Tracing the geographic origin of bivalves – for value, safety, and conservation

WSC2023 & ICMSS2023

25-27 September 2023

Peniche, Portugal

Ricardo Calado et al.

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Portugal’s best!!!

Ameijoas (clams) à Bulhão Pato

(you only start living after you have tasted them…)

When we look at this delicacy, what is the first thing that comes to mind?

Exactly!!!

Where did this seafood come from?

Was it sourced locally?

Was it legally harvested?

Is it safe to eat?

…

Manila clam
Venerupis philippinarum

Illegal harvesting of clams in the Tagus estuary, Lisbon! More than 150 slave Thai fishermen identified!

https://expresso.pt/sociedade/2017-12-31-Escravos-do-rio-1

Manila clam
Venerupis philippinarum

Over a 1000 people exploited (several are illegal/slave immigrants) on the illegal harvesting of clams in the Tagus estuary near Lisbon…

Nearly 18M Euros net value (no taxes being paid…) with ≈6K Tones collected per year!

Ajoelham-se no lodo do Tejo, fazem duas marés, vivem em condições indignas: mais de mil pessoas exploradas na apanha ilegal da amêijoa (expresso.pt)

Ohhh…!!!

OK, I didn’t know that…

Now, I really want to know!!!

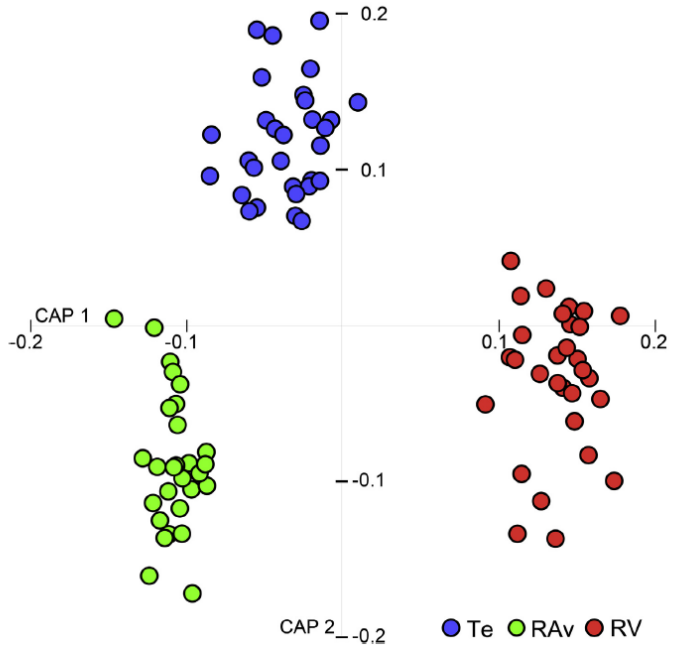
Can we tell apart seafood originating from different geographic locations?

Bivalves incorporate geochemical and biochemical cues from the environment during their lifetime that fingerprint them in unique ways!

Tracing the geographic origin of bivalves

Elemental analysis
of the shell
using ICP-MS

Fatty acid analysis
of the adductor muscle
using GC-MS



Food Control 118 (2020) 107368

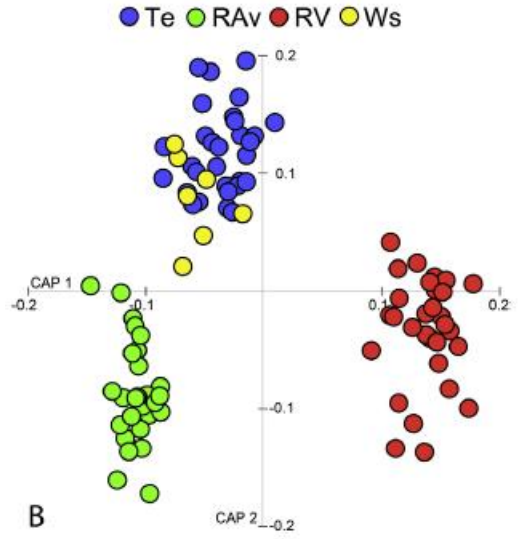
Contents lists available at ScienceDirect

