Against the Grain

Volume 18 | Issue 5 Article 8

November 2006

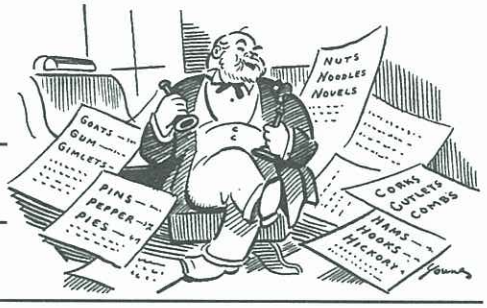
Digital Library of Earth Systems Education: Collections Assessment

Barbara DeFelice
Dartmouth University, Barbara.Defelice@Dartmouth.edu

Constance Rinaldo
Harvard University, crinaldo@oeb.harvard.edu

Recommended Citation
DeFelice, Barbara and Rinaldo, Constance (2006) "Digital Library of Earth Systems Education: Collections Assessment," *Against the Grain*: Vol. 18: Iss. 5, Article 8.
DOI: https://doi.org/10.7771/2380-176X.5008

Digital Library of Earth Systems Education: Collections Assessment



by **Barbara DeFelice** (Director, Digital Resources Program, Dartmouth College Library) <Barbara.DeFelice@dartmouth.edu>

and **Constance Rinaldo** (Librarian of the Ernst Mayr Library, Museum of Comparative Zoology, Harvard University) <crinaldo@oeb.harvard.edu>

BACKGROUND

The **Digital Library for Earth System Education (DLESE)** is a multi-faceted digital library that includes a searchable collection of metadata records for educational resources. Our work in **DLESE** focused on the Educational Resources Collection component of this digital library. When we refer to the **DLESE** collection in this paper, we mean this **Educational Resources Collection**. **DLESE** was open to public use in 2000 and continues today; our project examined data from spring of 2002 through December 2004. Aspects of the metadata, search system and collections workflows and policies have changed over time, so we will use current terminology in this paper, although some of the processes we describe have been modified since this project ended.

The collection was developed for teachers and learners interested in all aspects of the earth system. Records describe objects at different levels of granularity, such as a whole course, a syllabus, an image, a collection of images, a data set, a tutorial or an applet that illustrates a scientific concept (**Kastens** et al., 2005). When the **DLESE** search page is opened (*http://www.dlese.org*), a user can choose to search on a word or phrase or to use non-subject qualifiers (such as Grade Level and Resource Type). A user can also browse by subject or collection, and can limit subject term searches by Grade Level, Resource Type, Educational Standard and Collection.

DLESE describes its collection along the dimensions of Subject (originally called Topic), Grade Level (originally called Learning Context), and Resource Type (originally called Learning Resource Type), among other metadata elements (**DeFelice**, **Kastens**, **Rinaldo**, & **Weatherley**, 2006; **Rinaldo** & **DeFelice**, 2005). Metadata assigned to a resource must include one or more grade levels, resource types, and controlled vocabulary topic terms, which can be used to browse or to limit a free text subject search. Therefore, these attributes were used in our collection assessment project.

Collection assessment is the process of systematically comparing the scope and balance of a library's actual collection with the scope and balance of materials desired by the library users (**Hall**, 1985; **Nisonger**, 1992; **Richards** & **Eakin**, 1997). Materials desired by the users, staff, funding entities, and/or overseers of the library are described in the collection policy. Materials desired are also expressed in the actions of users, by the types of materials requested by the community, from direct user feedback, and through searches for materials. In the case of **DLESE**, information about users' desires comes from analysis of requests to the Search and Browse functions of the **DLESE Discovery System**.

Collection assessment becomes more critical when a collection is being built for an unknown audience. **DLESE** users are not required to register to search the Educational Resources component of **DLESE**, so there are no records of exactly who uses **DLESE**, how much, and how satisfied they are with the collections. Without a central collection development operation, there is no guarantee that the collection will be balanced in terms of depth and breadth. We did not assess individual resources in a collection, nor the effectiveness of individual items in improving science education. Our assessment was designed to try to identify gaps in the collection so that the intended audience could be served. Since the intended audience was "anyone interested in learning more about the Earth," the collection needed to satisfy any age level, people with different educational backgrounds, teachers and students in formal and informal learning environments, and people from a wide range of geographic areas (**Manduca** & **Mogk**, 2000). The collections assessment was intended to help guide **DLESE** collection developers by providing general directions for proactively building a useful collection for this broad audience.

