Proteus Partners Meeting 2012

hosted in London by Shell on June 14th


AquaMaps: Modelling and mapping global marine mammal distributions and densities

Kristin Kaschner

Evolutionary Biology & Ecology Lab,
Albert-Ludwigs-University Freiburg, Germany
Kristin.Kaschner@biologie.uni-freiburg.de

Outline

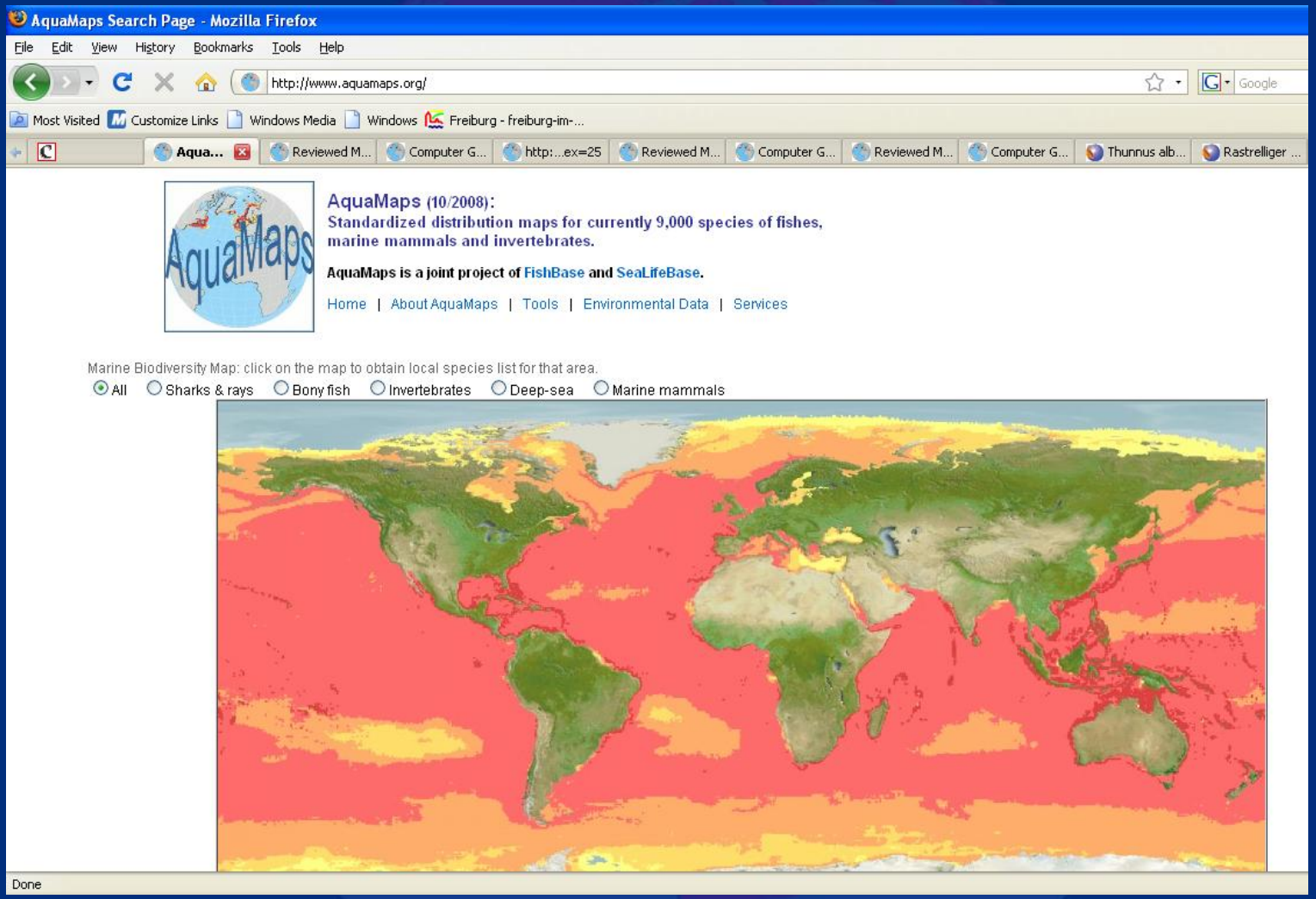
AquaMaps

- What is it and why do we need it?
- How does it work?
- What can we do with it?
- Ongoing efforts & future work

What is AquaMaps & why do we need it?

WHAT?

What are AquaMaps?



www.aquamaps.org

Kaschner et al, 2008

WHAT?

What are AquaMaps?

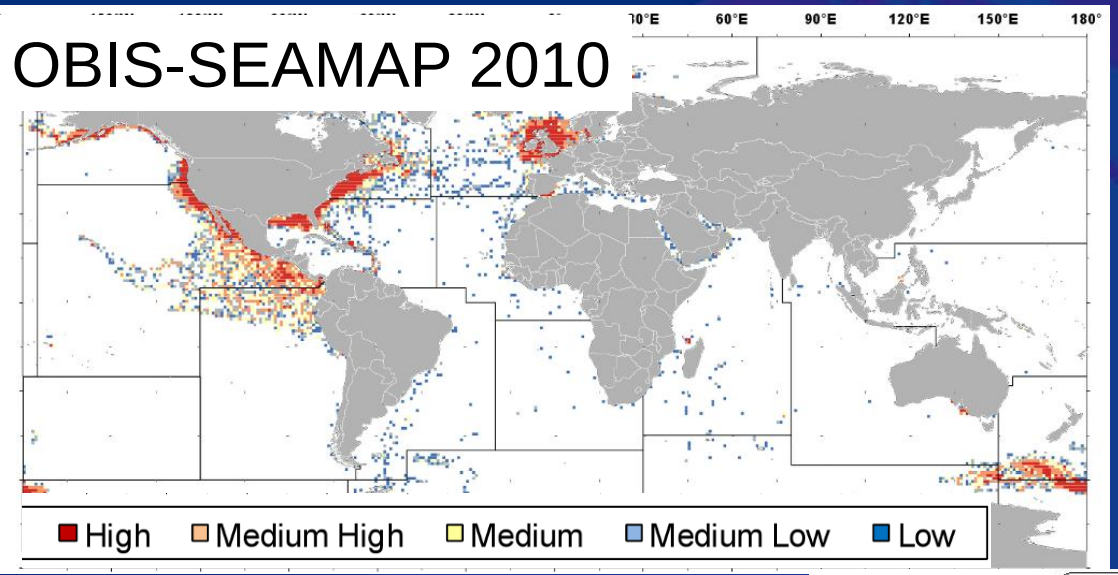
An online marine atlas and species distribution modelling tool aiming to produce computer-generated, reproducable species range maps for (evenually) all species using available data and a transparent, easily understandable and modifiable approach, so maps can be reviewed and improved by species experts.

➔ current taxonomic coverage: > 11 500 species

- marine mammals
- fishes
- marine turtles
- invertebrates
- algae
- (seabirds)

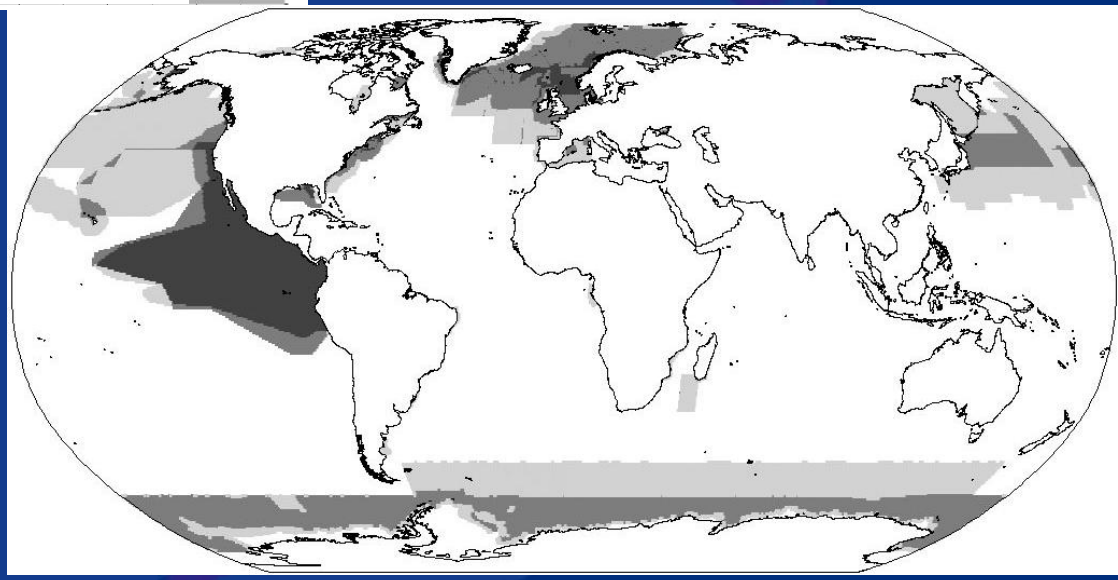
WHY?

Marine Mammals: Data Availability



➔ 700 000 point occurrence records!!

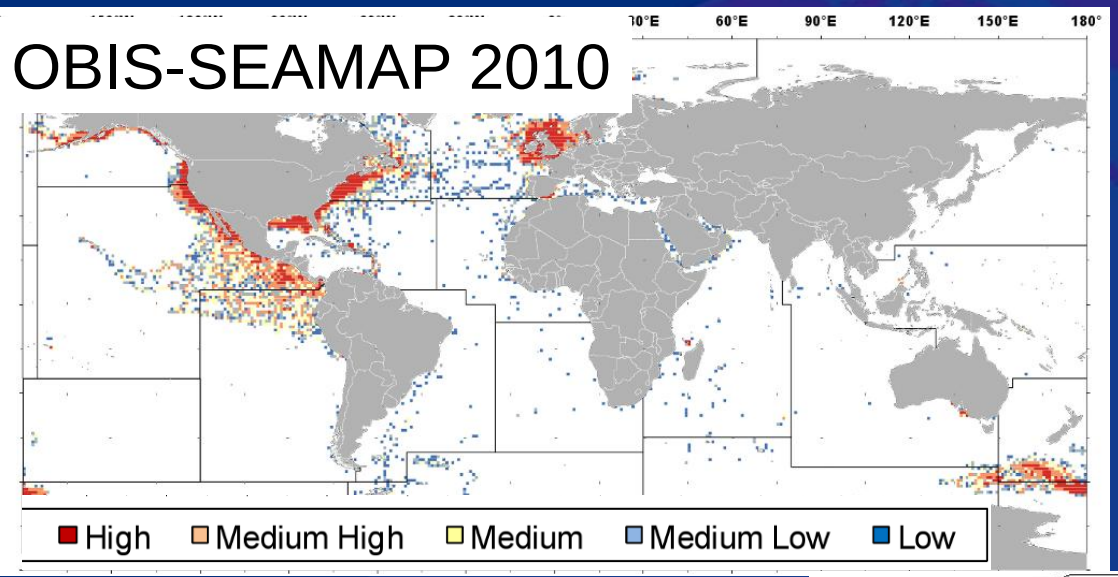
➔ 90 million km^2 survey coverage



Kaschner et al, accepted
Kot et al, 2010

WHY?

Marine Mammals: Data Availability



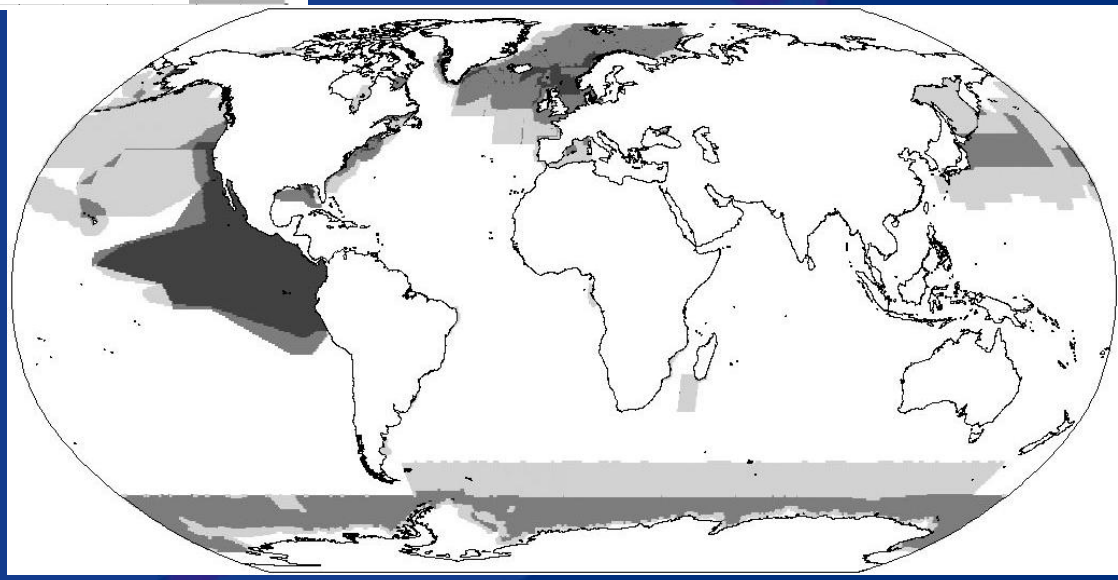
➔ > 40% of all species with no records

➔ > 70% of all records from N hemisphere shelf waters

➔ < 25% of the world‘s oceans

➔ < 10 % non-summer surveys

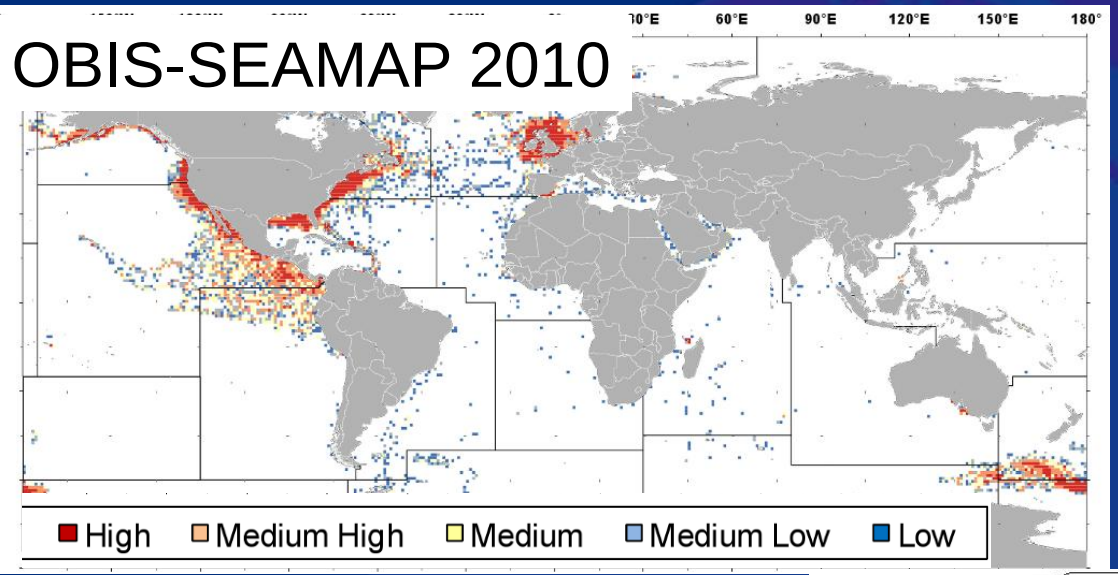
➔ ~ 10 % of distribution surveyed on average



