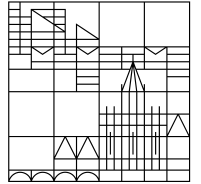




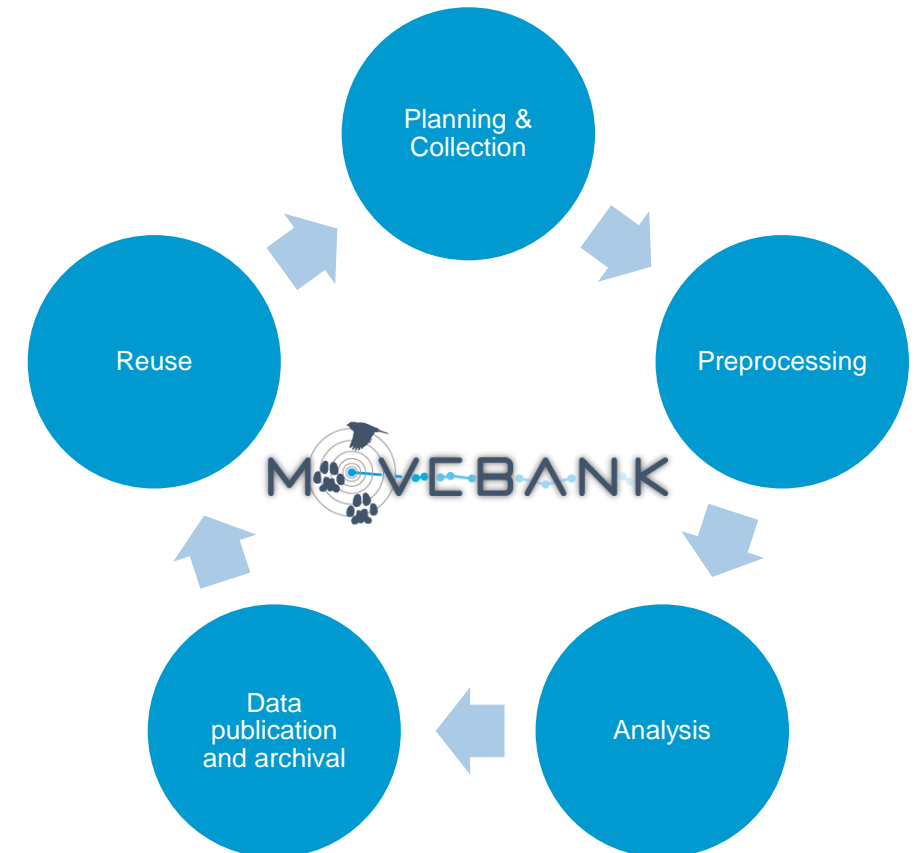
Universität
Konstanz



Research Data Management & Legal and Ethical Use of Animal Tracking Data

Gabriel Schneider, Communication, Information,
Media Centre (KIM), University of Konstanz

AniMove 2022, 13.09.2022



www.movebank.org



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What you will learn

Increase the...

Transparency

Security

of your research.

Potential for new...

Opportunities

Funding

Movebank 2.0

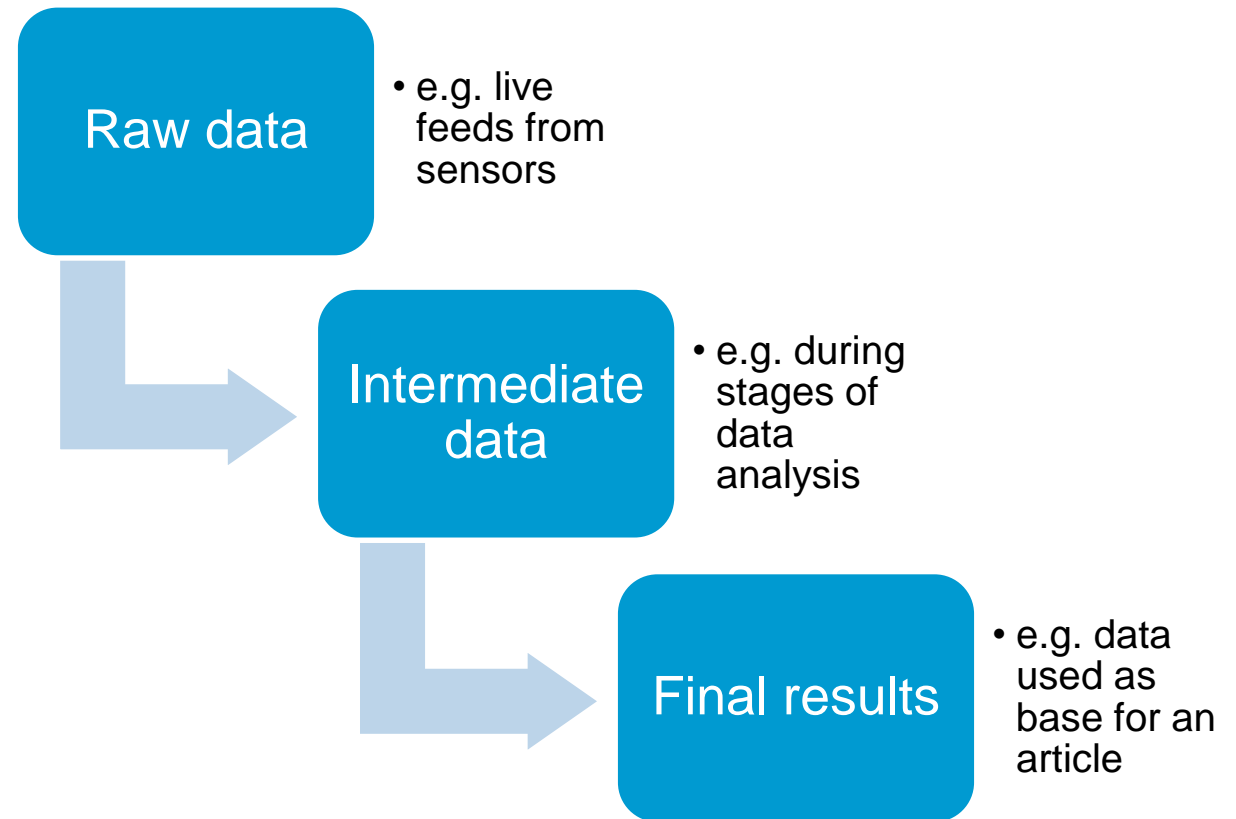
- funded by the Ministry of Science, Research and the Arts Baden-Württemberg
- Cooperation between:
 - MPI of Animal Behaviour
 - Communication, Information, Media Centre (KIM), University of Konstanz
 - Department of Computer Science in the Life Sciences, University of Konstanz
- Project duration from 06/2019 – 05/2023
- Goal → prepare Movebank for the future

Agenda

- **Research data management – why and how?**
 - The Research Data Lifecycle
 - The FAIR principles
- **Research data management with Movebank**
- **Sharing animal tracking data**
 - Legal considerations
 - Ethical considerations
- **Conclusions**

What is your research data?

“Data that are a) created through scientific processes/research (for example through measurements, surveys, source work), b) the basis for scientific research (for example digital artefacts), or c) documenting the results of research, can be called research data.”



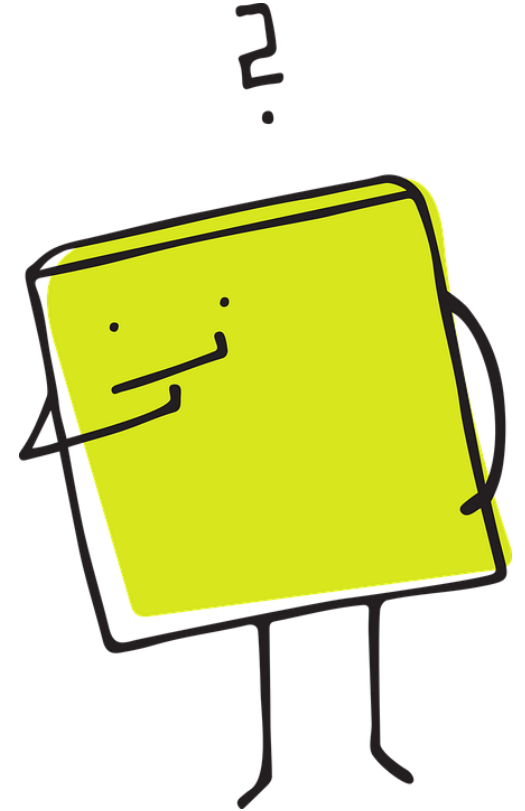
Source: Research data. Glossary entry at forschungsdaten.info.

Research data management – why?

