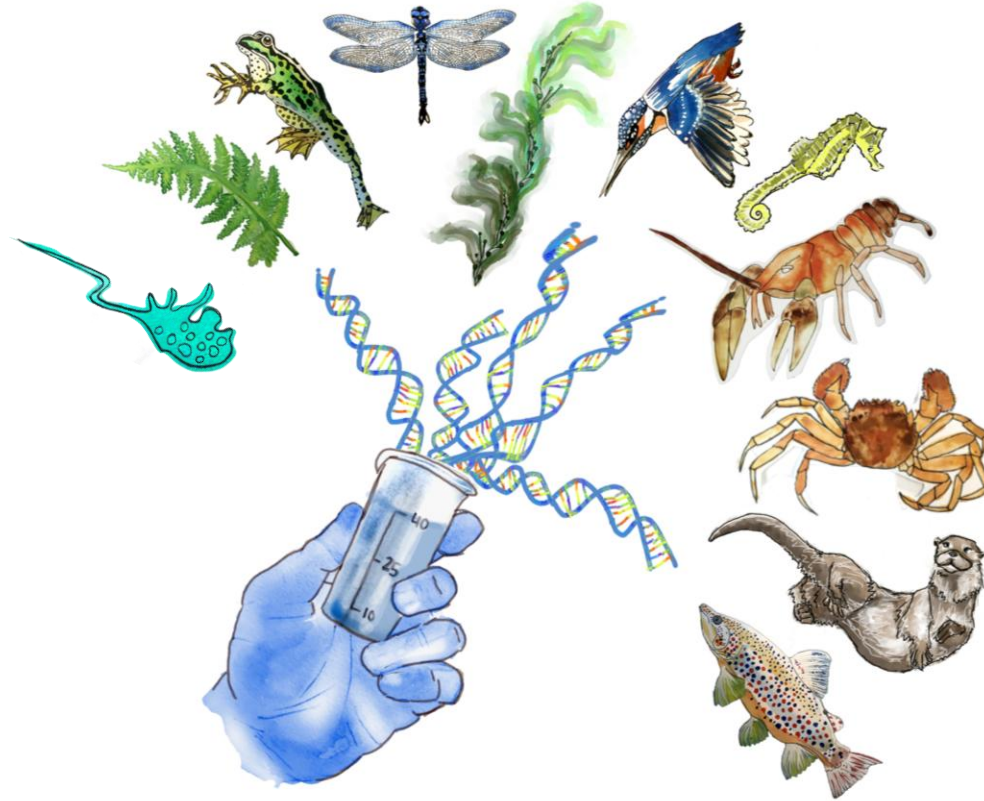




From Molecules to Management: Translating eDNA for monitoring nature

Lauren Cook, Molecular Ecologist @ UKCEH

What is eDNA and why does it matter

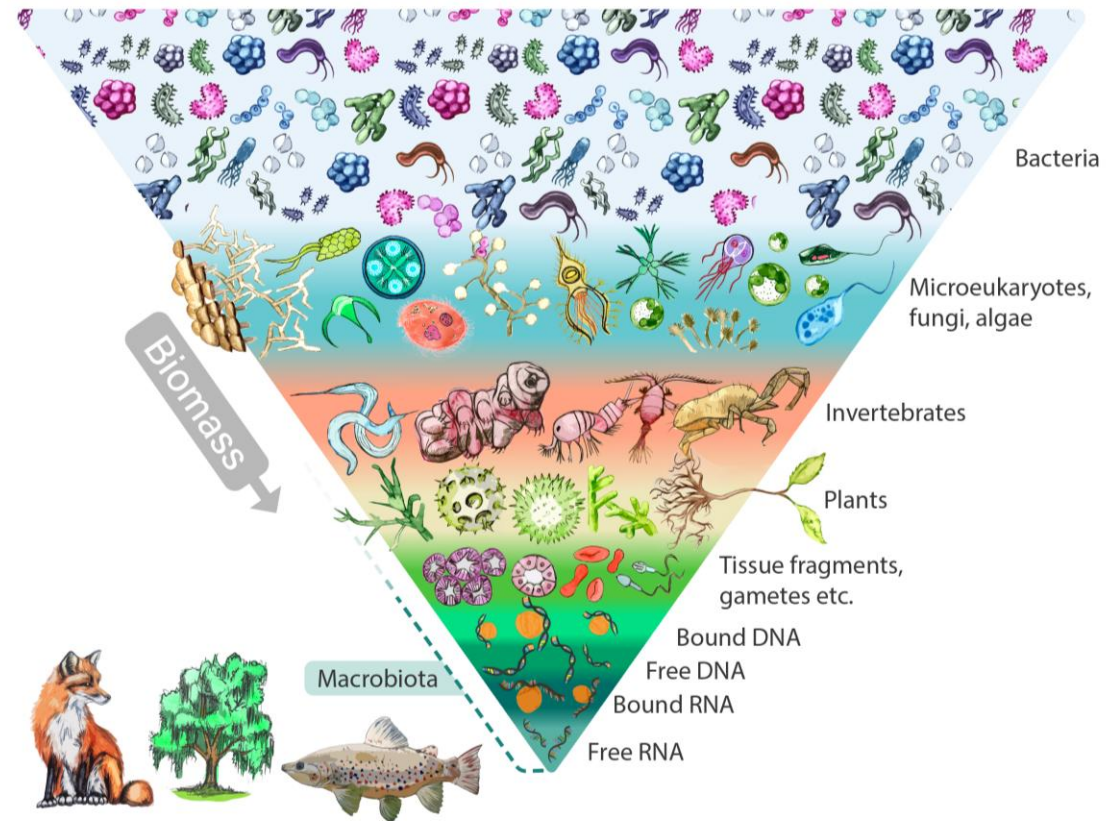


Efficient, non-invasive biodiversity monitoring

Detects elusive or rare species

Expands taxonomic coverage - from microbes to mammals

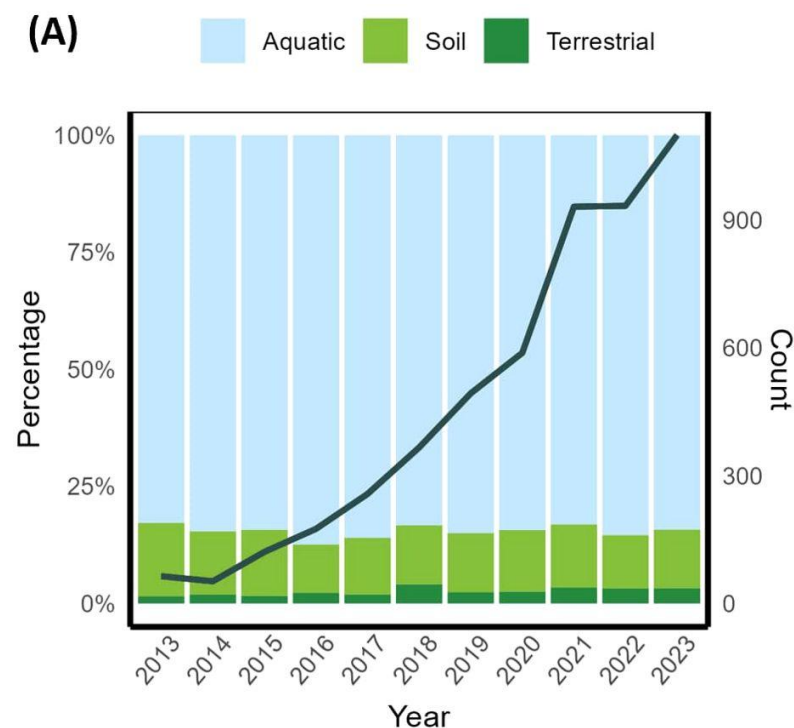
Where does the DNA come from?



From Cook et al., 2024, *Trends in Microbiology*

eDNA in Action (UK context)

- Molecular revolution: around **18 million eDNA records** since 2008
- Growing role in **regulatory** monitoring:
 - **Single-species detection** is **operational** - **Great crested newt** licensing, **crayfish** and crayfish plague EA approval
 - Emerging **community level** applications – e.g. fish communities, macroinvertebrates
 - **Evidence contribution** to environmental impact assessments, ecosystem assessments and habitat protections



Cowgill et al. (2025). *Frontiers in Conservation Science*, 5.

