

Evolving ABOL (the Austrian Barcode of Life Initiative): Reflections on a Decade of Coordinating a National Biodiversity Initiative

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The Austrian Barcode of Life (ABOL) initiative was founded in 2014 with the ultimate aim of systematically documenting all animal, plant, and fungal species occurring in Austria using DNA barcodes. From the beginning, the coordination of this nationwide initiative has been anchored at and spearheaded by the Natural History Museum Vienna (NHMW). For more than a decade, it has built an inter-institutional network that brings together biological collections, research institutions, authorities of protected areas, professional societies, and community scientists. ABOL therefore covers not only all aspects – from data infrastructure and basic research to applied research – but has increasingly developed into a key player in socially relevant biodiversity documentation and environmental monitoring in Austria.

This report takes stock of the organizational, infrastructural, and scientific development of the initiative during the period from 2014 to 2025. In addition to the creation of reference data for organisms from Austria, national and international networks were established, applications of DNA barcoding were implemented, and participatory formats such as the ABOL BioBlitzes were developed.

ABOL exemplifies a new form of a coordinated, integrative biodiversity research. It combines taxonomic expertise with molecular biological methods, openly accessible digital platforms, and societal participation. The outlook discusses the structural prerequisites required for ABOL to contribute in the long term to the implementation of international biodiversity goals. These include targets set by the EU Biodiversity Strategy for 2030. In doing so, ABOL can help address the global challenge of biodiversity loss.

Szucsich NU, Sonnleitner M, Ackerl F, Kargl V, Heinzl J, Hörweg C, Haring E (2026) The Evolution of ABOL (Austrian Barcode of Life): Rückblick auf ein Jahrzehnt der Koordination einer nationalen Biodiversitätsinitiative

Die Initiative „Austrian Barcode of Life“ (ABOL) wurde 2014 mit dem Ziel gegründet, alle in Österreich vorkommenden Tier-, Pflanzen- und Pilzarten systematisch mithilfe von DNA-Barcodes zu erfassen. Von Beginn an war die Koordination dieser landesweiten Initiative am Naturhistorischen Museum Wien (NHMW) angesiedelt. Die Koordination baute ein überinstitutionelles Netzwerk auf, das biologische Sammlungen, Forschungseinrichtungen, Schutzgebietsbehörden, Fachgesellschaften und engagierte Bürgerwissenschaftler:innen zusammenbringt – dieses wird seit über einem Jahrzehnt gepflegt und erweitert. ABOL deckt somit nicht nur alle Aspekte ab – von der Dateninfrastruktur und der Grundlagenforschung bis hin zur angewandten Forschung –, sondern hat sich zunehmend zu einem wichtigen Akteur für die gesellschaftlich relevante Dokumentation der Biodiversität und das Umweltmonitoring in Österreich entwickelt.

Dieser Beitrag zieht Bilanz über die organisatorische, infrastrukturelle und wissenschaftliche Entwicklung der Initiative im Zeitraum von 2014 bis 2025. Neben der Erstellung von Referenzdaten für Organismen aus Österreich wurden nationale und internationale Netzwerke aufgebaut, Anwendungen des DNA-Barcodings implementiert und partizipative Formate wie die ABOL-BioBlitze entwickelt.

ABOL ist ein Beispiel für eine neue Form koordinierter, integrativer Biodiversitätsforschung. Es vereint taxonomische Expertise mit molekularbiologischen Methoden, frei zugänglichen digitalen Plattformen und gesellschaftlicher Teilhabe. Der Ausblick erörtert die strukturellen Voraussetzungen, die ABOL benötigt, um langfristig bei der Umsetzung internationaler Biodiversitätsziele mitzuwirken. Dazu gehören die Ziele der

EU-Biodiversitätsstrategie 2030. So kann ABOL dazu beitragen, die globale Herausforderung des Biodiversitätsverlusts zu bewältigen.

Keywords: DNA barcoding, scientific collections, FAIR data, biodiversity, monitoring, data infrastructure, species identification.

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Background and external framework conditions

The systematic recording and documentation of species is a core task of biodiversity research – both in basic research and in applied fields such as nature conservation, environmental monitoring, and policy advice. In this context, the correct identification of species is of paramount importance. However, this expertise has become increasingly scarce in recent decades (Cardoso et al. 2011; Engel et al. 2021; Hochkirch et al. 2022).

Biological diversity – namely the diversity of species, their genetic diversity, and the diversity of habitats and biological communities – is severely threatened worldwide as well as in Austria (IPBES 2019; Umweltbundesamt 2025). The main drivers include land-use change, exploitation of natural resources, environmental pollution, invasive species, and climate change. This decline leads to the impairment of ecosystem functions, thereby endangering human health, economic systems, and quality of life (IPBES 2019). “Bending the curve” of global biodiversity loss thus is one of the greatest challenges of the 21st century (Leclère et al. 2020). Sound knowledge of biological diversity is a fundamental prerequisite for quantifying biodiversity loss and for data-driven implementation of measures for effective conservation efforts and sustainable use of natural resources.

Thus, an increasing demand for monitoring coincides with a decline in taxonomic expertise. In addition, the large diversity of organism groups means that rarely local experts are available for every taxonomic group. This clearly demonstrates the urgent need for new, standardized, and scalable methods for species identification and for safeguarding taxonomic experience for future generations. DNA barcoding can make a substantial contribution here and is gaining increasing importance worldwide (see Box 1 for methodological details).

Against this background, the present report reviews the developments and milestones achieved during more than a decade of operation by the Austrian Barcode of Life (ABOL) initiative. Since its foundation in 2014, ABOL has played a central role in the DNA-based identification and, more broadly, the scientific documentation of Austrian biodiversity, and has been involved in establishing the DNA barcoding approach across a wide range of applications. In addition to reviewing developmental steps and achieved milestones,

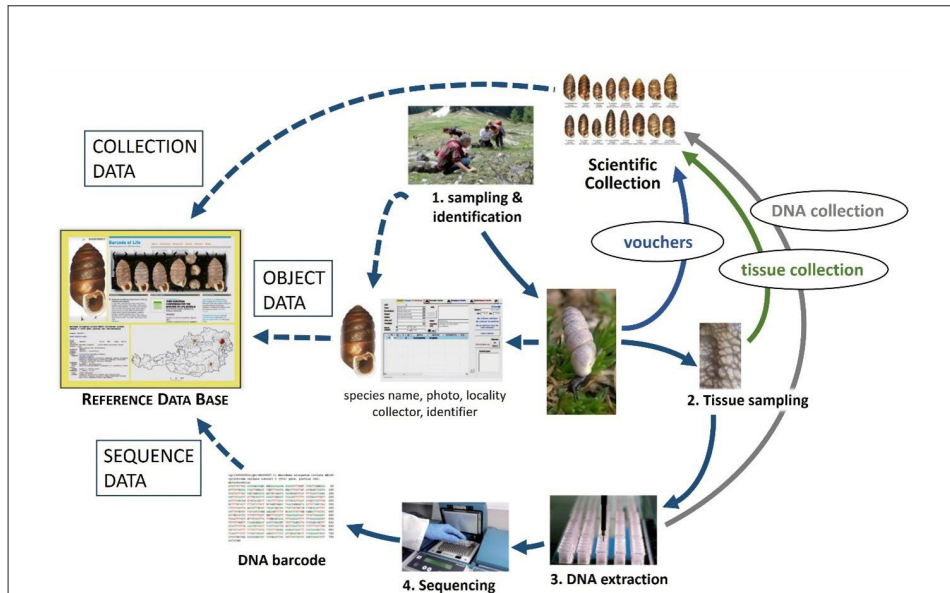
Box 1: The principle of DNA barcoding and how to establish a reference database

Fig. 1: Workflow of the generation of DNA barcode reference data. | **Abb. 1:** Arbeitsablauf zur Generierung von DNA-Barcode-Referenzdaten.

