

# **Ol London, 12-14 March 2024**

## **Complexities of Offshore Energy Infrastructure Planning Between Shallow Water and Deepwater Environments**

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Berger Geosciences LLC.

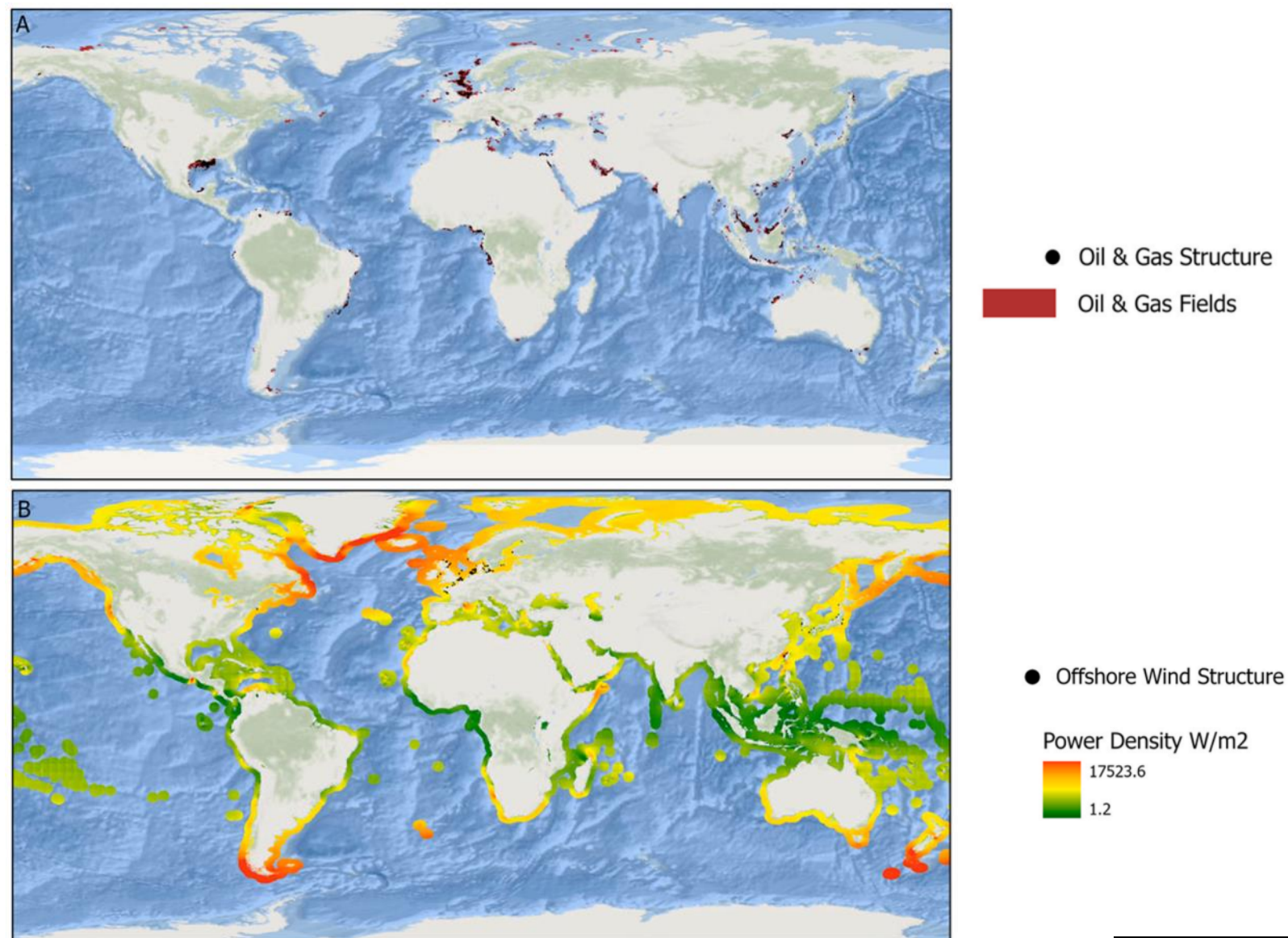
# Outline

- Introduction and significances
- Local vs. federal government regulations and its influence on shallow and deepwater infrastructure planning
- Case studies
- Key differences in geophysical planning of offshore energy infrastructure in shallow and deepwater environments
- Key differences in archaeological planning of offshore energy infrastructure in shallow and deepwater environments
- Conclusions

# Current Offshore Oil & Gas and Wind Energy Structures

## Significances:

- Offshore Oil & Gas fields are concentrated in the GOM, North Sea, and Middle East with scattered additional fields in S.E. Asia, West Africa, Mediterranean Sea, and South America
- Highest wind energy density (reds and yellows) are concentrated predominantly in temperate and arctic climate zones of the northern and southern hemispheres. Lowest wind energy density (greens) are in tropical and subtropical locations