Kaschner et al, accepted
Kot et al, 2010

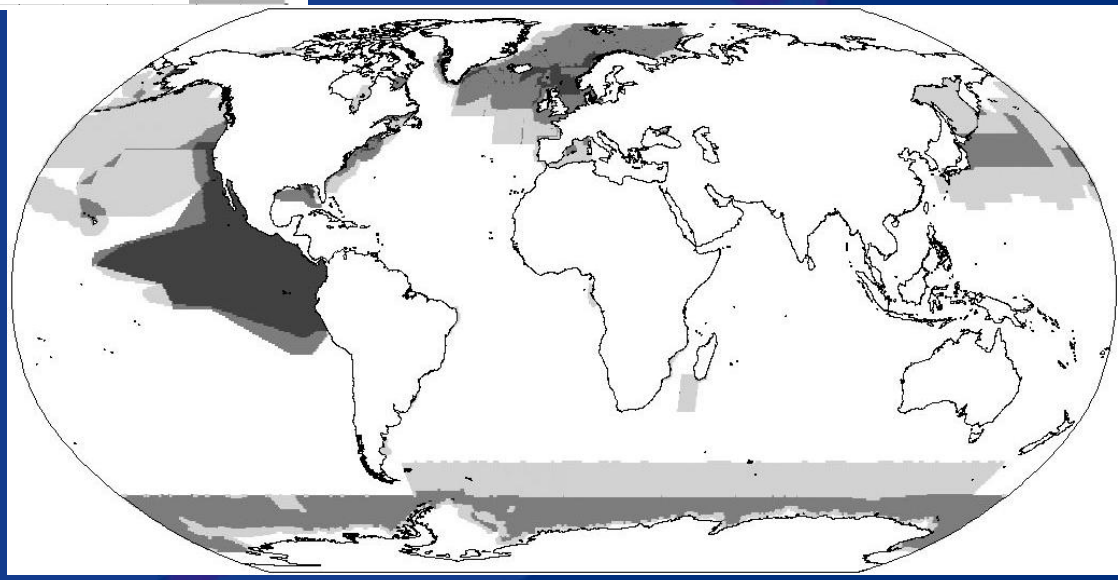
WHY?

Marine Mammals: Data Availability



➔ not enough data per species to apply standard SDMs

➔ non-representative coverage of species ranges

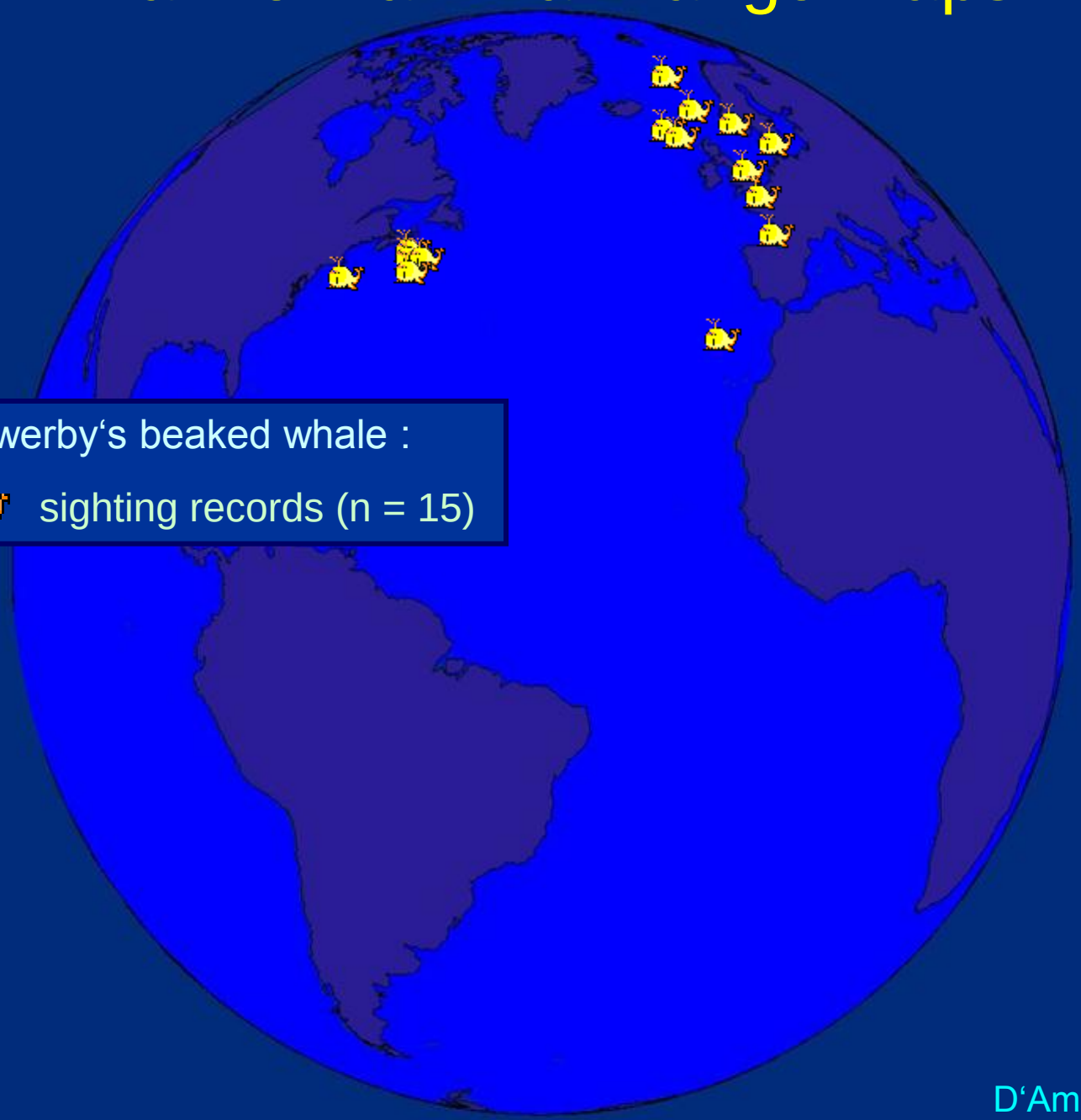


Kaschner et al, accepted
Kot et al, 2010

How does AquaMaps work?

HOW?

Marine Mammal Range Maps



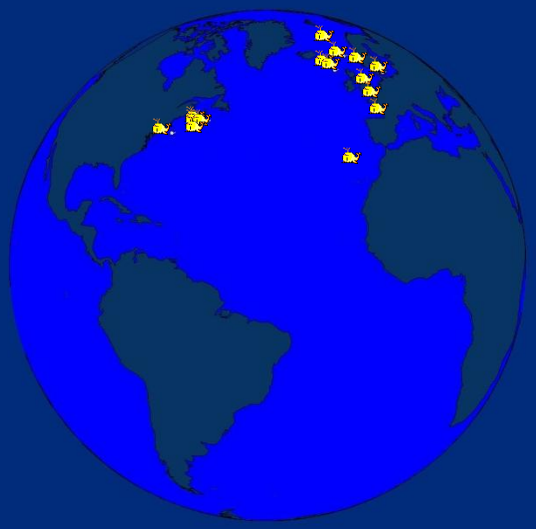
Sowerby‘s beaked whale :

sighting records (n = 15)

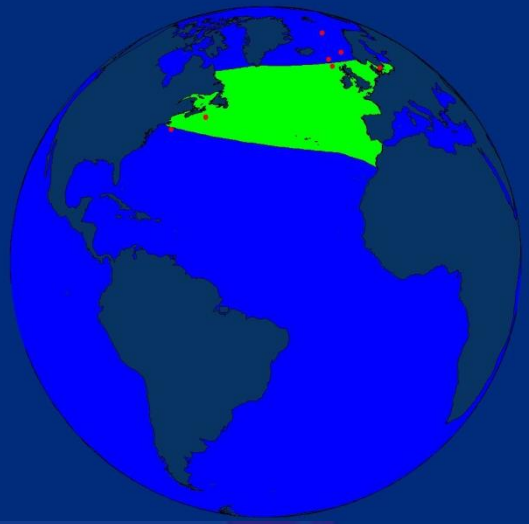
D‘Amico et al, 2003

HOW?

Marine Mammal Range Maps



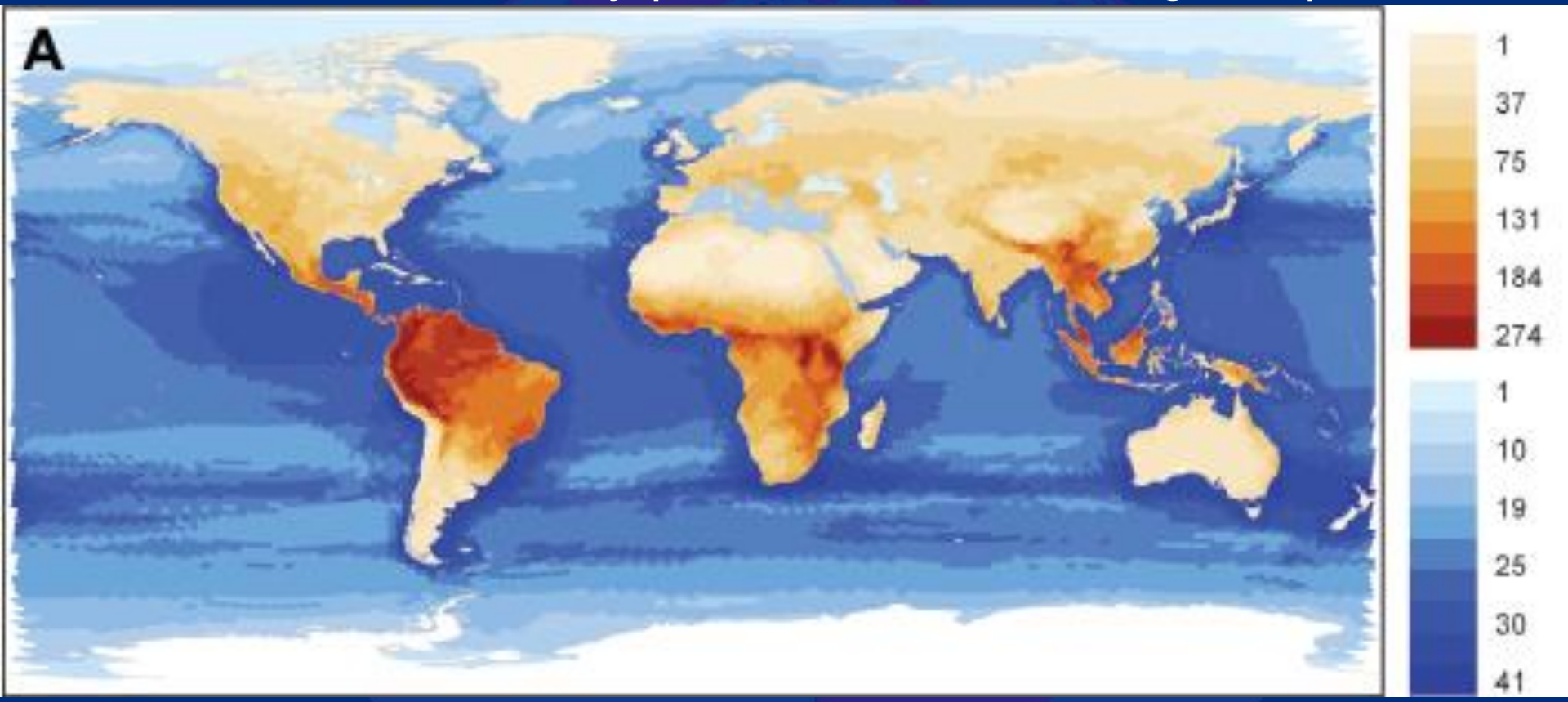
Expert drawn
range maps



HOW?

