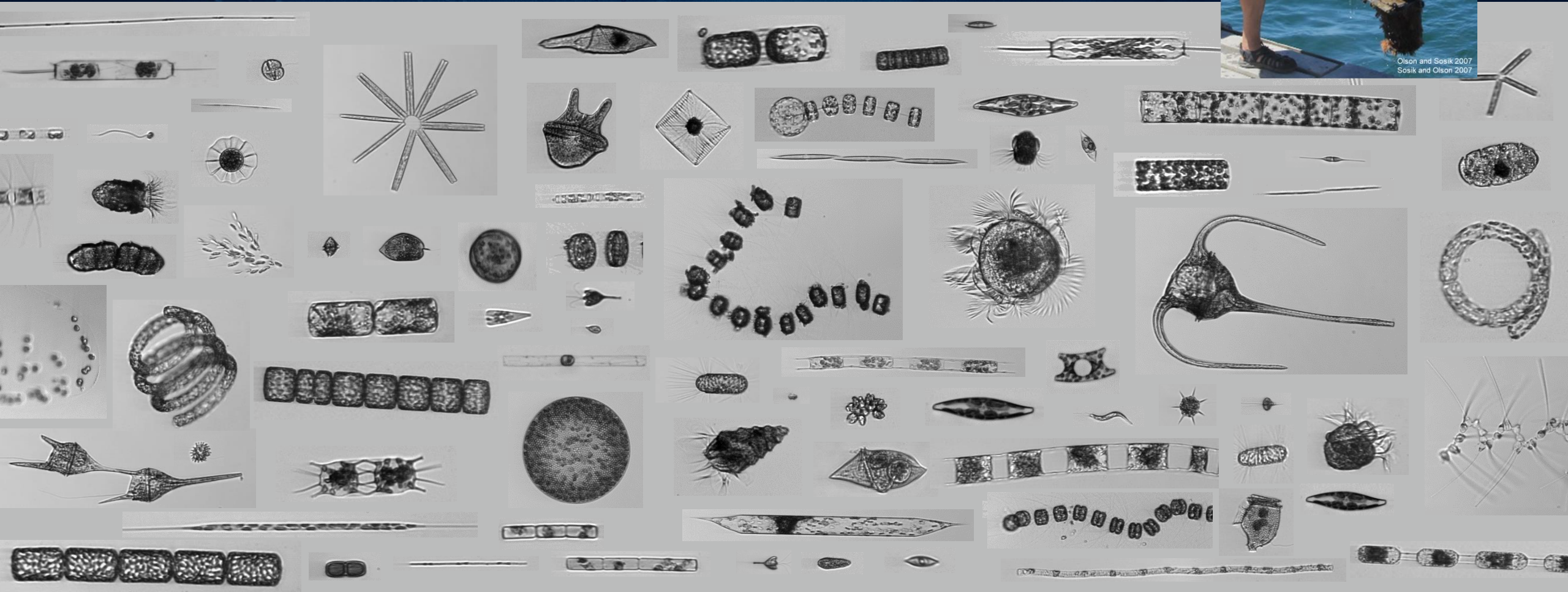


Status and Change in Planktonic Ecosystems

Accelerating data to knowledge pathways with
big data observations and AI / ML

Heidi M. Sosik

Meeting observational challenges with automated microscopy

