



A revised and enhanced AquaMaps 2.0

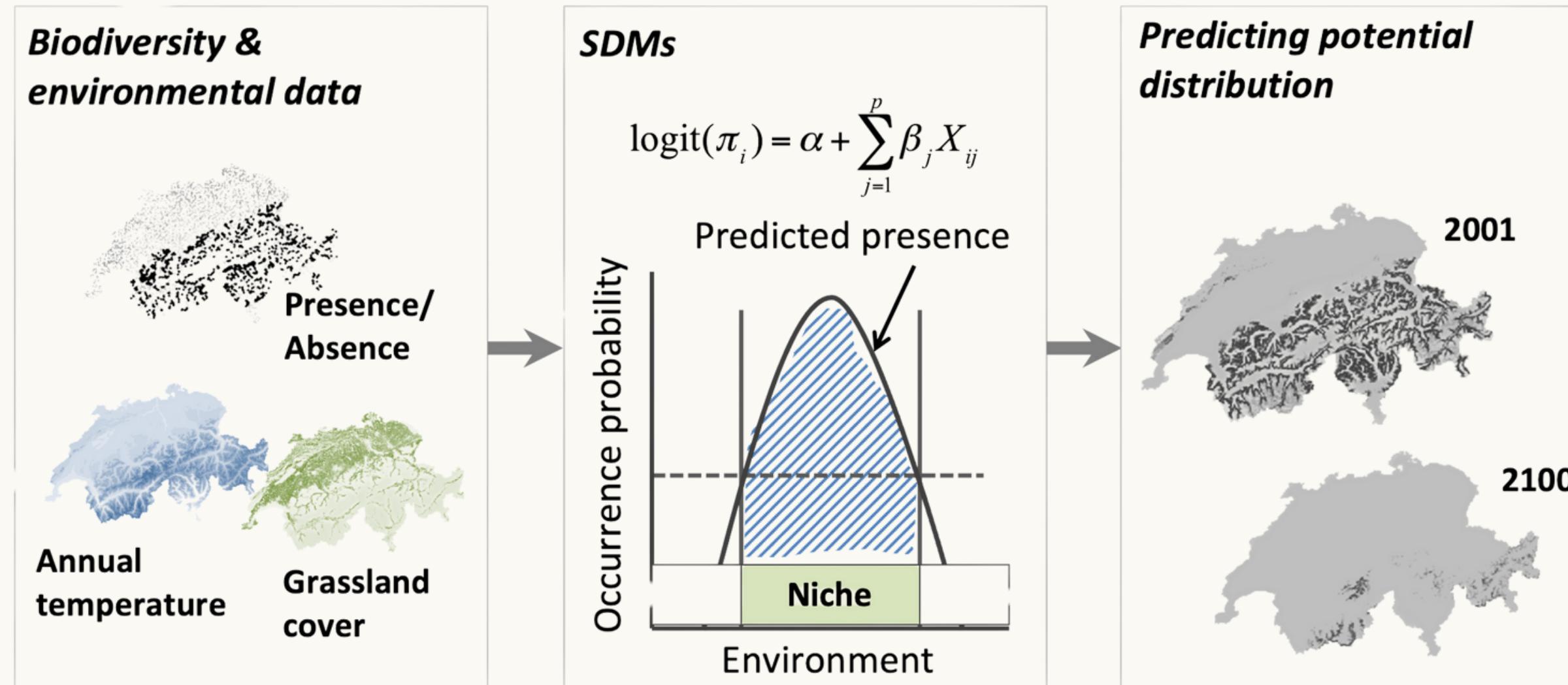
Applications for Ocean's Big Five

Presented by Yulia Egorova

made possible by the **AquaX** team

Species Distribution Model

« A species can occur in a **multidimensional environmental** interval that has been defined by the **evolution** shaping their physiological and competition characteristic to compete for resources and **persist** »



G. Evelyn Hutchinson



AquaMaps

What is AquaMaps

Founded in 2002

<https://www.aquamaps.org/>

An open Database

Gadus morhua Linnaeus, 1758
Atlantic cod

Upload your photos and videos
[Pictures](#) | [Videos](#) | [Sounds](#) | [Stamps, cons, misc.](#) | [Google image](#)



Gadus morhua
Picture by [Morris.P](#)

Add your observation in Fish Watcher
[Native range](#) | [All suitable habitat](#) | [Point map](#) | [Year 2050](#)

This map was computer-generated and has not yet been reviewed.
Gadus morhua Aquamaps Data sources: OBIP OBIS

Classification / Names [Common names](#) | [Synonyms](#) | [Catalog of Fishes](#)(genus, species) | [ITIS](#) | [Col.](#) | [WoRMS](#) | [Cloffa](#)

Teleostei (teleosts) > [Gadiformes](#) (Cods) > [Gadidae](#) (Cods and haddocks)

Etymology: *Gadus*: Latin, *gadus* = a fish, cod; ([Ref. 45335](#)).
More on author: [Linnaeus](#).

Environment: milieu / climate zone / depth range / distribution range [Ecology](#)

Marine; brackish; benthopelagic; oceanodromous ([Ref. 51243](#)); depth range 0 - 600 m ([Ref. 1371](#)), usually 150 - 200 m ([Ref. 54441](#)). Temperate; 0°C - 15°C; 83°N - 35°N, 76°W - 86°E ([Ref. 1371](#))

Distribution [Countries](#) | [FAO areas](#) | [Ecosystems](#) | [Occurrences](#) | [Point map](#) | [Introductions](#) | [Faunafri](#)

North Atlantic and Arctic: Ungava Bay in Canada along the North American coast to Cape Hatteras; North Carolina in the western Atlantic. East and west coast of Greenland; around Iceland; from Barents Sea including the region around Bear Island along the European coast to Bay of Biscay ([Ref. 88171](#)).

Length at first maturity / Size / Weight / Age

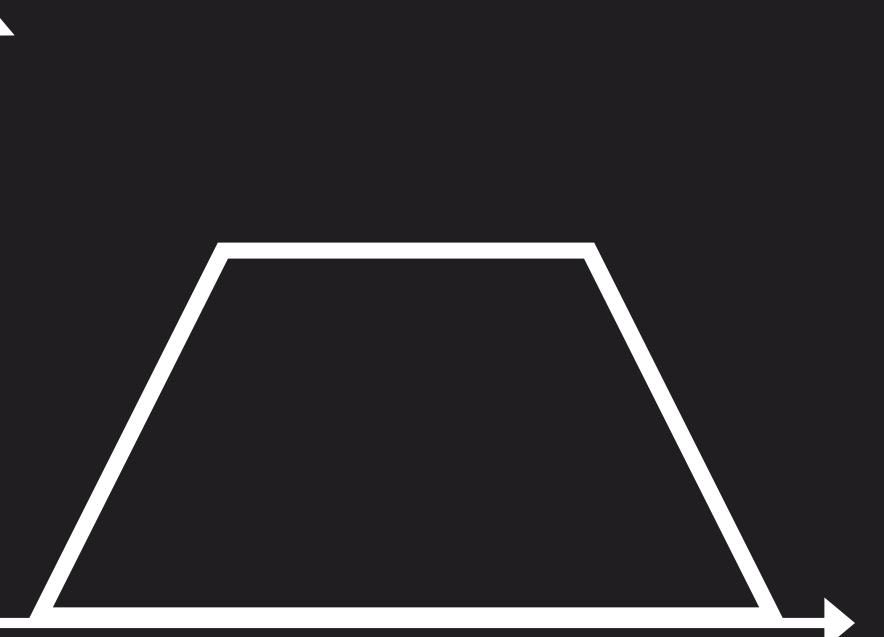
Maturity: L_m [65.4](#), range 31 - 74 cm
Max length : 200 cm TL male/unsexed; ([Ref. 1371](#)); common length : 100.0 cm TL male/unsexed; ([Ref. 1371](#)); max. published weight: 96.0 kg ([Ref. 9988](#)); max. reported age: 25 years ([Ref. 173](#))

Short description [Identification keys](#) | [Morphology](#) | [Morphometrics](#)

Dorsal spines (total): 0; Dorsal soft rays (total): 44 - 55; Anal spines: 0; Anal soft rays: 33 - 45; Vertebrae: 51 - 55. Protruding upper jaw, a conspicuous barbel on the lower jaw, and light lateral line, curved above the pectoral fins. Predorsal distance is less than one third of total length; body depth about 1/5 of total length. Color varies from brownish to greenish or gray dorsally and on upper sides, becoming pale and silvery ventrally. Peritoneum silvery.

Biology [Glossary](#) | [Search](#) [e.g. *epibenthic*] | [Rég](#)

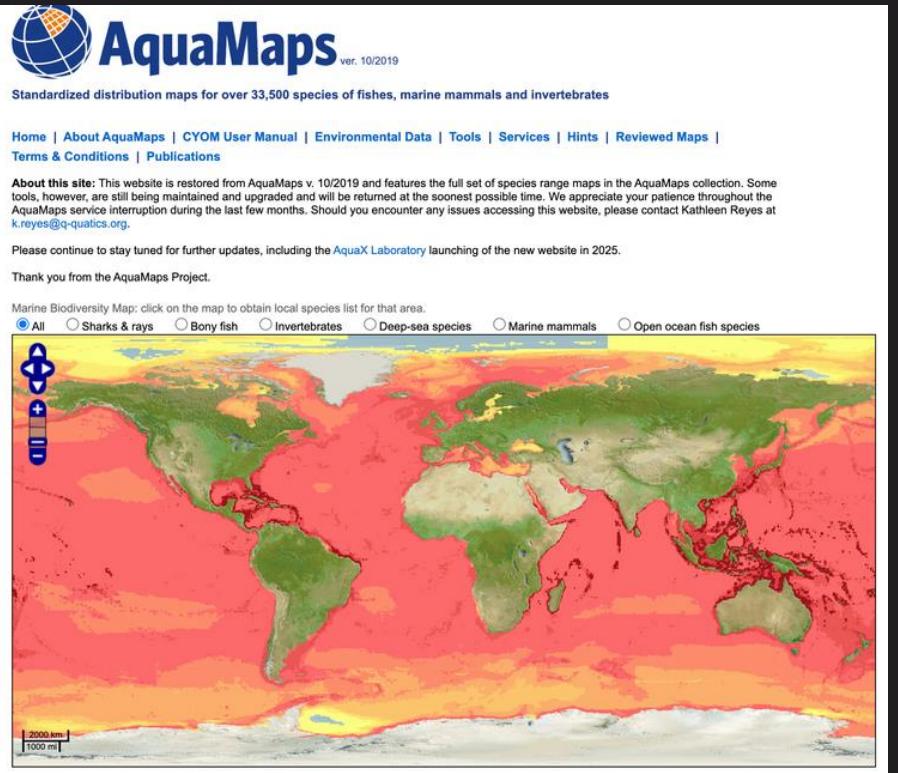
A simple Model



A biogeographical website with a database and information on all marine species and species richness

A trapazoidal model assuming the Hutchinson ecological niche

A tool

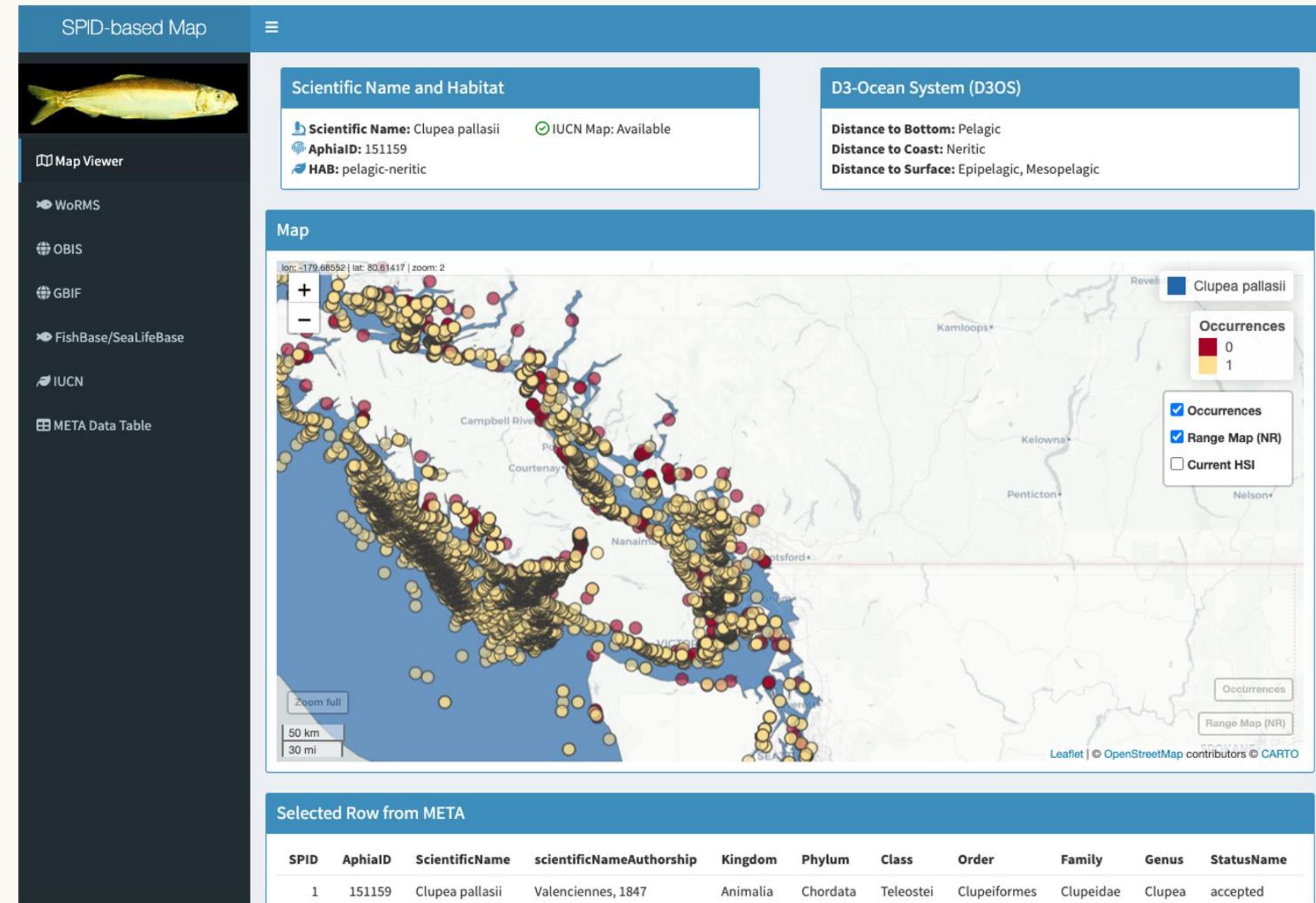


An open access and FREE tool for managers, stakeholders, NGOs, and international organizations for the conservation of biodiversity

