From Foundations to Fish: Movement and Habitat Use in Offshore Wind Farm Environments

Lauran Brewster, Alison Frey, Steve Cadrin, Chris Rillahan, Keith Hankowsky, Pingguo He

University of Massachusetts Dartmouth

School for Marine Science and Technology (SMAST)

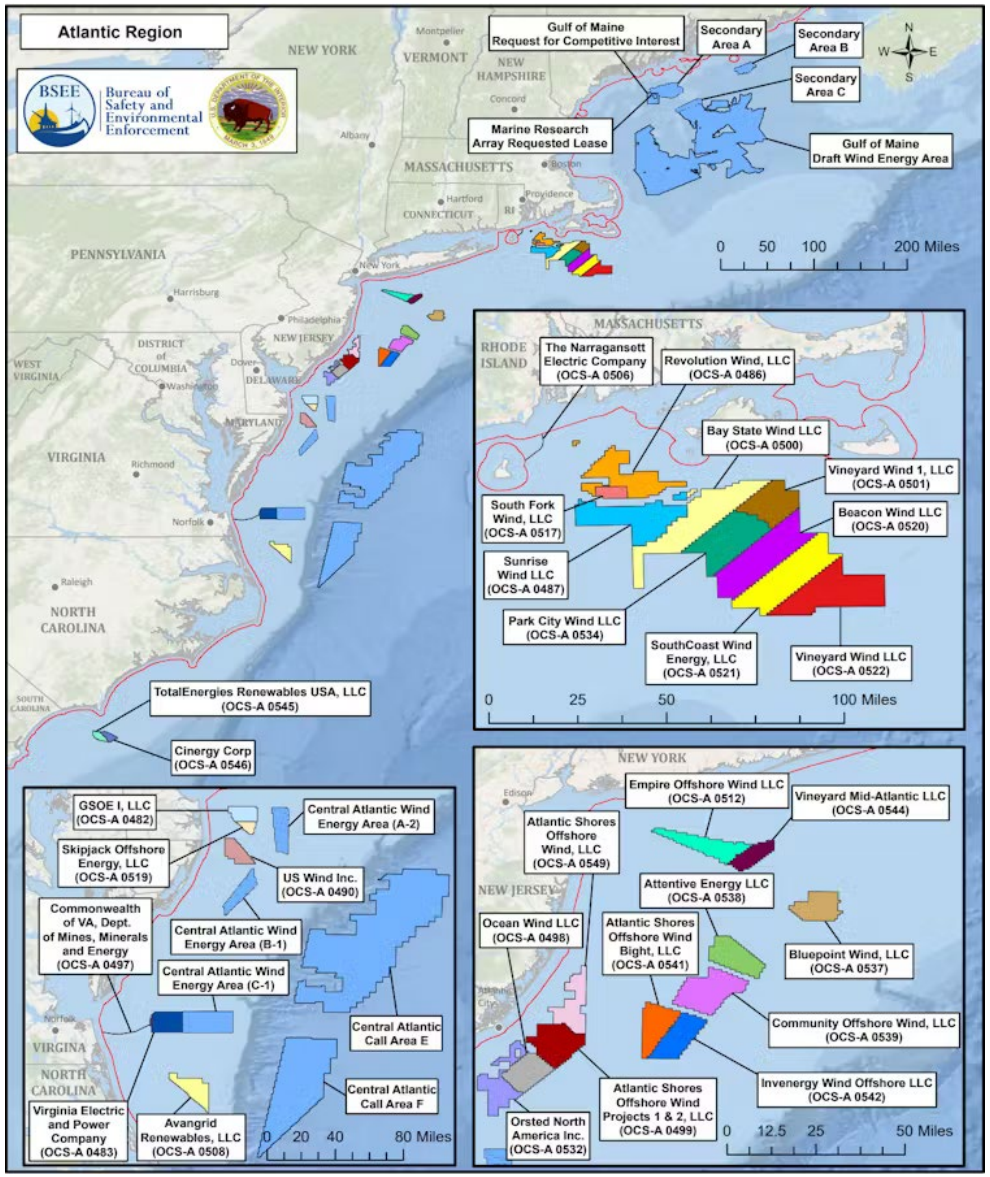


BOEM

Bureau of Ocean Energy Management

Background: Atlantic Offshore Wind Development

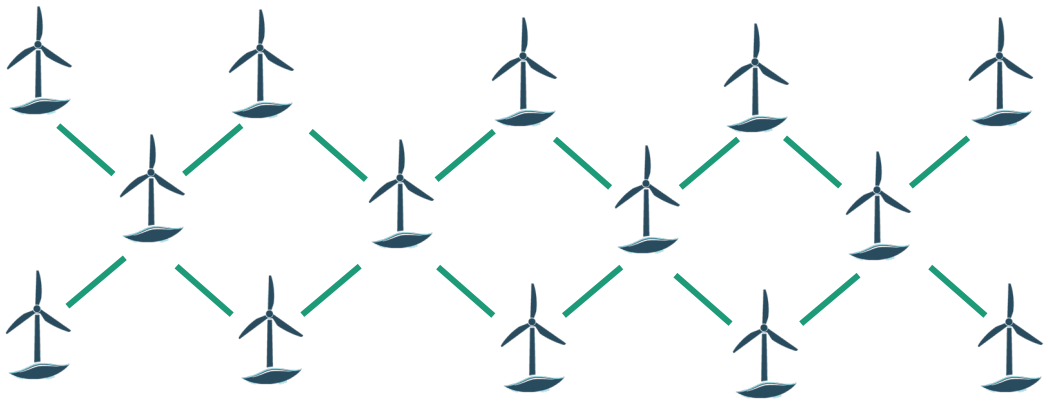
- Southern New England Lease Area:
  - 800 turbines
  - 1,418 sq. miles
