

FAIR and open collection data management

Dag Endresen | GBIF Node Manager for Norway

Global Biodiversity Information Facility

GBIF Global Biodiversity Information Facility

Illustration: Collections at the Smithsonian Museum of Natural History

MUSIT meeting, Oslo, Norway | 15th March 2021

GBIF PROVIDES “FAIR” DATA MOBILISATION INFRASTRUCTURE





Photo: Botany Collection, Algae, Smithsonian National Museum of Natural History Museum, by Chip Clark.

Very few museum specimens are digitized

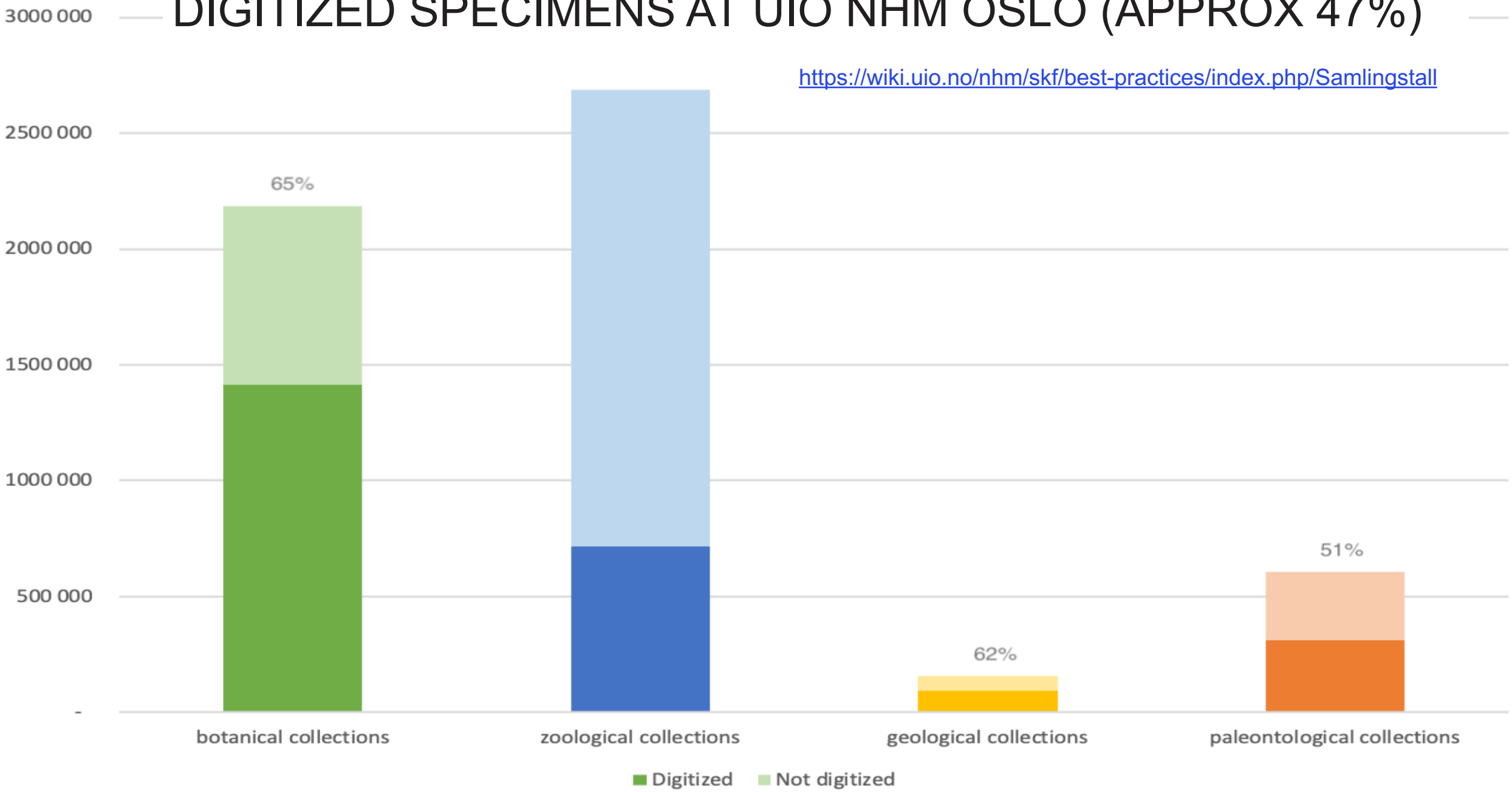
Natural history museum collections worldwide conserve an estimated **1.2 - 3 billion specimens**.
(Ariño 2010; Duckworth *et al*. 1993)

GBIF publishes 1,6 billion records – including **almost 200 million specimens**.

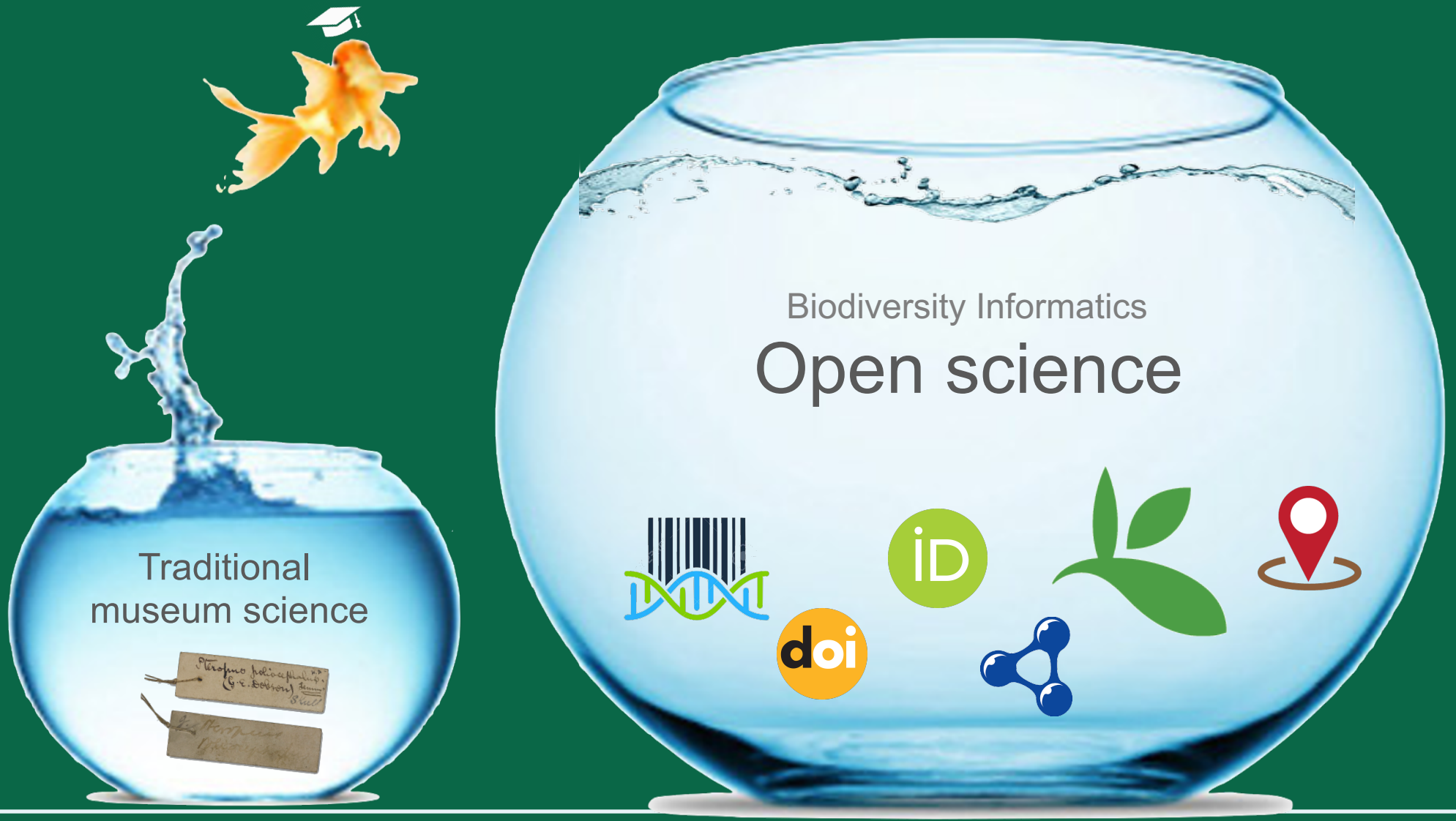
approx. 10% coverage?

DIGITIZED SPECIMENS AT UIO NHM OSLO (APPROX 47%)

https://wiki.uio.no/nhm/skf/best-practices/index.php/Samlingstall



new possibilities for novel curiosity-driven research



Global Biodiversity Information Facility

GBIF

WHY SHOULD MUSEUMS CARE ABOUT OPEN SCIENCE?



WHY APPROACH OPEN SCIENCE IN MUSEUMS?

- We are in the middle of an ongoing **paradigm shift** in scientific practice (*and impact metrics*).
- Natural History Museums will need to develop **different approaches**, than they needed in the past – *to remain relevant*.
- Society is gaining Big Data maturity and will **expect new services** from museum collections.
- The open science wave is moving **fast**!



DATA CITATION AS A NEW CURRENCY OF SCIENCE

- **Peer-reviewed scholarly papers** in high impact journals maintain considerable weight for impact metrics.
- A **movement** is under way to **build similar status for** open data, open metadata, open material samples, and other **open scientific research products**…

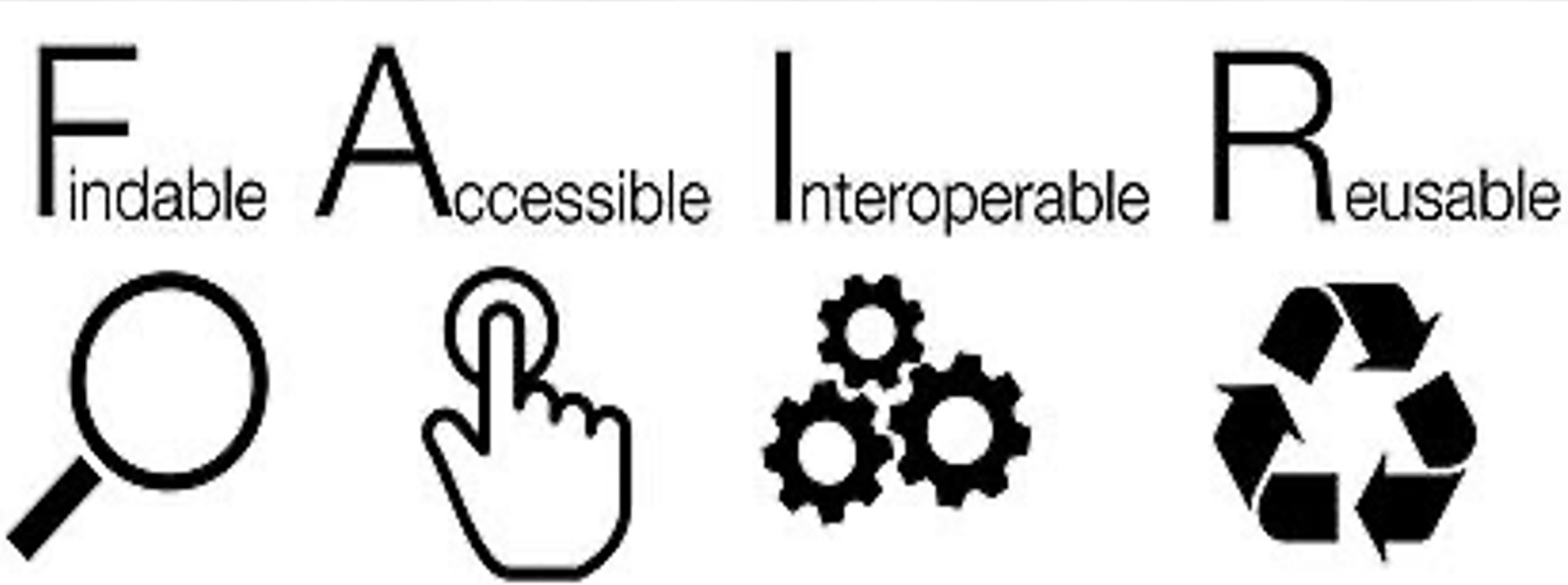




DECLARATION ON RESEARCH ASSESSMENT



- DORA recognizes the need to improve the ways in which the outputs of scholarly research are evaluated.
- DORA's vision is to advance practical and robust approaches to **research assessment** globally and across all scholarly disciplines.
- It has become a **worldwide initiative** covering all scholarly disciplines and key stakeholders.
  - The Declaration on Research Assessment (DORA) was developed in San Francisco in 2012.
  - To date (2021-03-14), 17 085 individuals and 2 169 organizations in 145 countries have signed DORA.
  - Covering funders, publishers, professional societies, institutions, and researchers.
  - The Research Council of Norway (RCN) signed DORA (in May 2018).
  - WHEN will UiO sign? (Signed by NMBU, NTNU, UiT, UiA, UiS, DKNVS, OsloMet, Oslo Univ Hospital…)



FAIR data is about ***machine-readable*** data …

… researchers need to do more than simply post their data on the web for it to be ***re-usable****.*

INVEST 5% OF RESEARCH FUNDS IN ENSURING DATA ARE REUSABLE

- *It is irresponsible to support research but not data stewardship. Huge sums of taxpayer funds go to waste because such data cannot be reused.*
- ***On average, 5% of overall research costs should go towards data stewardship.***
- ***If data are treated properly, researchers will have significantly more time to do research.***



Barend Mons, Nature 578: 491, 27 February 2020

Barend Mons co-leads GO FAIR and co-author of the FAIR principles (2016)



OPPORTUNITIES

- Enables new research methodologies that were not possible before.
- Skills for open research and open data are in increasing demand!
- Funding opportunities.
- GBIF brings new benefits and opportunities for our museums.


