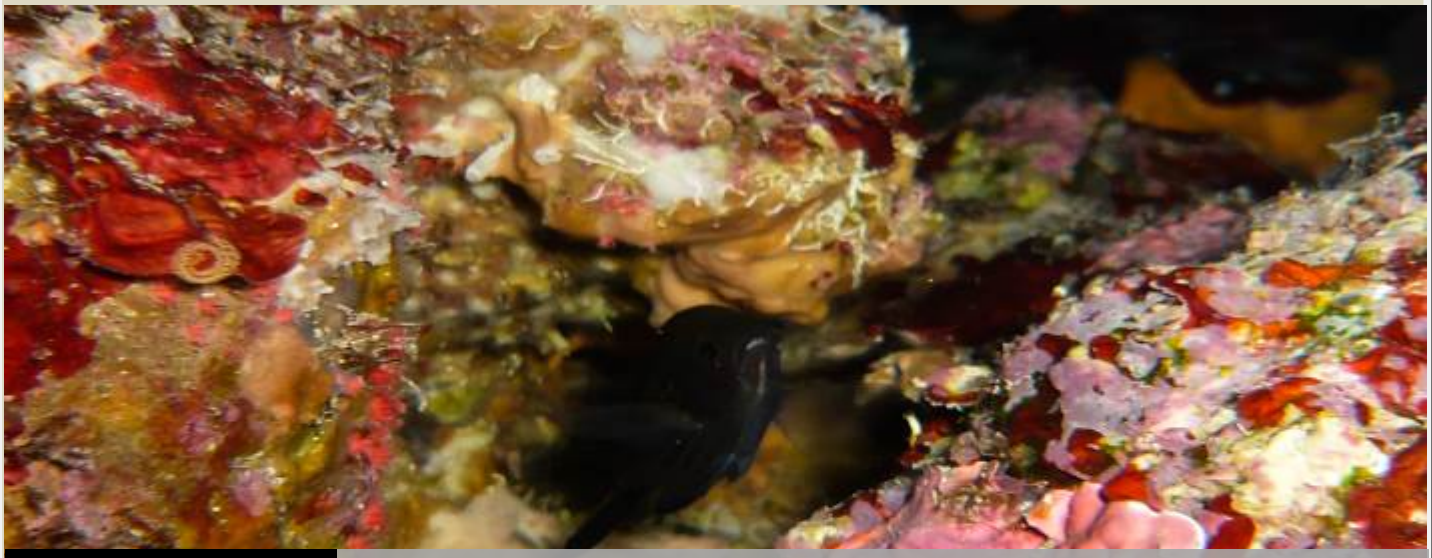
NATIONAL MARINE PARK OF ZAKYNTHOS

IN COLLABORATION WITH

UNIVERSITY OF THE AEGEAN, DEPT. OF MARINE SCIENCES



Final Report

CORALLIGENOUS SURVEY IN THE NORTH – EAST MEDITERRANEAN

IN THE FRAMEWORK OF EUROPEAN PROJECT ANR12 SEAS 0001-01 - CIGESMED

ZAKYNTHOS 2016

CORALLIGENOUS SURVEY IN THE NORTH – EAST MEDITERRANEAN

Final Report

Reporting Period: 2013 -2016

Authors: Dimitriadis C., Sini M., Gerovasileiou V., Sourbes L., Batjakas J., Koutsoubas D.

WORKING GROUP

Name	Affiliation	Specific tasks
Drosos Koutsoubas	NMPZ/ Univ. of the Aegean	Project coordinator for NMPZ
Laurent Sourbes	NMPZ	Report preparation, administrative and communication tasks
Charalampos Dimitriadis	NMPZ	Report preparation, administrative and communication tasks, field work
Vasilis Gerovasileiou	HCMR/NMPZ	Report preparation, communication tasks, field work
Maria Sini	Univ. of the Aegean/ NMPZ	Report preparation, communication tasks, field work
Elpiniki Kali	NMPZ	Report preparation, administrative and communication tasks
Anna Thalassini-Vali	NMPZ	Report preparation, administrative and communication tasks
Vatikiotis Konstantinos	NMPZ	Field work

NATIONAL MARINE PARK OF ZAKYNTHOS
HTTP://www.nmp-zak.org

DEPT. OF MARINE SCIENCES, UNIVERSITY OF THE AEGEAN
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Front page photos: C. Dimitriadis

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1st Reporting period annual report

1. INTRODUCTION

The current document is the first annual progress report (1st reporting period) of activities that were undertaken by the National Marine Park of Zakynthos as a subtask in the framework of the European Project CIGESMED according to deliverable requirements of the contract (Ref CNRS: DR12-JE 093 579) signed by NMPZ and CNRS. The first annual report includes the tasks and activities carried out from June of 2013 until February of 2014. The activities of the subtask 'Coralligenous Survey in the North – East Mediterranean' and their relation to the Work Packages (WP) of CIGESMED project are presented in Table 1.

Table 1: NMPZ's activities and their relation to CIGESMED project WPs

NMPZ Activities	Description	Connection to CIGESMED WP's
Activity 1	Coralligenous assessment and monitoring	**WP2** - *Coralligenous assessment and threats in the different basins* **WP3** - *Indicators' development and test*
Activity 2	Management tools	**WP4** - *Innovative monitoring tools* **WP6** - *Data management, mapping and assimilation tools*
Activity 3	Participatory process-Promotion -Public awareness activities	**WP5** - *Citizen science network implementation* **WP7** - *Outreach, dissemination and stakeholder engagement*

2. CIGESMED KICK OFF MEETING

D. Koutsoubas, M.Sini and D. Poursanidis, members of the NMPZ work team, participated in the kick off meeting of CIGESMED project which was held at Heraklion, Crete from 17th to 19th of April 2013.

During the three day meeting they had the opportunity to meet with other project participants, and get acquainted with the project structure, organization, and deliverables. They attended a series of presentations focusing on the description of the different work packages, the presence of coralligenous habitats in France, Greece, and Turkey, the experience obtained from previous citizen science projects (i.e. COMBER), and the application of knowledge trees in information assimilation and data management. The NMPZ members exchanged ideas and technical knowledge regarding the study of coralligenous, contributed to the compilation of a generalized species list regarding flora and fauna of

coralligenous communities in Greece, and registered in the Tree of Knowledge – consortium competences. Finally, M. Sini gave a short presentation on the main features and functions of photoQuad, a layer-based image processing software developed at the University of the Aegean, as a potential tool for the assessment of coralligenous communities in the context of CIGESMED project.

Figure 1: PHOTOQUAD Software presentation excerpts

3. CIGESMED FIELD TRIP IN MARSEILLE

V. Gerovasileiou and M. Sini, members of the NMPZ work team, joined the CIGESMED diving workshop held in Marseille from 2nd to 4th of July 2013. The aim of the workshop was to give the chance to participants from Greece and Turkey to get acquainted with the well-developed coralligenous assemblages found at the Bay of Marseille for future reference and comparison with coralligenous communities found elsewhere.

Two diving fieldtrips were realized during which coralligenous habitats were photographed using quadrats of different size in order to check their efficiency. The participants also had the opportunity to attend the following presentations / discussions: a) Encrusting Coralligenous Rhodophyta – the main algal bioconstructors, by Marc Verlaque (CNRS – MIO), b) Basic principles towards the development of a coralligenous index (IndexCor), by Stéphane Sartoretto (IFREMER), c) Development of photographic and video tools, by Romain Bricout (CNRS associate), d) Hands-on application of photoQuad, by Maria Sini (NMPZ, University of the Aegean). Finally, a round table discussion took place regarding the main biotic, abiotic, and observer attributes that should be considered during future fieldwork and data analysis.

4. COMMUNICATION WITH LOCAL DIVE CLUBS

During August 2013, NMPZ initiated communications with local dive centers and divers so as to obtain information regarding the presence of coralligenous communities along Zakynthos Island coastline. The task included an initial presentation of the coralligenous habitats to the diving centers through the use of visual material (e.g. photos, video). After the briefing, the divers recommended several locations around Zakynthos coasts where coralligenous habitats could

possibly be found. The obtained information was used to design the preliminary field survey in the NMPZ.

5. PRELIMINARY FIELD SURVEY IN NMPZ

For the establishment of suitable coralligenous study sites in Zakynthos Island (SW Ionian Sea, Eastern Mediterranean), a preliminary survey was conducted during September 2013 in three locations found at the SW part of the Island within the boundaries of the Marine Protected Area of the National Marine Park of Zakynthos (Figure 2). The choice of the locations was based on information provided by local diving centers and recreational divers, during dedicated interviews regarding the potential presence of coralligenous habitats along Zakynthos coastline. The locations of the examined candidate sites are presented in Figure 2.

Figure 2: The marine protected area of NMPZ including the zoning scheme of protection and the locations of the candidate sampling sites.

Figure 3: Locations of the three candidate sites in the NMPZ

CANDIDATE SITE 1: Marathonisi Islet

Coordinates: 37°40'57.43"N, 20°52'26.49"E

Divers: Charalampos Dimitriadis (NMPZ), Fanis Nikoloudakis (Divers Paradise Dive club)

Site description

The site is located in zone B of the Marine Protected Area of the National Marine Park of Zakynthos (NMPZ). In particular, the candidate sampling site is situated

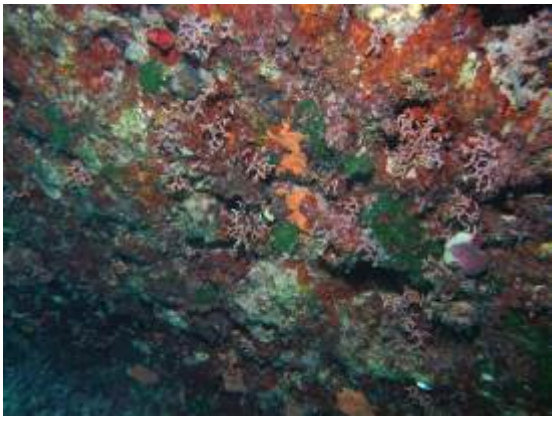
at the southern part of Marathonisi Islet and starts at around 15 m depth. The underwater topography consists of different habitats (e.g. sandy beds and *Posidonia oceanica* meadows) whereas large boulders with overhangs and crevices are also present. This site is exposed to the prevailing South-Southeast and Southeast winds and is influenced by the water exchange of Laganas Bay with the open Ionian Sea.

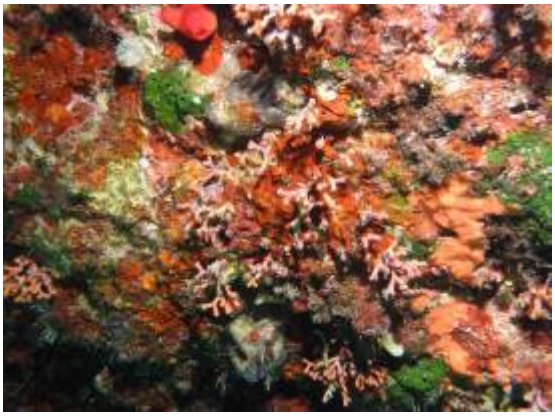
Human Pressures

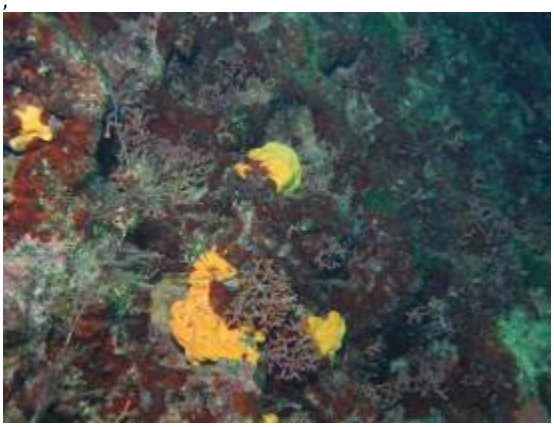
The preliminary survey and previous studies that have taken place in this area indicate the presence of ghost nets and abandoned long lines, as well signs of potential disturbance due to intense recreational diving activity.

