SEFS 13
SYMPOSIUM FOR EUROPEAN FRESHWATER SCIENCES

Freshwater biodiversity of temporary streams from the Canary Islands: status, trends, and new initiatives for conservation

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IRTA Institute of Agrifood Research and Technology

CSIC

FEHM lab RESEARCH GROUP Freshwater Ecology, Hydrology & Management

Royal Botanic Garden Edinburgh

UNIVERSITAT DE BARCELONA

USC UNIVERSIDADE DE SANTIAGO DE COMPOSTELA

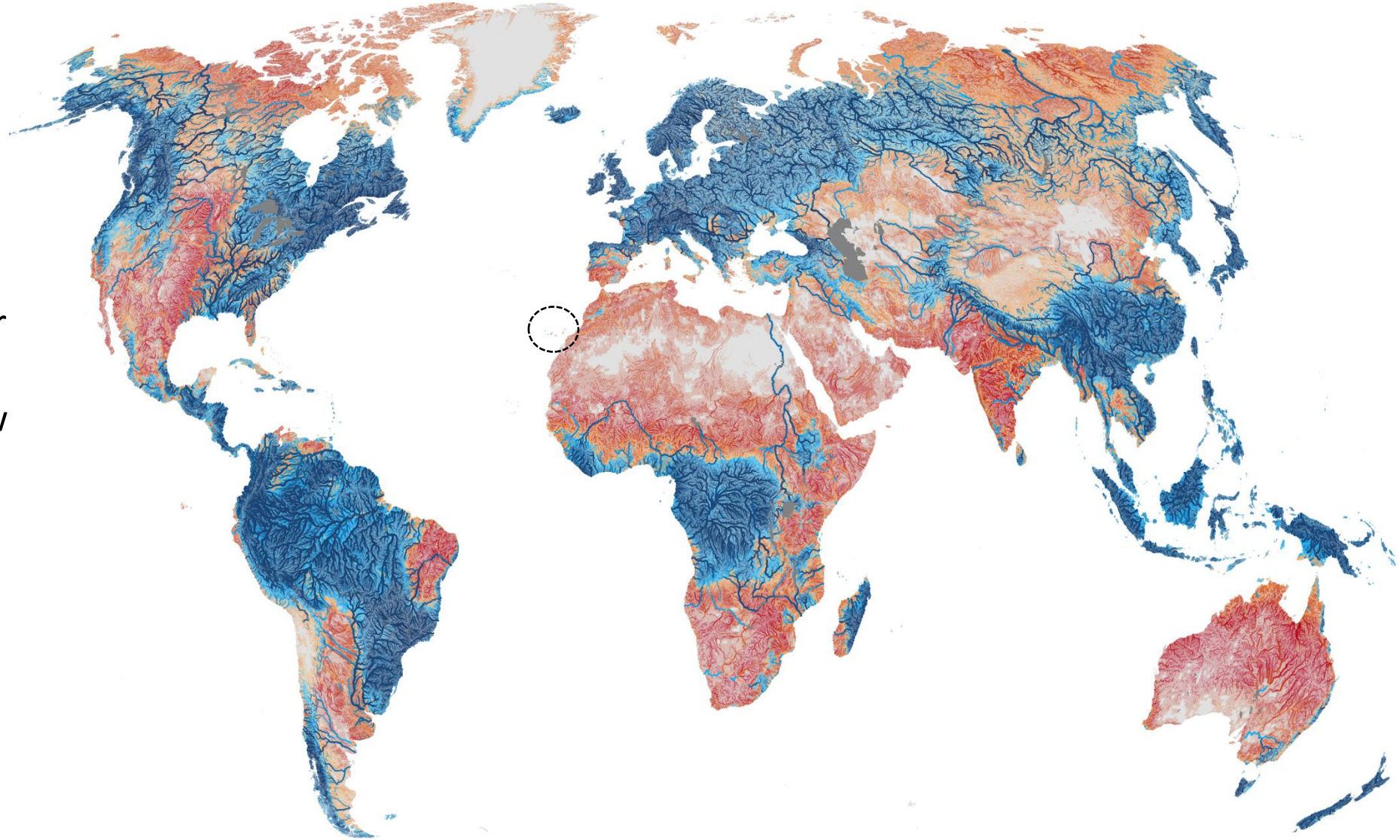
BIOACUANA CONACAN



THE MAJORITY OF RIVER NETWORKS GLOBALLY ARE PRONE TO STOP FLOWING

>60% Global river network experiencing flow intermittence

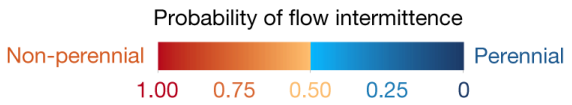
Messager et al. 2021



THE MAJORITY OF RIVER NETWORKS GLOBALLY ARE PRONE TO STOP FLOWING

, INCLUDING THE CANARY ISLANDS





- High **permeability** of the volcanic terrain.
- Overexploitation of **water resources**.
- Increased **aridity** (less precipitation and higher temperatures).

Increased severity and duration of the dry period.

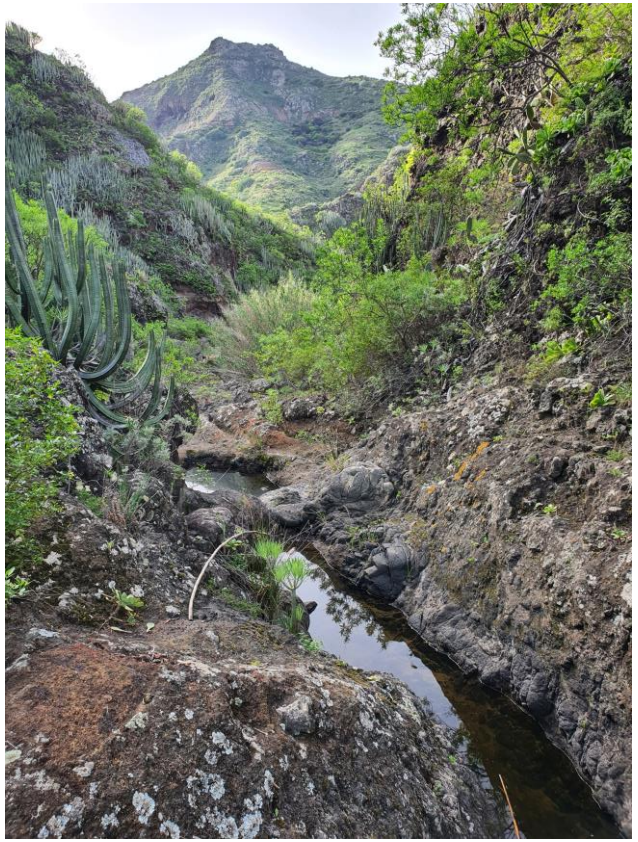
(Santamarta, 2013)