DNA barcoding is an internationally standardized method for molecular genetic species identification. It is based on specific, short DNA sequences (so-called DNA barcodes) that allow species to be distinguished and identified, and which can be PCR-amplified by fairly universal primers. A prerequisite is a reference database holding DNA barcodes from morphologically accurately identified organisms (animals, plants, or fungi). The identification of unidentified organisms is achieved by comparing sequenced DNA fragments of their genome with corresponding DNA barcodes stored in the reference database.

In animals, usually a fragment of the mitochondrial cytochrome c oxidase subunit I (COI) gene is analysed (Hebert et al. 2003). In fungi, variable regions between the nuclear rRNA genes are used as standard markers: ITS1 and ITS2 ("Internal Transcribed Spacer" 1 and 2; Schoch et al. 2012). In plants, genes of the chloroplast genome such as *rbcl* (ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit), *trnL-F* (chloroplast region encompassing transfer RNAs L to F) or *matK* (maturase K), as well as nuclear markers such as ITS1 or ITS2, are employed (e.g. CBOL Plant Working Group 2009; Jones et al. 2021). For specific organism groups, numerous additional gene regions have been proposed (e.g. Alam et al. 2024).

After sequencing the DNA fragments, sequence data along with object data (i.e. all information tied directly to a voucher) and collection data is stored in a reference database (Fig. 1).

These genetic markers can be used for species identification even when organisms are morphologically difficult to identify, for example when only fragments are available (Zeale et al. 2011; Galimberti et al. 2013; Aylward et al. 2018; Esnaola et al. 2018; Naaum et al. 2018; Reeves et al. 2018; Rytönen et al. 2018; French et al. 2022) or when dealing with difficult-to-identify developmental stages (Sonet et al. 2013). DNA barcoding also enables the analysis of species composition in mixed samples (DNA metabarcoding) and the detection of traces in the environment, such as in water, soil or even in air samples (environmental DNA, eDNA). DNA barcoding has therefore become a key technology for species identification in modern biodiversity research (Kress et al. 2015), since taxonomic knowledge is not necessary for the process of species identification itself, but only for the generation of DNA barcodes. A prerequisite for widespread application of DNA barcoding is a curated, publicly accessible reference database with taxonomically validated DNA barcode sequences. The international platform BOLD (Barcode of Life Data Systems; Ratnasingham & Hebert 2007; Ratnasingham et al. 2024) provides the infrastructure for analysis, storage, quality control, and global accessibility of these data and follows the core principles of FAIR data – findable, accessible, interoperable, and reusable (Wilkinson et al. 2016).

the report examines how ABOL is structured, the role of the *ABOL Coordination*, and the position ABOL may occupy in the future within the national and international context of biodiversity research, nature conservation, and environmental policy.

The impetus for launching the ABOL initiative was not only a response to the above-mentioned requirements but also to international developments in this field. Originating in Canada (CBG – Centre for Biodiversity Genomics, University of Guelph, Ontario), DNA barcoding was already on the way of being established internationally (Hebert et al. 2003), and several national DNA barcoding initiatives had already begun their activities (NorBOL in Norway, InBio in Portugal, NBOL in the Netherlands, FinBOL in Finland, GBOL in Germany, and SwissBOL in Switzerland). In Austria, individual researchers had already generated DNA barcodes (e.g. Graf et al. 2008; Huemer et al. 2014a, b; Resch et al. 2014), but a coordinated strategy was lacking. This gap was closed with the ABOL initiative, laying the foundation for DNA-based surveys within modern biodiversity monitoring in Austria.

ABOL was launched as an open, inter-institutional initiative that now connects stakeholders from research institutions, biological collections, protected areas, authorities, professional societies, and community scientists (a term proposed as an alternative for the more widely used term “citizen scientists”; see discussion in Christian et al. 2024). The breadth of the network necessitates coverage of all aspects of DNA barcoding, from data infrastructure and taxonomic basic research to applied biodiversity monitoring and ecological research. The aim is to integrate the DNA barcoding approach into the existing biodiversity research landscape. Monitoring approaches using DNA barcoding and DNA metabarcoding (i.e. the simultaneous identification of many species within the same sample via DNA sequence comparison) are consistently understood as complementary to existing approaches, greatly expanding our capacity for species identification without replacing traditional approaches

(Hajibabaei et al. 2007; Kress et al. 2015; Martins et al. 2025). A prerequisite for the application of DNA barcoding and its integration into monitoring activities is a reference database which is as complete as possible, and which contains accurate information linking taxonomy and DNA barcodes of voucher specimens that have been accurately identified based on morphological characteristics by experts (see Box).

The period covered by this report spans the years 2014 to 2025. The focus lies on the scientific and organizational achievements of the ABOL, its strategic development, and its increasing societal relevance. Particular attention is paid to the role of the *ABOL Coordination*, which functions as a central structure for governance, quality assurance, and networking at both national and international levels.

Short history and organizational structure of the ABOL initiative

ABOL is a decentralized initiative distributed across Austria, with a central coordination unit located at the Natural History Museum Vienna (NHMW). While “ABOL” or “ABOL initiative” refers to the entire network, the “*ABOL Coordination*” – as the organizational unit – is a third-party funded project which employs a team of approximately 2.5 full-time equivalents that maintains network contacts, organizes it, and drives its future development.

Pilot phase

Preparatory work leading up to the ABOL pilot phase began already in 2010, carried out by staff members of the NHMW (Elisabeth Haring and Helmut Sattmann). An initial group of interested individuals formed during the Biodiversity Day held at the NHMW on October 21, 2010 under the title “*Land der Vielfalt – zukunftsreich?*” (translates to: Land of Diversity – rich in future?). In the following years, a project was jointly developed together with representatives of various Austrian institutions (Zimmermann et al. 2013). Thanks to funding from the Ministry of Science, a three-year ABOL pilot phase was launched in 2014 (Tab. 1, <https://www.abol.ac.at/en/about-us/#history-how-it-started>). The aim of this pilot phase was to establish methods and workflows in four groups of organisms (butterflies, molluscs, vertebrates, and parasitic worms) and to generate corresponding reference DNA barcodes. The four pilot projects were carried out at the following institutions: Tyrolean State Museums (butterflies; lead: Peter Huemer), NHMW (molluscs; lead: Anita Eschner, Luise Kruckenhauser), University of Graz (vertebrates; lead: Stephan Koblmüller), and the University of Veterinary Medicine Vienna (lead of the overall pilot phase; parasitic worms; lead: Anja Joachim). Already within the pilot phase, the *ABOL Coordination* was established at the NHMW. It was responsible for coordinating the pilot projects, network building, communication, public outreach, and the conceptual development of the overall project. The *ABOL Coordination* was supported by a steering committee consisting of nine persons from different institutions. Even during the pilot phase, DNA barcodes of Austrian organisms were generated in additional associated projects that were not funded through the ABOL pilot. Partly conceived as small DNA barcoding projects, partly embedded in larger research projects, these projects provided valuable data for ABOL’s long-term goal – a reference database for Austrian animals, plants and fungi. From its very beginning the ABOL initiative agrees upon a workflow on generating DNA barcode references, where the tissue from which DNA is extracted stems from reliably identified specimens, vouchered in

a scientific collection. An ABOL database was set up already at the very beginning of the initiative, which was intended as a working tool to support partners in data compilation and quality control as well as in the data uploading process to BOLD. The Barcode of Life Data System BOLD was ultimately chosen as the international platform where all finalised DNA barcodes are made available, allowing for applied DNA barcoding and DNA metabarcoding studies.

