optimal collection profile? A hypothetical collection profile. The majority of the collection is maintained at LEVEL 7, but includes incoming material in need of sorting (LEVEL 2), resulting in specimens readily accessible to specialists (LEVEL 3).

United States met in Washington, D.C.<sup>1</sup> One discussion session was devoted to the issue of collection activities and resource management. The group consensus on a collection management flow chart is presented in Figure 13. The primary driving force guiding most collection activities should be the research and associated field work priorities at any given museum. Collection management priorities are independent of those of research and should be ranked as follows:

**Priority 1: Conservation (LEVEL 1)**

The protection and preservation of specimens and associated data should be the most important collections concern at any museum. Ideally this should include the conservation of keyboard strokes, that is, prospective data capture (Thompson *et al.*, 1990). The effort to type insect label orders, vial labels, etc. should be saved electronically and ultimately transferred to a general specimen label database (LEVEL 8 material).

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<sup>1</sup>American Museum of Natural History, Biological Research Centre (Ottawa), Bishop Museum, Canadian Museum of Nature, Cornell University, Commonwealth Scientific and Industrial Research Organization (Canberra), International Institute of Entomology (London), Smithsonian Institution, Systematic Entomology Laboratory (USDA), The Natural History Museum (London), University of Maryland (see McGinley *et al.*, 1992 for more information).

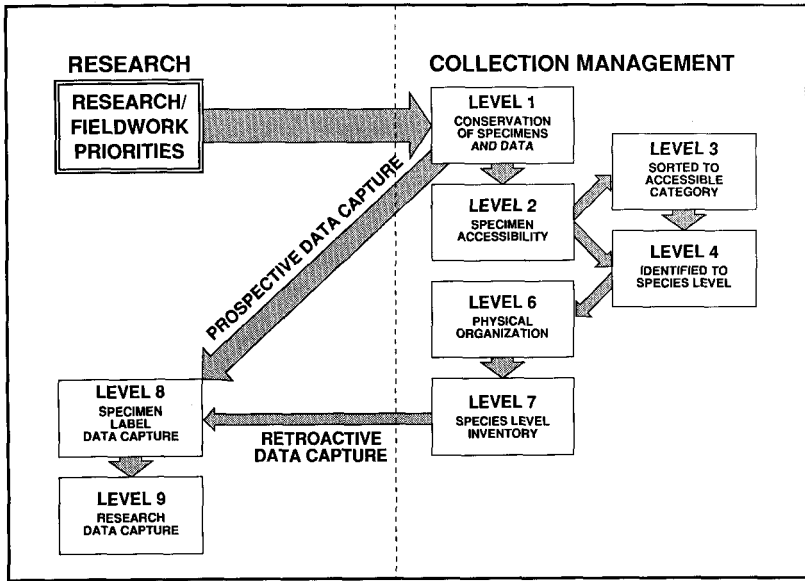


Figure 13. Research/collection management flow chart. Agreed upon by department heads and curators from major entomology departments in Australia, Canada, the United Kingdom, and the United States.

#### Priority 2: Accessibility (LEVEL 2)

Undetermined specimens should be made available to the research community as expeditiously as possible. Material should be sorted to the taxonomic category that allows for efficient access by specialists. This activity results in LEVEL 3 (sorted) and LEVEL 4 (identified) materials as depicted in Fig. 13.

#### Priority 3: Physical organization (LEVEL 6)

Taxa should be clearly labeled and logically arranged in collections; emphasis should be on ease of retrieval.

#### Priority 4: Species inventory (LEVEL 7)

A listing of species (and unidentified material) housed in collections is an extremely useful collection management tool. Only through species level inventory can quality assessments be made of collections (see below). Ideally such lists should be obtained as a secondary byproduct of literature-based curation activities (Priority 3). Tray/vial labels should be computer generated and species names retained in a database.



