



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



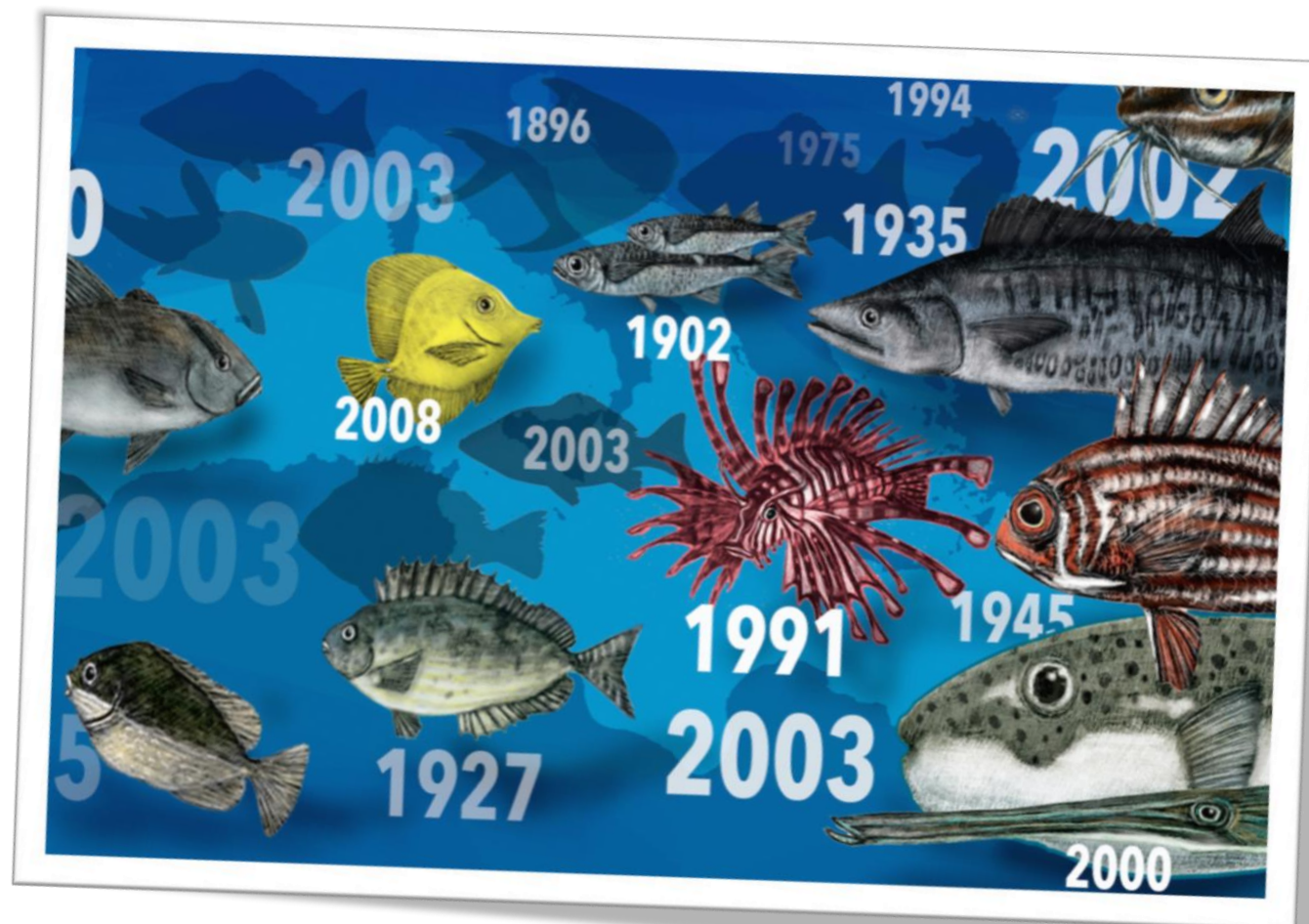
Updating the occurrences of Mediterranean exotic fish for the European Digital Twin of the Ocean

