ABSTRACT

A physical inventory of the open stacks collection at Indiana University was conducted to determine the rate of error in the corresponding bibliographic records. The inventory was started to address some errors that were found when materials were pulled for offsite storage, but took on an increased importance as participation in shared print programs increased. This article describes the methodology used to conduct the inventory, as well as the rate of error found in the records for a large, open stack collection.

Key words: Inventory, Shared Print Repositories, Open Stacks

Introduction

Inventories are not a new phenomenon in libraries. However, with the increased focus on collective collections and shared print initiatives, confidence in the accuracy of item records is taking on an increased importance. Decisions about what to keep or withdraw are being made at scale based upon the information about an item – and not necessarily with the physical volume in hand. So the question arises: how reliable is the data? Does that library really have a copy of a book that you want to withdraw? Do you actually have that book that few others own? Perhaps, more heretically, does it matter? The success or failure of shared print programs will ultimately rest on the reliability of the data, including factoring in an appropriate margin of error. Of course, it would be preferable to have records that reflect each library's holdings perfectly, but that outcome is neither realistic nor practical. After all, even a library with relatively pristine records will still have a few mistakes. At the very least, items are lost before records can be updated to reflect the change in status. Previous inventory or shelf accessibility studies also show that, collectively, library records are not exactly pristine. There are many discussions in the shared print community of how many copies are enough to ensure that the scholarly record is both preserved and accessible. Ensuring that enough copies are retained is a matter of having confidence in the records, but also accepting that there will be a margin of error in the accuracy of holdings statements. If we know that, for example, in most libraries that the margin of error is 10 percent, then we could factor that into how many copies we keep. The difficulty though is in knowing what that percentage of error is so that it can be accounted for across the collective collection. By guessing at a percentage, we risk saving too many or too few copies. There are a few studies that report on error rates that we can look to for guidance; however, more information is needed before broad generalizations can be made. This study examines the rate of

record error in a large research open stacks collection in an effort to contribute to the conversation around shared print initiatives.

Literature Review

The reliability of data is a key component of decision making in a shared print environment. As Demas and Miller point out, "Accurate and useful bibliographic records are essential to collaborative collection management. Libraries preparing to participate in shared print programs should make every effort to ensure that materials that are eligible for collaborative collection management are cataloged to a level that allows holding analysis and cross-collection comparison" (179). These records are used to determine not only what to keep, but also what to withdraw and therefore special care should be given to ensure that items are not needlessly tossed. As Lugg explains, "Data-driven deselection can only be as good as the underlying data. Accuracy depends on how recently and how well inventories and reclamation projects have been done." (203). Of course, the idea of accurate records expands beyond just one project as "collection maintenance decisions, whether made in conjunction with a shared print initiative or not, should be data-driven" (Baich, 102).

Conducting a physical inventory of library collections and cleaning up any record discrepancy is the most comprehensive method to ensure that the underlying data about the material is accurate. Whether conducting a full inventory or only a sample, many libraries have relied on this method to gather data to inform projects long before shared print repositories. For example, Stedman reports that the University of Canterbury in New Zealand was prompted to do an inventory to identify loss "as a result of an organized crime ring that targeted valuable books in libraries" (51) and Shouse and Teel used the inventory to serve as a "catalyst for collection development improvements" (129). Many published studies have focused on the procedures,

tools, or methodologies of conducting an inventory or others on the costs or value of doing either a complete or sample inventory (e.g. Chen & Ma; Emery; Haka & Ursery; Wild; Loesh; Nixon; Greenwood; and Sung, Whisler, & Sung). More research is needed however as relatively few studies have focused on a complete analysis of the results to inform a full discussion of record reliability.