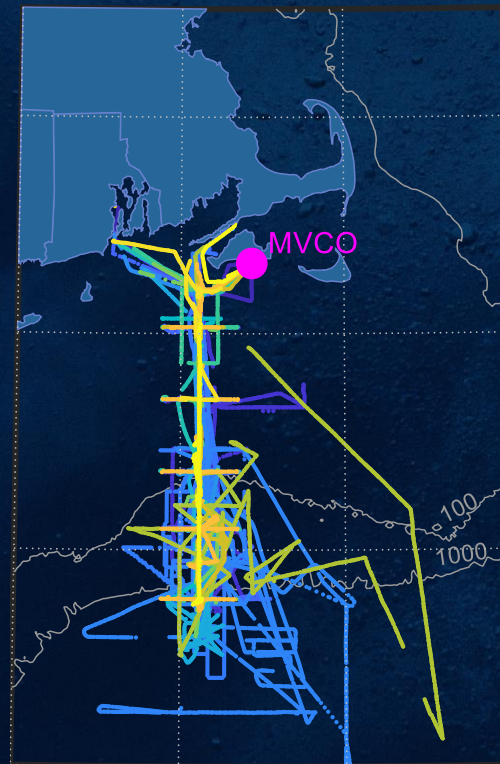


Plankton imaging across time and space in Northeast U.S. Shelf Long-Term Ecological Research (NES-LTER)

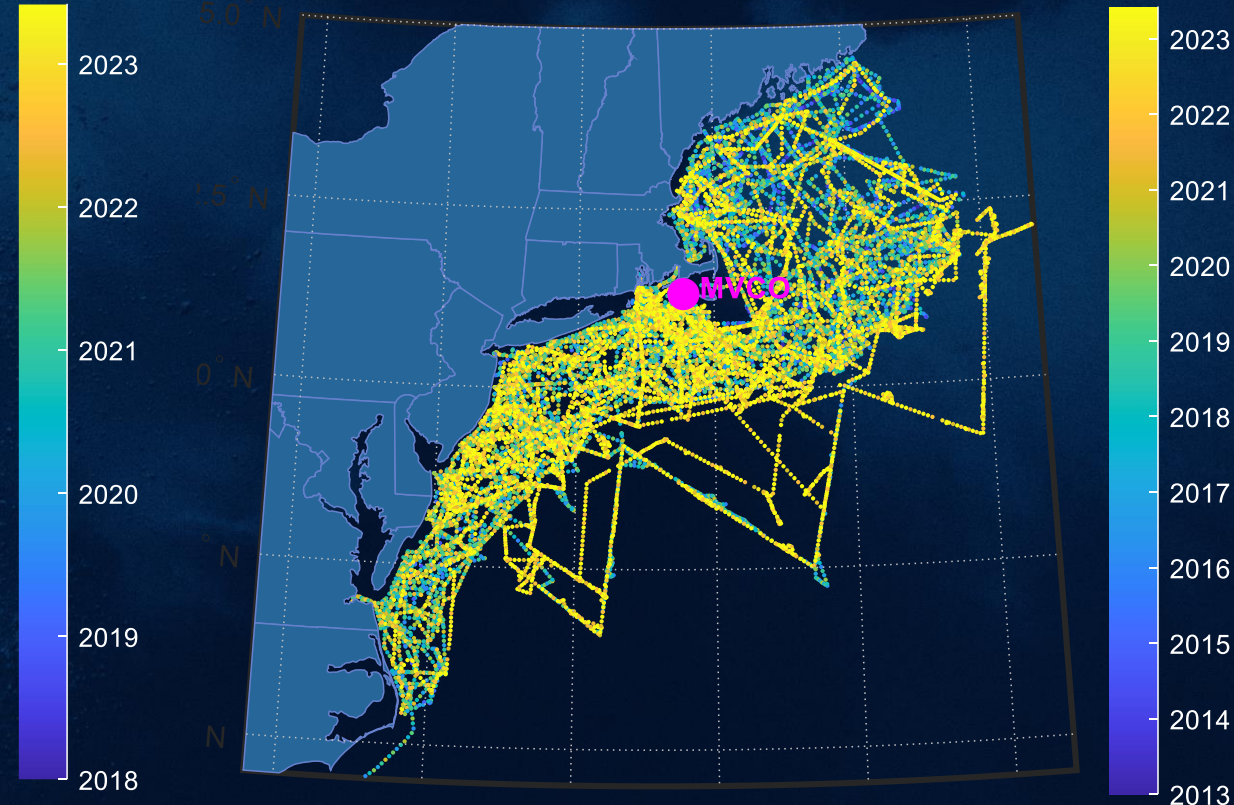
Sub-hourly since 2006
>310,000 samples
>1.3 billion images



