



# New dimensions in Fisheries and Aquaculture from the MicroCT and the R Virtual Labs



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RDA Europe-BlueBRIDGE Datathon on Fisheries and Aquaculture  
15 - 16 June 2017, HCMR, Heraklion, Crete, Greece

# LifeWatch - the concept of ESFRIs

**What they are:** Research Infrastructures (RIs) are considered to be **tools for science** and operate in the form of **facilities, resources** and **services**.

**How they function:** They **develop** our **technology** and provide a **thruster** for the **advancement** of **knowledge** by offering unique research services to the **users** and **stakeholders** from many states in order to **conduct top-level research** in **all** possible scientific **disciplines**: from social sciences to astronomy and from genomics to nanotechnologies.

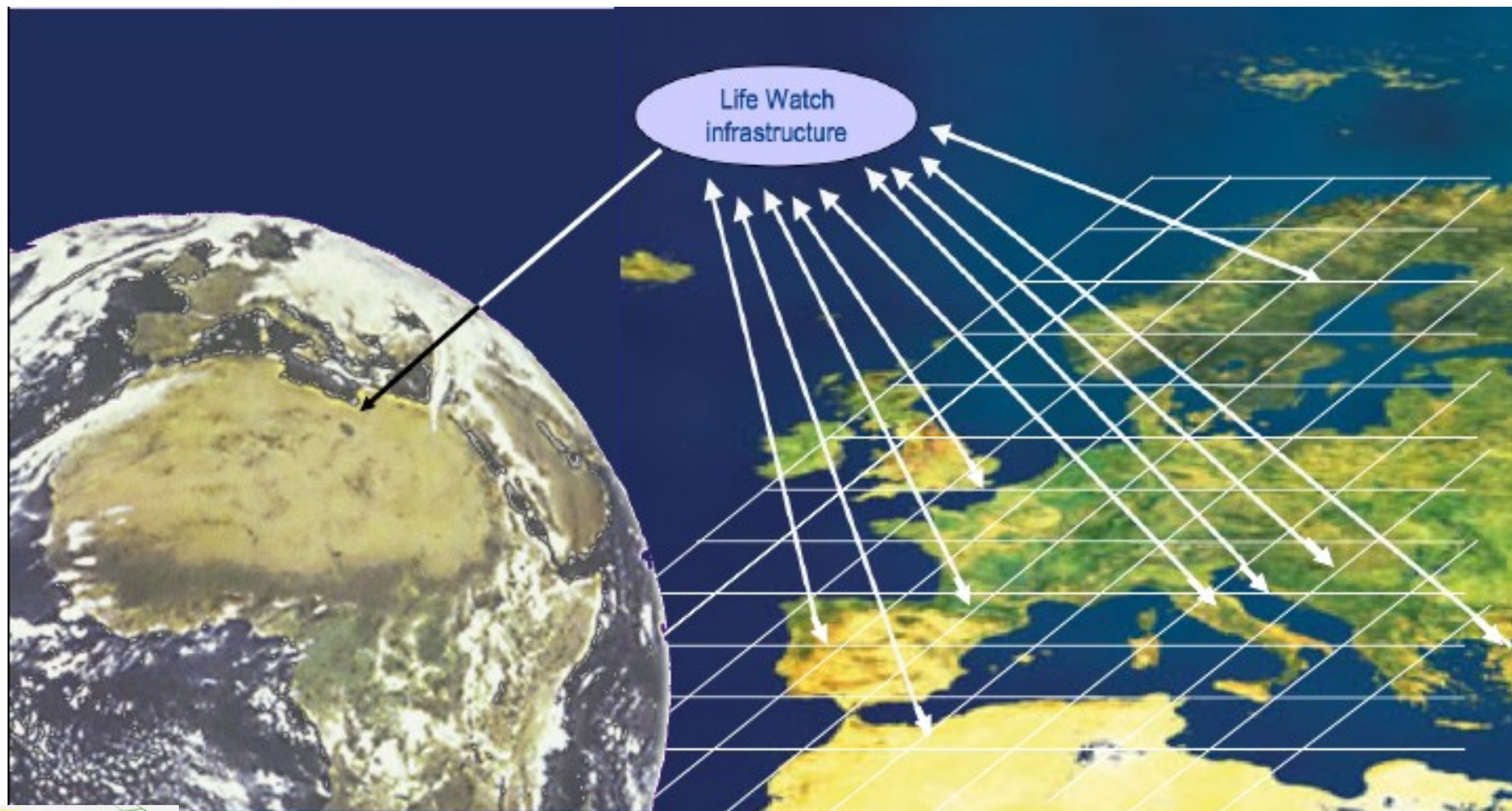
**Development implementation:** RIs may be '**single-sited**' (a single resource at a single location), '**distributed**' (a network of distributed resources), or '**virtual**' (the service is provided electronically).