The group consensus was that activities at LEVELS 8-10 have more to do with research than collection management. Complete specimen label data capture (LEVEL 8) should be associated with specific research projects. These might be as narrow as a monograph of a particular ant genus by one individual, or as broad as an international effort to database all ant specimens in all collections. Either way, such projects should be clearly defined and led by the researchers who will be using the information. Nearly thirty years ago, Walker (1963), while discussing cataloguing methods wrote: "Elaborate cross indexes are nice and can be very useful, but they take a tremendous amount of time to set up and continue. This is truly the researcher's work, and not the curator's job to maintain for other researchers." Thompson recently emphasized (McGinley *et al.*, 1992): "Automation, however, is only a tool, not a panacea for systematics, and improperly used will waste valuable and limited resources ... the question for entomological collections is what is the appropriate level of data capture for proper collection management." I believe this is an important question for all collections, not just Entomology.

The collection profiling system helps in setting priorities within the broad categories discussed above. For example, one can generate database reports that list the top ten conservation and accessibility problems for the entire NMNH Entomology Collection (Table 1). The NMNH lepidopterists knew they had a problem with unprepared specimens stored in paper envelopes, but the magnitude of this problem (784 drawer equivalents) was not fully appreciated until it was compared to other LEVEL 1 materials. The database sort on LEVEL 2 materials indicates areas where curators need to put more effort and/or the need to bring in specialists from other institutions where we lack the necessary expertise for particular taxa. All these numbers give relatively clear indications of collection needs, but they remain just that, mere numbers. Decision-making associated with the allocation of collection improvement funds also should take into account additional variables such as research support and loan activity. Nevertheless, the curation status data provide a firm starting point for the decision-making process.

### *Performance of Curators*

The curation standards, profiling system, and collection health indices discussed above provide management with important data concerning the current status and needs of any particular collection. They also provide information on the performance of individuals responsible for those collections. But how is actual performance measured over the course of a year or an entire career? In the area of research, we police ourselves with statistics on papers and pages published, amount of grant monies awarded, and so forth. Curatorial effort is difficult to assess because most museums lack quality control systems for collection oversight and/or accountability. Curation level data allow one to

Table 1. Top ten conservation and accessibility problems, NMNH Entomology Collection, April 7, 1992 [order, family, number of insect drawers; \* = papered material listed as estimated drawer equivalents].

Conservation (LEVEL 1)		Accessibility (LEVEL 2)	
Lepidoptera Miscellaneous	784*	Lepidoptera Miscellaneous	400
Diptera Miscellaneous	480*	Lepidoptera Noctuidae	168
Coleoptera Bruchidae	179	Coleoptera Cerambycidae	142
Lepidoptera Noctuidae	77	Coleoptera Chrysomelidae	124
Coleoptera Scolytidae	58	Coleoptera Scarabaeidae	98
Heteroptera Miscellaneous	57	Coleoptera Elateridae	92
Diptera Culcidae	49	Lepidoptera Pyralidae	86
Coleoptera Scarabaeidae	47	Heteroptera Miridae	70
Lepidoptera Limacodidae	39	Lepidoptera Arctiidae	68
Coleoptera Chrysomelidae	27	Lepidoptera Pieridae	67

compare the performance of curators as measured by the collection health indices of collections under their care (Fig. 14). More detailed assessments can be made, for example, comparison of performance in relation to size of collection responsibilities (Fig. 15). Naturally, other factors also must be considered in the evaluation of curators, such as loan activity and improvement of collection quality (see below).

### PLANNING FOR GREATER COLLECTION USE

#### *Off-site Enhancement Program*

Given the diversity of insects, no institution has the resident expertise to fully utilize all taxa in moderate to large-sized entomology collections. As a result, the long-term loan of large collections is commonplace. Unfortunately, such loans are usually handled informally, as just another loan of research materials with expectations and responsibilities not clearly defined. This informality often leads to misunderstandings. Furthermore, most long-term loans are relatively static arrangements - a collection is transferred, maintained separately, used by the researcher, and ultimately returned in a condition similar to that in which it was originally sent.

For these reasons, the NMNH Department of Entomology has initiated an Off-site Collection Enhancement Program. This involves nothing more than a renewable five-year loan of a large collection (including primary types) that is bound to a detailed Memorandum of Understanding of mutual benefit to both parties. This is an institutional agreement signed by museum directors or university presidents.