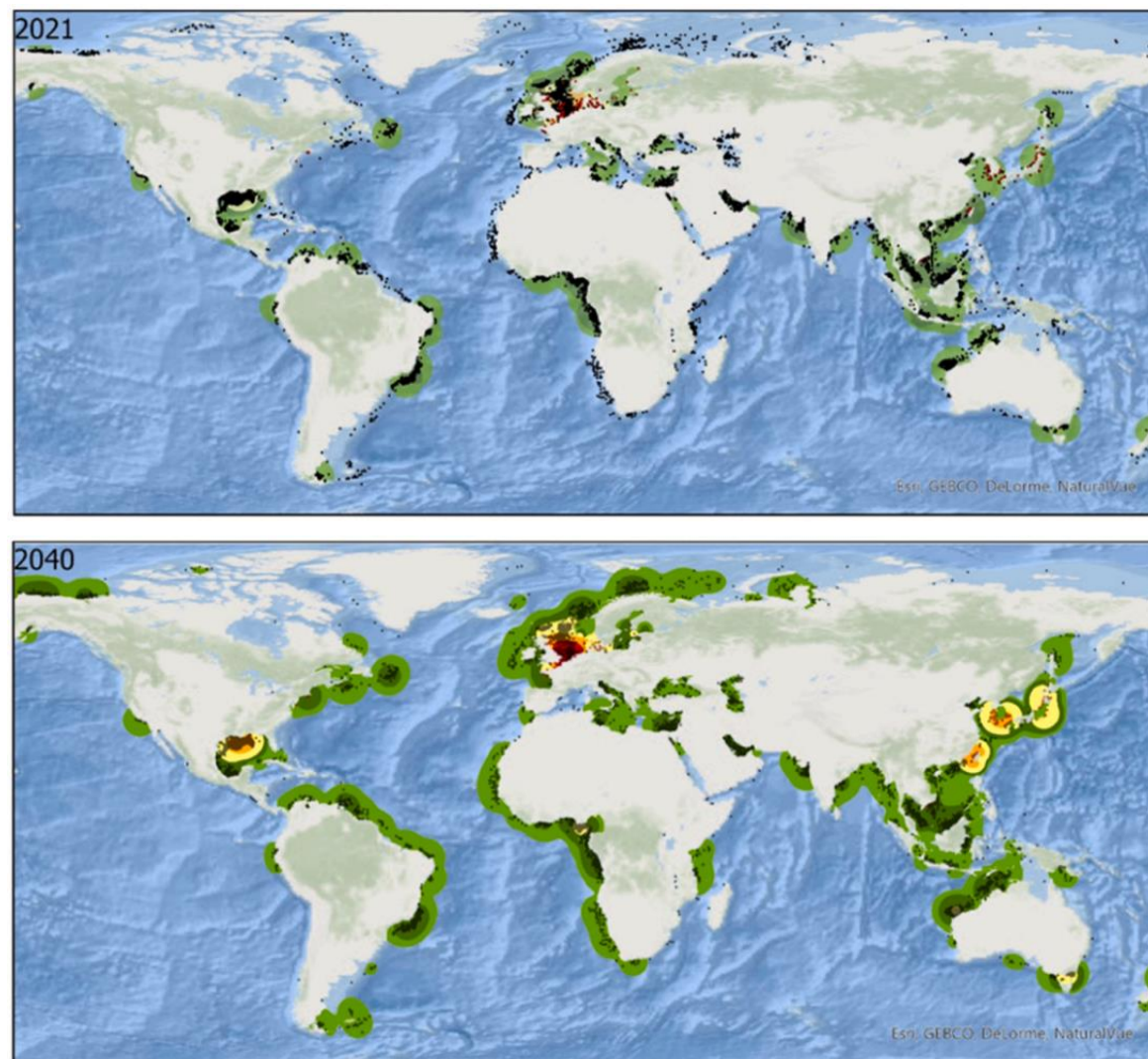
Gourvenec et al., 2022



# Predicted Density Increase of Offshore Energy Structures

## Significances:

- Growing energy demand
- Bigger push on renewable energy by local governments to reduce emission of greenhouse gases
- Lesser space to accommodate energy structures
- Removal/upgrade of older structures
- Proper planning of offshore infrastructure is essential
- Offshore energy structures will grow in both shallow and deep waters
- Infrastructure planning in shallow water differs significantly from its planning in deepwater due to different complexities of environments
- Different survey techniques are needed for acquisition, processing, and interpretation mechanisms