GBIF

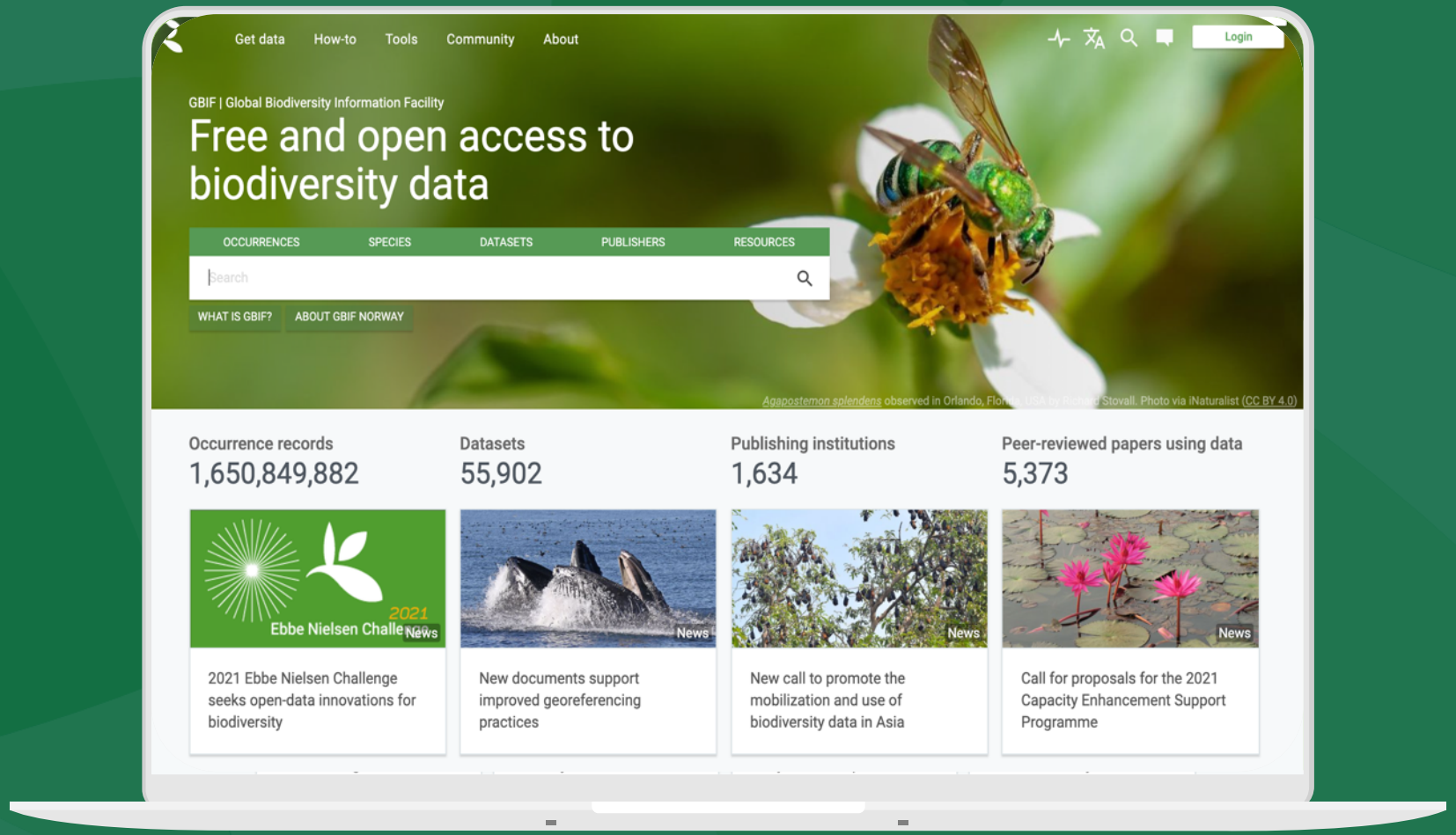
WHAT IS GBIF?

Intergovernmental network and research infrastructure

Provides anyone, anywhere, **free and open access to data** about all types of life on Earth

Voluntary collaboration through Memorandum of Understanding (MoU)

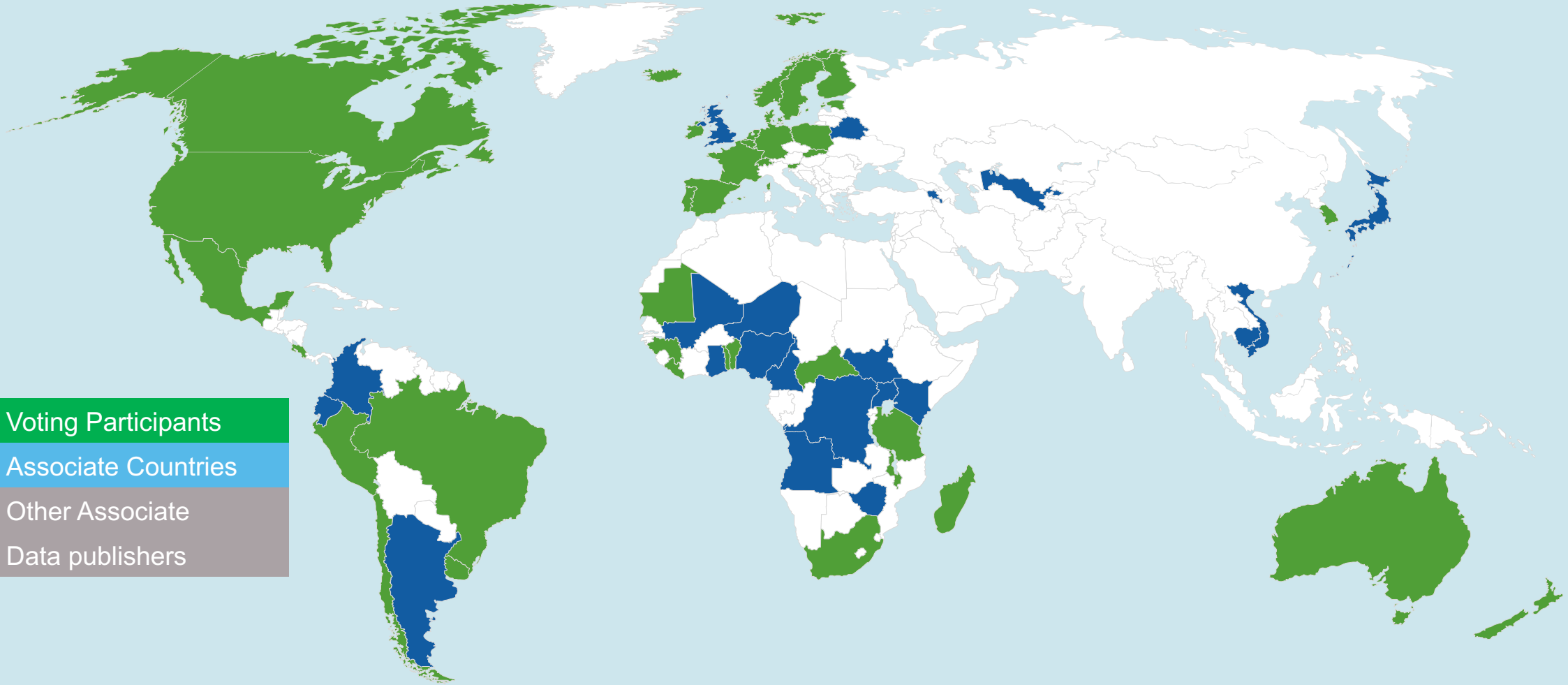
Participant nodes, Secretariat in Copenhagen, Denmark



https://www.gbif.org

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GBIF PARTICIPANT COUNTRIES

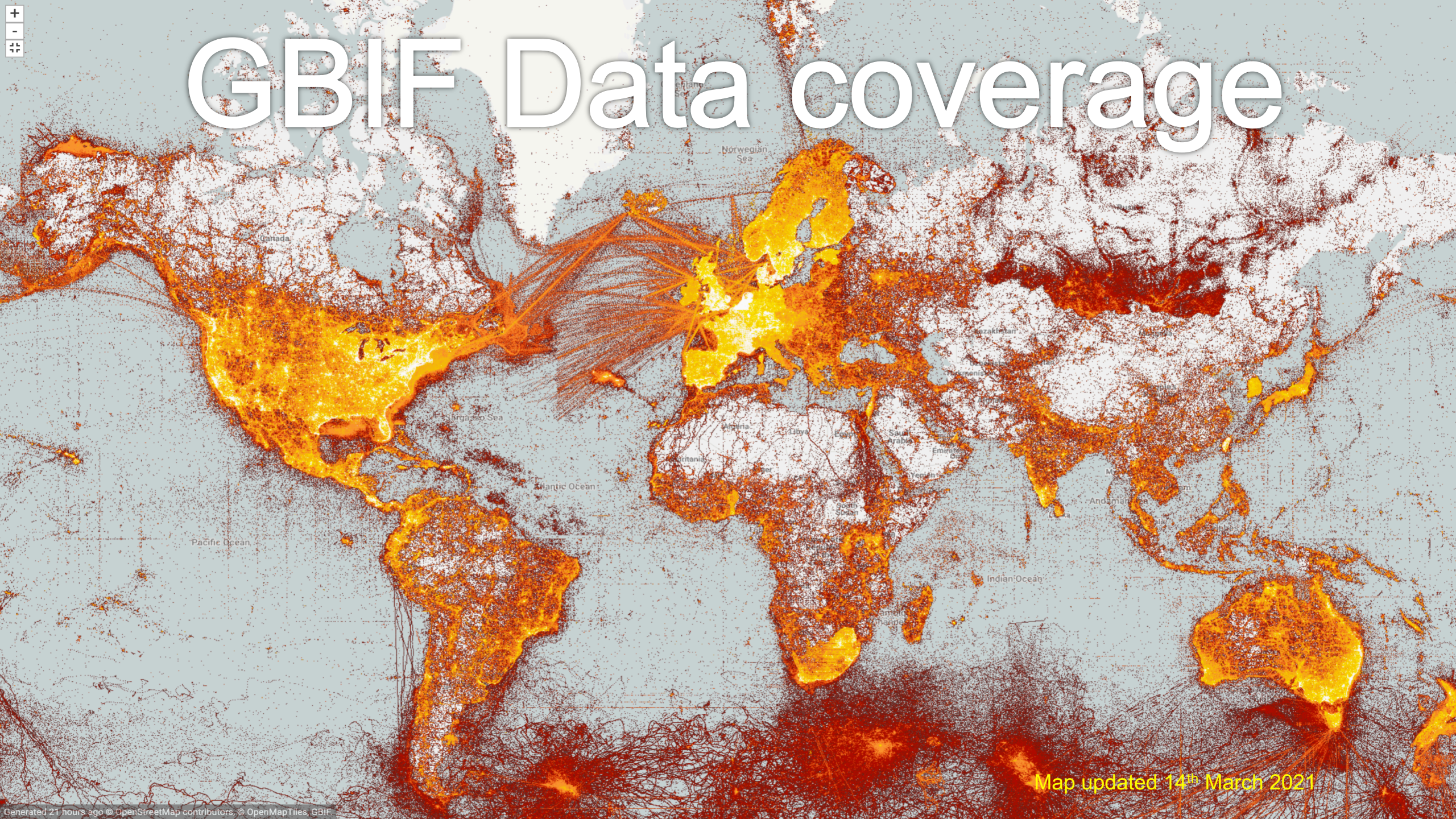


41	Voting Participants
21	Associate Countries
39	Other Associate
1721	Data publishers

https://www.gbif.org/the-gbif-network

GBIF

GBIF Data coverage



Generated 21 hours ago © OpenStreetMap contributors, © OpenMapTiles, GBIF

A WINDOW ON EVIDENCE ABOUT WHERE SPECIES HAVE LIVED, AND WHEN

Observations

Digitized specimens

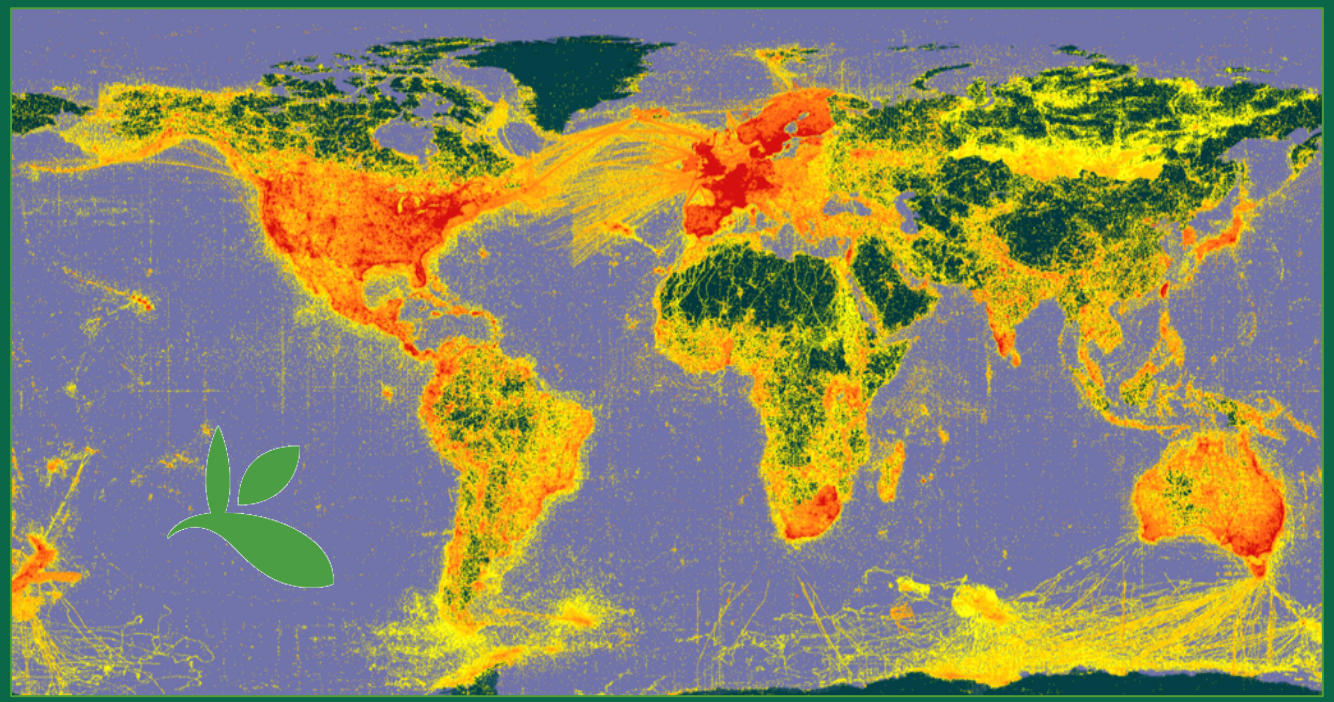
Literature

Data publishing and indexing

Common standards (DwC)

