



MiCO

**Migratory Connectivity
in the Ocean**

Supported by:



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

based on a decision of the German Bundestag

G  **BI**



Marine
Geospatial
Ecology
Lab

Duke University

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MiCO IS A CONSORTIUM

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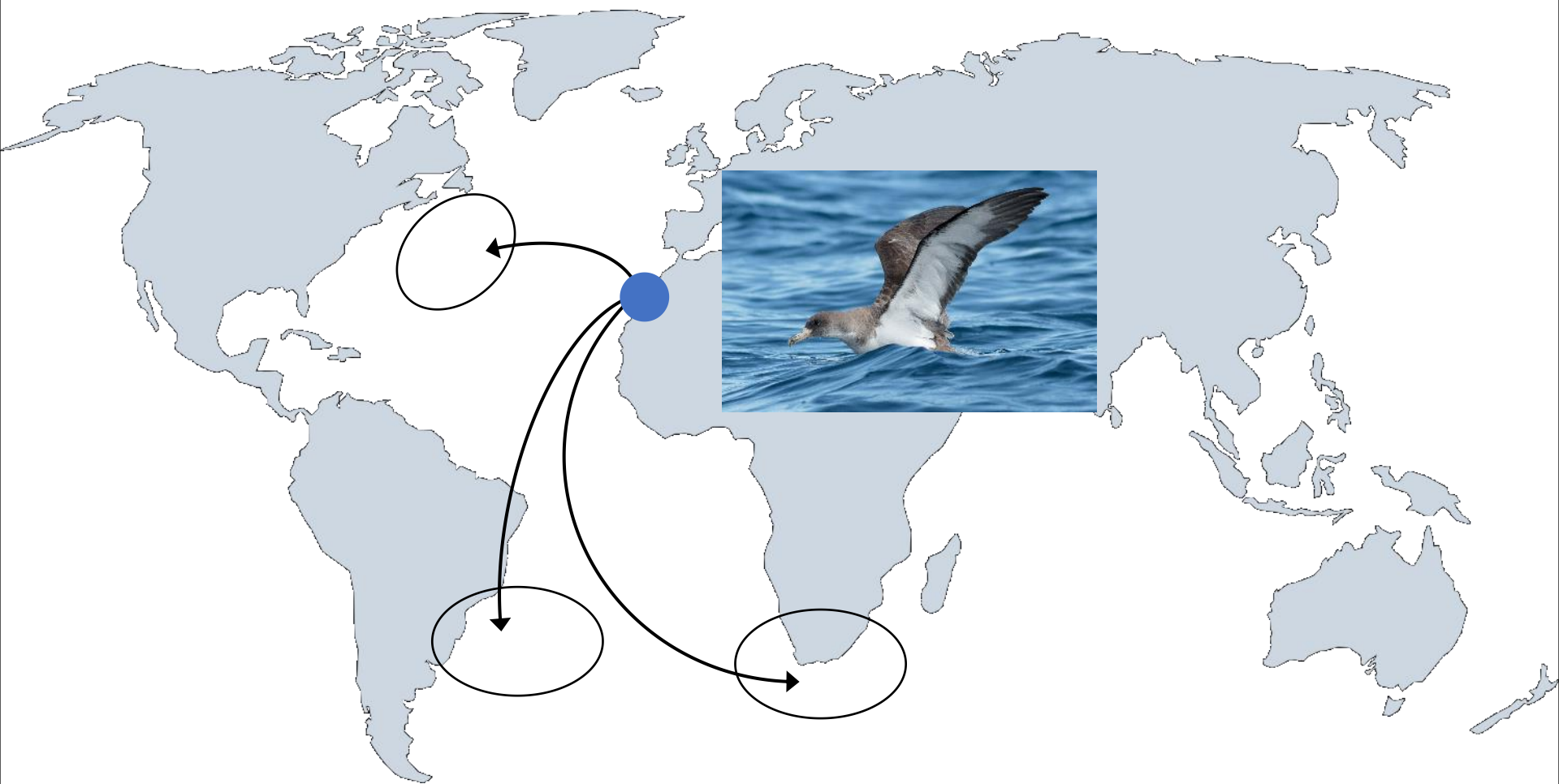
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What is Migratory Connectivity?

Migratory connectivity is the geographic linking of individuals & populations between one life cycle stage and