# LifeWatch - the concept of ESFRIs

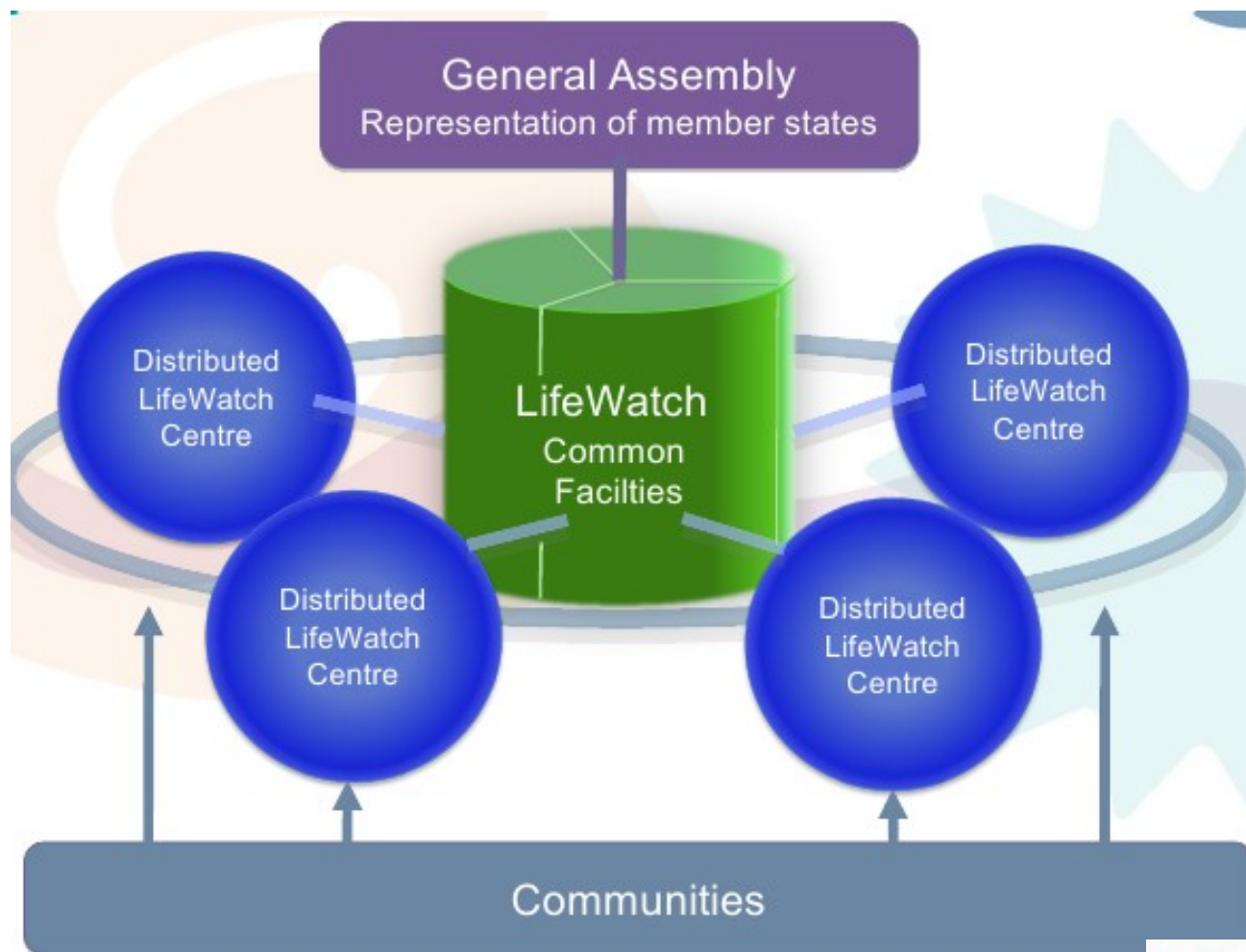




# LifeWatch -distributed infrastructure



# LifeWatch - organization



## Where do we stand?

**LifeWatch ERIC ALREADY established!!**  
**First General Assembly**  
**held in Seville, last month!!!**



## Modelling Biodiversity on Earth:

- Mapping of diversity, biomass, productivity and socio-economics
- Patterns, processes and consequences from change
- Prognosis under certain scenarios



# LifeWatch - challenges (Infrastructure)

## VRE: Virtual Research Environment:

- e-Services (electronic services)
- vLabs (virtual laboratories)
- Computational capacity unlimited space
- “Incubation chambers” for tech developed in  
Projects
- Transparency in scientific research practice



# LifeWatchGreece - What makes it?

- Human Network
- Physical Installations
- Equipment (mostly hardware)
- Software