Current and emerging applications

- **Biodiversity** monitoring
- **Habitat** quality
- **Pathogens** and **parasites** (e.g. COVID-19 in wastewater)
- **Agricultural** pests
- **Invasive** and **endangered** species
- **Carbon** origin analysis (including blue carbon)
- **Forensics** & wildlife crime
- **Ancient** DNA
- **Bioterror** and defence
- ...and more!

See – “eDNA: A Policy Explainer”, The Royal Society



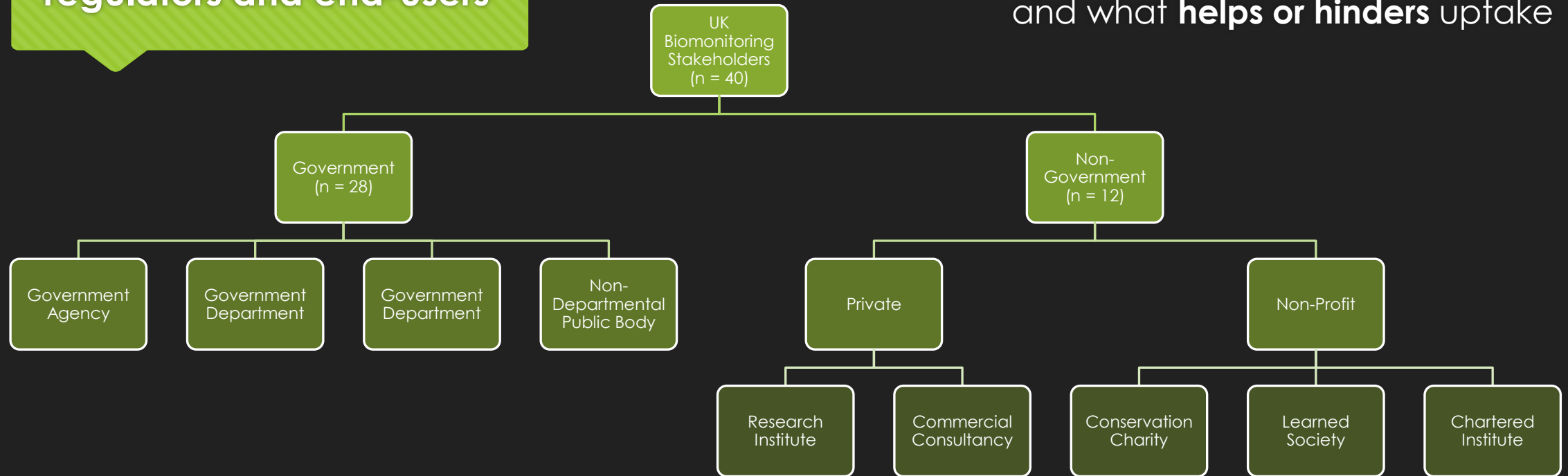
The Translation Challenge

- **Gaps** in biodiversity data
- Rapid **scientific advances** vs slower **policy adoption**
- Method **variation**, **uncertainty**, and **data integration** issues
- How do different interested parties **perceive eDNA** as a tool? What are the **challenges** and **barriers** to uptake? What are the **priorities**?