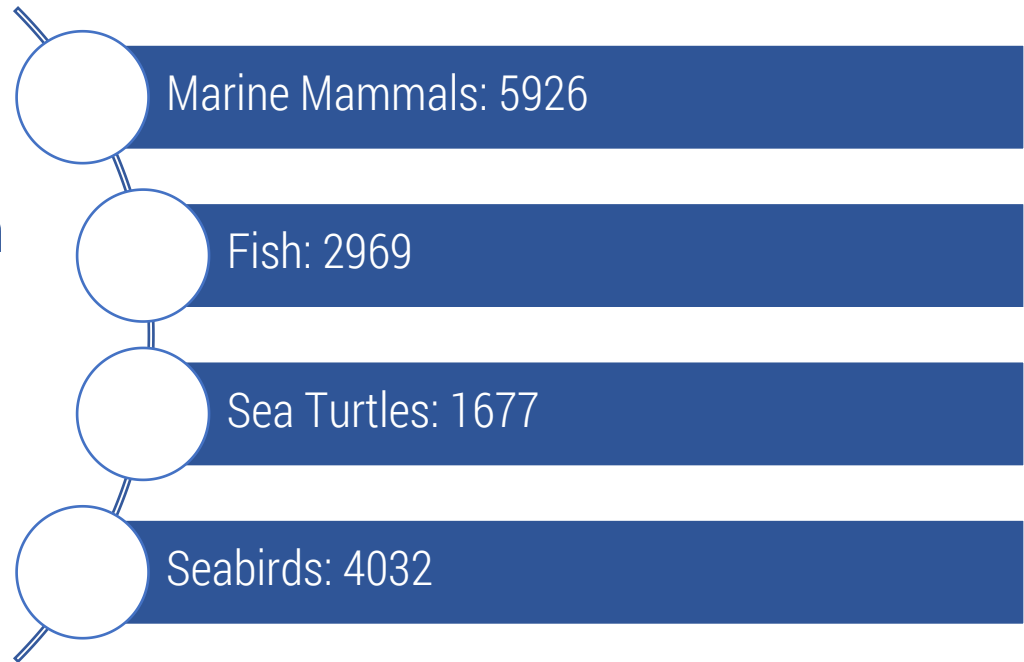


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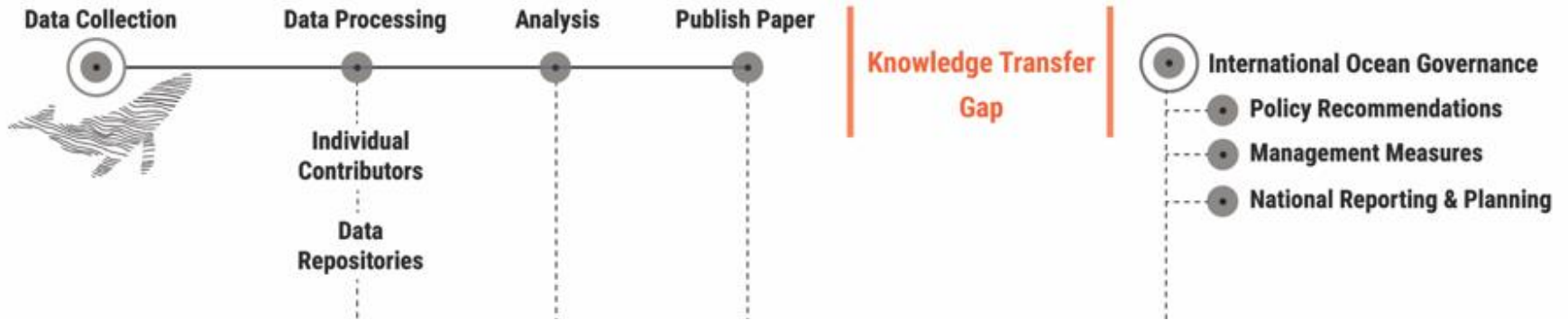


Abundance of publications on migratory species

>12,000 papers returned from a search for information on migratory connectivity since 1990



Limited research to policy track



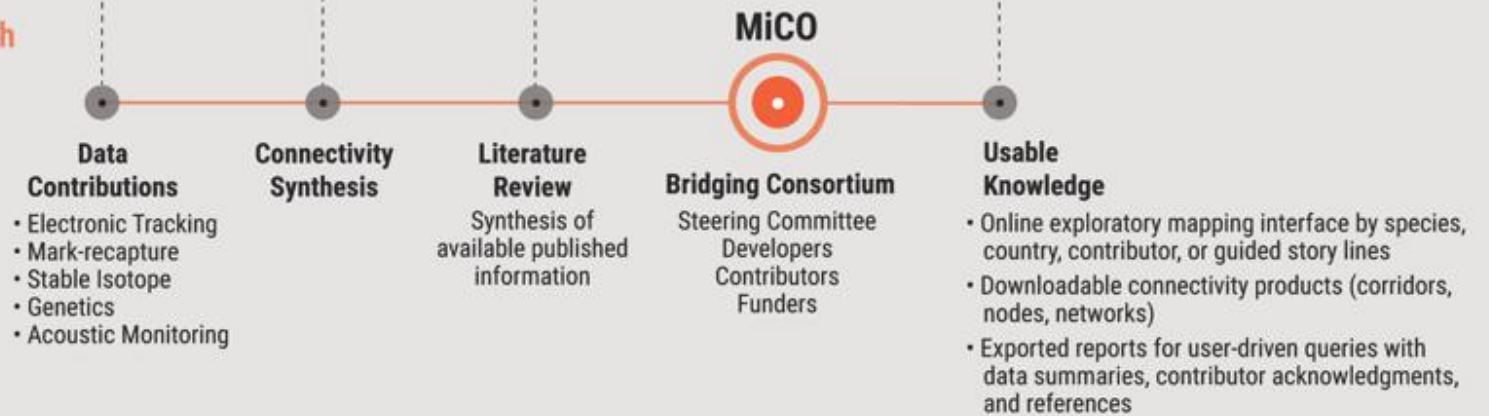


Migratory Connectivity Knowledge

Limited research to policy track



Bridging the gap with a policy-focused synthesis





The MiCO System

mico.eco/system

On April 1st, 2019 the MiCO System launches at the 2nd Intergovernmental Conference on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction (BBNJ).

[Learn more and explore the system](#)

Leatherback

Long, Lat: 3.58178, -7.94489

Node / Corridor						
Common name	Activity	Desc	Sex	Age	Tag	Type
Leatherback	Migrating	Post-nesting Migration	F	A	PTT	Dist.
Leatherback	Migrating	Post-nesting Migration	F	A	PTT	Dist.



What is MiCO's progress to date?

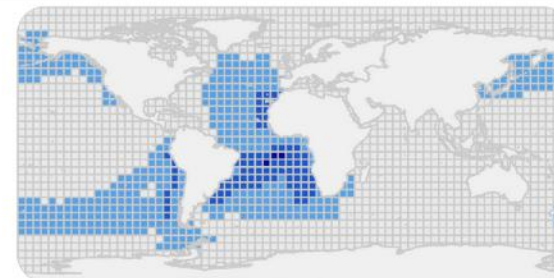
Reviewed **931** references about migratory connectivity data on **79** species
 Analyzed movements of **382** animals based on **95,632** locations
 Produced **23** nodes and **17** corridors for **7** species

		Nodes	Corridors
Humpback Whale	<i>Megaptera novaeangliae</i>	2	1
Ancient Murrelet	<i>Synthliboramphus antiquus</i>	4	4
Chatham Petrel	<i>Pterodroma axillaris</i>	3	2
Cory's Shearwater	<i>Calonectris diomedea</i>	5	6

See "Which migratory species do you want to explore?" below for more details

Assessments were made possible through
62 datasets from **35** contributors

See "Who has contributed?" below for more details



Atlantic-centric | Pacific-centric
 Concentration of species whose area use overlaps at a 5-degree resolution

Which migratory species do you want to explore?

MiCO collects animal tracking data from around the world, analyzes them and produces data products on area use in the form of nodes (e.g. feeding, wintering, breeding, etc.) and corridors. This section lists all migratory species MiCO is working on and overviews of their migrations and other activities. Click the title to start exploring.

How are the national waters (EEZs) of countries used by migratory species?

Nodes and corridors MiCO produced are associated with national waters (EEZs). This section lists countries with EEZs and overviews on how migratory species use these areas. Click the title to start exploring.

Who has contributed?

The development of the MiCO system and products are only possible with the participation of many researchers all over the world. This section lists all contributors and overviews of their contributions. Click the title to start exploring.



What is MiCO's progress to date?

Which migratory species do you want to explore?