54 cross-shelf transects since 2017
>25,000 samples
>85 million images

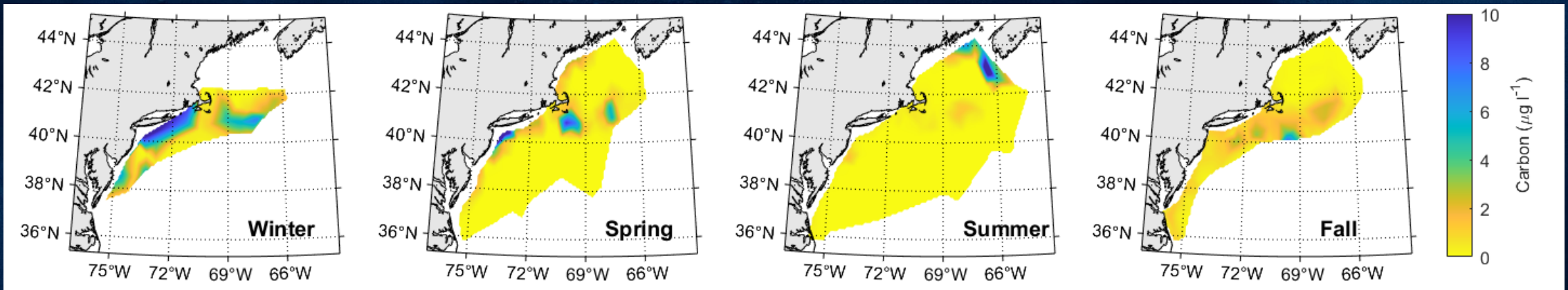
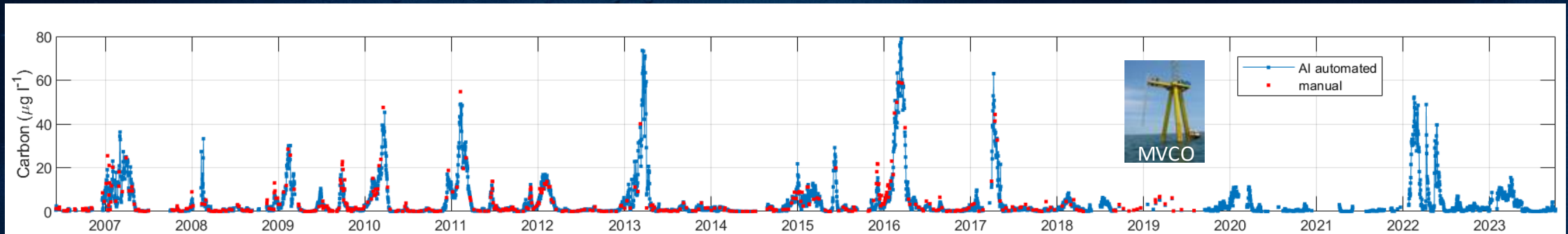


28 regional surveys since 2013
>22,000 samples
~50 million images



Plankton imaging across time and space in Northeast U.S. Shelf Long-Term Ecological Research (NES-LTER)

