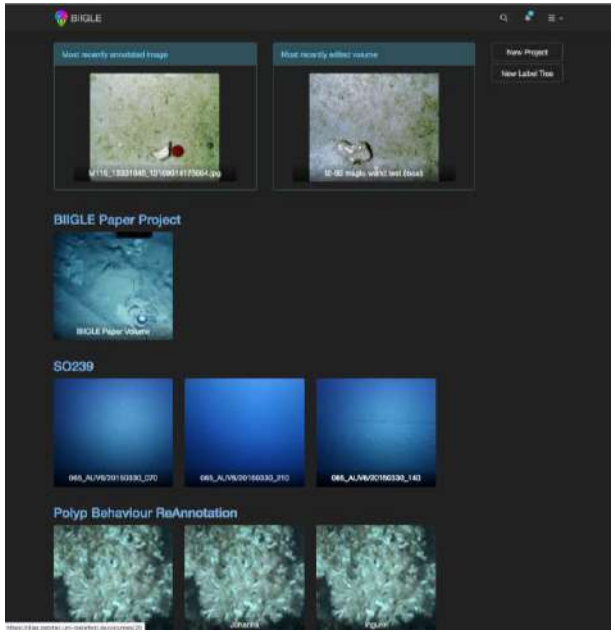


BIIGLE 2.0

OLIVIER SOUBIGOU
DFO/NSE/NE

CATHERINE BORREMANS
REM/BEEP/LEP

With the kind contribution of Prof. Tim Nattkemper

What is BIIGLE ?

Free online software for annotation of still images and videos

Developped by the Center for Biotechnology (CeBiTec) & Bielefeld University (Germany)

Biodata Mining Group
Bielefeld University

GEOMAR
Helmholtz-Zentrum für Ozeanforschung Kiel

ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

SENCKENBERG
world of biodiversity

Links and more information:

https://biigle.de/

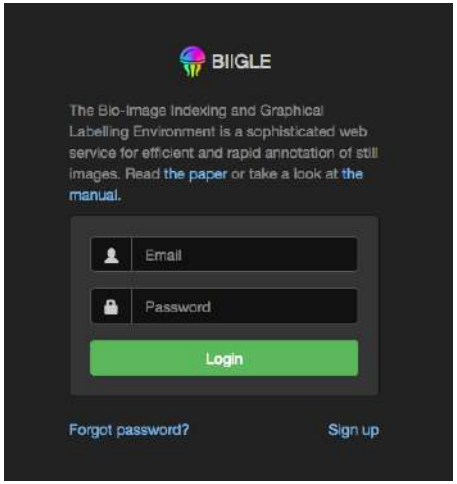
Langenkämper D, Zurowietz M, Schoening T and Nattkemper TW (2017) BIIGLE 2.0 - Browsing and Annotating Large Marine Image Collections. Front. Mar. Sci. 4:83. doi: 10.3389/fmars.2017.00083

BIIGLE Manual

BIIGLE

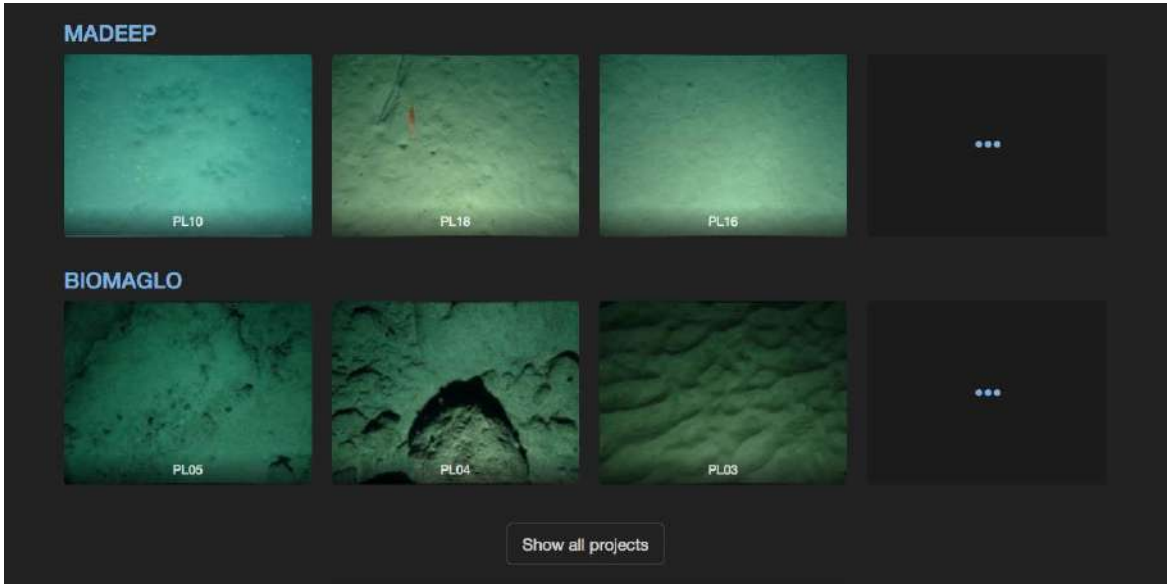
- Biigle & Ifremer history
- Web oriented platform, collaborative
- Centralized data storage
- Open source

