Collection Forum

CONDUCTING COLLECTION ASSESSMENTS WITH AN EMPHASIS ON PALEONTOLOGICAL COLLECTIONS

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Society for the Preservation of Natural History Collections

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Abstract.—Designing and completing a collection assessment can be a daunting, yet important exercise for collections managers and registrars. There are several excellent collection assessment case studies reported in the literature, but there is little guidance on how to begin and to customize an assessment for a collection, especially those with unusual space needs, such as paleontological collections. Outlined here is a guide for how to begin the process of conducting a collection assessment, including: preplanning; customizing categories, units, and rankings; quantifying space needs; data collection; data analysis; and mapping resulting needs.

INTRODUCTION

Collection assessments are essential for understanding a collection's strengths and weaknesses and allow one to focus resources on areas that need the most attention. Taking a quantitative approach to understanding the state of a collection is imperative to plan for future collection growth and configure collection storage space most efficiently. Having qualitative data about the health of a collection also is useful when writing grant proposals for collection improvement or for collection-based research projects.

Case studies of quantitative collection assessments have been well-established in the collections management literature (McGinley 1993; Williams et al. 1996; Hughes et al. 2000; Moser et al. 2000; Simmons and Muñoz-Saba 2003; Adrain et al. 2006; Favret et al. 2007; Camacho and Burneo 2009) and each study uses slightly different statistical approaches to identify and quantify collection health. In general, quantitative collection assessment methods involve using a categorical coding system to rank how well the collection meets predetermined collection standards. These ranks are assigned to a "profiling unit"—a discrete unit of collection material (e.g., a drawer, cabinet, isle) to be assigned a single grade according to its state of health (Moser et al. 2000). Some studies use the ranks to calculate a health index (McGinley 1993); other studies map rank data onto collection layouts using a color-coding system (Favret et al. 2007).

When designing a collection assessment, it is important to customize data collecting methods to produce clear and meaningful results that are of greatest utility to you. Due to the variety of collections found within natural history museums and the unique needs of each, the health categories and ranking schemes used to capture collection health in one kind of collection are not the best way to profile health in another. For example, paleontology collections do not face the same conservation and pest issues that zoology collections deal with simply because skin, hair, and tissues are more sensitive to deteriorative agents than rock or permineralized bone. Thus, although it might make sense to use a health category of "pest damage" for specimens in a zoology collection assessment, it could be appropriate to omit it from a paleontology collection assessment.

Another issue to consider when designing a collection assessment is how to assign an appropriate ranking scheme to adequately capture the range of health per health category. The number of numerical ranks per health category affect the way the health data are distributed and can make data interpretation difficult. For example, if the category of "conservation status" has two rank levels (i.e., rank of 1 means specimen is unstable and 2 means specimen is stable), one is unable to determine which unstable specimens need immediate conservation versus those that should be conserved soon, making prioritizing difficult. Alternatively, using 10 rank levels to score "conservation status" can introduce too much data and can muddle decisions concerning which specimens are priorities to conserve. In other words, the profiling unit used in an assessment will affect the resolution of the data being interpreted.

When using collections health data to create a tailored collections improvement plan, it might be easier to think of the collection as the number of specimens to be conserved, or the number of drawers, or the number of cabinets—or all three. Having a thorough understanding of what health information should be captured and at what resolution is an essential part of designing collection assessment procedures.

Within paleontological collections, understanding space requirements and potential space for future growth is of particular concern. Fossils often have highly variable sizes and shapes, especially when left unprepared out of the rock in which they were imbedded. Storing fossils with irregular dimensions in a cabinet can result in several unused cubic feet of storage space. However, arranging fossil storage with the primary goal of saving space is impractical for the way collections are used—fossils often are organized by geological time and formation in which the fossil was found. Even taxonomic organization cannot accommodate for size and shape inconsistencies due to preparation or preservation.

In this report, we outline a process that can be used for designing an effective quantitative collection assessment appropriate for the individualized needs of a collection. How to choose appropriate categorical variables to gather useful, interpretable data that can help improve the health of a collection will be reviewed. In addition, general procedures appropriate for assessing storage space specific to paleontological collections will be discussed.

Questions to Ask Before Designing Your Assessment

Time spent planning is important to any collections project, and will help identify problems and troubleshoot them in advance. Having answers to the following questions will allow you to develop your plan for data collection and will insure that the data you collect are complete and consistent.