Gourvenec et al., 2022

Offshore structures

- Oil & Gas Structure
- Offshore Wind Structure

Density of Offshore Structures

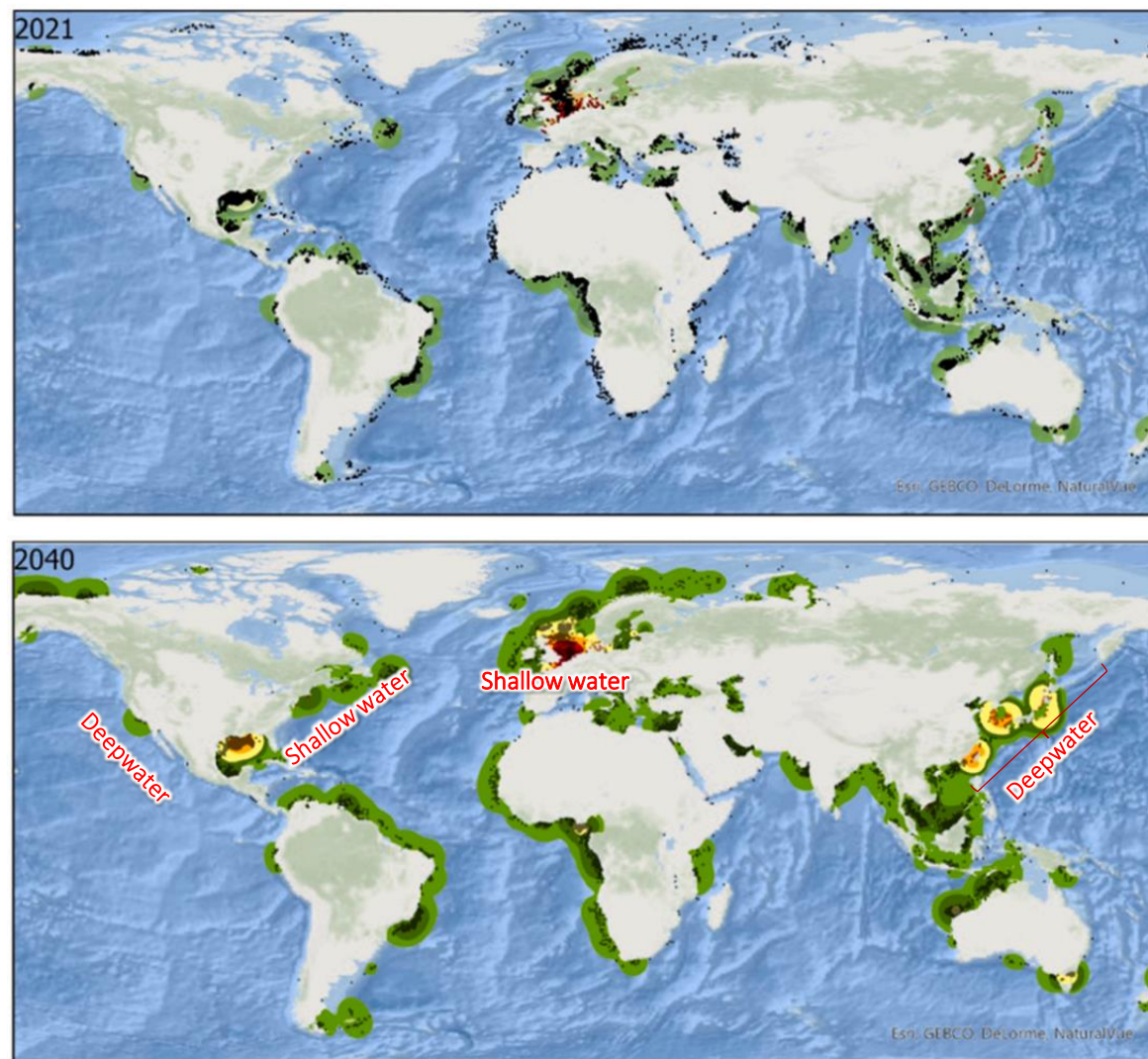
Structures per 0.1 degrees



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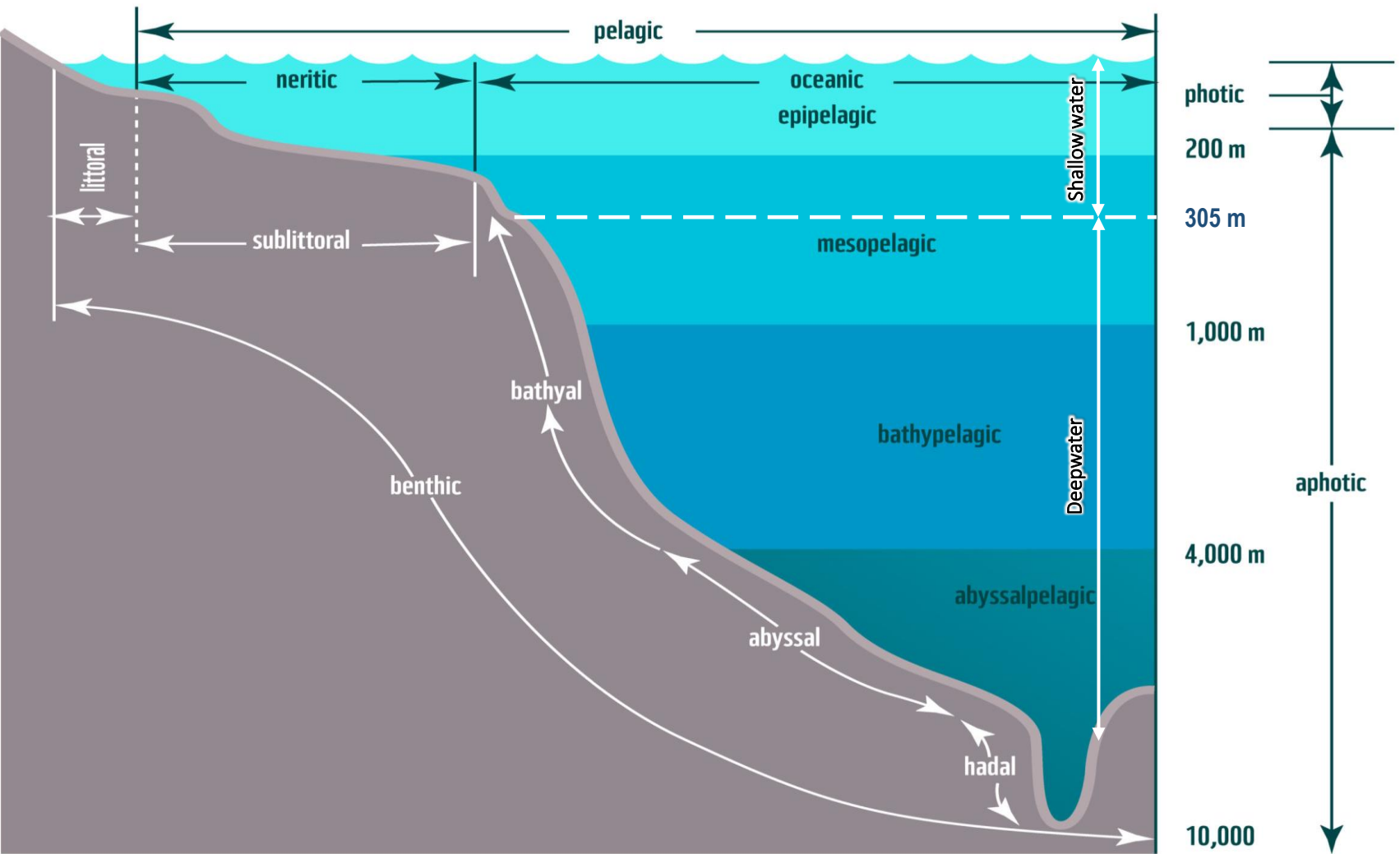
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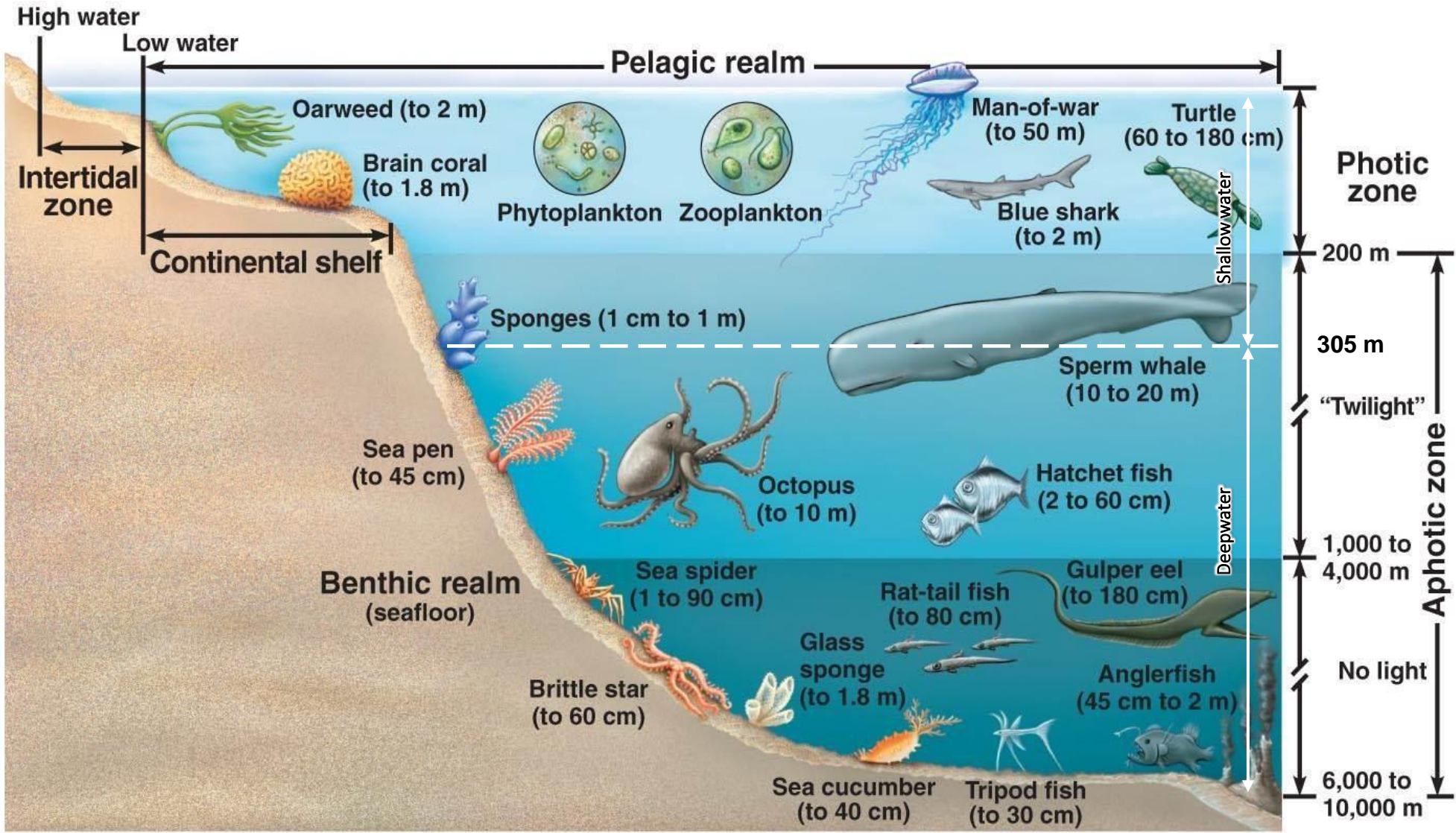




