Footprint of offshore wind infrastructure and other artificial structures in the U.S.

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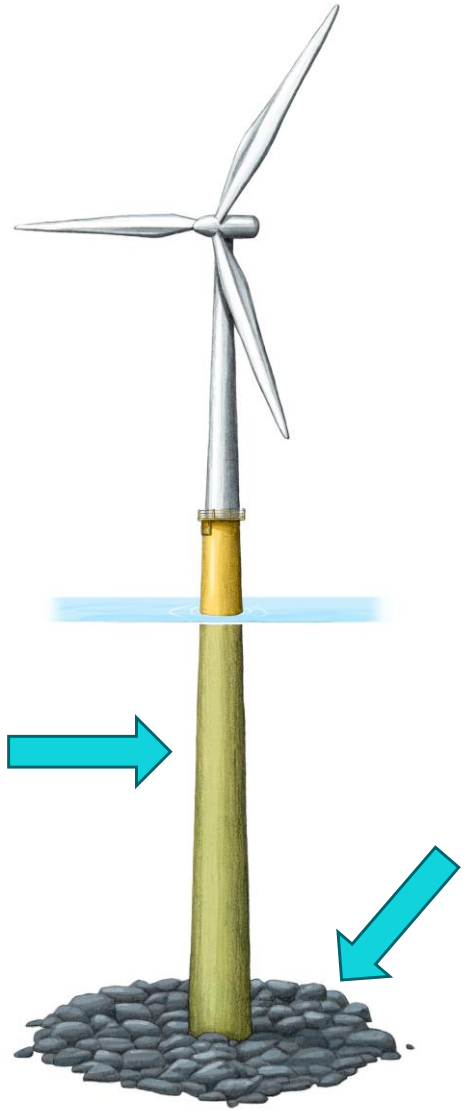
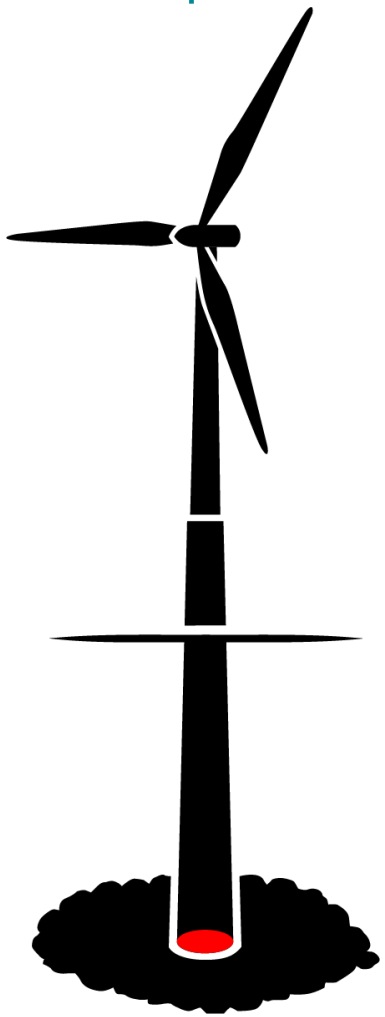
Artificial structures

What is the “footprint” of artificial structures in the U.S.?

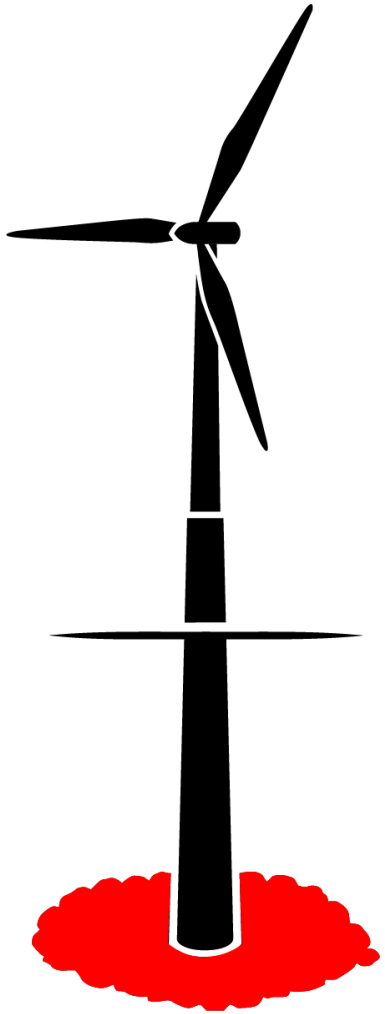
“Footprint” of offshore wind infrastructure in U.S. ocean?