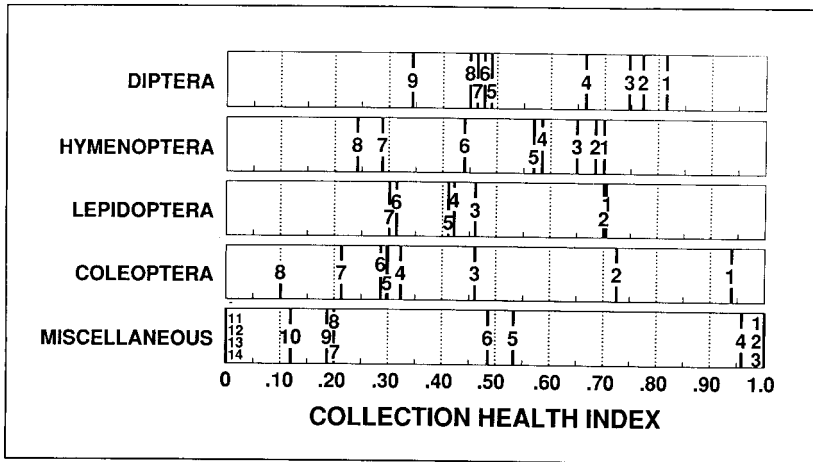


Figure 14. Performance of NMNH entomology curators, April 7, 1992. The collection health indices of collections under the care of individual curators are summarized. For confidentiality, curators are identified by numbers, for example, Diptera curators 1 through 9.

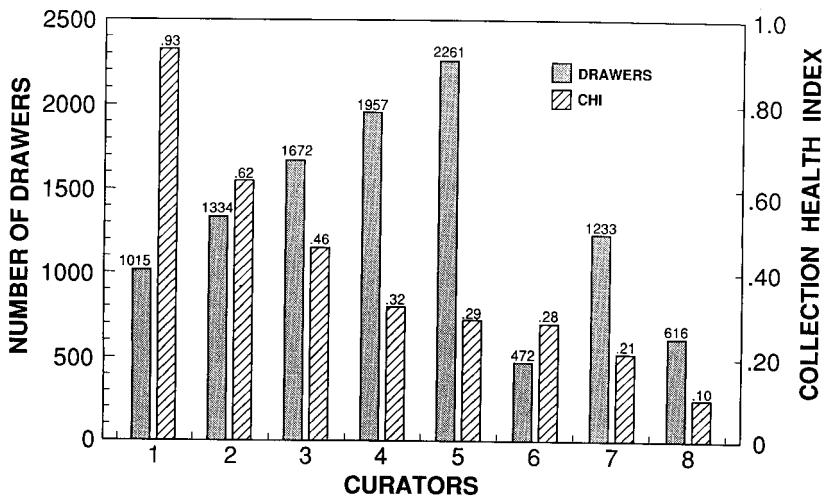


Figure 15. Performance of NMNH coleopterists in relation to size of collection responsibilities.

The following points should be addressed before considering such loans: 1) the loaned material should be clearly beneficial to the research program of the borrower, 2) the loan should improve the maintenance, curation standards and collection quality of the collection, 3) the loan should support the interests of the immediate research community, and 4) the loan should not endanger the collection integrity of the loaning institution unless so desired.

The NMNH and the Bishop Museum have recently initiated such an enhancement program. The NMNH bee fly (Bombyliidae) collection is moderately large, containing approximately 200,000 specimens and 775 primary types. We do not have resident expertise associated with this collection, but have had a good working relationship with Neal Evenhuis, a bombyliid specialist in Hawaii. The entire collection was shipped to the Bishop Museum in July 1990. In less than two years, the collection has been dramatically improved (Fig. 16), with the Collection Health Index jumping from .40 to .74 by April 1992. Lacking sufficient resources to properly curate and utilize this important collection ourselves, we negotiated an arrangement that maximizes its use, care and growth. Such loans should be encouraged but should be safe-guarded by formal institutional agreements (see Appendix A).

