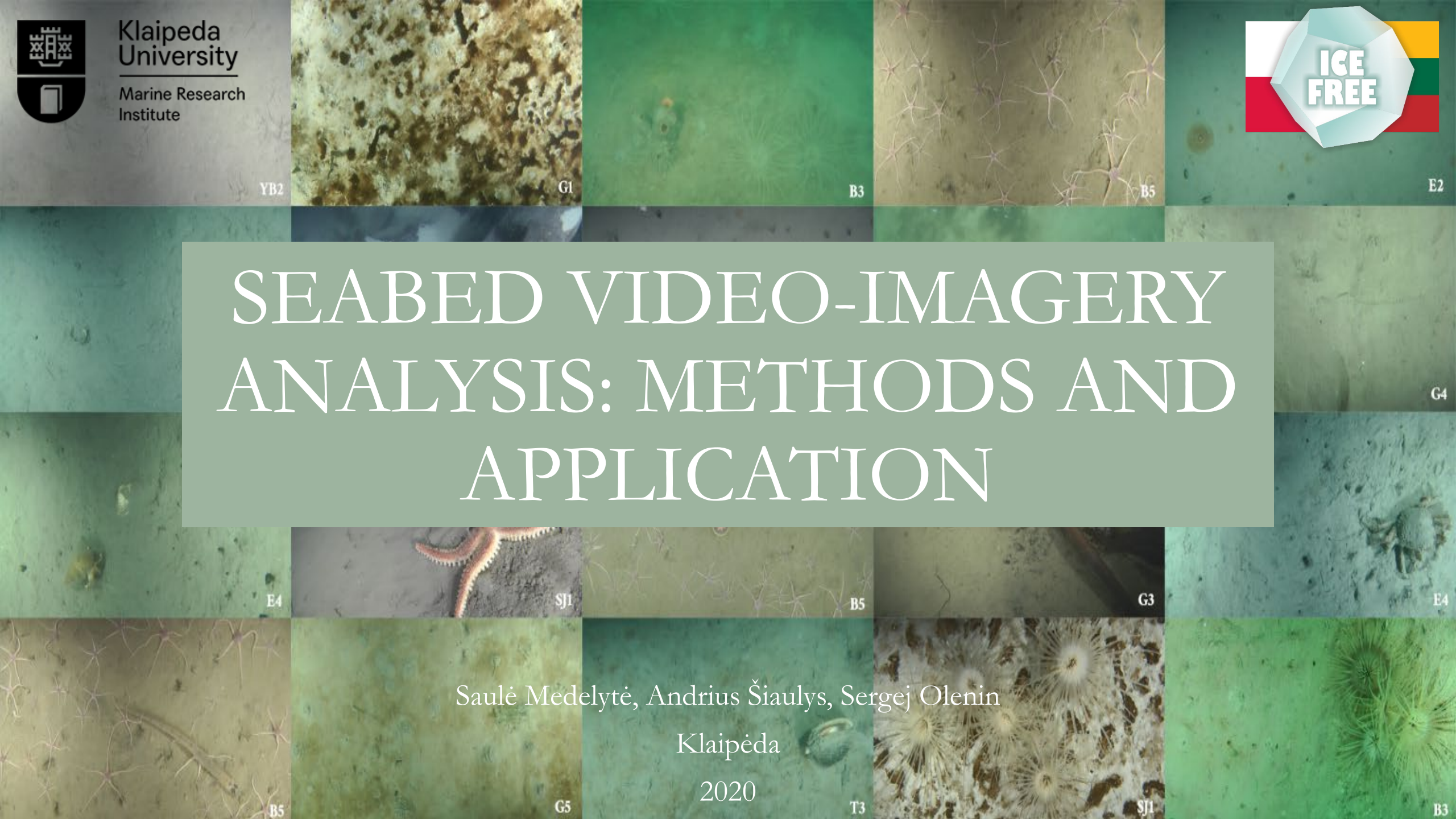


Klaipeda University
Marine Research Institute

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# SEABED VIDEO-IMAGERY