Of particular concern to the authors is the accuracy of data at larger academic libraries. Whether part of a formal shared print program or not, many smaller institutions in the midst of a space crunch are looking to large research libraries, often in their region, to determine whether an item would still be available should they choose to withdraw a book. This supposes though that the larger institution has updated their records to accurately reflect their holdings. However, as Wall noted "the likelihood of a library inventorying is affected, as might be expected, by the size of the collection." (28). She states that thirty-two percent of libraries with holdings over 600,000 volumes reported doing some inventory work, but only one library of this size reported doing a full inventory (29). DiCarlo and Maxfield also point out that "an inventory of a library with over 100,000 volumes is a task seldom undertaken" (345). Larger institutions tend to do inventories in a piecemeal fashion, if at all, based on reports of problems. For example, Atkins and Weible at the University of Illinois share that "the entire collection has not been inventoried and relies on reports from staff both in and outside the Central Circulation and Bookstacks Department to report problems finding materials." (18). Van Gemert from the University of Wisconsin-Madison also reports that no inventory had been done at Memorial Library, a collection of 3.2 million volumes, "within the collective memory" of present staff (581). He goes on to report of their one percent sample inventory project in response to concerns about loss but

notes the caveat that "a one percent sample inventory provides sufficient data for decision making on a broad scale; it does not, of course, identify all missing items at the title level" (583).

Since many larger academic libraries are participating in shared print initiatives, and they have fewer published inventory reports, another way to determine their data accuracy is through interlibrary loan (ILL) data. Beaubian et al. gathered data from the CIC (now Big Ten Academic Alliance, or BTAA) Consortium to identify challenges facing high volume interlibrary loan operations. They asked the 13 libraries to identify the top three reasons that they were saying no to an ILL request. Four libraries listed "Not on Shelf" as one of their top three issues, which for them occurred between 15 and 25 percent of the time that they were saying no to a request. (Beaubien et al, 75). When you consider the volume of unfilled requests at these four schools for the fiscal year reported, this represents over 33,000 titles at these schools that were not on the shelf. Of course, not all of these are truly missing, but we do begin to see the possible scale of the missing items, which would have a significant impact on shared collections data. As Indiana University was one of the four schools with a high percentage of "not on shelf" materials, we are also very interested in reducing this number.

Another way to evaluate record accuracy for shared print repositories is after the fact through validation studies. Recently, a few shared print projects have conducted either a full or sample study to evaluate whether the items *already committed* to a retention project were physically available and in a condition that would be amenable to circulation. Again, size matters. The Central Iowa Collaborative Collections Initiative (CI-CCI) is unique in that they attempted to validate all of their retention commitments, although as Koch and Welch noted, "the 144,000 retention volumes in the CI-CCI project represent a small fraction of most print retention collections…" (144). The Eastern Academic Scholars Trust (EAST) also conducted a

validation study, although one based on sample sizes because as Amato and Stearns note, "while a full scale validation is laudable, it was not feasible with East's over nine-million retention commitments." (163). Koch and Welch report, "by the end of the project, CI-CCI had validated more that 98 percent of our retention commitments" (147). Amato and Stearns report similar findings noting, "that materials are, in general, 97% likely to be available" (171). Our inventory project reported here found similar rates in terms of missing items; however, we also uncovered additional errors that needed to be addressed.

The environment

Indiana University Libraries holds a collection of over 9.9 million items on the Bloomington campus. The Herman B Wells Library is the largest of a multi-library system and primarily supports the humanities and social sciences disciplines and holds a collection of over 2 million print volumes. There are nine other libraries on campus such as the Education Library, Business/SPEA Information Commons, and the William and Gayle Cook Music Library. The largest collection however resides at the Ruth Lilly Auxiliary Library Facility (ALF), which is a high-density, off-site storage facility. The ALF currently holds 3.9 million low-use materials that include books, archival boxes, film, microfilm, maps, and media.

The original off-site storage facility opened in 2003 and has since been expanded twice. The ALF is a Harvard-style model where materials are shelved by size and kept in a vault that maintains constant temperature and humidity set points. The process of moving materials into this facility includes all of the various aspects of a traditional inventory. The record is verified for accuracy, the condition of the item is checked, and the location updated. Each individual book is touched, verifying its existence at that point in time. The end result is that the records for

things held in off-site storage are in very good condition. Our confidence in those records is very high, and the past 16 years have proven that our confidence is not misplaced. With over 640,000 retrieval requests received since the facility opened, and a 100 percent retrieval rate if the item is in the facility's inventory software, these materials end up being reliably accessible.