Marine Mammal Range Maps

Global biodiversity patterns based on range maps

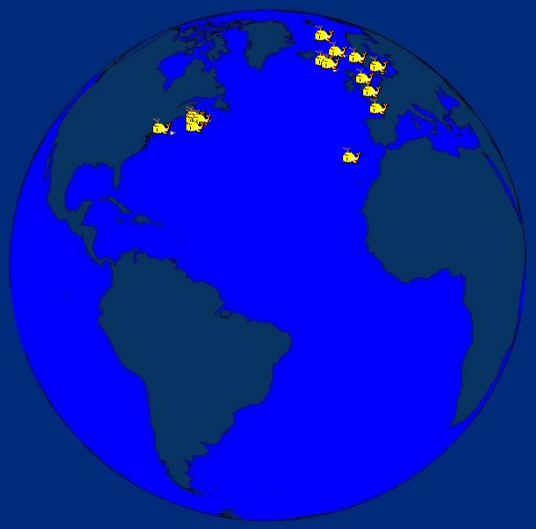


- ➔ 2/3 of species: cosmopolitan or ocean basin wide distribution
- ➔ Difficult to use for prioritization of areas in MSP
- ➔ Difficult to validate quantitatively

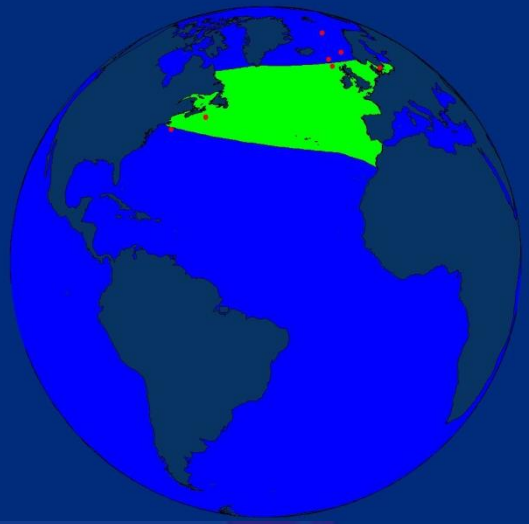
Schipper et al, 2008

HOW?

Marine Mammal Range Maps



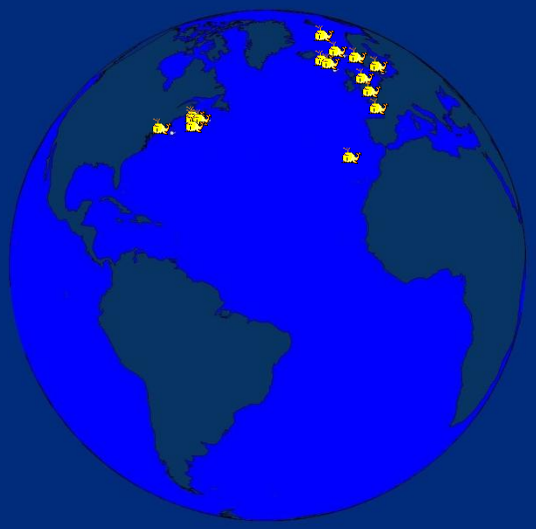
Expert drawn
range maps



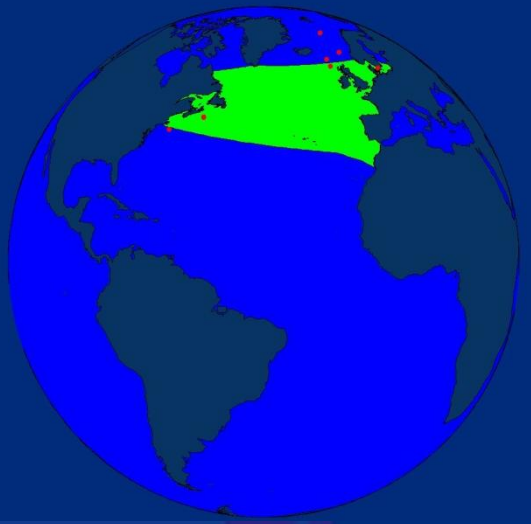
RES/AquaMaps:
Expert supported
SDM

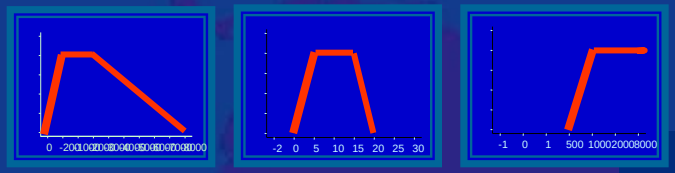
HOW?

Marine Mammal Range Maps



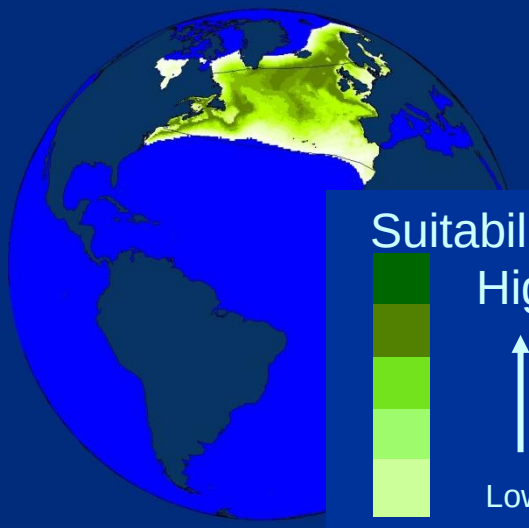
Expert drawn
range maps





Depth **SST** **Ice**

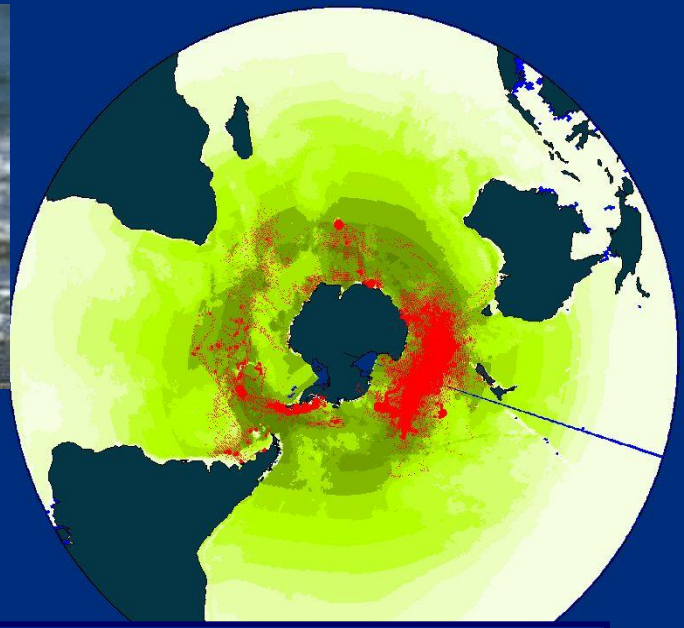
RES/AquaMaps:
Expert supported
SDM



Suitability
High
Low

RES/AquaMaps: does it work?

- Validating individual species range maps
  - Kaschner et al, 2006; MEPS

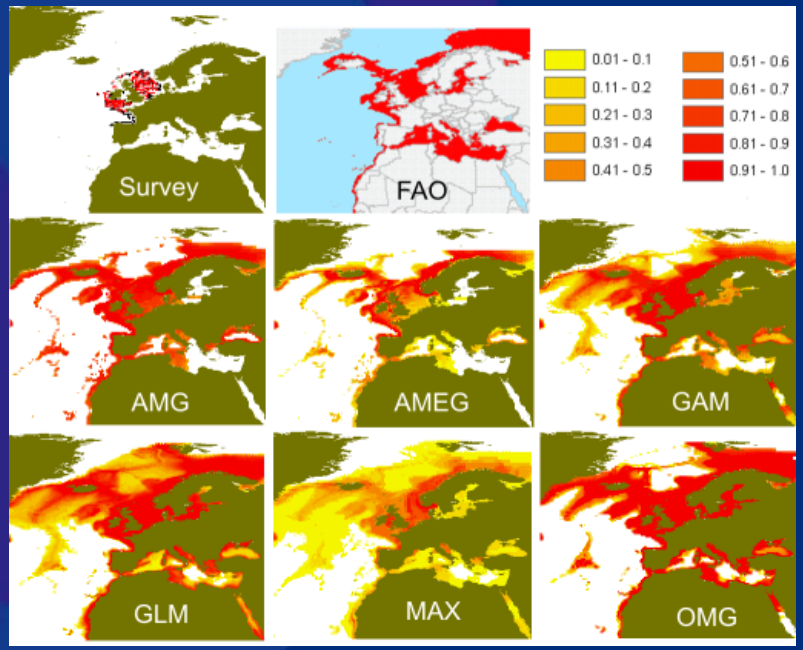


Southern elephant seal

HOW?

RES/AquaMaps: does it work?

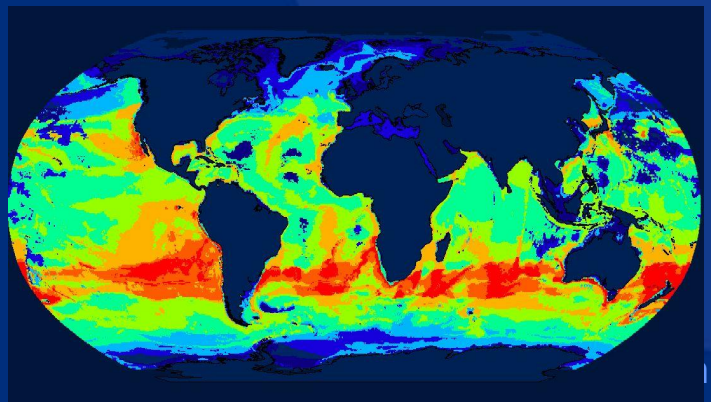
- Validating individual species range maps
  - Kaschner et al, 2006; MEPS
- Testing model performance in comparison to other approaches
  - J.Ready, K.Kaschner et al, 2010; Eco Mod

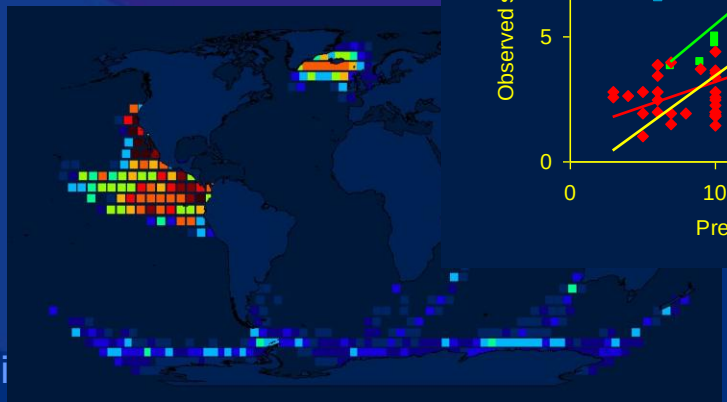


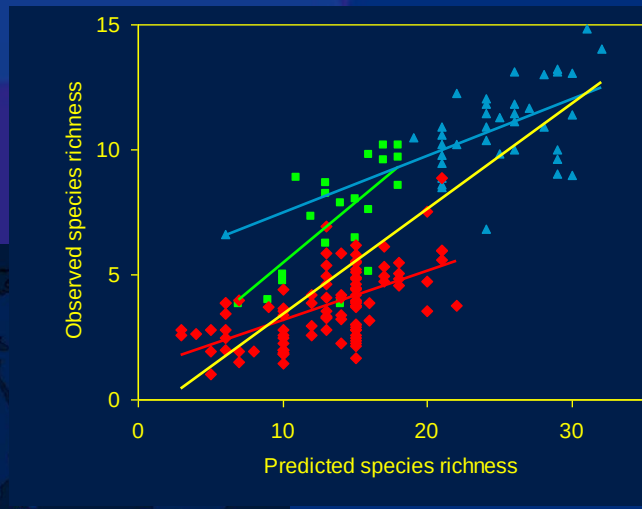
HOW?

RES/AquaMaps: does it work?

- Validating individual species range maps
  - Kaschner et al, 2006; MEPS
- Testing model performance in comparison to other approaches
  - J.Ready, K.Kaschner et al, 2010; Eco Mod
- Validating species richness maps
  - K.Kaschner et al, 2011







What can we do with AquaMaps?

APPLICATIONS?

AquaMaps - Applications

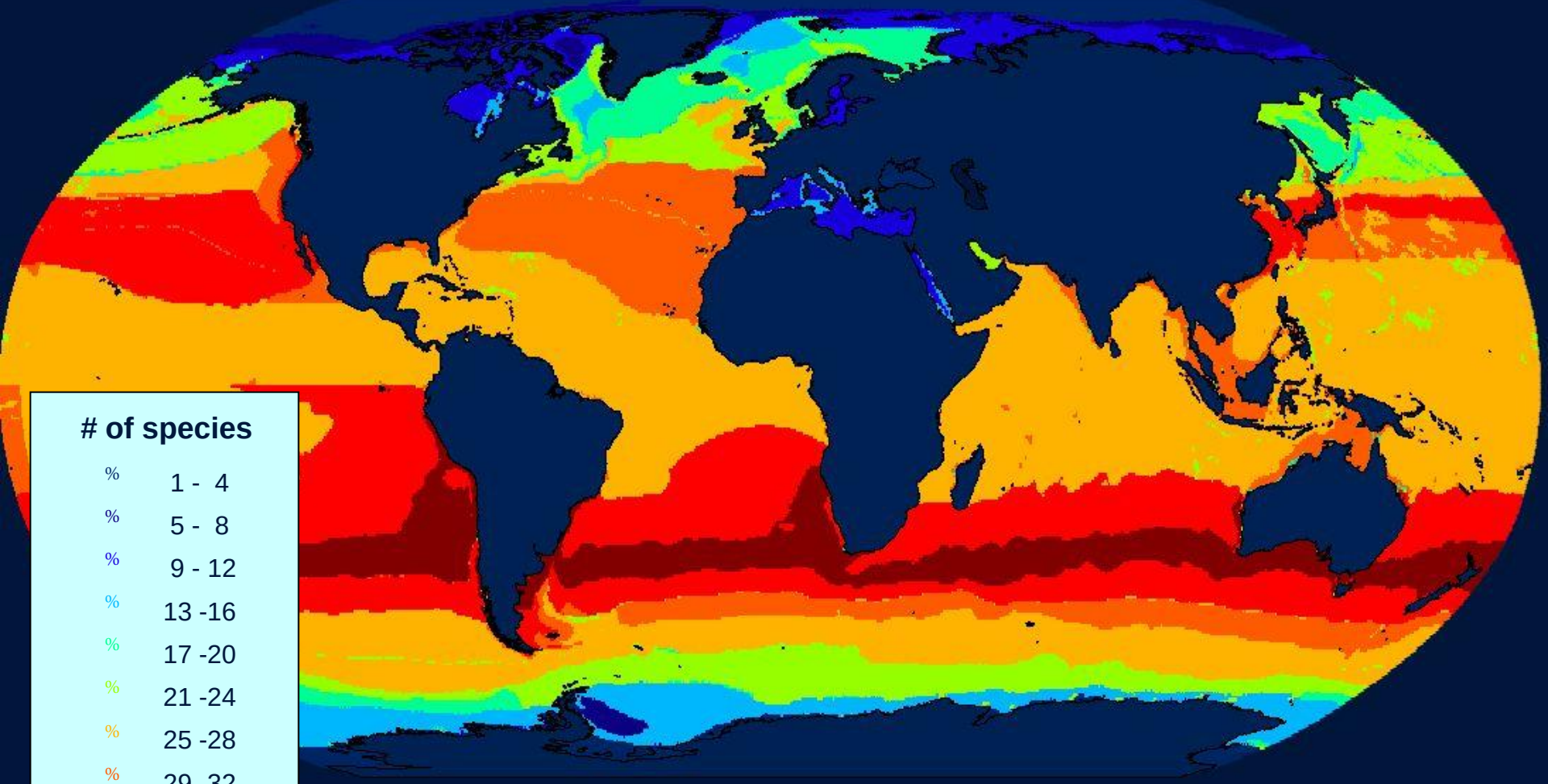
- Biodiversity patterns & core ranges
- Impacts of climate change
- Modelling migrations & densities
- .....