- Difficulties in reproducing and validating published research
- Inefficient use of public funds
- Increasing volume and complexity of data



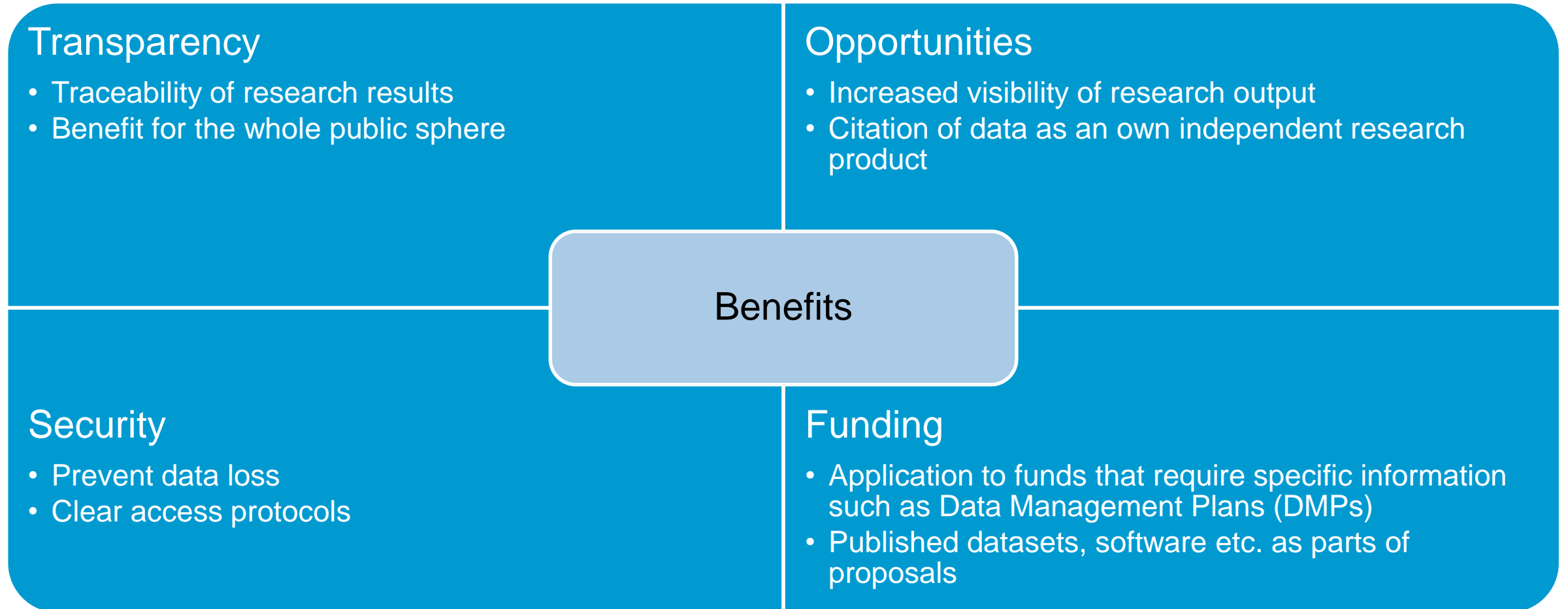
- **RDM offers increased transparency, traceability and efficiency**



Source: Team Open Science. What does Open Science mean?

Source: Boeker, E. Warum Forschungsdatenmanagement?

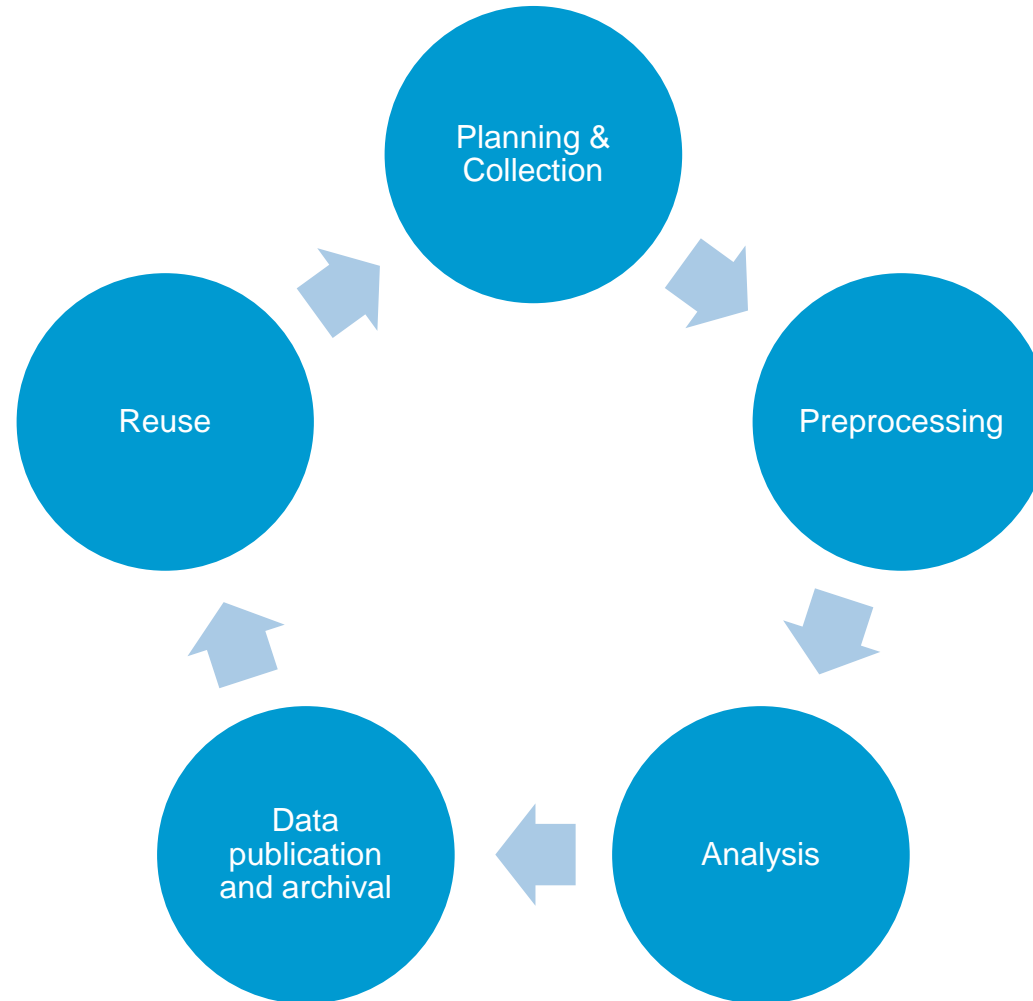
Research data management – why?



Source: Boeker, E. Warum Forschungsdatenmanagement?

Source: Deutsche Forschungsgemeinschaft. Package of Measures to Support a Shift in the Culture of Research Assessment.

The Research Data Lifecycle



Source: forschungsdaten.info. Der Datenlebenszyklus.

Research data management – how?

- **Planning**

- How will you handle data during and after project
- Data Management Plan (DMP)
 - Tools such as ARGOS or RDMO

Will I reuse data?

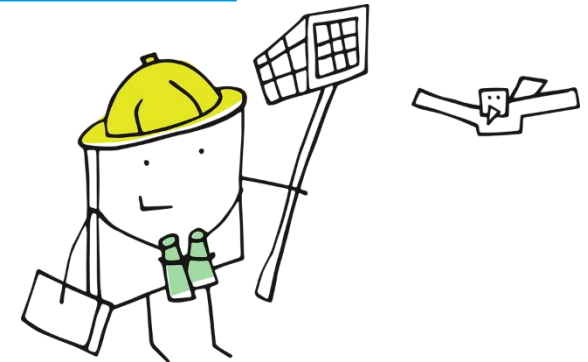
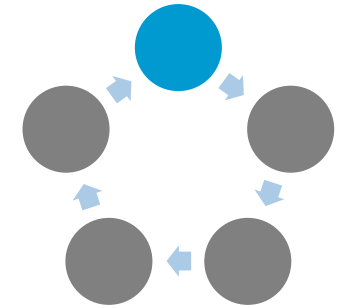
How much data
will I collect?

How will I
document my
data?

Where and under
which license will
I publish my
data?

- **Collection**

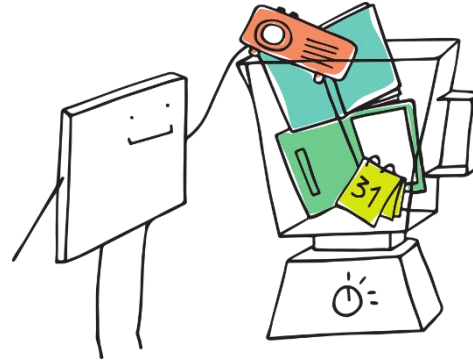
- Depends on the choice of methods, tools etc.