Example of use of BIIGLE for taxa identification on still images



1) Sign in

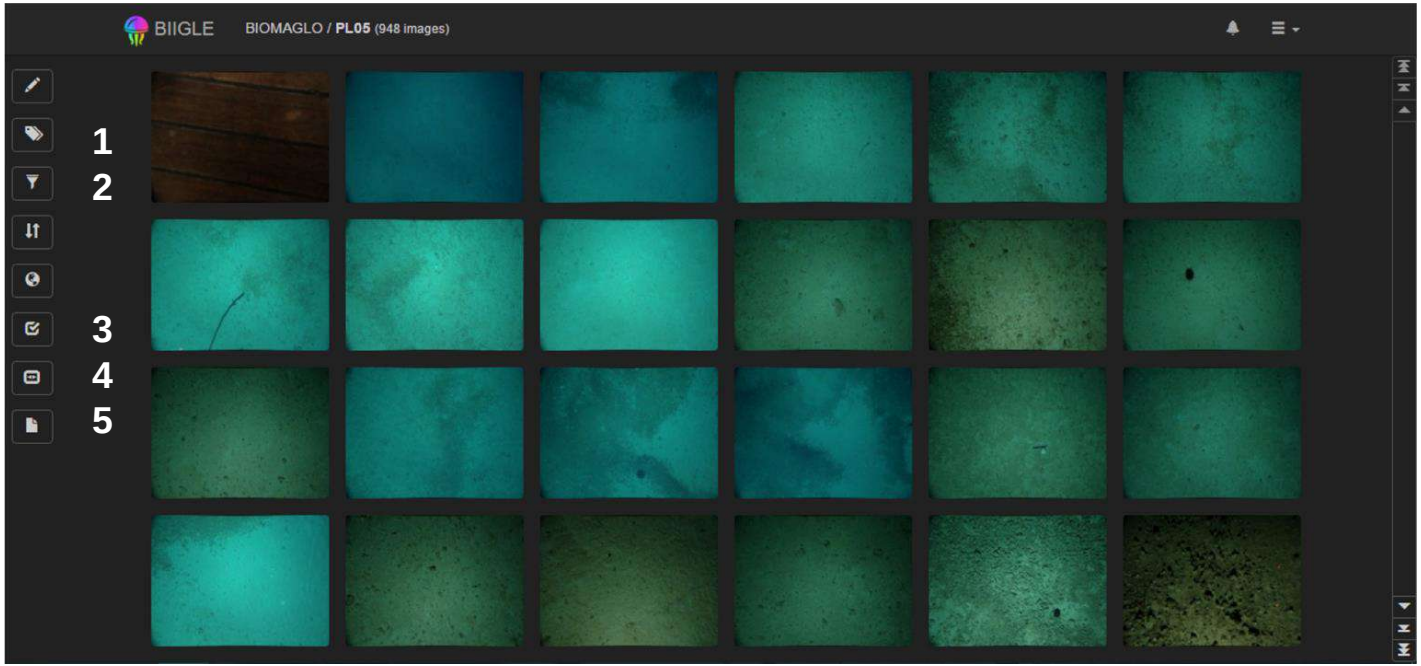
2) Select the project of interest



This part of the presentation is based on Mélissa Hanafi-Portier PhD thesis work

Example of use of BIIGLE for taxa identification on still images

Project navigation: 3) After selection of a **project** and **a volume, different functions available**



1) Give an overall label to the photo

2) Filter the photo by annotation or by users annotations

3) Use the Largo function

4) Compute the distance between laser points

5) Ask for a report (.csv) on all the photos

Example of use of BIIGLE for taxa identification on still images

Annotation interface: 4) When you select an image, you can annotate using the **label tree + selection of a polygon**

Label tree

- Newly created by user or WoRMS import
- Shareable between projects
- Import/export

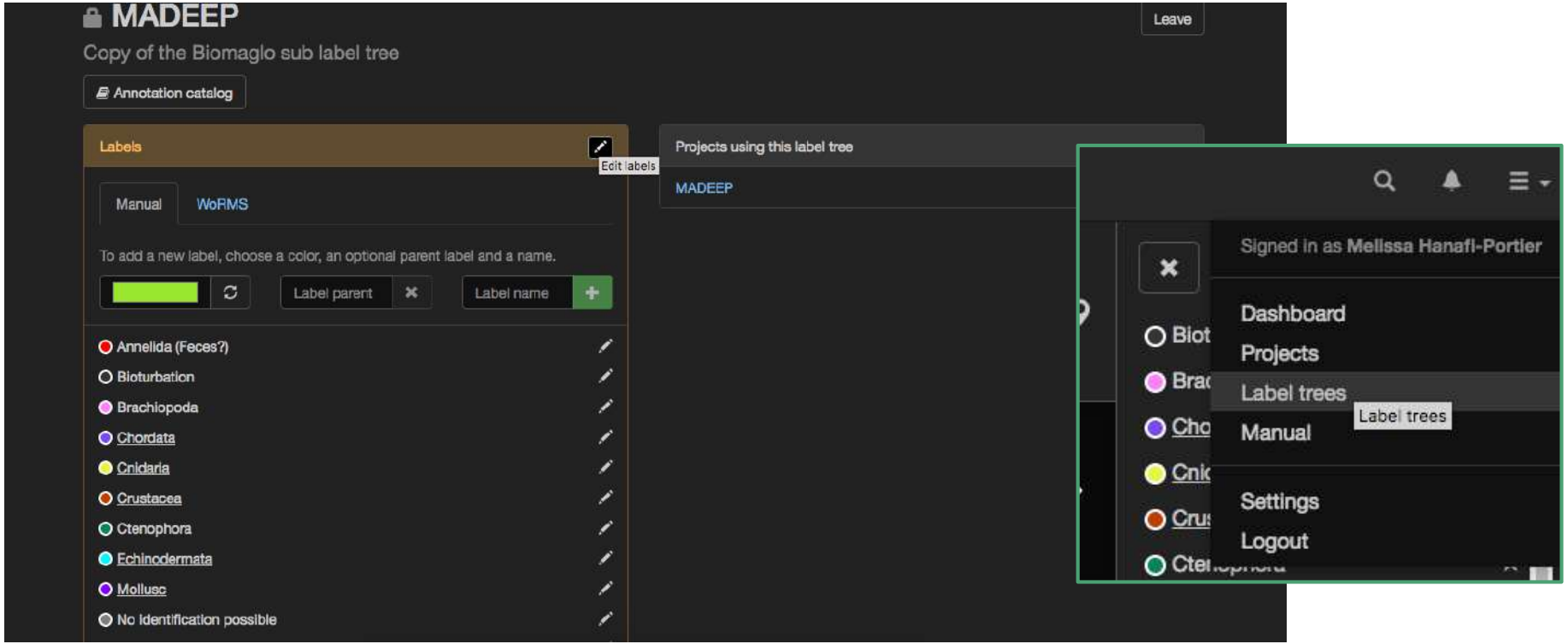
Annotation tools: selection of a polygon