DLESE was planned from the start to have a volunteer, contributor-based collection development program to support a broad scope statement and a diverse potential user group. The collection needed to be balanced, broad and of high quality for this very diverse, and to a large degree unknown, user group. Therefore, some means of monitoring the collection in order to guide the collection building efforts was needed. Otherwise, the collection might reflect only the interests of the early adopters/contributors, and fail to meet the needs of many new users. We wanted people to find something useful in the **DLESE** collection so they would be motivated to return.

When a library user finds no resource(s) that match a query, the user experiences a negative interaction with the library. Many factors contribute to this interaction, including user confusion about the search system, metadata or other kinds of indexing that does not match the user's inquiry, or lack of content that meets the need expressed in the search. We wanted to see if we could isolate the areas where a lack of content was the key issue.

METHODS

Data Acquisition

Working with the staff at the **DLESE Program Center (DPC)**, we identified the kinds of data and the formats for this data which we thought would be most useful at the beginning of the project. There are many different kinds of data to use, so it took a considerable amount of time to isolate the data that would give us the insights we wanted and to decide what filters to apply to the data. Working closely with the technical staff at the **DLESE Project Center**, we continuously checked the data for consistency and quality over time.

Digital libraries change constantly, and since the project started, some changes in topic terms took place, and other useful metadata was added, such as Educational Standards. However, we continued to focus on the key parameters for assessment that we picked in the beginning of the project, Subject, Resource Type and Grade Level. Search and browse logs show what users are looking for (user behavior), and searches that have no results (null searches) help identify potential collection gaps and perhaps provide information about where the search engine and user behavior do not match (**Gagnon** & **Makuch**, 2003). We mapped free text searches to the Subject metadata provided by **DLESE**. We reviewed and characterized zero-result (null) searches to determine if we could identify gaps in the collection to aid collection builders in developing balanced collections. We analyzed search logs to identify reasons for zero result (null) searches. The search engine was revised over time and these revisions changed responses for some of the observed user queries during the course of our study. As more resources were added search responses also changed.

continued on page 32

Accessing E-Collections ...
from page 28

journal collections: A Homeric struggle. *The Serials Librarian,* 42(3/4), 241-247.

Scholarly Stats. (n.d.) Retrieved August 4, 2006, from *http://www.mpstechnologies.com/scholarlystats.htm.*

Shim, W. & McCLure, C.R. Improving database vendor's usage statistics reporting through collaborations between libraries and vendors. Retrieved August 10, 2006 from *http://www.ala.org/ala/acrl/acrlpubs/crljournal/backissues2002b/november02/shim.pdf.*

Shepherd, P. (2003). Keeping count. *Library Journal*, 128 (2), 46-48. Retrieved August 4, 2006 from Wilson Web database.

We used search logs and collection data sorted by the controlled vocabulary terms for Resource Type, Grade Level and Subject to identify potential collection gaps. We compared numbers and percents of searches and items in the collection, and generated quarterly charts and graphs. This information was made available to the collection developers to help identify collection gaps. Examples of gaps identified this way include the materials for the primary grade levels, audio materials, and field trip guidebooks. It was possible to see gaps in resource types and grade levels across the general subjects, but not possible to track just subjects with any degree of confidence. We also used zero results searches to explore possible collection gaps. This is based on available metadata, not keywords in the description, full text of the resource, related links or other aspects of the record. Usable data about collections, browse and search have been available since March 2002, and consistent and more easily analyzed data since May 2002. Collections and usage data charts updated as of December 2004 are posted at the **DLESE/NSDL Collections Assessment** Website: *http://www.ldeo.columbia.edu/edu/DLESE/assessment/index.html.*

Subject Mapping

We manually analyzed free text keyword searches. Each search was mapped to the controlled vocabulary for Subject **(TABLE 1)**. Many searches could not be mapped, for instance geographic term searches, resource type searches ("applet"), out of scope searches like "friendship", concepts related to **DLESE** concerns but out of scope such as "chat use cases," and personal or corporate names that were not clearly associated with **DLESE** collection subjects. Subject mapping added to our knowledge of what users wanted, but was very time consuming, so we did not do it for all data sets.

