27-29 May 2024

imdis

International conference on Marine Data and Information Systems

Fish detection and classification at OBSEA

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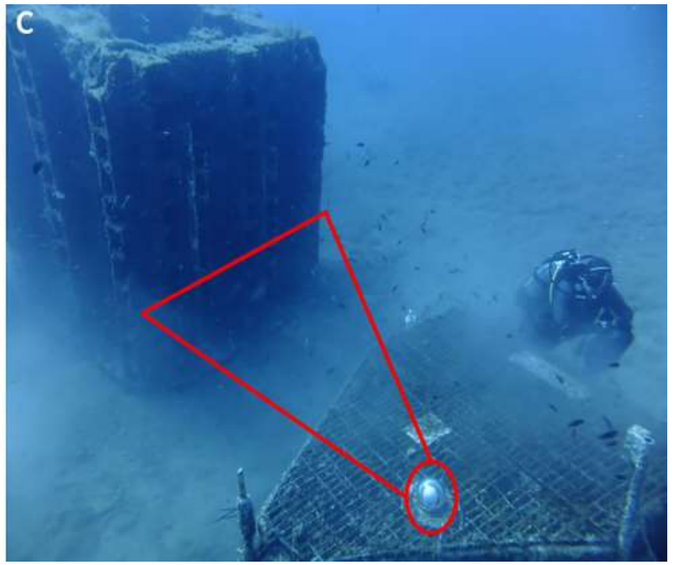
OBSEA Seafloor Observatory

- Underwater cabled observatory
- Located at NW Mediterranean Sea
- Shallow waters (20 m depth)

  Multiparametric data
- Image archive since 2011
- Fish abundance & behaviour studies



Introduction

iMagine project objectives

Use case at OBSEA observatory (UC3)