During the pilot phase the number of species from Austria covered in BOLD increased by almost an order of magnitude from 505 (as of July 16, 2014) to 4,241 species (as of August 29, 2017).

Main phase

For the transition from the pilot phase to a comprehensive main phase of ABOL, a project design was developed according to which DNA barcodes of at least 80% of all animal, plant, and fungal species occurring in Austria were to be generated within ten years, structured into ten taxonomic clusters (corresponding to different organism groups; Haring et al. 2015). Since a large number of the species are very rare, sometimes only recorded once in Austria, a coverage of 80% of the species was assessed as a realistic aim for a ten-years phase, based on an original estimate of 70,000 species for the fauna, flora and funga of Austria (Geiser 1998; Rabitsch & Essl 2009; Krisai-Greilhuber 2015). This goal was to be achieved with a total funding volume of approximately EUR 25 million over ten years. After accounting for institutional in-kind contributions amounting to EUR 9 million, a remaining funding requirement of approximately EUR 16 million was identified. As for this concept no global funding could be secured, an alternative approach had to be developed in which funding

Tab 1: Overview of the ABOL phases, * BMBWF – Federal Ministry of Education, Science and Research; ** BMFWF – Federal Ministry of Women, Science and Research; *** University of Veterinary Medicine Vienna | **Tab. 1:** Überblick über die ABOL-Phasen, * BMBWF – Bundesministerium für Bildung, Wissenschaft und Forschung; ** BMFWF – Bundesministerium für Frauen, Wissenschaft und Forschung; *** Veterinärmedizinische Universität Wien

Name	Duration	Funding	Budget in EUR	Funded project
Pilot phase	2014–2017	BMBWF*	499,668.33	4 pilot projects (VetMed***, NHMW, University of Graz, Tyrolean State Museums), <i>ABOL Coordination</i> (NHMW)
Main phase 1	2017–2021	BMBWF	621,200	<i>ABOL Coordination</i> project (NHMW)
Main phase 2	2021–2024	BMBWF; Universities of Vienna, Graz and BOKU Univ.	555,750 70,000	<i>ABOL Coordination</i> project (NHMW)
Main phase 3 ongoing	2024–2027	BMFWF**	798,180	<i>ABOL Coordination</i> project (NHMW)

focused on the *ABOL Coordination* alone. Data generation was not covered, but third-party funding had to be separately acquired by partner institutions, supported by the *ABOL Coordination* team. Due to the necessity to build up the reference database by a conglomerate of various projects (Haring et al. 2017), the initial time plan of ten years became unrealistic.

Financial structure of the main phase of ABOL

The main phase of ABOL started in November 2017, with funding for the *ABOL Coordination* provided by the Ministry of Science (former BMBWF, currently BMFWF; Tab. 1). After the first three-year period (ABOL I: 2017–2020), funding for the *ABOL Coordination* was subsequently extended twice, each time for a further three years. In the second phase (ABOL II: 2021–2023), additional funding contributions to the *ABOL Coordination* were provided by the University of Vienna (one year), the University of Graz (three years), and BOKU University (three years). The third ABOL phase (ABOL III: 2024–2027) is currently ongoing, again funded by the Ministry of Science.

As a conglomerate of projects serving the achievement of shared objectives, the ABOL initiative is financed through a diversified portfolio of funding sources acquired by the *ABOL Coordination* and/or its partners. While the *ABOL Coordination* is financed by the Federal Ministry of Science, various other funding schemes are used in projects of the ABOL initiatives, both for the generation of DNA barcodes as well as for applied DNA barcoding. For these projects money was acquired from federal funding schemes, such as higher education structural funds (HRSM; BMBWF, now BMFWF), the Biodiversity Fund (BMK, now BMLUK), the Austrian Science Fund (FWF), the Austrian Research Promotion Agency (FFG), as well as international schemes and EU funding programmes (WTZ,

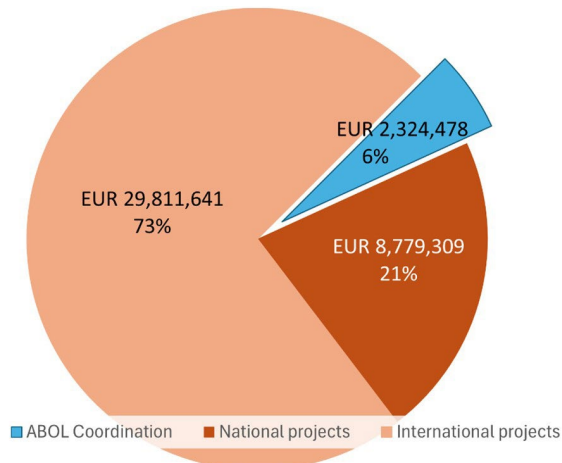


Fig. 2: Graphical representation of the leverage effect of the *ABOL Coordination* in the period 2014 to 2025. Not shown in Fig. 2 are the budgets of ABOL-associated projects from the pilot phase as well as in-kind contributions within projects. | **Abb. 2:** Grafische Darstellung des Hebeleffekts der *ABOL-Koordination* im Zeitraum von 2014 bis 2025. Nicht in Abb. 2 dargestellt sind die Budgets der Assoziierten ABOL-Projekte aus der Pilotphase sowie die Inkind-Leistungen innerhalb der Projekte.

OeAD, Horizon Europe) and EU programmes with regional co-financing (LE 14–20, etc.) (see Tab. 1 and Fig. 2). A substantial – although not explicitly quantified – contribution is provided by the in-kind efforts of project partners, who contribute significant in-kind resources both to the establishment of methods and to the generation of DNA barcodes. The *ABOL Coordination* is often involved in projects as a partner but also independently acquires third-party funding.

The costs of the *ABOL Coordination* across all phases (Fig. 2, blue) are low (6%) compared to the total funding volumes of ABOL projects that were acquired with the support of the coordination unit (Fig. 2, dark red), as well as compared to international projects in whose development ABOL was involved or which were supported by the coordination unit (Fig. 2, light red).

Developing reference data for Austrian biodiversity

Although the generation of reference data was no longer the exclusive common goal, since the majority of the funding acquired by ABOL could be obtained for applied DNA barcoding projects, it remained one of the central pillars of the initiative.

