40 Years of Zooplankton Biodiversity Assessment:

insights from the Gulf of Naples

(ZOOGoN-40Y)

Iole Di Capua

DTO-BioFlow
Integration of biodiversity monitoring data into the Digital Twin Ocean

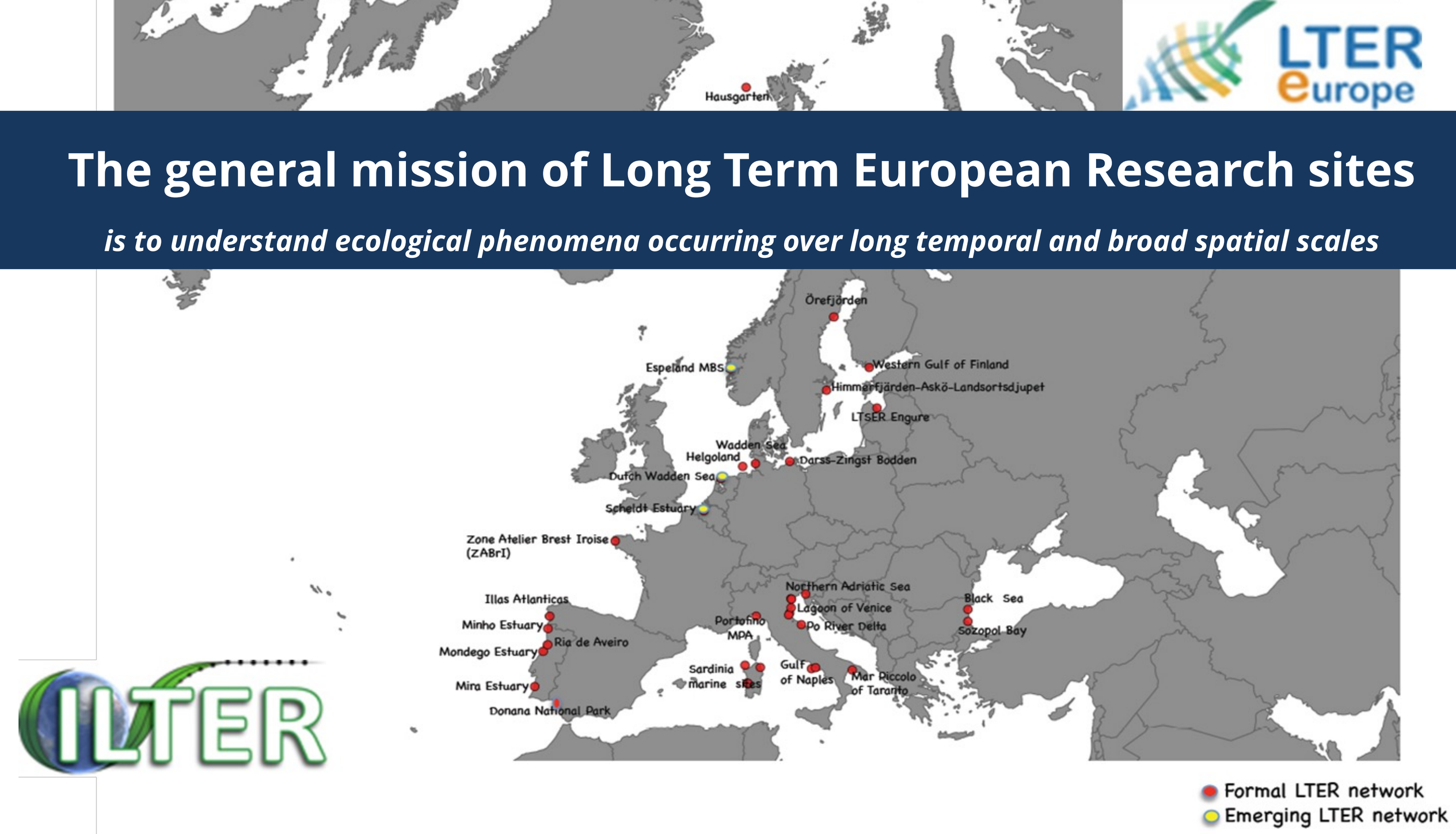
LTER MC Marechiara

Launched by Stazione Zoologica in 1984

to investigate the structure functioning of planktonic communities of the Gulf of Naples in relation to the environmental variability and climate change