A cross-platform database

Taxonomy:

- verified taxonomy from WORMS
- a unique Aphia ID



A cross-platform database

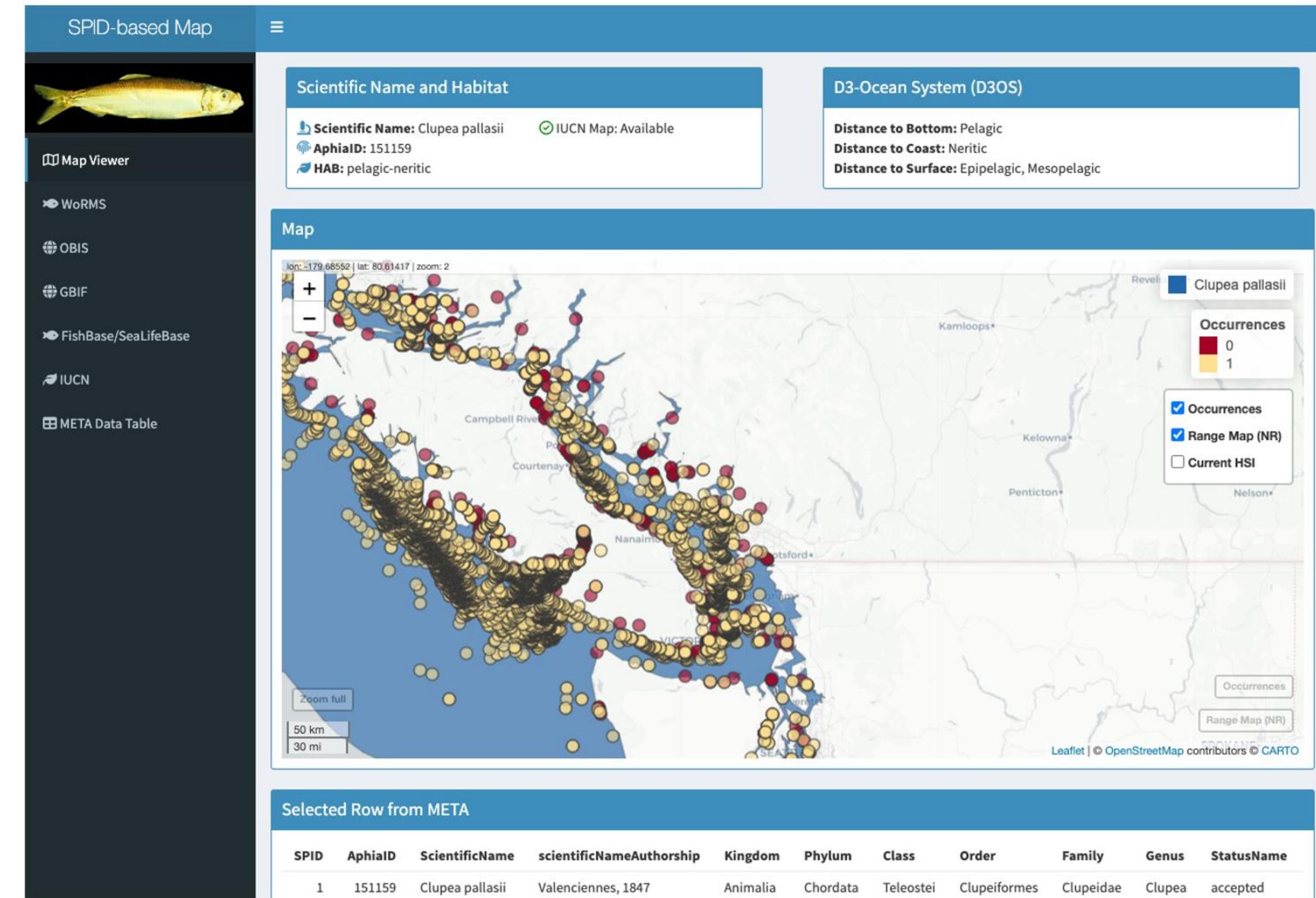
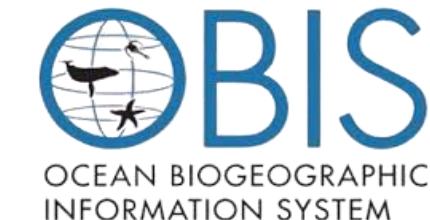


Taxonomy:

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Occurrence:

- From more several databases



A cross-platform database

Taxonomy:

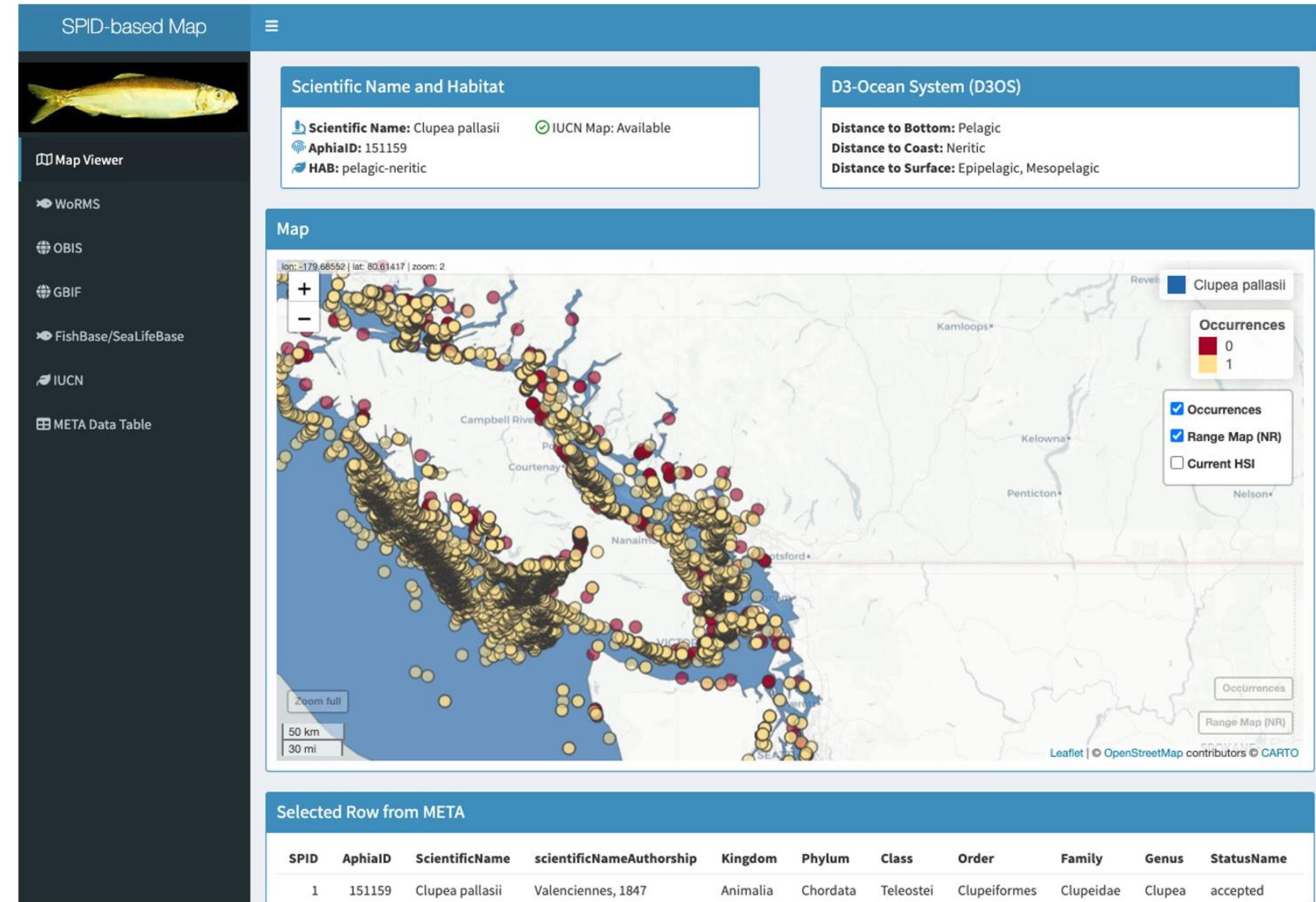
- verified taxonomy from WORMS
- a unique Aphia ID

Occurrence:

- From more several databases

Range map:

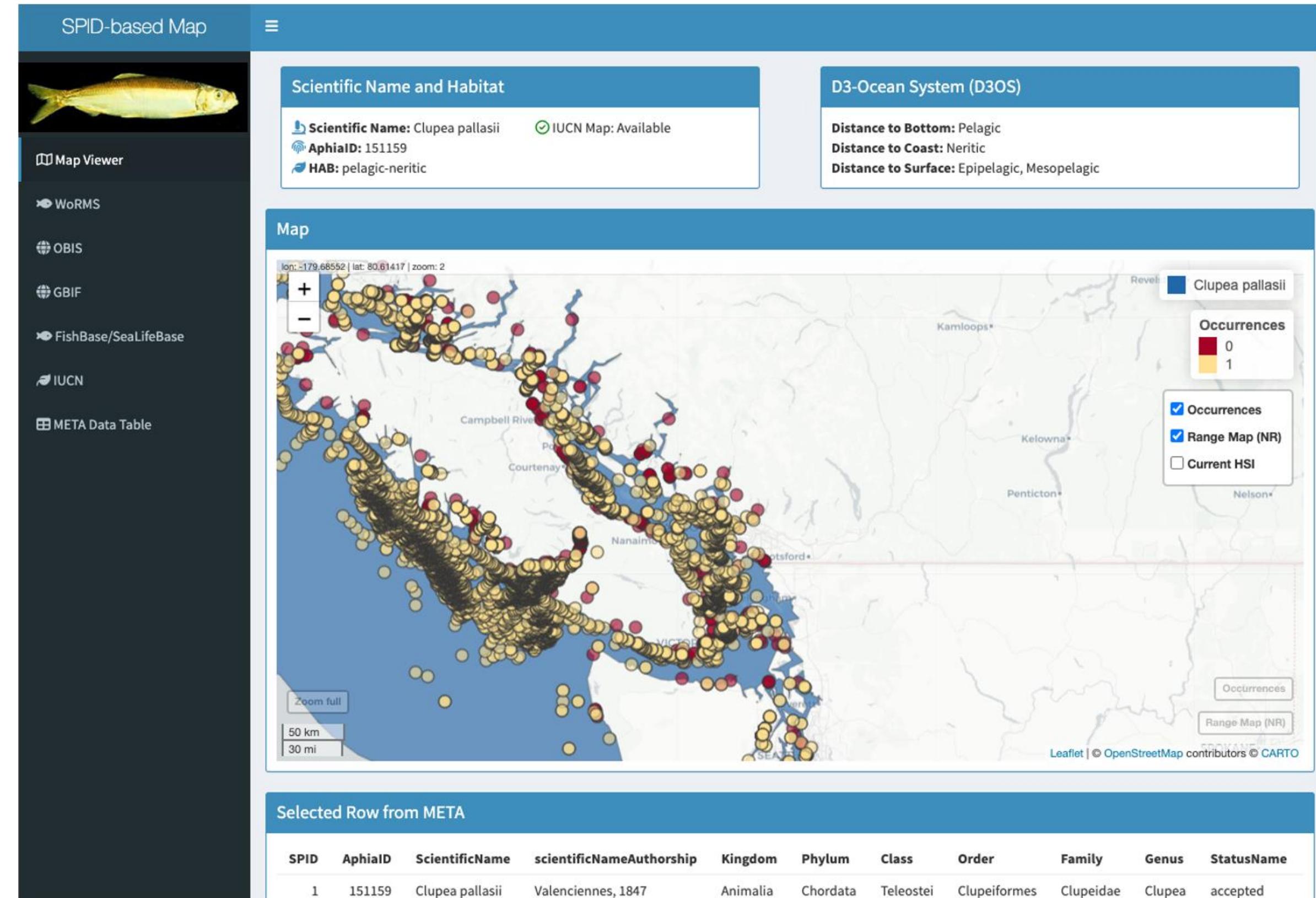
- Expert validated delimitation
- bounding box