APPLICATIONS?

Marine Mammal Biodiversity Patterns

AquaMaps

Probability threshold for assumed presence = 0



All species (n = 115)

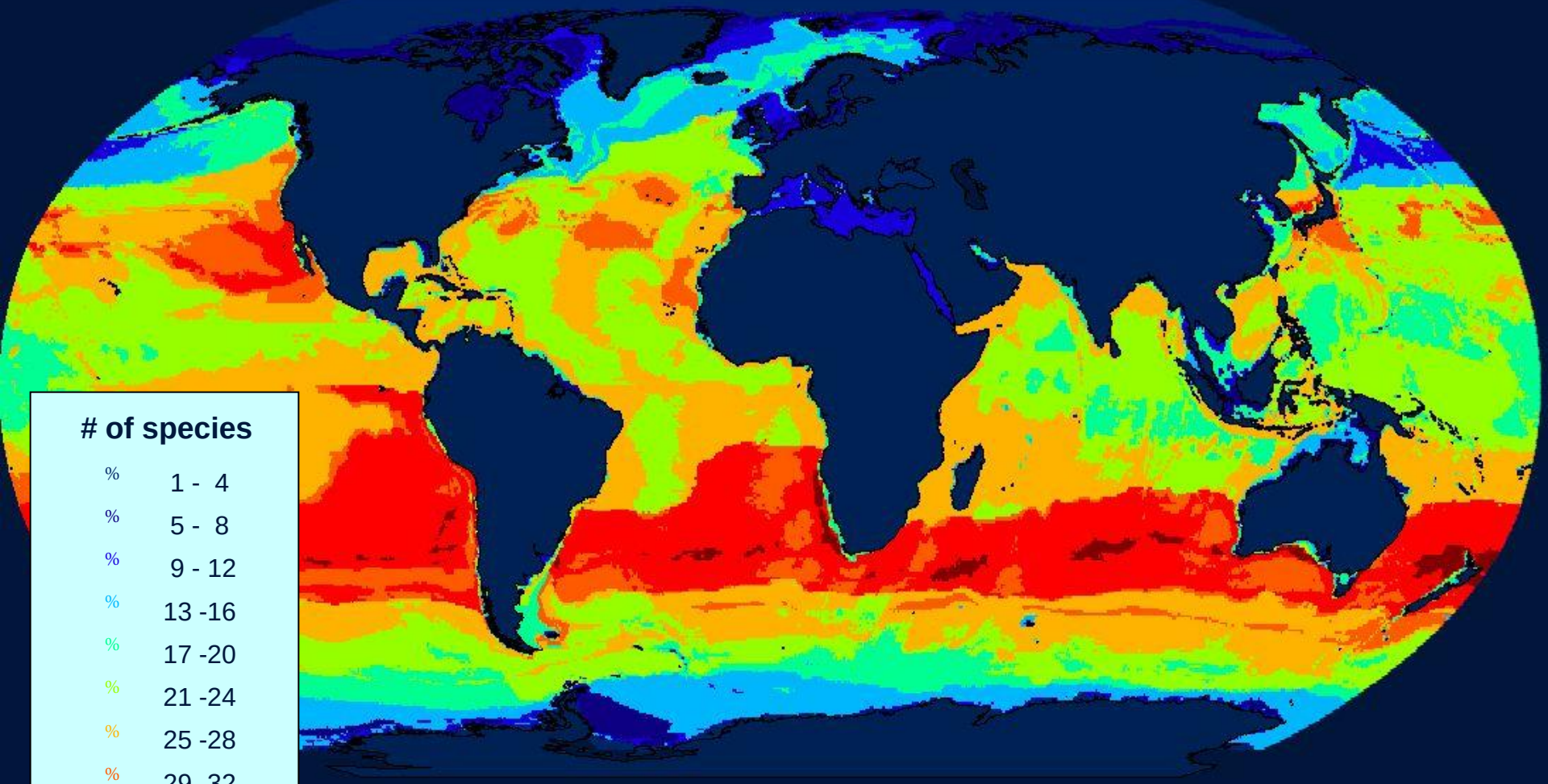
Kaschner et al, 2011

APPLICATIONS?

Marine Mammal Biodiversity Patterns

AquaMaps

Probability threshold for assumed presence > 0.2



All species (n = 115)

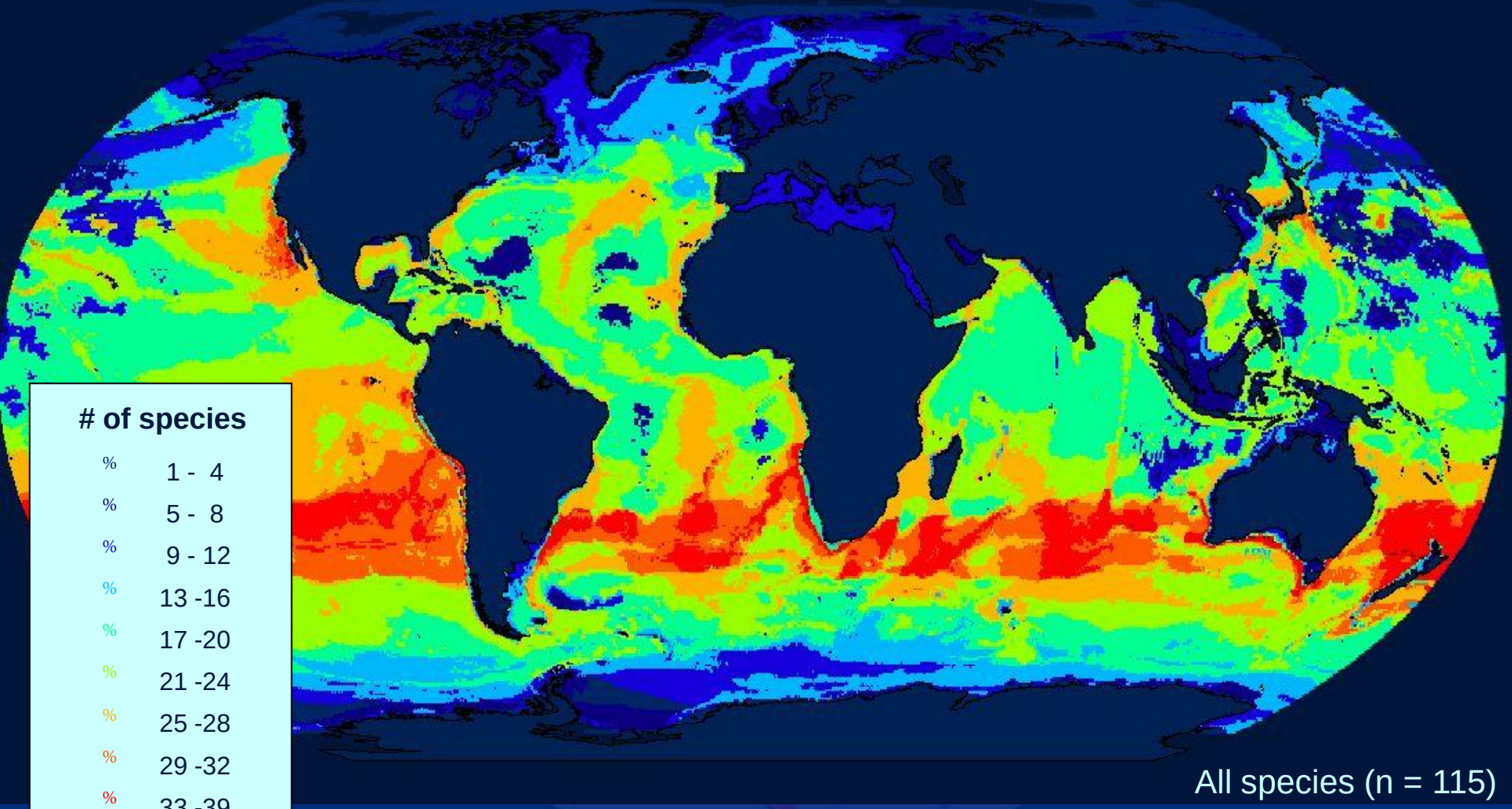
Kaschner et al, 2011

APPLICATIONS?

Marine Mammal Biodiversity Patterns

AquaMaps

Probability threshold for assumed presence > 0.4



All species (n = 115)

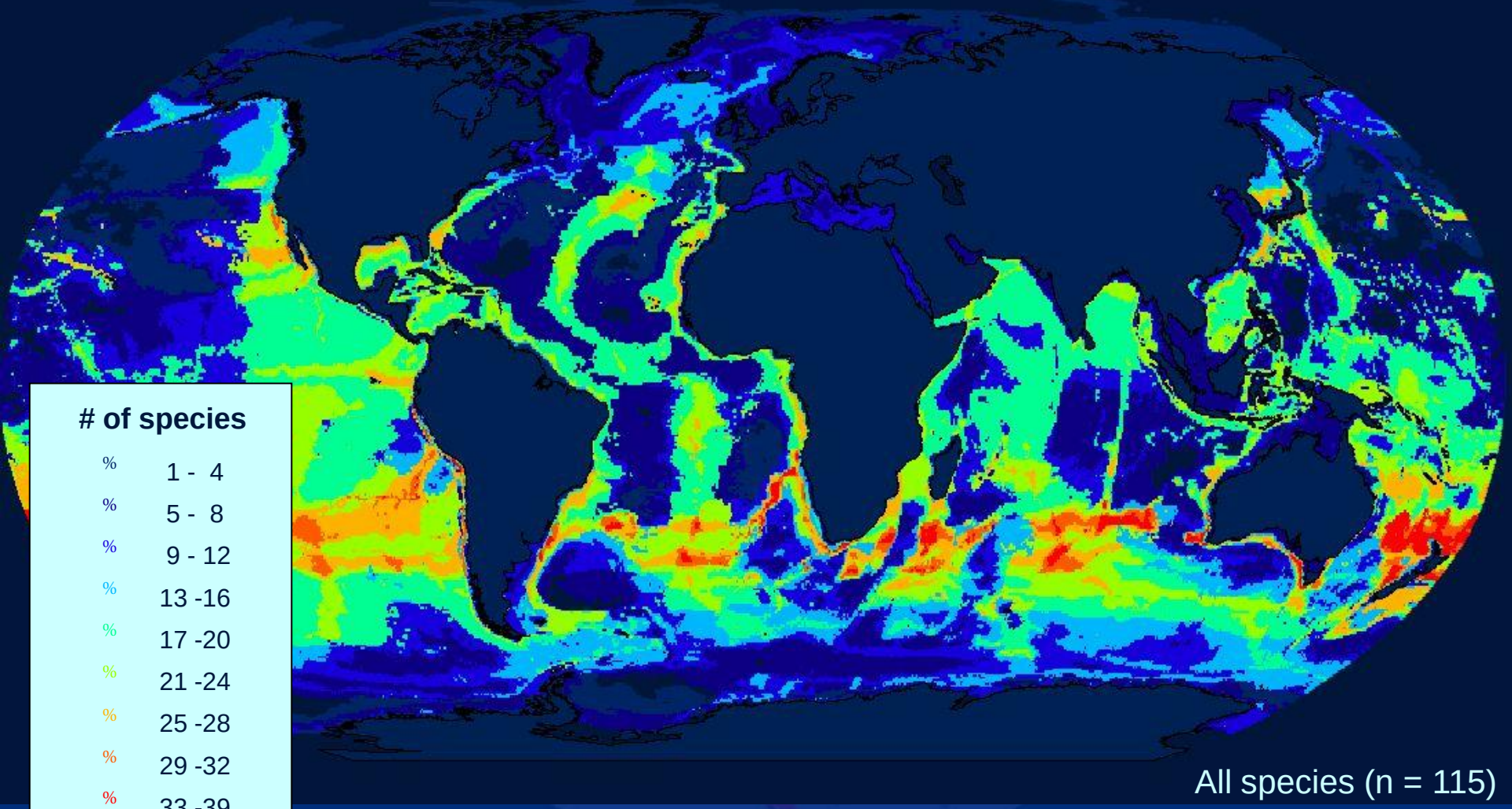
Kaschner et al, 2011

APPLICATIONS?

