## Data integration of Scuba benthic communities' photography surveys with physico-chemical multiparameter sensor platform as a means for more efficient coastal ecosytems studies



D. Berov <sup>1,2</sup>, N. Berov <sup>1</sup>

1- DiNiMar Ltd. Sofia, Bulgaria

2- Marine Ecology Laboratory, IBER-BAS, Bulgaria

dimitar.berov@gmail.com

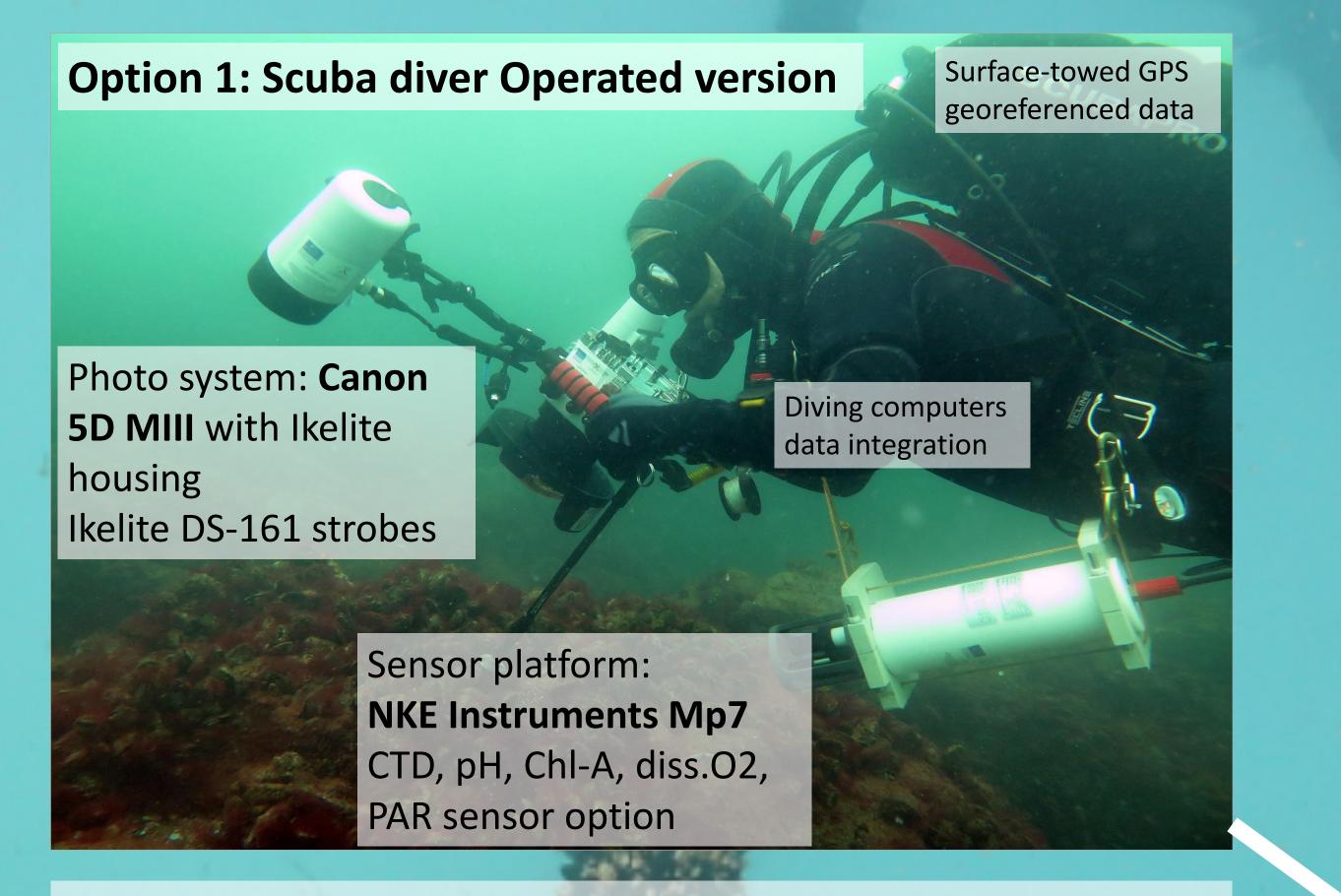




#### 1. Background and project goals

Modern advances in **digital underwater photography and photogrammetry allow a rapid and more efficient survey of benthic communities**. The usage of photography as a method for sampling allows the surveyors to gather significant amount of data in the limited time available underwater, which could then be quickly processed with image analysis software and analyzed with statistical software and GIS , **thus significantly shortening the time needed for sampling, data analysis and results generation**. Recently developed **multiparameter sensor platforms** are compact enough to be used by scuba divers, **opening up the opportunities for measuring relevant environmental factors in the exact locations of the benthic ecology surveys**, thus putting the obtained biological results in the correct oceanographical context.

