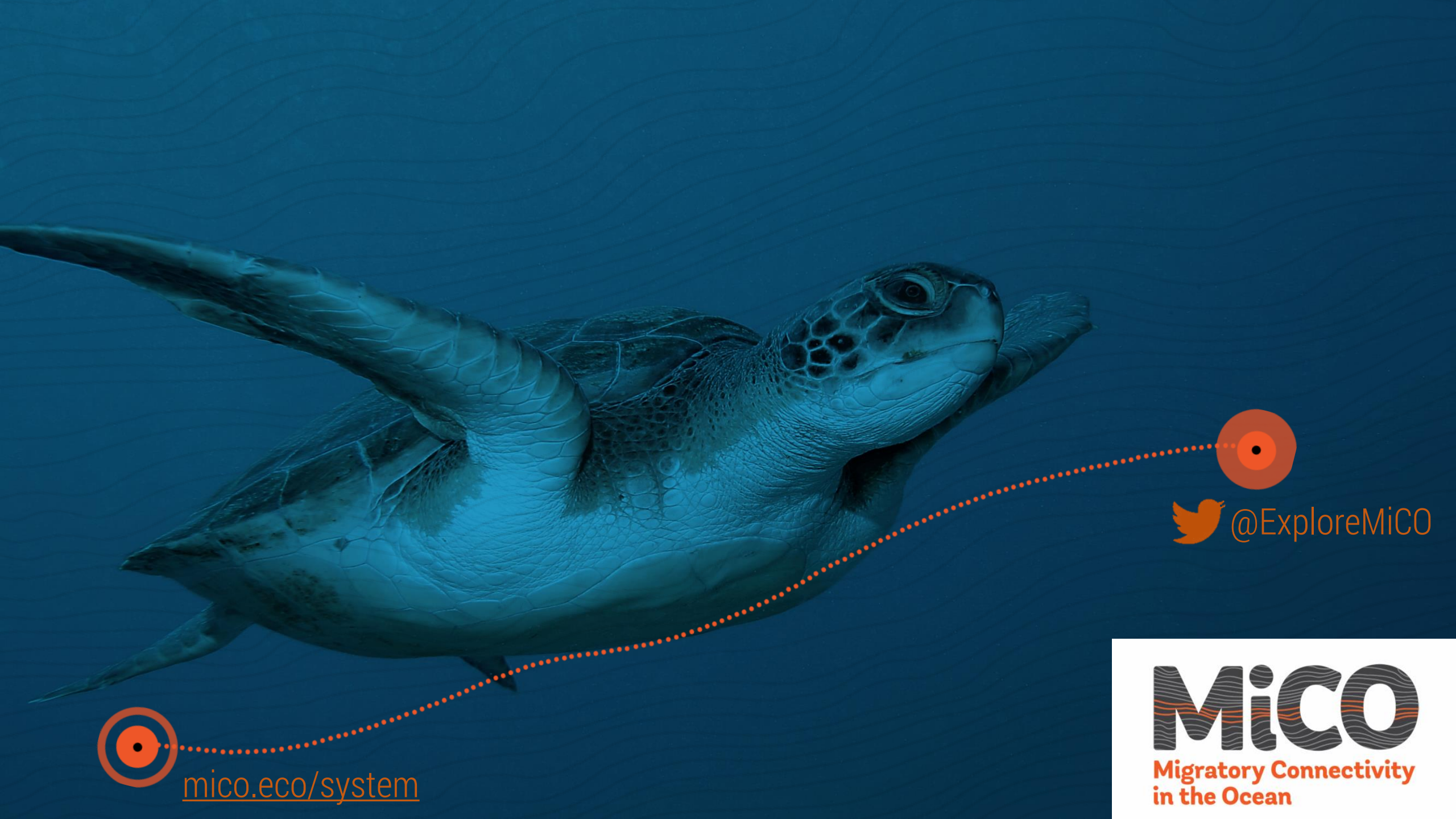
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MiCO
Migratory Connectivity
in the Ocean

MiCO IS A CONSORTIUM

Led by

The University of Queensland AUSTRALIA

Duke UNIVERSITY

Supported by

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

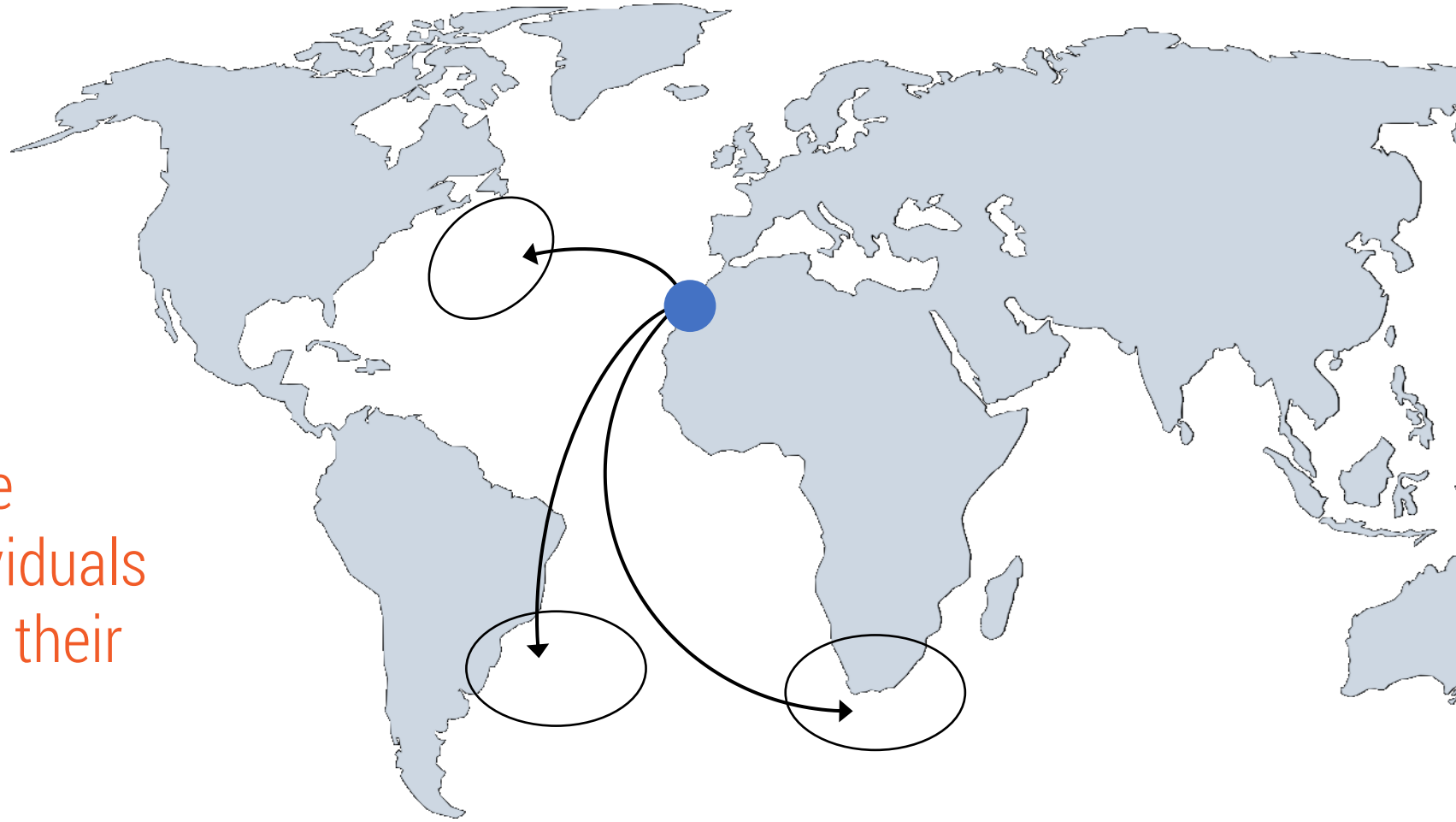
based on a decision of the German Bundestag