Example of use of BIIGLE for taxa identification on still images

Annotation interface: Collaborative approach: external experts can be involved in the annotation process

Example of use of BIIGLE for taxa identification on still images

Edit a label tree: Labels can be edited, versioned and shared in collaboration with other users. You cannot delete a label that is in use / You can assign the new label to a parent label.



How we use BIIGLE for taxa identification?

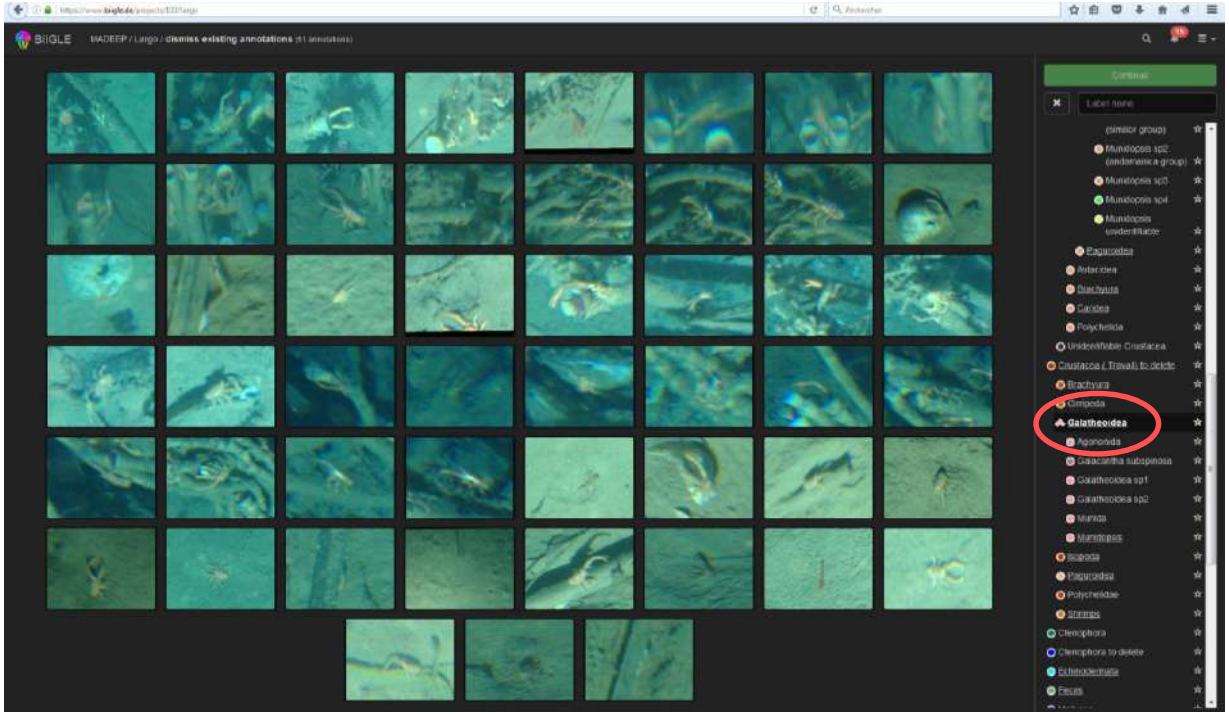
1) **First step: primary identification at low taxonomic level (by a deep-sea ecologist)**

Phylum, class, order (super-family) levels

How we use BIIGLE for taxa identification?

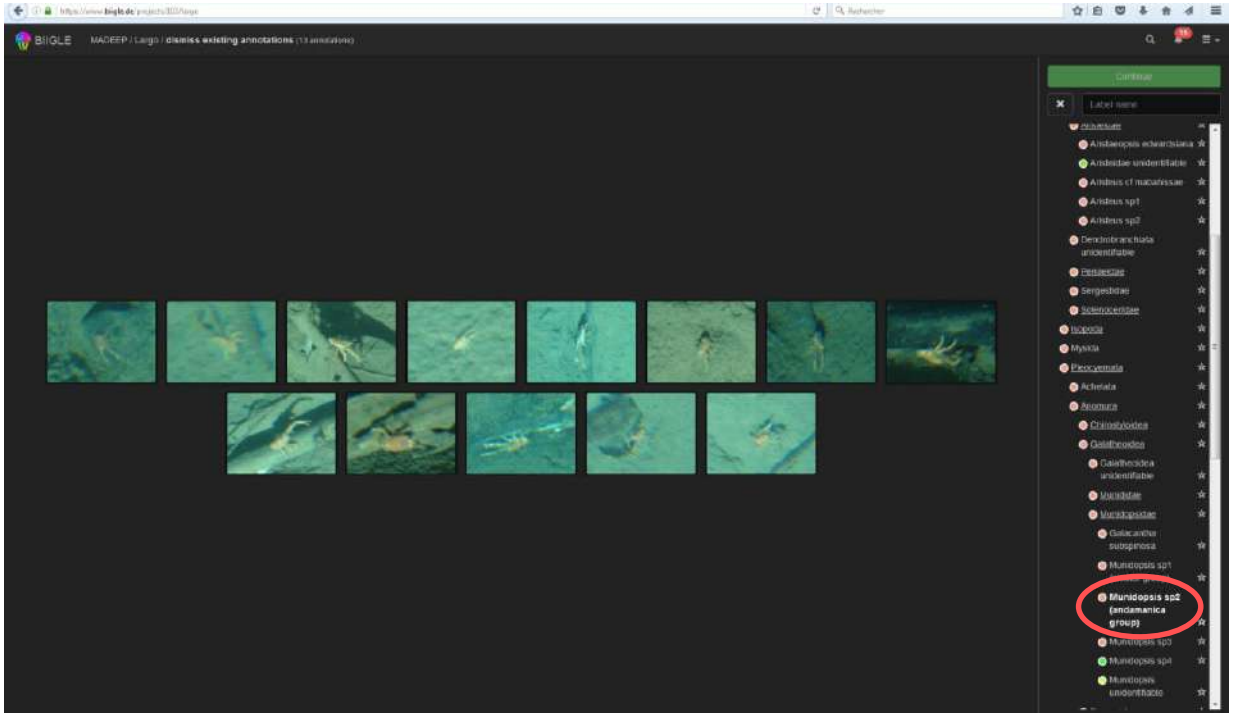
2) Improvement of taxonomic identification by experts