The general mission of Long Term European Research sites

is to understand ecological phenomena occurring over long temporal and broad spatial scales

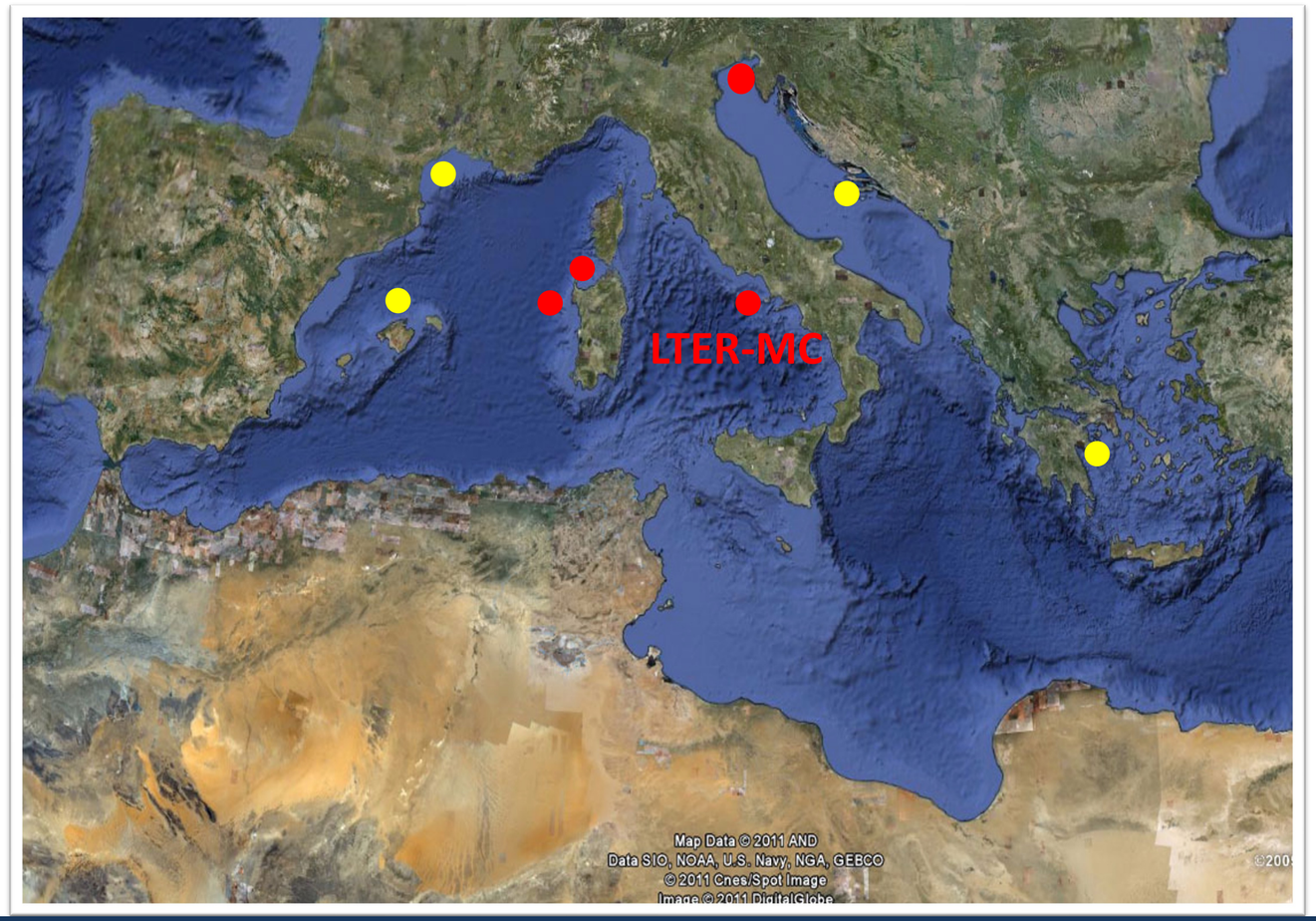


Planktonic time-series in Mediterranean Sea

Gulf of Trieste
Phyto: since 1984
Zoo: since 1970
monthly

Villefranche sur Mer
Phyto: since 1995
Zoo: since 1966
weekly

Baleares station
Zoo: since 1994
monthly



Stončica
Zoo: since 1959
monthly