# Shallow Water Vs. Deepwater Ocean Layers



# Shallow Water Vs. Deepwater

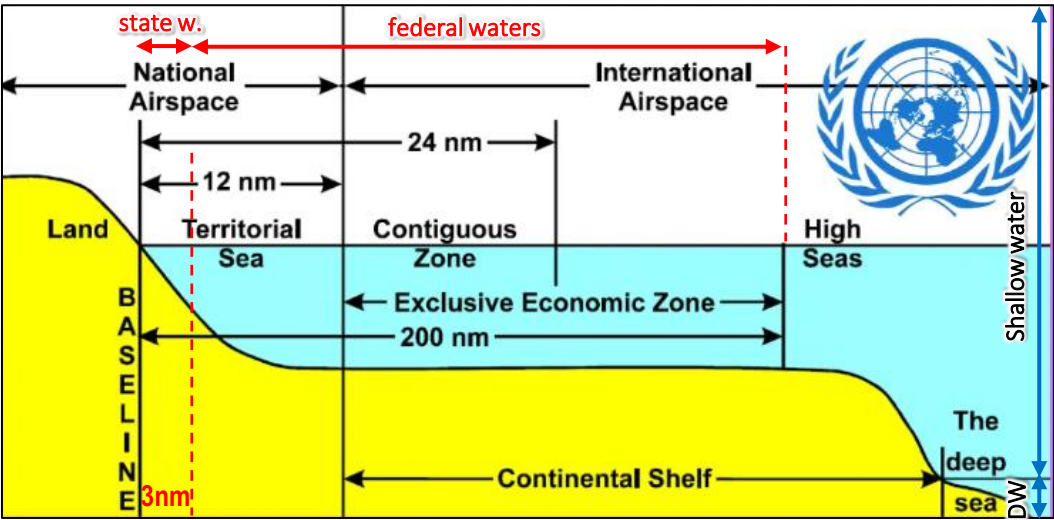
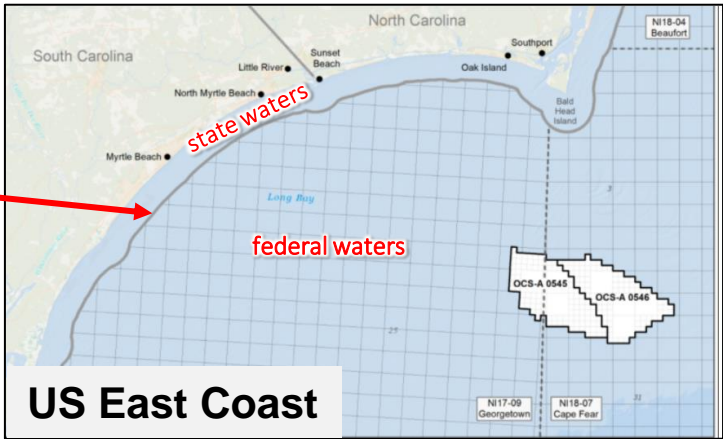


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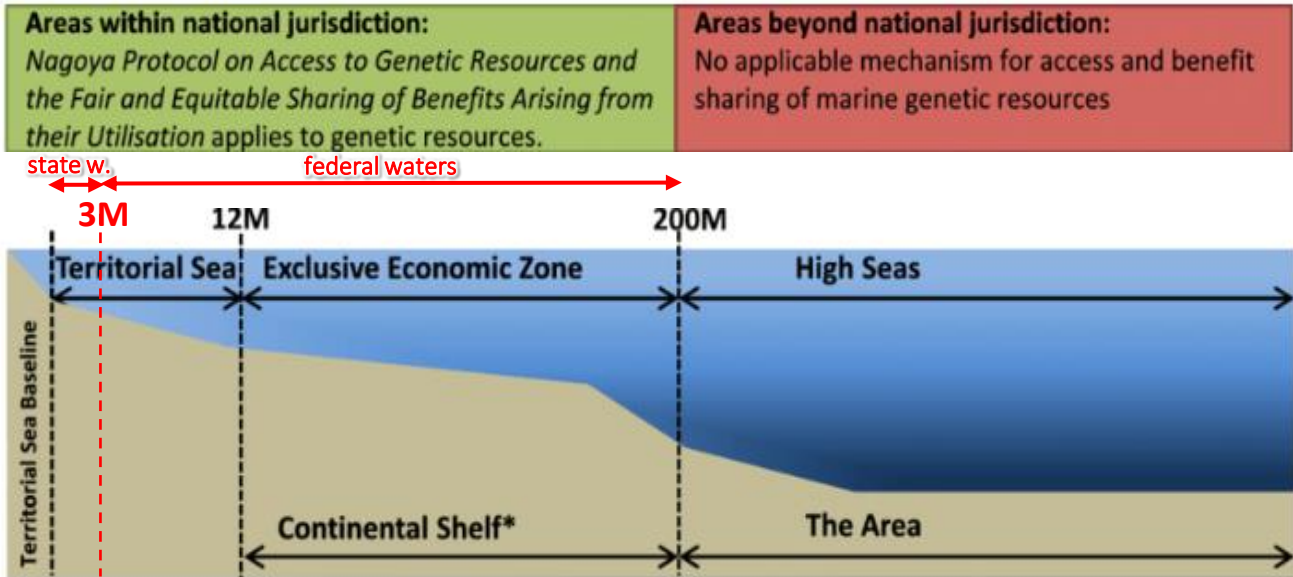


# Local and Federal Government Regulations

- Lease areas are located within the Exclusive Economic Zone
- Cable routes will cross the Territorial Waters
- In the U.S. the 3 nautical mile line separates federal and state waters
- Activities in shallow waters involve interaction with federal and local (state/city) governments as well as fisheries and recreational boaters
- Deepwater locations usually involve only federal government agencies