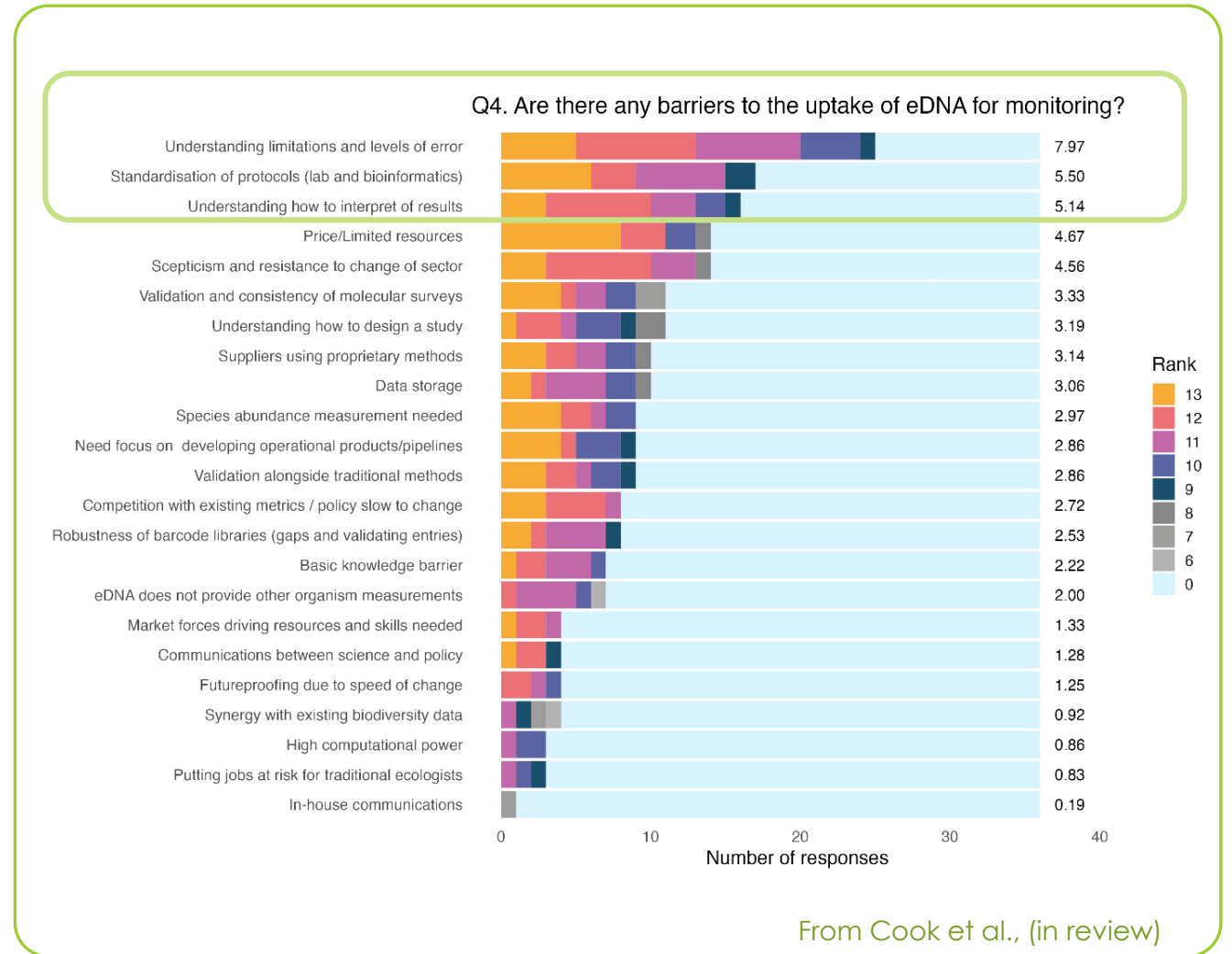
Translating eDNA: gathering perspectives from researchers, regulators and end-users

- **Interviews** with researchers, regulators, and end-users and **ranked responses**
- Aim: understand stakeholder **needs** and what **helps or hinders** uptake