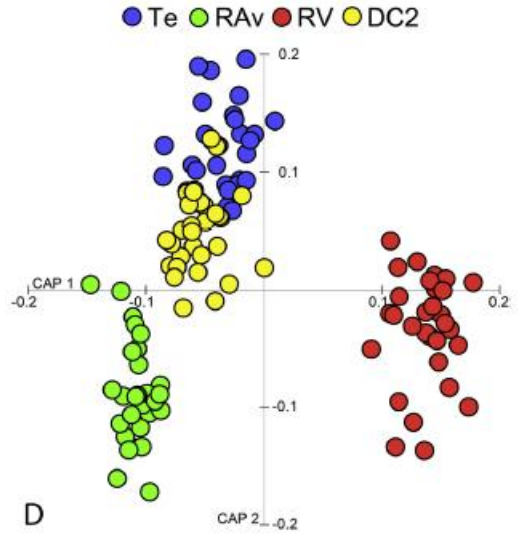
Food Control

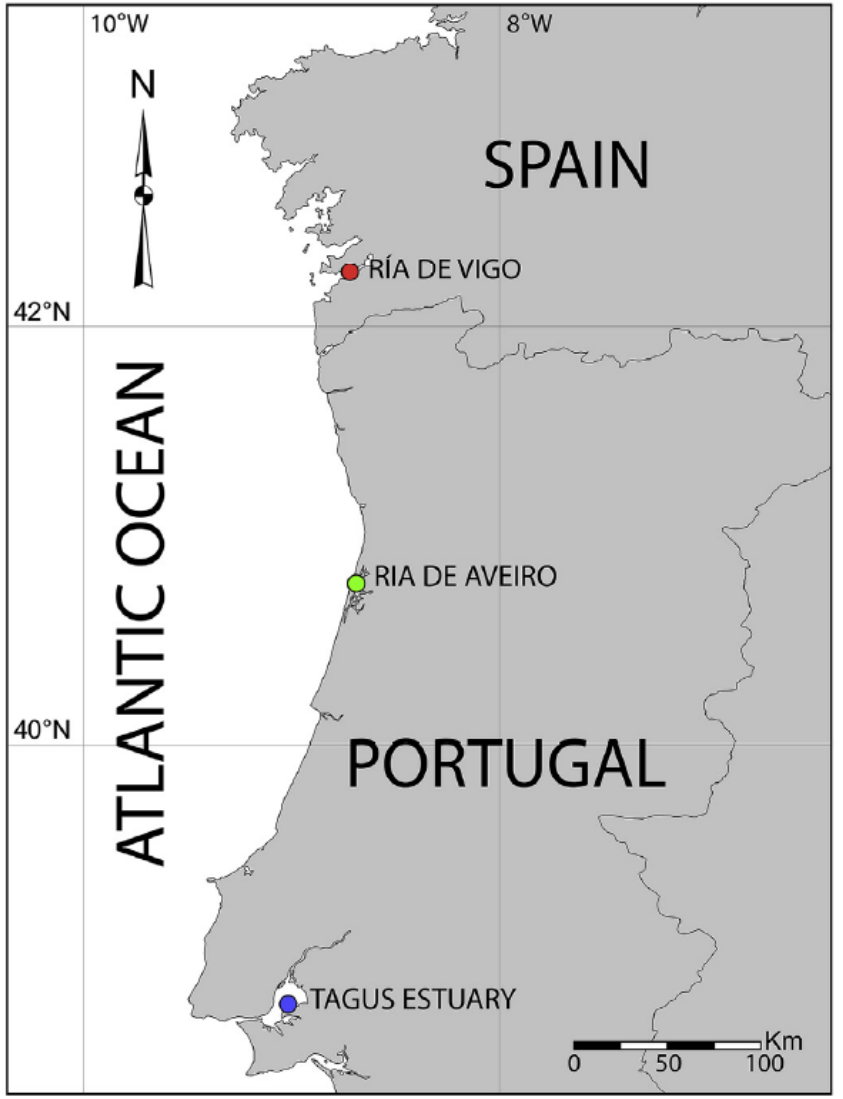
journal homepage: www.elsevier.com/locate/foodcont

Revealing the illegal harvesting of Manila clams (*Ruditapes philippinarum*) using fatty acid profiles of the adductor muscle

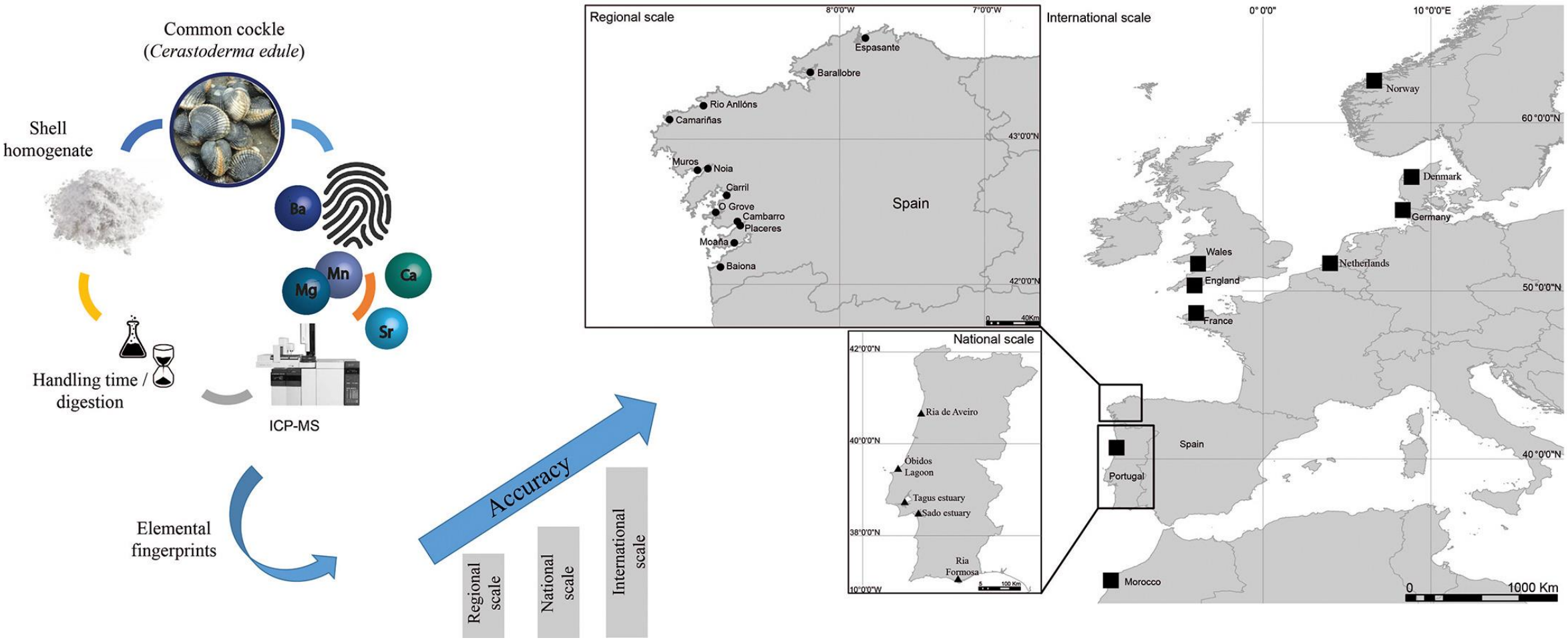
Renato Mamede[a,*], Fernando Ricardo[a], Andreia Santos[a], Seila Díaz[b,c], Sónia A.O. Santos[d], Regina Bispo[e,f], M. Rosário M. Domingues[g,h], Ricardo Calado[a,**]







