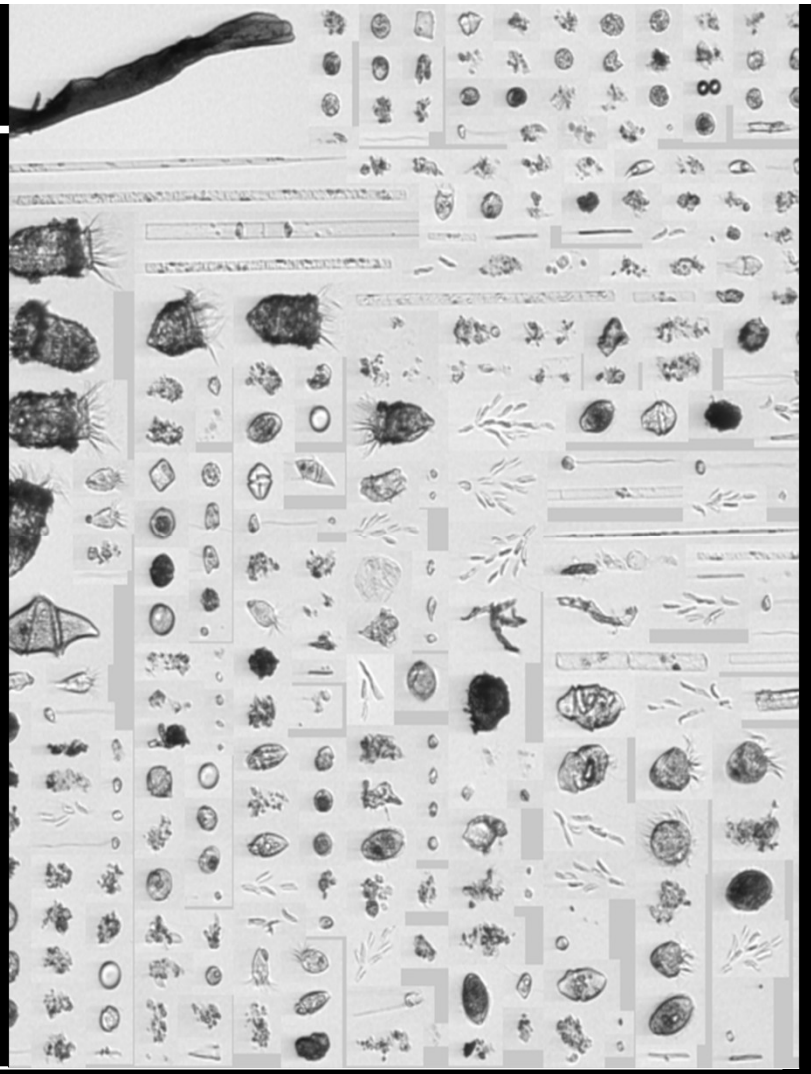
IFCB DATA REPOSITORY & AI-ENABLED CLASSIFIER

Felimon Gayanilo
Information Systems Architect/Enterprise IT

Harte Research Institute
Texas A&M University-Corpus Christi
(305) 335 1584 | felimon.gayanilo@tamucc.edu