A cross-platform database

Taxonomy:

- verified taxonomy from WORMS
- a unique Aphia ID



Occurrence:

- From more several databases

Range map:

- Expert validated delimitation

Ecology & Biogeography:

- depth range
- habitat
- bounding box

Before running SDM:

- Download occurrence data
- Define the species ranges
- Cleaning Occurrence

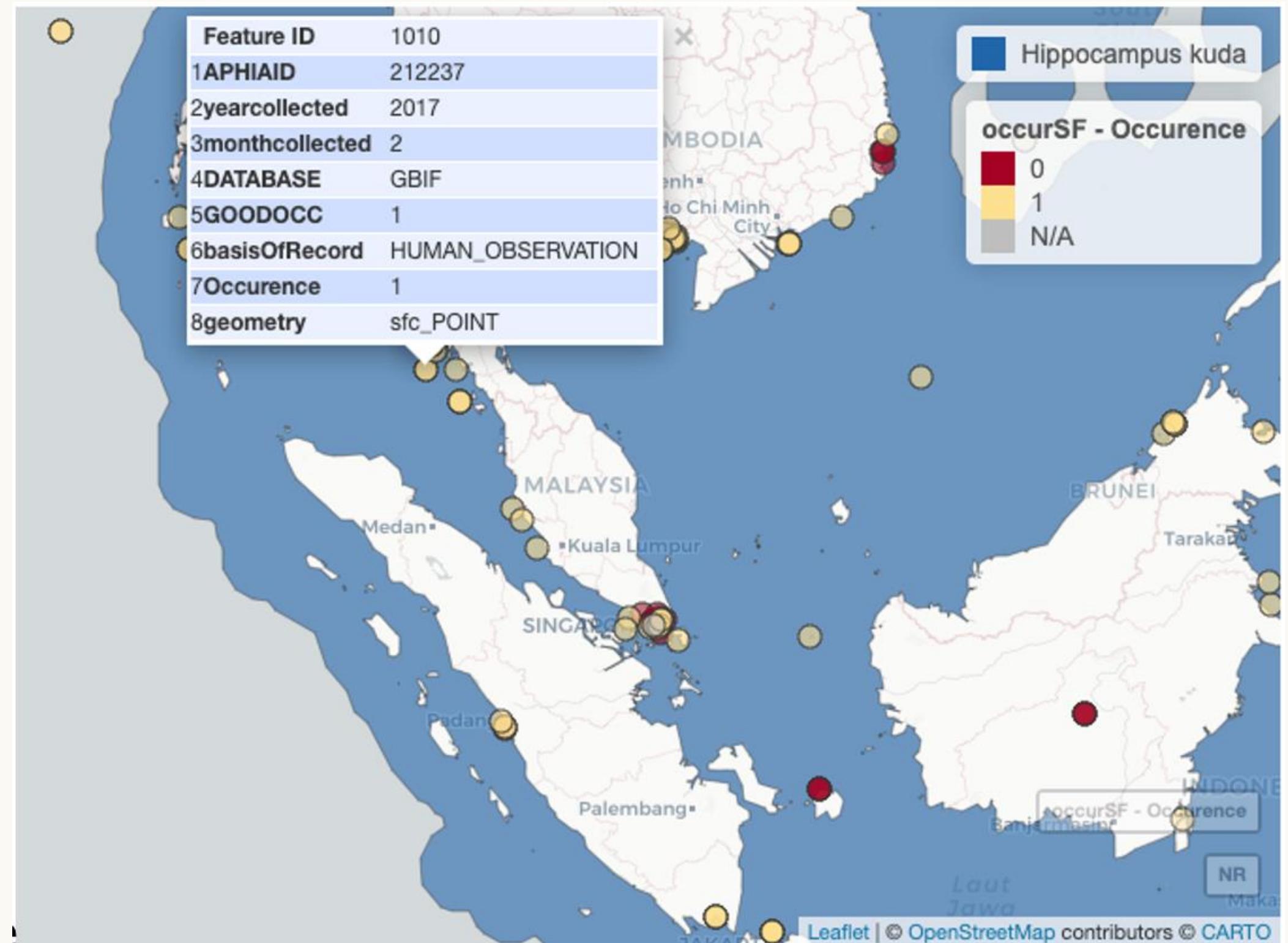
information Available

- "Lon/Lat",
- "AphiaID"
- "day/month/year"
- "basis of record"
- "FLAG"

remove duplicated entries from datasets

Flagged all the occurrences on land

Flagged occurrence outside expert knowledge
of AquaMaps RM or IUCN map



A New Environmental Database : Bio-Oracle 3.0



Period of layers

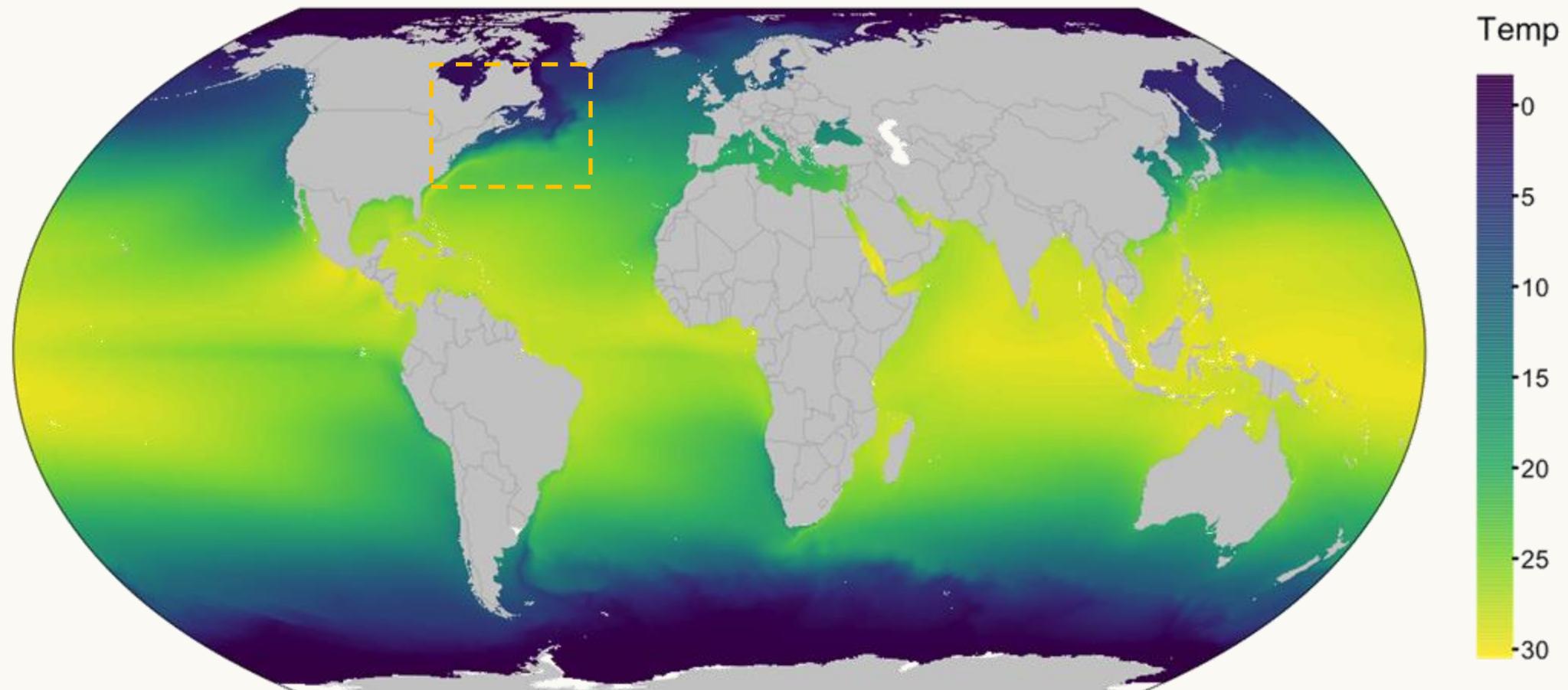
- Present-day conditions [decade 2000-2010]
- Present-day conditions [decade 2010-2020]
- Future conditions (select) ▾

- SSP1-1.9 SSP1-2.6 SSP2-4.5 SSP3-7.0 SSP4-6.0 SSP5-8.5

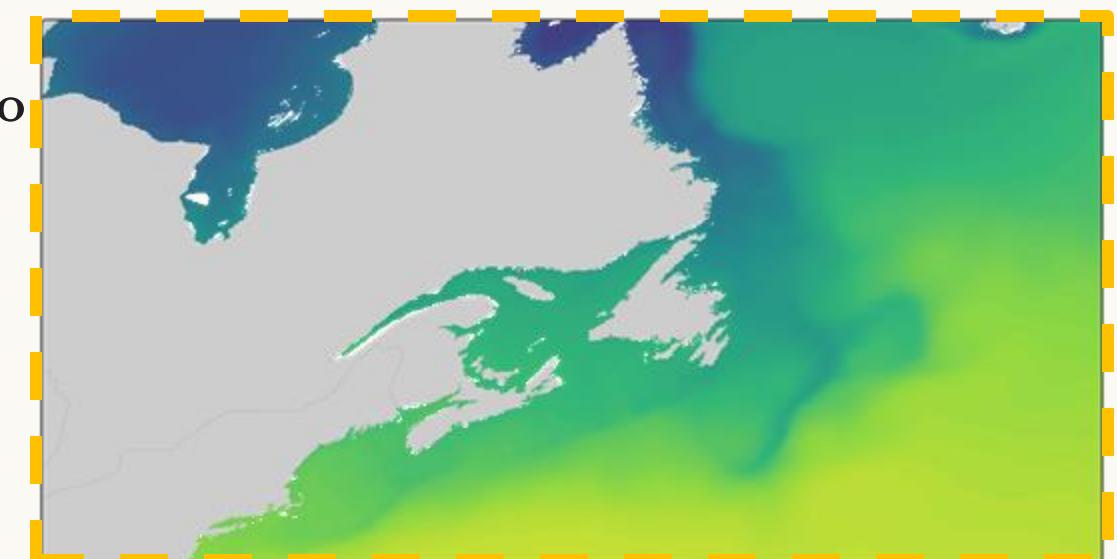
Data layers reflecting future conditions were developed under the Shared Socioeconomic Pathway (SSP) scenarios of future climate change. These span from a "sustainability" scenario SSP1-1.9 following the target of Paris Agreement of reduced greenhouse gas emissions, to the "fossil-fuelled development" SSP5-8.5 scenario of high emissions and low challenges to adaptation.

