

A diver in a dark wetsuit and scuba gear is positioned underwater, operating a camera mounted on a tripod. The diver is holding the camera's handle, and the tripod is set up on the seabed. The background shows a greenish, slightly murky underwater environment with some marine life visible. The text is overlaid on the upper half of the image.

DIGITAL PHOTOGRAMMETRY METHODS FOR BENTHIC RESEARCH – CURRENT APPLICATIONS AND FUTURE PERSPECTIVES

By Dimitar Berov & Georgi Hiebaum

IBER-BAS

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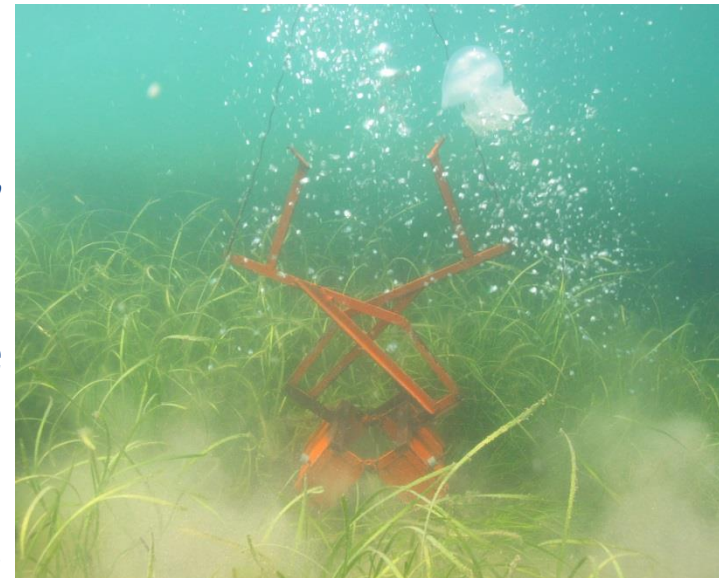
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2. Digital photogrammetry – IBER-BAS experience
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3. Concept for a new photogrammetry system

1. Use of photography in marine research

Limitations of marine benthic biological research :

- * The benthos is not directly accessible to humans
 - * Benthic samples give an 'abstract' of the 'real' underwater world
 - * humans need visual information to see the 'whole picture', to understand natural processes and patterns
- Or
- * 'A picture is worth a thousand worms' (Solan et al. 2003)

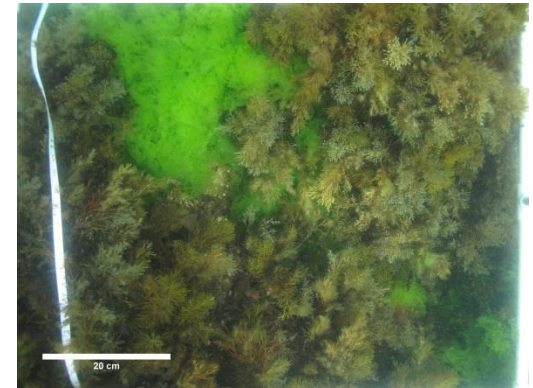
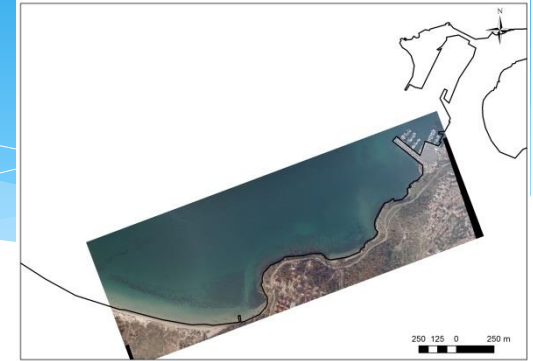


1. Photogrammetry –definition, usage

Photogrammetry: the practice of determining the geometric properties of objects from photographic images

Examples of use:

- Satellite and aerial mapping
- Geological, ecological and archaeological surveys
- microscopy

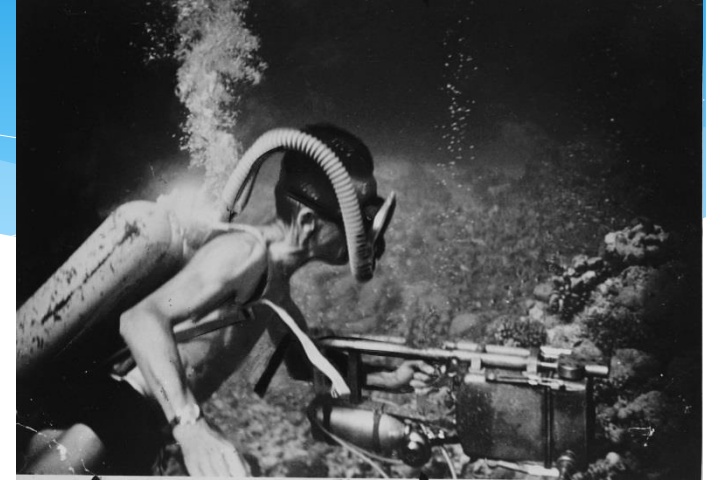


1. Use of photography in marine research

‘Classical’ usage of UW photography:

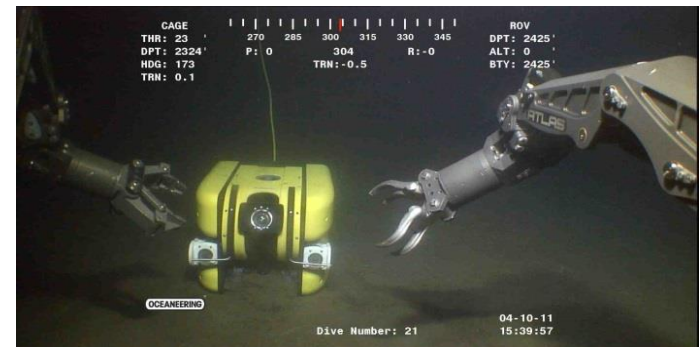
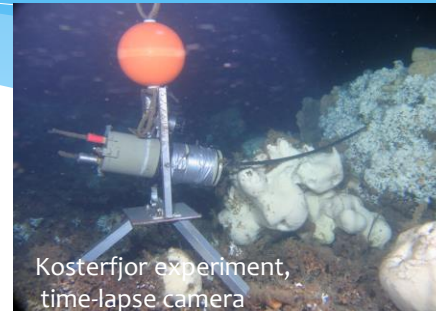
- First visual records of marine life
- Photo and film surveys
- Quantitative photogrammetry in benthic studies (since the 1960s)
- Submersibles and photo landers surveys of the deep-sea

Main limitation : amount of photos taken (data collected) underwater by divers and submersibles



1. Modern photo study methods – digital photography

- * Digital photography : unlimited photos, high resolution, easy data transmission, computerized image analysis, integration in databases
- * Usage in :
 - Deep-sea research: Photo landers and UW wired observatories
 - ROV/crawler/AUV systems

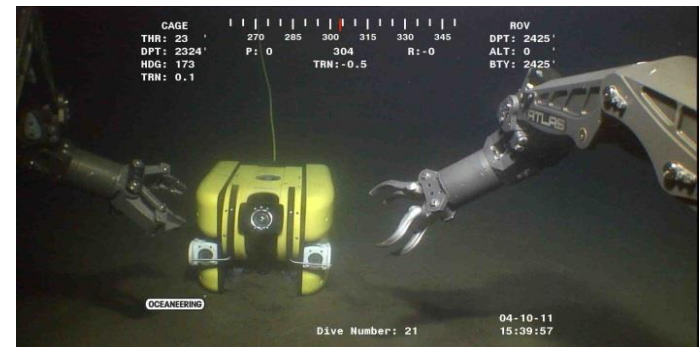
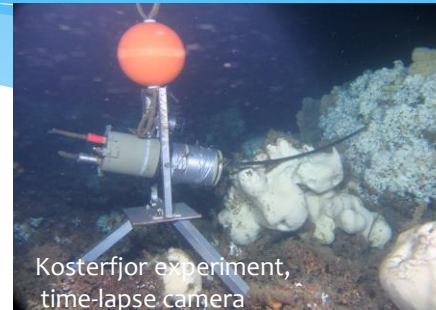