    - For perspective: the entire land area of RI is 1,034 sq. miles
- Mid-Atlantic Lease Areas:
  - ~1,100 turbines
  - 2,062 sq. miles
    - For perspective: the entire land area of DE is 1,982 sq. miles

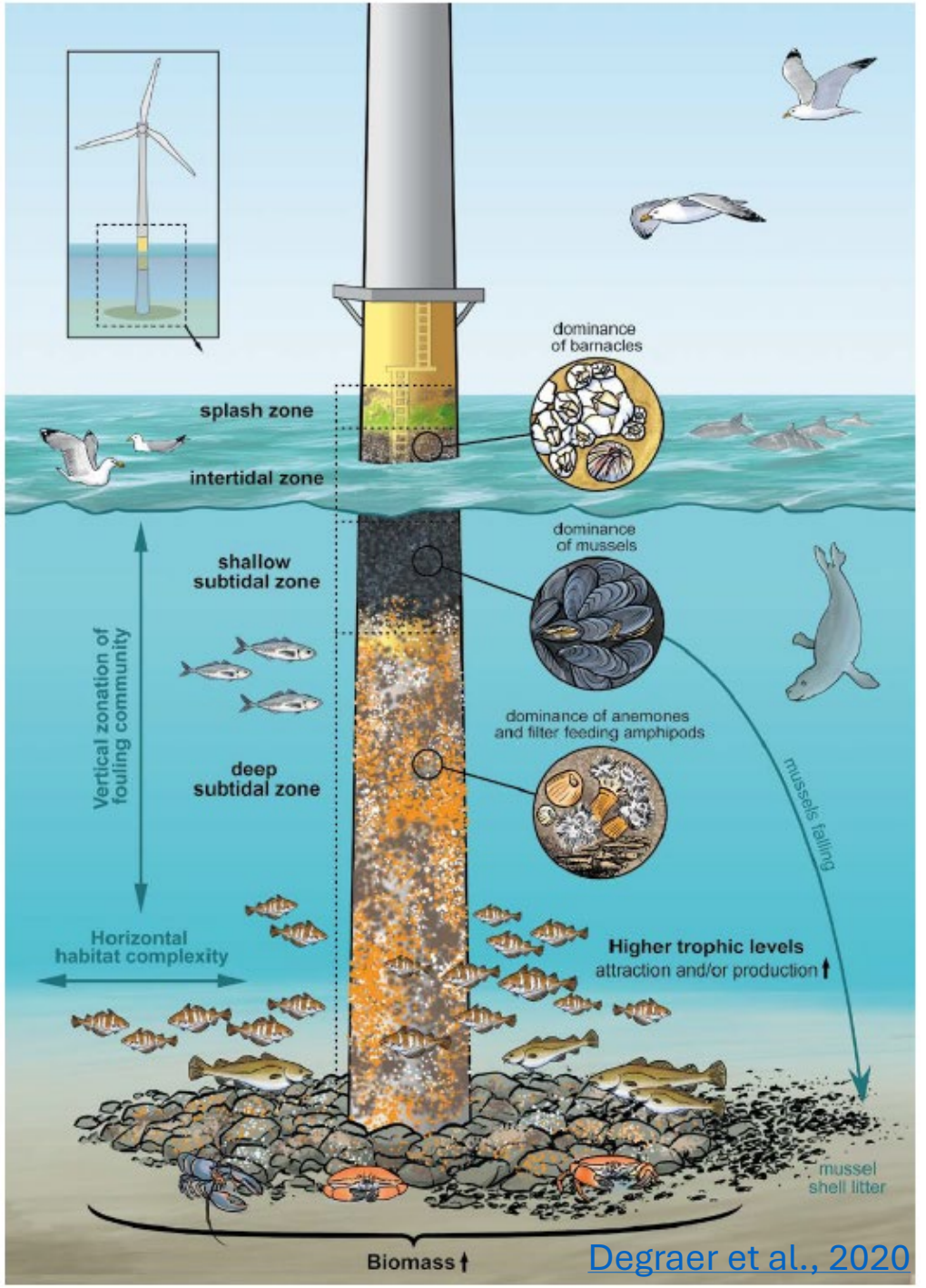


Project Objectives

Determine **individual** and **additive** impacts of multiple wind turbine structures by evaluating:

1. Do fish move among turbines?
2. Do turbines act as isolated reefs or connected networks?
3. Does space use differ vertically and seasonally?