Research data management – how?

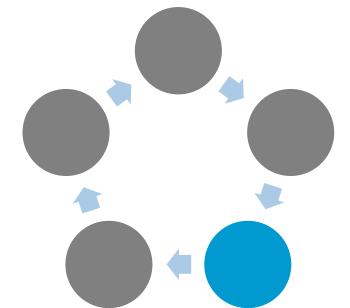
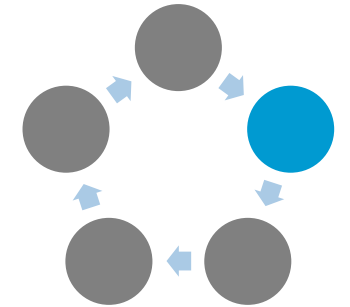
- **Preprocessing**

- Data selection, transformation, file formats, quality control, ...



- **Analysis**

- Apply scientific methods to answer your research questions



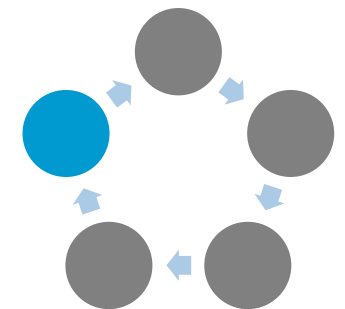
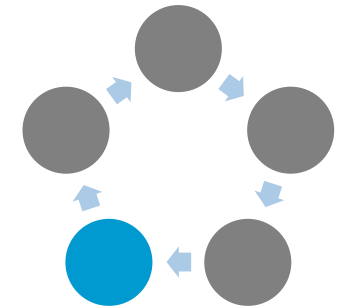
Research data management – how?

- **Data publication and archival**

- Publication in a repository
- Licensing and access conditions
- Guarantee of long-term availability

- **Reuse**

- Searching for interesting datasets to use in your own research
- Pay attention to specific licensing



The FAIR principles

Findable



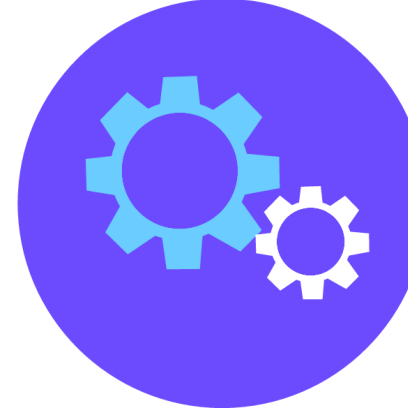
- Persistent identifier
- Rich metadata
- Indexed in repository

Accessible



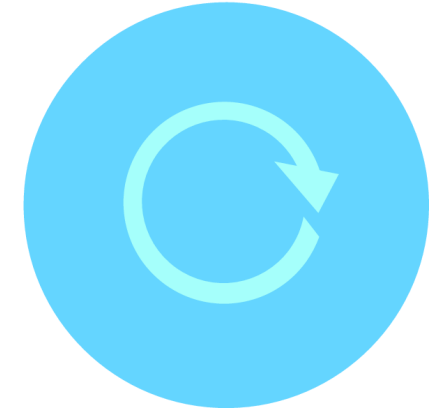
- Access via open protocol
- Authorization if needed
- „tombstone“ metadata

Interoperable



- Shared vocabulary for description
- FAIR vocabulary
- References to other (meta) data

Reusable



- Clear license
- Accurate and relevant metadata
- (meta) data meets community standards

Source: Paulina Halina Sieminska. A FAIRy tale graphics .(Version 1.0.0). 2019. Zenodo. <http://doi.org/10.5281/zenodo.3267168>. [23.08.2022].

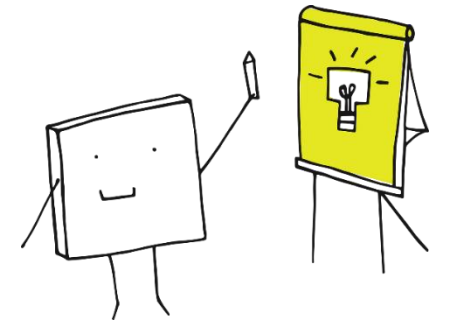
Source: Wilkinson et al. The FAIR Guiding Principles for scientific data management and stewardship.

The FAIR principles



Source: forschungsdaten.info. FAIRe Daten.

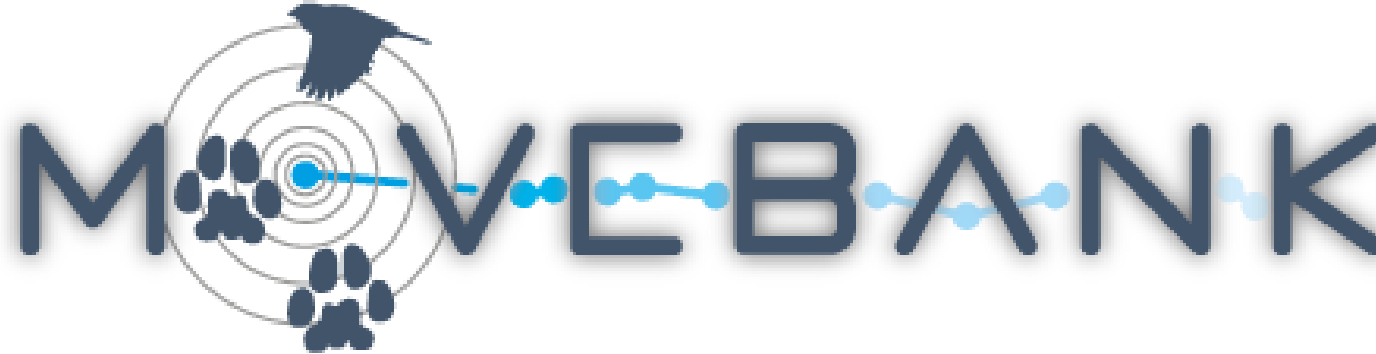
Research data management – summary



- **Research data management helps you with**
 - making your research process as efficient and secure as possible
 - sharing your own research and reusing the data of other researchers
 - meeting funder requirements
- **An important part of RDM are the FAIR principles**
 - Findability, Accessibility, Interoperability, Reusability

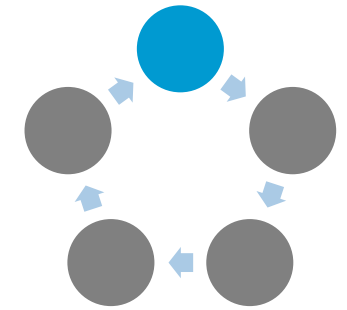
Source: GO-FAIR. FAIR principles.