Characteristic photos

Depth 15 – 20 m







CANDIDATE SITES 2 & 3: KERI – MAVROS KAVOS

Coordinates:
Site Keri: 37°38'46.15"N, 20°50'9.80"E
Site Mavros Kavos: 37°38'42.32"N, 20°49'48.90"E

Divers: Charalampos Dimitriadis (NMPZ), Fanis Nikoloudakis (Divers Paradise Dive club)

Sites description

Both sites are situated at the SW part of Zakynthos Island, close to the westernmost boundaries of the NMPZ. The area is characterized by cooler water temperatures in comparison to Laganas Bay, possibly due to the direct exposure to the open Ionian Sea and the local wind driven upwellings. The topography of both sites is characterized by extensive vertical rocky walls with crevices, overhangs and numerous submerged caves. Rocky cliffs starting from 100 – 150 m above sea level drop vertically to depths of 30 – 40m. These geomorphological

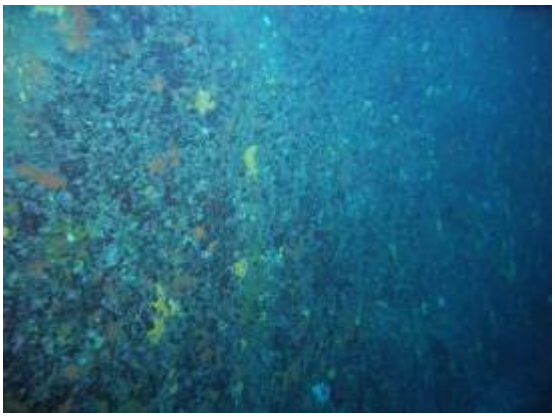
features account for the increased shadowy conditions observed locally over the greatest part of the day. At both sites depth of sciaphilic – coralligenous communities were recorded from 10 to 30 m.

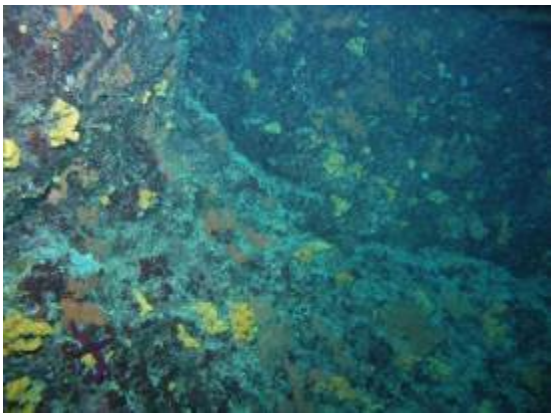
Human Pressures

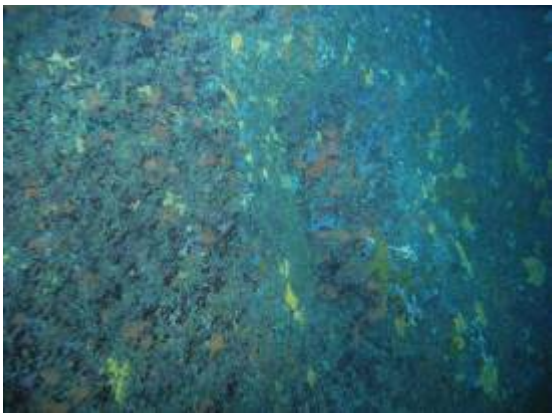
The preliminary survey and previous studies that have taken place in these areas indicate the presence of ghost nets and abandoned long lines, as well signs of potential disturbance due to intense recreational diving activity.

Characteristic photos:

Site KERI – Depth 15 -30m

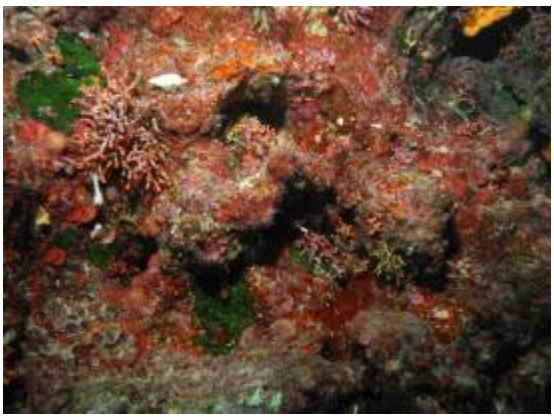
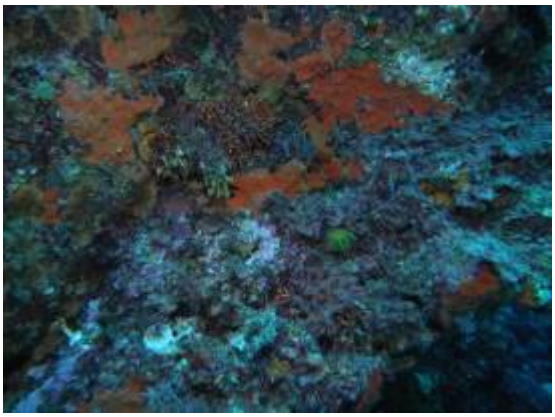






Site MAVROS KAVOS – Depth 12-30 m




Species list from the preliminary survey

A total of 42 species were encountered during the preliminary survey (Table 2).

Table 2: Species recorded in the candidate sampling sites of Zakynthos Island.

	Keri	Mavros Kavos	Marathonisi
Rhodophyta			
Amphiroa rigida J.V. Lamouroux, 1816			+
Amphiroa cryptarthrodia Zanardini, *1844*			+
Liagora viscida (Forsskål) C.Agardh, 1822			+
Peyssonnelia spp	+	+	+
Peyssonelia cf. *bornetii*	+	+	+
Peyssonnelia squamaria (S.G. Gmelin) Decaisne, 1841		+	+
Peyssonnelia rosa-marina Boudouresque & Denizot, 1973			+
Peyssonelia cf. *rubra*	+	+	+
Mesophyllum sp.	+		
Mesophyllum alternans (Foslie) Cabioch & M.L.Mendoza, 1998		+	+
Tricleocarpa fragilis (Linnaeus) Huisman & R.A.Townsend, 1993			+
Chlorophyta			
Pseudochlorodesmis furcellata (Zanardini) Børgesen, 1926			+
Palmophyllum crassum (Naccari) Rabenhorst, 1868	+	+	+
Foraminifera			
Miniacina miniacea (Pallas, 1766)		+	
Porifera			
Acanthella acuta Schmidt, 1862	+		
Agelas oroides (Schmidt, 1864)	+	+	+
Aplysilla rosea (Barrois, 1876)			+
Axinella damicornis (Esper, 1794)	+	+	
Cacospongia mollior Schmidt, 1862			+
Chondrosia reniformis Nardo, 1847		+	
Cliona schmidti (Ridley, 1881)			+
Crambe crambe (Schmidt, 1862)	+	+	+
Fasciospongia cavernosa (Schmidt, 1862)			+
Petrosia (Petrosia) ficiformis (Poiret, 1789)	+		+
Phorbas tenacior (Topsent, 1925)	+		
Spirastrella cunctatrix Schmidt, 1868	+	+	+
Terpios gelatinosa (Bowerbank, 1866)			+
Cnidaria			
Caryophyllia sp.		+	
Eudendrium sp.		+	+
Leptopsammia pruvoti Lacaze-Duthiers, 1897	+		+
Madracis pharensis (Heller, 1868)		+	+
Mollusca			
Rocellaria dubia (Pennant, 1777)			+
Annelida			
Hermodice carunculata (Pallas, 1766)			+
Myxicola infundibulum (Montagu, 1808)			+
Protula tubularia (Montagu, 1803)		+	
Bryozoa			
Adeonella sp.	+	+	+
Myriapora truncata (Pallas, 1766)	+	+	+
Rhynchozoon neapolitanum Gautier, 1962		+	
Schizomavella sp.		+	
Echinodermata			
Echinaster sepositus (Retzius, 1783)			+
Ophidiaster ophidianus (Lamarck, 1816)	+	+	
Tunicata			
Halocynthia papillosa (Linnaeus, 1767)			+

Remarks

Based on the observations of the preliminary surveys, coralligenous assemblages at Marathonisi site were only found as enclaves in onverhangs and crevices. On the other hand, the western sites of Keri and Mavros Kavos could potentially be used as sampling sites of Zakynthos, as defined by the geomorphological characteristics (i.e. steep vertical walls) and the associated benthic communities. The scarcity of rich coralligenous communities observed may be due to the prevailing oligotrophic conditions that characterize both the S. Ionian and S. Aegean Seas. Considering this peculiarity, further site investigation is recommended in order to determine the optimum location/s.

6. SCIENTIFIC MEETING BETWEEN NMPZ AND HCMR AND FIELD SURVEY IN THE NORTH AEGEAN SEA

V. Gerovasileiou, member of the NMPZ work team, T. Dailianis and G. Chatzigeorgiou, members of the HCMR work team, met in the framework of a scientific meeting organized by HCMR, the leading collaborator of CIGESMED WP 5, in the framework of COMBER citizen science project, on the 12th of October, in Thessaloniki. The two teams had the opportunity to discuss about the development of the CIGESMED citizen science network, in NMPZ and the rest of Greece.

On the 13th of October they dived in typical coralligenous communities of the North Aegean Sea, in Chalkidiki Peninsula, and identified typical assemblages and species, marking the differences and similarities with communities of the NW Mediterranean, the South Aegean and Ionian seas.

7. PRELIMINARY WORK FOR CITIZEN SCIENCE

The preliminary work for the citizen science component of the project included actions towards the development of a network that will bring together the local dive centers and recreational divers with the scientific group of NMPZ. Diving activity in the Marine Protected Area of NMPZ A is well developed. Four dive centers are operating in the area for more than a decade and a close collaboration of the MPA with the dive centers has recently been established for the co-management of the diving activity. Rough estimations considering the diving activity in the NMPZ suggest that more than 10.000 dives are taking place in this area per year, including both visitor and local resident divers. Hence, the establishment of a citizen science network for the monitoring of coralligenous in Zakynthos Island is feasible, and further work towards the development of a cost-effective, reliable, user friendly and sustainable in the long term scheme should be considered.
The preliminary design of the citizen science network was discussed with the leading collaborator of CIGESMED WP 5 (HCMR members) during two scheduled

meetings (October 2013 and February 2014) in order to establish the basic principles of the citizen science network development. In this respect, future actions for the establishment of the CIGESMED citizen science network have been planned in close collaboration with HCMR.

8. PRELIMINARY FIELD SURVEY IN CRETE

In the framework of setting up a common monitoring network of coralligenous stations in Greece, M. Sini and D. Poursanidis, members of the NMPZ work team, joined members of the HCMR team in order to investigate potential sites in Crete. The fieldtrip was organized by HCMR from 12th to 18th of November 2013. The NMPZ members participated in the dive trips, collected photographs and samples of marine fauna and flora, and contributed to species identification. The two teams discussed about their future collaboration in the realization of the various CIGESMED project tasks (e.g. sampling, monitoring, and citizen science network development).

9. ACTIVITIES PROGRESS AND FUTURE PLANNING

Summary of activities progress of the present project in relation to CIGESMED work packages is provided in the following table.

NMPZ Activities	CIGESMED WP's	NMPZ PROGRESS
Activity 1 *Coralligenous assessment and monitoring*	**WP2** - *Coralligenous assessment and threats in the different basins* **WP3** - *Indicators' development and test*	Preliminary field survey and candidate site selection, preliminary biodiversity assessment of coralligenous communities, preliminary identification of the possible threats and sources of disturbance, collaboration with national partners (HCMR) of CIGESMED project
Activity 2 *Management tools*	**WP4** - *Innovative monitoring tools* **WP6** - *Data management, mapping and assimilation tools*	Not relevant to the current reporting period
Activity 3 *Participatory process- Promotion - Public awareness activities*	**WP5** - *Citizen science network implementation* **WP7** - *Outreach, dissemination and stakeholder engagement*	Communication with local dive clubs, preliminary actions for citizen science network development, collaboration with national partners (HCMR) of CIGESMED project

2nd Reporting period annual report

1. INTRODUCTION

The current document is the second annual progress report (2nd reporting period) of activities that were undertaken by the National Marine Park of Zakynthos as a subtask in the framework of the European Project CIGESMED according to deliverable requirements of the contract (Ref CNRS: DR12-JE 093 579) signed by NMPZ and CNRS. It includes the tasks and activities carried out from February of 2014 until April 2015. The activities of the subtask 'Coralligenous Survey in the North – East Mediterranean' and their relation to the Work Packages (WP) of CIGESMED project are presented in Table 1.