For example: a selection with Largo tool on Galathoidea



How we use BIIGLE for taxa identification?

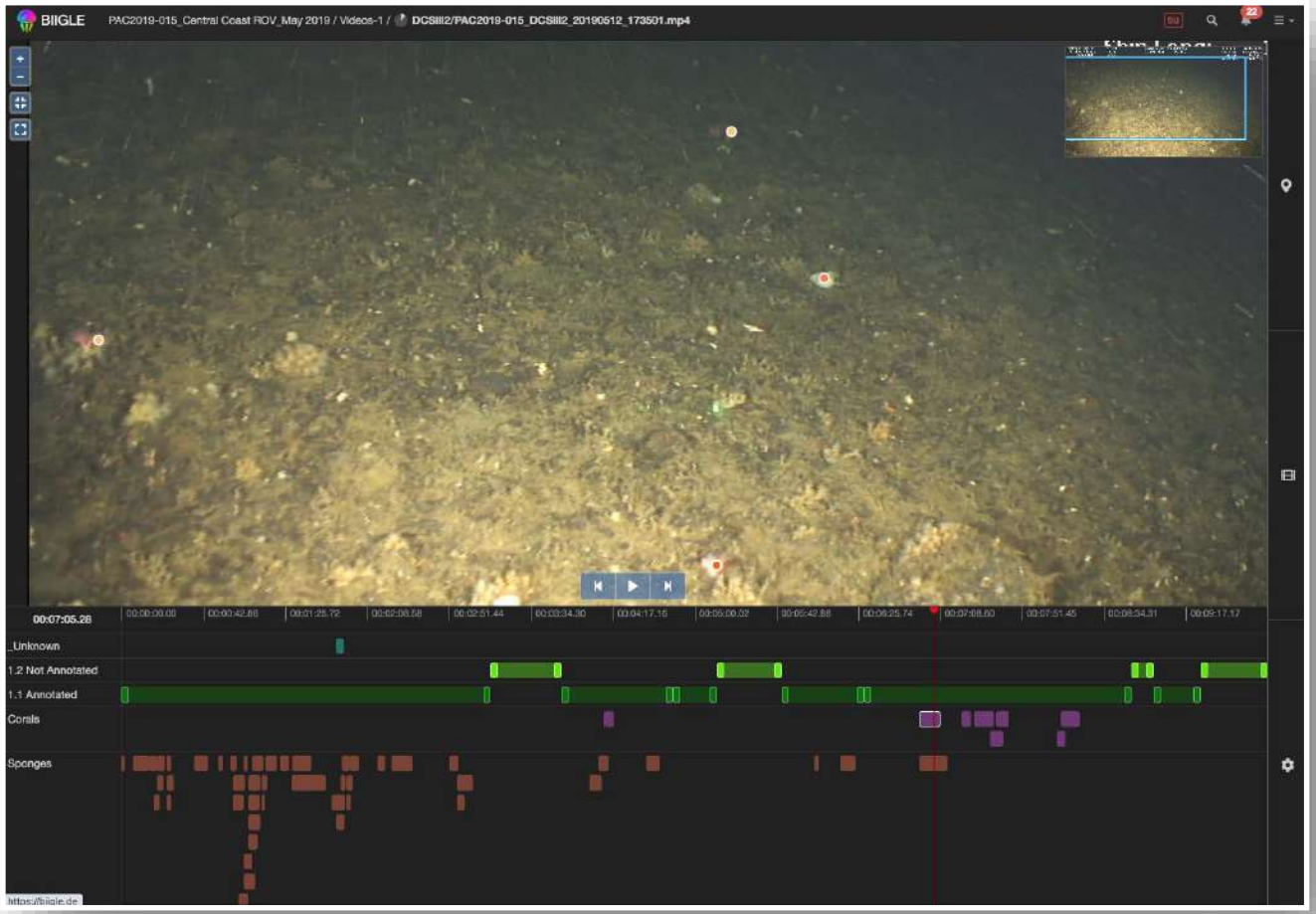
2) Improvement of taxonomic identification by experts



