

# THE SECRET LIFE OF THE SEA

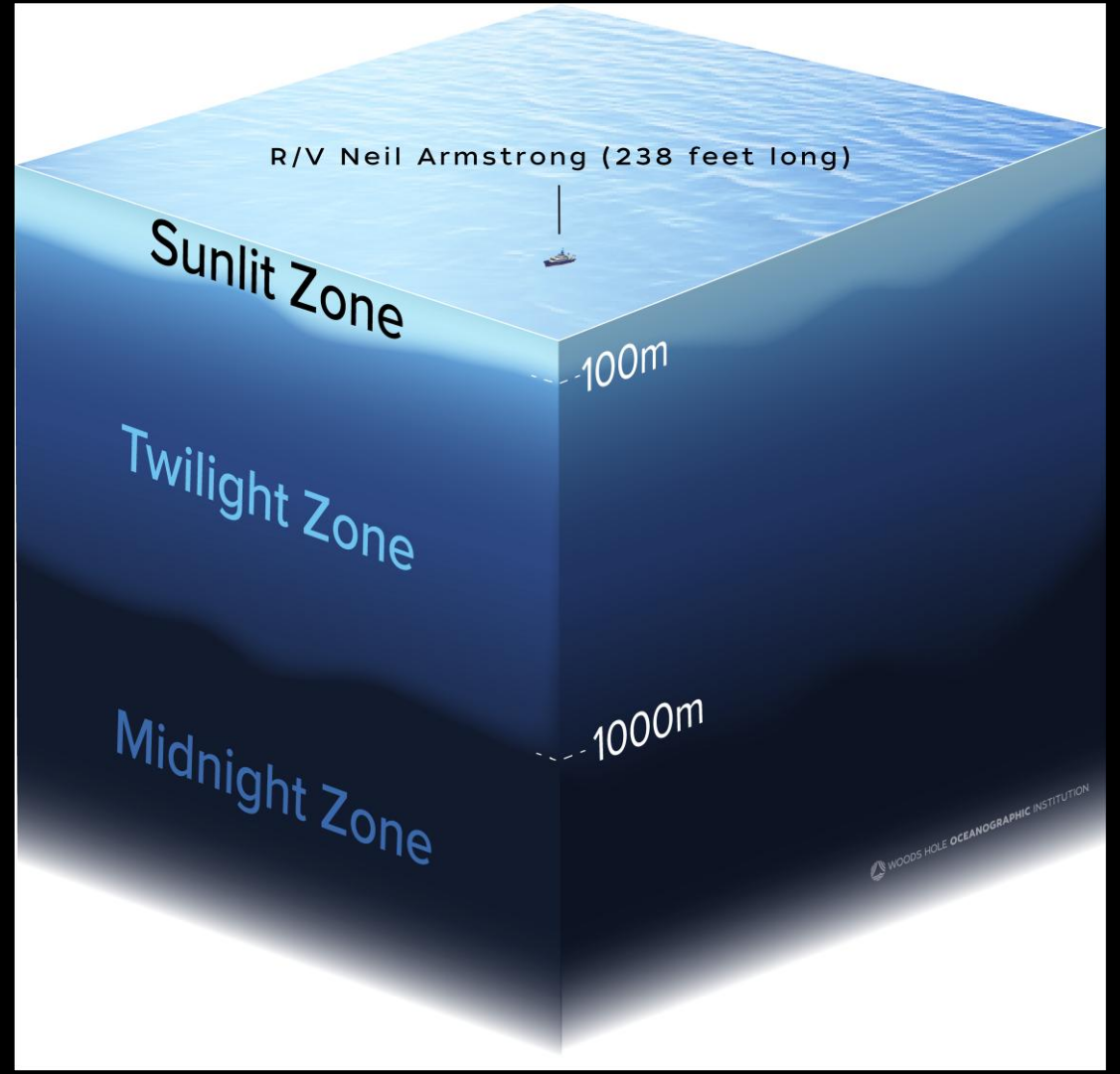
EXPLORATION, DISCOVERY AND UNEXPECTED SOLUTIONS

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Steve Dougherty Photography











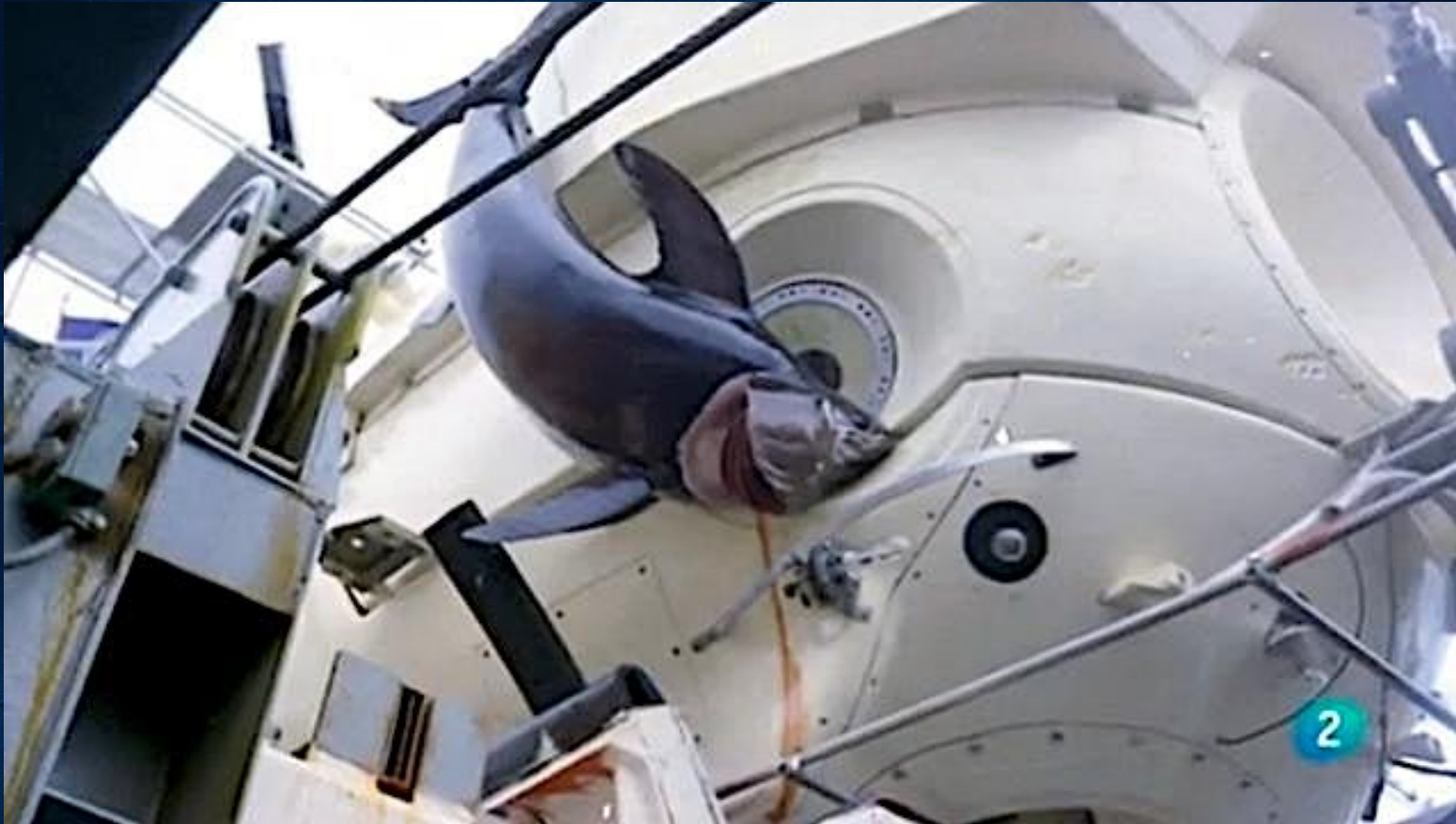
# Deep, diverse and definitely different