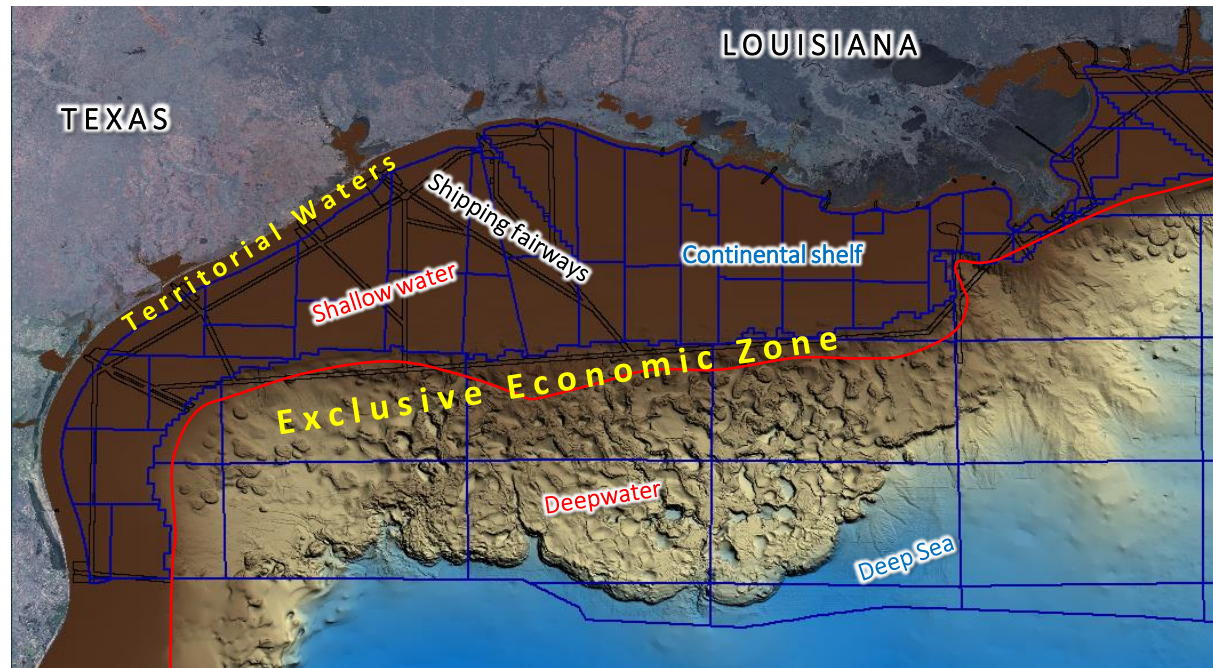
United Nations Convention on the Territorial Sea and the Exclusive Economic Zone (effectively since 1994)



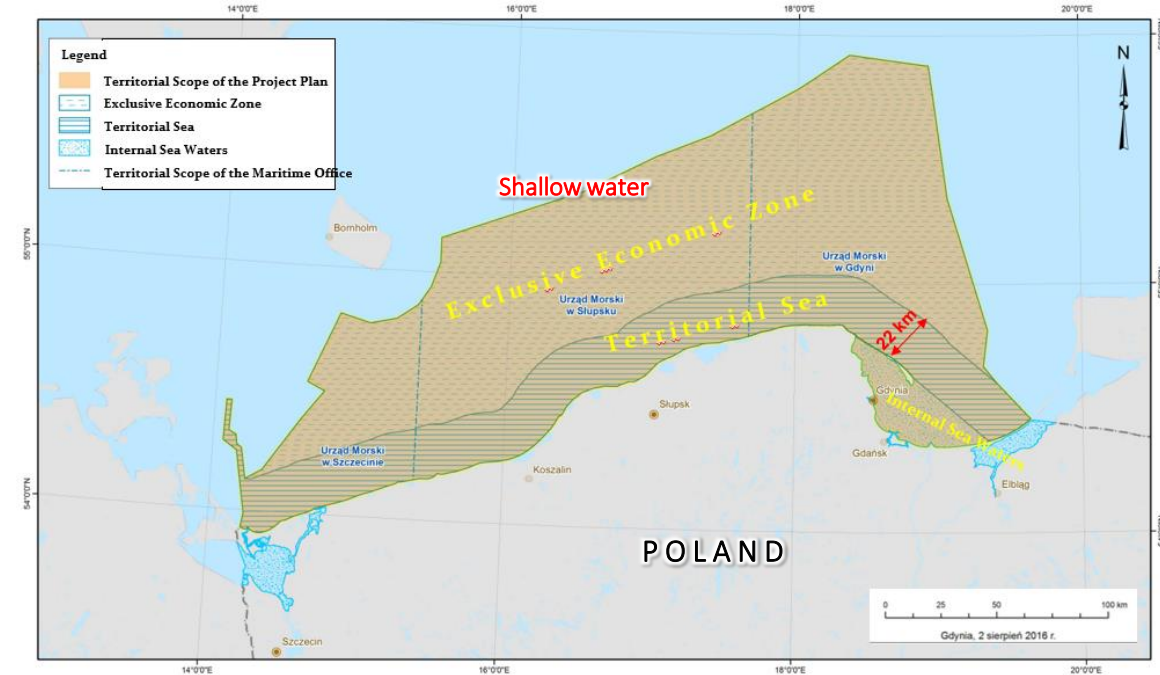
Vierros, Marjo & Suttle, Curtis & Harden-Davies, Harriet & Burton, Geoff. (2016). Who Owns the Ocean? Policy Issues Surrounding Marine Genetic Resources. Limnology and Oceanography Bulletin. 25. 10.1002/lob.10108.