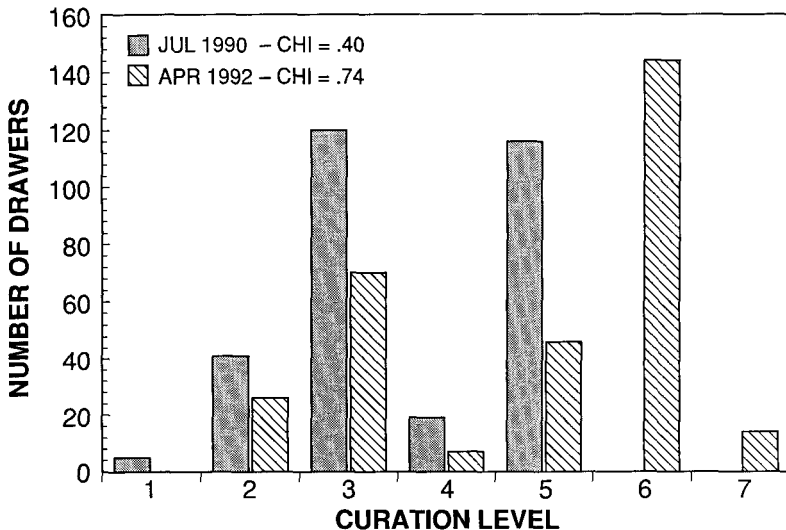


Figure 16. Off-site Enhancement Program: collection profiles of NMNH Bombyliidae collection in July 1990 and April 1992; CHI is Collection Health Index.

## PLANNING FOR COLLECTION GROWTH

### *Collection Quality*

The profiling system described above provides a snapshot of collection health in terms of conservation, accessibility, organization and data capture, but in no way measures collection quality in terms of contents. A collection may have a high health index (see above) but how valuable is it as a systematic resource? The proper measures for the quality of a collection are the same as those used for assessing the value of sites for conservation: taxonomic diversity and species richness. The NMNH flower fly (Syrphidae) collection has a relatively low collection health index (CHI = 0.38), due to the need to upgrade 142 drawers at LEVEL 5 (Fig. 17). A review of the entire Diptera collection shows that the NMNH has representative of all 146 fly families (Fig. 18). Looking at just the flower flies, the collection holds 100% of syrphid suprageneric taxa, 95% of syrphid genera, and 46% of currently recognized species. Thus the flower fly collection has a very high taxonomic diversity. While the species richness may seem low, given that most insect species are known only from the original types, this also is a high value. This measure of collection quality helps promote qualitative directions for collection growth as opposed to collection building for the sake of collection building. It also underscores the importance of species inventories and international taxonomic catalogs and/or checklists.

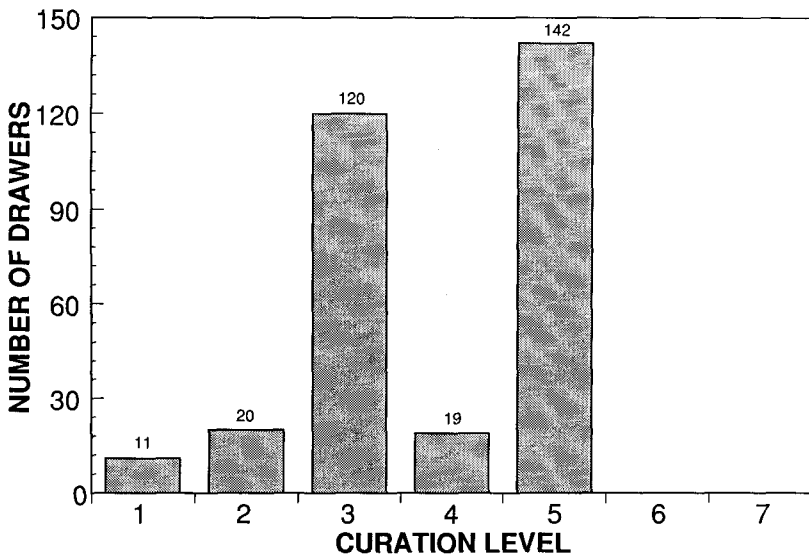
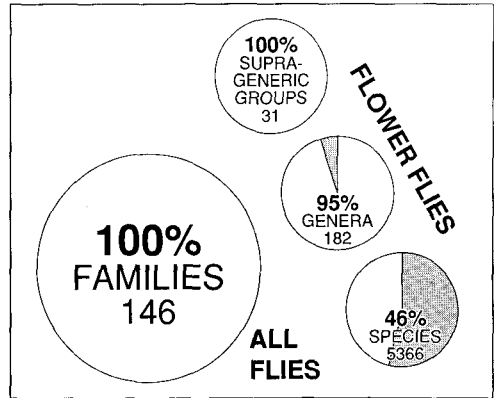