THE MAJORITY OF RIVER NETWORKS GLOBALLY ARE PRONE TO STOP FLOWING

, INCLUDING THE CANARY ISLANDS

Barranco de Igueste (Tenerife)

Disconnected pools



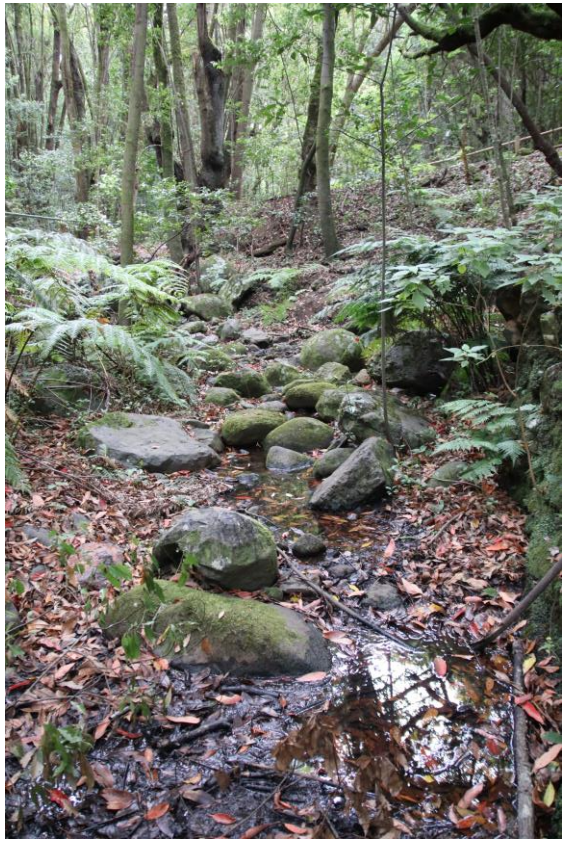
Barranco de Afur (Tenerife)

Disconnected pools

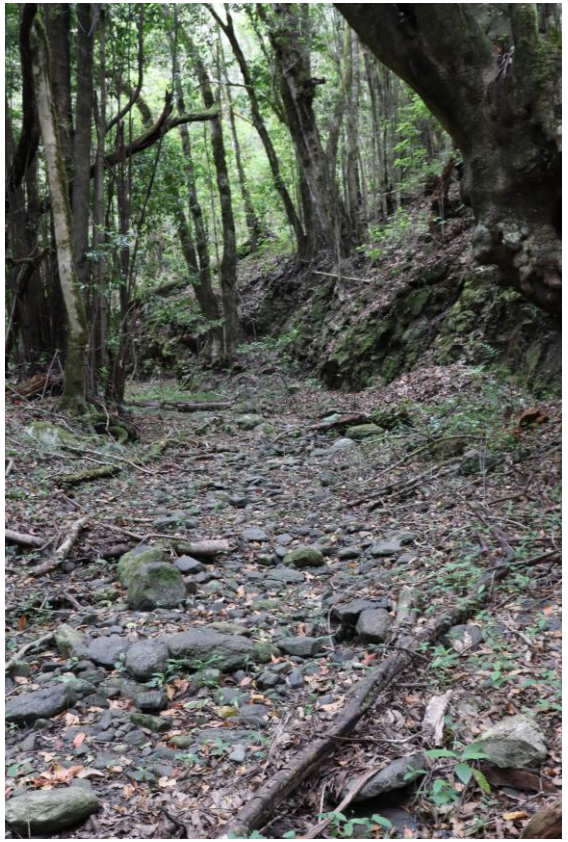


Barranco de Sobreagulo (La Gomera)

Disconnected pools



Dry



©Bioacuana-Conacan

THE MAJORITY OF RIVER NETWORKS GLOBALLY ARE PRONE TO STOP FLOWING

, INCLUDING THE CANARY ISLANDS

Barranco de Cedro (La Gomera)

Flow



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Barranco de las Angustias (La Palma)

Flood

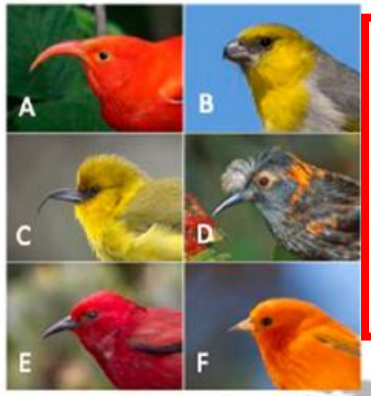


©Parque nacional Caldera de Taburiente

BIODIVERSITY

MOST SCIENTIFIC PAPERS ON FLORA, VEGETATION, VERTEBRATES AND TERRESTRIAL ARTHROPODS

adaptive radiation



Drepanidini tribe (Hawaii)

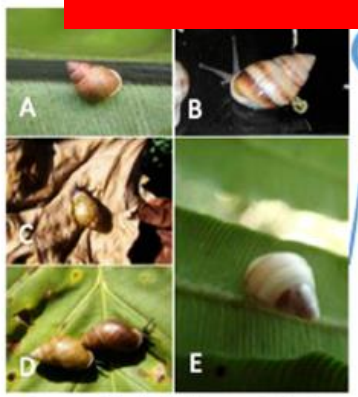


Genus *Aeonium* (Canary Islands)

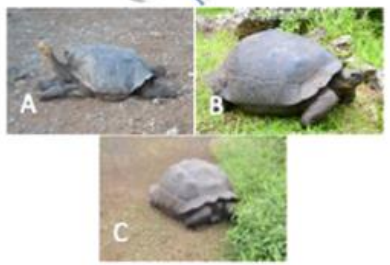


Genus *Podarcis* (Balearic Islands)





Genus *Partula* (French Polynesia)