- Publish real-time biodiversity
- Ecosystem Monitoring using underwater images

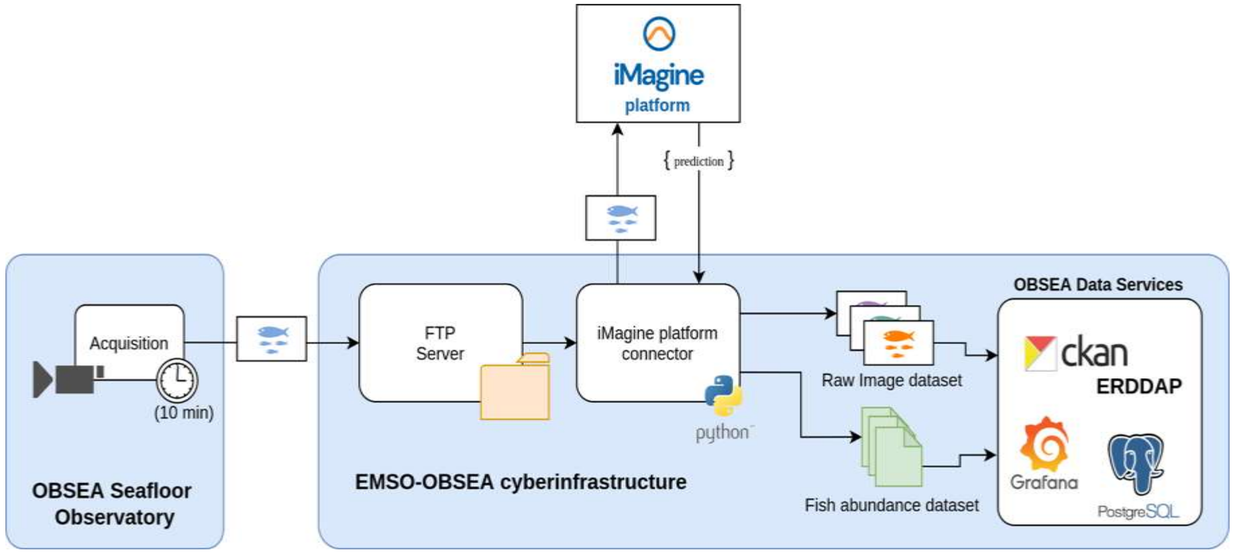
Target users

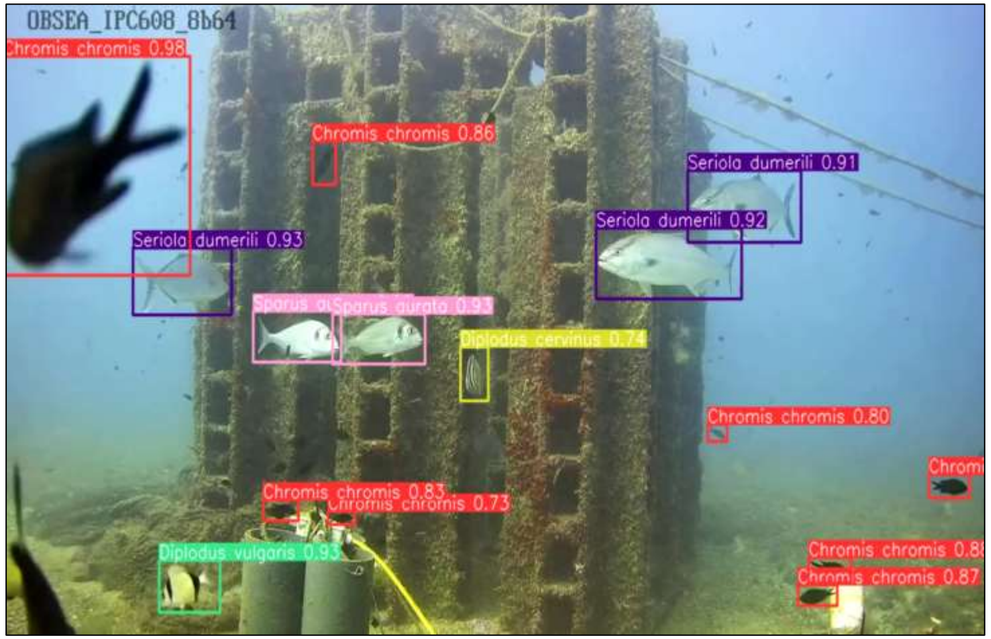
Marine scientists

Data managers

AI Model

YOLO v8/9



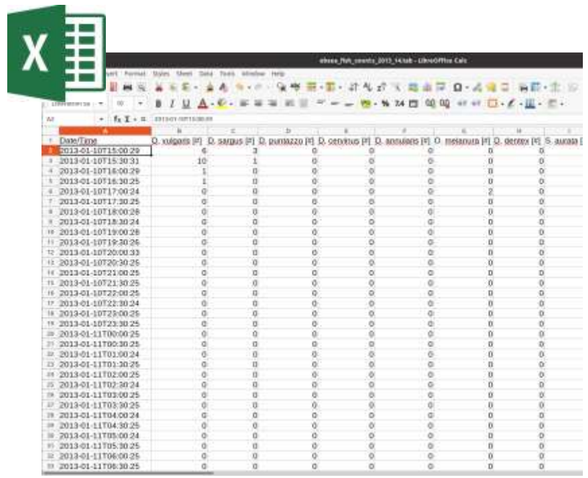


Traditional Ecological Monitoring

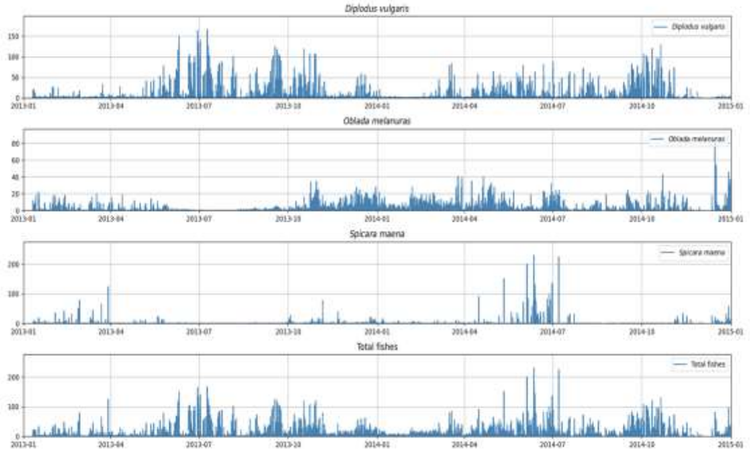
1. Underwater pictures

2. Manual fish counts

3. Spreadsheet with counts



4. Abundance time-series



Extremely time-consuming!!