GCOOS GULF OF AMERICA COASTAL OCEAN OBSERVING SYSTEM

TEXAS A&M UNIVERSITY CORPUS CHRISTI | HARTE RESEARCH INSTITUTE

ASSOCIATED PROJECT

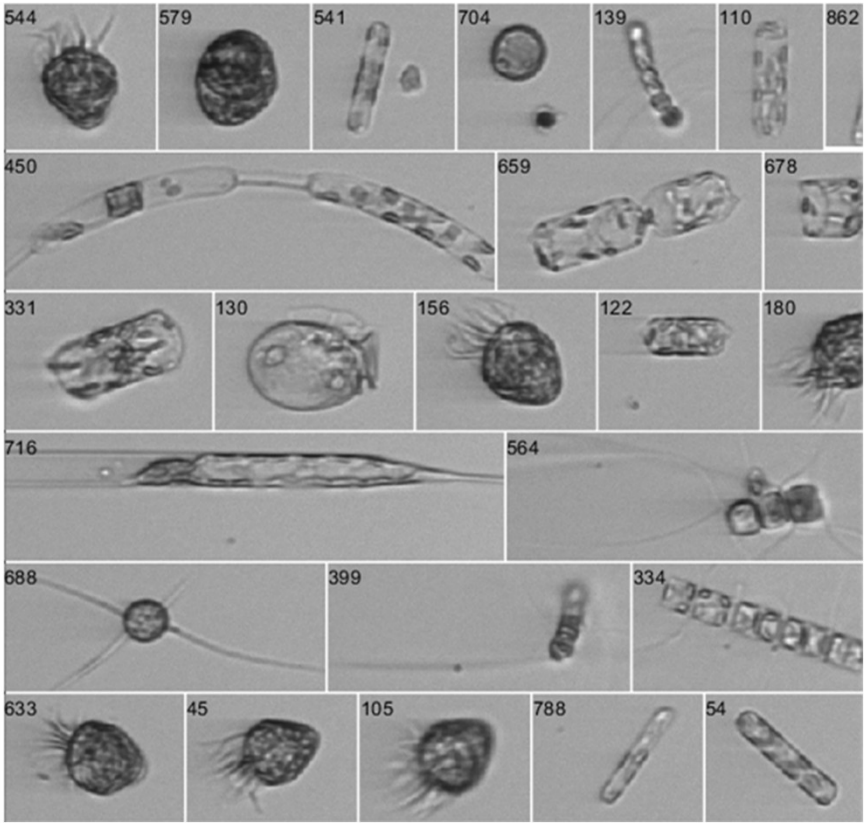
- Coastal Phytoplankton Monitoring in Texas (largely: state funded)
- Water quality is essential for healthy coastal ecosystems & early detection of harmful (toxic) algae is limited in Texas.

Goal: to expand our capacity for phytoplankton monitoring using a combination of advanced instrumentation (IFCB) and AI models.

