DRYAD SUSTAINABILITY PLAN: INTERVIEW SURVEY FINDINGS

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1. **EXECUTIVE SUMMARY**

1.1. **INTRODUCTION**

This study provides a summary of a survey of 12 journals’ and organisations’ experiences in working with supplementary materials and specifically supplementary data. The information has been collected to inform and provide input to Dryad’s sustainability plan.

The survey was undertaken by telephone interview, although email responses were accepted where a call was not possible. We asked about interviewees’ job roles and the impact of supplementary materials and data on these; costs and policies; funding sources; and recommendations for Dryad’s sustainability. Three Dryad participants interviewed were also asked for their views on the collaboration. A range of roles and organisational types working with supplementary materials and data were selected for interview including journal editors and collection or archive managers, scholarly societies, publishers and archives (a list of organisations interviewed is provided in appendix 1).

1.2. **FINDINGS:**

**Policies for supplementary materials and datadata**
- quality control of supplementary data, in terms of peer or editorial review is variable;
- there are currently few policies by specific journals covering metadata for supplementary materials or for long term preservation or access. Exceptions include: Internet Archaeology where supplementary data was handled by a third party; and policies developed collectively by partners in the Dryad consortium.

**Handling supplementary materials and data**
- in four cases minimal impact on work duties was reported; in five others a significant but often unquantified impact (two of these might be considered data publications with a focus on publishing data papers or datasets); and in three cases the information was not available or unknown;
- the variable level of impact on work duties can often be explained in terms of the level of effort or importance applied to supplementary materials and data: copy editing, format migration, addition of metadata, etc through to a minimal effort of simply hosting the material; and/or high-levels of automation in the workflow;
- supplementary data appears mostly to have grown organically at the various journals investigated, with both the work and the costs being absorbed into the daily running of journals;
- in three cases, journals also specifically mentioned that they are experiencing rapid growth in the number of articles submitted with supplementary material and data: for one journal the percentage has increased from 2% a decade ago to 87% in 2009; for another journal the growth has been from 32 articles in 2000, to 251 in 2009 – an
increase of 784%; finally for the publications of another society, journal articles including supplementary material rose from 6% in 2005 to 38% in 2009;

- For the three Dryad partners interviewed, contact with Dryad is currently low, probably because the initiative is relatively new and Dryad is phasing its roll-out to participants.

**Costs for supplementary materials and data**

These were in most cases unknown or only partially known. Costs mentioned but usually not quantified include: digital storage costs, often met by the publisher; salary costs of journal staff working with the archives; and long term preservation costs. Detailed cost information was really only available from one of the interviewees who had participated in an activity based costing study.

**Sources of revenue for supplementary materials and data**

Current sources:

- Only author fees and journal subscription fees were mentioned as current revenue sources for the supplementary materials in journals;
- Three journals have author charges for supplementary materials. These are as follows:
  - Journal of Clinical Investigation - authors are charged $300 for supplemental data to appear online with accepted articles;
  - Ecological Archives - submission of ‘appendices and supplements’ is free up to 10MB. Above this, there is a fee of $250 for the first 1 GB and $50 for each subsequent GB. The fee for publication of a data paper is $250 for publication of the abstract in the relevant journal plus publication of up to 10 MB in Ecological Archives. An additional $250 is charged for data sets between 10MB and 1GB, and for larger datasets there is an additional $50 per GB fee;
  - The Federation of American Societies for Experimental Biology (FASEB) charges $100 for each Supplementary file.
- The archiving organisations relied primarily on (uncertain) research grants and temporary or re-current core funding, but one had access to a small endowment and another has a charging policy for some depositors.

Potential other sources suggested were:

- government funding: particularly considering the requirement of funding bodies to make data available;
- learned societies: possible ‘community support’ via subscriptions to a service;
- publishers: some publishers host such material within their fee to societies or subscribers, so might contribute to a service that undertook this role: it is a bundled cost by publishers to societies and subscribers (even if some perceive it as “free”).
1.3. **INTERVIEWEES’ RECOMMENDATIONS**

Principal among these were to endeavour to build a community of users, by entering into a serious dialogue with publishers, authors and journal editors, and using open source software. Wiley and Dataverse specifically stressed that they would welcome further dialogue with Dryad.

1.4. **CONCLUSIONS**

With regard specifically to cost and revenue considerations, little is known by journals about the specific costs of handling supplementary materials and data. Costs, principally staff time, were observed to vary according to the tasks undertaken and value added. It is currently not possible to compare costs with those for Dryad as they are largely unknown, or for tasks such as adding metadata etc which are not currently undertaken.

However it could be observed that proposed costs for Dryad (although it excludes some tasks and adds others compared to the journals) do not appear unreasonable compared to existing author charges where these exist for publishing supplementary data files.
2. **Introduction**

2.1. **Dryad**

Dryad is a digital repository for the publication of data associated with scientific publications. The initial costs of repository development were borne by NESCen and current development is funded primarily by a 4-year grant from the National Science Foundation (expiring 2012), as well as funds from the Institute for Museum and Library Services. In the long term, some combination of page charge receipts, society and institutional subscriptions, grants and other sources will be needed to ensure that the repository is not dependent on ephemeral grant funding, and one of the major tasks of the Dryad Board will be to reach agreement among the journals on a sustainability plan and help implement it.

The Dryad Board has charged the Dryad project staff with developing a sustainability model that would identify the value-added benefit of the repository to different parties (depositors, users of archived data, journals, publishers, societies, funding organizations, etc), the costs of operation, and a mix of potential sources of revenue.

Charles Beagrie Limited is supporting the Dryad Board and Project Team with these tasks, and this report represents one strand of this support. It provides a survey of 12 journals’ and organisations’ experiences with working with supplementary materials and, within that broad area, the narrower one of data; their policies and how these have evolved; the costs they have incurred in providing this service, and how they have been met. This information has been collected to inform and provide input to the next iteration of its sustainability plan.