Gulf of Saronikos
Zoo: since 1987
monthly or seasonally

Sardinia sites
Phyto: 1997-2007/
2010-2014
Seasonally

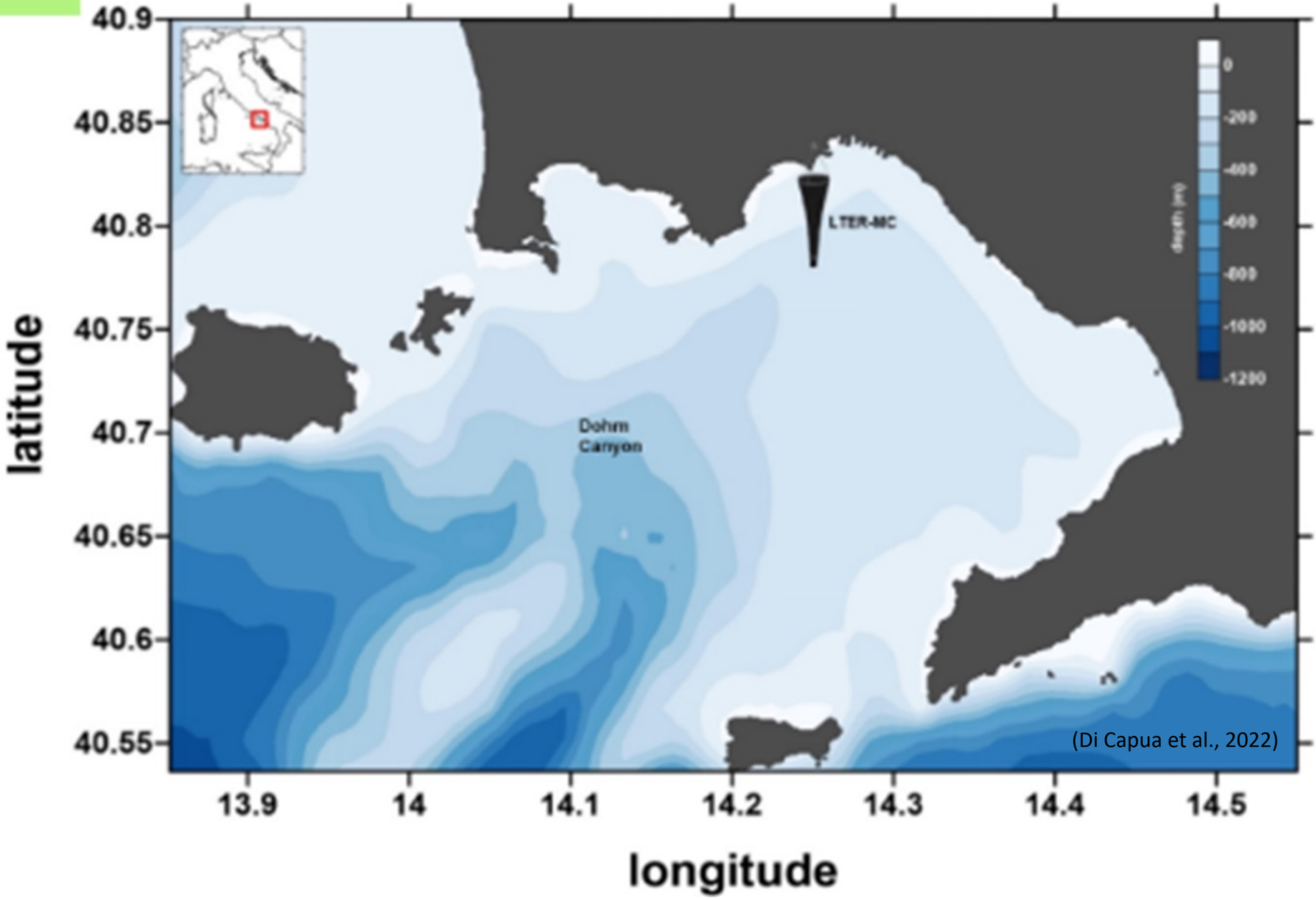
● LTER sites

● Plankton time-series

LTER-MC is one of the few and longest time-series in the MED

LTER-MareChiara site

- Western Mediterranean Sea
- Central Tyrrhenian Sea
- Gulf of Naples
- 2 miles offshore (40°48.5’N,14°15’E)
- ca 75 m depth



LTER MC Marechiara

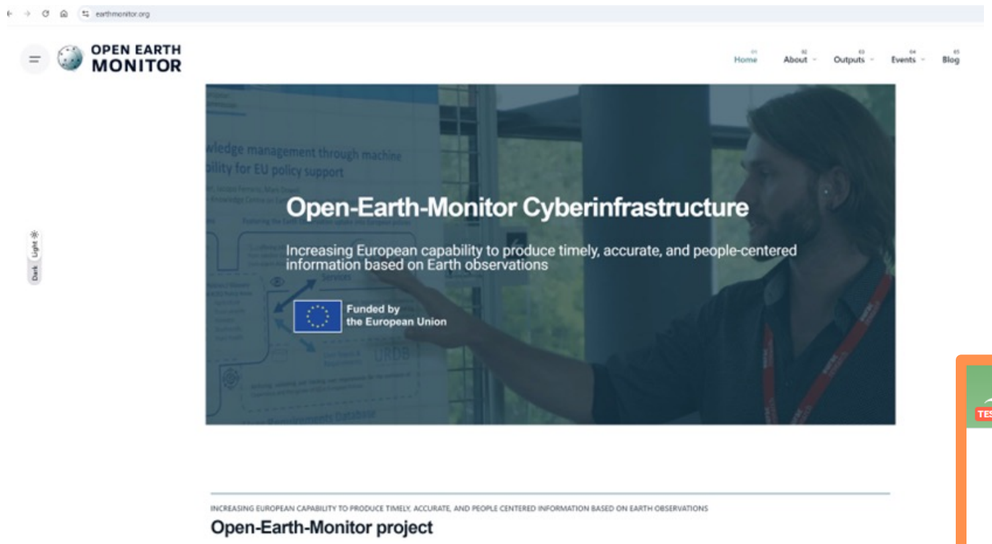
More than 15 variables and high sampling frequency

	VARIABLES
PHYSICS	Temperature Salinity Irradiance
CHEMISTRY	Dissolved Oxygen Inorganic Nutrients Organic Nutrients Particuled Carbon and Nitrogen (since 2007) Dissolved Organic Carbon (since 2007)
BIOLOGY	Fluorescence Chlorophyll Photosynthetic pigments (since 1997) Picoplankton and Heterotrophic Bacteria (since 2007) Phytoplankton Ciliates (1997-2010) Mesozooplankton