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Activity 3	Participatory process-Promotion -Public awareness activities	**WP5** - *Citizen science network implementation* **WP7** - *Outreach, dissemination and stakeholder engagement*

2. 2nd GENERAL ASSEMBLY OF CIGESMED PROJECT

D. Koutsoubas, M. Sini and V. Gerovasileiou, members of the NMPZ work team, participated in the General Assembly of CIGESMED project which was held in Izmir, Turkey from 6th to 9th of May 2014. During the meeting they had the opportunity to discuss with other project participants as well as to present the results derived from the 1st reporting period (1st annual report) with respect to Zakynthos study sites and project objectives (Figure 1).
The members of the NMPZ work team exchanged ideas and technical knowledge regarding field work (e.g. study sites, protocols), preliminary results (e.g. species lists), data analyses, citizen science, and potential post-CIGESMED initiatives.

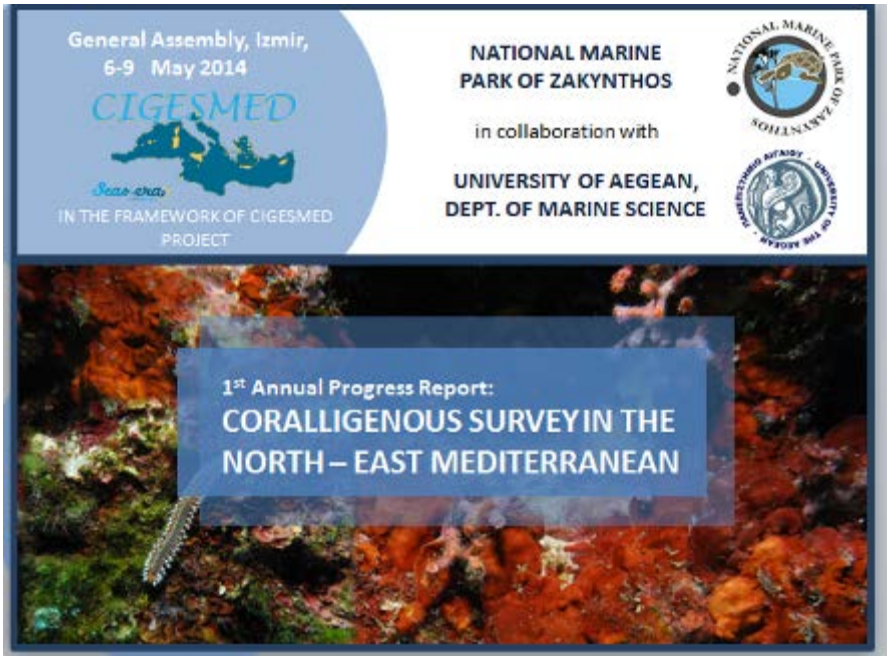

Figure 4: Presentation of NMPZ work team progress with respect to the 1st reporting period of CIGESMED project

3. PARTICIPATION IN SCIENTIFIC SYMPOSIA

Z. Erga, D. Koutsoubas, V. Gerovasileiou and M. Sini, members of the NMPZ work group, presented part of the CIGESMED results to the "7th National Conference of the Hellenic Ecological Society (HELECOS)", where they participated with the following poster contribution:

- Erga Z., David R., Guillemain D., Zuberer F., Dailianis T., Gerovasileiou V., Sini M., Koutsoubas D., Verlaque M., Féral J-P. & A. Chenuil: *Distribution of genetic diversity within* Lithophyllum stictaeforme/cabiochiae *in the NW Mediterranean*, 7th National Conference of the Hellenic Ecological Society (HELECOS), 9-12 October 2014, Mytilene, Greece.

M. Sini and V. Gerovasileiou, members of the NMPZ work group, participated in the three "Symposia on the conservation of Mediterranean marine key habitats", which were organized by the RAC-SPA/UNEP-MAP in Portoroz, Slovenia, on 27-31/10/2014:

- 5th Mediterranean Symposium on Marine Vegetation (27-28 October 2014)
- 2nd Mediterranean Symposium on the conservation of Coralligenous and other Calcareous Bio-concretions (29-30 October 2014)
- 1st Mediterranean Symposium on the conservation of Dark Habitats (31 October 2014)

Both members of the NMPZ work group presented the results of their individual research activities on eastern Mediterranean sciaphilic assemblages and also contributed to the following CIGESMED poster contribution:

- Çinar M.E., Feral J-P., Arvanitidis C., David R., Taşkin E., Dailianis T., Doğan A., Gerovasileiou V., Dağli E., Aysel V., Issaris Y., Bakir K., Salomidi M., Sini M., Açik S., Evcen A., Dimitriadis C., Koutsoubas D., Sartoretto S., Önen S. and contributors, 2014. Preliminary assessment of coralligenous benthic assemblages across the Mediterranean Sea. 207-208. [In Bouafif C., Langar H. and A. Ouerghi (editors). 2014. Proceedings of the second Mediterranean Symposium on the conservation of Coralligenous and other Calcareous Bio-Concretions. RAC/SPA, Tunis, 247 pp.].

During the Symposia they discussed with other CIGESMED partners from CNRS (France) and Ege University (Turkey) about the ongoing progress of different work packages, and potential post-CIGESMED initiatives.

4. INTERNAL MEETING OF GREEK PARTNERS

During the 22nd and 23rd of December 2014, NMPZ organized an internal project meeting (held in Thessaloniki, Greece), between NMPZ, University of Aegean and HCMR work team members. During this meeting D. Koutsoubas, C. Dimitriadis, V. Gerovasileiou and C. Arvanitidis discussed several issues regarding the progress of the various CIGESMED work packages, and set up a preliminary time-schedule including future tasks that need to be realized at Zakynthos Island.

5. PROCUREMENT OF EQUIPMENT

In November 2014, NMPZ was equipped with HOBO Water Temperature Pro v2 data loggers (Figure 2), which will be installed at Zakynthos sampling sites during the next sampling period, in order to set up a long-term benthic temperature sampling station. Loggers' data are anticipated to contribute to the monitoring and the better understanding of the local environmental conditions.

Figure 2: Onset's Waterproof Data Logger system which will be installed at Zakynthos sampling sites for a long –term temperature monitoring.

6. ACTIVITIES RELATED TO CITIZENS SCIENCE WP

V. Gerovasileiou and M. Sini, transferred knowledge and experiences obtained by the NMPZ management authority during previous Citizen Science projects, and, in collaboration with HCMR, they contributed to the overall design and development of the CIGESMED Citizen Science approach. Furthermore, they participated in the report writing for "Work Package 5: Citizen Science Network Implementation".

7. FIELD WORK

As stated in the 1st interim report report, due to the scarcity of coralligenous formations in Zakynthos that was evidenced during the preliminary surveys, further site investigation was considered essential in order to determine the optimum sampling location(s). In this context, an additional joint NMPZ and HCMR survey took place during June 2014 in order to further investigate the previously identified locations.

Site exploration for coralligenous communities

The survey focused on the most promising locations of last year's survey, that is Keri and Mavros Kavos (see 1st Interim Report). This area is located at the SW part of Zakynthos Island, close to the westernmost boundaries of the NMPZ protected area and is characterized by relatively cool water temperatures, possibly due to direct exposure to the open Ionian Sea and local wind-driven upwellings. The location can be characterized as generally pristine, yet it should be noted that it represents the main recreational diving area of the island, and is regularly visited by groups of divers every day during the summer months in an organized way. The latter means that dive masters and instructors usually escort groups of divers, while during pre-dive briefing sessions they inform divers about the protection measures that are active in the Protected Area of NMPZ, the fragility of marine organisms and the importance of their habitats. Extensive vertical rocky walls with crevices, overhangs and numerous submerged caves characterize the topography of the location. Rocky cliffs starting from 100-150 m above sea level drop vertically to depths down to 30-40 m. These geomorphological features account for the increased shadowy conditions observed locally over the greatest part of the day. The selection of new diving sites was based on examination of the superficial morphology of the coast, study of the bathymetry of the area, alongside relevant information provided by local divers and the personnel of the NMPZ management agency based on previous diving experience. A total, of five sites were investigated (Figure 3; Table 2).

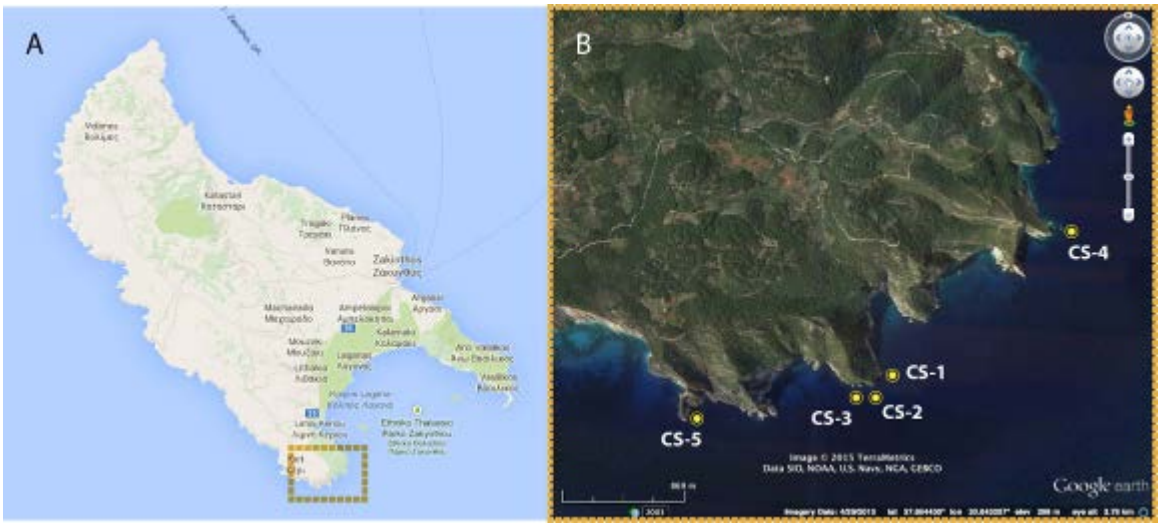

Figure 3: Map of Zakynthos (A) showing the surveyed area and the five candidate sites investigated (B).

Table 2: Coordinates and depth range of the candidate sites surveyed at Zakynthos.

Site name	Latitude	Longitude	Depth range
CS-1	37.647284°	20.845715°	15-20 m
CS-2	37.646343°	20.844765°	23-25 m
CS-3	37.646158°	20.843603°	25-29 m
CS-4	37.656884°	20.860451°	30-35 m
CS-5	37.644985°	20.830411°	15-25 m

At least one exploratory dive was performed at each site, the aim of which being to assess the existence and extent of coralligenous communities, as well as to provide a rough estimation of topography and depth range. Sites CS-1, CS-2 and CS-3 were considered as the most suitable for studying coralligenous communities in the framework of the project (Figures 4-6). Sites CS-4 and CS-5 were excluded from further investigation, due to interrupted or rare presence of coralligenous formations (mainly in the form of enclaves). Specifically, CS-4 featured a steep muddy slope extending down to 35 m depth, with emerging irregular rocky outcrops forming small walls, crevices and overhangs. However, the absence of shadowy conditions resulted in the restricted development of sciaphilic assemblages mainly under overhangs, in crevices, or within *Posidonia oceanica* rhizomes, while on the upper surface of the rocks photophilous algae (*Cystoseira* spp.) patches predominated (Figure 7). At CS-5, coralligenous enclaves were confined at the semi-vertical walls at the entrance of a semi-submerged marine cave, thus not extending at a length suitable for deploying transects (Figure 8). Out of the cave photophilous algal dominated assemblages prevailed.