Manuela D'Amen

The Mediterranean Sea is considered one of the **most invaded marine ecosystems** on earth

Biological invaders pose **crucial threats** for biodiversity, ecosystem integrity and human activities

The existing geo-referenced observations of exotic species often remain **scattered in scientific literature** and are **not easily accessible**





Extraction of
georeferenced
occurrences from the
scientific Mediterranean
literature



Each record has undergone a
meticulous validation process,
cross-checked against original
sources, and subjected to
multiple peer reviews

scientific **data**

OPEN

DATA DESCRIPTOR

Check for updates

ORMEF: a Mediterranean database of exotic fish records

Ernesto Azzurro^{1,2,3}, Sonia Smeraldo^{1,3}, Annalisa Minelli⁴ & Manuela D'Amen^{1,3,5}

The Mediterranean Sea is recognized today as the World's most invaded marine region, but observations of species occurrences remain scattered in the scientific literature and scarcely accessible. Here we introduce the ORMEF database: a first comprehensive and robust compilation of exotic fish observations recorded over more than a century in the Mediterranean. ORMEF consists today of 4015 geo-referenced occurrences from 20 Mediterranean Countries, extracted from 670 scientific published papers. We collated information on 188 fish taxa that are thus divided: 106 species entered through the Suez Canal; 25 species introduced by shipping, mariculture, aquarium release or by means of other human activities; 57 Atlantic species, whose arrival in the Mediterranean has been attributed to the unassisted immigration through the strait of Gibraltar. Each observation included in the ORMEF database was submitted to a severe quality control and checked for geographical and taxonomic biases. ORMEF is a new authoritative reference for Mediterranean bio-invasion research and a living archive to inform management strategies and policymakers in a period of rapid environmental transformation.

SEANOE Sea scientific open data edition

ORMEF: Occurrence Records of Mediterranean Exotic Fishes database

Click to download the data DATA

Date	2022-04-15
Temporal extent	1896 -2020
Author(s)	Azzurro Ernesto ^{1,2} , Sonia Smeraldo ^{1,3} , Manuela D'Amen ^{1,3}
Affiliation(s)	1 : CNR-IRBIM, National Research Council, Institute of Biological Resources and Marine Biotechnologies, Largo Fiera della Pesca 1, 60125 Ancona, Italy. 2 : Stazione Zoologica Anton Dohrn, Villa Comunale, 80121 Naples, Italy. 3 : Stazione Zoologica Anton Dohrn, Fano Marine Centre, Viale Adriatico 1, 61032 Fano, Italy.
DOI	10.17882/84182
Publisher	SEANOE
Keyword(s)	Non-indigenous species, Fisheries, Mediterranean Sea, Marine Ecology, Marine Biology, Fishes, Exotic species, Alien species, Lessepsian migration, Suez Canal, Shipping, Aquarium release, Ballast waters, Aquaculture, Neoinvasive species

This image is licensed under a Creative Commons Attribution 4.0 International License. Total occurrences of fish species that entered the Mediterranean Sea by 2020. Species' first records are indicated by triangles

SEANOE

Sea scientific open data edition

ORMEF: Occurrence Records of Mediterranean Exotic Fishes database

Click to download the data

DATA

This image is licensed under a Creative Commons Attribution 4.0 International License. Total occurrences of fish species that entered the Mediterranean Sea by 2020. Species' first records are indicated by triangles