At a large spatial scale, the geographic origin of bivalves can be confirmed with an accuracy up to 95% or more!



The larger the spatial scale, the more accurately one can confirm the geographic origin of bivalves.

Science of the Total Environment 814 (2022) 152304

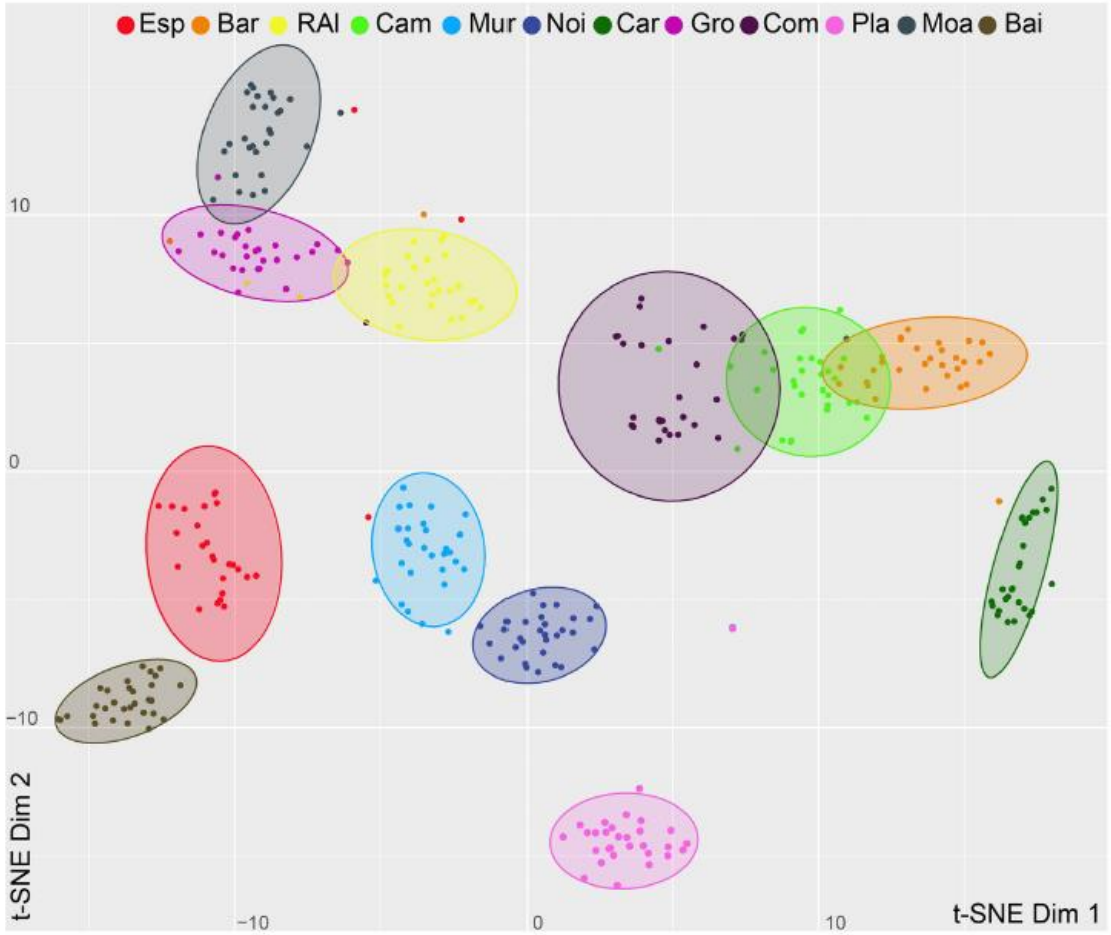
Contents lists available at ScienceDirect