Null Searches

The methods we used for the null result search analysis were designed to work with the **DLESE** metadata, search system, and collection scope. First we categorized and identified the reasons for null searches, next we isolated null searches that were due to lack of materials in the collection from other sorts of null searches and we looked for patterns over time. The categories of null searches include out of scope searches (OS), syntax errors (SYN), qualified and nonqualified searches (Q/NQ), good searches and searches with geographic terms (geog). **(TABLE 2)**

When we began analyzing data we had more classes of searches but over time we collapsed some of the categories and added one (geographic terms). We considered these categories to be the most useful characterizations of null searches for our purposes. These may be useful to others trying to characterize null searches.

Out of Scope Searches

First we determined which searches were outside the **DLESE** scope. The test for in scope was this question: "is **DLESE** a primary source for information on this topic?" This question does not address the amount of information available, simply the scope. Of course, this question did not help us in all cases! It is difficult to determine if a URL in a search request is in scope, especially if the URL produces no results simply because of a mistake in typing. Other examples of out of scope searches included inquiries about financial subjects or human resources.

Searches with Syntax Errors

Next we classified null results searches by whether or not they contained syntax problems. This group contained a variety of errors such as misspellings and stray non-alphabetical characters such as punctuation and numbers. This group also encompassed foreign language words and natural language queries such as, "How can rock strata be moved from their original position?" Natural language and foreign language queries originally had their own group but we collapsed them into "syntax" problems. As the search engine changed, natural language searches produced results, as did searches with dates and some stray characters.

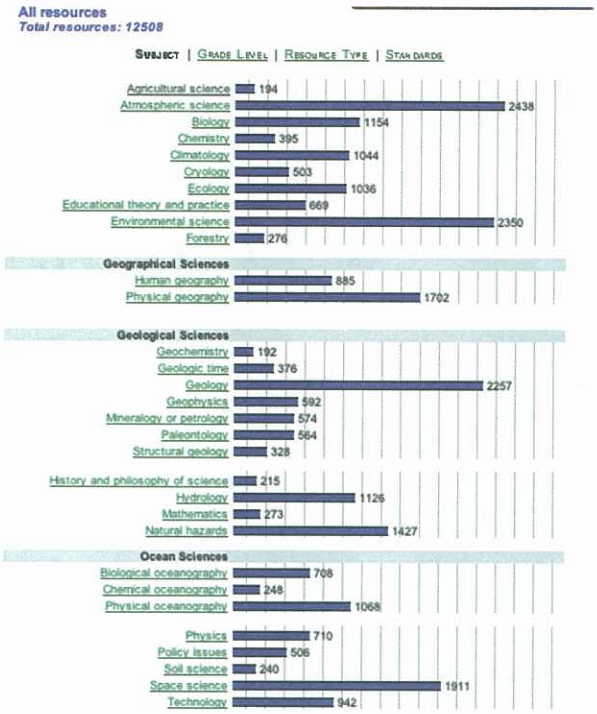


TABLE 1: DLESE subject controlled vocabulary

	# Search results	Search value	NOTES	SYNTAX	OUT OF SCOPE	Q/NQ
951	0	hurricane agnes				0
952	0	hurricane descripition		syn		0
953	0	hurricane Earl				0
954	0	Hurricane Earl				0
955	0	hurricane eye				0
956	0	Hurricane Strike				0
957	0	Hurricane Strike				0
958	0	hurricane strike				0
959	0	hurricane strike module				0
960	0	hurricane strike module				0
961	0	hurricane tracking				0
962	0	hurricanemeasurements		syn		0
968	0	hurricanes Ivan				0
969	0	hydraulic system				0
970	0	hydrogen engine				0
971	0	hydrogen seperation		syn		0
972	0	hydrogeology				0
973	0	ice age				0
974	0	ice cream			os	0
982	0	igneous statistics				0
983	0	ILLINOIS INVASIVE SPECIES	geog			0
984	0	Illinois invasive species	geog			0
985	0	illustration of anatomy of lizard			os	0
986	0	images floods damage				0
987	0	images of floods damage				0
988	0	In Search of the Edge				0

TABLE 2: A sample worksheet for a null search analysis that shows the searches that retrieved zero results and how they are coded.