In the long-term, DNA barcodes of all Austrian organisms shall be publicly available via the international data platform BOLD. All references generated during the various phases of ABOL thus are made publicly available, except when still under processing by the authors

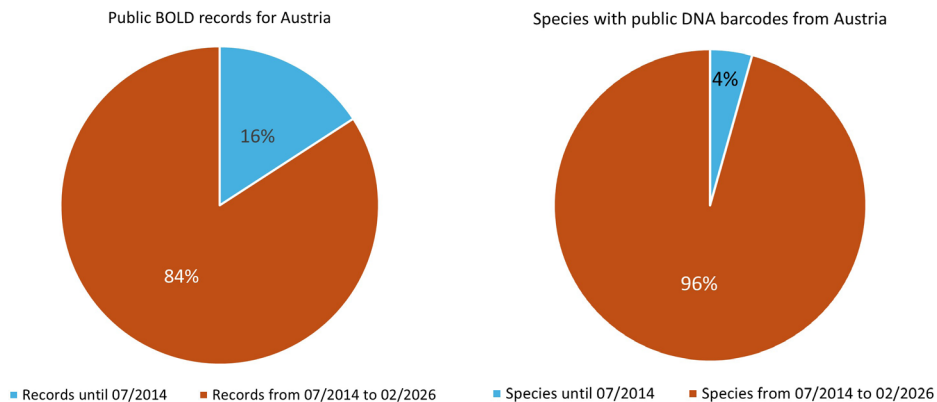


Fig. 3: Pie chart of published BOLD records for Austria. Only 16% (07/2014: 10,181 records) of currently published records (02/2026: 64,301 records) were present before the start of the ABOL pilot phase. | **Abb. 3:** Tortendiagramm der veröffentlichten BOLD-Datensätze für Österreich. Nur 16 % (07/2014: 10.181 Datensätze) der aktuell veröffentlichten Datensätze (02/2026: 64.301 Datensätze) waren vor Beginn der ABOL-Pilotphase vorhanden.

Fig. 4: Pie chart of species with DNA barcodes published in BOLD for Austria. Only 4% (07/2014: 505 species) of the currently covered species (02/2026: 11,589 species) were present before the start of the ABOL pilot phase. | **Abb. 4:** Tortendiagramm der in BOLD für Österreich veröffentlichten Arten mit DNA-Barcodes. Nur 4 % (07/2014: 505 Arten) der aktuell erfassten Arten (02/2026: 11.589 Arten) waren vor Beginn der ABOL-Pilotphase vorhanden.

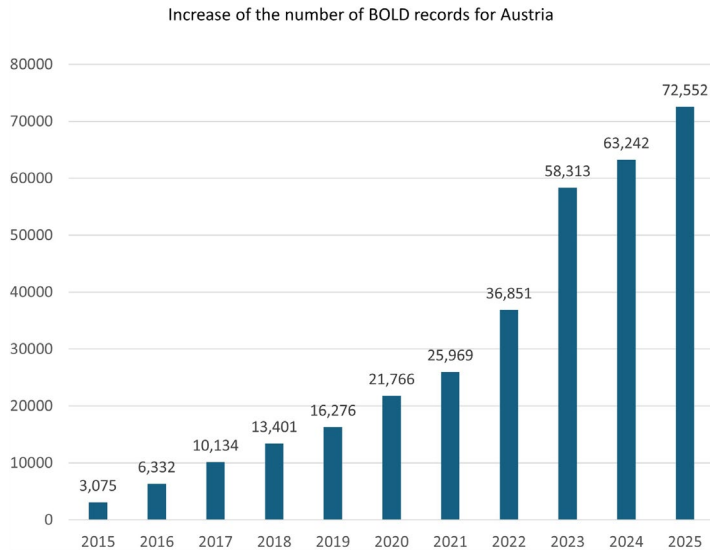


Fig. 5: Annual total numbers of records with sequences from Austrian organisms in BOLD during the period 2015 to 2025 (public and unpublished; only records included with a minimum sequence length of 300 base pairs) (data provided by the BOLD administrative team). | **Abb. 5:** Jährliche Gesamtzahl der Datensätze mit Sequenzen österreichischer Organismen in BOLD im Zeitraum von 2015 bis 2025 (öffentlich und unveröffentlicht; nur Datensätze mit einer Mindestsequenzlänge von 300 Basenpaaren wurden berücksichtigt) (Daten bereitgestellt vom BOLD-Team).

who generated the data. The *ABOL coordination* always supports partners making DNA barcodes public. With March 10, 2026, 64.301 records from Austrian organisms were publicly available in BOLD (Fig. 3). 84% of the latter were generated during the various phases of the *ABOL Coordination*.

Regarding species numbers, 96% of species with publicly available DNA barcodes in BOLD were added to the reference database during the various phases of ABOL (Fig. 4).

Overall, 70,000 records with sequences were generated and submitted to BOLD over the course of the ABOL project (Fig. 5).

Adapting the goals of ABOL

Austria's funding landscape offers limited opportunities for projects focusing on the generation of reference data, but it does provide funding schemes for applied aspects of DNA barcoding. This limitation was a major reason for the expansion of the objectives of the ABOL initiative. Initially, there was a strong focus on completion, curation and validation of the reference database and on building and maintaining a network of partners. Over the course of the main phase of ABOL, the objectives were increasingly expanded to include the promotion of biodiversity research in general (with a particular emphasis on DNA barcoding approaches). This went hand in hand with a stronger emphasis on applied aspects of DNA barcoding, the expansion of the network to include stakeholders, and on bridging science,

society, and policy. These developments were further reinforced by the growing societal relevance of biodiversity research in the face of global challenges.

ABOL-RefDat, a project funded by the Biodiversitätsfonds (BMK) and running from January 1, 2024, to October 31, 2025, is one of the first ABOL projects dedicated exclusively to the generation of DNA barcodes. This allows for a thought experiment to assess whether the initial plan to achieve DNA barcodes of 80% of all animals, plant and fungi of Austria within a ten-year period was realistic. Within the project, 5,724 DNA barcodes were generated for 2,773 species from Austria. If the total of national funding acquired by ABOL (given in Fig. 2) would have been used to generate DNA barcodes, the goal of recording 80% of Austrians biodiversity could have already been achieved. This highlights the importance of continuous funding to ensure smooth and effective progress in building a complete reference library.

The advantage of the current priorities and objectives of the ABOL initiative is the integration of data and knowledge in the multidimensional space of the biodiversity research landscape. This integration is a core task of the *ABOL Coordination*.

The significance of a coordinated ABOL initiative in the multidimensional biodiversity research space and the tasks of the *ABOL Coordination*

In the following, the significance of a coordinated ABOL initiative is described along two interdependent axes: one axis ranging from scientific infrastructures through basic research and applied research to societal relevance, and a geographical axis ranging from regional to national and international aspects. While the implementation of individual projects is a shared responsibility of all partners of the ABOL initiative, the integration of the DNA barcoding approach along these axes is among the central tasks of the *ABOL Coordination*.

Some of these tasks, such as ensuring the efficient generation of DNA barcodes, were embedded in the concept of the ABOL initiative from the outset, whereas others evolved in response to the initiative's history and to changing framework conditions. This applies in particular to the acquisition of projects through various funding schemes. Data generation within many larger and smaller independently funded projects not only poses greater challenges for coordination and harmonization (compared to a single comprehensive funding scheme as originally planned) but also led to a shift toward applied projects (Fig. 2).

Transdisciplinary dimension and societal integration: from data infrastructure through basic research to applied research and societal relevance

The ABOL initiative encompasses all aspects be they infrastructural, scientific, or societal.

To coordinate this breadth, the *ABOL Coordination* itself is structured into three strongly interconnected areas. The **e-Infrastructure management** is responsible for tasks related to data infrastructure aspects. It ensures compliance with quality standards and coordinates data flows from sub-projects to the ABOL database and from there to BOLD, as well as metadata flows to other Austrian and international biodiversity platforms. The **overall**

taxonomic coordination serves as the interface to taxonomic experts and is responsible for all matters related to the generation of DNA barcodes. It prevents undesirable duplication of efforts and helps to close gaps. By integrating molecular genetic approaches into taxonomic research, it acts as an indispensable interface between data-producing partners and scientific collections. The overall taxonomic coordination requires strong national networking and high communication skills. It coordinates information flows both among taxonomic experts and from ABOL to the public. The **ABOL management** is responsible for the applied aspects of DNA barcoding and their societal relevance. It coordinates the communication between regional, national, European and international initiatives and networks (iBOL, iBOL Europe, DiSSCo, eLTER, EOSC, etc.) and represents ABOL externally (stakeholders, media). The ABOL management provides ABOL partners with a common voice and coordinates information flows between partner institutions, between ABOL and international partners, and toward stakeholders.