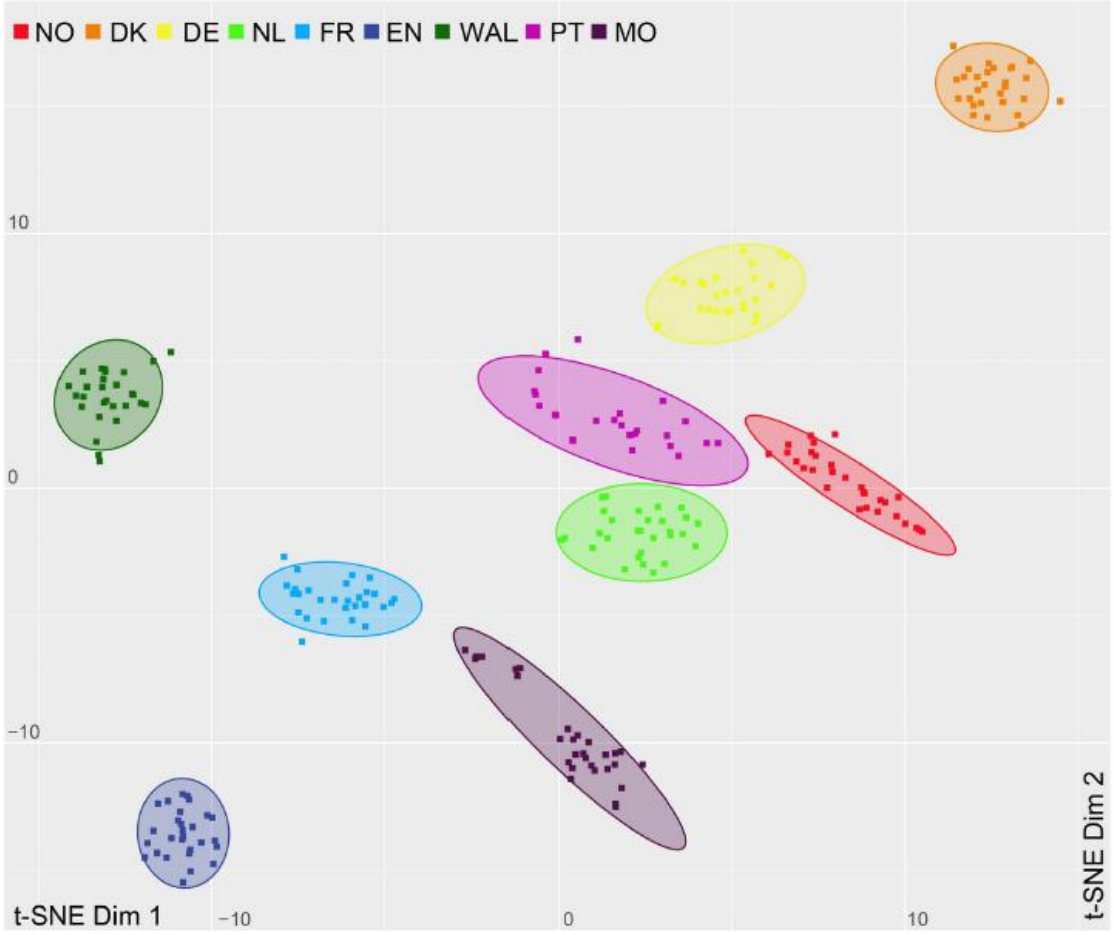
Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Assessing the elemental fingerprints of cockle shells (*Cerastoderma edule*) to confirm their geographic origin from regional to international spatial scales

Fernando Ricardo [a,*], Renato Mamede [a], Alicia L. Bruzos [b,c], Seila Díaz [b,c], Julien Thébault [d], Eduardo Ferreira da Silva [e], Carla Patinha [e], Ricardo Calado [a,*]