Remote-sensing

Environmental DNA



Data discovery and use

https://www.gbif.org/occurrence/search

GBIF

SOURCES OF DATA IN GBIF: DIGITIZED SPECIMENS FROM MUSEUM COLLECTIONS

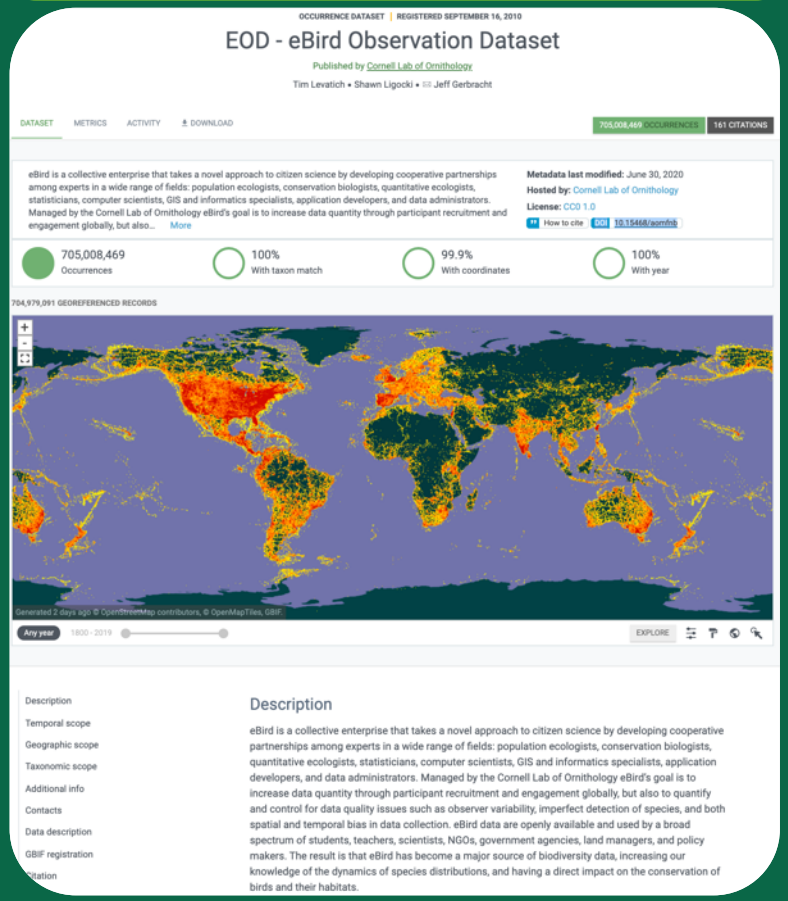




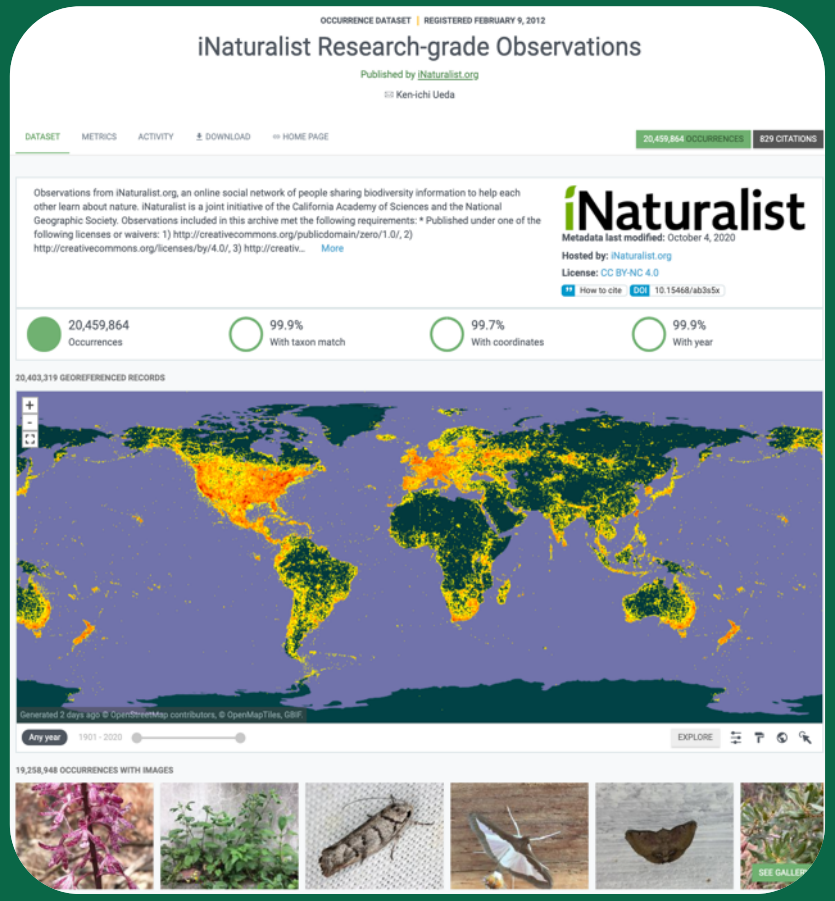
GBIF

SOURCES OF DATA IN GBIF: CITIZEN SCIENCE OBSERVATIONS

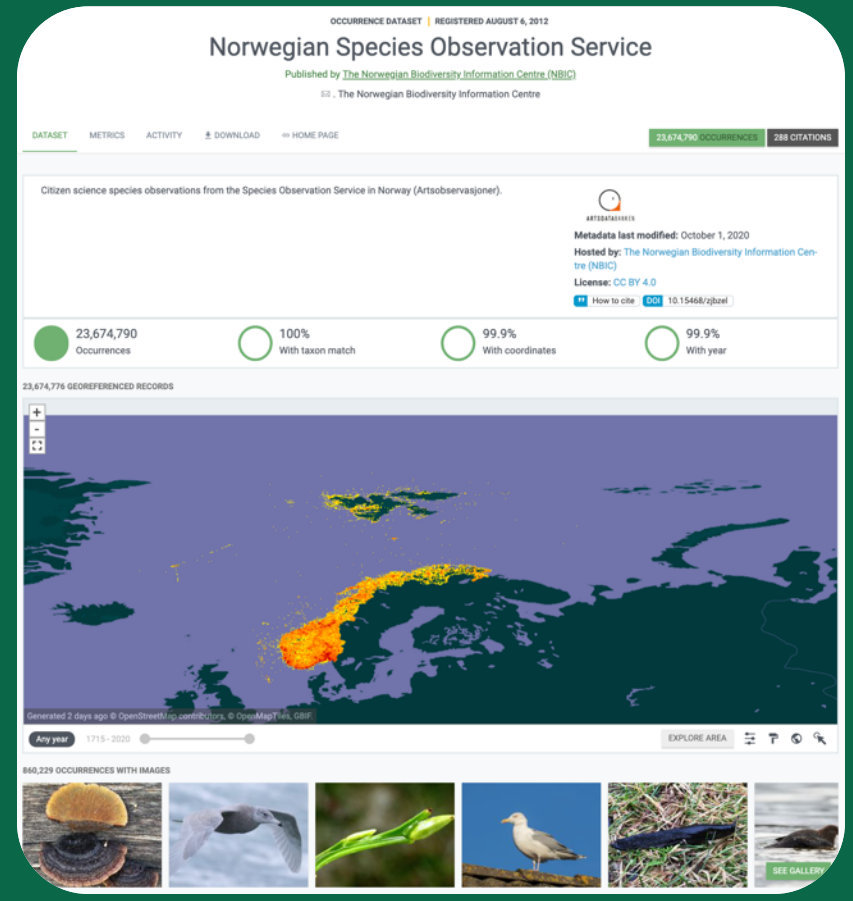
eBird



iNaturalist



ARTSDATABANKEN



GBIF

SOURCES OF DATA IN GBIF: TAXONOMIC LITERATURE, OLD AND NEW





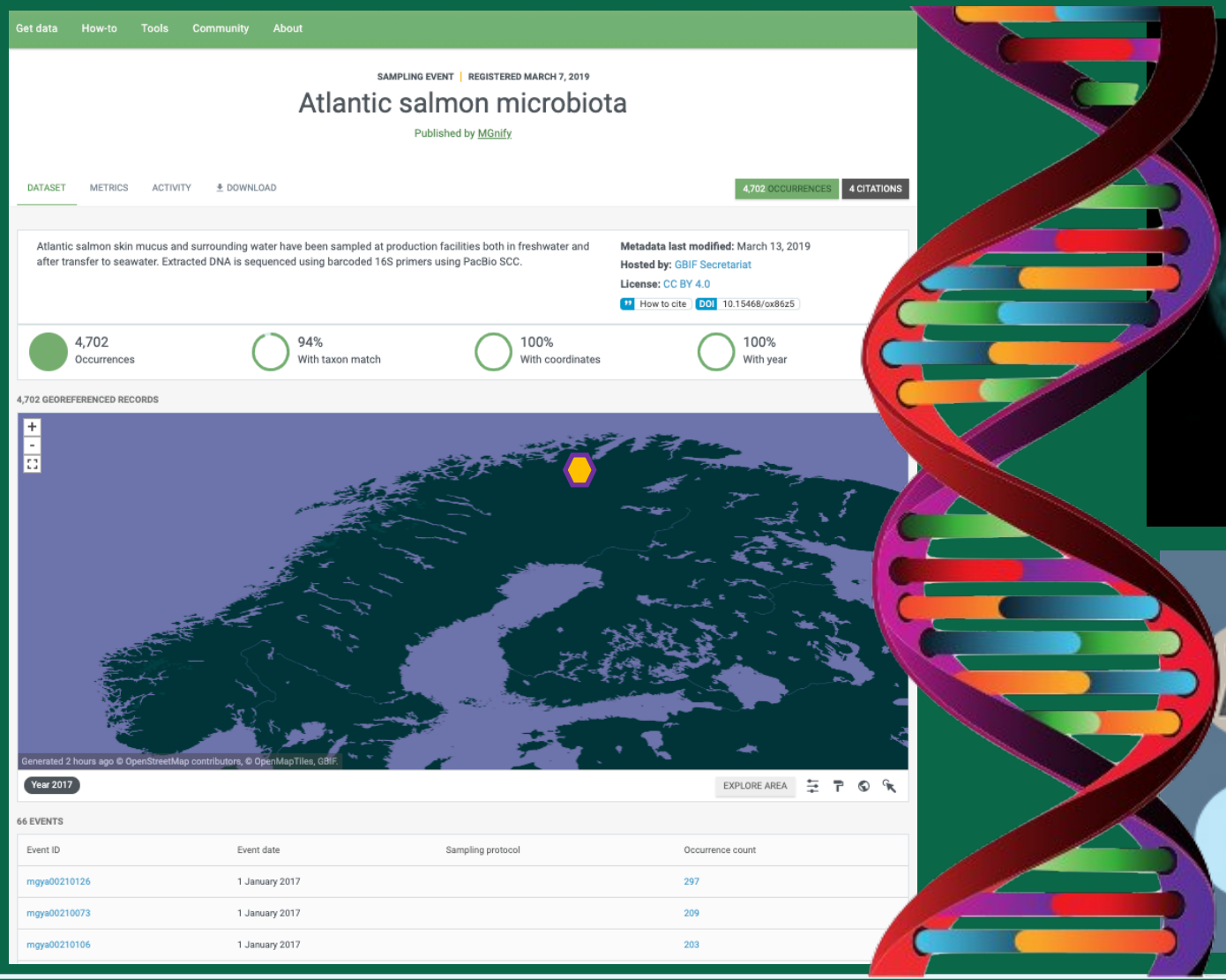
PLAZI
TAKING CARE OF FREEDOM

Data liberation

ACS Publications
MOST TRUSTED. MOST CITED. MOST READ.
BioMed Central
The Open Access Publisher
ELSEVIER
NATIONAL PRESS FOUNDATION
npg
nature publishing group
PLOS
aap PSP
stm
Taylor & Francis Group
an informa business
WILEY
Wolters Kluwer

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SOURCES OF DATA IN GBIF: DNA SEQUENCE-DERIVED OCCURRENCE DATA







MGnify -- https://www.gbif.org/publisher/ab733144-7043-4e88-bd4f-fca7bf858880

SPECIES OCCURRENCE RECORDS WITH MULTIMEDIA EVIDENCE

27th January 2021

75 million records with taxonomically identified images *(1.8 million from Norway)*

- 41.1 million specimens *(Norway: 884 763)*
- 31.3 million human observations *(Norway: 923 763)*
- 1.4 million material samples *(Norway: 38 386)*