# Local and Federal Government Regulations for Shallow and Deepwater Environments

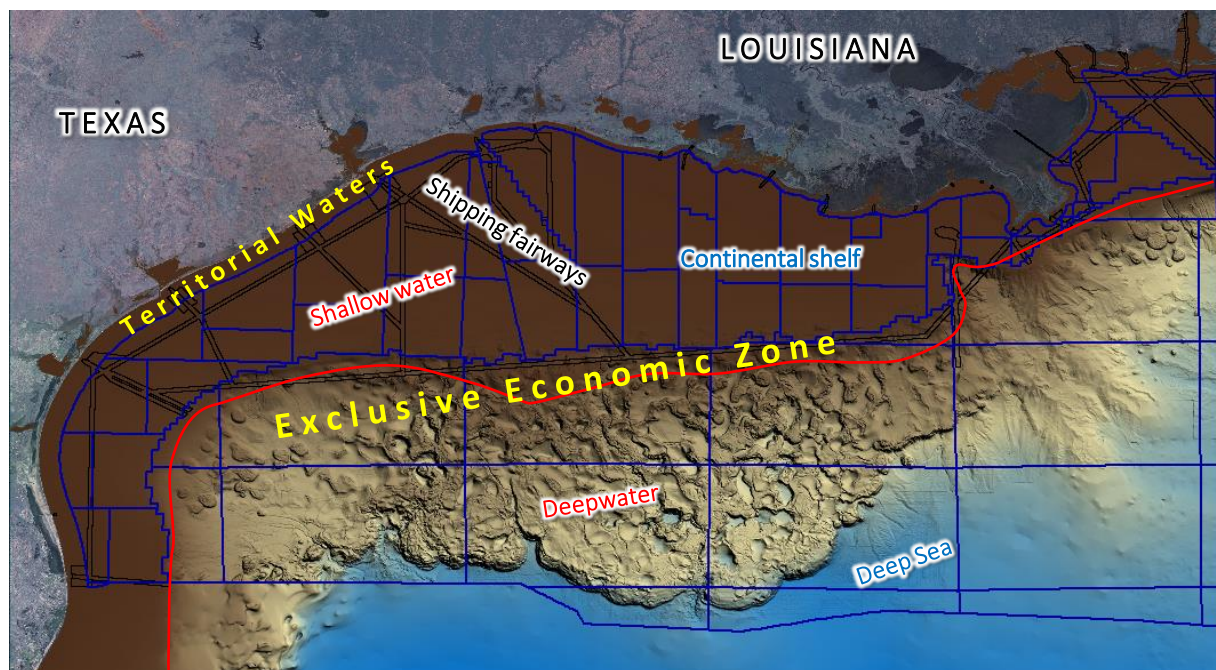


Exclusive Economic Zone in the United States, Gulf of Mexico

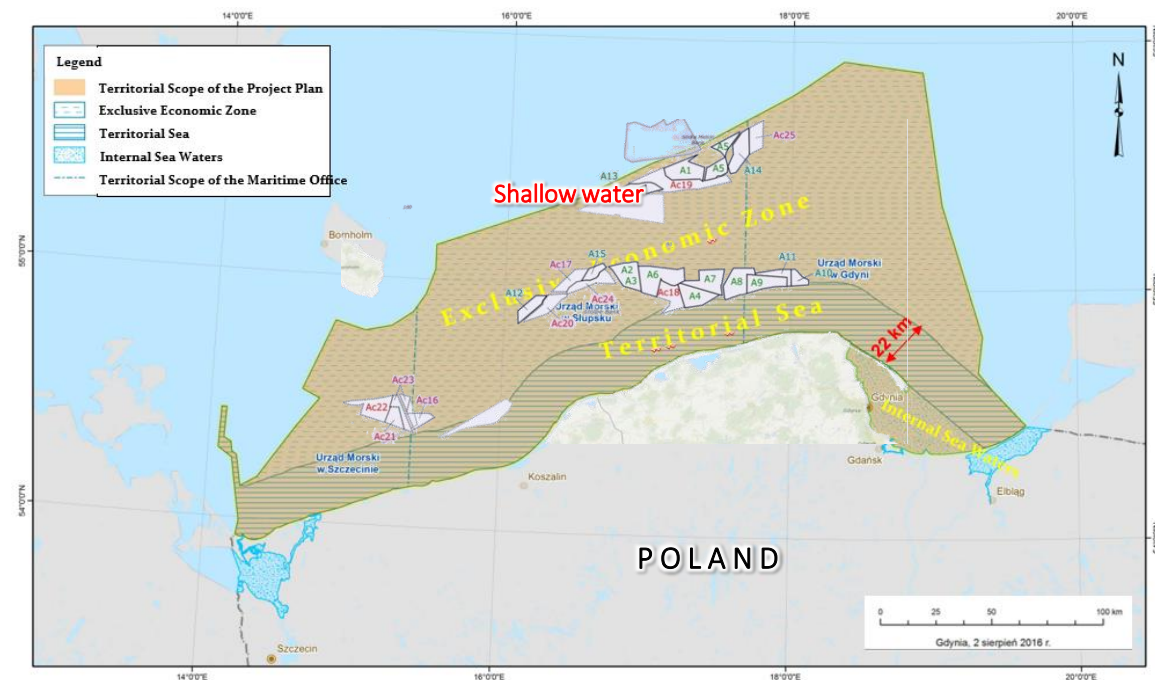


Exclusive Economic Zone in Poland, the Baltic Coast

# Local and Federal Government Regulations for Shallow and Deepwater Environments



Exclusive Economic Zone in the United States, Gulf of Mexico



Exclusive Economic Zone in Poland, the Baltic Coast

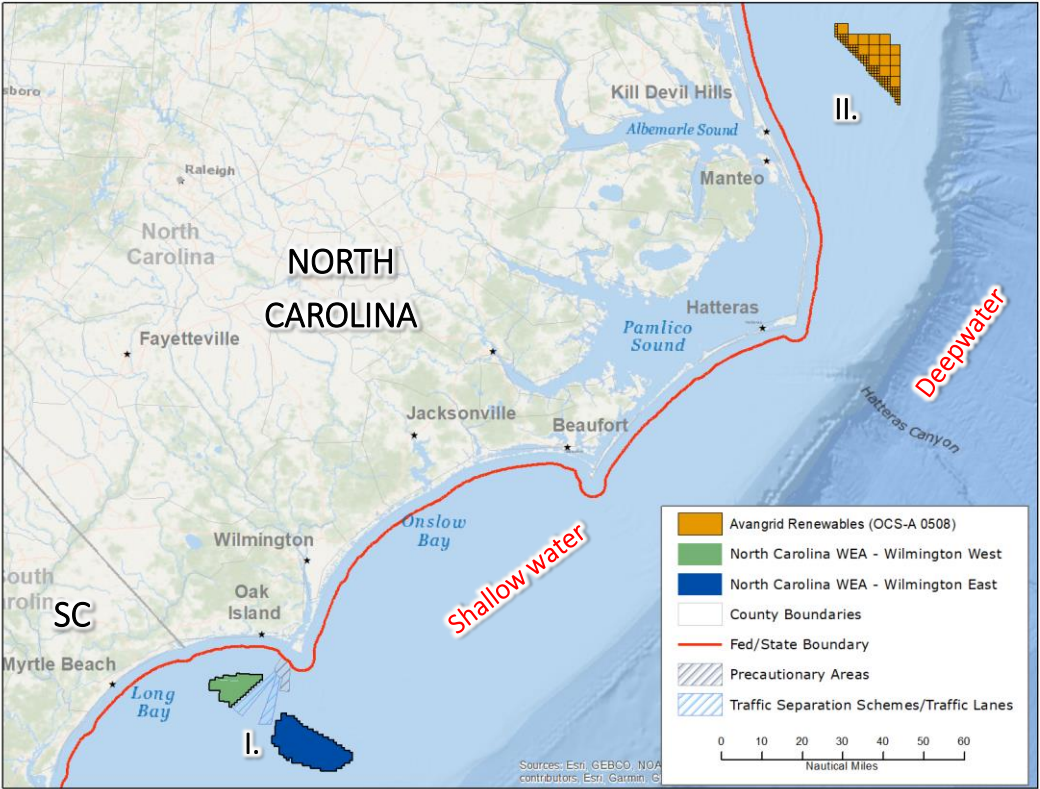
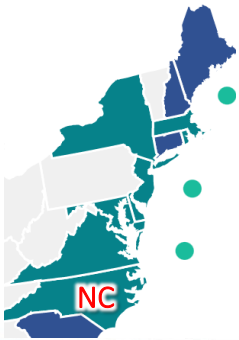


