Open Research for Marine Biodiversity

Mobilising existing data to address the biodiversity and climate crises

Tom Webb, October 2021

The end result
A paper built with Open Research

https://doi.org/10.1002/ece3.6407

Thermal affinity of marine species
What is it, and why is it important?

- Organisms of all species have a preferred range of environmental temperatures

- They suffer, and may die, if you put them in temperatures hotter (or colder) than this

- We know we are making the seas warmer

- Knowing the thermal affinities of marine species helps to predict how communities will respond to this

- This is important for biodiversity, and for ecosystem services such as fisheries

Thermal affinity of marine species

How can we measure it?

- Gold Standard: Experimentally expose organisms to a range of temperatures and monitor their responses

- This is difficult, expensive, and can be ethically problematic

- People have done this for a few hundred species

- Others have collated all this data into meta-analyses and made it openly available

- But there are ~250,000 described marine species - experiments will never catch up
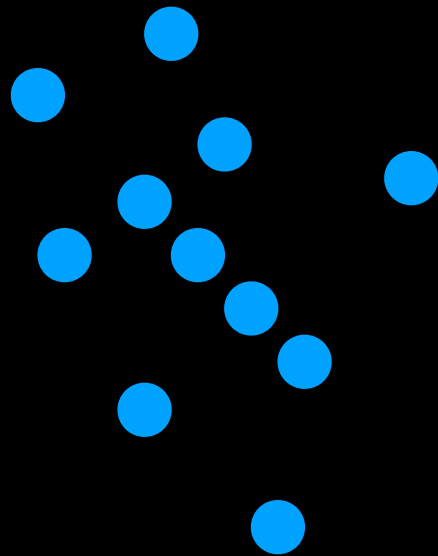
Thermal affinity of marine species

A short cut using open data and tools

If we know where organisms live, and we if know the environmental temperature in those locations - can we use this to assess thermal affinity for a larger range of marine species?

Occurrence records for
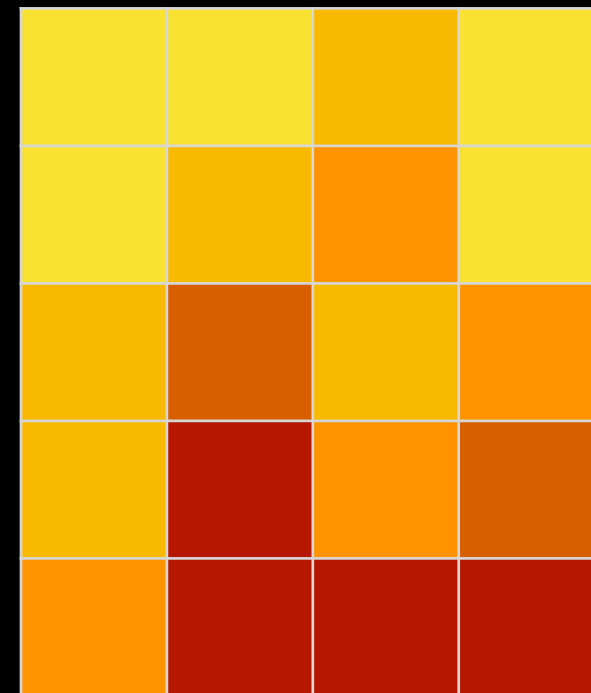a species - where does
it live?
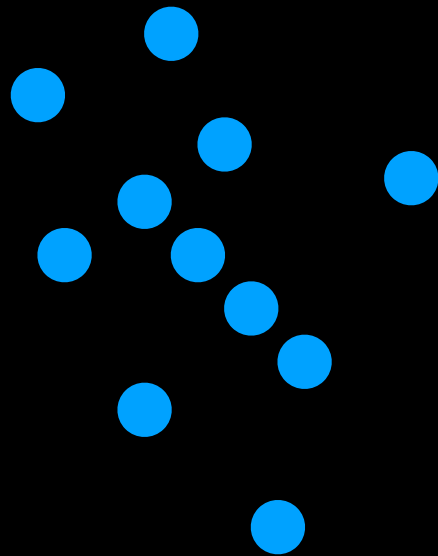
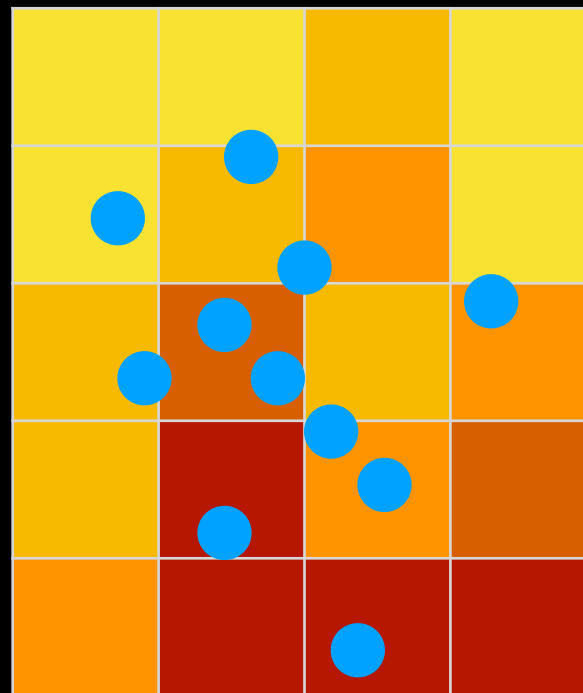Occurrence records for
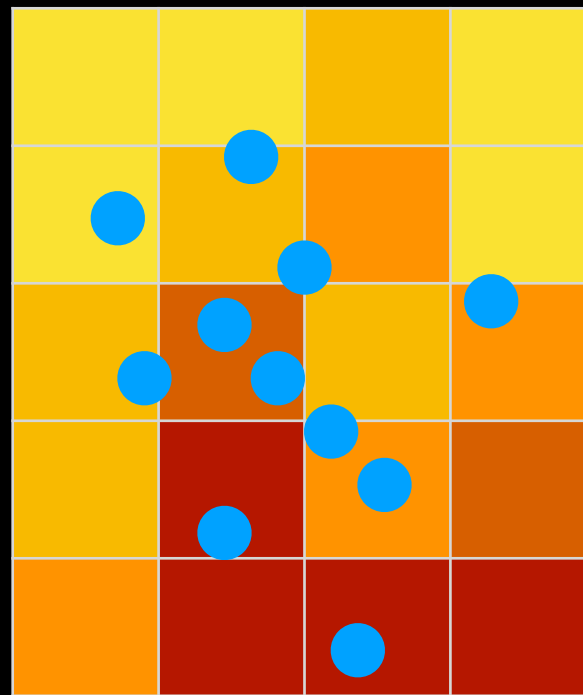a species - where does
it live?