Family, genus (species) levels
Morphospecies

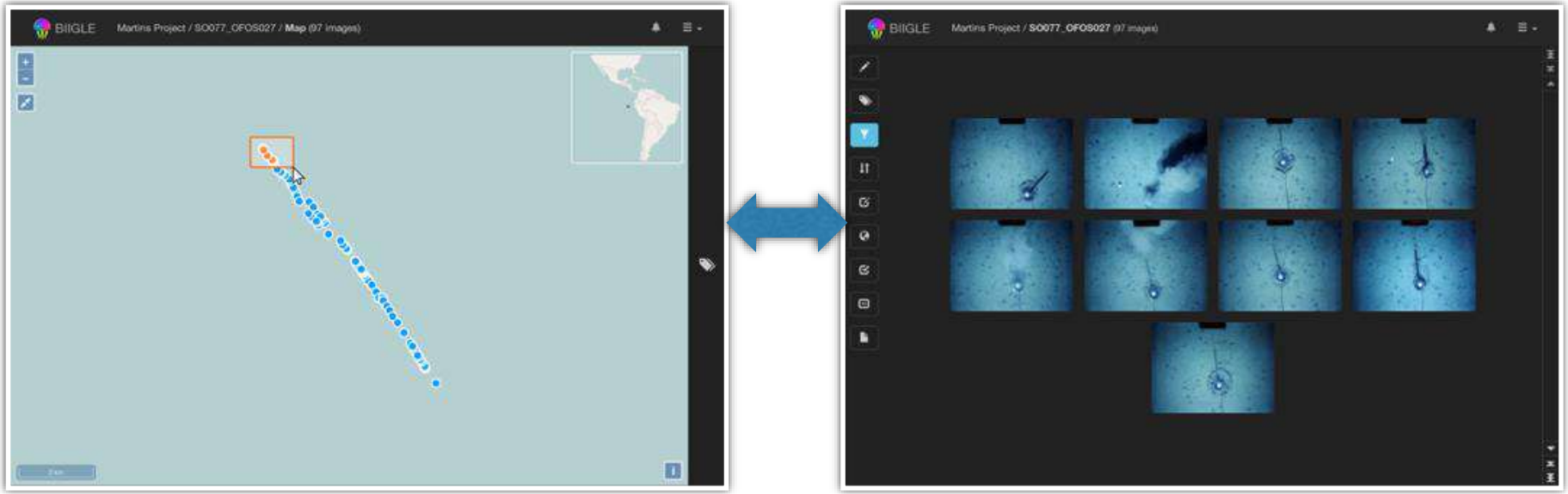
Tutorial (C. Borremans)

Video annotation



Other BIIGLE features

- Laser point detection
- Images metadata
- Different formats of reports (exports)



Geospatial browsing, filtering/gating and visualization

Deep Learning: Example of the assessment of benthic communities in the PAP zone with MAIA

- assessment of benthic communities in the PAP zone
- 12k images
- 30k annotations
- 19 classes

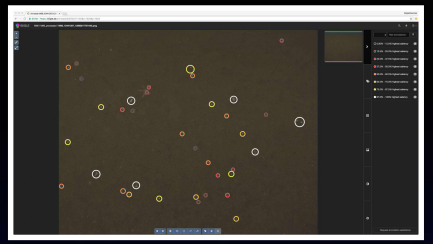
National Oceanography Centre
NATURAL ENVIRONMENT RESEARCH COUNCIL

Biodata Mining Group
Bielefeld University

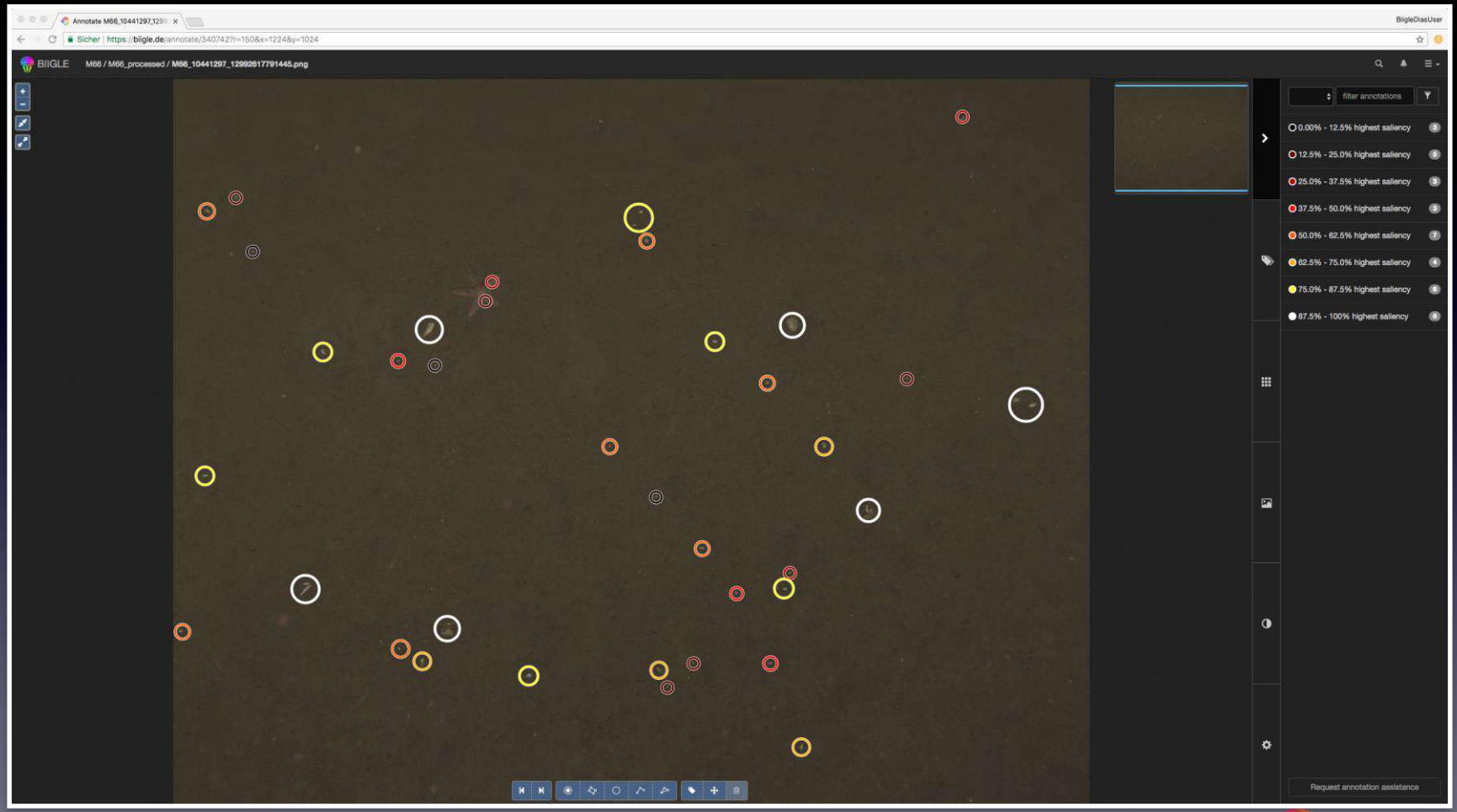
Unsupervised Detection with autoencoder Network