Degraer et al., 2020

Study site: Block Island Wind Farm

- Constructed 2016
- Five 6-MW turbines
- ~0.5 nm apart
- Jacket piling foundations

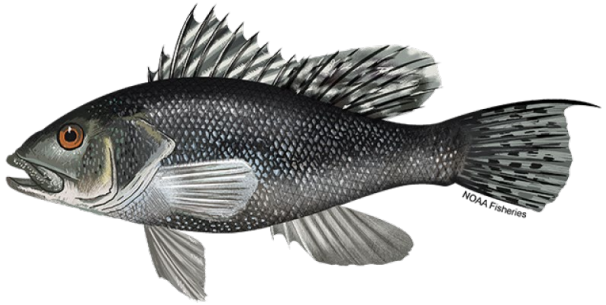




Methods

Two complementary methods were used to link population-level habitat use with individual-level movement and connectivity

1. **Optical imaging:** baited remote underwater video systems (BRUVS)
2. **Acoustic telemetry:** tagging and tracking of three commercially and recreationally important species



Black Sea Bass
(Centropristis striata)



Summer Flounder
(*Paralichthys dentatus*)



Striped Bass
(*Morone saxatilis*)

Acoustic Telemetry

Fish Tag ID #	Date Time	Receiver Station	Receiver Station Latitude	Receiver Station Longitude
1	2026-10-26 16:00	A	41.8724	-71.8263
1	2026-10-26 17:30	B	42.9311	-71.2740
2	2026-10-26 16:45	A	41.8724	-71.8263



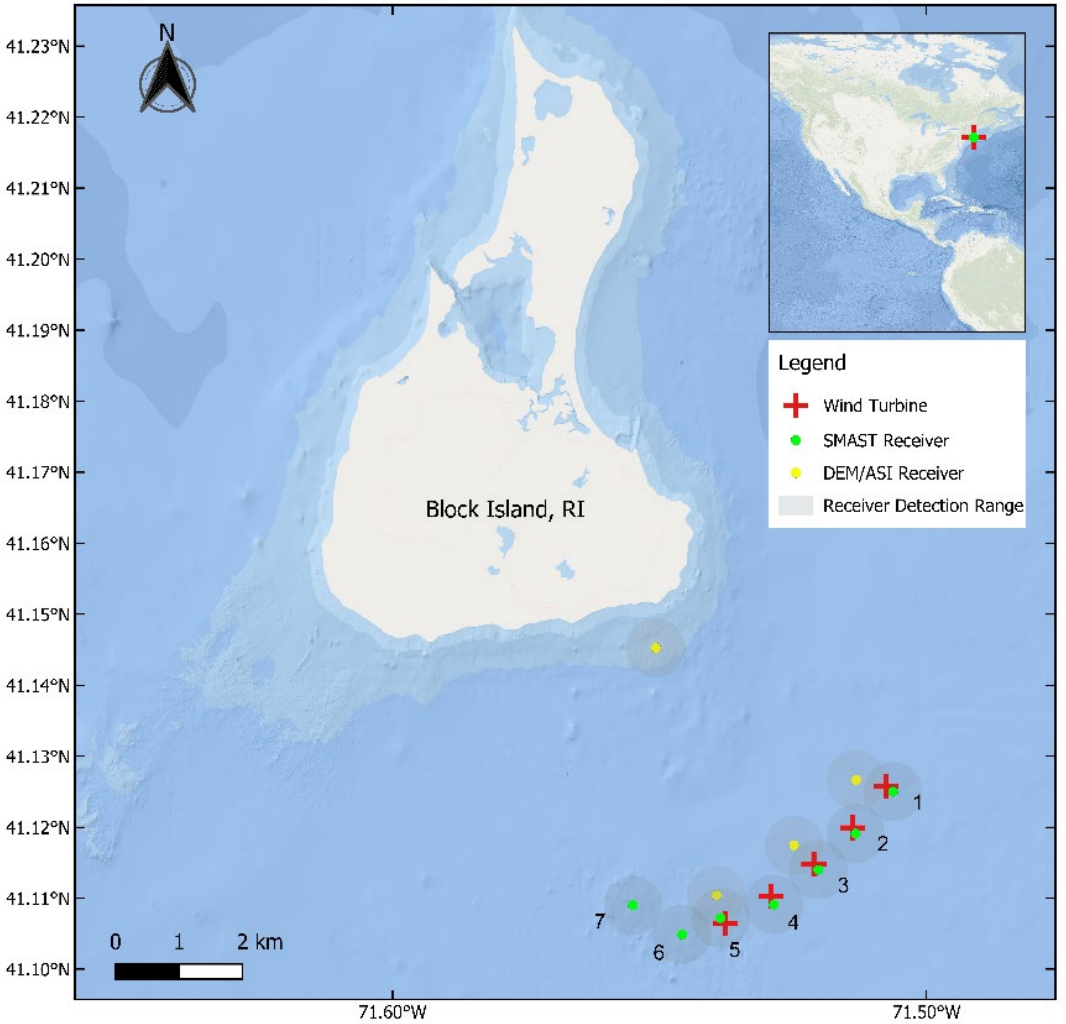


https://innovasea.com

Methods: Acoustic Telemetry

- Goal → 150 Tags; ~50/spp.
  - V13P → Black Sea Bass (internal), Summer Flounder (external)
  - V16P → Striped Bass (internal)
- Seven VR2Tx receivers
- Cooperative work RI fishermen
- Data sharing via Atlantic Cooperative Telemetry Network