ANALYSIS: METHODS AND APPLICATION

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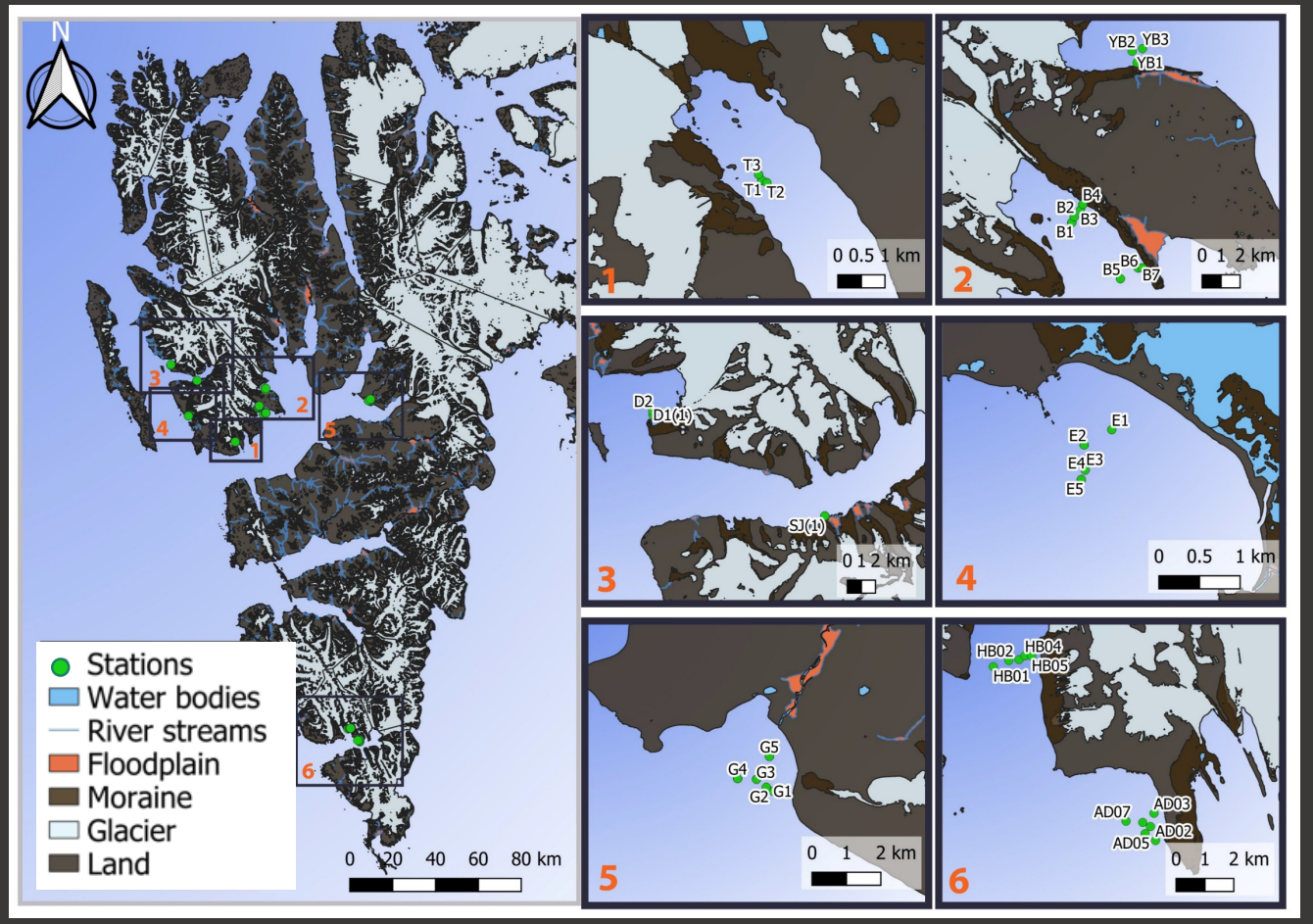
# Methods and Study area