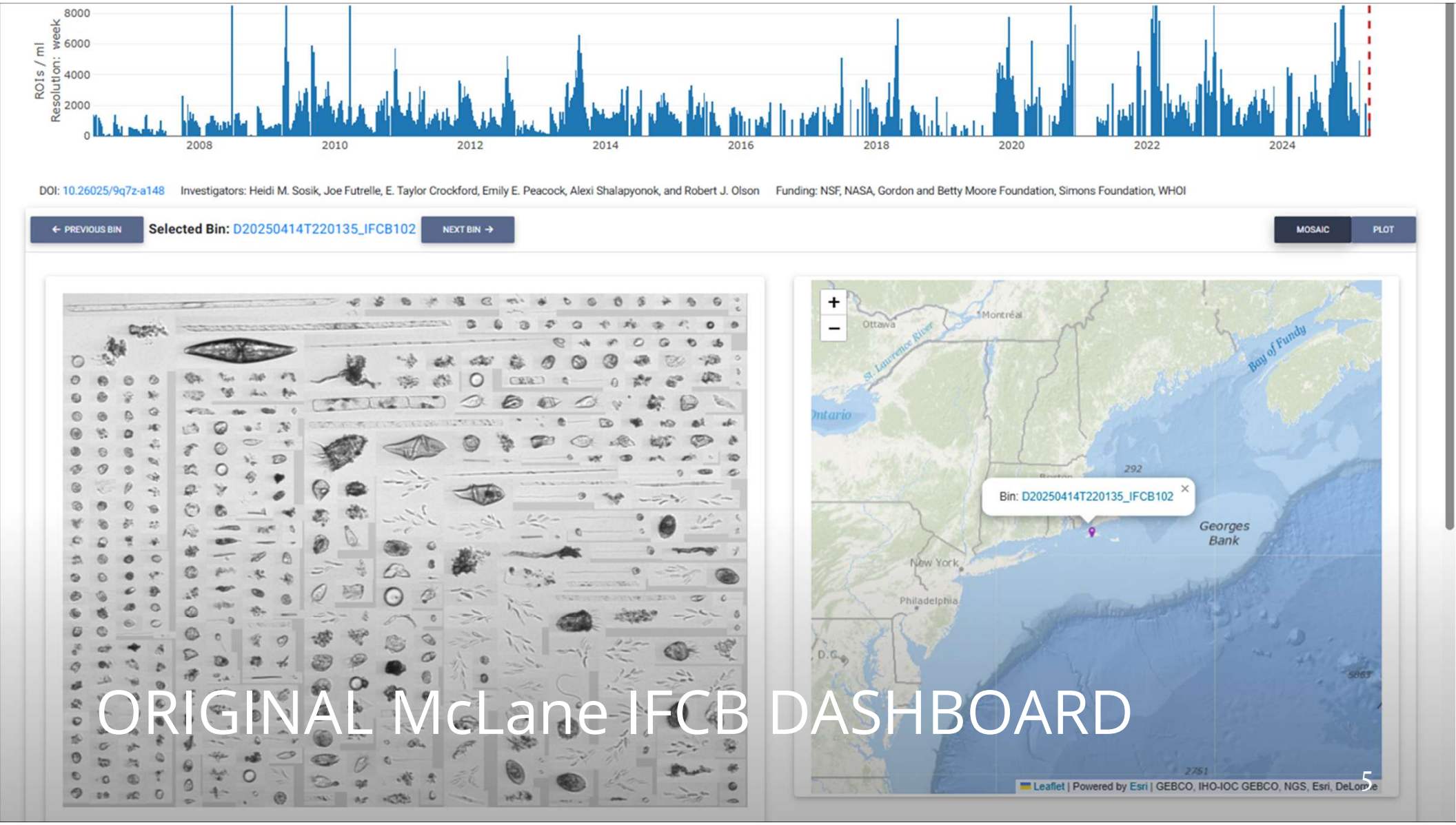
THE Imaging FlowCytoBots (IFCB)

- Captures phytoplankton images in water drawn from environment
- Use annotated images to develop AI-trained machine learning to identify cells
- Images identified/classified in near real time
- Warnings can be established based on thresholds for harmful species
- Communicated to relevant agencies to initiate warnings & increase sampling as needed