3293 images
M66, North Sea
(Data provided by NOC)

AE
3 fully connected layers
latent(hidden) layer
of 252 nodes
=10% of input size
<10h training time
on NVIDIA Titan X
~10^5 image patches



174k detections
ranked by saliency
1 sec / image



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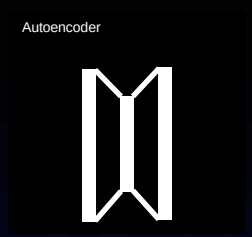
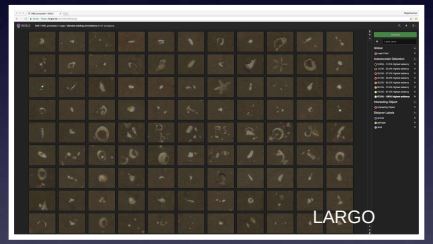
Unsupervised Detection with autoencoder Network



Human observer assistance



AE output (sorted),
classified into five saliency ranks
100-87.5% most salient
87.5-75% most salient
…

4 label categories
(interesting, animal, garbage, shell)
All labels are put into one
category (for now) for FCN training

MAIA—A machine learning assisted image annotation method for environmental monitoring and exploration. Martin Zurowietz, Daniel Langenkämper, Brett Hosking, Henry A. Ruhl, Tim W. Nattkemper, **PLoS ONE**, Nov 2018, https://doi.org/10.1371/journal.pone.0207498

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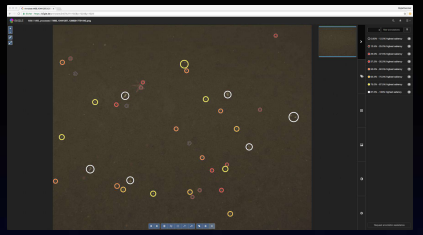
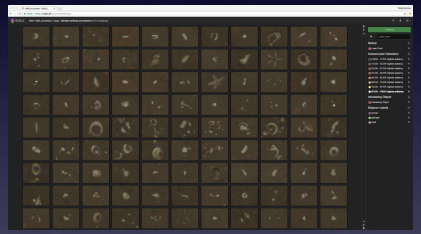
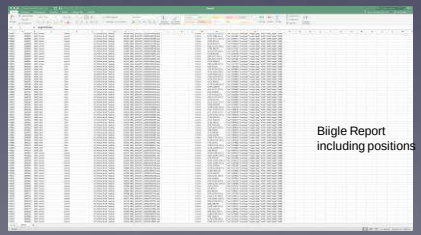
Unsupervised Detection with autoencoder Network

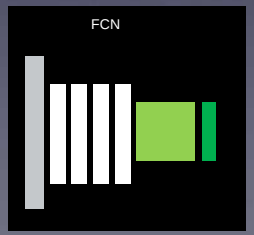


Human observer assistance



Fully convolutional network (FCN) [1] learning (5-40h on NVIDIA Titan X) and application





1 sec / image

semantic segmentation (segmentation + label for every pixel) red=> animal, blue => shell

[1] Long, J et al. "Fully convolutional networks for semantic segmentation." *CVPR*. 2015.

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Example of MAIA output

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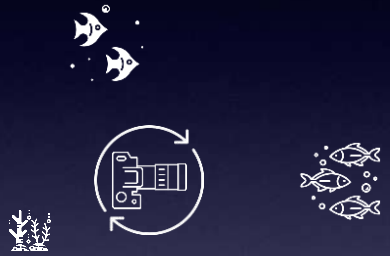
TIAMAT

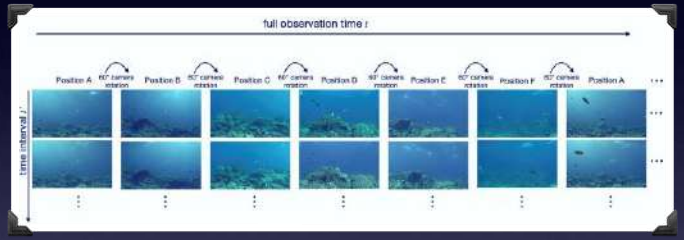
- ANR / DFG project
- University of Bielefeld: machine learning
- Ifremer: spatial integration, visualization and analysis
- Datasets: observatories, exploration

Deep Learning: Classification or tropical fish in rotating stationary observatories