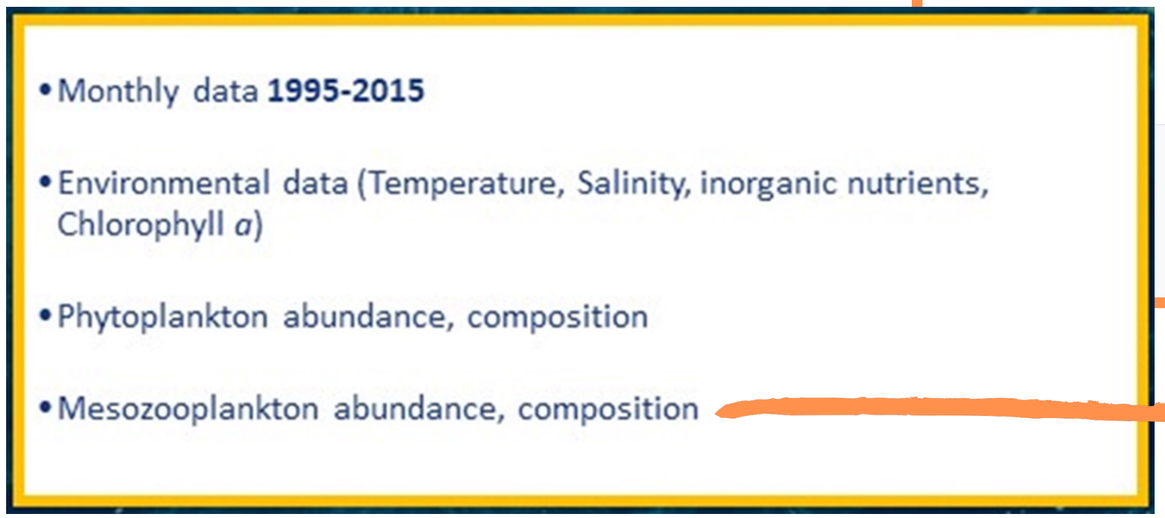
The environmental and planktonic data were collected:

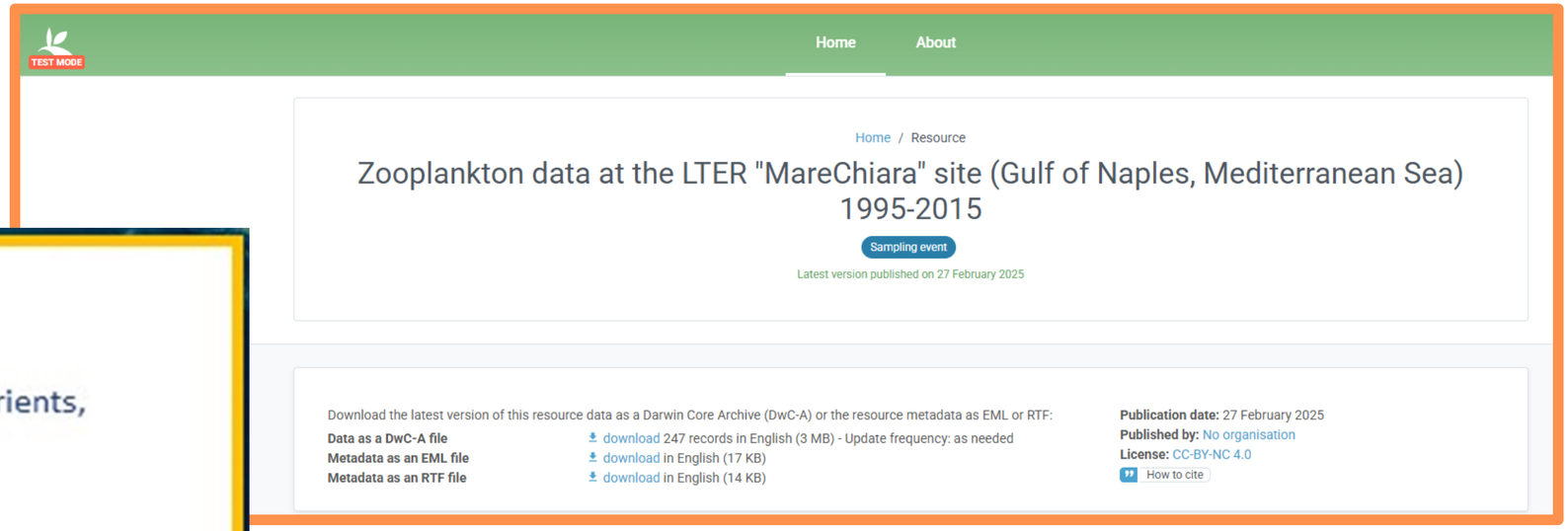
- ✓ **fortnightly from 1984-1990**
- ✓ **weekly from March 1995 to date**

