GLOBAL BIODIVERSITY INFORMATION FACILITY

Recommendations of the GBIF Multimedia Resources Task Group

September 2008

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Members of the GBIF Multimedia Resources Task Group at its face-to-face meeting in Copenhagen, Denmark during 19-21 June 2008. L to R: Vishwas Chavan, Robert Morris, Greg Riccardi, Ivan Teage, Patrick Leary, Annette Olson, Gregor Hagedorn, Eamonn O' Tuama, Vijay Barve and Greg Whitbread. Absent: Mikko Heikkinen could not participate in the meeting.

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CONTENT

1. Background:

The Global Biodiversity Information Facility (GBIF) recognises the need for Primary Biodiversity Data[1] and Information to extend beyond its current focus of specimen and observations based data records. With GBIF's renewed target of facilitating access to an ever increasing number of resources of "fit-for-use" primary biodiversity data, it is imperative to explore the feasibility of mobilising various types of primary biodiversity data, including those documented through multimedia objects such as photographs, illustrations, audio-recordings, and video-recordings. Because the potential volume and quality of these data types is at least as great as that represented by observational data (potentially even larger), it merits special consideration. GBIF further recognises the potential of a biodiversity-related multimedia object to be used as "primary biodiversity record" if the metadata associated with an object is available. Towards this end, GBIF convened the Multimedia Resources Task Group (MRTG) to suggest strategies to expand the types of species' occurrence (observation) data it can make available, through the mobilisation of multimedia resources. MRTG constitutes of multimedia experts, managers and users of some of the large biodiversity-related scientific and public domain media repositories.

This document reports the recommendations by MRTG. The primary recommendation of the group is that GBIF should facilitate the discovery and mobilization of multimedia resources as Primary Biodiversity Data. The strong consensus of MRTG is that GBIF must above all reduce burdens on its Participants[2] as one method of accomplishing access to increased, high-quality resources. One recurring theme in the deliberations was a strong feeling that mobilising multimedia resources extends the utility of

[1] Primary Biodiversity Data: Definition

- Digital text or multimedia data record detailing facts about the instance of occurrence of an organism, i.e. on the What, Where, When, How and By Whom of the occurrence and the recordings (as per GBIF Work Programme 2009 – 2010)
- All observational data including multimedia detailing facts about the instance of occurrence of an organism including WHO, WHAT, WHERE, WHEN, and HOW an observation was gathered (as defined by the Observational Data Task Group)

[2] GBIF Participants: This term is used in this report to represent wider community of GBIF national and thematic functionaries including NODES, data publishers (formerly known as data providers) as well users who often provide feedback on the quality, and fitness-for-use of GBIF mobilised data.

occurrence records and supports other use including species descriptions, taxonomic identification, and other use cases such as those supported by the Species Profile Model (SPM)[3], etc.

2. Objectives:

The mission of the Global Biodiversity Information Facility (GBIF) is to facilitate free and open access to biodiversity data worldwide via the Internet. To best serve this mission a comprehensive resource discovery service must be implemented for all types of primary biodiversity data. It was envisaged that the Multimedia Resources Task Group will work closely with TDWG[4] and other initiatives engaged in development of multimedia data management and in data exchange/sharing standards and protocols. MRTG was tasked with providing recommendations on how to mobilise multimedia resources in biodiversity through the GBIF network, with specific recommendations on the following aspects.

- Criteria for multimedia data sharing infrastructure
- Best practices for multimedia resources metadata exchange/sharing
- Estimation of the scale of multimedia resources in biodiversity
- Metadata schema(s) for multimedia data management, and data exchange / sharing
- Whether existing provider services such as DiGIR[5], TAPIR[6], BioCASe[7] will need to be altered, or new tool developed to handle these data types
- Ways to encourage potential data providers to participate in the

[3] Species Profile Model (SPM): http://wiki.tdwg.org/SPM
[4] TDWG: Biodiversity Information Standards (formerly known as Taxonomic Database Working Group), http://www.tdwg.org/
[5] DiGIR: http://digir.sourceforge.net/
[6] TAPIR: http://wiki.tdwg.org/twiki/bin/view/TAPIR/TapirLink
[7] BioCASe: http://www.biocase.org/

GBIF network for discovery of and access to multimedia resources

- Increasing involvement of industry leaders, and use of GPS[8] enabled mobile devices and other recording tools

Majority of these issues were discussed in detail by the Task Group.

