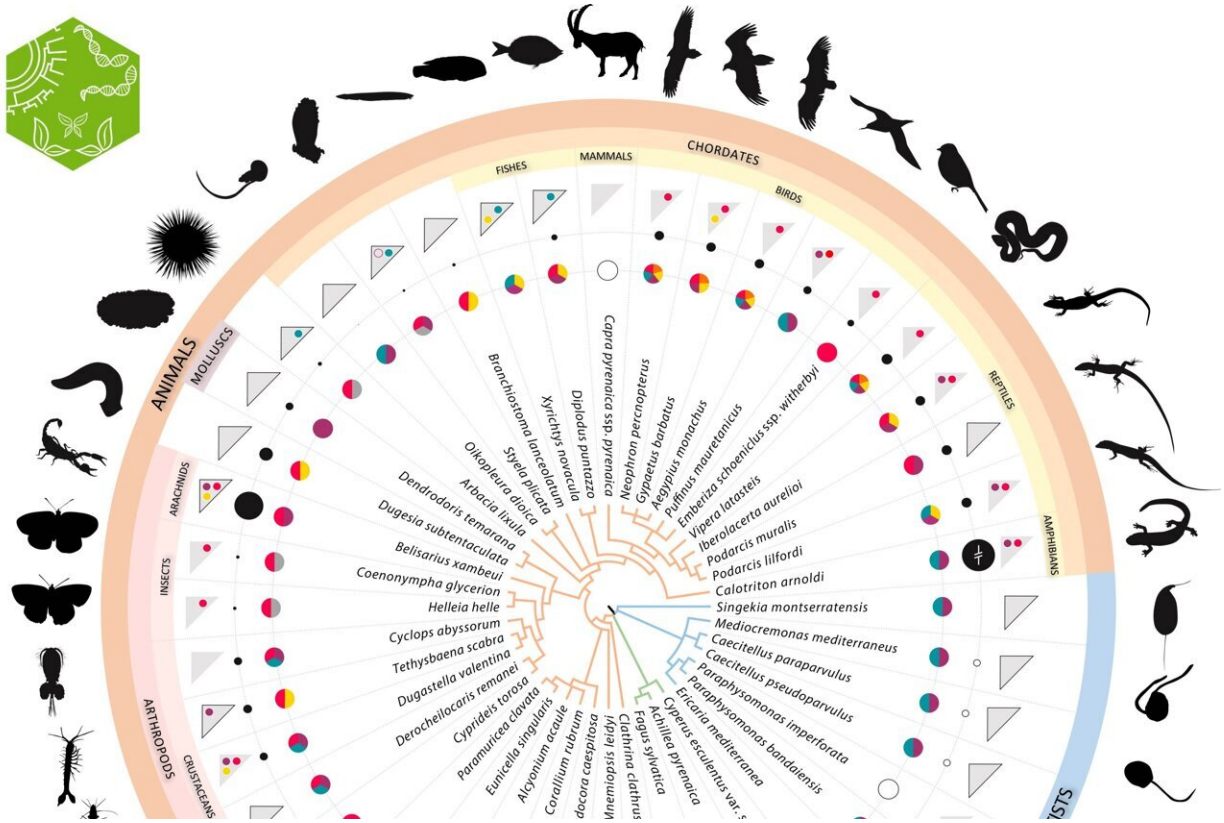
Project to sequence genomes of 40,000 plant, animal and fungi species in Catalan-speaking territories

July 18 2024



The Catalan Initiative for the Earth BioGenome Project (CBP) aims to prevent the loss of biodiversity and the extinction of living beings in a territory which is becoming more threatened by climate change. Credit: *NAR Genomics and Bioinformatics* (2024). DOI: 10.1093/nargab/lqae075

Biodiversity loss is one of the most alarming threads the planet faces. Degraded habitats, overexploited resources, climate crisis and invasive species are some of the factors that threaten the richness and variety of living species.

The rapid and progressive disappearance of organisms—some experts talk about a sixth mass extinction—will create major imbalances and ecosystems, alter ecological cycles and relationships between species, affecting all forms of life, including the human species.

Sequencing the genomes of all plants, animals and fungi on Earth—about 2 million known species—to protect biodiversity as we know it: This is the aim of the Earth BioGenome Project (EBP), which will characterize the genomic biodiversity of species in different regions of the planet.

The Catalan Initiative for the Earth BioGenome Project (CBP) is also participating in this international project, which will sequence the genomes of the eukaryotic species—that is, those with cells that have a defined nucleus—that are in the Catalan-speaking territories (Andorra, Northern Catalonia, Balearic Islands, the Valencian Community and Principality of Catalonia).

Now, an article in the journal *NAR Genomics and Bioinformatics* has reported on the CBP project.

The main authors of the text are Professor Montserrat Corominas, from the UB's Faculty of Biology, the UB Institute of Biomedicine (IBUB) and the Institute for Catalan Studies (IEC), and Professor Roderic Guigó, from the Cenetr for Genomic Regulation (CRG), Pompeu Fabra University (UPF) and IEC. The NARGAB article explicitly cites the Catalan translation, which is available in the Zenodo database.