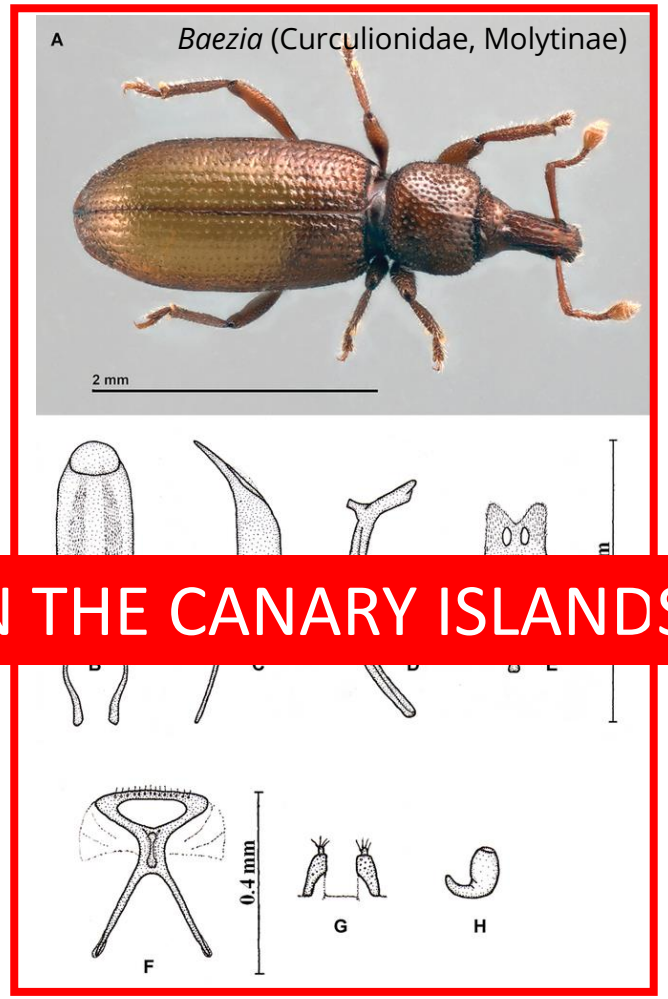
Genus *Chelonoidis* (Galápagos)



Genus *Psiadia* (Mascarenes)

Fernández-Palacios et al.2021

WHAT ABOUT FRESHWATER BIODIVERSITY IN THE CANARY ISLANDS?

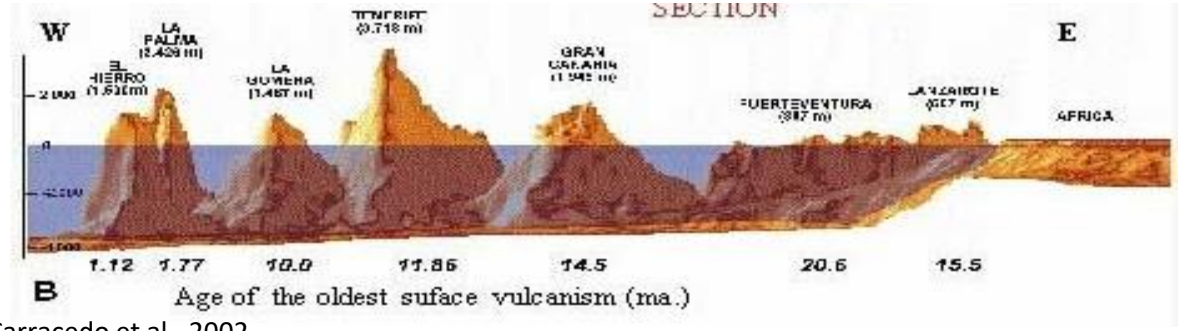


Garcia et al.2021

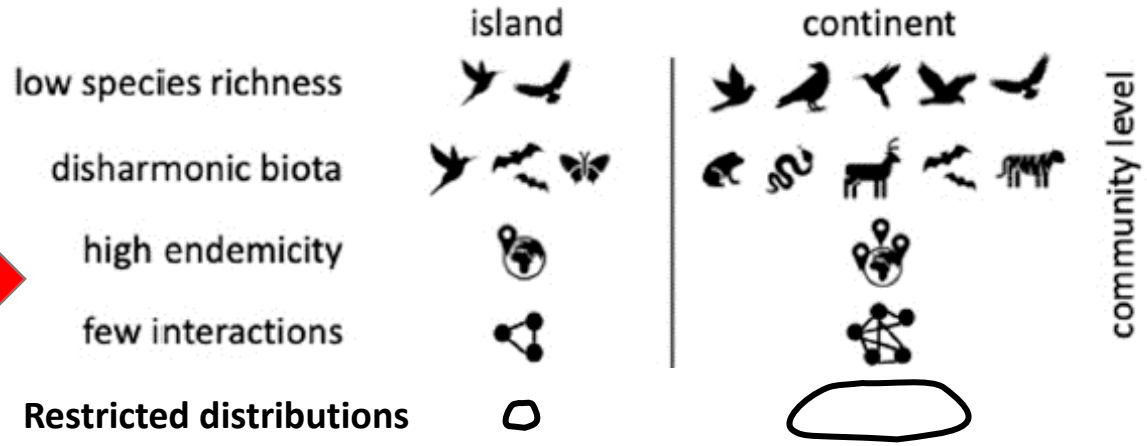
WHAT ABOUT FRESHWATER BIODIVERSITY IN THE CANARY ISLANDS?

What shapes the Canary islands biodiversity?

1. **Volcanic origin**, they have never had physical contact with any continent.
2. **Subtropical climate**, warm temperatures and little seasonal variation.
3. Unusual **age** in relation to other volcanic islands (20 - 1 My)
4. **High elevations** in the central and western islands (>1500 masl).
5. Influence of the **northeastern wind** system and the cold sea current from the Canary Islands
6. **Intermediate degree of isolation**, located 1,400 km from the nearest coast of the Iberian Peninsula and 100 km west of the west African coast.



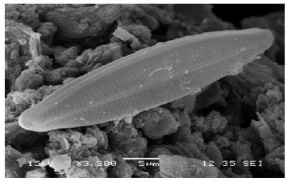
Carracedo et al., 2002



Mixture of endemic and non-endemic species with distributions that cover Mediterranean and African continental areas.

- Aquatic insects
- Diatoms





- (Absence of native fish and amphibians).

