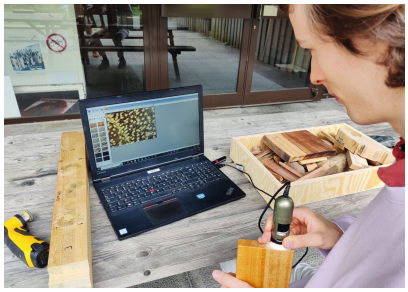
Accurate species identification of biological material is required to assess and understand biodiversity and ecosystems but also to, for example, implement animal and plant (including wildlife) trade regulations, prevent infectious disease outbreaks, screen the food chain, or deploy agricultural pest control programs. In response to the recurrent societal need for reliable species identifications of biological specimens and products of socio-economic relevance, the Belgian Science Policy (BELSPO) has been supporting and financing two initiatives which are carried out by two Federal Scientific Institutions (FSIs), the Royal Belgian Institute of Natural Sciences (RBINS) and the Royal Museum for Central Africa (RMCA).



© ENFORCE_RMCA - Identification of a tropical wood sample using wood anatomical analysis

© BopCo - Sampling of illegally imported wild meat intercepted at Brussels International Airport

BopCo: The Barcoding Facility for Organisms and Tissues of Policy Concern

Established in 2015 within the framework of the EU RI LifeWatch, BopCo has recently evolved into a BELSPO-financed Centre of Expertise: BopCo-CE. BopCo-CE aims at identifying biological material like Invasive Alien Species, CITES-listed species, agricultural and horticultural pest species, human and veterinary disease organisms (including parasites) and their vectors, organisms of the food chain, species of forensic interest, quarantine species, indicator and sentinel species (e.g., ecotoxicological test species), species of hygienic concern, species of pharmaceutical importance, species

with economic impacts, species that damage or pose risks to human infrastructures and activities, beneficial species (e.g., biological pest control, pollinators), and others of societal relevance.

ENFORCE: The Belgian Centre of Expertise for Forensic Wood Research

ENFORCE was established in 2022 as part of the BELSPO relance and transition program to strengthen federal scientific research capacity. Based at the RMCA, its main objective is to provide scientific support in the combat against illegal timber trade. As about one third of all commercial tropical timber enters the European Union through Belgium, such a centre was deemed essential in order to allow companies, NGOs, and government agencies to check the correct species and origin of wood and wood products.

Access to Expertise and Advanced Scientific Infrastructure

As BopCo-CE and ENFORCE are based at RBINS and RMCA, they have access to a broad taxonomic expertise, international networks, methodological know-how and scientific infrastructure for species identifications, including fully equipped DNA and microtome laboratories, (stereo)microscopes, Scanning Electron Microscopes, DART-TOFMS spectrometry, µCT scanners, huge natural history collections like the internationally important xylarium (wood collection), high-resolution photographic equipment, and extensive libraries.

In this way, species identifications can rely on morphology-based taxonomic know-how and unique specimen collections available at both FSIs in combination with DNA-based methods and a network of external experts. DNA-based methods are especially useful when morphological identifications are difficult or impossible (e.g., early life stages, processed food items, cryptic species, degraded or fragmented specimens). Apart from classical wood anatomy, ENFORCE is equipped with the first Belgian DART Time-Of-Flight mass spectrometer. This method reveals the chemical fingerprint from a single sliver of wood. The combination of both methods often permits to upgrade identifications up to the species level, which is particularly important for casework dealing with CITES-listed species.

Research and Service Synergies

Since their establishment, BopCo-CE and ENFORCE have grown significantly in numbers of users, partners, and portfolio of expertise, techniques, and offered services. To further strengthen and expand their capacity to offer customer-oriented and up-to-date species identification services, they need scientific support through the development and

exploration of novel methodologies to identify organisms and derived products or to trace the origins of biological materials, i.e., to act as a wildlife forensics service in the broadest sense.

For BopCo-CE, this scientific support is provided by JEMU, the Joint Experimental Molecular Unit. JEMU is a BELSPO-financed unit that started in 2007 and is shared by RMCA and RBINS. It aims at conducting and supporting fundamental and applied scientific research in the fields of molecular systematics, i.e., phylogeny, phylogeography, DNA barcoding, species delimitation and population genetics, with a particular focus on the use of old DNA and the valorisation of natural history collections for this type of research.

Future Integration and Growth

The growing demand for reliable species identifications drives BopCo-CE, JEMU, and ENFORCE to foster new scientific opportunities and expand (inter-)national collaborations and partnerships. In view of these common challenges and policies, and given their similar aims and scientific complementarity, it has been decided to coordinate the activities of the three entities under a common umbrella. This alignment will facilitate access to, and visibility of, the expertise, facilities, and services that BopCo-CE, JEMU, and ENFORCE, and their host institutions can offer.

As a first step, the synergy between the identification services of BopCo-CE and ENFORCE, as well as the activities of JEMU, are advertised via a joint website presenting the Belgian network for species identification services, speciesID.

Strategic Objectives

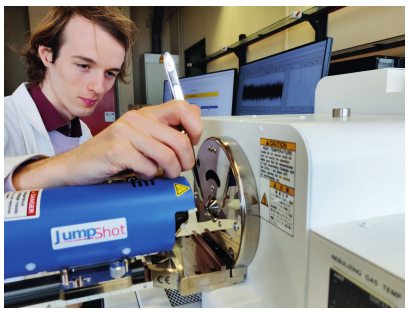
A further integration of BopCo-CE, JEMU, and ENFORCE will be realized by a formal Memorandum of Understanding between RBINS and RMCA and through the development of a joint workplan. The objectives within this workplan are centred along three inter-related axes:

- (i) The exploration and implementation of new species identification tools resulting from recent technological innovations (e.g., eDNA, Next Generation and Oxford Nanopore Sequencing, qPCR, AI-driven identification tools to screen timber shipments using portable equipment).
- (ii) The development of a comprehensive federal unit covering the identification of a broad range of policy concern organisms through synergistic and collaborative work with other institutional units providing complementary identification services and building new or expanding existing reference databases to compare incoming cases against them.

- (iii) The upgrading of the virtual and physical communication tools (e.g., renewed website, folders, social and public media, participation in scientific conferences and outreaching events).

A Stronger, More Sustainable Future

Altogether, the establishment of the joint Centre of Excellence on Species Identification and Molecular Taxonomy will not only provide the various governmental, regional, and public stakeholders with a more versatile and customer-friendly service to deal with societal challenges, policies, and actions, but will also allow for a stronger scientific synergy, increased visibility, and a more structural future sustainability of the consortium.



© ENFORCE_RMCA - Chemical analysis of a wood sliver with a mass spectrometer (DART-TOFMS)

© ITM/Anna Schneider - The Asian tiger mosquito, one of the exotic mosquitoes encountered in Belgium and for which BopCo-CE is conducting surveys, together with the Institute of Tropical Medicine