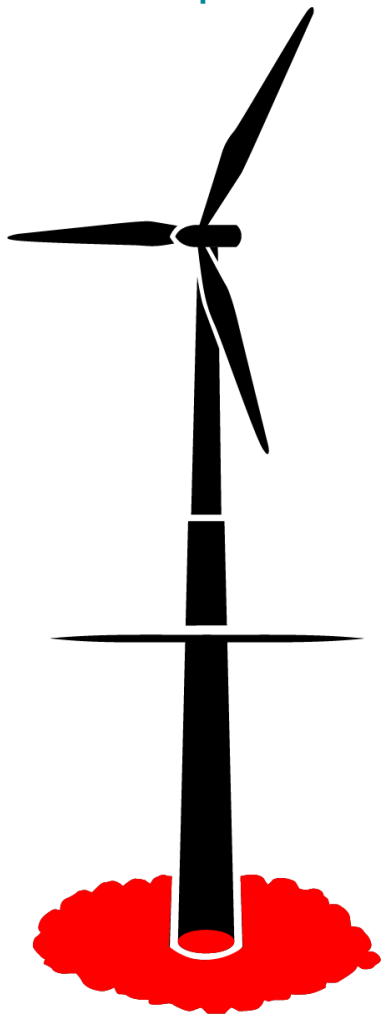
turbine seafloor footprint



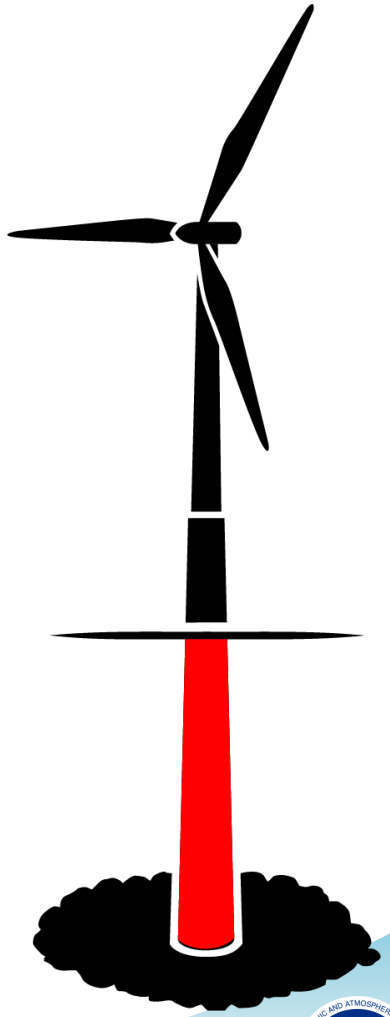
scour protection seafloor footprint



total seafloor footprint



turbine watercolumn footprint



Illustrations by Alex Boersma

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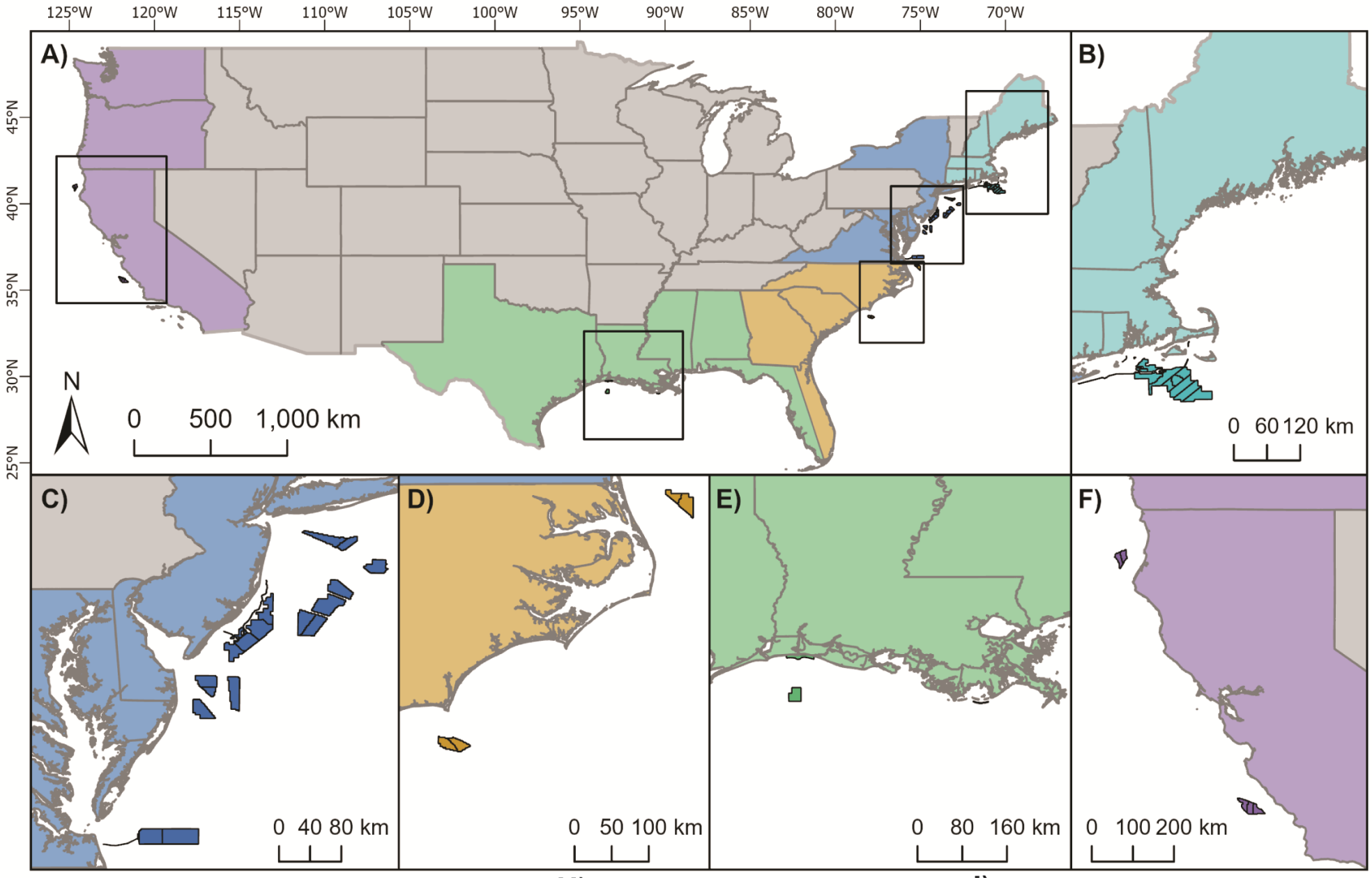

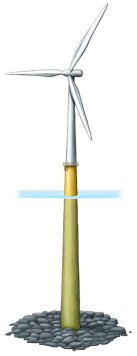

Pacific calculations based on monopiles; working on updating to floating

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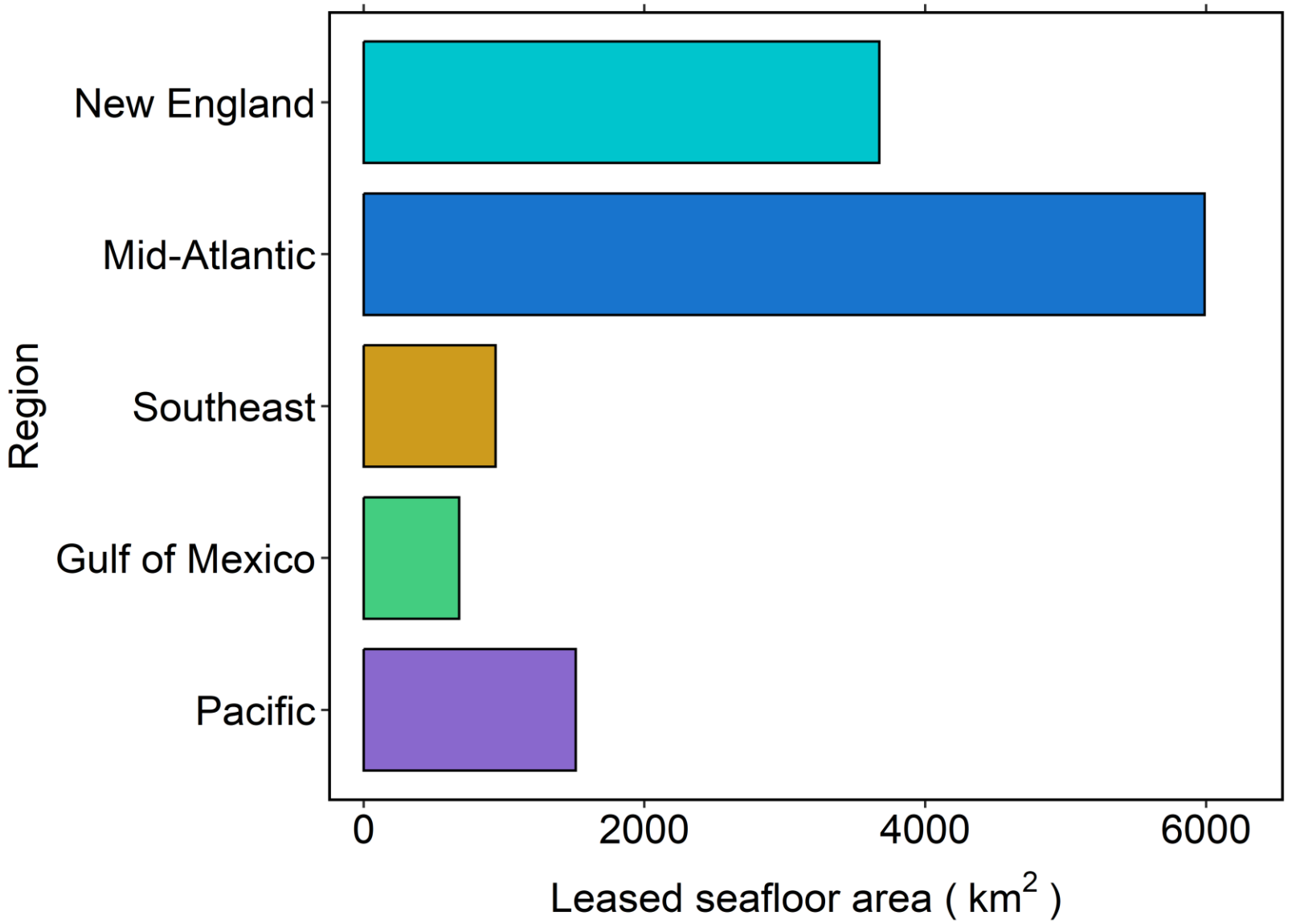
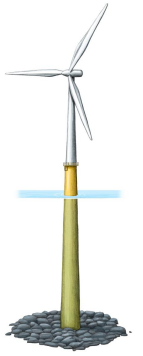
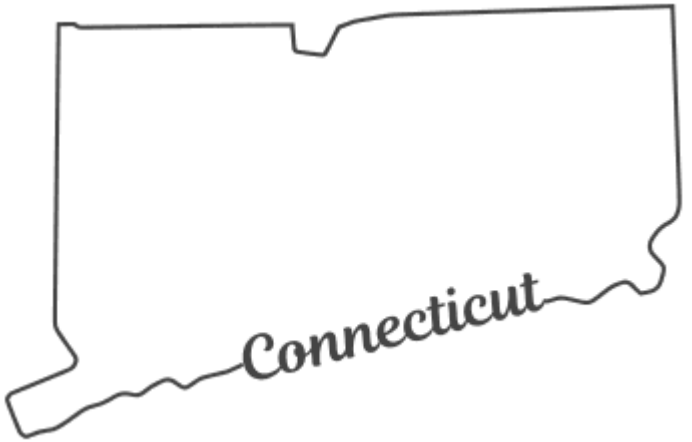