As the DNA barcoding approach is generally dependent on a reference database that serves as the basis for DNA-based identification, it inherently has a strong research data infrastructure component. In the original development plan of the ABOL initiative, drafted during the pilot phase, the data infrastructure aspect – with the primary goal of building the reference database – was strongly emphasized. Due to the ultimately implemented funding model, consisting of core funding only for the *ABOL Coordination* and the acquisition of third-party funding for data and application projects, the shared objectives of the initiative expanded towards more applied aspects. This development was reinforced by the biodiversity crisis coming more into the geopolitical focus. The ABOL long-term objectives thus also include the general promotion of biodiversity research and monitoring, as well as support for the transformation toward a nature-positive society.

As a result, the objectives of the ABOL initiative now span the full dimension from data infrastructure through basic research and applied research to societal relevance.

Infrastructure aspects of ABOL

One of the main objectives of the ABOL initiative is to achieve a high coverage of DNA barcodes for organisms occurring in Austria, thus contributing to the international initiative iBOL and its data portal BOLD. By the end of 2025, DNA barcodes for approximately one third of the roughly 75,000 animal, plant, and fungal species occurring in Austria were available in BOLD – note that during the course of ABOL the estimated number of species increased from originally 70,000 to 75,000, based on new publications (Geiser 2018; Schratt-Ehrendorfer et al. 2022; Krisai-Greilhuber 2015). However, part of the data in BOLD is not yet publicly accessible, for example because it is still under embargo pending publication. The *ABOL Coordination* continuously strives to increase the proportion of publicly accessible data and provides partners with support in data management.

DNA barcoding is a collection-oriented scientific approach. DNA barcodes from reliably identified organisms serve as reference sequences for species identification. Voucher specimens of these reference organisms are deposited in scientific collections, ensuring the traceability of the identifications and their anchoring in physical objects. The digital storage of metadata of reference organisms, ideally complemented by digitized specimens, creates

an interface with the national scientific data infrastructure project OSCA (Open Scientific Collections Austria, <https://osca.science/en/>; Korth et al. 2025).

The *ABOL Coordination* is committed to the highest quality standards and ensures that data of the highest possible quality are made available for research and application. Accordingly, the ABOL mission statement formulates the following quality standards: DNA barcoding sequences are generated from taxonomically (a priori) identified organisms. Reference organisms originate either from publicly accessible scientific collections or, if freshly collected, are deposited in such collections. Where available, remaining DNA is stored in a DNA/tissue bank. DNA barcodes are uploaded together with the associated metadata (i.e. data that describes characteristics of other data – e.g. the name of the person which performed the morphological species identification) to the international database BOLD. All steps in the DNA barcoding workflow – from collection and documentation through sampling, DNA analysis, data evaluation, and data submission – are carried out in strict compliance with the highest (laboratory) standards and controls. All data, whether DNA barcodes or application data, are made publicly available whenever possible in accordance with the FAIR principles.

The *ABOL Coordination* regularly offers workshops for partners and other interested parties, like e.g. participants of the ABOL BioBlitzes and managers of protected areas, on the use of *Specify* (ABOL database) and BOLD as well as on topics related to data collection, quality assurance, and biodiversity informatics. These activities contribute to broad knowledge transfer within the community and strengthen capacity building in modern biodiversity research. Between 2017 and 2025 in total 18 workshops have taken place with more than 150 participants.

The ABOL website also provides a platform for showcasing the diverse projects of the ABOL initiative and thus supports the dissemination obligations of many partners. Through this visibility and active communication, the website functions as a central element of multi-dimensional integration into the larger context – from national monitoring programs and international research infrastructures to global biodiversity strategies.

The Austrian research funding landscape offers limited opportunities for submitting purely data infrastructure projects. Likewise, European funding programs for research infrastructures mostly do not allow for data generation. Nevertheless, several projects with a predominantly infrastructural character have been implemented. Through these activities, the ABOL initiative has contributed at a technical level to the establishment and expansion of IT infrastructure and laboratory capacities at several universities. For example, between 2017 and 2021, a major infrastructure project for establishing DNA barcoding pipelines at universities was carried out under the HRSM project (Hochschulraumstrukturmittel; <https://www.abol.ac.at/en/project/hrsm-project/>), funded with EUR 1 million by the Ministry of Science. This collaborative project involved the *ABOL Coordination* (NHMW) and five Austrian universities (lead: University of Graz).

By generating DNA barcodes connected to new voucher specimens, ABOL has also contributed to the expansion of scientific collections at partner museums. In the project **ABOL-RefDat**, funded by the Biodiversity Fund (BMK, later BMLUK), 5,724 novel DNA barcodes were generated for 5,509 individuals (of 2,773 Austrian species) (<https://www.abol.ac.at/en/project/abol-refdat-2/>). The project was acquired and coordinated by the *ABOL*

Coordination. In addition to data production, a key objective was the involvement of various institutions and experts.

However, the reference data in BOLD do not represent the only data infrastructure component of ABOL. ABOL also aims to make all data generated through DNA barcoding applications in Austria available for reuse. With the involvement of a university-based ABOL consortium, the project **ATIV-Biodat** (<https://www.abol.ac.at/en/project/ativ-biodat-2/>) is currently underway, aiming to establish a trans-university infrastructure for linking national and international biodiversity databases.

Aspects of basic research

Promoting taxonomic research in Austria is among the main objectives of the ABOL initiative. A central task of the *ABOL Coordination* is the integration of DNA-based methods into taxonomy. This integrative taxonomic approach, which combines taxonomic classification based on phenotypic (i.e. morphological or behavioral traits) and genotypic (i.e. DNA barcodes) characteristics, increases the direct relevance of taxonomic research for applied biodiversity research, making ABOL an important hub for biodiversity research and documentation in Austria (e.g. Kirichenko et al. 2015; Reier et al. 2019; Schäffer et al. 2019 a, b). The long-term goal of the ABOL initiative is a complete inventory of all animal, plant, and fungal species in Austria. The *ABOL Coordination's* task is to make the generation of the required DNA barcodes as efficient as possible and to minimize duplication among partner institutions. This agenda aligns closely with the research focus of museums and scientific collections in general. By generating DNA barcodes, important information connected to physical reference organisms is made accessible to society; accordingly, the establishment of the reference database also falls within the scope of digitization initiatives of scientific collections that follow the extended specimen concept (Webster 2017).

DNA barcoding has great potential for detecting cryptic diversity (e.g. Huemer et al. 2014b; Eschner et al. 2015; Schäffer et al. 2019a, b; Reier et al. 2020b). One highlight was the discovery of a fish species previously unknown from Austria in the upper Mur River. The emerald gudgeon (*Romanogobio skywalkeri*) was newly described (Friedrich et al. 2018), and its distribution and population structure are currently being investigated in a dedicated project (<https://www.abol.ac.at/project/smaragdgressling-2/>).