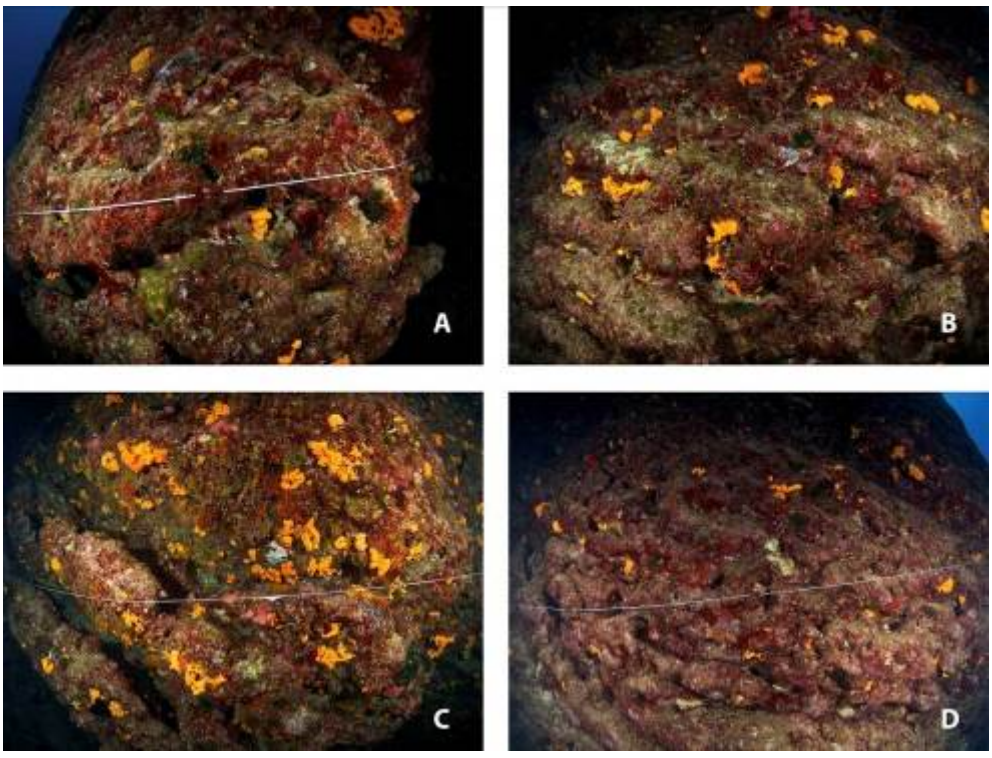

Figure 4: Photos showing coralligenous assemblages across the transect line at site CS-1.

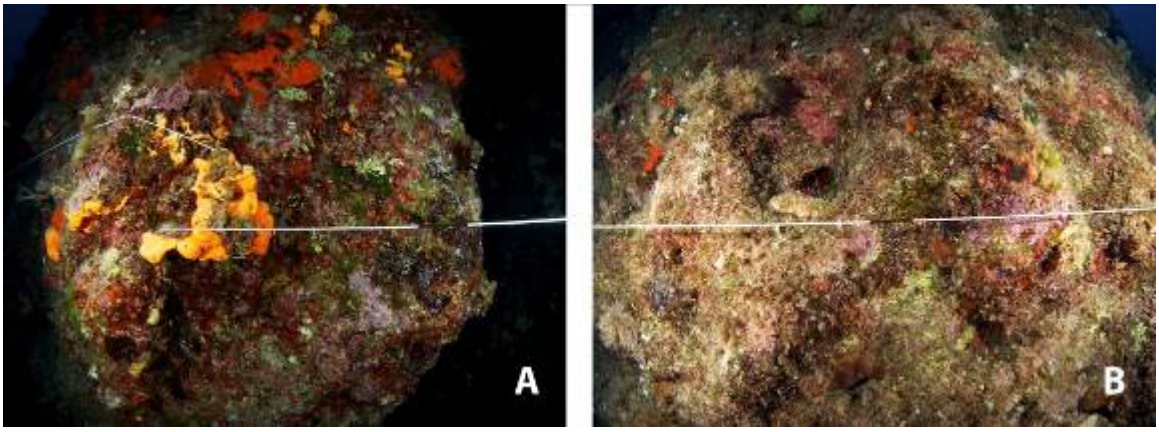

Figure 5: Photos showing coralligenous assemblages across the transect line at site CS-2.

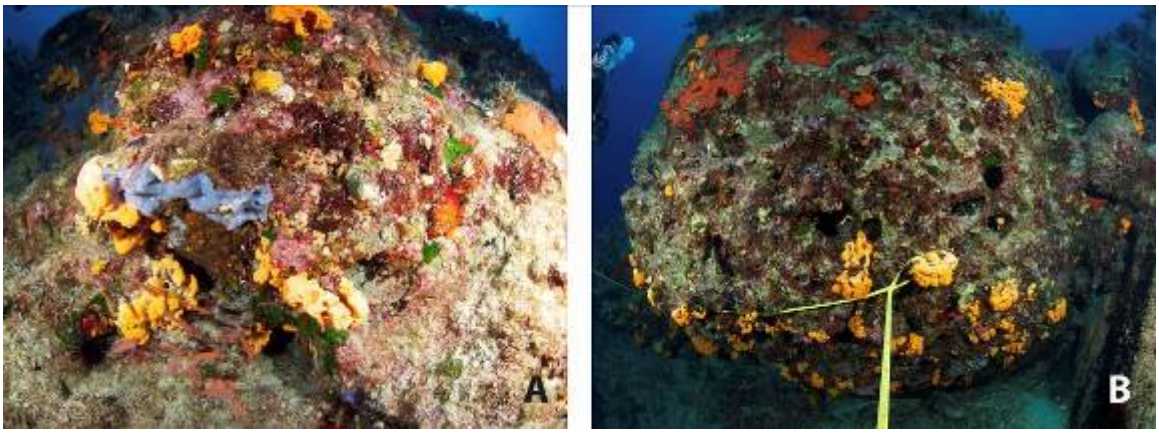

Figure 6: Photos showing coralligenous assemblages across the transect line at site CS-3.

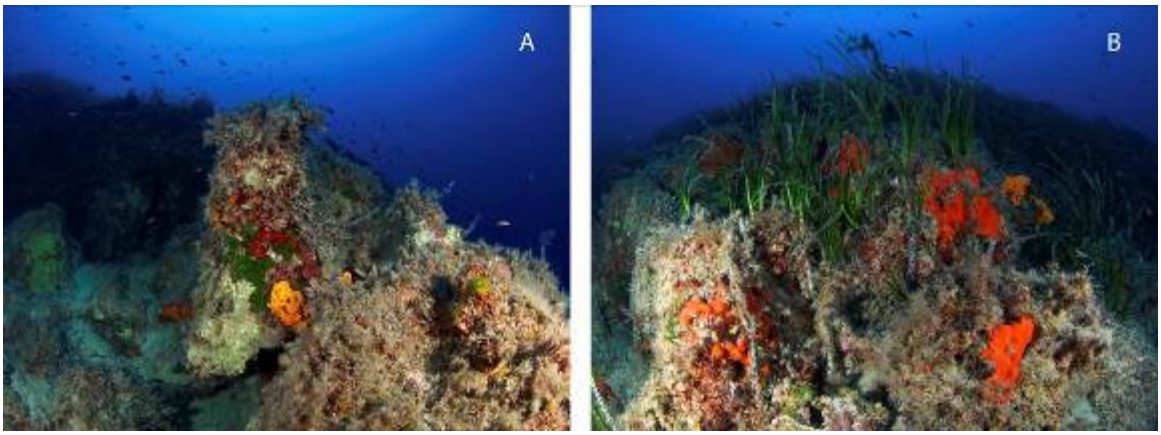

Figure 7: Aspects of candidate site CS-4, showing limited coralligenous formations under overhangs (A) or pre-coralligenous communities combined with *Posidonia oceanica* patches (B).

Figure 8: Aspect of candidate site CS-5, showing limited coralligenous enclaves confined at the semi-vertical walls at the entrance of a semi-submerged cave.

Characterization and mapping of the selected sites

According to information obtained during the exploratory phase at each site, a marked nylon line or a measuring tape (i.e. the sampling transect) was set-up along those parts of the wall that were characterized by a representative cover of coralligenous communities. The sampling transect was used in order to describe community composition, as well as the main structural characteristics of the habitat, using the following field methods. At each five-meter segment of the transect, a diver recorded topographic parameters (i.e. orientation, inclination and rugosity (see Appendix of present report – "Habitat Mapping Protocol"). Along the same five-meter segments, a second diver estimated biotic cover through visual census (see Appendix of present report – "Biotic Cover Protocol"). Additionally, biotic cover was also estimated using the first steps of the rapid visual assessment (RVA) approach (Gatti et al., 2015; see Appendix of present report – "RVA Protocol"). Finally, wide-angle photo-samples were taken by means of a Panasonic 8 mm fisheye lens on an Olympus OM-D E-M5 micro 4:3 camera, at predetermined length intervals of 5 m distance. At each step two photo-samples were taken: one close-up, roughly covering a surface of 1 to 2 m^2, and a general aspect photograph covering a more extended area. This was done in order to obtain a photographic archive of each transect that enables validation of the *in situ* visual assessment, as well as for future reference. All field sampling techniques used follow the requirements of the proposed CIGESMED Protocols (Module 1: Protocol «*Profiles and stands cartography*»).

Recorded topographic data for the three selected Zakynthos sites are presented in Table 3, while the studied transects are illustrated in Figure 9, according to the estimated orientation. A total of 105 meters of coralligenous communities was assessed, at an average depth of 28 m. Representative photographs from each site's transect are presented in Figures 4 to 6.

Table 3: Topographic characteristics of the three selected Zakynthos sites as recorded *in situ* (inclination and rugosity abbreviations according to the CIGESMED protocol – V: vertical; C: ceiling; T: tiny; S: small; M: medium; L: large)

	Segment (m)	Orientation	Inclination	Rugosity
SITE CS-1	0-5	SW	V	S
	5-10	W	V	L
	10-15	SW	C	L
	15-20	S	V	M
	20-25	S	C	L
	25-30	SE	V	M
	30-35	NE	V	L
	35-40	NE	C	S
	40-45	E	C	S
	45-50	SE	V	T
SITE CS-2	0-5	SE	V	S
	5-10	S	V	M
	10-15	S	V	M
	15-20	SE	V	M
SITE CS-3	0-5	S	V	S
	5-10	E	V	M
	10-15	SE	V	S
	15-20	S	V	S
	20-25	S	V	M
	25-30	SW	V	M
	30-35	SE	V	L

Figure 9: Tracing of the diving transects surveyed at each studied site. Each site consists of 5-meter segments of varying orientation.

Species recorded in the study sites

A total of 50 taxa belonging to 10 taxonomic groups (Table 4) were recorded at the selected sites during the fieldwork, mostly consisting of macroalgae (11) and sponges (11) (Figure 10). The highest number of taxa was recorded at site CS-1 (44), followed by CS-3 (27) and CS-2 (16). Furthermore, samples of the bryozoan *Myriapora truncata* and encrusting calcareous algae (whilst targeting samples of *Lithophyllum* spp.) were collected for genetic analysis. Given the characteristics of the sites, the proposed CIGESMED Protocol (Module 4: Sampling protocol for population genetics) could not be followed, as the coralligenous communities were not continuous, and it was not possible to obtain sufficient amount of samples from predetermined orientations and slopes. The collected samples for genetic analysis were properly dried and stored in bottles and then forwarded to CNRS for further laboratory analyses.