The purpose of this project was to develop and test a modular system, integrating data from photogrammetry benthic surveys, GPS navigation data and physico-chemical parameters measurements, with possibilities for results exports in statistical packages, GIS, and oceanographical data visualization programs.



# 2. Data processing and integration platform



#### **MS Access-based front-end interface**

- Surveys metadata write up
- Raw data input and output selection
- Queries options

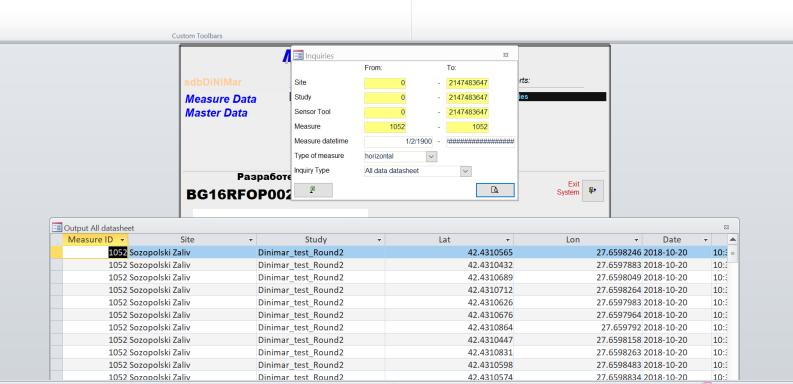
#### Microsoft SQL server back-end platform:

- **Time-based synchronization of data** from diff. data sources (GPS, sensors, camera)
- Dive computers data import in .xml format exports from www.divelogs.de (most common brands supported)
- EXIFF write up of georeferenced of photos (CLR VB .NET- based)
- Automatic water column profiles start detection
- Modular system can accommodate new instruments and data formats

	Custom Toolbars		
Marine Data Integration			^
📑 Maintain Measu	rement Data	23	_
Measure ID	11 Type of measure multiple vertical ~	Sync Sensor Tools and Camera with: 15 Sensor Tool NKE MP7	
Description	Тест 1.05	Diving Tool	
Start of measure	6/6/2018 10:20:24 AM End of measure	Tool 19 Dive Scubapro Mantis M2	
Study	3 MSFD_Reefs_2017	Start for Diving tool 7/23/2018 9:39:40 AM To the bottom, cm 60	
Site	11 Kavarna	Processing Status	
Employee	2 Dimitar Berov		
BoattD		<b>∩Photo Camera</b>	
GPS Tracker		Camera 10 Canon G10	
Tracker	5 GPS Tracker GARMIN 1	Start of camera img.	
Search GPS offset, s	Max ZERO depth 0.1	Images Folder e_Canon5D\19.05.2018 Canon %D + Ikelite DS161 + GPS	
Processing Status	✓ Import	Processing Status V Import	
Measure Sensor		Comment	
Tool ID	Start of Sensor ToolProcessing Status		
▶ 15 ★	Imported ~		
<b>T</b>			
Sensor Tool NKE	MP7 Sync Delete		
Record: M 4 1 of 49			
		КОНКУРЕНТОСПОСОБНОСТ	~
Form View			Nowered by Microsoft Access
	Micro	soft Access	– 0 ×
File Add Inc.	Mico		~

lumns 📴 🖃 🔊 👗 🔖 🛅 🛃 🕅 🔺 🕨 🛃 🚅 👮

🔃 🔍 🚜 🍓 🍞 Filter Excluding Selection ゾ 🏭 🜾 👌 🛴 Unhide Columns 📓 🖃 🤊 🐰 ங 🛅 🗃 🙌 4 🕨 🎽 🖃