GOBI

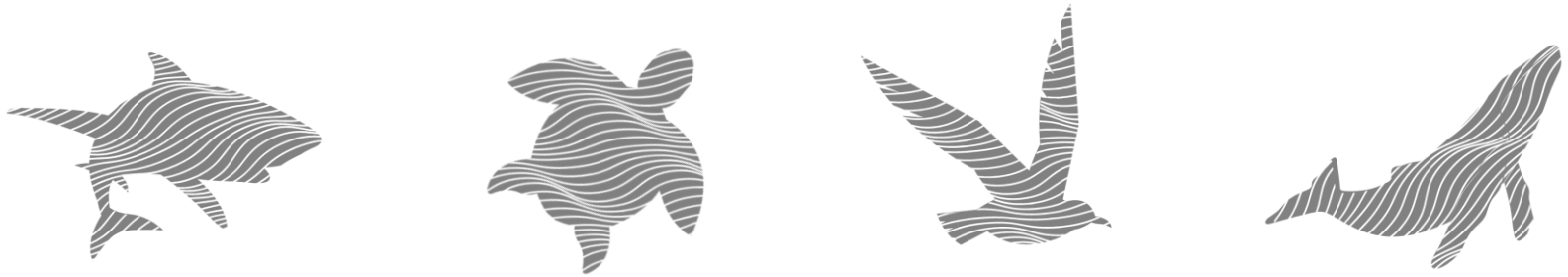
UNEP WCMC

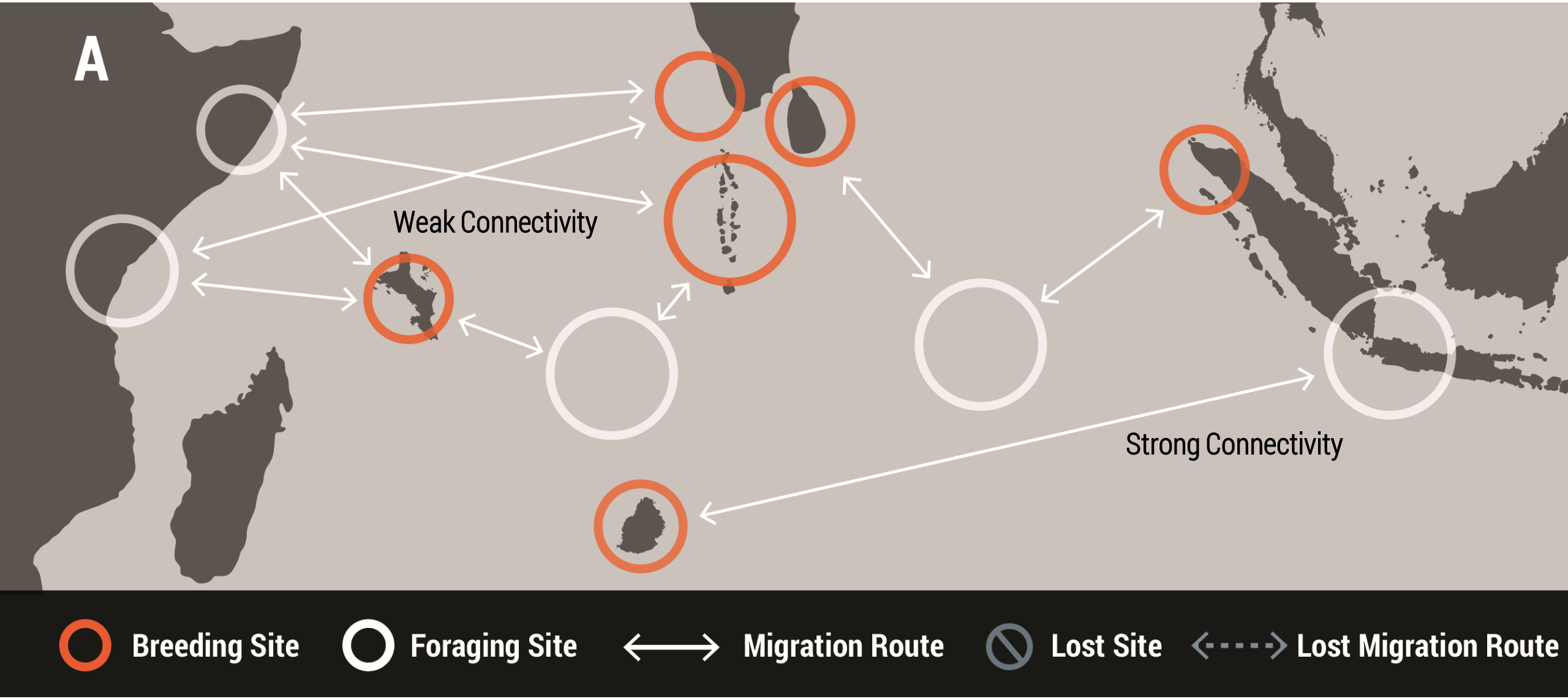
GLOBAL FISHING WATCH

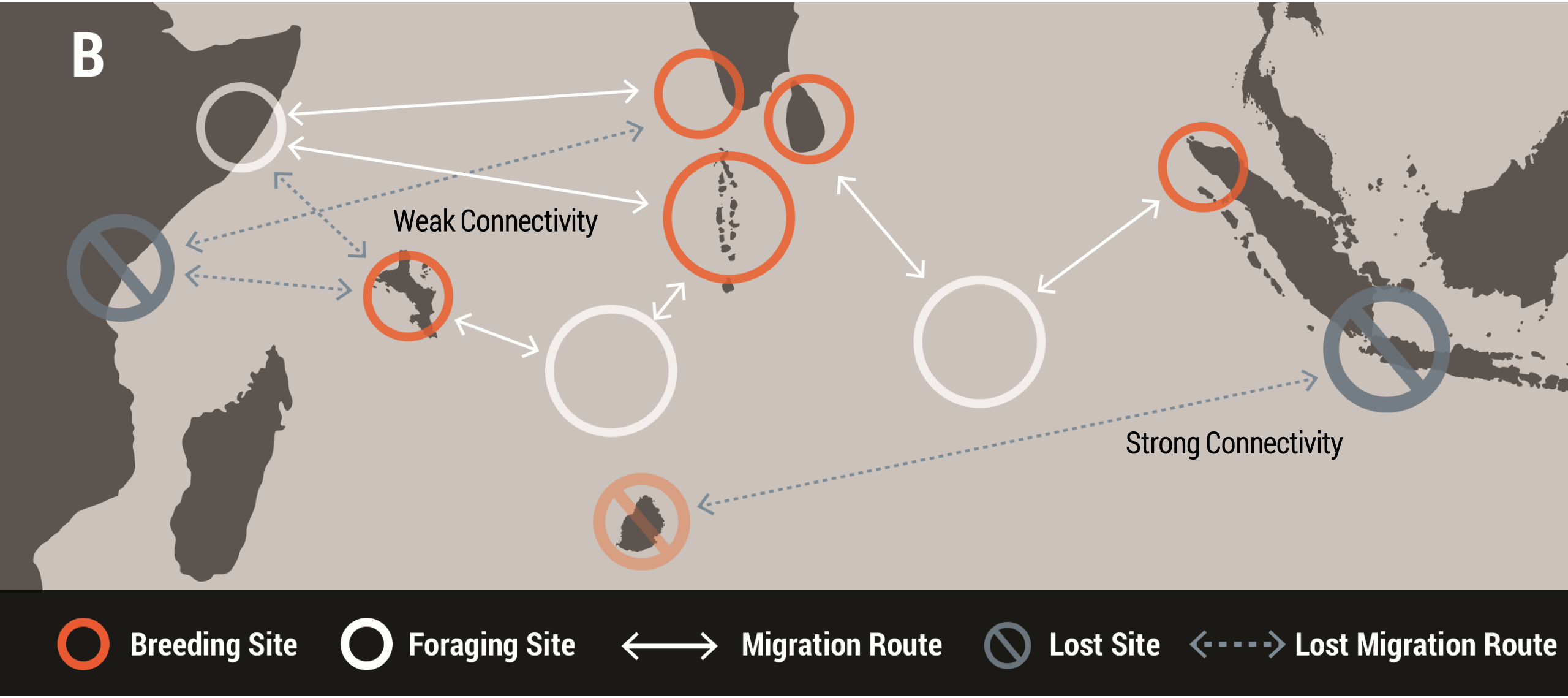
What is Migratory Connectivity?



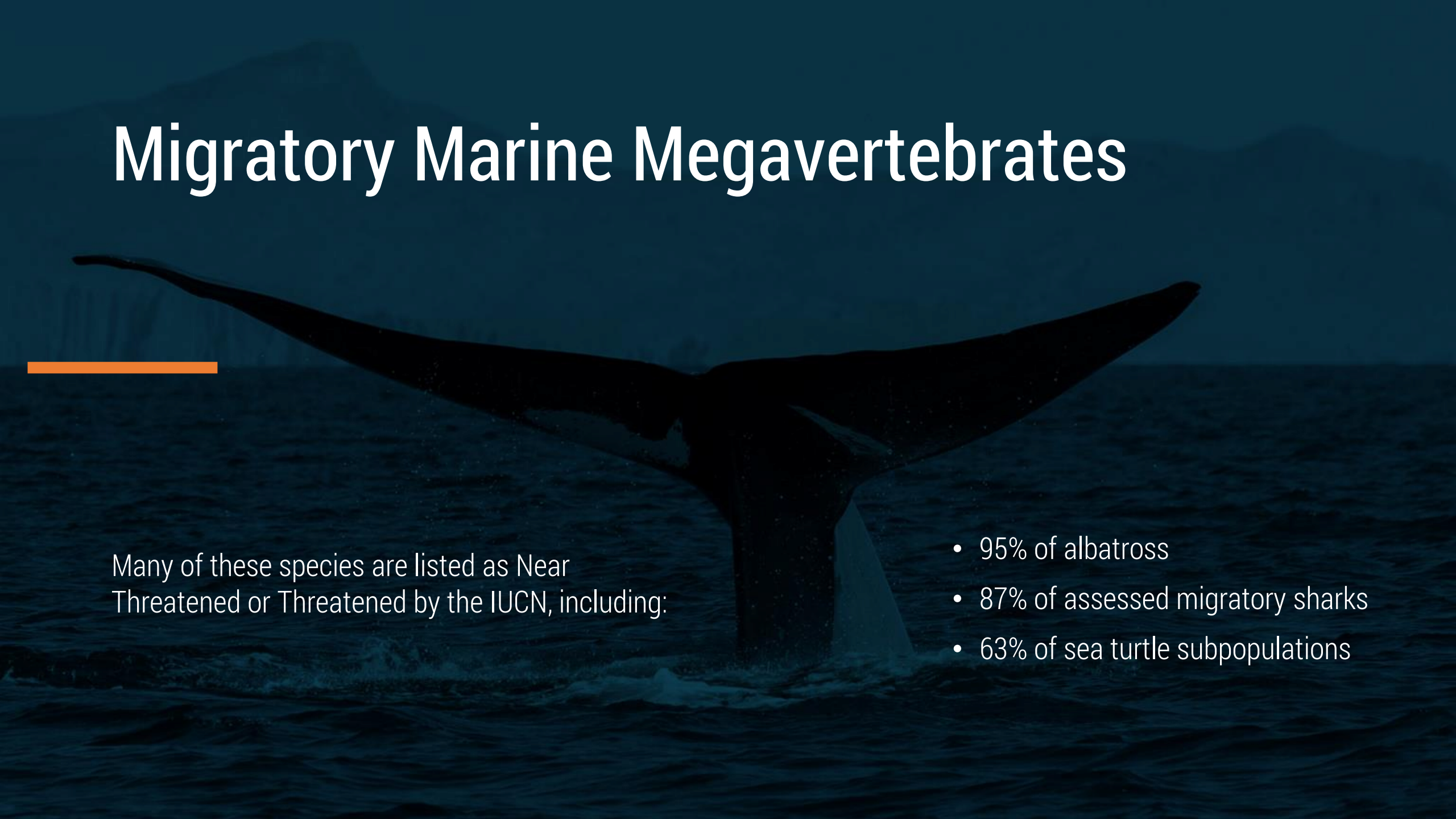
Migratory connectivity is the geographical linking of individuals and populations throughout their migratory cycles




A
Weak Connectivity
Strong Connectivity
Breeding Site
Foraging Site
Migration Route
Lost Site
Lost Migration Route


B
Weak Connectivity
Strong Connectivity
Breeding Site
Foraging Site
Migration Route
Lost Site
Lost Migration Route

Migratory Marine Megavertebrates



Many of these species are listed as Near Threatened or Threatened by the IUCN, including:

- 95% of albatross
- 87% of assessed migratory sharks
- 63% of sea turtle subpopulations

Who cares?

PROCEEDINGS B

royalsocietypublishing.org/journal/rspb

Evidence synthesis

Check for updates

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Subject Areas:
ecology

Keywords:
areas beyond national jurisdiction, migratory species, marine spatial planning, area-based management

The importance of migratory connectivity for global ocean policy

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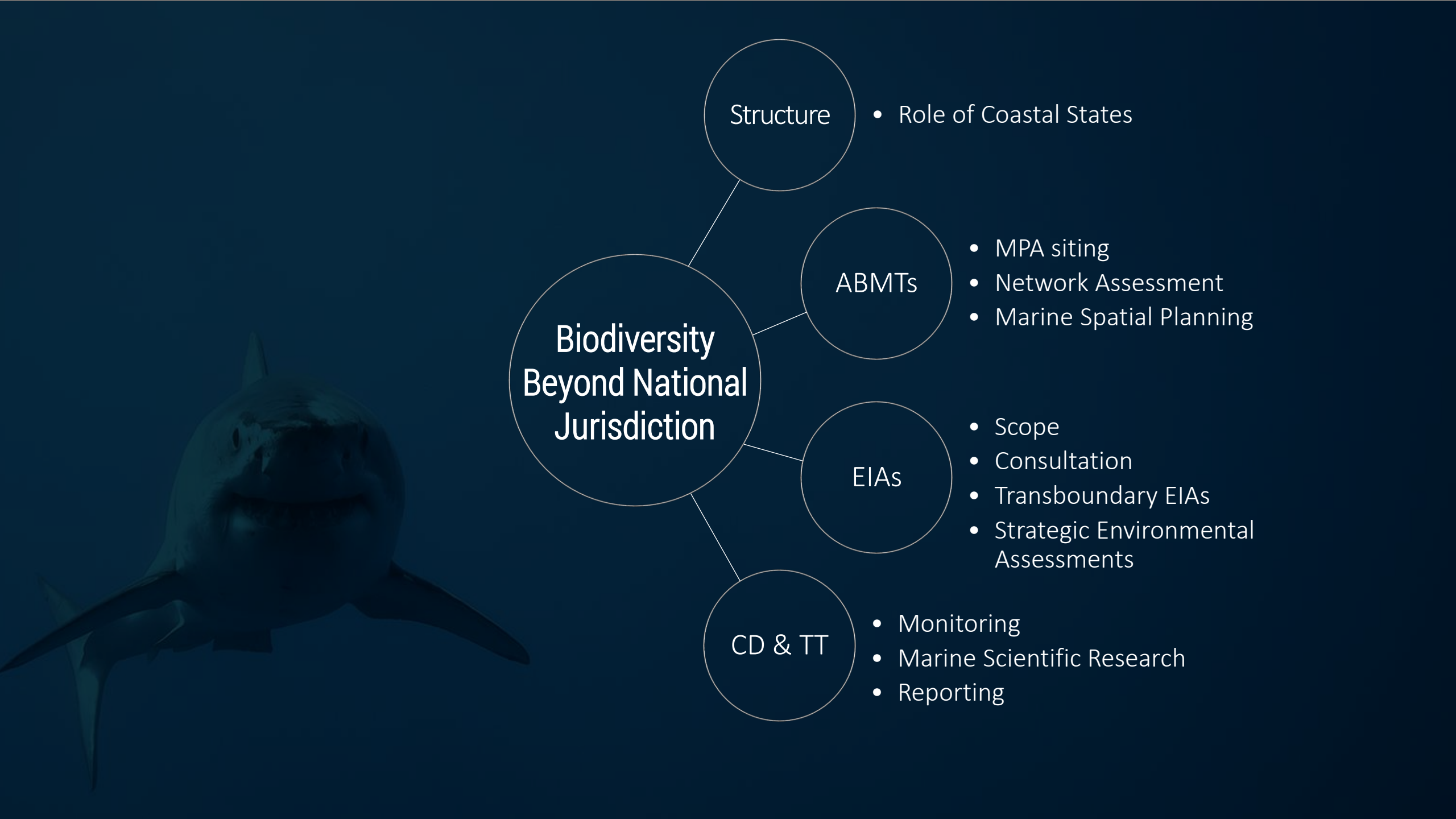
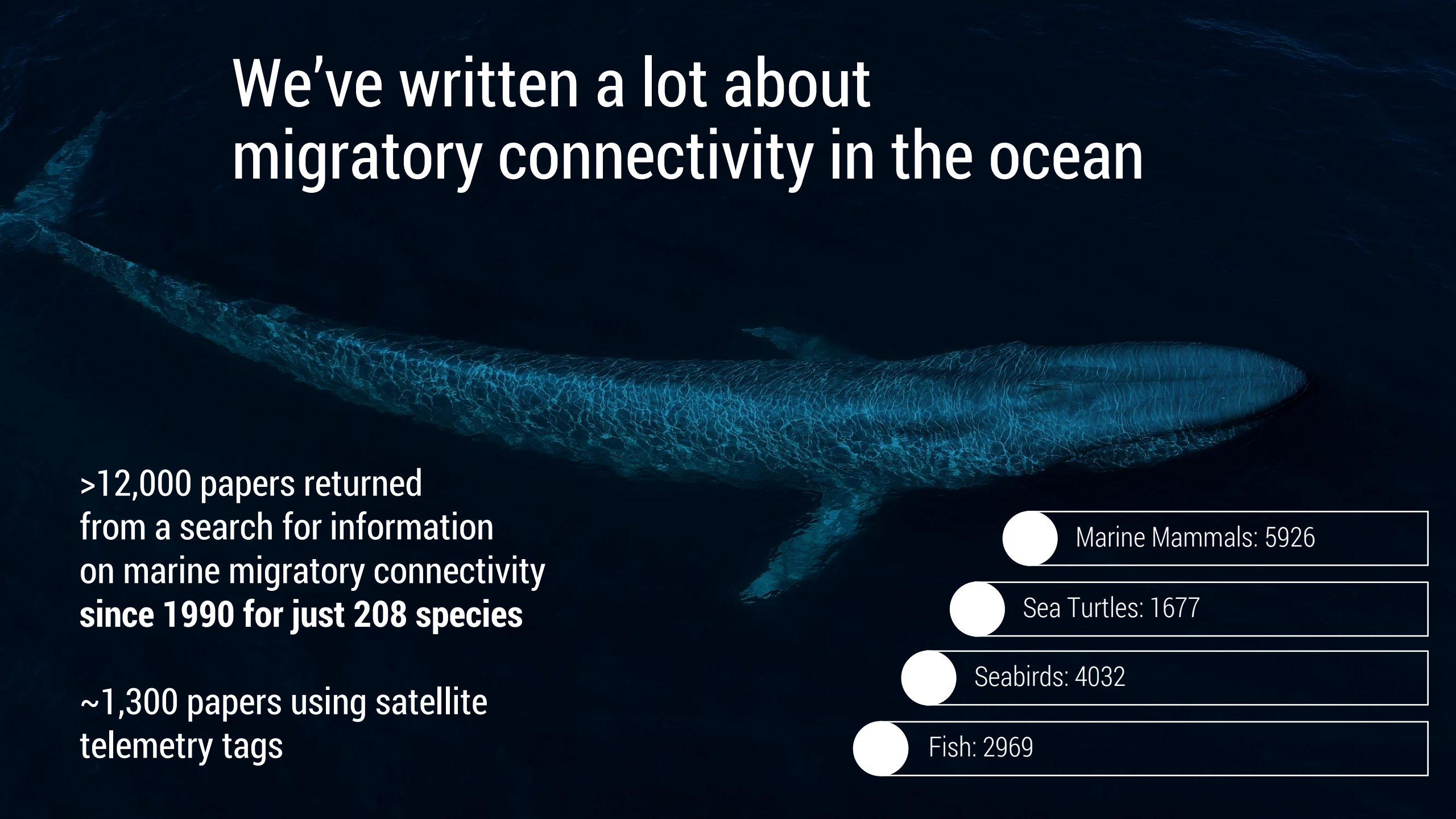
International policy arenas that require information describing Migratory Connectivity in the Ocean