## The “Bristlemouth”



# Swordfish vs. Alvin





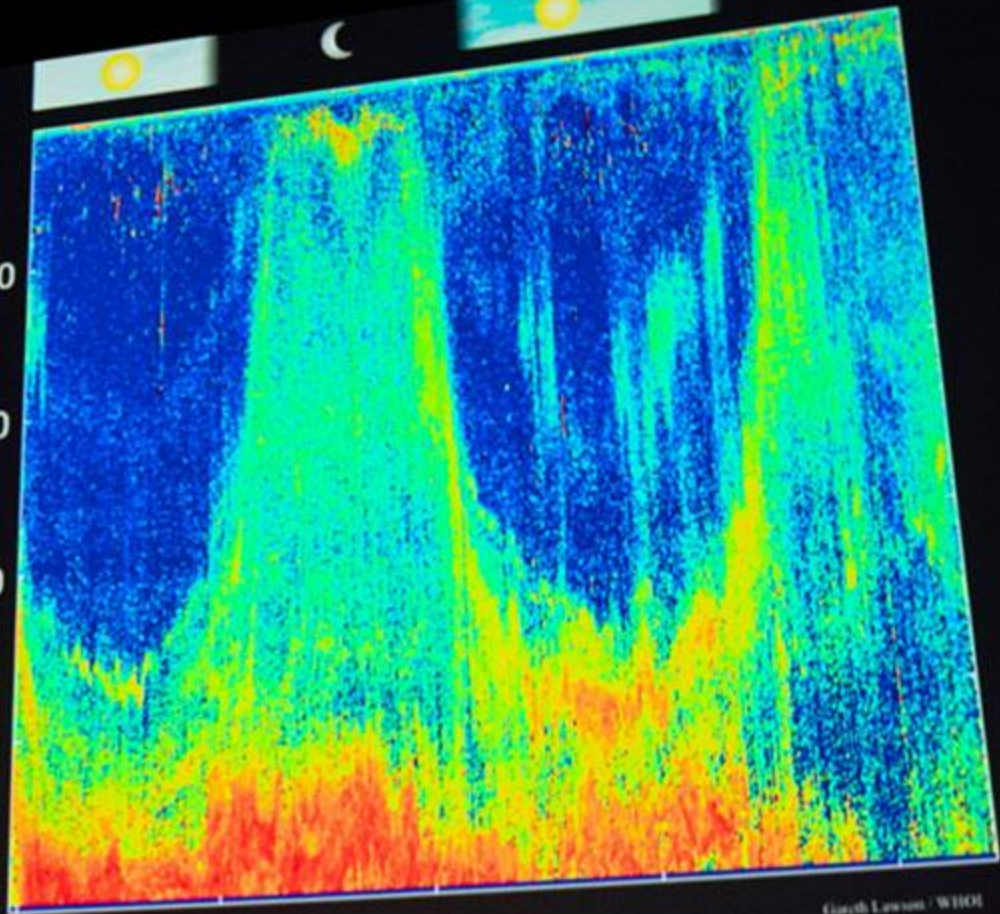
Depth  
(meters)

100

200

300

400



Garth Lawson / WHOI

**TED**



**TED**

**Audacious**

**Project**

**1**

**Advance Science**

**2**

**New Technology**

**3**

**Policy**



# LARGEST MIGRATION ON EARTH

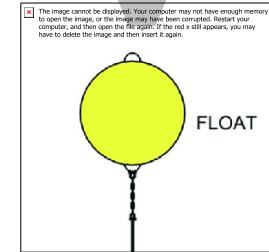
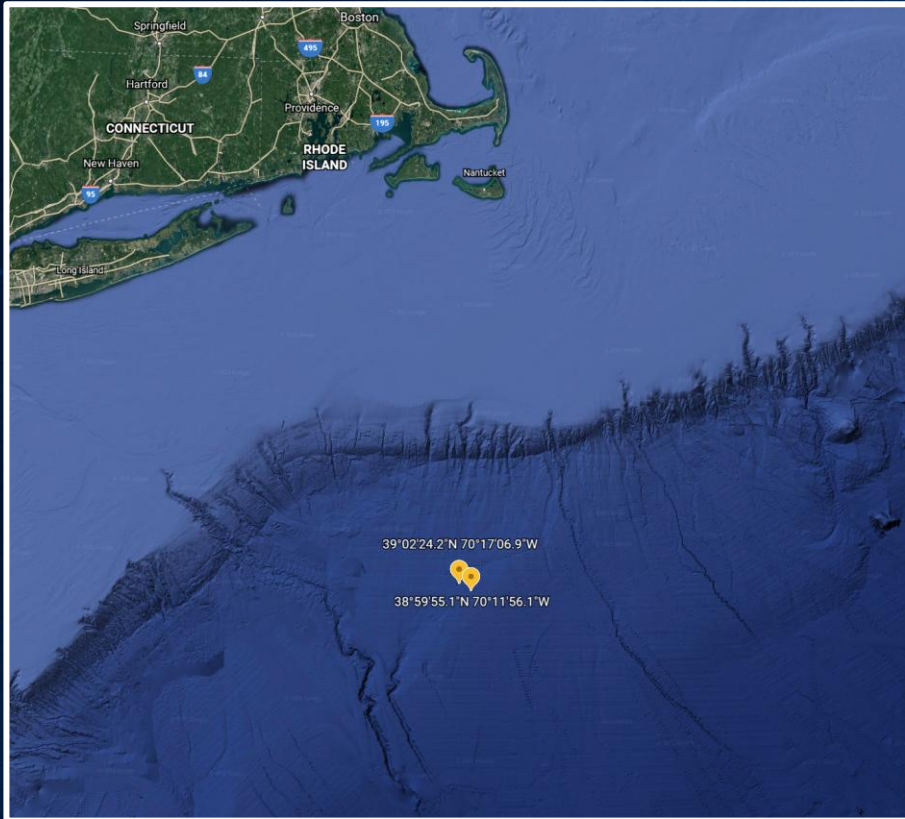
200 meters