The same cannot be said of our open stacks collections. As lists were generated for consideration of sending to off-site storage, it became apparent that there were a few issues. For example, there would be a record indicating two copies of a book where one had circulated a hundred times and the other had zero uses. There was little likelihood that the second volume was actually on the shelf. In many cases, we also had a system-supplied barcode for a record indicating that the item had not circulated since the records were transferred over from a previous catalog system. However, when these items were to be pulled from the stacks and sent to storage, they were nowhere to be found. There were enough problems discovered through the process of moving items to storage that a small inventory pilot project of 10,000 volumes across three randomly selected LC call numbers was undertaken to determine the scale of the issues. That pilot project revealed an alarming number of problems, with 5.7 percent of items missing, and an additional 10.9 percent of records having a cataloging issue. We also found a surprisingly high number of volumes in the stacks that we did not know that we had as there were no records for them. Given our increased reliance on data-driven decision making, this level of error was simply unacceptable. Thus, we began our first-ever complete inventory of the collections.

Methodology

The initiation of the inventory process required workflow planning and coordination between the Wells Library's Stacks Unit Manager, Cataloging Head of Database Management, and the ALF Internal Processing (AIP) Unit Manager, and yielded the following process:

1. Item scanning (Stacks Unit) and error report generation (Cataloging)
2. Error resolution (Stacks, Cataloging)
3. Evaluation and processing of unbarcoded items (Stacks, AIP, Cataloging)

Each of these units contributed staff time to the project, but no additional staff or students were hired. The Stacks Unit performed the bulk of the work, so priorities were shifted away from shelf-reading to accommodate an inventory, but no other changes were necessary. The Cataloging unit already had a problem-resolution unit, so they incorporated the items discovered during the inventory into their workflow. The Libraries' IT department supplied a single laptop and barcode scanner for the project. All of the work for this project was conducted during normal operating hours.

Scanning and error report generation

The inventory process begins by scanning the barcodes of items so that an automated report can be generated comparing the catalog shelf list against what is on the shelf. Stacks Unit employees begin each inventory scan session by shelf reading and ordering the first three shelves of the call number area to be scanned. Ensuring the call-number order accuracy of the first several scanned items is necessary to establish the appropriate call number range context for shelf-list report generation. Next, the stacks employee, equipped with a laptop and hand scanner, scans barcodes in shelf-order. While scanning, the employee collects and sets aside all unbarcoded items encountered. Those items are then returned to the Stacks Unit office for evaluation by full time unit staff.

At the end of a scanning session, the file is checked for formatting or scanner-related errors – e.g. the scanner read "9000016060159" instead of "**3**9000016060159" or inserted a letter

into the barcode. This file is then sent to the Head of Database Management, who runs a database report against the scan file of all recorded stacks holdings within the scanned call number range of the appropriate library and item location. A report is generated based on the comparison that separates the errors into three broad categories. The first section of the report highlights errors within the system such as shadowed records, incorrect circulation statuses, and items with system-generated call numbers. The second section reports any deviations in call number shelf-order indicating a book may be misshelved or has another issue. The final section of the report is a listing of barcodes that should have been scanned in that section but were not. These reports are returned to the Stacks Unit Manager for error resolution.

Error resolution

Stacks employees search for each problematic item listed on the error report to ascertain the nature and accuracy of the highlighted error. Each error is then fixed by the Stacks employee or given to someone in another unit to resolve.

Section 1

Section 1 of the report highlights bibliographic record and circulation status errors such as brief bibliographic records, incorrect item locations, invalid or unrecognized barcodes, and shadowed records.

Some record errors in this section of the report are very straightforward to fix. Items that are flagged as CHECKEDOUT, or that belong to other libraries within the IU system (such as the examples below), are routed to the Circulation Unit for discharging, clearing overdue fines, and routing to the appropriate destination.

```
T860.L1 N4 (30000094871930) has wrong library: SBEND
```

```
T860.L1 N4 (30000094871930) has wrong current location:
CHECKEDOUT
 charged to [patron barcode] on 2015-10-03
```

Other Section 1 errors, such as incorrect item locations (e.g. STACKS instead of _RCSTACKS) are also resolved within the Stacks Unit. Many of the other errors that are flagged in this section of the report however are more difficult to resolve as they require extensive investigation that often relies on either expertise in cataloging or institutional history, or sometimes a combination of the two.