Fish (29)
 Marine mammals (27)
 Seabirds (16)
 Sea turtles (7)

▼ animals crossing countries

Cory's Shearwater *Calonectris diomedea*

138 animals crossing 29 countries

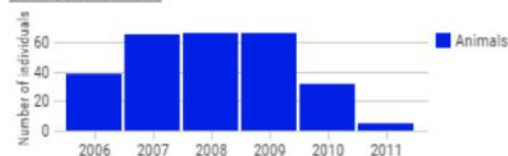
5 nodes and 6 corridors

Traveling to
 66.010 (N)
 -59.170 (W) 48.600 (E)
 -48.470 (S)

Longest distance (km) monitored
 Breeding 62,002.21 in 127 days
 Migrating 76,254.60 in 110 days
 Non-Breeding 74,537.88 in 93 days

Area (km²) of distribution ranges
 from 71,063.35 to 2,926,584.81 in 11 Core Areas
 from 1,428,178.14 to 40,311,278.72 in 11 Use Areas

Data Contributions



Monthly Activities

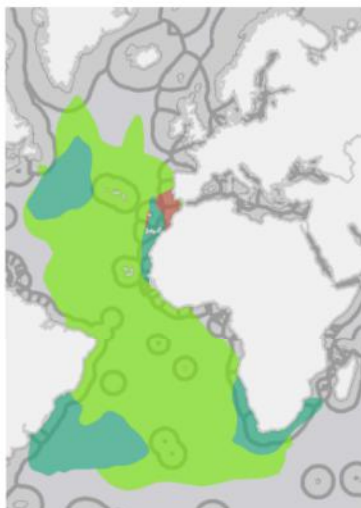




Which migratory species do you want to explore?

- Fish (29)
- Marine mammals (27)
- Seabirds (16)
- Sea turtles (7)

Map View



Map of Use Areas color-coded by activity

Explore Stories with MiCO Mapping Tool

- All Migratory and Area-use Information →
- Migrating vs. Non-migrating Strategies →
- Alternative Migration Strategies →

Countries (EEZs) and ABNJ*

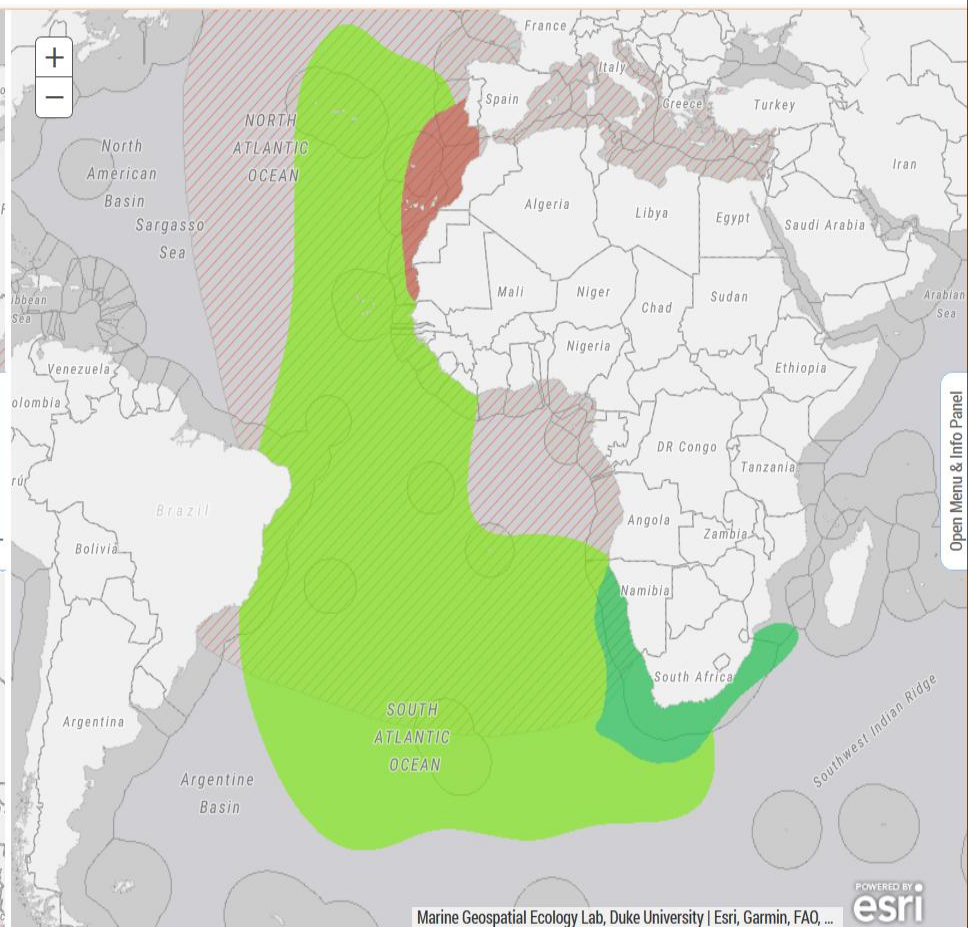
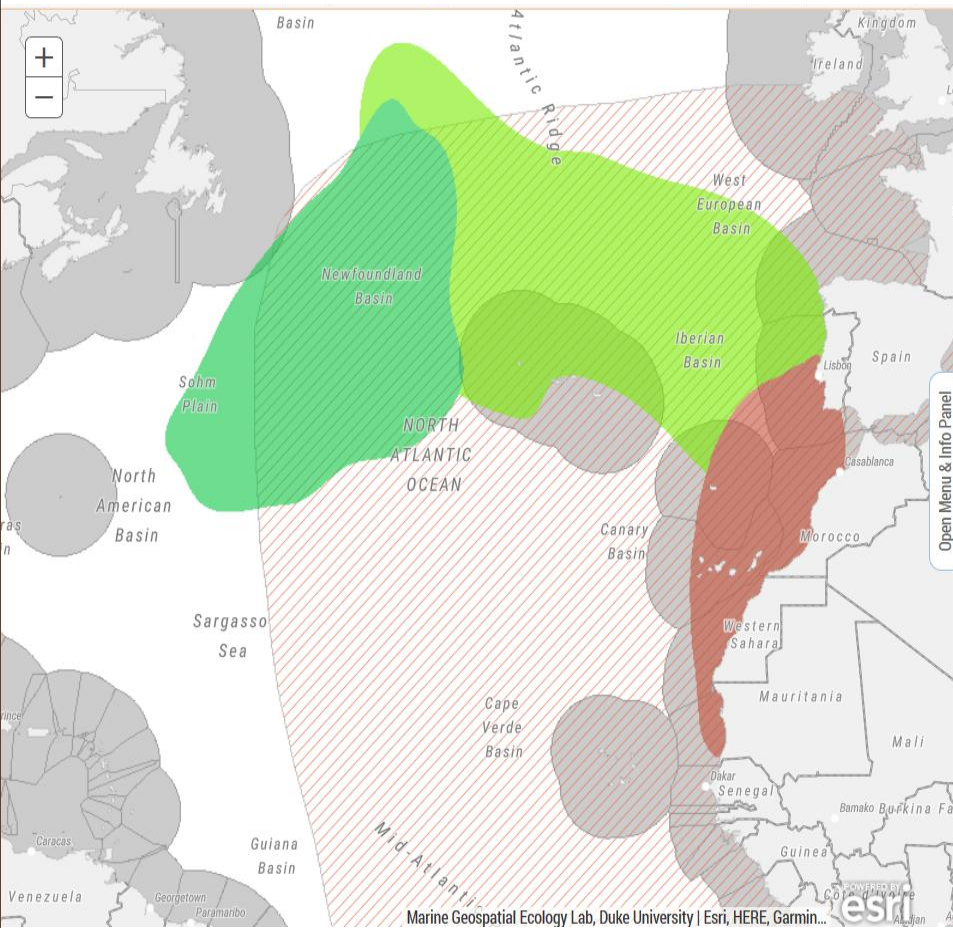
	Area beyond EEZs (%)	
	Use Area	Core Area
ABNJ	78.6	70.7