Qualified versus Non-qualified Searches

Qualified searches are search terms that are modified by Resource Type or Grade Level, which are both available as search qualifiers and browseable categories in the **DLESE** discovery system. Non-qualified searches are search terms that have no modification by these limits. Any type of qualifier reduces the number of search results, multiple qualifiers are often null searches.

Good Searches

The null result search terms were then analyzed to determine what searches should be discoverable within **DLESE** but were not. Examples of searches that produced no results at times included "ocean pollution," "ocean floor topography," and "mul-

continued on page 34

tiple sides of global warming." In-scope null searches with no syntax errors were labeled "good" and we divided those into "qualified" (the search included a limit to grade level and/or learning resource type) and "non-qualified" good searches. We looked for clues to collection gaps in the unqualified, good null searches. **(TABLE 3)**

Geographic Terms

We also classified searches by the presence of significant geographic components. From manually reviewing searches, it was clear that many searches included specific place names, and since the scope of the **DLESE** collection includes any materials on the earth system, it seemed that specific geographic places needed to be represented in the collection, and therefore provided an important area for collection development.

It is important to note that the characterizations of the results came from looking at the data manually and thinking about the role of the searches. Developing these characterizations was an iterative process as we reviewed the data over time. The process that we developed is human resource intensive and we understand that automation of the process is necessary. However, it is critical to do the human-mediated analysis first: this is the way we discovered the need to identify searches with geographic terms.

FINDINGS

We reviewed the Good, Non-qualified searches to see if we could identify common features and put these into categories to further isolate the potential collection gaps. We found a lot of interesting trends through doing this. The categories that these fell into included full or partial sentences ("natural language"), multiple search terms, geographic search terms, topics combined with a learning resource type or grade level, material about **DLESE** projects or people, collection gaps and specific places and natural disasters. **(FIGURE 1)**

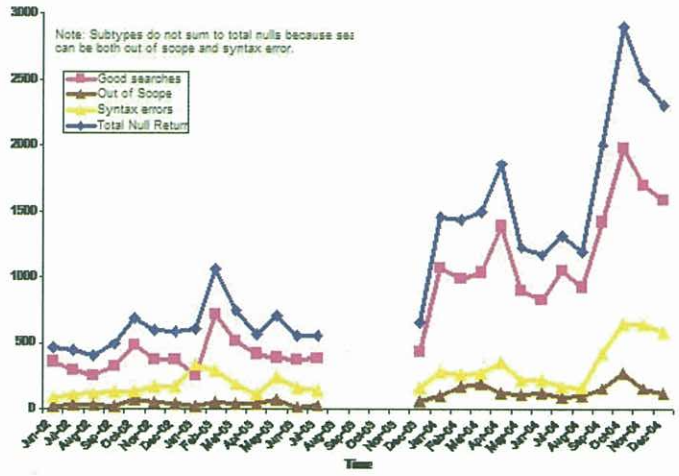


FIGURE 1: Numbers of null searches, total and by type; data gap 8/03-11/03 is due to system changes.

Users, in trying to construct a natural language search, sometimes put in so many words that the search failed, when if limited to one or two terms from that string the search would work. An example is: "Is the water in the Middle East Drinkable?" Multiple search terms represent a different problem: these are not posed in a natural language query but consist of a string of terms with no operators, such as "plate movement future" or "fatalities tsunami." We call this "googlization" because word order is not important when using **Google**, but was important during the early development of the **DLESE** search engine. It appears that **Google** has influenced user behavior but few other search engines operate under those rules.

