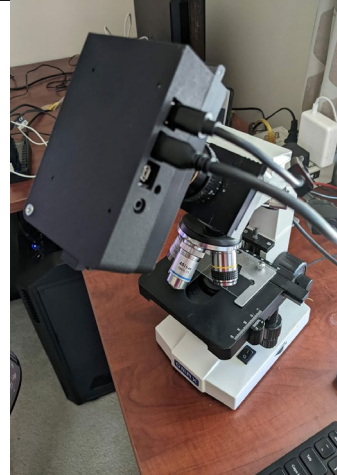# STAMPing Out HABS

HABscope V2.0
"From the Culture to the Cloud"


```
def process_video(taxa):
    """Process the sucker.

    Read video input file, gets cons list,
    draws target indicator and updates settings. Skips first n frames
    and last n frames to avoid shaking. N defined in config file

    Author: robertdcurrier@gmail.com
    Created:    2018-11-06
    Modified:   2022-02-09
    Notes:

    Now working on pt5_process_video using Xception network.  We need
    taxa to check for min/max cell size and ROI spacing but we no longer
    pass as an arg. The input file will contain taxa by default so we
    extract from there, thus allowing us to not specify taxa for the
    actual classifcation task, but still use all the pre-classifcation
    screening methods to winnow down the list.
    """
    global thumbs
    # local variables
    frame_count = 0
    target_frame = None
    target_cons = None
    max_num_cons = 0

    args = get_cli_args()
    input_file = args["input"]
    config = get_config()
    file_name = input_file
    logging.info('process_video(%s)' % taxa)

    # Where we store our good cons
    good_cons = []
    video_file = cv2.VideoCapture(file_name)
    size = (int(video_file.get(cv2.CAP_PROP_FRAME_WIDTH)),
            int(video_file.get(cv2.CAP_PROP_FRAME_HEIGHT)))
    max_frames = (int(video_file.get(cv2.CAP_PROP_FRAME_COUNT)))
    skip_frames = config['cv2']['skip_frames']
    skip_snip_frames = config['cv2']['skip_snip_frames']
    fps = config['cv2']['fps']
    # Taxa-specific descriptors
    edges_min = config['taxa'][taxa]['edges_min']
    edges_max = config['taxa'][taxa]['edges_max']
    roi_spacing = config['taxa'][taxa]['roi_spacing']
    cell_width_min = config['taxa'][taxa]['cell_width_min']
    cell_width_max = config['taxa'][taxa]['cell_width_max']
    cell_height_min = config['taxa'][taxa]['cell_height_min']
    cell_height_max = config['taxa'][taxa]['cell_height_max']
    line_thick = config['taxa'][taxa]['poi']['line_thick']
    rect_color = eval(config['taxa'][taxa]['poi']['rect_color'])
    x_offset = config['taxa'][taxa]['x_offset']
    y_offset = config['taxa'][taxa]['y_offset']

    # Loop over frames skipping the first few...
    frame_count += 1
    frames_read = 0
    thumbs = 0
```


Bob Currier
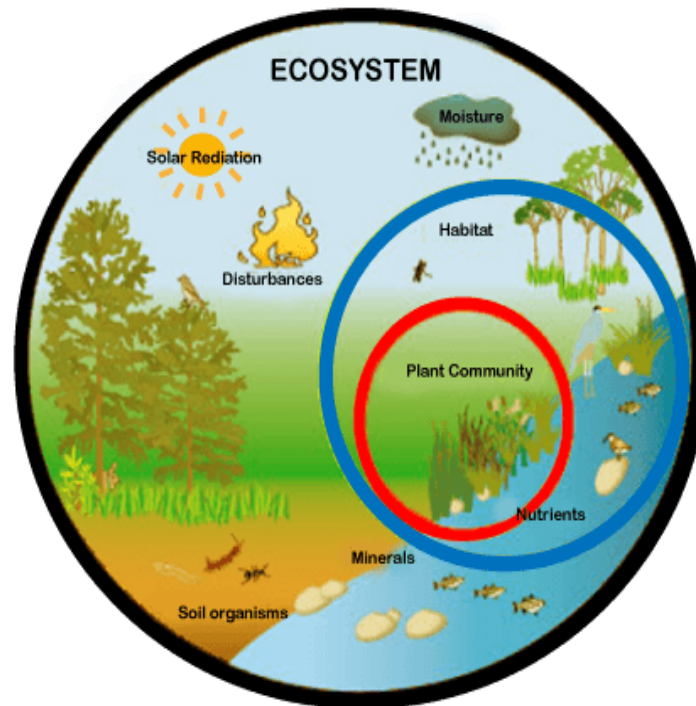Research Specialist
bob.currier@gcoos.org