IFCB IMAGES

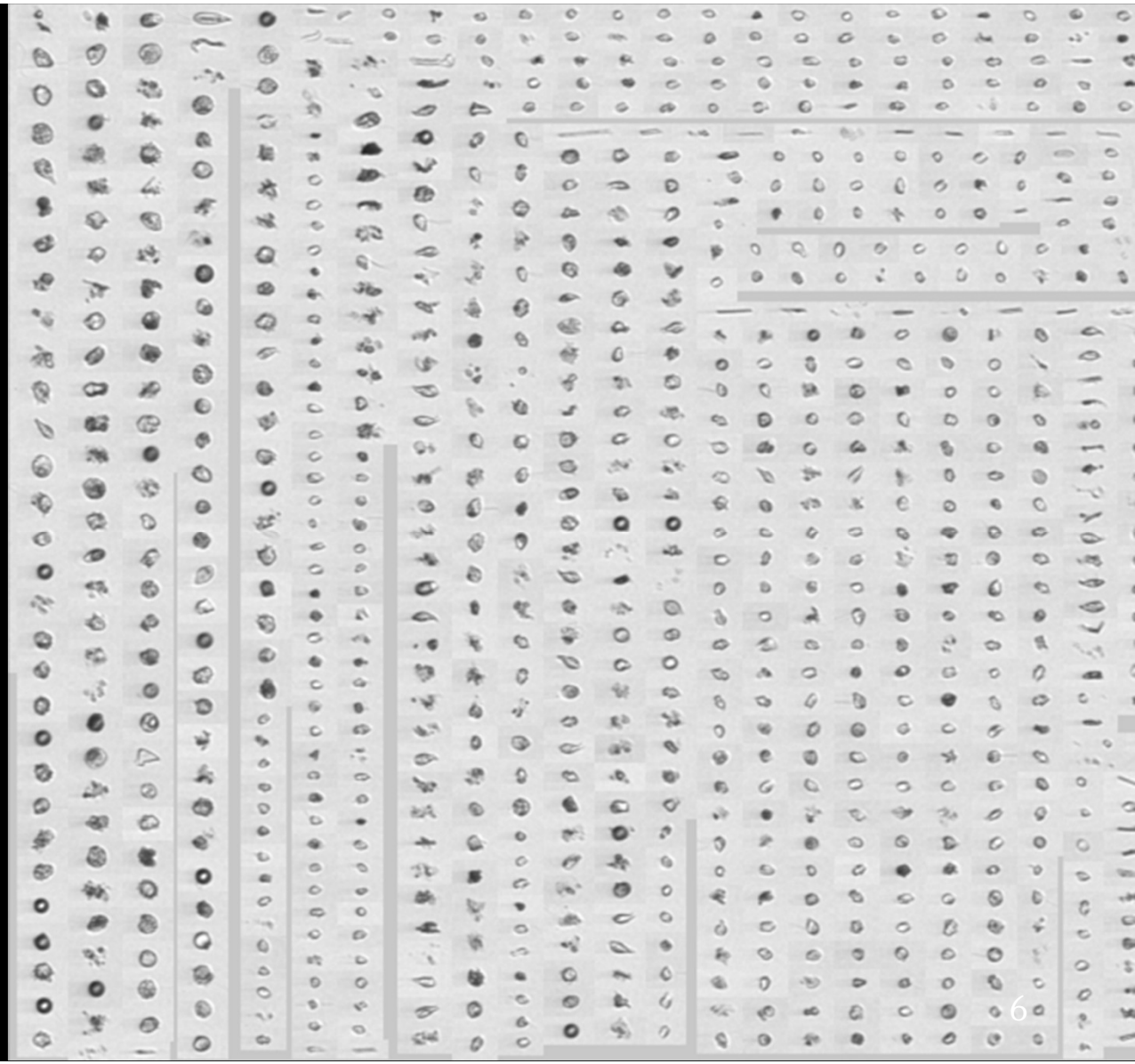


- Produces black and white images
- 150 µm filter protects the fluidics system from larger particles
- Laser-induced chlorophyll fluorescence measurement is sensitive enough to detect cells of 5 µm in size, but image identification may only be reliable above 10 µm