Users often added geographic terms to many subject searches where just that subject should retrieve results but the addition of a geographic specific place caused a zero result. We felt that it was important to isolate these as

continued on page 36

ancient maritime activities
annenberg
annenberg
anthroposphere
applying geography to interpret the past
aquatic botany for elementary school students
arbuckle uplift ardmore, ok
arbuckle uplift ok
arbuckle uplift, ardmore, ok
archaea origin of life
ardmore basin
ardmore geological society
ardmore uplift
ardmore, ok
Armero disaster
Armero disaster due to Nevado Del Ruiz volcano
Artifical ground freezing
Aspen Co-weather patterns
atmospheric hazards grand canyon
atoll evolution
atom labs
Atomic Radii
autopoiesis
autopoiesis
Avogadro's number
Azurite
Azurite Bisbee, Cochise Co., Arizona
azurite mining in arizona
Bangkok Thailand
barracuda environment
Beach terminology
bering landbridge
bermuda triangle
colorado aerial photographs
Oklahoma's major landforms
pacific nw dams
peekskill ny geology
new jersey's nonrenewable natural resources

TABLE 3: Sample of good, non-qualified searches that were indicators of collection gaps.

collection gaps, since this is an earth systems collection. The assumption that the audience would want to find place based educational materials was supported in our analysis.

DLESE allows a user to search a broad topic and combine topics with terms for Resource Type or Grade Level, but when users just blended all those in one search string, the search did not produce results. In some cases, there really was nothing in the collection that covered that topic and had that particular resource type or grade level assigned. In others, it was not possible to discover the material that way. An example is "Pictures of sea animals, big ones, for second graders to draw for classroom project." Besides the educational resources collection that we were assessing, **DLESE** has several different components which can be searched. Users sometime do not make a distinction between the domain of educational resources and the domain of administrative information. So names of people involved with **DLESE** were not discoverable in the educational resources collection. Some searches combined various elements of these categories.

This categorization alone would not help us isolate collection gaps. Some searches in these categories would have found results if constructed differently. For example, null searches for people's names are not useful for identifying collection gaps. But zero result searches that combined terms for Resource Type and Grade Level might be useful as guides on where to focus collection building. Since it was not easy to isolate the reasons for the zero result geographic searches, it seems reasonable to both add place specific materials and supplement the geographic terms as much as possible. There were many searches that did not fall into any of these categories and these may point to collection gaps. This simply means that if a search did not fall into one of our categories, that topic provides a good starting place for further investigations, such as looking at logs of user requests for materials or looking at other collection depth indicators. However, it may be more costly to do further research than it might be to refocus collection building in the areas indicated by the zero result logs.

Despite the growth in the size of the collection and number of users, the percent of all searches that retrieve null results remained fairly steady and has not decreased in the way we expected. **(FIGURE 2)**

DISCUSSION

The analysis of searches and browses on the metadata elements of Subject, Resource Type, and Grade Level was most helpful for determining gaps in types of resources, such as the need for audio materials, or grade levels, such as the need for more K-12 materials. Null search analysis was the best approach to understand subject area gaps. In the **DLESE** case, knowing what the collection contained and what users wanted helped us adjust the collection development focus over time. At best, this kind of analysis only leads to clues about the materials needed and the paths that users take to find them in a specific digital library. However, we should not ignore those clues. It was clear that the collection needed materials that covered a much wider range of geographic areas and that the metadata needed to describe the geographic areas covered at many different levels. Zero

continued on page 38

against the grain **people profile**

Director, Digital Resources Program
Dartmouth College Library
Phone: (603) 646-3565 <barbara.defelice@dartmouth.edu>

Barbara DeFelice

BORN & LIVED: Oregon City, Oregon; Baileyville and Rumford Maine; So. Hadley, Amherst and Cambridge Massachusetts; Bozeman, Montana; Hanover, New Hampshire; Thetford, Vermont.

EARLY LIFE: Hiking, climbing, music, lots of reading.

FAMILY: All over the map geographically and in every other way too.

EDUCATION: BA in English from **UMass/Amherst**, MSIS from **Simmons**, Master of Arts in Liberal Studies from **Dartmouth College**.