- International Whaling Commission
- Regional Fisheries Management Organizations
- International Seabed Authority
- International Maritime Organization
- Biodiversity Conventions & MEAs (e.g., CBD, CMS)
- Assessments (IPBES, Regular Process, etc.)
- Aichi Targets, SDGs, Post-2020 Global Biodiversity Framework

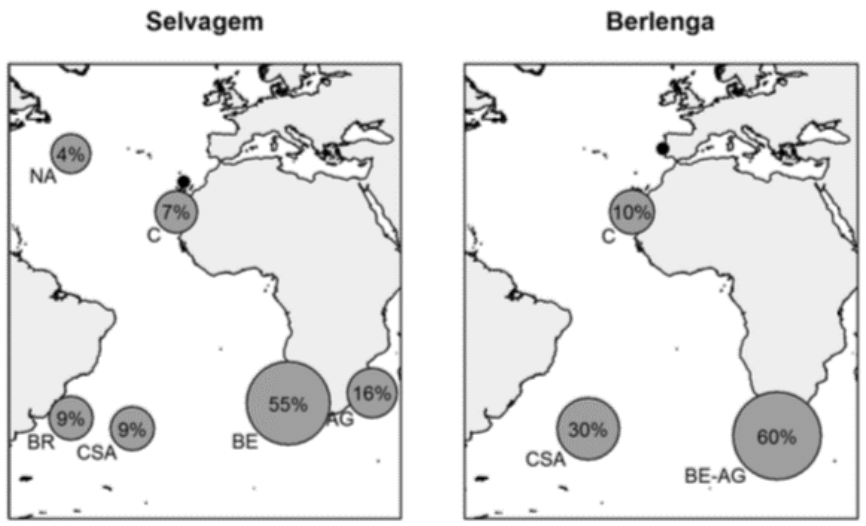

Biodiversity Beyond National Jurisdiction
Structure
• Role of Coastal States
ABMTs
• MPA siting
• Network Assessment
• Marine Spatial Planning
EIAs
• Scope
• Consultation
• Transboundary EIAs
• Strategic Environmental Assessments
CD & TT
• Monitoring
• Marine Scientific Research
• Reporting

We've written a lot about migratory connectivity in the ocean

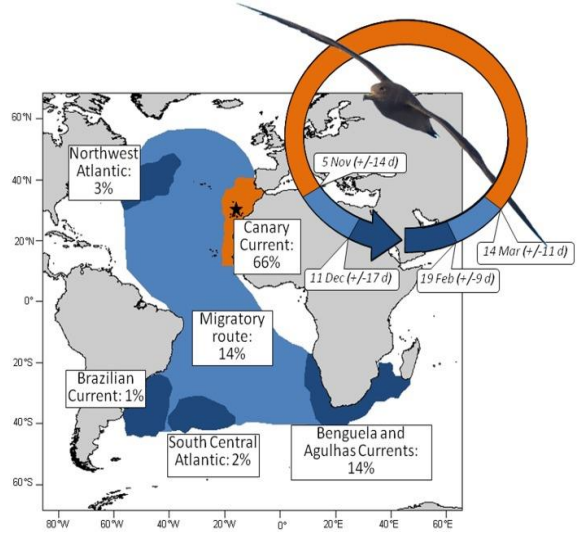


>12,000 papers returned from a search for information on marine migratory connectivity **since 1990 for just 208 species**

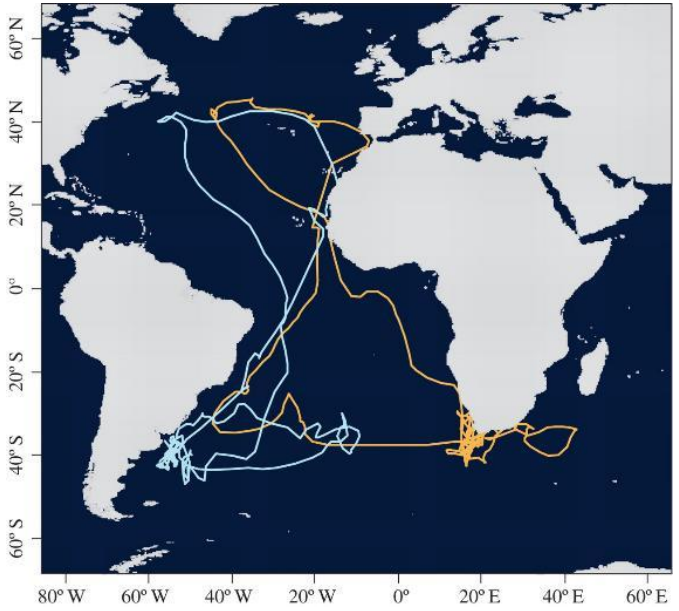
~1,300 papers using satellite telemetry tags



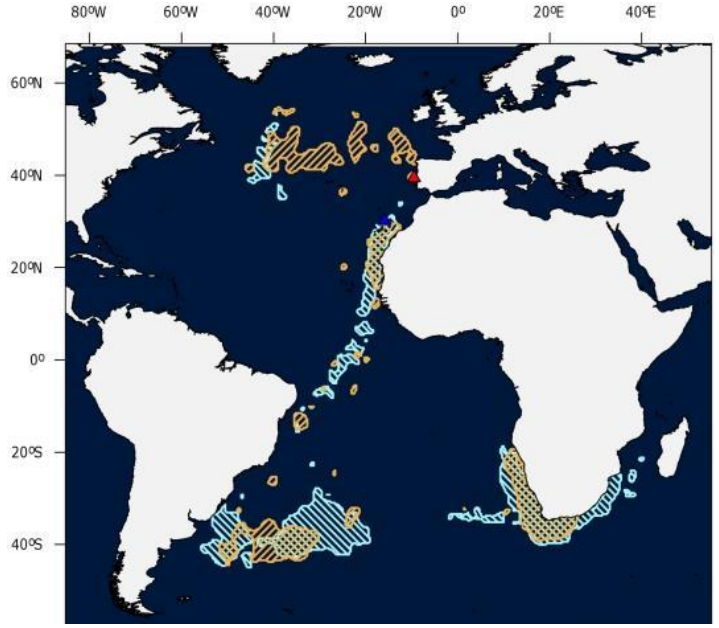
Ramos R, Granadeiro JP, Nevoux M et al. 2012



Ramos et al. 2012



Gonzalez-Solis, Croxall, Oro, Ruis. 2007

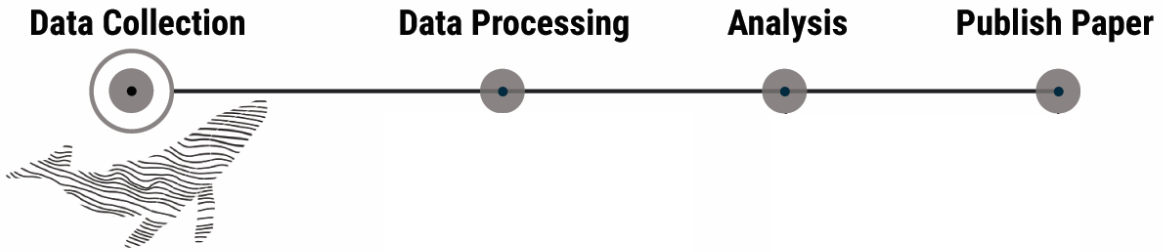


Catry P, Dias MP, Phillips RA, Granadeiro JP (2011)


Academic Research
We have a knowledge transfer problem
12,000 papers with information on migratory connectivity from 1990-2016