685 806 audio files *(Norway: 3 566)*

2 825 videos *(Norway: 4)*



https://www.gbif.org/occurrence/gallery

GBIF

BY THE NUMBERS | 15 MARCH 2021

GBIF

Species occurrence records

1 661 934 359

Datasets

56 967

Country Participants **62**

Organizational Participants **39**

Publishers

1 652

Peer-review papers using data

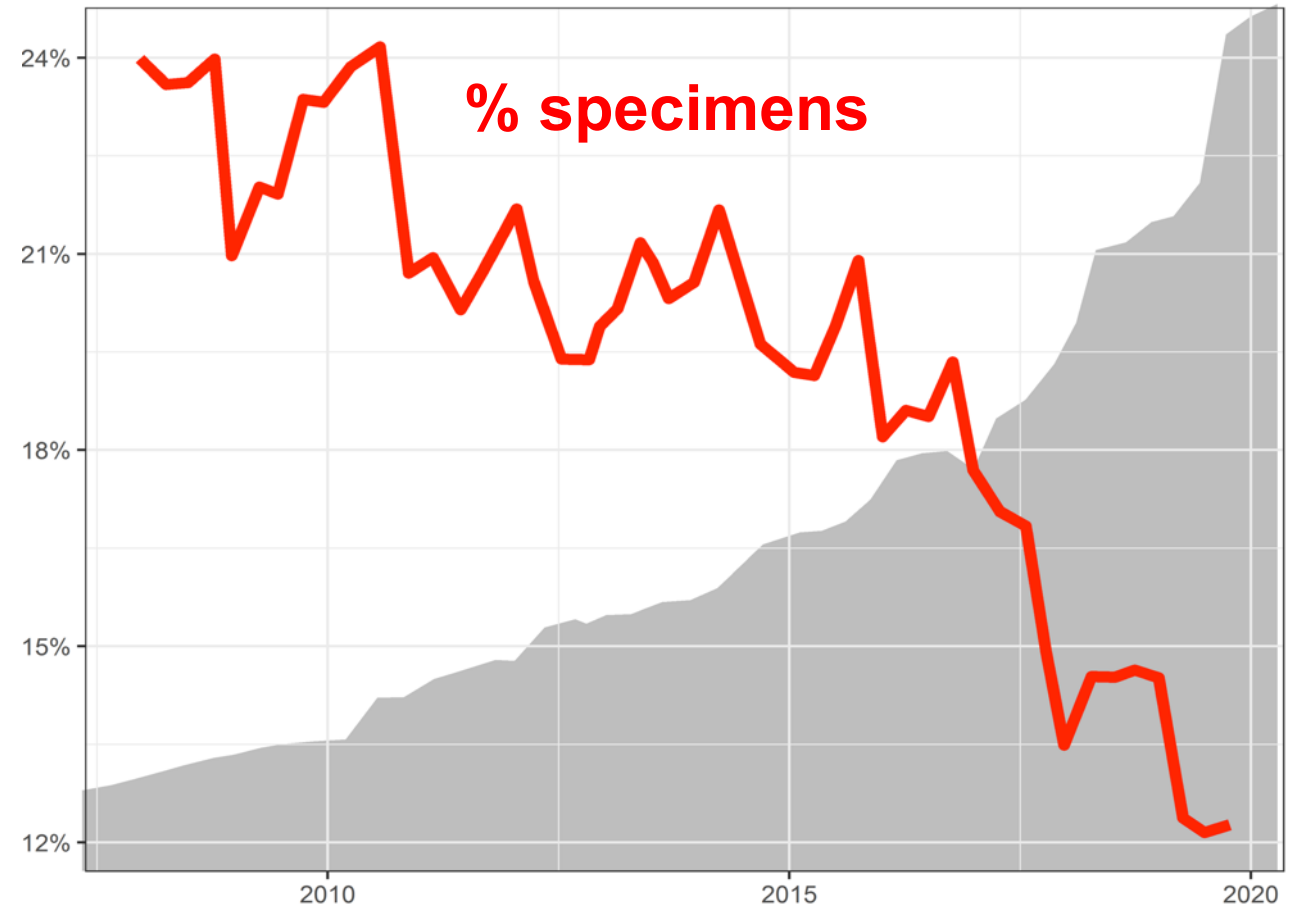
5 571

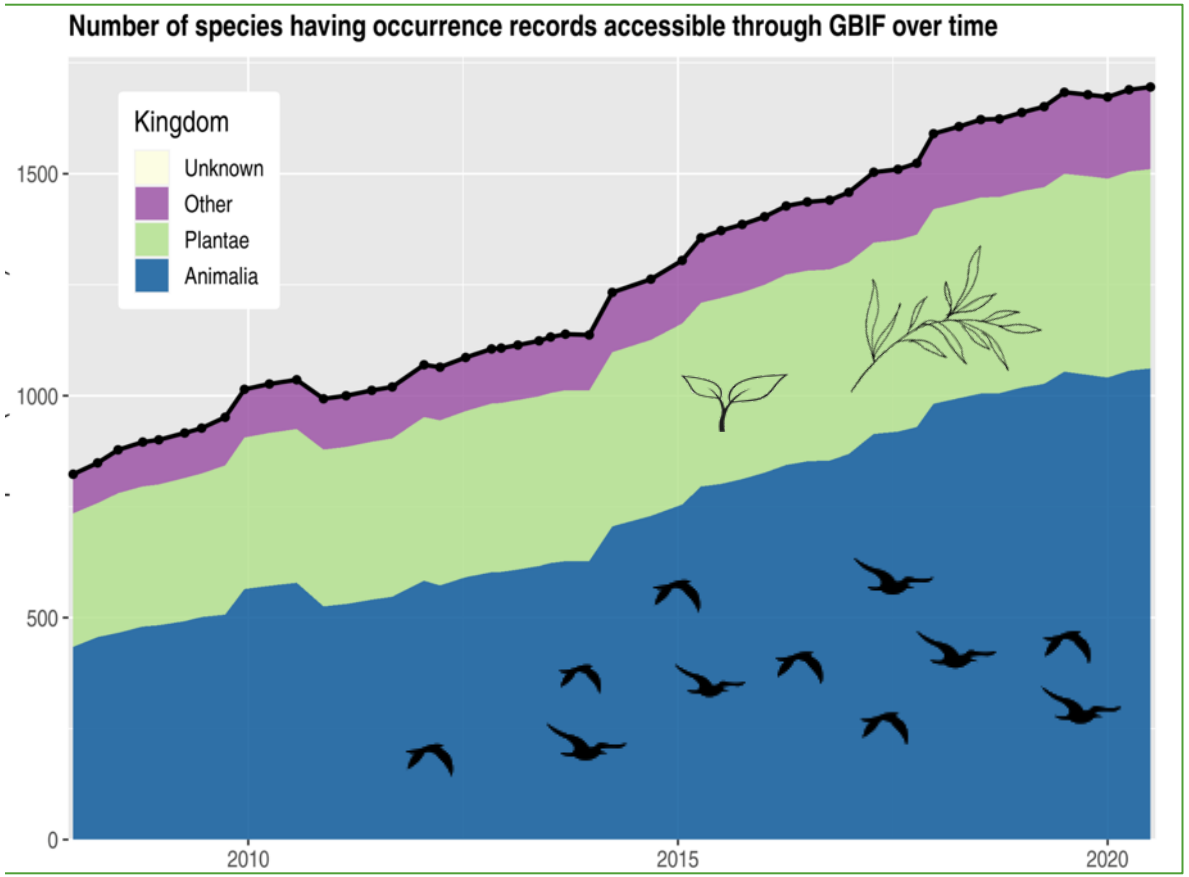
Average records downloaded per month (2020)

23.6 billion

GBIF

DATA TRENDS ON GBIF.org





https://www.gbif.org/analytics/global

GLOBAL BIODIVERSITY VS. DIGITALLY AVAILABLE DATA

1267 mill. animals

335 m plants

21 m fungi

17 m bacteria

0,04 m virus

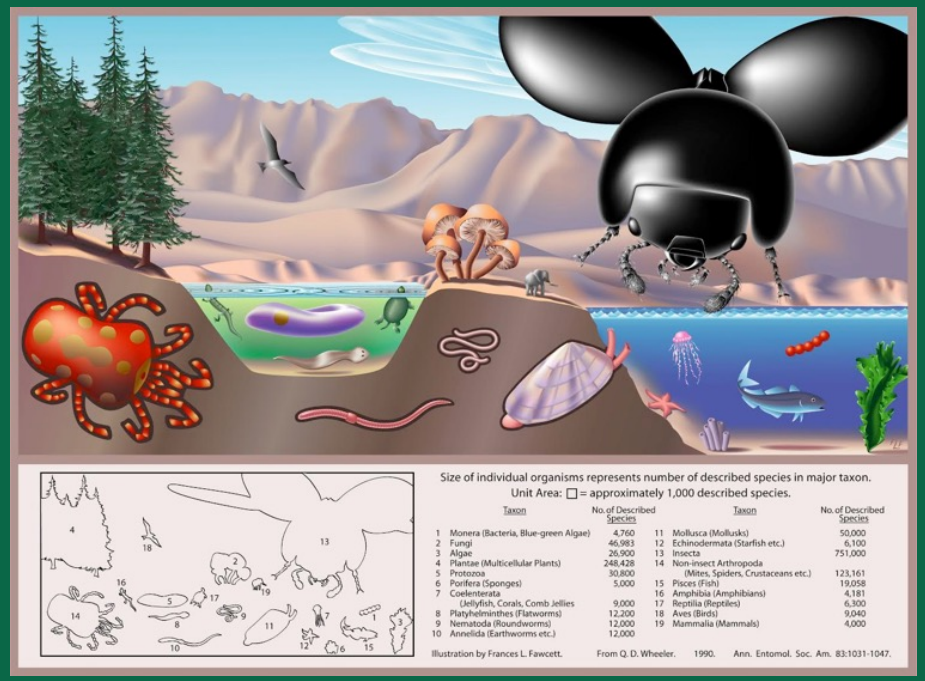
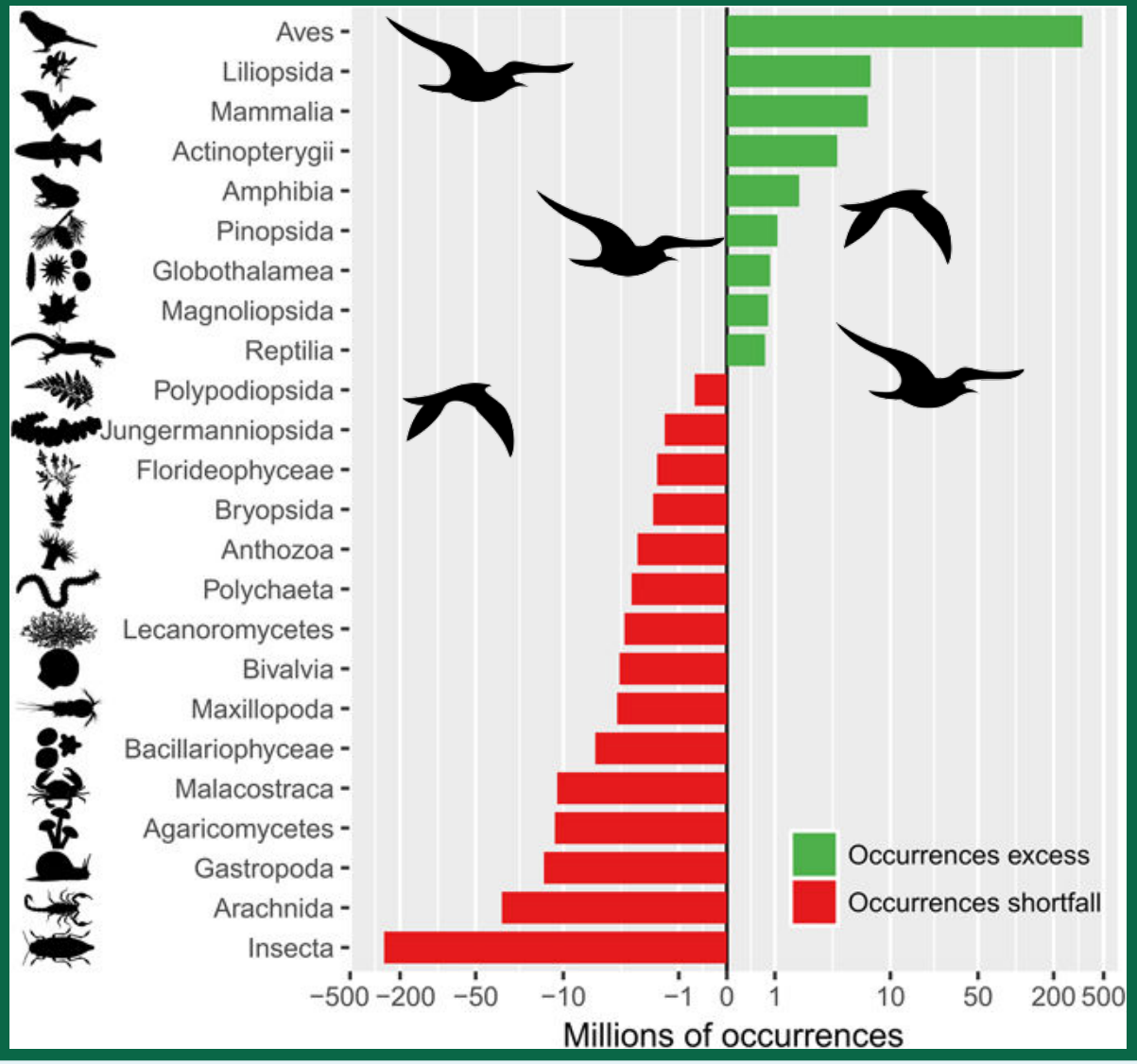