~13,000 km^2 leased offshore wind area



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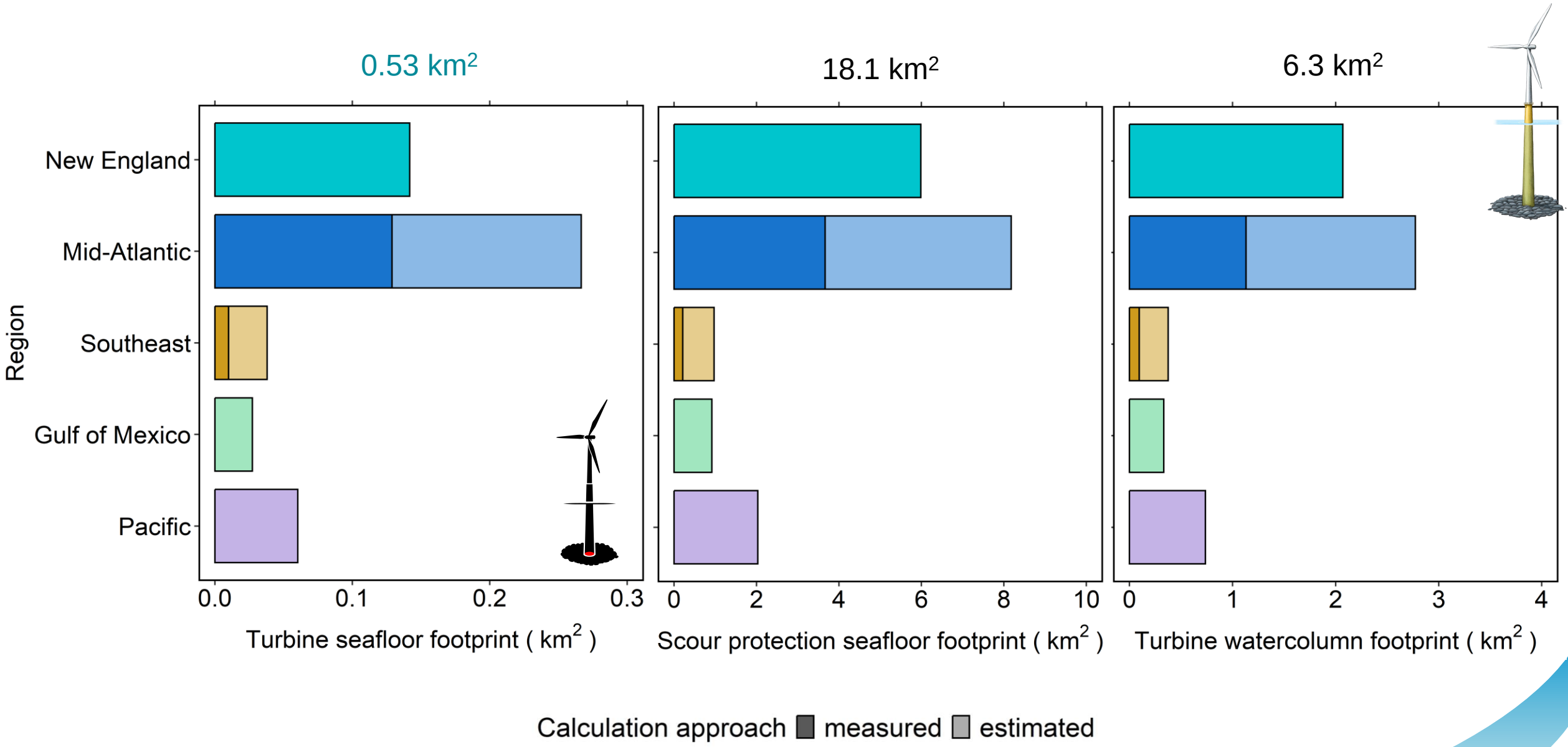
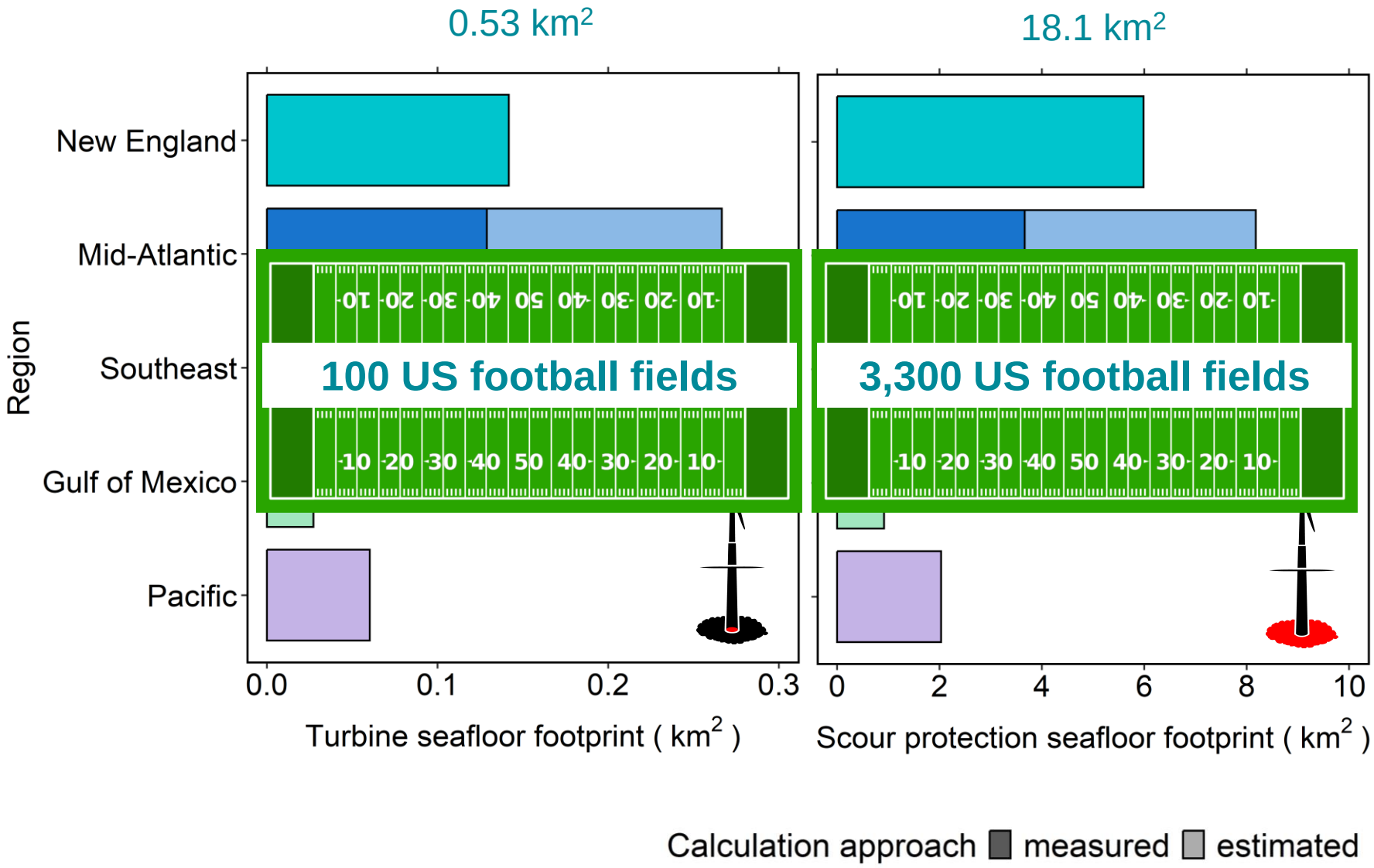
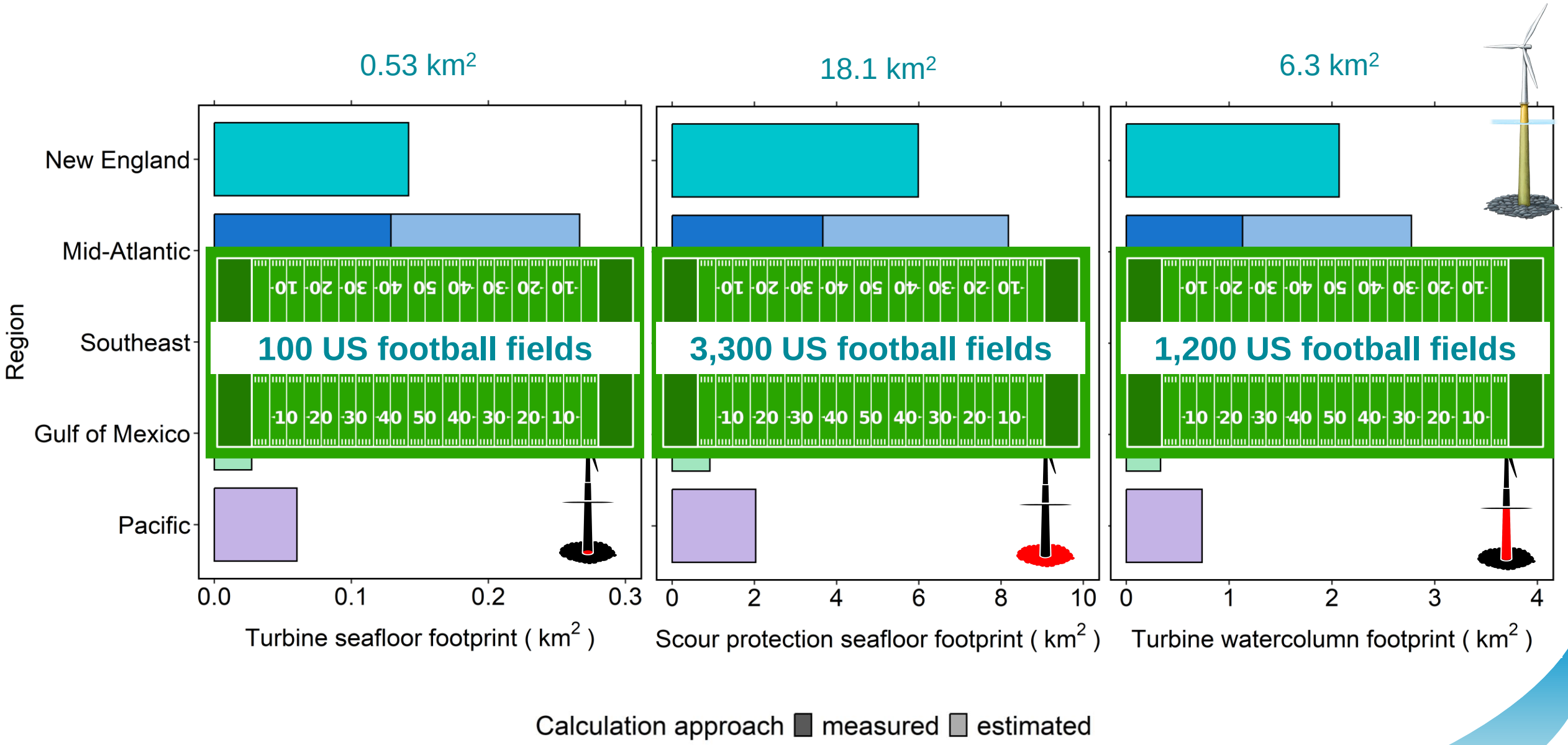