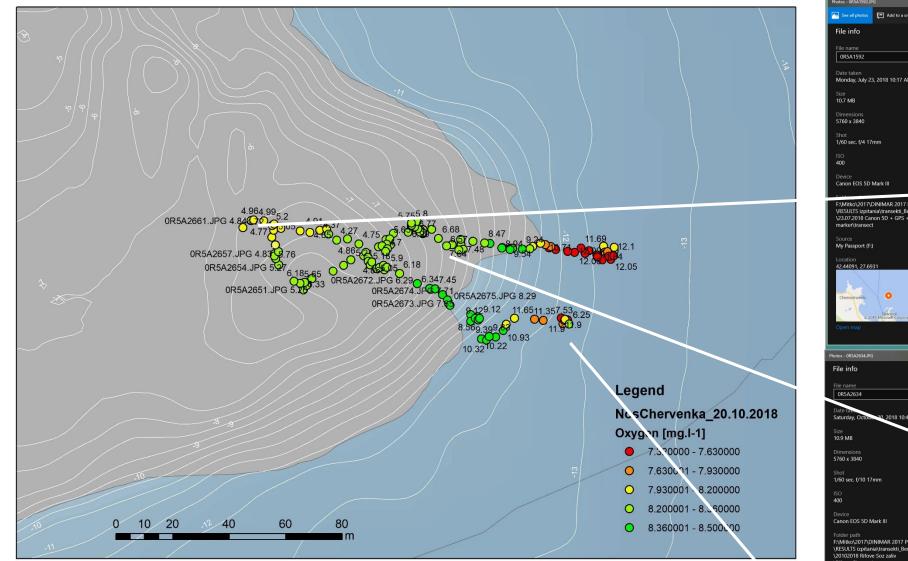
#### 3. Data outputs

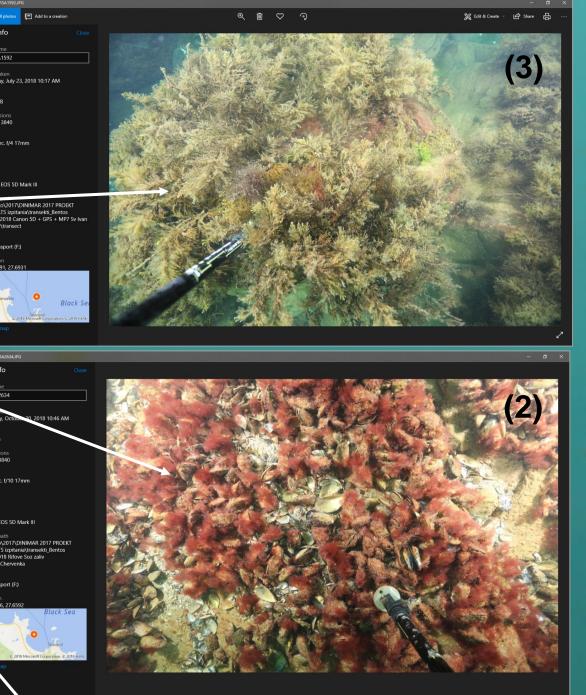
Synchronized and georeferenced tabular data (csv, xlsx) from all systems and sensor from diver and platform deployment surveys for imports to Arc GIS, statistical software.

SeaDataNet ODV datasheets for oceanographic data analysis from water column profiles and diver surveys.

4.2 Shallow coastal waters ecological status
'express' survey
from a vessel of opportunity
detection of local blooms and small-scale

- ecological status deterioration
- 'instant' data processing in ODV





### 4. Results: case studies

 Mussel farms development and impact on benthic communities
 Mapping of coastal benthic ecosystems - MSFD Descriptor 1.6 surveys

#### 4.1 Case study "Functional map of a benthic reef"

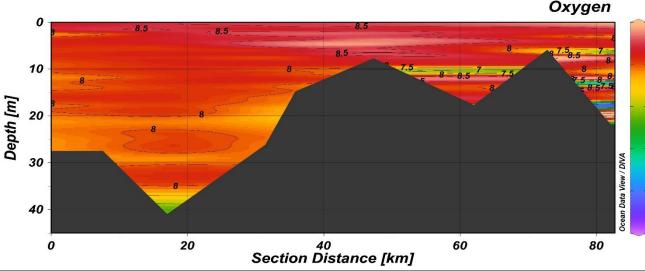
- georeferenced position of specific benthic communities
- in-situ measurement of biological parameters e.g. oxygen concentrations
- GIS data integration with remote sensing and geoloical mapping data

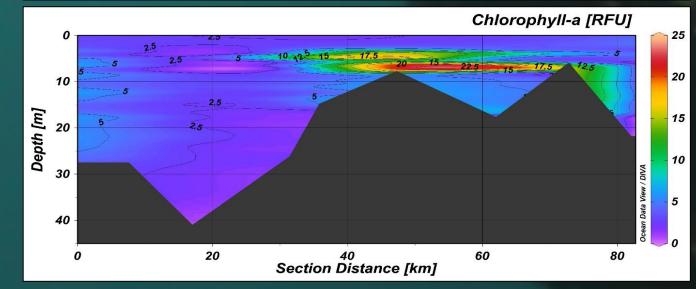
**Results:** high-resolution 'map' of change in oxygen gradient with transition from sandy bottoms heterotrophic communities (1) towards mixed auto-heterotrophic rocky reefs *with M. galloprovincialis* filter feedeers overgrown with red microalgae communities(2), and autotrophic shallow-water *Cystoseira barbata* communities (3).



- Coastal water quality monitoring from small vessels (of opportunity)
- Environmental impact assessment studies -'Mopang' oil spill, Burgas Bay







Проект BG16RFOP002-1.002-0023-C01 "Разработване на иновативен метод за подводно дигитално фотограметрично заснемане на морското дъно в комбинация с инструментално измерване на физико-химични и биологични параметри на водната среда" се осъществява с финансовата подкрепа на Оперативна програма "Иновации и конкуренстоспособност"2014 -2020 съфинансирана от Европейския фонд за регионално развитие на Европейския съюз.