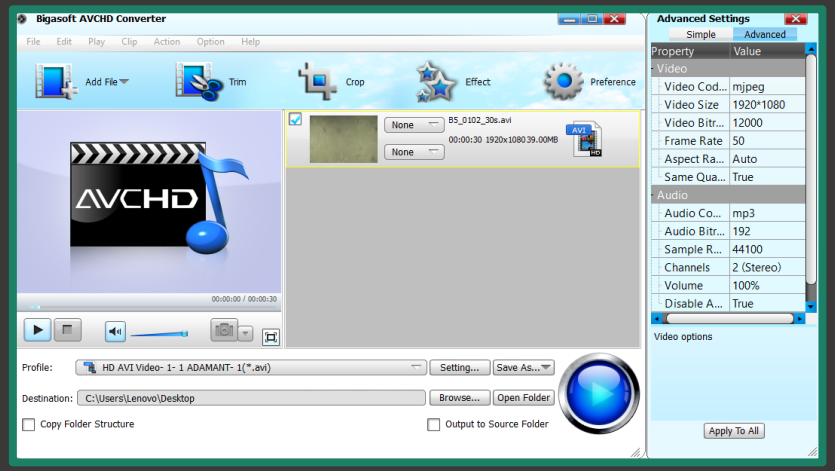
- An underwater video survey was carried out during 2018-2019 summer months in 9 bays;
- In total 271 min of video material were collected
- Video footage was transformed into 204 video mosaics which were used for visual analysis.