Marine Mammal Biodiversity Patterns

AquaMaps

Probability threshold for assumed presence > 0.6



# of species

%	1 - 4
%	5 - 8
%	9 - 12
%	13 -16
%	17 -20
%	21 -24
%	25 -28
%	29 -32
%	33 -39
%	40 -46

All species (n = 115)

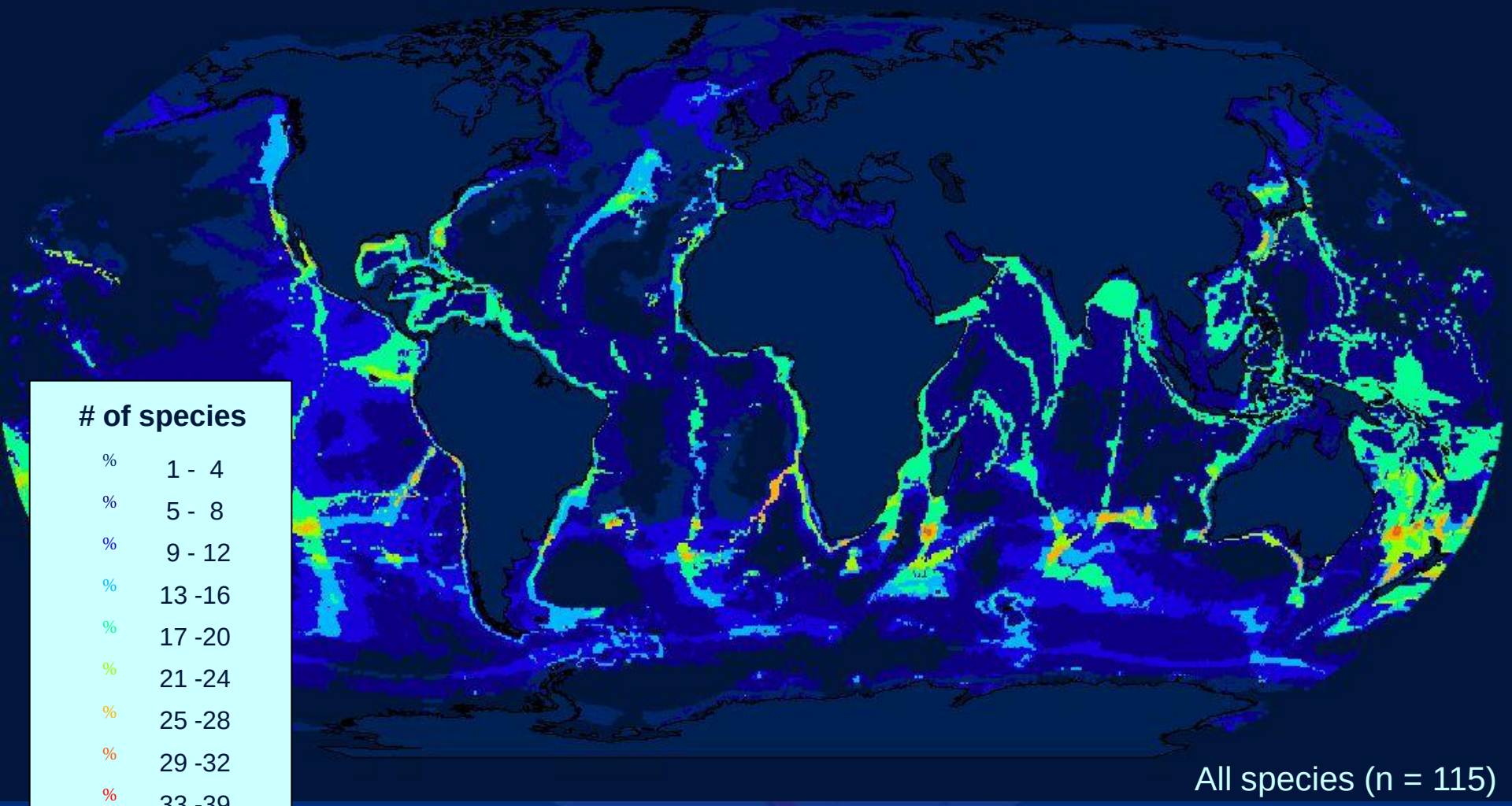
Kaschner et al, 2011

APPLICATIONS?

Marine Mammal Biodiversity Patterns

AquaMaps

Probability threshold for assumed presence > 0.8



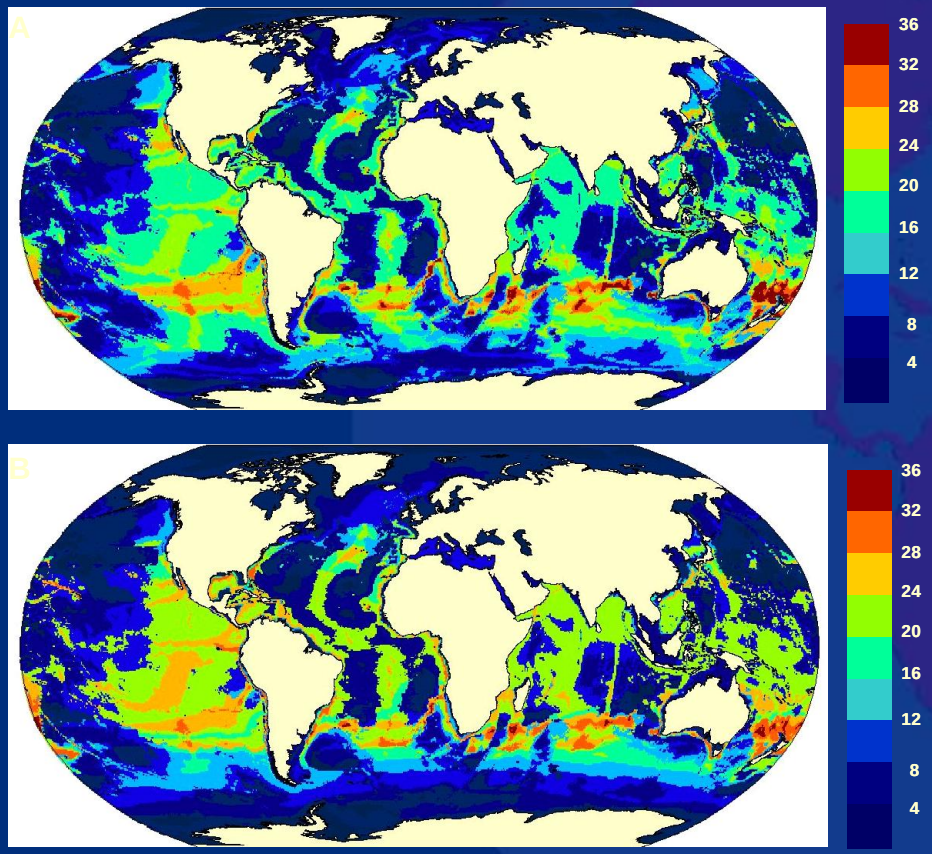
All species (n = 115)

Kaschner et al, 2011

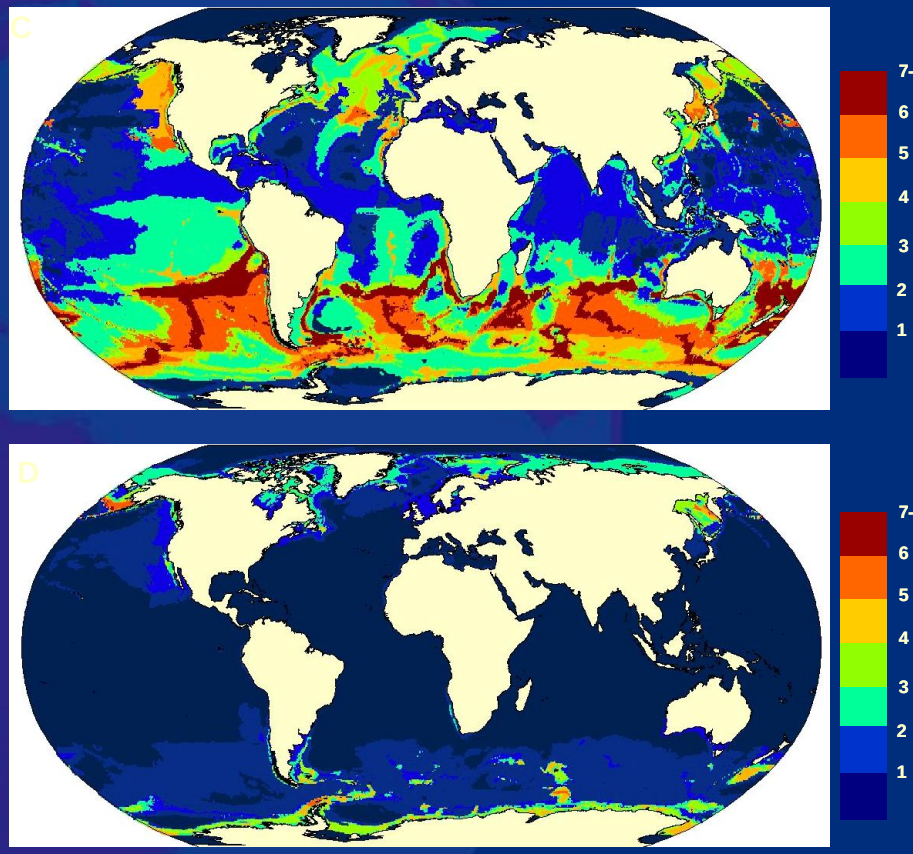
APPLICA
TIONS?

Hotspots of Species Richness

All species



Baleen whales



Toothed whales

Pinnipeds

Probability threshold for assumed presence > 0.6

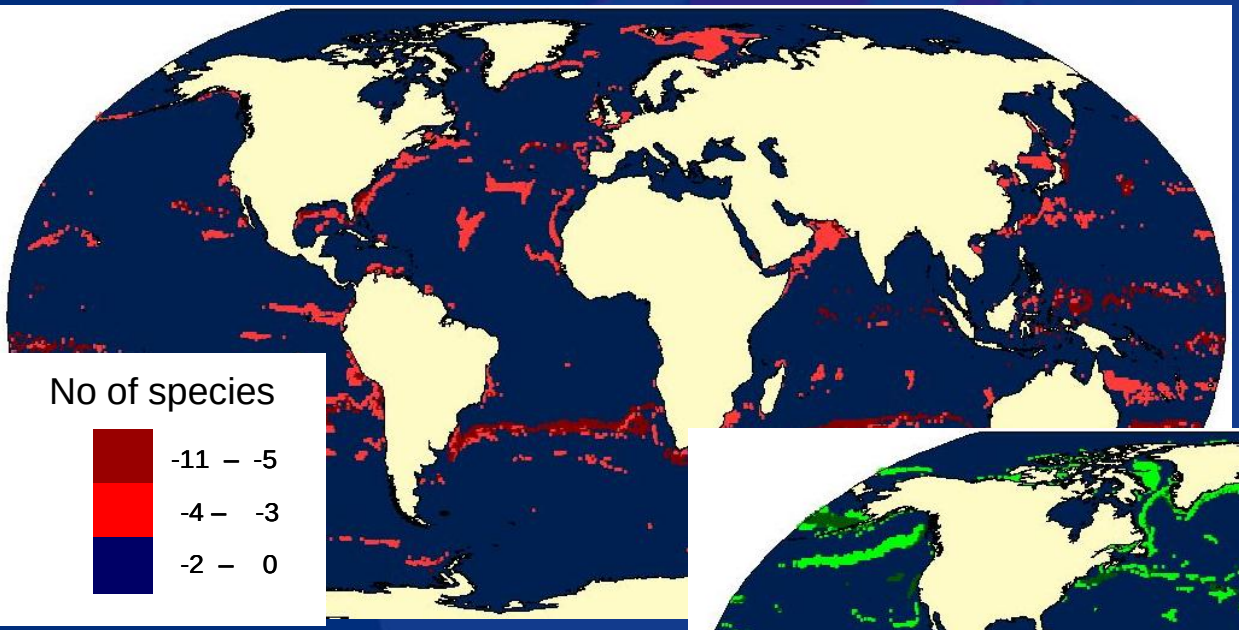
Kaschner et al, 2011

APPLICATIONS?