Not reproducible

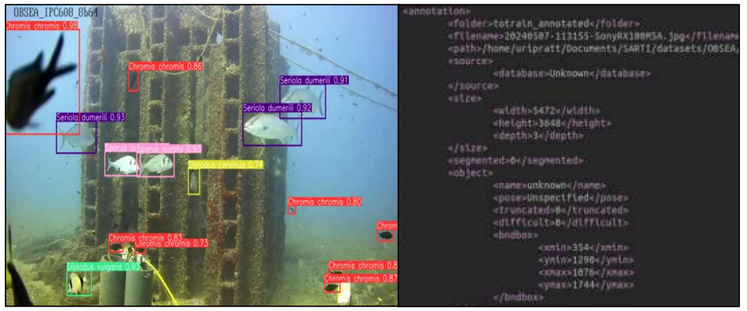
Expertise in biology

AI-based Ecological Monitoring

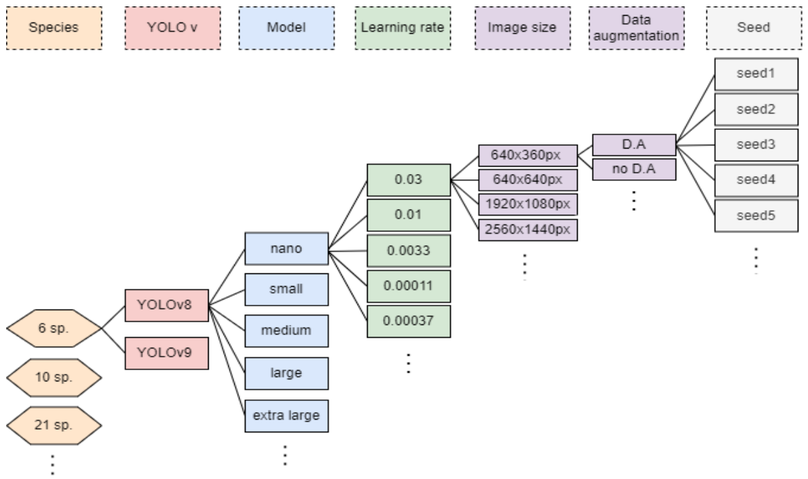
1. Label underwater pictures

2. AI model (object detection)

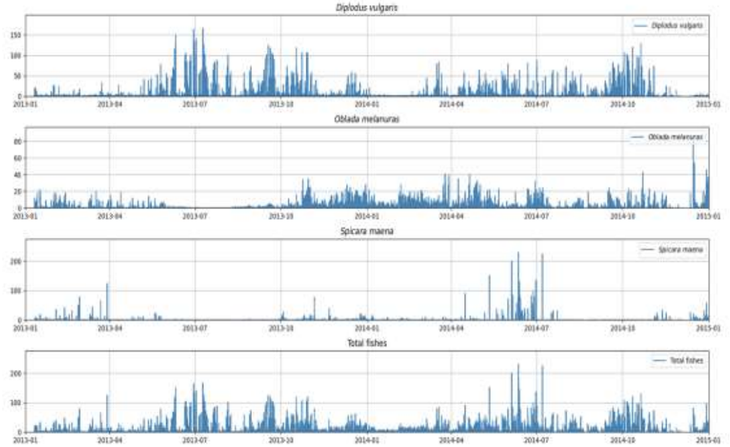
4. Store predictions



3. Train and Detect



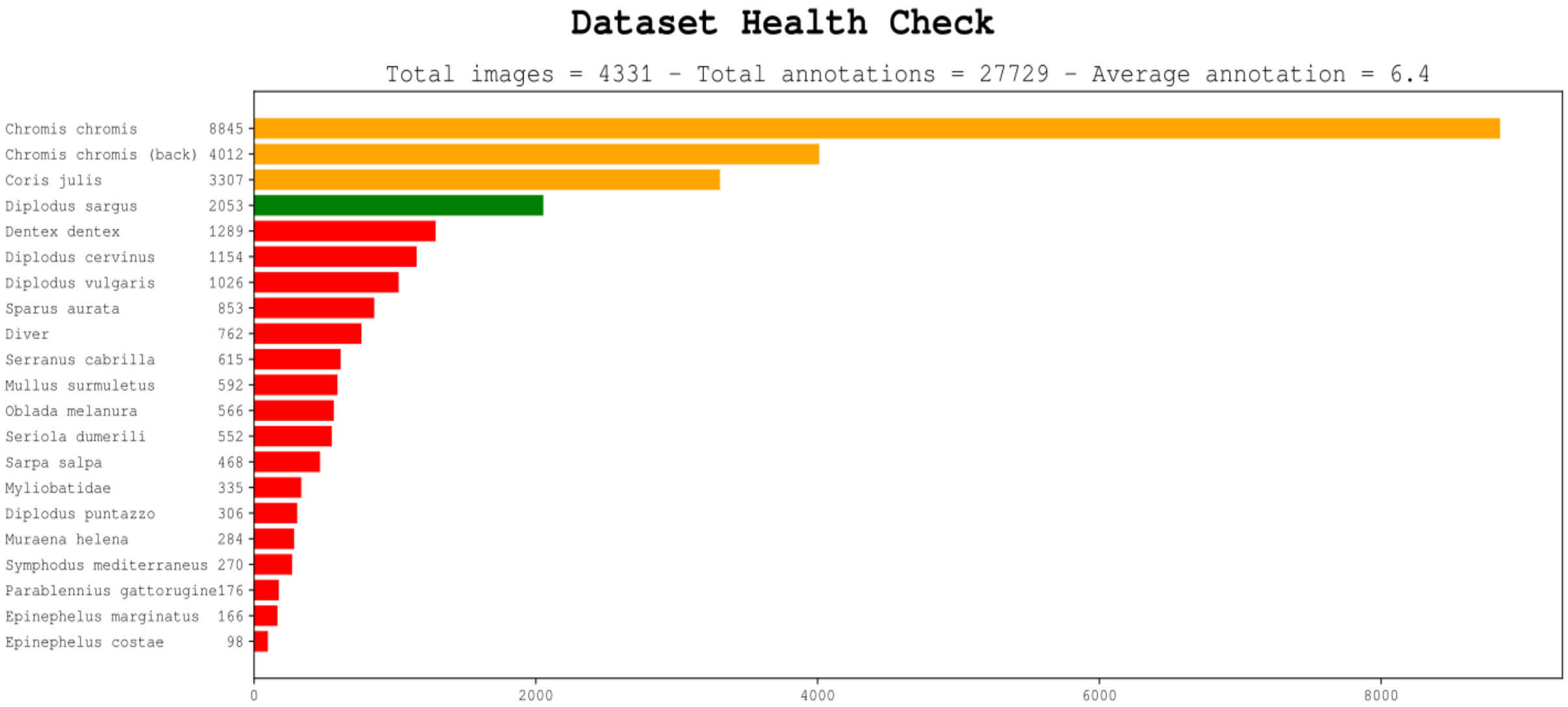
5. Abundance time-series



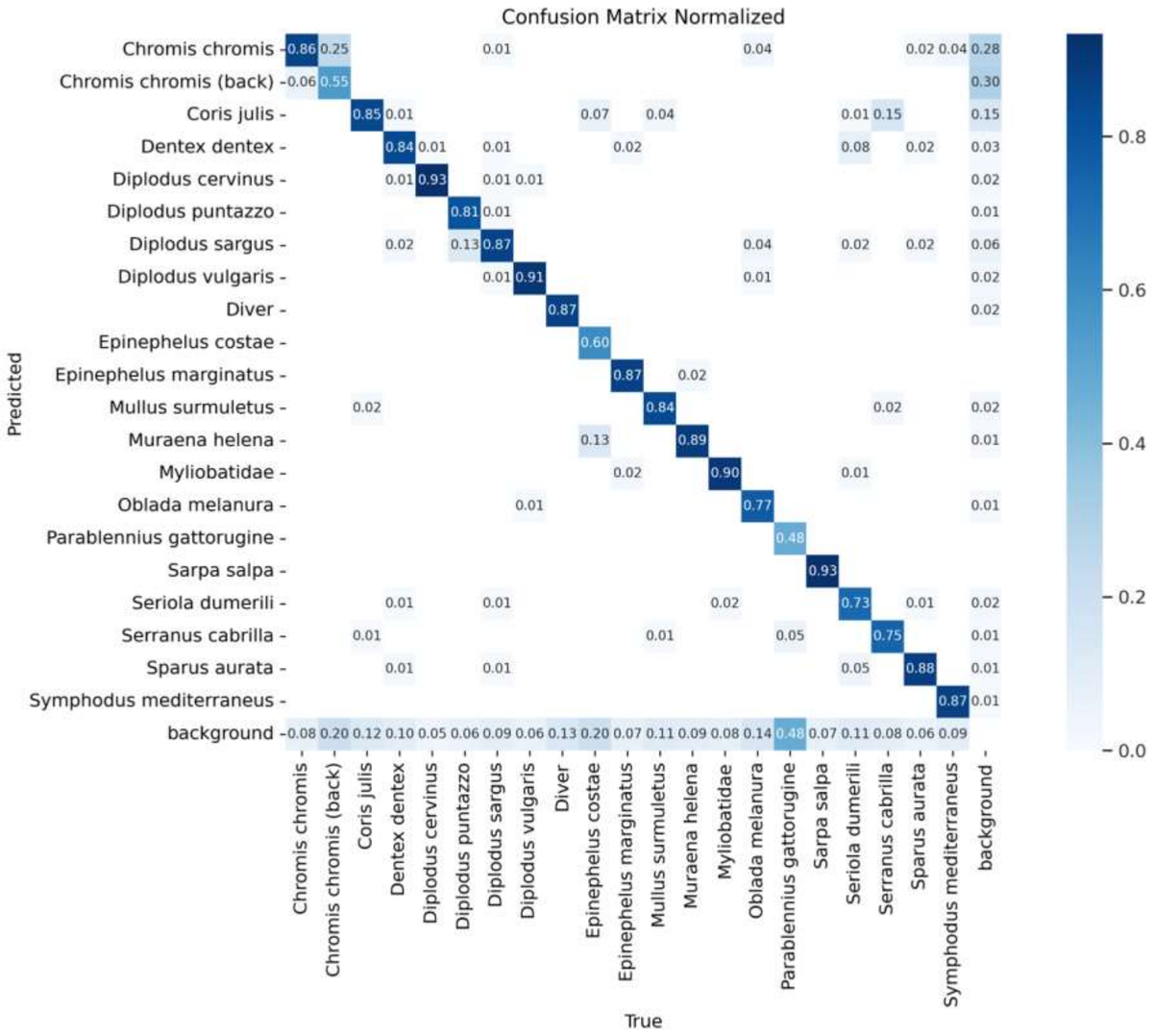