3. Participants and Affiliations:

The Task Group was constituted on March 11, 2008 with Dr. Robert Morris, Professor of Computer Sciences, University of Massachusetts at Boston, United States of America as its Chair. Members of the group include:

- Greg Riccardi, Professor of Information Science, Florida State University, Tallahassee, United States of America.
- Greg Whitbread, Australian National Botanic Garden, Australia.
- Vijay Barve, Foundation for Revitalisation of Local Health Tradition, India.
- Gregor Hagedorn, Institute for Epidemiology and Pathogen Diagnostics, Federal Research Center for Cultivated Plants, Germany.
- Annette Olson, National Biological Information Infrastructure, US Geological Survey, Reston, VA, United States of America.
- Patrick Leary, Encyclopedia of Life, Marine Biological Laboratory, Woods Hole, MA, United States of America.
- Ivan Teage, ARKive, Wildscreen, United Kingdom.
- Eamonn O Tuama, Senior Program Officer for IDA[9], Global Biodiversity Information Facility, Copenhagen, Denmark.

[8] GPS: Global Positioning System, http://en.wikipedia.org/wiki/Global_Positioning_System
[9] IDA – Inventory, Discovery and Access is one of the work areas of GBIF Informatics thematic area.

- Vishwas Chavan, Senior Program Officer for DIGIT[10], Global Biodiversity Information Facility, Copenhagen, Denmark.

Vishwas Chavan, Senior Program Officer for DIGIT was the GBIF Secretariat coordinating officer for the Task Group.

4. Modus Operandi:

Given the geographical spread of the Task Group members, most of the business was conducted through an email mailing list, wiki and teleconferences. Email discussions are archived in GBIF Secretariat's LiveLink system. The MRTG wiki[11] can be accessed at http://wiki.gbif.org/gbif/wikka.php?wakka=MultimediaResourcesTaskGroup.

Two tele-conferences were held on 15th April 2008, and 22nd May 2008. In addition to these, MRTG also carried out a SurveyMonkey survey of potential observational data providers (publishers). The survey was commissioned in early May 2008 and concluded on 26th May 2008. Results of the survey are detailed in *Annexure 1*. Face-to-face meeting of MRTG was held at Copenhagen, Denmark during 19-21 June 2008 to priorities its recommendations, and determine the broad outline of the Multimedia Metadata Schema for Biodiversity[12].

5. Recommendations:

The Recommendations below consist of three items: the recommendation itself, a rationale, and a brief mention of what burdens will fall on GBIF (Secretariat and its Participants[13]). The Recommendations are characterized as: 1) those which are mostly social issues; and 2) those which are mostly technical issues.

Throughout this document, we distinguish metadata that describes multimedia and the multimedia resource itself (e. g., a digital or non-digital

[10] DIGIT: Digitisation and mobilisation of primary biodiversity data is one of the work areas of GBIF Informatics thematic area.
[11] MRTG Wiki: http://wiki.gbif.org/gbif/wikka.php?wakka=MultimediaResourcesTaskGroup
[12] Multimedia Metadata Schema for Biodiversity: Subgroup of MRTG met in Woods Hole, USA during 12-13 September to finalise the Multimedia Metadata Schema for biodiversity.
[13] GBIF Participants: This term is used in this report to represent wider community of GBIF national and thematic functionaries including NODES, data publishers (formerly known as data providers) as well as users who often provide feedback on the quality, and fitness-for-use of GBIF mobilised data.

image, audio, or video object or stream).

