WP5 Open Science Support

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Agenda

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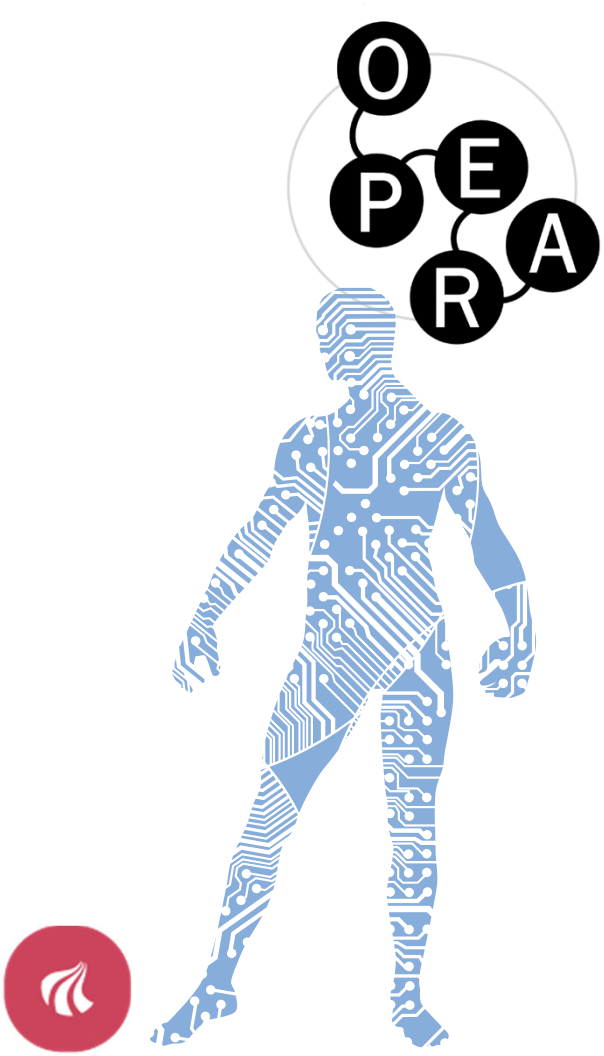

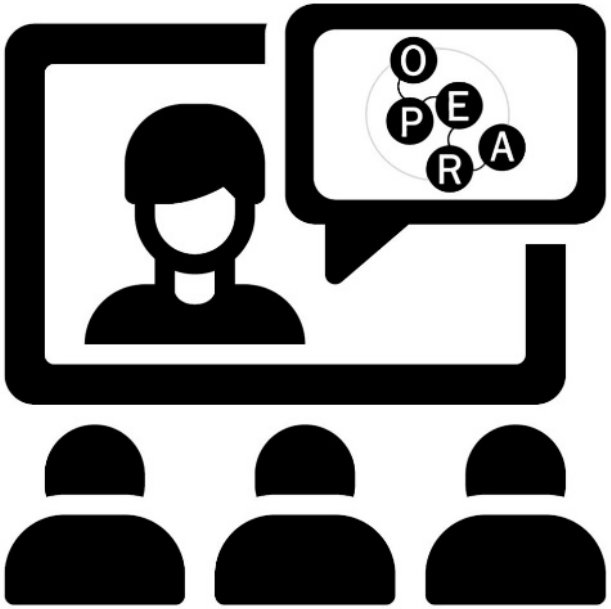

Introduction

The OPERA project
WP5 on Open Science support

WP5 Open Science Support

WP5 aims at finding and evaluating ways Open Science efforts may form part of research analytics, metrics and evaluation
– and to prepare the inclusion of some of these approaches in analytics platforms like NORA
- and test them

<u>Status</u>:

- **review** of open science manifestos - in draft
- **review** of open data indicators - ready
- **usability test of NORA** with relevant stakeholders - planned

WP5 Open Science Support

Participants

- **Birger Larsen** (WP lead), Aalborg University
- **David Budtz** (deputy lead), Aalborg University
- **Pelle Annfeldt Israelsson**, Aalborg University
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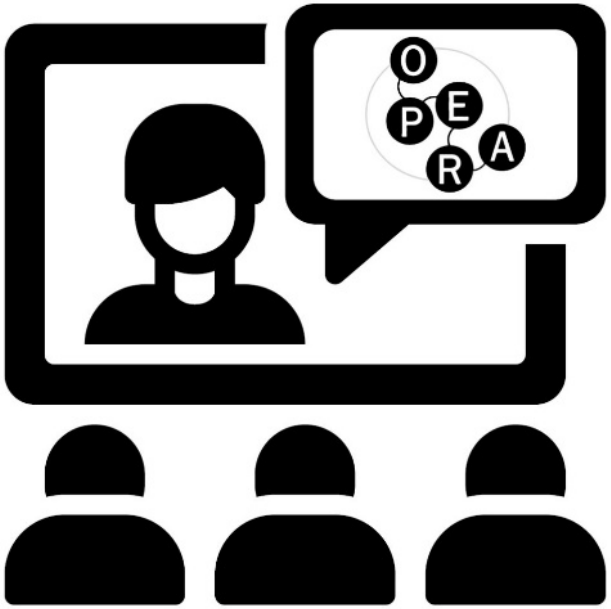
- **Karen Hytteballe Ibanez**, Technical University of Denmark
- **Karsten Kryger Hansen**, Aalborg University Library
- **Nils Thideman**, Aalborg University Library
- … and others



Open Science efforts

Defining Open Science
The complexity of Open Science
Measuring Open Science?

def. Open Science

"Open Science has the potential to increase the quality, impact and benefits of science and to accelerate advancement of knowledge by making it more reliable, more efficient and accurate, better understandable by society and responsive to societal challenges, and has the potential to enable growth and innovation through reuse of scientific results by all stakeholders at all levels of society, and ultimately contribute to growth and competitiveness of Europe."

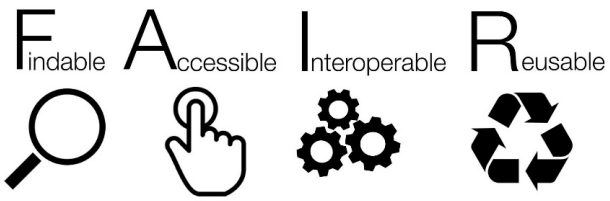
– Competitiveness Council, 2016

What?