Figure 17. Curation profile of NMNH flower fly (Syrphidae) collection, April 7, 1992.

Figure 18. Collection quality of NMNH Diptera and flower fly (Syrphidae) collections as measured by taxon representation, April 7, 1992 (data provided by F.C. Thompson).



### *Collections Impact Statements*

Collection growth presupposes there are adequate resources to prepare and house new material. Too often new collections simply "happen" with little thought given to advanced planning for their care. Curators go into the field, collect thousands of specimens, and assume that their organizations will accept this material without question. The NMNH Department of Entomology is associated with forty-two entomologists from three independent agencies who set their own agendas and schedules for field work. It is, however, the Department that provides preparation materials (pins, vials, alcohol, labels, and so forth), storage equipment (unit trays, drawers, cabinets, and so forth) and space.

In order to plan and budget for necessary resources, the department chairperson needs to know who is doing what and when. As a result, the Departmental Collections Management Policy now requires curators to file a Collections Impact Statement if any collecting or other mode of acquisition might require significant departmental resources (see Appendix B). This is simply a communication-planning document that clarifies resource needs at the outset. While the impact statements are a matter of policy, issues relating to implementation and compliance are still being developed.

### *CONCLUSIONS*

In an organizational sense, natural history museums can be described as hegemonies of scholars (R. Champion, personal communication). As Griffin (1987) points out, they tend to follow the professional bureaucracy model of Mintzberg (1983) in which organizations rely on the specialized skills of their employees. "Each professional works relatively independently of colleagues but close to the client. The standards are imposed by outside professional associations over which the organization is able to exert little influence and no

control. The operating core is the key part of the bureaucracy and the only other part elaborated is the support staff. The structure is highly decentralized" (Griffin, 1987).

More directly in the natural history context, Waddington (1989), while discussing collections management at the Royal Ontario Museum writes ". . . flexible institutional policies allow different departments to respond to the traditions and needs of their various disciplines while being monitored by a minimum of controls imposed by the organizational structure of the museum." The above authors correctly characterize the museum environment and point out the need to delegate significant authority and independence to specialists. However, a fine balance must exist between management and specialists to ensure that effective minimum controls actually do exist so that inappropriate traditions are not perpetuated and resource allocation decision-making is based on sound and comparable data. The curation standards and profiling system described herein provide the entomological community with a collection vocabulary that promotes clarity in entomological collection management. This language, based on the common issues of conservation, accessibility, organization and data capture, is one that could be translated into dialects of relevance to other disciplines. With this language, goals can be set and systems can be established to monitor progress to those goals. Collection management within and across disciplines can attain the highest level only if those individuals charged with managing them demonstrate a commitment to quality management through tactful yet effective leadership. Thirty years ago, Walker (1963) wrote: "I would ask that there be a greater willingness to accept change in collection care, in spite of the difficulties of change, and I would ask that the problems of collection care be attacked with more imagination."

I believe we have made and continue to make significant progress in collections management as evidenced by technical advances in materials conservation, automation, and so forth. The real challenge for the natural history museum community is our willingness to accept fundamental change in the way we manage these resources and use new tools.

### *ACKNOWLEDGMENTS*

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## APPENDIX A

*Memorandum of Understanding  
Smithsonian-Bishop Museum  
Off-site Collection Enhancement Program: Bombyliidae*

The National Museum of Natural History, Smithsonian Institution ("NMNH"), whose address is Washington, D.C. 20560, and the Bernice P. Bishop Museum ("Bishop Museum" or "BPBM"), whose address is P.O. Box 19000-A, Honolulu, Hawaii 96817-0916, hereby agree to undertake an Off-site Collection Enhancement Program for the NMNH collection of Bombyliidae, in accordance with the following terms and conditions.