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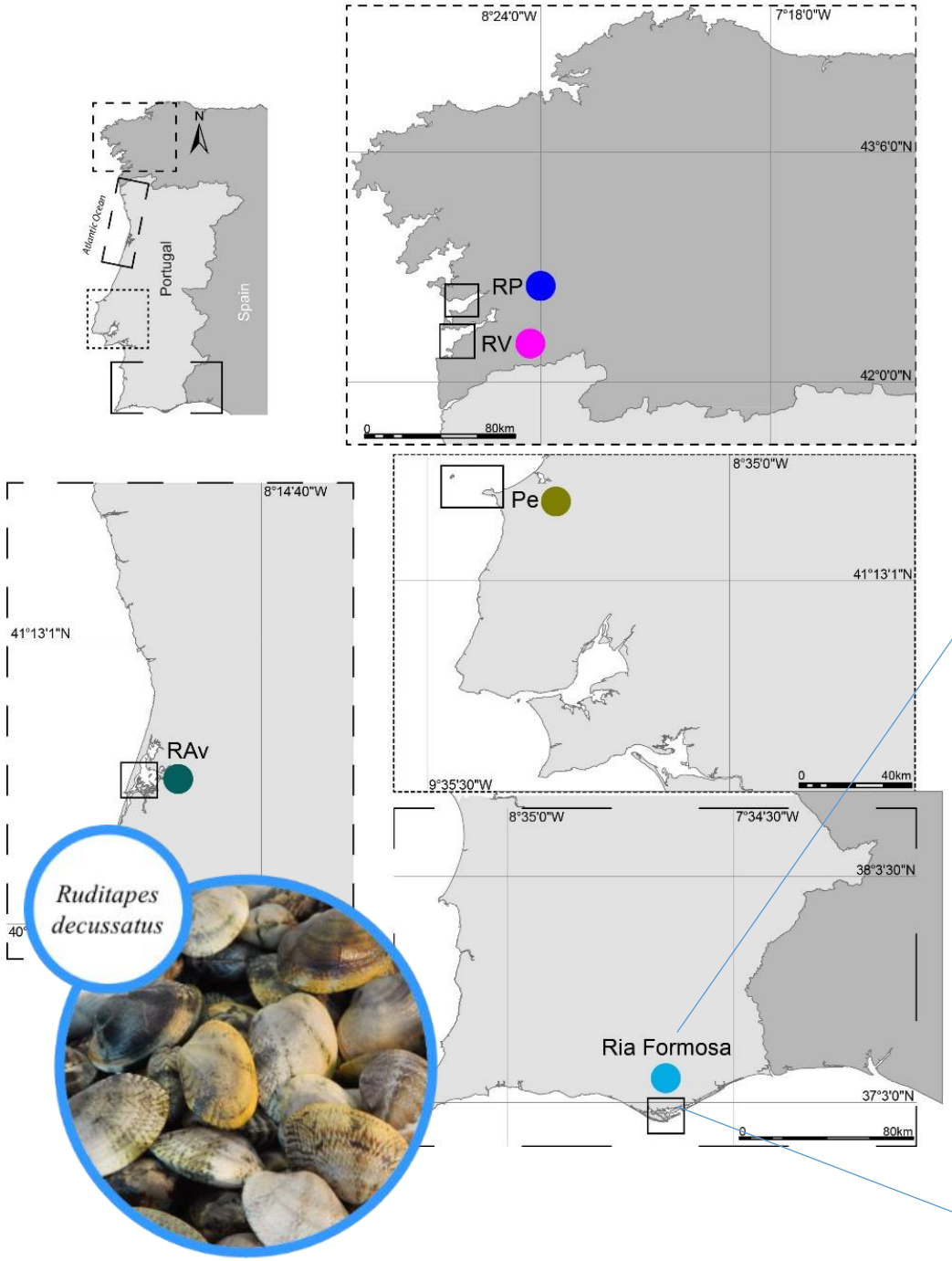
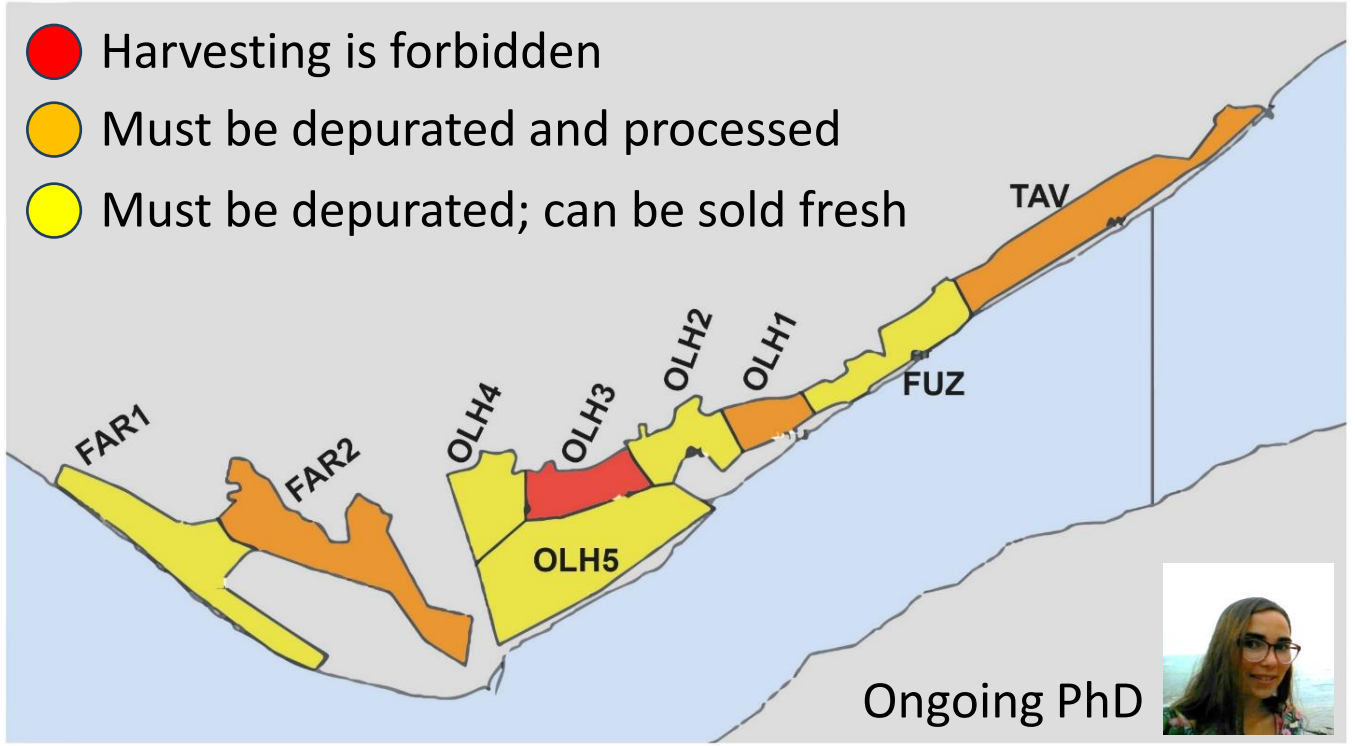
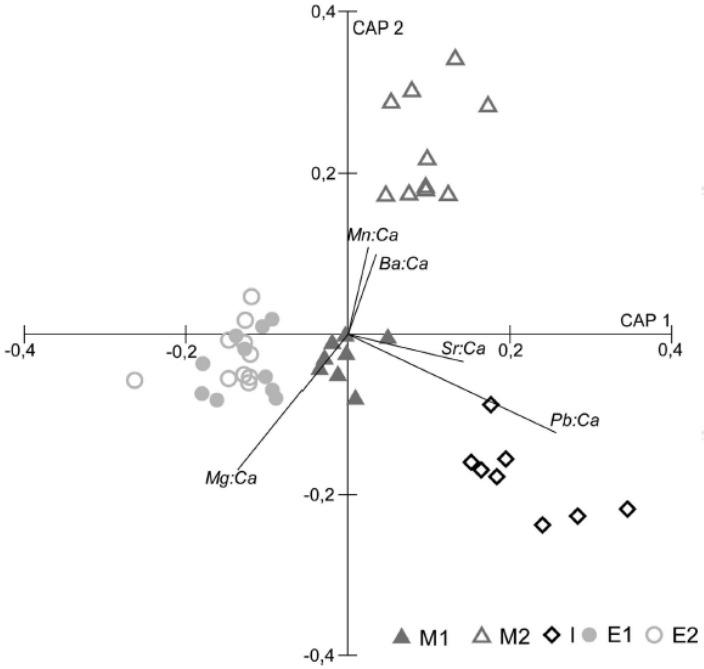
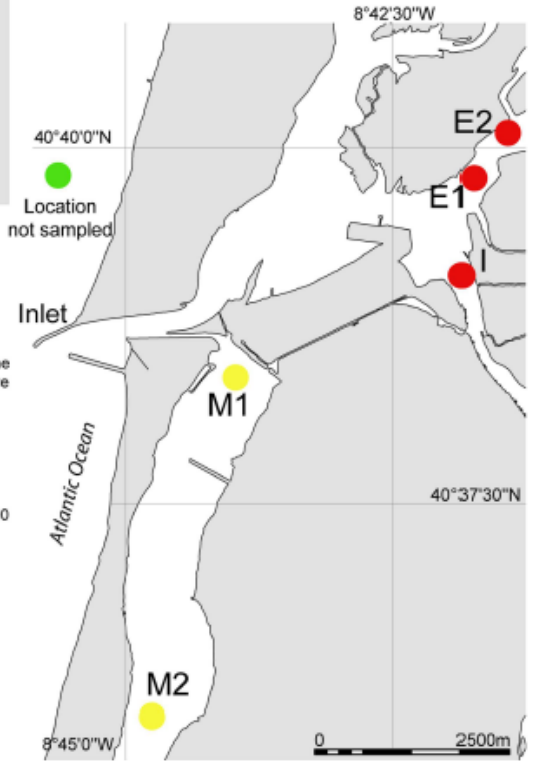