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Record_ID	Species	AphiaID	Family	Category	Year	Country	Precision of coordinates	Decimal_Lat	Decimal_Long	Reference	DOI
1	Ablennes hians	159246	Belonidae	EXOTIC CAN	2018	Israel	Pre	32,286	34,785	Golani, D. First record of the flat needlefish Ablennes hians (Valenciennes, 1846) in the Mediterranean Sea (Osteichthyes, Beloniformes, Belonidae). BiolInvasions Rec. 8, 410-412 (2019).	https://doi.org/10.1186/s41200-019-0174-5
2	Abudefduf hoefleri	273699	Pomacentridae	EXOTIC HM	2014	Malta	Pre	358,351	14,563	Vella, A., Vella, N. & Darmanin, S. A. The first record of the African Sergeant, Abudefduf hoefleri (Perciformes: Pomacentridae), in the Mediterranean Sea. Mar. Biodiv. Rec. 9, 1-5 (2016b).	https://doi.org/10.1186/s41200-016-0008-7

4,015 geo-referenced
occurrences

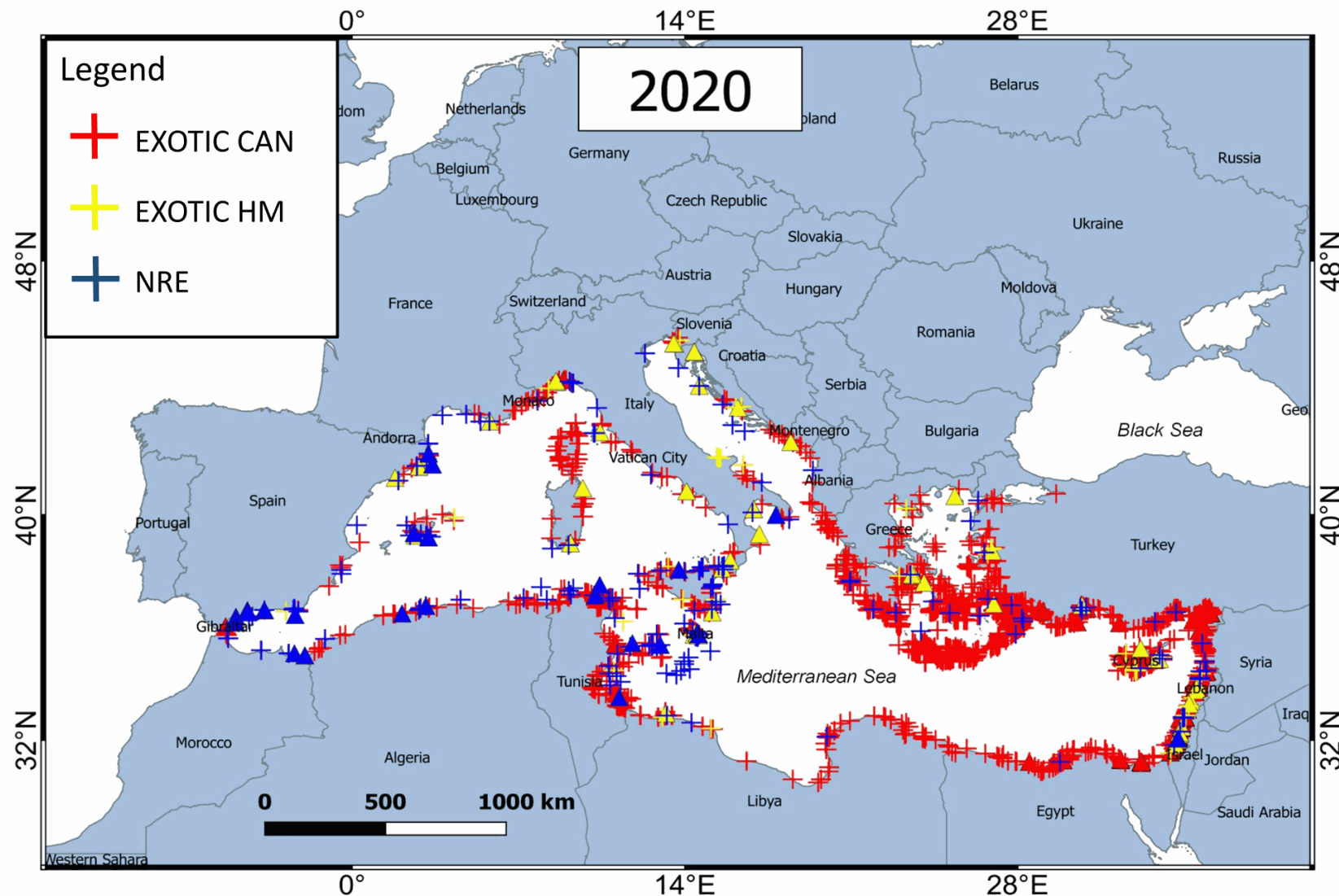
188 fish taxa

20 Mediterranean
countries

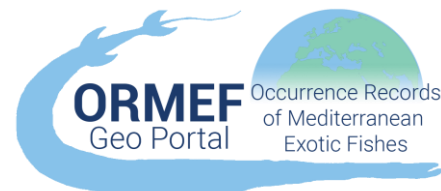
670 scientific
publications

1896-2020

Time extent



Each record enters the ORMEF geoportal
following the FAIR principles



Welcome to the ORMEF GeoPortal