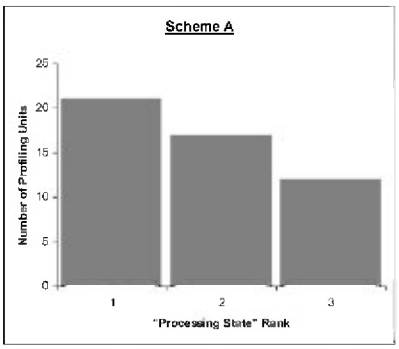
1. Why do you need to profile the health of your collection? Was the collection previously neglected? Are you planning to apply for research or collections improvement grants? Are you expecting a large-volume acquisition?
2. What is the time frame that you have to complete the assessment? Will this project be contingent on funding deadlines?
3. Who are the people who will be working on this project? How many hours can be dedicated to data collection for the assessment?
4. How thorough an assessment can you complete given your available financial or human resources? Is there one portion of the collection or one aspect on which you should focus or omit altogether? Can you collect more data than is immediately needed in preparation for future needs?

Scheme A

	Processing State
Rank 1	0-3 processing criteria fulfilled
Rank 2	4-6 processing criteria fulfilled
Rank 3	7-9 processing criteria fulfilled

Scheme B

	Processing State
Rank 1	0-1 processing criterion fulfilled
Rank 2	2 processing criteria fulfilled
Rank 3	3 processing criteria fulfilled
Rank 4	4 processing criteria fulfilled
Rank 5	5 processing criteria fulfilled
Rank 6	6 processing criteria fulfilled
Rank 7	7 processing criteria fulfilled
Rank 8	8 processing criteria fulfilled
Rank 9	9 processing criteria fulfilled



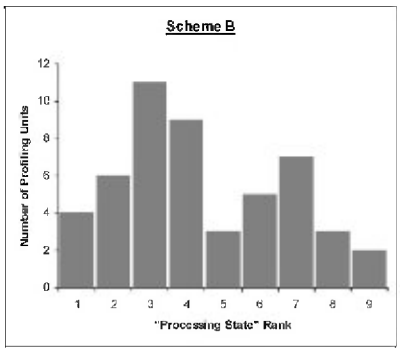


Figure 1. Scheme A and Scheme B illustrate two different ranking schemes to describe how completely a profiling unit has been processed. The same hypothetical data were used for both schemes. Processing criteria might include proper housing materials, complete catalog record, complete database record, database record includes digital images of specimens, etc. Scheme A is best for capturing a broad snapshot of collection health; Scheme B is best for capturing details of where specific collection health issues are present.

Choosing Health Categories, Ranking schemes, and Profiling Units

The health categories you choose to evaluate, the ranking scheme you use for each category, and the profiling unit you measured for each category will shape the outcome of your collection assessment. Categories should capture best the state of the collection according to your predetermined standards of curation (e.g., types of specimen tray used, label, completeness of documentation). The categories used within Moser et al. (2000)—conservation status, processing state, storage containers, arrangement, specimen identification, and inventory—cover the basic variables of collection health, but you can add other categories to capture additional health qualities that you deem necessary to measure.

Each category should have a ranking scheme in which the gradation between "best" and "worst" conditions can be reflected by a numerical value. Figure 1 shows an example of two different ranking schemes used to describe the health category "Processing State" and how these two schemes might describe the same hypothetical data. When you are determining how many ranks per each category, consider the differences between *best* and *worst* and how many corrections would have to be made to change a *worst* profiling unit

to *best*. The number of conditions that must be met to have a *best* state can be your highest rank. For example, if there are five conditions to be met, profiling units that meet all five conditions will get a rank of 5. If only four conditions are met, that unit will be ranked 4, three conditions met will receive a 3, etc. If you decide there are too many conditions to have an optimal state for a health category, it might be more beneficial to split one category into two or more categories so you can identify which condition (e.g., numbering, labeling) needs to be addressed.

Depending on how you plan to use your data, data interpretation might be easier if all categories have the same number of ranks. For example, conservation status, processing state, and storage containers all might have three possible ranks that reflect *best*, *moderate*, and *poor* states (e.g., ranks 3, 2, and 1 respectively). This type of approach is most useful when you want to take a broad, overall look at the health of multiple categories at the same time. At a glance, you will know that all profiling units with a rank of 3 currently are at their optimal state. Alternatively, using the same number of ranks for each health category might not adequately capture the state of each health category. Three ranks might be necessary to measure conservation status, but you might want to look into the state of processing in more detail and use five ranks instead of three.