ORIGINAL McLane IFCB DASHBOARD

MANUAL CLASSIFICATION OF IMAGES IS A CHALLENGE



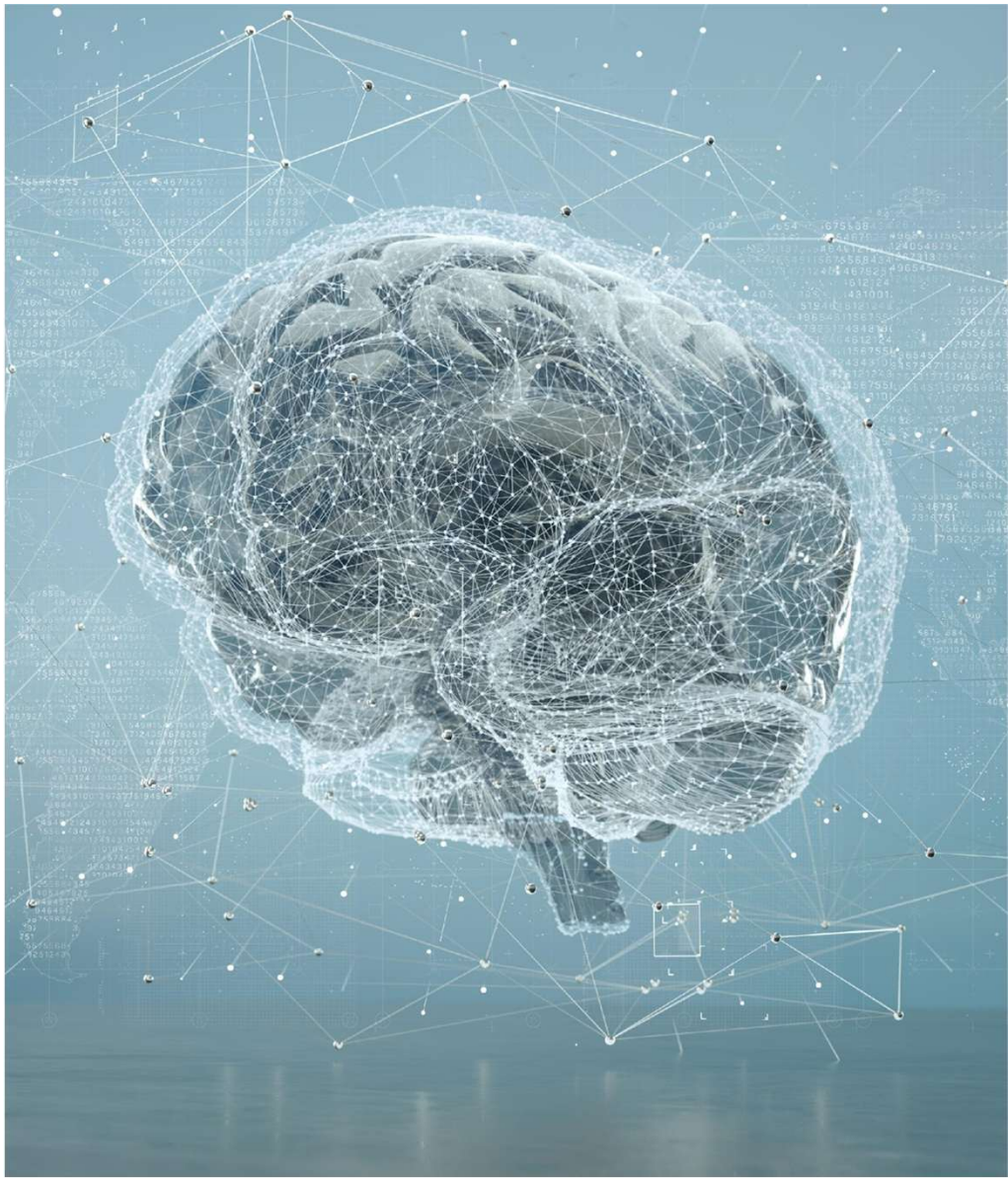
AI-ENABLED CLASSIFIER

Applied:

- Pre-ML: Image augmentation (1:10);
- ML: ResNET50 (stochastic gradient descent (SGD) , epoch=50, 50 convolutional + 2 I/O layers; 3.5hrs processing with over 100K annotated images in 1 H100)
- Classification: 'blink'
- Technology stack: Ubuntu, Python, TensorFlow, Keras, PyTorch