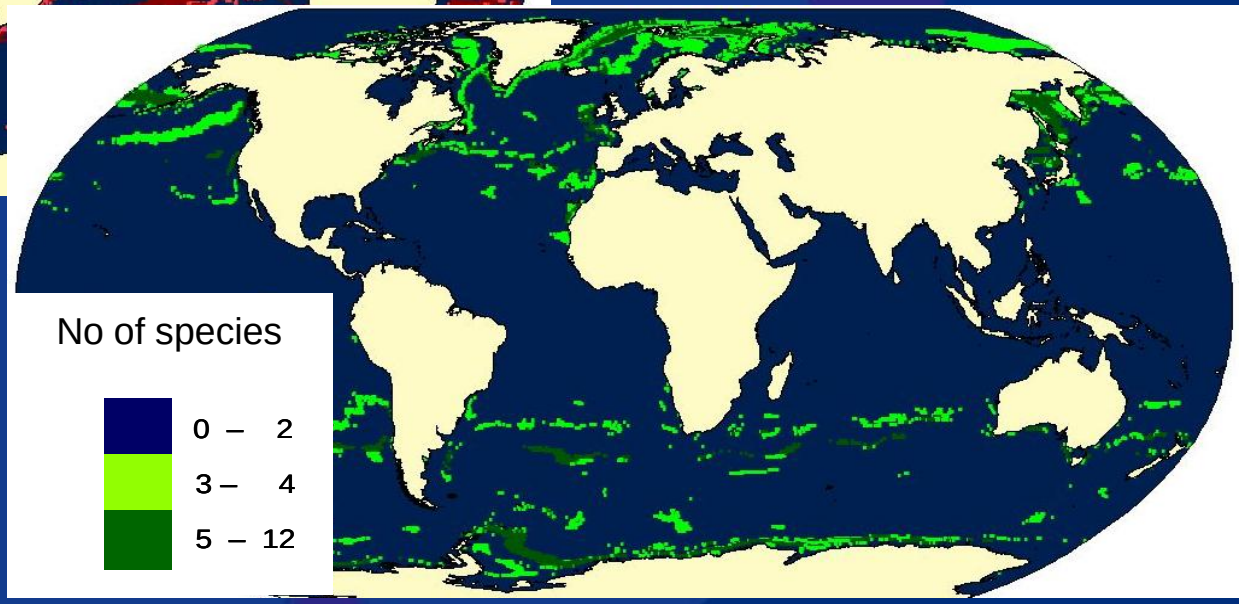
Effects of Climate Change: 2050

AquaMaps

Loss in native species



Gain in species



All MM species

RES threshold for assumed presence > 0.6

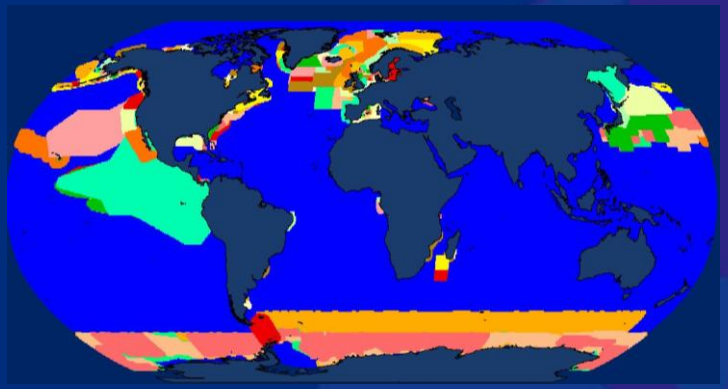
Kaschner et al, 2011

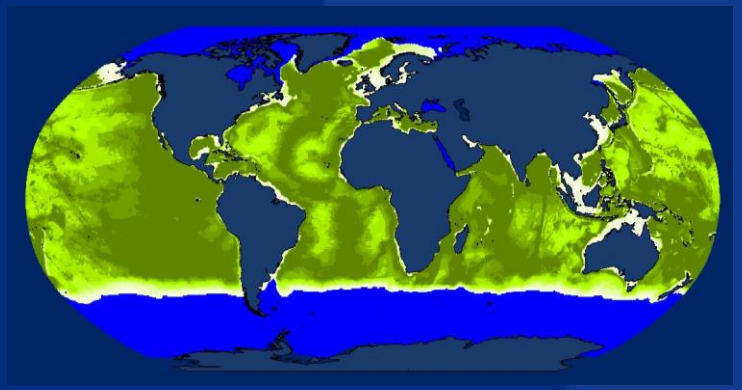
APPLICATIONS?

Marine Mammal Migrations & Density

AquaMaps

Observed densities





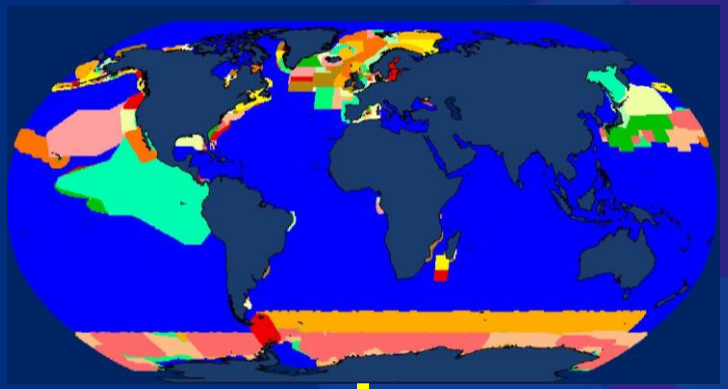
Seasonal Predictions

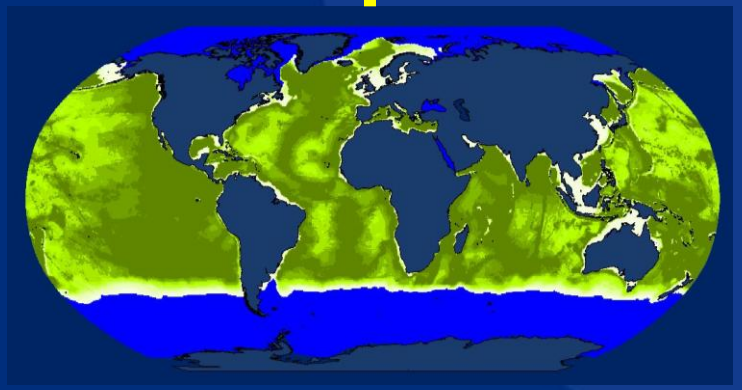
 Kaschner et al, in prep

APPLICATIONS?

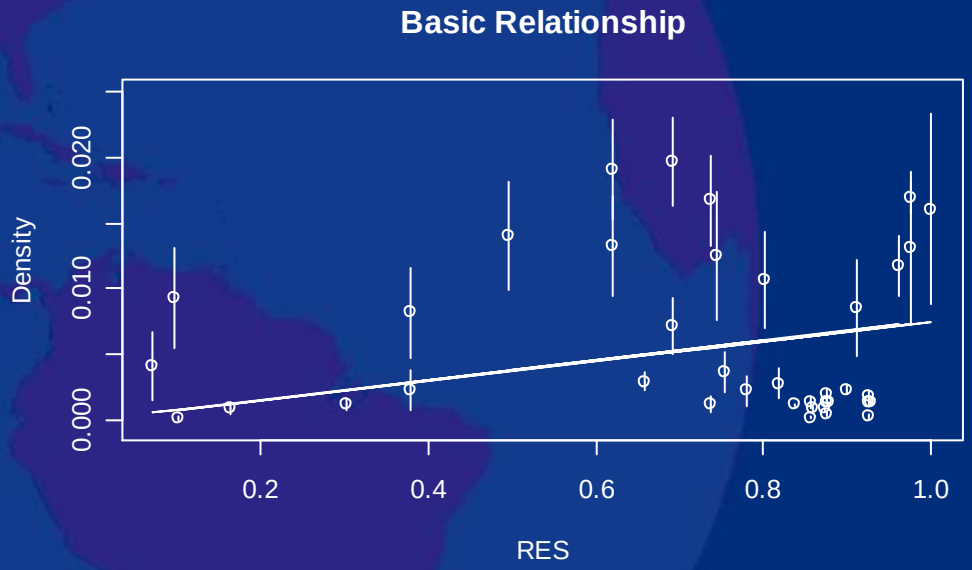
Marine Mammal Migrations & Density

Observed densities





Seasonal Predictions



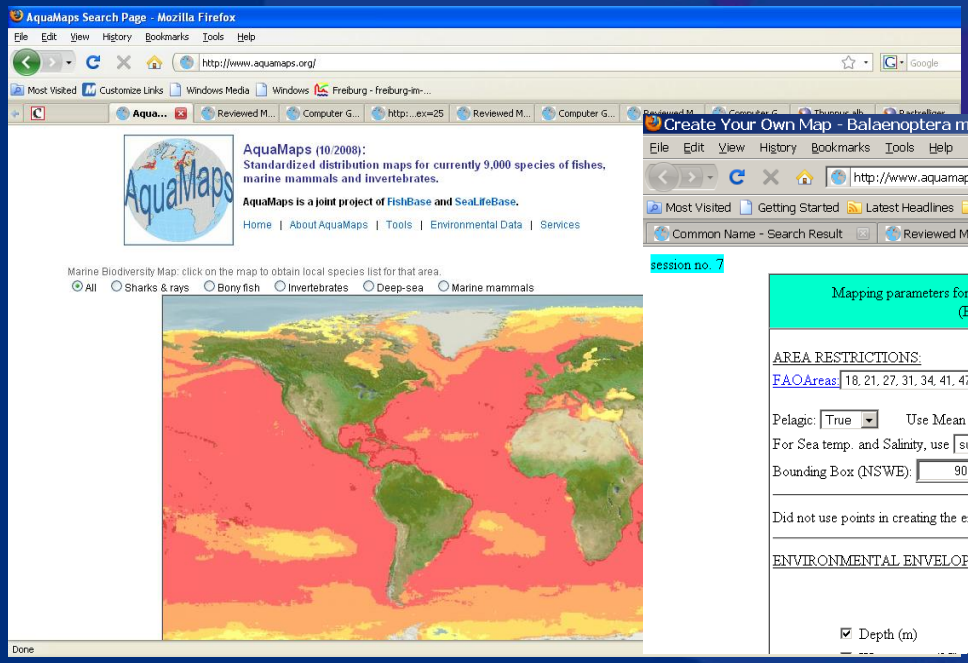
 Kaschner et al, in prep

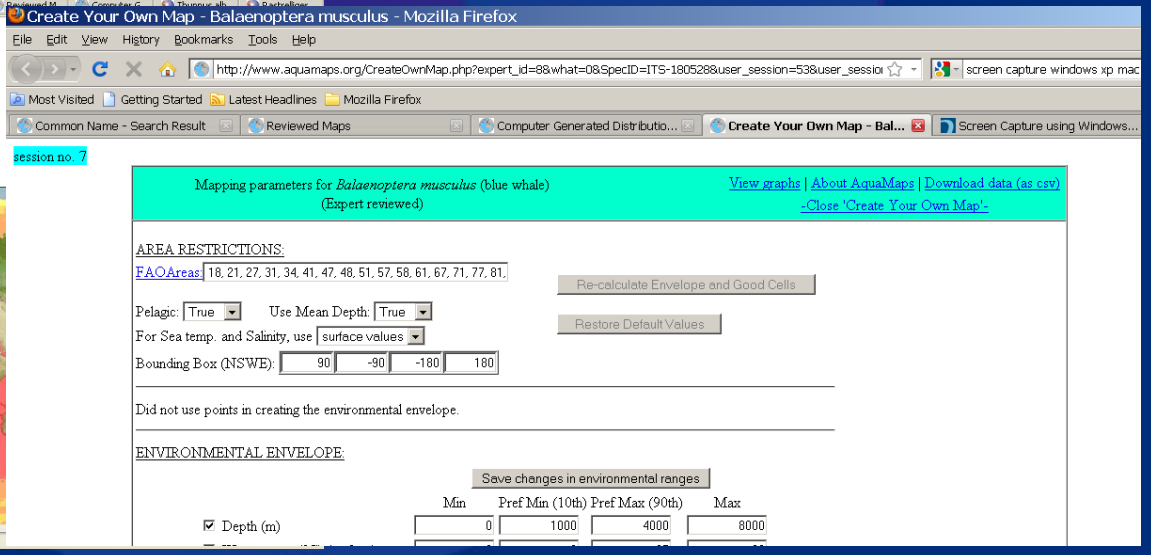
Ongoing efforts & Future work

FUTURE EFFORTS

AquaMaps – towards a Wiki approach

- **IMarine**
- **EU-Bon**
- **CCI Proposal**





www.aquamaps.org

Create Your Own Map - Tool

FUTURE EFFORTS

AquaMaps – Identifying Priority Sites for Conservation

- **GOBI & CBD EBSAs**
- **UNEP LifeWeb**
- **PELAGIC**

GOBI
Global Ocean Biodiversity Initiative
www.gobi.org

UNEP

CESAB
CENTRE DE SYNTHÈSE ET D'ANALYSE SUR LA BIODIVERSITÉ

FRB
FONDATION POUR LA RECHERCHE SUR LA BIODIVERSITÉ

FONDATION TOTAL

FUTURE EFFORTS

AquaMaps – Investigating Climate Change

- **FutureOceans**
- **Nereus Project**

Take Home Messages

Take home messages

AquaMaps

- Existing online SDM tool & atlas covering > 11 500 species
- have been validated extensively, both on a species level as well as at higher taxonomic levels
- allows investigation of large-scale biodiversity patterns, impacts of climate change and extrapolation of densities in unsurveyed areas
- can help research into anthropogenic impact assessments & large-scale, long-term Marine Protected Area design in less studied areas such as e.g. the High Seas

Acknowledgements

- FutureOceans & AquaMaps (www.aquamaps.org) & INCOFISH Project (www.incofish.org)
  - Nina Garilao, Josephine Rius Barile, Kathy Kesner-Reyes, Paul D. Eastwood, Andrew B. South, Sven O. Kullander, Tony Rees, Reg Watson, Jon Ready, Eli Agbayani, Daniel Pauly & Rainer Froese
- PELAGIC (CESAB – FRB/Fondation Total)
  - David Kaplan, Ana Rodrigues
- CREEM, SMRU, & SMRU Ltd (The ERMC(S)/Sonar S2117/SAFESIMM project & Joint Industry Project Cetacean Stock Assessment):
  - Catriona Harris, Carl Donovan, Rodrigo Wiff, Nicola Quick, John Harwood, Rob Wiliams
- The Sloan Foundation & the FMAP Project (www.fmap.ca):
  - Derek Tittensor, Jon Ready, Tim Gerodette & Boris Worm
- 'Sea Around Us' project (www.seaaroundus.org) & Pew Charitable Trusts of Philadelphia, USA
  - Reg Watson, Andrew Trites, Daniel Pauly

Thank you.....