Available data format & storage



Task 4.5 Preparation of ocean, seas and coastal waters *in-situ* data





https://ipt.vliz.be/upload/resource?r=lter_mc_zooplankton

LTER-MC Meso-Zooplankton

1512 sample

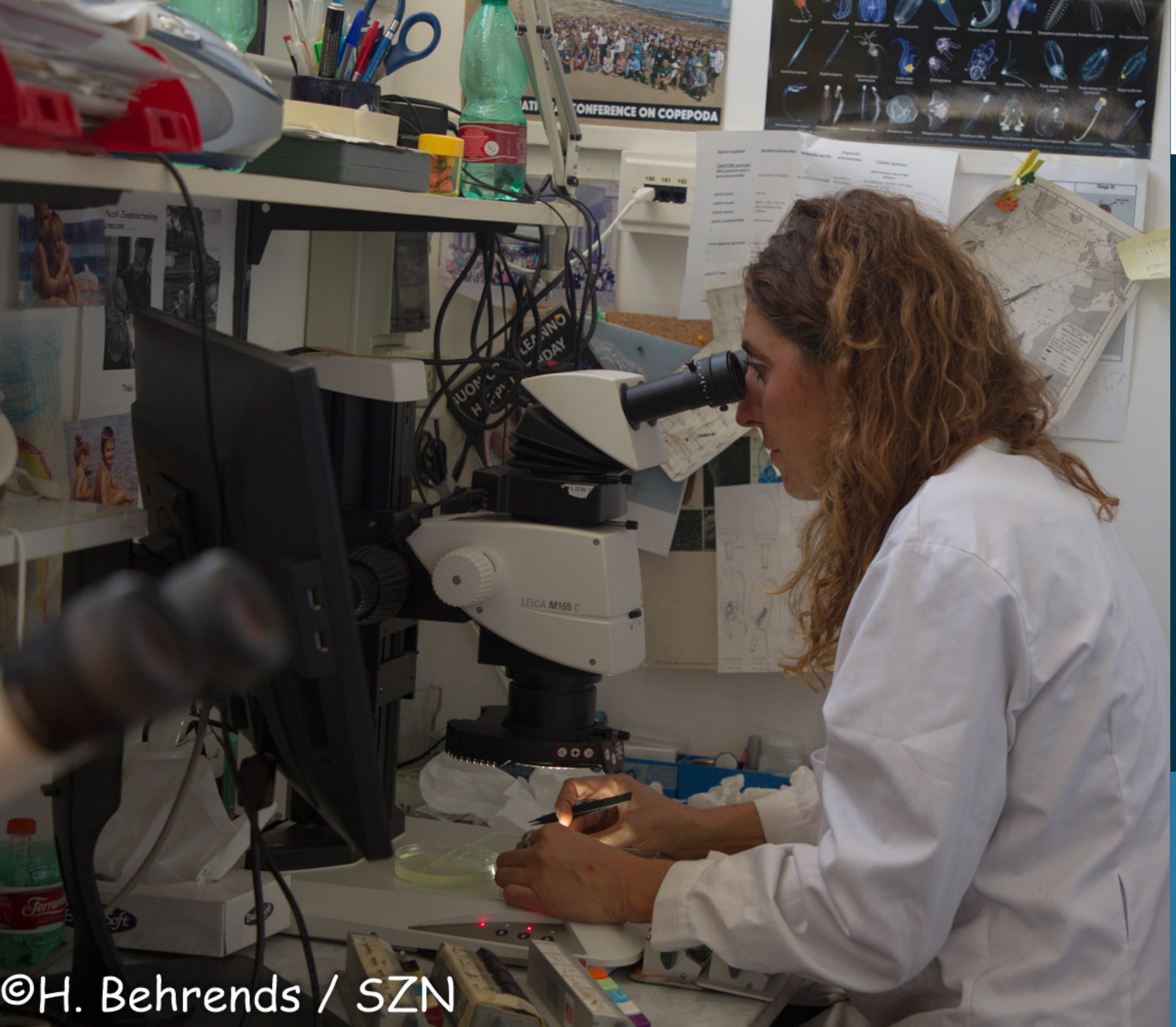
since 1984

to date

LTER-MC Meso-Zooplankton

Samples

- Quali-quantitave analysis
- Biomass (as dry weight)