Image: FL Fawcett in Wheller Ann. Entomol. Soc. Am. 1990



Troudet et al. Nature Scientific Reports 2017

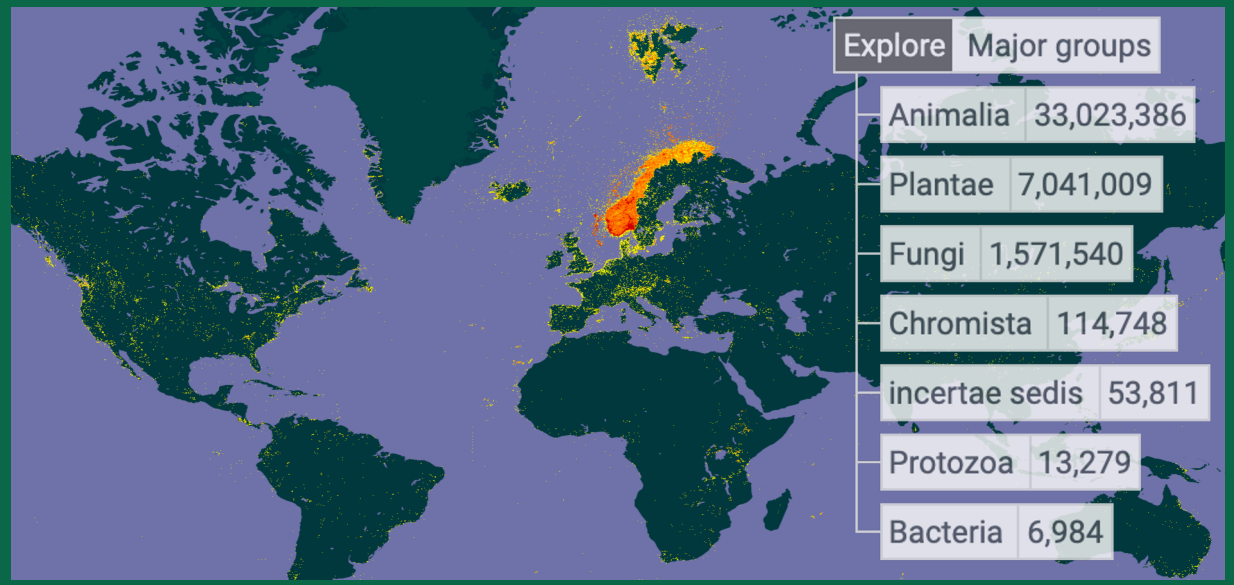
GBIF

BY THE NUMBERS | 15 MARCH 2021 -- NORWAY

GBIF.no

Species occurrence records *(published from)*

41 824 982



Datasets *(published from)*

307

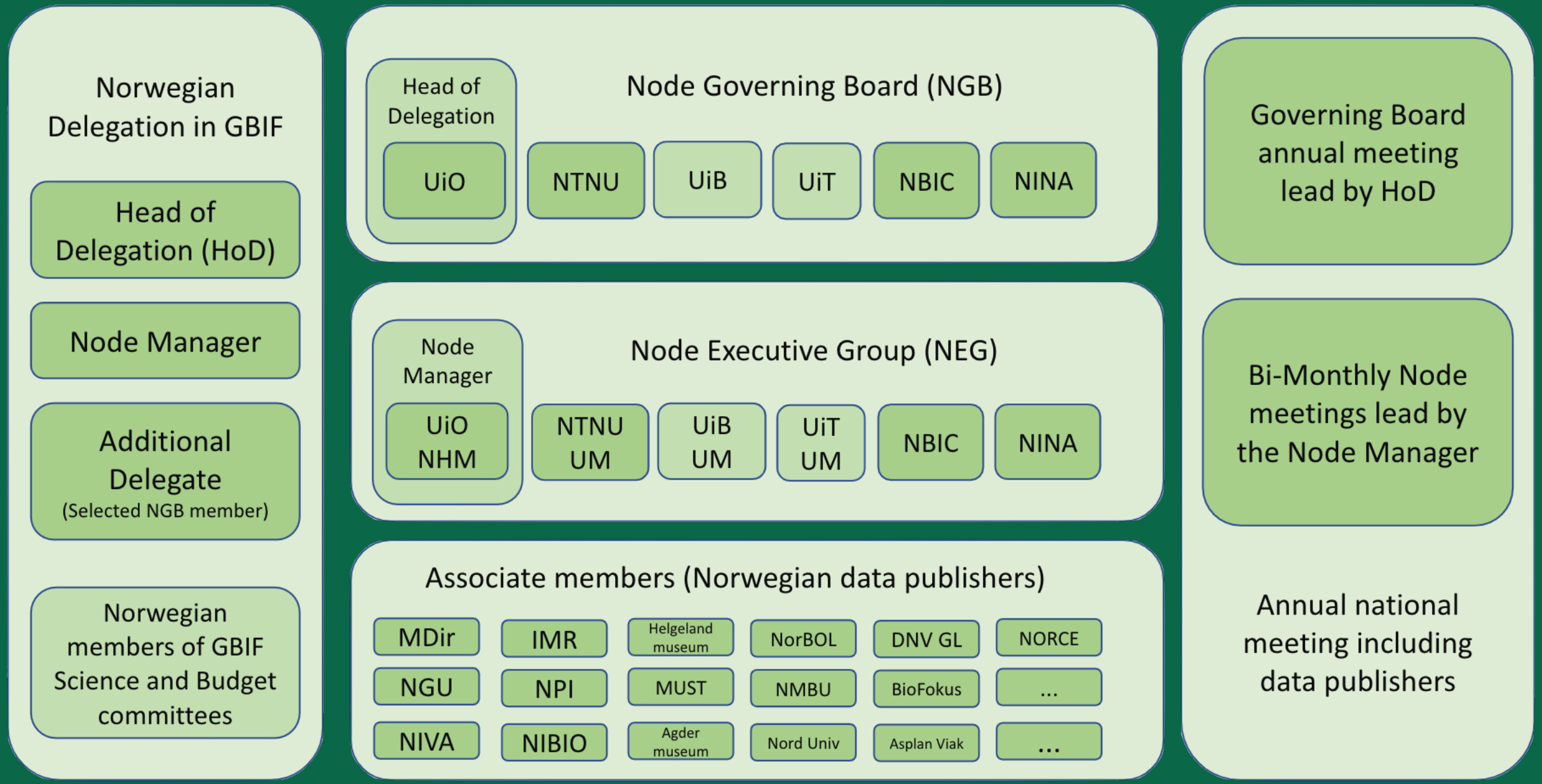
Publishers (from Norway)

38

Peer-review papers using data (co-author from Norway

131

GBIF



New governance model for GBIF Norway under establishment in 2021

THANK YOU

Dag Endresen | GBIF Norway

helpdesk@gbif.no





data use

GBIF: MULTIPLE-PURPOSE DATA PUBLISHING SERVICES



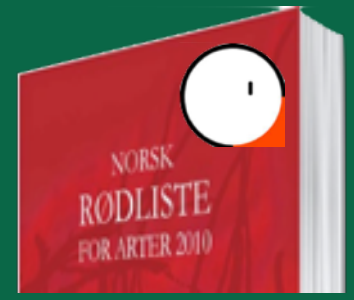
GBIF.no

Bio-Collections
& ecology datasets

Darwin Core

EU Directive reporting
(proposed workflow)

IUCN



Norwegian Red List

Research
data portals

elixir

BOLD SYSTEMS

GBIF
portal

FAO
FIAT PANIS

Convention on
Biological Diversity

ipbes
Science and Policy
for People and Nature

UNEP

GBIF

POLICY LINKS

Convention on Biological Diversity

SUSTAINABLE DEVELOPMENT GOALS

ipbes
Science and Policy for People and Nature

COUNTRY PROFILES

Norway

Norway

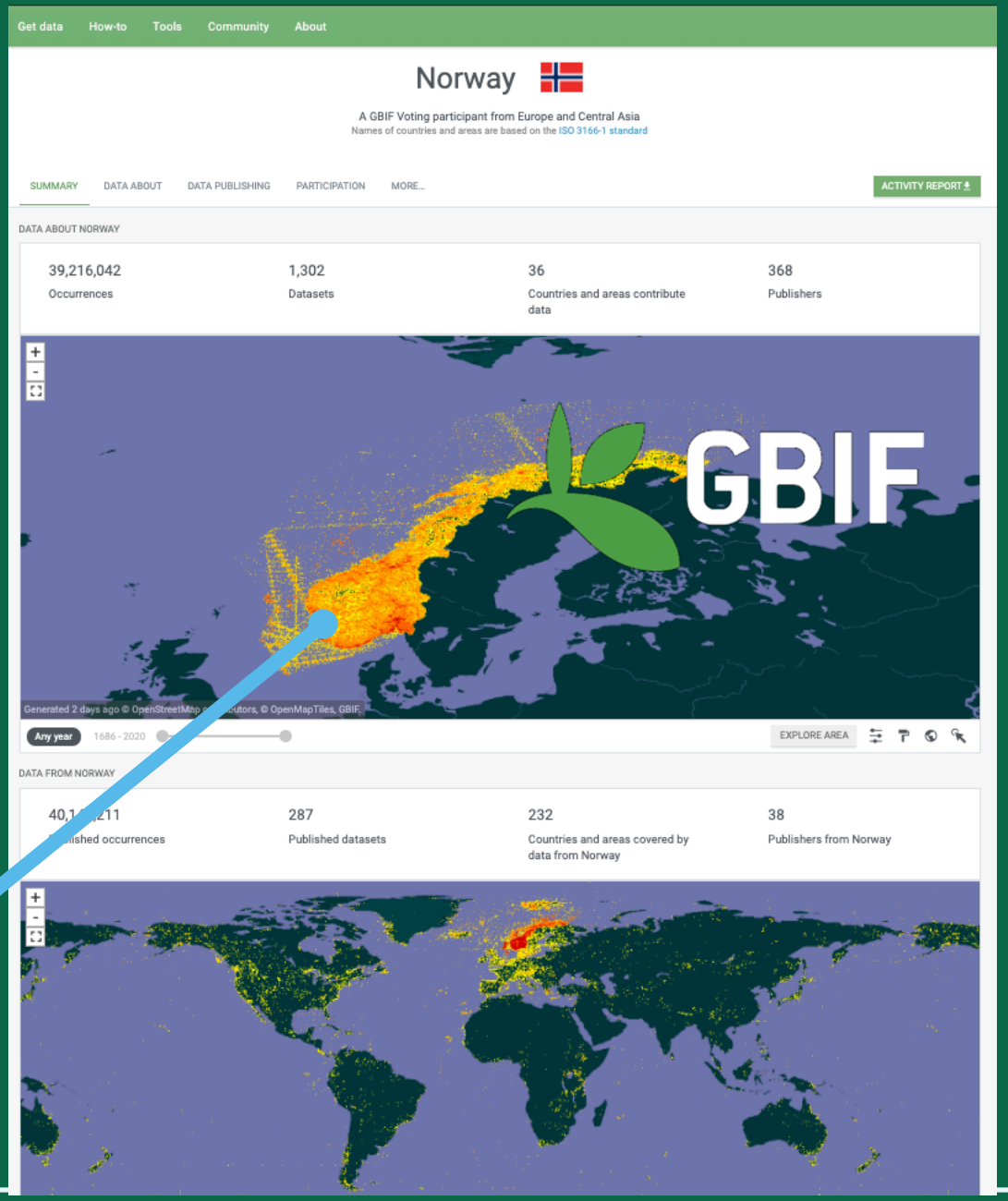
Convention
Party since: 1993-12-29
By: Ratification

Cartagena Protocol
Party since: 2003-09-11
By: Ratification

Nagoya Protocol on Access and Benefit-sharing
Party since: 2014-10-12
By: Ratification

Nagoya – Kuala Lumpur Supplementary Protocol on Liability and Redress
Party since: 2018-03-05
By: Accession

Further Information
- InforMEA Profile
- UNFCCC Profile
- World Heritage Site
- GBIF Data
- WTO Statistics



International treaties – *national progress based on national GBIF data publication*

GBIF

POLICY LINKS: AICHI TARGETS



- Trend in invasive alien species introductions (through Global Register of Introduced and Invasive Species)



- Species Protection Index
- Protected Area Representativeness Index



- Comprehensiveness of conservation of socioeconomically/culturally valuable species
- Agrobiodiversity Index
- Crop Wild Relative Index

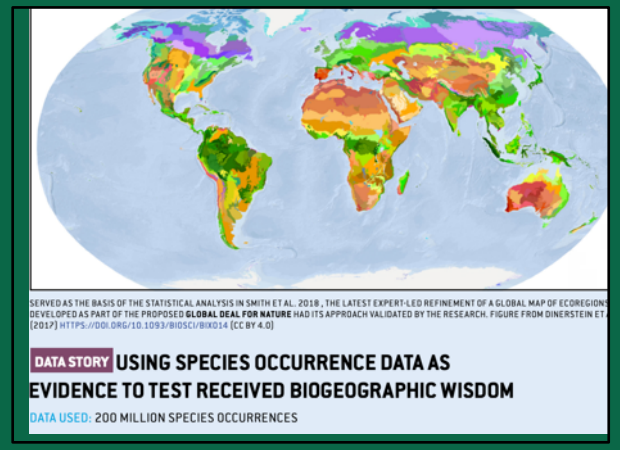


- Growth in species occurrence records accessible through GBIF
- Species Status Information Index

https://www.cbd.int/cooperation/csp/gbif.shtml | https://www.cbd.int/csp/survey/GBIF.pdf

GBIF

A DATA RESOURCE TO SUPPORT RESEARCH AND SUSTAINABLE DEVELOPMENT



SERVED AS THE BASIS OF THE STATISTICAL ANALYSIS IN SMITH ET AL. 2018 , THE LATEST EXPERT-LED REFINEMENT OF A GLOBAL MAP OF ECOREGIONS DEVELOPED AS PART OF THE PROPOSED **GLOBAL DEAL FOR NATURE** HAD ITS APPROACH VALIDATED BY THE RESEARCH. FIGURE FROM DINERSTEIN ET. (2017) HTTPS://DOI.ORG/10.1093/BIOSCI/BIX014 (CC BY 4.0)