*ABNJ: Areas Beyond National Jurisdiction

Country	Area (%) of			
	EEZ covered by species		Species covered by EEZ	
	Use	Core	Use	Core
Angola	45.8		0.4	
Argentina	11.0		0.3	
Ascension	100.0		0.7	
Azores	100.0	54.6	2.0	7.4
Brazil	87.1	1.8	4.7	0.7
Canada	0.5		0.1	
Canary Islands	99.9	35.6	0.8	2.0
Cape Verde	100.0	21.6	1.3	2.0
Gambia	99.0	99.0	0.0	0.3
Ghana	13.2		0.0	
Greenland	1.3		0.2	
Guinea	99.2	54.4	0.2	0.6
Guinea-Bissau	99.0	99.0	0.2	1.2
Ivory Coast	91.2		0.3	
Liberia	99.9		0.4	
Madeira	100.0	25.2	0.9	1.5
Mauritania	99.7	99.7	0.3	2.0
Morocco	88.6	6.6	0.5	0.2
Mozambique	20.6		0.2	
Namibia	99.9	20.6	1.0	1.4
Portugal	99.9		0.6	
Saint Helena	100.0	70.6	0.8	3.7
Senegal	99.3	99.3	0.3	1.8
Sierra Leone	99.7	1.5	0.3	0.0
South Africa	92.6	14.3	1.9	2.0
Spain	26.6		0.3	
Trindade	100.0	43.8	0.8	2.5
Tristan da Cunha	100.0		1.6	
Uruguay	92.3		0.3	

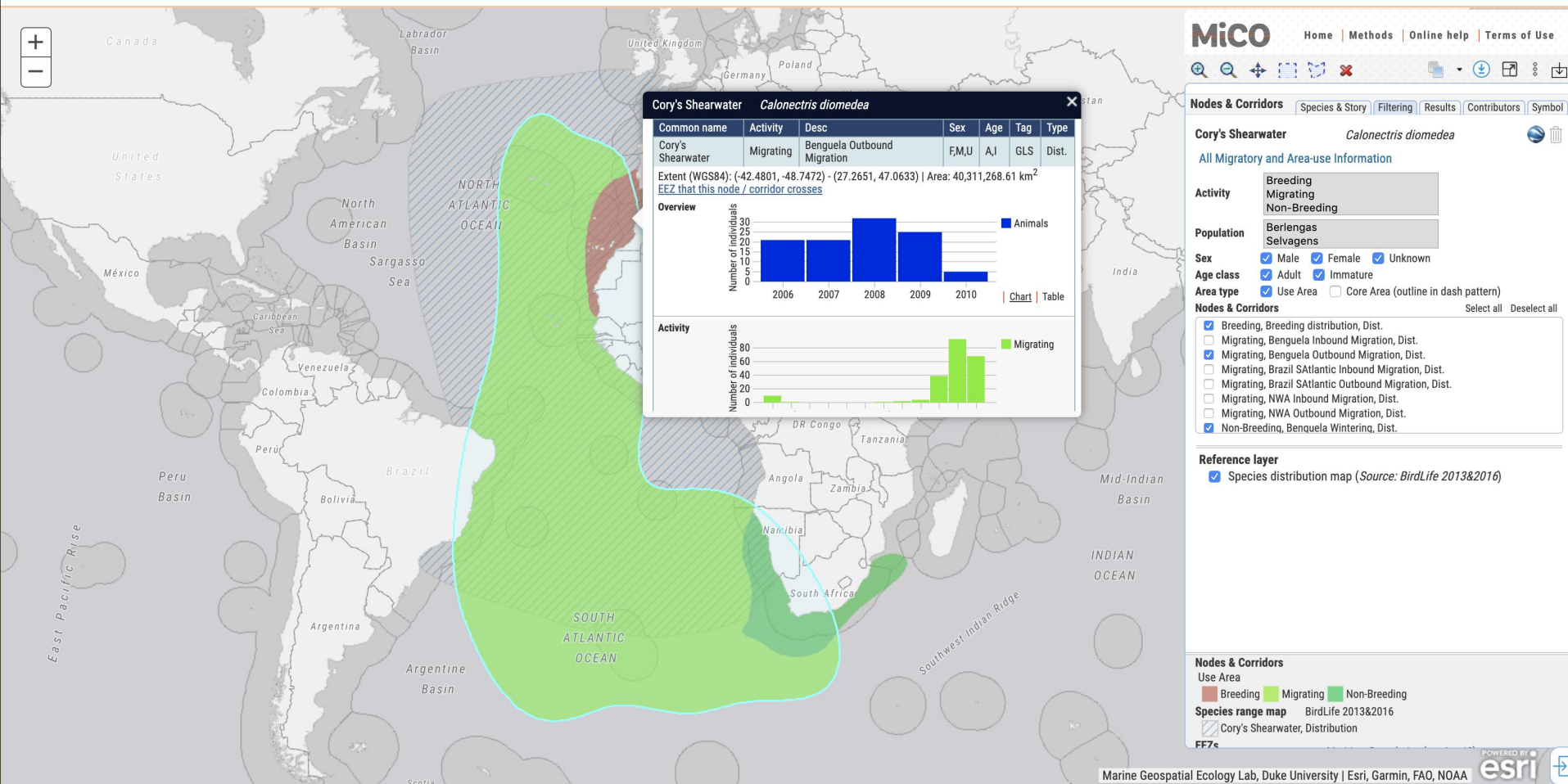
EEZ covered by species: Percentage of EEZ area covered by species Use Area or Core Area.
Species covered by EEZ: Percentage of species Use Area or Core Area covered by EEZ.