A. Recommendations about Social Issues:

Recommendation 1: GBIF multimedia mobilization efforts should recognize the range of breadth and depth of IT resources available to publishers[14] of biodiversity media. Training and tools for suitable for organisations with sophisticated organizations will not be the same as those for smaller providers using, for example, personal image management tools.

Rationale: Limited as it was, the survey reported that lack of funding and Information Technology resources represented the largest obstruction to participation.

Burdens: GBIF may have to select and advocate suitable mobilization platforms, commission standard practices for their use, and provide training in those practices.

Recommendation 2: GBIF should commission a Training Manual for Mobilisation of Multimedia Resources, and Training courses for mobilizing multimedia resources related to biodiversity.

Rationale: See Recommendation 1.

Burdens: Costs to GBIF of commissioning, publishing, and delivering courses.

Recommendation 3: GBIF should require that metadata about media resources is provided either without any restriction on its use or reproduction, or under a suitable open-content license (such as Creative Commons[15]). At the same time, GBIF should make it clear that this does *not* apply to the media resource itself. For resources, the metadata recommendations below are designed to insure that the copyright holders' resource usage terms or licenses are clearly available to users of GBIF.

Rationale: Metadata service should confirm to standard GBIF service practices. However, some publishers, notably commercial organization, may

[14]Publishers: Throughout this report term "Publishers" or "Data Publishers" has been used instead of "data providers" as used in previous GBIF reports and communications. GBIF facilitate discovery, and access to data.

[15]Creative Commons: http://creativecommons.org/

not permit widespread use of resources without license negotiation.
Burdens: On GBIF: production of suitable provider agreements.

Recommendation 4: Technical and social mechanisms should be developed to assist providers with the ability to license their resources. Creative Commons licenses[16] should be the preferred license in the absence of a choice by the user.
Rationale: The survey seems to suggest that large publishers are aware of licensing issues. Small publishers were not represented in the survey, but probably have less information about the differences between different kinds of licenses.
Burdens: GBIF may have to either (a) allow license terms to be purely textual, reducing the utility to software discovery mechanisms or (b) develop a machine-readable license metadata standard that provides the ability to detect that there are standard (e. g. CC) licenses applied.

Recommendation 5: GBIF data and metadata sharing agreement should provide that *if* a publishers's metadata supports thumbnail or other preview access (e.g. by a URL), then GBIF is granted the right to cache and display such a thumbnail.
Rationale: Recent court cases in the U.S. have found that thumbnail display is fair use under copyright laws. Not all copyright holders may agree with this decision, and the recommended policy is meant to prevent potential dispute.
Burdens: Imposes a provision burden which some providers might decline to accept on technical or policy grounds.

Recommendation 6: Develop a comparison table of metadata support tools, together with attributes that ease the provision of metadata when the metadata architecture is complete. Consider selecting some for support and

[16]Creative Commons license: Creative Commons (CC) is a non-profit organization devoted to expanding the range of creative works available for others to build upon legally and to share. The organization has released several copyright licenses known as Creative Commons licenses. These licenses allow creators to easily communicate which rights they reserve, and which rights they waive for the benefit of other creators (http://creativecommons.org/).

training.

Rationale: No matter what metadata standards are promulgated, adoption will be facilitated by useful management tools and hindered without such tools.

Burdens: MRTG and the current wiki can collect names of such tools. GBIF may wish to commission deeper review and analysis of such tools in connection with Recommendations 1 and 2.

Recommendation 7: Develop and implement a strategy to create a cultural change toward routine geo-referencing of multimedia resources for which a location is meaningful with emphasis on geo-coding as close as possible to the time of acquisition.

Rationale: Particularly for media, Google tools have received wide spread adoption. Other tools such as GeoPicSync may also provide scalable geo-coding for media collections.

Burdens: GBIF needs to evolve strategies and action plans to accomplish this across its Participants.

Recommendation 8: Mobilize massive geo-referenced acquisition of media at many, many places, e.g. exploit camera-equipped mobile phones, pocket cameras, and such other location-enabled consumer devices as may emerge.