1. Modern photo study methods – digital photography

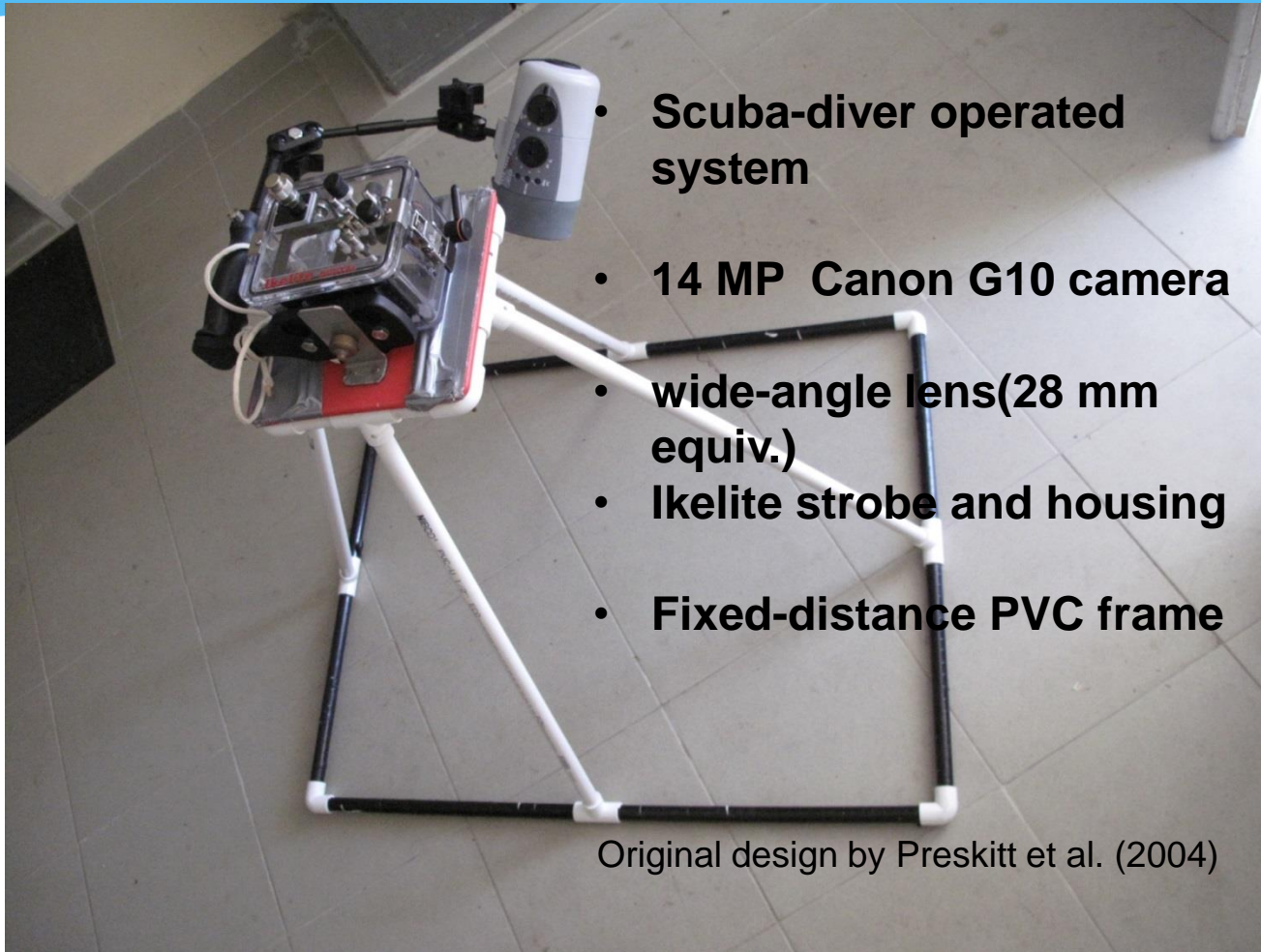
* Cons:

- High cost of owning and operating ROV/AUV systems
- Technically complex to deploy, operate and maintain

=> SCUBA surveys are still a viable option in shallow-water studies

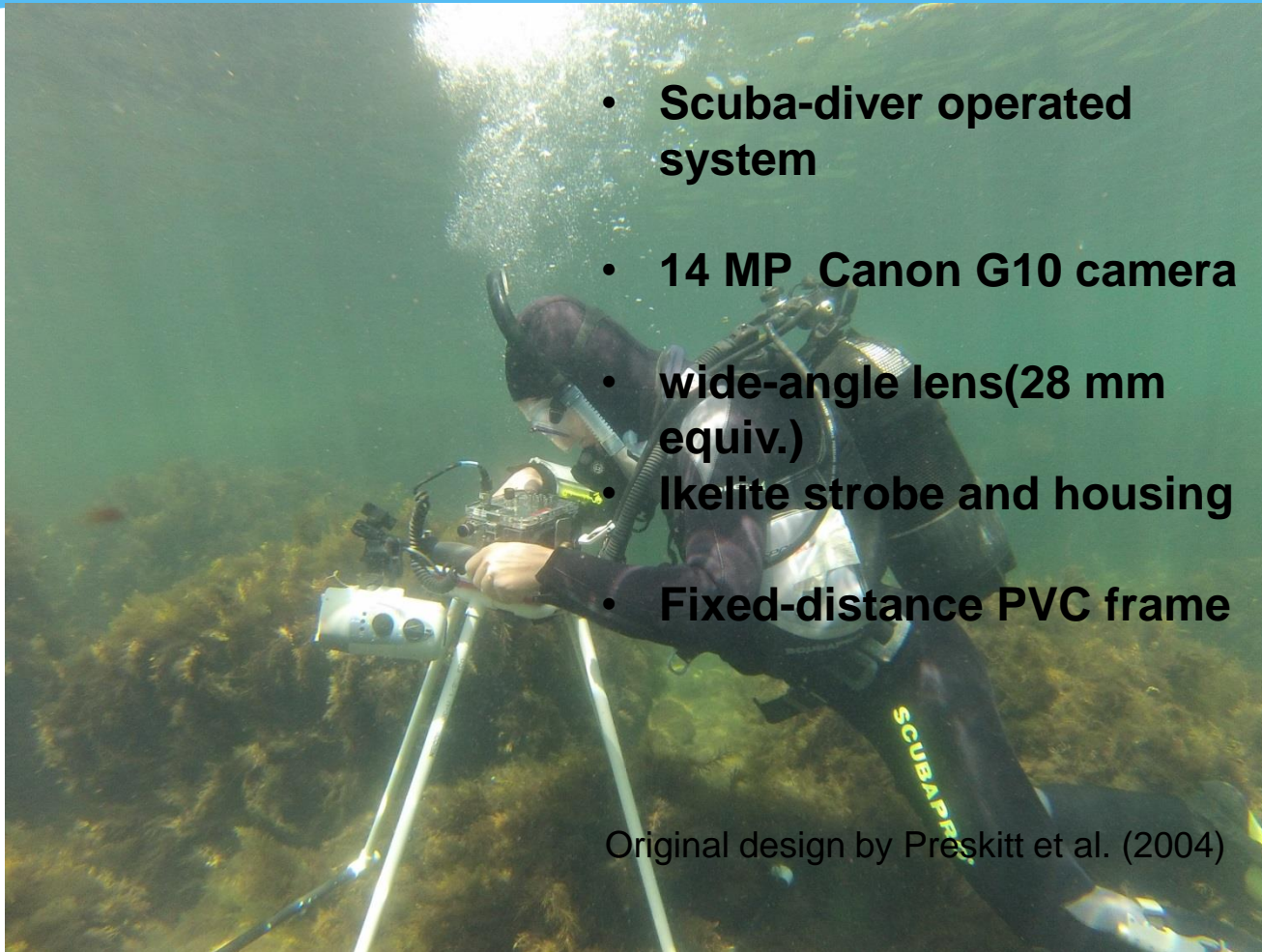


2.1 Digital photogrammetry IBER-BAS experience



2.1 Digital photogrammetry

IBER-BAS experience



- **Scuba-diver operated system**
- **14 MP Canon G10 camera**
- **wide-angle lens(28 mm equiv.)**
- **Ikelite strobe and housing**
- **Fixed-distance PVC frame**