Biomass dominant diatom species
Guinardia delicatula

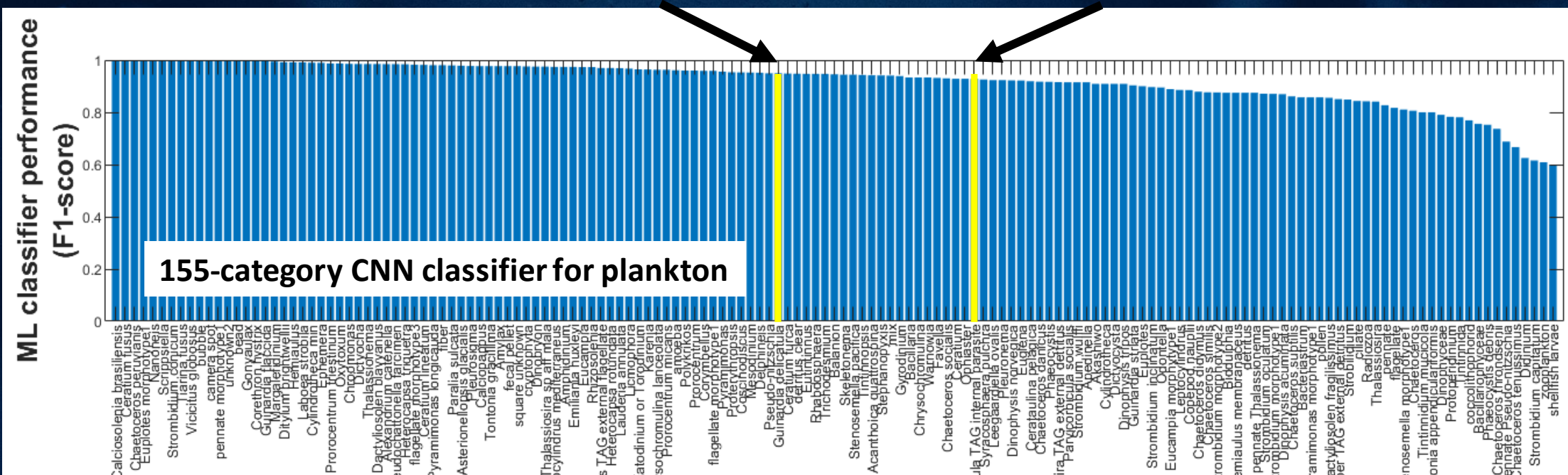


Deep machine learning is a critical component for ecological interpretation of billions of images