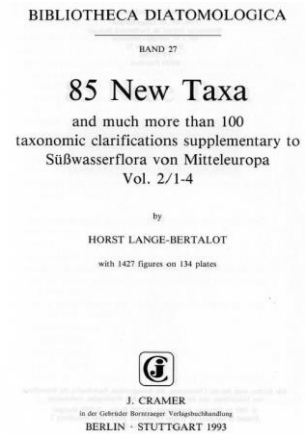
Fernández-Palacios et al. 2021

DIATOMS: THE MOST UNKNOWN

1950s **1990s** **2000s**

Ramon Margalef
University of Barcelona





First diatom identifications

Ulnaria ulna
Ulnaria delicatissima v. angustissima

Horst Lange-Bertalot
Goethe-Universität
Frankfurt am Main

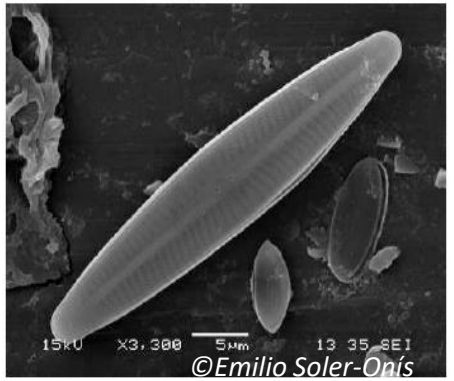


Kurt Krammer
Institut für
Oberflächenanalyse E.V



15 new (and possibly endemic) species

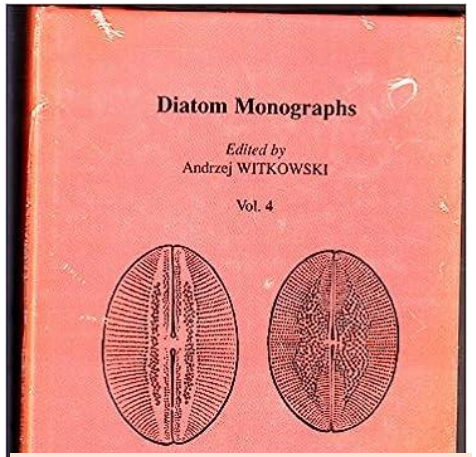
Fragillaria canariensis
Nitzschia tenerifa
Nitzschia macaronesica
Navicula canariana
Navicula macaronesica
...



Marina Aboal et al. 2003
University of Murcia



21 citations



Floristic list of non marine diatoms (Bacillariophyta) from Iberian Peninsula, Balearic Islands and Canary Islands. 2003.

DIATOMS: THE MOST UNKNOWN

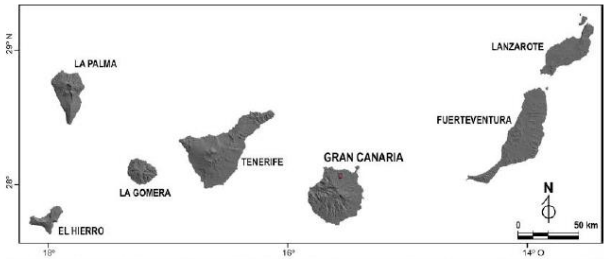
2015

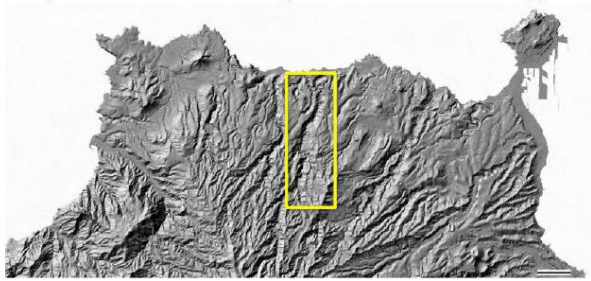
Emilio Soler-Onís
Observatorio Canario de
Algas Nocivas



217 diatom taxa, 15 of these new to science and possibly endemic to the area.

Only in a single stream!

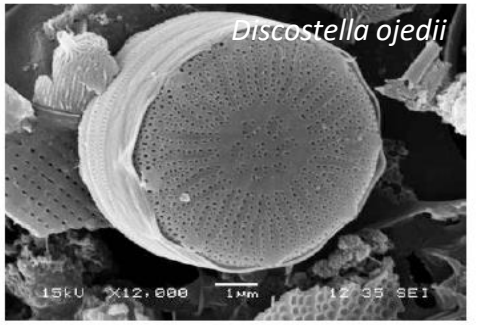


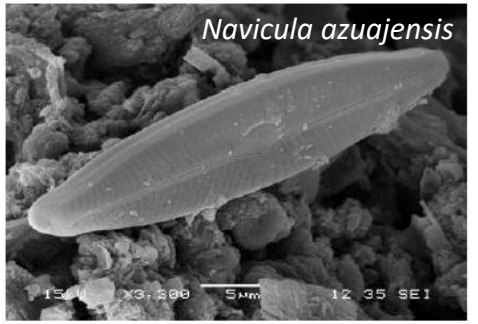


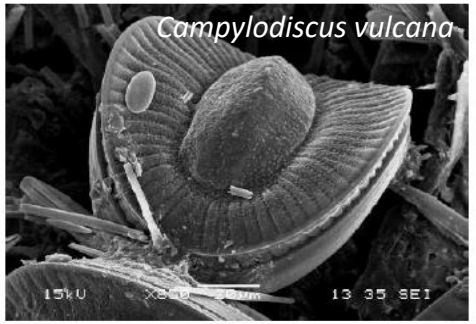


©Emilio Soler-Onís

Discostella ojedii
Halamphora labiata
Microcostatus doramae
Pinnularia vermistriata
Craticula tiburtina
Diadesmis pseudogallica
Humidophila tamaranae
Luticola parva
Luticola terentola
Pinnularia vermistriata
Navicula aerolata
Navicula azuajensis
Campylodiscus canariensis.
Campylodiscus vulcana
…







©Emilio Soler-Onís

MACROINVERTEBRATES: MOST STUDIES ON AQUATIC INSECTS

Of the 7,000 species of arthropods registered, **insects** represent **83%** (Hernández-Teixidor et al., 2014).

78 species (without considering the Diptera order)
30% endemics (Luderitz et al 2016; Vidaña, 2020).

Most species with limited dispersal

High level of endemisms in Trichoptera (10 species) and Coleopera (28 species)

HIGH VULNERABILITY

CURIOSITIES

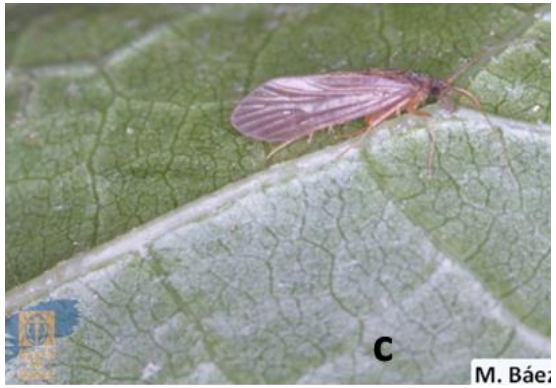
- Absence of lotic taxa typical of palearctic continental rivers such as Plecoptera and the family Elmidae (Coleoptera).
- A single species, of the usually very diverse family Limnephilidae (Trichoptera) (Malmqvist et al., 1993; 1995).