Receiver detections allow us to quantify residency, spatial breadth, and connectivity across the BIWF array and regional network



Approved UMassD IACUC (Protocol #23-01)

Results: Acoustic Telemetry

Species	Total Tagged	# Fish Detected Locally	# Post-release Fish Detected Locally	Total Length (Mean, ±SD)	Days at liberty (Median, IQR)
Black Sea Bass	**63**	**59**	**48**	41 ± 4 cm	112 (259)
Summer Flounder	**35**	**33**	**30**	45 ± 5 cm	55 (116)
Striped Bass	**50**	**33**	**15**	77 ± 12 cm	660 (280)

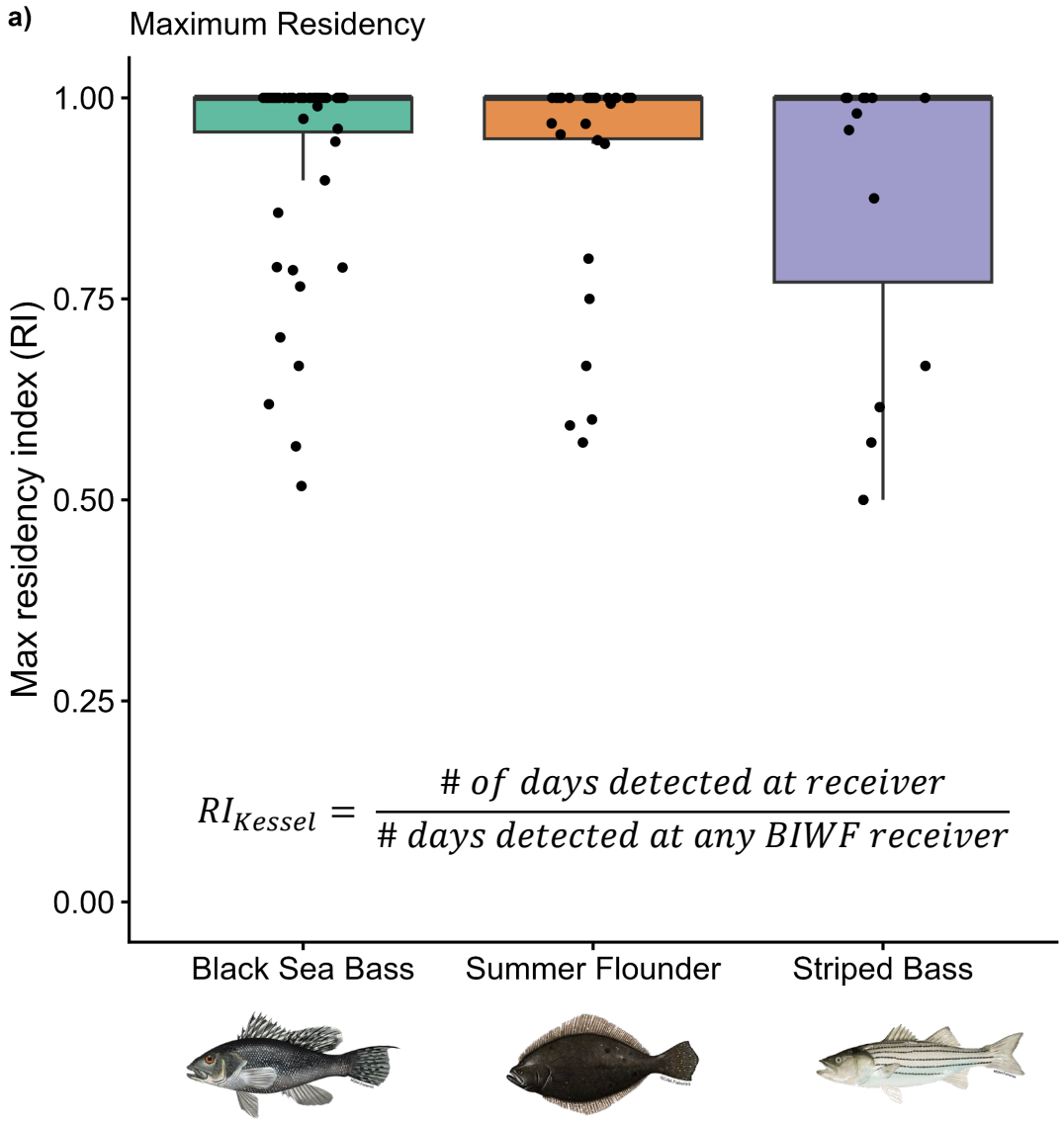
- 5 tags returned (1 redeployed)
- 1 lost receiver (adjacent rocky habitat; Sept 2023)