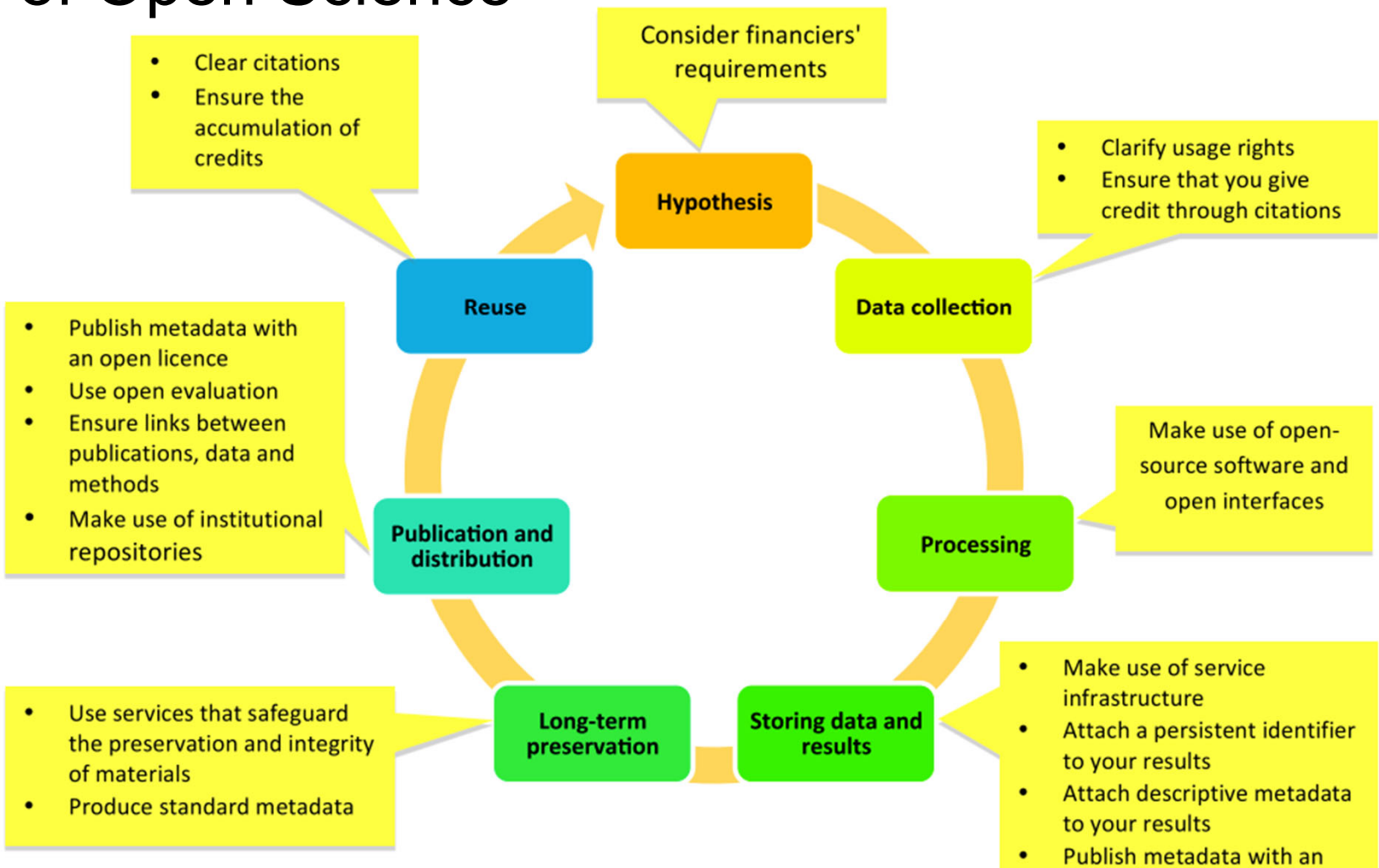
FOSTER defines Open Science (OS) as the practice of science in such a way that others can collaborate and contribute, where research data, lab notes and other research processes are freely available, under terms that enable reuse, redistribution and reproduction of the research and its underlying data and methods.

def. Open Science

- Open Science movement across scientific fields
- Manifestos and Principles
  - **Amsterdam Call for Action on Open Science** → "data sharing and stewardship" environment
  - **FAIR Guiding Principles for Open Data**
- Reproducibility crisis? → need for high quality **open** data



Complexity of Open Science



[Open Science and Research Handbook (2014)]

Complexity of Open Science

fteval JOURNAL
for Research and
Technology Policy Evaluation

September 2017, Vol. 44, pp. 50 -56
DOI: 10.22163/fteval.2017.276

NEW INDICATORS FOR OPEN SCIENCE

POSSIBLE WAYS OF MEASURING THE UPTAKE AND IMPACT OF OPEN SCIENCE

DIETMAR LAMPERT, MARTINA LINDORFER, ERICH PREM, JÖRG IRRAN AND FERMÍN SERRANO SANZ

7 Open Science aspects (Lampert et al., 2017)

- **A. The scientific process**
  1. Conceptualization and data gathering/creation
  2. Analysis
  3. Diffusion of results
  4. Review and evaluation
- **B. The system level**
  5. Reputation system, recognition of contributions, trust
  6. Open science skills and awareness
  7. Science with society

Quality of metadata	mean rating (0..10 max.)
quality of metadata (versioning, volume, data format, description of fields, etc.)	8.2
PU R RFO	

1. Conceptualization and data gathering/creation

Figure 1: Stakeholder groups - abbreviations and colour

R	researchers
RO	research (conducting) organisations
RFO	Research-funding organisations
PM	policy-makers
PU	publishers

Requirements from research funders	mean rating (0..10 max.)
% of research funders that mandate the provision of the data / software code produced in the context of the funded activity AND who mandate the conformity to data (exchange) standards	7.9
RFO PM	

Accessibility	mean rating (0..10 max.)
accessibility of open data / code as % of all data / code produced by publicly (co-)funded projects	9.1
R RO RFO	

Machine-readable	mean rating (0..10 max.)
% of machine-readable data / metadata	7.9
PU R RFO	

Availability of metadata	mean rating (0..10 max.)
availability of explanatory metadata as % of all available data (resulting from publicly (co-)funded research)	7.5
PU R RFO	

Quality of metadata	mean rating (0..10 max.)
quality of metadata (versioning, volume, data format, description of fields, etc.)	8.2
PU R RFO	

Simulation results	mean rating (0..10 max.)
usability of simulation results (models, data, and code)	7.5
R RFO PU	

Data services	mean rating (0..10 max.)
(types of) open data services offered	8
PU R RO	

Data compilation/publication costs incorporated	mean rating (0..10 max.)
% of funded projects incorporating costs for data compilation / publication and maintenance (of the repository/data sets)	7.6
PM RFO RO	

Long-term availability	mean rating (0..10 max.)
is the (long-term) availability of the data guaranteed (availability of a sustainability plan (yes/no))	8.2
RFO RO PM	

Sharing policies	mean rating (0..10 max.)
# of sharing policies in research organisations (sharing of data, organisms, etc.)	7.6
RO	

5. Reputation system, recognition of contributions, trust

Figure 2: Roles in the scientific process. Source: Liz Allen et al. (2014): Credit where credit is due; Amy Brand, Liz Allen, Micah Altman et al. (2015): Beyond authorship: attribution, contribution, collaboration, and credit.

Term	Definition
Conceptualization	Ideas; formulation or evolution of overarching research goals and aims
Methodology	Development or design of methodology; creation of models
Software	Programming, software development; designing computer programs; implementation of the computer code and supporting algorithms; testing of existing code components
Validation	Verification, whether as a part of the activity or separate, of the overall replication/reproducibility of results/experiments and other research outputs
Formal Analysis	Application of statistical, mathematical, computational, or other formal techniques to analyze or synthesize study data
Investigation	Conducting a research and investigation process, specifically performing the experiments, or data/evidence collection
Resources	Provision of study materials, reagents, materials, patients, laboratory samples, animals, instrumentation, computing resources, or other analysis tools
Data curation	Management activities to annotate (produce metadata), scrub data and maintain research data (including software code, where it is necessary for interpreting the data itself) for initial use and later reuse
Writing – Original Draft	Preparation, creation and/or presentation of the published work, specifically writing the initial draft (including substantive translation)
Writing – Review & Editing	Preparation, creation and/or presentation of the published work by those from the original research group, specifically critical review, commentary or revision – including pre- or post-publication stages
Visualization	Preparation, creation and/or presentation of the published work, specifically visualization/data presentation
Supervision	Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team
Project Administration	Management and coordination responsibility for the research activity planning and execution
Funding acquisition	Acquisition of the financial support for the project leading to this publication.