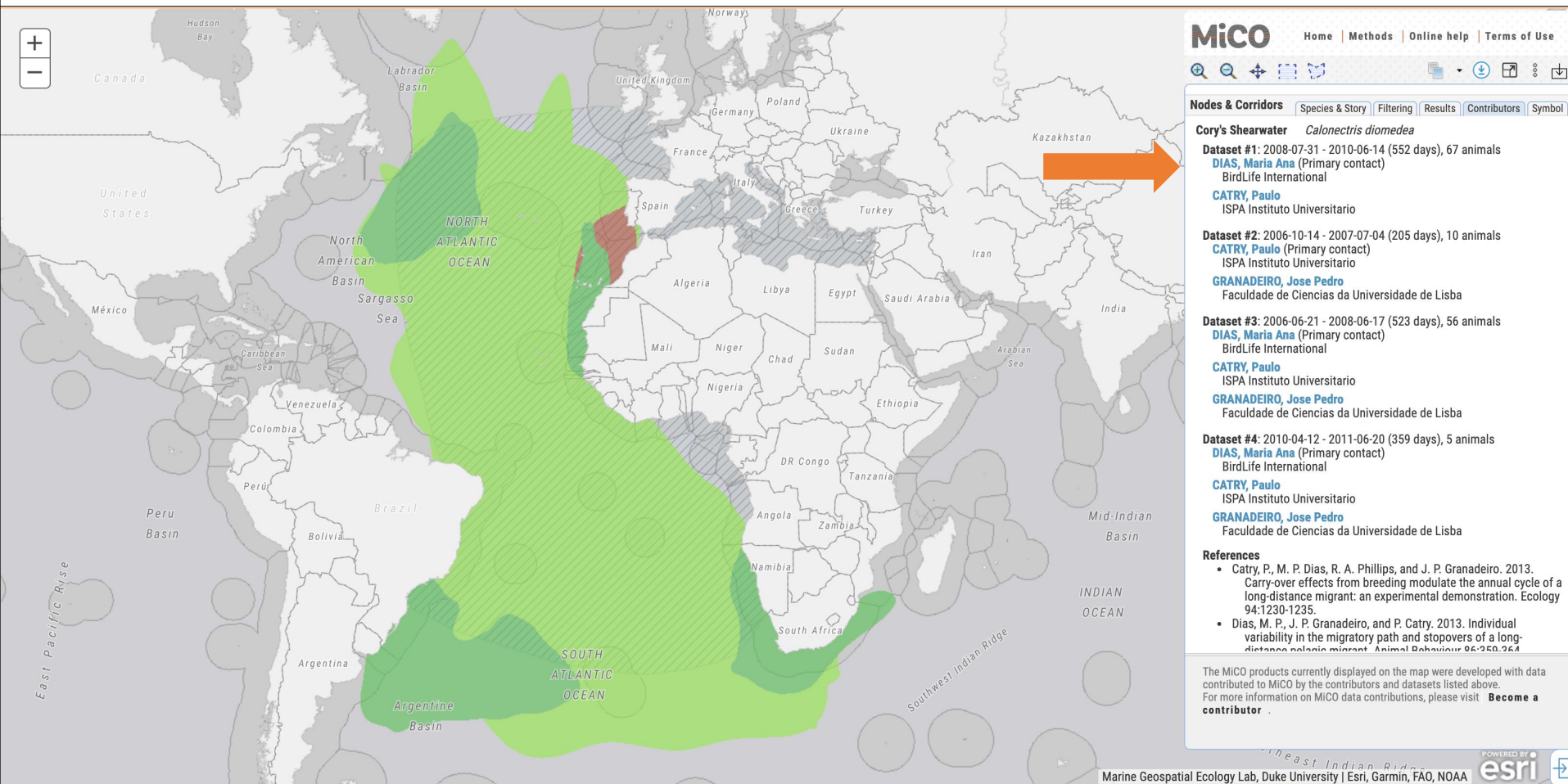
Migratory Connectivity in the Ocean (MiCO). Highly migratory marine species nodes and corridors, developed with data contributed to MiCO. Available from the MiCO System Version 1.0. MiCO. <https://mico.eco>. Accessed June 9 2019.