DATA STORY **USING SPECIES OCCURRENCE DATA AS EVIDENCE TO TEST RECEIVED BIOGEOGRAPHIC WISDOM**

DATA USED: 200 MILLION SPECIES OCCURRENCES

Conservation

- Protected areas
- Threatened species
- Invasive species risk

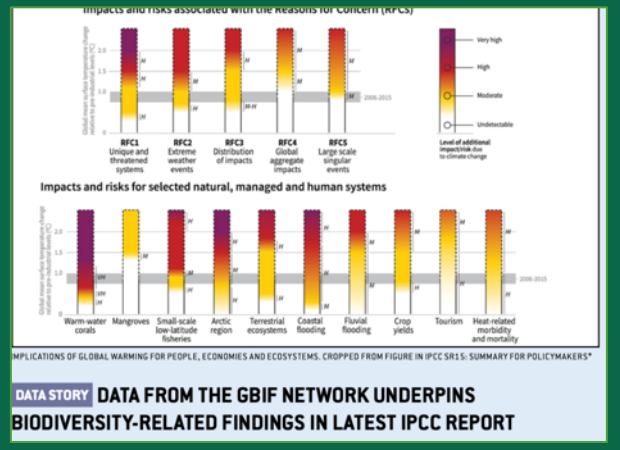


COFFEA LIBERICA BY DINESH VALKE HTTPS://WWW.FLICKR.COM/PHOTOS/DINESH_VALKE/5597839545 (CC BY-SA 2.0)

DATA STORY **DEVELOPING AN INDICATOR FOR SUSTAINABLE DEVELOPMENT GOALS & BIODIVERSITY TARGETS USING OPEN DATA**

Food Security

- Crop wild relatives
- *In situ*, *ex situ* conservation of genetic diversity
- Fisheries planning



MPLICATIONS OF GLOBAL WARMING FOR PEOPLE, ECONOMIES AND ECOSYSTEMS. CROPPED FROM FIGURE IN IPCC SR15: SUMMARY FOR POLICYMAKERS*

DATA STORY **DATA FROM THE GBIF NETWORK UNDERPINS BIODIVERSITY-RELATED FINDINGS IN LATEST IPCC REPORT**

Climate change

- Modelling impacts on species ranges
- Adaptation strategies
- Mitigation benefits, risks



PTEROPUS GIGANTEUS BY HEMANT KUMAR HTTPS://WWW.GBIF.ORG/OCCURRENCE/1092888502 (CC BY-NC 4.0)

DATA STORY **FLYING FOXES PREDICT NIPAH VIRUS TRANSMISSION RISK**

DATA USED: 47,942 SPECIES OCCURRENCES

Human health

- Disease risk based on occurrence of vectors, hosts, reservoirs
- Medicinal plants
- Hazards e.g. snakebite

https://www.gbif.org/science-review

GBIF

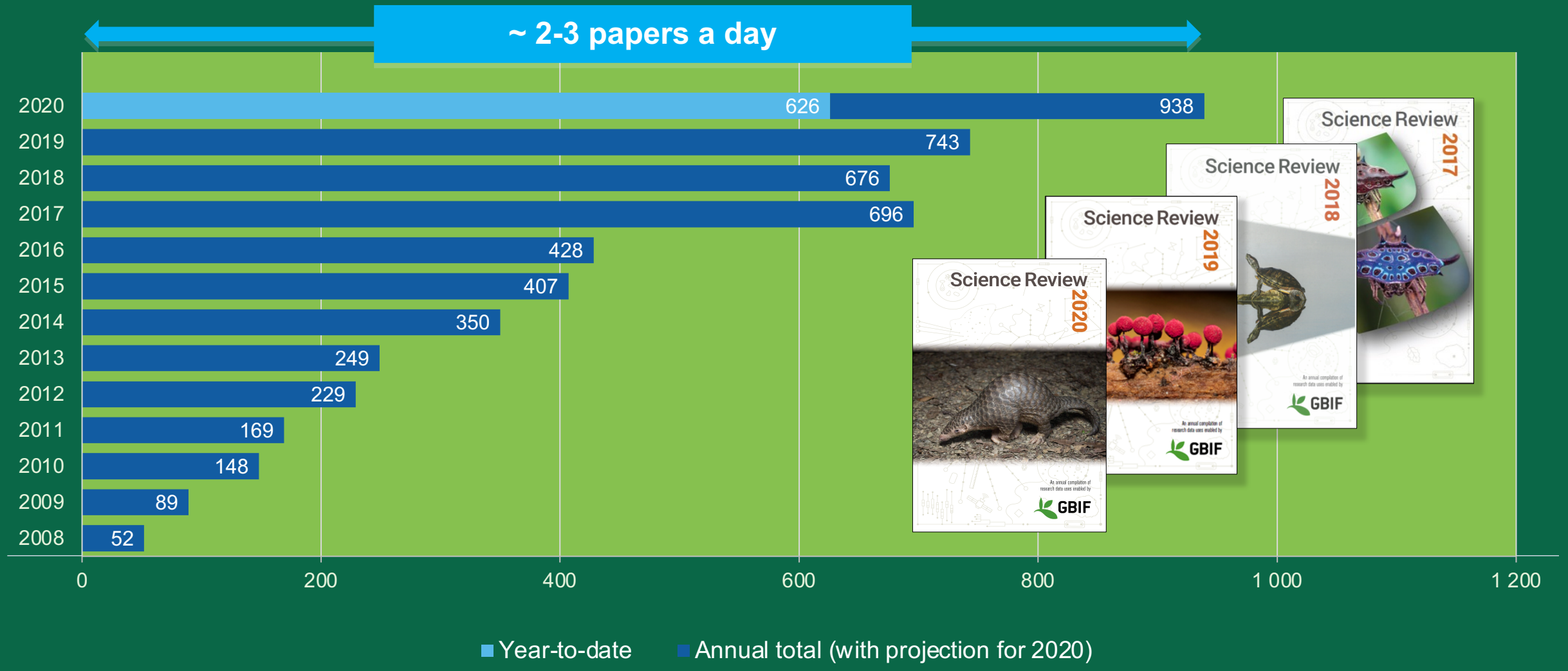
CREDIT FOR DATA REUSE

To incentivize the sharing of useful data, the scientific enterprise needs a well-defined ***system that links individuals with reuse of data sets they generate***

Pierce *et al*. Credit data generators for data reuse, *Nature* 6 June 2019



PEER-REVIEWED PUBLICATIONS USING GBIF-MEDIATED DATA



https://www.gbif.org/resource/search?contentType=literature&literatureType=journal&relevance=GBIF_USED&peerReview=true

#CiteTheDOI

GBIF

HOW TO CITE DATA MEDIATED BY GBIF

1. **Download data** from GBIF.org
2. and receive recommended citation with a **download DOI**
3. **Cite the DOI** in published research or other work

Example: GBIF.org (15 March 2021) GBIF Occurrence Download **https//doi.org/10.15468/dl.xxxxxx**

https://www.gbif.org/citation-guidelines

#CiteTheDOI

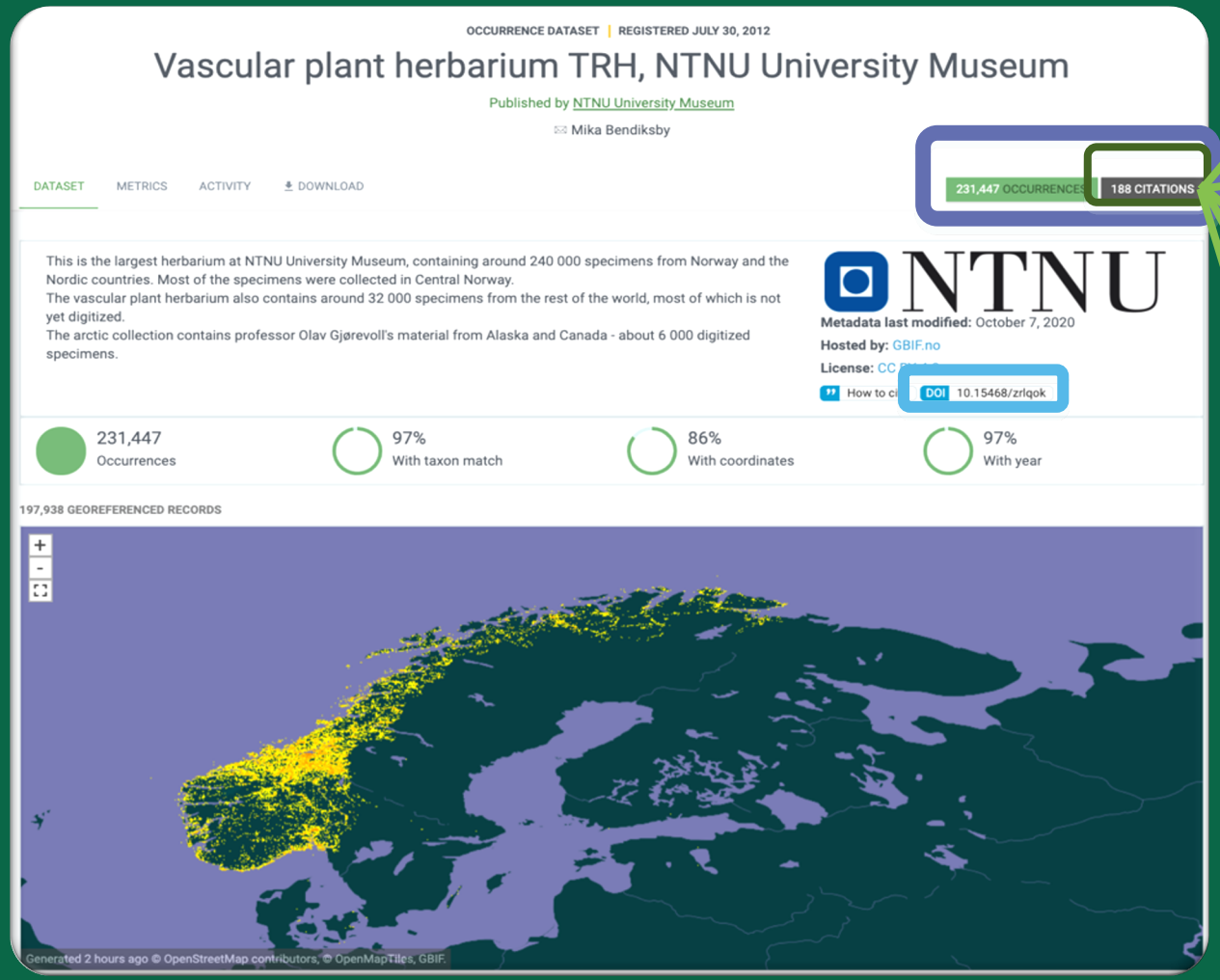
GBIF

DOI BASED DATA CITATION AT GBIF.ORG

dataset

citations

papers







NTNU Vascular plants: https://doi.org/10.15468/zrlqok

#CiteTheDOI

GBIF

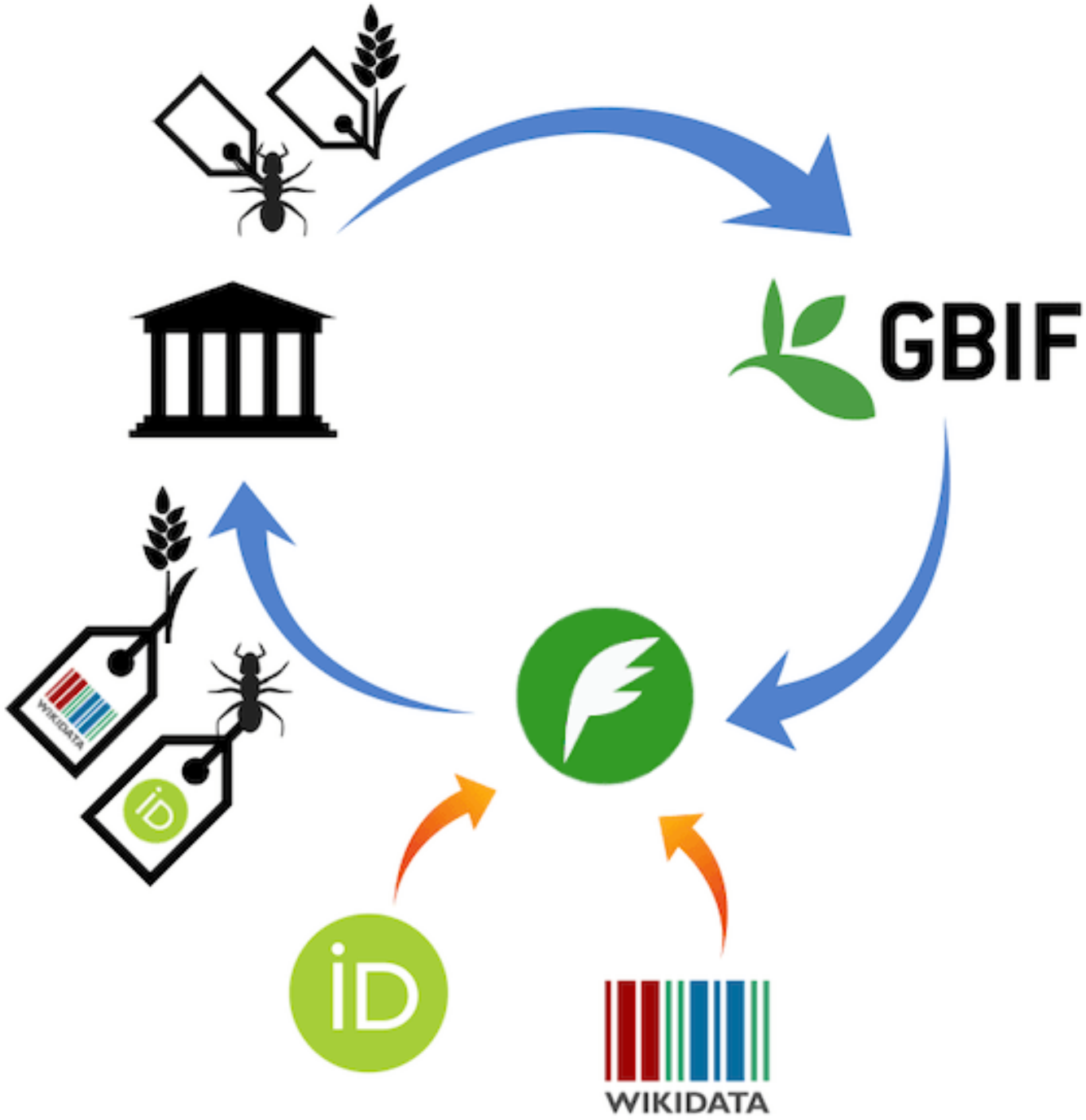


new tools - bionomia

BIONOMIA

Link natural history specimens
to the world's collectors.

https://bionomia.net





Link natural history specimens to the world's collectors.