Rationale: Multimedia acquisition by consumer devices is declining rapidly in price, and social sites for sharing the results have very large membership.

Burdens: GBIF will need to pursue discussions with "non-traditional" enablers of multi-media, such as mobile phone providers, camera manufacturers, multi-media social site operators such as Flickr[17], PicassaWeb[18], and YouTube[19] etc.

Recommendation 9: GBIF Participants should establish one or more national, regional, and thematic multimedia repositories with the same level of service as those for other data types.

[17] Flickr: http://www.flickr.com
[18] PicasaWeb: http://www.picasaweb.com
[19] YouTube: http://www.youtube.com

Rationale: Multimedia data have the same, or perhaps greater, utility to the broader biodiversity community than the occurrence-centered data now served by GBIF

Burdens: Possibly a major new direction for GBIF requiring further investment by its Participants.

B. Recommendations about Technical Issues:

Recommendation 10: Multimedia metadata should be supported in an indexing or caching service with machine and human interfaces, at both the collection level and the object level (image, audio, video, and drawing).

Rationale: Multimedia resources with appropriate data can serve a myriad of use cases, including: documenting occurrence at a place and time of species, ecosystems, species behavior and organism interactions, identification characteristics, and phenotypic and seasonal variation to name a few. Not all these use cases are limited to geo-referenced media.

Burdens: Marshalling resources across a wide variety of providers may impose IT burdens that some publishers cannot, or have no motivation, to accept. GBIF will have to provide a range of solutions to induce such providers to participate. Some examples are detailed elsewhere in this document.

Recommendation 11: The proposed GBIF Global Biodiversity Resource Discovery System (GBRDS), and its Integrated Publishing Toolkit (IPT) should support multimedia metadata and resources.

Rationale: Explicit implementation of Recommendation 10.

Burdens: GBIF must extend its current data type support in GBRDS and IPT.

Recommendation12: The design of required or recommended metadata should promote the ability of users of GBIF services to determine fitness for use without requiring the users to acquire the underlying resource. At a minimum licensing or other access control terms should be available through GBIF services.

Rationale: As in Recommendation 3, publishers may not be offering

unrestricted access to resources. It is particularly important that software agents not require human intervention to make an initial determination that a particular resource might be useful.

Burdens: GBIF may need to commission the development and periodic review of fitness-for-use mechanisms.

Recommendation 13: A single metadata schema should be developed that is able to treat resource collections and objects uniformly.

Rationale: Some media formats, e.g. JPEG2000[20], obscure the difference between a structured collection of media objects and a single object. In addition, some of the recommendations here, e.g. the fitness for use utility (Recommendation 12), apply equally to collections and objects.

Burdens: GBIF must design a quality assurance mechanism to insure that this recommendation becomes an enforceable requirement throughout the life cycle of any metadata schema. This implies that design requirement documents must be produced for the production, evaluation, and extension of any metadata schema. See also: Recommendation 10.

Recommendation 14: Controlled vocabularies for metadata values should be encouraged and supported technically, but plain text should be supported for these as well.

Rationale: Some Providers may have only tagging (folksonomy[21]) facility.

Burdens: For content metadata, these vocabularies are likely specialized to various disciplines, and not within the current purview of MRTG.. It is likely that the problem is shared by the SDD[22] and SPM activities of GBIF and TDWG, so perhaps a discussion should occur at the 2008 TDWG meeting, and in relevant wikis. Multimedia Metadata Drafting Group meeting during 12-13 September, 2008 at Woods Hole, USA addressed this problem for technical metadata (image acquisition details, formats, etc.) and social metadata (license terms, attribution, etc.)

[20] JPEG 2000: http://www.jpeg.org/jpeg2000/

[21] Folksonomy: Folksonomy (also known as collaborative tagging, social classification, social indexing, and social tagging) is the practice and method of collaboratively creating and managing tags to annotate and categorize content.

