



TERRIS



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POLICY BRIEF

The case for Biological Nomenclature in Europe

Executive summary

In our natural world, over 1.2 million species have been named using Linnaeus's binomial system. This standardised method allows clear communication across science, politics, and cultural barriers. Biological nomenclature, crucial for global biodiversity research, conservation, and policymaking, faces challenges due to its **fragmented infrastructure** and **lack of integration within major research frameworks**. Current issues include isolated management, risk of data loss, inconsistency, training and funding limitations. To address these, we recommend integrating nomenclature systems into European research infrastructure, adopting **FAIR principles** for database and interface modernisation, developing innovative funding models, and implementing database mirroring within Europe. Such actions will serve as an indispensable component of resilience, accessibility, and global collaboration, which are essential for effective biodiversity conservation and will significantly contribute to the European Green Deal and the European Biodiversity Strategy 2030.

The need to have a solid reference name for policy-making

Biological nomenclature is not merely a component of biological taxonomy but rather a cornerstone of biodiversity research, conservation efforts, and policy-making. It provides the **standardised framework necessary for the global scientific community to communicate accurately**. Despite this, the infrastructure supporting biological nomenclature **is fragmented and suffers from a lack of comprehensive support and integration within major research initiatives**.

Over 1.2 million species have been scientifically described, and each has been given a unique binomial name. Developed by Carl Linnaeus in the 18th century, this system remains the universal language for the communication of biodiversity information across scientific, political and cultural barriers.



Catalogue of Life

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Policies and protection measures depend on the precise identification of species to target actions effectively. For example, the International Union for Conservation of Nature (IUCN) Red List, which plays a key role in conservation priorities, relies heavily on standardised names for its assessments. Environmental legislation and international agreements like the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) rely on standardised nomenclature to accurately specify protections for species, as do the European Habitats Directive, Birds Directive and Invasive Alien Species Regulation in Europe.

Nomenclature aids in the management of species and in addressing other societal threats as public health and biosecurity, by providing robust ground for coordinated responses across regions, countries and continents, and thus helping to prevent or mitigate ecological, health and agricultural impacts.

As just one example, the European and Mediterranean Plant Protection Organization's database is largely accessed by names and has over a million visitors a year looking for information.

The agricultural, pharmaceutical, and biotechnology industries also rely on accurate species identification to source materials, comply with regulations, conduct research and generate innovations. The economic implications of misidentification can be significant, affecting trade, performance and compliance costs. Even from a cultural heritage perspective, nomenclature ties into the history of biological exploration and discovery. Museums and herbaria store millions of nomenclatural type specimens, each labelled with dates, places and people that provide a link to expeditions, policies, events and expertise.

Europe's pivotal role in the naming and classification of global biodiversity over the past two centuries has led to a significant concentration of biological nomenclature resources within its borders. Many type specimens, vital for the accurate identification and classification of species, are housed in European museums, herbaria, and other institutions, along with some of the world's largest biodiversity libraries and scientific publishers. Under the Convention on Biological Diversity (CBD), Europe has a responsibility to address equitable access to and sharing of benefits from the utilisation of genetic resources, particularly with the countries of origin.



Gothenburg Botanic Garden

Current challenges

Biological nomenclature integrates four critical types of data that are needed for the accurate classification and study of biodiversity. These are the Latin names assigned to a taxon, the people who described them, the scholarly literature that details their characteristics, and the type specimens that serve as a bridge between the name and the taxon concept. Together, these elements ensure clarity and consistency in the identification of species across the global scientific community.

Within the current landscape of nomenclatural databases are the International Plant Names Index (IPNI) providing a comprehensive database of the scientific names and bibliographical details of seed plants, ferns, and lycophytes. Index Fungorum and Mycobank, are dedicated to fungi, offering global fungal catalogues and acts as a reference for mycological studies. AlgaeBase covers algae, BryoNames focuses on bryophytes, cataloguing mosses, liverworts, and hornworts, and ZooBank is the official registry for zoological nomenclature, under the International Code of Zoological Nomenclature (ICZN), catalogues names at all ranks for the animal kingdom.

However, none of these databases is complete, nor aligned with improved standards also for the digital world. Nomenclature databases suffer of fragmentation and lack of FAIR compliance:



Nomenclatural databases are often isolated, managed by single institutions or individuals, which not only poses significant risks such as data loss and inconsistency but also leads to a lack of standardised access mechanisms, hindering data integration, particularly in linked data environments.