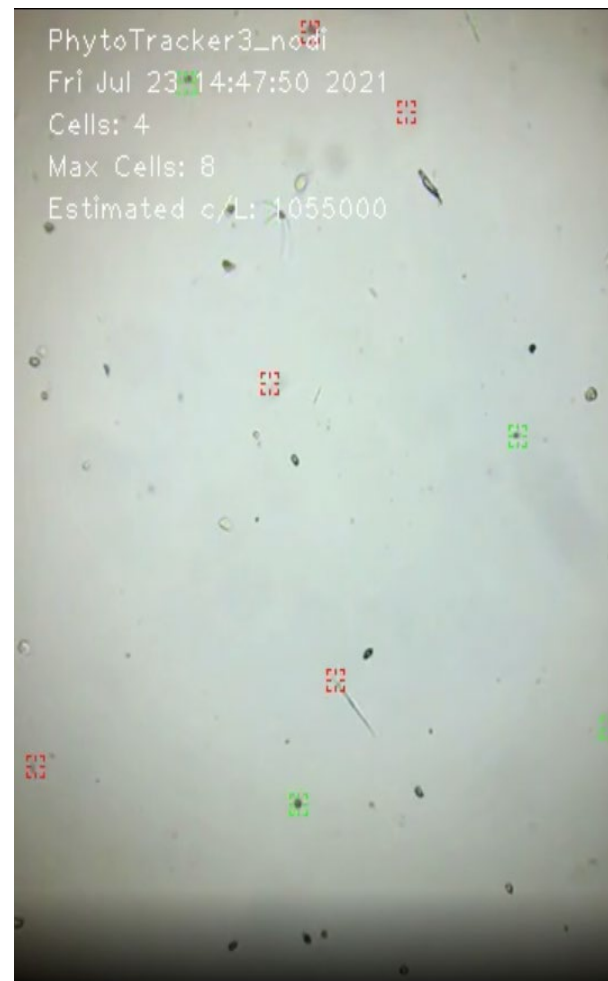# HABscope Is An Ecosystem

HABscope is not:

A single device

A single application

Designed to allow individual components to work alone

HABscope 1.0

- One Device: Apple iPod

- One Menu Item

- 0 Lines of Code

PhytoTracker3_nodi
Fri Jul 23 14:47:50 2021
Cells: 4
Max Cells: 8
Estimated c/L: 1055000

HABscope 2.0

- **STAMP: Single Taxa Multiple Passes**
- Multi-stage pipeline:
  - Morphological Features
  - Image Features
  - AI Classifier
  - Cell Quantifier
- Raspberry Pi 4.0 with 14MP RPi HQ Camera
- 3 taxa: *Karenia, Pyrodinium, Alexandrium*
- Taxa-specific camera settings
- 4 second analysis time in the cloud
- Internet not required to record videos
- AI-Analyzed image pushed to volunteer
- On-board classification in the near future
- **$500 per unit**