Genetic data form the basis for numerous scientific studies, for example in taxonomy, phylogenetics, population genetics, or ecology. Thus, they constitute perfect showcases for reuse of collection data.

Aspects of applied research

The DNA barcodes in the reference database form the basis for numerous applications. Once established and intercalibrated with traditional approaches, DNA barcoding offers a cost- and time-efficient complementary method for species identification of animals, plants, and fungi in many fields. Thus, the *ABOL Coordination* integrates not only taxonomic research with molecular genetic research, but also with systematic and conservation-relevant research.

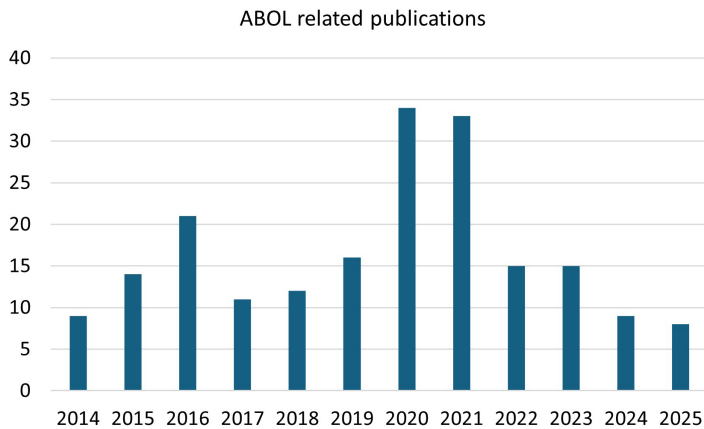


Fig. 6: Number of scientific publications in the context of ABOL per year. | **Abb. 6:** Anzahl der Veröffentlichungen im Kontext von ABOL pro Jahr.

In addition to high-quality reference data, the establishment and application of DNA barcoding approaches – particularly in the analysis of mixed samples (metabarcoding) and environmental samples (eDNA metabarcoding) – serve to establish DNA barcoding as a complementary species identification approach.

Like other initiatives at the European and global level, ABOL promotes the establishment of genetic methods in biodiversity monitoring and applied research. This includes projects on the use of DNA barcoding to detect pathogens causing swimmer's itch in water bodies (Reier et al. 2020a; Helmer et al. 2021, 2023), as well as the identification of dragonflies using DNA from exuviae (Sittenthaler et al. 2023a, b).

The **BioPlanbar** project aimed to integrate DNA barcoding and metabarcoding into the preparation of environmental impact assessments (Koblmüller et al. 2019).

Thanks to close cooperation between the *ABOL Coordination* and stakeholders, applications are continuously adapted to stakeholder needs. In the **GeMonA+** project, a genetic module is being developed in cooperation with LTER-Austria as a contribution to a holistically coordinated biodiversity monitoring system in Austria.

The scientific achievements of ABOL in both basic and applied research are most clearly reflected in the number of scientific publications generated during the various phases of the ABOL initiative (Fig. 6).

Aspects of outreach and societal value

Outreach into society is one of the defining strengths of ABOL. It distinguishes the initiative from many purely scientific projects and helps to foster a culture of shared responsibility for biodiversity.

The *ABOL Coordination* acts as a central interface – a unifying element that holds together the multidimensional construct of the ABOL initiative – and makes it visible through public outreach activities (lectures, workshops, newsletters, social media activities, and its own website). The goal is to present complex topics such as genetic species identification in an accessible way and to highlight their benefits for society, conservation, and policy. This strengthens the acceptance of molecular genetic methods within the biodiversity discourse and integrates scientific knowledge into society. Since 2020, ABOL has jointly organized conferences with the Biodiversity Hub; these were held as multi-day biodiversity conferences in 2023 and 2025 under the title *Days of Biodiversity*, together with other organizers. These events featured a highly diverse program that brought together players from biodiversity research and practice, decision-makers from politics and administration, NGOs, interested citizens, and the media.

In addition, the **ABOL BioBlitzes** (Sonnleitner et al. 2022) promote the participation of community scientists in the generation of scientific knowledge. Initiated by the *ABOL Coordination* in 2019, altogether 37 BioBlitzes have been performed (Tab. 2). They involve

Tab 2: Overview of the ABOL BioBlitzes between 2019 and 2025. | **Tab. 2:** Überblick über die ABOL-BioBlitze zwischen 2019 und 2025.

ABOL-BioBlitz	Year	Location
Test BioBlitz (“Probeblitz”)	2019	Tattendorf, Lower Austria
GEO Day of Nature, Biosphere Reserve Nockberge	2019	Diversity in shores and slopes at Millstätter See, Carinthia
Day of Biodiversity Upper Austria	2019	Grein – around Mühlberghof, Upper Austria
Day of Biodiversity, Biosphere Reserve Wienerwald	2019	Pressbaum, Lower Austria
Day of Biodiversity Vienna	2019	BOKU university area, Knödelhüttenstraße, 1140 Vienna
Day of Biodiversity Tyrol	2019	Brandenberg valley, municipality Brandenburg, Tyrol
Day of Biodiversity National Park Hohe Tauern	2019	Gössnitz valley, Carinthia
Day of Biodiversity, Biosphere Reserve Wienerwald	2020	Pötzleinsdorfer Schlosspark, Geymüllergasse, 1180 Vienna
GEO Day of Nature, Biosphere Reserve Nockberge	2020	Around Grundlalm, Carinthia
Day of Biodiversity National Park Hohe Tauern	2020	Umbal valley, East Tyrol
Day of Biodiversity Tyrol	2020	Municipality Gössen, Tyrol
Day of Biodiversity Vienna	2021	Donauinsel, 1220 Vienna
Day of Biodiversity, Biosphere Reserve Wienerwald	2021	Eichgraben, Lower Austria

ABOL-BioBlitz	Year	Location
GEO Day of Nature, Biosphere Reserve Nockberge	2021	Zunderwand near Kaning, Radenthein, Carinthia
Day of Biodiversity Tyrol	2021	Municipality Pfunds, Tiroler Oberland, Tyrol
Day of Biodiversity National Park Hohe Tauern	2021	Municipality Muhr in the Lungau, Salzburg
Day of Biodiversity, Biosphere Reserve Wienerwald	2022	Ottakring, 1160 Vienna
Insect Camp	2022	Leiser Mountains, Lower Austria
Day of Biodiversity Tyrol	2022	Ehrwalder Becken, Tyrol
GEO Day of Nature, Biosphere Reserve Nockberge	2022	St. Lorenzen ob Reichenau, Carinthia
Day of Biodiversity National Park Hohe Tauern	2022	Malta valley, Carinthia
Day of Biodiversity Vienna	2023	Garden plot – ÖBB Landwirtschaft BBL – Region Ost Zweigverein Kagan, 1210 Vienna
Day of Biodiversity, Biosphere Reserve Wienerwald	2023	Klosterneuburg, Lower Austria
Insect Camp	2023	Nature Park Weißbach near Lofer, Salzburg
GEO Day of Nature, Biosphere Reserve Nockberge	2023	between Peitlernock and Bärenauock in Innerkrams, Carinthia
Day of Biodiversity Tyrol	2023	Leutasch, Tyrol
Day of Biodiversity National Park Hohe Tauern	2023	Defreggen valley, East Tyrol
Day of Biodiversity, Biosphere Reserve Wienerwald	2024	Liesing, 1230 Vienna
GEO Day Carinthia	2024	Geo park Karawanken, Carinthia
GEO Day of Nature, Biosphere Reserve Nockberge	2024	around lake Windebensee (at the Nockalm road), Carinthia
Insect Camp	2024	Nature Park Karwendel, Tyrol
Day of Biodiversity National Park Hohe Tauern	2024	Habachtal, Salzburg
Day of Biodiversity Vienna	2025	Area Breitenlee, 1220 Vienna
Day of Biodiversity, Biosphere Reserve Wienerwald	2025	Baden near Vienna, Lower Austria
Insect Camp	2025	Nature Park Hohe Wand, Lower Austria
Day of Biodiversity National Park Hohe Tauern	2025	Gradental (Schobergruppe) in the National Park municipality Großkirchheim, Carinthia
GEO Day Carinthia	2025	Mittagskogel, Karawanken, Carinthia