ORMEF is a free, online searchable database about Mediterranean Exotic Fishes. It provides updated geo-referenced information for scientists, conservationists and policy makers, disseminating specialist's knowledge and experience to a broad audience.



Here you can search for information by species. Use the box to type the scientific name of the fish you are interested in or click on the [map](#) and open the filters.



221
SPECIES

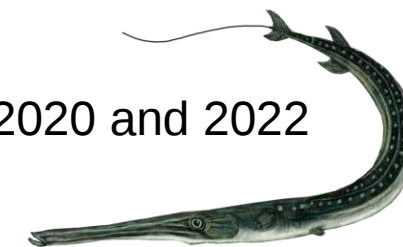


12553
GEO-REFERENCED RECORDS

[Cookies policy](#)



It includes also geo-referenced data extracted from scientific papers published between 2020 and 2022
These data are not yet publicly available



SPECIES

ORMEF provides information not only on Non Indigenous fishes that are introduced by human activities but also on Atlantic species that are presumably arrived through the straits of Gibraltar without the direct assistance of human agency.



Hemiramphus far (Forsskål, 1775)
 Hemiramphidae
 Order: Belontiiformes
 Aphia ID: 126389
 FishBase: https://www.fishbase.de/summary/Hemiramphus-far.html

FIRST MEDITERRANEAN RECORD

Reference Steinitz W, 1927, Beiträge zur Kenntnis der Küstenfauna Palästinas, Pubblicazioni della Stazione Zoologica di Napoli, 9(3-4): 311-353
 Year of first record 1927
 Location of first record na
 Country of first record Israel