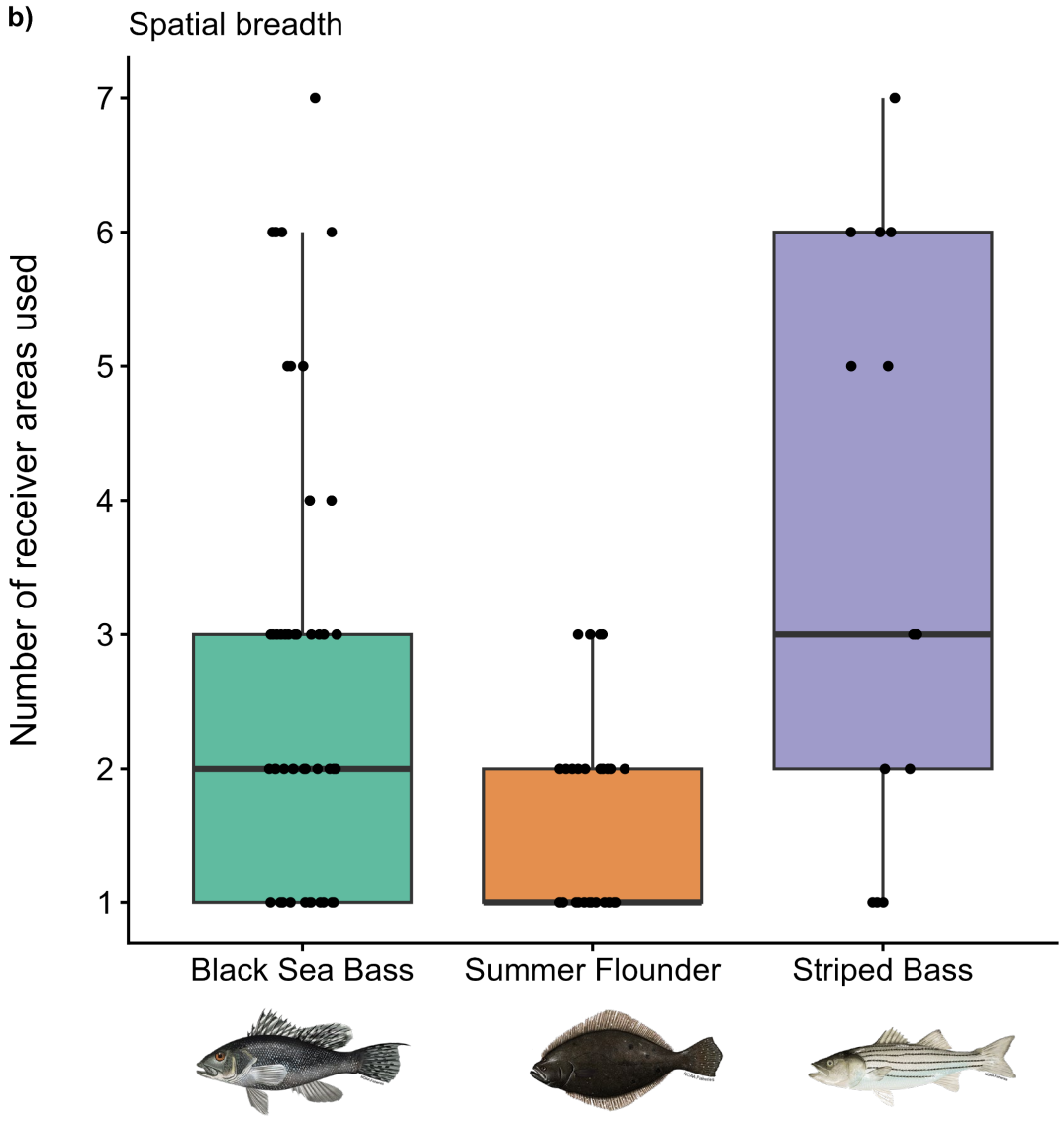


Post-release fish detected locally across all three species allow comparison of wind farm array use