Let scientist do science, not count fish!

50k img analyzed { *scientist = 1 year* / *AI-model = 12 h*

Semi-automatic labelling



Progress to date…



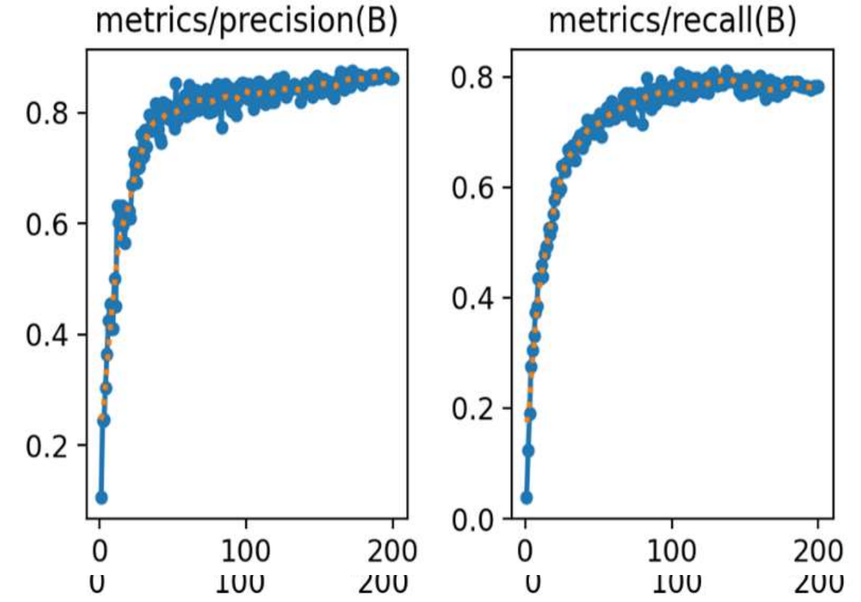
mAP = 0.82@0.5
12 classes
2125 images
12524 annotations

0.88 mAP@0.5
21 classes
4122 images
26467 annotations

November 2023

May 2024

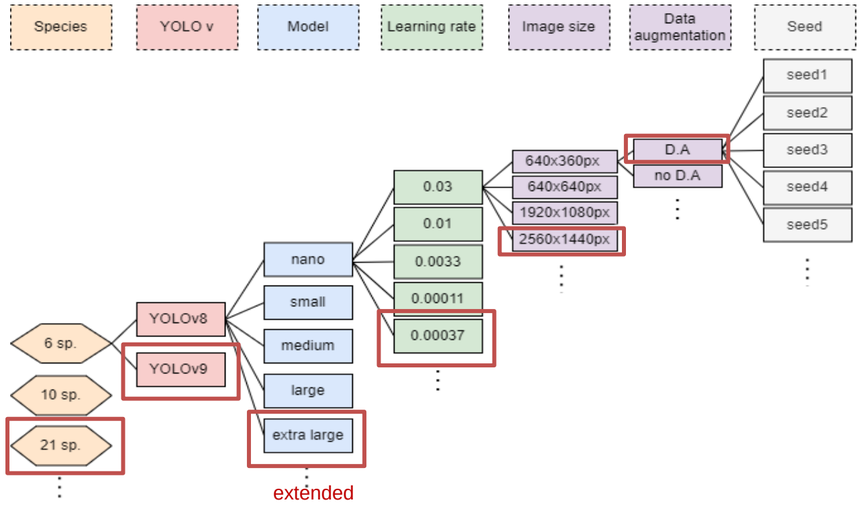
Continuous improvement!