Anacaena haemorrhoa (Coleoptera: Hydrophilidae)



Melademа imbricata (Coleoptera: Dytiscidae)



Tinodes canariensis (Trichoptera: Psychomyiidae).



Lepidostoma tenerifensis(Trichoptera: Lepidostomatidae).

MACROINVERTEBRATES: MOST STUDIES ON AQUATIC INSECTS

But not in global databases

https://geo.igb-berlin.de/maps/621/view

Global Ecology and Biogeography
A Journal of Macroecology

DATA ARTICLE | Open Access

The global EPTO database: Worldwide occurrences of aquatic insects

Afroditi Grigoropoulou, Suhaila Ab Hamid, Raúl Acosta, Emmanuel Olusegun Akindele, Salman A. Al-Shami, Florian Altermatt, Giuseppe Amatulli, David G. Angeler ... See all authors

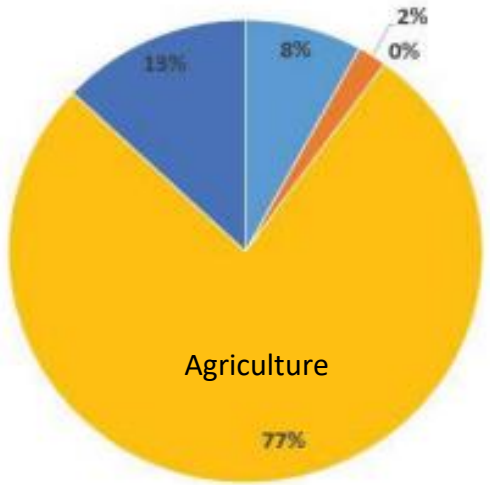
All records only on Odonata!!!



MAIN THREATS

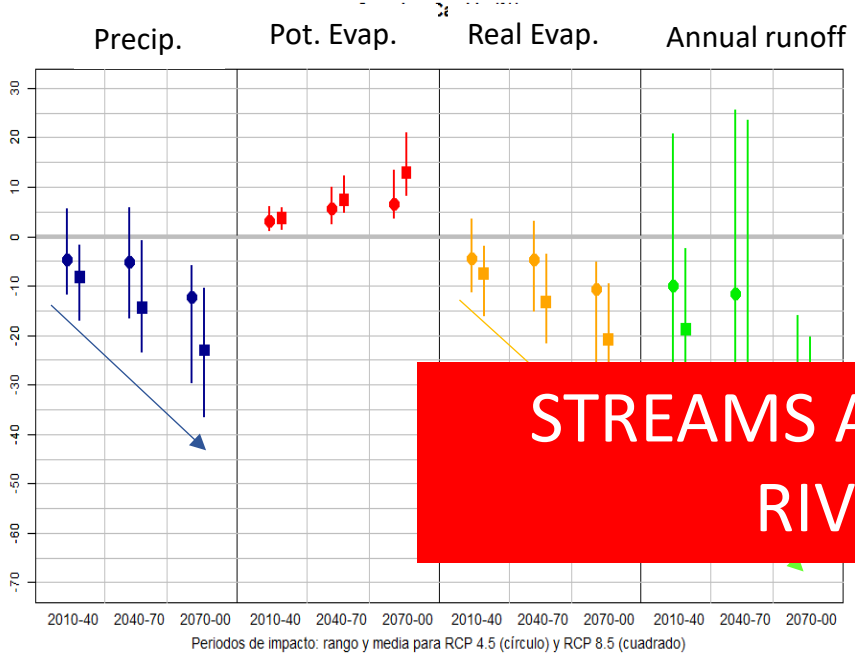
1. WATER USES: extraction of surface and underground water for agriculture, tourism and urbanization.

% Water uses in La Palma





2. CLIMATE CHANGE:



STREAMS AND RIVERS NOT INCLUDED IN WFD RIVER MANAGEMENT PLANS!!!

3. INVASIVE SPECIES:

19 invasive animal species in surface waters of the Canary Islands. 12 fish, 4 gastropods, 2 decapods and one turtle. Gastropod *Physella acuta* is widespread.







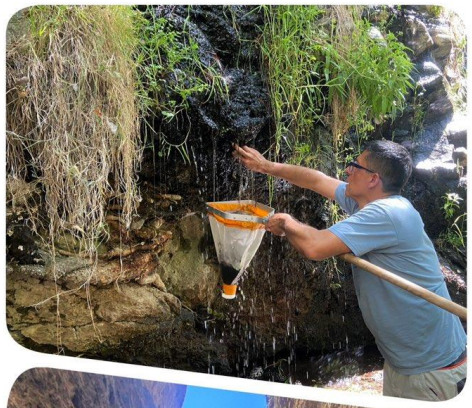
CONSERVATION ACTIONS: BIOACUANA AND CONACAN PROJECTS

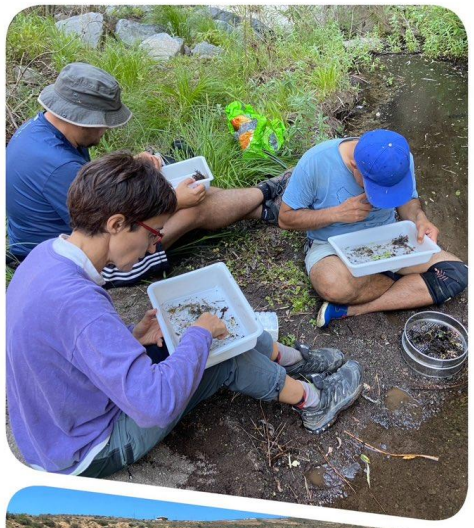
OBJECTIVE: Contribute to inform the protection of **freshwater biodiversity** of the Macaronesian Region by collecting data from streams in Tenerife, la Palma and la Gomera islands.