At smaller spatial scales confirming the geographic origin of clams can be more challenging, but it is paramount for food safety and product valorization…
But it can still be achieved!



Indeed, it can still be achieved!





SCIENTIFIC REPORTS

OPEN

Trace element fingerprinting of cockle (*Cerastoderma edule*) shells can reveal harvesting location in adjacent areas

Received: 22 December 2014
Accepted: 27 May 2015
Published: 07 July 2015

Fernando Ricardo[1], Luciana Génio[1], Miguel Costa Leal[1], Rui Albuquerque[1], Henrique Queiroga[1], Rui Rosa[2] & Ricardo Calado[1]

Fishing/production areas for bivalves in the EU are ranked according to the levels of *Escherichia coli* present in the flesh and intra-valvular liquid of live specimens.

A areas : bivalves may not display more than 230 most probable number (MPN) *E. coli* per 100 g of flesh and intra-valvular liquid; no post-harvest treatment required.

B areas : 90% of bivalves must not exceed 4.600 MPN E. coli per 100 g of flesh and intra-valvular liquid, with the remaining 10% not exceeding 46.000 MPN *E. coli* per 100 g of flesh and intra-valvular liquid; must be depurated, relayed or cooked by an approved method.

C areas : bivalves must not exceed the limits of a five-tube, three dilution MPN test of 46.000 *E. coli* per 100 g of flesh and intravalvular liquid; must be relayed or cooked by an approved method.

We have already screened several different types of seafood, with emphasis on multiple bivalve species.