2.2. **Supplementary Materials and Supplementary Data**

It is necessary at this point to clarify the terms supplementary materials and supplementary data. According to Schwarzman (2009), supplementary or (as he calls it) supporting material can be defined according to whether the print or electronic version of a journal is considered to be the ‘copy of record’. For those who consider the former, supplementary material constitutes anything that cannot be printed because of the:

- dynamic nature of the material (e.g., multimedia, executable files), or
- page limit; or
- typesetting problems (e.g., “spread” tables).

Those who consider the electronic version may, alternatively define supplementary materials as:

- evidence that provides deeper support for the points made in the main paper;
- large data sets and multimedia that can only be presented online (actually the same as the first point above);
• detailed information about the methods (specific to the Biology and Medicine field, Schwarzman, but could come under the category of ‘page limit’ above).

Of major interest to the present project was the subset of the above that could be described as ‘data’. Even more specifically, the focus was on such data as accepted by Dryad for its repository. This, to give non-exhaustive examples from the Dryad website, consists of:

• spreadsheets or other tables;

• images or maps;

• text files (alignments or character matrices) formatted for specialized analysis programs.

Although these were the objects of interest to the study, the term ‘supplementary materials’ was used initially with interviewees to avoid the problem of informants assuming, by the word ‘data’, that we were interested only in dynamic datasets. We also wanted to know if there was any information on the relative cost of data as opposed to general supplementary materials. In fact, we found that most interviewees could not discriminate between these two.

Whilst our small-scale study did not specifically ask respondents for their definitions or concepts of ‘supporting materials’, material most mentioned fell very much into the ‘print as copy of record’ category, and more specifically that designated as supplementary materials due to page number limitations. This was not exclusively the case, however, as multimedia was mentioned, albeit as being rarely submitted. In sum, the kinds of supplementary materials discussed by interviewees were:

• supporting materials such as tables of data, images or figures, mathematical formulae or equations;

• data sets (generally Excel or other spreadsheet files);

• data papers: a separate paper consisting of data, published as an abstract in the print article and in full online;

• ‘Multimedia’: this was rare. One learned society which ‘occasionally’ received video to accompany publication submissions created a YouTube channel to host it, embedding links from the main article.

Thus, considering Dryad’s view of supplementary data, the supplementary materials discussed by respondents correspond closely to the supplementary data of interest to Dryad.

3. **Methodology**

3.1. **Methods**

Data were gathered from the organisations website and some published sources but primarily by semi-structured telephone interviews of between 20 and 30 minutes. Four of
these were undertaken by a three-way conference call system, where the Principal Consultant, formed a third party to interviews by the research consultant and interviewee.

Where it was not possible to schedule a telephone call, responses were sent by email. Interviewees were given the general question areas in advance, in case they needed to consult colleagues or to gather requested data etc.

The interviews consisted of questions and discussions around:

- interviewees’ job roles and the extent to which dealing with supplementary materials (and in particular, data) forms a part of these;
- handling supplementary materials and data, with specific regard to policies and costs. Information on the latter included staff time and resource use, where concrete costings were not available or – as was generally the case – unknown;
- current and potential funding sources.

Four interviewees from journals participating in the Dryad initiative were also asked about their motives for joining Dryad and their experiences of working with the repository. All interviewees were asked, as a final question, if they had any advice they felt relevant, or could point us to other journals or individuals who might be able to inform the project. A copy of the questionnaire is included as Appendix 5.

As we were asking for what sometimes might be considered as sensitive commercial information, we guaranteed anonymity to our informants. Names of journals or publishers are only included in this report, therefore, where the information acquired is already in the public domain such as the organisation’s website.

3.2. Population and Sample

We wished to obtain information from a range of people who had experience in working with supplementary materials and data, such as journal editors, data collection or archive managers. Thirteen people from 12 organisations gave information on their policies and practices, 10 by telephone interview (including one with two people from the same organisation in a teleconference) and three via email. A complete list of the journals and organisations interviewed appears in Appendix One below (Note that Appendices 2-4 describe the following repositories whose data collection or archiving staff were interviewed: Dataverse, Pangaea and The Archaeology Data Service).

Interviewees’ job roles were:

- Collections Manager for a Data Service organisation
- Project Manager for a learned society
- Journal Data Archives Manager
- Principal Investigator
- Investigator
- Two Publishing Managers
- Head of Publishing
- Associate Publishing Director
Interview subjects were also a mix of those working with or for journals already participating in the Dryad initiative, and those not doing so, albeit also maintaining supplementary data as part of their e-journal service. Academic authors and end users of supplementary data were beyond the scope of the current study.

4. **FINDINGS**

4.1. **Policy for Supplementary Materials and Data**

**General findings**
Few appeared to treat supplementary data with anything like the rigour they might do with the main body of articles. One said he looked at ‘some’ supplementary materials (not necessarily datasets), just to apply a level of quality control, but generally supplementary materials were included ‘as is’, to quote one interviewee. One of the societies included in the study (the American Medical Association), however, has formalised levels of editorial input for supplementary materials for its various journals¹. These are:

- Level 1 (or zero!): No editorial review with a disclaimer to that effect (in fact, this is not used, as it is ‘inconsistent with brand promise’);
- Level 2: A “little” editing and no composition or proofreading, but the content bypasses the production department. This is used for JAMA and some Archives journals
- Level 3: The complete editorial and production workflow, same as the print journal - used for some Archives journals

Considering the above, the work entailed in managing supplementary materials generally appears to be variable, with quality issues dealt with generally in a less rigorous manner than that accorded to the main text, albeit with exceptions such as that described in the final example, above. The same could be said about the peer review process, to which this report now turns.

**Peer review and supplementary materials**
Our findings suggested that, although peer reviewers had access to this content (indeed, in cases where there was automatic online submission processes, it was impossible not to be exposed to it) there was much doubt about the extent to which reviewers evaluated this material or, in fact, whether some included it at all in their readings. Also, the point was made by a Publishing Manager that it might be more difficult to find reviewers who were skilled enough to evaluate supplementary data than could review main papers or even

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certain supplementary materials – this might entail judging the format, presentation and even the manipulation of data.