Sequencing genomes to protect species

Knowing the genome of living beings is decisive for designing tools and strategies to help minimize—or even reverse—the loss of biodiversity and the extinction of species. A quarter of all known species on the European continent are found in the Països Catalans (Catalan-speaking territories), where there is a high level of biodiversity and an abundance of endemic species, many of which are seriously threatened by global climate change, which is likely to have a major ecological impact on the Mediterranean basin, especially in freshwater ecosystems and mountain areas.

"One of the great achievements of the Catalan Initiative for the Earth BioGenome Project (CBP) is that it has been able to encourage scientists from very different disciplines within biology, areas in which they have traditionally worked in isolation from each other.

"This favors interdisciplinary research, which is essential for the progress of science," says Montserrat Corominas, professor at the UB's Department of Genetics, Microbiology and Statistics and head of the REGnetREG research group at the UB.

Obtaining the genomes of all species on Earth "may be the most important project in the history of science, and one of the most important in the history of mankind. Knowing these genomes will provide knowledge of biological processes with unprecedented resolution.

"All this knowledge will have an impact that we cannot yet even imagine in areas such as medicine, agriculture, biotechnology, etc., and also in many industrial processes, which are increasingly dependent on biological processes.

"This scientific milestone will therefore be essential for the development of the bioeconomy, i.e. an economy that develops with nature and not against nature," stresses expert Roderic Guigó, head of the Computational Biology and Health Genomics research program at the Center for Genomic Regulation (CRG).

The Balearic shearwater: A genome of reference in conservation

Biologists, botanists, zoologists, geneticists, bioinformaticists, microbiologists, ecologists and other experts have contributed their research efforts to an investigation that, for now, has the sequencing of the genomes of 76 species in its sights.

In the pilot phase of the PBC, which began in the summer of 2020, a digitized catalogue of the eukaryotic species living in Catalonia has been created, with species of little-explored taxa, such as the freshwater flagellate (Singekia montserratensis); rare, endemic or difficult to locate species, such as the Catalan blind scorpion (Belisarius xambeui), or those considered emerging as biological models, such as the wall lizard (Podarcis muralis).

The genomes of endangered species such as the Montseny brook newt (Calotriton arnoldi), the most endangered amphibian in Europe, or the red coral (Corallium rubrum); species used in medicine, such as the Pyrenean chamomile (Achillea ptarmica subsp. pyrenaica), or of economic interest, such as the pearly razorfish (Xyrichtys novacula), are also to be provided.

One of the first genomes sequenced is that of the Balearic shearwater (Puffinus mauretanicus), a marine bird endemic to the Balearic Islands, critically endangered—especially due to accidental captures in

longliners—according to the International Union for Conservation of Nature (IUCN).

Professors Marta Riutort and Julio Rozas, from the UB's Faculty of Biology and the UB Biodiversity Research Institute (IRBio) have coordinated the study to decipher this genome of reference in conservation.

"Having the complete genome has allowed us to evaluate the real situation of the Balearic shearwater populations much better," says Riutort. "It has also opened the way for us to develop a tool that should help in their conservation and which has already aroused the interest of the groups involved," adds Rozas.

Addressing the challenge of biodiversity genomics

Nearly 150 experts from institutions such as the UB, CRG, IBE-UPF-CSIC, ICREA, CNAG, ICTA-UAB, BSC-CNS, CRAG, ICBIBE, CSIC-UIB and IBB, among others, have participated in this project. Most of the genomes are sequenced at the National Center for Genomic Analysis (CNAG), based at the Barcelona Science Park (PCB), and the results are available on the PBC website.

"Thanks to the advances in DNA sequencing technologies and analysis procedures, we can obtain high-quality reference genomes of animal and plant species at a rate unthinkable just a few years ago," says expert Tyler Alioto, head of CNAG's genome assembly and annotation group.

"Analyzing sequencing data to form a genome is equivalent to deciphering a jigsaw puzzle with millions of pieces. It has been necessary to develop powerful computational tools."

Sharing resources to protect biodiversity worldwide

The article published now highlights the rich biodiversity of the territories that have historically shared a strong cultural tradition, mainly reflected in the use of the Catalan language. Thus, the PBC was promoted in 2019 by the Catalan Society of Biology (SCB), thanks to the legacy of Leandre Cervera (1891–1964)—president of the entity in hiding during Franco's regime—with the initial support of the Catalan Institution of Natural History (ICHN) and the Institute for Catalan Studies (IEC).

For the authors, this paper is also a way of bringing their research closer to all citizens, who, in the end, are the ones who fund the research activity. This is particularly relevant as part of an initiative open to the whole of society that appeals to a shared cultural and linguistic heritage.

Since June 2024, the coordination group that manages the activities of the project—which is renewed every four years—is led by Marta Riutort (UB-IRBio) and Javier del Campo (Institute of Evolutionary Biology-IBE).

Beyond the borders of the Catalan-speaking territories, the PBC wants to form part of a global transformative movement to raise social awareness of the threat that biodiversity loss generates for human well-being, promoting a different and more balanced relationship with nature around the world.

"Our wish is that, when the international project comes to an end, we will be able to say that we have made a significant contribution from our countries," conclude Montserrat Corominas and Roderic Guigó.

More information: Montserrat Corominas et al, The Catalan initiative for the Earth BioGenome Project: contributing local data to global

biodiversity genomics, *NAR Genomics and Bioinformatics* (2024). DOI: 10.1093/nargab/lqae075