1000 meters





# 1. Imaging the Twilight Zone



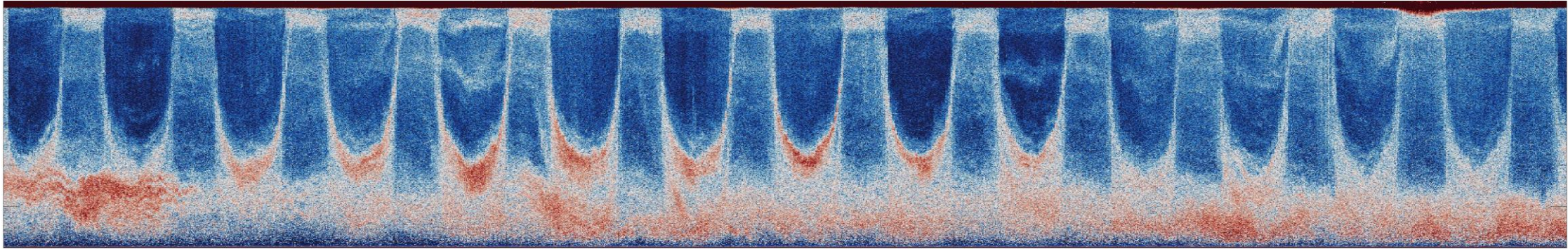
**600m  
depth**

**Acoustic  
Release**

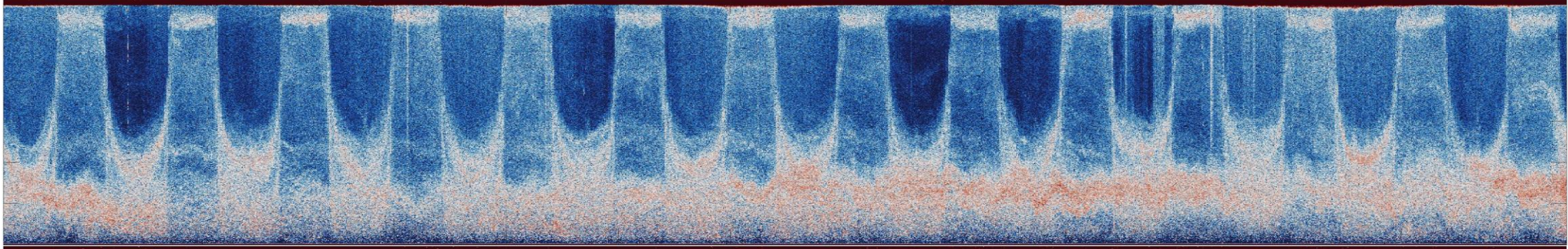




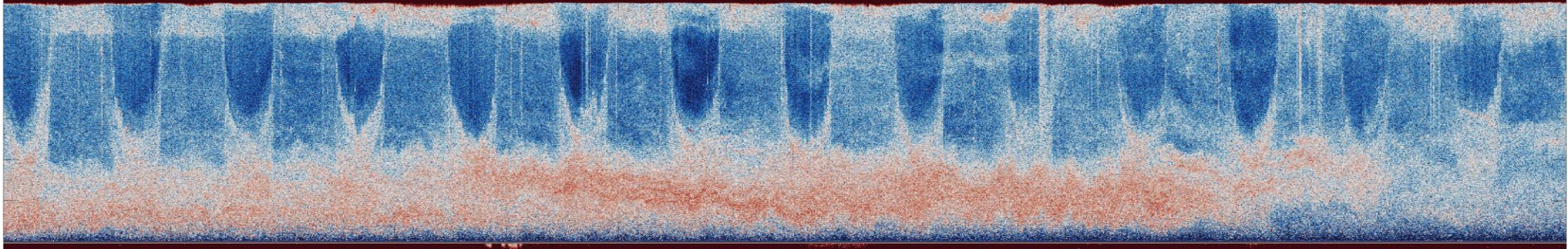
**Aug. 2021**



**September**

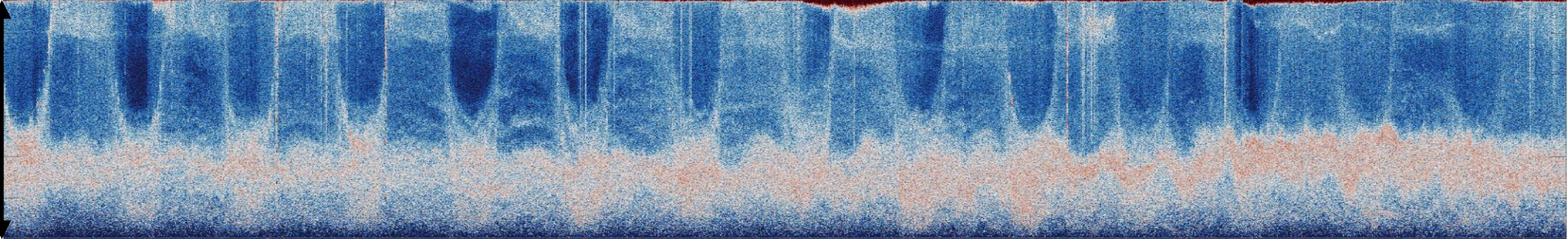