Get started » Your profile

- recordedByID
- identifiedByID

ORCID WIKIDATA GBIF

GBIF

Occurrences 3

Recorded by

Recorded by ID

https://www.wikidata.org/wiki/Q94522

Search

CLEAR

Identified by

Identified by ID

https://www.wikidata.org/wiki/Q94522

Search

CLEAR

Record number

Occurrence id

Organism id

Publishing country or area

Elevation

Depth

Locality

Water body

State province

Repatriated

Is in cluster

DWCA extension

SEARCH OCCURRENCES | 24,923 RESULTS

TABLE | GALLERY | MAP | TAXONOMY | METRICS | DOWNLOAD

Scientific name	Country or area	Coordinates	Month & year	Basis of record	Dataset
Sphaerophorus fragilis (L.) Pers.	Norway	60.6N, 6.7E	1975 August	Preserved specimen	Lichen herbarium, Oslo (O) UiO
Atriplex 1758	Spain		1971 January		Oslo (O) UiO
Schismus barbatus (L.) Thell.	Spain		1971 January		Oslo (O) UiO
Amaranthus L.	Spain		1971 January		Oslo (O) UiO
Setaria Beauv.	Spain	28.3N, 16.5W	1971 January		Oslo (O) UiO
Amaranthus L.	Spain		1971 January		Oslo (O) UiO
Spergularia (Pers.) J. & K.Presl	Spain		1971 January		Oslo (O) UiO
Salix phylicifoli			ust		Oslo (O) UiO
Beta patellaris			uary		Oslo (O) UiO
Bromus rigidus			uary		Oslo (O) UiO
Asparagus pas			uary		Oslo (O) UiO
Cheilanthes ma			uary		Oslo (O) UiO
Spergula fallax			uary		Oslo (O) UiO
Schismus barb			uary		Oslo (O) UiO
Asphodelus fistulosus L.			1970 January		Oslo (O) UiO
Polypodium serratum Milde	Spain	28.2N, 15.6W	1970 January		Oslo (O) UiO
Sporobolus indicus R.Br.	Spain	28.1N, 15.5W	1970 January		Oslo (O) UiO
Trisetaria pumila (Desf.) Maire	Spain	28.1N, 15.5W	1970 January		Oslo (O) UiO
Schismus barbatus (L.) Thell.	Spain		1970 January	Preserved specimen	Vascular Plant Herbarium, Oslo (O) UiO

Catalogue number	2007334
Occurrence ID	**urn:catalog:O:V:2007334**
Other catalogue numbers	urn:uuid:0574816d-3d99-41b8-b3b8-c6035de0e929
Event date	1971-01-04
Recorded by	Johannes Lid
Recorded by ID	http://www.wikidata.org/entity/**Q94522**
Date identified	1971-01-04T00:00:00
Identified by	Johannes Lid
Identified by ID	http://www.wikidata.org/entity/**Q94522**





Johannes Lid

Lid

* January 11, 1886 – September 29, 1971 †

writer, botanist

Norwegian botanist (1886-1971)

https://www.wikidata.org/wiki/Q94522

Norway

Help Attribute Refresh stats Refresh

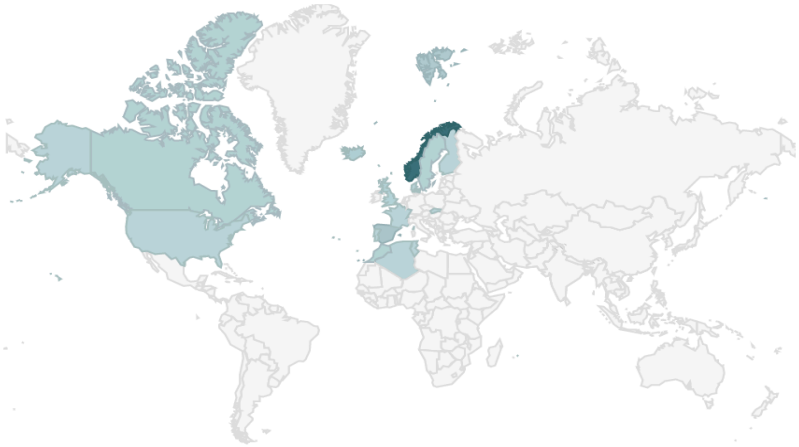
Overview | Specialties | Network | Deposited At | Specimens | Science Enabled

33,581 specimens identified from at least 20 countries
37,238 specimens collected from at least 19 countries
9,543 specimens used in 74 works

Progress 92%

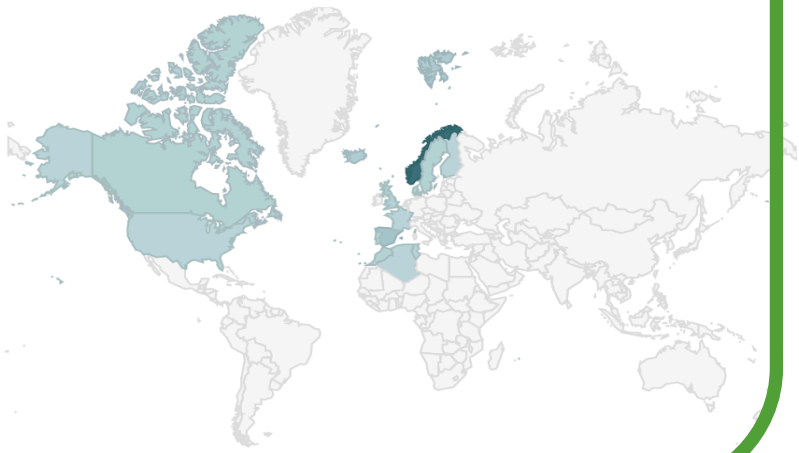
Identified From

Map | List

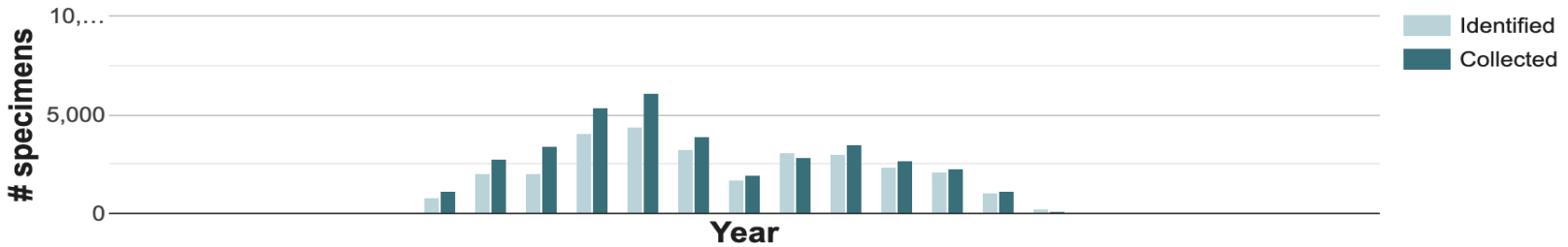


Collected From

Map | List



Dates Identified and Collected





Johannes Lid

Lid

* January 11, 1886 – September 29, 1971 †

writer, botanist

Norwegian botanist (1886-1971)

https://www.wikidata.org/wiki/Q94522

Norway

Help Attribute

Overview | Specialties | Network | Deposited At | Specimens | Science Enabled

Collected or identified specimens in the following Families:

Families Collected 294

Poaceae	4,613
Cyperaceae	4,000
Asteraceae	1,959
Brassicaceae	1,885
Rosaceae	1,842
Caryophyllaceae	1,712
Salicaceae	1,272
Juncaceae	1,149
Sphagnaceae	813
Fabaceae	746

Families Identified 236

Cyperaceae	4,607
Poaceae	4,465
Brassicaceae	2,034
Asteraceae	1,844
Rosaceae	1,693
Salicaceae	1,489
Caryophyllaceae	1,484
Juncaceae	915
Fabaceae	711
Saxifragaceae	592



Johannes Lid

Lid

* January 11, 1886 – September 29, 1971 †

writer, botanist

Norwegian botanist (1886-1971)

https://www.wikidata.org/wiki/Q94522

Norway

Help Attribute

Overview Specialties Network Deposited At Specimens Science Enabled

Co-collectors Identified For Identifications By

Has collected with:

Asplund, Erik
* October 09, 1888 – July 30, 1974 †
Sweden

Identified Poaceae and collected Poaceae

37,941 specimens claimed

Befring, Olav J.
* July 31, 1915 – May 20, 2000 †
Norway

Identified Asteraceae and collected Salicaceae

480 specimens claimed

Dahl, Eilif
* December 07, 1916 – March 17, 1993 †
Norway

Identified Parmeliaceae and collected Parmeliaceae

16,230 specimens claimed

Ekman, Elisabeth
* December 18, 1862 – May 25, 1936 †
Sweden

Identified Brassicaceae and collected Salicaceae

544 specimens claimed



Enander, Sven Johan
* December 29, 1847 – December 16, 1928 †
Sweden

Identified Salicaceae and collected Salicaceae

338 specimens claimed

Floderus, Björn
* August 14, 1867 – May 12, 1941 †
Sweden

Identified Salicaceae and collected Salicaceae

217 specimens claimed



Gjærevoll, Olav
* September 24, 1916 – August 30, 1994 †
Norway

Identified Poaceae and collected Cyperaceae

18 specimens claimed



Havaas, Johan
* October 19, 1864 – April 27, 1956 †
Norway

Identified Cladoniaceae and collected Cladoniaceae

5,121 specimens claimed



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Overview | Specialties | Network | Deposited At | Specimens | Science Enabled

Specimens deposited and curated at the following institution(s):

Specimens Collected

17 organizations **37,238** specimens

O	33,469
BG	2,814
TRH	341
TROM	263
S	142
LD	100
UPS	62
BHAM_MAXTED	22
Bioversity	13
UTE	4
BHAM_Maxted	2
ICEL	1
NHMO	1
TAAM	1
ca.ubc	1
KMN	1
NHMUK	1

Specimens Identified

11 organizations **33,581** specimens

O	29,581
BG	2,608
TRH	891
TROM	278
KMN	183
DUKE	28
ICEL	6
UPS	3
ca.ubc	1
UTE	1
NHMUK	1



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Attributions made by:



Endresen, Dag

6,254 specimens attributed



Rindal, Eirik

Norway

300 specimens attributed

GBIF Sourced

36,776 specimens attributed



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Public Profile Refresh

Johannes Lid

Search

Discovered 50+ | Fix Attributions | Reclaim Ignored | Bulk Attributions

Help attribute 3,470 specimens. Choose collected, identified, or Both. Make less exact

Advanced Search & Filter

Bulk Assignment

Both	Scientific Name	Collected By	Identified By	Date Collected	Date Identified	Family	Institution	Catalog Number	Type Status	Not them
Both	Carex	Johannes Lid		1931-08-21		Cyperaceae	TAM	TAM0138019		Not them
Both	Bryochiton microscopicus Döbbeler & Poe 1978	Johannes Lid	Marie Louise Davey	08.12.1932	07.05.2016	Pseudoperisporiaceae				Not them
Both	Bryochiton microscopicus Döbbeler & Poe 1978	Johannes Lid	Marie Louise Davey	08.11.1928	07.05.2016	Pseudoperisporiaceae				Not them
Both	Arabis alpina L.	Johannes Lid		1930-07-18 00:00:00		Brassicaceae	Z	Z-000112086		Not them
Both	Umbilicaria arctica	Lid, Johannes	Culberson, William, L.	1919-08-27		Umbilicariaceae	DUKE	403843		Not them



Johannes Lid

Lid

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https://www.wikidata.org/wiki/Q94522

Norway

Help Attribute

Overview Specialties Network Deposited At Specimens Science Enabled

9,543 specimens used in 74 works

Science Enabled by Specimen Data

Géron, C., Lembrechts, J. J., Borgelt, J., Lenoir, J., Hamdi, R., Mahy, G., ... Monty, A. (2021). Urban alien plants in temperate oceanic regions of Europe originate from warmer native ranges. Biological Invasions. doi:10.1007/s10530-021-02469-9 https://doi.org/10.1007/s10530-021-02469-9

13

When colonizing new areas, alien plant species success can depend strongly on local environmental conditions. Microclimatic barriers might be the reason why some alien plant species thrive in urban areas, while others prefer rural environments. We tested the hypothesis that the climate in the native...