Original design by Preskitt et al. (2004)

2.1 Digital photogrammetry – methodology



Image size from 1 m distance

0,4 pixels/cm² resolution

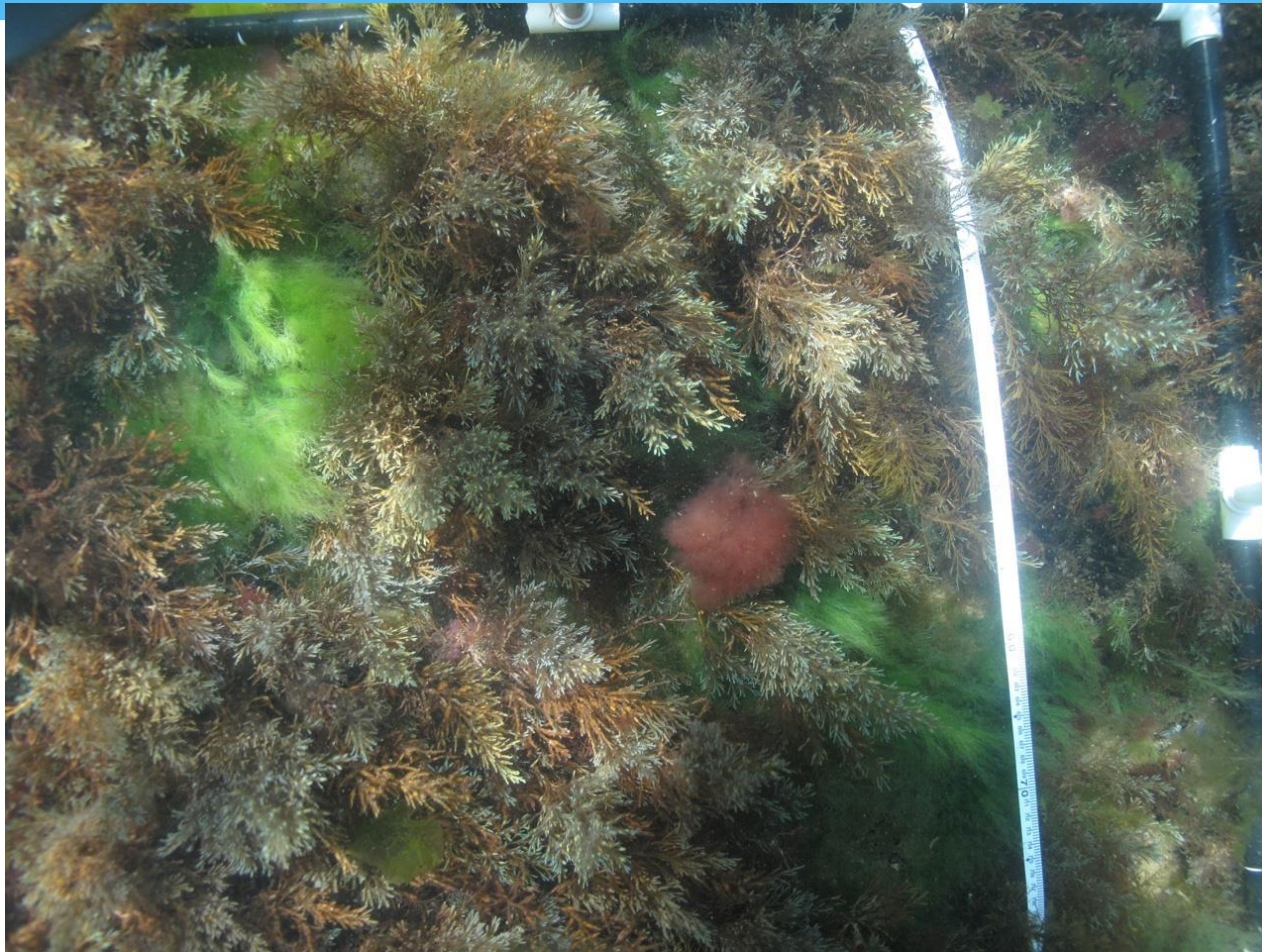
6138 cm²

68,2 cm

2.2 Digital photogrammetry – macroalgal communities survey

68,2 cm

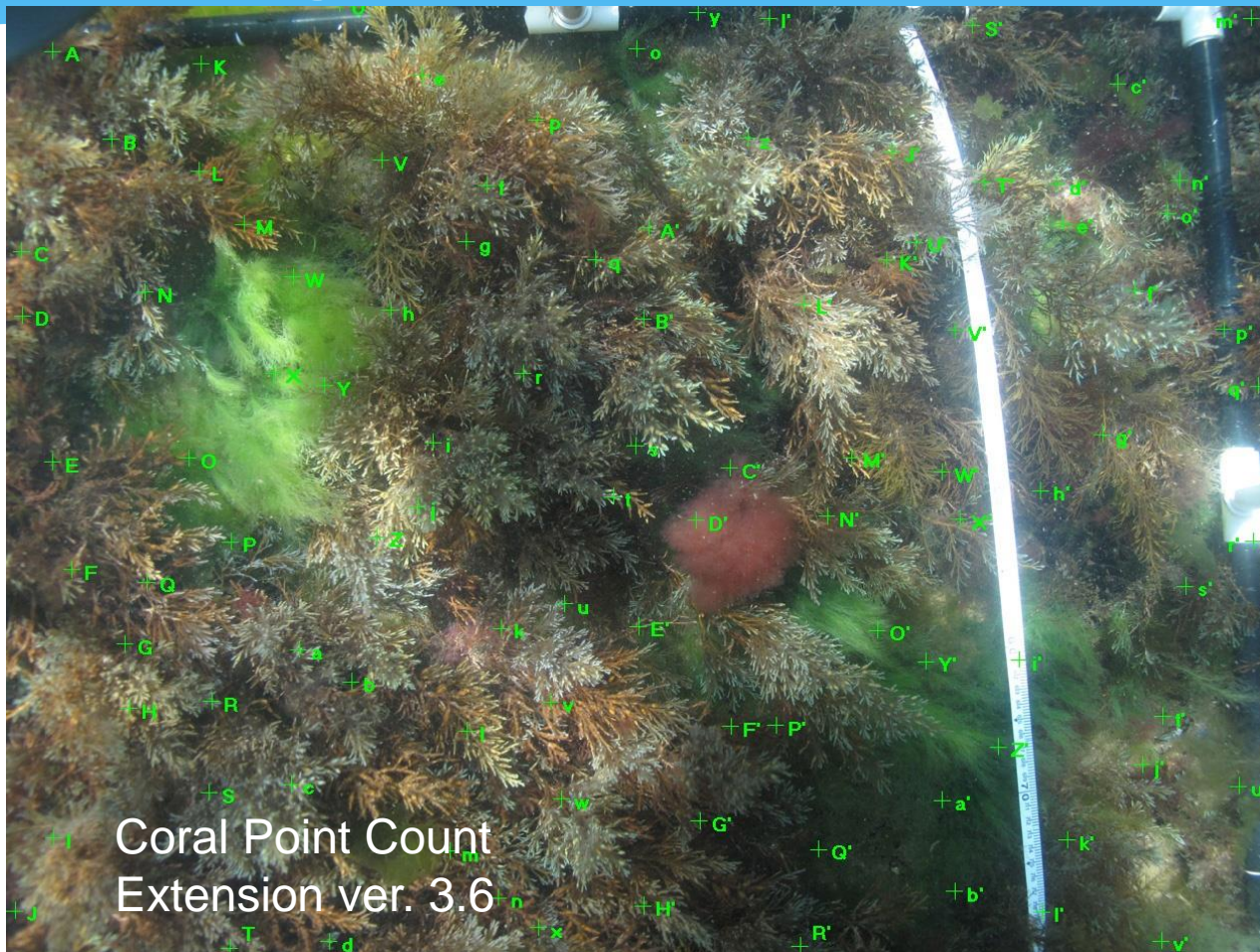
6138 cm²



2.2 Digital photogrammetry – macroalgal communities survey

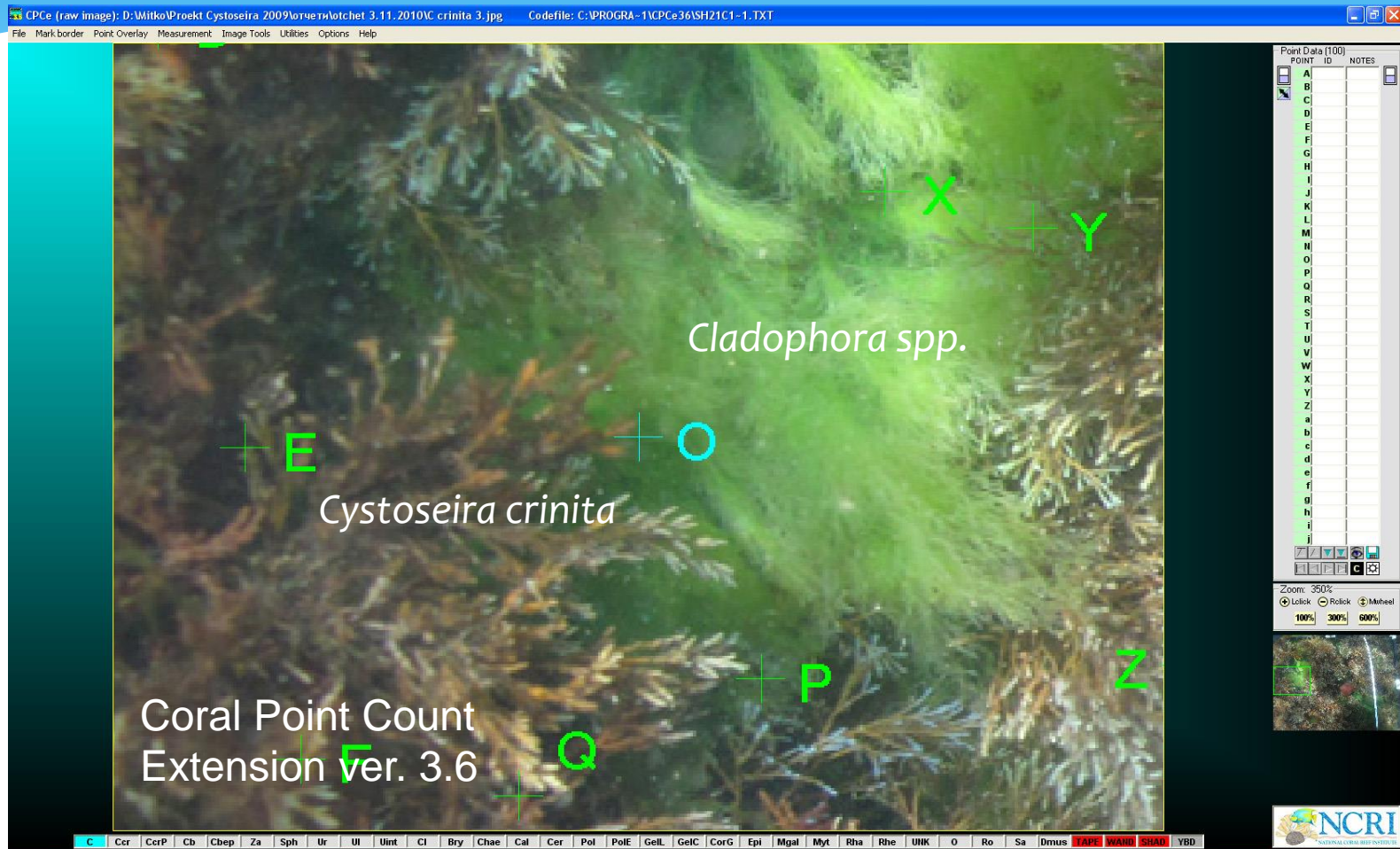
68,2 cm

6138 cm²



Coral Point Count
Extension ver. 3.6

2.2 Digital photogrammetry – macroalgal communities survey



2.2 Digital photogrammetry – macroalgal communities survey