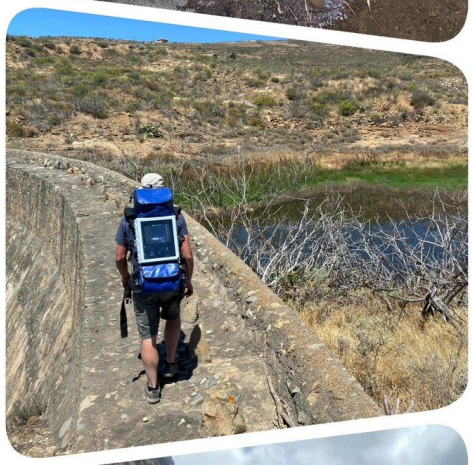
These projects are generating information on:

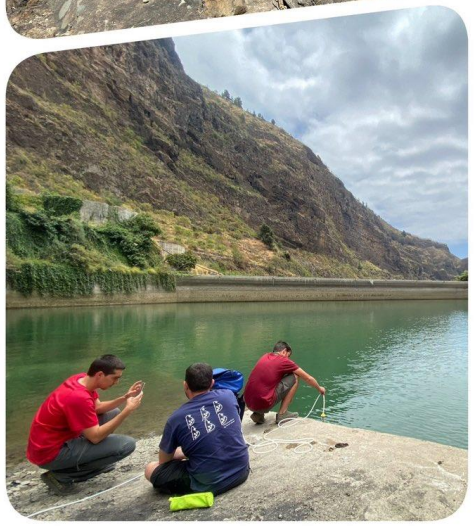
1. **hydrology**
2. **taxonomic and genetic diversity** of aquatic insects and diatoms
3. the distribution of aquatic **invasive species**
4. the **vulnerability** of aquatic insects and diatoms to **climate change**
5. priority areas for the **conservation** of biodiversity to design a long-term aquatic monitoring network.