We have been collaborating on a regular basis with authorities…

POLICIA MARITIMA

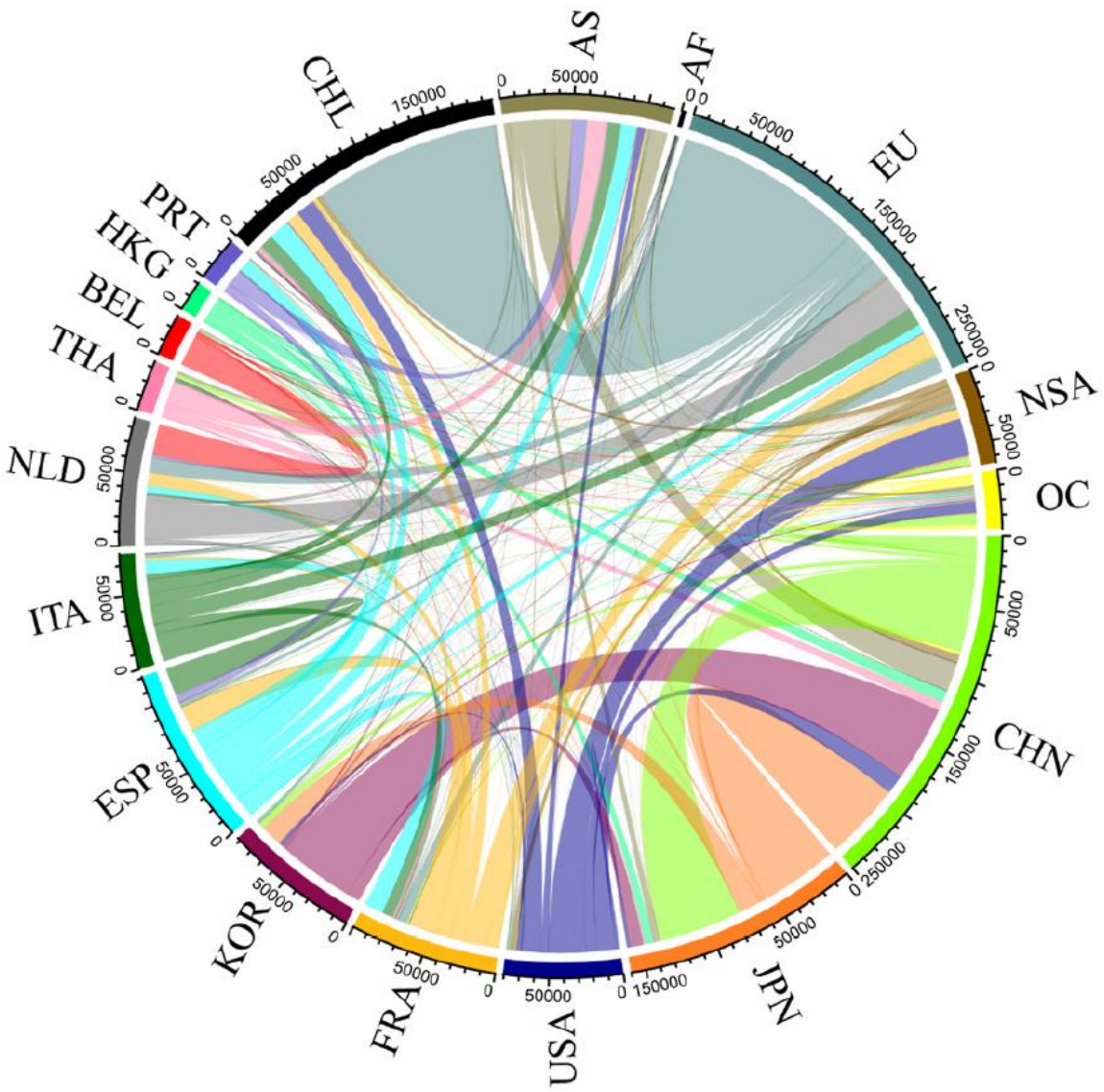
GUARDA NACIONAL REPUBLICANA
PELA LEI E PELA GREI

ASAE
Autoridade de Segurança Alimentar e Económica

AUTORIDADE DE SEGURANÇA ALIMENTAR E ECONÓMICA
ÓRGÃO DE POLÍCIA CRIMINAL

RASTREMAR

TraSeafood



The new National Laboratory for Traceability of Fisheries and Aquaculture Products

Food Control 152 (2023) 109840

Contents lists available at ScienceDirect

Food Control

journal homepage: www.elsevier.com/locate/foodcont

Current trends in the traceability of geographic origin and detection of species-mislabeling in marine bivalves

Andreia Santos [a,*], Fernando Ricardo [a], M. Rosário M. Domingues [b,c], Carla Patinha [d], Ricardo Calado [a,**]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Sou a ria de Aveiro, o sal do mundo!

I am Ria de Aveiro, the salt of the world!

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Câmara Municipal

Grey-Green-Blue Infrastructure

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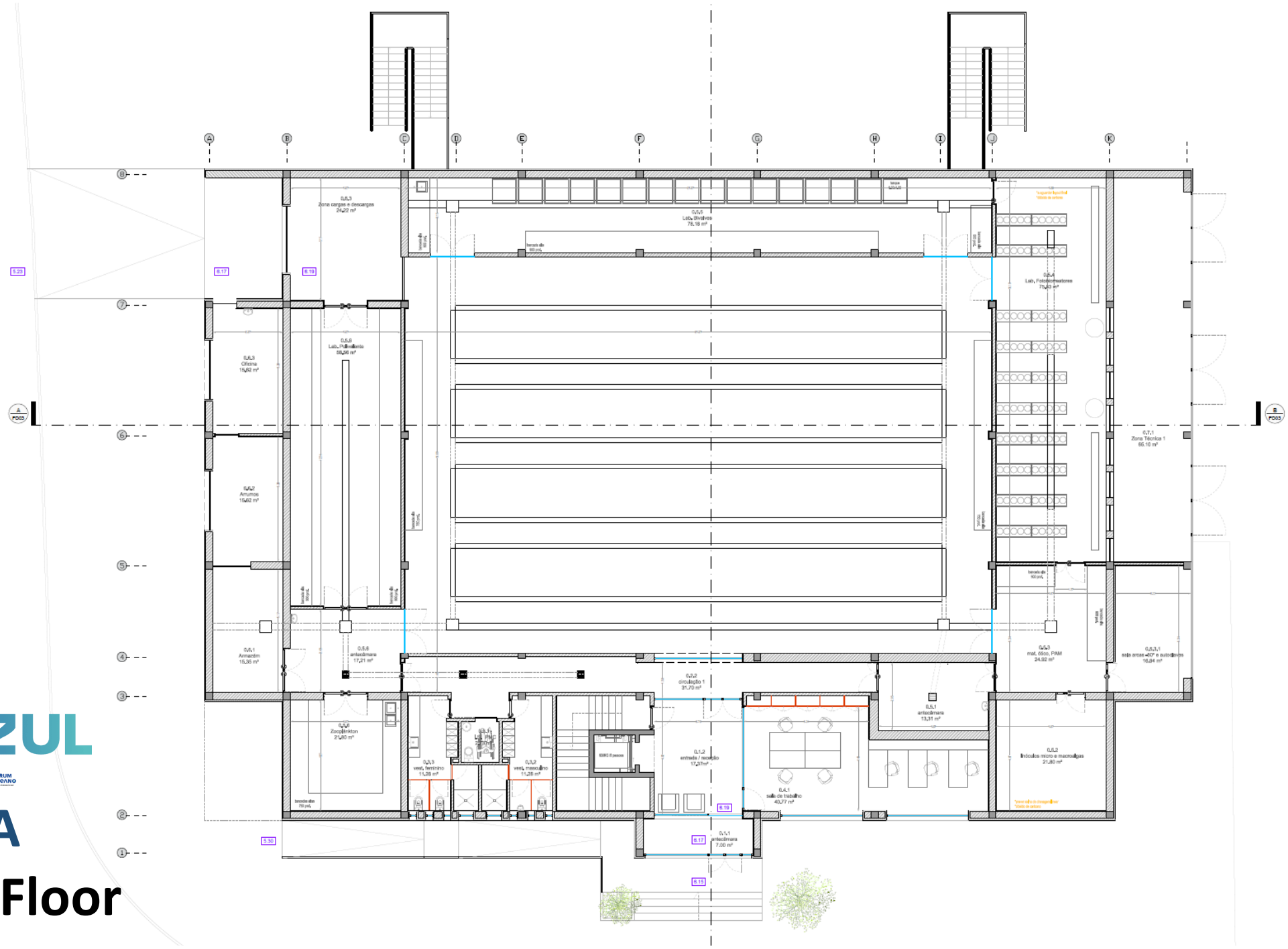
CITAQUA