We know what the problem is…

Limited research to policy track

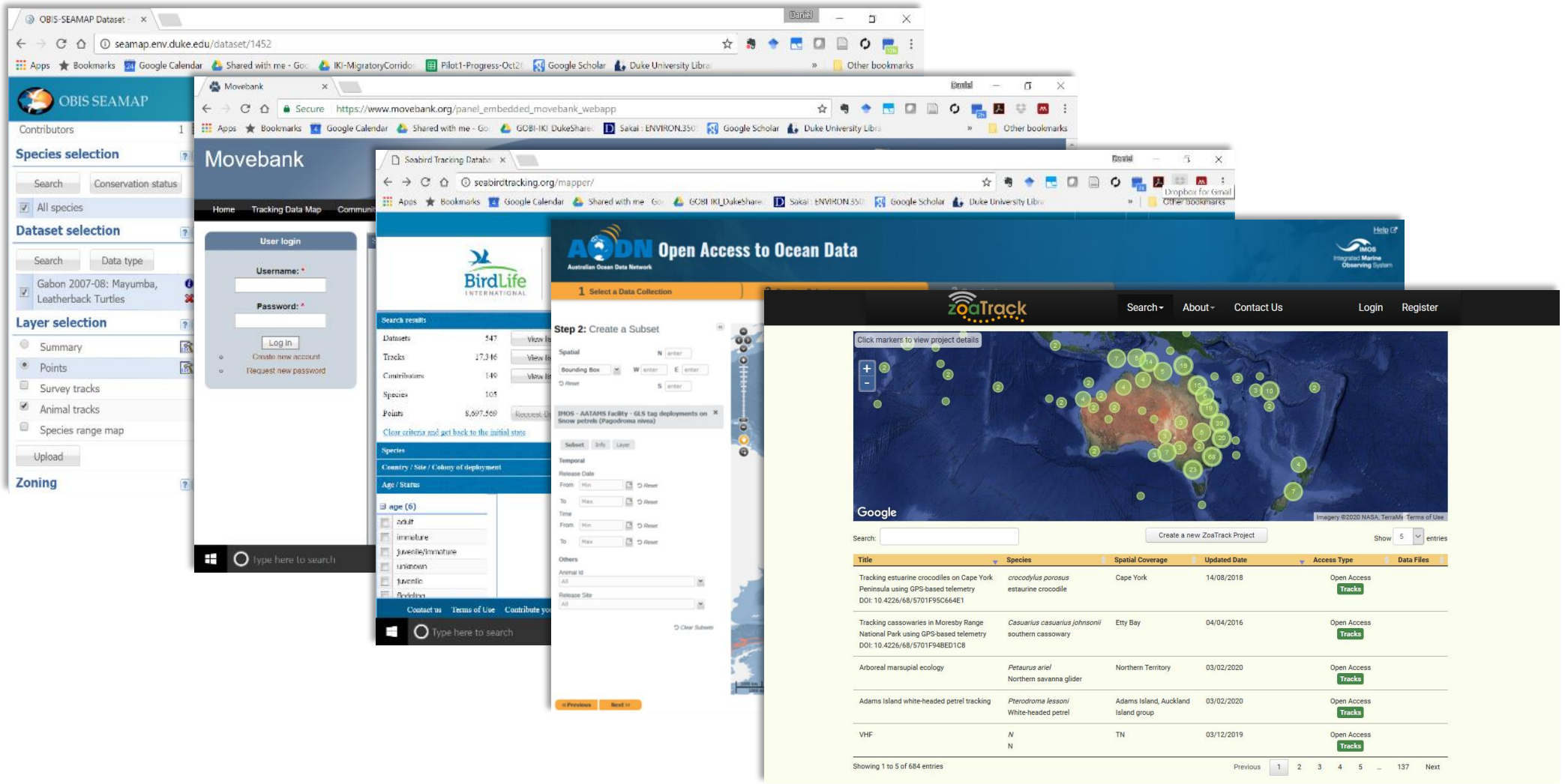


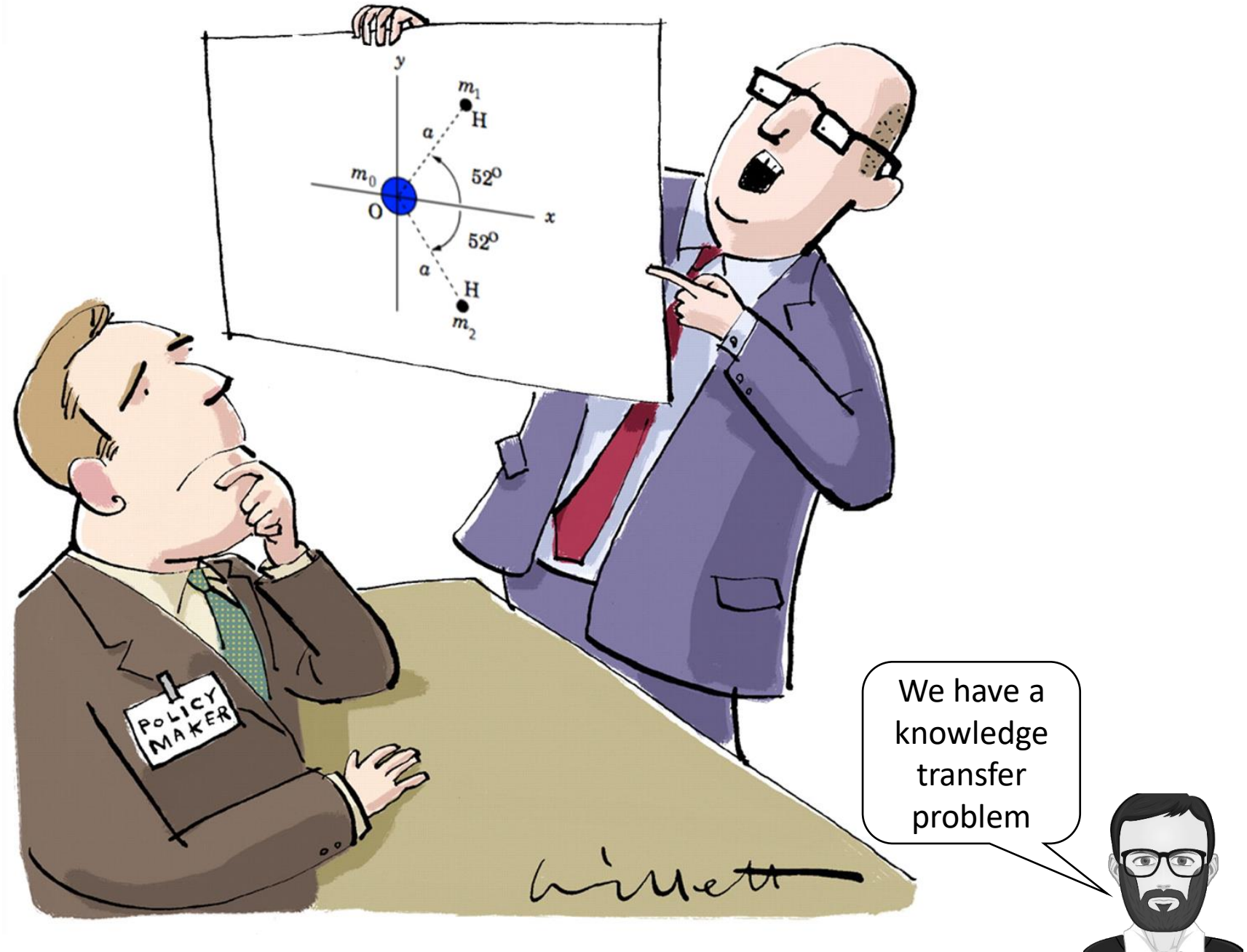
Knowledge Transfer Gap

Corporate Needs

- Develop EIAs
- Reduce Operational Risk
- Investment/Siting

And it is not just our words that are getting lost…




y
m_1
H
a
m_0
52°
O
x
52°
a
H
m_2
POLICY MAKER
We have a knowledge transfer problem

DATA

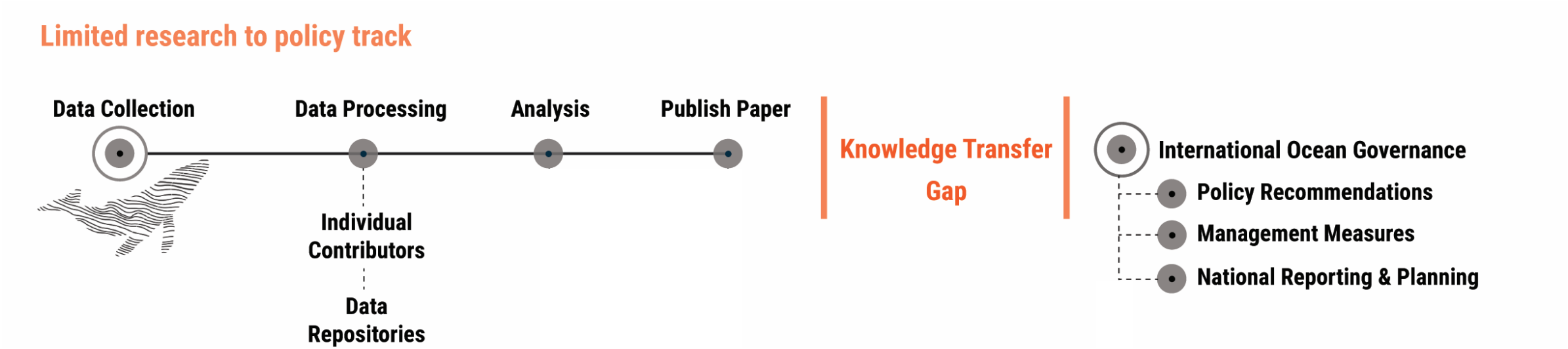
Obstacles:

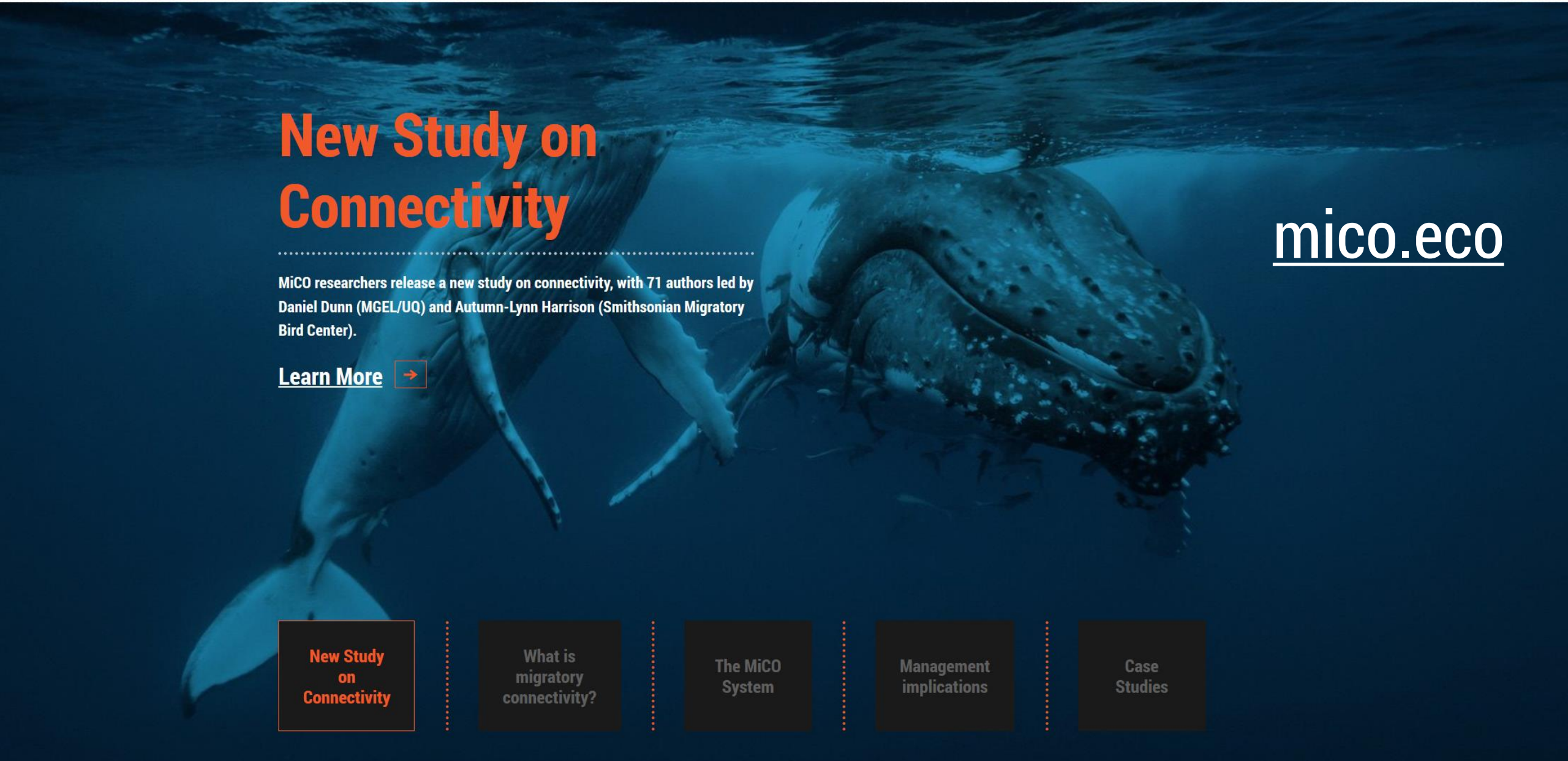
- Budget
- Capacity
- Time

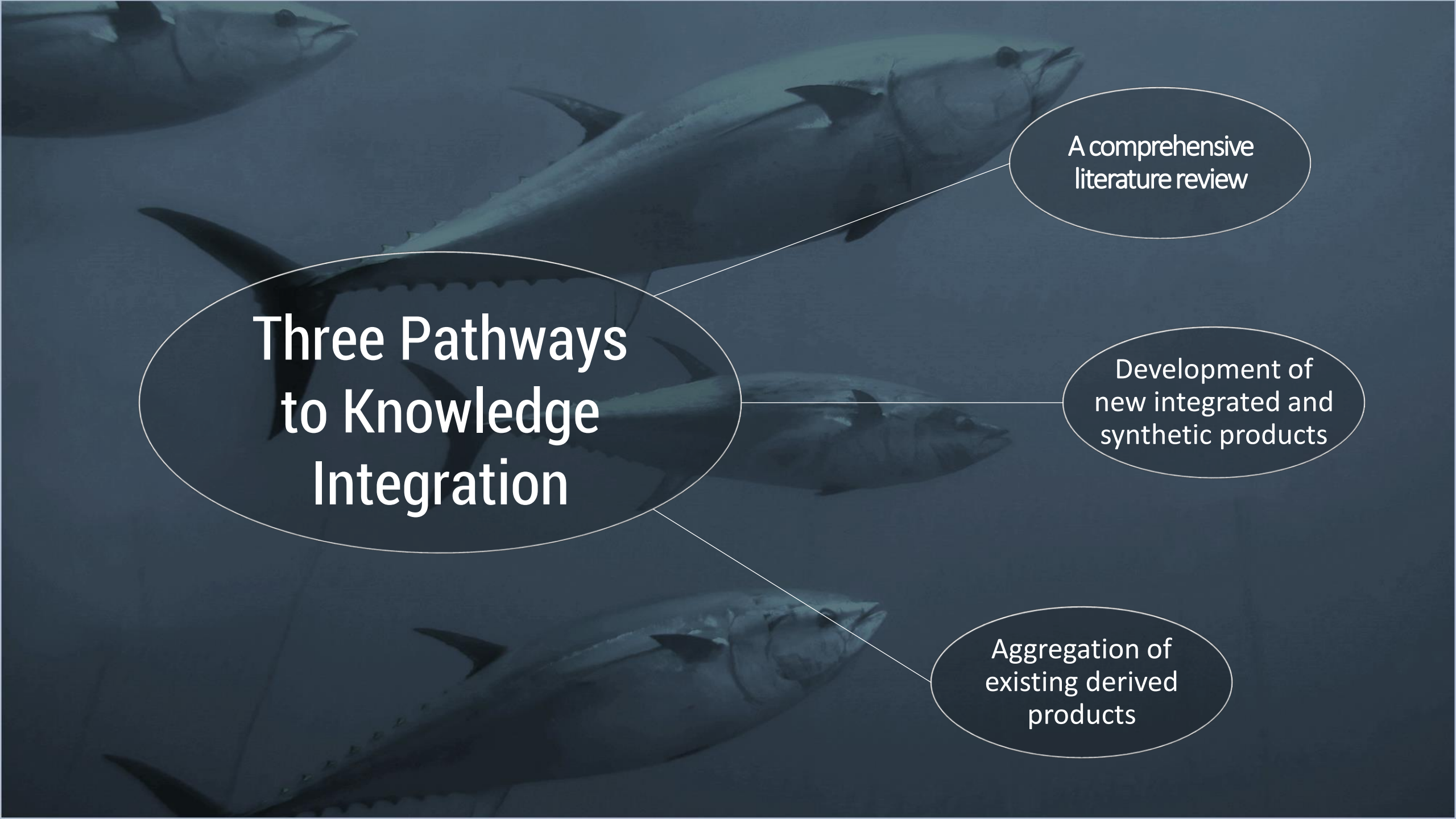
DATA

The sea-change happening *now* is aggregation of…

We also know what the solution is…




MiCO Migratory Connectivity in the Ocean
Become a Contributor | Launch MiCO System | Events & Publications
New Study on Connectivity
MiCO researchers release a new study on connectivity, with 71 authors led by Daniel Dunn (MGEL/UQ) and Autumn-Lynn Harrison (Smithsonian Migratory Bird Center).
Learn More
mico.eco
New Study on Connectivity
What is migratory connectivity?
The MiCO System
Management implications
Case Studies


Three Pathways to Knowledge Integration
A comprehensive literature review
Development of new integrated and synthetic products
Aggregation of existing derived products

Sampling methods to inform connectivity

Satellite telemetry or geolocator

Mark-recapture

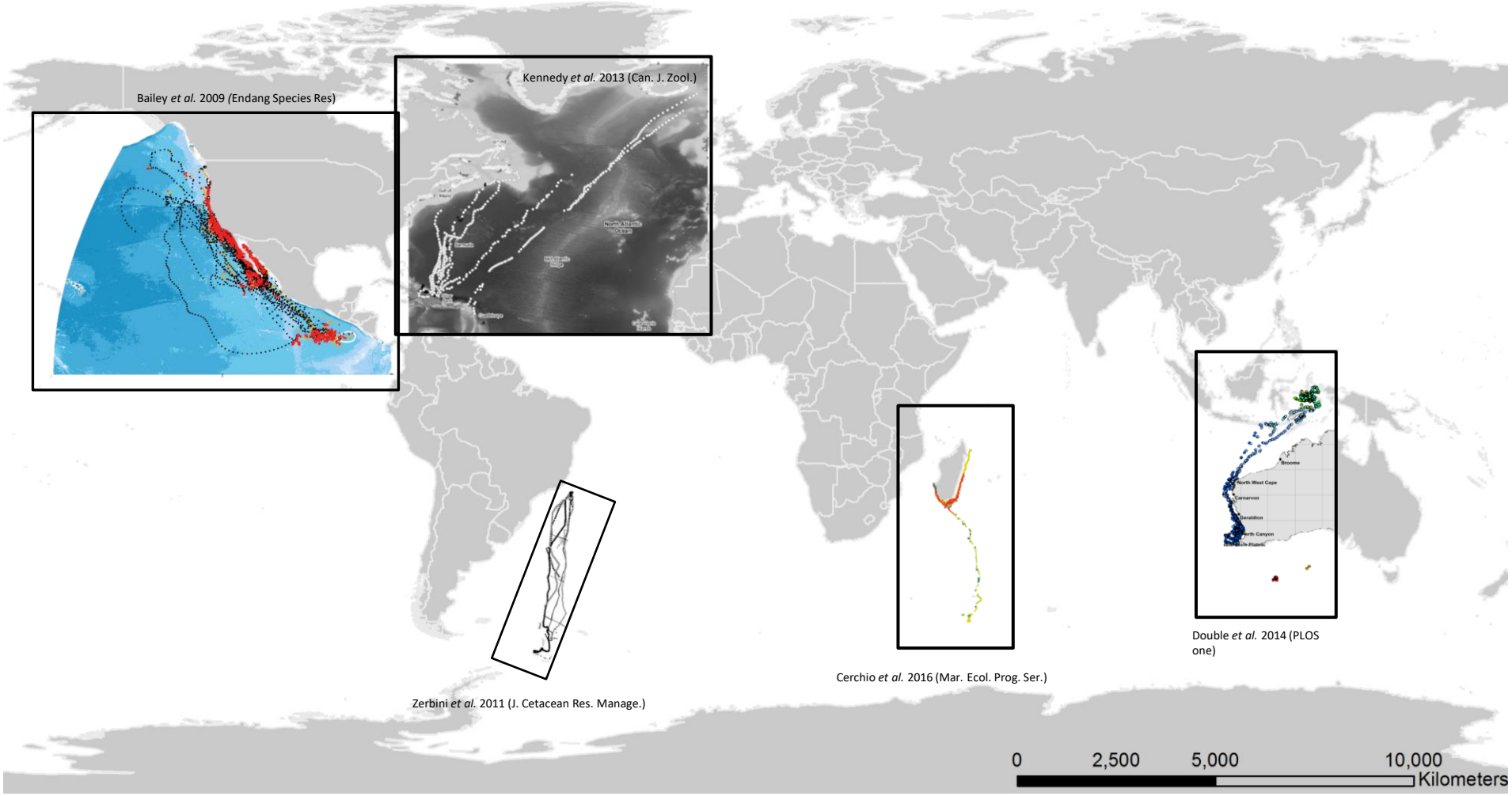
Stable isotope

Passive acoustic monitoring

Genetic sampling

Lit review

Literature Review of telemetry studies



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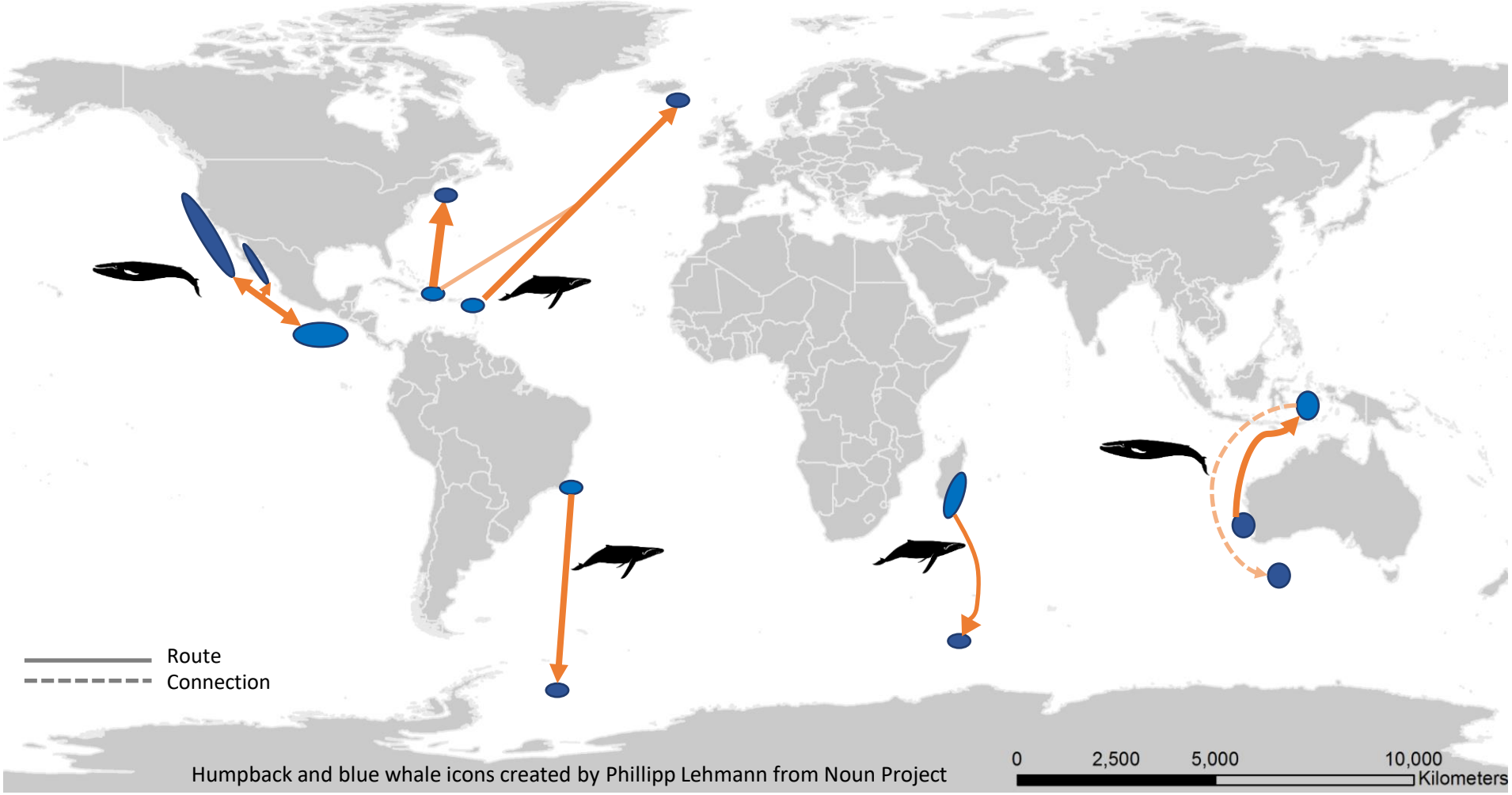
Literature Review of telemetry studies



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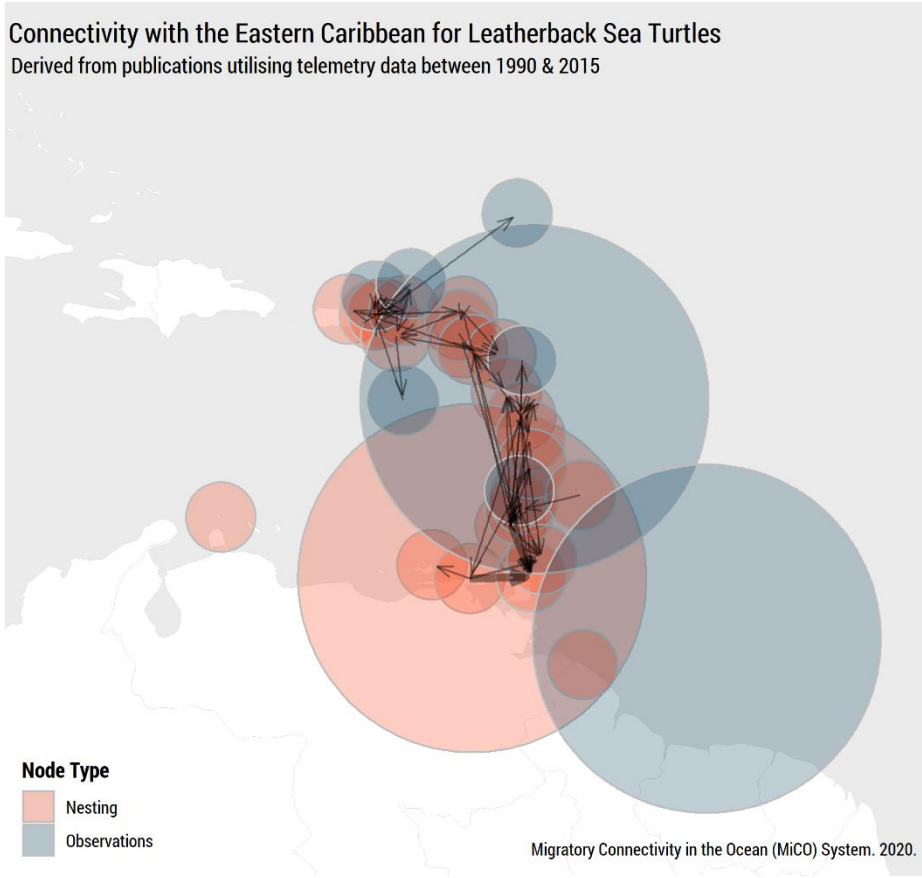
Network models from telemetry literature