+

Gridded sea temperature
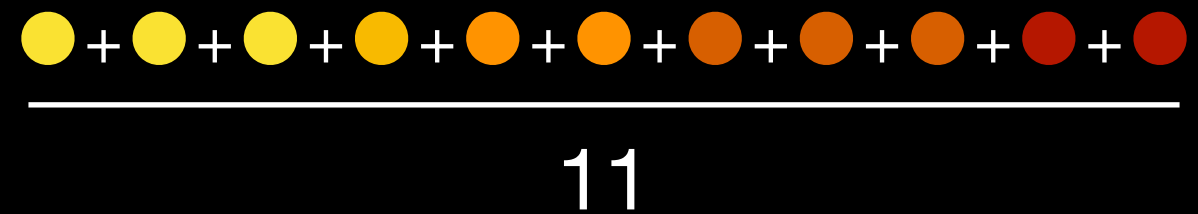dataset - what are the
environmental conditions?

Temperature of Occurrences

Temperature of Occurrences

Thermal affinity = average temperature of occurrences

Operationalising the concept using Open Research infrastructure

WoRMS — World Register of Marine Species — http://marinespecies.org/

Taxonomy, species traits

OBIS — OCEAN BIODIVERSITY INFORMATION SYSTEM — https://obis.org/

Species occurrences

Bio-ORACLE — Marine data layers for ecological modelling — https://www.bio-oracle.org/

Sea temperature

WoRMS
World Register of Marine Species
http://marinespecies.org/

OBIS OCEAN BIODIVERSITY INFORMATION SYSTEM
https://obis.org/
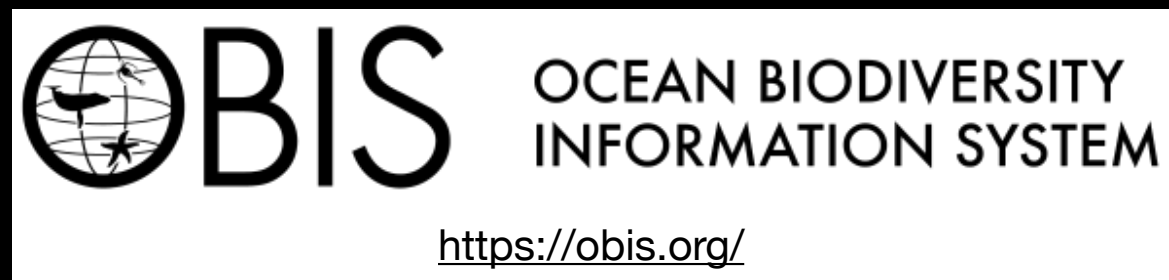
Bio-ORACLE
Marine data layers for ecological modelling
https://www.bio-oracle.org/