Whatever approach you choose, each health category and its respective ranking scheme should be concisely defined in writing. These definitions can be referred to as needed during data collection to avoid ranking errors and inconsistencies, particularly if several different people work on scoring each profiling unit.

Once you know the kind of data you need, choose a profiling unit appropriate to your assessment. Moser et al. (2000) states that "profiling units are the discrete subsets of the collection that are evaluated according to the scoring categories ...." Your profiling unit should be small enough to get the resolution you need, but large enough to prevent data collection from becoming overly cumbersome. If you want to analyze your data in multiple ways (e.g., by cabinet, formation, or taxon), make sure each group can be extracted from the profiling unit.

Capturing Space Requirements for Paleontological Specimens

Paleontological collections are susceptible to deterioration from physical forces as defined by Waller (1994). Common storage issues include specimen lots where specimens are piled together in a box, or specimen boxes stacked upon each other in drawers. In addition, specimens often are stored in drawers that cannot accommodate their height, which causes the specimens to scrape the drawer above them every time the drawer is opened or closed. Issues such as these arise when a collection is short on available space or when specimens were incorrectly curated in boxes that are too small. In either scenario, collection space usually is lost in order to mitigate the problem.

Storage space needs should be assessed by evaluating each profiling unit by how much expansion space is needed to accommodate stacked or cramped fossils compared to how much space is available in profiling units that are empty or not filled to capacity. We found the easiest way to accomplish this was to make *expansion requirements* a health category. Our ranking scheme for expansion requirements was as follows: Rank 1—the profiling unit must be expanded to over half its current volume; Rank 2—the profiling unit must be expanded to less than half its current volume, and Rank 3—there is sufficient space for the profiling unit's contents. To measure available space within the collection, a similar ranking scheme was developed to measure *available space* as a health category: Rank 1—No space available, Rank 2—half of the volume of the profiling unit

Table 1. Ranking schemes for *expansion requirements* and *available space*. In a sense, the two categories are inverses of each other. Making each a separate health category allows for easy data comparison and analysis.

Rank	Expansion requirements	Available space
1	Over half the of profiling unit is needed for expansion	No space in profiling unit is available for expansion
2	One half or less of the of profiling unit is needed for expansion	One half or less than the profiling unit is available for expansion
3	No expansion space needed	Over half of the profiling unit is available for expansion

is available for expansion; and Rank 3—Profiling unit almost or completely empty. If you have a cabinet with unused and available drawer slots (and you have drawers on hand to fill the slots), be sure to treat those slots as profiling units when recording *space available* data. Table 1 compares the *expansion requirements* and *available space* ranking schemes. Using these ranks, the available and overcrowded space in your collection can be tallied, averaged, and illustrated on a collection layout. Your space surplus or deficit can be calculated by subtracting the values for space needed from the values for space available.

Data Collection

Consistency in data collection is crucial, especially if multiple people are assigning ranks to profiling units. Be sure to take enough time to train all workers to ensure that their work is consistent. Also, as workers become practiced in quickly assigning ranks to profiling units, there is a risk of inconsistency within an individual worker's data set. To avoid the data being biased within or between workers, the definitions of each health category's rank must be specific and detailed. A worker should not have to guess about whether a drawer of specimens should be ranked poor or fair. We recommend building in quality control checkpoints during the data collection phase. The person overseeing the assessment should spot-check the rankings of one profiling unit for each worker when data collection is 25%, 50%, 75%, and 100% complete. Ideally, the way profiling units were ranked should not be affected by who assigned the rank or by when the rank was assigned.

Your data should be digitized in spreadsheet form for ease of manipulation and analysis. Your data sheet can be as simple or as complex as you need. An Excel spreadsheet is sufficient, but given your needs and resources you might want to put your data in a relational format such as an Access database or add fields to your existing specimen database. Table 2 shows a sample data table and Figure 2 shows a map of the data for Conservation Status based on the sample data table. The columns list each category and the rows list each unit ranked. It might be helpful to include a column for "notes" where you can include any information not captured in the health categories, such as the presence of old loan slips or missing specimens that must be addressed by the collections manager.

There are a few options for how workers can input their data. The most low-tech option is to give each worker a hard copy of a blank spreadsheet to fill in as they are working. Later, they can enter their data into a master digital file. If you have a small workforce, it might be more efficient to enter data directly on a laptop that a worker can take with them as he or she moves through the collection. The most high-tech option is to have workers use speech recognition software, Bluetooth headsets, and a nearby laptop

Table 2. Sample data table for three cabinets with three drawers each.