Leatherback Sea Turtles

Raw data
- 96 papers
- 397 sites
- 321 connections

Synthesized network
- 133 meta-sites
- 205 meta-connections



MiCO Migratory Connectivity in the Ocean

proteus

UN environment programme WCMC

Network models from telemetry literature

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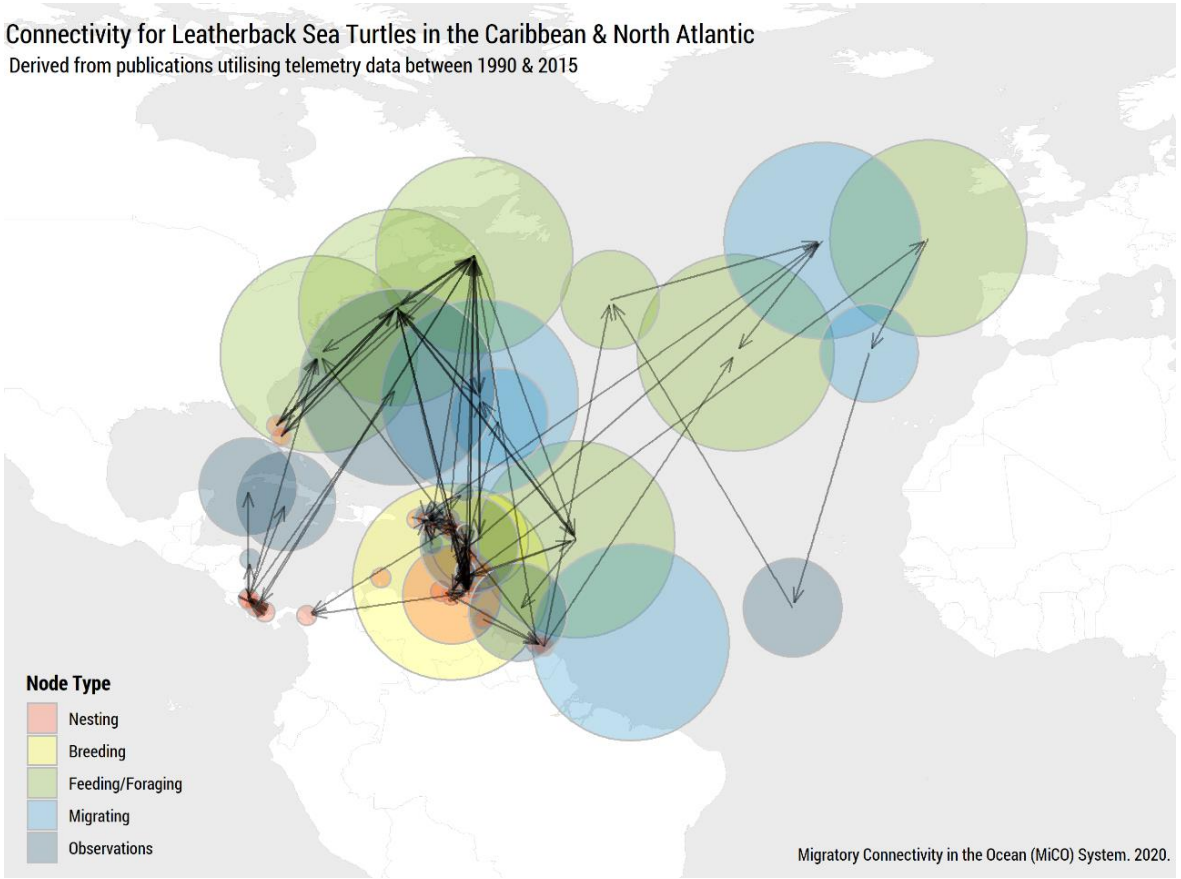
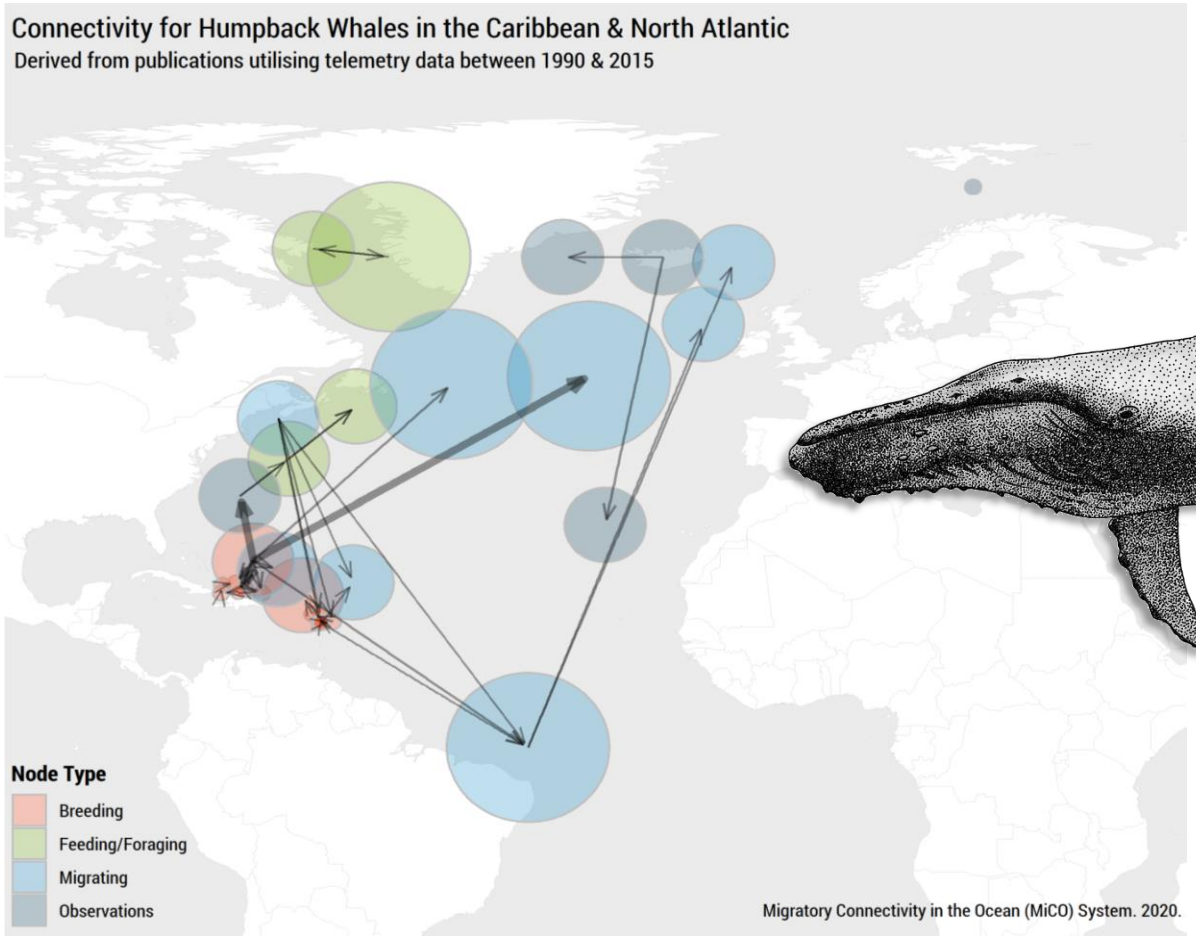
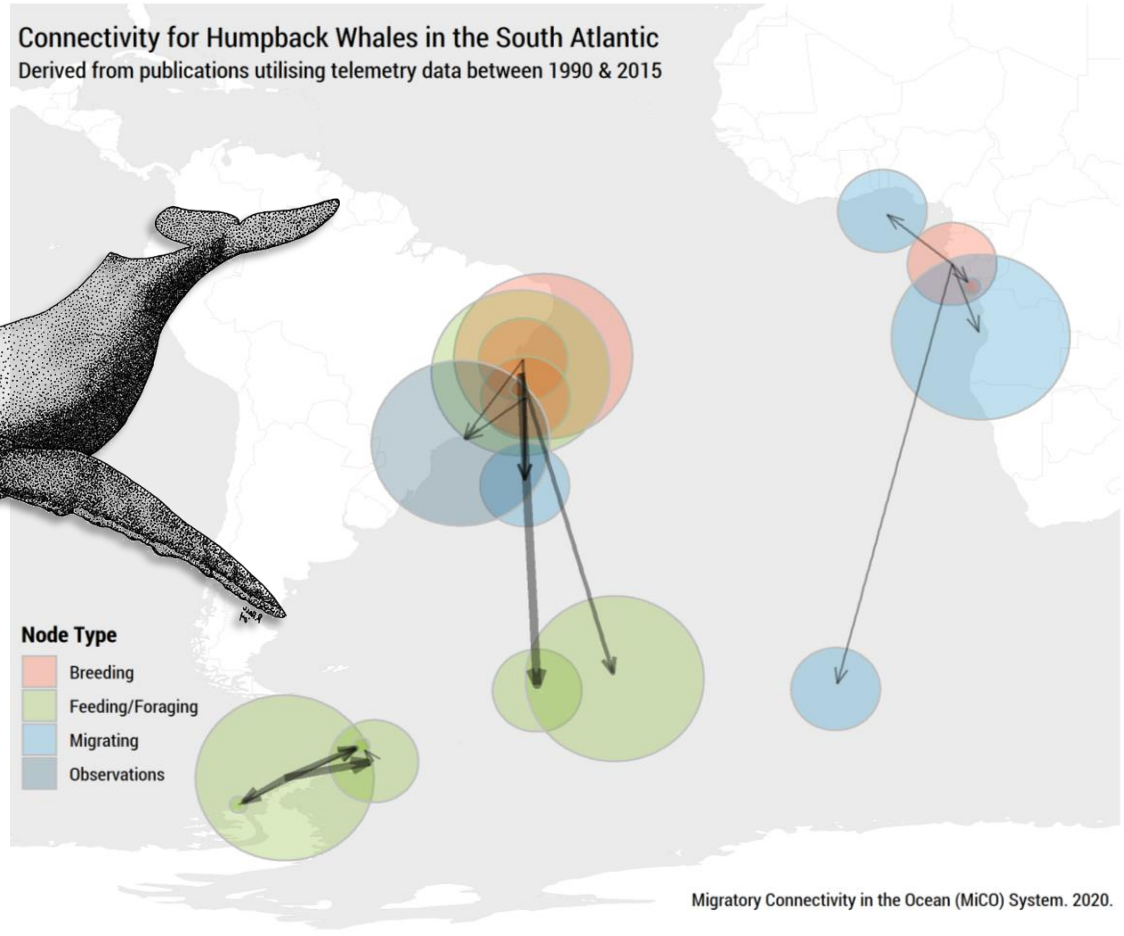