# North Carolina Wind Farm State Activities - Overview

## Commercial Wind Leases Offshore North Carolina:

- I. Carolina Long Bay:
  - OCS-A 0545 – Total Energies Renewables USA, LLC
  - OCS-A 0546 – Duke Energy Renewables Wind, LLCLease Auction was on May 11, 2022

- II. Kitty Hawk Offshore Wind (OCS-A 0508) – Avangrid Renewables



# Oregon Wind Farm State Activities

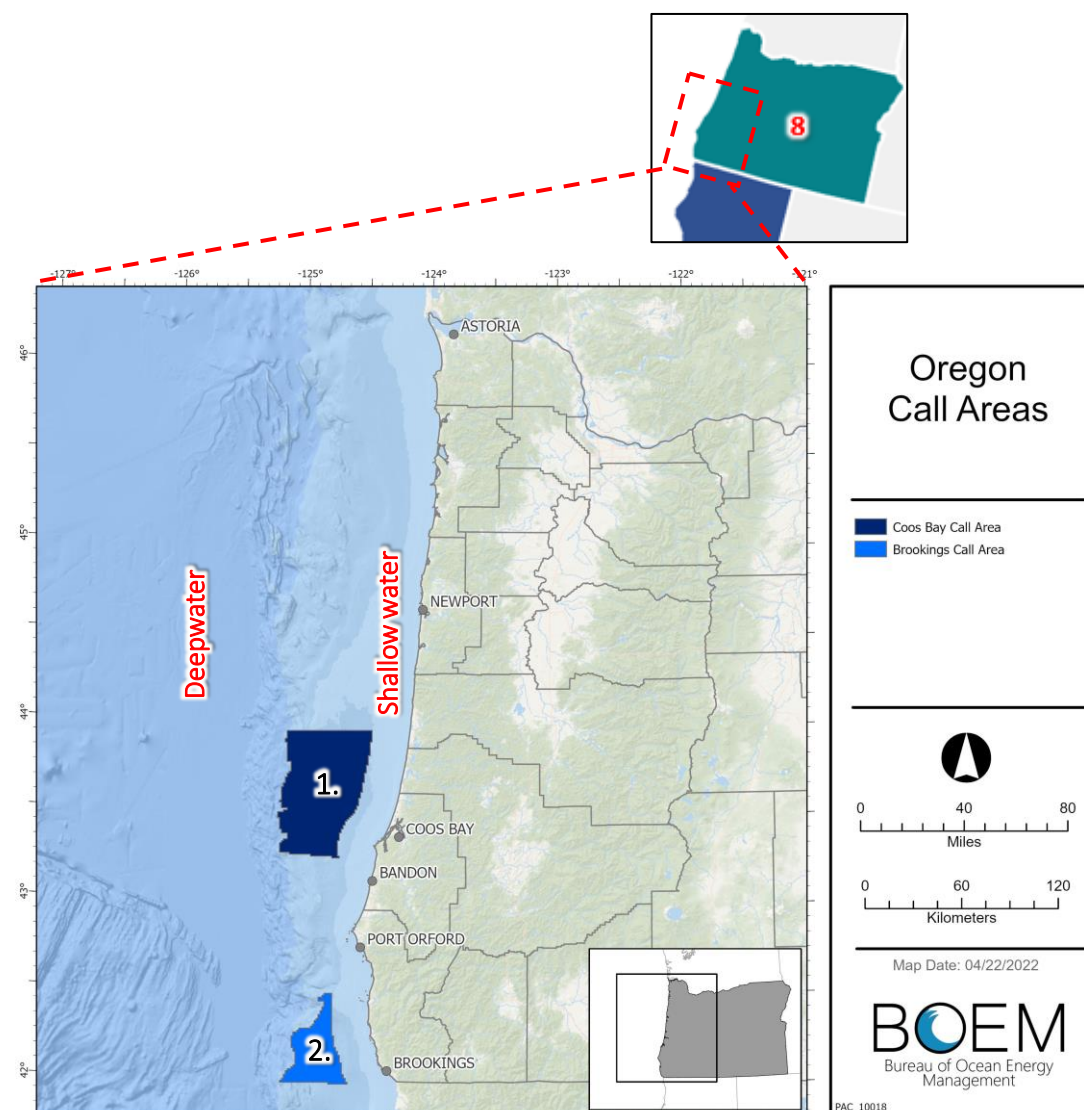
## Commercial Wind Leases Offshore Oregon:

### 1. Coos Bay Call Area:

- Location: 13.8 mi from Charleston, Oregon
- Depth range: 394 – 722 ft
- Total area: 872,854 acres

### 2. Brookings Call Area:

- Location: 13.8 mi from Brookings, Oregon
- Depth range: 410 – 1,115 ft
- Total area: 286,444 acres





# Geophysical Offshore Energy Infrastructure Planning

## Shallow vs. Deepwater Environments

### Shallow Water

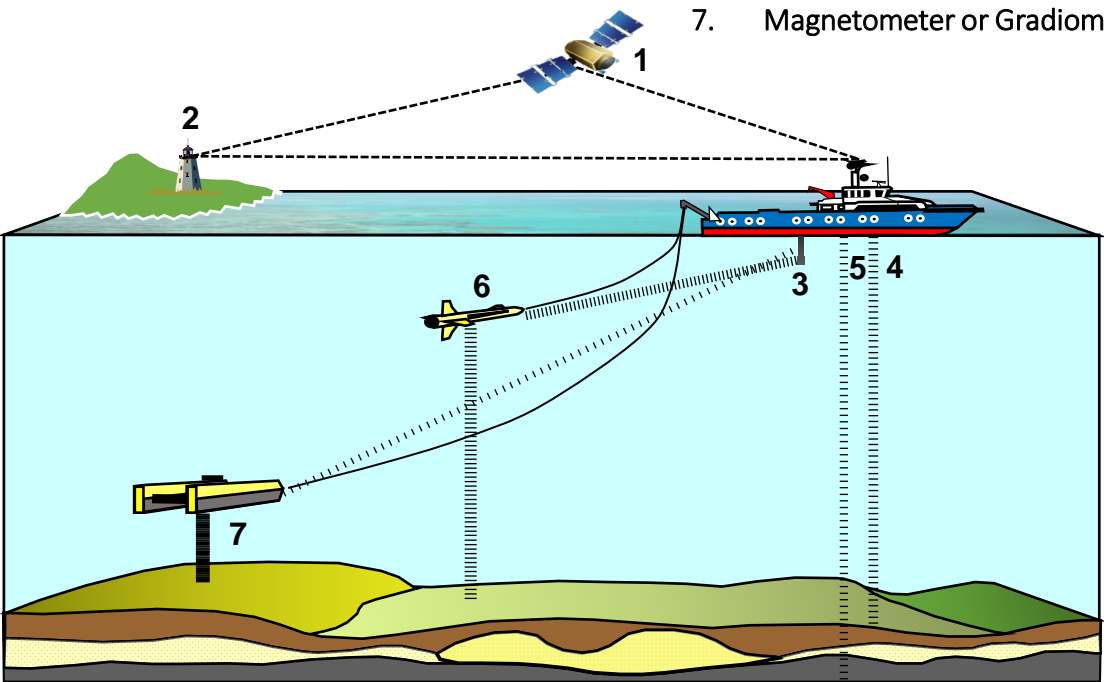
- Depth <1000' (305m)
- Relatively smaller vessels
- 2D seismic, rare 3D seismic