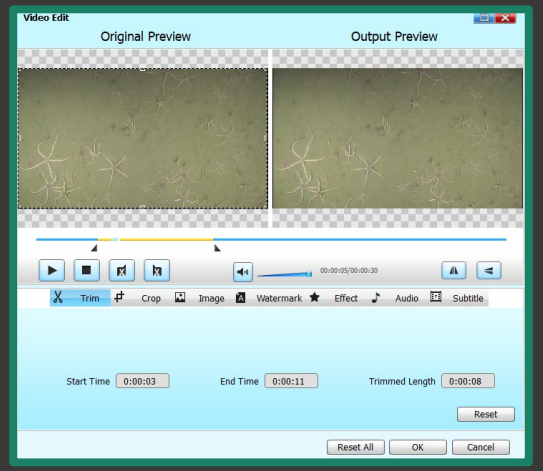


# Prt. 1 Video preprocessing

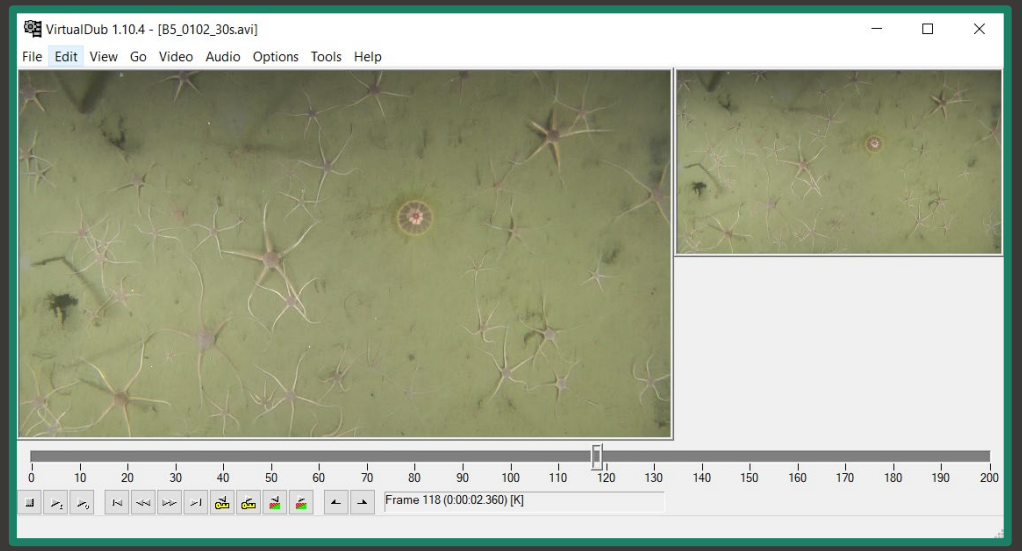
Trimming,

changing codec



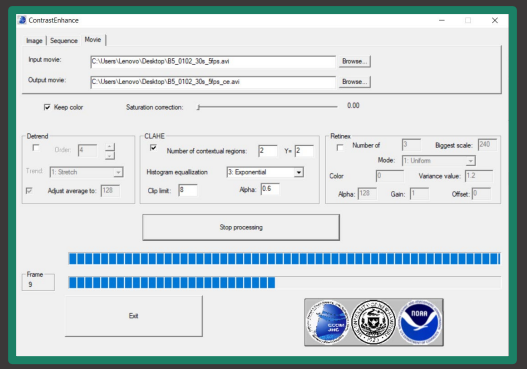



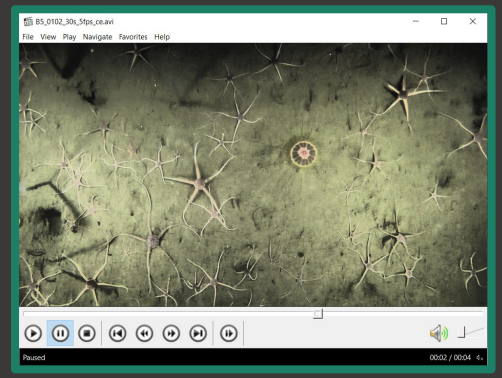

Reducing frame rate and frame size

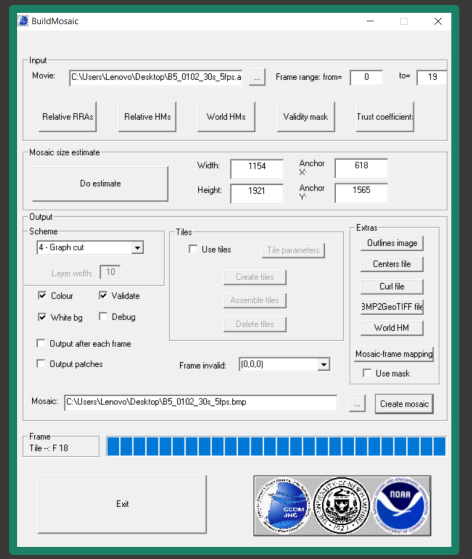