1. A stationary video camera turns 60° every 30s



2. The resulting time series can be used to monitor a bigger area



3. AI is used to detect „interesting“ objects without any human input using…

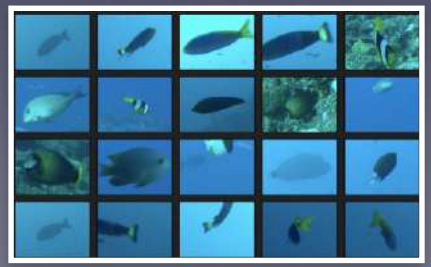
…Dino

Caron et al. „Emerging Properties in Self-Supervised Vision Transformers“, ICCV 2021

…Movement

4. A machine learning Algorithm is trained on the manual annotations to detect fish

5. The AI automatically detects fish



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BIIGLE in Ifremer (since January 2021)

https://biigle.ifremer.fr/

- Ask for an account

- Access to the data

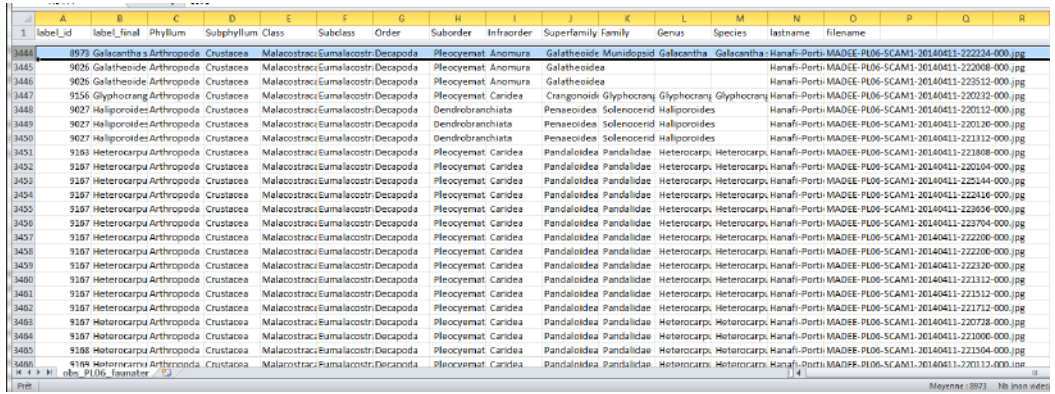
  ! mp4 format for videos

- Projects, volumes, label tree,… to be defined by the user

Contacts: Olivier Soubigou, Mickael Dequidt, Catherine Borremans

Geo-referencing /quantifiying data using Adelie software

BIIGLE export file



label_id	label_final	Phyllum	Subphyllum	Class	Subclass	Order	Suborder	Infraorder	Superfamily	Family	Genus	Species	lastname	filename
8973	Galacantha s	Arthropoda	Crustacea	Malacostraci	Eumalacostr	Decapoda	Pleocyemat	Anomura	Galatheoide	Munidopsid	Galacantha	Galacantha	Hanafi-Porti	MADEE-PL06-SCAM1-20140411-222224-000.jpg
9026	Galatheoide	Arthropoda	Crustacea	Malacostraci	Eumalacostr	Decapoda	Pleocyemat	Anomura	Galatheoidea				Hanafi-Porti	MADEE-PL06-SCAM1-20140411-222008-000.jpg
9026	Galatheoide	Arthropoda	Crustacea	Malacostraci	Eumalacostr	Decapoda	Pleocyemat	Anomura	Galatheoidea				Hanafi-Porti	MADEE-PL06-SCAM1-20140411-223512-000.jpg
9156	Glyphocrang	Arthropoda	Crustacea	Malacostraci	Eumalacostr	Decapoda	Pleocyemat	Caridea	Crangonoidi	Glyphocranj	Glyphocranj	Glyphocranj	Hanafi-Porti	MADEE-PL06-SCAM1-20140411-220232-000.jpg
9027	Haliporoides	Arthropoda	Crustacea	Malacostraci	Eumalacostr	Decapoda	Dendrobranchiata		Penaeoidea	Solenocerid	Haliporoides		Hanafi-Porti	MADEE-PL06-SCAM1-20140411-220112-000.jpg
9027	Haliporoides	Arthropoda	Crustacea	Malacostraci	Eumalacostr	Decapoda	Dendrobranchiata		Penaeoidea	Solenocerid	Haliporoides		Hanafi-Porti	MADEE-PL06-SCAM1-20140411-220120-000.jpg
9027	Haliporoides	Arthropoda	Crustacea	Malacostraci	Eumalacostr	Decapoda	Dendrobranchiata		Penaeoidea	Solenocerid	Haliporoides		Hanafi-Porti	MADEE-PL06-SCAM1-20140411-221312-000.jpg