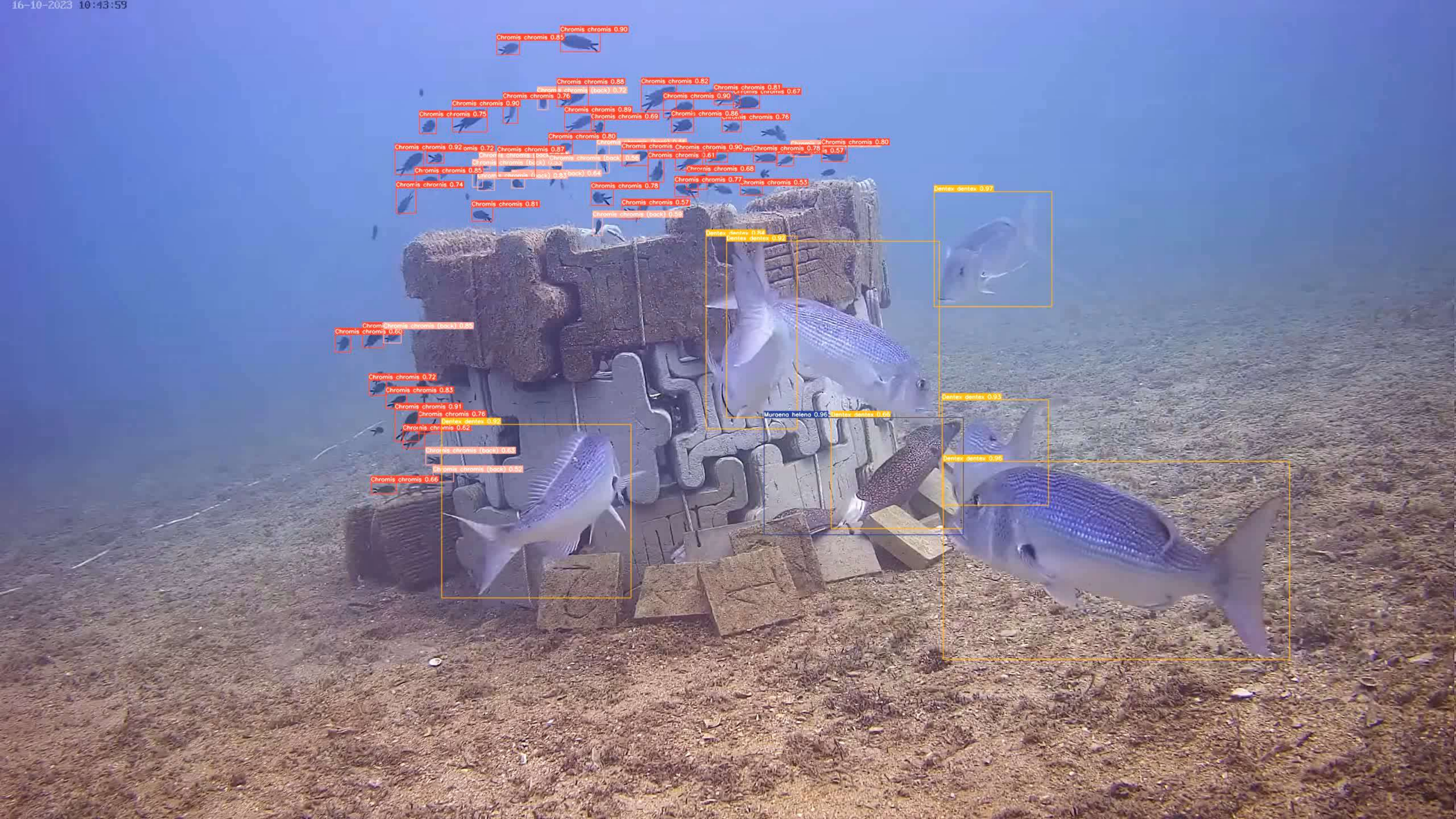


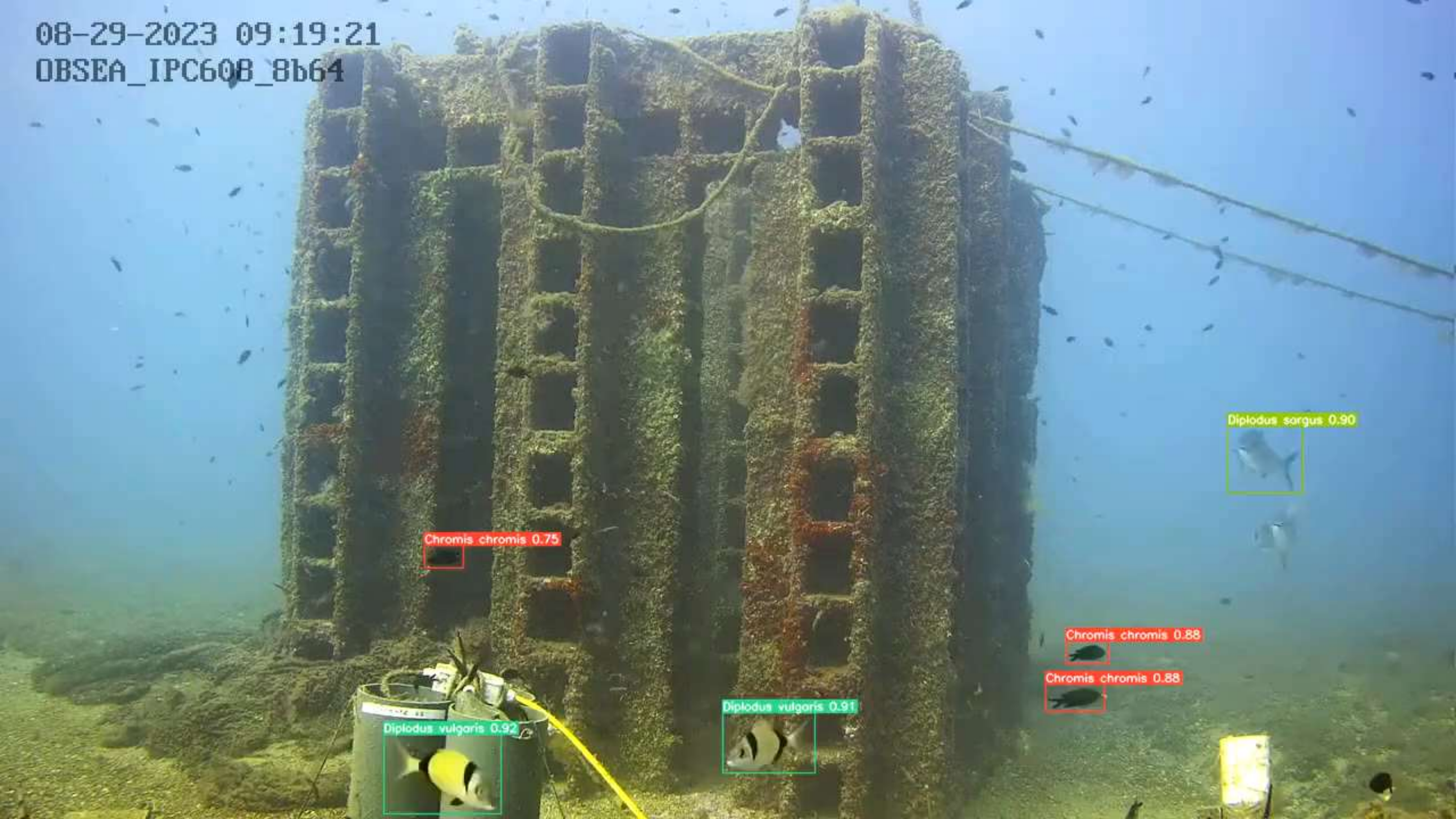
Progress to date…

- Dataset Preparation 80% ✓
- Model training ✓
  - YOLOv8 multiple configurations
  - MLflow integration (also ClearML)