Depth of layers

- Surface layers [conditions at the top layer of the ocean]
- Benthic layers [conditions along the sea bottom]



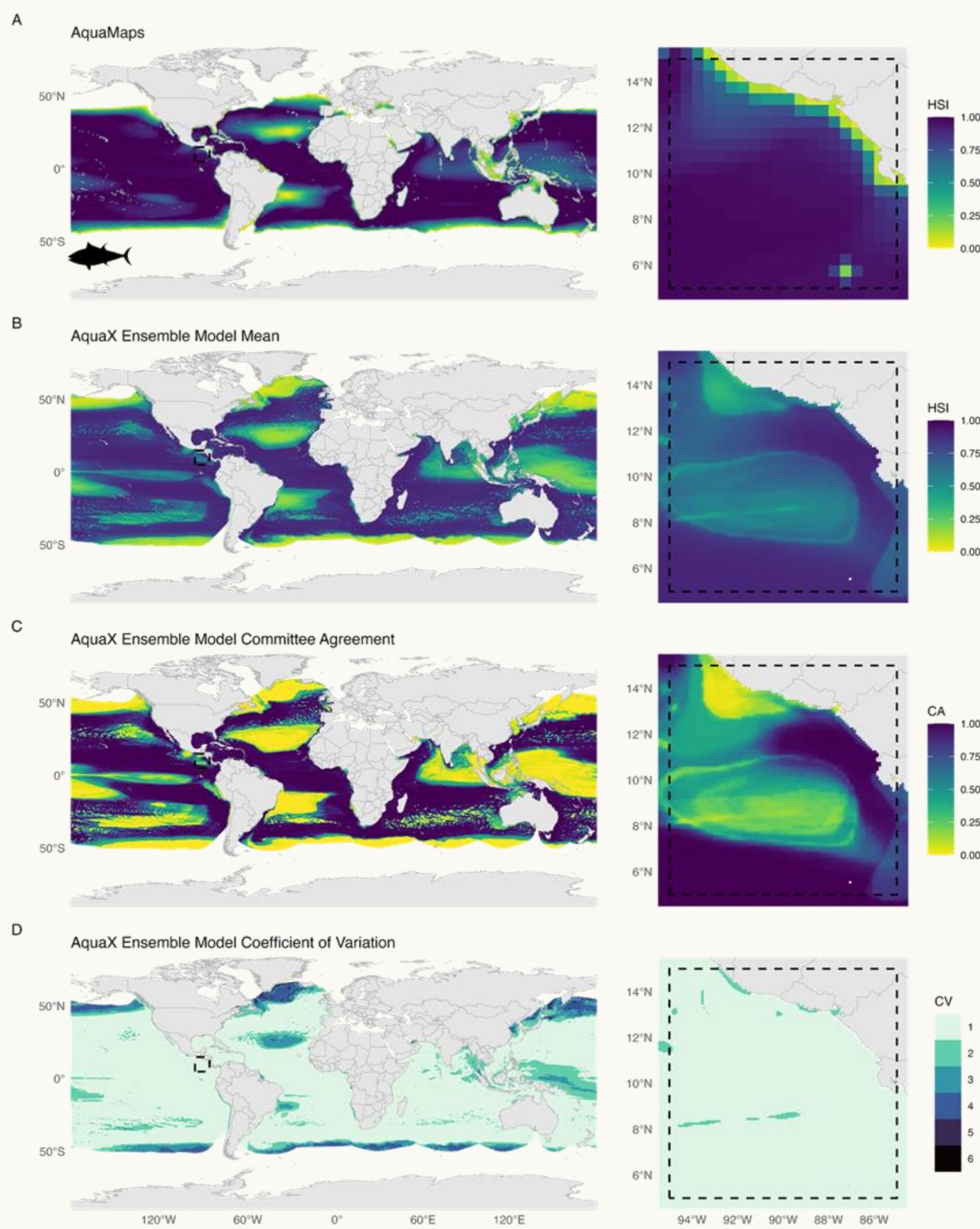
- Spatial Resolution : 0.05°
- 3 SSP-RCP scenarios
- 3 Decades
- 2 vertical layers



Package: [biooracle](#)

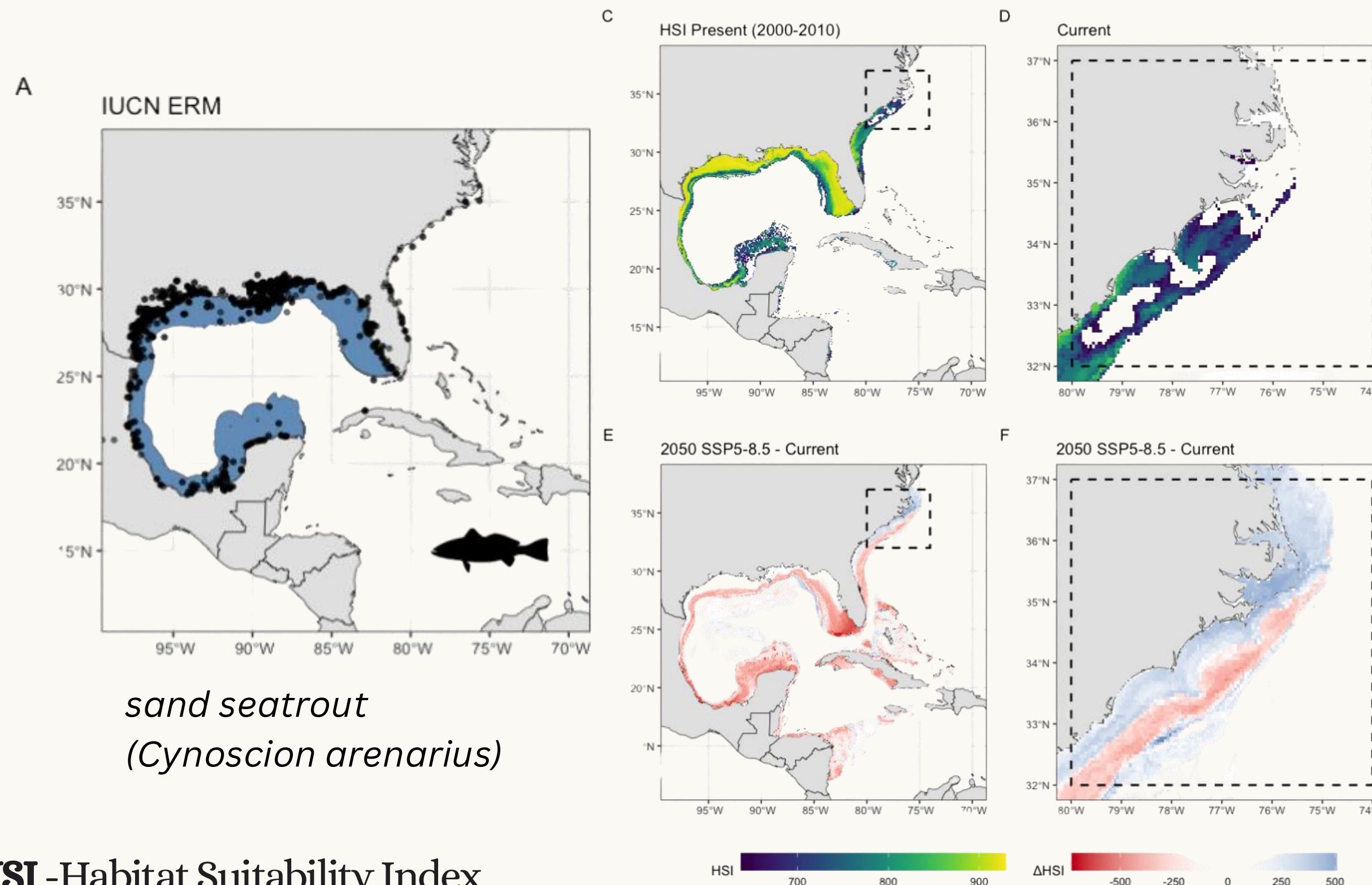
A Modern Modelling Approach

- An ecologically distinct way to model **pseudo-absences**
 - Environmental thinning of occurrence
 - Environmental PA sampling in n dimension
 - Surface Range Envelope
 - with spatial disk if benthic/demersal
- An **ensemble model** of 10 independent algorithms: package biomod2 4.2.4
 - Habitat suitability maps
 - Validation metrics
 - Spatial Uncertainty maps



Applications

Species Current and Future distribution

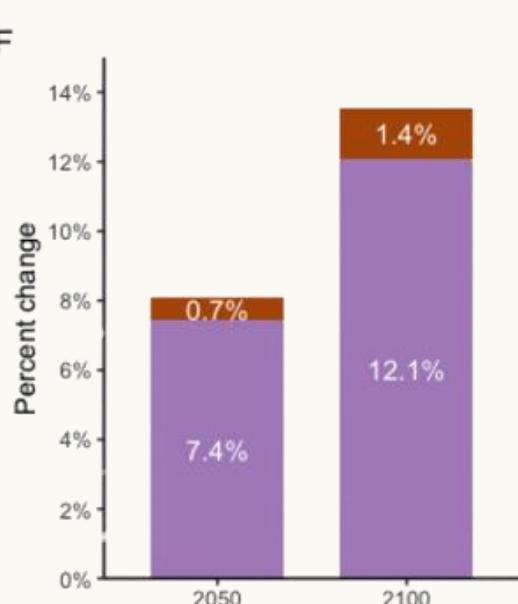
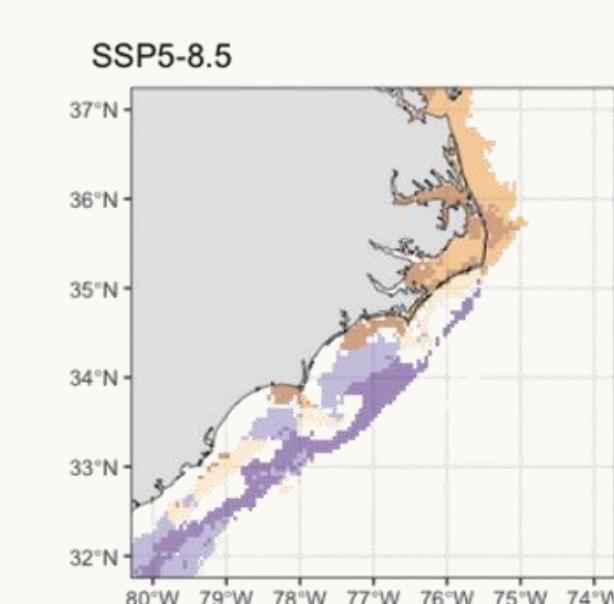
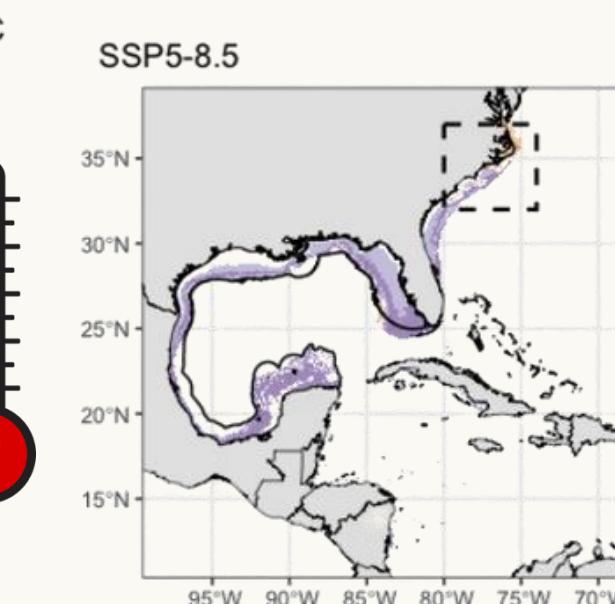
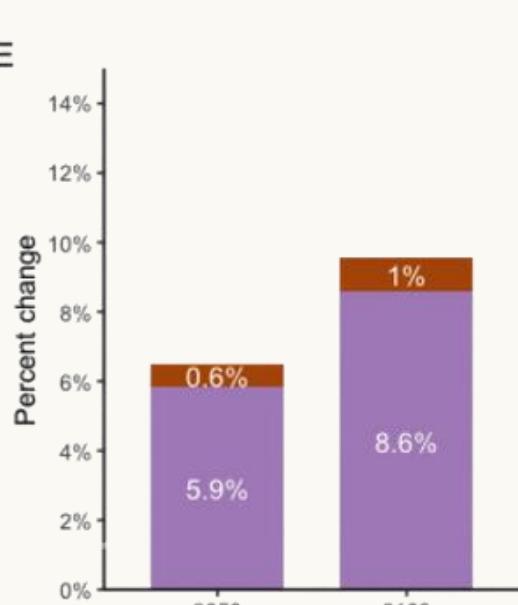
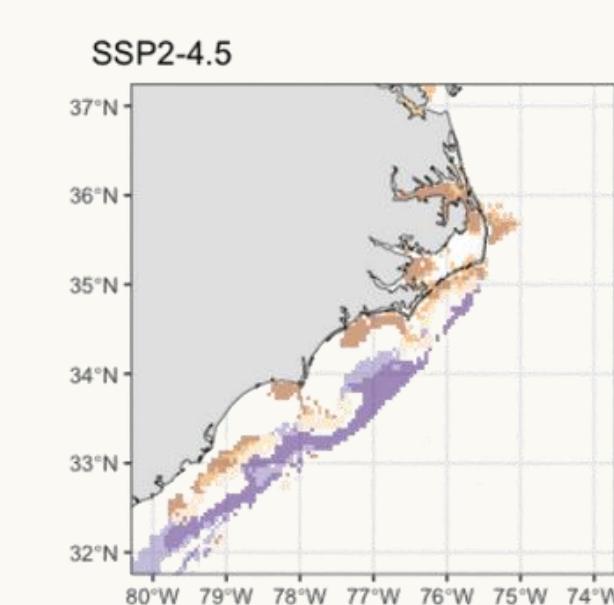
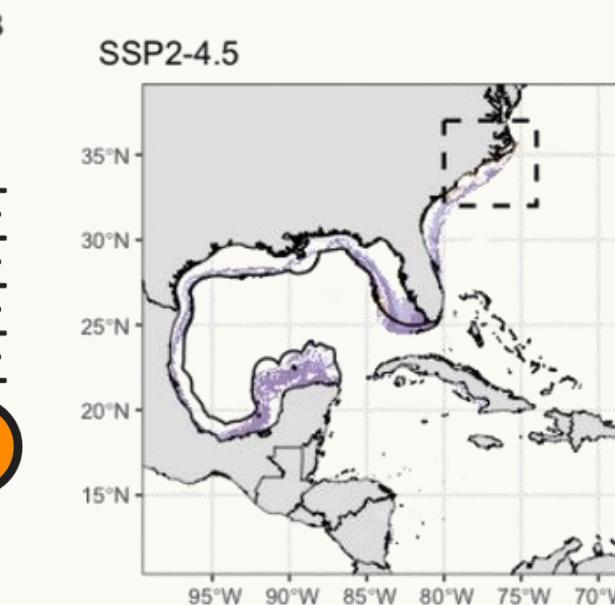
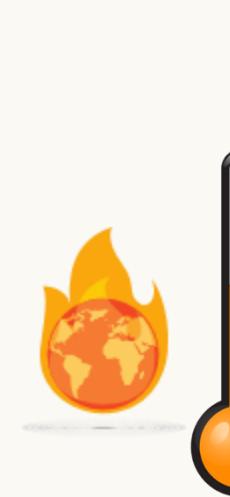
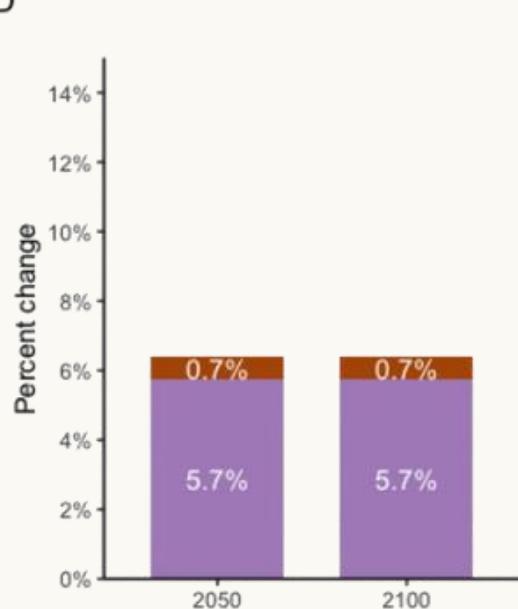
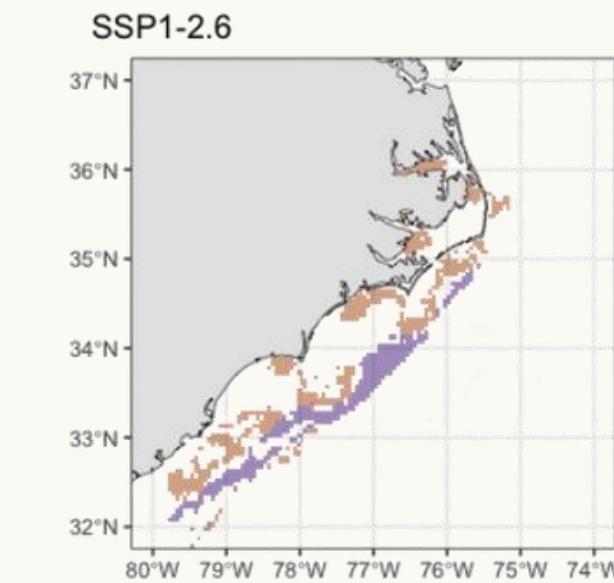
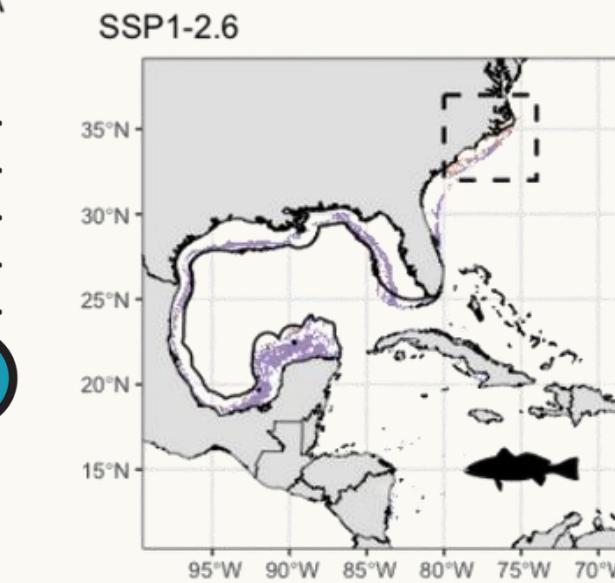