Ecological Archives, does however, have a rigorous peer review system, at least for specific forms of data. It uses the form labelled as ‘Data Papers’, which ‘emphasize the collection, organization, synthesis, and thorough documentation of data sets of ecological value. Only the abstract appears in Ecology; the data and metadata are available through Ecological Archives online’. This provides a comprehensive peer-review process for such material, through which ‘the Ecological Society of America hopes to provide a high-profile outlet for data compilations and recognition for ecologists who create them’.

**Working with Dryad**

Very few observations were forthcoming on three Dryad participants’ experience of working with Dryad, possibly because Dryad is relatively new and is phasing its roll-out to participants so current contact time with the organisation appears very low. Even the Data Archives Manager for a participant journal, who worked on a day to day basis with supplementary data, had little contact so far.

That said, there were several comments about the benefits (and potential benefits) of working with Dryad. The repository appeals because of the importance of having the ability to access supplementary data using search engines. Also, centralising the data was said to be ‘a very good thing’. Another attraction was seen as that of the possibility of assigning D.O.I.’s (Digital Object Identifiers) to data so, therefore, they have the facility to be cited.  

Finally, one interviewee spoke of two related issues Dryad had the potential to address:

- making data available; and
- facilitating the underlying principle of replication (e.g. to use the data to replicate an experiment).

### 4.2. Handling Supplementary Materials and Data

**The growth of supplementary materials**

In describing their job roles, most interviewees tended to also outline the growth of supplementary materials generally and, at the same time, supplementary data, in the journal for which they worked. In three cases, journals also specifically quantified the rapid growth in the number of articles submitted with supplementary material and data: for one journal the percentage has increased from 2% a decade ago to 87% in 2009; for another journal the growth has been from 32 articles in 2000, to 251 in 2009 – an increase of 784%; finally for the publications of another society, journal articles including supplementary material rose from 6% in 2005 to 38% in 2009. One society’s representative said that supplementary materials...

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2 http://esapubs.org/esapubs/journals/ecology.htm#Dat  
3 ‘The DOI System provides a framework for persistent identification, managing intellectual content, managing metadata, linking customers with content suppliers, facilitating electronic commerce, and enabling automated management of media. DOI names can be used for any form of management of any data, whether commercial or non-commercial’ (the International DOI Foundation: http://www.doi.org/)
material had now become ‘standard with every article’. This growth is worth discussing in depth, as it greatly informs the project.

Of major interest is that such supplements appear to have grown organically at the various journals investigated. In other words the process generally started on the initiative of authors requesting to submit such material. Before this authors would have to contact each other for supplementary data or other material. Confronted with these requests, the journals then had to find a way to accommodate supplementary materials, be they appendices adding extra information, static data tables or dynamic content, within an existing structure. The implications of this ‘organic growth’ are that:

- costs have been absorbed into the daily running of the journal. The cost of hosting supplementary materials, be they in the form of data or extra information or diagrams etc., is saved in some cases by the reduced size of journal papers. A table that would have been in the main body of an article that would have been printed (as well as appearing online) is now put out as XL or pdf file;
- the burden has largely fallen on authors to provide material in an ‘acceptable format’ (although at one journal the Data Archives Manager has seen her workload increase dramatically – offset only by the gradual increase in efficiency of the software packages with which she works);
- supplementary data have not been searchable. This is because they are not assigned D.O.I.s, metadata has not been included in them and no search mechanism has been set up (this is not the case with the repositories whose staff have been interviewed, whose whole focus is, of course, on providing data access);
- policies have not been fully developed for the above, nor for long term preservation or access – again, with the exception of the repositories to whom we spoke (or journals participating in Dryad who are implementing the Joint Archiving Policy). The Internet Archaeology and Archaeology Data Service, for example, does have policies in place, benefiting the journal Internet Archaeology, which entrusts that service with its supplementary data and journal archive.

**Work necessary in handling supplementary materials and data**

In four cases minimal impact on work duties was reported; in five others a significant but often unquantified impact (two of these might be considered data publications with a focus on publishing data papers or datasets); and in three cases the information was not available or unknown.

The Data Archives Manager for one of the learned societies contacted and the Collections Manager for one of the repositories, not surprisingly, had the most ‘hands-on’ role in working with supplementary materials. The role of the former is to make submitted supplementary files publishable in the society’s journals. She said that although the society requests html format for appendices and metadata, they ask authors to send Word documents as well so that they can be sure no errors are introduced in the file conversion and to also see the intended display. One area of concern is the variations seen in the display of converted
Greek symbols across platforms (clearly, this would apply to the main document as well as to supplementary material). A lot of her work consists of cleaning up Microsoft-specific code in HTML files, cleaning up the HTML code in general, placing the material within the standard templates, re-sizing and placing image files and equations, checking links. As far as possible, the supplementary materials adhere to the journals’ style guide for main articles, which appear online and in print. If the journals of the society receive LaTeX files or other highly mathematical appendices they must be converted to and displayed as PDF files linked from the HTML template.

The Director of Publications for another organisation estimated that staff spend around 15% of their time processing and posting supplementary data (from 5% which they ‘used to spend’). Much of this time is spent communicating with authors to negotiate which parts of their submission need to go into the main article and which can be submitted as supplementary material. How much additional material they wish to submit is also negotiated and takes up people’s time. She feels that some authors submit too much extraneous data. Despite these tasks, she reports that her organisation has the capacity to cope with this workload. This may become an issue in the future, however.

Several other interviewees or email informants working for a journal did not place any emphasis on the labour involved in managing supplementary materials. The workload appears in other cases to fall almost entirely on the author. Indeed, even in the case mentioned above, it is incumbent upon the author to adhere to stringent guidelines. For example, any references in an appendix must include a full literature citation apart from that which appears in the print article, each appendix, supplement, or data paper title must be included and adhere to length limits, naming conventions for equations, tables and figures (i.e., a second table in Appendix B will be named “Table B2”), and so on.