# LifeWatchGreece Research (e-)Infrastructure



# LifeWatchGreece eServices and vLabs

Institute of Marine Biology, Biotechnology and Aquaculture - HCMR

## Home Page



**RvLab**



**MedOBIS vLab**



**Ecological Modeling**



**Literature Mining**



**Data Services**



**MicroCT Services**



**Genetic Services**



**Greek Taxon  
Information System  
(TIS) Services**



**Biological  
Specimens  
Collection Services**



**Mobile Applications**

LifeWatchGreece portal  
(after registration)





RvLab

## R vLab Registration (Select and submit. That's it!)

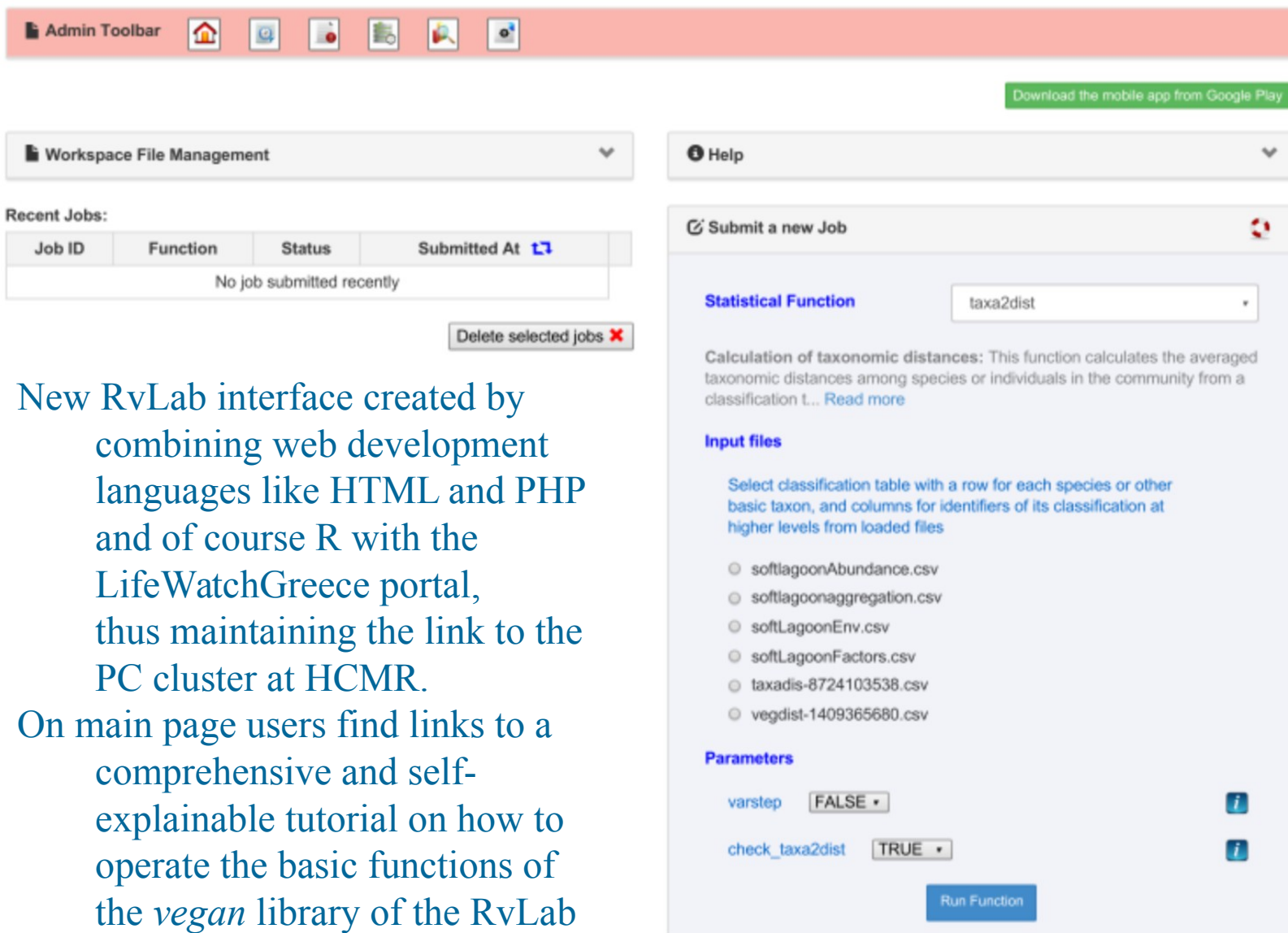
Please, provide me access to R vLab for:

- ☒ 1 day
- ☐ 1 week
- ☐ 1 month
- ☐ 6 month

[Register](#)

**Note:** Please, try to select the registration period that represents in the best way your intentions. For example, if you are requesting short-term access only to try or check out the R vLab functionality, select the "1 day". Making such a selection help us to provide a minimum quality of service to as many users as possible.

