

**DRIIHM**

**Laboratory of Excellence**

**Inter-Disciplinary Research Facility on Human-Environment Interactions**

**Call for research projects 2022**

## **Project references**

*A **OHM Project** involves only one OHM ; an **inter-OHM Project** involves several OHMs.*

The **OHM** and **inter-OHM Projects** allow you to request a budget.

For **inter-OHM Projects** the contact of the concerned OHM directors is essential before any online project submission.

**\***: required data

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First name leader**\***: Cristian

Last name leader**\***: Correa

Session: 2022

### **Coauthors:**

Delphine Vanhaecke, Pablo Saenz

### **Project title****\***:

Basin-wide biodiversity survey through environmental DNA metabarcoding

### **Abstract (250 words) \***

Biodiversity surveys are a key input for conservation planning, and monitoring plans using environmental DNA have the potential to offer a standardized and cost-efficient method to survey biodiversity in aquatic ecosystems. We propose conducting cost efficient vertebrate biodiversity surveys through water sampling and eDNA metabarcoding in c. 30 water bodies and reaches in Valle de Exploradores. Pilot surveys by our team already demonstrated the feasibility of this approach (Figure 1).



**Project title in French\*:**

Inventaire de la biodiversité à l'échelle des bassins versants grâce au metabarcoding de l'ADN environnemental

**Abstract in French (250 words\*)**

Les inventaires de la biodiversité sont des éléments clés pour planifier les stratégies de conservation. Les plans de surveillance utilisant l'ADN environnemental ont le potentiel d'offrir une méthode standardisée et rentable pour étudier la biodiversité dans les écosystèmes aquatiques. Nous proposons de mener des inventaires sur la biodiversité des vertébrés grâce à l'échantillonnage de l'eau et au méta-codage de l'ADN environnemental dans près de 30 plans d'eau de la Vallée des Explorateurs, Chili. Des travaux préliminaires réalisés par notre équipe ont déjà démontré la faisabilité de cette approche (Figure 1).

**Type of project\*:**

- OHM Project [X]
- Inter-OHM Project [ ]

**OHM(s) involved\*:**

Assuming this item is about human-environment interactions, this project is relevant because virtually all anthropogenic activities in Valle Exploradores will affect biodiversity in some way. Therefore accelerating rate of anthropogenic change including species introductions (cats, dogs, rats, fish, cattle), habitat modification, nutrient or food subsidies, drainage alteration, etc., as well as the remoteness and spatial scale of Valle de Exploradores calls for any viable rapid, reproducible and reliable assessment of biodiversity as complete as possible on the landscape. This proposal is about a rapid and cost-efficient snapshot of the current state of vertebrate biodiversity in the valley, a good complement and guide towards more thorough baseline studies yet to come.

**Keywords:**

Disciplines (possible choices on the last page of the document):

Ecology, Biology, Genetics, Genomics, Limnology, Occurrence, Geo Spatial

**Context (500 words) \***

There is an increasing global demand for cost-effective, non-invasive methods to assess and monitor biodiversity. The most promising emerging technologies to supply this demand capitalize on the recovery and identification of organism's DNA from free particles in the environment, a technique known as environmental DNA (eDNA) metabarcoding. Sampling is relatively easy with these methods, for example, filtering a volume of water, and this is what makes eDNA metabarcoding especially suitable for exploratory biodiversity surveys in remote, inhospitable, or hard to access

regions. In the current context, we propose eDNA surveys as a first step to reveal biodiversity gradients within Valle de Exploradores, including patterns in the distribution of amphibians, fishes, birds and mammals.

### **Purposes (500 words) \***

- Conduct biodiversity surveys in a heterogeneous sample of c. 30 water bodies/reaches within Valle de Exploradores, and possibly adjacent basins for contrast.
- Depending on opportunities regarding logistics, conduct biodiversity surveys in remote, isolated and pristine locations, such as headwater lakes. (Chopper ride anyone?)
- Build biodiversity inventories and characterize distributional patterns and gradients.