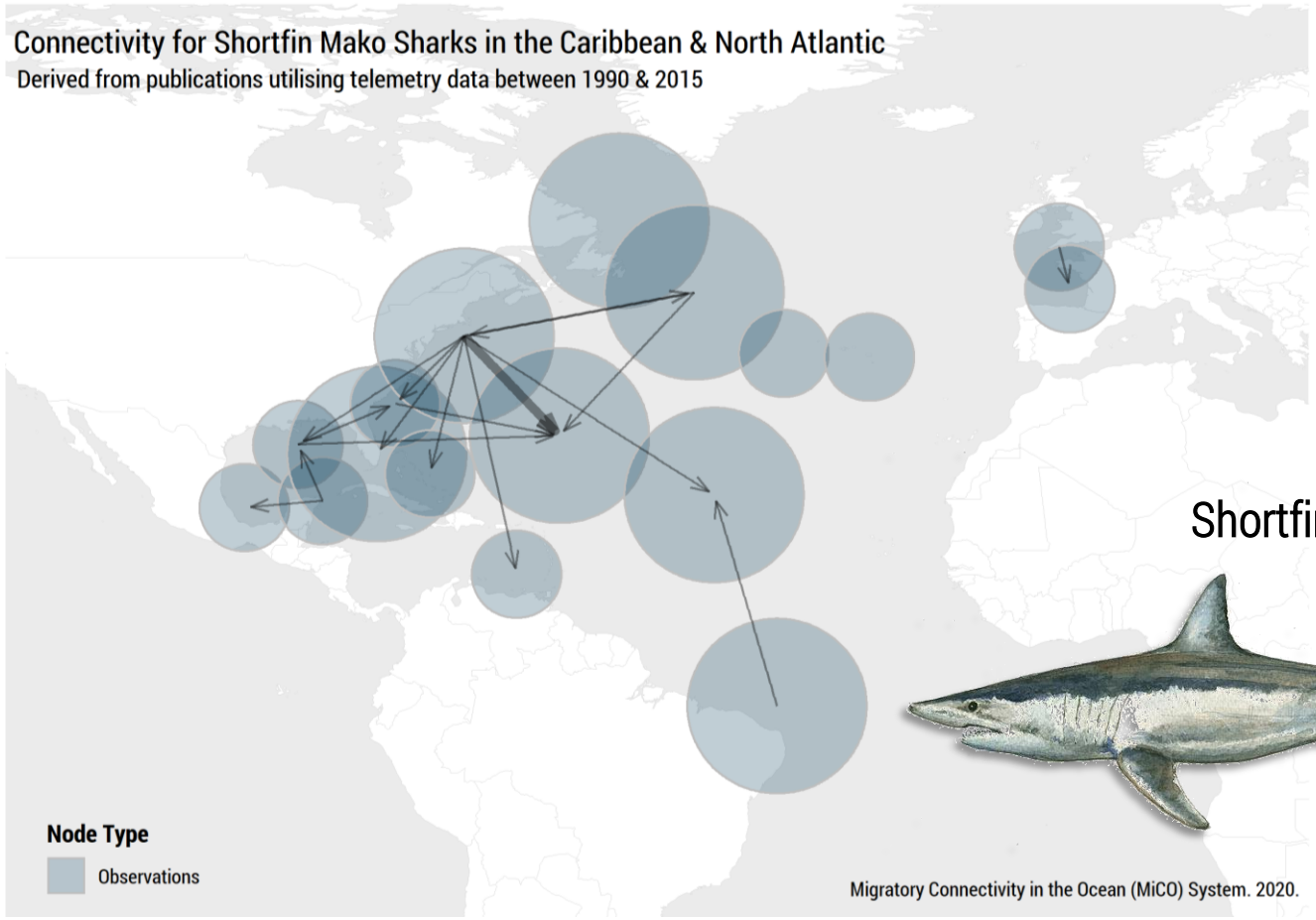
Usable Knowledge for Industry





MiCO Migratory Connectivity in the Ocean

Network models from telemetry literature



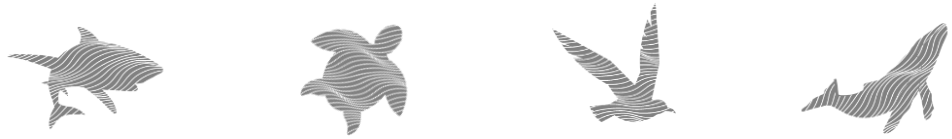
Shortfin Mako Sharks

MiCO Migratory Connectivity in the Ocean

A lot of information and a lot more to incorporate

Currently:

- synthesized >30 species * region networks
- Should have 80+ species by May
- Only looking at telemetry papers, more info in papers using mark/recapture, stable isotope, genetic and acoustic sampling methods
- Hundreds more species to be addressed



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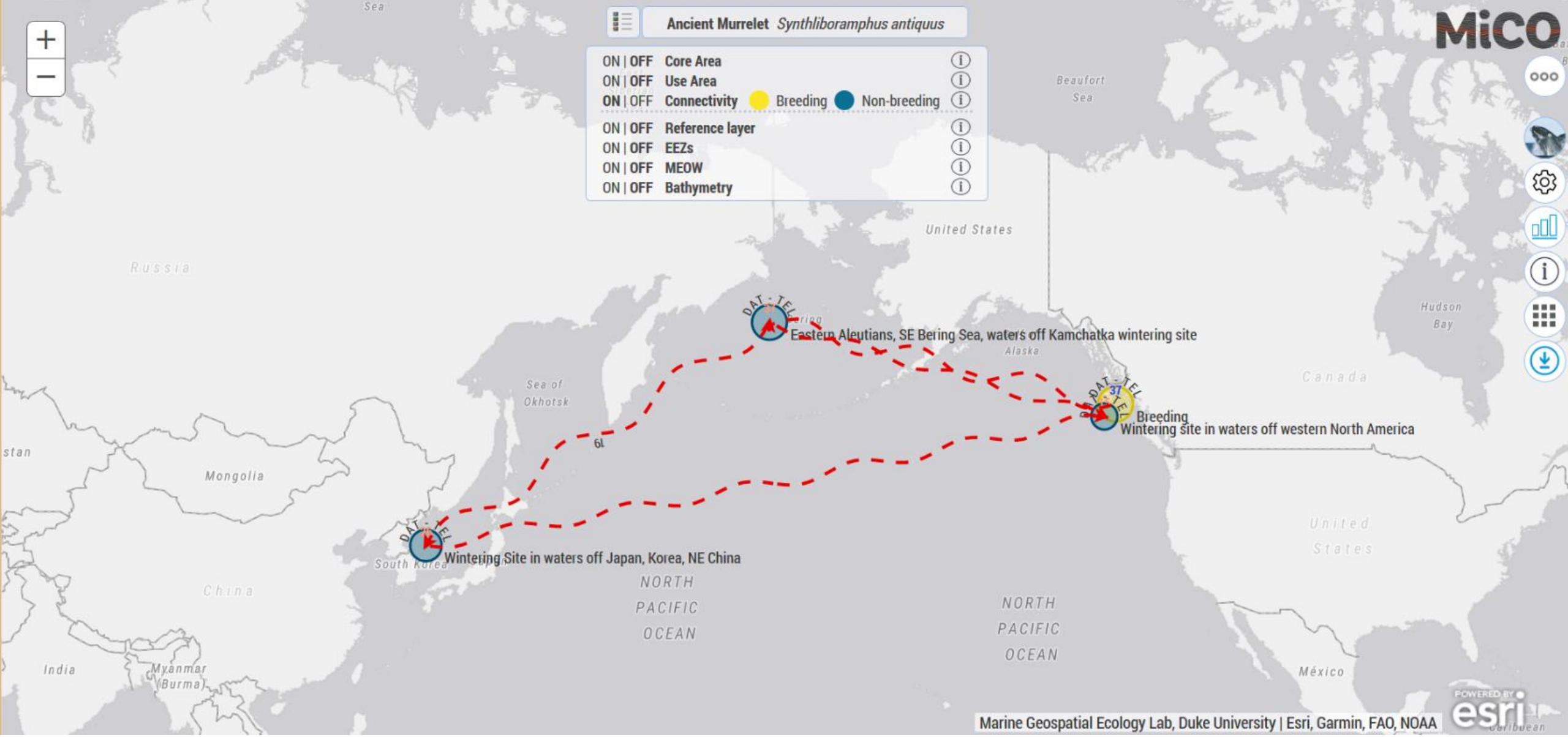
Fish (35)
Albacore Tuna
Atlantic Bluefin Tuna
Basking Shark
Bigeye Thresher Shark
Bigeye Tuna
Black Marlin
Blackfin Tuna
Blue Marlin
Chilean Devil Ray
Common Dolphinfish
Common Thresher Shark
Dugong
European Eel
Giant Manta Ray
Great Hammerhead
Great White Shark
Killer Whale
Longbill Spearfish
Longfin Mako
Pacific Bluefin Tuna
Porbeagle
Reef Manta Ray
Sailfish
Scalloped Hammerhead
Shortfin Mako
Silky Shark
Skipjack Tuna
Southern Bluefin Tuna
Spinetail Devil Ray
Striped Marlin
Swordfish
Wahoo
Whale Shark
White Marlin
Yellowfin Tuna

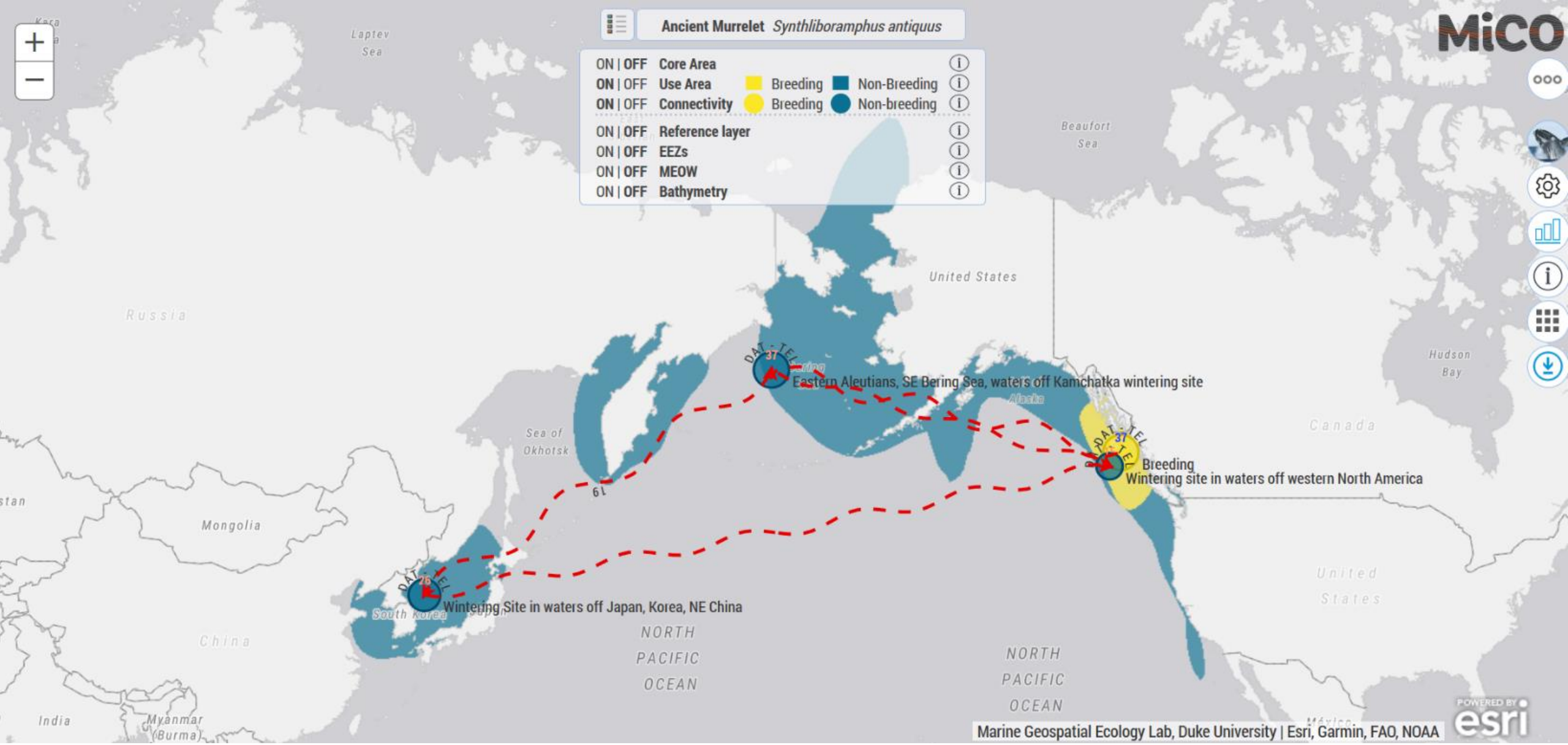
Seabirds (16)
Amsterdam Albatross
Arctic Tern
Black-browed Albatross
Black-footed Albatross
Grey-headed Albatross
Hawaiian Petrel
Laysan Albatross
Light-mantled Albatross
Northern Giant Petrel
Short-tailed Albatross
Sooty Albatross
Southern Giant Petrel
Southern Royal Albatross
Wandering Albatross
White-chinned Petrel
Yellow-billed Loon

MarineMammals (26)
American Manatee
Atlantic White-sided Dolphin
Beluga
Blue Whale
Bowhead Whale
Bryde's Whale
Cuvier's Beaked Whale
Fin Whale
Grey Seal
Heaviside's Dolphin
Humpback Whale
Long-finned Pilot Whale
Narwhal
North Atlantic Bottlenose Whale
North Atlantic Right Whale
North Pacific Right Whale
Pantropical Spotted Dolphin
Polar Bear
Risso's Dolphin
Sei Whale
Short-beaked Common Dolphin
South American Fur Seal
South American Manatee
Southern Right Whale
Sperm Whale
White-beaked Dolphin

SeaTurtles (all 7)
Flatback
Green
Hawksbill
Kemp's Ridley
Leatherback
Loggerhead
Olive Ridley