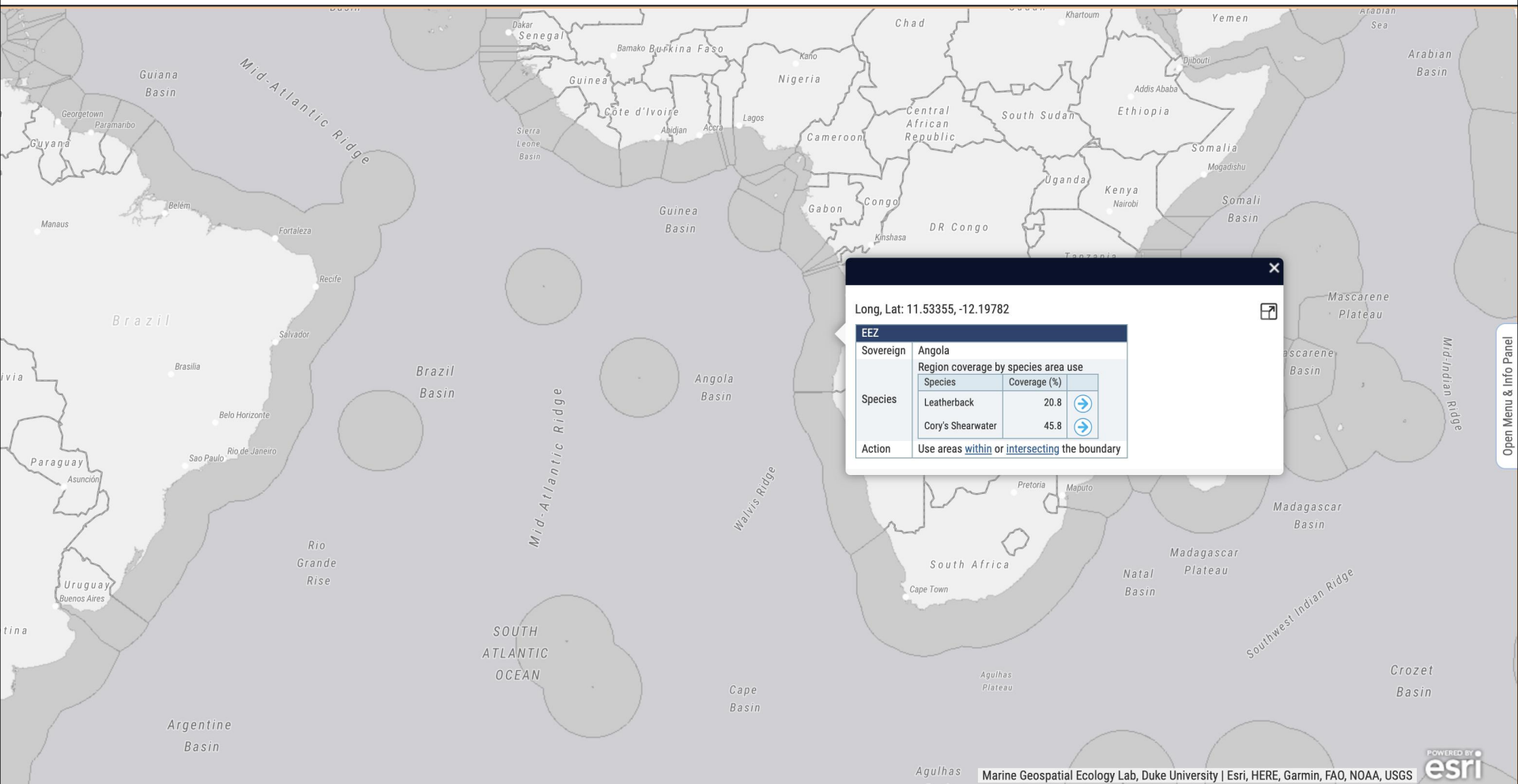
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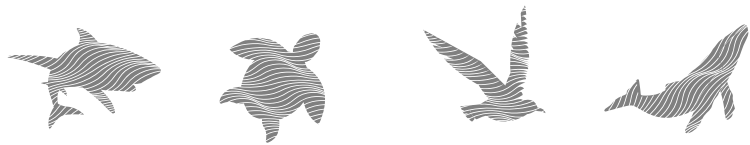
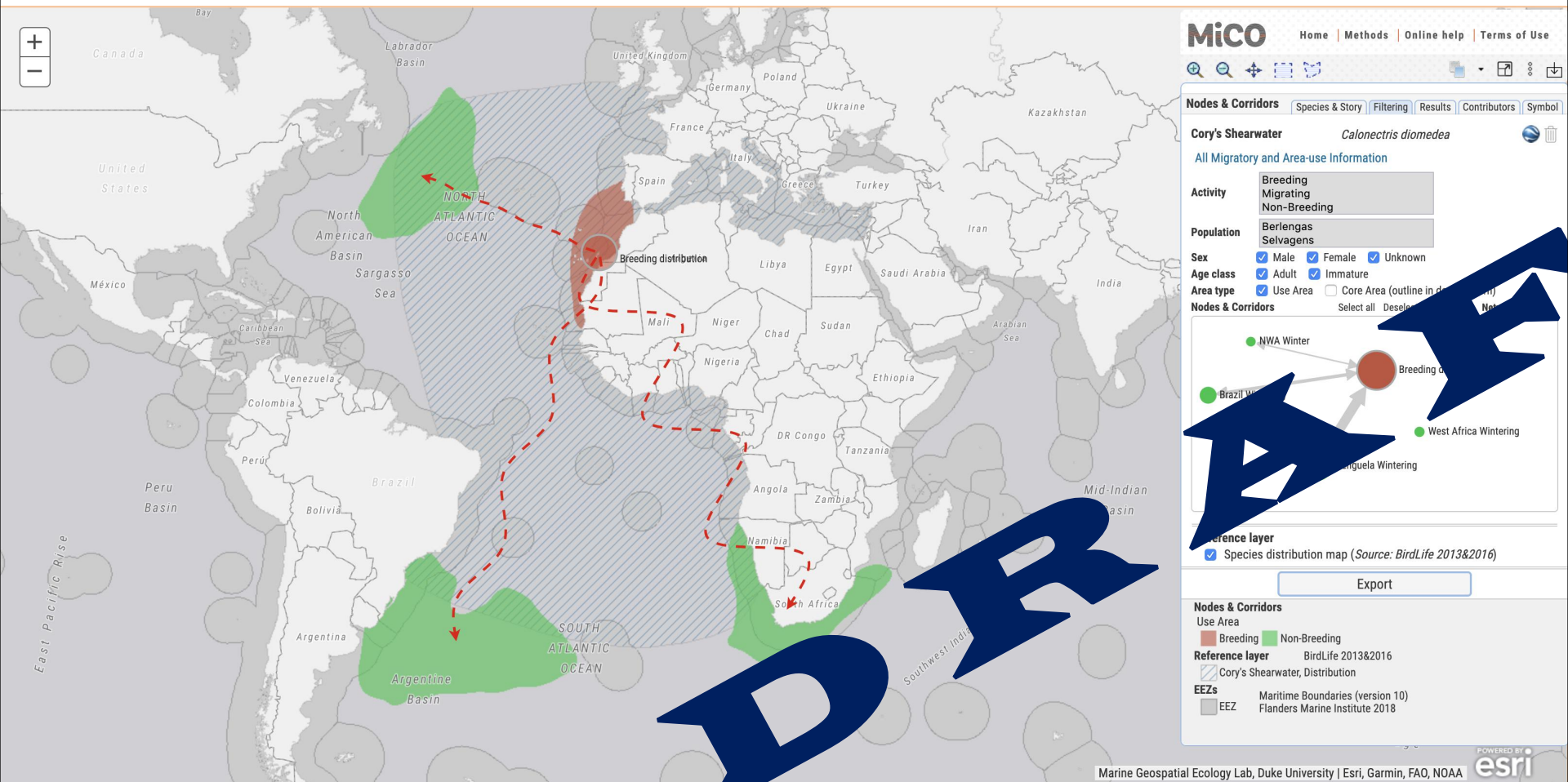