CPGe (raw image): D:\Witko\Projekt Cystoseira 2009\2009 - danni\Cystoseira\stancii\Agalina09_2010\transect 1\IMG_4575 1..JPG Codefile: C:\PROGRA~1\CPGe\36\SH21C1-1.TXT

File Mark border Point Overlay Measurement Image Tools Utilities Options Help

h

Gelidium spp.

Cystoseira barbata

s

t

u

C'

D'

Point Data (100)

POINT ID	NOTES
k	Cor
l	Cor
m	Cor
n	Cor
o	Cor
p	Cor
q	Cor
r	Cb
s	Cb
t	
u	
v	
w	
x	
y	
z	
A'	
B'	
C'	
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E'	
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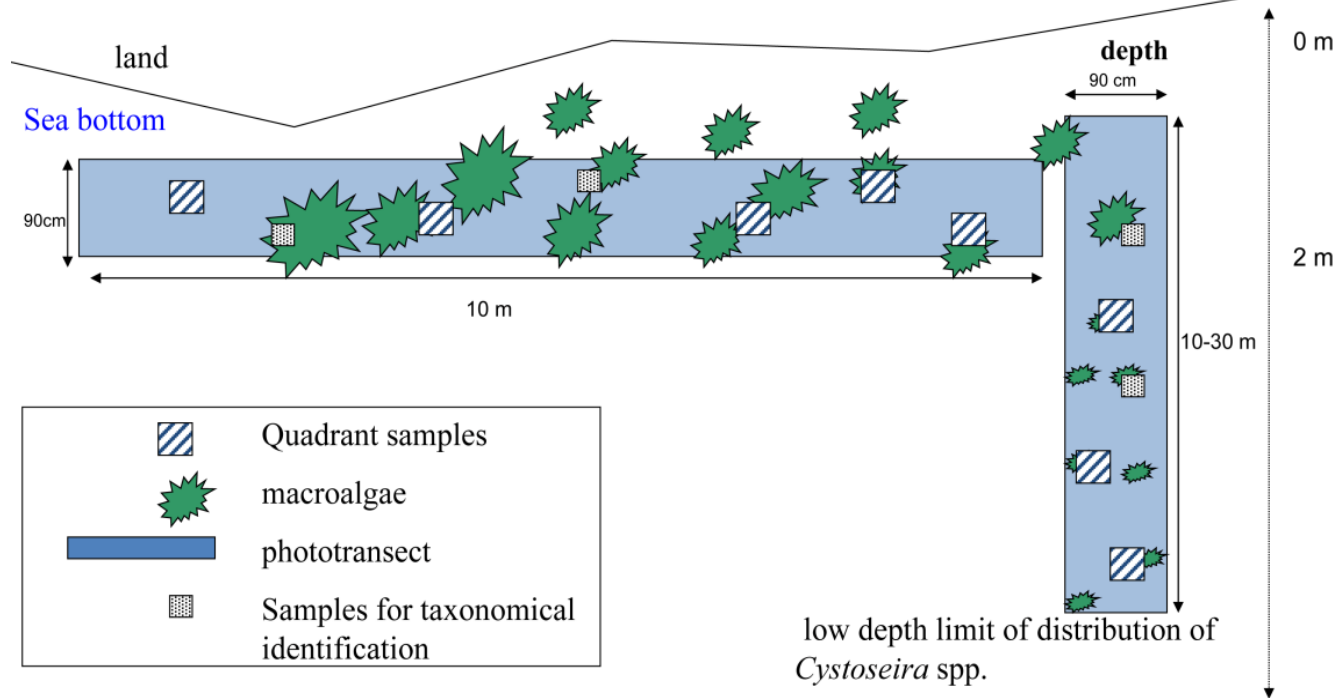
Zoom: 400%