A Publishing Manager gave another reason why costs were not significant despite submissions of supplementary materials increasing. This was that workflows are now centred around digital tasks – article submission is now digital, for example, and systems in use are more integrated, meaning that workflows have become much quicker and easier. In fact, when considering staffing needs and recruitment, the workload generated by handling supplementary materials globally – let alone the subset of data therein - is never considered an issue.

Submission to the Dataverse archive repository is also highly automated. Staff time on the Dataverse project (described in Appendix Two: The Dataverse Network, below) is now focussed mainly on that of curation and the time spent by experts in enhancement of the meta-data. The parallel was made that it costs a library more to catalogue a book than to store it.
The long-term fate of supplementary materials

In most cases this did not seem to have been thought through in any great depth. One publisher interviewed felt that it was the responsibility of National and Legal Deposit Libraries rather than publishers or journals to ensure this. Another said that continuing access to data depended on funding and could not be guaranteed. However, several journals required authors to deposit some forms of data into existing scientific databanks. One society representative said that there have been questions raised about access to supplementary data cited in the journal, and whether it falls under the control of the society or elsewhere. Some interviewees mentioned that they are participating in e-journal archiving solutions or services such as LOCKSS, the KB e-Depot, PORTICO and CLOCKSS but seemed unaware that supplementary material and data was not part of the archive material submitted by most publishers or accessioned by the publication archives.

The data repositories contacted for the project had generally given more consideration to this issue as might be expected given their focus.

4.3. Costs for Supplementary Materials and Data

As mentioned above, costs generally appear to have been absorbed into the daily running of the journal (although it must be said that information on this point was not forthcoming from all interviewees).

Costs cited include:

- maintenance and digital storage;
- interface design and development costs;
- salary costs of staff working with the archives;
- long-term preservation.

We have been given costs for all of these elements for one journal via its archive provider. None of the others could quantify these, and even for the journal for which figures were available, these were not calculated by the journal, but by its data repository partner (a consortium comprising a charity and a number of university departments) with which the journal works. This particular organisation often deals with large or very large supplementary datasets. Cost information supplied regarding the journal of interest was calculated specifically for this study. Broader information on the costs incurred by the repository is taken from a case study recently completed for Keeping Research Data Safe 2 (Beagrie et al forthcoming). The first Keeping Research Data Safe study made a major contribution to understanding of long-term preservation costs for research data by developing a cost model and indentifying cost variables for preserving research data in UK universities (Beagrie et al, 2008). The Keeping Research Data Safe 2 (KRDS2) project has built on this work. It has identified and analysed collections of long-lived research data and information on associated preservation costs and benefits. It aims to provide a larger body of material and evidence
including case studies against which existing and future research data preservation cost modelling exercises can be tested and validated.

**Maintenance and storage**
Few details were offered regarding these, except in the one case mentioned above, because they were unknown. Indeed, they had probably never been calculated. A Publishing Manager said that their computers hosted 1,500 journals, including all the supplementary data, plus other material and ‘other things happening’. It is, thus, impossible to calculate the costs specifically of hosting either supplementary material or the subset that constitutes ‘data’. One interviewee claimed that such costs for his society were ‘minimal’.

One of the repositories contact, however, did have a one-off computer storage charge, which is £0.3GB pounds per Mb, including maintenance. The point was made by an interviewee working on another repository that the longer time goes on the less expensive it will be to store data. Also, the more people who participate the less expensive it will be per person to run the system. Thus it was, in the view of one interviewee, particularly important to foster collaboration with authors in order to achieve these economies of scale.

Two of the societies included in the project use Highwire Press, an ePublishing platform, which works with independent scholarly publishers, societies, associations, and university presses to facilitate the digital dissemination of journals, reference works, books, and proceedings. Two other society journals interviewed were using the publishing platforms of either Oxford University Press or Wiley.

**Interface design and development costs**
Development costs and interface design was only mentioned by one interviewee: in this case as a major part of the technical effort for ingesting, archiving and providing access to major datasets integrated with data papers in an electronic journal (i.e. there is a considerable difference in scale for each dataset to those typically expected in Dryad). Advice, meetings, and design for various completed supplementary data projects took on average eight weeks of technical officer and one week of management time. Split over the KRDS2 lifecycle the staff costs on average for each project were: Pre-Archive 3 management days; Acquisition 2 management days, 5 technical days; Ingest 10 technical days; Archive 5 technical days; Access 20 technical days.

**Staff costs**
With regard to the costs in terms of staff time, these are very variable as discussed in the section on work necessary in handling supplementary materials and data above.

One interviewee furnished very detailed staff costs in the overall costs of data curation, as follows:

- total staff costs (exclusive of FEC) as percent of all costs: 50 percent
- total storage costs as percent of all costs: 20 percent
Total staff costs are therefore about 2.5 times total larger than total storage costs in this case. Even though the archive collections vary considerably in size (ranging from 8 MB to 39.9 GB), staff costs as a percentage of total costs varied within a much narrower band across the collections\(^4\). Only four of the 24 archive collections exhibited a staff-to-total cost ratio less than 45 percent.

An analysis had suggested that given that staff costs appear to be at best only weakly correlated with archive size, this seems to suggest that expansion of archival capacity, in addition to lowering the average per unit cost of curation, is relatively inexpensive in absolute terms. Also looking at the distribution of staff costs over the five major activities (pre-archive, acquisition, ingest, archive, and access), the largest proportion is accounted for by the access category (31 percent). However, the activities leading up to and including ingest of the materials into the archive collectively account for 55 percent of total staff costs. The process of actually preserving the materials (archive category) accounts for only 15 percent of total staff costs.

**Long-term preservation and access.**

Indicative costs can be inferred from the charging policy of the Archaeology Data Service. For selective deposits over 100MB the repository makes a charge of £0.3 GB pounds per megabyte to cover storage and refreshment, plus its charges for administration, ingest and dissemination (variable, according to file formats and size). This pricing applies to deposits up to 100GB in size. For deposits of more than 100GB, prices again vary\(^5\).