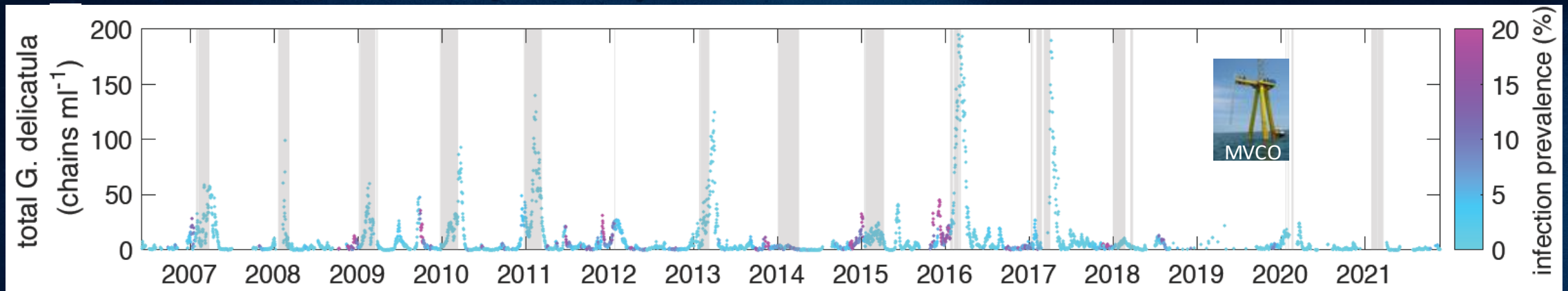
Healthy *G. delicatula*

Parasite-infected *G. delicatula*



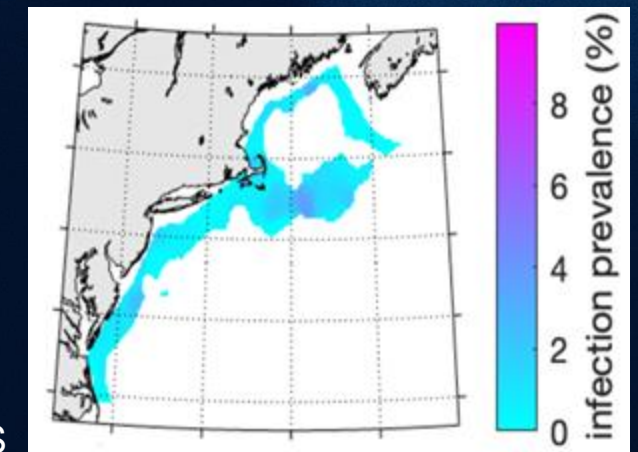
Plankton imaging across time and space in Northeast U.S. Shelf Long-Term Ecological Research (NES-LTER)

Species-specific infection by lethal parasite



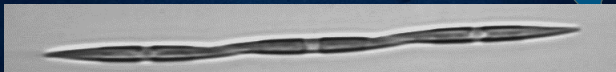
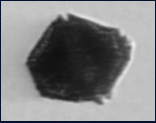
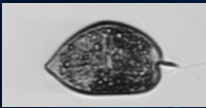
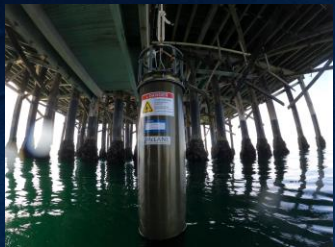
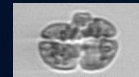
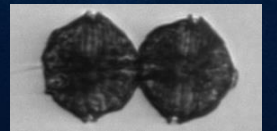
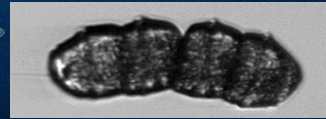
Newly recognized source of diatom mortality
Food web implications