MARXAN
conservation solutions

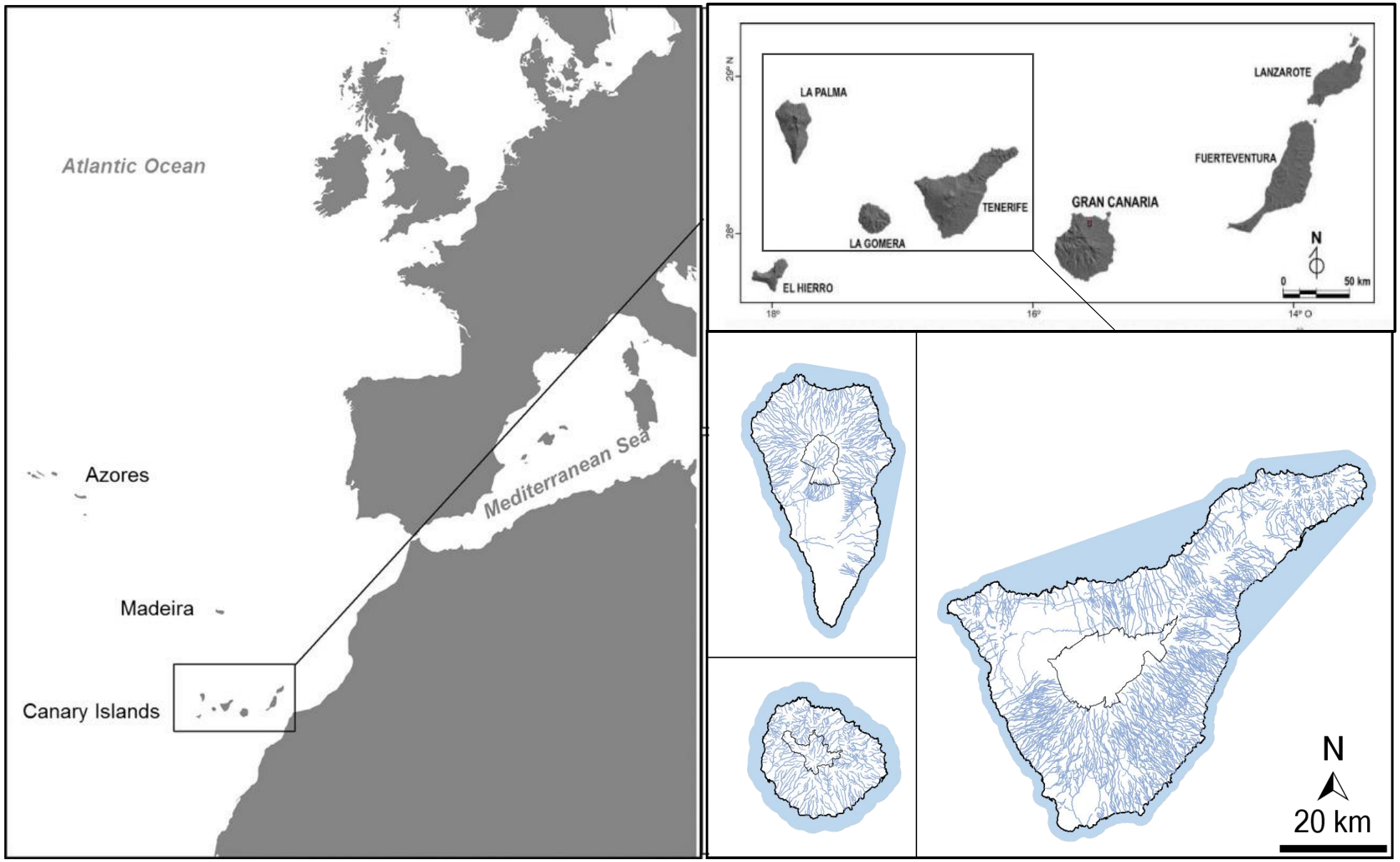




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STUDY SITES



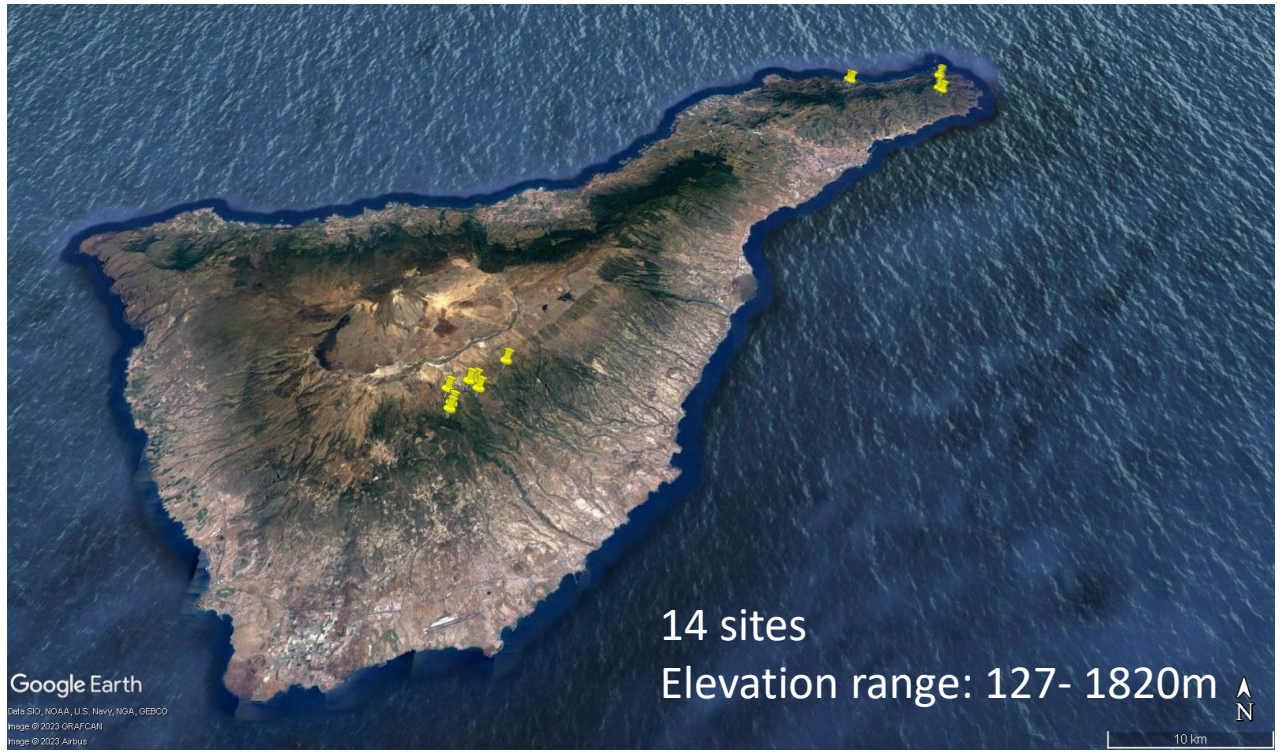
- **3 islands**: Tenerife, La Palma, La Gomera
- A total of **32 sampling sites**
- Located in **Protected areas** (Natural and National Parcs)

BIOACUANA

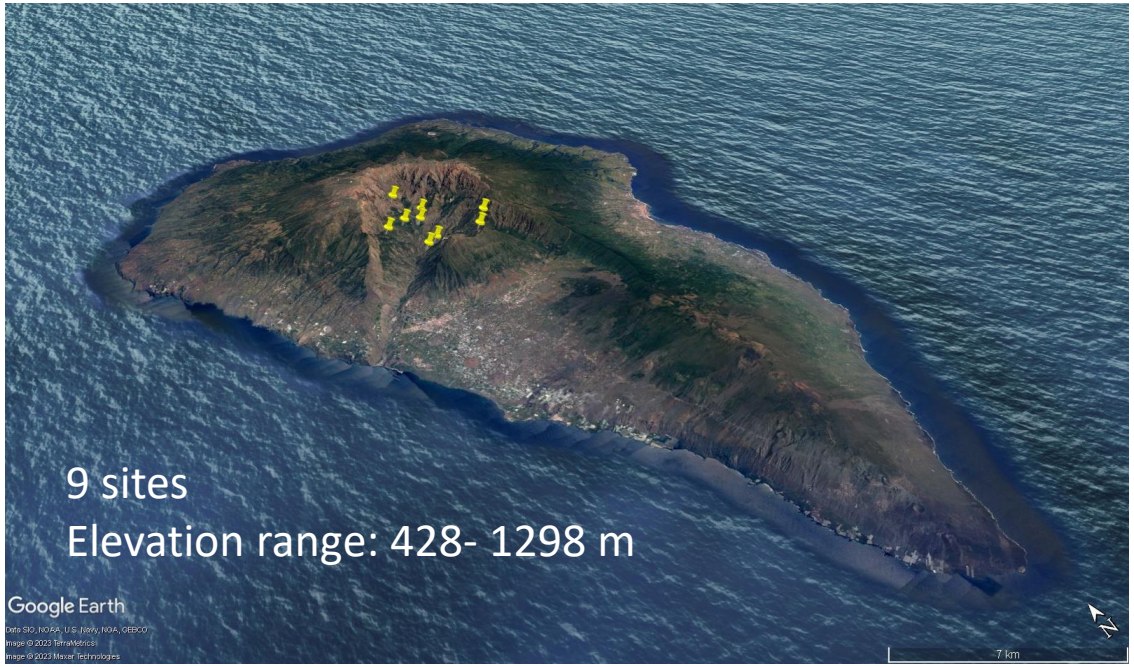
CONACAN

STUDY SITES

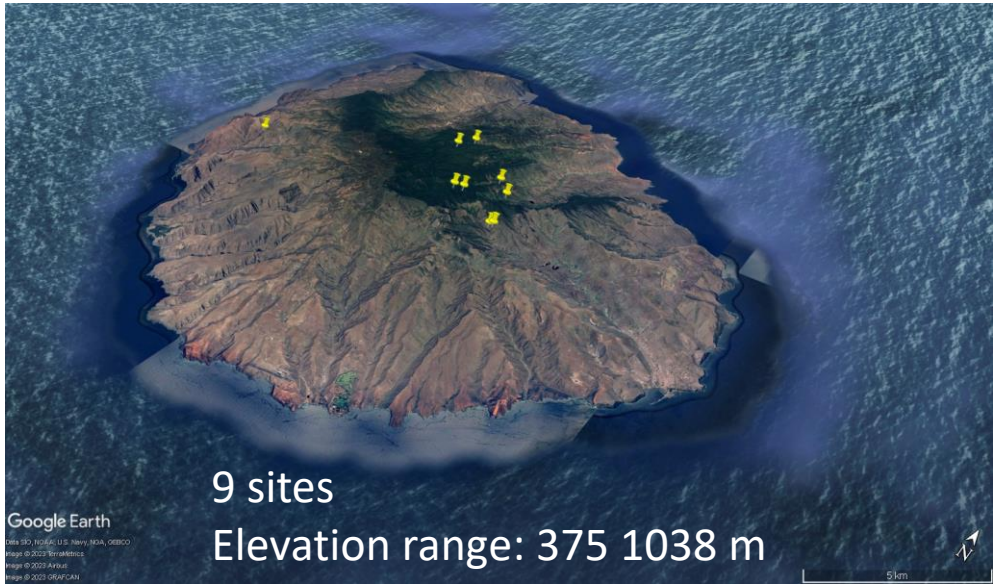
Tenerife



La Palma



La Gomera



High environmental heterogeneity

Hydrology

Distance from the continent

Vegetation

Aridity

Geological age

Area

WHAT DID WE DO?