**Global costings**

It was possible, with one interviewee (The Collections Manager for a data repository) to examine the combined cost of pre-archive, acquisition, and ingest phases of activities. One point of interest was to see whether this cost varies with the size of the collection. Pre-archive is assigned the same figure for all collections, and is therefore uncorrelated with collection size. Acquisition costs and ingest costs do not seem to have a discernable correlation with collection size. The data therefore suggests that the costs of expanding the size of the archive are primarily fixed.

The known cost figures for four of the journal supplementary datasets in the archive ranged between 0.52 to 1.70 GB Pounds per MB. Although there are only four specifically costed supplementary datasets from the journal, archiving costs for their other uncosted supplementary datasets were thought to be similar to those of the data repository in general. Those figures demonstrated a significant correlation between archive size and per unit cost, which suggested that economies of scale operate in this context. Economies of scale usually emerge when fixed costs represent a substantial component of total costs. In the context of this archive, staff costs seem to represent the main “fixed costs” of data curation. These

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\(^4\) 12 of the archive collections exhibited a staff cost/total cost ratio of 60-62 percent; 6 of 50-59 percent; 2 of 40-49 percent; 1 of 30-39 percent; 2 of 20-29 percent; 1 of 10-19 percent;  
\(^5\) [http://ads.ahds.ac.uk/project/userinfo/charging.html](http://ads.ahds.ac.uk/project/userinfo/charging.html)
costs appear to be substantial and not strongly correlated (if at all) with archive size. Larger collections therefore reduce per unit cost by spreading staff costs over higher volumes of data curation activity.

An important point generally from other interviews, is that costs do not appear to have simply increased linearly with the production and dissemination of the journals. The cost of hosting supplementary materials is saved in some cases by the reduced size of journal papers. A table that would have been in the main body of the article is now put out as an Excel or pdf file, and so pages are saved. Also, in at least one case, the publisher has met the cost of storage, although as the quantity of supplementary materials grows, there was a view that a new contract might need to be negotiated (the issue was not even mentioned in the current contract, and there was some doubt as to whether it had ever been calculated).

4.4. Funding sources for supplementary materials and data

Only two current sources of revenue were cited for supplementary materials and data in journals. These were author submission fees and journal subscriptions. Interviewees differed in their opinion of the suitability of these: what was practical in terms of revenue options for some journals did not apply for others. Regarding author submission fees, some interviewees were quick to point out that their cost was for the article submission – there was no additional cost for the additional submission and repository of supplementary materials.

One interviewee felt that if the costs of this were also to be passed to the authors they would simply not submit to the journal. They would not see this as part of their obligation, and there are other journals to which they could submit. Also, authors can deposit certain types of specialized data in various other repositories [although it should be noted they do not cover the material in Dryad. Dryad also has co-operative “handshaking” agreements with these repositories to share relevant metadata]⁶. One journal, although charging authors who are not members of its learned society $60 per page for publication (society members do not pay) waives this fee under certain circumstances. By contrast, another interviewee argued that authors did not complain, for example, about being charged for using colour figures, and that, therefore, they should be prepared to pay for supplementary materials.

Only three journals interviewed charged authors specifically for supplementary materials. In one case, Ecological Archives, submission of ‘appendices and supplements’ is free up to 10MB. Above this, there is a fee of $250 for the first 1 GB and $50 for each subsequent GB. The fee for publication of a data paper is $250 for publication of the abstract in the relevant journal plus publication of up to 10 MB in Ecological Archives. An additional $250 is charged for data sets between 10MB and 1GB, and for larger datasets there is an additional $50 per

⁶ Examples of repositories mentioned, where authors store data related to articles appearing in interviewees’ journals included Genbank and TreeBASE. Genbank is a genetic sequence database, hosted by the National Center for Biotechnology Information. This is an annotated collection of all publicly available DNA sequences. One editor said that 50% of articles with supplementary materials had the data deposited. TreeBASE is a relational database of phylogenetic information hosted by the Yale Peabody Museum). One interviewee encouraged authors to use this repository.
GB fee\(^7\). The journal of another organisation, the Federation of American Societies for Experimental Biology (FASEB) charges $100 for each supplemental file. Authors are advised on the website to decrease supplemental file upload charges by combining supplemental information into a single file, whenever possible. However, so much material, in many different files, is being submitted ‘zipped’, that zip files may not be permitted in the future. Finally at the Journal of Clinical Investigation authors are charged $300 for supplemental data to appear online with accepted articles.

One journal operates an author submission page fees policy that aims to minimise author charges, whilst increasing journal revenue and stimulating the submission of supplementary materials. The reason why this journal’s archives of supplementary material have grown is because it allows authors to shorten articles. This reduces the time from submission to publication and reduces the charges authors pay per page for the accepted published article. However, this does not mean that the revenue stream from authors goes down because the journal can now publish more articles if they are shorter. There is a set page limit budget set by the governing board; for example, it is allowed a certain number of pages per issue. The length of supplementary appendices, however, can be highly variable: most run about 3 printed pages (if they were to be printed) but a few may exceed 40 printed pages, although this is rare. The largest data sets are those associated with Data Papers.

By contrast, one interviewee felt that charging authors directly for depositing data was against the ethos of Dryad, which was set up to be ‘freely available’. It could not thus describe itself if authors were charged in this way [note some confusion here - Dryad aims to be freely available for access – this does not mean deposits are necessarily free].

The other current revenue source was the subscriptions to the journal itself. The publishing editor interviewed pointed out that revenue here derived mainly from institutional subscriptions. As this interviewee and others intimated, it was important for research and scholarly activity for academic literature to be available, and so the balance between charging and open access was a very delicate one.