[22] SDD: http://www.diversitycampus.net/Projects/TDWG-SDD/

Best Practice: Mechanisms should be used that enable or guarantee critical record-level metadata to accompany multimedia resource through the GBIF network.

Rationale: Multimedia applications such as aggregators may render a resource in ways that do not reveal all metadata, which then become inaccessible to clients of that application.

Burden: Additional training in the use of these mechanisms may be necessary for GBIF Participants.

Recommendation 15: Make a provision in metadata schema to specify that that the copyright owner or available licenses are unknown.

Rationale: Some publishers have large numbers of such resources, and when contacted may be willing to research the issue. Such media might not be served by the publishers, but their existence should be discoverable.

Burdens: This creates a requirement on the designers of the metadata standard.

Recommendation 16: Support the identification of resources with publisher-defined GUID schemes in resource or collection level metadata.

Rationale: Media byte streams may be less in need of GUIDs than physical objects like specimens, because those streams can have hashcodes associated with them to tell whether an image is the "same" as an original. Providers can decide whether different byte streams (e. g., different resolutions) get the same GUID or not.

Burdens: GBIF must provide education and support for the issuance and management of GUIDs.

Recommendation 17: Metadata standards should support ability to express relations among described objects, e. g. that image I isMemberOf collection C.

Rationale: Mobilisation will encounter a wide variety of organization of repositories. Discovery mechanisms will need to understand how to dig into them either to find images or to find subcollections.

Burdens: Multimedia Metadata Drafting Group considered this at its meeting during 12-13 September 2008 held at Woods Hole, USA. If semantics is imposed, they will need to be expressible by whatever transport mechanisms are in place and the target has to be able to map the concept into its own organization.

Best Practice: GUIDs should be accompanied by some kind of expiration indication if not persistent.

Best Practice: Normalization principles for metadata, should conform to TDWG or GBIF best practices, e.g. nation names should be offered as ISO country codes.

Recommendation 18: Provide services for geomancy (geo-referencing) and scientific name recognition

Rationale: Increase the utility of tagged data

Burdens: If provided metadata is to be unedited, may need to define a metadata annotation mechanism.

Recommendation 19: Metadata schema should allow support for the relation "documents", which asserts that a multimedia object provides evidence for an assertion that something else (e. g. an observation) is a GBIF primary biodiversity datum in the sense of species occurrence, ecosystem occurrence, behavioral occurrence, etc.

Rationale: The initial GBIF purpose is to document occurrence.

Remark: Multimedia Metadata Drafting Group has considered this at its Woods Hole, USA meeting during 12-13 September 2008.

Recommendation 20: MRTG should propose a lightweight metadata schema by combining existing schemata of KeyToNature[23], the NBII Digital Image Library[24], and Morphbank[25].

Rationale: With the addition of georeferencing this could lead to a consensus schema that will certainly allow use of multimedia resources and

[23]KeyToNature: http://www.keytonature.eu/wiki/Main_Page
[24]NBII Digital Image Library: http://images.nbii.gov/
[25]Morphbank: http://www.morphbank.net/

its metadata various kinds of biodiversity research and analysis.

Burdens: Although already drafted by the Multimedia Metadata Drafting Group in its Woods Hole, USA meeting during 12-13 September 2008, follow up discussion is expected in the 2008 TDWG meeting, and the schema must be shepherded through the standards processes of TDWG and other relevant standards bodies.

Recommendation 21: Metadata should be able to specify media formats, including proprietary ones. Specification mechanism should be extensible. No particular format should be endorsed.

Rationale: Applications that acquire the actual images may be helpless without such metadata.

Remarks: This has been addressed by the Multimedia Metadata Drafting Group at its Woods Hole, USA meeting held during 12-13 September 2008.

Recommendation 22: Develop metadata specifications that allow specification of media manipulation by the provider after acquisition.

Rationale: Publishers may crop, rotate, adjust colors or contrast in the media they serve. Some of these may or may not impact one or another fitness for use. For several use cases it is important to understand certain – not otherwise visible – manipulations, to determine the fitness-for-use for a given use case.