# Prt.2 Mosaicing

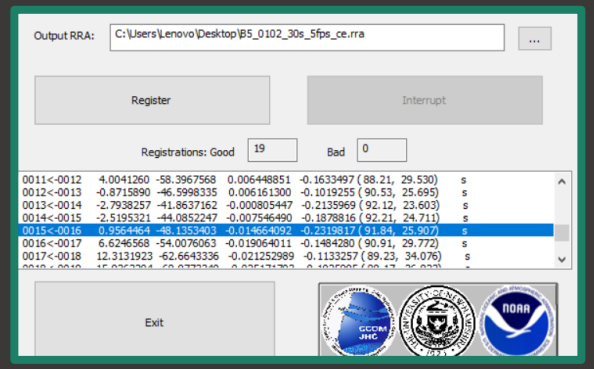
Enhancing Contrast

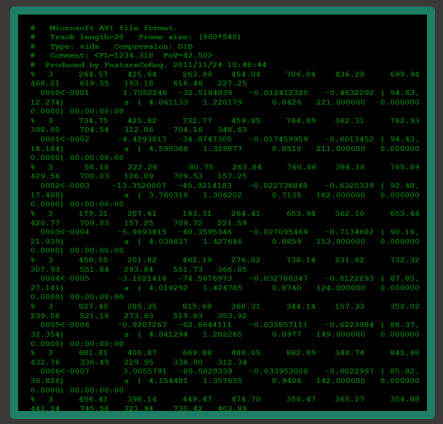


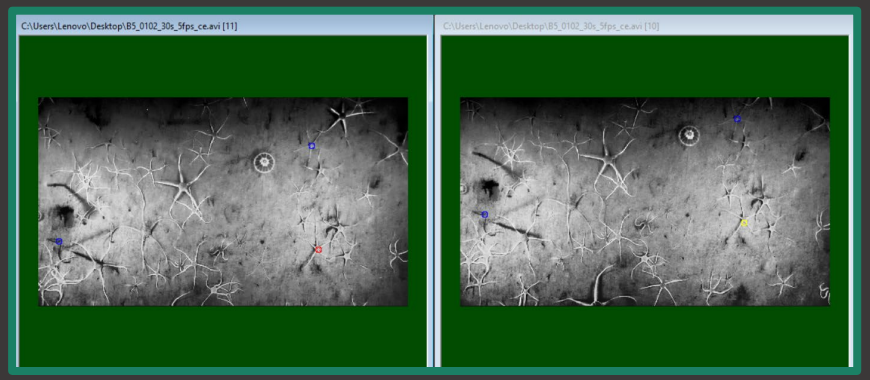




Pair-wise registration



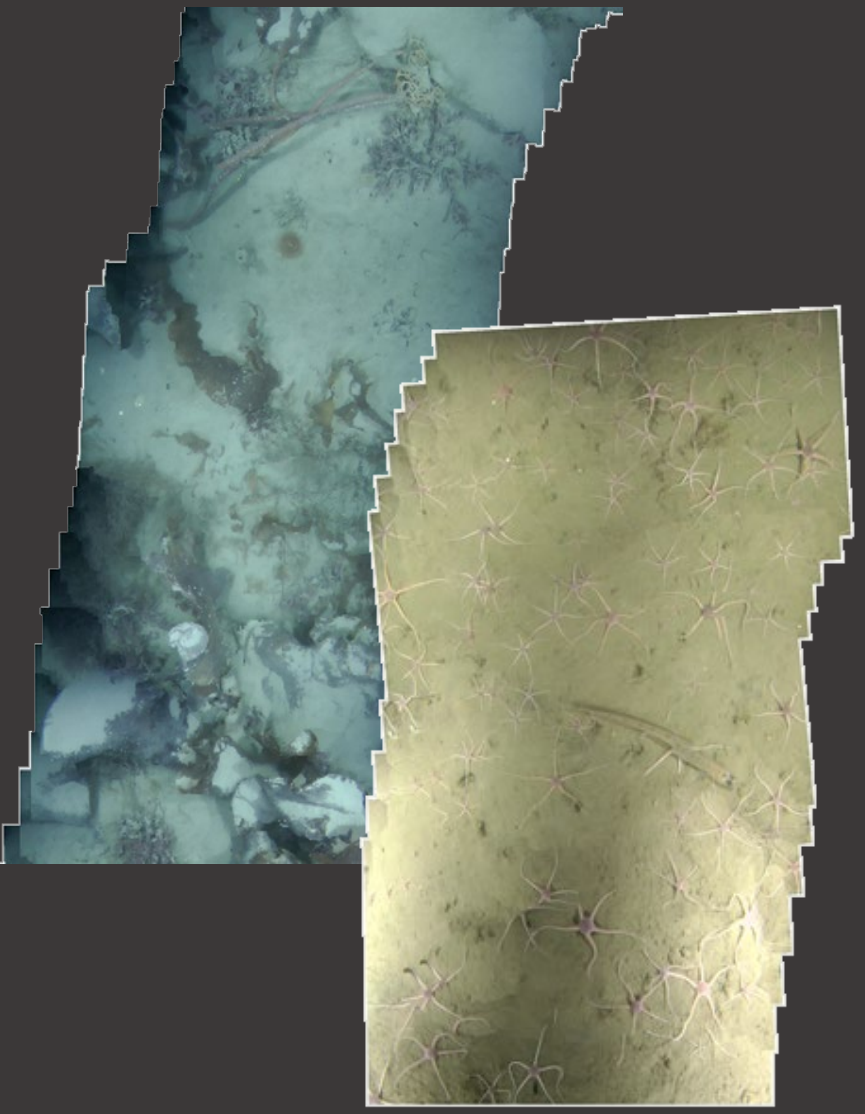



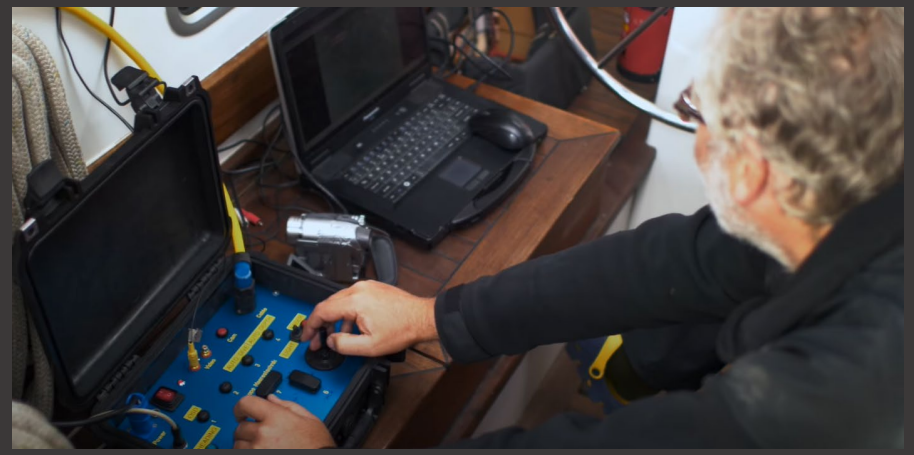
Pair-wise registration manually if needed