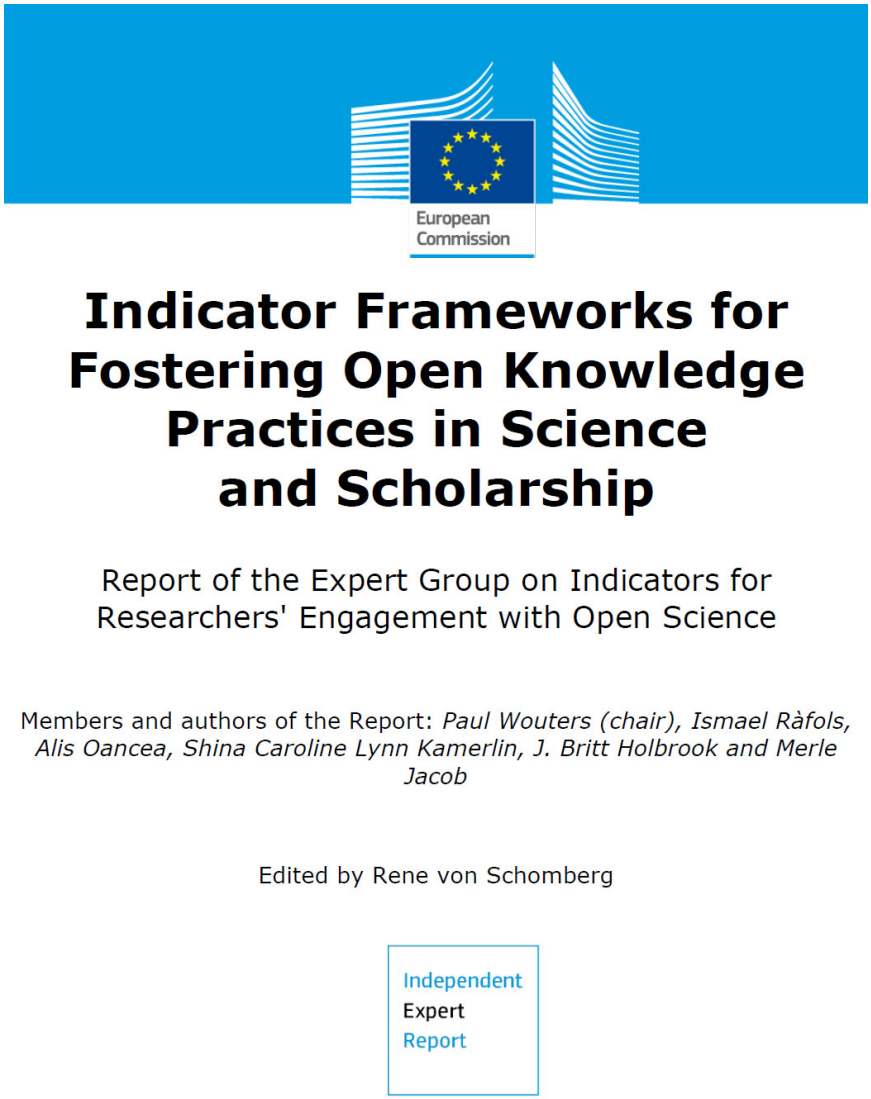
6. Open science skills and awareness - e.g. curating and maintaining large data sets

7. Science with society - promotion of the engagement of citizens in science and research

e.g. OPERA WP2

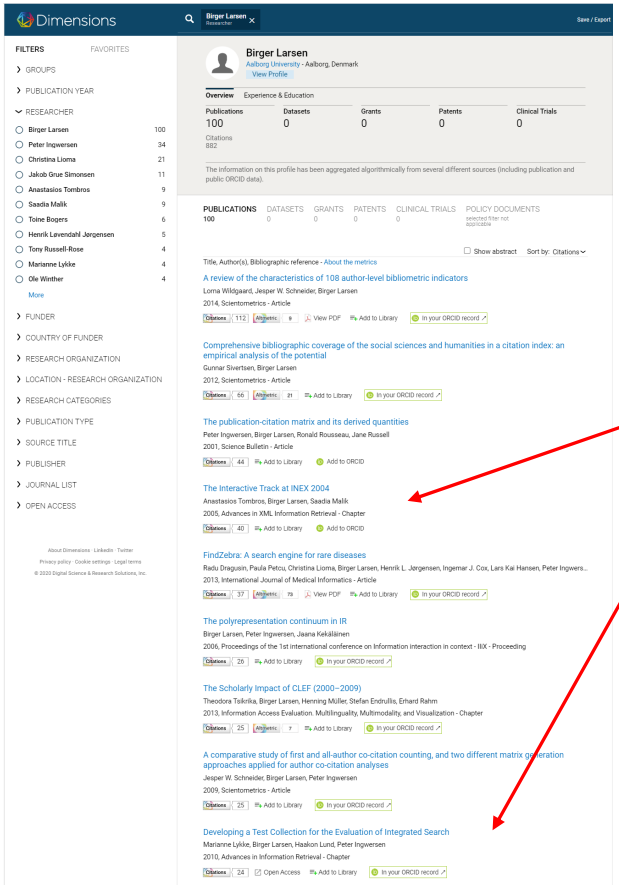
Should we measure Open Science?

- Long awaited report…
- Very reluctant to propose concrete indicators; afraid of adverse affects
- Recommends to develop 'Indicator Frameworks' and 'Toolboxes' "…to **guide the responsible development, interpretation, and use of indicators by policy makers, research management and researchers**…"
- The **frameworks** enable the collective definition of the evaluative needs given the context of the research field and the epistemic culture in the relevant communities
- The **toolboxes**, on the other hand, are oriented towards more technical questions, and are based on the collective expertise of the relevant communities