HABscope 2.0 Demonstration

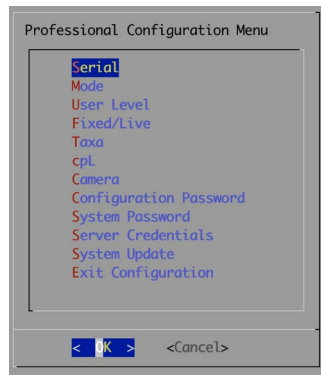Live *Karenia brevis* at 400X
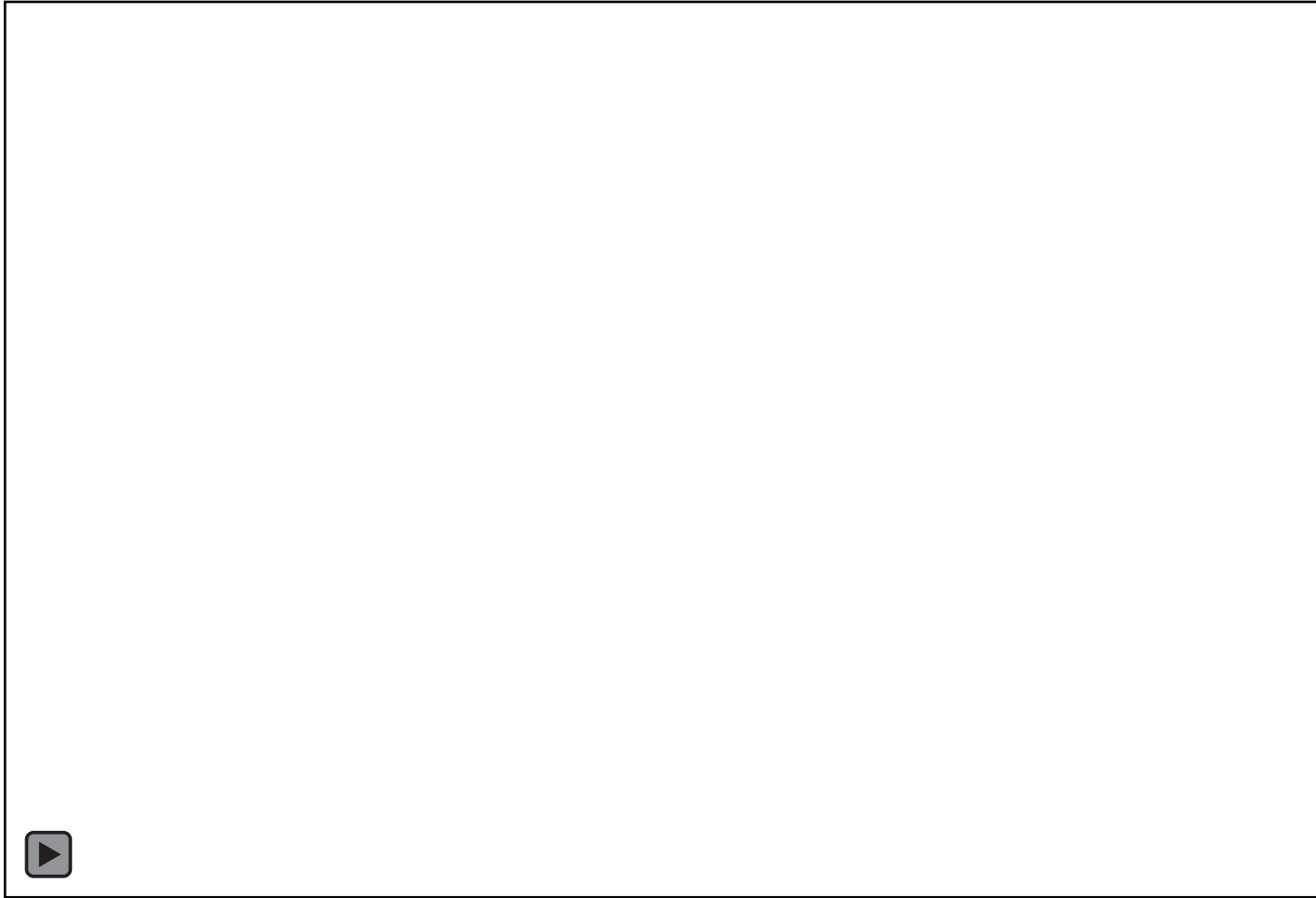
HABscope System Diagram