Developed by HCMR and FORTH



The screenshot shows the RvLab web interface. At the top is an 'Admin Toolbar' with icons for home, dashboard, reports, and other functions. Below it is a 'Workspace File Management' section. A 'Recent Jobs' table is empty, showing 'No job submitted recently'. To the right is a 'Help' section and a 'Submit a new Job' form. The form has a 'Statistical Function' dropdown set to 'taxa2dist'. Below this is a description of the function: 'Calculation of taxonomic distances: This function calculates the averaged taxonomic distances among species or individuals in the community from a classification t... [Read more](#)'. Under 'Input files', there is a list of CSV files: 'softlagoonAbundance.csv', 'softlagoonaggregation.csv', 'softLagoonEnv.csv', 'softLagoonFactors.csv', 'taxadis-8724103538.csv', and 'vegdist-1409365680.csv'. The 'Parameters' section has 'varstep' set to 'FALSE' and 'check\_taxa2dist' set to 'TRUE'. A 'Run Function' button is at the bottom right.

Recent Jobs:

| Job ID                    | Function | Status | Submitted At |
|---------------------------|----------|--------|--------------|
| No job submitted recently |          |        |              |

Delete selected jobs ✖

Submit a new Job

**Statistical Function** taxa2dist

Calculation of taxonomic distances: This function calculates the averaged taxonomic distances among species or individuals in the community from a classification t... [Read more](#)

**Input files**

Select classification table with a row for each species or other basic taxon, and columns for identifiers of its classification at higher levels from loaded files

- softlagoonAbundance.csv
- softlagoonaggregation.csv
- softLagoonEnv.csv
- softLagoonFactors.csv
- taxadis-8724103538.csv
- vegdist-1409365680.csv