An egocentric example…

… of the impact of Open Data = personal motivation



data →

data →

data →

Birger Larsen

FOLLOW

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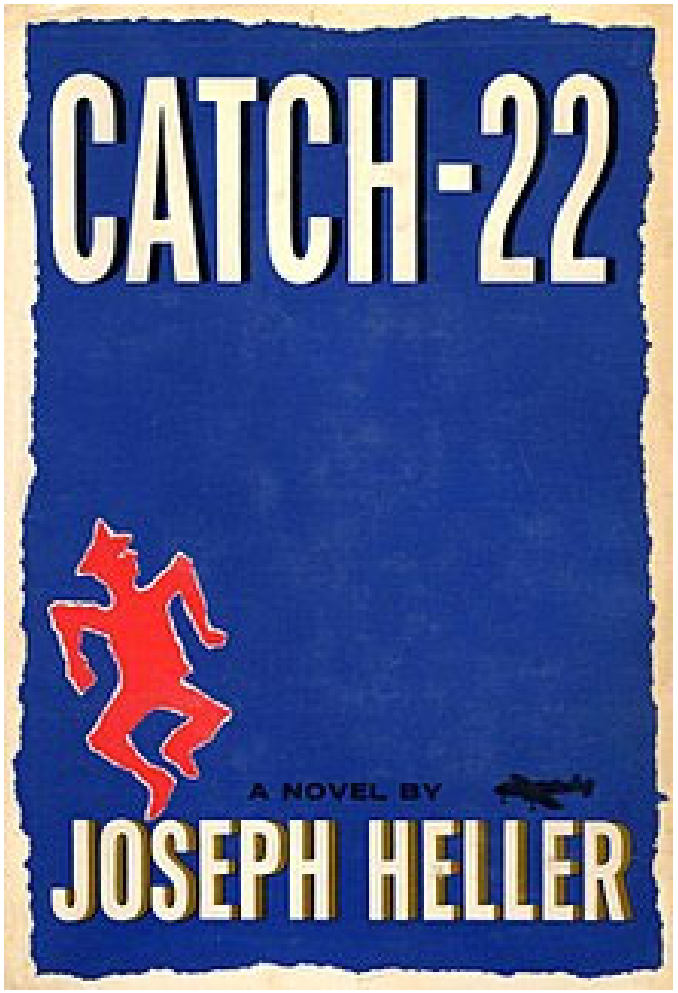
Verified email at hum.aau.dk - Homepage
Information Retrieval Digital Libraries Informetrics Bibliometrics

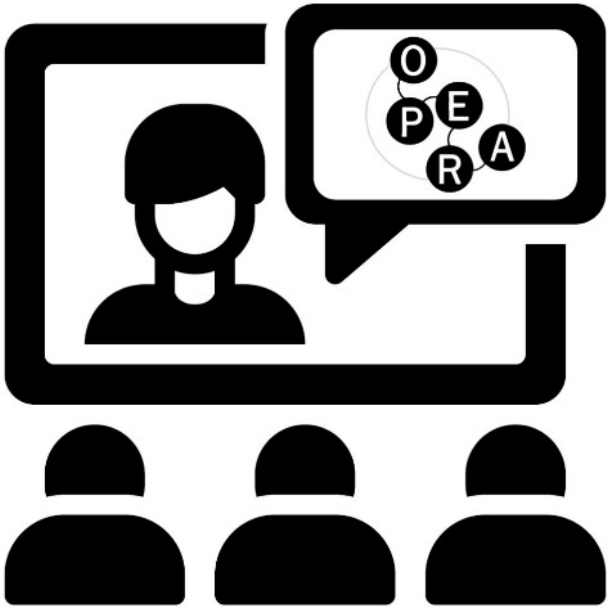
TITLE	CITED BY	YEAR
A review of the characteristics of 108 author-level bibliometric indicators L Wildgaard, JW Schneider, B Larsen Scientometrics 101 (1), 125-158	141	2014
Comprehensive bibliographic coverage of the social sciences and humanities in a citation index: An empirical analysis of the potential G Sivertsen, B Larsen Scientometrics 91 (2), 567-575	121	2012
The publication-citation matrix and its derived quantities P Ingwersen, B Larsen, R Rousseau, J Russell Chinese Science Bulletin 46 (6), 524-528	84	2001
Developing a test collection for the evaluation of integrated search M Lykke, B Larsen, H Lund, P Ingwersen European Conference on Information Retrieval, 627-630	72	2010
The interactive track at INEX 2004 A Tombros, B Larsen, S Malik International Workshop of the Initiative for the Evaluation of XML Retrieval …	63	2004
FindZebra: a search engine for rare diseases R Dragusin, P Petcu, C Lioma, B Larsen, HL Jørgensen, IJ Cox, ... International Journal of Medical Informatics 82 (6), 528-538	59	2013
The polyrepresentation continuum in IR B Larsen, P Ingwersen, J Kekäläinen Proceedings of the 1st international conference on Information interaction …	49	2006
Supporting polyrepresentation in a quantum-inspired geometrical retrieval framework I Frommholz, B Larsen, B Piwowarski, M Lalmas, P Ingwersen, ... Proceedings of the third symposium on Information interaction in context …	48	2010
Applying diachronic citation analysis to ongoing research program evaluations P Ingwersen, B Larsen, I Wormell The Web of Knowledge: A Festschrift in Honor of Eugene Garfield, Information …	48	2000
Influence of a performance indicator on Danish research production and citation impact 2000–12 P Ingwersen, B Larsen Scientometrics 101 (2), 1325-1344	41	2014
The interactive track at INEX 2005 B Larsen, S Malik, A Tombros International Workshop of the Initiative for the Evaluation of XML Retrieval …	41	2005

Open Science summary

- Large movement, backed by central actors
- Hard not to agree to visions
- Huge potential impact for science and society

- Complex…
- Not for free through… Incentives?
- How to measure? Any reliable data available?





Data and indicators for Open Data

Initial WP5 results
Examples of data and indicators

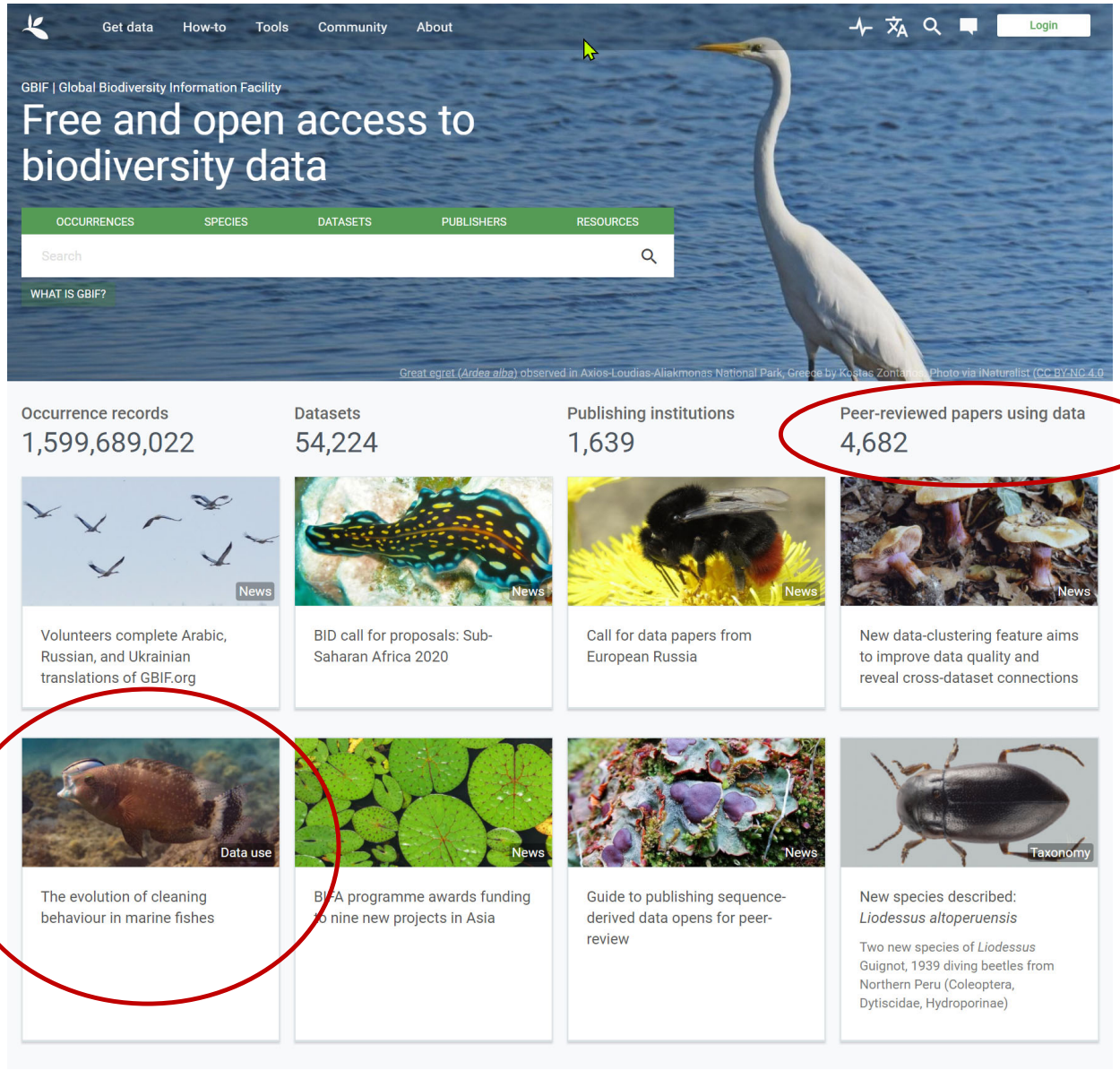
OPERA WP5 Review of Existing and Proposed Indicators for Open Science Activities