Being global resources, **nomenclatural databases face difficulties securing sustainable funding** as they transcend national research priorities. For example, none are mirrored across continents, as other critical resources are, such as molecular sequence and databases.



Currently, **these databases do not benefit from the structured support and integration within the broader European research infrastructure, hindering their development and maintenance**. A chronic lack of investment has led to a shortfall in adherence to basic principles, such as FAIR, which hampers their effectiveness in supporting global biodiversity research and collaboration and Open Science, limiting transparency and accessibility in the global sharing of taxonomic information.



Biological nomenclatural databases encompass large sets of names that still need to be curated, enhanced and linked

Strategic Importance of Biological Nomenclature

Although none of the above challenges is new and significant difficulties may arise in overcoming them all together, the critical need remains and must be addressed:

➤ To avoid Misinterpretation:

The Codes of Nomenclature standardise the names of organisms globally, maintaining consistency in scientific communication and substantially reducing the risk of error.

➤ To enhance Research and Conservation:

Standardised nomenclature is essential for the effective management and conservation of biodiversity, facilitating global collaboration and data sharing.

➤ To support Policy and Decision Making:

Accurate biological nomenclature underpins environmental legislation, international biodiversity conservation agreements, and biosecurity measures.

➤ To enable Technological Advancements:

Integrating nomenclature databases with modern technologies such as AI and data analytics could revolutionise biodiversity monitoring and research.

➤ To ensure High quality Curation:

The meticulous manual curation of entries in nomenclature databases by experts enhances the reliability and accuracy of the information, upon which aggregated name lists, such as the Catalogue of Life, rely.

➤➤➤ **Stable and harmonised naming leads to reliable species identification**

Recommendations

Though TETTRIs project has not addressed the topic of nomenclature individually, the need to support the availability of reliable data, tools and mechanisms to identify species remain at the core of the TETTRIs final objectives, in support of the taxonomic community research efforts. CETAF endorses the need for special efforts dedicated to tackle this detected critical issue in one or several of the following recommended pathways:

1 INTEGRATION INTO EUROPEAN RESEARCH INFRASTRUCTURES:

Recognize biological nomenclature systems as critical research infrastructures and integrate them into existing networks like the European Open Science Cloud (EOSC) and as a reference resource in spaces such as the Knowledge Center for Biodiversity (KCB).

2 ADOPTION OF FAIR PRINCIPLES:

Invest in the modernization of nomenclatural databases to ensure they are findable, accessible, interoperable, and reusable, and follow European principles for Open Science.

3 FUNDING AND GOVERNANCE MODELS:

Develop innovative funding models that reflect the global nature of these databases, through international coalitions or partnerships.

4 ADVANCED LINKING OF DIGITAL INFORMATION:

Strengthen the connections between taxonomic names and their associated type specimens, the authorities who described them, and the relevant biodiversity literature, and implement validation processes for database enhancement and enlargement.

5 MIRRORING NOMENCLATURE DATABASES IN EUROPE:

Implement mirroring of key nomenclatural databases within Europe, providing redundancy and seamless access to crucial biodiversity information and services.



RBINS, Thierry Hubin

Final Statement

Investing in biological nomenclature is not merely a scientific necessity but a **strategic imperative that supports broader objectives of biodiversity conservation**, sustainable development, innovation and global scientific collaboration. The integration of nomenclatural databases into a structured European and global research framework will ensure their sustainability, enhance their accessibility, and significantly contribute to the global management of biodiversity data.

Mirroring key nomenclatural databases within Europe will enhance the resilience and accessibility of biodiversity data, and ultimately facilitate the building of new services. It will also support high-quality, collaborative research; it will contribute to the robustness of biodiversity conservation efforts across the continent and thus to the successful implementation of the European Biodiversity Strategy 2030, and under the umbrella of international endeavours as the Global Biodiversity Framework.

In that context, policymakers, funding agencies, museums, herbaria and international standards organisations need to **recognize the strategic value of biological nomenclature** and **provide the necessary investment and support to secure its future**.



Glossary

Taxon concept: An abstract idea used to define and categorise organisms into distinct groups, such as species, based on shared characteristics, such as reproductive isolation, morphology, genetic similarity, and shared evolutionary history.

Biological nomenclature: Developed by Carl Linnaeus in the 18th century, this system uses a binomial nomenclature to uniquely identify a species concept through a standardised two-part name consisting of a genus name and a species name.

Biological Taxonomy: The scientific practice of classifying organisms into a structured system of hierarchical categories, such as families, genera, and species. This system is based on shared characteristics, including morphology, genetic similarity, and evolutionary relationships, allowing for the organised identification and study of biodiversity.