Research data management with Movebank



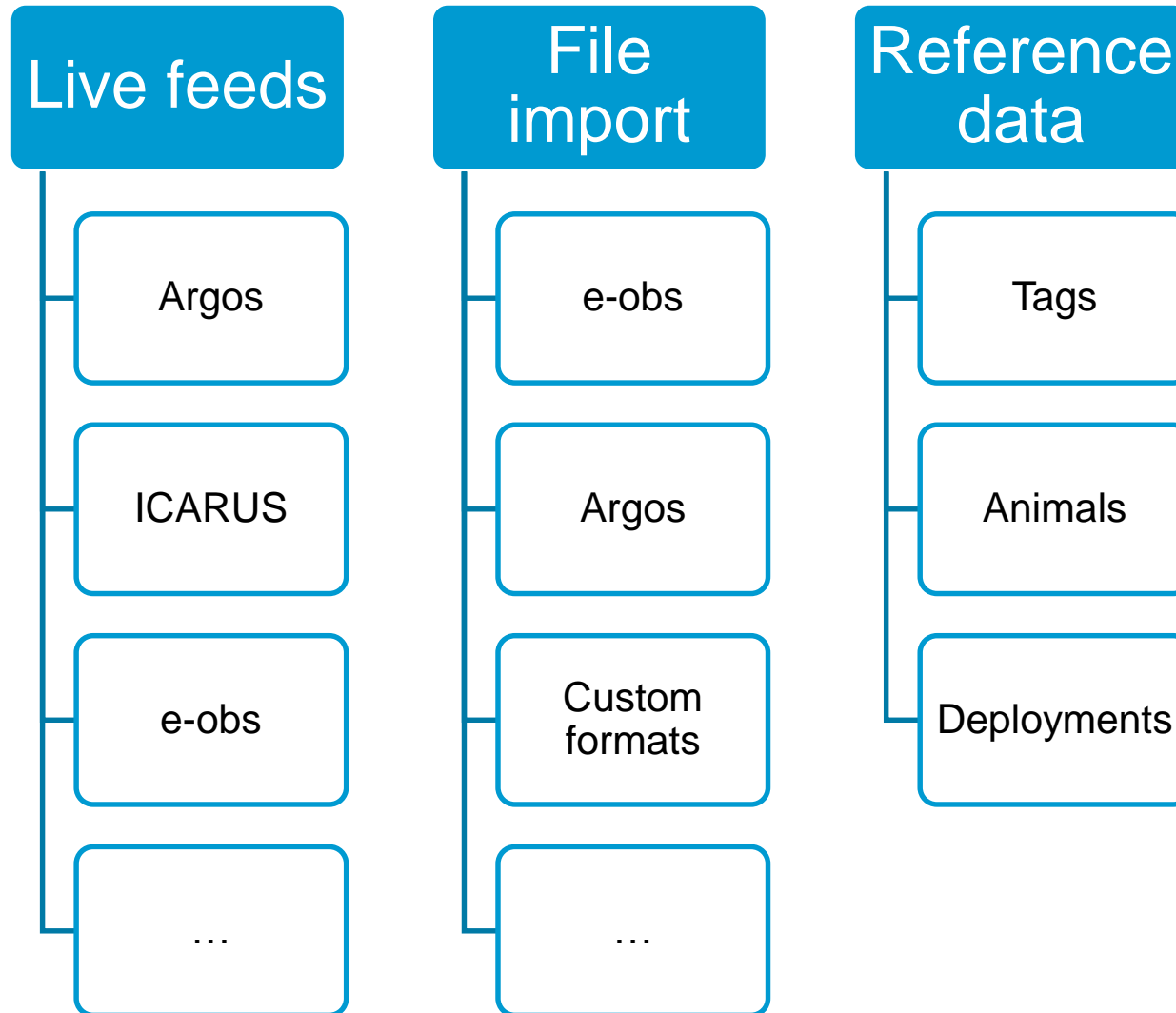
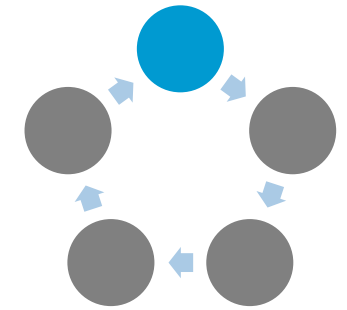
www.movebank.org

RDM with Movebank – Collection



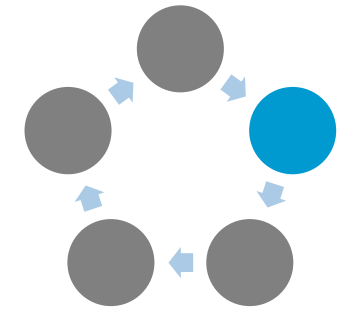
- **Animals are caught in the field and equipped with sensors**
 - Sensor selection
 - Different technologies
 - Different size & weight
- **Animals are released and tags transmit/log data**
 - Sensors must
 - Send data over long distances
 - Function under difficult conditions

RDM with Movebank – Collection



Source: Movebank. Manual.

RDM with Movebank – Preprocessing



Manage Attributes | Map | Help | Filter Data | Run data filters.

Study: Coyotes, Kays and Bogan, Albany NY
Sensor Type: Radio Transmitter

Map zoom options

Display Options: View or hide outliers, undeployed events, or a specific time range.

Select which columns to view in the table. Show/Hide Columns

Timestamp	Location Lat	Location Long	Behavioural Classification
2003-08-19 21:55:00	42.699	-73.863	I
2003-08-22 01:40:00	42.700	-73.866	A
2003-08-22 05:25:00	42.701	-73.866	I
2003-08-29 09:10:00	42.702	-73.869	I
2003-09-02 12:55:00	42.702	-73.859	I
2003-09-03 16:40:00	42.701	-73.867	I
2003-09-09 20:25:00	42.702	-73.862	I
2003-09-11 00:10:00	42.699	-73.862	I
2003-09-16 03:55:00	42.701	-73.866	I
2003-09-17 07:40:00	42.702		
2003-09-18 11:25:00	42.701		
2003-09-29 15:10:00	42.702		
2002-11-27 18:55:00	42.737		
2002-12-13 22:40:00	42.739	-73.776	
2002-12-17 02:25:00	42.736	-73.774	
2002-12-27 06:10:00	42.732	-73.766	
2002-12-27 09:55:00	42.731	-73.767	
2002-12-28 13:40:00	42.735	-73.767	
2003-01-08 17:25:00	42.735	-73.778	
2003-01-22 21:10:00	42.736	-73.776	
2003-01-31 00:55:00	42.734	-73.769	
2003-02-01 04:40:00	42.732	-73.768	
2003-02-07 08:25:00	42.736	-73.775	
2003-02-11 12:10:00	42.731	-73.772	
2003-02-12 15:55:00	42.737	-73.778	

Change from blue to white shading shows a transition to events for a different animal or tag.

Blue marks show the selected events within the data table. Click to jump to the events.

Select groups of events on the map.

Selected events.

Selected records

Hold shift or ctrl key to select multiple events.

Save Cancel

General purpose filters:

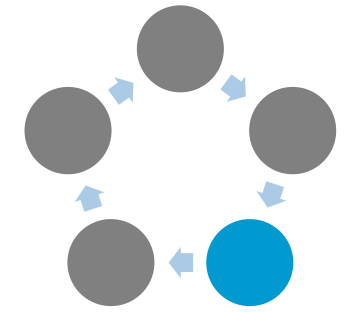
Duplicates

Value range

Speed

Source: Movebank. Manual.

RDM with Movebank – Analysis



Software packages (R, Java, ...)

- Run locally or via web service
- Examples: move, MoveVis, ctm, ...

Env-DATA

- Enrich and combine Movebank data with environmental data

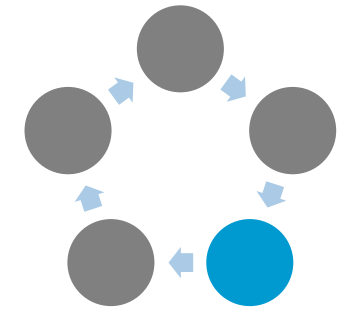
MoveApps

- Combine modular apps without coding



Source: Movebank. Software.

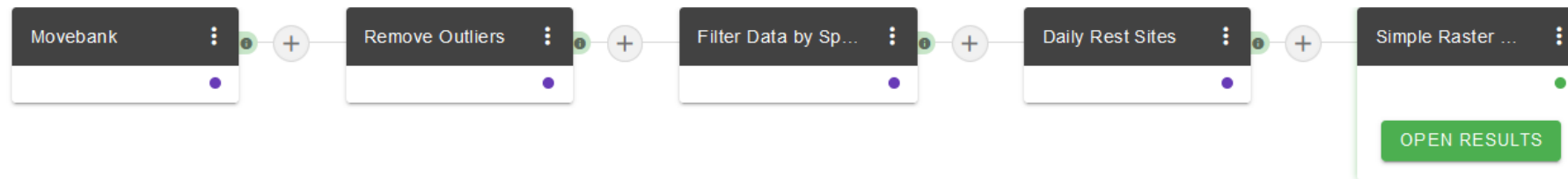
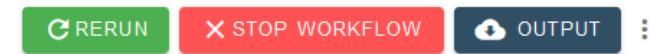
RDM with Movebank – MoveApps



- **No-code analysis platform**
 - Launched beta in February 2021

Roost Sites ●

Winter Roosts – Workflow that extracts Winter Roost sites of e.g. Bean Geese in a defined region. The used Apps remove outliers, filter by space (Germany and Poland) and extract all roosts in which the tracked animals stayed for longer than 2 hours in a radius of 1 km, not moving faster than 1 m/s. The output map is a raster summary.