It's all about the SDFN: Self Describing File Name

The File Name is the Metadata

HSV0001_1643906643_karenia_live_0000000_0000000_raw.mp4

Culture

HABscope
1,500 lines of Python3

HABlab
Optical Workbench

Taxa Libraries
10,000 images/taxa
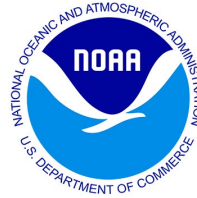
Model Test and Train
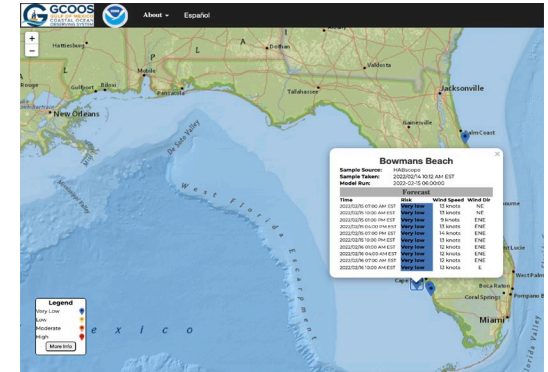2,000 lines of Python3

Local Components

HABscope System Diagram

Web Portal

3 Docker Containers
5,000 lines of code
Python3 and Flask
Authentication Database
NOAA Model CSV Generation
Approval and Editing of Uploads

NOAA Model
Code Unknown

HABforecast Site

3,000 lines of code
Python3 and Flask
One Docker Container
300,000+ Views in past year

Cloud Components

Adding Taxa to HABscope

Deep Learning is like dog training: Many dog owners, few dog experts

User
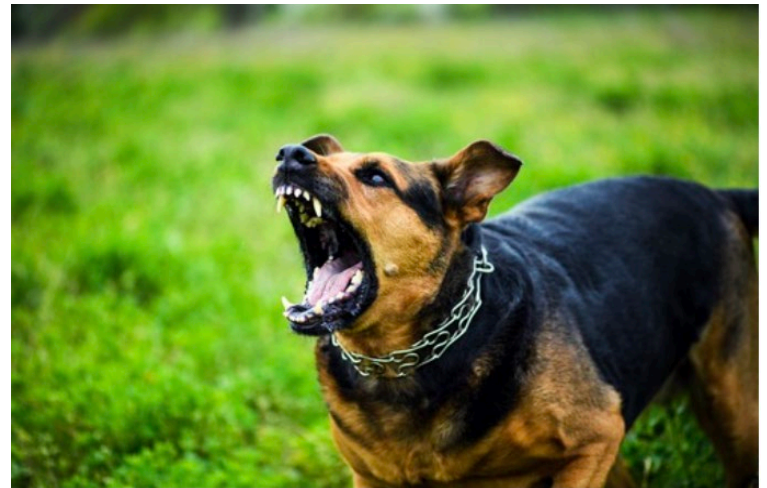
Expert

Building a Training Library
Two Viewpoints

Casual User

Copies Code From Web
Images all provided and curated
No Work Needed
Click and Run

Data Scientist

No Images Available
Must Build From Scratch
Data Dirty
Weeks/Months of Work
Definitely NOT Click and Run

Training The Model

Pushing The Button Is Only 1% Of Total Workload

HABscope vs 'The Big Guns'

FlowCam

IFCB

Only HABscope provides End to End solution with data product (HABforecast) automatically available to all users in the cloud. And we do it for $500 per unit.

Interested In Learning More?

- Contact our volunteer coordinator Grant Craig grant.craig@gcoos.org
- Currently working on converting 40 Habscope 1.0 volunteers to 2.0
- 10 HABscope 2.0 units going to Alaska in Spring 2022 (*Alexandrium)*
- Chesapeake Bay coming online Spring 2022 (*Alexandrium)*
- Expanding will require additional funding and personnel
- Suggest new taxa for training: if it can be cultured we can build a model
- Not just for saltwater HABs – can be used wherever needed if there is a model
- Survey mode great for K-12 or building micro biodiversity records (no analysis)

Thanks to IOOS Pilot project funding and NCCOS MERHAB Program