New hypotheses linked to climate change

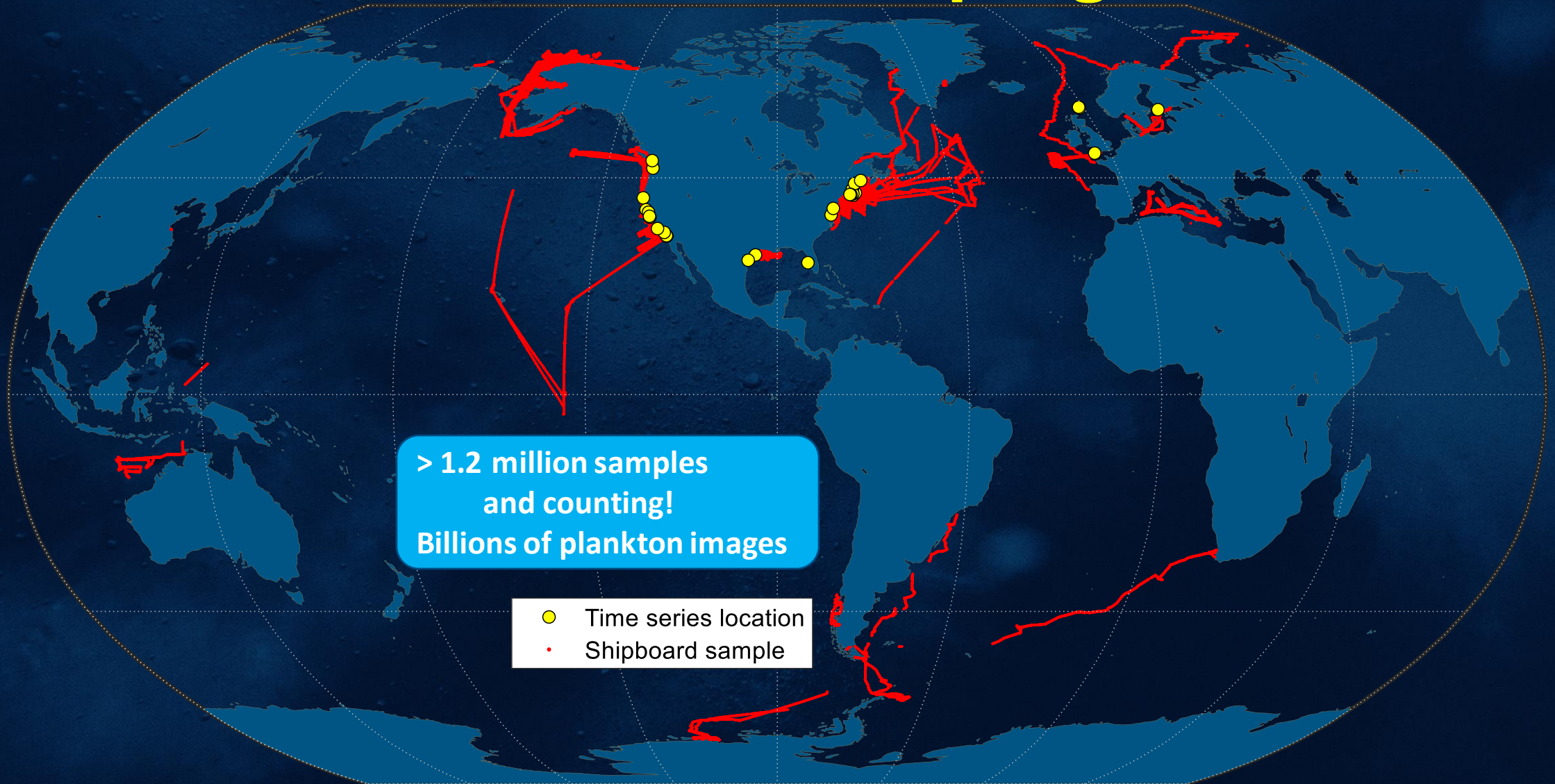


Peacock et al. 2014
Catlett et al. 2023 PNAS

IFCB network for harmful algal bloom detection



Global IFCB sampling

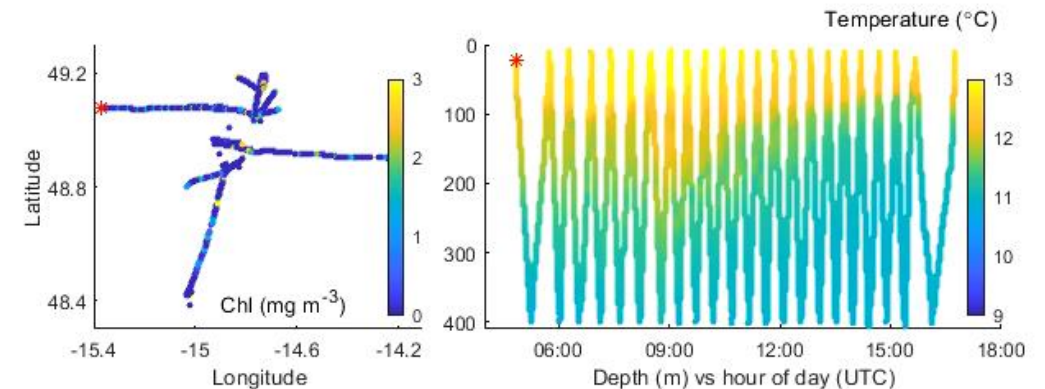
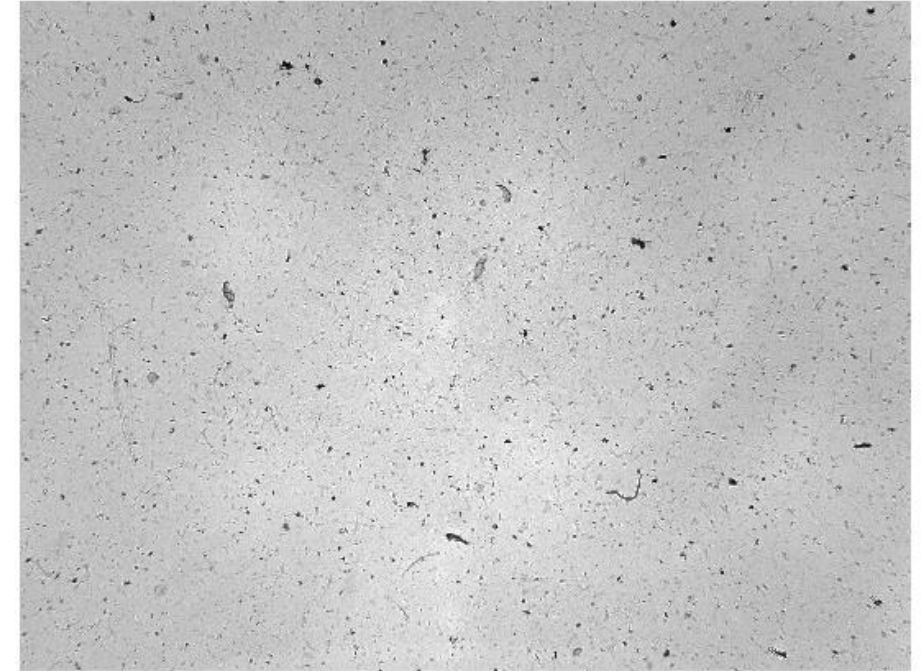
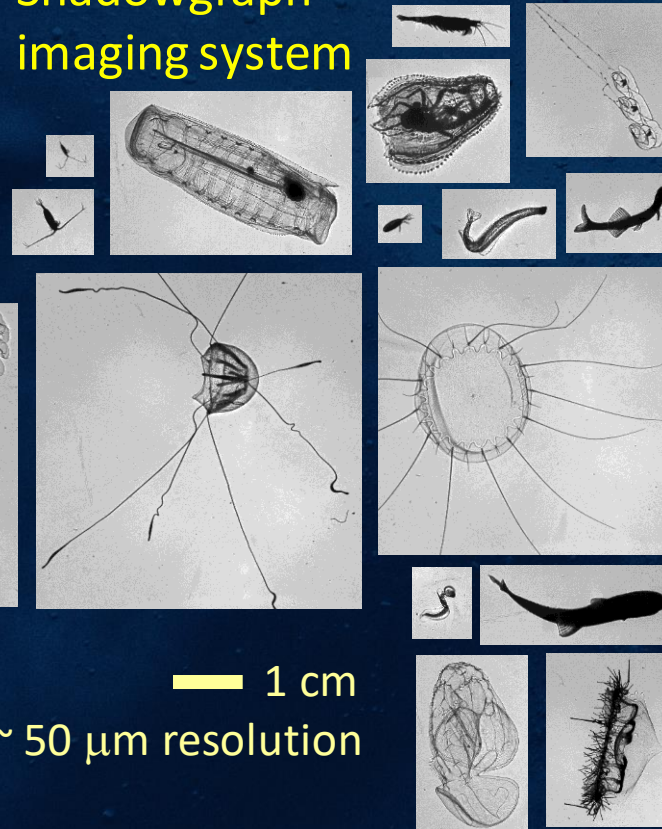


Imaging effective for zooplankton and marine snow dynamics

Towed sensor platform



Shadowgraph
imaging system



Growing need for AI-enabled observing



Long-Range
Autonomous
Underwater
Vehicle

Prototype shadowgraph camera system

On the horizon:

→ AI on the edge for classification & adaptive sampling guided by image data

Deployed nearshore, Mon Feb 12, 2024

→ Through Winter Storm “Lorraine”

8-day mission

Transit 160 km out and back

>1.5 million image frames

~8 TB expected



Winter Storm “Lorraine”
Tue Feb 13