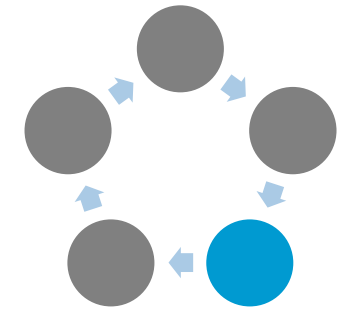
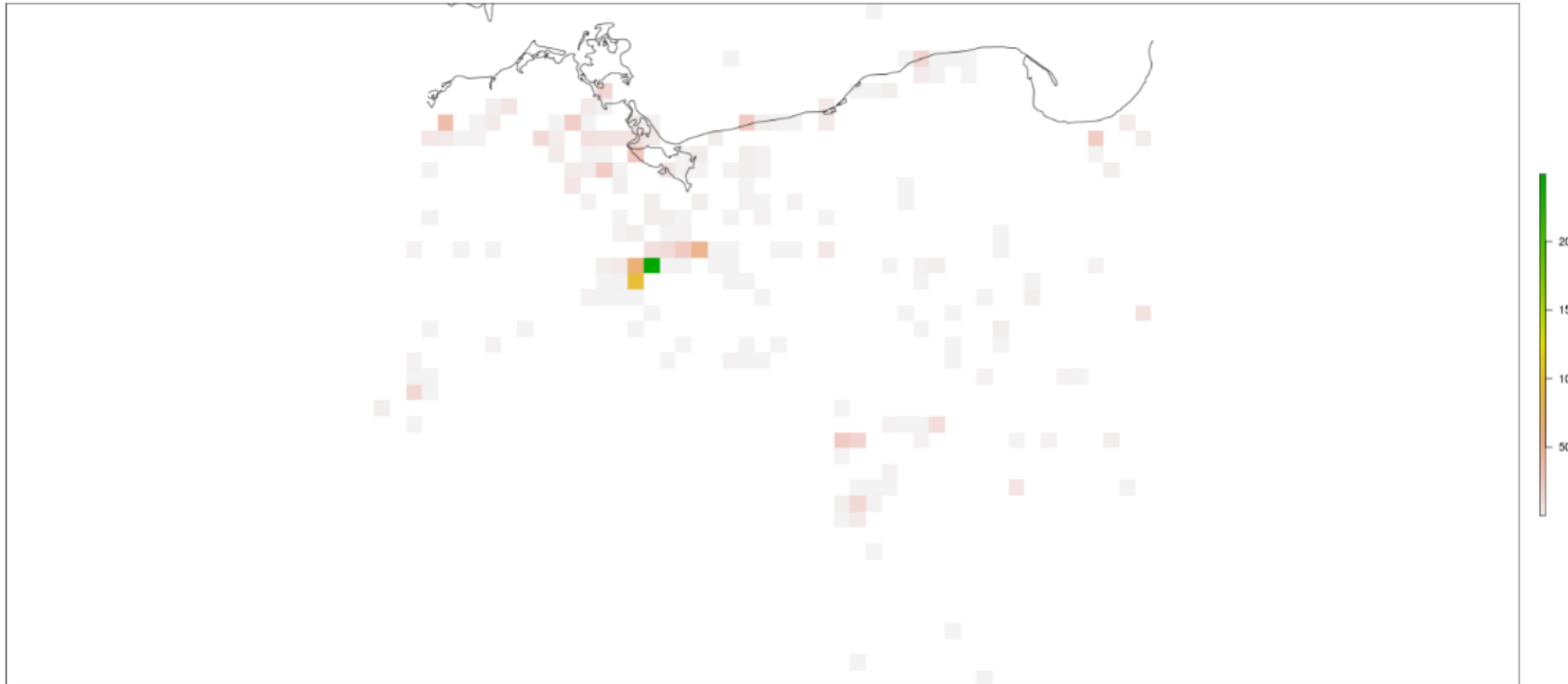


Source: MoveApps. platform to share and use movement data analysis tools.

RDM with Movebank – MoveApps

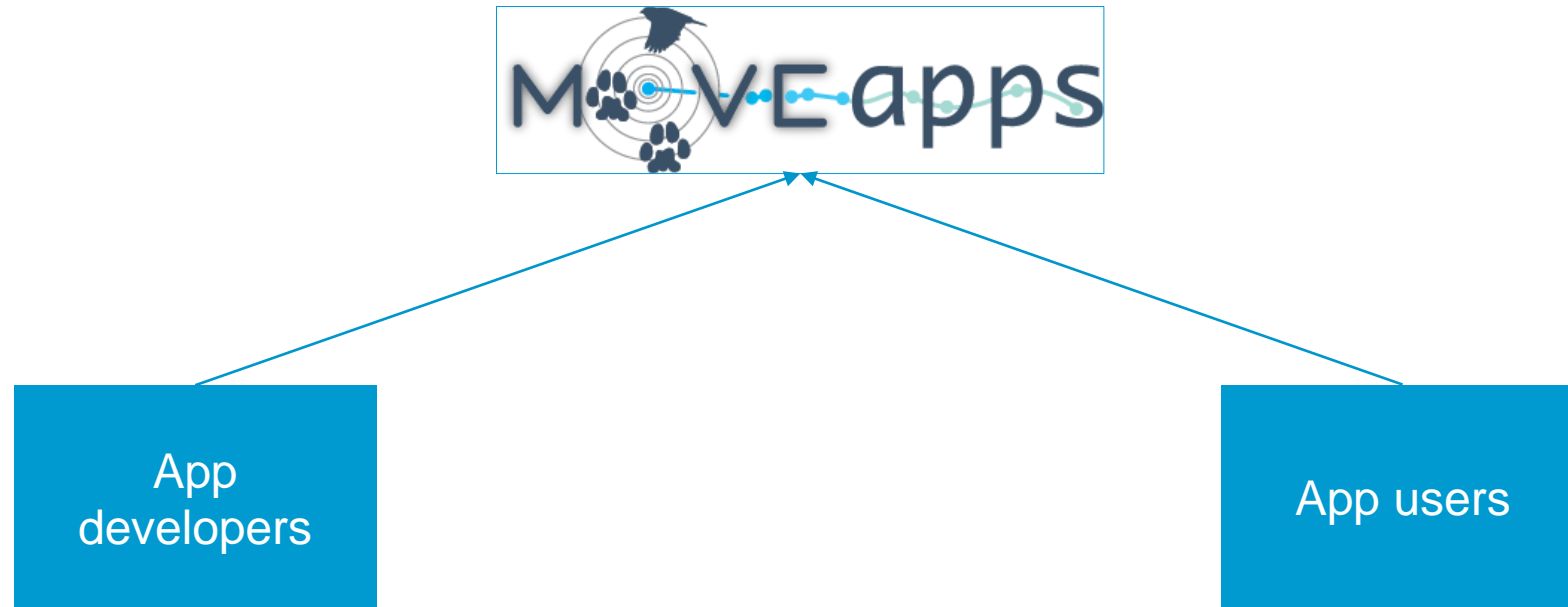
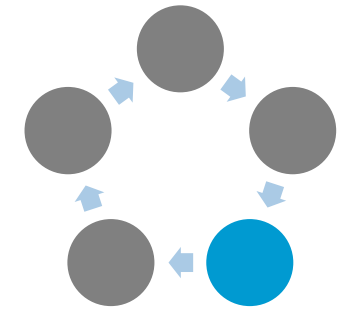
Raster map of location density

Choose a raster grid size in m



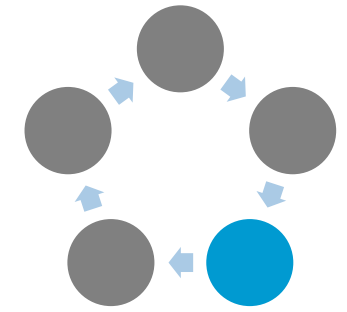
Source: MoveApps. platform to share and use movement data analysis tools.

RDM with Movebank – MoveApps



Source: MoveApps. platform to share and use movement data analysis tools.

RDM with Movebank – MoveApps



Sharing

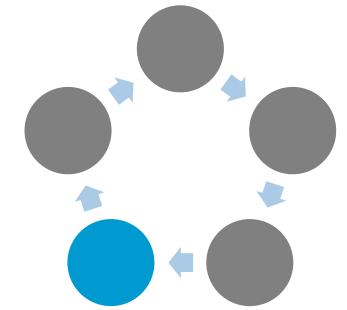
- Directly on the platform
- Public vs. selected access
- Local copies

Publication

- Description with metadata
- Publication via the Movebank Data Repository
- Citation in papers

Source: MoveApps. platform to share and use movement data analysis tools.

RDM with Movebank – Publication and Archival



- **Movebank Data Repository**

- Established in 2012 as part of a DFG project
- Operated by KIM of the University of Konstanz in close collaboration with MPIAB
- Persistent publication of Movebank data and MoveApps workflows

12666
animals

276 data
packages

116
journals

204 taxa

Review



We review datasets to make sure that they are complete, correct, and well described, so important details aren't lost.

Cite



Published datasets get a DOI that others can use to give researchers credit for their work.

License



Published datasets are licensed by Creative Commons to make it easier for the data to be re-used in the future.

Discover

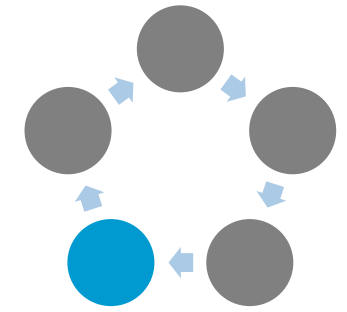


The DOIs ensure that the published data files can always be found, even if URLs change over time.