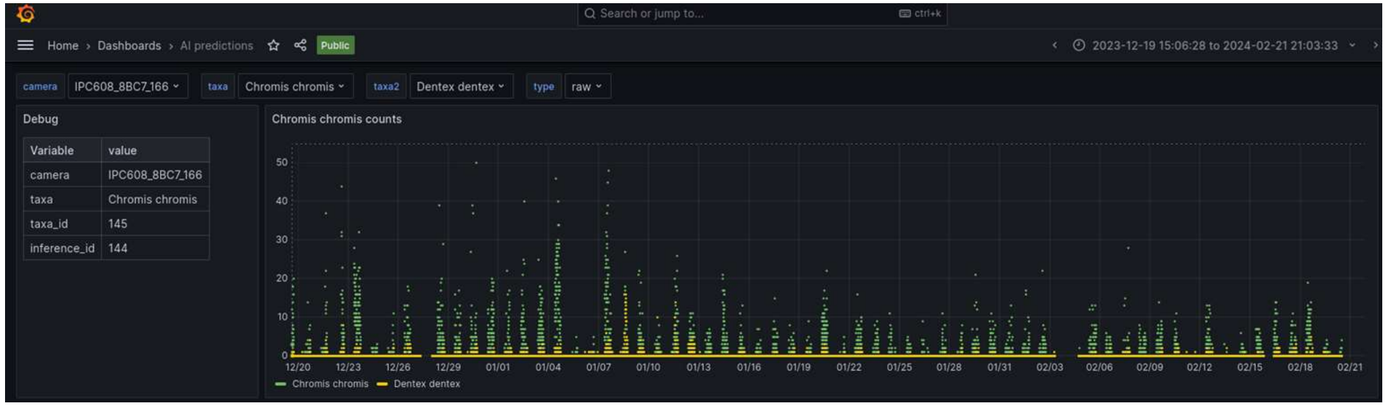
- Training dataset published on Zenodo ✓
  - DOI: 10.5281/zenodo.11195949
- Real time streaming on YouTube ✓
  - https://www.youtube.com/watch?v=byrGnGMAHGI