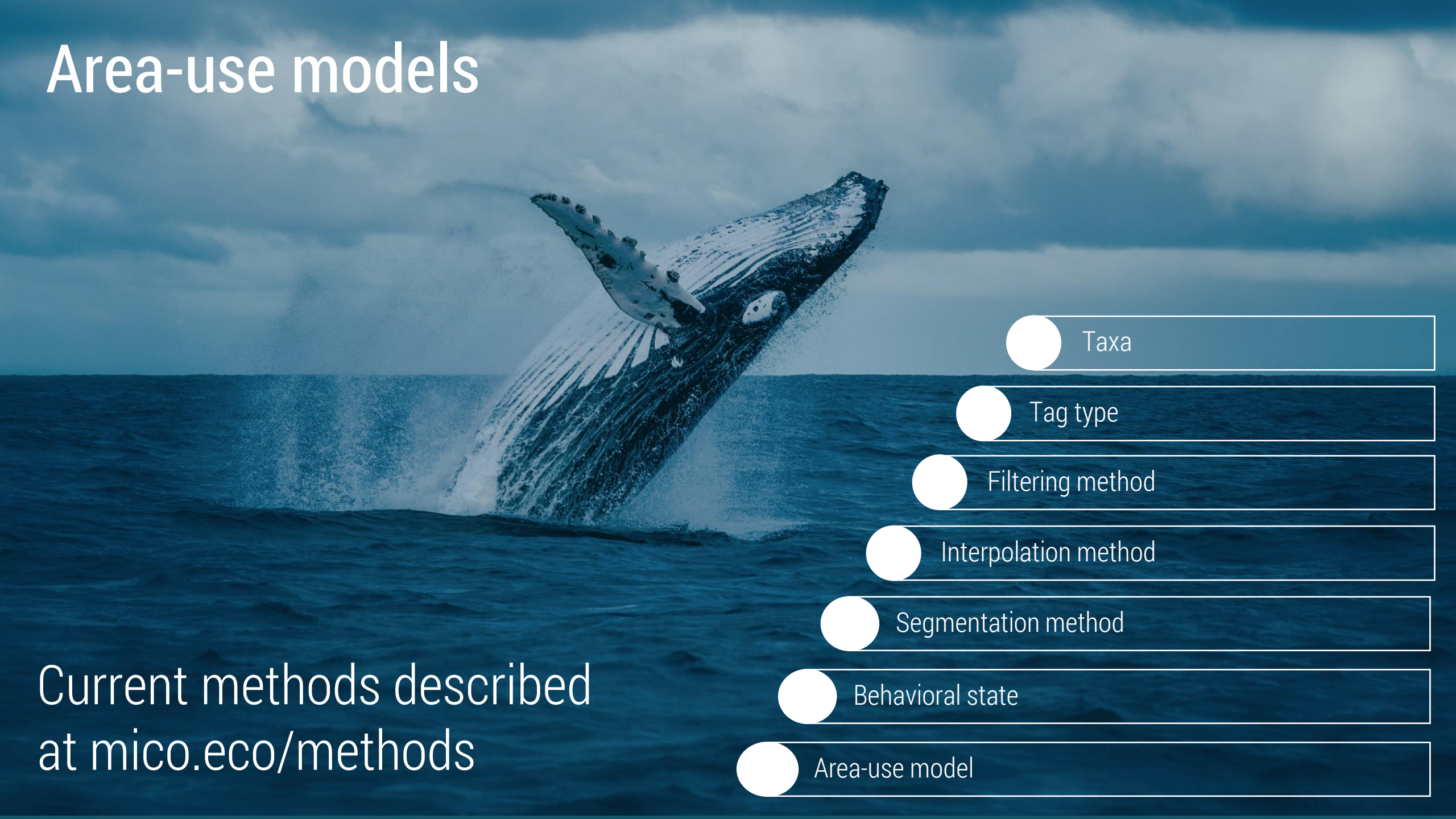


MiCO Migratory Connectivity in the Ocean



MiCO Migratory Connectivity in the Ocean

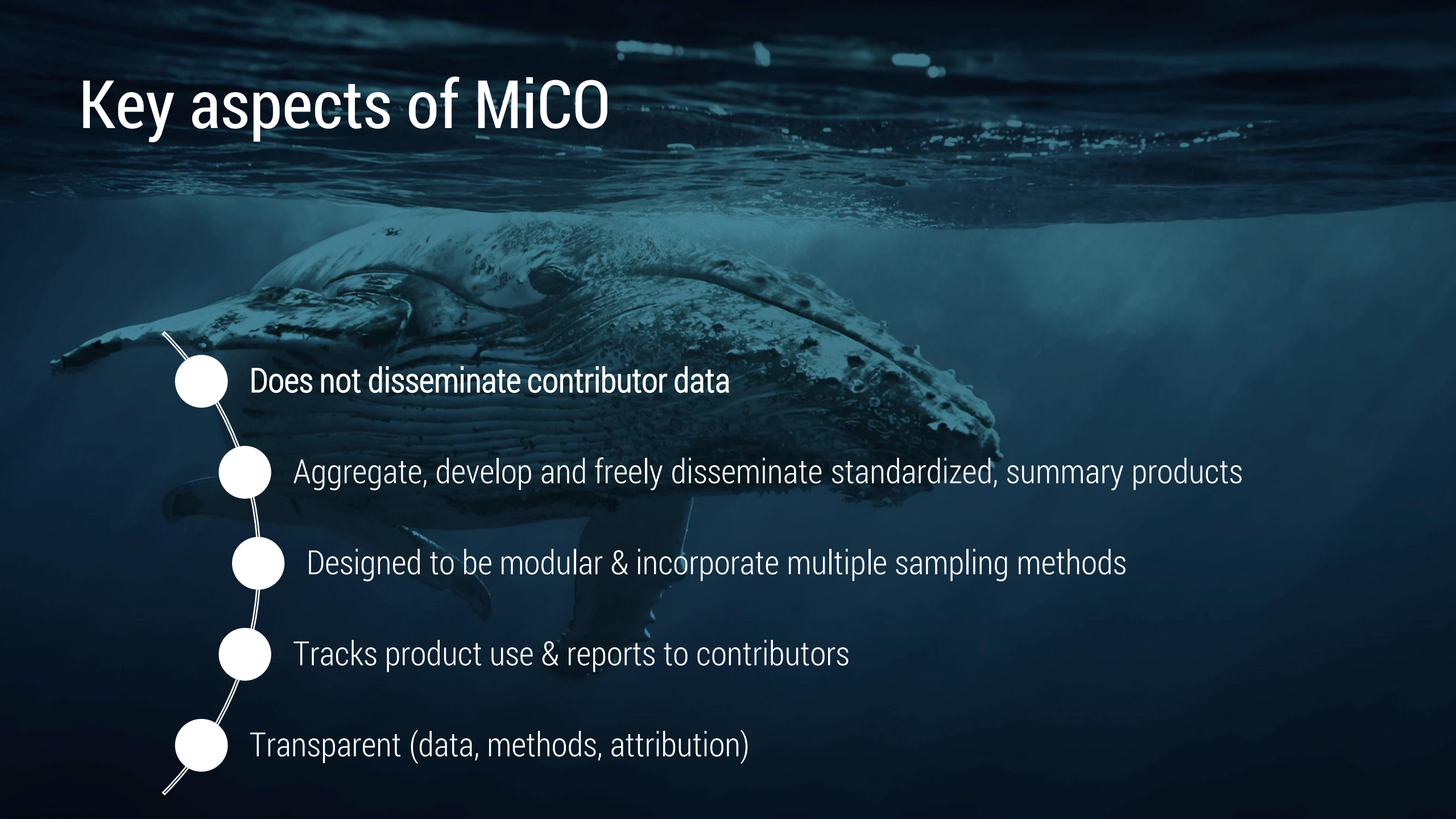
Area-use models



- Taxa
- Tag type
- Filtering method
- Interpolation method
- Segmentation method
- Behavioral state
- Area-use model

Current methods described at mico.eco/methods

Key aspects of MiCO



- Does not disseminate contributor data
- Aggregate, develop and freely disseminate standardized, summary products
- Designed to be modular & incorporate multiple sampling methods
- Tracks product use & reports to contributors
- Transparent (data, methods, attribution)

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Next Steps

System:

- *Incorporate network models from the literature review*
- Download feature for network models
- Add more area-use models
- Multi-method network models
- Better describe uncertainty

Research Partners:

- Collaborate on proposals to integrate datasets
- Collaborate on analyses of this new dataset

Industry and Policy Partners:

- Identify preferred product formats
- Pilot projects to integrate MiCO output into existing processes (e.g., EIAs or MSP)
- Co-develop proposals for industry-academia collaborations

How, can I join the fun?

MiCO development has or is being undertaken by:

- 1 Undergrad Honours student
- 8 HDR (7 Masters + 1 PhD)
- 9 Research Staff
- 50+ MiCO partners

Ongoing opportunities:

- Hiring a 2-year Post-Doc at UQ in next 3-6 months
- PhD research scholarships at UQ, or TA scholarships at Duke
- Masters projects
  - generating models and case studies of the implications of connectivity for governance of migratory species

Thanks!

Daniel Dunn
Director, Applied Marine Biogeography Lab
School of Earth and Environmental Sciences
University of Queensland

Contact Info
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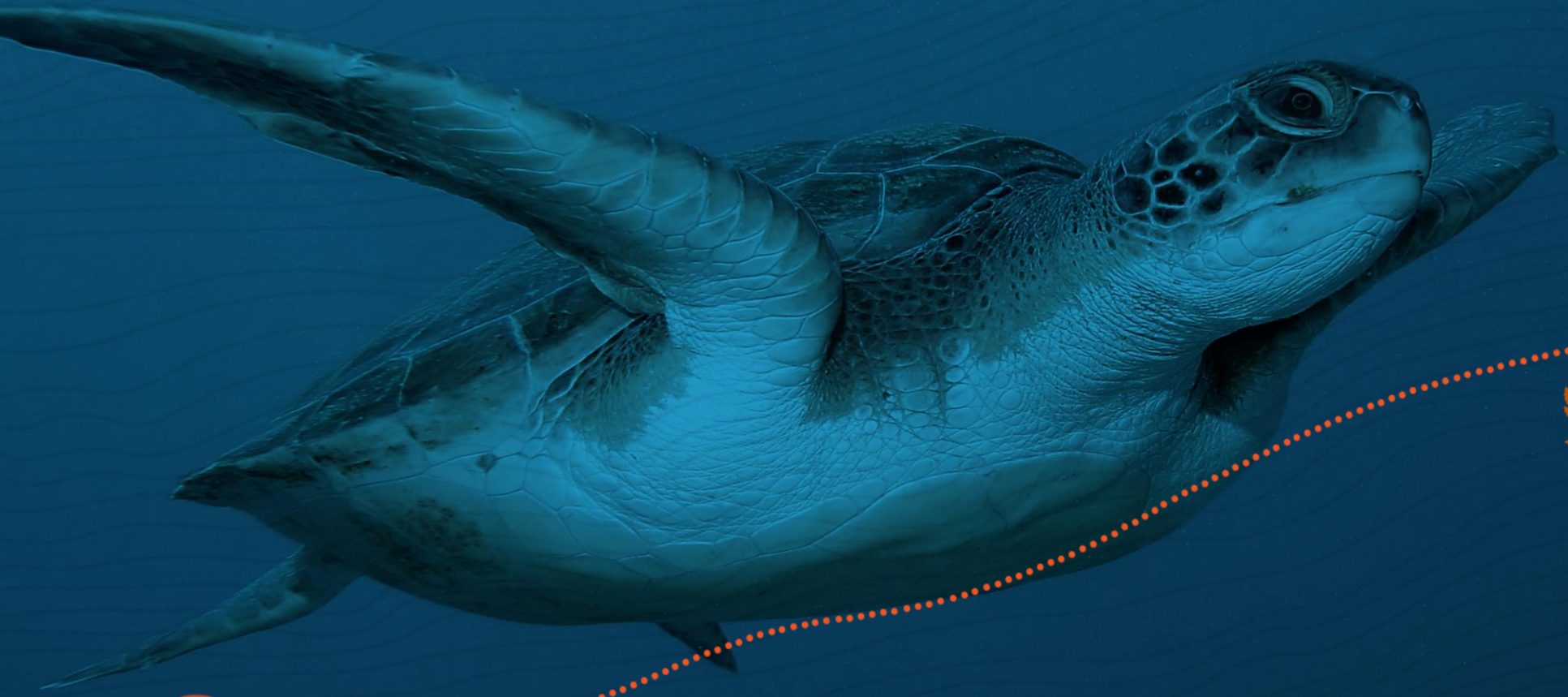
w marinebiogeo.org
t @danielcdunn



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