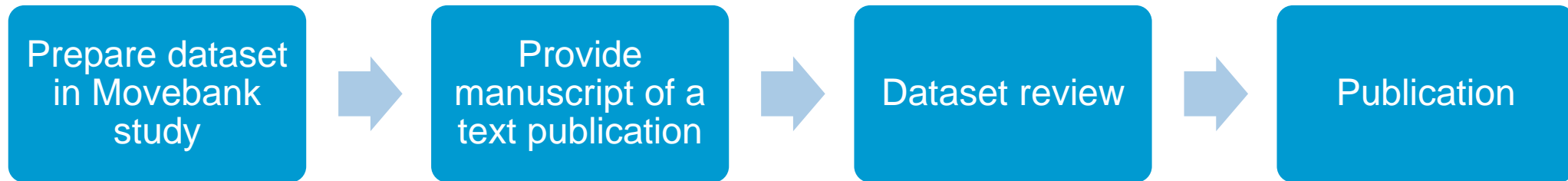


Source: Movebank. Movebank Data Repository.

RDM with Movebank – Publication and Archival



- **Example dataset publication**

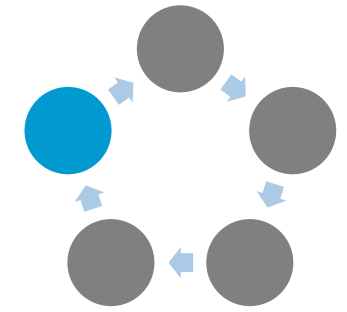


- **Publication requirements**

- Datasets
 - Data in Movebank
 - Paper manuscript
- MoveApps workflows
 - Data in the Movebank Data Repository
 - Paper manuscript/preprint

Source: Movebank. Movebank Data Repository.

RDM with Movebank – Reuse



- Movebank Data Repository – example dataset

Data from: Overall dynamic body acceleration in straw-colored fruit bats increases in headwinds but not with airspeed

When using this dataset, please cite the original article.

O'Mara MT, Scharf AK, Fahr J, Abedi-Lartey M, Wikelski M, Dechmann DKN, Safi K (2019) Overall dynamic body acceleration in straw-colored fruit bats increases in headwinds but not with airspeed. *Frontiers in Ecology and Evolution*. doi:10.3389/fevo.2019.00200

Additionally, please cite the Movebank data package:

Scharf AK, Fahr J, Abedi-Lartey M, Safi K, Dechmann DKN, Wikelski M, O'Mara MT (2019) Data from: Overall dynamic body acceleration in straw-colored fruit bats increases in headwinds but not with airspeed. Movebank Data Repository. doi:10.5441/001/1.k8n02jn8

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Package Identifier doi:10.5441/001/1.k8n02jn8



Abstract

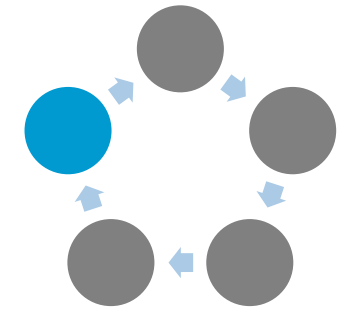
Atmospheric conditions impact how animals use the aerosphere, and birds and bats should modify their flight to minimise energetic expenditure relative to changing wind conditions. To investigate how free-ranging straw-colored fruit bats (*Eidolon helvum*) fly with changing wind support, we use data collected from bats fit with GPS loggers and an integrated triaxial accelerometer and measure flight speeds, wingbeat frequency, and overall dynamic body acceleration (ODBA) as an estimate for energetic expenditure. We predicted that if ODBA reflects energetic expenditure, then we should find a curvilinear relationship between ODBA and airspeed consistent with aerodynamic theory. We expected that bats would lower their airspeed with tailwind support and that ODBA will decrease with increasing tailwinds and increase with wingbeat frequency. We found that wingbeat frequency has the strongest positive relationship with ODBA. There was a small, but negative, relationship between airspeed and ODBA, and bats decreased ODBA with increasing tailwind. Bats flew at ground speeds of 9.6 ± 2.4 ms⁻¹ (mean \pm sd, range: 4.3 to 23.9 ms⁻¹) and airspeeds of 10.2 ± 2.5 ms⁻¹, and did not modify their wingbeat frequency with speed. Free-ranging straw-colored fruit bats therefore exerted more total ODBA in headwinds but not when they changed their airspeed. It is possible that the flexibility in wingbeat kinematics may make flight of free-ranging bats less costly than currently predicted or alternatively that the combination of ODBA and airspeed at our scales of measurement does not reflect this relationship in straw-colored fruit bats. Further work is needed to understand the full potential of free-ranging bat flight and how well bio-logging techniques reflect the costs of bat flight.

Keywords

animal movement, animal tracking, avian migration, biotelemetry, body acceleration, Burkina Faso, *Eidolon helvum*, flight behavior, Ghana, GPS logger, straw-colored fruit bat, Zambia,

Source: Movebank. Movebank Data Repository.

RDM with Movebank – Reuse



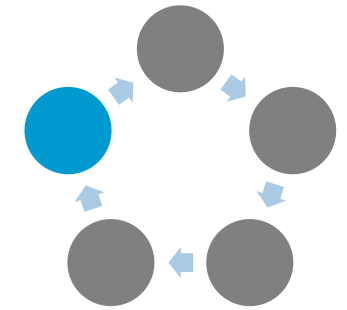
Movement data

Reference data

Readme

Source: Movebank. Movebank Data Repository.

RDM with Movebank – Reuse



Movement data
& Readme

Straw-colored fruit bats (*Eidolon helvum*) in Africa 2009-2014-gps [View File Details](#)

Download: [README.txt](#) (18.56Kb)

Download: [Straw-colored fruit bats \(*Eidolon helvum*\) in Africa 2009-2014-gps.csv](#) (4.497Mb)

To the extent possible under law, the authors have waived all copyright and related or neighboring rights to this data.



Other sensor
data & Readme

Straw-colored fruit bats (*Eidolon helvum*) in Africa 2009-2014-acc [View File Details](#)

Download: [README.txt](#) (18.56Kb)

Download: [Straw-colored fruit bats \(*Eidolon helvum*\) in Africa 2009-2014-acc.csv](#) (1.250Gb)

To the extent possible under law, the authors have waived all copyright and related or neighboring rights to this data.



Reference
Data & Readme

Straw-colored fruit bats (*Eidolon helvum*) in Africa 2009-2014-reference-data [View File Details](#)

Download: [README.txt](#) (18.56Kb)

Download: [Straw-colored fruit bats \(*Eidolon helvum*\) in Africa 2009-2014-reference-data.csv](#) (23.28Kb)

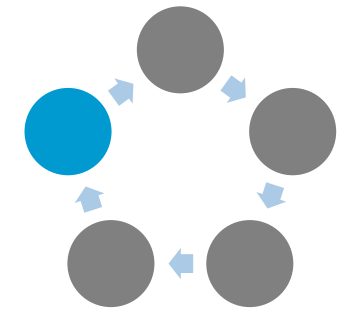
To the extent possible under law, the authors have waived all copyright and related or neighboring rights to this data.



click, download
& re-use

Source: Movebank. Movebank Data Repository.

RDM with Movebank – Reuse



- **Movebank Data Repository – example MoveApps workflow**
 - Xml file with metadata
 - App source code

```
<?xml version="1.0" encoding="UTF-8"?>
<!--This XML file describes the whole metadata of a published MoveApps workflow. For a detailed description of the metadata
<!--The metadata below consists of properties that describe the workflow, including information about the workflow itself ('
<metadata>
  <workflow>
<!--The information contained in the 'workflow' element describes the workflow itself. This includes general information abo
  <workflowPid>https://dx.doi.org/10.5441/001/1.7tq16jr8</workflowPid>
  <workflowTitle>Migration Mapper</workflowTitle>
  <workflowDescription>Clean and filter your data to view migration tracks.</workflowDescription>
  <workflowPeople>
    <workflowPerson>
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      </workflowPersonAffiliation>
    </workflowPerson>
  </workflowPeople>
</workflow>
</metadata>
```

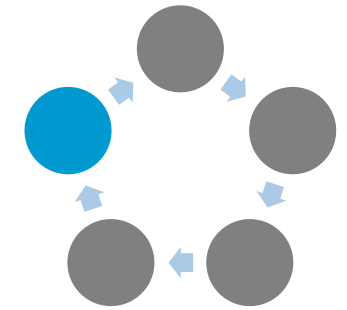
01_movebank-download-4.3.zip	27.10.2021 09:42	ZIP-komprimierte...	7 KB
02_RemoveOutliers-2.2.zip	27.10.2021 09:42	ZIP-komprimierte...	6 KB
03_thinData-byTime-2.1.zip	27.10.2021 09:42	ZIP-komprimierte...	5 KB
04_FilterData-bySeason-2.2.zip	27.10.2021 09:42	ZIP-komprimierte...	11 KB
05_SegmentData-bySpeed-2.4.zip	27.10.2021 09:42	ZIP-komprimierte...	5 KB
06_SegmentPlot-Raster-3.2.zip	27.10.2021 09:42	ZIP-komprimierte...	3.000 KB




.gitignore	02.02.2021 13:42	GITIGNORE-Datei	1 KB
appspec.json	02.02.2021 13:42	JSON-Datei	2 KB
copilot-sdk.R	02.02.2021 13:42	R-Datei	3 KB
copilot-sdk.Rproj	02.02.2021 13:42	RPROJ-Datei	1 KB
logger.R	02.02.2021 13:42	R-Datei	2 KB
README.md	02.02.2021 13:42	MD-Datei	4 KB
RFunction.R	02.02.2021 13:42	R-Datei	7 KB

Source: Movebank. Movebank Data Repository. MoveApps Attribute Dictionary.