Table 4: Species recorded *in situ* at the three selected Zakynthos sites

Taxa / Site	Site CS-1	Site CS-2	Site CS-3
Macroalgae			
Codium bursa (Olivi) C.Agardh	+	+	+
Codium coralloides (Kützing) P.C. Silva	+		
Palmophyllum crassum (Naccari) Rabenhorst	+	+	+
Cystoseira spp.	+	+	+
Padina pavonica (Linnaeus) Thivy	+	+	+
Lithophyllum spp.	+		+
Neogoniolithon mamillosum (Hauck) Setchell & L.R.Mason			+
Mesophyllum spp.	+	+	+
Peyssonnelia rubra (Greville) J.Agardh	+		+

Peyssonnelia squamaria (S.G.Gmelin) Decaisne	+		+
Peyssonnelia spp.		+	+
Porifera			
Agelas oroides Schmidt, 1864	+	+	+
Chondrosia reniformis Nardo, 1847	+	+	+
Cliona celata Grant, 1826	+		
Cliona schmidtii (Ridley, 1881)	+		
Cliona viridis (Schmidt, 1862)	+	+	+
Haliclona (Soestella) mucosa Griessinger, 1971	+		
Pleraplysilla spinifera Schulze, 1879	+		
Spirastrella cunctatrix Schmidt, 1868	+	+	+
Ircinia spp.	+		
Phorbas tenacior Topsent, 1925			+
Dictyonella spp.			+
Anthozoa			
Caryophyllia (Caryophyllia) inornata Duncan, 1878	+		
Hydrozoa spp.	+		
Madracis pharensis Heller, 1868	+	+	+
Leptopsammia pruvoti Lacaze-Duthiers, 1897	+	+	+
Polychaeta			
Bispira volutacornis Montagu, 1804	+		
Myxicola infundibulum (Montagu, 1808)	+		
Sabella spallanzanii Gmelin, 1791	+		
Protula spp. Montagu, 1803	+		
Serpula vermicularis Linnaeus, 1767	+		+
Hermodice carunculata (Pallas, 1766)	+		
Mollusca			
Lithophaga lithophaga (Linnaeus, 1758)	+		
Rocellaria dubia (Pennant, 1777)	+		
Thylacodes arenarius (Linnaeus, 1758)	+		
Vermetidae spp.	+		
Crustacea			
Dardanus calidus (Risso, 1827)	+		
Palinurus elephas (Fabricius, 1787)			+
Scyllarides latus (Latreille, 1803)	+		
Echinodermata			
Holothuria sanctori Delle Chiaje, 1823	+		
Ophidiaster ophidianus Lamarck, 1816	+		+
Sphaerechinus granularis Lamarck, 1816			+
Bryozoa			
Adeonella calveti Canu & Bassler, 1930	+	+	+
Myriapora truncata Pallas, 1766	+	+	+
Reptadeonella violacea (Johnston, 1847)	+		
Rhynchozoon spp.	+	+	+
Schizomavella spp.	+		+
Tunicata			
Halocynthia papillosa Linnaeus, 1767	+	+	+
Microcosmus sabatieri Roule, 1885	+		
Miniacina miniacea Pallas, 1766	+		
Total species number	**44**	**16**	**27**

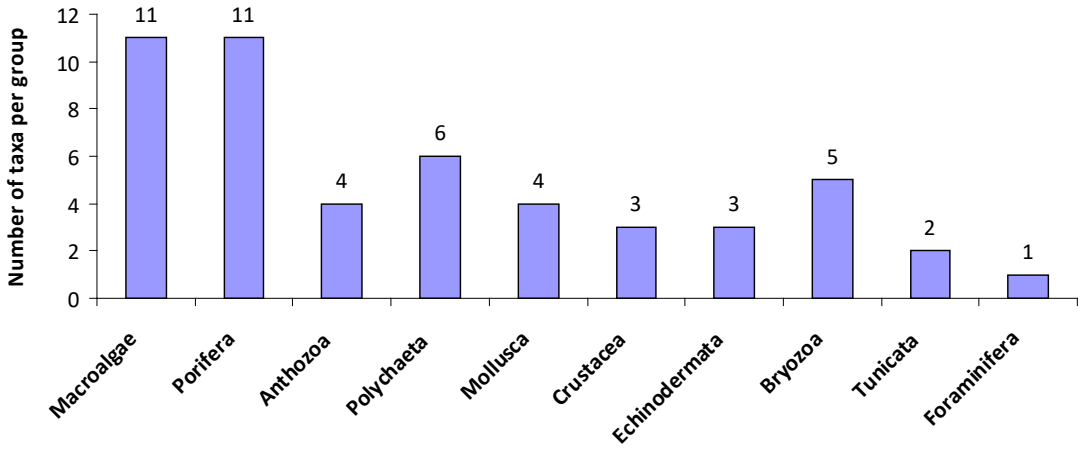

Figure 10: Number of taxa recorded at the three study sites of Zakynthos per taxonomic group.

Easy methods for biodiversity and good health assessments

The assessment of coralligenous communities in the study area of NMPZ was performed by two divers. The first diver estimated visually (Figure 11) the percent spatial coverage of sessile biota in the three sites described above. The followed methodology was based on the CIGESMED protocol (Module 1: Protocol «*Profiles and stands cartography*») with modifications (see Appendix 1-3 at the end of the report). The scientific diver estimated in each segment of the transect line (5 m width x 2 m height) the percent coverage of the following 9 morphological and taxonomic categories: calcareous encrusting algae, non-calcareous encrusting algae, erect algae, turf-forming algae, encrusting sponges, massive sponged, Scleractinia, encrusting bryozoans, and erect bryozoans. Furthermore, the diver created a list of the species recorded across the transect line at each site.

Figure 9: Diver estimating visually the percent spatial coverage of sessile biota in sites CS-1.

A second scientific diver was responsible for implementing the first steps of the rapid visual assessment (RVA) approach for the characterization of coralligenous outcrops (Gatti et al., 2015). RVA was not performed in CS-2 due to the small extent of coralligenous communities in this location and its proximity to CS-3. The species list presented in Table 4 includes *in situ* records by the two scientific divers.

Coverage results are presented in tables 5-8. Macroalgae dominated at all sites, with a mean coverage of 80.5%, while sessile animals had a mean coverage of 19.5%. Specifically, calcareous encrusting algae had a higher coverage at CS-1 and lower in CS-3 where erect algae (e.g. *Cystoseira* spp.) prevailed. Turf-forming algae dominated in CS-2. The highest coverage of sessile animals was found in CS-1 (27.5%). Porifera was the dominant animal phylum in all sites (12.5%) followed by Bryozoa (6.5%). Scleractinia presented a small coverage in all sites (0.4%).

Coralligenous communities in all sites were characterized by intermediate three-dimensional complexity; the majority of the recorded species belonged to the intermediate (1-10 cm height) and basal levels (1 cm height) according to the bionomic categorization of the RVA protocol (Gatti et al. 2015). Only one ascidian species (*Microcosmus sabatieri*) created an upper layer (>10 cm height) at CS-1. Five bio-eroding species were spotted in the three sites: the sponges *Cliona celata*, *C. viridis* and *C. schmidtii* and the bivalve molluscs *Lithophaga lithophaga* and *Rocellaria dubia*. The assessment of thickness and consistency of calcareous layer showed that penetration in CS-1 ranged between 0.4 and 1.2 cm and in CS-3 between 1.5 and 2.8 cm.

Table 5: Coverage of sessile biota for each segment of the transect at CS-1.

Taxa / Segment	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	30-45	45-50
Calcareous encrusting algae	10	60	50	10	40	40	35	30	5	0
Non-calcareous encrusting algae	0	20	10	50	20	20	15	15	5	5
Erect algae	30	0	0	0	0	0	0	0	10	70
Turf-forming algae	55	0	20	25	0	0	0	0	55	20
Encrusting sponges	3	0.5	3	2	5	10	5	25	10	5
Massive sponged	1	7	7	5	15	15	17	5	5	0
Scleractinia	0	0.5	0	0	2	0	3	0	0	0
Encrusting bryozoans	0.5	2	0	3	3	10	20	20	0	0
Erect bryozoans	0.5	10	10	5	15	5	5	5	10	0

Table 6: Coverage of sessile biota for each segment of the transect at CS-2.

Taxa / Segment	0-5	5-10	10-15	15-20
Calcareous encrusting algae	10	20	20	5
Non-calcareous encrusting algae	20	0	10	10
Erect algae	5	10	15	15
Turf-forming algae	40	60	45	60
Encrusting sponges	10	5	5	0
Massive sponges	5	5	5	0
Scleractinia	0	0	0	0
Encrusting bryozoans	5	0	0	5
Erect bryozoans	5	0	0	5

Table 7: Coverage of sessile biota for each segment of the transect at CS-3.

Taxa / Segment	0-5	5-10	10-15	15-20	20-25	25-30	30-35
Calcareous encrusting algae	5	5	5	10	20	0	10
Non-calcareous encrusting algae	5	10	10	10	10	0	20
Erect algae	20	40	40	25	10	30	20
Turf-forming algae	60	30	30	40	40	65	10
Encrusting sponges	5	10	10	5	5	0	0
Massive sponges	5	5	5	5	10	5	30
Scleractinia	0	0	0	0	0	0	5
Encrusting bryozoans	0	0	0	0	0	0	5
Erect bryozoans	0	0	0	5	5	0	0

Table 8: Mean coverage of sessile biota in the three sites.

Taxa / Site	CS-1	CS-2	CS-3	Mean
Calcareous encrusting algae	28	13.8	7.9	16.5
Non-calcareous encrusting algae	16	10	9.3	11.8
Erect algae	11	11.3	26.4	16.2
Turf-forming algae	17.5	51.3	39.3	36
Encrusting sponges	6.9	5	5	5.6
Massive sponges	7.7	3.8	9.3	6.9
Scleractinia	0.6	0	0.7	0.4
Encrusting bryozoans	5.9	2.5	0.7	3
Erect bryozoans	6.6	2.5	1.4	3.5
Macroalgae	72.5	86.3	82.9	80.5
Sessile animals	27.5	13.8	17.1	19.5

8. ACTIVITIES PROGRESS AND FUTURE PLANNING

Summary of activities progress of the present project in relation to CIGESMED work packages is provided in the following table.

NMPZ Activities	CIGESMED WP's	NMPZ PROGRESS
Activity 1 *Coralligenous assessment and monitoring*	**WP2** - *Coralligenous assessment and threats in the different basins* **WP3** - *Indicators' development and test*	Field survey and candidate site investigation, preliminary biodiversity assessment of coralligenous communities, development of easy methods for biodiversity and good health assessment, collaboration with national partners (HCMR) of CIGESMED project
Activity 2 *Management tools*	**WP4** - *Innovative monitoring tools* **WP6** - *Data management, mapping and assimilation tools*	Participation in monitoring tools design
Activity 3 *Participatory process- Promotion - Public awareness activities*	**WP5** - *Citizen science network implementation* **WP7** - *Outreach, dissemination and stakeholder engagement*	Close collaboration with HCMR

9. REFERENCES

Gatti G., Bianchi C. N., Morri C., Montefalcone M., Sartoretto S., 2015. Coralligenous reefs state along anthropized coasts: Application and validation of the COARSE index, based on a rapid visual assessment (RVA) approach. *Ecological Indicators* 52: 567–576.

10. APPENDIX

Biotic Cover Protocol

	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
ALGAE Calcareous Encrusting																				
ALGAE NON Calcareous Encrusting																				
Erect ALGAE																				
TURF																				
PORIFERA Encrusting																				
PORIFERA massive																				
Scleractinia																				
BRYOZOA encrusting																				
BRYOZOA erect																				
Adeonella																				
Myriapora																				
SERPULIDS																				
TUNICATI																				
Notes:																				

Habitat Mapping Protocol

GPS start				**GPS** end				**Ημερομηνία**	

Τμήμα (m)	Προσαν (μοίρες)	Κλίση				Ανωμαλία εδάφους				Σκουπίδια	Παρατηρήσεις
		F	I ~45°	V	C	T	S	M	L	Υλικό	
0-5											
5-10											
10-15											
15-20											
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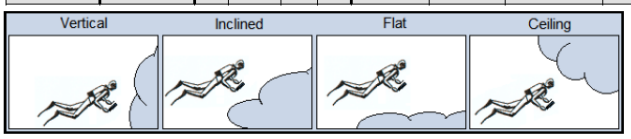
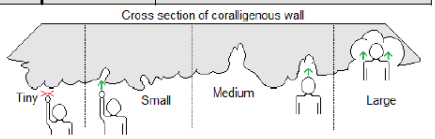




Rapid Visual Assessment (RVA) Protocol

MORPHOTYPE	Depth	Max Depth	Slope	Orient

Substrate penetration (cm)	1:	2:	3:	4:	5:	6:	

Bioeroders	Absent	Occasional	Abundant

Basal Layer ≤ 1 cm (Cover %)				
Calc Algae %	Non-Calc Encr algae %	Animal %	Turf - Filamentous %	Sediment %

Intermediate Layer ≤ 10 cm
LIST OF SPECIES
6 PHOTOS !!!