- **Tracking** accurately the reported invasion of sea trout
- Help for **MPA managers**
- **A tool** for Fisheries management

Applications

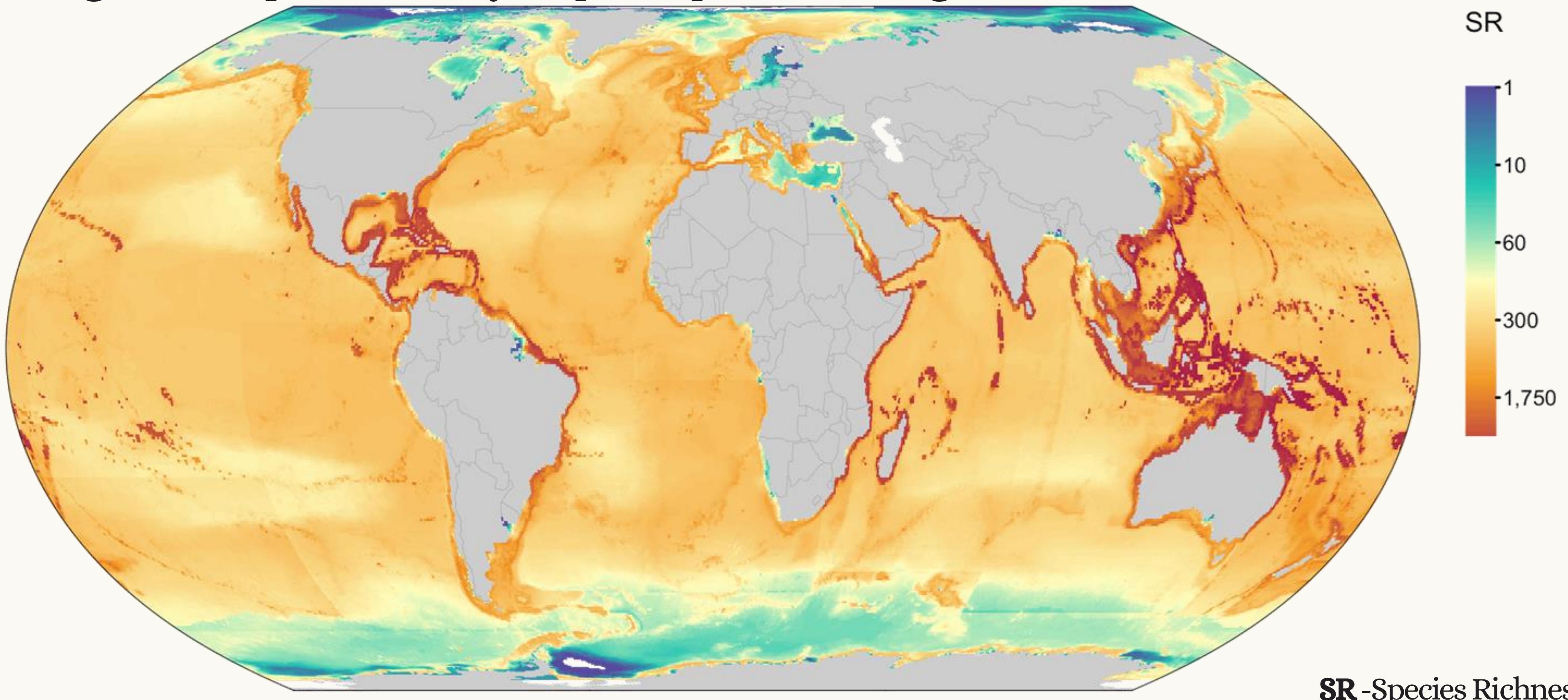
Climate change species indicators

- Indicator of **Local Extinction** and **Local Invasion**
- Change in habitat occupation
- Climate refuge