100% 300% 600%

C	Cor	CorP	CorCl	CorAcr	Cb	CbCl	Cbep	Za	Sph	Ur	Ul	Ulnr	Cl	Bry	Chae	Cal	Cor	Pol
PoE	GeL	GeC	CorG	Epi	Mgal	Myt	Rha	Rhe	B-Gr	UWK	O	Ro	Sa	Dmus	LAPE	Yshae	SHAD	YBD

NCRI

2.2 Digital photogrammetry – macroalgal communities survey



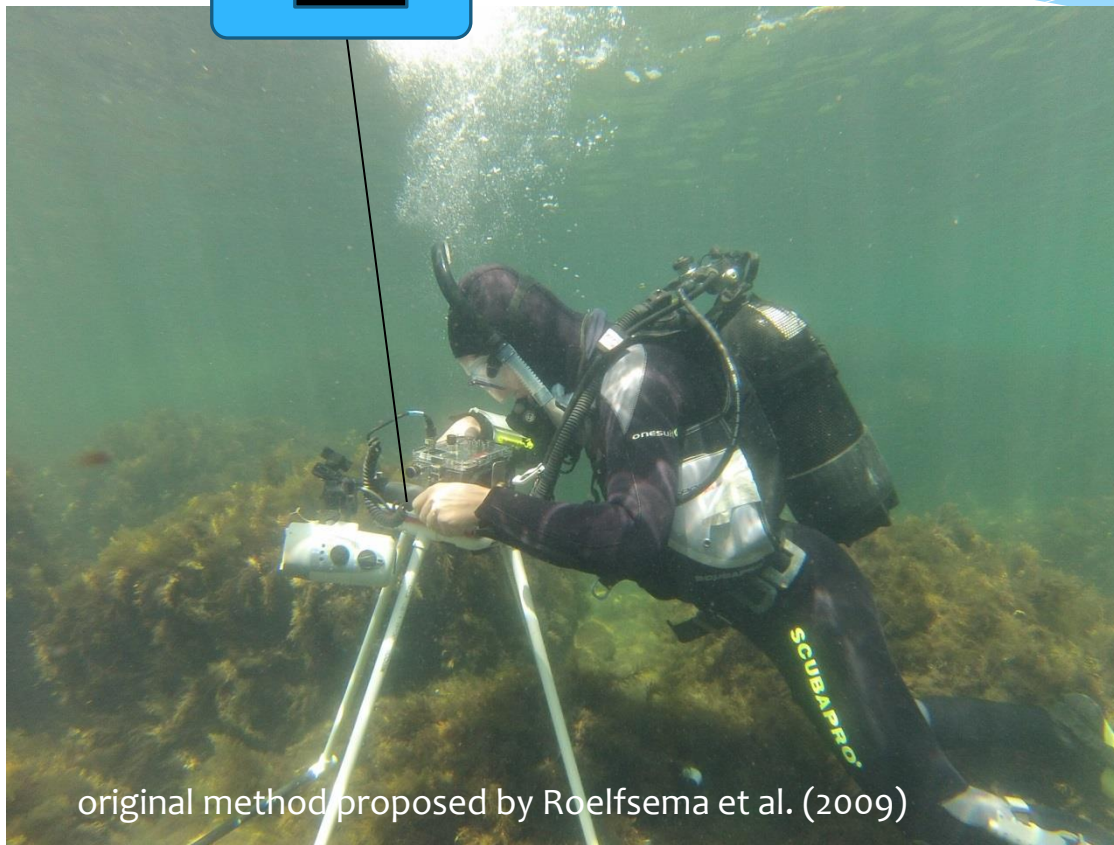
2.2 Digital photogrammetry – macroalgal communities survey

Sampling vs. Photogrammetry

	samples	photo transect
samples per dive	5-10 min per sample; 6-12 samples per dive	10-15 sec per photo; 40-50 photos per dive
Time to analyze sample	1-2 hours	5-10 min
area sampled per dive	0,24-0,48 m ²	20-30 m ²
species identified per sample	3 to 15	3 to 11
Total number of species	65	15

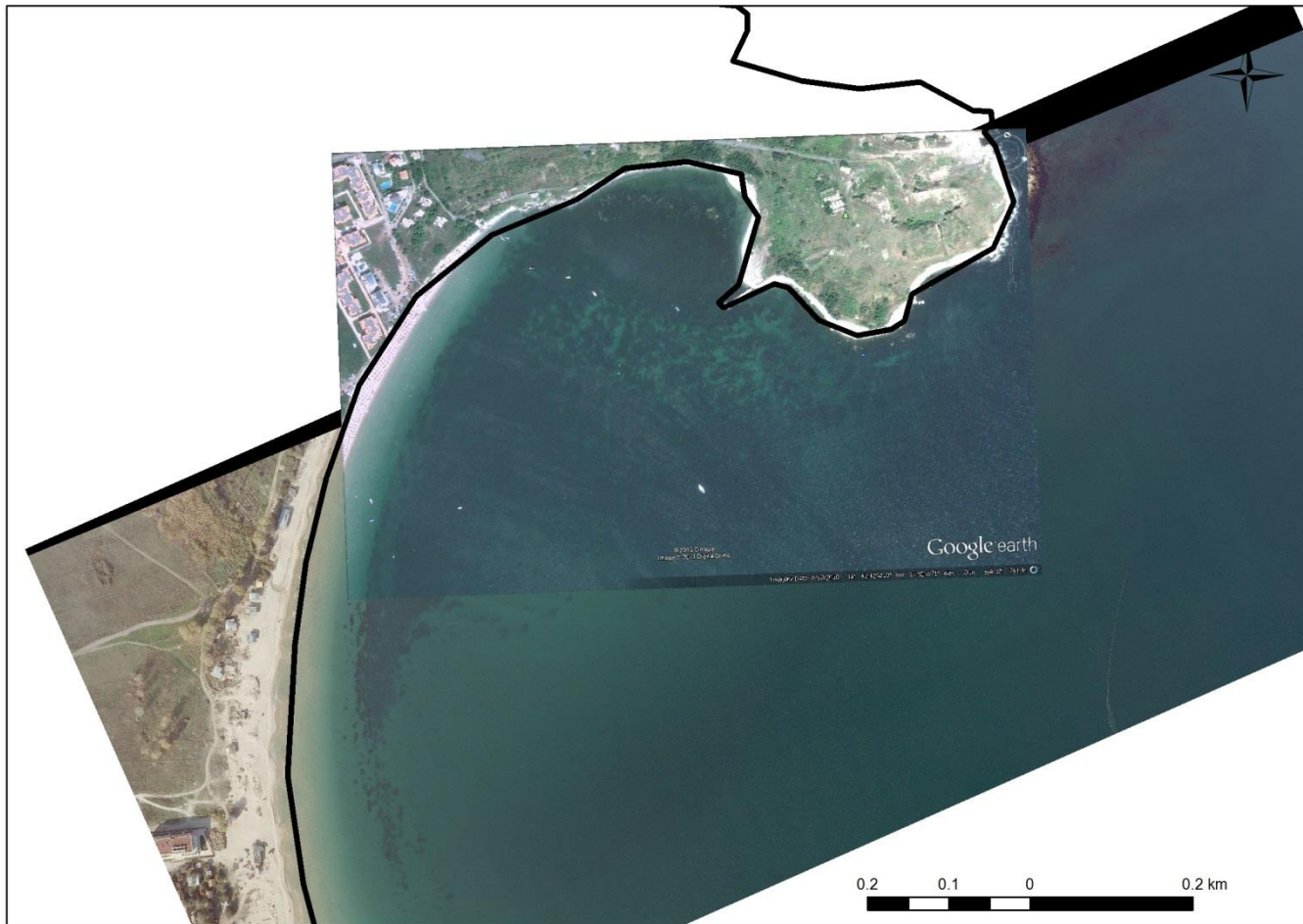
2.2 Digital photogrammetry – benthic habitat mapping