As a final point on charging authors or adding to the subscription costs of journals to fund Dryad, one interviewee pointed out that determining the ownership of data currently going into Dryad is not easy. It is not necessarily the journal (because of countless copyright variations), and continues it may be the author (if so which one?); it may be the host institution in which the research was conducted; the funding body (in cases of multiple funding which funder?), or there may be no owner. In conclusion she feels that this situation makes charging for access ethically and potentially legally complex and presents another

\(^7\) http://esapubs.org/esapubs/conditions.htm#Fin
motivational challenge for payment on deposition [however this argument could also be seen as a case for charging as proposed by Dryad on deposit not on access].

Various other potential sources of income were suggested. These were:

- **government funding**: It was pointed out that there is a requirement of funding bodies to make data available and therefore a good case could be made for funding. NCBI works on this model, so it would not be a unique situation;
- **learned societies**: A possible ‘community support’ via society subscriptions to a service was suggested. This was described in the sense of a community of scholars or society members contributing for the good of the society;
- **publishers**: At present, as intimated above, publishers seem to be hosting supplementary materials and not charging journals. This is not a ‘source of revenue’ as such, but at least takes some of the costs from the journal to the publisher (although it has to be said that, in fact, some publishers host such material within their fee to societies or other institutions’ subscription fee, so it is a bundled cost);
- **authors’ research funding**: One of the repositories whose Collection Manager was interviewed is moving towards an Open Access model to broaden access to the contents of the journal. In doing so, it is set to lose significant subscription income. The repository is therefore recommending that authors approach them at an early stage so that these costs can be included in research funding applications, thus accruing revenue for the journal and repository, but without burdening individual authors.

Rather than rely on any of these funding streams – or to augment them, the journal [or more accurately the society or publisher of the journal] itself may decide to pay. This was suggested, but would be dependent on costs incurred. One interviewee opined that some journals may meet the costs themselves, feeling both that supplementary materials are necessary and worth the outlay and that the journal has a responsibility to the research community.

5. **Interviewees’ Recommendations**

As a final question, interviewees were asked if they had any recommendations or other information they felt was appropriate. The main message to come out of the points raised was that Dryad needs to put as much effort as possible into community building. This includes:

- talking more to journal editors. One interviewee suggested it would be good to get the really big ‘top-line’ journals interested, such as Nature or Science, although the

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8 Quotes from email co-correspondence following a telephone interview
nature of the repository – being one of ‘small science’ may not be conducive to participation by these journals;

- entering into a serious dialogue with publishers – one publisher already hosts the supplementary materials of an interviewee’s journals and it was suggested they could meet the costs of Dryad. Also as one interviewee pointed out talking only to journal editors does not give a complete picture of current policies and practices, as editors only know these for their own journal. Publishers, however, can give a better overview of various workflows and procedures. Dryad needs to think, according to this interviewee, of databases which take account of these. Wiley publishers also expressed directly in their interview a strong interest in further dialogue with Dryad;

- collaborating more with authors, partly to encourage deposit, and also to see – in the case of author charging, where the author can obtain or recoup the fee (building such charges into funding bids has already been mentioned as an example of this);

- using Open Source software to encourage usage. This allows unrestricted access and therefore stimulates participation by the widest number of people and journals possible, and is the model upon which the Dataverse project was developed. [note Dataverse is not a comparable model to Dryad but the principle of having communal ownership is clearly applicable. Dataverse also expressed an interest in joint open source development with Dryad]. Gary King, who is the Principal Investigator on the project, explains:

  “Dataverse Network software is open source, free, and available to all. One can build modules that snap into it to provide facilities or services we do not yet offer. …If worse comes to worst, the software is owned by all and anyone may use it to build on what we have done or to take the project in a different direction’ (King, 2007: p196).

These activities were all seen as good bases for sustainability. In addition, it was pointed out that, in addition to funds being directly accrued via publishers, authors or societies, funding bodies take particular note of communities of practice and are far likelier to fund projects such as Dryad if there is already a social infrastructure and demonstrable community involvement in place.

6. CONCLUSIONS

According to Teresa Attwood and (Attwood et al, 2009: p318) ‘For information to be usable, it must be stored and organized in ways that allow us to access it, to analyse it, to annotate it and to relate it to other information; only then can we begin to understand what it means; only with the acquisition of meaning do we acquire knowledge’. The Dryad Repository is an attempt to address this question by providing, in particular, the facility to allow end-users to perform sophisticated searches within supplementary materials – particularly data - not only by publication, but also by taxonomy, geography, biological concept, etc.
This study has discussed journal editors’ and others’ experiences with supplementary materials and data, with regard specifically to formulating a sustainability plan for Dryad.

The variability in approach with regard to the rigour with which such material was peer or editorially reviewed, suggests very much that supplementary materials have not (yet) been accorded the same status as the ‘main’ journal article. This was one of the findings of Schwarzman (2009) in his survey of editors and others involved with the production of academic journals. The present study also found, as did his:

- supporting material items are usually not presented the same way as the ‘main’ article – although this might be unavoidable (better to present a table in Excel than html, for example, to allow for data manipulation);

- supporting components are often presented in author-submitted formats that may not meet archival standards (although, as noted earlier, in some cases much time was taken up in converting them).

With regard specifically to cost and revenue considerations, little is known by journals about the specific costs of handling supplementary materials and data. Costs, principally staff time, were observed to vary according to the tasks undertaken and value added. It is currently not possible to compare costs with those for Dryad as they are largely unknown, or for tasks such as adding metadata etc which are not currently undertaken.

However it could be observed that proposed costs for Dryad (although it excludes some tasks and adds others compared to the journals) do not appear unreasonable compared to existing author charges where these exist for publishing supplementary data files.

There is much here to consider, but as Attwood et al (2009: p317) conclude in their review of initiatives into recent projects to ‘provide new ways of interacting with the literature, and new and more powerful tools to access and extract the knowledge sequestered within it’, the benefits that may accrue by providing better access to data ‘could be a cost-efficient investment in a new type of knowledge landscape, one that better serves the needs of new millennium readers, authors and publishers’.
7. REFERENCES

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Beagrie, N., Lavoie, B., Woollard, M. (forthcoming 2010), Keeping Research Data Safe 2
(Joint Information Systems Committee).