**Parameters**

varstep FALSE

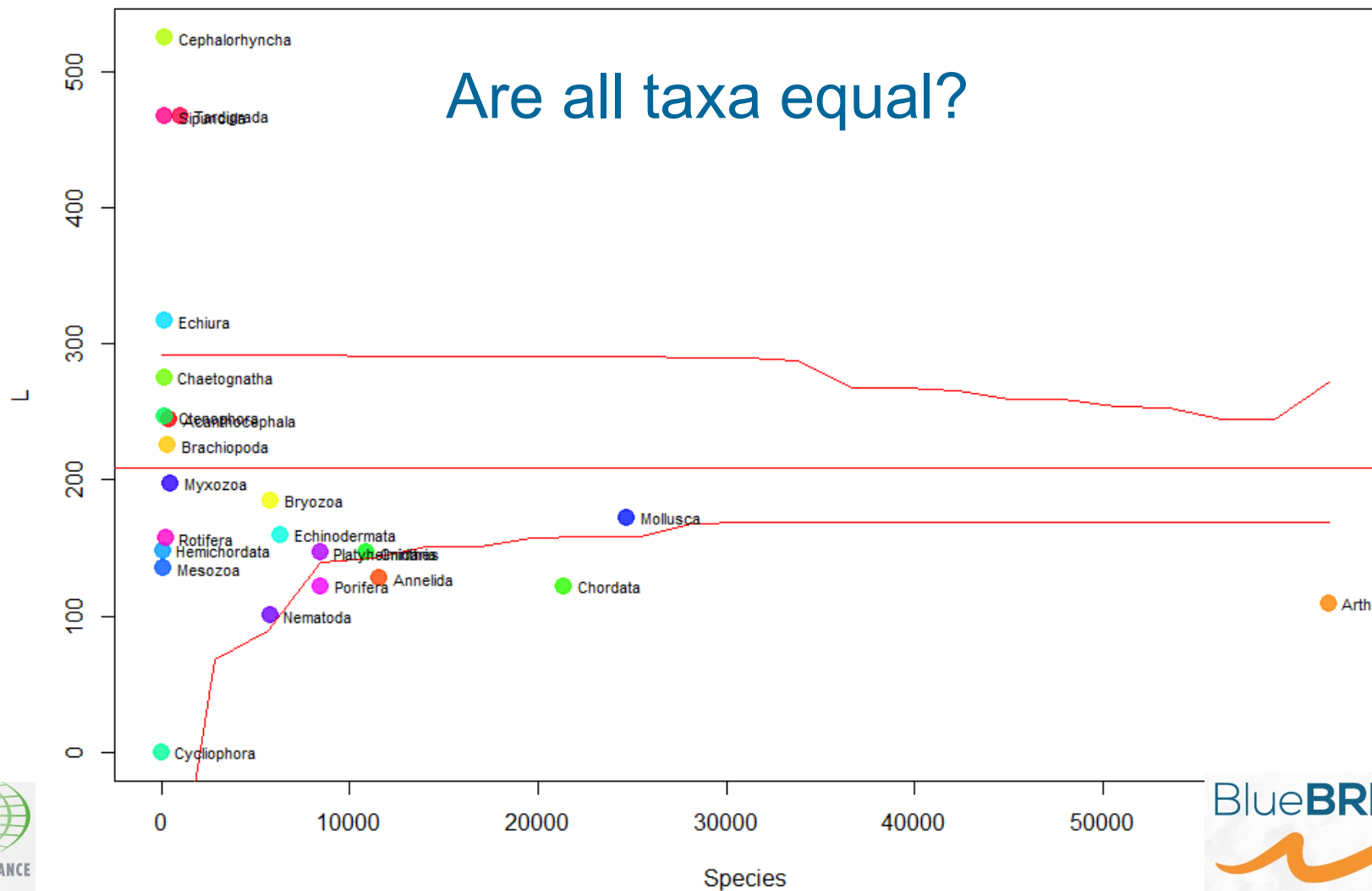
check\_taxa2dist TRUE

Run Function

New RvLab interface created by combining web development languages like HTML and PHP and of course R with the LifeWatchGreece portal, thus maintaining the link to the PC cluster at HCMR.

On main page users find links to a comprehensive and self-explainable tutorial on how to operate the basic functions of the *vegan* library of the RvLab

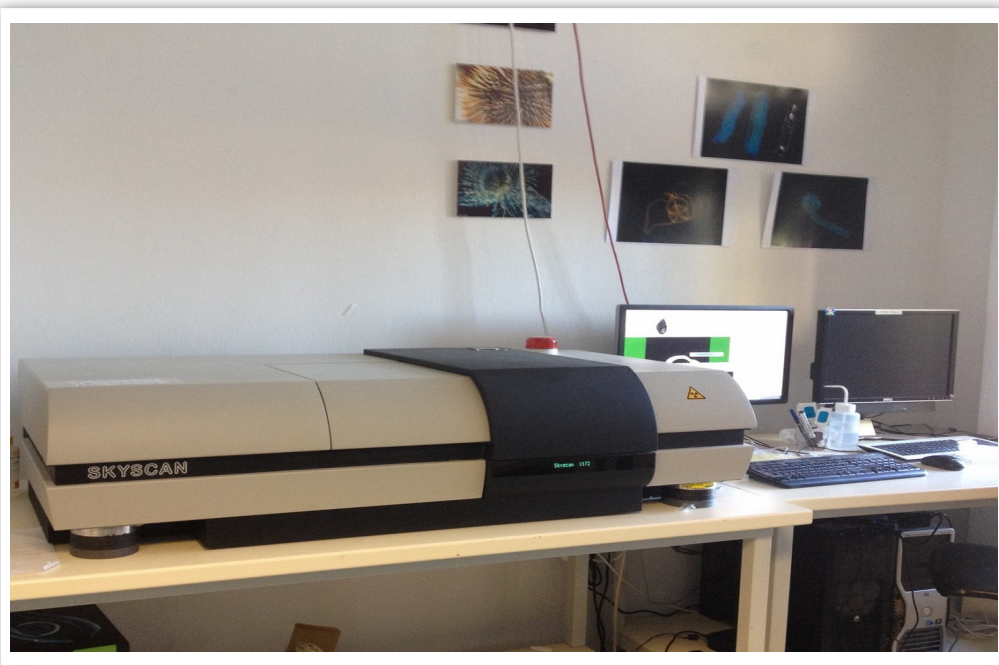
If you use RvLab in a publication, please cite: "Varsos C, Patkos T, Oulas A, Pavloudi C, Gougousis A, Ijaz U, Filiopoulou I, Pattakos N, Vanden Berghe E, Fernández-Guerra A, Faulwetter S, Chatzinikolaou E, Pafilis E, Bekiri C, Doerr M, Arvanitidis C (2016) Optimized R functions for analysis of ecological community data using the R virtual laboratory (RvLab). Biodiversity Data Journal 4: e8357." <https://doi.org/10.3897/BDJ.4.e8357>





# LifeWatchGreece Micro\_CT vLab

- **650** scans have been created and for the initiation of this web service only **17** of them were uploaded
- The uploaded datasets belong to several marine species and they are fully annotated with metadata



7 micro-CT datasets can be downloaded from the Dryad Digital Repository which is a repository system for several datatypes

The remaining datasets can be shared through personal communication as the storage is still under construction

# LifeWatchGreece Micro\_CT vLab

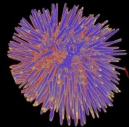


The screenshot displays the Micro\_CT vLab web application interface. The top navigation bar includes a 'Lifewatch Account' button and a menu with links: Home, Annelida, Arthropoda, Chordata, Echinodermata, Mollusca, Ochrophyta, About, and Contact. A search bar is located below the navigation bar.