Results: Acoustic Telemetry

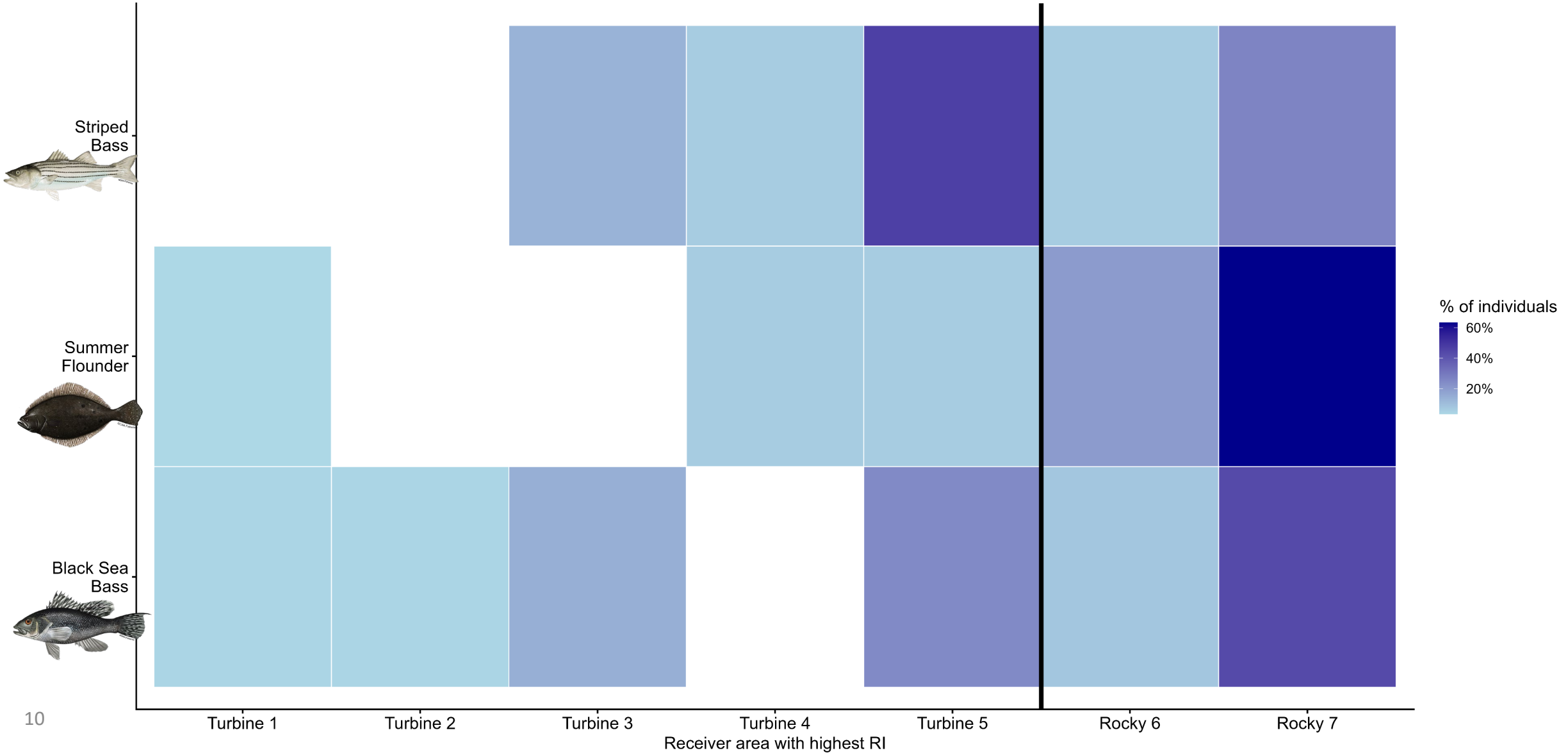
→ 1) *How do fish use the BIWF array? — Residency and spatial breadth*





Results: Acoustic Telemetry

→ 2) *Where within the array are detections concentrated? — Highest residency index*