- Review WP5B: examine existing and proposed indicators for Open Science activities with a focus on data sharing in fields that have a long tradition for Open Data. We aim to select the most relevant and promising indicators for inclusion in Research Analytics Platforms and Research Information Systems
- **Motivation**: A prerequisite for making data sharing visible is an understanding how agencies, organisations, platforms and repositories facilitate data sharing, either as part of the Open Sciences movement or as part of the traditions within their field
- We therefore examine central examples of how existing data portals operate and how data sharing and data citation is facilitated in them

Examples

- Physics, astronomy, space and environment research are all datacentric fields of research
  - ***NASA*** was chosen as a representative of how research data are shared between researchers in a multifaceted scientific community
  - The ***Global Biodiversity Information Facility (GBIF)*** was selected because it illustrates how data collected by researchers across the world are created and shared in order to understand nature, and as it is a good example of the needs for standardisation of datasets and data citation practices
- Several new initiatives are aiming to collect and mediate open data
  - ***Mendeley data*** is a new initiative from Elsevier creating a data repository connected to their existing publishing and library platform
  - ***Google Dataset Search*** *(beta)* utilises the Google search engine to identify datasets across the web and the different existing data depositories making these datasets accessible from a single-entry point

- GBIF - the Global Biodiversity Information Facility – was established in 2001 based on an OECD memorandum of understanding. GBIF is an international network and research infrastructure funded by the world's governments and aimed at **providing anyone, anywhere, open access to data about all types of life on Earth**
- The GBIF repository was created so that the knowledge for the natural world could expand and dissemination in a manner that avoids duplication of effort and expenditure. GBIF acts as coordinator and provides institutions with the common standards and open-source tools which enable participants to engage with the natural scientific community
- A typical dataset consists of counts of some species in certain locations. The current number of datasets can be seen in the GBIF search engine: at the time of writing a total of **52,434 datasets**, including 19,427 occurrence datasets, 31,237 checklist datasets, 1,457 sampling events and 303 metadata datasets
- GBIF itself is more interested in the **number of species included** its data – which cannot easily be counted as a single number but lies somewhere between 1 and 2.3 million. Also of interest is the **number of occurrences of species**, which is more than 1.5 billion in GBIF at present


Get data
How-to
Tools
Community
About
Login
GBIF | Global Biodiversity Information Facility
Free and open access to biodiversity data
OCCURRENCES
SPECIES
DATASETS
PUBLISHERS
RESOURCES
Search
WHAT IS GBIF?
Great egret (Ardea alba) observed in Axios-Loudias-Aliakmonas National Park, Greece by Kostas Zontanos. Photo via iNaturalist (CC BY-NC 4.0
Occurrence records
1,599,689,022
Datasets
54,224
Publishing institutions
1,639
Peer-reviewed papers using data
4,682
News
Volunteers complete Arabic, Russian, and Ukrainian translations of GBIF.org
News
BID call for proposals: Sub-Saharan Africa 2020
News
Call for data papers from European Russia
News
New data-clustering feature aims to improve data quality and reveal cross-dataset connections
Data use
The evolution of cleaning behaviour in marine fishes
News
BIFA programme awards funding to nine new projects in Asia
News
Guide to publishing sequence-derived data opens for peer-review
Taxonomy
New species described: Liodessus altoperuensis
Two new species of Liodessus Guignot, 1939 diving beetles from Northern Peru (Coleoptera, Dytiscidae, Hydroporinae)

GBIF Global Biodiversity Information Facility

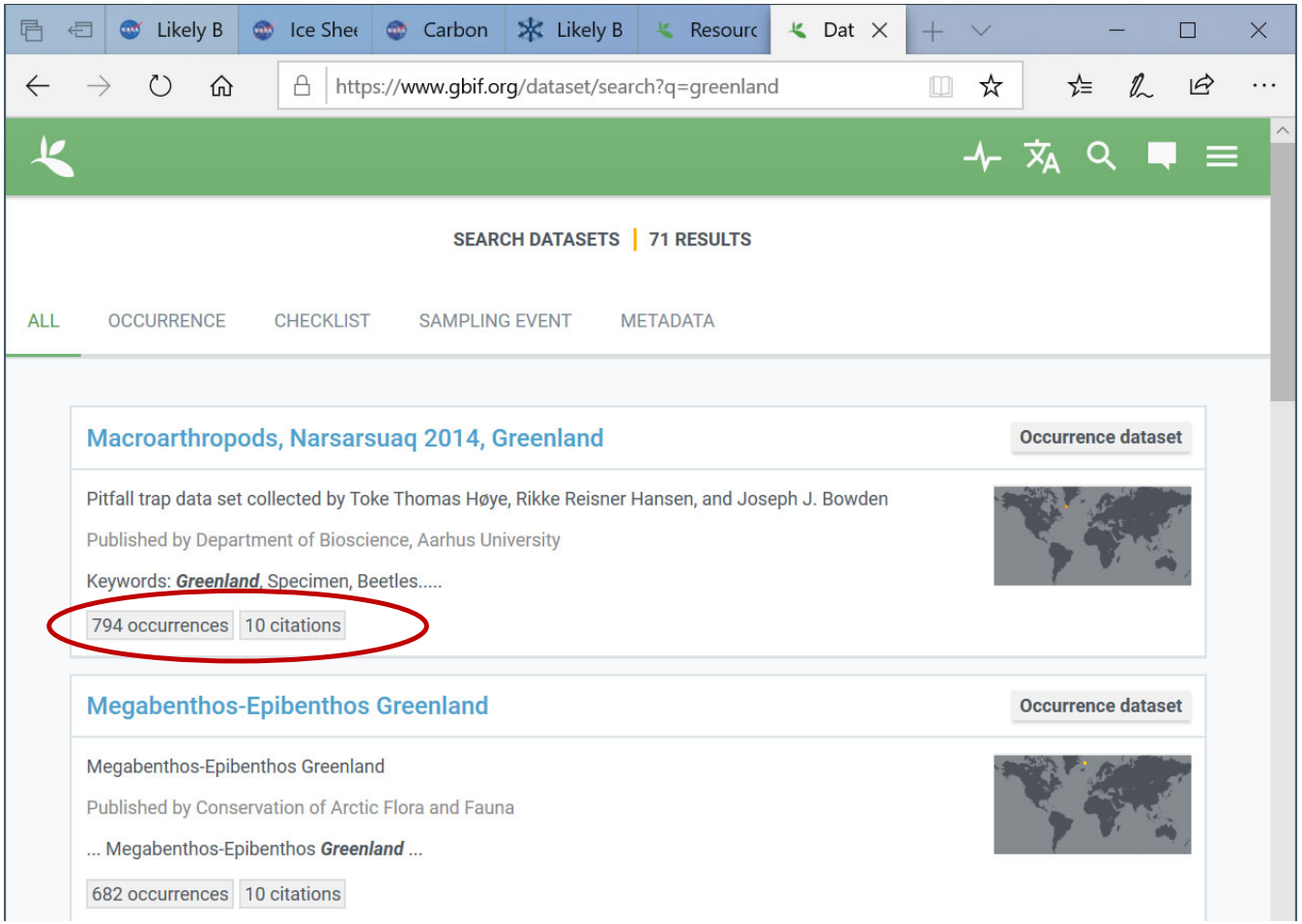
- GBIF requires users who download individual datasets or search results and use them in research or policy to **cite them using a DOI**
- **Detailed citation guidelines are provided**, including instructions for how to cite downloads with multiple datasets, individual datasets, datasets accessed through third-party tools (such as python or R), as well as custom datasets exports
- **Users must be registered to download**. To aid users an email with dataset specific citation instructions is sent every time a dataset is downloaded, and a list of all downloaded datasets are listed in each user's profile to further aid correct citation
- Note that **downloads often consist of data selected from multiple datasets**, e.g. someone interested in bumblebees (*genus Bombus*) would get results for the over 250 species of bumblebee from datasets that include these. Such downloads with selected data from multiple datasets are assigned their own unique DOI