Building mosaic

# Video mosaicing

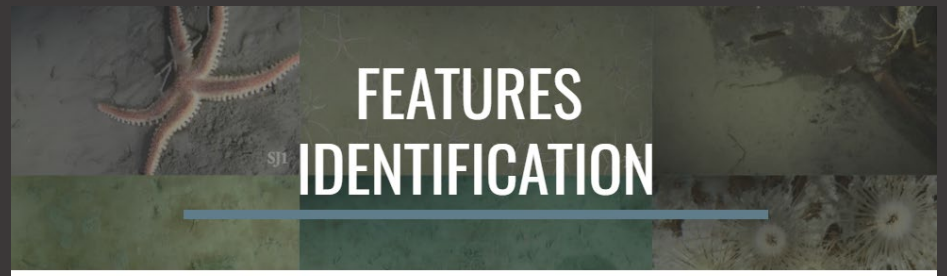


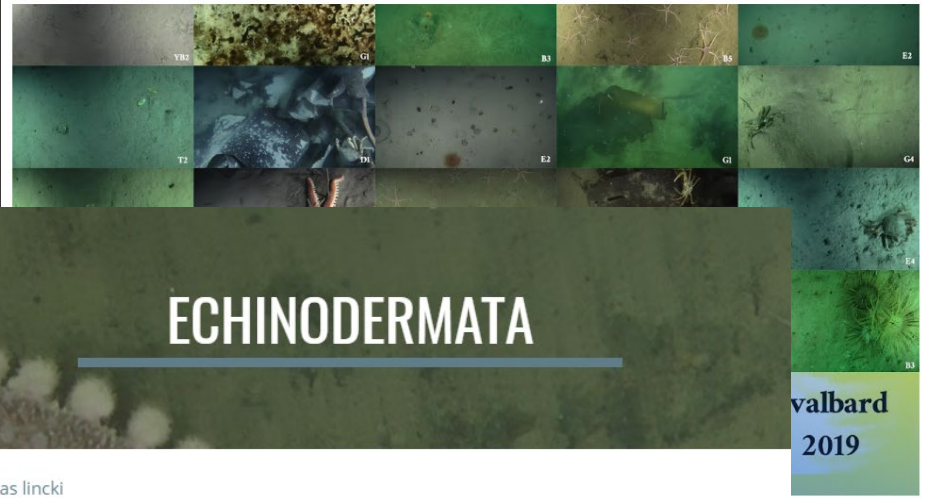


| Data | Vietovė | ROV tran./min | UW moz. |
|---|---|---|---|
| **24.07.2019** | Gipsvika | 5 / 60 min | 67 |
| **26.07.2019** | Yoldiabukta | 3 / 30 min | 1 |
| **27.07.2019** | Borebukta | 7 / 68 min | 43 |
| **27.07.2019**<br>**28.07.2019** | Eidembukta | 3 / 15 min | 15 |
| **29.07.2019** | St. Johnsfjorden | 1 / 17 min | 10 |
| **29.07.2019** | Dahlbrebukta | 2 / 37 min | 11 |
| **30.07.2019** | Trygghamma | 3 / 31 min | 19 |
| **31.07.2018** | Adriabukta | 7 /27 min | 24 |
| **31.07.2018** | Burgerbukta | 5 / 14 min | 14 |
| **Iš viso** | | 26 /271 min | 204 |

# Features ID

- Features identification catalogue was created and freely available to anyone who received a link;
- 72 features were identified to the least possible taxonomic level. Common identified features were Mollusca (19), Arthropoda (13) and Annelida (11)
- To avoid possible errors it was decided to use higher taxonomic rank for features that were debatable, physical features were discarded so at the end 43 most reliable ones were used for further analysis.
- Many thanks to prof. Marcin Węsławski, dr. Yuri Kantor, dr. Alexey V. Golikov, dr. Piotr Balazy, Kajatan Deja, V. Spiridonov, Aleksandr I. Kokorin and Vitaly L. Syomin who helped with the taxonomic identification of benthic species.
- Some pisces and bryozoa are still not fully identified. Identification of these groups would increase diversity.