Section 2

Stacks workers investigate out-of-order errors from Section 2 of the report by checking flagged items on the report against the current shelf order in the stacks. Once a flagged item is located, the first step is to compare the call number on the book's label to the call number on the report. If there are any discrepancies, the book is set aside and reviewed by a full-time unit employee. As with Section 1 errors, minor bibliographic adjustments are made by full-time Stacks unit employees (e.g. correcting call number punctuation), while items that needed major bibliographic record maintenance or label correction (see fig. 1.1, 1.2) are sent to Cataloging.

[Figure 1 here]

[Figure 2 here]

If the call numbers do match and the book was simply out of order, it is returned to the appropriate shelf location.

Section 3

The items listed in Section 3 – items that appear in the database shelf-list, but that were not scanned – are split into two groups: those with standard 14-digit barcodes, and those with hyphenated, system-supplied item IDs (figure 1.3).

[Figure 3 here]

Stacks employees search for the call numbers associated with system-supplied IDs among the unbarcoded books collected during scan sessions. If a match is found, the item is either barcoded and shelved by the Stacks Unit or routed to storage or Cataloging for further record processing. Items with system-supplied IDs that Stacks workers are unable to locate are compiled into a list and sent to the Head of Database Management for suppression from the OPAC and integration into the Cataloging unit's record maintenance workflow. The logic behind this decision is that these items are either no longer in the library's collection, or they have been mis-shelved or mis-labeled and will turn up later during the inventory process. Unscanned items with 14-digit barcodes are searched according to the Stacks Unit's standard missing items search procedures.

Evaluation of unbarcoded items

Fulltime staff take each unbarcoded item found during inventory and search it by call number and/or title against the libraries' catalog. This process results in one of two scenarios. The first is that there is no corresponding catalog record. These items are evaluated for rarity, duplication, condition, and collection priorities and are sent to the cataloging unit to be either kept or withdrawn from the collection. The second scenario is that there is a bibliographic record that matches the unbarcoded item in hand. In some cases the unbarcoded item is the only copy and the record has an incorrect or system supplied barcode attached to it. These records are corrected and updated as we attach a barcode to the item and return it to the stacks or send it to storage. In

most cases, the unbarcoded item in hand is another copy that was just never barcoded. The existence of the barcoded copy is verified, and the unbarcoded copy is either kept in the collection, moved to off-site storage, or withdrawn based on evaluative criteria.

Results and discussion

From May of 2015 through December of 2018, the Stacks Unit scanned 354,830 physical items (approximately 15% of the reported collection) in IUB's Herman B Wells Library. Although the inventory continues to present day, we selected this three and a half year period for analysis due to the robustness of the dataset and consistency of data collection methods during the timespan. A data collection spreadsheet was set up and the errors were tracked for each call number range scanned. The errors were broken down into the three broad categories aligning with the report sections and a fourth section to track unbarcoded items found was also added. Within Section 1 of the report, these errors were further subdivided into either a cataloging/record error or status/circulation errors. Additionally, whether an unscanned barcode (from Section 3 of the report) was found or not was also recorded. The resultant data set can be found at http://hdl.handle.net/20.500.12419/592.

Record errors

All items in Section 1 of the error report could be attributed to a mismatch between the catalog record and the physical item attributes. Items that had incorrect bibliographic metadata, label or call number errors, or had a barcode but had no corresponding bibliographic record or only had a minimal record were categorized as cataloging errors. The other category, status errors, was generally attributed to incorrect circulation statuses.

Inventory of this segment of the library's physical collections revealed an overall 2.16% error rate with regards to cataloging or item status issues. These numbers were fortunately much

lower than expected or feared and went a long way toward mitigating the elevated level of concern caused by the earlier pilot test. These results are an average across all of the scanned collections however, and the error rates across individual scanned sections actually ranged from a low .10% to a high 12.03%. Moreover, further analysis of cataloging and status errors revealed networks of compound errors across items and collection segments, which reflected the complex, historical narrative of the library's collection.