1. NMNH will loan to the Bishop Museum all of its specimens of Diptera of the family Bombyliidae (the "Collection") and sufficient drawers, unit trays, and cabinets to accommodate anticipated expansion of the Collection after curation for a period of five years, subject to renewal by agreement of the parties. A species inventory of the Collection and a collection profile based on curatorial standards adopted by the NMNH and the Bishop Museum is attached hereto as Appendix A.

2. The Bishop Museum will provide proper care and maintenance of the Collection and associated data, including label data, correspondence, type catalog data, and field research notes throughout the term of this Agreement. It is understood and agreed that the Collection will be curated by Dr. Neal L. Evenhuis, who is currently on the staff of the Bishop Museum Department of Entomology (the "Researcher").

3. The Bishop Museum will provide adequate storage and security for the Collection, which shall be subject to the review and acceptance of the NMNH. The NMNH will make periodic site visits at reasonable intervals to inspect the status of the Collection. Site visits will be scheduled in advance with the Bishop Museum, and the Bishop Museum agrees to make reasonable accommodations to permit a thorough inspection.

4. Upon receipt of the Collection, the Researcher will prepare a condition report, which will be sent to the Chairman of the Department of Entomology at NMNH within thirty days of receipt of the Collection by the Bishop Museum.

5. Within one year of receipt of the Collection by the Bishop Museum, the Researcher will sort, identify, and return to NMNH a synoptic collection of voucher specimens, exclusive of uniques, as represented in the Collection. If ongoing research identifies additional voucher specimens from the Collection, such specimens will be sent to NMNH to augment the initial voucher specimen shipment.

6. It is anticipated that the Researcher will acquire through field research additional Bombyliidae specimens that would appropriately be added to the Collection. Accessions into the Collection shall be subject to the approval of NMNH. The Researcher will make periodic written proposals to NMNH describing specimens recommended for accessioning into the Collection. The Chairman of the Department of Entomology of NMNH will notify the Researcher of the NMNH decision on accession proposals. NMNH will prepare accession papers for specimens approved pursuant to this process. Subsequently accessioned specimens will be recorded and treated as part of the Collection and subject to the terms of this Agreement. Voucher specimens of new accessions shall be sent to NMNH.

7. All further acquisitions of Bombyliidae at NMNH subsequent to the shipment of the Collection will be sent to the Bishop Museum postpaid after processing and accessioning by NMNH. Such new accessions shall be recorded and treated as part of the Collection and subject to the terms of this

Agreement. NMNH will supply the Bishop Museum with sufficient drawers and unit trays to properly house any subsequent additions to the Collection.

8. All loan transactions against the Collection during the term of this Agreement will be processed by the Bishop Museum. Outgoing loans are subject to the approval of the Chairman of the NMNH Department of Entomology, or his/her designate. The following statement will be printed on invoices for all outgoing loans processed by the Bishop Museum: "These specimens are the property of the National Museum of Natural History (NMNH), Smithsonian Institution. BPBM is acting as agent for NMNH." Copies of all documents concerning loan transactions against the Collection will be submitted to NMNH at the time of the transaction.

9. The Bishop Museum will be responsible for receiving and cancelling outstanding loans made while the Collection was located at the NMNH. NMNH will supply the Bishop Museum with copies of outstanding loan documentation and a draft of an appropriate loan recovery form. The Bishop Museum agrees to use its best efforts to recover overdue outstanding loans, and will notify NMNH promptly of any problems encountered with respect to loans.

10. All requests for identification of Bombyliidae received by NMNH or the U.S. Department of Agriculture during the term of this Agreement will be referred to the Researcher, who agrees to handle them.

11. The Bishop Museum will give NMNH prompt written notice of any damage or loss to the Collection.

12. The Researcher will provide to the Chairman of the Entomology Departments of NMNH and the Bishop Museum annual reports each January, documenting Collection acquisitions, loans, improvements, and damage or losses. Annual reports will include collection profile updates that incorporate the standards adopted by both Entomology Departments.