**December**



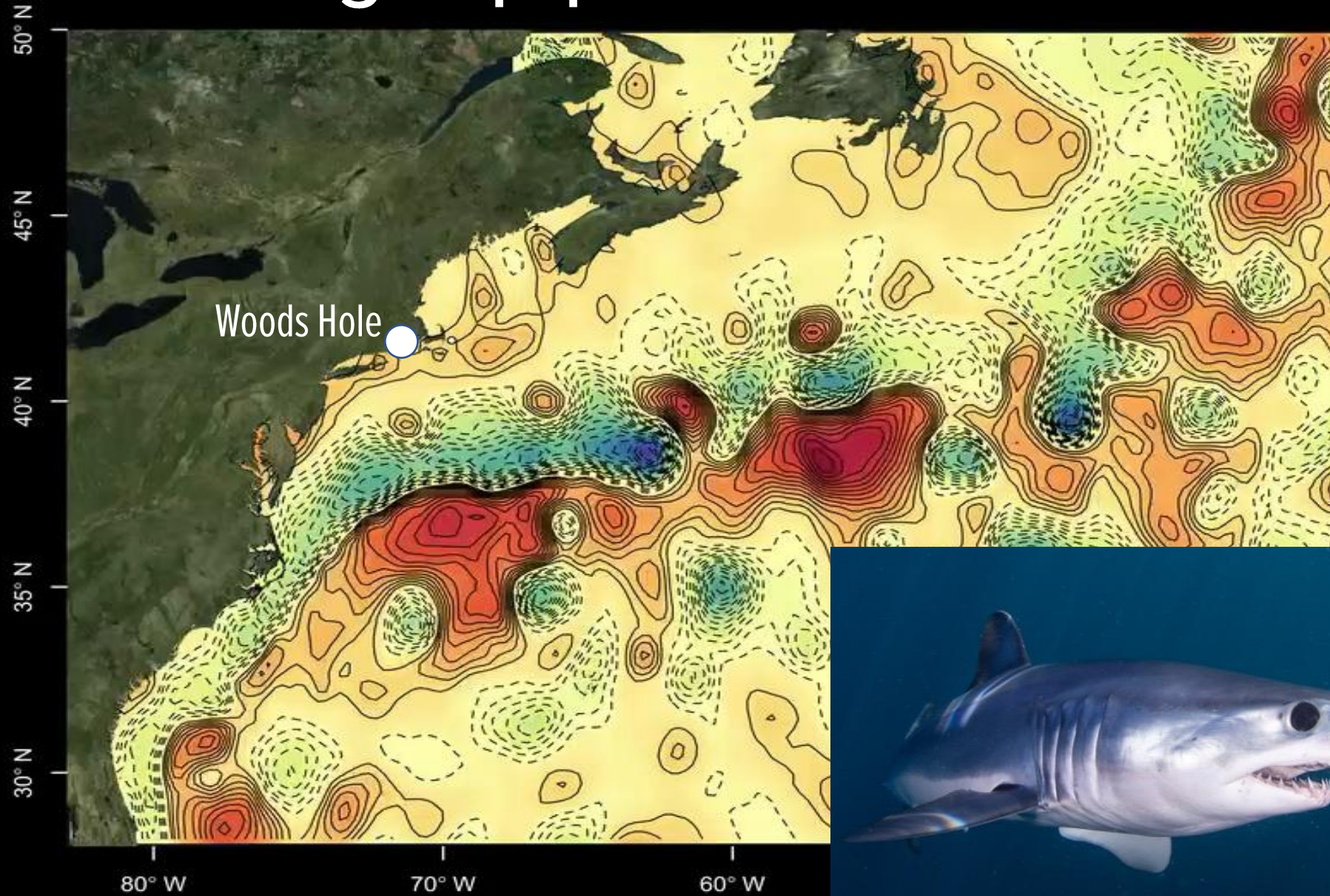
**January**

580 m





# Tracking top predator fish





**Swordfish** → **Lancetfish** →



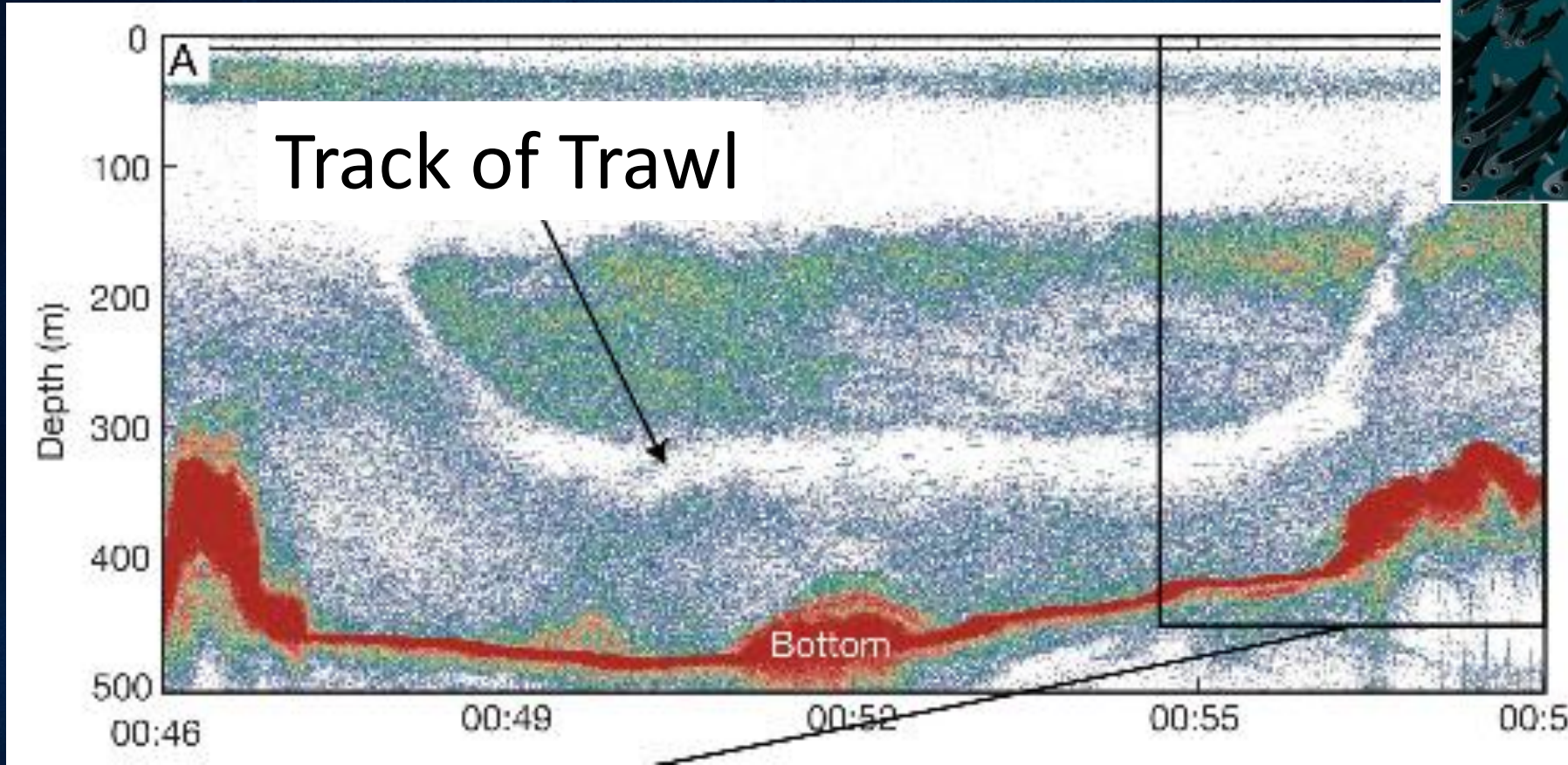
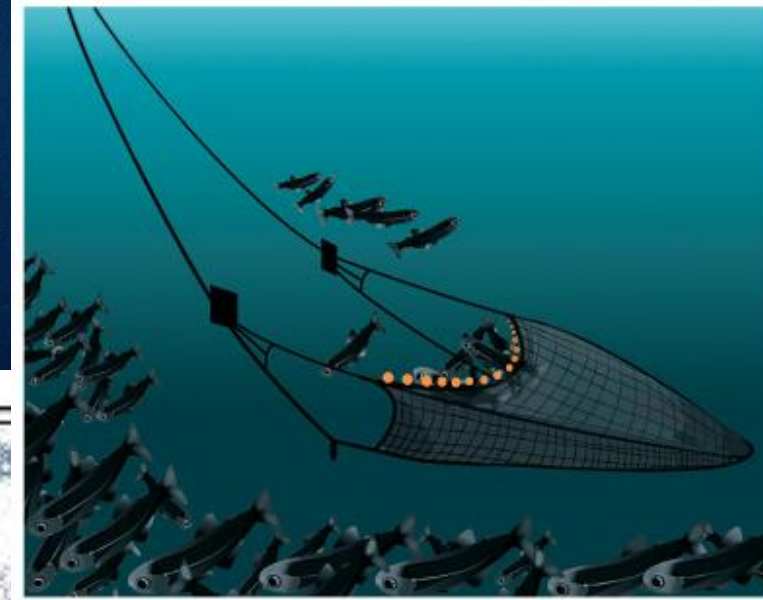
**Barracudina** ↓