The main content area is titled 'Alitta succinea (Polychaeta)'. It features a 'Species' dropdown menu with the following options: Annelida, Polychaeta, Phylodocida, Nereididae, Alitta, and Alitta succinea. Below this, there are tabs for 'General Info', '3D Visualization', 'Video', and 'Metadata'. The '3D Visualization' tab is active, showing a 3D model of the specimen. The model is a segmented, elongated body with many small appendages. The interface includes a 'Slice.Drop' tool for interacting with the 3D model, with a '3D Opacity' slider and a 'Threshold' slider. The model is displayed in a 3D view, with a 2D cross-section view shown below it. The 2D view is a grayscale image of the specimen's internal structure, with a red line indicating the slice position. The 3D model is yellow, and the 2D view is grayscale.

On the right side of the interface, there is a 'Related Content' section. It contains three items, each with a thumbnail image and a title: 'Syllis gracilis (Polychaeta)', 'Phylodoce sp. (Polychaeta)', and 'Alitta succinea (Polychaeta)'.

The Virtual Museum of



Natural History

## Virtual Museum of Natural History

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### ABSTRACT

The "Virtual Museum of Natural History"™ (VMNH) is a new, multi-institutional project for sharing and viewing high resolution 3D data of objects of interest, especially biological organisms, for naturalists, developmental biologists, medical scientists, archaeologists, anthropologists, geologists, etc. Scientists can freely use the VMNH web site to upload, download, and discuss a wealth of 3D data. To motivate participation, users who prepare a publication using the VMNH will offer co-authorship to the original up-loaders. Viewing of 2D cross sections is available to anyone and videos of 3D renderings are available on our YouTube Channel [youtube.com/channel/UCGCBXNk6BMQxtV\\_Thvkmw](https://www.youtube.com/channel/UCGCBXNk6BMQxtV_Thvkmw). Volumetric data acquired from Micro Computed Tomography (Micro CT) devices (SkyScan1275 and Nikon-XTH225) has provided our initial 1200 datasets from about 900 specimens. The largest phylum represented is mollusks, for which we have 722 shell specimens of 198 species in 172 genera. Of special interest are 598 shell specimens in graded sizes (growth series) of 88 species in 75 genera. For example, 23 specimens of *Nautilus pompilius* range from 10 mm to 22 cm. Other specimens include animal eyes, marine eyes, de-identified human autopsy specimens, brittle worms, annelids, cephalopods, and various vertebrates. The Marine Biological Lab Marine Resources Center also provided 111 specimens including 32 animals, 31 invertebrates, and 2 seaweeds (*S. fluitans* and *S. natans*). All organisms were first imaged unstained to reveal the radiographically dense anatomical features, and imaged again after staining with Iodine to reveal soft tissues. Plans are underway to add datasets from embryos at graded stages of development in chickens, zebrafish, mice, humans, and marine invertebrates. Those with a particular interest in the VMNH are encouraged to participate on a yearly basis as a "virtual curator" representing a particular group of datasets.

### A NEW THREE DIMENSIONAL IMAGE SHARING PLATFORM

Micro Computed Tomography (MicroCT) provides uniquely high resolution, three dimensional, and rich data sets useful for biological analysis of specimens

MicroCT is a relatively rare technology, but many scientists could benefit from access to such data, other specialized imaging technologies will complement MicroCT data such as OCT

The Virtual Museum of Natural History aims to provide a platform for scientists to share imaging data and build collaborations across many and diverse fields

To catalyze the effort, we have contributed over 1000 of our own specimen data sets of marine specimens, mollusk shells, animal specimens, and de-identified human autopsy specimens.

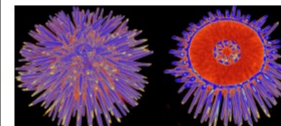
See our gallery below including mollusk "growth series," useful for studying mathematics of growth, and organisms stained in iodine revealing soft tissue in addition to hard components

Find us at: [virtualmuseumnaturalhistory.org](http://virtualmuseumnaturalhistory.org) and [virtnat.org](http://virtnat.org)

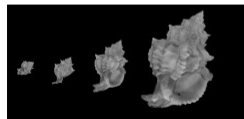
YouTube Channel: The Virtual Museum of Natural History



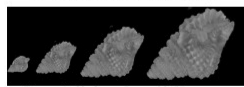
Bruker SkyScan MicroCT Device



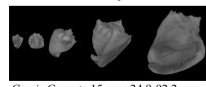
Colorized *Arbacia punctulata* Purple Urchin