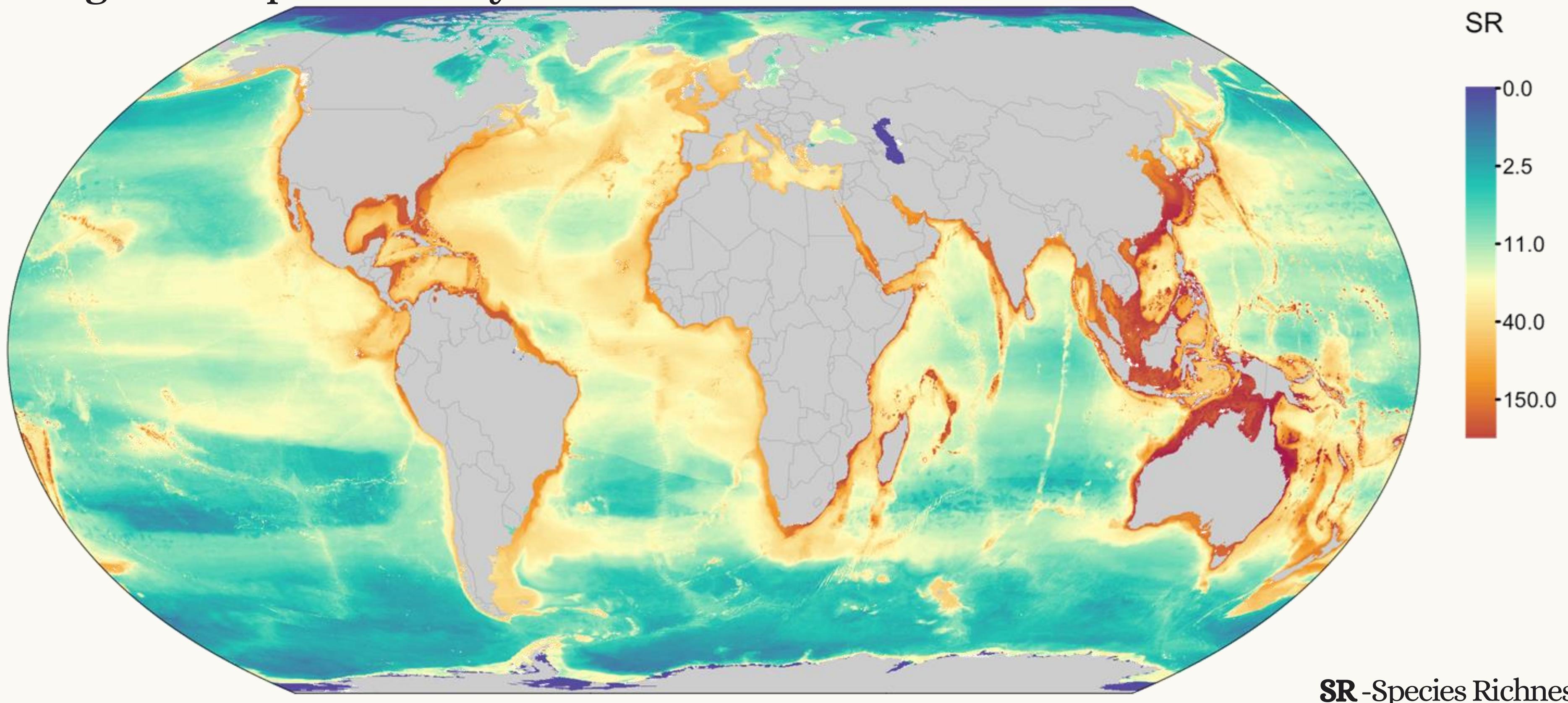


gain loss

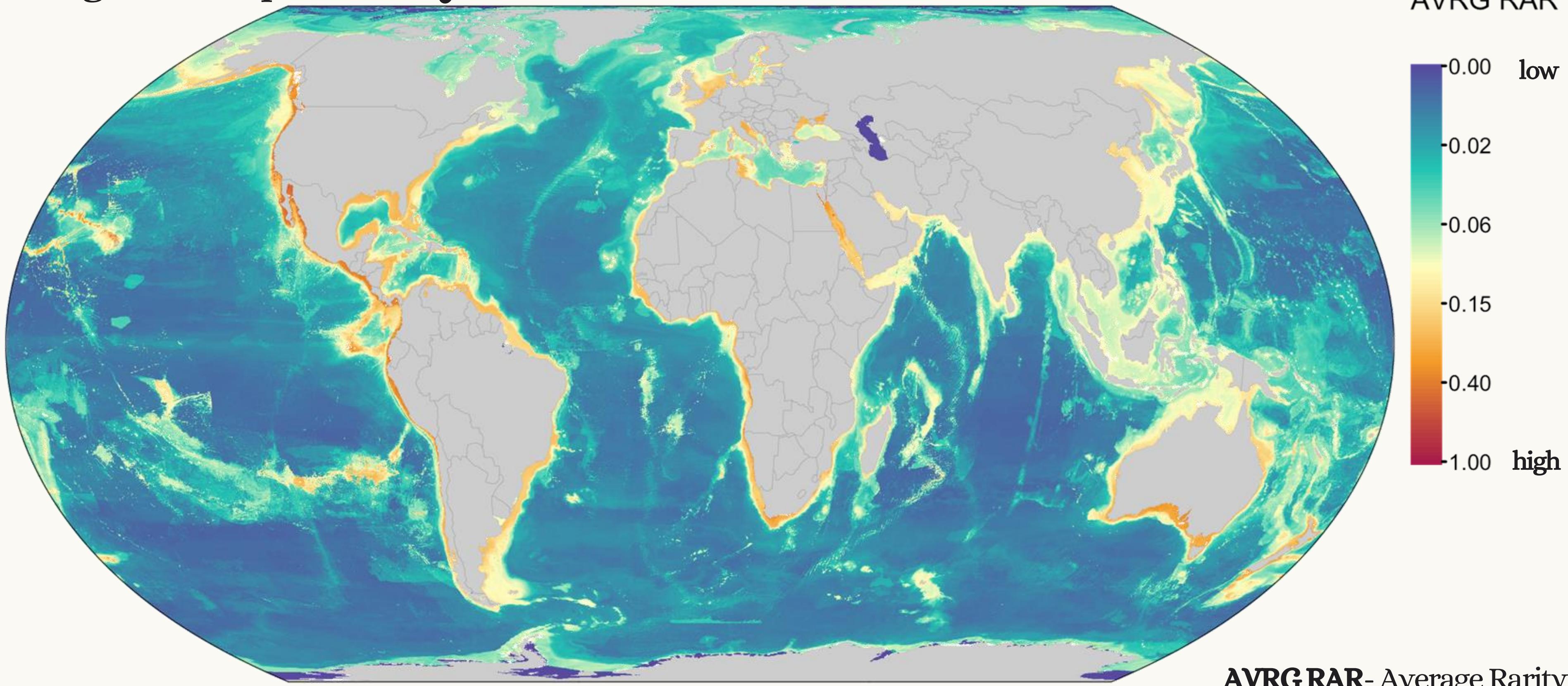
A global map of diversity (AquaMaps 0.5x0.5 degrees)



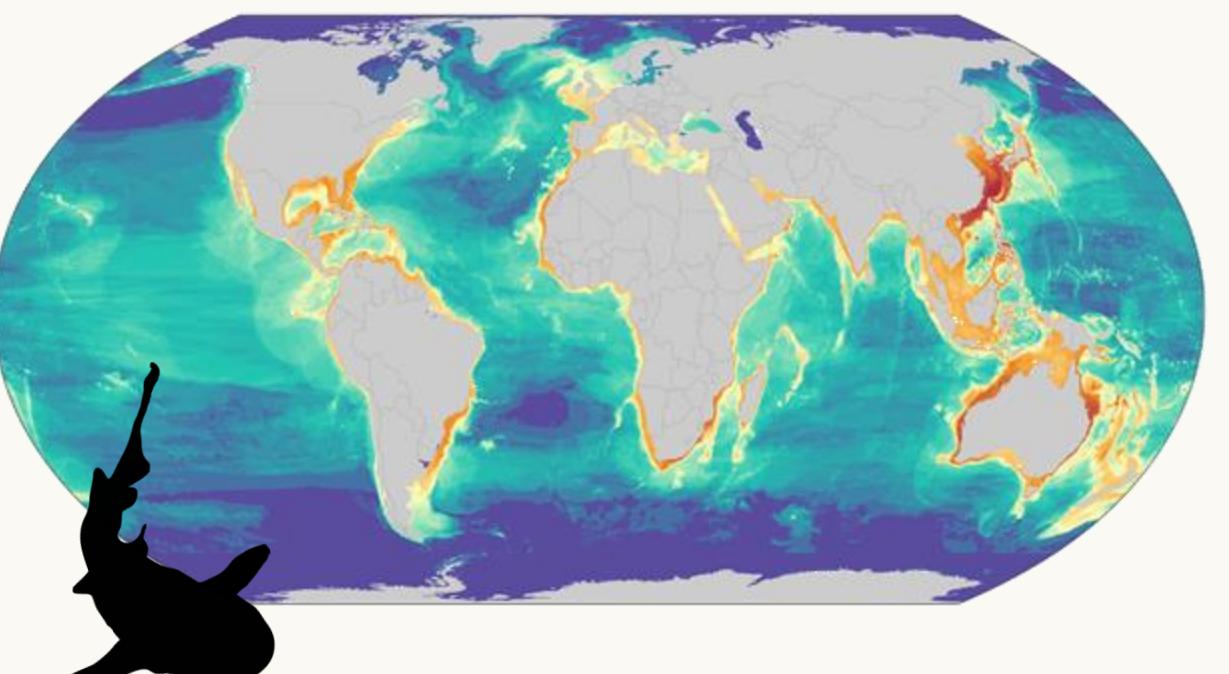
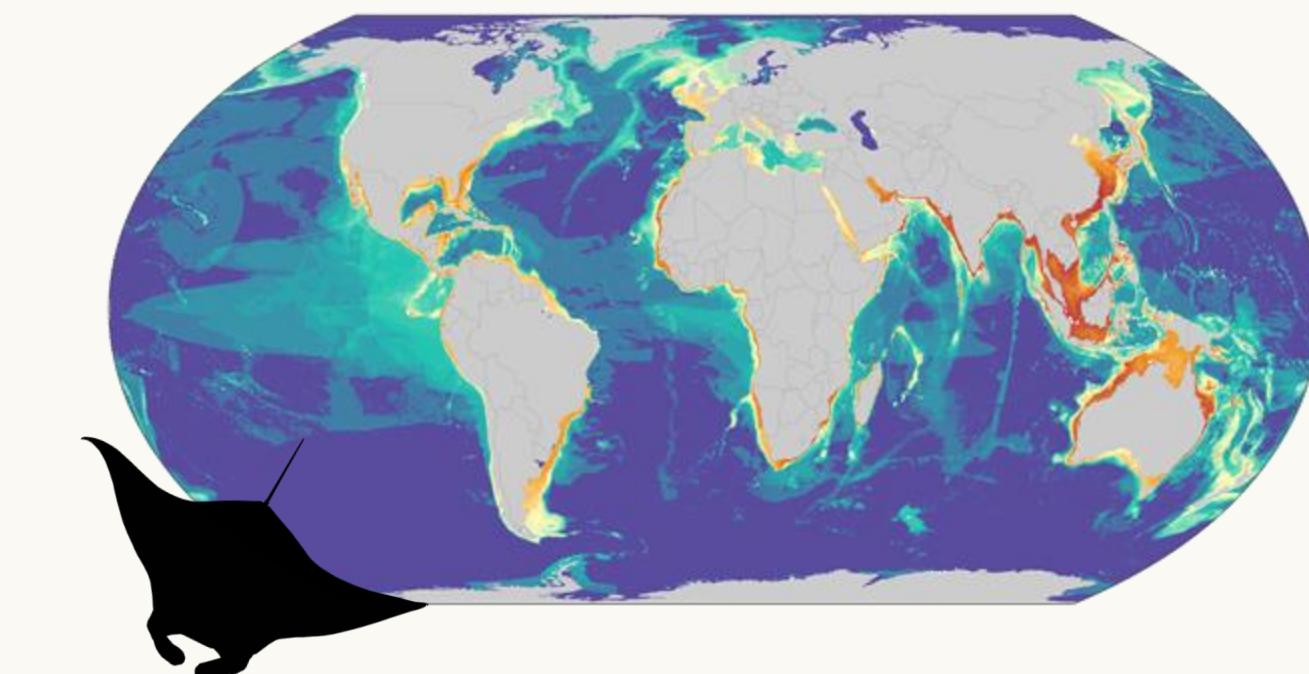
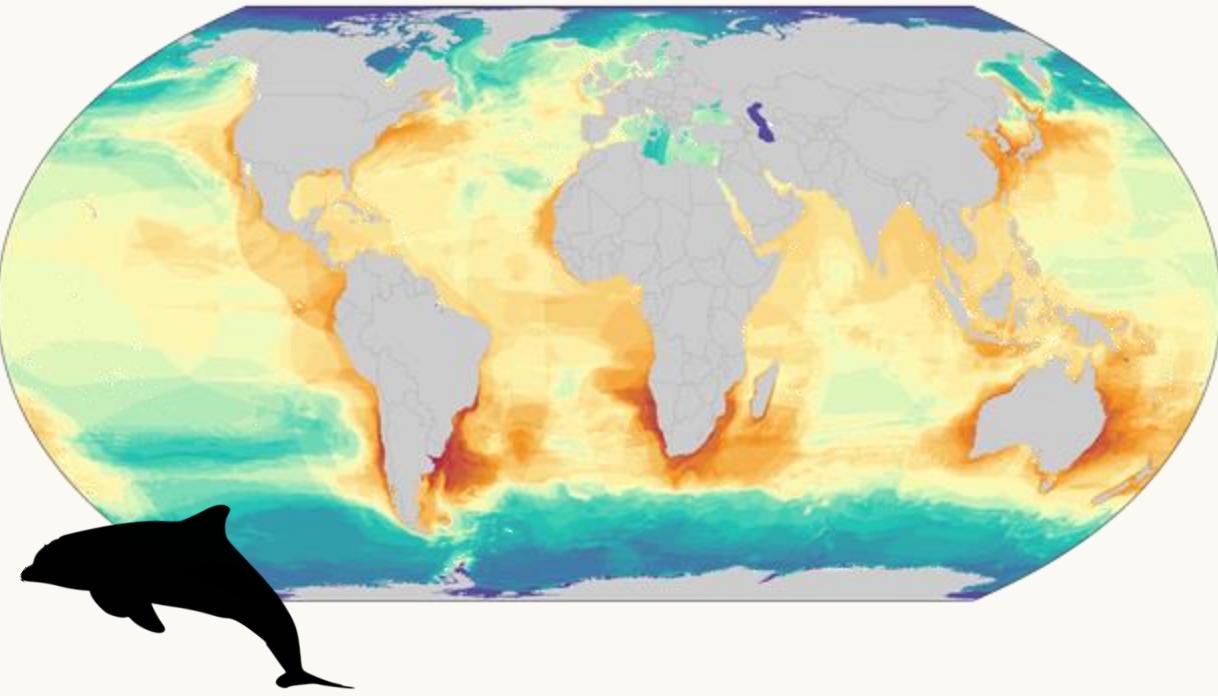
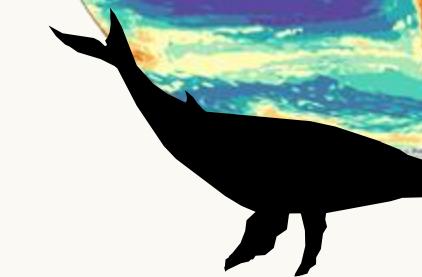
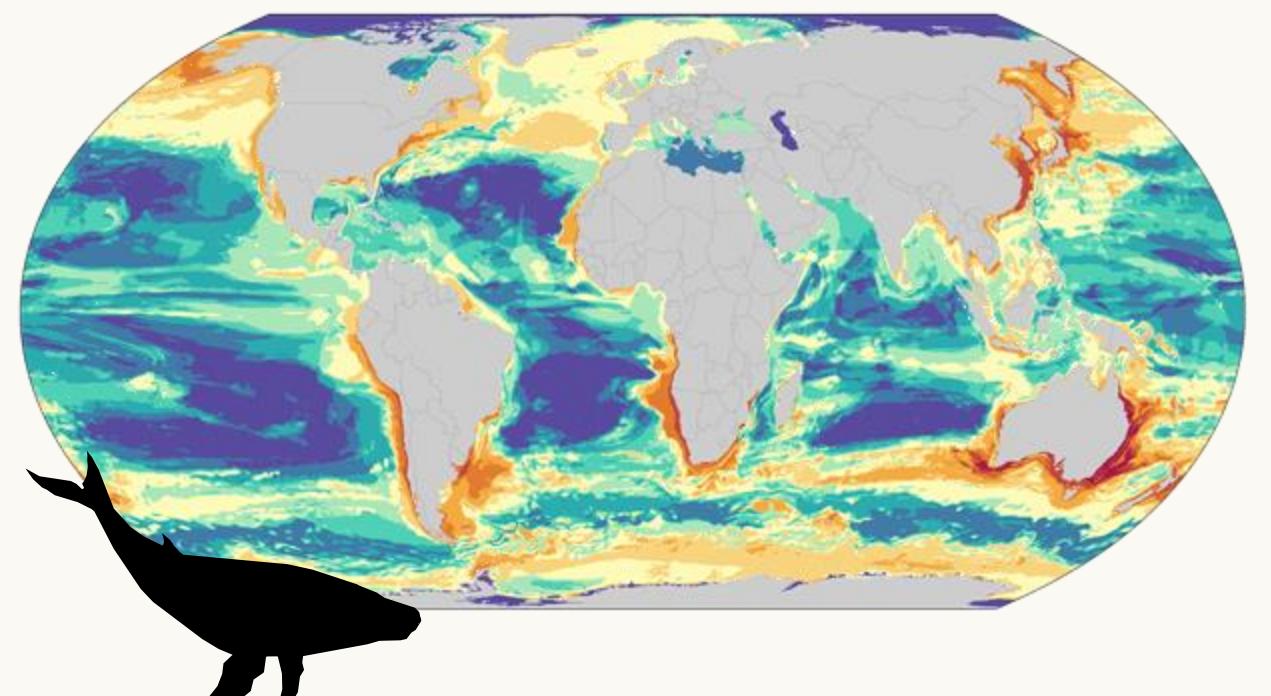
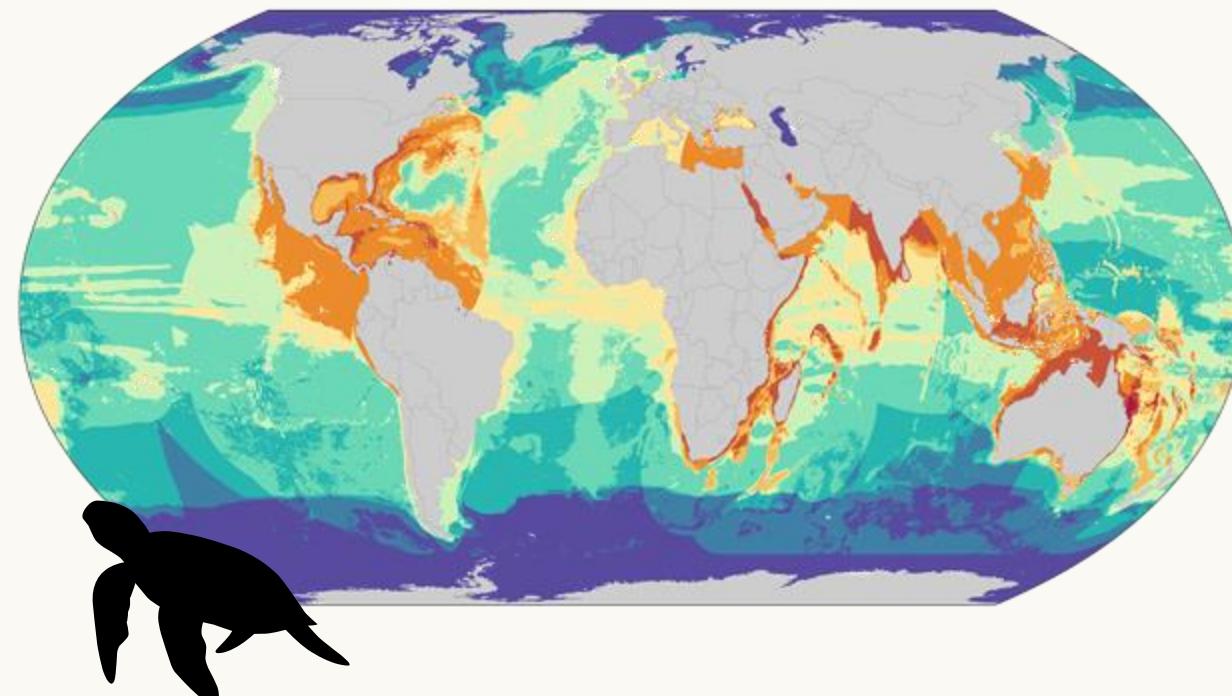
A global map of diversity **at 5km resolution**