**Lanternfish**





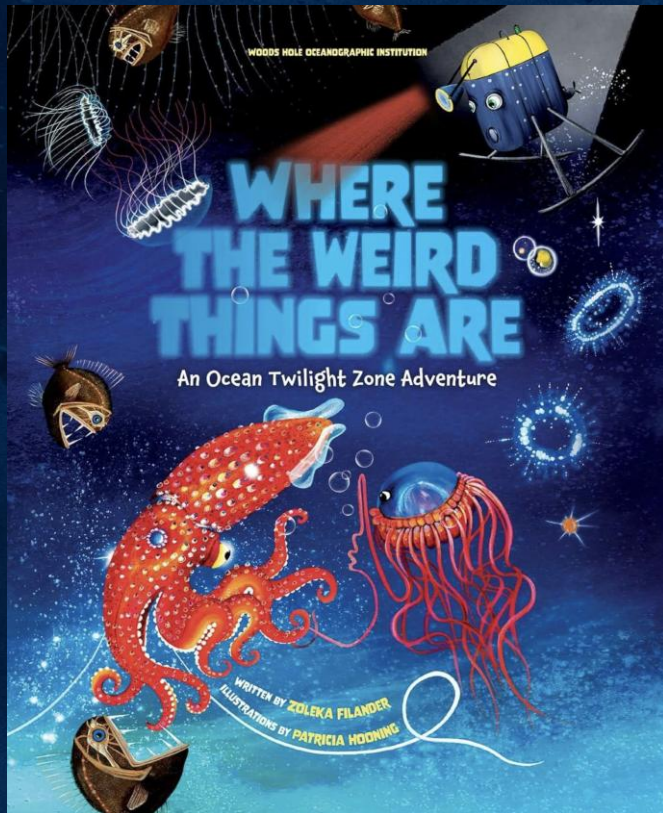
# 2. Technology



Trawl Net  
Avoidance



# “MesoBot”



4.8 ★★★★★





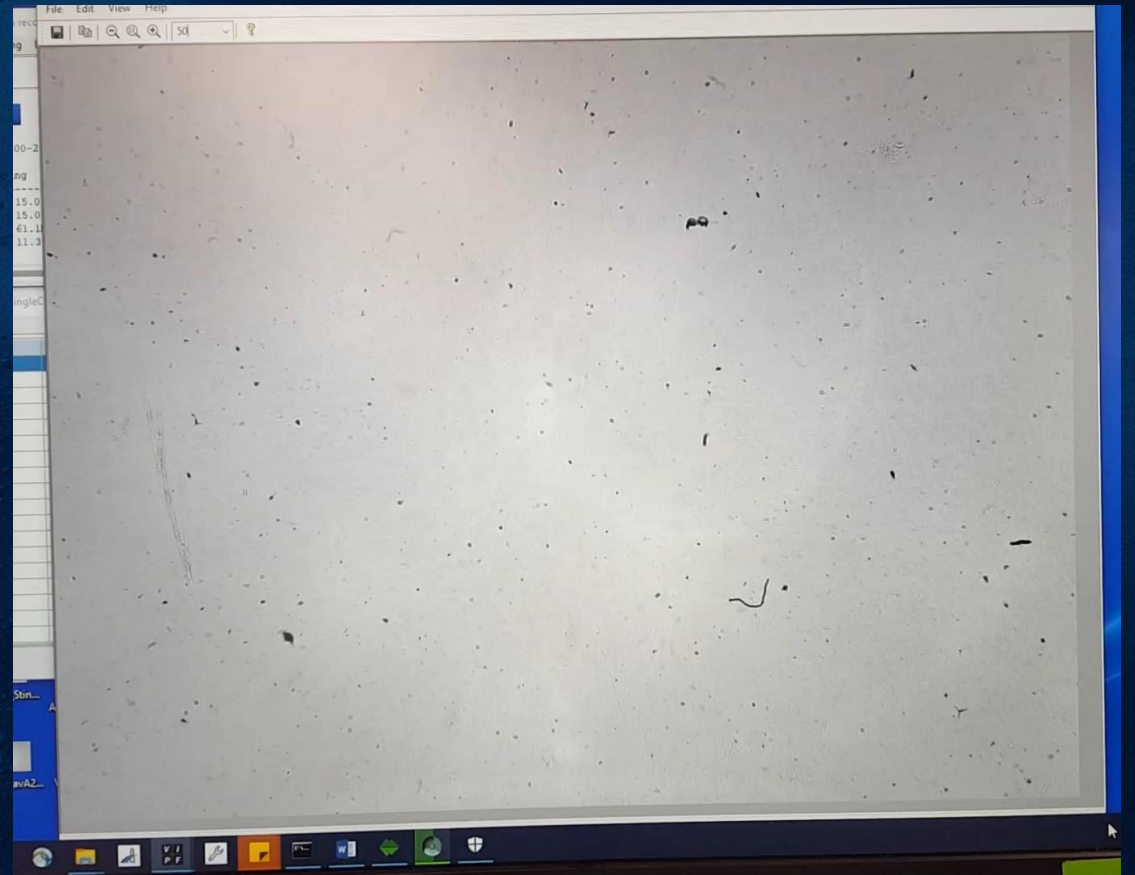


MATERIA

J. FUJII



# “StingRay”





# Twilight Zone “Facebook”

1 cm





*“the most stupendous snowfall on earth”*

Rachel Carson





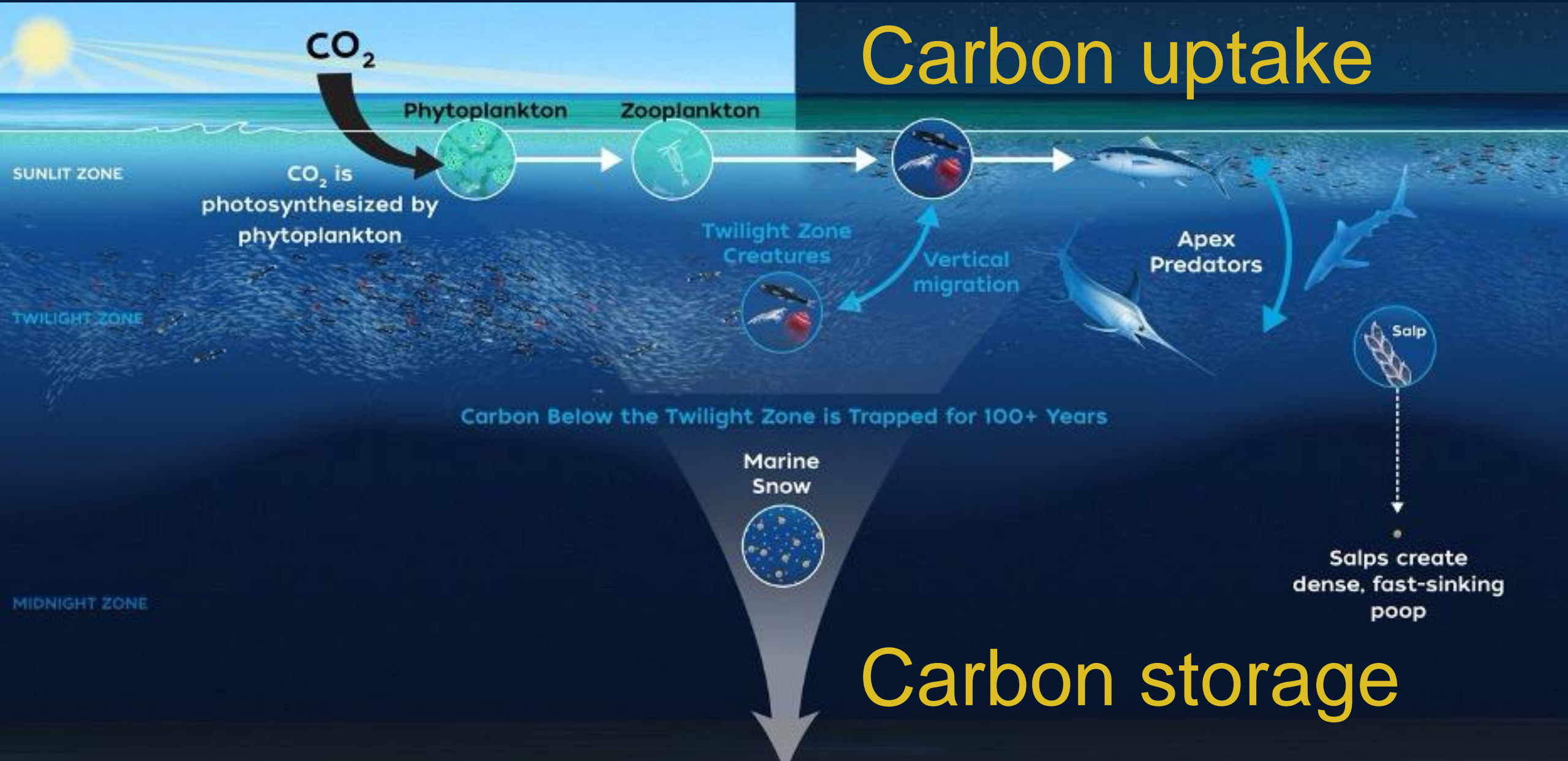
# Siphonophore

SOURCE: SCHMIDT OCEAN INSTITUTE





# | The Ocean Biological Pump





# 3. Policy – OTZ Ecosystems Services



The twilight zone helps store **2 to 6 billion** tons of carbon annually.