### **Methodology (500 words) \***

The use of eDNA technologies in aquatic ecosystems have increased exponentially in the last decade, becoming arguably the best suited tool for rapid and simultaneous surveys of biodiversity across taxonomic groups (Stat et al., 2017). It is based on the fact that organisms are constantly releasing particles filled with DNA to their environment (e.g., skin, scales, bodily fluids and faeces; Taberlet et al. 2012, Rees et al., 2014). So, a water sample from a certain site contains the eDNA of the aquatic biodiversity present at that site, including rare (e.g. endangered, invasive) and cryptic species which otherwise are hard to detect (Bohman et al. 2014). By coupling PCR amplification of target genes (and taxa) on the DNA extracts to next-generation sequencing (NGS), reliable biodiversity datasets will be obtained. This technique is known as eDNA metabarcoding (Stat et al., 2017). Specifically, we will sequence mitochondrial (COI) and ribosomal gene fragments (16S y 12S) (Kress et al. 2015; Leray & Knowlton 2015; Machida et al. 2017) and match these sequences against gigantic, open access databases of reference (e.g., GenBank; BOLD Systems, [www.barcodinglife.org](http://www.barcodinglife.org); [www.referencemidori.org](http://www.referencemidori.org)), and against our own growing database which contains hundreds of Chilean species we've been curating in the last few years. A pilot survey of this approach (Figure 1) as well as more in-depth spatial survey in Valdivia conducted by our team (Saens et al. 2020, DOI: 10.1002/edn3.200) demonstrated the usefulness of the proposed methods for the intended purposes.

### **Expected results (500 words) \***

We expect to detect dozens of vertebrate species scattered in the landscape, and to reveal clear distributional patterns, depending on the type of water body sampled, and type of surrounding terrestrial habitat. We expect to find anthropogenic signs only in sites nearby the route buildings or pastures, but not in more remote and pristine sites. We also expect to find biodiversity gradients associated to altitude and salt water intrusion in the estuary, similar to results by our team using similar methods in the Valdivia River estuary (Saenz et al. 2020, Environmental DNA, DOI: 10.1002/edn3.200).

### **Motivations (250 words) \***

			Exchange rate, 1 € =	960 CLP
Item Category	CLP	Quantity	Total	Total €
Return field trip Valdivia-Exploradores-Valdivia	\$1,000,000	1	1000000	1042
Car rental	\$1,000,000	1	1000000	1042
Lodging & Outfillting	\$700,000	1	700000	729
Consumables	\$200,000	1	200000	208

Honoraries (field and lab tech)	\$3,000,000	1	3000000	3125
DNA extraction and sequencing, per sample	\$40,000	30	1200000	1250
TOTAL				7396

**Your lab attachment is it French\*?**

No, but it can be if needed.

**Is it a CNRS laboratory\*?**

NO

**Your laboratory or structure\* :**

Instituto de Conservación Biodiversidad y Territorio (ICBTe)  
Centro de Humedales Río Cruces (CEHUM)  
Universidad Austral de Chile

**Laboratory Code:**

**Full Address\* :**

CRISTIAN CORREA

Fac. Ciencias Forestales (ICBTe)

UACH Campus Teja, Valdivia

Valdivia, Los Ríos

Chile

**Possible reference:**

**Full Address:**

## Participants

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Full Address	Instituto de Conservación Biodiversidad y Territorio (ICBTe) Centro de Humedales Río Cruces (CEHUM) Universidad Austral de Chile Valdivia, Chile
Short CV (250 words)	<p>Dr. Cristian Correa, Chilean, completed his undergraduate degree in Marine Biology, at Universidad Católica del Norte, Chile, and after a short practice, moved to Canada to work as a project manager in Dr. Mart Gross' Conservation Biology lab at University of Toronto. He then moved to Montreal where he begun a MSc degree which he later turned into a PhD program in Dr. Andrew Hendy's Eco-Evolutionary Dynamics lab at McGill University in Montreal. Cristian completed his PhD in 2012, and after a short postdoc in the same institution, he has been adjunct professor at Universidad Austral de Chile living off research grants and teaching. His primary interests are the ecology and evolutionary biology of Patagonian fishes, including food webs, impacts of biological invasions, phylogeography, migratory life histories, and population structure. He is also part of an international research network that focuses on how eco-evolutionary dynamics are altered by anthropogenic changes, particularly urbanization. Cristian teaches several statistics and ecology courses at both undergraduate and graduate levels.</p> <p><a href="https://orcid.org/0000-0002-8608-6858">https://orcid.org/0000-0002-8608-6858</a></p> <p><a href="https://scholar.google.ca/citations?user=H3toP-0AAAAJ&amp;hl=en&amp;oi=sra">https://scholar.google.ca/citations?user=H3toP-0AAAAJ&amp;hl=en&amp;oi=sra</a></p>