MOST MEANINGFUL CAREER ACHIEVEMENT: Working on the National Science Library project **DLESE** was a highlight because it brought together my interest in earth sciences, education and information resource development and management.

IN MY SPARE TIME I LIKE TO: Hike and study rocks, kayak, practice Tai Chi, and dance; teach kids about these activities.

FIRST JOB: Reference Librarian.

FAVORITE BOOKS: *Crossing to Safety* and anything else by **Wallace Stegner**; also books by **Wendell Berry** and **William Gibson**.

PET PEEVES: Whiners.

PHILOSOPHY: Never stop moving, stay flexible.

WHERE DO I SEE THE INDUSTRY IN THE NEXT FIVE YEARS: More standards are adopted by all the participants; more information projects and products are developed by scholars partnering with librarians and publishers.

CAREER GOAL I'D LIKE TO ACHIEVE IN THE NEXT FIVE YEARS: Developing a successful digital resources program; helping to change the current state of scholarly publishing.

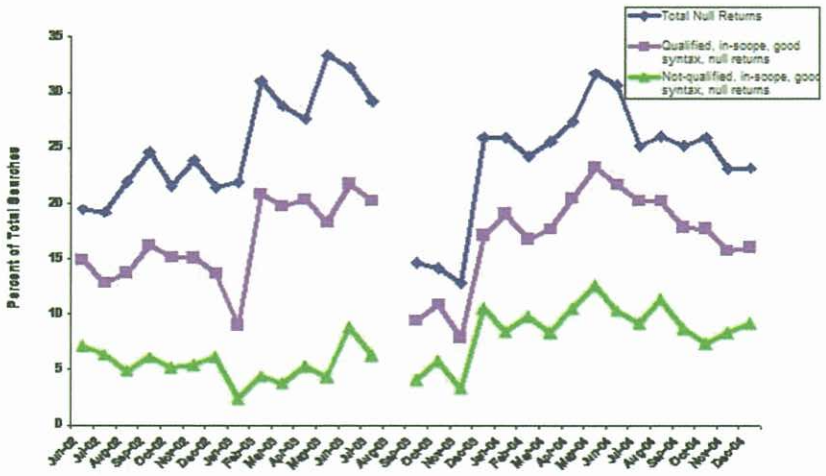


FIGURE 2: Null results as a percent of all searches, changes over time.

result searches can represent a negative user micro-interaction with a resource, and it would be encouraging to that user to have a system that is responsive to the need described in the search. We recognize that it may not be possible or desirable to eliminate zero result searches, and that was not the goal of the project.

One reason that null searches may have remained steady in spite of the growth of the digital resources in **DLESE** might be that during the time of this study, collection development changed from adding one record at a time to batch loading of collection, and in one example during this time, **DLESE** added over 1000 records with the same metadata. In that case, the numbers increased by 1000 but the variety did not. The kind of collection assessment described here focused on the need to add breadth to the collection rather than depth. Other factors in the steady state of the null search percents are the interaction of the user and the search system. It is possible that there is some sort of expected percent of zero result searches across time in this type of digital library.

ACKNOWLEDGEMENTS

Part of this work was funded by **NSF** grants DUE02-26233, DUE02-26292 and DUE02-85839. We thank **John Weatherley** and his staff at the **DLESE Program Center** for supplying the filtered data, and **Kim Kastens** and **Neil Holzman** of the **Lamont-Doherty Earth Observatory** at **Columbia University** for their work on creating graphs and charts (**Neil**) and for many productive and interesting discussions about trends in the data and what they mean for collection development (**Kim**).

REFERENCES CITED

DeFelice, B., Kastens, K., Rinaldo, C., & Weatherley, J. (2006). *Insights into Collections Gaps through Examination of Null Result Searches in DLESE.* Opening Information Horizons, the **Sixth ACM/IEEE-CS Joint Conference on Digital Libraries**, Chapel Hill, NC.

Gagnon, S., & Makuch, J. (2003). *Using Data from Web-server Logs to Develop a Concept-based Browse Set.* Navigating the Shoals: Evolving User Services in Aquatic and Marine Science Libraries, Proceedings of the **29th International Aquatic and Marine Science Libraries and Information Centers (IAMSLIC) Annual Conference**, Mystic, CT.