That's up to **6 times** the carbon emitted by cars worldwide.



Without it, Earth could be **6-11°F warmer**.



That prevents **\$300 to \$900 billion** in economic loss each year.



# High Seas Treaty

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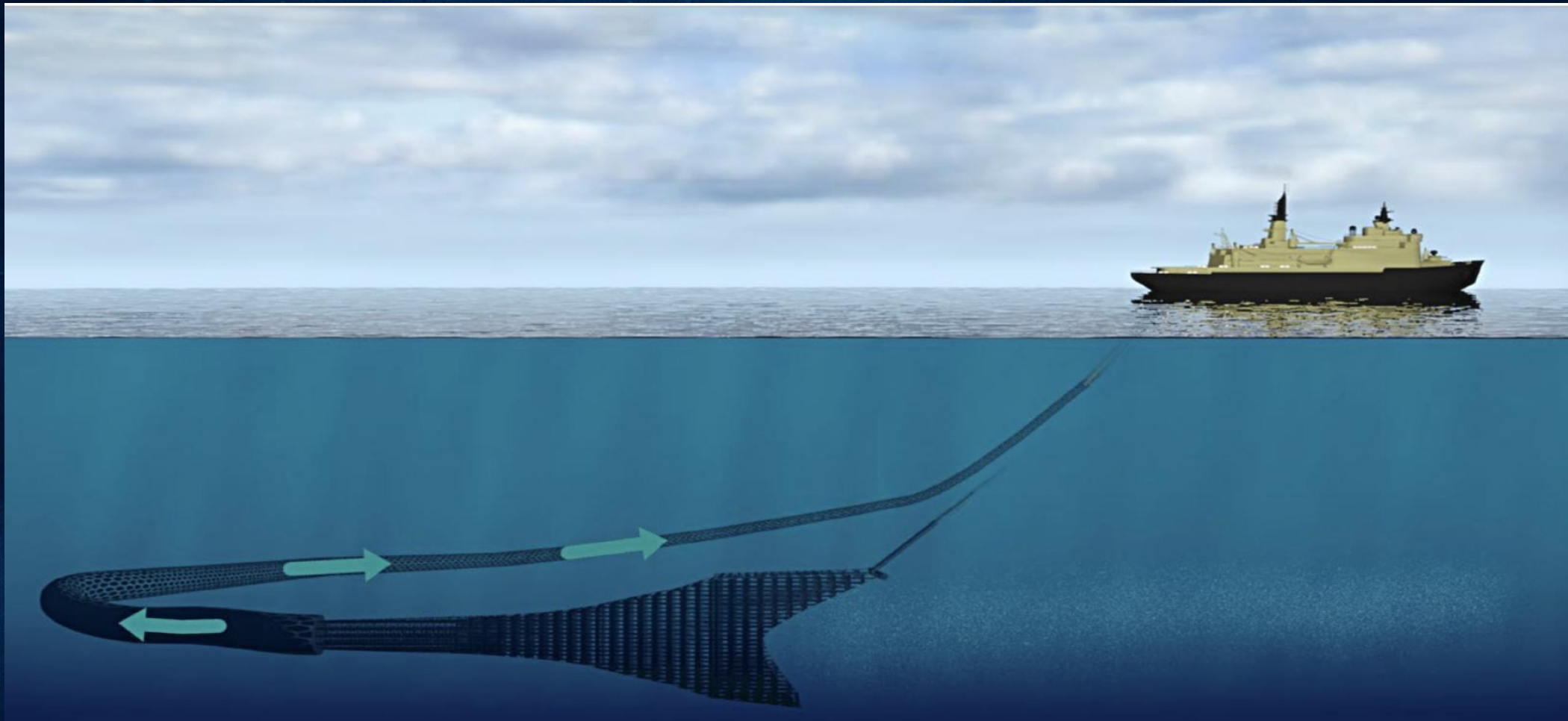
“To conserve and protect the high seas and ensure the sustainability of its marine biodiversity”



NYC, Sept 2023



# Threat – Mesopelagic fishing

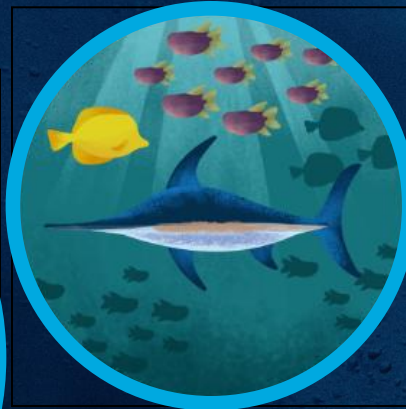




# Threat – Marine Carbon Dioxide Removal



Iron fertilization

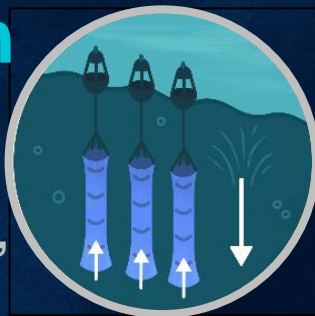


Ecosystem recovery

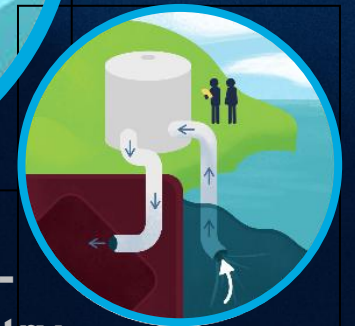
Seaweed farming



Ocean alkalinity



Ocean "tubes"