GBIF Global Biodiversity Information Facility

- GBIF also **actively searches for research uses and citations** of biodiversity information accessed through GBIF's global infrastructure
- **Daily searches** are carried out in Google Scholar, Scopus, Wiley Online Library, SpingerLink, NCBI Pubmed and bioRxiv, and the **results are curated** and added to a database from which **citation statistics** can be extracted
- These citing articles are shown on the main http://gbif.org search page when searching for datasets with details available on each dataset page and can also be searched directly

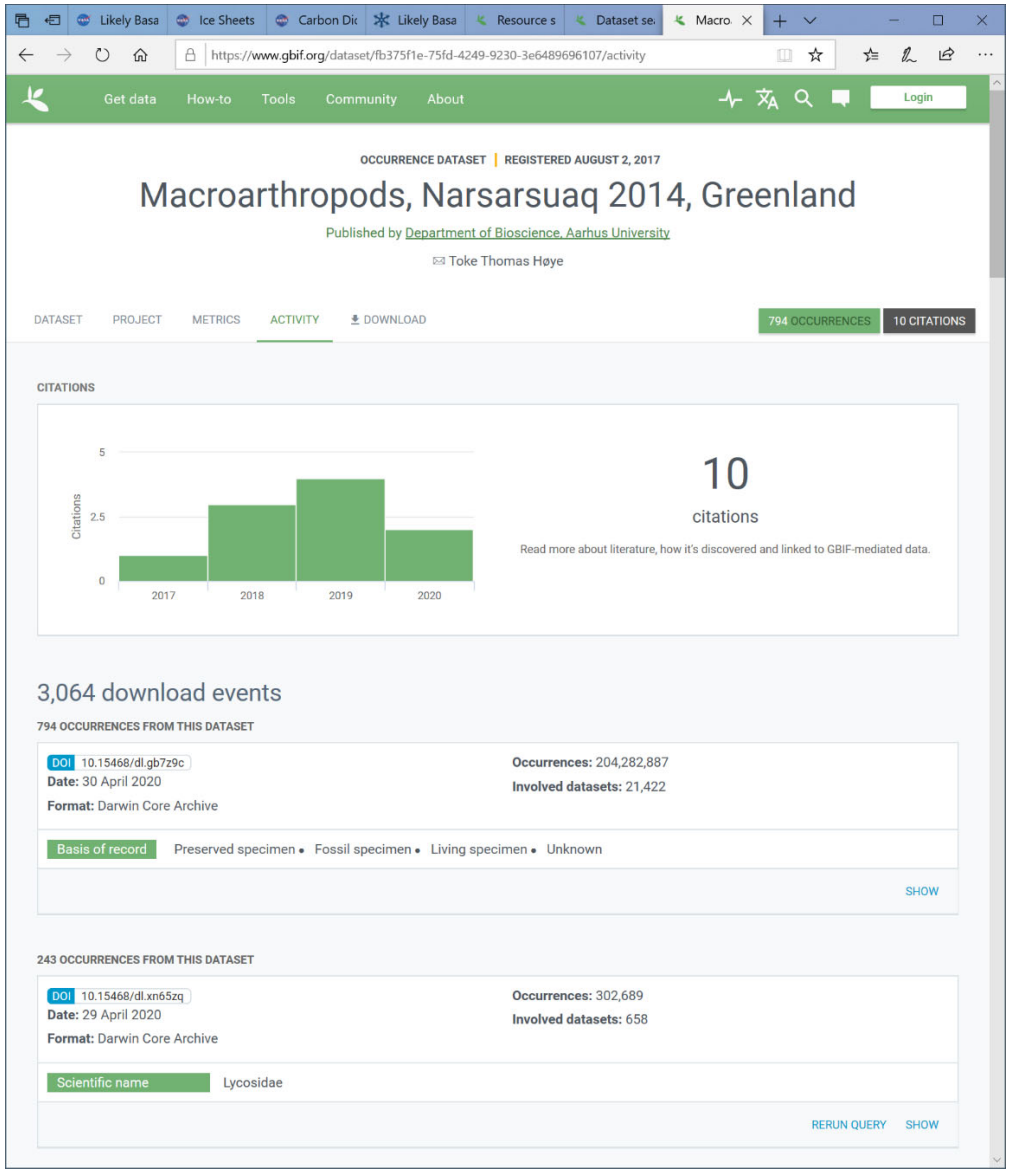
GBIF Global Biodiversity Information Facility

- *GBIF example dataset search results – including data set size and number of citing publications*