0.53 km2
18.1 km2
6.3 km2
Region
New England
Mid-Atlantic
Southeast
Gulf of Mexico
Pacific
0.0
0.1
0.2
0.3
0
2
4
6
8
10
0
1
2
3
4
Turbine seafloor footprint (km2)
Scour protection seafloor footprint (km2)
Turbine watercolumn footprint (km2)
Calculation approach measured estimated


0.53 km²
18.1 km²
New England
Mid-Atlantic
Southeast
Gulf of Mexico
Pacific
Region
100 US football fields
3,300 US football fields
0.0
0.1
0.2
0.3
0
2
4
6
8
10
Turbine seafloor footprint (km²)
Scour protection seafloor footprint (km²)
Calculation approach measured estimated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Region
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100 US football fields
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1,200 US football fields
0.0
0.1
0.2
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2
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1
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Turbine seafloor footprint (km²)
Scour protection seafloor footprint (km²)
Turbine watercolumn footprint (km²)
Calculation approach measured estimated

Southeast US - Summary

Lease Name	WEA size (km^2)	Max number of turbines	Structured footprint (km^2)	Vertical footprint (km^2)
CVOW	456	202	0.76	0.28
CVOW-West	714	~315	~0.76	~0.89
Kitty Hawk North AKA CVOW-South	158	69	0.21	0.12
Kitty Hawk South	338	121	0.36	0.42
Carolina Long Bay – Duke	223	64	0.24	0.28
Carolina Long Bay – TotalEnergies	222	64	0.24	0.28