Surface-towed GPS system (Garmin 76CS)

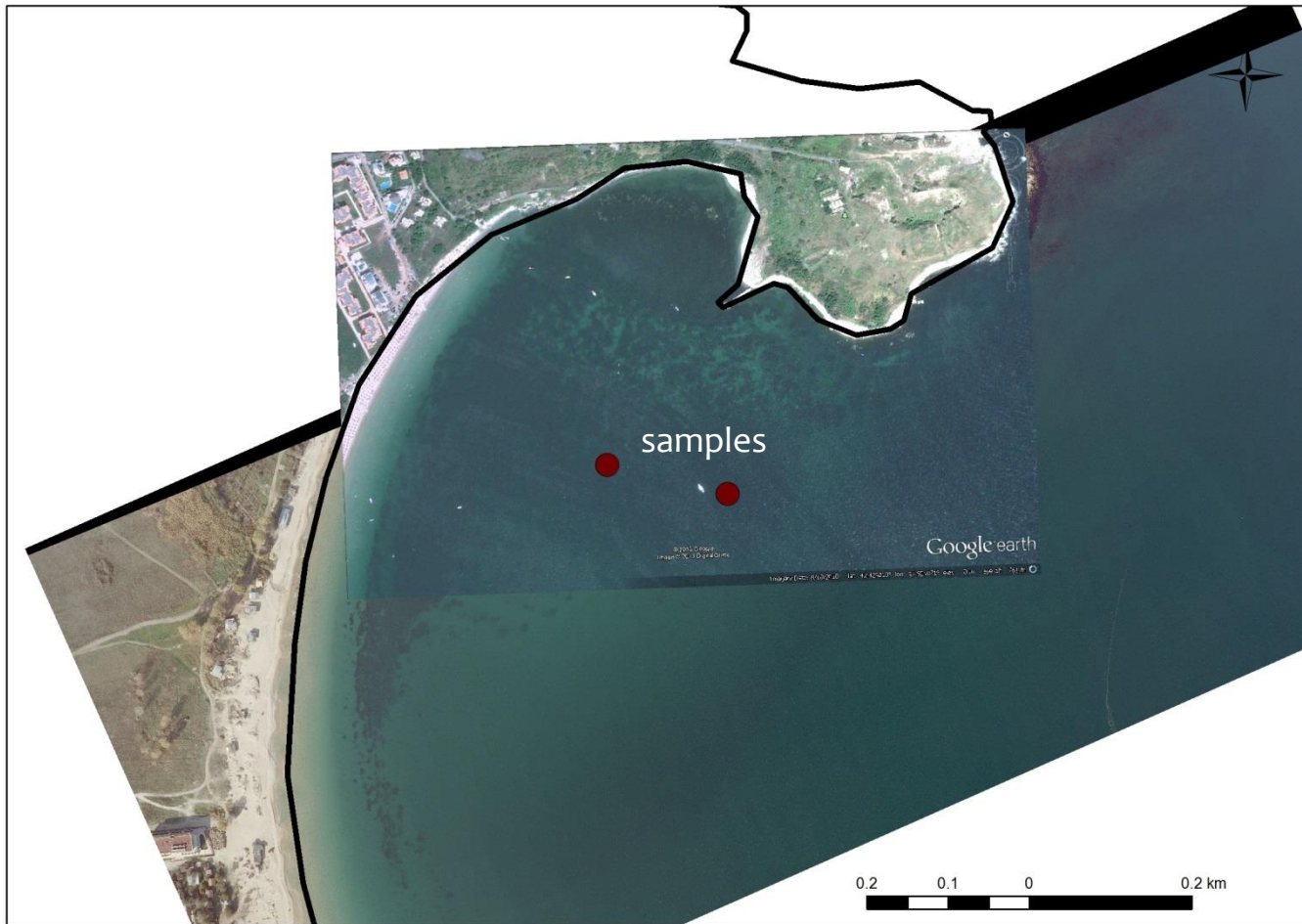


- Time-stamp synchronized digital photos and GPS track
- Image analysis with CPCE
- Photo-GPS data integration in ArcGIS (GPS photo link software)

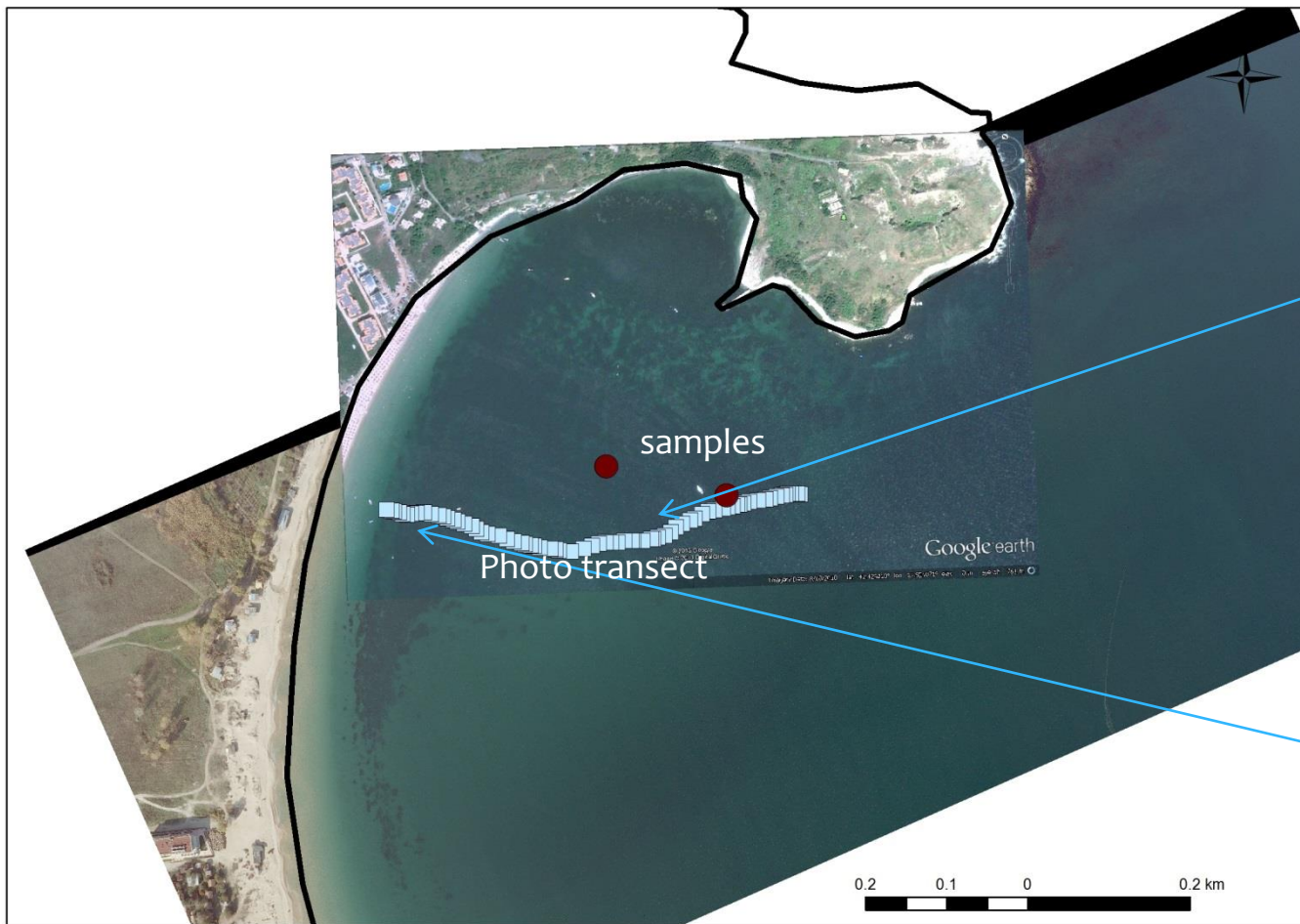
2.2 Digital photogrammetry – benthic habitat mapping, *Zostera* meadows