RDM with Movebank – Reuse



- Movebank – study browser



for animal tracking data

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[Animals](#) [Tags](#) [Files](#) [Argos Feeds](#) [File Formats](#)

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[Agouti Radio Tracking on BCI](#)
[American bittern - Huschle - USA](#)
[American mink \(Neovison vison\) space use in Illinois \(data from Ahlers\)](#)
[American White Ibis Behavioral Seasons](#)
[Andean Condor Vultur gryphus Bariloche, Argentina, 2013-2018](#)
[Annual Movements of Bicknell's Thrush \(Catharus bicknelli\) from Light-](#)
[Antarctic petrel 3D flights, Svarthamaren, Antarctica \(data from Tarrow](#)
[Arctic fox Bylot - Argos tracking](#)
[Arctic fox Bylot - GPS tracking](#)
[Arctic fox Herschel - Argos tracking](#)
[Arctic hare Alert - Argos tracking](#)
[Arctic shorebird migration tracking study - American Golden-Plover](#)
[Arctic shorebird migration tracking study - Dunlin](#)
[Arctic shorebird migration tracking study - Pectoral Sandpiper](#)

Studies

View Download Env-DATA

Study Details

Study Name

Contact Person

Principal Investigator

PI Contact Details

Citation

Acknowledgements

Grants used

License Type

License Terms

Study Summary

Study Reference Location

Longitude

Latitude

Movebank ID

Study Statistics

Number of Animals

Number of Tags

Number of Deployments

Time of First Deployed Location

Time of Last Deployed Location

Taxa

Number of Deployed Locations

Number of Records

GPS

Acceleration

About study details

Processing Status

Aromas Hills Bobcat Habitat Connectivity Study

ucsc@bobcat (Laurel Serieys)

Laurel Serieys

University of California, Santa Cruz 1156 High Street Santa Cruz, CA, USA

Serieys et al. 2021. Road-crossings, vegetative cover, land use and poisons interact to influence corridor effectiveness. Biological Conservation (in press)

not set

not set

 BY-NC

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not set

-121.604

36.888

501787846

Number of Animals

12

Number of Tags

12

Number of Deployments

12

Time of First Deployed Location

2018-03-01 00:00:23.000

Time of Last Deployed Location

2018-12-29 17:30:23.000

Taxa

Urocyon cinereoargenteus, Lynx rufus

Number of Deployed Locations

163634

Number of Records

Deployed (outliers) / Total (outliers)

GPS

163634 (0) / 163685 (0)

Acceleration

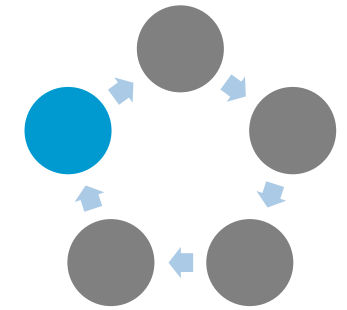
4257402 (0) / 4261182 (0)

About study details

Processing Status

Up-to-date

RDM with Movebank – Reuse



[Data](#) [Help](#) [Tools](#) [Archiving](#) [News](#)

[About](#) [Login/Register](#)

Studies where I can download any data ▾

Filter by Study Name

Study - Aromas Hills Bobcat Habitat Connectivity Study
[Animals](#) [Tags](#) [Files](#) [Argos Feeds](#) [File Formats](#)

African elephants in Etosha National Park (data from Tsalyuk et al. 2018)

Agouti Radio Tracking on BCI

American bittern - Huschle - USA

American mink (Neovison vison) space use in Illinois (data from Ahlers)

American White Ibis Behavioral Seasons

Andean Condor Vultur gryphus Bariloche, Argentina, 2013-2018

Annual Movements of Bicknell's Thrush (Catharus bicknelli) from Light

Antarctic petrel 3D flights, Svarthamaren, Antarctica (data from Tarrow)

Arctic fox Bylot - Argos tracking

Arctic fox Bylot - GPS tracking

Arctic fox Herschel - Argos tracking

Arctic hare Alert - Argos tracking

Arctic shorebird migration tracking study - American Golden-Plover

Arctic shorebird migration tracking study - Dunlin

Arctic shorebird migration tracking study - Pectoral Sandpiper

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not set

not set

License Type

License Terms

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Longitude

Latitude

Movebank ID

-121.004

36.888

501787846

Study Statistics

Number of Animals

Number of Tags

Number of Deployments

Time of First Deployed Location

Time of Last Deployed Location

Taxa

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Number of Records

GPS

Acceleration

12

12

12

2018-03-01 00:00:23.000

2018-12-29 17:30:23.000

Urocyon cinereoargenteus, Lynx rufus

163634

Deployed (outliers) / Total (outliers)

163634 (0) / 163685 (0)

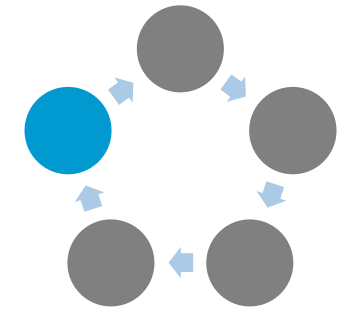
4257402 (0) / 4261182 (0)

[About study details](#)

Processing Status

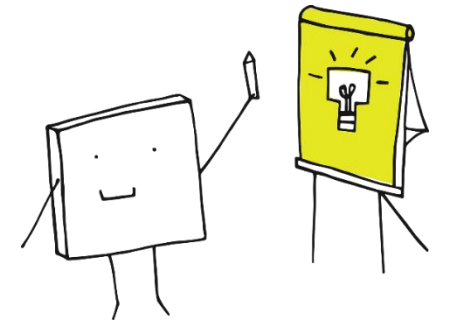
Up-to-date

RDM with Movebank – Reuse



- **Metadata is distributed to other services**
 - Web of Science Data Citation Index
 - Mendeley Data
 - Google Scholar
- **→ Increased findability and citations**

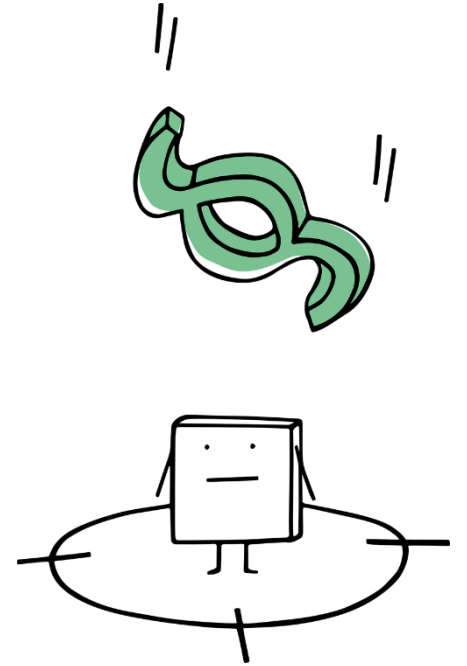
RDM with Movebank – summary



- **Movebank offers tools and services along the Research Data Lifecycle**
 - Collect your data and harmonize it
 - Use filters or prepare your data manually
 - Different options for analysis
 - Publish your own data
 - Search for other relevant datasets

Data sharing – Legal considerations

- **Disclaimer → No universal applicable suggestions possible**
 - Always contact the legal support of your institution
- **Legality and ethics are different things**
 - Violating legal restrictions can lead to legal trouble
 - Even if you are allowed to use a dataset legally it can still be unethical



Source: Renirie, Rebecca. Data Ethics and the use of digital data.