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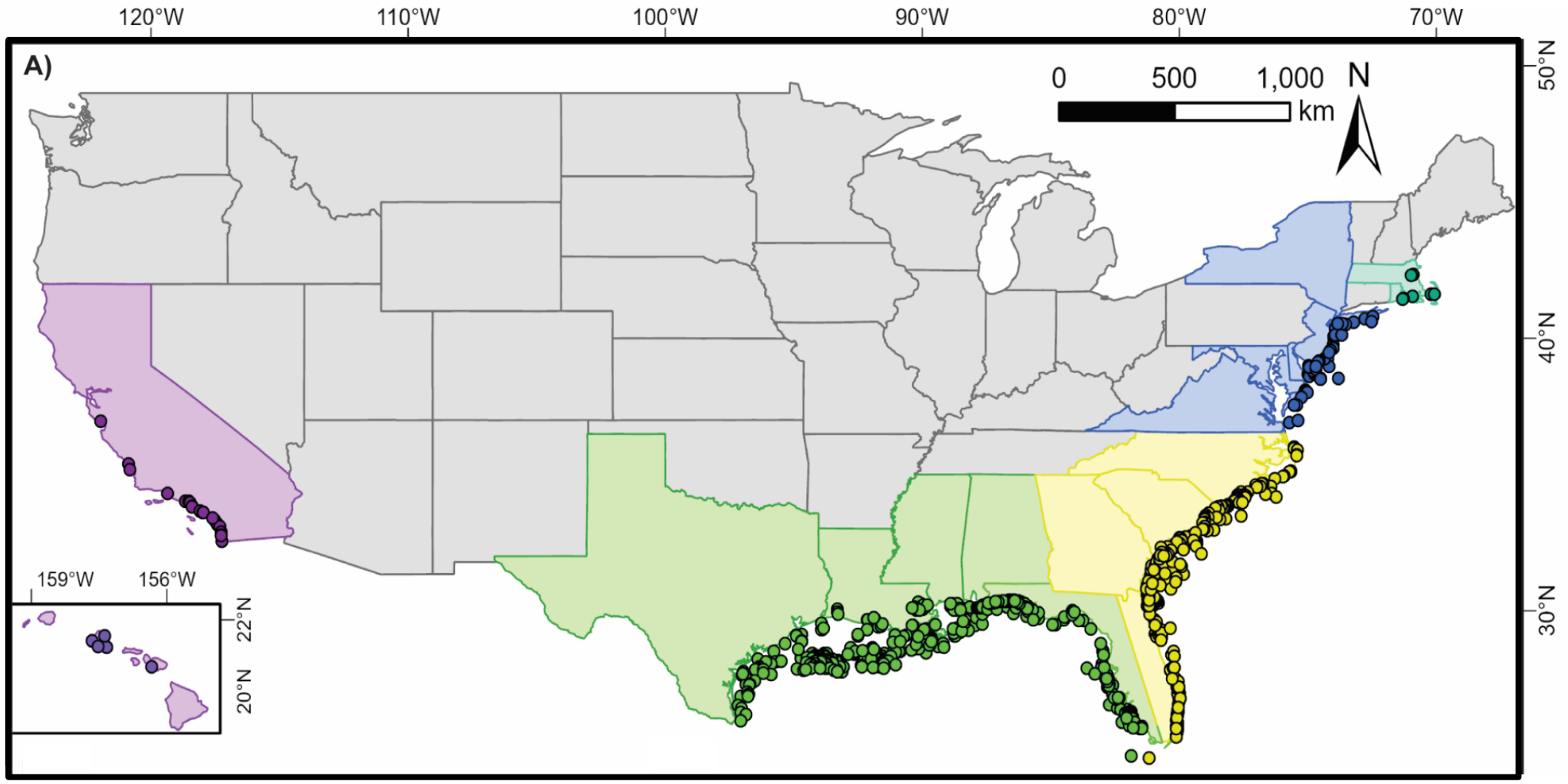
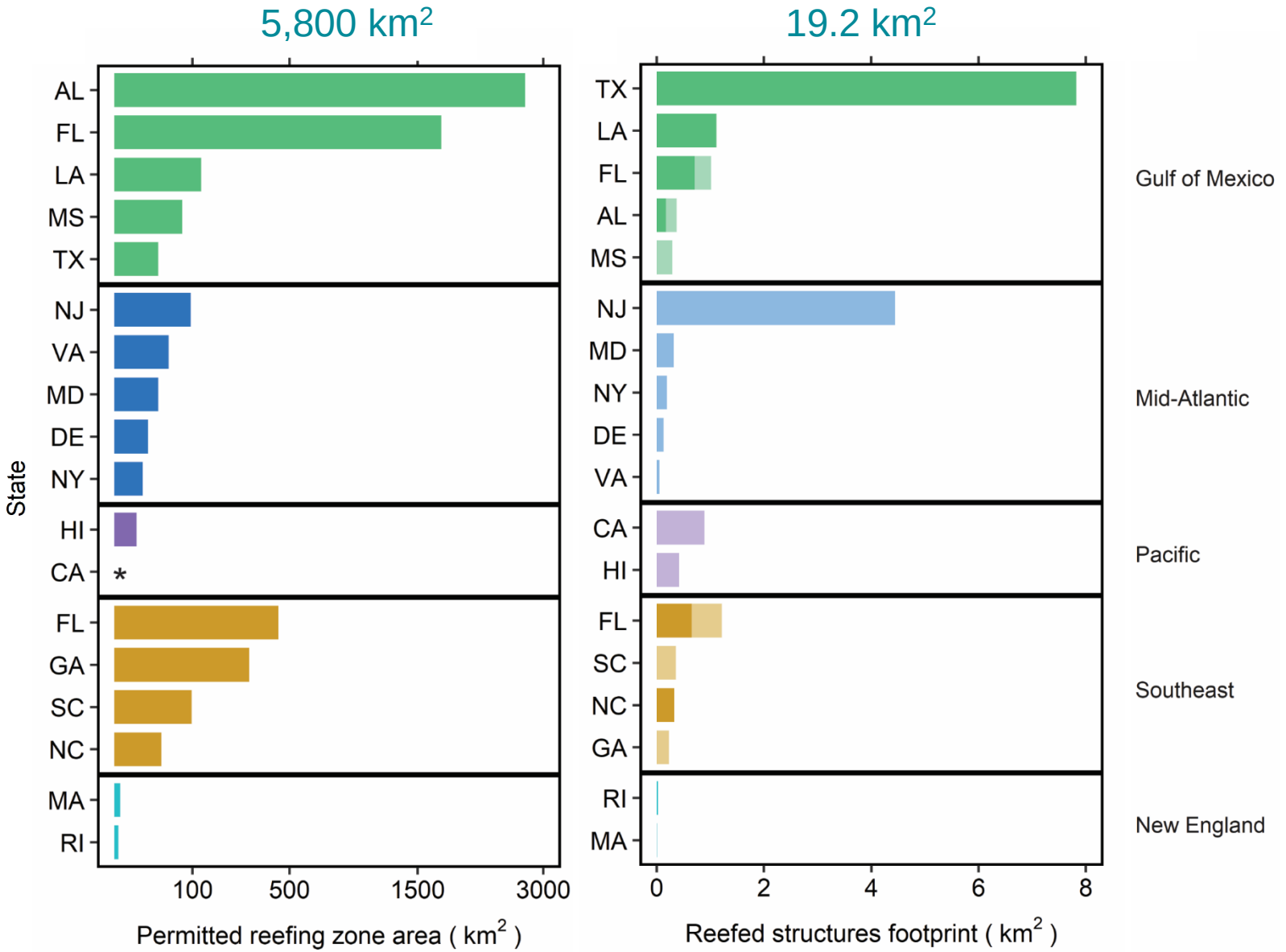
Context - artificial reef “footprint” in U.S. ocean?