Upper Layer > 10 cm				
Species	Cover %	Max height	Epibiosis %	Necrosis %

Selected field work photos (by T. Dailianis, M. Sini, K. Vatikiotis, C. Katsoupis, C. Arvanitidis, V. Gerovasileiou)


SUZUKI

3rd Reporting period annual report

1. INTRODUCTION

The current document is the third Annual Progress Report (3rd reporting period) of activities that were undertaken by the National Marine Park of Zakynthos as a subtask in the framework of the European Project CIGESMED according to deliverable requirements of the contract (Ref CNRS: DR12-JE 093 579) signed by NMPZ and CNRS. It includes the tasks and activities carried out from April 2015 until May 2016. The activities of the subtask '*Coralligenous Survey in the North – East Mediterranean*' and their relation to the Work Packages (WP) of CIGESMED Project are presented in Table 1.

Table 3: NMPZ's activities and their relation to CIGESMED Project WPs

NMPZ Activities	Description	Connection to CIGESMED WP's
Activity 1	Coralligenous assessment and monitoring	**WP2** - *Coralligenous assessment and threats in the different basins* **WP3** - *Indicators' development and test*
Activity 2	Management tools	**WP4** - *Innovative monitoring tools* **WP6** - *Data management, mapping and assimilation tools*
Activity 3	Participatory process-Promotion -Public awareness activities	**WP5** - *Citizen science network implementation* **WP7** - *Outreach, dissemination and stakeholder engagement*

2. GENERAL ASSEMBLY OF CIGESMED PROJECT 2015

D. Koutsoubas, C. Dimitriadis, M. Sini and V. Gerovasileiou, members of the NMPZ/University of the Aegean work team, participated in the General Assembly of CIGESMED project which was held in Mitilene, Greece from the 18th to the 24th of May 2015. During the meeting they had the opportunity to discuss with other Project participants as well as to present the results derived from the 2nd reporting period (2nd Annual Report) with respect to Zakynthos study sites and Project objectives (Figure 1). In more details, C. Dimitriadis presented the progress of the tasks that were assigned to the NMPZ during the second year of CIGEMED project duration. These tasks included: i) Field surveys that have been conducted (Characterization and mapping of the selected sites) following the requirements of the proposed CIGESMED Protocols «Profiles and stands cartography», ii) Collection of samples of the bryozoan *Myriapora truncata* and encrusting calcareous algae (whilst targeting samples of *Lithophyllum* spp.) for

genetic analyses, iii) Preliminary assessment of community composition and structural patterns.
The members of the NMPZ/University of the Aegean work team exchanged ideas and technical knowledge regarding field work (e.g. study sites, protocols), preliminary results (e.g. species lists), data analyses, citizen science, and potential post-CIGESMED initiatives.

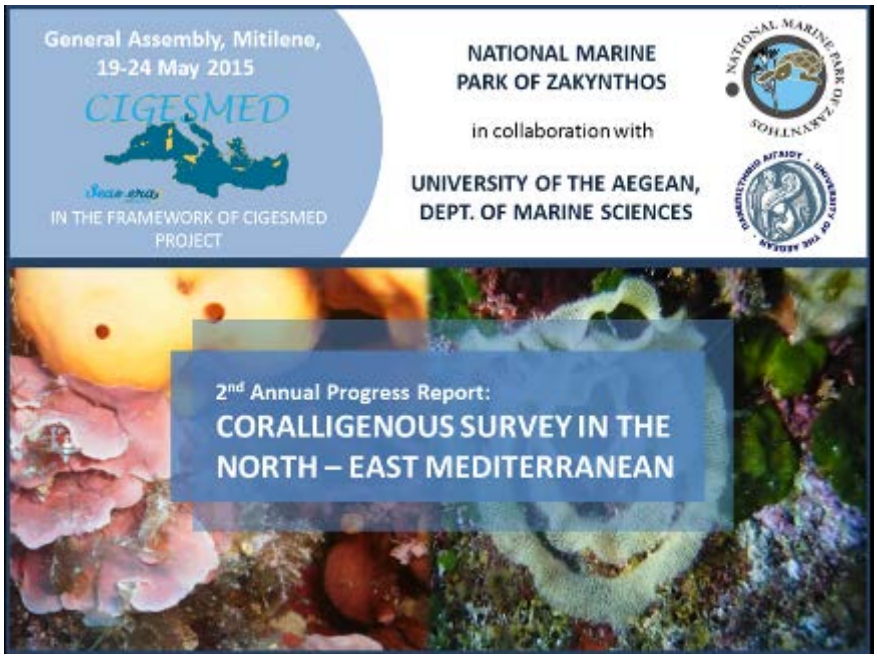


Figure 5: Presentation of NMPZ/University of the Aegean work team progress with respect to the 2nd reporting period of CIGESMED project

3. WORKING MEETING IN MARSEIILE, DECEMBER 2015

D. Koutsoubas, M. Sini and V. Gerovasileiou participated to the activities of the working meeting which was held in Marseille at December 2015. During the meeting they were involved in the designing and planning of publications and promotional actions with respect to CIGESMED project results and outputs. At the same time, they were also involved in the discussion of how to expand and enlarge CIGESMED project activities to the next call of proposals.

4. INTERNAL MEETING OF GREEK PARNTERS 2015

During the 28th and 30th of December 2015, NMPZ organized an internal project meeting (held in Thessaloniki, Greece), between NMPZ, University of Aegean and HCMR work team members. During this meeting D. Koutsoubas, C. Dimitriadis, V. Gerovasileiou and M. Sini discussed several issues regarding the progress of the

various CIGESMED work packages, and set up a time-schedule including future tasks that need to be realized at Zakynthos MPA.

5. PARTICIPATION IN SCIENTIFIC SYMPOSIA

V. Gerovasileiou member of the NMPZ/University of the Aegean/HCMR working group along with other members of the CIGESMED Working Group, presented part of the CIGESMED results to the 13th International congress on the zoogeography and ecology of Greece and adjacent regions (ICZEGAR) held in Crete from 7 to 11 October 2015, with the following Poster contribution:

- Gerovasileiou V., Dailianis T., Panteri E., Gatti G., Issaris Y., Sini M., Salomidi M., Dimitriadis C., Michalakis N., Doğan A., Thierry de Ville d'Avray L., David R., Çinar M.E., Koutsoubas D., Arvanitidis C., Féral J-P. Establishing a citizen science initiative for the mapping and monitoring of coralligenous assemblages in the Mediterranean Sea. Proceedings of 13th ICZEGAR conference, 7-11 October, Herakelion, Greece, 119p.

The members of the NMPZ/University of the Aegean/HCMR working group along with other members of the CIGESMED working group participated in the publication regarding Citizen Science activities of CIGESMED project which was presented as a the poster presentation at the 1st ECSA Conference 2016 *'Citizen Science – Innovation in Open Science, Society and Policy'* held in Berlin from 19 to 21 May 2016:

- Gatti G., Dimitriadis C., Gerovasileiou V., Dailianis T., Panteri E., Issaris Y., Sini M., Salomidi M., Michalakis N., Doğan A., Thierry de Ville d'Avray L., David R., Çinar M.E., Koutsoubas D., Arvanitidis C., Féral J-P. 2016. Citizen Science for CIGESMED, or how to engage divers in marine ecological monitoring: first steps of a new project. Proceedings of the First International ECSA Conference, 19–21 May, Berlin, Germany, 63p.

During the International Symposium 'Marine Protected Areas in Greece and the Mediterranean: Designing for the Future by Applying Lessons Learnt from the Past' which was organized by the Management Agency of the National Marine Park of Zakynthos and held in Zakynthos from 4 to 6 December 2015 the member of CIGESMED working group C. Arvanitidis presented orally the activities of CIGESMED project. At the same time, assessment of coralligenous habitat in the marine protected area of NMPZ was also presented by the members of NMPZ/University of the Aegean/HCMR working group under the following CIGESMED Poster contribution:

- Dailianis T., Sini M., Gerovasileiou V., Dimitriadis C., Sapouna A., Vatikiotis K., Katsoupis C., Çinar M.E., Féral J-P., Koutsoubas D., Arvanitidis C. 2015. Ecological assessment of coralligenous assemblages in the National Marine Park of Zakynthos (Ionian Sea, Greece). Proceedings of the International Symposium 'Marine Protected Areas in Greece and the

Mediterranean: Designing for the Future by Applying Lessons Learnt from the Past', Zakynthos, Greece, 4-6 October, 32p.

During the Symposia members of the NMPZ/University of the Aegean/HCMR working group discussed with other CIGESMED partners from CNRS (France) and Ege University (Turkey) about the ongoing progress of different work packages, and potential post-CIGESMED initiatives.

6. DESSIMINATION

A new promotional trifold leaflet, was created by the members of NMPZ/University of the Aegean/HCMR working group regarding the activities of CIGESMED project that were carried out at the Marine Protected Area of NMPZ. The original template of the leaflet was delivered to CNRS in pdf format of high resolution for further use and exploitation (WP6).

Further dissemination/promotional/outreach actions included the communication of CIGESMED activities in the MEDPAN Network as well as the engagement of local stakeholders (diving clubs, dedicated divers) to Citizen Science activities of the project.

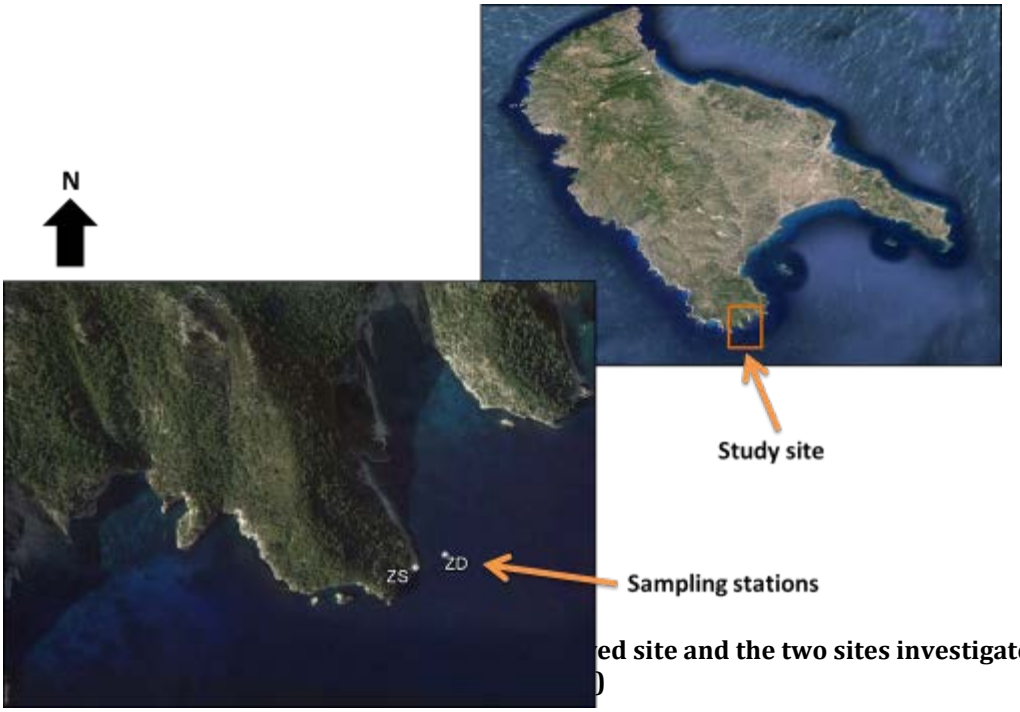
7. FIELD WORK

Following the previous surveys (2014) in the NMPZ for the exploration of coralligenous communities (see 2nd progress report for the candidate sites), NMPZ/University of the Aegean/HCMR working group established the final research site for the study and monitoring of coralligenous habitat in the Marine Protected Area of NMPZ during June of 2015. All other candidate sites that were surveyed during 2014 were excluded from further investigation, due to interrupted or rare presence of coralligenous formations. The research site is located at Lakka/Mavros Cavos area which is located at the SW part of Zakynthos Island, close to the westernmost boundaries of the NMPZ protected area and is characterized by relatively cool water temperatures, possibly due to direct exposure to the open Ionian Sea and local wind-driven up-welling. The location can be characterized as generally pristine, yet it should be noted that it is included among the most popular recreational diving areas of the island, and is regularly visited by groups of divers every day during the summer period (May to October) in an organized way by the local Diving Clubs. The latter means that dive masters and instructors usually escort groups of divers, while during pre-dive briefing sessions they inform divers about the protection measures that are active in the Protected Area of the NMPZ, the fragility of marine organisms and the importance of their habitats (established after close collaboration with the scientific personnel of the NMPZ Management Agency). Extensive vertical rocky walls with crevices, overhangs and numerous submerged caves characterize the topography of the specific location. Rocky cliffs starting from 100-150 m above sea level drop vertically to depths down to 30-40 m. These geomorphological

features account for the increased shadowy conditions observed locally over the greatest part of the day.
Two research stations were established and surveyed within the research site of NMPZ (Table 1). Their topographic features are presented in table 1. The conducted surveys at these stations aimed to:

- Identify coralligenous communities structure
- Identify the environmental conditions
- Record and evaluate the threats

For the identification of the environmental conditions of the surveyed stations, 6 HOBO Water Temperature Pro v2 data loggers (Figure 3) were installed in order to set up a long-term benthic temperature sampling station (Figure 4). The loggers were installed at fixed depths (0, 5, 10, 20, 30, 40m). Loggers' data are anticipated to contribute to the monitoring and the better understanding of the local environmental conditions.



ed site and the two sites investigated (ZS)

Table 4. Topographic features of the surveyed sampling stations

Station	Transect	Coordinates		Date	Depth range	Orientation	Inclination	Rugosity

		Latitude	Longitude					
ZS	**ZSA**	37.647239°	20.845430°	5/6/2015	15-17	W	Vertical	Large
ZS	**ZSB**	37.647239°	20.845430°	5/6/2015	15-17	S, SW	Vertical	Medium
ZS	**ZSC**	37.647239°	20.845430°	5/6/2015	15-17	NE	Vertical	Large
ZD	**ZDA**	37.647548°	20.846123°	6/6/2015	38-39	NW	Inclined / Subvertical	Medium-Large
ZD	**ZDB**	37.647548°	20.846123°	6/6/2015	38-39	W	Vertical	Medium-Large
ZD	**ZDC**	37.647548°	20.846123°	6/6/2015	38-39	SW	Vertical	Medium-Large

Figure 3: Onset's Waterproof Data Logger system which was installed at Zakynthos sampling sites for a long –term temperature monitoring.

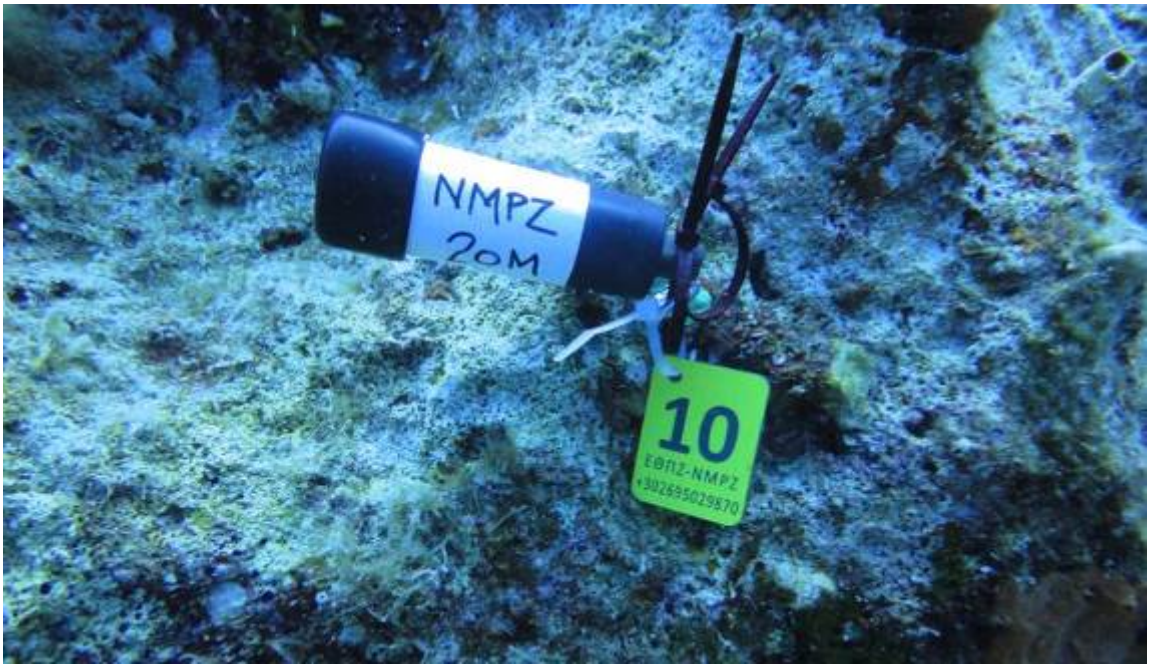


Figure 4: Installed data loggers at the sampling site of NMPZ

All the standard protocols and techniques of CIGESMED project were used during the surveys as they are thoroughly described at the 2nd progress report. The collected data were processed, inserted to a data base and then sent to the leader of CIGESMED WP2 for further analysis.
Moreover, additional samples of specimens of coralligenous species that are common across the Mediterranean such as *Mesophyllum sp* and *Myriapora truncata*, were also collected from the study area during the surveys. These samples were sent to the laboratory of IMBE for molecular analysis (WP4).

8. SPECIES RECORDED IN THE STUDY SITE

A total of 95 taxa belonging to 14 major taxonomic groups (Table 3) were recorded at the selected sites during the fieldwork, mostly consisting of Porifera (28) and Echinodermata (9) (Figure 5). The highest number of taxa (75) was recorded at the shallower station (ZS) while at the deep station (ZD) were recorded 68 taxa.

At the ZS station, most dominant taxa were Porifera (19) and Echinodermata (9), while at the ZD station were Porifera (22) and Rhodophyta (8) (Figure 5). More specific, the most abundant sponges at the ZS stations were *Agelas oroides* and *Crambe crambe*. Echinoderms while they had a "relative" high number of species (9) at the ZS station, their abundance was rather low. At the ZD station most abundant sponges were *Agelas oroides*, *Axinella* spp., *Chondrosia reniformis*, *Clionia viridis*, *Dysidea fragilis*, *Haliclona (Halichoclona) fulva*, *Penares* sp., *Pleraplyssila spinifera* and *Spirastrella cuncantrix* and from the rhodophytes were *Lithophyllum* sp., *Mesophyllum* sp., *Peyssonnelia rubra*, *Peyssonnelia squamaria*, and *Peyssonnelia* spp., respectively (Table 3).

Table 3. The list of coralligenous species and their relative abundance at coralligenous stations of Zakynthos [1 = low (rare or isolated individuals), 10 = average (dispersed population), 100 = abundant (abundant and dense population)] *Alien species.

Species/Stations	*ZS*	*ZD*
ALGAE		
Encrusting calcareous algae	100	
Red algae unid.1		100
Turf-forming algae	100	10
CHLOROPHYTA		
Cladophora pellucida (Hudson) Kützing, 1843	10	
Codium bursa (Olivi) C.Agardh, 1817	1	
Codium effusum (Rafinesque) Delle Chiaje, 1829		10
Palmophyllum crassum (Naccari) Rabenhorst, 1868	100	100
PHAEOPHYCEAE		
Dictyota dichotoma (Hudson) J.V.Lamouroux, 1809		1
Halopteris spp.	10	1
RHODOPHYTA		
Amphiroa cryptarthrodia Zanardini, 1844		10
Lithophyllum sp.		100
Mesophyllum sp.	100	100
Neogoniolithon mamillosum (Hauck) Setchell & L.R.Mason, 1943		10
Peyssonnelia rosa-marina Boudouresque & Denizot, 1973	10	10
Peyssonnelia rubra (Greville) J.Agardh, 1851	100	100
Peyssonnelia squamaria (S.G.Gmelin) Decaisne, 1842	10	100
Peyssonnelia spp.	100	100
FORAMINIFERA		
Miniacina miniacea (Pallas, 1766)	100	10
PORIFERA		
Agelas oroides (Schmidt, 1864)	100	100
Axinella damicornis (Esper, 1794)	1	10
Axinella spp.	1	100
Cacospongia mollior Schmidt, 1862	10	10
Chondrosia reniformis Nardo, 1847	1	100
Crambe crambe (Schmidt, 1862)	100	
Cliona celata Grant, 1826	10	
Cliona schmidti (Ridley, 1881)	10	10
Cliona viridis (Schmidt, 1862)	10	100
Dendroxea lenis (Topsent, 1892)	10	
Dictyonella incisa (Schmidt, 1880)		1
Dysidea fragilis (Montagu, 1814)		100
Fasciospongia cavernosa (Schmidt, 1862)		1
Haliclona (Halichoclona) fulva (Topsent, 1893)	1	100
Haliclona (*Soestella*) *mucosa* (Griessinger, 1971)	1	10
Haliclona sp.		1

Hemimycale columella (Bowerbank, 1874)		10
Ircinia sp.	1	
Merlia sp.	10	
Oscarella imperialis Muricy, Boury-Esnault, Bézac & Vacelet, 1996		10
Penares sp.	1	100
Petrosia (*Petrosia*) *ficiformis* (Poiret, 1789)		1
Phorbas tenacior (Topsent, 1925)	1	10
Pleraplysilla spinifera (Schulze, 1879)	1	100
Terpios gelatinosa (Bowerbank, 1866)	10	
Sarcotragus foetidus Schmidt, 1862	1	10
Sarcotragus spinosulus Schmidt, 1862		1
Spirastrella cunctatrix Schmidt, 1868		100
CNIDARIA		
Caryophyllia (*Caryophyllia*) *inornata* (Duncan, 1878)	10	10
Leptopsammia pruvoti Lacaze-Duthiers, 1897	1	100
Madracis pharensis (Heller, 1868)	10	10
Polycyathus muellerae (Abel, 1959)	1	
Hydrozoa (spp.)	1	
Scleractinia (spp.)	10	10
POLYCHAETA		
Hermodice carunculata (Pallas, 1766)	10	10
Bispira volutacornis (Montagu, 1804)	1	
Myxicola infundibulum (Montagu, 1808)	10	1
Sabella spallanzanii (Gmelin, 1791)	1	
Serpulidae (sp.)	10	10
Salmacina spp. / *Filograna* spp.	1	1
Protula tubularia (Montagu, 1803)	10	
CRUSTACEA		
Dardanus calidus (Risso, 1827)	1	
Scyllarides latus (Latreille, 1803)	1	
MOLLUSCA		
Gastropoda		
Flabellina affinis (Gmelin, 1791)	1	
Thylacodes arenarius (Linnaeus, 1758)	1	1
Peltodoris atromaculata Bergh, 1880		1
Bivalvia		
Lithophaga lithophaga (Linnaeus, 1758)	100	
Rocellaria dubia (Pennant, 1777)	10	10
BRYOZOA		
Adeonella spp.	100	100
Beania magellanica (Busk, 1852)		10
Cellepora sp.	1	
Myriapora truncata (Pallas, 1766)	100	100
Reptadeonella violacea (Johnston, 1847)	100	