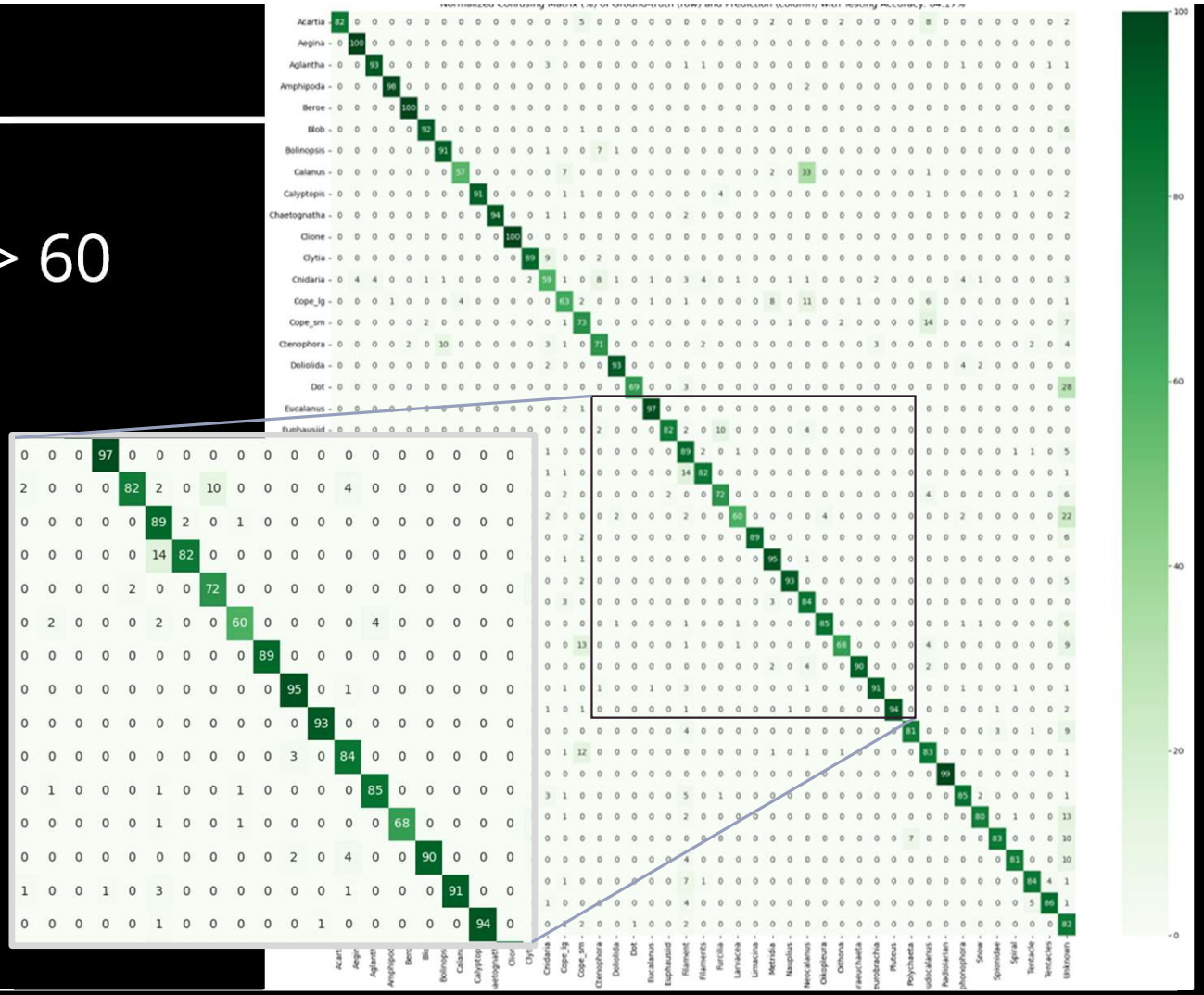
On the Pipeline:

- YoloV11
- RandomForestClassifier (SciKit)



ACCURACY 100 -> 60

... a function of the number of annotated images, and the system is expected to improve in time