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Full Address	Pablo Saenz-Agudelo, Instituto de Ciencias Ambientales y Evolutivas, Universidad Austral de Chile, Valdivia 509000, Chile.
Short CV (250 words)	<p>Dr. Pablo Saenz is a professor from Universidad He holds a PhD from McGill University in Montreal, Canada, completed an NSERC postdoctoral fellowship at the Hawai'i Institute of Marine Biology (HIMB), and a postdoctoral position at the King Abdullah University of Science and Technology (KAUST) in Saudi Arabia. His current research is focused on understanding the origins of reef fish biodiversity and how it is maintained using a combination of traditional and next-generation sequencing approaches. He is particularly interested in exploring new ways to track monitor and monitor environmental shifts in our oceans with environmental DNA (eDNA), with a focus on the fish fauna, their diet, and microbiome as biological indicators.</p>

	<a href="https://orcid.org/0000-0001-8197-2861">https://orcid.org/0000-0001-8197-2861</a>  <a href="https://scholar.google.ca/citations?hl=en&amp;user=svclW9AAAAAJ">https://scholar.google.ca/citations?hl=en&amp;user=svclW9AAAAAJ</a>
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Phone	
Full Address	Universidad de Aysén Campus Lillo Eusebio Lillo 667 Coyhaique, Chile
Short CV (250 words)	Delphine Vanhaecke is a research investigator and academic at the Universidad de Aysén, Coyhaique, Chile where she created the Laboratory of Molecular Ecology and Biodiversity through regional funding. She is currently the director of the research Project MOBI-Aysén, which is aimed at the development and evaluation of an eDNA toolkit for detection and monitoring of marine mammals and vertebrates in general. Delphine obtained her BSc and MSc degree in Biological Sciences from Ghent University, Belgium (2002-2007) and her PhD degree in conservation genetics from the Aberystwyth University, Wales, UK (2008-2012). During her PhD she studied the evolutionary effects of salmonid invasions and aquaculture on the native fish species in Chile applying landscape and conservation genetics methodology. She worked at the Flanders Marine Institute, Belgium as Scientific Officer where she established and managed collaborative marine science projects between Belgium and Kenya.

Last Name	
First Name	
Email	
Phone	
Full Address	
Short CV (250 words)	

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## Discipline choices:

Anthracology	Ecology	Limnology	
Anthropology	Ecology of health	Malacology	
Archaeobotany	Economy	Management sciences	
Archeology	Ecophysiology	Medicine	
Archaeozoology	Entomology	Meteorology	
Architecture	Epigenetics	Oceanography	
Biochemistry	Genetic	Paleobotany	
	Genomics		
Biogeochemistry		Paleoclimatology	
	Geography		
Biogeography		Paleoenvironmental	
	Geohistory		
Biology		Paleontology	
	Geology		
Botany		Palaeopathology	Phytosociology
	Geomatic		
Carpology		Palynology	Proteomics
	Geomorphology		
Chemistry		Petrography	Sedimentology
	Georeferencing		
Climatology		Phenology	Systematic
	Geo Spatial		
Cytogenetics		Pastoralism	Sociology
	German literature and civilization		
Dendrochronology	Occurrence	Phylogeny	Social-anthropology
Dendroclimatology	History	Public health	Transcriptomic
Dendrology	Hydrology	Psychology	Urbanism
Eco-epidemiology	Ichthyology	Pedology	Zoology