Burdens: This has been addressed by the Multimedia Metadata Drafting Group at its Woods Hole, USA meeting held during 12-13 September 2008.

Recommendation 23: Provide users of tagging systems (like Flickr, PicassaWeb, etc.) with facility for bulk assignment of metadata to media served by those systems.

Rationale: Reduce the barrier to participation

Burdens: This requires the development of Best Practices for the use of these systems.

Recommendation 24: Collaboratively with community and platform publishers, develop demonstration sites exhibiting practices which raise the utility of their media for science, environment protection, and education.

Rationale: This would both serve and engage the community.

Burdens: MRTG and GBIF need to identify the sub-communities and recruit evangelists in them to do this. This probably involves representatives from the operators of the sites, whether those are social networks or individual repositories.

See also: Long term Recommendation 25, which is a special case of this recommendation.

C. Long Term Recommendations:

Recommendation 25: Develop demonstration sites for Flickr and similar other public folksonomy-based public multimedia repositories to demonstrate best practice for their tagging and machine API facilities.

Rationale: Try to raise awareness of need for Entity-Attribute-Value architectures compared to folksonomies.

Burdens: Same as Recommendation 24 of which this is a special case.

Recommendation 26: Stimulate and encourage innovation around removing the human time intensive nature of metadata assignment, such as is provided by tools like BioGeomancer[26] and Herbis[27].

Rationale: If assignment takes minutes/image the end is nowhere near in sight.

Burdens: This should be considered as part of the evaluation of metadata tools which is pre-requisite to Recommendation 6.

Recommendation 27: Organize collaboration with organizations, (e.g. NBII) with experience in motivating disparate stakeholders towards developing strategies for mobilizing them.

Rationale: Too many pictures, not enough scientists… Some groups, e.g.

[26] Biogeomancer: http://www.biogeomancer.org/
[27] HERBIS: http://www.herbis.org/

Citizen Science groups, may have training but lack services. Others, e.g. some Flickr groups may have services but lack training.
Burdens: GBIF will need to organize further workshops oriented toward social issues.

Recommendation 28: Develop mechanisms to allow providers to specify that appropriate metadata, particularly terms of use, be provided at the collection level, but be served "by inheritance" as sub-collection or as record level metadata for objects in the collection.
Rationale: Ease the burden of providers who wish to put some of the same metadata on all objects in a collection
Burdens: The metadata schema may have to have inheritance mechanisms, and tools may need development of training as for Recommendation 23.

6. Summary:

During its prototype phase, GBIFs focus has been to tap low hanging fruit, especially those dealing with specimen- and observation-based primary biodiversity datasets. GBIF currently facilitate access to 145 million primary biodiversity records. MRTG understand that the GBIF Work Programme 2009-2010 is setting target of discovery of datasets totaling 5 billion primary biodiversity records, and mobilisation of 2 billion records through its Participants and non-participant networks.

Under these circumstances it becomes imperative that GBIF explores the feasibility of extending its data types beyond specimen and observation based primary biodiversity records. Therefore, it was timely to commission this Task Group to investigate how to mobilise an ever increasing number of of "fit-for-use" biodiversity related multimedia resources. Recognising the urgency of mobilising these resources and their metadata, MRTG not only debated on multiple aspects of multimedia resources mobilisation, but also invested its energy in developing the "Multimedia Resources Metadata Schema for Biodiversity".

The MRTG realises the vast potential both within and outside the GBIF network to channel the heterogeneous and distributed biodiversity-related

multimedia resources through multi-cultural data publishers and partners. The MRTG believes that, if implemented as early as possible, these 28 recommendations, as detailed in the preceding sections, together with the adoption of "Multimedia Resources Metadata Schema" will help GBIF to fulfill its aspirations of providing access to billions of primary biodiversity records in the next few years. If achieved, it would transform GBIF from a mega-science initiative into a truly Global Information Infrastructure that would not only be able to help channel the participation of not only biodiversity researchers, but those of citizen scientists at large!