# Features ID

- Some features belongs to the same taxonomic rank, but one is identified to lower rank than other e.g. ***Euchone* sp.** belongs to Sabellidae family, but **Sabelidae** is also a feature that was given to an object which was hard to determine to species level;
- Similar example with **Bivalve siphon** and **Mya sp. siphon** features, both are Bivalves, however **Mya sp. siphon** is identified to lower taxonomic rank of genus.
- Some features were hard to identified due to a lack of image quality

Balanus

~~or Mytilus?~~

*Euchone* sp. feature

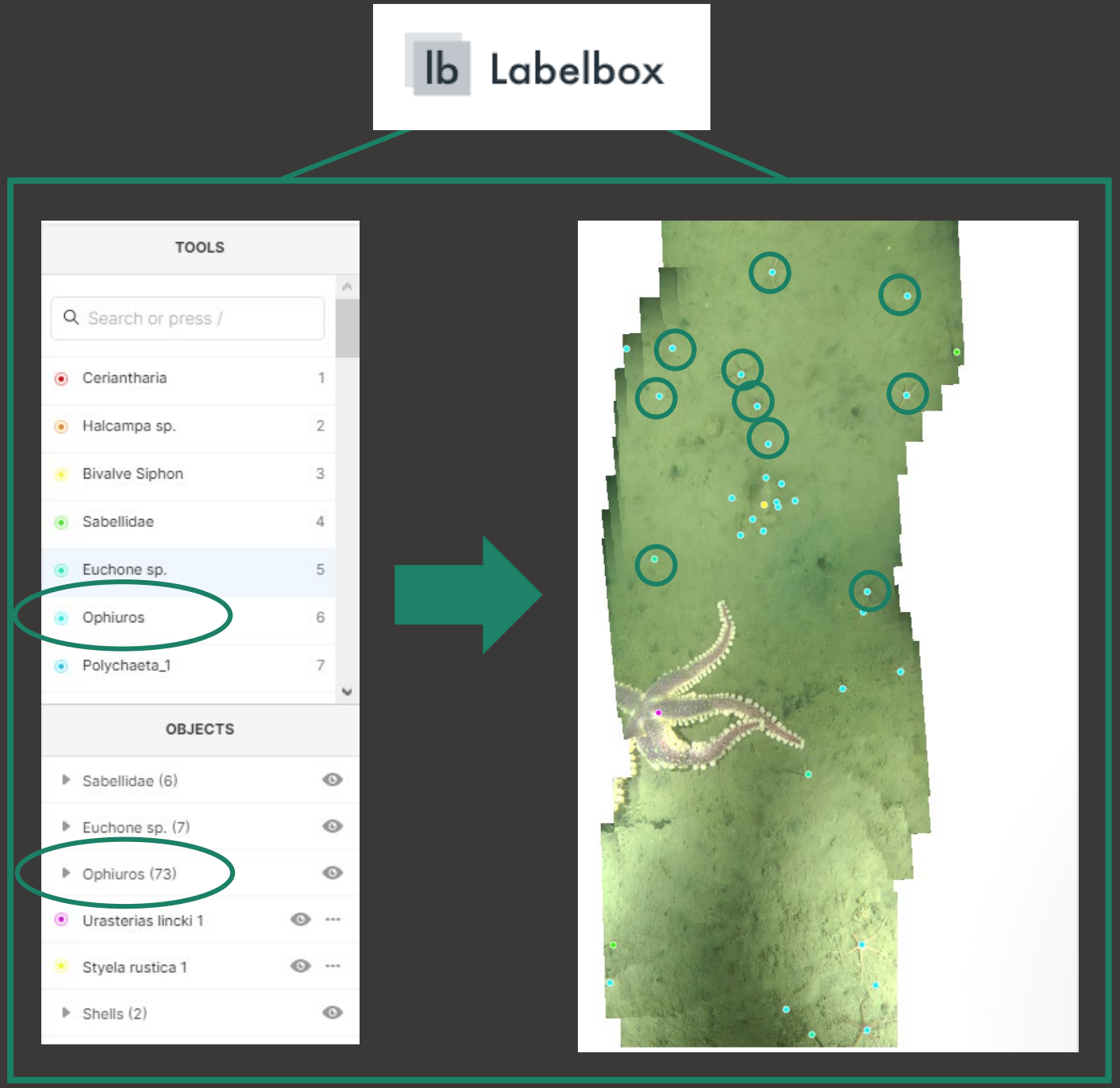
Sabellidae feature

Mya sp. siphon

Bivalve siphon

# Counting features

- Labelbox is a powerful image/video labeling tool for image classification, object detection and segmentation, here we used it for feature labeling on mosaics.