PATH

Most probable path Suez Canal

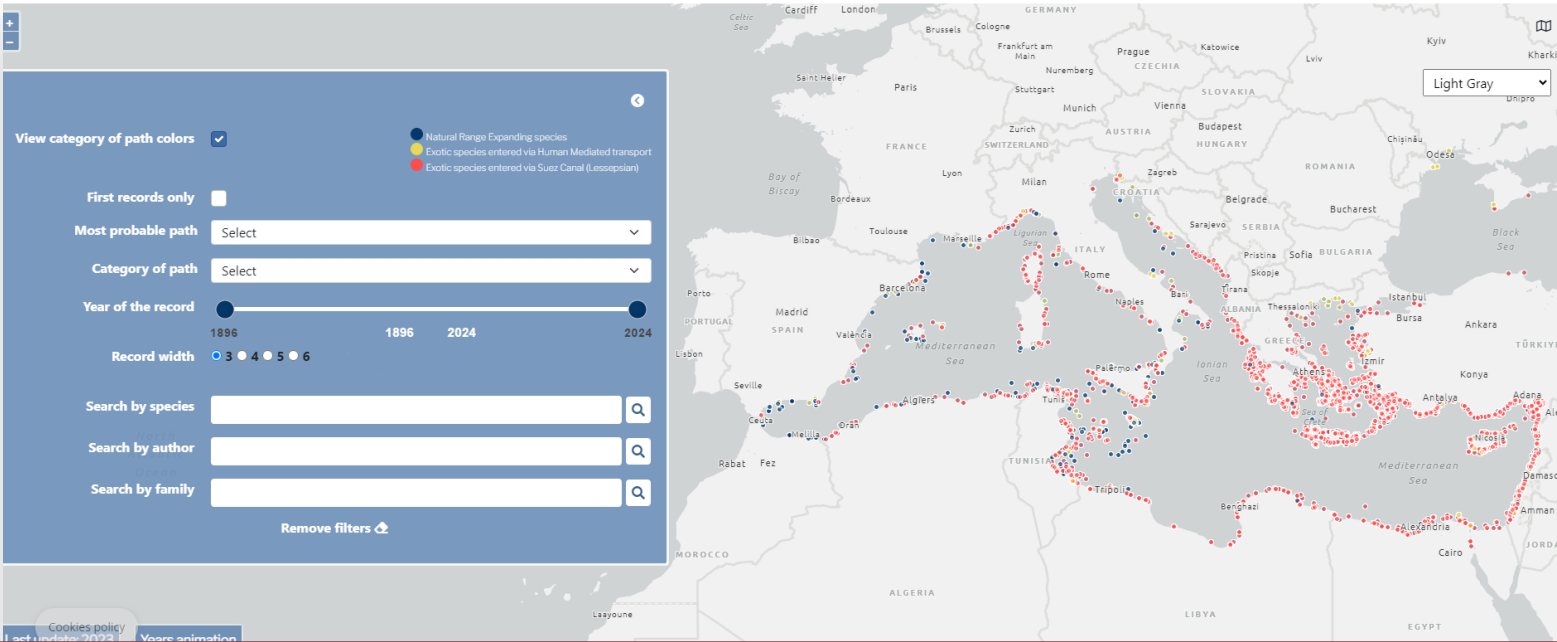
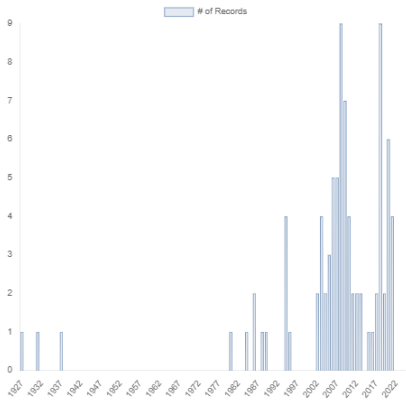
DISTRIBUTION