*Hexaplex trunculus* 25 spcs 9-91 mm



*Distorsio Clathrata* 5 spcs 39-55 mm



*Cassis Cornuta* 15 spcs 24.9-92.2 mm

#### SINGLE SHELL SPECIMEN LIST

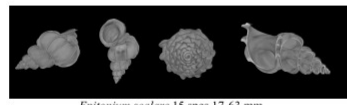
*Acteon cloisae* 29.2 mm  
*Aporrhais* 79.3 mm  
*Amalthea australis* 21.4 mm

*Cerithium dohrnii* 36.1 mm  
*Cerithium christophi* 32.8 mm  
*Choromastix platys* 23.4 mm  
*Clanculus pharon* approx. 18 mm  
*Phyllaea bellina* approx. 18.0 mm  
*Phyllaea* approx. 18.0 mm

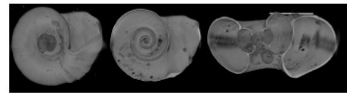
*Hydatina zonata* 38.9 mm  
*Japhania japhania* 30.6 mm  
*Japhania depicula* approx. 5 mm  
*Laguncula californica* 42 mm  
*Laguncula* approx. 42 mm

*Neritina granosissima* 26.5 mm  
*Quenstedtia erinacea* 29.0 mm  
*Opisthotoma* approx. 2.9 mm  
*Ovula castellata* 34.0 mm  
*Planorbis* approx. 10.0 mm

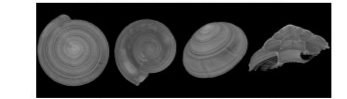
*Sermyla gibberula* 10.8 mm  
*Thracia murex* 74.6 mm  
*Tibia cristata* 24.1 mm  
*Tricola pulla* 7.5 mm  
*Tricola* approx. 7.5 mm



*Epitonium scalare* 15 spcs 17-63 mm

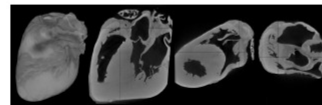


*Nautilus pompilius* 23 spcs 10 mm-22cm

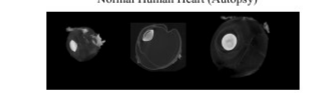


*Architectonica perspectiva* 7 spcs 35-44 mm

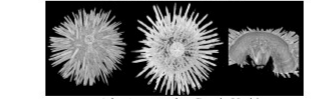
#### SINGLE SHELL SPECIMEN LIST



Normal Human Heart (Autopsy)



Normal Human Eye (Autopsy)



*Arbacia punctulata* Purple Urchin

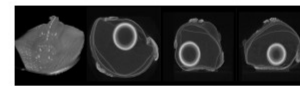
#### SHELL GROWTH SERIES SPECIMEN LIST

*Acantia brevitata* 6 spcs 17-27 mm  
*Agonostoma imperiale* 5 spcs 27-59 mm  
*Aporrhais papilionacea* 7 spcs 35-44 mm  
*Arca zebra* 5 spcs 29-78 mm  
*Arca* approx. 29-78 mm

*Cerastoma vermicum* 4 spcs 18-25 mm  
*Clanculus leucoguttatus* 3 spcs 35-44 mm  
*Conus miles* 9 spcs 43-85 mm  
*Conus purpurascens* 8 spcs 15-68 mm  
*Conus* approx. 15-68 mm

*Melongen corona operculum* for 108.5 mm  
*Micromelasma hargreavesi* 6 specimens 12-18 mm  
*Mitra crispata* 34 spcs 33-43 mm  
*Natica cantabra* 8 spcs 17-47 mm  
*Natica* approx. 17-47 mm

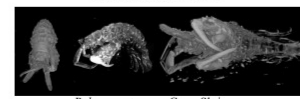
*Syrinx aramus* 4 spcs 20.0-84 mm  
*Tachycaulus egmontianus* 4 spcs 32-70 mm  
*Tectarius grandinatus* 6 spcs 7-30 mm tall  
*Tegula baroniana* 5 spcs 8-23 mm  
*Trochus* approx. 8-23 mm



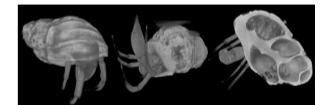
*Leucoraja erinacea* Little Skate and Eye