9163	Heterocarpu	Arthropoda	Crustacea	Malacostraci	Eumalacostr	Decapoda	Pleocyemat	Caridea	Pandaloidea	Pandalidae	Heterocarpu	Heterocarpu	Hanafi-Porti	MADEE-PL06-SCAM1-20140411-221808-000.jpg
9167	Heterocarpu	Arthropoda	Crustacea	Malacostraci	Eumalacostr	Decapoda	Pleocyemat	Caridea	Pandaloidea	Pandalidae	Heterocarpu	Heterocarpu	Hanafi-Porti	MADEE-PL06-SCAM1-20140411-220104-000.jpg
9167	Heterocarpu	Arthropoda	Crustacea	Malacostraci	Eumalacostr	Decapoda	Pleocyemat	Caridea	Pandaloidea	Pandalidae	Heterocarpu	Heterocarpu	Hanafi-Porti	MADEE-PL06-SCAM1-20140411-225144-000.jpg
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9167	Heterocarpu	Arthropoda	Crustacea	Malacostraci	Eumalacostr	Decapoda	Pleocyemat	Caridea	Pandaloidea	Pandalidae	Heterocarpu	Heterocarpu	Hanafi-Porti	MADEE-PL06-SCAM1-20140411-223656-000.jpg
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9167	Heterocarpu	Arthropoda	Crustacea	Malacostraci	Eumalacostr	Decapoda	Pleocyemat	Caridea	Pandaloidea	Pandalidae	Heterocarpu	Heterocarpu	Hanafi-Porti	MADEE-PL06-SCAM1-20140411-222200-000.jpg
9167	Heterocarpu	Arthropoda	Crustacea	Malacostraci	Eumalacostr	Decapoda	Pleocyemat	Caridea	Pandaloidea	Pandalidae	Heterocarpu	Heterocarpu	Hanafi-Porti	MADEE-PL06-SCAM1-20140411-223320-000.jpg
9167	Heterocarpu	Arthropoda	Crustacea	Malacostraci	Eumalacostr	Decapoda	Pleocyemat	Caridea	Pandaloidea	Pandalidae	Heterocarpu	Heterocarpu	Hanafi-Porti	MADEE-PL06-SCAM1-20140411-221312-000.jpg
9167	Heterocarpu	Arthropoda	Crustacea	Malacostraci	Eumalacostr	Decapoda	Pleocyemat	Caridea	Pandaloidea	Pandalidae	Heterocarpu	Heterocarpu	Hanafi-Porti	MADEE-PL06-SCAM1-20140411-221512-000.jpg
9167	Heterocarpu	Arthropoda	Crustacea	Malacostraci	Eumalacostr	Decapoda	Pleocyemat	Caridea	Pandaloidea	Pandalidae	Heterocarpu	Heterocarpu	Hanafi-Porti	MADEE-PL06-SCAM1-20140411-221712-000.jpg
9167	Heterocarpu	Arthropoda	Crustacea	Malacostraci	Eumalacostr	Decapoda	Pleocyemat	Caridea	Pandaloidea	Pandalidae	Heterocarpu	Heterocarpu	Hanafi-Porti	MADEE-PL06-SCAM1-20140411-220728-000.jpg
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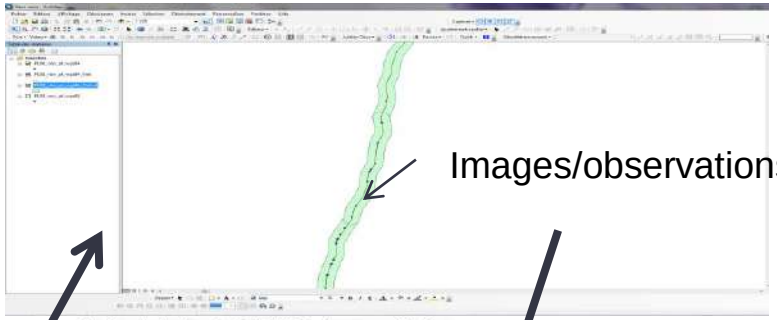
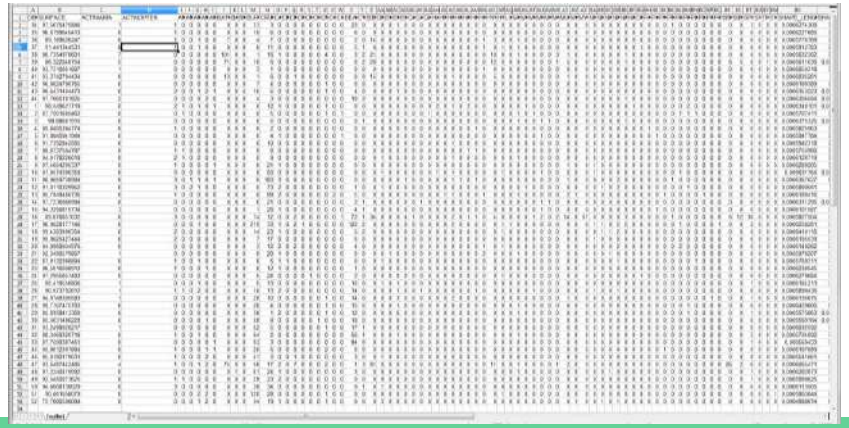
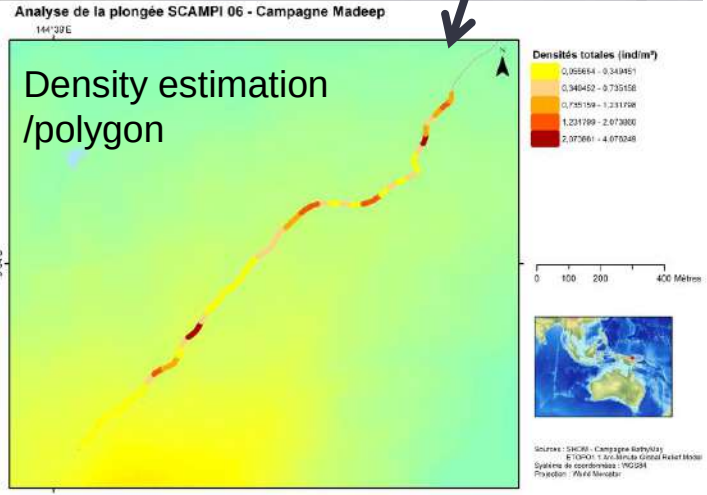
9188	Heterocarpu	Arthropoda	Crustacea	Malacostraci	Eumalacostr	Decapoda	Pleocyemat	Caridea	Pandaloidea	Pandalidae	Heterocarpu	Heterocarpu	Hanafi-Porti	MADEE-PL06-SCAM1-20140411-220112-000.jpg

Sampling units (polygons)



Images/observations

ADELIE input file



Data import