©H. Behrends / SZN

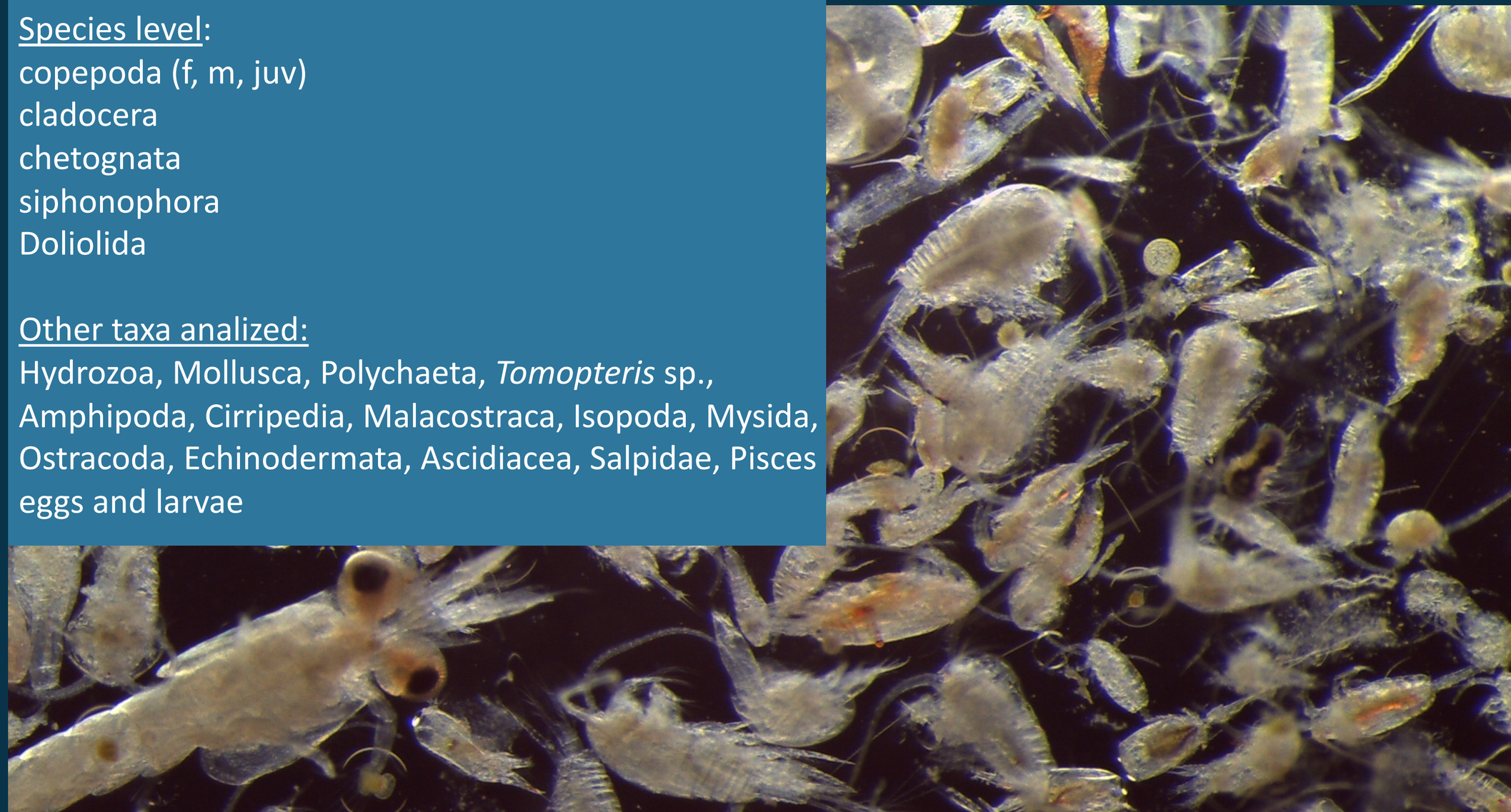
LTER MC Marechiara

using MORPHOLOGICAL approach

Taxonomic resolution
Meso-Zooplankton

Species level:
copepoda (f, m, juv)
cladocera
chetognata
siphonophora
Doliolida

Other taxa analized:
Hydrozoa, Mollusca, Polychaeta, *Tomopteris* sp., Amphipoda, Cirripedia, Malacostraca, Isopoda, Mysida, Ostracoda, Echinodermata, Ascidiacea, Salpidae, Pisces eggs and larvae



ZOOGoN-40Y Objectives :

- *Harmonize historical and contemporary data*
- *Strengthen long-term biodiversity monitoring*
- *Improve species identification accuracy (new entry and NIS)*
- *Develop a FAIR-Compliant long-erm Dataset (1984–2024)*
- *Ensure open and accessible data*

STAZIONE ZOOLOGICA ANTON DOHRN
SZN

ZOOGoN-40Y Task 1:

152 new samples to process

M&M:

- ***Stempel pipette sub-sampling***
- ***Mini-Bogorov Chamber examination***
- ***Species-level taxonomic ID***
- ***QA/QC: Calibration and repeated counts***

ZOOGoN-40Y Task 2:

- ✓ ***Merge historical (1984–2015) & new data (2016–2024)***
- ✓ ***Data Harmonization & FAIRification***
- ✓ ***Standardization using:***
  - ***Darwin Core Archive***
  - ***WoRMS LSIDs***
  - ***NERC Vocabulary Server***
  - ***ISO19115 Metadata***
  - ***EMODnet publication with QC***