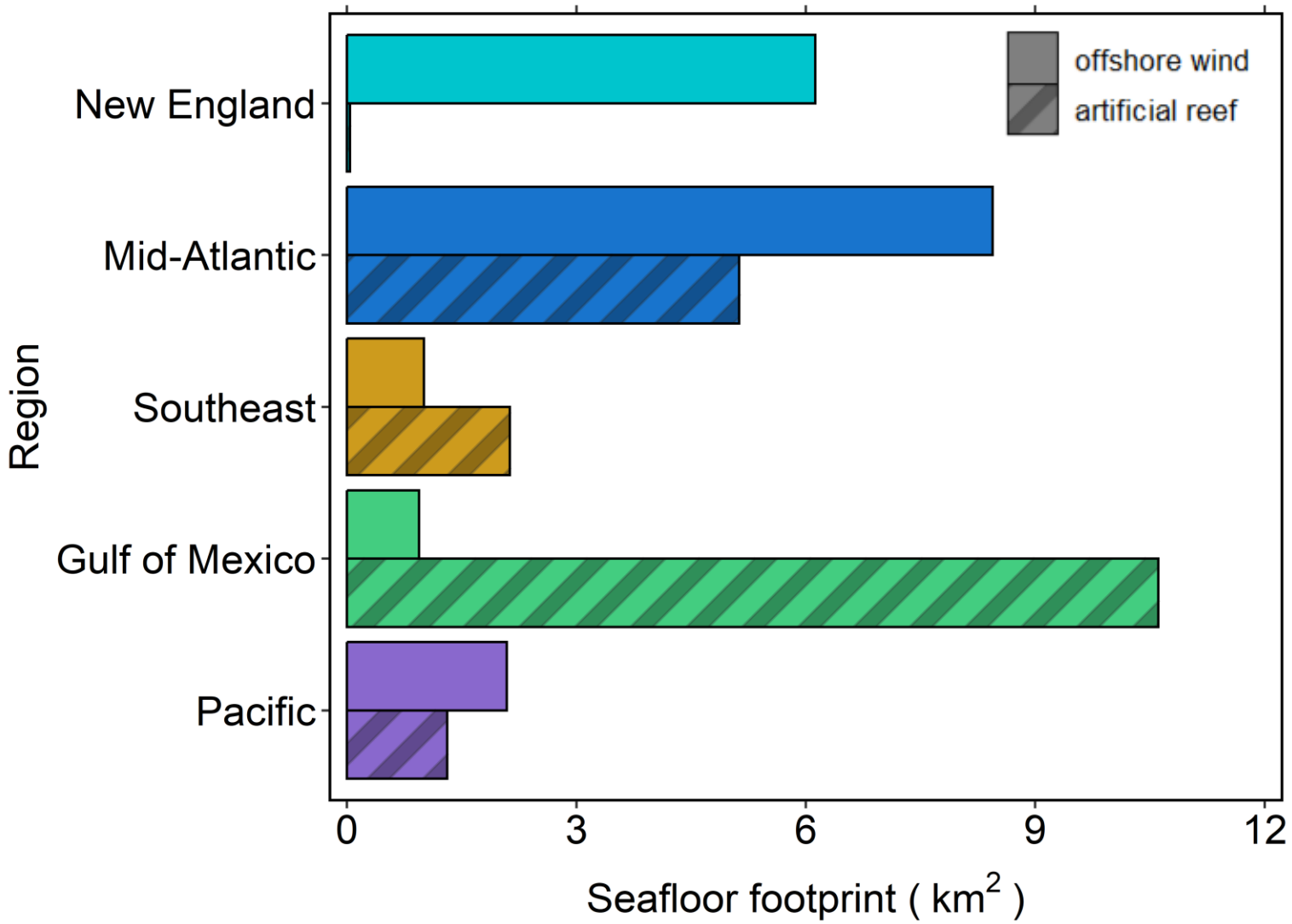


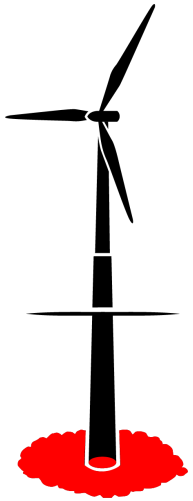
Paxton et al. 2024, *Nature Sustainability*



Paxton et al. 2024, *Nature Sustainability*

Offshore wind versus artificial reef seafloor footprint





Wind (2030):

- ~18.6 km^2 footprint
- ~3,400 football fields

Artificial reefs (2020):

- ~19.2 km^2 footprint
- ~3,600 football fields

Wind seafloor footprint = 0.96x artificial reef seafloor footprint

** Seafloor only!*

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Implications and take homes

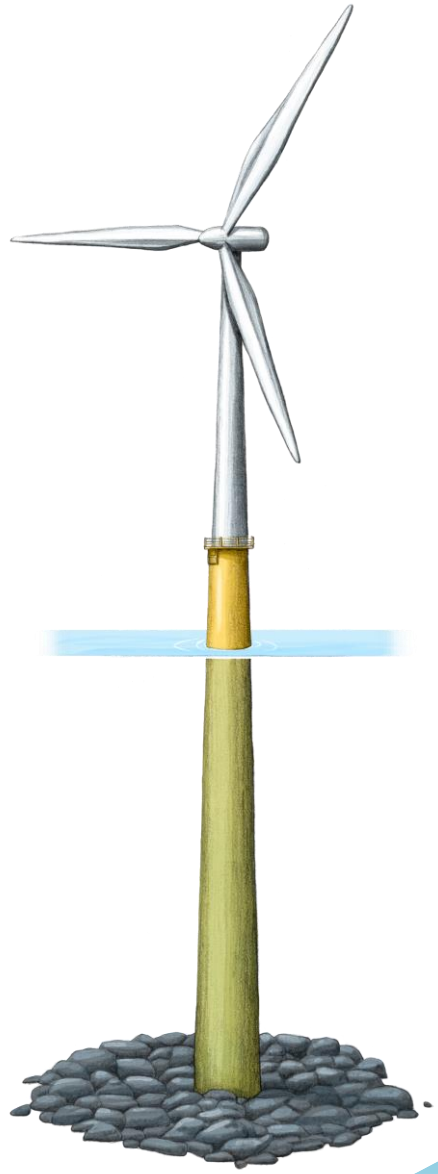
Seafloor footprint of offshore wind infrastructure is similar to that of artificial reefs

- Temporal scale (wind ~ 1 decade; artificial reefs 1899 – 2020)
- Spatial scale (wind concentrated; artificial reefs widespread)

Leased area of offshore wind is 2X greater than that of artificial reef zones

Burgeoning offshore wind development will result in **unprecedented influx** of artificial structures in U.S. ocean

Need to understand **ecological risks and benefits** of offshore wind infrastructure installation



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Questions?