2.2 Digital photogrammetry – benthic habitat mapping



2.2 Digital photogrammetry – benthic habitat mapping



3-6 m depth:
Zostera marina-
dominated community

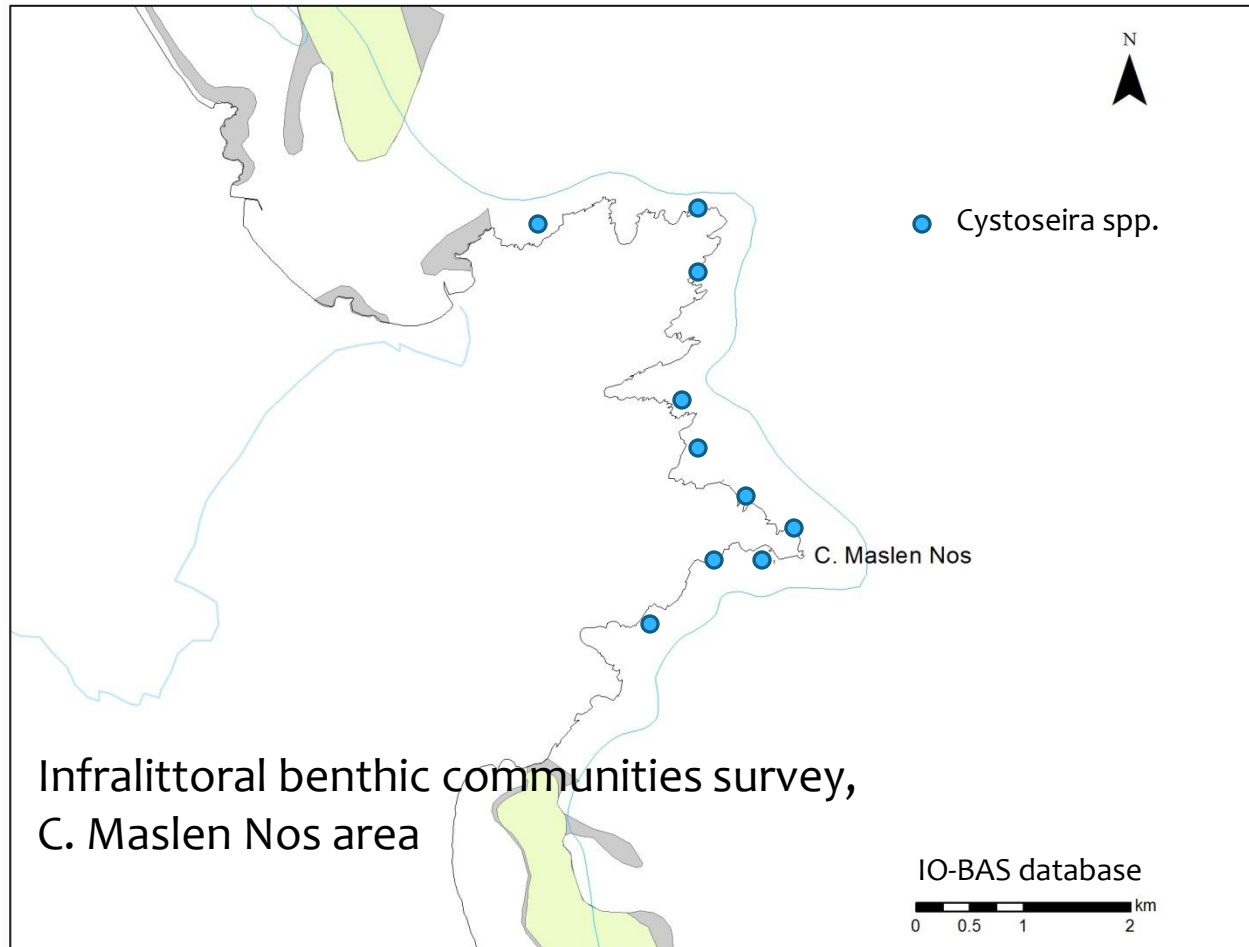
1-3 m depth:
Zostera noltii-
dominated community