Proteus Partners Meeting 2012

hosted in London by Shell on June 14th


Marine and Coastal Habitat Data &Validation Tools

Proteus Annual Meeting, London, 14th June 2012

Claire FitzGerald

From a business perspective

- Reducing risk whilst increasing sustainability
- Decision support
- Harmonisation with EIA, risk assessment, coastal sensitivity assessment

Business data needs

- Areas of Ecological Importance
  - Habitats
  - Protected Areas
  - Other spatial regulatory areas
- Human Use
- Oceanographic & physical features

UNEP WCMC

Meeting these needs

- Data of spatial & temporal resolution appropriate to planning
  - Standardised attributes
  - Scalable data
- Use innovative methods to transform the rate of data provision, and data quality
  - Build the tools
  - Build the communities
  - Build the capacity of the communities to use the tools
- Demonstrate utility and value – Pilots projects

UNEP WCMC

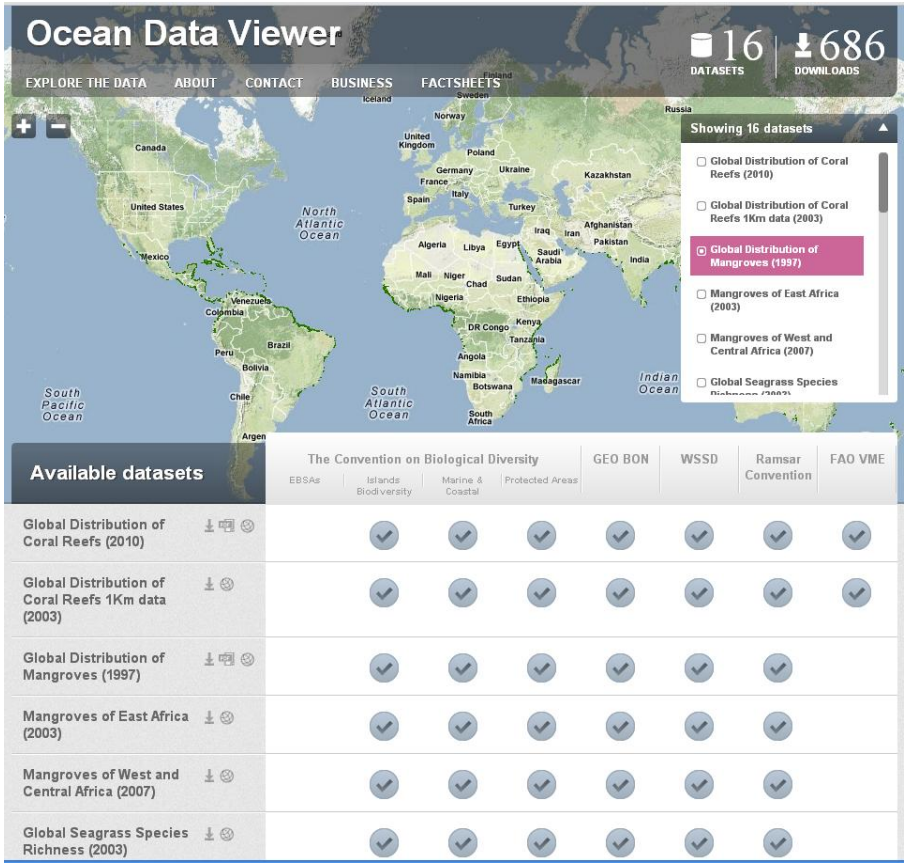
Service to Business

- Collect, collate and standardise core data products
- Provide a single point of access for data
- Provide training and guidance to business in using these data and products

UNEP WCMC

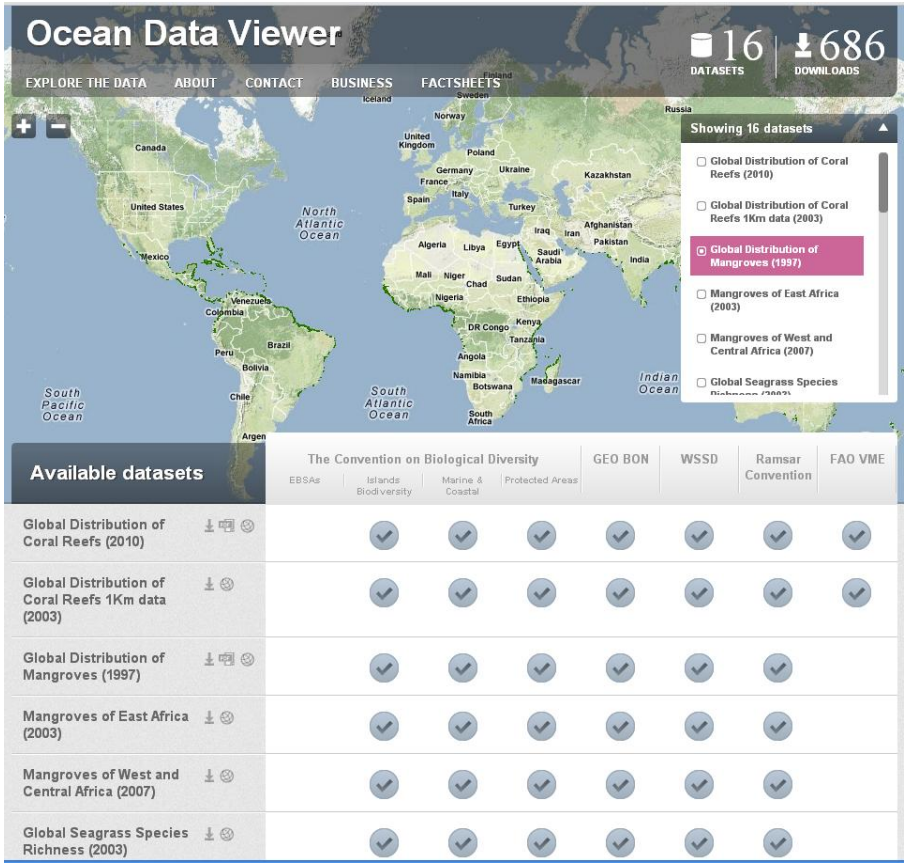
Ocean Data Viewer

- Data service for Business
- Platform for future data improvements
- Well documented
- Key data layers
- data.unep-wcmc.org



Ocean Data Viewer

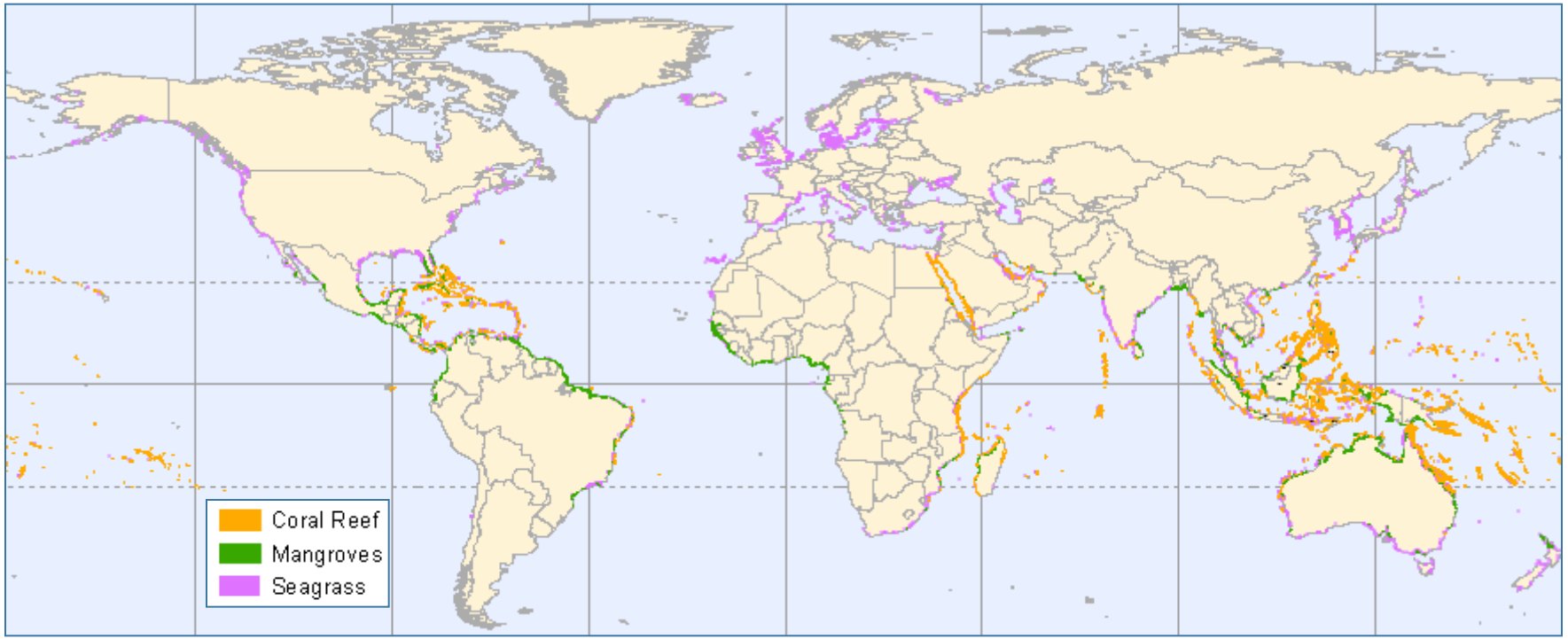
- Help companies avoid and/or minimize threats to biodiversity
- Access to critical site-scale ocean and coastal data
- Allows incorporation of important biodiversity priorities into risk assessment procedures



UNEP WCMC

Download from Ocean Data Viewer

- Habitat data - Coral Reef, Mangrove, Seagrass



UNEP WCMC

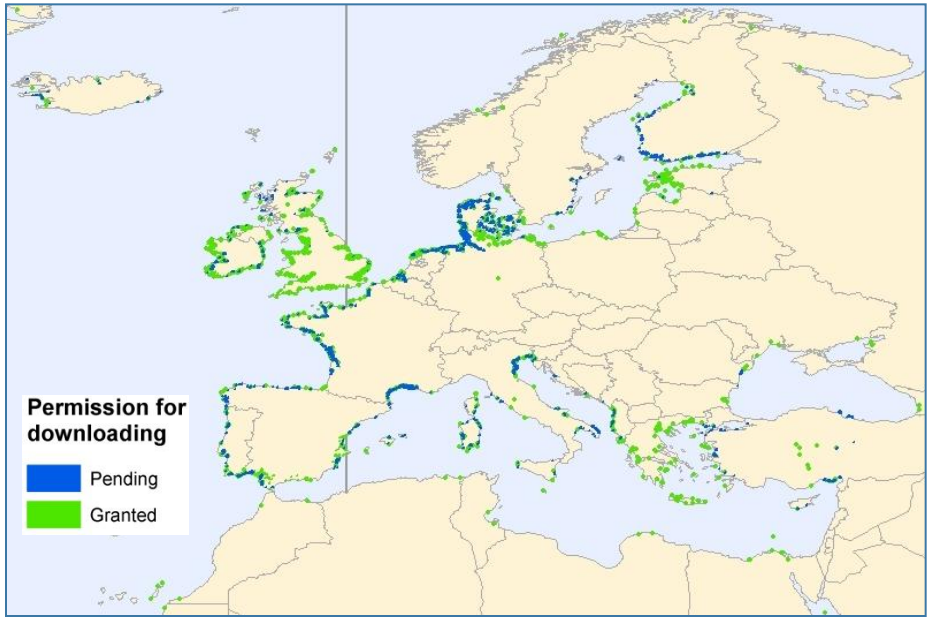
Data improvements – Coral reef

- Highest resolution available global data
- Information from multiple sources have been organised into a standardised format
- Accompanying documentation
- Easy user interpretation

UNEP WCMC

Data improvements – Saltmarsh

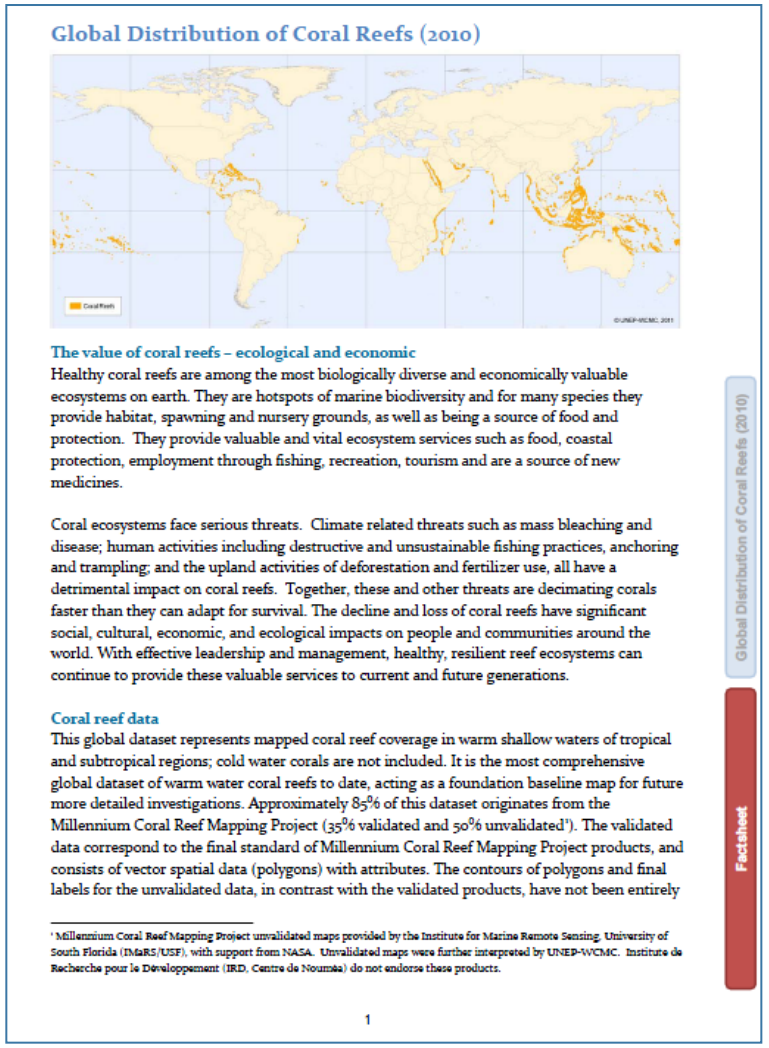
- Spatial data updates
  - **24** countries across Europe and South America
  - Adding **8,000 km²** to the global saltmarsh dataset
  - Bringing current global saltmarsh estimate to **65,000 km²**
  - Work is ongoing



UNEP WCMC

Data improvements – Factsheets

- Available:
  - Coral Reefs
  - Seagrass
  - Mangroves
- Economic and ecological value
- Dataset history and description
- Using this data – why and how
- Metadata
- Data attribute description



Global Distribution of Coral Reefs (2010)

The value of coral reefs – ecological and economic

Healthy coral reefs are among the most biologically diverse and economically valuable ecosystems on earth. They are hotspots of marine biodiversity and for many species they provide habitat, spawning and nursery grounds, as well as being a source of food and protection. They provide valuable and vital ecosystem services such as food, coastal protection, employment through fishing, recreation, tourism and are a source of new medicines.