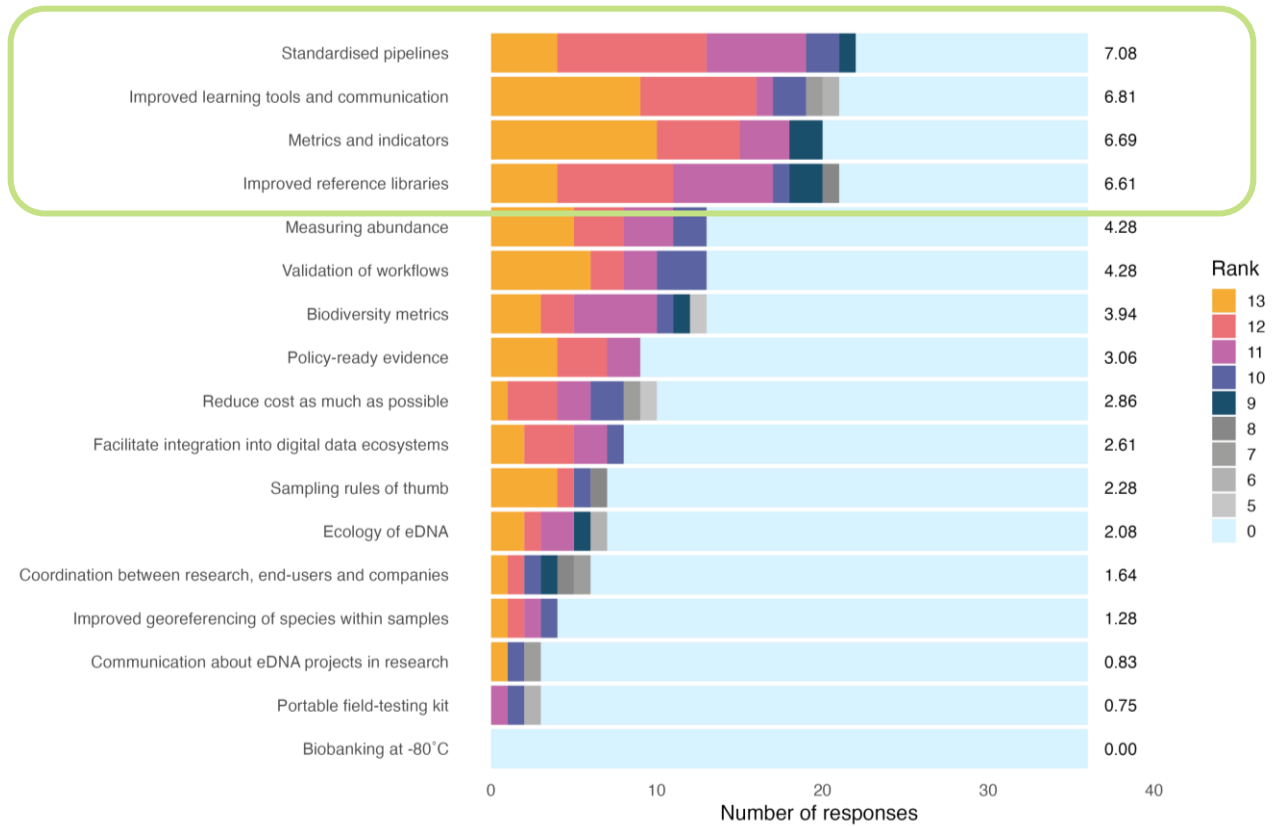
Key findings: Barriers to eDNA uptake

- Understanding **limitations** and **error levels**
- Standardisation of protocols
- Understanding how to **interpret results**



Key findings: Development priorities

- **Standardised** pipelines
- Improved **learning tools** and communication
- **Metrics** and indicators
- Improved **reference** libraries



From Cook et al., (in review)

Data Integration & the NBN Atlas

- First **full eDNA dataset** available on NBN atlas (2022), however **data requirements in development** (Natural England and Sanger).
- Importance of **metadata** and **FAIR** data principles - no previous **uniformity** in the format of DNA record data
- Opportunity to make eDNA **discoverable** and **comparable** – rare for eDNA papers to make data available on a biodiversity portal

"if eDNA remains a tool that only geneticists can wield, then it will only recognize a small fraction of its potential"
Mike Bunce



Environmental DNA

Open Access

Dedicated to the study and use of environmental DNA for basic and applied sciences