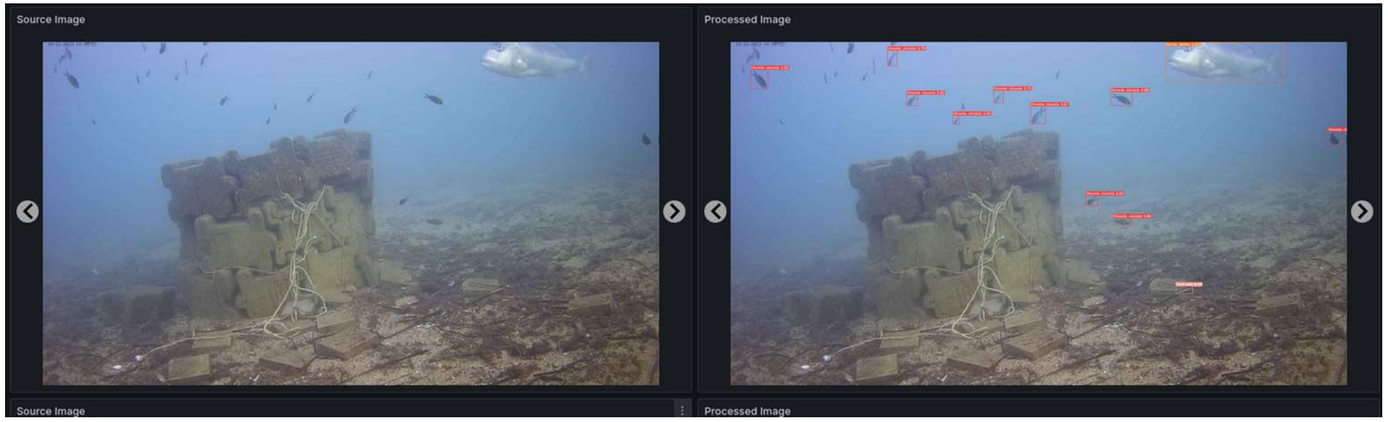



16-10-2023 10:43:59
Chromis chromis 0.85
Chromis chromis 0.90
Chromis chromis 0.88
Chromis chromis 0.82
Chromis chromis 0.81
Chromis chromis 0.67
Chromis chromis 0.76
Chromis chromis 0.90
Chromis chromis 0.90
Chromis chromis 0.75
Chromis chromis 0.89
Chromis chromis 0.69
Chromis chromis 0.86
Chromis chromis 0.76
Chromis chromis 0.80
Chromis chromis 0.92
Chromis chromis 0.87
Chromis chromis 0.90
Chromis chromis 0.78
Chromis chromis 0.80
Chromis chromis 0.61
Chromis chromis 0.85
Chromis chromis 0.68
Chromis chromis 0.74
Chromis chromis 0.77
Chromis chromis 0.53
Chromis chromis 0.78
Chromis chromis 0.81
Chromis chromis 0.57
Dentex dentex 0.97
Dentex dentex 0.84
Dentex dentex 0.92
Chromis chromis 0.66
Chromis chromis 0.72
Chromis chromis 0.83
Chromis chromis 0.91
Chromis chromis 0.76
Dentex dentex 0.92
Chromis chromis 0.62
Muraena helena 0.96
Dentex dentex 0.66
Dentex dentex 0.93
Dentex dentex 0.96
Chromis chromis 0.66


08-29-2023 09:19:21
OBSEA_IPC608_8b64
Diplodus sargus 0.90
Chromis chromis 0.75
Chromis chromis 0.88
Chromis chromis 0.88
Diplodus vulgaris 0.91
Diplodus vulgaris 0.92

Next steps





- Move to production
- Alarm system with key species
- Try oriented bounding box

- Scientific exploitation:
  - Predator-prey interactions
  - Ecological models
  - Correlation with environmental data

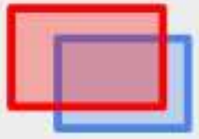
27-29 May 2024

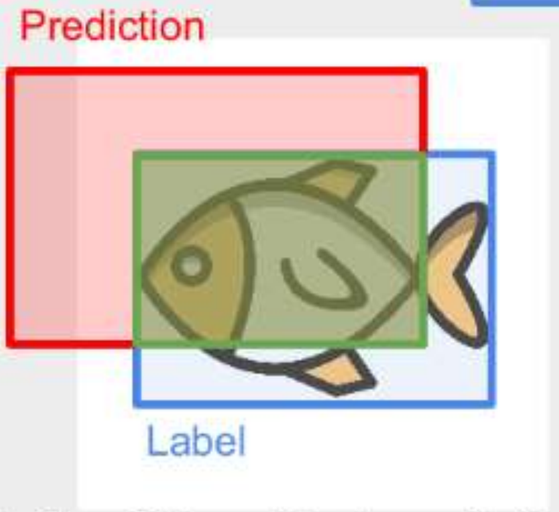
International conference on Marine Data and Information Systems

SeaDataNet AISBL · Havforskningsinstituttet · Ifremer · MARIS · MEDIN · National Oceanography Centre · INGV · iMagine · IODE · eosc Blue-Cloud2026

IoU, Precision and Recall

$$\textbf{IoU} = \frac{\text{intersection}}{\text{union}} = \frac{\text{intersection}}{\text{union}}$$





IoU < 0.5 → Bad prediction

IoU > 0.5 → Good prediction

(0.5 adjustable threshold)

$$\textbf{Precision} = \frac{TP}{TP + FP}$$

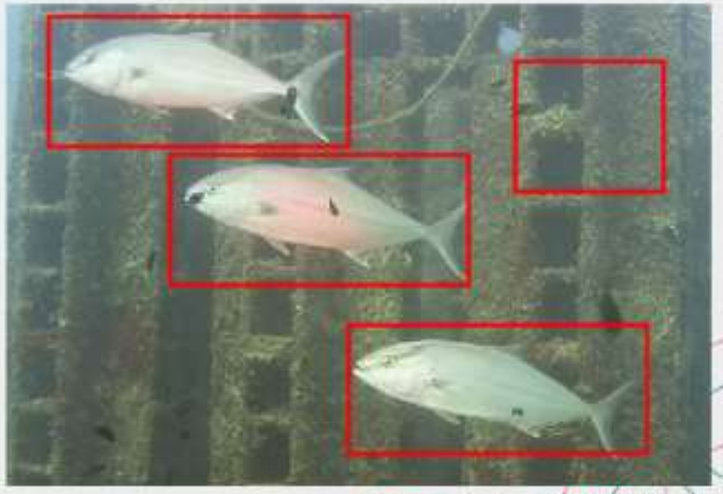
TP: True Positives

FP: False Positives

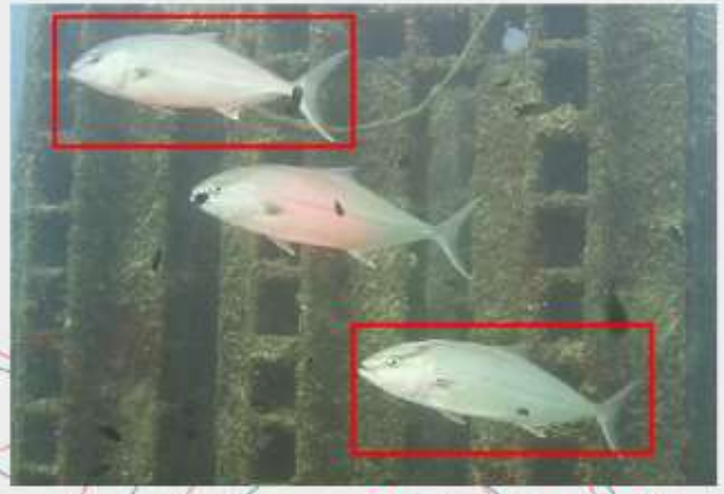
$$\textbf{Recall} = \frac{TP}{TP + FN}$$