Data sharing – Data ownership & licenses

- Pay attention to data ownership
 - Possibilities:

Creator of
the data

Project PI

Research
Institution

Funder

- Look at institutional guidelines and contact your **local legal support**
- Owners can, **depending on the law**:
 - Keep sole ownership
 - Sign over to someone else
 - License their work

Source: Renirie, Rebecca. Data Ethics and the use of digital data.

Data sharing – Creative Commons licenses

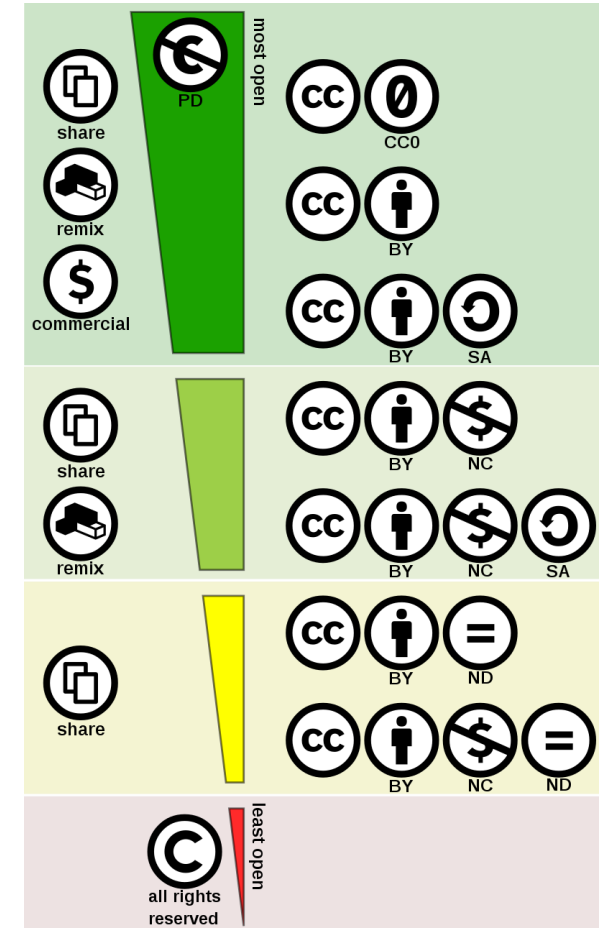
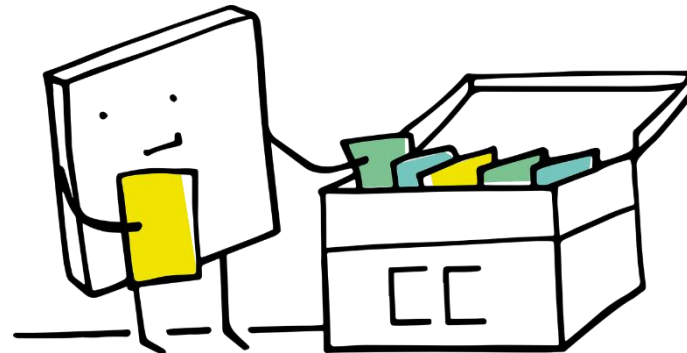
- **Creative Commons (CC) is a nonprofit organization**
 - A set of modular licenses
 - Internationally known and accepted
 - Suitable for research data
 - Easily understandable



Source: Creative Commons. Creative Commons.

Data sharing – Creative Commons licenses

- **Four different elements to mix**
 - **BY** – “Credit must be given to the creator”
 - **NC** – “Only noncommercial uses of the work are permitted”
 - **ND** – “No derivatives or adaptations of the work are permitted”
 - **SA** – “Adaptations must be shared under the same terms”
- **Possible example licenses**
 - CC BY
 - CC BY-SA
 - CC BY-NC-ND
 - CC0

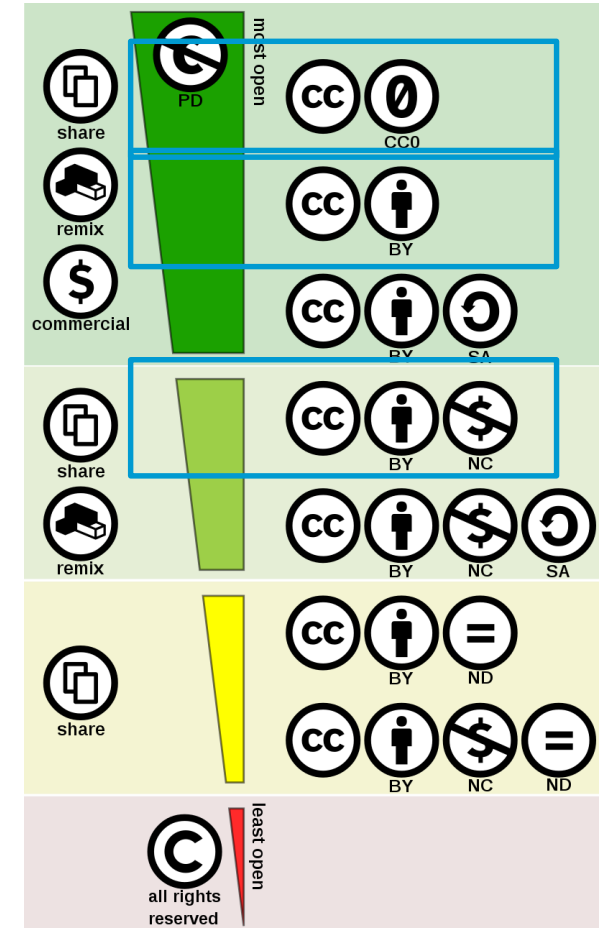


Source: Shaddim.
<https://commons.wikimedia.org/w/index.php?curid=47247325>.

Source: Creative Commons. Creative Commons.

Data sharing – Creative Commons licenses

- **Movebank**
 - CC0
 - CC BY
 - CC BY-NC
 - Owner defined terms for non-public data
- **Movebank Data Repository**
 - CC0 only



Source: Shaddim.

<https://commons.wikimedia.org/w/index.php?curid=47247325>.

Source: Movebank. Data policy.

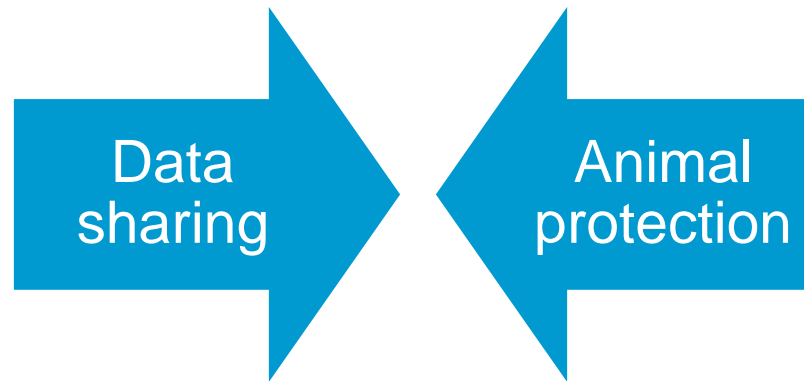
Data sharing – Ethical considerations

- **Example misuse of animal tracking data**
 - Professional ecotourism
 - Commercial fishers
 - Aqua- or agriculturists
- **Mechanisms in Movebank**
 - Study discoverable but without individual locations
 - Prevent data download completely
 - Share access only with selected collaborators
 - Restrict access to more recent data

Source: Lennox et al. A Novel Framework to Protect Animal Data in a World of Ecosurveillance.

Source: Movebank. Manual.

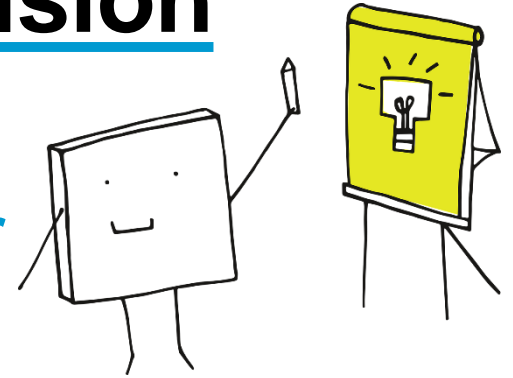
Data sharing – Ethical considerations



Source: Lennox et al. A Novel Framework to Protect Animal Data in a World of Ecosurveillance.

Legal and ethical considerations – Conclusion

- Contact your legal department/support if anything is unclear
- Pay attention to data ownership
- Use Creative Commons licenses and tailor them to your needs
- Consider ethical implications of data sharing and publication



Sources

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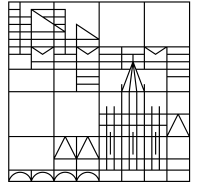
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Universität
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**Thank
you!**

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