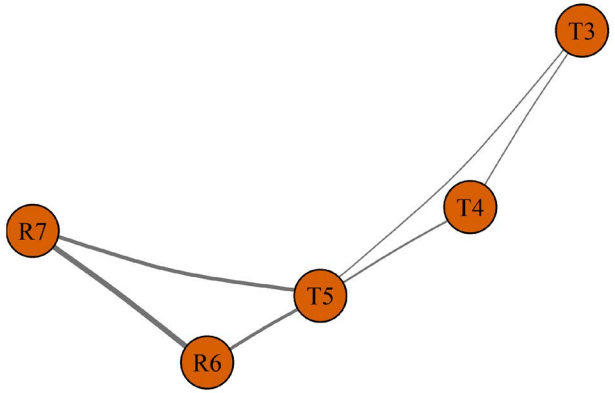
Preliminary Results: BIWF Array Use

→ 3) *How broadly and connectedly do fish use the BIWF array? Network analysis*

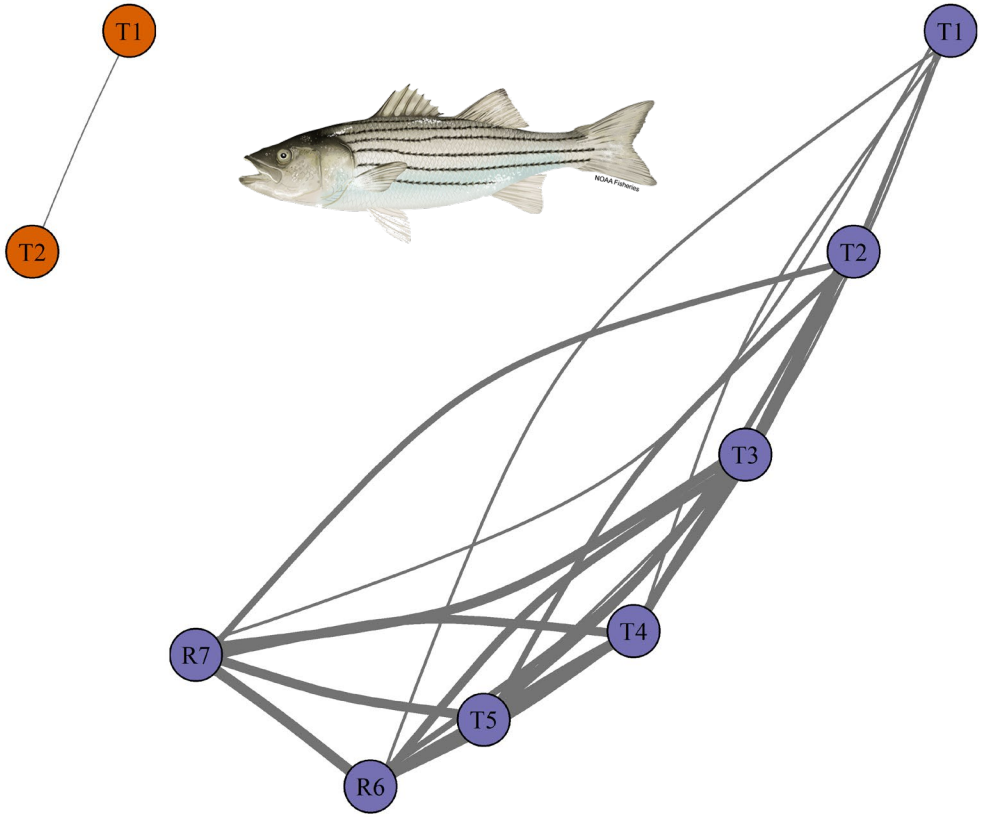


Black Sea Bass
median = 2 stations
range 1–7
n = 48





Summer Flounder
median = 1 station
range 1–3
n = 30

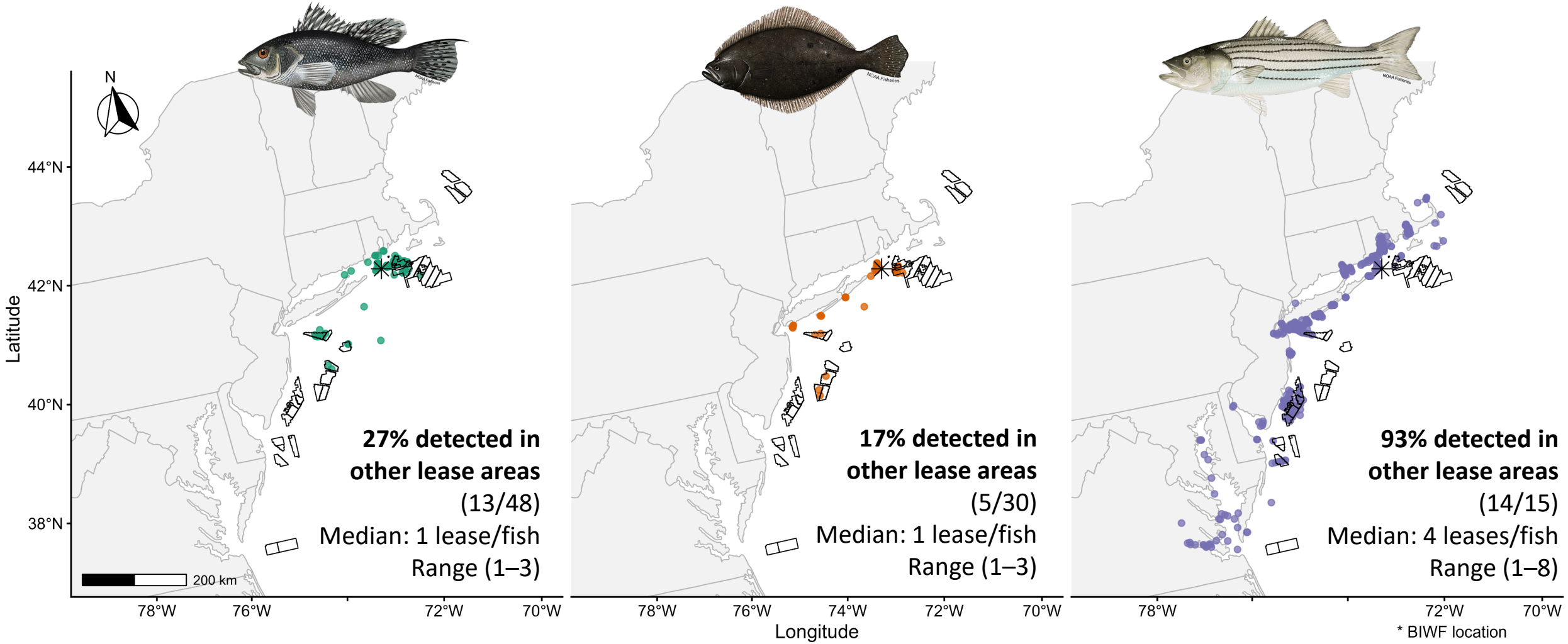


Striped Bass
median = 3 stations
range 1–7
n = 15

Spatial use of the BIWF array differs among species; receiver overlap limits interpretation of connectivity between adjacent turbines