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Abstract network diagram



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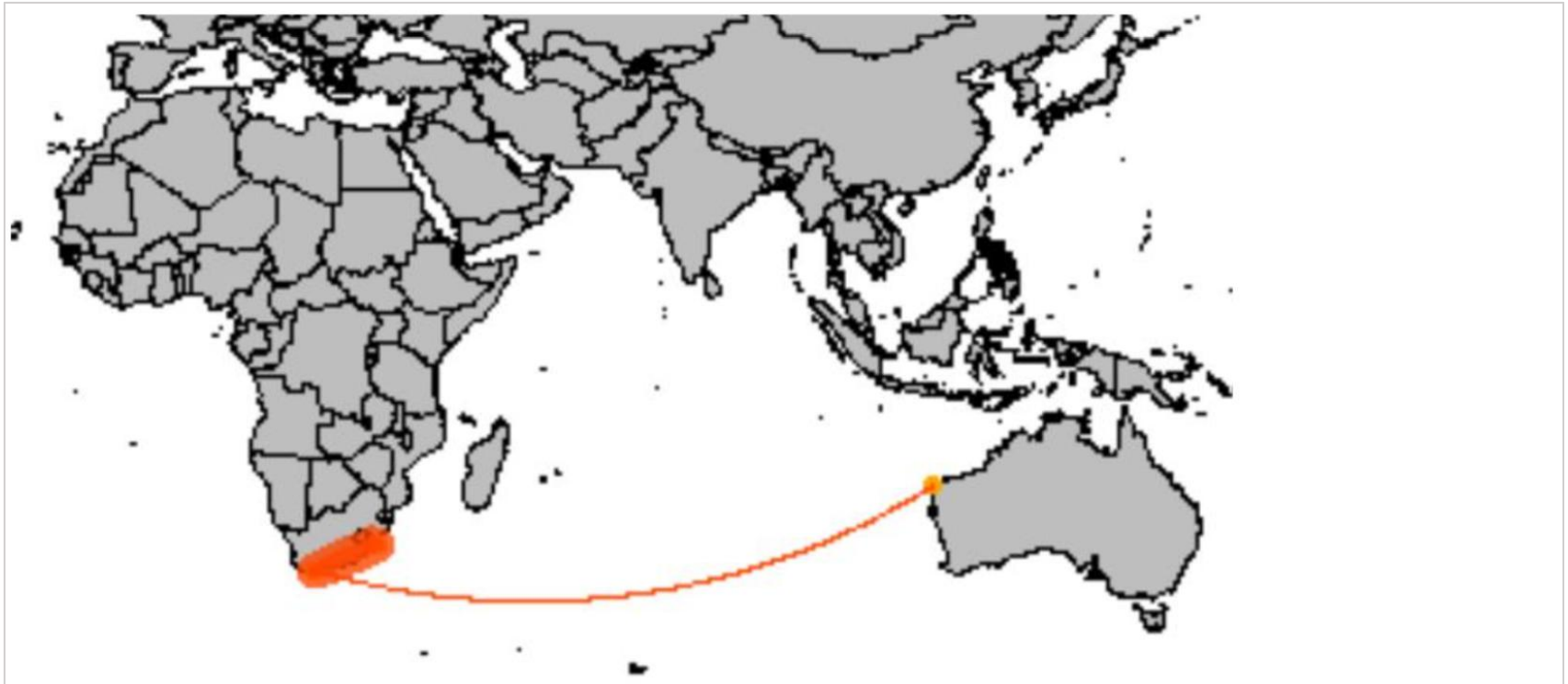


Figure 4. Great white shark connectivity model in the Western Indian Ocean (5 sites; 4 routes).

Kot*, C.Y., S. DeLand*, S. Poulin*, M. Whitten*, E. Fujioka, C. Curtice, D.C. Dunn. 2019. Migratory connectivity of marine megafauna in the Western Indian Ocean and Southeast Pacific. Migratory Connectivity in the Ocean (MiCO).

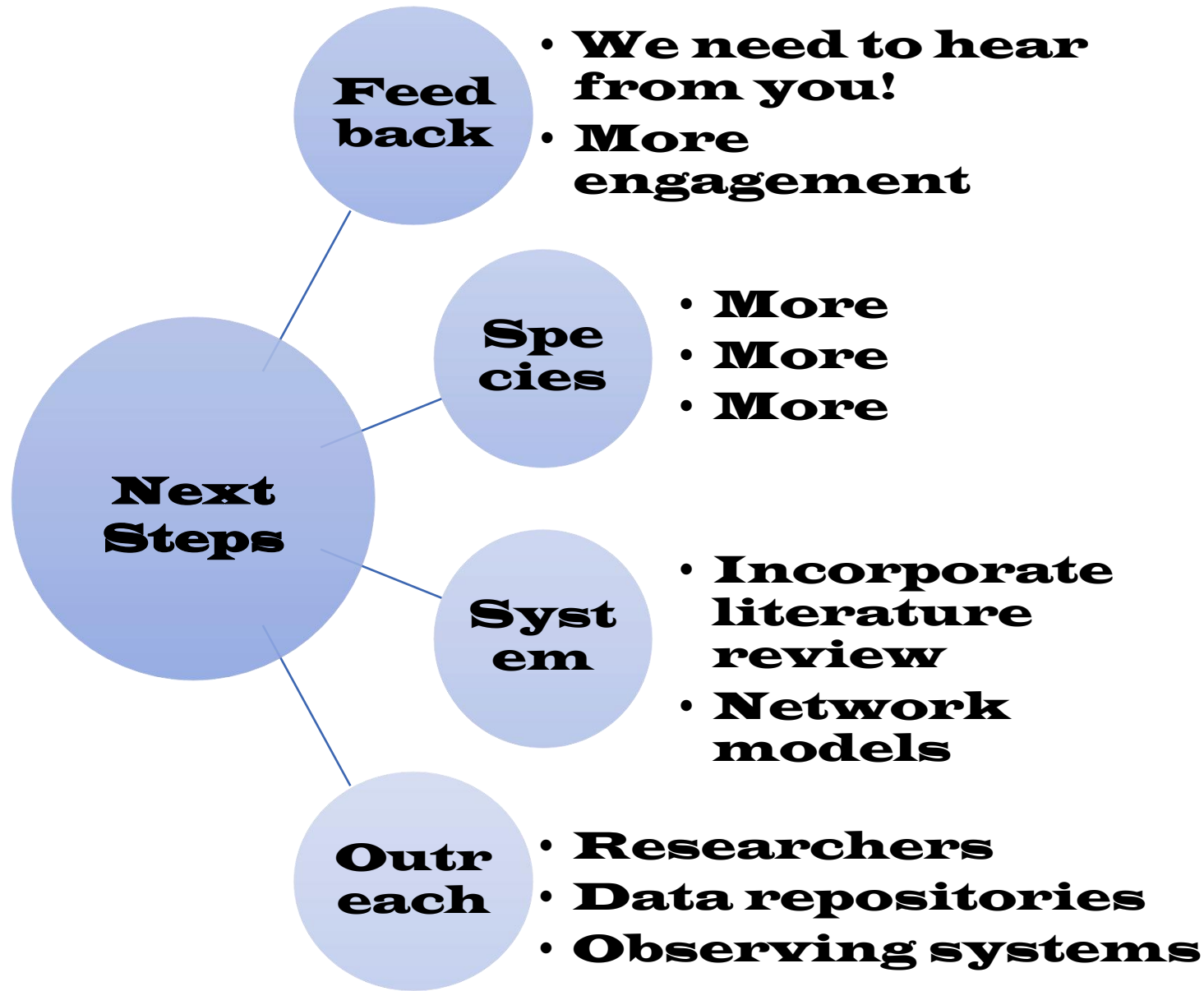
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Engagement & Outreach