Free and Open Source software environment for statistical computing and graphics

https://www.r-project.org/

WoRMS — World Register of Marine Species
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Bio-ORACLE — Marine data layers for ecological modelling
https://www.bio-oracle.org/

IDE — RStudio
https://www.rstudio.com/

Data Science — Tidyverse
https://www.tidyverse.org/

R
https://www.r-project.org/

Spatial Data
https://github.com/rspatial

Documentation — R Markdown from RStudio
https://rmarkdown.rstudio.com/

API Access — ROpenSci
https://ropensci.org/

WoRMS

World Register of Marine Species
http://marinespecies.org/

OBIS
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Bio-ORACLE
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https://www.bio-oracle.org/

Version Control & Hosting
https://github.com/

IDE
R Studio
https://www.rstudio.com/

Data Science
Tidyverse
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R
https://www.r-project.org/

Spatial Data
https://github.com/rspatial

Documentation
R Markdown
from **R Studio**
https://rmarkdown.rstudio.com/

API Access
ROpenSci
https://ropensci.org/

Outputs

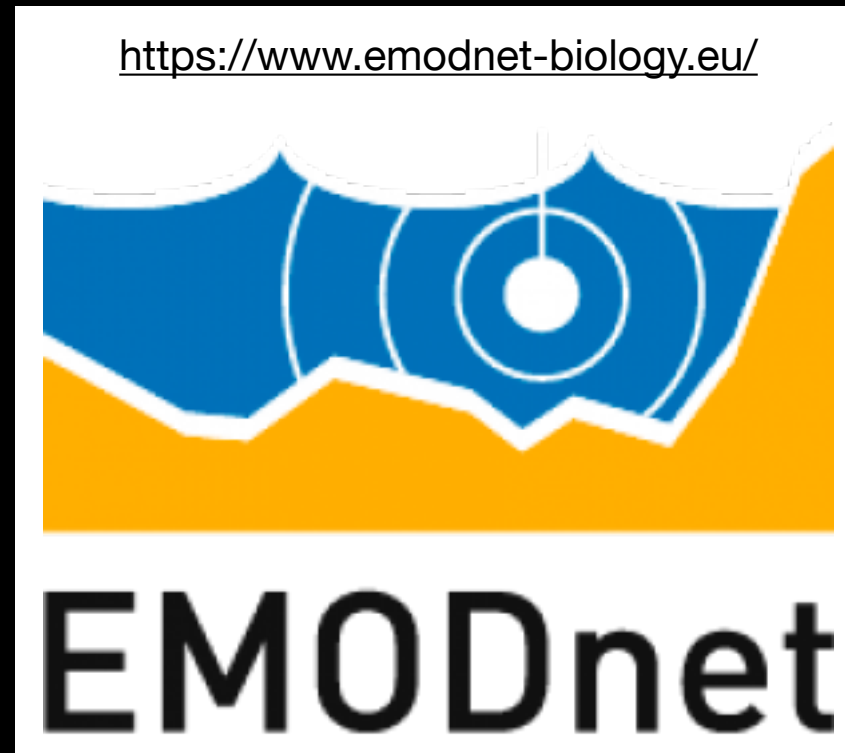# The paper

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DATA AVAILABILITY STATEMENT

A major aim of this work is to make the tools required to replicate, adapt, and extend the methods presented freely available to the community. Our work uses existing publicly available data, and we show users how to access the same data from within the open source statistical environment R. Processed datasets and code for analysis and visualization are available via GitHub (https://github.com/tomjwebb/occurrence-derived-thermal-affinity) and are also deposited in Figshare via the University of Sheffield's Online Research Data repository, https://doi.org/10.15131/shef.data.12249686 .

https://github.com/tomjwebb/occurrence-derived-thermal-affinity
https://doi.org/10.15131/shef.data.12249686

Further data products

https://www.emodnet-biology.eu/

Unlocking European Marine Biodiversity Data

Extension to all European marine species: https://doi.org/10.1002/ece3.6407

Extension to seabed habitats: https://github.com/EMODnet/EMODnet-Biology-Benthic-Habitats-Occurrences-Traits

Open Research mobilises the data we need to address the climate and biodiversity crises, and gives others the tools to take our work further

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