STAZIONE ZOOLOGICA ANTON DOHRN
SZN

DTO-BioFlow
Integration of biodiversity monitoring data into the Digital Twin Ocean

ZOOGoN-40Y Current Situation:

- ✓ *Data across PCs, HDs, cloud – non-standard formats*
- ✓ *Only few data from 1995–2015 in EMODnet format*

ZOOGoN-40Y Challenges:

- ✓ *Integrate 40 years of data*
- ✓ *Labor-intensive ID of recent samples (2020-2024)*
- ✓ *Data accessibility & FAIR compliance*

STAZIONE ZOOLOGICA ANTON DOHRN
SZN

DTO-BioFlow
Integration of biodiversity monitoring data into the Digital Twin Ocean

ZOOGoN-40Y Relevance and Impact:

Scientific Impact: Enhances zooplankton knowledge

Global Standards: FAIR, Darwin Core, WoRMS

Supports:

- ✓ ***Early biodiversity shift detection***
- ✓ ***Marine ecosystem management***
- ✓ ***Digital Twin of the Ocean***

STAZIONE ZOOLOGICA ANTON DOHRN
SZN

Thanks

iole.dicapua@szn.it

Twitter: iole@iolezoo
Skype: iolezoo

Acknowledgments

Thank to M.G. Mazzocchi, F. Margiotta and LTER-MC teams, and the crew of the R/V Vettoria for assistance during the work at sea.

ICES CIEM

WGIMT
WGZE
WGEUROBUS

SCOR WG157
MetaZooGene
Metabarcoding Zooplankton Diversity (Ocean Decade Action No. 102.2)

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the granting authority can be held responsible for them.