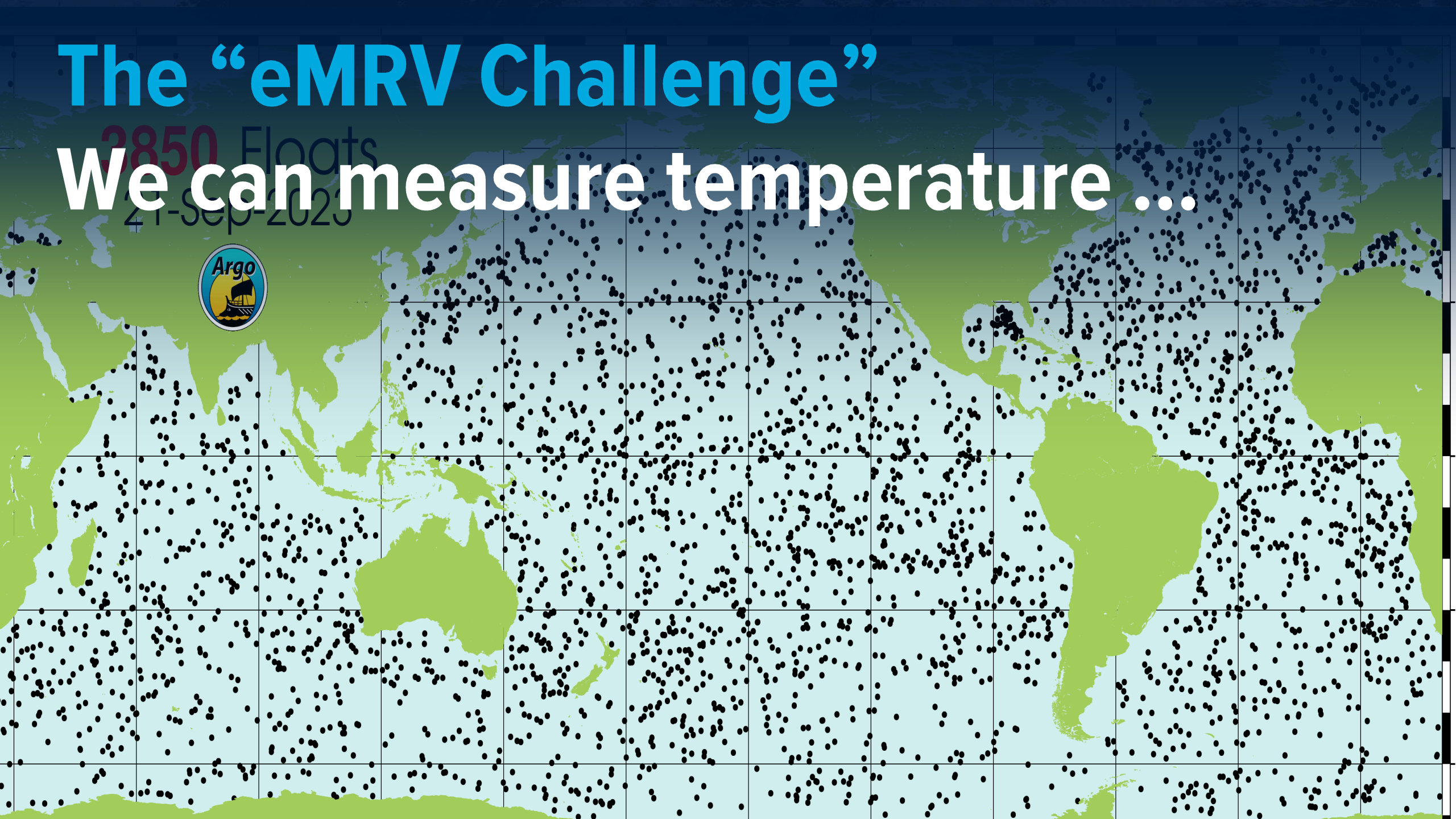


Electro-chemistry



# The “eMRV Challenge”

We can measure temperature ...