#### Positioning Systems

1. Satellite positioning system
2. Differential GPS
3. Hydroacoustic positioning system

#### Shallow Water Survey Methods

4. Multibeam
5. Subbottom Profiler
6. Side-Scan Sonar
7. Magnetometer or Gradiometer



### Deepwater

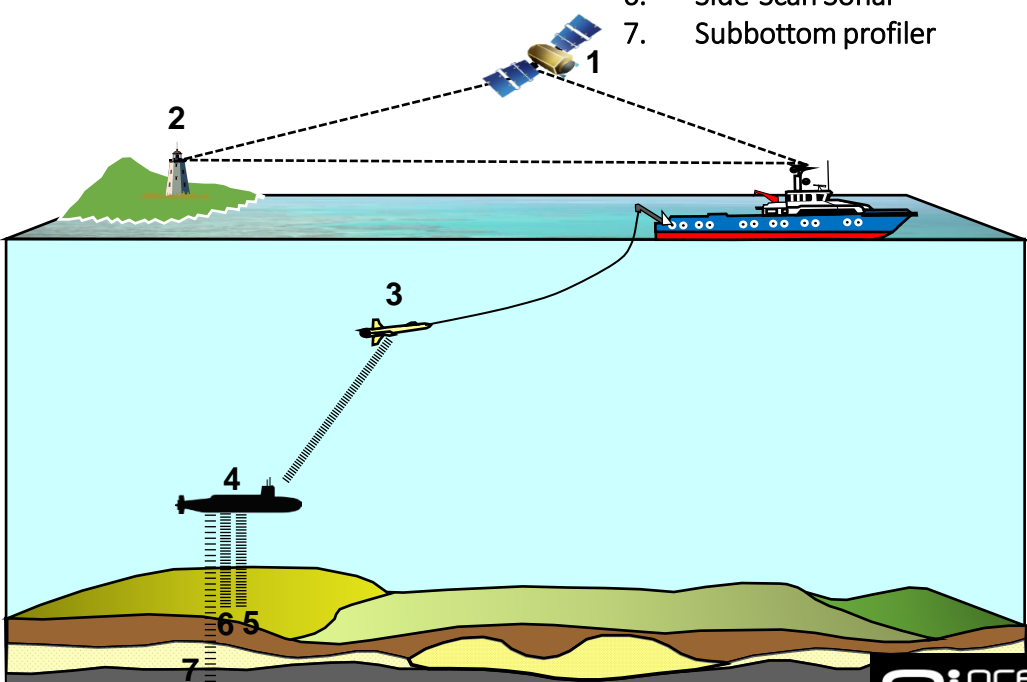
- Depth >1000' (>305m)
- Larger vessels or AUVs
- 3D seismic

#### Positioning Systems

1. Satellite positioning system
2. Differential GPS

#### Deep Water Survey Methods

3. Tow Fish
4. Autonomous Underwater Vehicle (AUV)
5. Multibeam
6. Side-Scan Sonar
7. Subbottom profiler

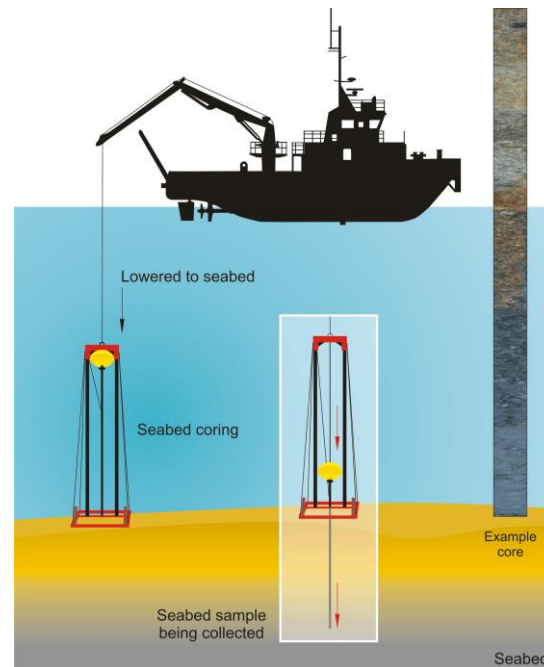


# Archaeological Offshore Energy Infrastructure Planning

## Shallow vs. Deepwater Environments

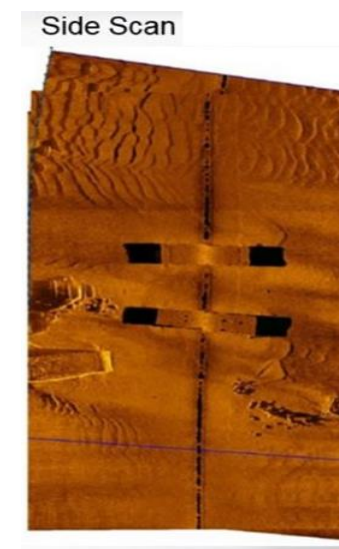
### Shallow Water

- Depth <1000' (305m)
- Submerged prehistoric sites excavation <100m
- Sediment core sampling
- Magnetometers <200m (magnetic anomalies or ferrous metals on or below the seabed)
- Side Scan Sonar (seafloor features, infrastructure, sonar contacts e.g. shipwrecks)
- Sub-bottom Profiler (shallow MTD, shallow faults)
- MBES Backscatter (seafloor topography)
- Multibeam Bathymetry (seafloor relief)



### Deepwater

- Depth >1000' (>305m)
- AUV
  - Side Scan Sonar (seafloor features, infrastructure, sonar contacts e.g. shipwrecks)





# Conclusions

- Growing energy demand triggers development of shallow and deepwater offshore energy infrastructure
- Shallow water assessments need to deal with both local and federal regulations, fisheries, ship routes, and recreational boaters
- Deepwater assessments mostly deal with federal regulations
- Increasing significance of AUV surveys with higher demand of deepwater assessments
- More deepwater assessment specialists are needed

# QUESTIONS?