Annexure 1

Results of the Survey of Multimedia Resources Providers

GBIF's Multimedia Resources Task Group conducted an online survey of multimedia resources related to biodiversity during May 5-27, 2008.

The major objective of this survey was to understand the extent of potentially useful, sharable biodiversity multimedia resources (images, audio, video, etc.) and repositories that hold them.

The survey was also intended to (a) discover the current barriers to sharing these multimedia resources in the public domain, and (b)determine the degree to which each resource is tagged with data elements (e.g. what, when, where, by whom and how) that are essential to facilitating its potential use as a species occurrence record. Survey further asked permissions of the custodians and/or developer to publish the attributes and URL of public repository.

Of the 210 respondents who undertook the survey 61% (128) were familiar with GBIF as against 38.1% (80) who did not know much about GBIF. Some of the salient outcomes of the survey in listed below.

- Estimates of distinct resources with attributes held in repositories - 93% of the distinct images are held in repositories with definite attributes (such as scientific names, geo-references, etc.) as against 27.5% drawings, 25.6% audios and 21.6% videos.
- Entire repository or subgroup - 87.3% respondents (48) reported for entire repository, while only 12.7% (7) reported subgroup managed by them at a public repository such as Flickr, PicassaWeb, etc.
- Nos. of Images - 23.6% (13) repositories hold fewer than 1000 images. 36.4% (20) repositories hold between 1000 to 9999 images, where in 18.2% (10) hold up to 49999, 18.2% (10) up to 99999. Only 3.6% (2) repositories hold up to 499,999 images.
- Nos. of Drawings - 52.4% (11) repositories hold fewer than 1000 drawings. 38.1% (8) repositories hold between 1000 to 9999 drawings, where in 4.8% (1) hold up to 49999.

- Nos. of Audios - 83.3% (15) repositories hold fewer than 1000 audios. 11.1% (2) repositories hold between 1000 to 9999 audios.
- Nos. of Videos - 87.5% (14) repositories hold fewer than 1000 videos. 6.3% (1) repositories hold between 1000 to 9999 videos.
- Attributes and applications for Images - 37 (68.5%)repositories reported that all their images do have scientific names associated with it, where in 8 (14.8%) repositories have 3/4th of their images with scientific name attribute. 16 (31.4%) repositories reported that all the images do have common name attribute, where in 6 (12.5%) repositories reported that all the images have associated latitude/longitude information. 28 (51.9%) repositories do have all images with their place name information. 31.9% (15) repositories have APIs for image acquisition by internet applications for all their image holdings. 27.3% (12) repositories reported that all their images are with API for metadata or tag acquisitions.
- Attributes and applications for drawing – 70% of the repositories reported that all its drawing have scientific name attributes, as against 13% common names. 35% of the repositories have place names associated with all the drawings.
- Attributes and applications for audios – 46% repositories reported that all audios have scientific name attributes and 23% repositories with all its audios with associated common name information.
- Attributes and applications for videos - 46% repositories reported that all videos have scientific name and common name attributes.
- Repository themes - 71% (32) repositories are dedicated to a particular theme (e.g. invasive species, arctic biota, marine fauna, etc.) and same dedicated to groups of organisms. 64.4% repositories are location specific.
- Organisation and/or subgroup holding the repository – 92.6% (50) respondents stated that their organization or sub group hold the repository.
- Authorisation to publish the repository description – 96% (51) respondents stated that they authorize GBIF to make the descriptive information for the repository public.

- Barriers – 64% (31) respondents cited funding as major barrier to share multimedia resources in the repository. 60% (29) cited management time as the major reason. 50% (24) cited lack of attribution, credit, and acknowledgement to media owner as reason not to share. 41% (20) had concerns about misuse or other abuse of the media. IT resources are barriers as per 31% (15) respondents; where in 23% (11) felt that scientific expertise is another barrier.
- Participation – 77% (37) respondents expressed their interest in participation if GBIF organizes multimedia resources services such as portals, discovery, indexing, catching or serving media and metadata.