TP: True Positives

FN: False Negatives



Precision: 75%
Recall: 100%



Precision: 100%
Recall: 66.6%

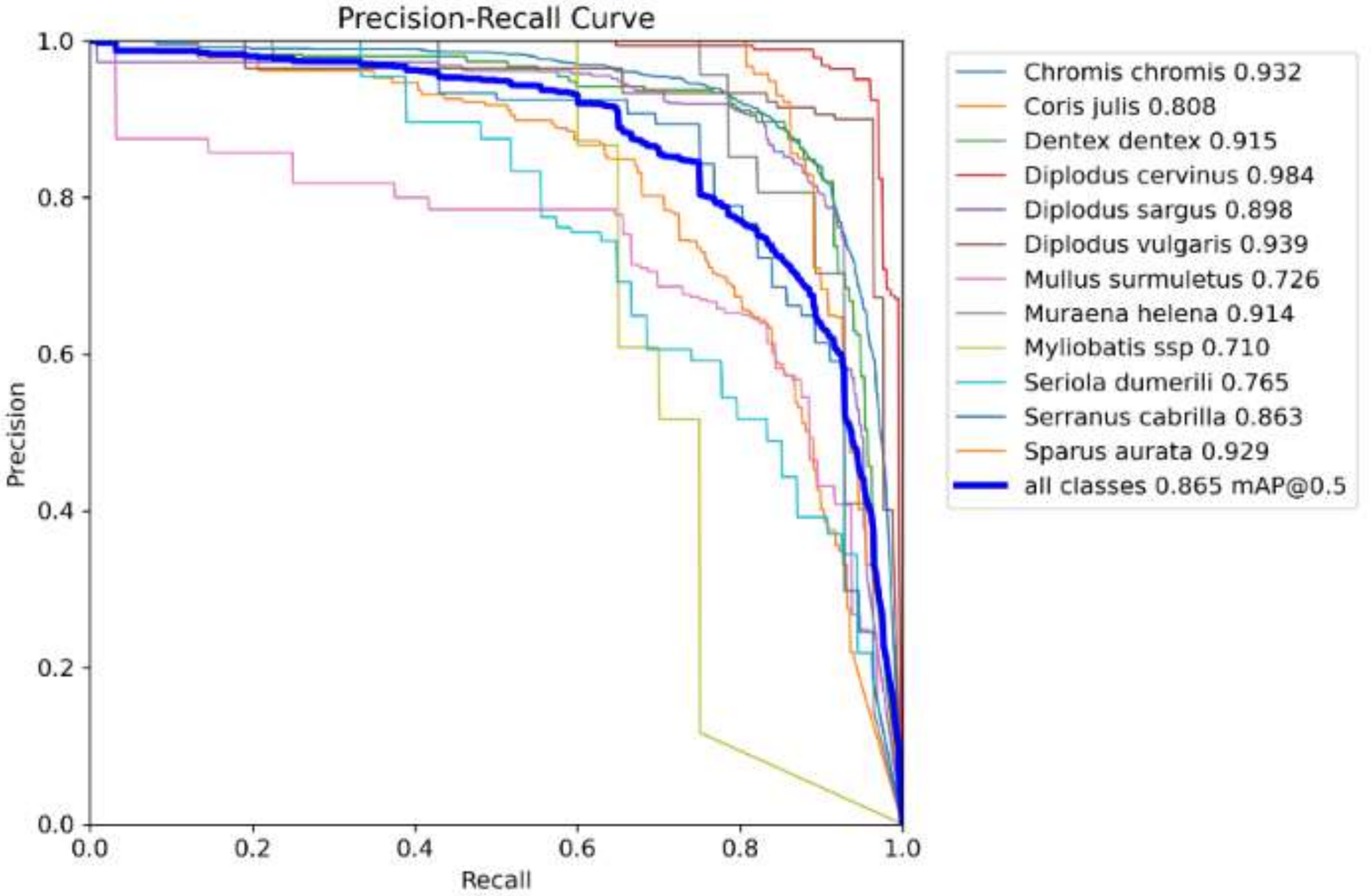
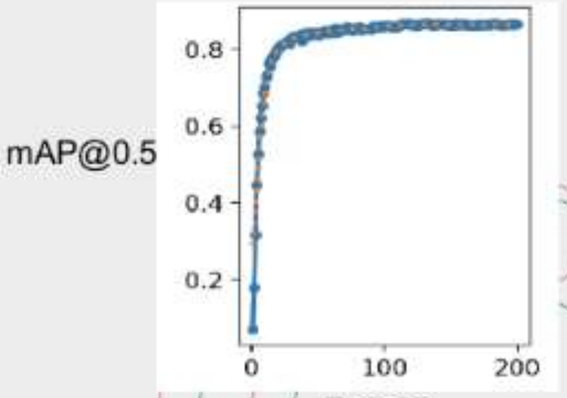
Average Precision and mAP

Average precision

- Area under the PR curve
- Calculated for each class

Mean Average Precision (mAP)

- Mean of all APs
- Usually set at IoU=0.5
  - mAP@0.5
- de-facto standard metric!



- **image size**
  - Higher the better…
  - …but slower
  - Useful for small fish
- **Epochs**
  - Higher the better…
  - …up to a point
- **Batch size**
  - Higher the better….
  - …if you have the resources!
- **More training data!**