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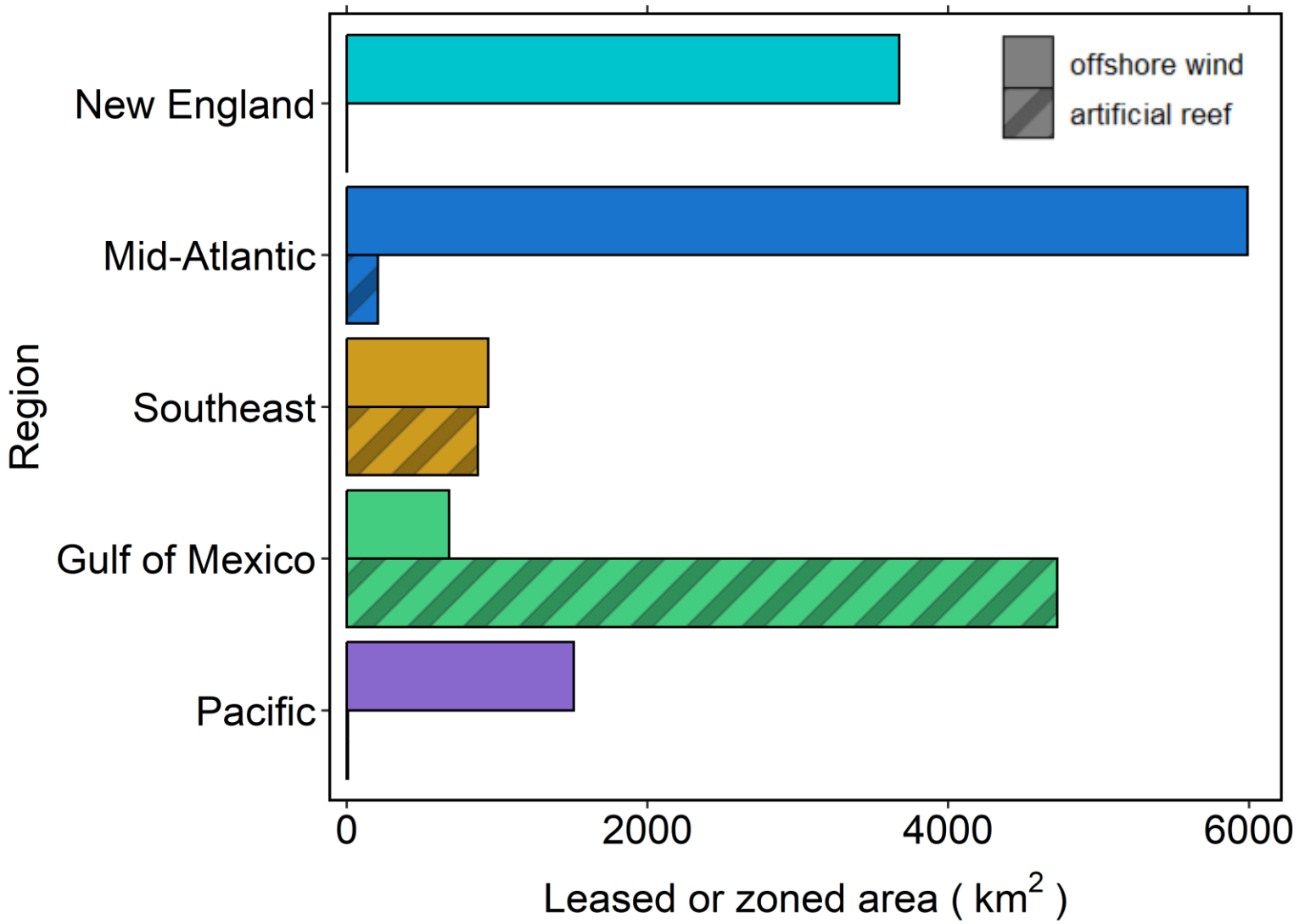
Acknowledgements

- **Offshore wind:** John Walter, Kate Wilke
- **Artificial reefs:** D'amy Steward, Chris Taylor, Nate Bacheler, Todd Kellison, Ken Riley, state artificial reef program managers, Alex Boersma, John McCord

Image: Ørsted

Offshore wind versus artificial reef leased or zoned area



Wind:

- ~13,000 km^2 leased
- Size of Connecticut

Artificial reefs:

- ~5,800 km^2 zoned
- Size between Delaware to Rhode Island

Wind leases area = 2.2x artificial reef zone area

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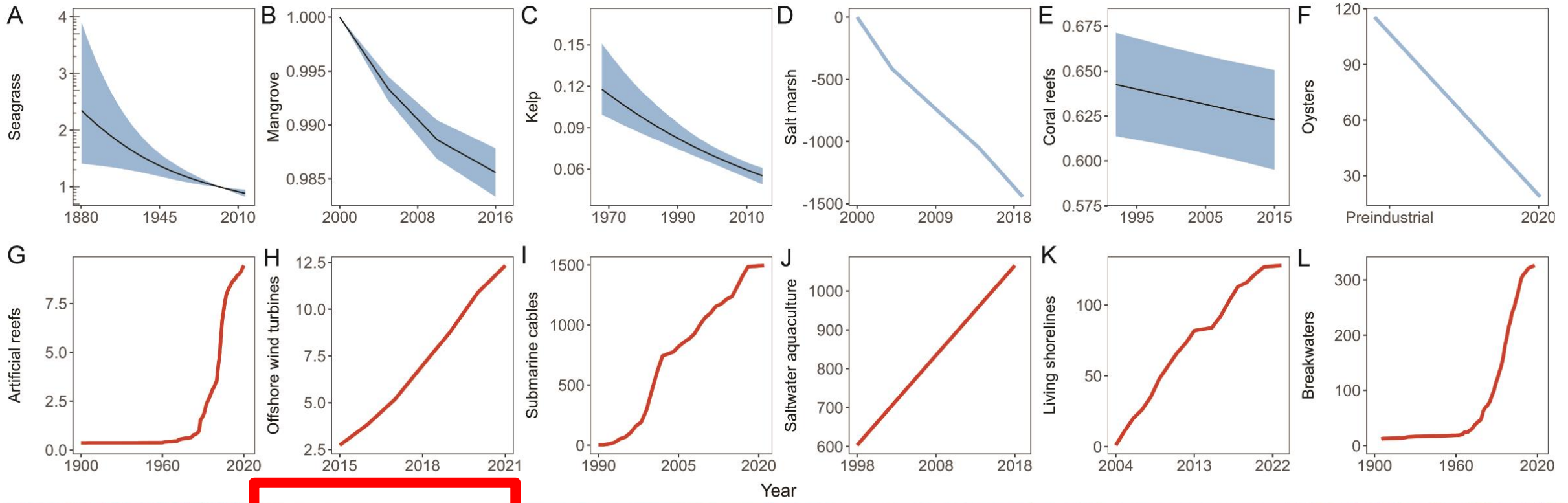
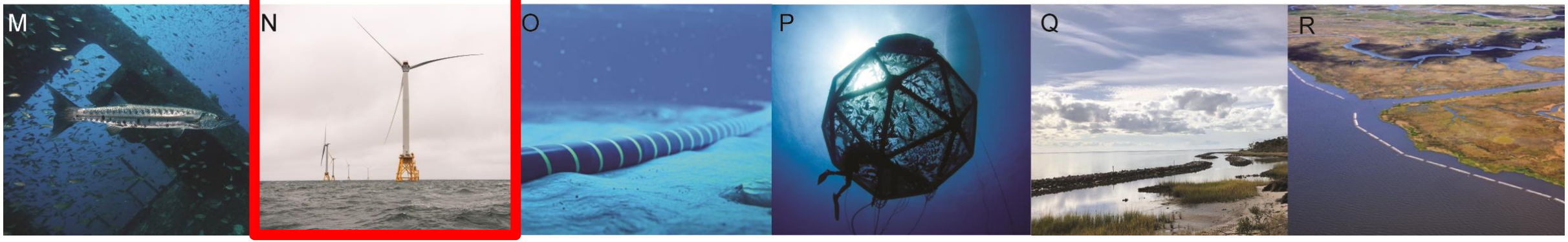
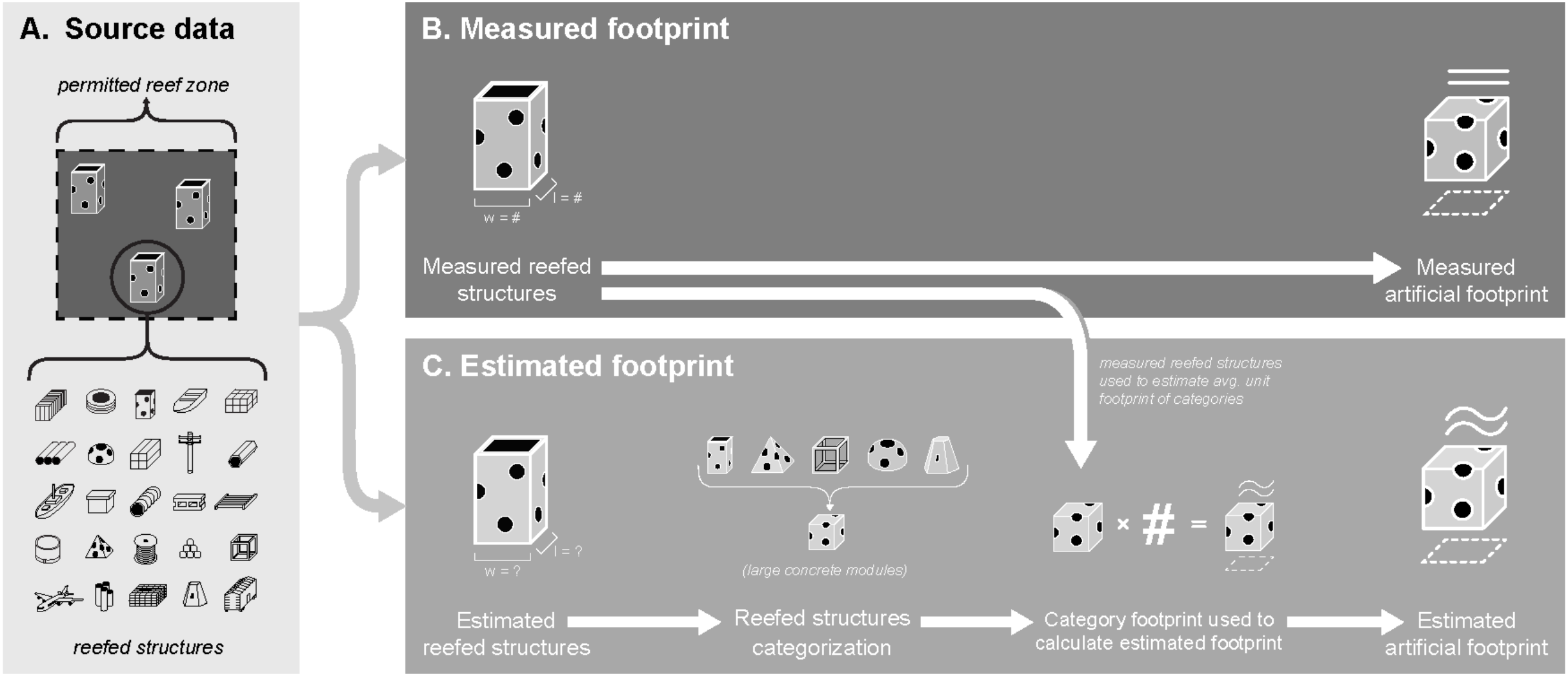
Rise in built structures amidst declines in natural habitats