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Schwartzmann, A., 2009, Supporting Material, 2 November 2009 (unpublished manuscript)
8. **APPENDICES**

8.1. **APPENDIX ONE: PROJECT RESPONDENTS**

<table>
<thead>
<tr>
<th>Journal/Organisation/ publisher (if different)</th>
</tr>
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</table>
| 1    | • Journal of Clinical Investigation  
     | • American Society for Clinical Investigation |
| 2    | • Journal of the American Medical Association  
     | • American Medical Association |
| 3    | • Molecular Phylogenetics and Evolution  
     | • Elsevier |
| 4    | • Journal of Heredity  
     | • American Genetic Association  
     | • Oxford University Press |
| 5    | • Ecological Society of America |
| 6    | • Pangaea: Publishing Network for Geoscientific & Environmental Data |
| 7    | • Internet Archaeology and Archaeology Data Service |
| 8    | • Dataverse Network  
     | • Harvard University |
| 9    | • Wiley-Blackwell  
     | • Ecology Letters (Dryad partner) and other journals |
| 10   | • OECD Publishing |
| 11   | • Royal Society |
| 12   | • Federation of American Societies for Experimental Biology (FASEB)  
     | • The FASEB Journal |

8.2. **APPENDIX TWO: THE DATaverse NETWORK**

Dataverse is a digital community library of research data, which enables sharing of data and the studies associated with that data. This digital library contains many collections and volumes of data. In short, it:

- is a web application that serves out individual 'dataverses' to scholars, research groups, journals, presses, scholarly organizations, departments, libraries, universities, and archives.
• was developed at Harvard University by the Institute for Quantitative Social Science. Several institutions -- including IQSS -- maintain permanent archives and run the necessary software and servers.
• is Open-source, and needs no installation for a user to make their own dataverse.
• facilitates data access and analysis for researchers and students; and ensures long-term preservation
A dataverse is one view of the universe of data available in a Dataverse Network (DVN). A dataverse holds one or more collections of data, and can contain any number of individual volumes of data. Data can be uploaded to a dataverse, or linked to from another dataverse. The host DVN provides extensive services to each dataverse, including permanent data archiving, preservation, cataloging, dissemination, citation, searching, format conversion, ‘subsetting’, and online statistical analysis. The DVN provides:

• **Accessible, public distribution of contents:** DVNs can harvest collections and studies from other repositories that are compliant with the Open Archives Initiative (OAI), and provide access to all contents through a single interface;
• **Recognition, persistence and verification:** When one contributes a study to a dataverse, the DVN assigns a citation to the study automatically. This citation gives recognition to study and data creators in terms of web visibility (within their own dataverse) and scholarly citation credit (through the combination of our data citation standard and links to the authors print publications). With this citation, all participants in a study are credited and recognized;
• **A unique, global, persistent identifier:** this is part of the citation for every study. When you contribute subetable data to a study, the DVN also generates a Universal Numerical Fingerprint (UNF) identifier for the study. Each sub settable data set also receives a UNF, and the data is preserved in a format-independent state by the DVN;
• **Validation:** By viewing the UNF citation for specific data, users can validate that the data they choose to use is correct, without being able to see the data;
• **Authorization and Legal Protection:** The DVN enables you to control distribution and contribution of both studies and data. You can enable or disable contributions to your dataverse. You also can enable and disable downloads of your study files. Authorization controls.
A DVN installation, like any library, can be open to the public or closed to specific membership. Institutions and large organization can install the DVN software to host shared-access digital library services, and to control access to their library’s contents. In addition, a DVN can harvest studies from other DVNs. Community members use these digital storage and archive services to view and create dataverses and studies.

**Sources**
This information was taken from:


http://thedata.org/#section-2

8.3. Appendix Three: PANGAEA

PANGAEA (Publishing Network for Geoscientific & Environmental Data) is an information system operated as an Open Access library aimed at archiving, publishing and distributing geo-referenced data from earth system research. The system guarantees long-term availability of its content through a commitment of the operating institutions. The data and any associated material in PANGAEA is made available under the Creative Commons Attribution license if not otherwise specified in the description of the dataset.

Most of the data are freely available and can be used by referencing the related publication or the dataset citation. A few password protected data sets are under moratorium from ongoing projects. The description of each data set is always visible and includes the principle investigator (PI) to ask for access.

Each dataset can be identified, shared, published and cited by using a Digital Object Identifier (DOI). Data are archived as supplements to publications or as citable data collections. Citations are available through the portal of the German National Library of Science and Technology.

Archiving follows the Recommendations of the Commission on Professional Self Regulation in Science (pdf, 200 kB) for safeguarding good scientific practice.

The policy of data management and archiving follows the Principles and Responsibilities of ICSU World Data Centers and the OECD Principles and Guidelines for Access to Research Data from Public Funding.

Authors submitting data to the Pangaea data library for archiving agree that all data are provided under a creative commons license.

The system is hosted by

- Alfred Wegener Institute for Polar and Marine Research (AWI), 27515 Bremerhaven, Germany
- Center for Marine Environmental Sciences (MARUM), University of Bremen, 28359 Bremen, Germany

PANGAEAN is funded by:

- The European Commission, Research
- Federal Ministry of Education and Research (BMBF)
- Deutsche Forschungsgemeinschaft (DFG)
- International Ocean Drilling Program (IODP)
Sources

This information was taken from:

http://www.pangaea.de/about/

8.4. APPENDIX FOUR: THE ARCHAEOLOGY DATA SERVICE (ADS)

The Archaeology Data Service (ADS) supports research, learning and teaching with high quality and dependable digital resources. It does this by preserving digital data in the long term, and by promoting and disseminating a broad range of data in archaeology.

The aim of the Archaeology Data Service (ADS) is to collect, describe, catalogue, preserve, and provide user support for digital resources that are created as a product of archaeological research. The ADS also has a responsibility for promoting standards and guidelines for best practice in the creation, description, preservation and use of archaeological information. For those classes of archaeological data where there are existing archival bodies the role of the ADS will be to collaborate with the appropriate national and local agencies to promote greater use of existing services.