OPINION AND PERSPECTIVE | Open Access |

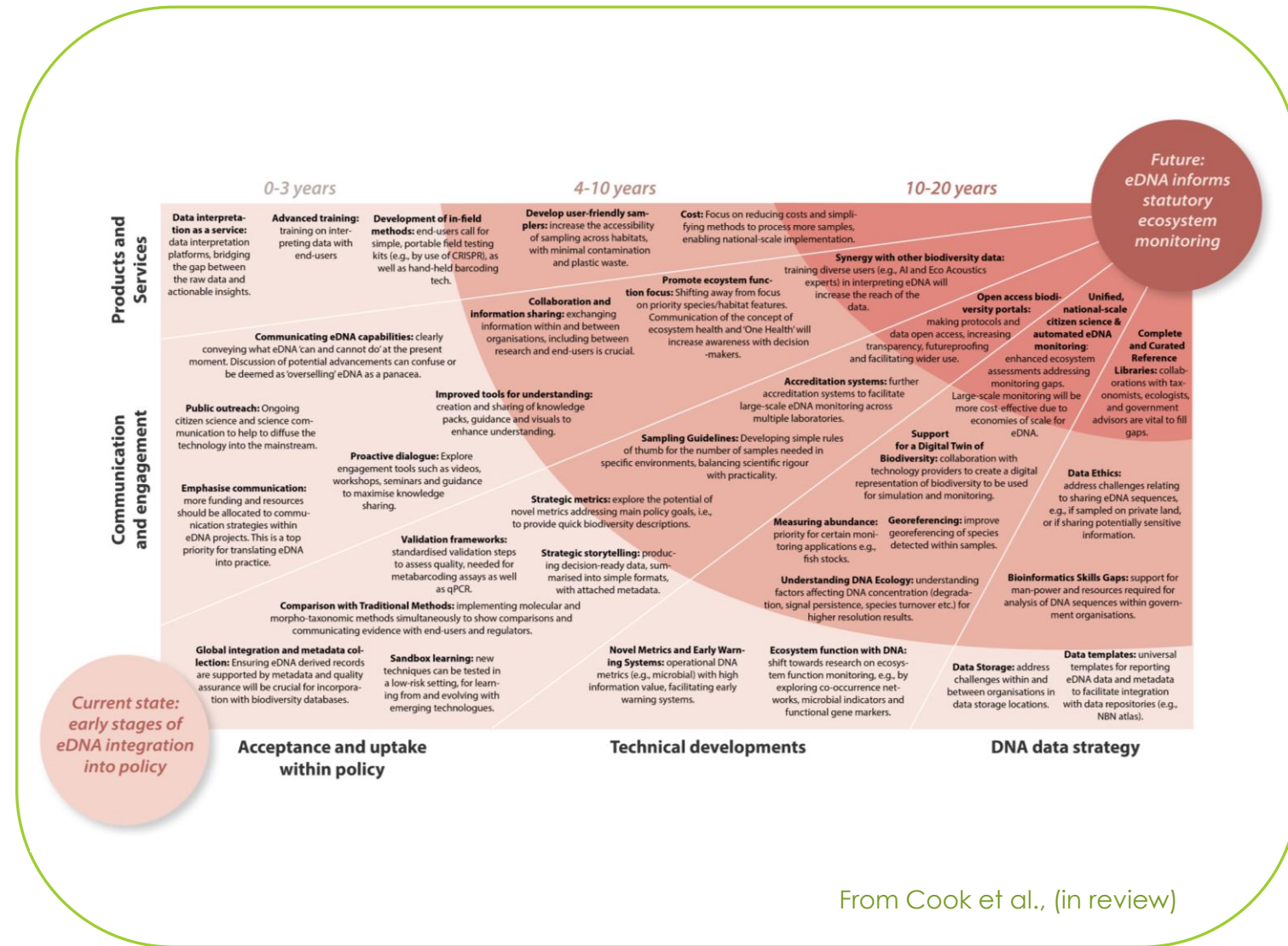
Making environmental DNA (eDNA) biodiversity records globally accessible

Oliver Berry , Simon Jarman, Andrew Bissett, Michael Hope, Corinna Paeper, Cindy Bessey, Michael K. Schwartz, Josh Hale, Michael Bunce