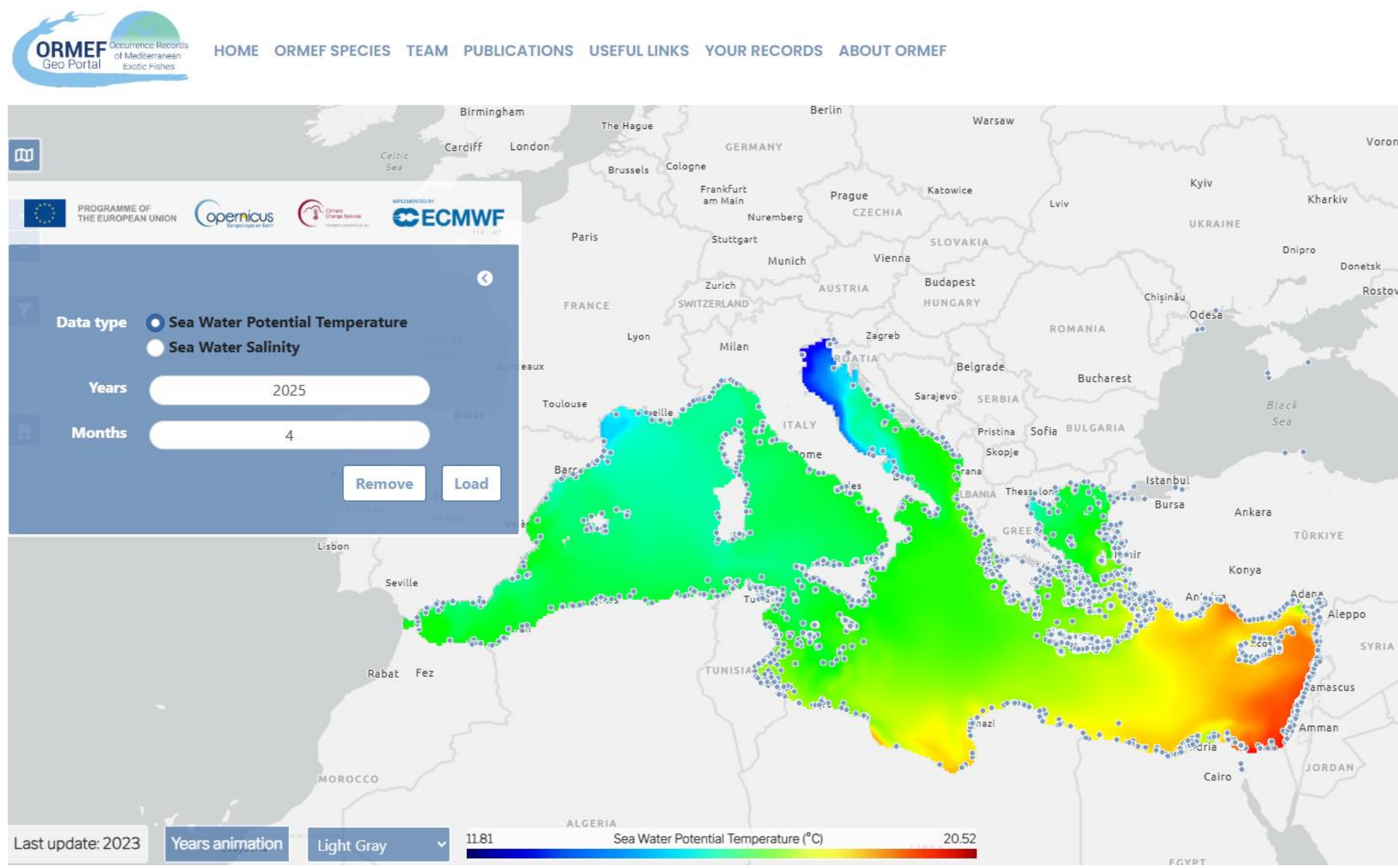
Native sea area Indo-Pacific
 Abundance in the colonized areas Established Very common
 Depth range (m) 0-50

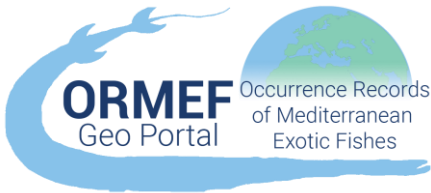
RECORDS LOCATION



FIRST RECORDS: Mediterranean Sea, Black Sea, Marmara Sea, Atlantic Sea







TRANSITION TO A
 NEW DB STRUCTURE

RECORDS CODES	DETAILS ON THE SOURCE OF THE DATA	SPECIES	COORDINATES	BASIC DATA ON THE RECORD	ADDITIONAL DATA ON THE RECORD	INFO ON THE COMPILER AND DATE	DATA ON BD VERSION
Sequential number Record_ID	Source Authors Year of publication Title Journal Volume Pages DOI	Species Code Species	Precision of coordinates Decimal_LAT Decimal_LONG	Month Year of record First record Location Country Area (NEW)	Collector Local Abundance Number of individuals Sampling method Depth (m) Habitat Catalogue INFO on Source Remarks	DATE of Data input Filled By	

Future perspectives: inclusion of abiotic variables, static data on the species

GOAL

Building on the currently available version of the ORMEF database we aim to integrate newly reported geo-referenced occurrences and align the database with the Digital Twin of the Ocean (DTO) requirements.