Paxton et al., *In Revision, BioScience*

Artificial reef “footprint” in U.S. ocean



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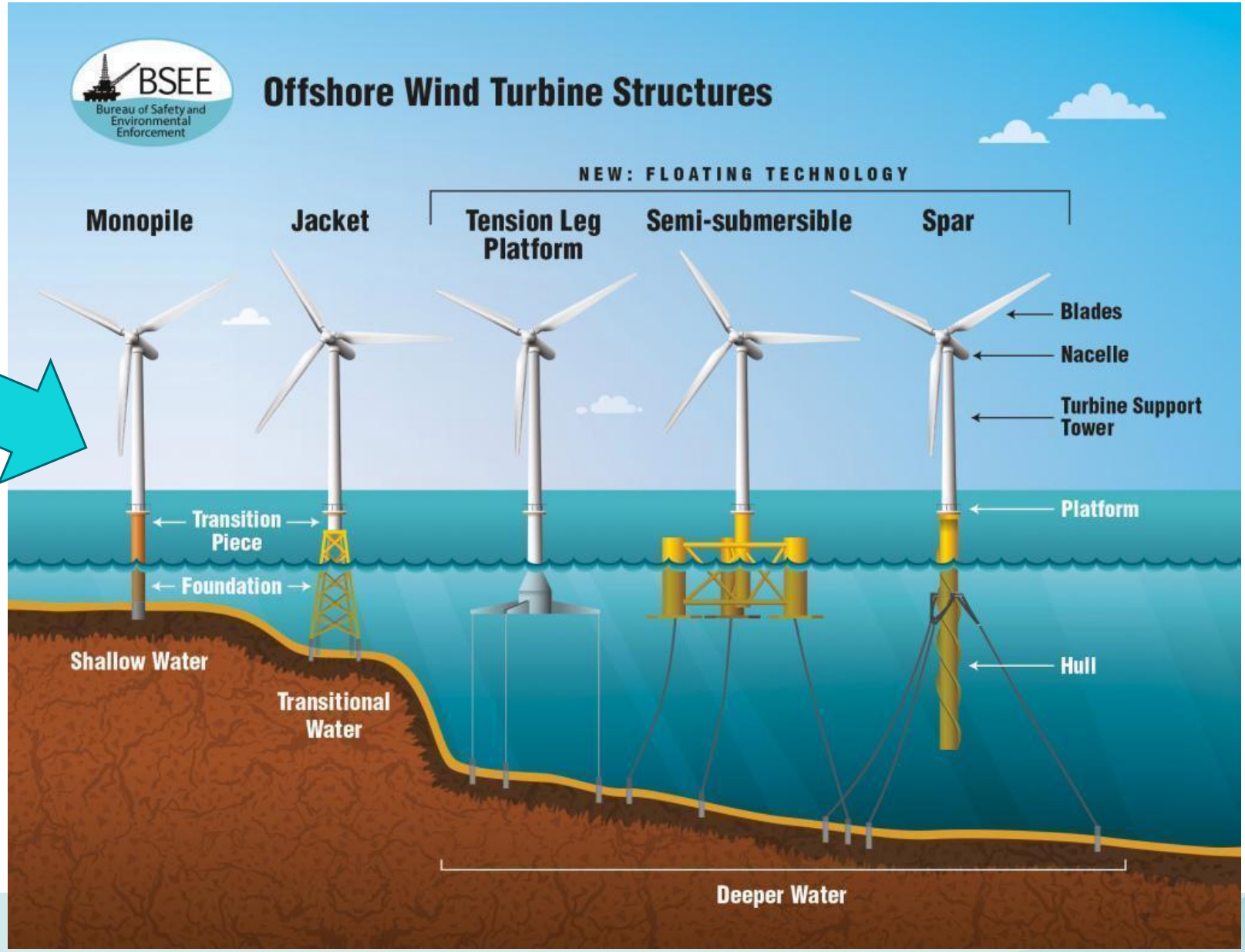

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