Project Summary

phytoplankton.tamucc.edu

IFCB Data Repository & Classifier

Hi Felimon Gayanilo, Logout

Add projects

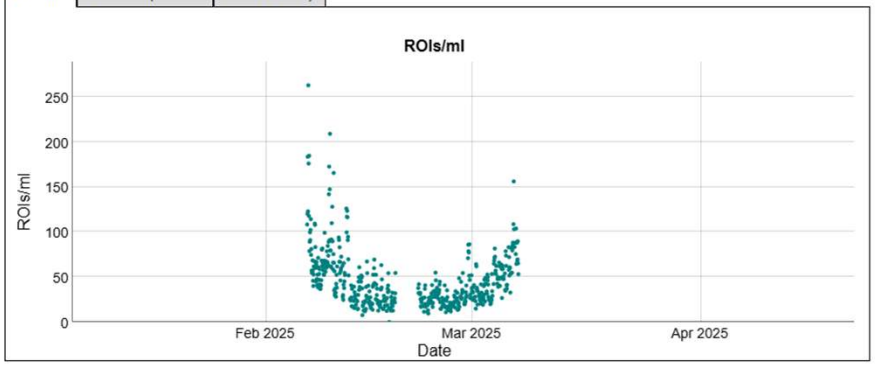
Project Overview | Bin Browsing | Class Summary | AI Classify

Project: Texas State Aquarium {TSA} Details +

Description	IFCB deployed in bench top mode at the Texas State Aquarium receiving continuous water flow from intake pumps
Date Satrted	2025-01-06
Area	Corpus Christi Bay just northeast of the Harbor Bridge and Port of Corpus Christi, slightly restricted water flow due to break waters
Latitude	27.8142
Longitude	-97.3916
Contact Name	Laura Beecraft
Contact Email	laura.beecraft@tamucc.edu
Privacy Status	Private

Project Summary: Texas State Aquarium

ROIs/ml | IFCB Temperature | IFCB Humidity



Species Name	Abundance (cells/ml) for latest bin
Asterionellopsis glacialis	2.237
CerataulinaDactyliosolenGuinardia spp	0.407
Cerataulina sp	0.203
Chaetoceros didymus	0.814
Chaetoceros subg. Hyalochaete	1.424
Chaetoceros subg. Phaeoceros	1.424
detritus	1.831
diatom - centric	0.407
dinoflagellate - scripsielloid	1.017
dinoflagellate (<30 um)	10.78
Dinophysis sp	0.203

TEXAS A&M UNIVERSITY CORPUS CHRISTI | HARTE RESEARCH INSTITUTE

For inquiries:
6300 Ocean Drive, UNIT 5869
Corpus Christi, TX, 78412-5869
Contact Us

Bin Browsing

phytoplankton.tamucc.edu/reclassify

IFCB Data Repository & Classifier

Hi Felimon Gayanilo, Logout

Project Overview | **Bin Browsing** | Class Summary | AI Classify

Project: Demo Project {DEM} Details +

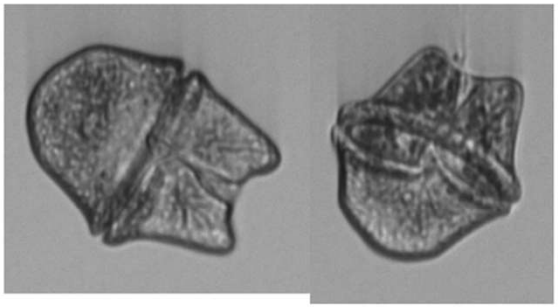
Bin: D20250228T165827_IFCB210 Details

Class: Select a class from the bin Details

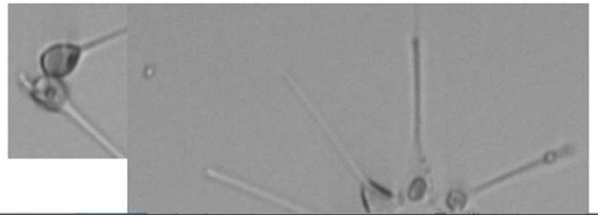
Resize Select Reclassify ← reclassify

NOTE: Select Image to Reclassify. Reclassify to UNCLASSIFIED for items that are candidates for deletion

Akashiwo sanguinea



Asterionellopsis glacialis



Bin Summary: D20250228T165827_IFCB210

Species Name	Abundance (cells/ml)
Acantharia	0
Actinoptychus sp	0
Akashiwo sanguinea	0.406
Amphidinium cf	0
Amphiprora sp	0
Asterionellopsis with detritus	0
Asterionellopsis glacialis	1.624
Asterionellopsis unicells	0
Bacillaria sp	0
Bacteriastrum sp	0
CerataulinaDactyliosolenGuinardia spp	0.203
Cerataulina sp	0
Chaetoceros didymus	1.827
Chaetoceros subg. Hyalochaete	2.841
Chaetoceros subg. Phaeoceros	1.218
Chaetocers sp (<10 um)	0