Labelbox

# Not only for counting

- Image segmentation and annotation of visual features.
- Extraction of biological information (abundance, dimensions of objects, area, etc.).
- Opportunities for automated image recognition.

TOOLS

| | |
|---|---|
| Tube dwelling polychaetes | 1 |
| Shrimps | 2 |
| Bivalvia siphons | 3 |
| Gastropoda | 4 |
| Pisces | 5 |
| Infaunal polychaetes | 6 |
| Bryozoa | 7 |
| Hyas species | 8 |
| Urasterias lincki | 9 |
| Cerianthus lloydii | |

OBJECTS

- Bivalvia siphons (2)
- Pisces (5)
- Bryozoa (4)
- Alcyonidium gelatinosum (47)
- Shells (3)
- Cobble/Pebble (21)
- Detritus (9)
- Barnacle (7)
- Hermit crab 1

# Other applications of Arctic video data

**DEMERSAL - A deep learning-based automated system for seabed imagery recognition and quantitative analysis**

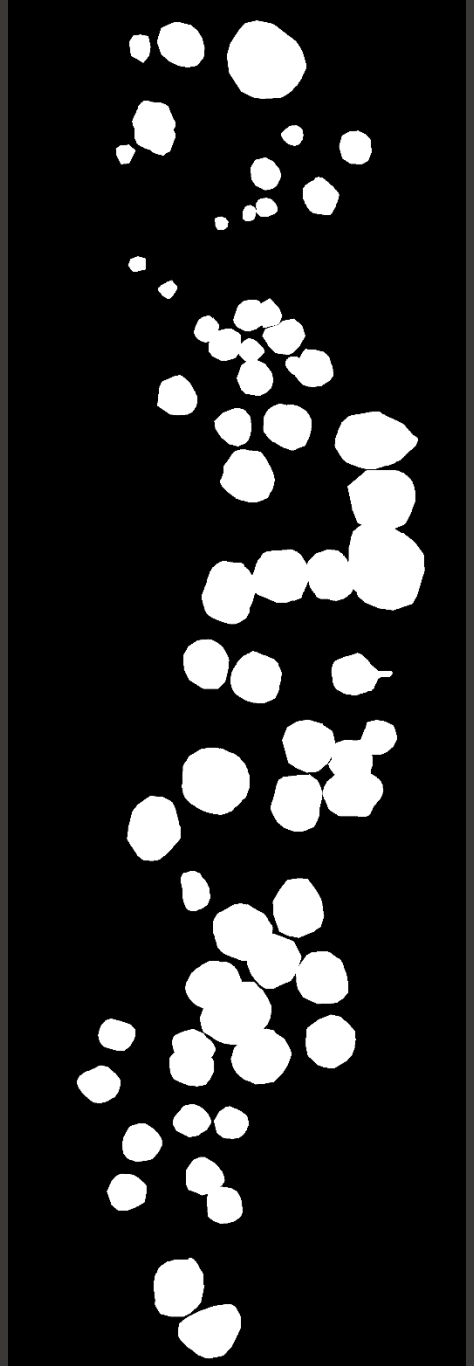
- Creating and sharing of annotated underwater video data for future development of image recognition tools for underwater imagery
- Development of automatic image recognition of Arctic benthos

*Together with Kaunas University of Technology*

# Sharing of annotated data

- Creating and sharing of annotated underwater video data for both biology and IT scientists
- Dataset consists of 47 video mosaics, 12 biological features, 2305 annotated objects, 4 experts

*Manuscript for “Data in Brief” journal*



# Towards automated image recognition

- Annotation of all objects of one class (Ophiuroidea) in two mosaics
- Two experts
- Deep learning based training
- Accuracy of automated recognition
- Expert sensitivity
- Partial annotation

*Manuscript for “Ecological informatics” journal*

Thank you!