2.2 Digital photogrammetry – benthic habitat mapping

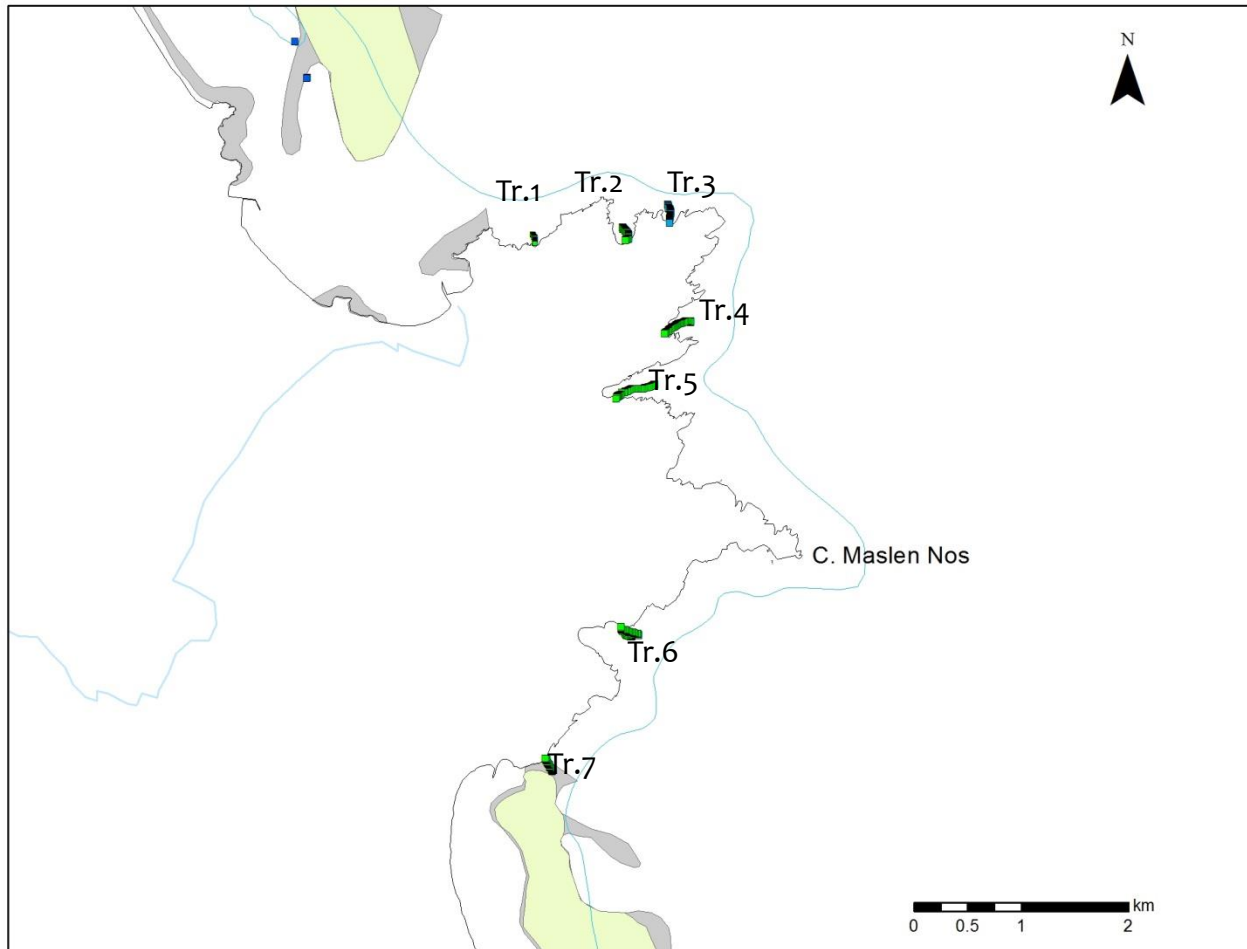


* Total area of meadow: 2.3 km²

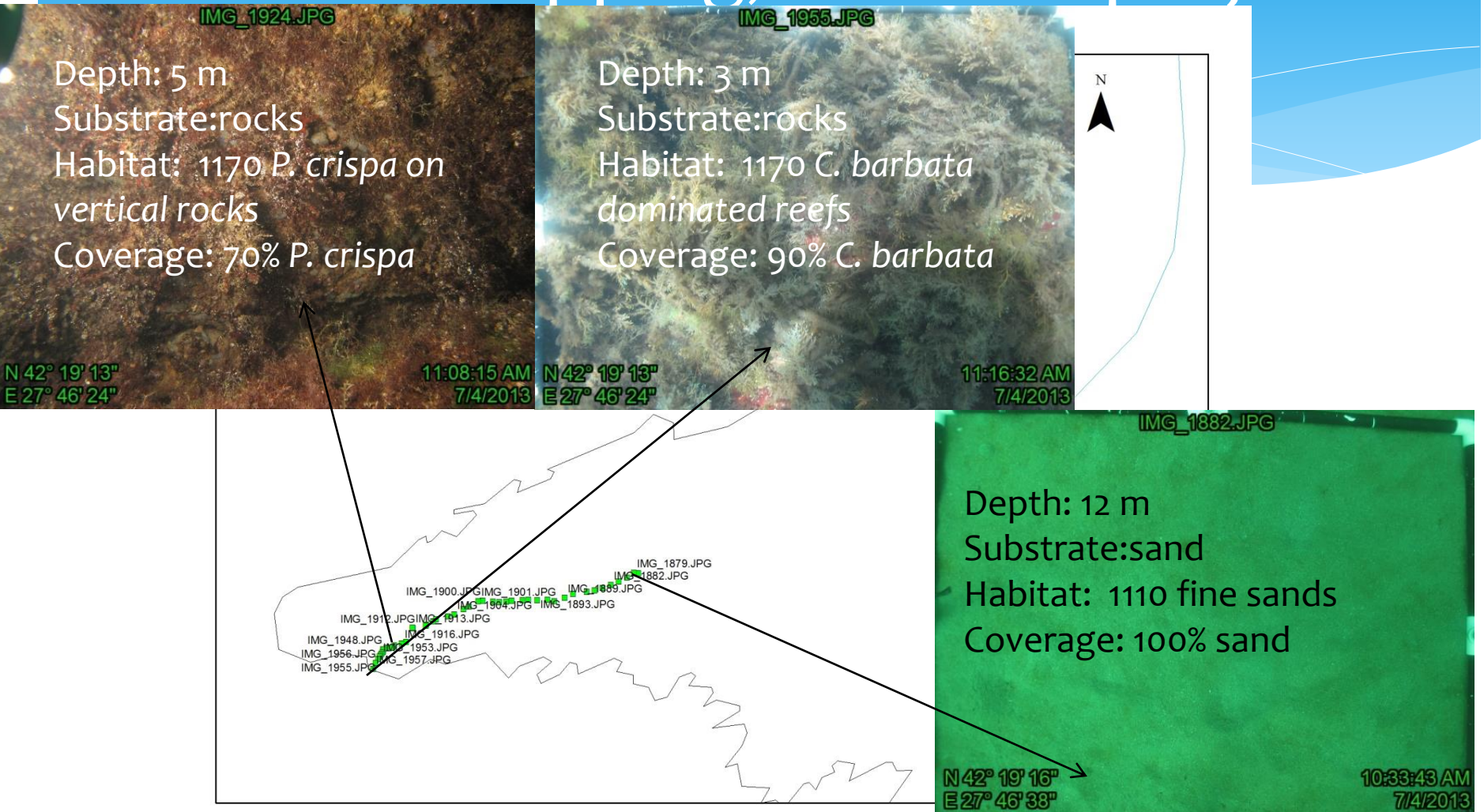
2.2 Digital photogrammetry – benthic habitat mapping, Coconet project



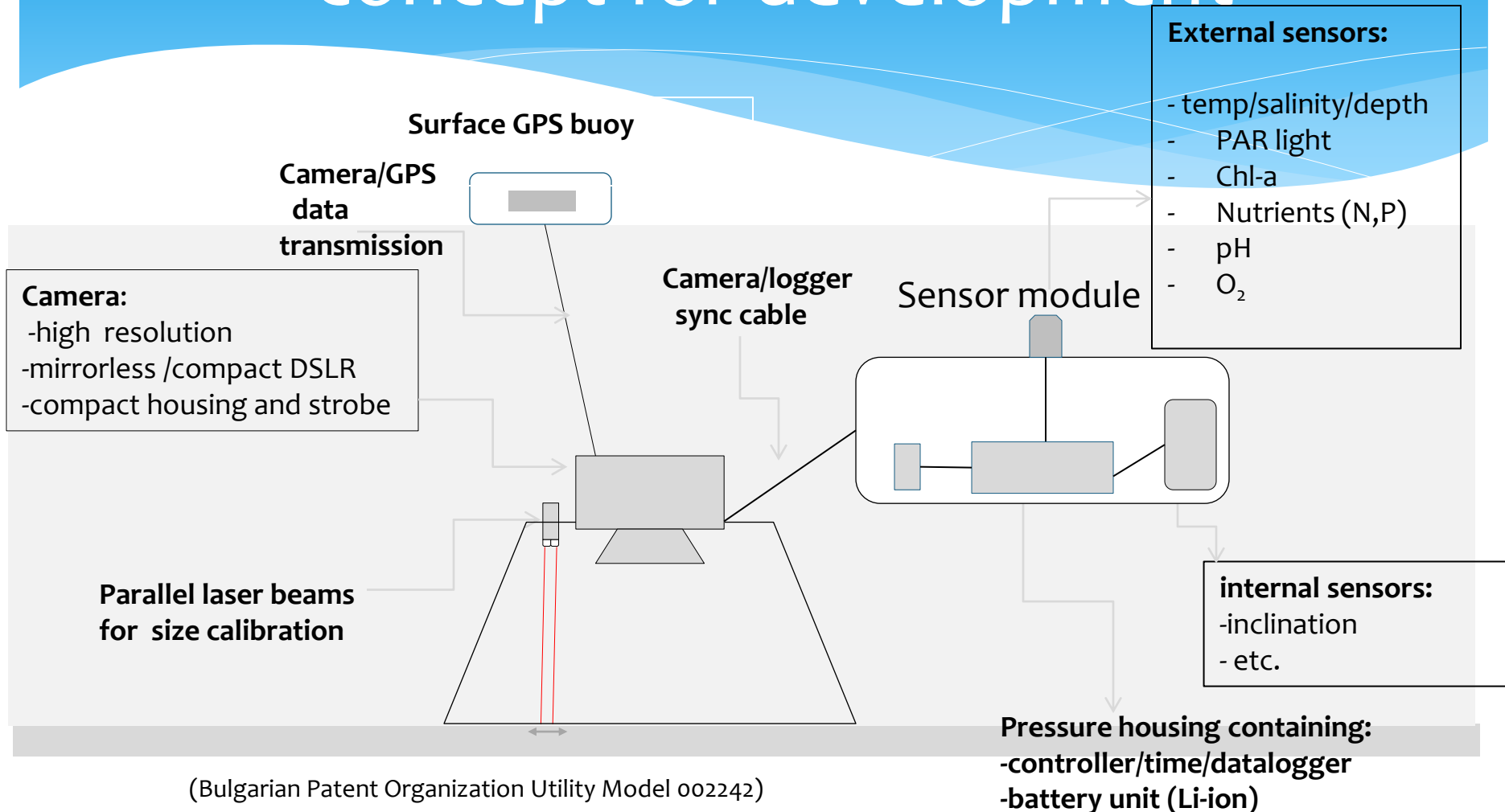
2.2 Digital photogrammetry – benthic habitat mapping, Coconet project



2.2 Digital photogrammetry – benthic habitat mapping, Coconet project



3. Digital photogrammetry –concept for development



An underwater photograph showing a rocky reef covered in dense, vibrant green seaweed and brownish-brown algae. The water is clear and blue, with sunlight filtering through from the top right. The text "Thank you!" is overlaid in the upper right corner.

Thank you!