community scientists with high biodiversity expertise collecting samples that contribute to building the reference database. Beyond integrating new partners into the ABOL initiative, the ABOL BioBlitzes also serve science communication, public outreach, and early-career support by enabling the validation of morphological identifications through DNA barcoding. In workshops offered by the *ABOL Coordination*, taxonomic experts can learn how to process their DNA barcoding data and thus contribute to the curation of the DNA reference database. The ABOL BioBlitzes are also listed on the national citizen science platform “Österreich forscht.”

The *ABOL Coordination* communicates the goals of the initiative to policymakers. It maintains contacts with stakeholders such as ministries, authorities, and the Environment Agency Austria (Umweltbundesamt), and is engaged in committees and organizations. Members of the *ABOL Coordination* (Nikolaus Szucsich and Elisabeth Haring) represent the *ABOL Coordination* on various scientific advisory boards and bodies, such as the Austrian Biodiversity Council and the Austrian Academy of Sciences’ Commission for Biodiversity in Austria (“Biodiversity Austria, Biodiv-A”), where they are also involved in IPBES-related matters. The biodiversity community, which was already brought together during the ABOL pilot phase, formed the basis for the establishment of the Austrian Biodiversity Council (<https://www.biodiversityaustria.at/biodiversitaetsrat/>), which was thus able to build on an existing network.

The transdisciplinary character of the ABOL initiative is also reflected in the ABOL network itself. From the outset of the ABOL pilot phase, numerous institutions and individuals expressed interest in participating in ABOL. This partner network grew substantially over subsequent phases and now includes staff from many institutions – including all Austrian universities active in biological research, federal and regional museums, biosphere reserves, national parks, nature conservation departments, NGOs – as well as numerous individuals (<https://www.abol.ac.at/en/about-us/#cooperation-partners>).

Within the network, partners assume very different roles and functions. Only some are involved in generating DNA barcodes, usually within the framework of third-party funded projects. Others contribute to methodological development, applied projects, or act as stakeholders (e.g. representatives of protected areas) who are integrated into projects. The *ABOL Coordination* has organized workshops to convey DNA barcoding expertise and knowledge of the BOLD reference database to stakeholders. The ABOL conferences organized by the *ABOL Coordination* (from 2020 onward replaced by ABOL’s participation in the *Days of Biodiversity*) also served as platforms for the exchange of knowledge and experience.

Particularly noteworthy is the establishment of a successful consortium consisting of the *ABOL Coordination* and university staff from several Austrian universities. This consortium has already completed a major infrastructure project for establishing DNA barcoding pipelines at universities (HRSM project) and is currently conducting further projects (notably GeMonA+ and ATIV-Biodat).

Geographical dimension: from regional and national to European and global aspects

The ABOL initiative is closely linked to European and international biodiversity research infrastructures. A central element of this networking is the systematic integration of DNA barcodes generated in Austria into the international data portal BOLD.

The *ABOL Coordination* is closely connected to European and international biodiversity research infrastructures. International networking is indispensable to ensure the comparability of biodiversity indices when addressing global challenges. ABOL coordinator Nikolaus Szucsich has been a member of the iBOL Science Committee since 2015 (<https://ibol.org/about/science-committee/>) and represents the ABOL initiative within the European subsidiary organization iBOL Europe.

Via OSCA (Open Scientific Collections Austria) (Korth et al. 2025), ABOL is linked to DiSSCo (Distributed System of Scientific Collections), a European initiative that promotes the digitization and networking of scientific collections at the European level.

Knowledge transfer also takes place across national borders, for example within the framework of an OeAD project in Zambia, in which two DNA barcoding workshops were held for staff and students at the University of Zambia in Lusaka (lead: University of Graz; <https://www.abol.ac.at/project/sambia/>).

The global Horizon Europe project LIFEPLAN (<https://www.helsinki.fi/en/projects/lifeplan>) is an iBOL project that investigates the impact of human land use (especially settlement) on biodiversity. At more than 200 twin sites – each comprising a pair of one near-natural and one urban location – biodiversity is surveyed using Malaise traps, spore traps, soil samples, camera traps, and microphones. ABOL partners are involved with three twin sites in LIFEPLAN. The use of state-of-the-art approaches (ranging from metabarcoding to artificial intelligence; Hardwick et al. 2023) and analytical methods will contribute to advancing our understanding of global biodiversity.

The *ABOL Coordination* likewise represented ABOL in the EU COST Action DNAqua-Net (Leese et al. 2016). The aim of this EU COST Action was to establish an interdisciplinary research network focusing on the development of gold standards for novel biodiversity-relevant indices using DNA-based approaches for the ecological assessment of European waters (Elbrecht et al. 2017; Pawlowski et al. 2021; Blancher et al. 2022). In addition to a gap analysis (Weigand et al. 2019) and the development of standardized approaches (Meissner et al. 2021), DNAqua-Net provided a learning platform for the next generation of European researchers, preparing them for new technologies. Together with water management authorities, policymakers, and other stakeholders, the group developed a concept for the routine application of DNA-based tools within legally binding assessment frameworks.

The *ABOL Coordination* team

Since the start of the project, an interdisciplinary team has been built up that covers the three areas of the *ABOL Coordination* (see also 3.1.). The *ABOL Coordination* currently consists

of the following team members (in total 2.5 FTE): Nikolaus Szucsich has the leading role as the ABOL Manager; Michaela Sonnleitner, Janine Heinzl and Victoria Kargl are responsible for overall taxonomic coordination and act as ABOL BioBlitz coordinators. Florian Ackerl works as e-infrastructure manager. Former members encompass Denise Grau and Oliver Macek (as former e-infrastructure managers) and Christoph Leeb and Sabine Schoder (in taxonomic coordination).

Institutional embedding: The anchoring of the *ABOL Coordination* at the Natural History Museum Vienna is based on the fact that DNA barcoding is inherently a collection-based approach to DNA-based species identification. The aim is to consistently maintain the link between the DNA barcode and the collection object (reference individual). This traceability enables transparency and quality control. Currently Elisabeth Haring and Christoph Hörweg are the project leaders of the *ABOL Coordination*. Former project leaders encompass Helmut Sattmann and Christian Bräuchler.

The *ABOL Coordination* is supported and accompanied by the Scientific Advisory Board established in 2017. The composition and development of the coordination team and the Scientific Advisory Board are available on the ABOL website (<https://www.abol.ac.at/en/about-us/>).

Challenges, outlook, and vision

The network as key asset

By integrating various individuals and institutions, as well as different research fields and stakeholders, the *ABOL Coordination* ensures the creation of synergies, the pooling of resources, and continuous knowledge transfer between science, society, administration, and political decision-makers. Over the past decade, the ABOL initiative has evolved from a funded project into a central platform for biodiversity research in Austria. Its network function is not a “by-product” but rather the backbone of the initiative, initiated and continuously developed by the *ABOL Coordination*.