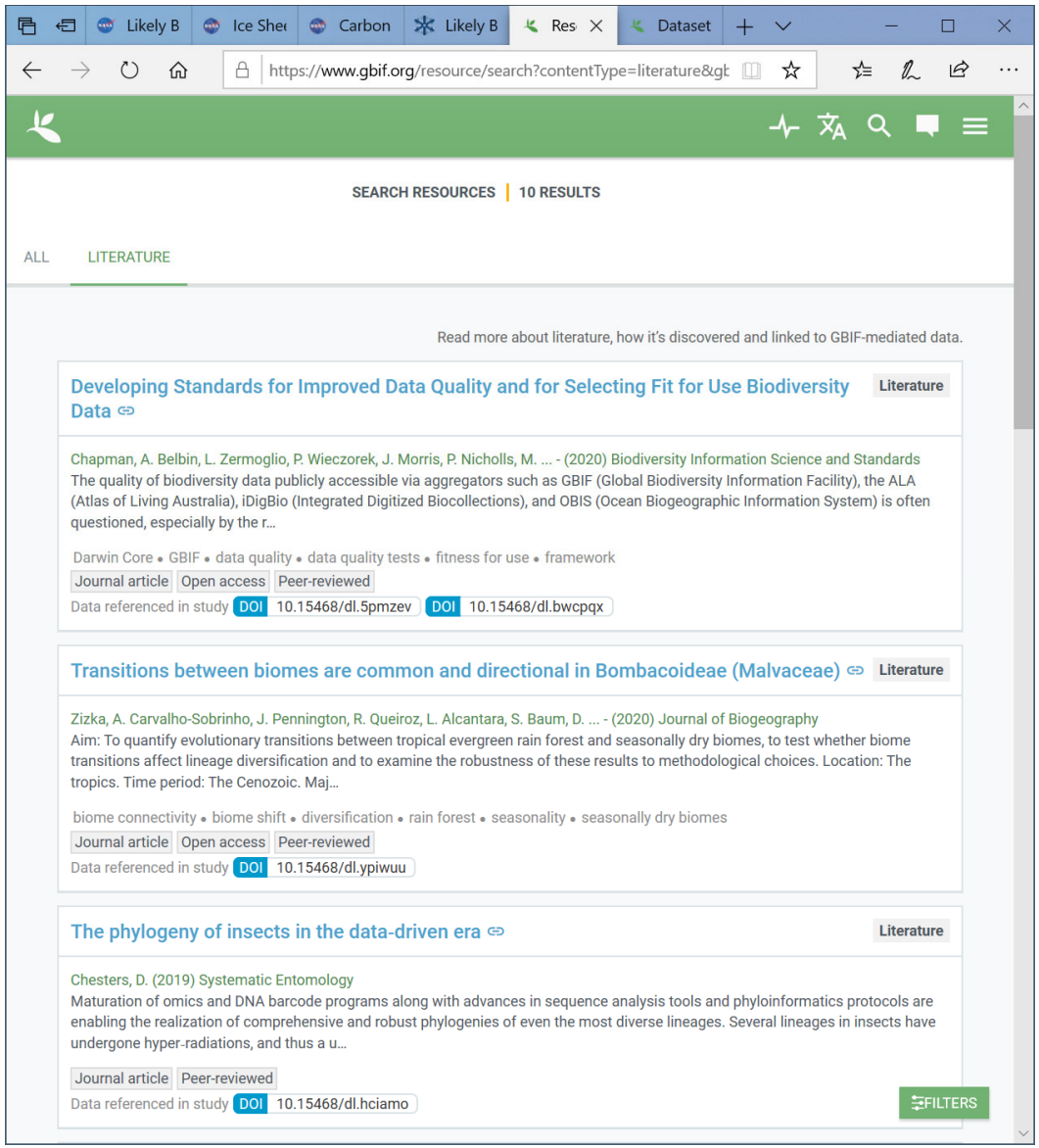
GBIF Global Biodiversity Information Facility

- *GBIF dataset example – with citation and download details*
- *The dataset has 794 occurrences – in some cases all were included in the 3,064 download events, in other cases only some of the occurrences*



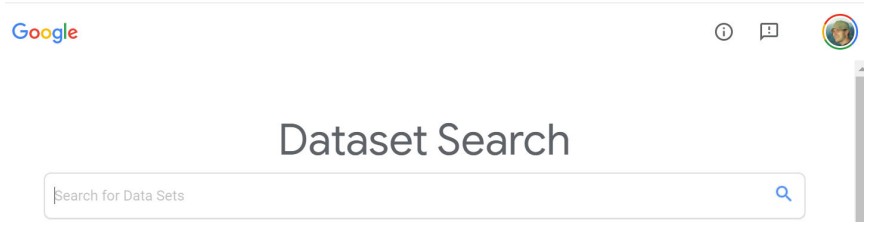
GBIF Global Biodiversity Information Facility

- *Example of metadata of publications citing a GBIF dataset*
- *Where possible publications are linked to external fulltexts*