The Archaeology Data Service (ADS) was founded by a consortium comprising the Council for British Archaeology with the Universities of Birmingham, Bradford, Glasgow, Kent at Canterbury, Leicester, Newcastle, Oxford and York. The ADS is guided by an advisory committee consisting of representatives from all sectors of the discipline. The ADS is based at the University of York.

The Archaeology Data Service is funded by the Arts and Humanities Research Council and, until 2008, by the Joint Information Systems Committee of the Higher Education Funding Councils for England, Scotland and Wales and the Department of Education for Northern Ireland.

Sources

This information was taken from:

http://ads.ahds.ac.uk/project/about.html

http://ads.ahds.ac.uk/project/general.html

8.5. APPENDIX FIVE: THE INTERVIEW QUESTIONNAIRE

Dear xxx

Thank you very much for agreeing to talk to us about supplementary materials in electronic journals and repositories for the archiving and sharing of such data. We are seeking
information on the possible value-added benefit of such repositories to different parties (depositors, users of archived data, journals, publishers, societies, funding organizations, etc), the procedures and costs of handling supplementary material for journals, potential sources of revenue etc. We are extremely grateful that we are able to talk to you on these issues. You can be assured that any information we receive will be treated with strict confidence and will be anonymised in any dissemination of our findings.

The interview will be with myself on a one-to-one basis, although – as you are one of the first people with whom I will be talking, the Principal Investigator Neil Beagrie may be online too, so that we can discuss together afterwards any small modifications we may need to make to our next interviews.

We hope to ask the following questions. Not all may be applicable to/or answerable by every interviewee but these issues and questions may provide a framework for the interview. Please feel free to discuss any additional issues you think relevant.

In some cases it may be helpful to consult with your colleagues on potential responses and gather information for the questions in advance of the interview.

Many thanks once again for your time and help.

Interview questions:

xxx
Dryad project: possible interview questions

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(C) FOR NON-DRYAD INTERVIEWEES NOT WORKING WITH SUPPLEMENTARY DATA
.............................................................................................................................................. ERROR! BOOKMARK NOT DEFINED.

NOTE:
Some of the ‘editor-only’ questions might be appropriate to ask of others, depending on their experience. One possibility might be to just ask, when we send the questions out, for interviewees to determine themselves what questions they can answer (we could even ask them to consult colleagues before the interview if there are some questions they can’t).

Main essential questions in red – when warranted possible areas for additional detailed probing in black.

1. FOR ALL PARTICIPANTS:

1.1. INITIAL QUESTIONS

• Your role for the Journal and in relation to supplementary materials?

• Have other colleagues contributed information for the interview?

1.2. FINAL QUESTIONS

• Are there other individuals or journals that you think we should speak to?

• Any other information you think is relevant and wish to add?
2. **(A) FOR DRYAD PARTICIPANTS**

2.1. **ALL (PARTICIPANT) INTERVIEWEES:**

*Perceived benefits and concerns.*

Questions:

- What led you to become a participant in the Dryad initiative?
- What do you see as the possible benefits accrued by having a ‘one stop’ data deposit system such as proposed by Dryad?
- What do you see as the possible benefits accrued by having a ‘one stop’ data deposit system such as proposed by Dryad?
- Have you experienced, or do you envisage, problems regarding:
  - the nature, quantity and quality of supplementary material?
  - hosting of supplementary material and it’s linkage with article content (e.g. indexing/tagging file formats / compatibility)? *(Please consult your technical department if necessary to respond to this question)*
- What has been the impact of including supplementary data on the research practices and dissemination of findings on your users?

*Current cost of operation and sources of revenue*

Questions:

- Have you implemented a policy (e.g. the Joint Data Archiving Policy) around preservation / continuing access to supplementary materials? (if yes brief details, if no what is current practice for supplementary materials)
- Do you have any information on costs (e.g. an average cost) for acquiring, processing, and retention of supplementary data? Is this per article, dataset, or other unit?
- Could you break down these costs in any way (e.g. staff time, computing costs etc.)?
- Is this cost absorbed in your total expenditure, or has it required raising revenue (e.g. author page charges etc?)

*Obligations and incentives for authors*

Questions:

- Do you have any quality or format guidelines for supplementary material?
- What is the obligation on authors to provide supplementary data?
- How willing are they to meet these?
- Are there any incentives for authors?

*The peer review process and supplementary material*

Questions
3. **(B) For non-Dryad Interviewees who work with supplementary data**

3.1. **All (non-participant) interviewees:**

- Do you have experience of taking, archiving and disseminating supplementary data from authors?
- What has been the impact, in your view, of including supplementary data on the research practices and dissemination of findings on your users?
- What do you see as the possible benefits accrued by having a ‘one stop’ data deposit system such as proposed by Dryad?
- Have you experienced, or do you envisage, problems regarding:
  - the nature, quantity and quality of supplementary material?
  - hosting of supplementary material and it’s linkage with article content (e.g. indexing/tagging file formats / compatibility)? *(Please consult your technical department if necessary to respond to this question)*

**Current cost of operation and sources of revenue**

Questions:

- Do you have a policy around preservation / continuing access to supplementary materials? (If yes brief details, if no what is current practice for supplementary materials)
- Do you have any information on costs (e.g. an average cost) for acquiring, processing, and retention of supplementary data? Is this per article, dataset, or other unit?
- Could you break down these costs in any way (e.g. staff time, computing costs etc.)?
- Is this cost absorbed in your total expenditure, or has it required raising revenue (e.g. author page charges etc?)

**Obligations and incentives for authors**

Questions:

- Do you have any quality or format guidelines for supplementary material?
- What is the obligation on authors to provide supplementary data?
- How willing are they to meet these?
- Are there any incentives for authors?
The peer review process and supplementary material

Questions

- To what extent is supplementary material peer reviewed?
- How rigorous is the evaluation of it compared to the article content?
- How automated is the submission process?