Codes of Nomenclature: globally agreed-upon sets of rules and guidelines established by the scientific community to standardise the naming of taxon concepts.

Type Specimens: a physical example of an organism that serves as the principal reference point for the taxon name, effectively linking the taxon concept.

Nomenclatural Databases: Specialised databases that track scientific names of organisms, providing vital information such about their classification, synonymy and associated literature.

FAIR Principles: Principles that guide data management and sharing practices to enhance the utility and accessibility of digital data sets.



Transforming European Taxonomy through training, research and innovations



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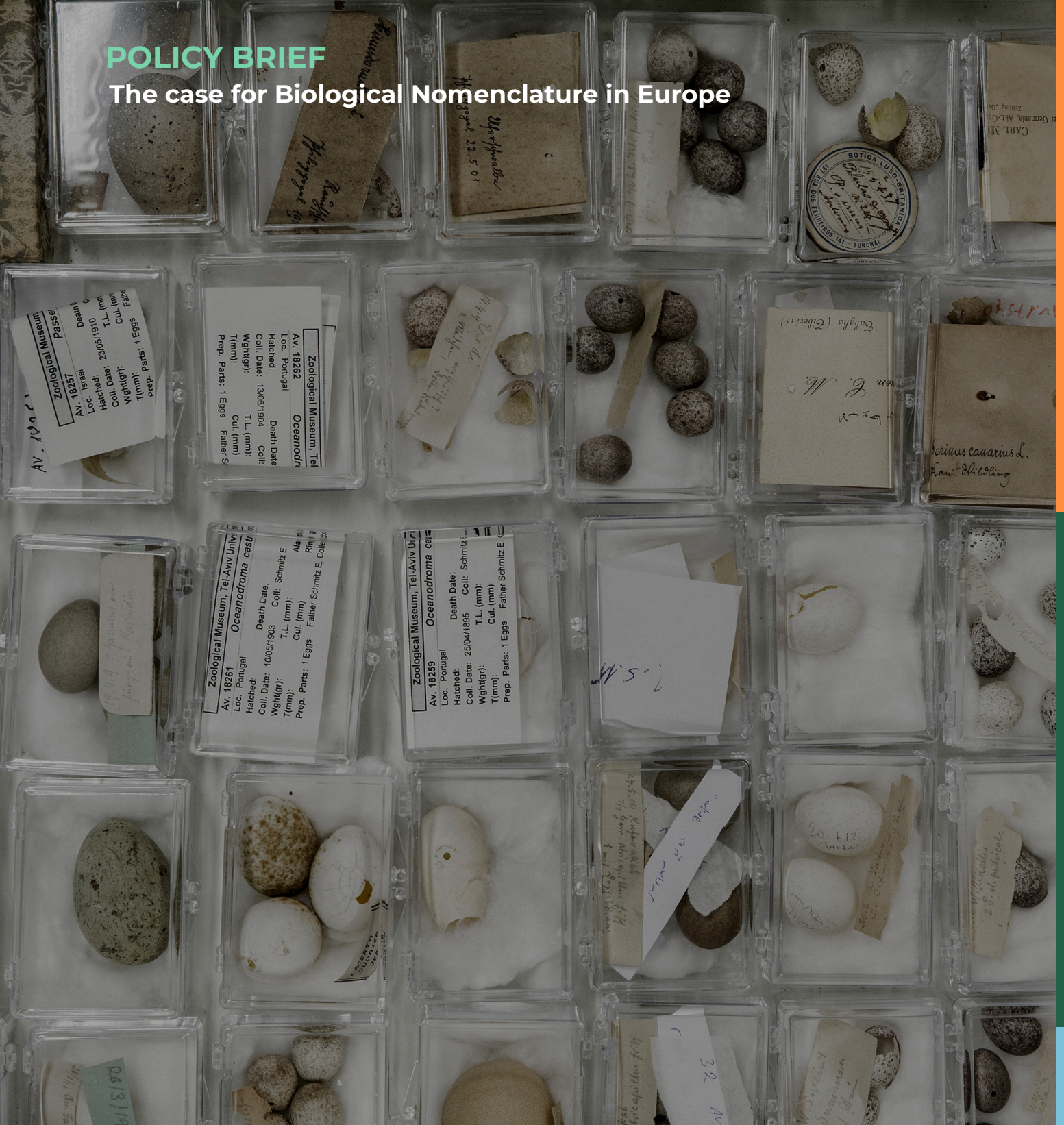
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