Hall, B. H. (1985). *Collection Assessment Manual for College and University Libraries.* Phoenix, Arizona: Oryx Press.

Kastens, K., DeFelice, B., Devaul, H., DiLeonardo, C., Ginger, K., Larsen, S., et al. (2005). Questions & Challenges Arising in Building the Collection of a Digital Library for Education: Lessons from Five Years of DLESE. *D-LIB Magazine*, 11(11).

Manduca, C., & Mogk, D. (2000). *DLESE: Digital Library for Earth System Education A Community Plan.* Boulder, CO: DLESE Program Center.

Nisonger, T. E. (1992). *Collection Evaluation in Academic Libraries: A Literature Guide and Annotated Bibliography.* Englewood, Colorado: Libraries Unlimited.

Richards, D. T., & Eakin, D. (1997). *Collection Development and Assessment in Health Sciences Libraries.* Scarecrow Press, Lanham, MD: Medical Library Association.

Rinaldo, C., & DeFelice, B. (2005). *DLESE, Digital Library for Earth System Education: Using Search Logs to Assess a Digital Library Collection.* Poster presented at the **IAMSLIC Conference (International Association of Aquatic and Marine Science Libraries and Information Centers)**, Rome, Italy.

against the grain **people profile**

Constance Rinaldo

Librarian of the Ernst Mayr Library Museum of Comparative Zoology
Harvard University, 26 Oxford St., Cambridge, MA 02138
Phone: (617) 495-4576 Fax: (617) 496-6838)
<crinaldo@oeb.harvard.edu> *http://library.mcz.harvard.edu*

BORN & LIVED: Born Tacoma, Washington grew up in Boston MA; lived in Oregon, Illinois, Maryland, Vermont and New Hampshire (currently).

EDUCATION: BA in Biology and Anthropology, **University of MA/Boston**; MS in Zoology, **University of Connecticut**; MLS **University of Maryland**.

PROFESSIONAL CAREER AND ACTIVITIES: National Agricultural Library Intern 1988-1989, **Dartmouth College Biomedical Libraries** 1989-1999; **Ernst Mayr Library of the Museum of Comparative Zoology** 1999-present.

IN MY SPARE TIME I LIKE TO: Hike, garden, read and watch my kids perform in the circus.

FAVORITE BOOKS: *My Family and Other Animals* by **Gerald Durrell**; *All Creatures Great and Small* by **James Herriot**; *Pride and Predjudice* by **Jane Austen**.

HOW/WHERE DO I SEE THE INDUSTRY IN FIVE YEARS: More social networking via libraries; increased educational functions, more and better filtering of information, better management of and access to electronic resources.

Changing the way Libraries and Faculty Assess Periodical Collections in the Electronic Age

by **Jenica Rogers** (Collection Development Coordinator and Technical Services Librarian, SUNY Potsdam) <rogersjp@potsdam.edu>

Background

Libraries have been struggling with a period of transition for the past ten years. It became clear in the mid 1990s that the emergence of the Internet as an information stream would reshape and reframe our professional values and practices, but for the most part libraries simply had to wait and see exactly how that would happen. As librarians have struggled to predict the future and act accordingly, we've had ample time to observe what has come to pass. We now know that the Internet had a profound effect on the production and distribution of scholarly information, and changed the user's expectation of information delivery equally dramatically. At the same time, library budgets were strained by depressed economics in higher education, and the emergence of online information resources, coupled with the rising costs of periodicals, increased that constraint. As user expectations have changed, and purchasing power has shrunk, libraries have struggled to balance traditional collecting habits with emerging patterns in our information culture.

Speaking practically, as budgets remained flat and the need for online content increased, libraries curtailed monograph purchasing, and have been forced to cut their periodicals subscriptions. Each year, as prices rise, and acknowledging the overlap of most online resources with traditional print periodicals, libraries have turned to their print subscriptions to create budget flexibility, cutting the least used titles and the lower-demand niche titles from the collection.

Today many libraries have reached the point at which they can no longer comfortably or responsibly reduce their print periodical holdings

continued on page 40