A global map of **Rarity**



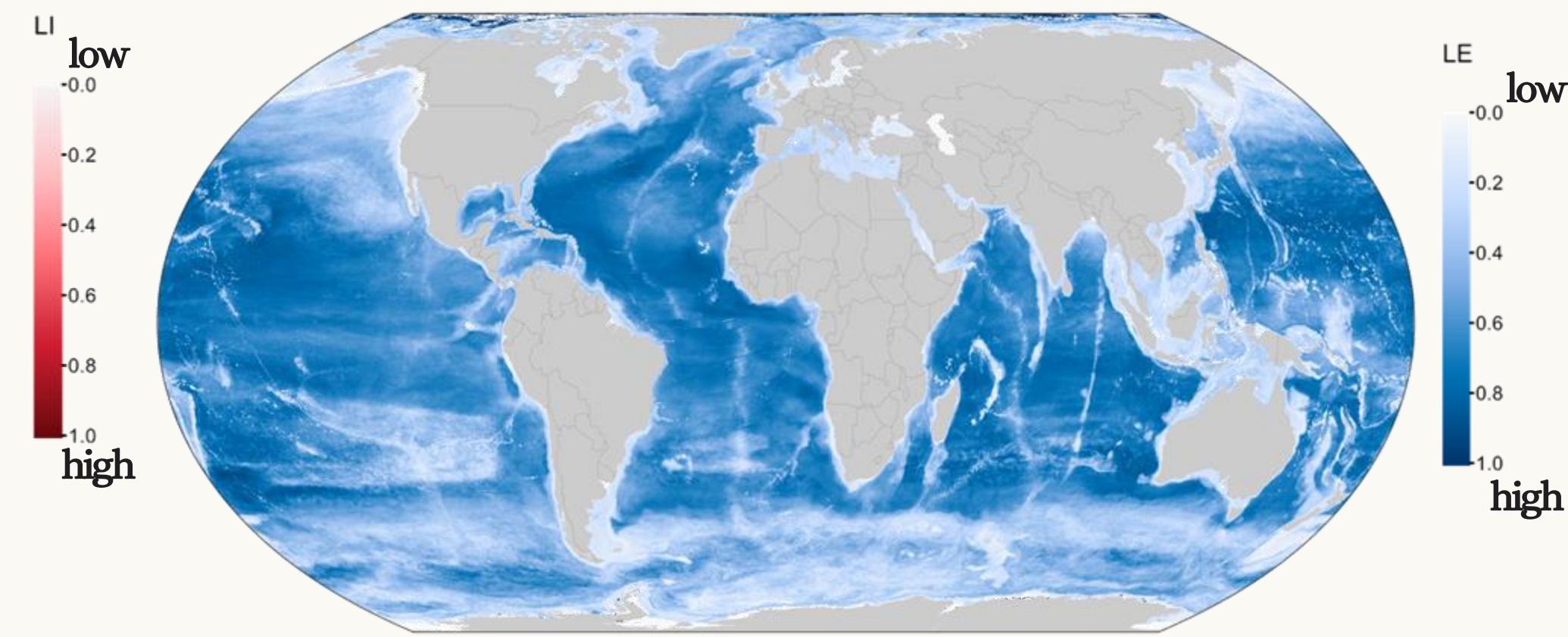
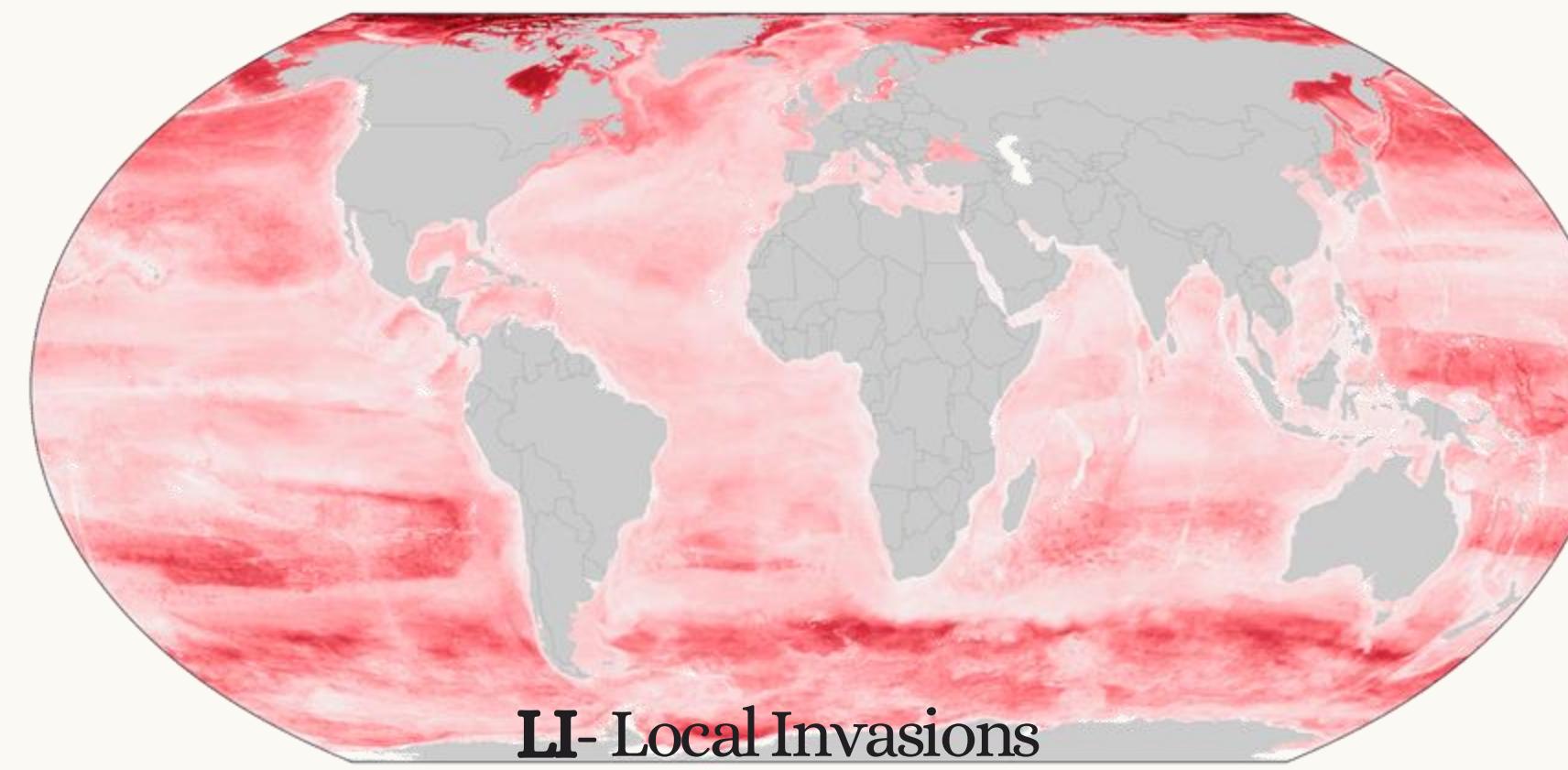
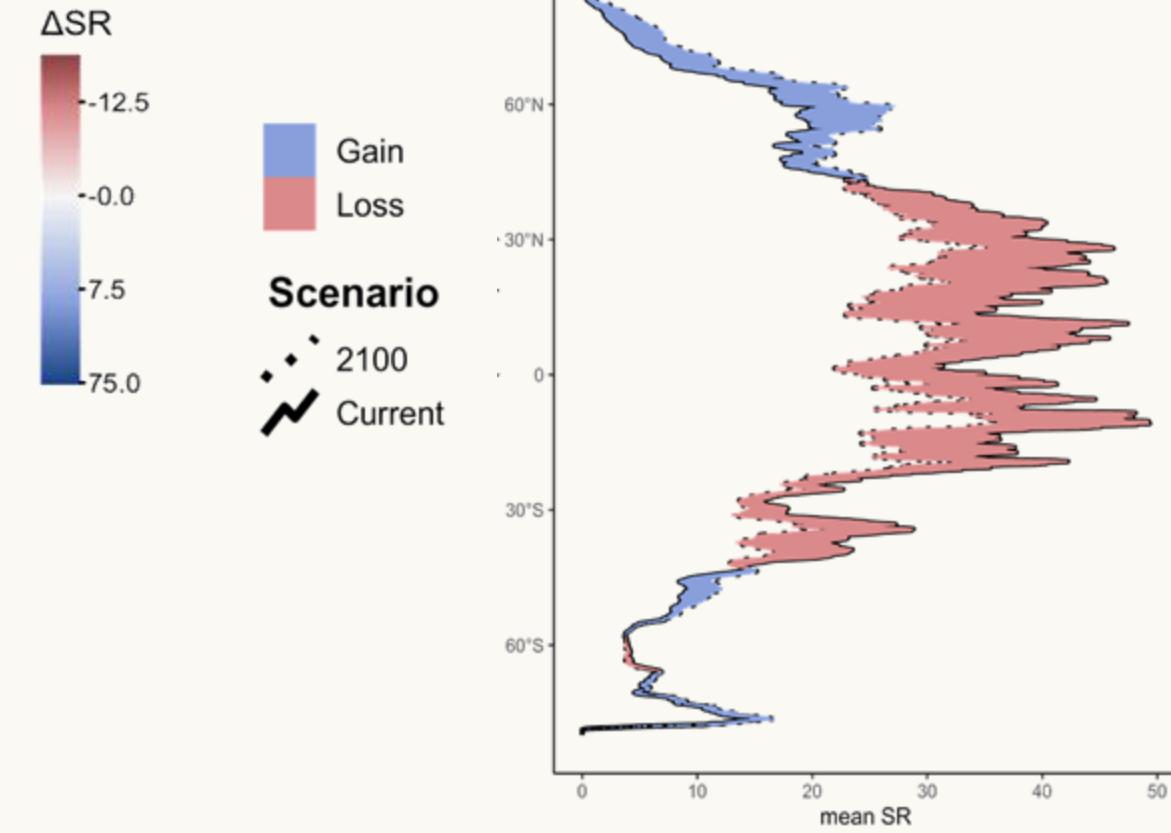
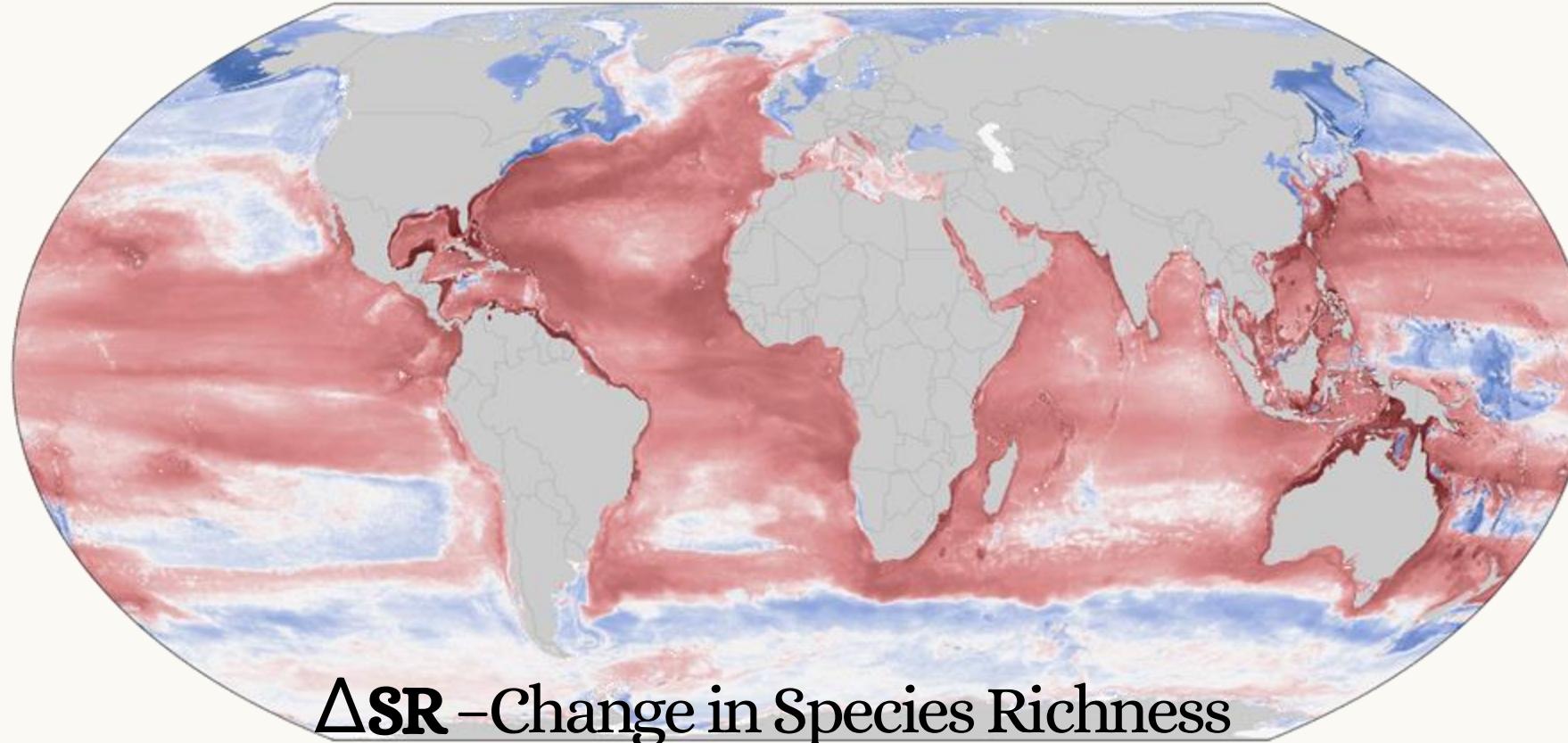
A global map of diversity at 5km resolution **and for multiple taxa**