*Alitta virens* Clam Worm



*Palaeomonetes* spp. Grass Shrimp



*Pargurus longicarpus* Long-clawed Hermit Crab



*Libinia* spp. Spider crab



*Dyspanopes sayi* Mud Crab



# LifeWatchGreece Collaboration - Synergies

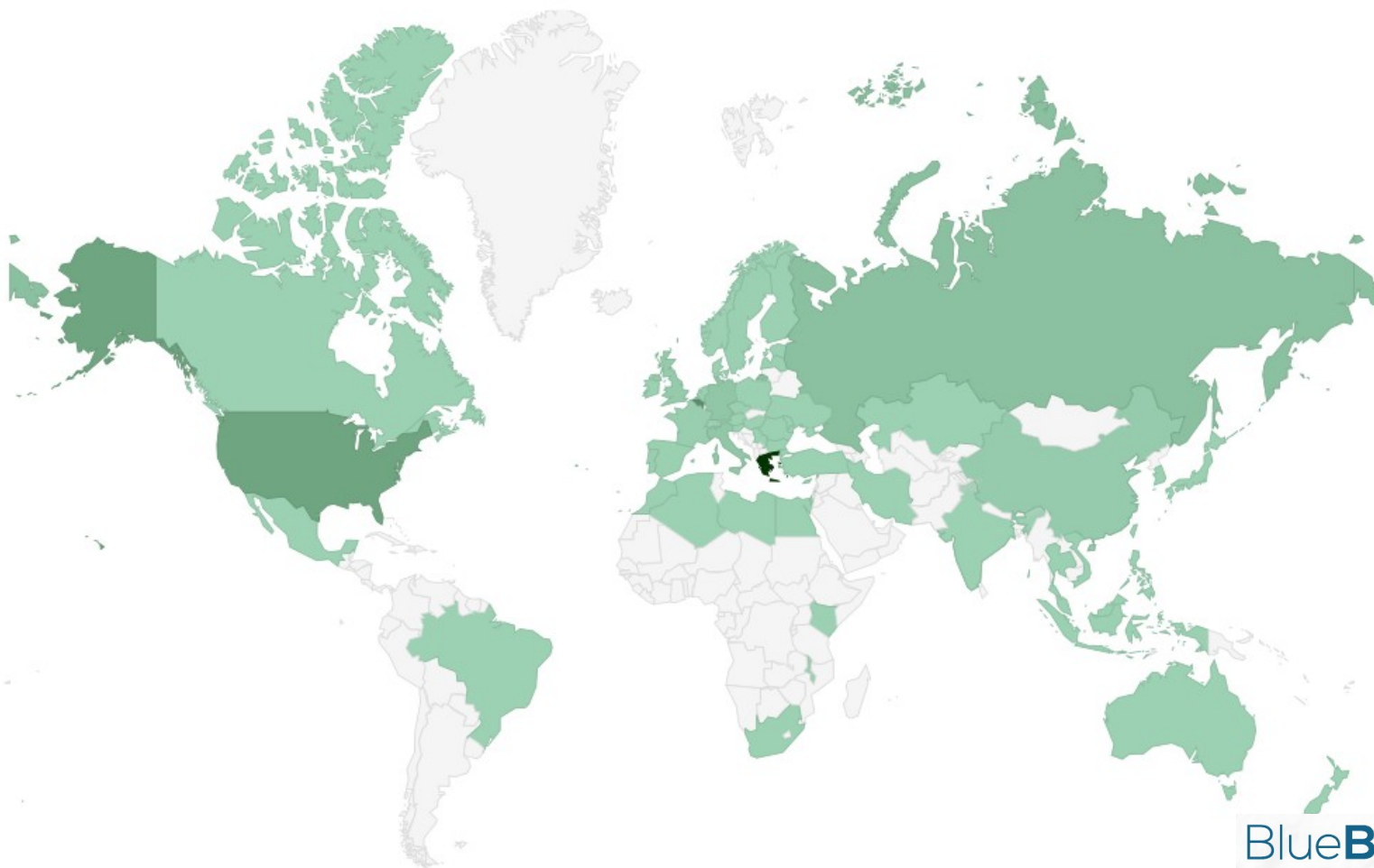
Projects used LifeWatchGreece RI:

- EMBOS
- MAPMED
- EMODnet Biology
- EU BON
- SYNTHESYS
- ActionMed

RIs to which LifeWatchGreece  
contributes:

- EMRC
- DiSSCo (under development)
- LTER\_Europe
- Biolmaging\_GR
- ELIXIR\_GR
- CMBR

Traffic origination for Portal



# LifeWatchGreece-How can I participate?

→ Explore the web site:

<http://www.lifewatchgreece.eu>

→ Inform us about your needs (methods of analysis, software, etc.)

→ Send your messages to: [info@lifewatchgreece.eu](mailto:info@lifewatchgreece.eu)

→ Contribute and publish your own data and metadata;  
Example from the 21 LifeWatchGreece Special Collection  
papers (first part):

[http://bdj.pensoft.net/browse\\_user\\_collection\\_documents.php?  
collection\\_id=10&journal\\_id=1](http://bdj.pensoft.net/browse_user_collection_documents.php?collection_id=10&journal_id=1)





# Thank you