9 specimens

Pérez-Navarro, M. Á., Serra-Diaz, J. M., Svenning, J., Esteve-Selma, M. Á., Hernández-Bastida, J., & Lloret, F. (2021). Extreme drought reduces climatic disequilibrium in dryland plant communities. Oikos. doi:10.1111/oik.07882 https://doi.org/10.1111/oik.07882

11

High rates of climate change are currently exceeding many plant species' capacity to keep up with climate, leading to mismatches between climatic conditions and climatic preferences of the species present in a community. This disequilibrium between climate and community composition could diminish, h...

25 specimens

Allstädt, F. J., Koutsodendris, A., Appel, E., Rösler, W., Reichgelt, T., Kaboth-Bahr, S., ... Pross, J. (2021). Late Pliocene to early Pleistocene climate dynamics in western North America based on a new pollen record from paleo-Lake Idaho. Palaeobiodiversity and Palaeoenvironments. doi:10.1007/s12549-020-00460-1 https://doi.org/10.1007/s12549-020-00460-1

3

Marked by the expansion of ice sheets in the high latitudes, the intensification of Northern Hemisphere glaciation across the Plio/Pleistocene transition at ~2.7 Ma represents a critical interval of late Neogene climate evolution. To date, the characteristics of climate change in North America duri...

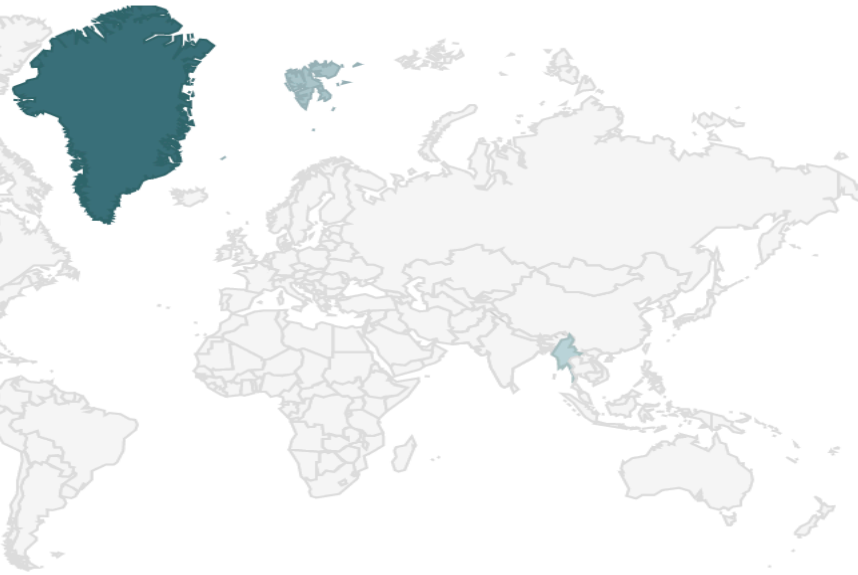
Identified From

Map List



Collected From

Map List





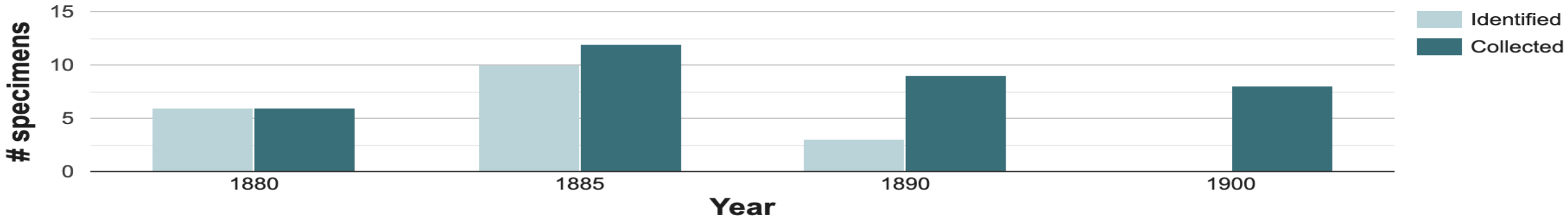
Fridtjof Nansen

Fridtjof Nansen; Fridtjof Wedel-Jarlsberg Nansen. October 10, 1861 – May 13, 1930 †

zoologist, polar explorer, diplomat, professor, politician, photographer

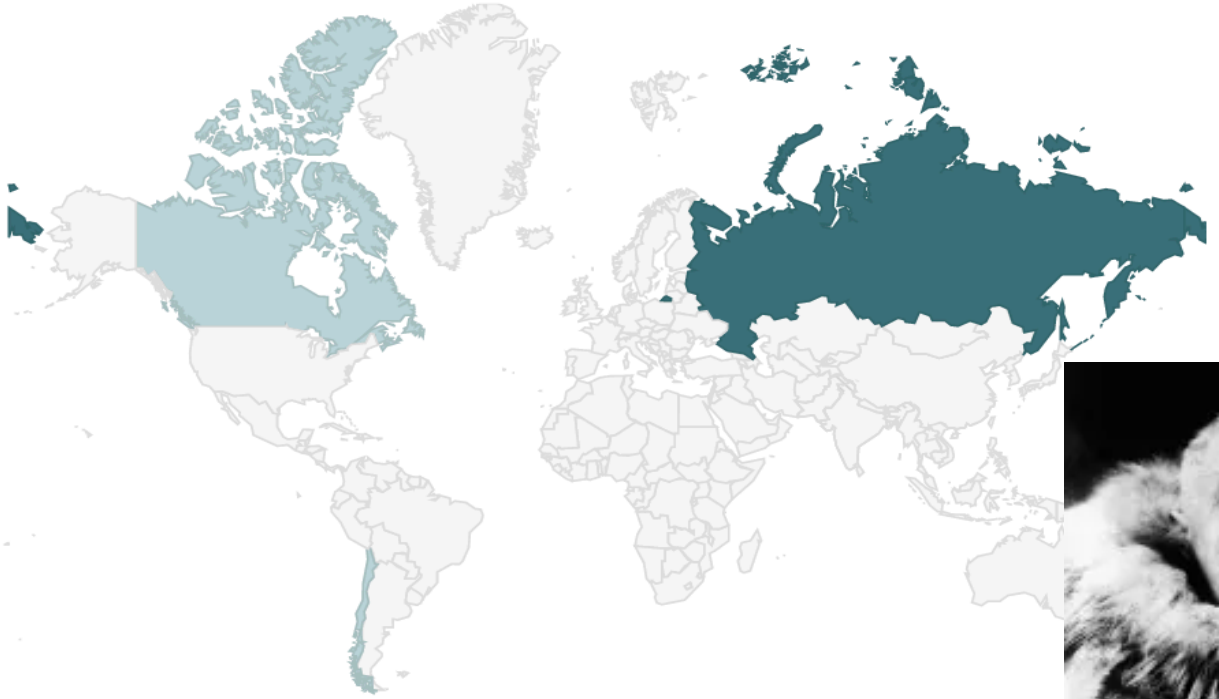
https://www.wikidata.org/wiki/Q72292

Dates Identified and Collected



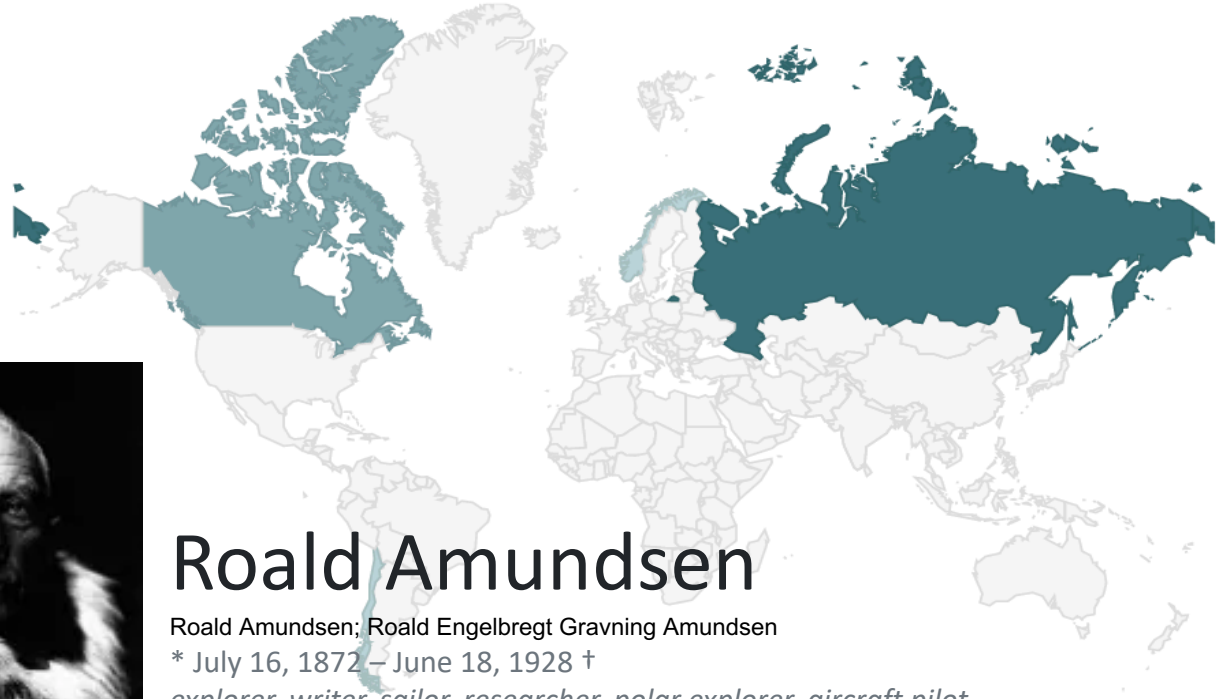
Identified From

Map List



Collected From

Map List

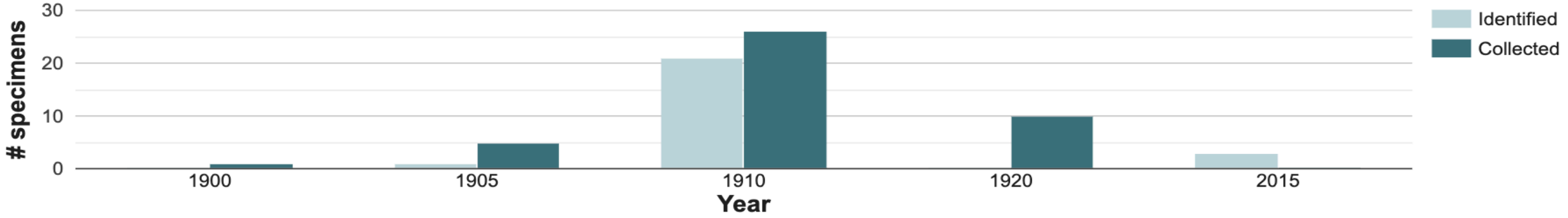




Roald Amundsen

Roald Amundsen; Roald Engelbregt Gravning Amundsen
* July 16, 1872 – June 18, 1928 †
explorer, writer, sailor, researcher, polar explorer, aircraft pilot
Norwegian explorer; first person to reach the South Pole
https://www.wikidata.org/wiki/Q926

Dates Identified and Collected



Identified From

Map List



Collected From

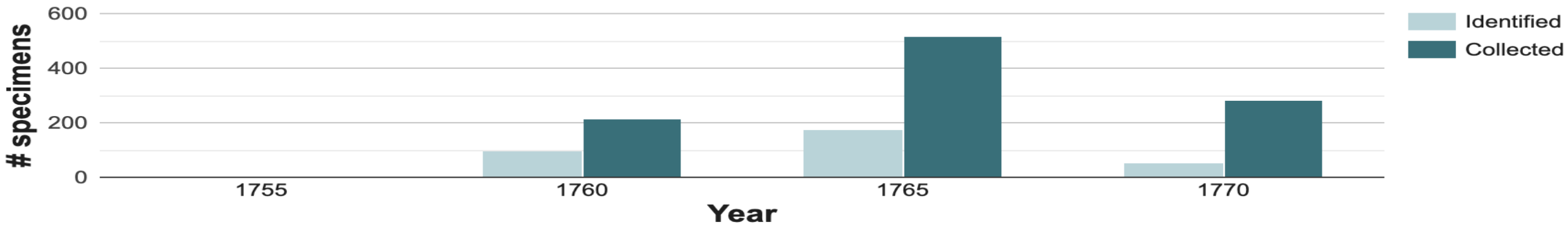




Johan Ernst Gunnerus

Johan Ernst Gunnerus; Gunnerus. * February 26, 1718 – September 25, 1773 †
botanist, ornithologist, pteridologist, bryologist, priest, zoologist, theologian, lichenologist, university teacher, mycologist, philologist, philosopher
https://www.wikidata.org/wiki/Q703279

Dates Identified and Collected



Identified From

Map List

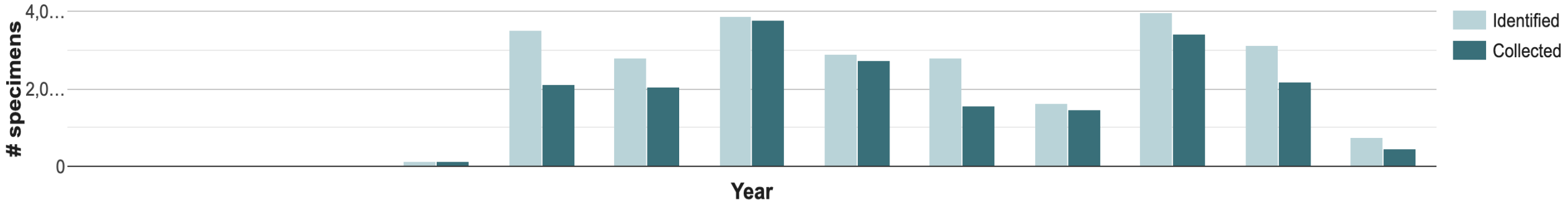
Collected From

Map List



https://orcid.org/0000-0003-4524-0617

Dates Identified and Collected



THANK YOU

Dag Endresen | GBIF Norway

helpdesk@gbif.no