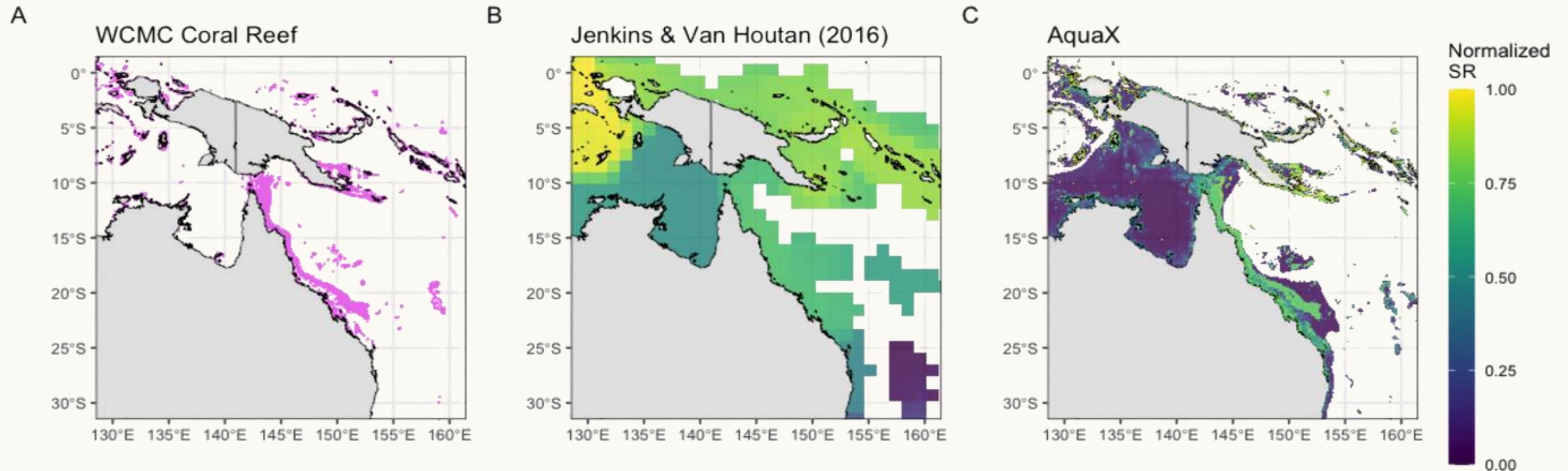
low

high

Indicators of climate change impacts



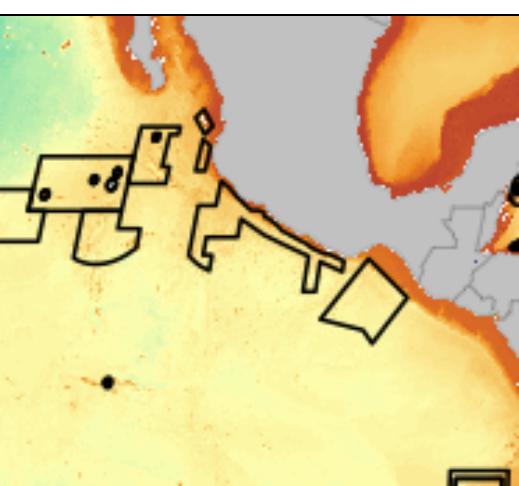
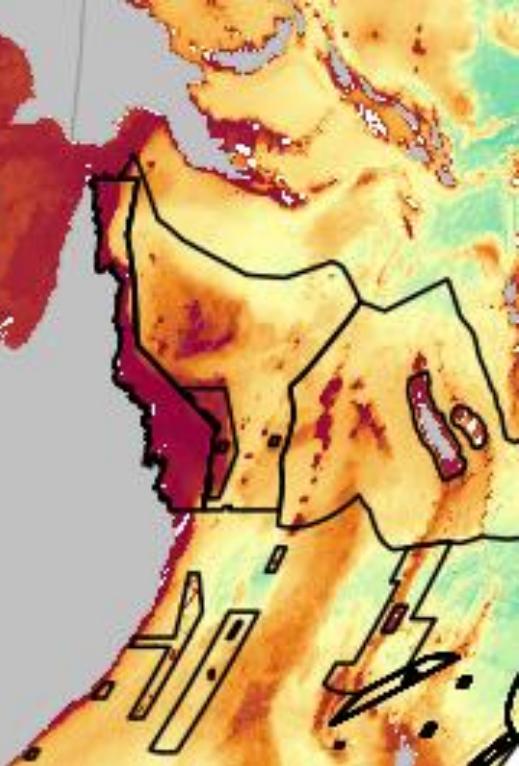
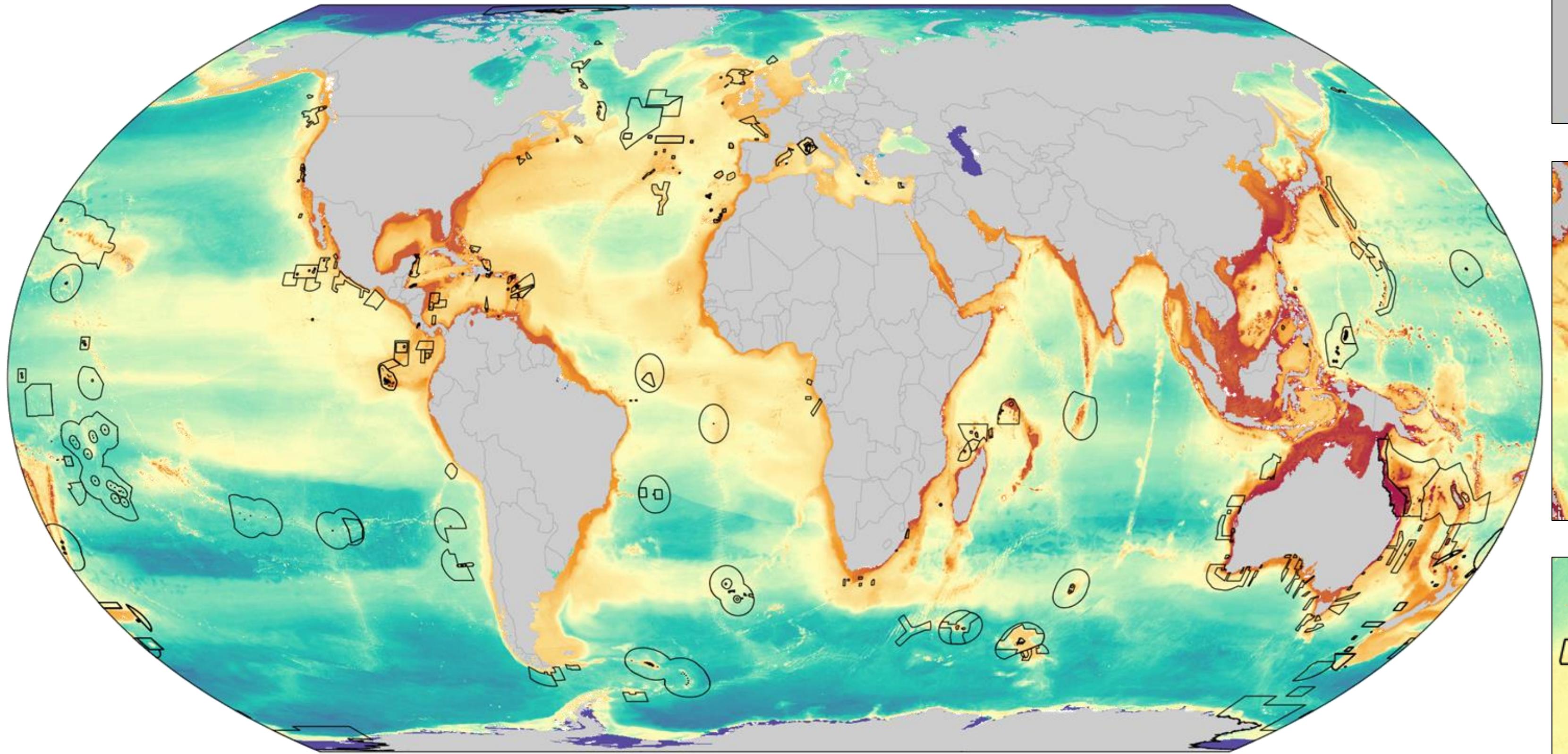
Indicator to study present and future Biodiversity distribution



- **Comparison** with previous publish work
- Analysis of **spatial patterns** for multiple group
- A good compromise between High resolution and diversity information

Applications

Assess the effectiveness of MPAs



The AquaMaps/AquaX Team and collaborators



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E. Garcia



J. Casemajor



N. Gammal



R. Froese



W. Cheung



D. Palomares



N. Bailly



K. Sora



M. Oyinlola



J. Mayer



A. Schmill



K. Reyes



K. Kaschner



D. Tittensor



K. Boerder