Item status errors

Over 2600 items with status errors were discovered during the inventory process, accounting for just .74% of the record problems. Items with status errors included those with shadowed records, items that had been shelved but not discharged, shelved items belonging to other libraries, or items that had been designated Missing, Discard, or Lost in the integrated library system and that did not possess label errors. The largest subset within the status errors belongs to items that we thought had disappeared from the collection. As of December of 2018, the unit had located 1,796 items that had been declared "missing" in the ILS prior to the start of inventory scanning processes.

Cataloging errors

Cataloging errors encountered during inventory affected 5038 items, or 1.42% of the record problems, and were divided into three distinct categories: label, record, and barcode errors. Transposed numbers (e.g. "P78" instead of "P87") and misread handwritten call numbers on title pages (e.g. accidentally reading "P3000" instead of "F3000") constituted the majority of the label errors, though some labels had simply been placed on the incorrect item during cataloging processes.

Label errors constituted approximately 43% of all cataloging errors. Items with record errors included unlinked items, items with incomplete bibliographic records (brief bibs), or items with incorrect item types, home locations, barcode numbers, call numbers, titles, or other MARC fields.

Record errors constituted around 38% of cataloging errors and often mimicked label or barcode errors at first glance. For example, incorrect barcodes flagged on a report might appear as either an out of order item or an item with no record. In the case of the former, the out-of-order barcode was typically associated with a different item in the catalog than the one it was physically attached to. In the latter case, it was necessary to ascertain if the barcode was simply incorrect for the item or if the item itself lacked a catalog record. Incorrect barcode numbers on items with records were counted as record errors while barcoded items that lacked records altogether were counted as barcode errors. These barcode errors represent approximately 19% of cataloging errors.

The percentages of cataloging and status errors (10.9%) and items declared missing (5.7%) during the pilot inventory dwarf those discovered during the formal inventory processes, both of which hovered around 2%. However, though these errors constitute a small *percentage* of the whole collection scanned, the reality of the matter is that these errors, at the item-level, could have resulted in over 14,600 unfilled patron requests due to erroneous record information in the OPAC. Moreover, in a shared print environment in which collection analyses occur only at the record level or in which item-level inventories are only considered ideal (Revitt 2014) or "strongly encouraged" (SCELC 2018) activities, this number of unchecked errors threatens the integrity of shared holdings data - particularly if collections are housed in an open stacks environment.

Not scanned

Inventory error reports flagged a total of 10,839 cataloged items that were not scanned during inventory activities. Around 36% of these items were located on a second pass, in proper shelf order, and had not been scanned as the result of either human error or mechanical scanner malfunctions.

The remaining 6981 items, or 64% of the unscanned barcodes, were not located on a second pass and were declared missing. Some of these missing items were discovered over the course of later scan sessions as they had been placed further afield out of order due to either labeling or shelving errors.

Out of order

16,549 scanned items (4.66%) were flagged as out of order on the shelf. 2,162 (13%) of these out-of-order items were misshelved as a result of call number labelling errors, while the remaining 14,387 had simply been placed in the incorrect location. In totality, cataloging, record status, and shelving errors, adversely affected the OPAC discoverability of over 18,000 items and the physical discovery of over 23,000 items in the Wells Library's Research Collection prior to inventory.

The 6,981 items marked missing during the 2015-2018 inventory cycle present a significant catalog record reliability issue and might be an obvious point of departure for discussing the value of large-scale collection inventories. However, the 16,549 misshelved items identified in the scan reports, which represent 4.66% of all scanned items, present an arguably more significant obstacle to catalog reliability. While some of these out-of-order books were discovered one or two items away from their designated locations, others were found in completely different call number ranges. However, due to a lack of patron inquiry and the

staffing required to perform daily - or even weekly - shelf-reading activities of the print collections, these items were never marked missing in the system. Depending on a library user or employee's level of familiarity with or motivation for navigating call number systems and library stacks, any of these 16,549 items could have been passed over and declared missing. Nevertheless, over the course of the 2015-2018 inventory cycle, the Stacks unit only discovered 1,796 items (only some of which ended up in report Section 2 as out of order) that had been officially flagged as missing within the catalog. This discrepancy between system-reported missing items and unreported, but *functionally* missing items is a significant source of inconsistency between the collection as represented in the catalog and the collection as discoverable on the shelves.