Coral ecosystems face serious threats. Climate related threats such as mass bleaching and disease; human activities including destructive and unsustainable fishing practices, anchoring and trampling; and the upland activities of deforestation and fertilizer use, all have a detrimental impact on coral reefs. Together, these and other threats are decimating corals faster than they can adapt for survival. The decline and loss of coral reefs have significant social, cultural, economic, and ecological impacts on people and communities around the world. With effective leadership and management, healthy, resilient reef ecosystems can continue to provide these valuable services to current and future generations.

Coral reef data

This global dataset represents mapped coral reef coverage in warm shallow waters of tropical and subtropical regions; cold water corals are not included. It is the most comprehensive global dataset of warm water coral reefs to date, acting as a foundation baseline map for future more detailed investigations. Approximately 85% of this dataset originates from the Millennium Coral Reef Mapping Project (35% validated and 50% unvalidated[1]). The validated data correspond to the final standard of Millennium Coral Reef Mapping Project products, and consists of vector spatial data (polygons) with attributes. The contours of polygons and final labels for the unvalidated data, in contrast with the validated products, have not been entirely

[1] Millennium Coral Reef Mapping Project unvalidated maps provided by the Institute for Marine Remote Sensing, University of South Florida (IMaRS/USF), with support from NASA. Unvalidated maps were further interpreted by UNEP-WCMC. Institute de Recherche pour le Développement (IRD, Centre de Nouméa) do not endorse these products.

1

Global Distribution of Coral Reefs (2010)

Factsheet

UNEP WCMC

Further improvements

- Global Mangrove Data
  - 1997 World Atlas available to download NOW
  - 2000 UNEP/USGS available end 2012
    - Highest resolution (30m) global dataset
    - Only spatially consistent global dataset
    - USGS updates and final processing underway
  - 2010 World Atlas available to view June 2012
    - for access contact UNEP-WCMC
- Cold coral reef (global) - pending access approval

UNEP WCMC

Data improvements – Standards

- Developed in collaboration with the International Blue Carbon Scientific Working Group (IBCSWG)
- Blue Carbon – carbon stored by coastal and ocean ecosystems such as mangroves, seagrasses and saltmarshes
- Set of standardised core data and metadata attributes for mangroves, seagrasses and saltmarshes
- Result – consistent data
- Finalised core attributes to be tested at pilot sites

UNEP WCMC

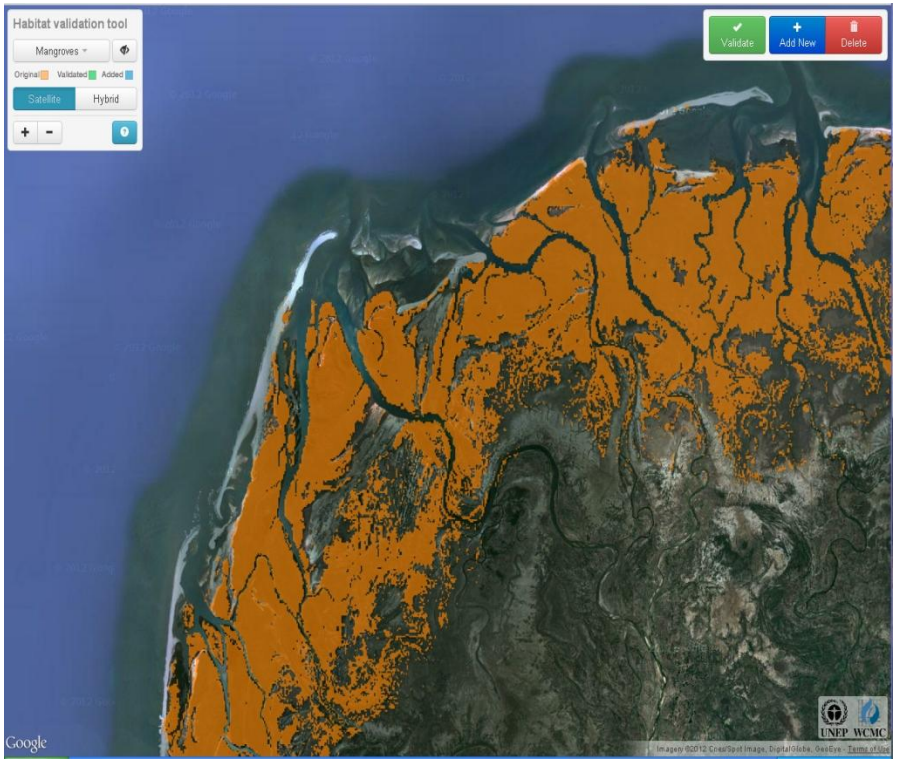
Data improvements - Validation

- For all remotely collected information e.g. by satellite, aerial photos; it is necessary to confirm and validate it's accuracy using another data source
- Validation of global habitat datasets never before possible at this scale
- Expert validation based on:
  - Local data
  - Local knowledge
  - Underlying imagery in validation tool
- validation.unep-wcmc.org

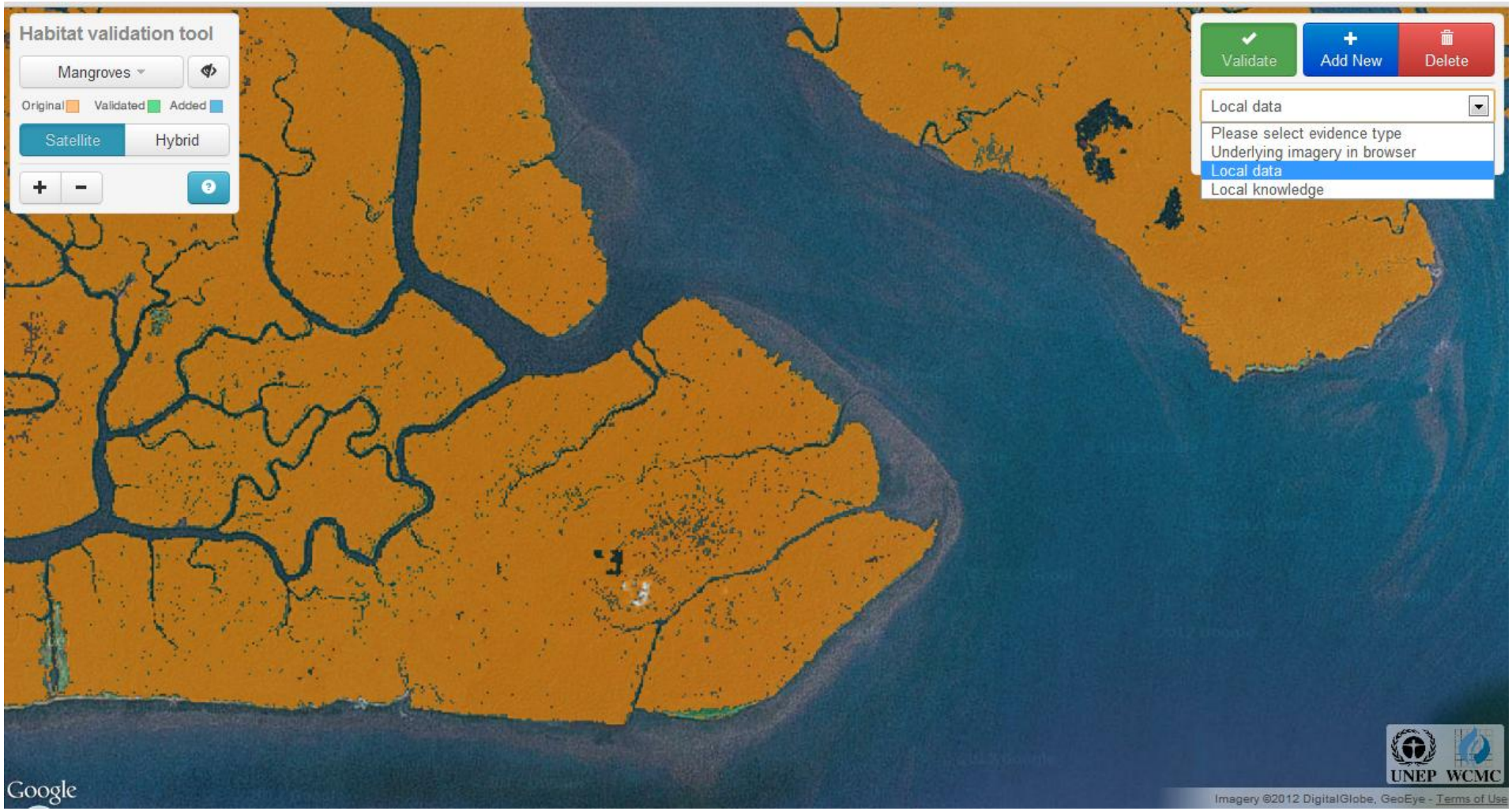
UNEP WCMC

Habitat Validation Tool

- Validate, generate and improve coastal habitat spatial extent data online
- Tested with:
  - African subset of the UNEP/USGS Mangroves (2000)
  - Global Coral Reefs (2010)
  - Saltmarsh mapping online
- User edits incorporated into the online layer



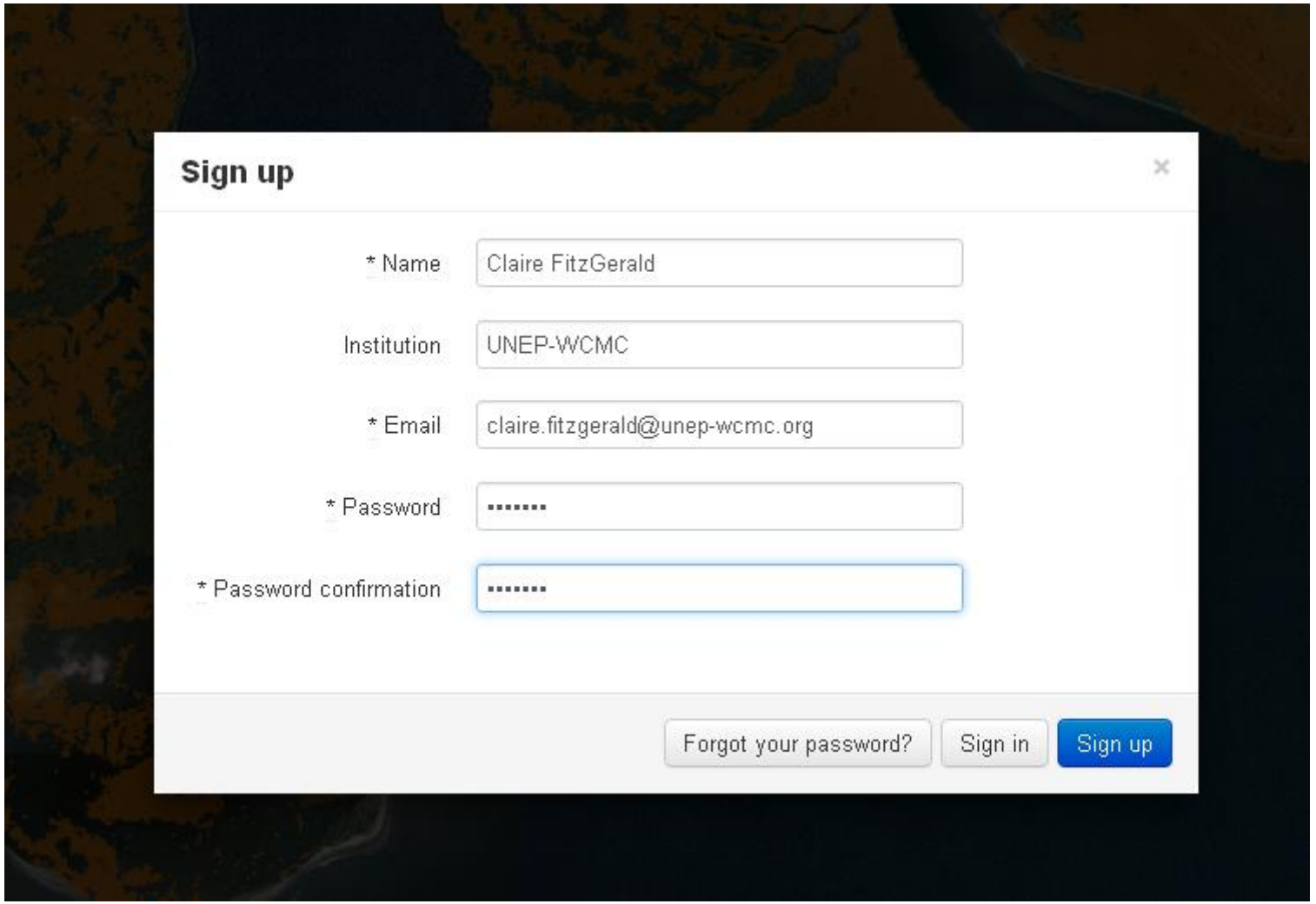
Zoom in to begin editing



Select evidence type and area to validate

UNEP WCMC

Experts register and submit validation



Habitat Validation Tool - Future

- Validate additional global datasets
  - Seagrass
  - Mangrove
- Upload spatial data
  - for integration into the online dataset
- Download online version
  - accompanied by official static version
  - according to user defined area of interest
- Online habitat change detection
  - Multi-date imagery

UNEP WCMC

Data Improvements – Networking and Partnerships

- Building data improvement networks using online validation tools
- Promotion of UNEP-WCMC's *Better Data, Better Decisions* initiative
- Habitat Validation Tool launched May 22nd, International Day for Biological Diversity
- Further events - Conference of the Parties (COP 11) to the Convention on Biological Diversity (CBD), Hyderbad 1-19 Oct 2012

Better Data,
Better Decisions

A global data partnership to transform coastal ecosystem monitoring and assessment

UNEP WCMC

UNEP WCMC

Proteus Partners Meeting 2012

hosted in London by Shell on June 14th