United by the common goal of promoting biodiversity research, the coordinated ABOL initiative brings together universities, research institutions, museums, and other collections. This allows expertise from classical taxonomy, molecular biology, bioinformatics, and applied ecology to be combined. Without this platform, many collaborations would not have come about, and one of the future tasks of ABOL will therefore be to continuously strengthen and promote these connections. The benefits of the ABOL network are evident in numerous project-level collaborations – both small and large – often spanning institutions and disciplines and/or involving community scientists, thereby facilitating substantial knowledge exchange and transfer.

The ABOL network also has an outward impact: through participation in European projects e.g. DNAqua-Net (Leese et al. 2016) or TETTRIs (Magee 2025), and data flows into international platforms (BOLD, GBIF). ABOL is embedded in global biodiversity initiatives. This enhances the international visibility of Austrian biodiversity initiatives and strengthens their integration into global networks and international forums. ABOL also

fulfils a networking function through its involvement in advisory bodies (e.g. the Austrian Biodiversity Council; the Austrian Academy of Sciences' Commission for Biodiversity in Austria – “Biodiversity Austria (Biodiv-A)”) and through its links with various relevant national platforms (e.g. the Austrian Biodiversity Atlas, GBIF Austria, ZOBODAT).

Over more than a decade, the *ABOL Coordination* has evolved as a servant of many masters: regarding involved institutions, it covered scopes from basic research to various applications of species identification, geographical perspectives from regional to global scales, and connected with stakeholders, politics, and society.

To maintain these bridging functions, it would be most appropriate to strive for a jointly financed consolidation. Associating the *ABOL Coordination* with a single institution would risk restricting its activities to institutional agendas. One way to mitigate such risks would be to integrate the *ABOL Coordination* into a national biodiversity centre, as proposed by the Biodiversity Council of Austria.

The maintenance of such a network is time-consuming and resource-intensive and requires secure coordination to ensure continuous communication, alignment, and strategic development. This coordination work enables the networking of experts across institutions, disciplines, and regions, thereby creating the framework for cooperative research and the shared use of resources.

The *ABOL Coordination* as a long-term infrastructure

The *ABOL Coordination* provides its partners with comprehensive support in data processing and quality control and assists with data preparation for international platforms such as BOLD. Continuing this way in the future, the *ABOL Coordination* delivers central services that are in high demand within the community and clearly position the initiative as a national research infrastructure. Running a working database based on *Specify* (Mengarelli et al. 2025) enables a linkage of taxonomy, DNA sequences, metadata, and scientific collections, creating an integrated data environment that functions both as an internal tool for the *ABOL Coordination* and as an interface for partners preparing data for upload to BOLD. Thus, the *ABOL Coordination* can maintain its role in quality assurance by giving structured feedback to taxonomic experts, thus fostering the continuous improvement of the reference data.

Yet, while some of the services provided by the *ABOL Coordination* are readily measurable, reducing its role to a purely infrastructural function would neither adequately reflect the scope of its activities nor meet the needs of the community. One of the major roles of the *ABOL Coordination* is the internal and external communication of the ABOL initiative.

Driving innovation in biodiversity research through ABOL

Since its establishment, ABOL has significantly advanced biodiversity research in Austria by combining coordinated research activities with strong efforts in mobilization, networking, and community building. Research projects have been central to this development, providing both scientific outputs and the framework for collaboration among museums, universities, regional initiatives, and taxonomic societies. For the further development of

DNA-based biodiversity research in Austria, continuing and expanding these collaborative structures will remain essential.

From a scientific perspective, several areas will require particular attention. A major challenge remains the identification and documentation of cryptic diversity, which continues to reveal previously overlooked species and evolutionary lineages and the hidden diversity, especially in megadiverse groups of organisms. In addition, further standardization of laboratory protocols, data generation, and reference libraries will be crucial to ensure comparability and long-term usability of DNA barcode data. Finally, the application of DNA-based methods in biodiversity monitoring is rapidly gaining importance. Strengthening the integration of DNA barcoding and metabarcoding approaches into ecological monitoring and conservation practice will be a key task for the coming years.

Through its coordinated network and reference data generation, ABOL provides an essential foundation for these developments and will continue to play a central role in advancing biodiversity research and evidence-based conservation in Austria.

The future of ABOL along the dimension from data infrastructure to societal outreach

The global biodiversity crisis represents a major societal challenge that requires coordinated scientific responses. This challenge must be addressed not only at the international level but also within Austria. Effectively tackling biodiversity loss requires a coordinated research agenda, in which multiple institutions and disciplines collaborate toward shared objectives.

Given the complexity of biodiversity research – spanning taxonomy, ecology, molecular biology, environmental monitoring, data management, and policy-relevant applications – coordination is essential to ensure coherence, avoid duplication of efforts, and maximise the societal impact of research activities. A coordinated framework can facilitate the integration of expertise across institutions and promote the development of shared infrastructures and standards.

With more than a decade of experience in connecting research institutions, infrastructures, and application-oriented stakeholders, the *ABOL Coordination* is well positioned to assume a central role in such a framework. It contributes to addressing societal challenges on several interconnected levels, i.e. the data infrastructural level, the level of research, as well as the level of networks, by linking biodiversity research with societal and political decision-making.

Overcoming the societal challenges needs a strong base in data infrastructures, committed to the FAIR data principles. By ensuring a close linkage between data, databases, and scientific collections, the *ABOL Coordination* will continue to contribute to a dynamic global data infrastructure network. At the same time, it itself functions as an infrastructure.

Intensified and increased efforts of biodiversity research are necessary to allow for evidence-based solutions. Thanks to the *ABOL Coordination* the initiative has successfully established itself as a key structure within Austrian biodiversity research. Future progress will need a balanced combination of research infrastructure development connecting scientific collections as well as national and international platforms and data networks, to achieve

long-term frameworks for data generation, storage, and accessibility. Ideally this is implemented through partnerships among key institutions such as the Universities, the Natural History Museums, regional biodiversity hubs, and the numerous scientific societies and associations that often harbor rare biodiversity expertise. At the same time, scientific progress will rely on extended research funding (e.g. FWF, EU programs) specifically dedicated to establishing the data infrastructure needed.

More than ever, overcoming scientific challenges demands for effective collaboration through well-functioning networks of scientists, nature conservation practitioners, authorities and policymakers, to finally foster a broader societal transformation toward a more sustainable and nature-compatible society. Here, the network of ABOL partners is a strong pillar for Austria, well integrated into the international context.

Crucial to the future viability of the initiative is the establishment of a permanently secured, professionally operating, and strategically embedded coordination structure. Only under these conditions can ABOL further expand its role as a national platform for biodiversity research, provide stable infrastructure for data, expertise, and knowledge transfer, and make substantial contributions to the implementation of national and international commitments in the fields of nature conservation and biodiversity monitoring. At a time when framework conditions are changing at all levels and demands on biodiversity research continue to grow, an initiative can only be successful in the long term if coordination functions are performed reliably and continuously.

ABOL stands at a decisive point in its development, facing the challenge of securing its activities over the long term while strategically expanding its scope to a broader initiative that supports biodiversity research in general. In particular, this necessitates sustainable funding of the central coordination unit and the integration of its activities into national and international biodiversity monitoring programs (Basille et al. 2024). With the *ABOL Coordination* forming the organizational backbone of ABOL, the initiative can remain functional as a decentralized network.

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