First published: 21 December 2020 | <https://doi.org/10.1002/edn3.173>

The Road Ahead

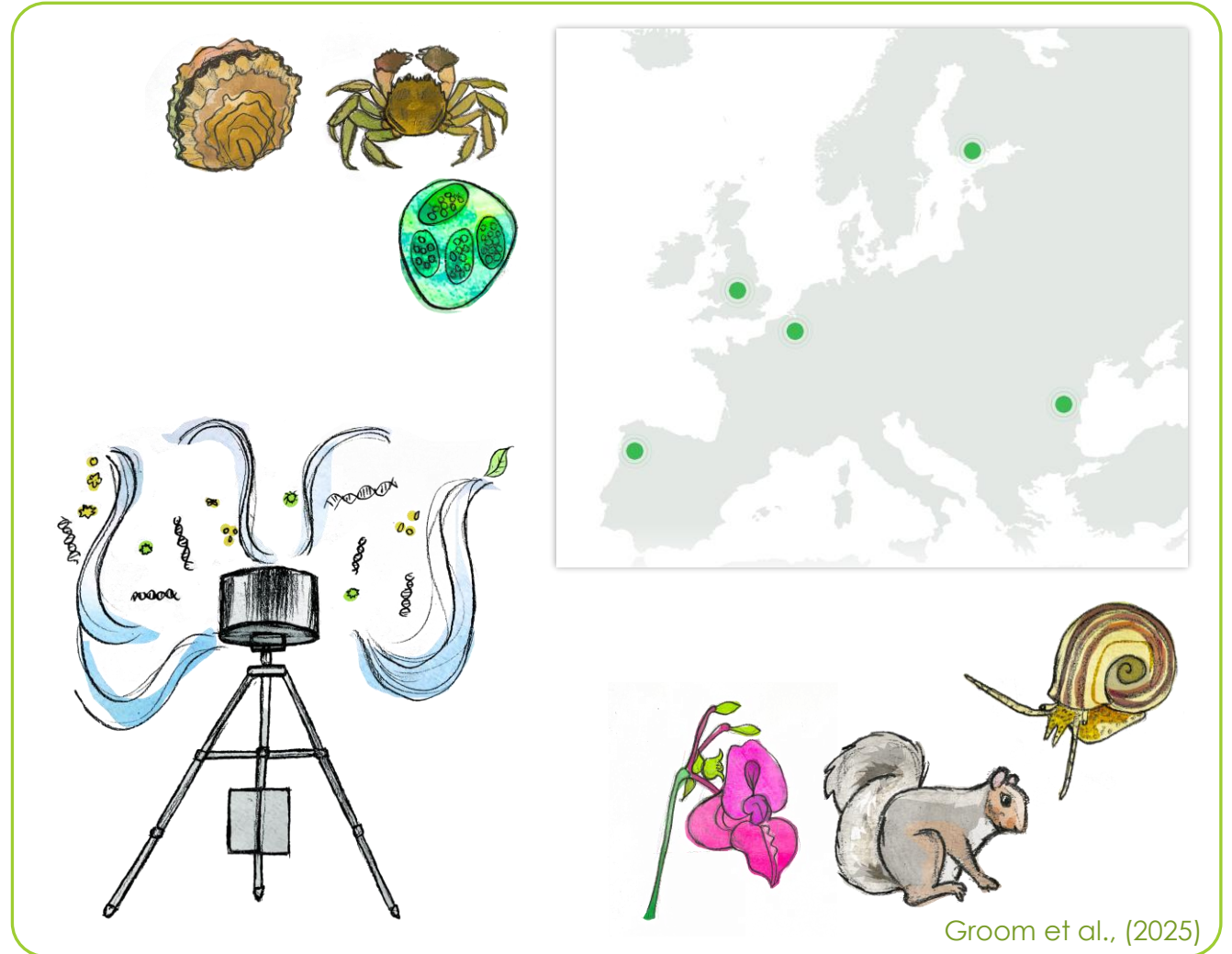
- **Confidence** → standardisation, validation and error reporting
- **Connectivity** → data integration & standardisation
- **Collaboration** → co-development with users and **communication** tools



From Cook et al., (in review)

Monitoring invasive species with airborne eDNA

- Novel technologies: **Air eDNA + computer vision + citizen science**
- **5 'living labs' - co-creation** of methodologies
- **Metabarcoding:** plants, fungi, invertebrates and vertebrates.
- Detections published on **open access biodiversity platforms** (GBIF).
- **FAIR data** standards.



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Platform Kinetics



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Closing Thoughts

- eDNA now moving from **innovation** to **implementation**
- **Integration** with NBN Atlas and other biodiversity databases is key to long-term impact
- **Collaboration** will ensure data become actionable evidence

Feel free to contact
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