No barcode, no record

The unit also discovered an additional 10,286 unbarcoded items lacking catalog records altogether, meaning the unit was able to physically account for a total of 365,382 items. These unbarcoded items, in addition to 961 barcoded items lacking catalog records, constitute a total of 11,513 physical items with no corresponding catalog records discovered during inventory activities. Though these items did not appear in the catalog, they bore the markings of pre-ILS cataloging procedures (e.g. IU Libraries ownership stamps, checkout cards, etc.). This indicates that, due to a historical lack of intentional or systematic item-level maintenance following large-scale collection or catalog projects, these items disappeared from the catalog while remaining on the shelf. The majority of these items lacked barcodes, which suggests that they had disappeared from the computerized catalog before the library began barcoding the collection. The number of items found that were previously unknown to us also has some implications for shared print as some items may in fact be more widely held or not as rare as previously assumed. It also impacts

a library's overarching collections narrative by identifying further points of discrepancy between physical items and cataloged holdings.

Implications for shared print

Overall, our inventory uncovered an error in 2.16% of the records of barcoded items. In addition, 3.05% of items should have been scanned but were initially missing and an additional 4.66% of items were initially marked as out of order making them difficult to locate. Furthermore, we discovered over 10,500 items that we did not know that we had, which would have represented almost 2.97% of our sample size. While noting that some of these errors were easily corrected and approximately one third of initially missing items were found, taken together the number of problems initially discovered represents a significant total of 12.84%.

Of course, not all of the problems encountered would have equal implications for shared print initiatives. For example, most of the out of order items were indeed accounted for, just not perhaps where we expected them to be. While findability is certainly an issue for access, the majority of these items were found within a few places of where they should have been. The more concerning number is the number of items that were not scanned and have now been declared missing. Since most large, research libraries do not conduct full inventories, this could represent a significant number of volumes. In our own collection, we have yet to find about 2% of the collection, which overall would represent about 40,000 items in the Wells Library. This percentage of still unfound items is in line with the shared print validation studies discussed previously, although it is still only one aspect of the total errors discovered. While not discounting some loss, not all of these books are real of course. Many are likely duplicate records that were created by mistake or other cataloging or circulation work that was not cleaned up

properly. Still, with records indicating that we own a particular volume, other schools may decide to withdraw their copy mistakenly thinking that we have it and could loan them ours.

The percentage of catalog errors that we discovered within barcoded items is something that should give shared print programs pause, although our inventory methodology also had some serious limitations when it comes to shared print work. For example, we did not look at bibliographic information unless the barcoded item had another indication that something was wrong with it. Therefore, items might very well be a mismatch in edition or even have more serious bibliographic issues but would not have been looked at or corrected unless it *also* had another issue that triggered the program to add it to the error report. Thus, we have no way of measuring the full scope of bibliographic errors, but it is surely more than what we report here.

Conclusion

The inventory of a large, research open-stack collection reveals that a number of items have incorrect bibliographic or status errors in addition to having an even larger number of items that are difficult or impossible to find due to misshelving or incorrect holdings data. This has implications for shared print repositories as many decisions are made based purely on the records for items and not with items in hand. Perhaps at a minimum, participants in a shared print program should disclose when the last inventory of the collections was conducted. Another option would be to only rely on materials that are in storage facilities instead of open stacks collections as those materials have been reliably discoverable in a way that the open stacks collections have not. For example, our participation with the HathiTrust Shared Print repository only counted on those materials held in our high-density storage facility. This could severely restrict participation in shared print programs however. Therefore, more research needs to be

done before an error rate for shared print repositories can be agreed upon, but we hope that our findings contribute to that discussion.

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