Class Summary

phytoplankton.tamucc.edu/class

IFCB Data Repository & Classifier

Hi Felimon Gayanilo, Logout

Project Overview | Bin Browsing | Class Summary | AI Classify

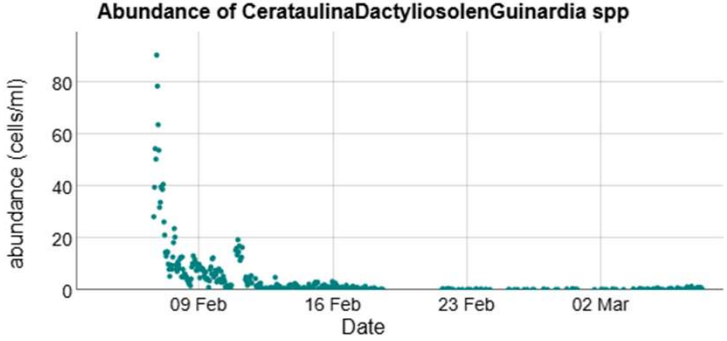
Project: Texas State Aquarium {TSA} Details +

Class: CerataulinaDactyliosolenGuinardia spp Details

Resize Select Reclassify

NOTE: Select Image to Reclassify. Reclassify to UNCLASSIFIED for items that are candidates for deletion

Class Summary: CerataulinaDactyliosolenGuinardia spp



Date	Abundance (cells/ml)
2025-02-06 15:59:02	28.234
2025-02-06 16:53:44	39.591
2025-02-06 17:48:25	54.448
2025-02-06 18:43:08	50.426

Classify an Image

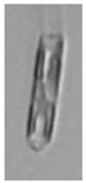
phytoplankton.tamucc.edu/classify

IFCB Data Repository & Classifier

Hi Felimon Gayanilo, Logout

Project Overview | Bin Browsing | Class Summary | AI Classify

Choose File test_2.png



AI Classify

Classified as : cerat_dact_guin

Confidence : 99 %

Date : 4/21/2025

Time : 9:22:44 PM

Description:

Class including chain-forming diatoms of the genus cerataulina, dactyliosolen, guinardia (and potentially others) that could not be distinguished to the genus level

TEXAS A&M UNIVERSITY CORPUS CHRISTI | HARTE RESEARCH INSTITUTE

For inquiries:

6300 Ocean Drive, UNIT 5869
Corpus Christi, TX, 78412-5869

Contact Us

LIVE DEMO IF TIME PERMITS …

https://phytoplankton.tamucc.edu/

GCOOS GULF OF AMERICA COASTAL OCEAN OBSERVING SYSTEM

TEXAS A&M UNIVERSITY CORPUS CHRISTI | HARTE RESEARCH INSTITUTE

THANK YOU

Felimon Gayanilo

Information Systems Architect/Enterprise IT
Harte Research Institute
Texas A&M University-Corpus Christi
(305) 335 1584 | felimon.gayanilo@tamucc.edu

Acknowledgment:

- Mike Wetz, PhD: Chair, Coastal Ecosystem Processes HRI/TAMUCC
- Laura Beecraft, PhD: Assistant Research Scientist, HRI/TAMUCC
- Sandeep Jilla: Software Developer, HRI/TAMUCC (GCOOS)
- Edama Sathwika: Software Developer, HRI/TAMUCC

https://phytoplankton.tamucc.edu/

GCOOS GULF OF AMERICA COASTAL OCEAN OBSERVING SYSTEM

TEXAS A&M UNIVERSITY CORPUS CHRISTI | HARTE RESEARCH INSTITUTE