Profiling unit	Conservation status	Processing state	Storage containers	Expansion requirements	Available space	Notes
Cabinet 1						
Drawer 1A	1	3	2	2	1	2 expired loan slips
Drawer 1B	2	3	1	1	1	
Drawer 1C	3	2	1	3	2	Contains field notes
mean	***2***	***2.67***	***1.33***	***2***	***1.33***	
Cabinet 2						
Drawer 2A	1	2	2	1	1	
Drawer 2B	1	2	2	1	1	
Drawer 2C	1	3	1	3	3	
mean	***1***	***2.33***	***1.67***	***1.67***	***1.67***	
Cabinet 3						
Drawer 3A	3	1	3	2	1	
Drawer 3B	3	1	3	2	1	One missing specimen
Drawer 3C	3	3	3	2	1	
mean	***3***	***1.67***	***3***	***2***	***1***	
Collection mean	***2***	***2.21***	***1.99***	***1.89***	***1.33***	

to enter data simply by speaking. This greatly can improve the speed at which data can be collected if the data being collected are primarily numerical, which are very well-suited for speech recognition software.

Data Analysis and Interpretation

To draw meaningful conclusions from your data, the average scores for each health category must be calculated. If your profiling unit is a specimen drawer, we recommend calculating averages for (1) the entire cabinet, (2) each aisle of cabinets, and (3) the entire collection. Keep in mind how much detail you need versus how broad a picture you need.

We recommend using similar methods to Favret et al. (2007) to map your data and related calculations on your collection layouts. That way, you can quickly pinpoint where the problem areas are in your collection. You might find that a problem area for one health category is different from a problem area in another. If your data collection schemes were well planned, you should be able to answer any questions about your collection's health by doing simple calculations, creating histograms, and generating collection data maps to compare and analyze health.

When using your assessment data to plan for collection improvement, think about how each health category can affect and overlap with one another. Prioritize problems to address based on (1) the overall goals of your assessment, (2) your available resources to mediate issues, and (3) a logical, practical order in which to mediate issues.

Concluding Remarks

To conduct an effective collection assessment it is important to spend some time a priori designing your data collection protocols. This preplanning phase will facilitate timely and accurate data collection, analysis, and eventual prioritization and planning. This process is especially beneficial for those who manage large collections with varied needs and can help to clearly define needs and goals. Using this guide for getting started

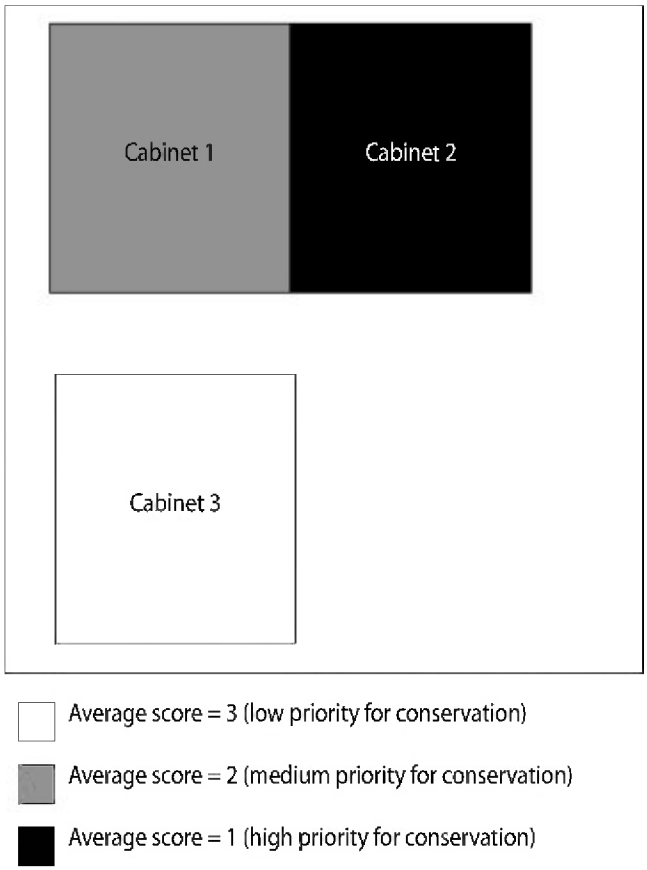


Figure 2. Hypothetical collection map based on *Conservation Status* data from Table 2. According to the data, the cabinet is the highest priority for conservation needs is Cabinet 2.

and other published case studies should facilitate collection assessment no matter what the collection or needs may be.

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