Preliminary Results: Regional Connectivity

→ 4) *How many BIWF fish were detected in other BOEM wind lease areas?*

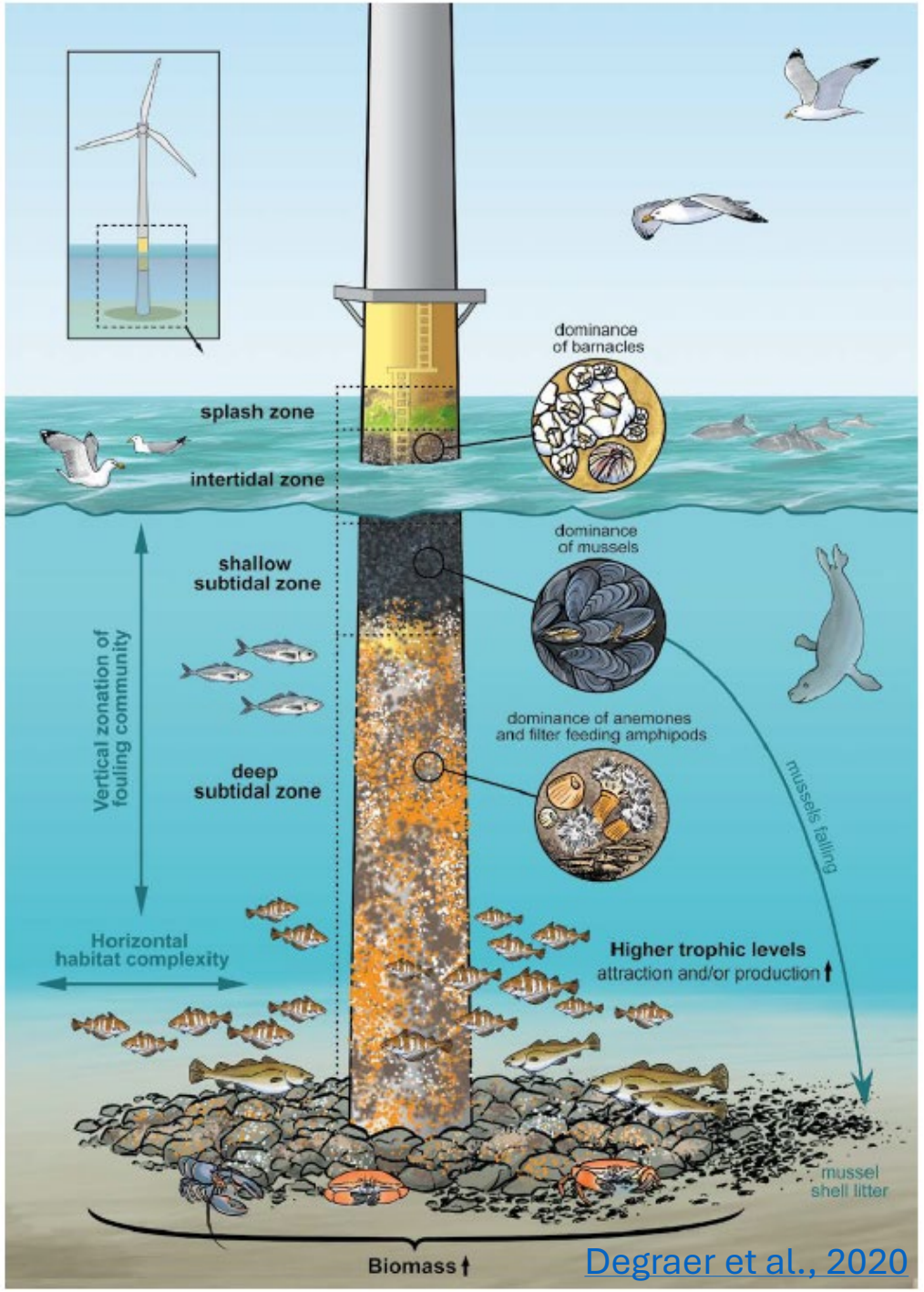


Connectivity among offshore wind lease areas was substantially broader for striped bass than for black sea bass or summer flounder

Preliminary Conclusions

- **Species used the BIWF array differently**
  - Summer flounder showed the narrowest spatial breadth
  - Striped bass showed the broadest
- **Receiver areas within the BIWF array were highly connected acoustically**
  - High overlap between adjacent receivers limits turbine-specific interpretation
- **Fish tagged at BIWF were detected across the broader regional receiver network**
  - Striped bass showed substantially broader connectivity than black sea bass or summer flounder

Spatial patterns of wind farm use and regional connectivity were strongly species dependent



Degraer et al., 2020

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Questions?

lbrewster@umassd.edu