KEY Objectives

1

To expand the ORMEF database by incorporating the dataset now only viewable through the ORMEF web platform, resulting in approximately a threefold increase in the number of records compared to the previous database version (total of 12,553 new geo-referenced occurrences from 805 scientific publications, covering 221 fish taxa)

2

To identify and integrate newly reported geo-referenced occurrences from the most recent scientific literature published after 2022 up to 2025

3

To ensure the entire ORMEF database and its future updates are formatted, standardized, and quality-controlled to meet the requirements for data ingestion in of the Digital Twin of the Ocean (DTO)

Methodology

First step



DB UPDATE

Deep literature review up to the end of 2025

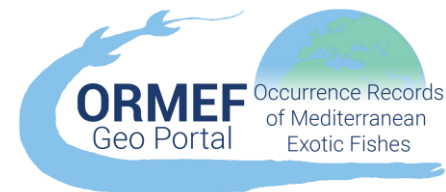
Methodology

First step

Second step

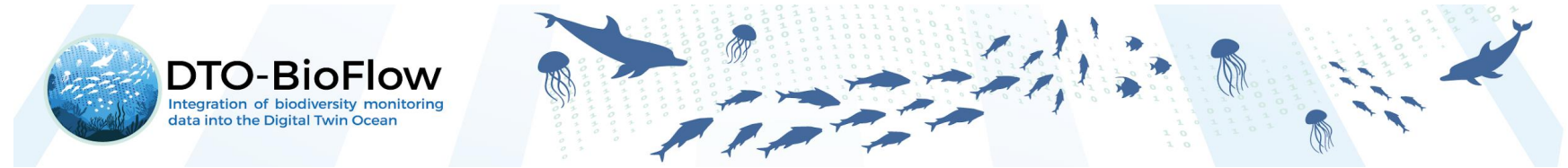


UPDATED DB



Methodology

First step



Second step

Standardization of the whole updated dataset with a harmonized format that meets the requirements for ingestion in the Digital Twin of the Ocean (DTO).

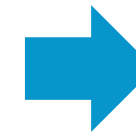
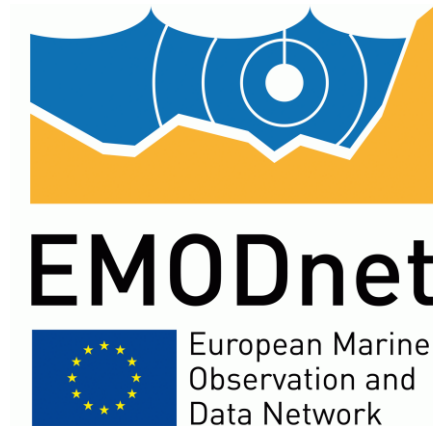
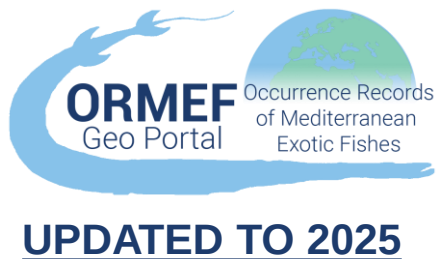
Data flow pipelines to EMODnet Biology and to the EU Digital Twin of the Ocean (DTO)

Third step

- Current Training
- On-line course by EMODnet Biology/EurOBIS

Expected results

The final ORMEF database will provide a unique collection of introduced fish records from 1896 to the most recent introductions



ORMEF TEAM



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