HYDROLOGICAL CHARACTERIZATION

- Conductivity **data loggers**



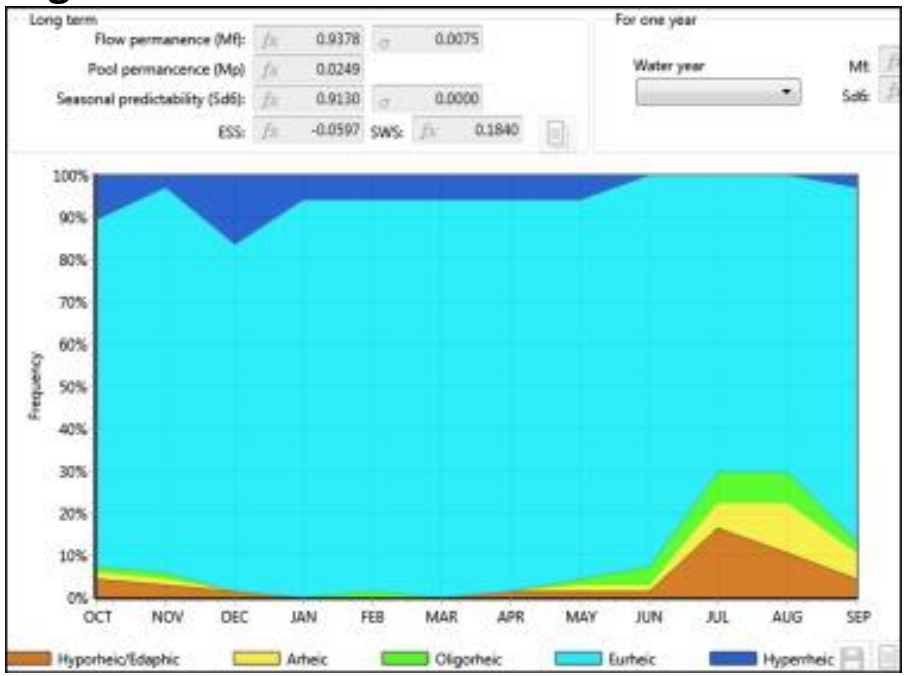


- **Satellite** and photos from wikilok and others
- **Interviews** to local people and stakeholders (National Park rangers)
- **Flow data**, if available

Hydrological alteration



Flow regime classification



BIODIVERSITY: TAXONOMIC AND MOLECULAR APPROACHES

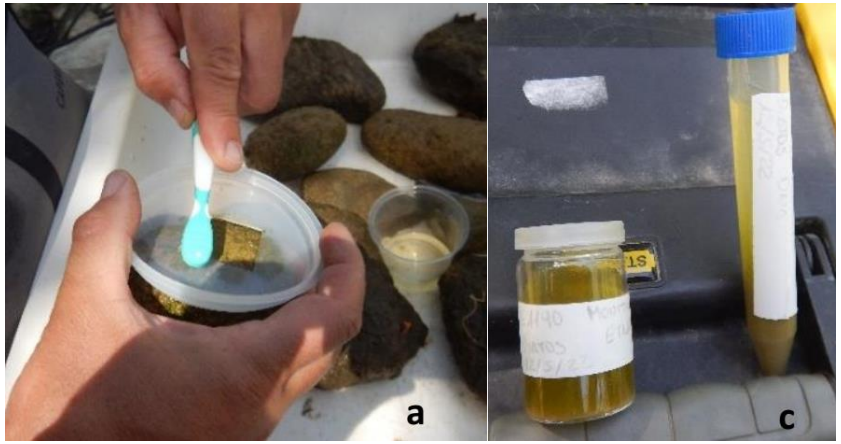
Sampling in Nov 2022 and May 2023, to be continued in Nov 2023

AQUATIC MACROINVERTEBRATES



Kick net + light traps

DIATOMS



Sampling waterfalls and all type of substrates

INVASIVE SPECIES



Smith –Root e DNA sampler

To be done:

- DNA **barcoding** and **metabarcoding**: species identification and genetic diversity
- genetic inventory (**haplotypic diversity**) of aquatic species (diatoms, macroinvertebrates and invasive species)
- clarification of the real **taxonomic status of conflicting species** and evaluation of the **genetic structure of the populations** in the case of aquàtic insects.

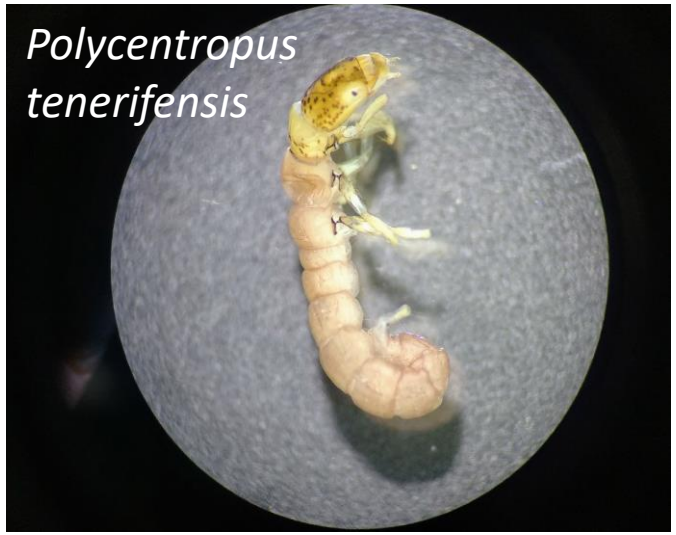
PRELIMINARY RESULTS FROM THE 1ST SAMPLING

New distribution and descriptions of some macroinvertebrate species



- First La Gomera island record for the Dipteran ***Tonnoiriella mollis*** (Psychodidae)
- First La Palma island record for the Dipterans ***Mollophilus*** *(*Limoniidae), ***Cardiocladius***, ***Parametriocnemus*** *(*Chironomidae*)* and the Platyhelminthe ***Dugesia***

- **Updated distribution** of the Trichoptera ***Polycentropus tenerifensis*** (Polycentropodidae), ***Stactobia gomerina*** (Hydroptilidae), and ***Oecetis canariensis*** (Leptoceridae) **considered extinct by recent studies** (Lüderitz et al., 2016)
- **First female (adult) description** of the endemic species ***Polycentropus tenerifensis***







Thank you!

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CSIC

FEHM lab RESEARCH GROUP
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Royal Botanic Garden Edinburgh

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UNIVERSIDAD DE SEVILLA