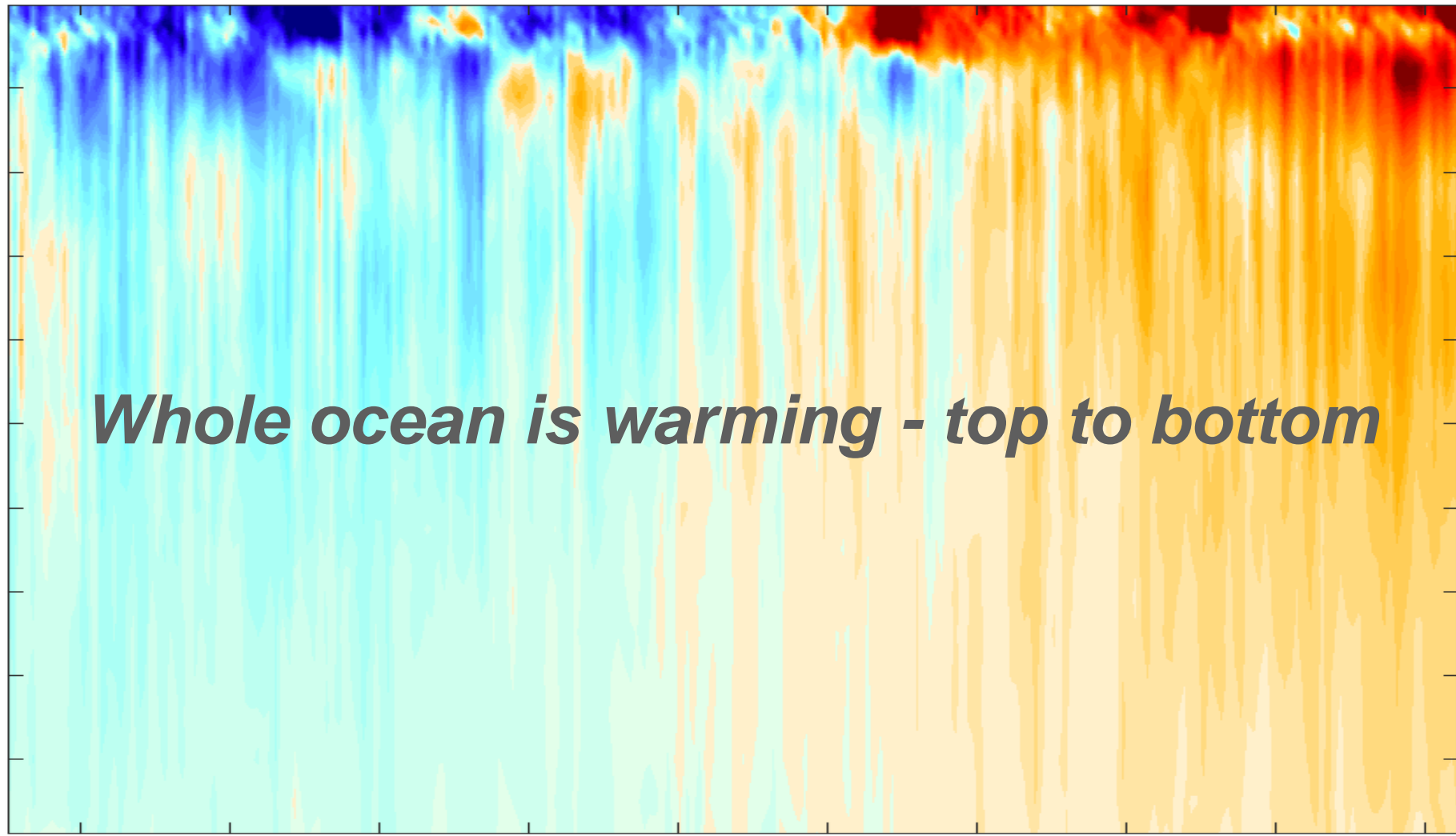


# Global ocean temperature change (°C)

Surface

1000m

2000m



*Whole ocean is warming - top to bottom*

degrees C

0.15  
0.1  
0.05  
0  
-0.05  
-0.1  
-0.15

year



**...but not carbon & nutrients**





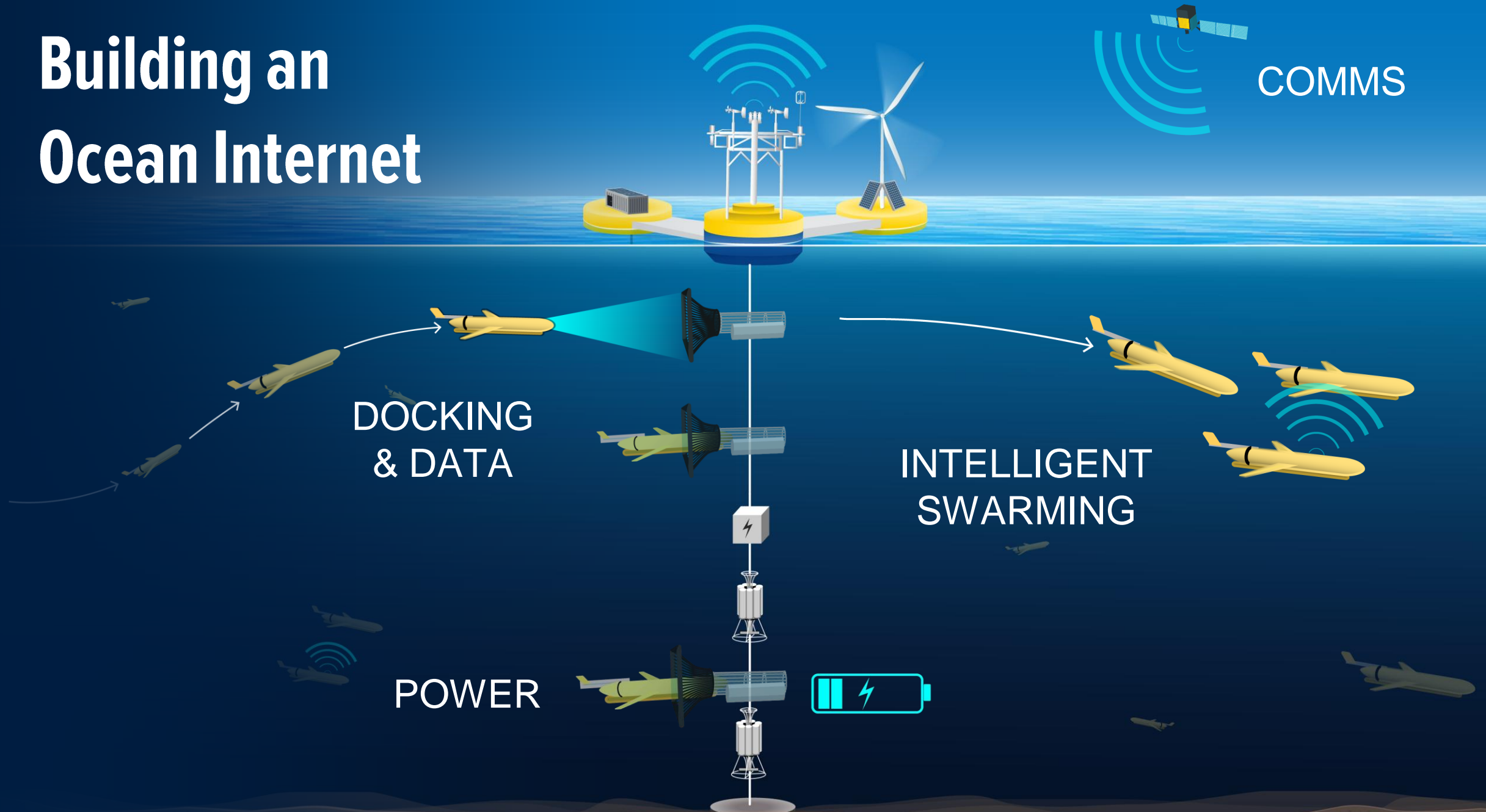
# Call to Action

- Ocean Internet of “Vital Signs” sensors
- Always-on, always-connected
- Adaptive, intelligent sampling





# Building an Ocean Internet



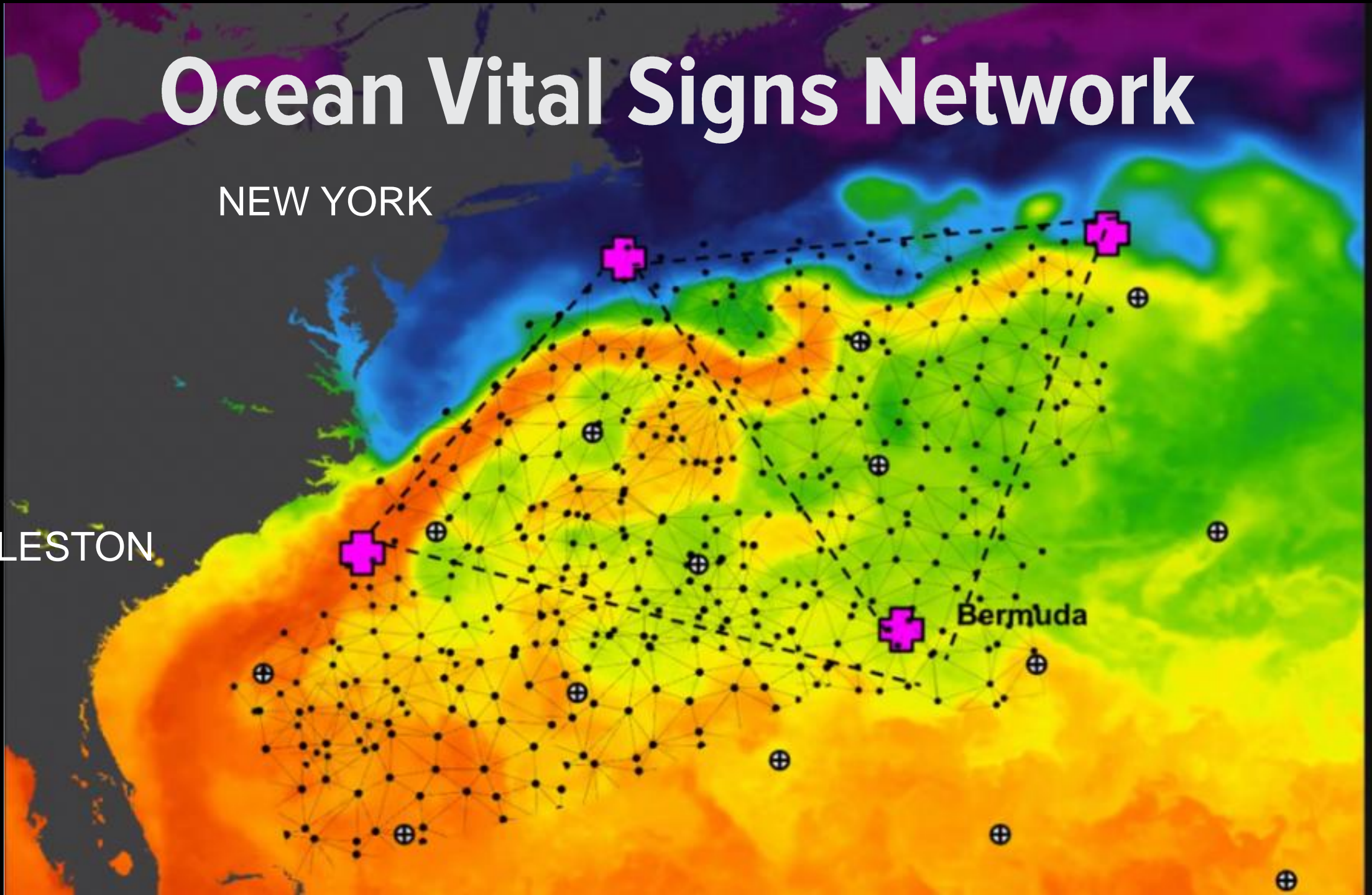


# Ocean Vital Signs Network

NEW YORK

CHARLESTON

Bermuda







# A new era of ocean observing





**High-integrity,  
independent  
science  
must lead**