19 November 2020

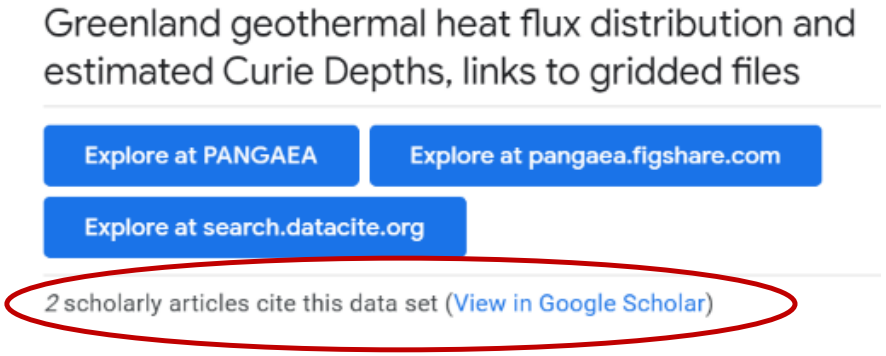
Google Dataset Search

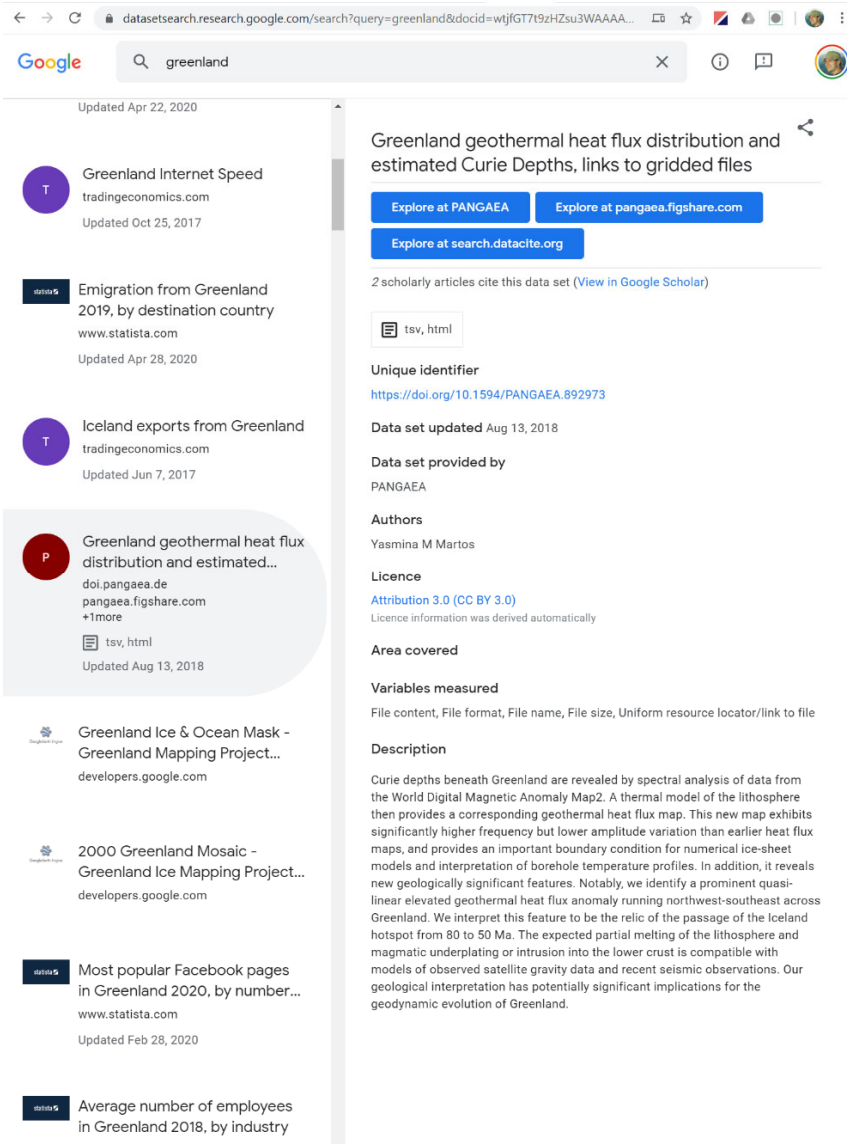


- Google Dataset Search is a new dataset search function, providing access to **datasets identified by Google on the open web**
- Datasets can be **included if they have assigned correct schema.org metadata**. Once metadata have been added, Google needs be to notified and the dataset metadata can be crawled
- **Google Dataset Search does not store the datasets themselves** but acts as a platform that links to data providers
- In case several providers provide access to the same dataset, **Google attempts to deduplicate** this and provides links from the dataset to all providers
- In addition, if the dataset is **cited in Google Scholar, the number of Google Scholar citations is shown - and links to an automatic Google Scholar search**

Google Dataset Search

- *Example dataset in Google Dataset Search – with links to data providers and to citing articles in Google Scholar*





Google Dataset Search

- *Automated search in Google Scholar from Google Dataset Search (see previous)*
- *Note that number of citations in Google Dataset Search does not appear to be recently updated (2 vs. 4 citing articles)*

Lessons learnt

- Overall, the analysis of the existing portals shows that there are several different initiatives that facilitate open data sharing – both field specific and generic, both commercial and sponsored by governments or research organisations
- Some of these
  - function as **aggregators of metadata** (and do not offer any archiving of data themselves)
  - some publish data from certain platforms or organisations
  - some **facilitate self-archiving of datasets**
- Most aggregators do a fairly good job of presenting consistent metadata, e.g. preserving titles, author information, and DOIs and pointing back to the original source
- However, different metadata levels and metadata specific to some sources can be a challenge – with some fields being empty in an aggregator, and some information from the original source that does not fit into the aggregator scheme

Lessons learnt

- Most of the examined examples attempt to give statistics on **the number of dataset views and dataset downloads**.
  - However, as the same dataset can be discovered in several aggregators the views downloads statistics are also distributed and are hard to aggregate and analyse. Thus getting an overview and correct total for these figures is difficult
- (This situation is of course not unlike that of citation counts for publications where the same article may have different citation counts in Web of Science, Scopus, Google Scholar and ResearchGate…(

Lessons learnt

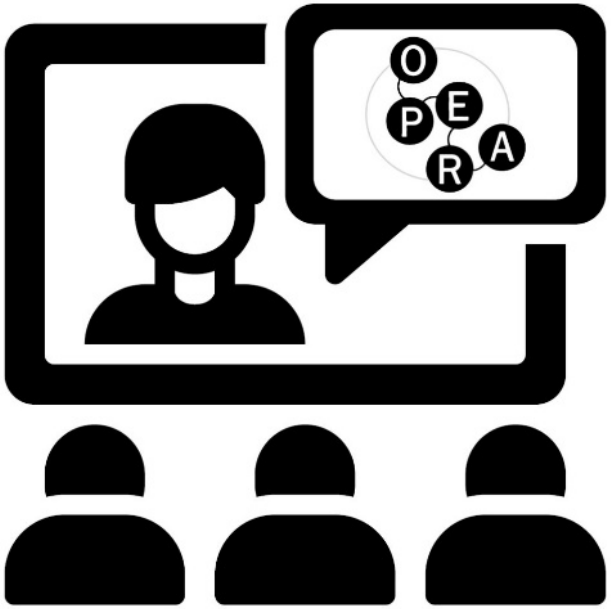
- In addition to views and downloads, actual usage of data that leads to a **dataset citation** in new publications is interesting and important to monitor
- Google Dataset Search reports the number of citations in Google Scholar - automatically identified via a search on DOIs and archive name
- GBIF does daily automated searches in a number of sources, and manually curates these

Lessons learnt

- Identifying dataset citations is made difficult because a data citation culture is still to be established in most fields
- Many citations to datasets may be missed because
  - 1) many different ways of citing datasets is being used with little consistency (e.g. referring to the dataset in the main text, vs. in a footnote or in the reference list)
  - 2) some may not be used to citing data, but cites the article describing the data instead or not at all

Lessons learnt

- To counter this, several aggregators and dataset repositories give **detailed instructions on how to cite the dataset**, e.g. by posting a reference that can be readily copied in a manuscript
- GBIF has the most advanced solution where not only each dataset can be cited, but also subsets and aggregates receive their own citable DOI. The disadvantage of this is that **the same data can be cited with several different DOIs**
- Even with such elaborate support in place example studies show that the **data citation culture is still weak** – see Kahn, Thellwall and Koucha (2019) for GBIF



Concluding discussion

Summary of issues

Data and Indicators summary

- Open Science and Open data are complex phenomena – we can propose a wide range of potential data and indicators that might be useful
- However, for many of these we have no or limited data – or data that is not very reliable…
- Even when we have data, e.g. on searches, views, downloads and data citations – we know little about what they actually *mean*
- Views, downloads and citations are often reported… these and more advanced indicators can be hard to interpret
- **= we are at a very early stage in relation to measuring Open Science efforts in a meaningful and productive way**

What to do then in OPERA??

- Very scarce data on Open Science are available → cannot be directly imported to all or even many records in the OPERA NORA
- Examples of data on Open Science Efforts can be found
  - E.g. open datasets, with size information, views, downloads and citations
  - **Add these in NORA as examples (even simulated) and study how relevant stakeholders react to and interpret these**
  - → final WP5 deliverable**: usability test of NORA**
    - Live NORA + mock-ups with sample Open Science indicators
    - Eyetrack+ deans, research managers, researchers, doctoral students etc. as they interact with NORA and the mock-ups, interview them about perceptions and usefulness


Thank You

Acknowledgments

- OPERA partners
- Pelle Annfeldt Israelsson
- Brian Kirkegaard Lunn
- Internal OPERA reviewers

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- **ReACT - Responsible Impact Project** - https://www.communication.aau.dk/research/Research+Projects/react/
- **NASA Open Data Portal** - https://data.nasa.gov/
- **Global Biodiversity Information Facility (GBIF) Repository** - https://www.gbif.org/search
- **Mendeley Data** - https://data.mendeley.com/
- **Google Dataset Search** - https://datasetsearch.research.google.com/