13. NMNH will advertise the terms of this Agreement to the entomological community through notices in appropriate publications, such as the Entomological Society of America Newsletter, The Flyer (international newsletter for Diptera research), Insect Collection News (ICN, newsletter for entomology collections), the Association of Systematic Collections Newsletter and the Fly Times (North American Dipterists Society newsletter).

14. Costs related to the initial shipment of the Collection from NMNH to the Bishop Museum and its return upon termination will be split equitably by NMNH and the Bishop Museum.

15. Either party may terminate this Agreement upon giving thirty days written notice. Unless otherwise instructed by NMNH, the Collection will be returned to NMNH no sooner than one year after the termination of this Agreement.

16. Upon termination, the Collection, and all NMNH storage equipment, will be returned to NMNH. The method of packing and shipping shall be subject to the advance approval of NMNH. A condition report will be prepared prior to packing the Collection and will be provided to NMNH prior to shipment of the Collection.

17. Upon termination, and subject to the approval of NMNH, the Bishop Museum may retain a synoptic collection of specimens from the Collection, exclusive of unique and type specimens.

18. The Bishop Museum will give prompt written notice to NMNH if the Researcher ceases to be an active member of the staff of the Bishop Museum.

19. The terms of this Agreement may not be modified except by written agreement signed by both parties.

**ACCEPTED AND AGREED:**

For the Bernice P. Bishop Museum

\_\_\_\_\_ [signed 6 July 1990]  
Donald W. Duckworth, Director

For the National Museum of Natural History

\_\_\_\_\_ [signed 5 July 1990]  
Frank H. Talbot, Director

## *APPENDIX B*

*Collections Impact Statement  
Department of Entomology, National Museum of Natural History  
Collections Management Policy (revised February 28, 1992)*

Plans for collecting made by a departmental staff member, resident affiliate associated with the national entomological collections, or departmental associate that would result in an impact of \$1,000 or more on departmental resources, including personnel processing time, supplies, space, and equipment must be reviewed by the Collections Committee and approved, in advance of the project, by the Chairman of the Department. Otherwise the specimens may not be accessionable in the National Collections.

All extra-departmental or non-affiliate collectors who want to collect for the Department must also fill out an impact statement (of a slightly different type) and have it reviewed and approved by the Collections Manager before departmental supplies can be given or loaned. If not, their collections may not be accepted by the Department.

### Required Information

- I. Information in part to be used on SI-15 (or equivalent travel papers) in justification statement for trip.
  - A. Dates of project or expedition (start, finish):
  - B. Sites to be visited:
  - C. Funding source(s):
  - D. Participants:
  - E. Mode(s) of travel:
  - F. Vaccines, etc. necessary?
  - G. Emergency contact points (please supply addresses, phone numbers, and names of contacts):
  - H. Will collecting of your target taxa involve threatened or endangered species or adversely affect the general biodiversity in the areas of study?
  
- II. Collecting authority
  - A. Host country permits necessary? Please elaborate:
  - B. National or State Park permits needed? Please elaborate:

For information only - your cooperation is appreciated

- III. Collecting strategy
  - A. Methods of collecting:
  - B. Type of specimen or sample storage for transit:
  - C. Type of transit for specimens:
  - D. Type of data capture: computer, notebooks, paper scraps?  
Please elaborate:
  - E. Outline of data elements captured with specimens:
  - F. Data captured for samples? For individual specimens?  
Please elaborate:
  - G. Collection sample sources: transects, plots, random sites, permanent pond, others? Please elaborate:
  - H. Biodiversity information available from collecting strategy? Please elaborate:

**IV. Preparation strategy:**

- A. Estimated preparation time per sample:
- B. Are samples appropriate for sorting in the ANTSE system?
- C. Preparation time in field or lab, or both:
- D. Personnel available:
- E. Projected additions to departmental backlog:
- F. Impact on equipment and/or supply orders:
- G. Impact on departmental space:

Please submit your Statement to the Collections Committee at least one month in advance of your trip or provide an immediacy statement to the Committee Chairman for rapid action.