Ground Floor



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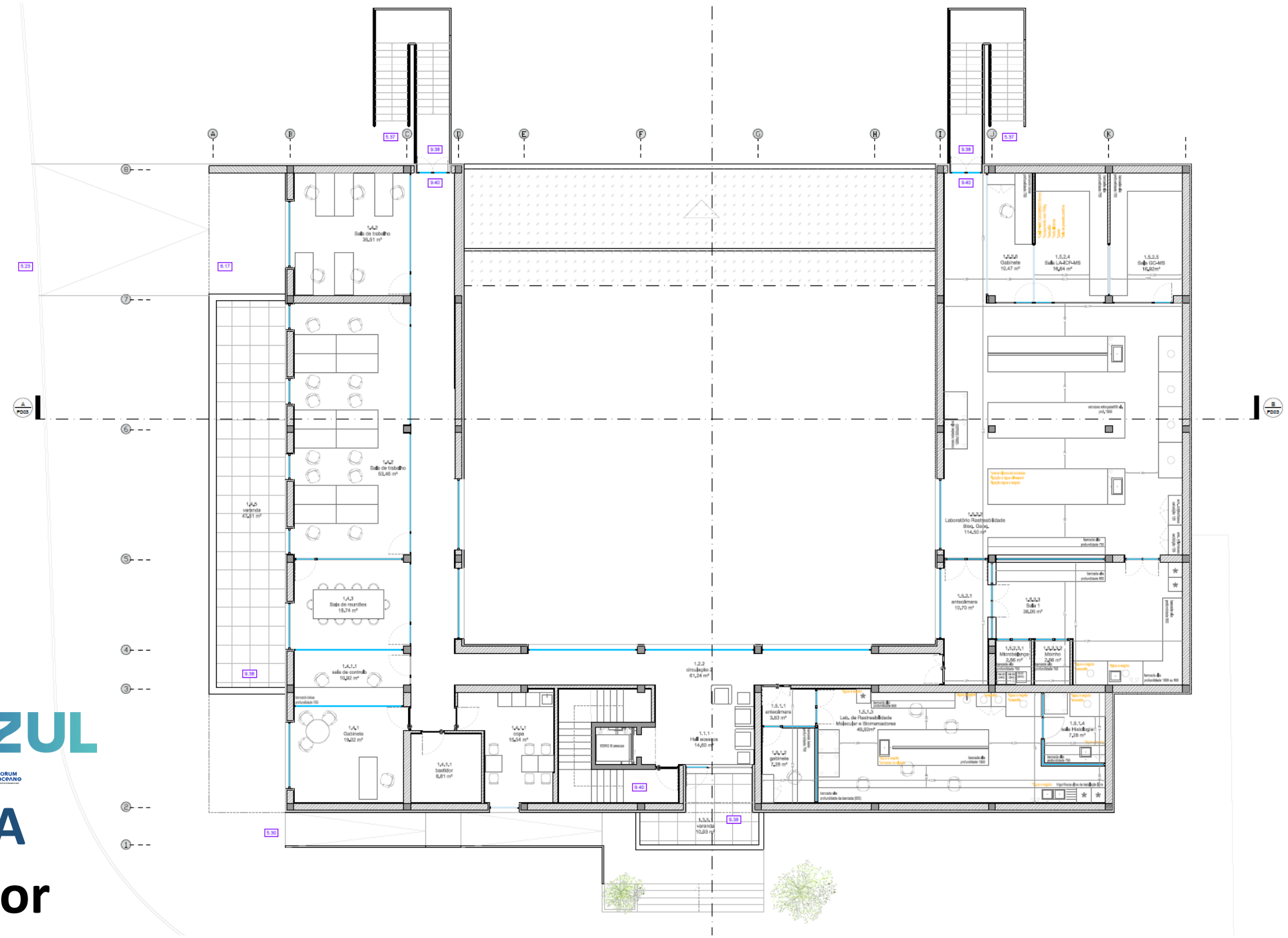
CITAQUA

First Floor



Portugal pioneered the creation of origin certification as early as the 18th century with Port Wine (*Vinho do Porto*).

One can use the same rationale and certify the geographic origin of bivalves.

This can add value to bivalves and enhance food safety!

We look forward for new challenges and collaborations!

We ambition to create an open global database of elemental and biochemical fingerprints.

Know your seafood!

It matters!






Thank you for your attention!
Obrigado pela vossa atenção!

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PRR Plano de Recuperação e Resiliência
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