1. Report: Migratory connectivity of marine megafauna in the Western Indian Ocean and Southeast Pacific
2. Side event publicly launching MiCO at the **BBNJ ICG2 meeting**, organized by UNEP-WCMC and hosted by Ecuador.
3. International Sea Turtle Symposium workshop on migratory connectivity
4. **STRONG High Seas CPPS** workshop
5. **MarViva workshop**
6. **Important Marine Mammal Areas** (IMMA) workshop in Kota Kinabalu
7. Sustainable Oceans Day at **Convention on Biological Diversity CoP 14**
8. **Benguela Current LME region workshop** to update and supplement the described EBSAs in that region
9. World Conference on Marine Biodiversity
10. **MarViva workshop** "Towards a governance model for the Costa Rica Thermal Dome"
11. UNEP-WCMC presented two MiCO cases studies at the **WIOMSA meeting** in South Africa
12. **IIED Workshop** on "Ecological connectivity between coastal waters and the high seas: scientific evidence to underpin UNCLOS negotiations on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction"
13. International Sea Turtle Symposium presentation
14. **Convention on Migratory Species** Expert Workshop on Migratory Connectivity
15. International Marine Protected Areas Congress
16. Bio-Logging Symposium
17. Society for Marine Mammalogy Conference
18. A MiCO side event at the **Convention on Migratory Species** Conference of the Parties to introduce delegations to the project and lay the groundwork for future use and inclusion of the system in resolutions
19. Animal Movement Ecology session at the **Gulf and Caribbean Fisheries Institute**
20. **CPPS/UNEP-WCMC** CPPS Integrated Regional Ocean Policy and ABNJ project workshop
21. **Convention on Biological Diversity** "Expert workshop to develop options for modifying the description of ecologically or biologically significant marine areas, for describing new areas, and for strengthening the scientific credibility and transparency of this process"
22. Side event at the **4th BBNJ PrepCom** meeting hosted by NF-Nereus Program and Costa Rica, and their Deputy Permanent Representative to the UN, Mr. Rolando Castro Córdoba co-chaired the event along with Co-PI Daniel Dunn
23. Side event at the **3rd BBNJ PrepCom** on Adjacency co-chaired by the Permanent Representative to the UN from the Federated States of Micronesia, Ambassador Jane Chigiyal, and Co-PI Dunn.







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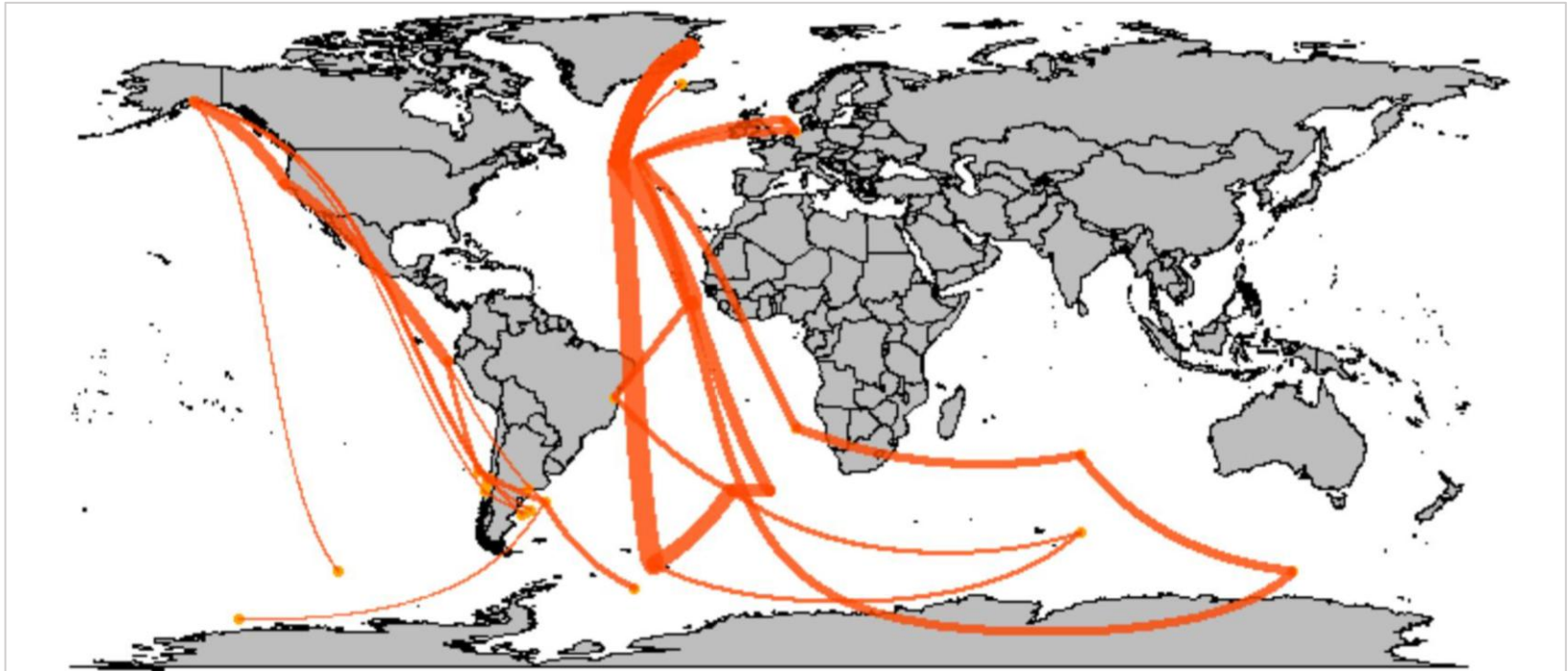


Figure 11. Arctic tern connectivity model in the West Indian and Southeast Pacific (33 sites; 36 routes).

Kot*, C.Y., S. DeLand*, S. Poulin*, M. Whitten*, E. Fujioka, C. Curtice, D.C. Dunn. 2019. Migratory connectivity of marine megafauna in the Western Indian Ocean and Southeast Pacific. Migratory Connectivity in the Ocean (MiCO).

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