Rhynchozoon neapolitanum Gautier, 1962	10	100
Schizomavella (*Schizomavella*) *mamillata* (Hincks, 1880)	100	100
Encrusting bryozoa	100	
ECHINODERMATA		
Arbacia lixula (Linnaeus, 1758)	1	1
Centrostephanus longispinus (Philippi, 1845)	1	1
Echinaster (*Echinaster*) *sepositus* (Retzius, 1783)	1	
Hacelia attenuata Gray, 1840	1	
Holothuria (*Panningothuria*) *forskali* Delle Chiaje, 1823	1	
Holothuria (*Platyperona*) *sanctori* Delle Chiaje, 1823	1	
Ophidiaster ophidianus (Lamarck, 1816)	1	1
Paracentrotus lividus (Lamarck, 1816)	1	1
Sphaerechinus granularis (de Lamarck, 1816)	1	1
TUNICATA		
Didemnum commune (Della Valle, 1877)		100
Didemnum maculosum (Milne Edwards, 1841)	1	100
Didemnum sp.	1	
Halocynthia papillosa (Linnaeus, 1767)	10	1
PISCES		
Anthias anthias (Linnaeus, 1758)	1	10
Apogon imberbis (Linnaeus, 1758)	10	
Chromis chromis (Linnaeus, 1758)	100	100
Coris julis (Linnaeus, 1758)	100	100
Diplodus sargus sargus (Linnaeus, 1758)		10
Diplodus vulgaris (Geoffroy Saint-Hilaire, 1817)		10
Scorpaena spp.	100	1
Serranus scriba (Linnaeus, 1758)	1	10

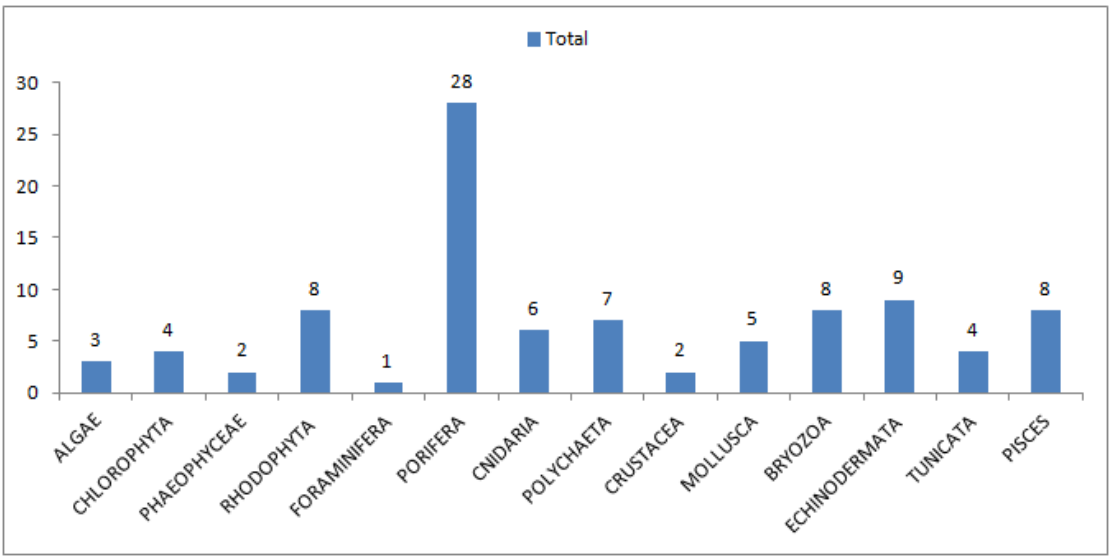


Figure 5. Distribution of total number of species to groups.

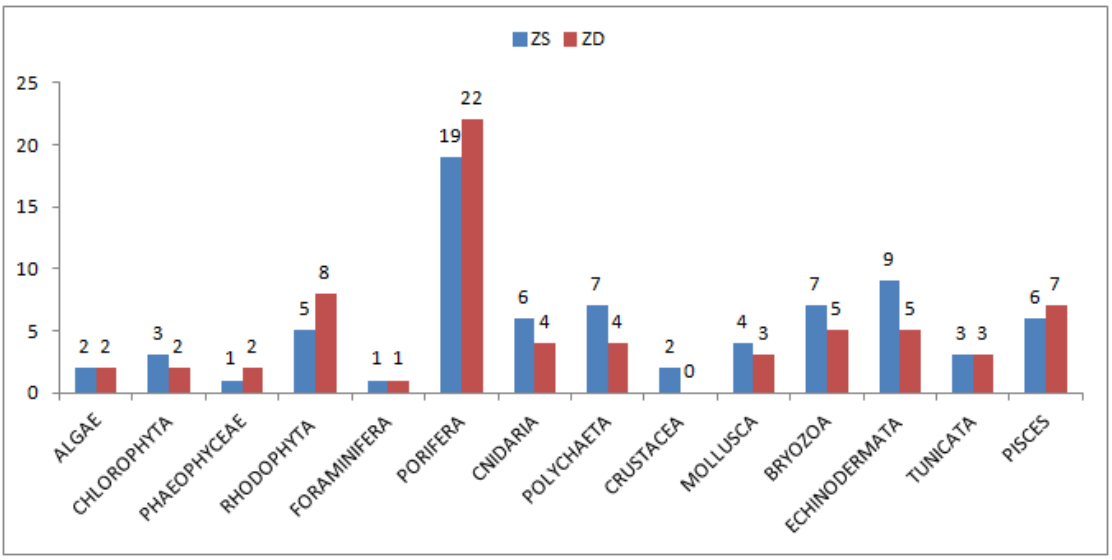
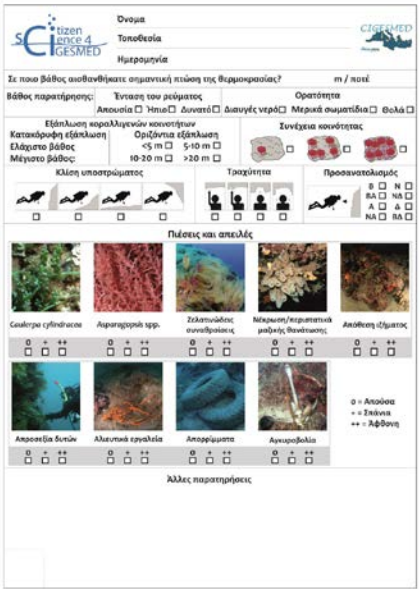


Figure 6. The number of species found in each group and station.

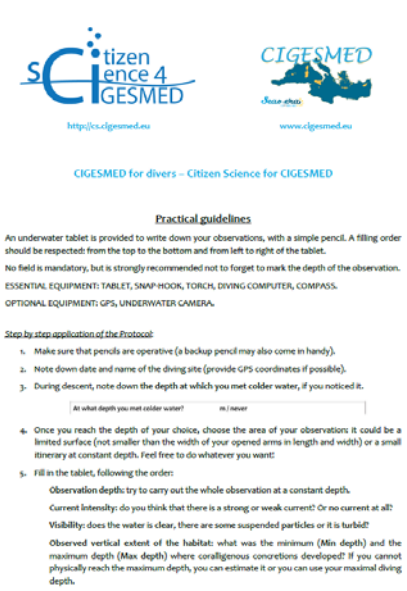
8. CITIZEN SCIENCE ACTIVITIES

The NMPZ/University of Aegean working group was actively involved in the activities performed in the framework of the Citizen Science WP of CIGESMED project (WP5) (Citizen Science for CIGESMED). The following activities were carried out by the working group of the NMPZ/ University of Aegean:

a) Participation in the compilation and translation in the Greek language of the underwater slates that will be used by the citizen scientists for the study and monitoring of the coralligenous habitat.



b) Participation in the preparation of the practical guidelines (short and long version) documents and translation in the Greek language.



CIGESMED for divers – Citizen Science for CIGESMED

Practical guidelines

An underwater tablet is provided to write down your observations, with a simple pencil. A filling order should be respected: from the top to the bottom and from left to right of the tablet.

No field is mandatory, but is strongly recommended not to forget to mark the depth of the observation.

ESSENTIAL EQUIPMENT: TABLET, SNAP HOOK, TORCH, DIVING COMPUTER, COMPASS.

OPTIONAL EQUIPMENT: GPS, UNDERWATER CAMERA.

Step by step application of the Protocol:

1. Make sure that pencils are operative (a backup pencil may also come in handy).
2. Note down date and name of the diving site (provide GPS coordinates if possible).
3. During descent, note down the depth at which you met colder water, if you noticed it.

At what depth you met colder water?	m / never

4. Once you reach the depth of your choice, choose the area of your observations: it could be a limited surface (not smaller than the width of your opened arms in length and width) or a small itinerary at constant depth. Feel free to do whatever you want!
5. Fill in the tablet, following the order:

   Observation depth: try to carry out the whole observation at a constant depth.

   Current intensity: do you think that there is a strong or weak current? Or no current at all?

   Visibility: does the water is clear, there are some suspended particles or it is turbid?

   Observed vertical extent of the habitat: what was the minimum (Min depth) and the maximum depth (Max depth) where coralligenous concretions developed? If you cannot physically reach the maximum depth, you can estimate it or you can use your maximal diving depth.

CIGESMED για Δύτες, Πολίτες-Επιστήμονες για το πρόγραμμα παρακολούθησης των κοραλλιγενών οικοτόπων

Τι είναι οι 'κοραλλιγενείς' οικότοποι;

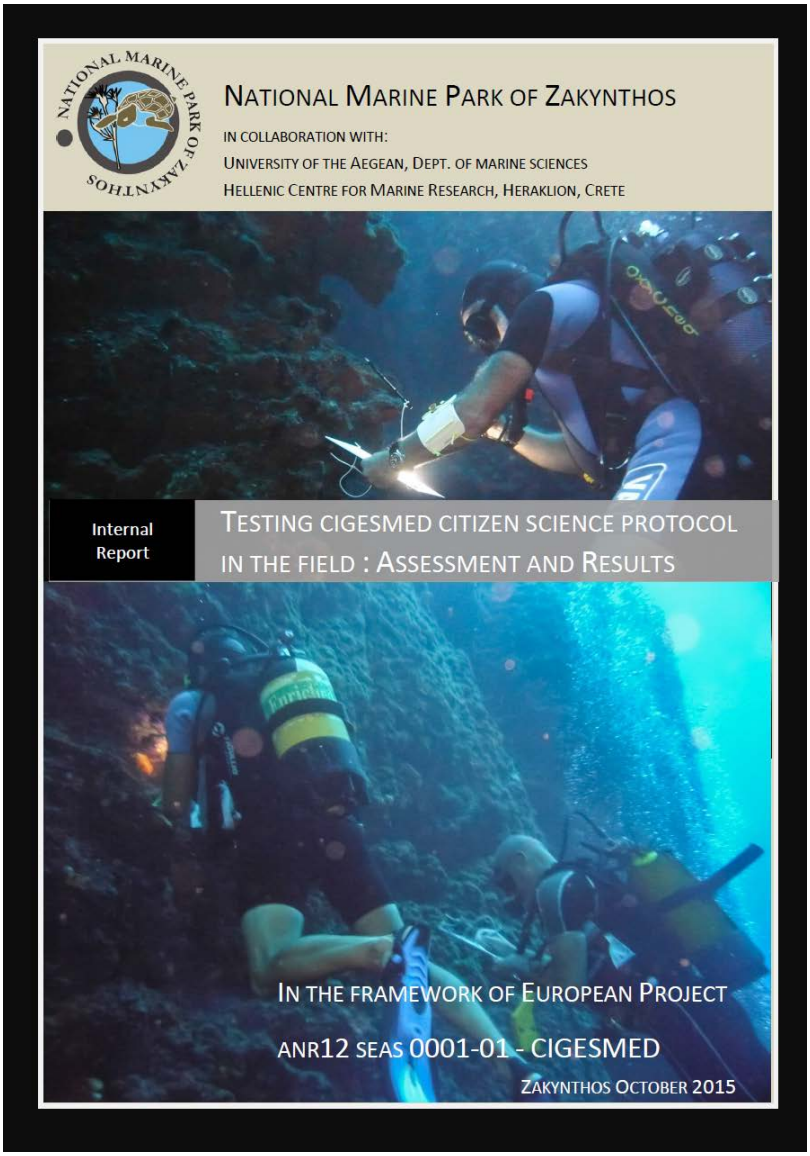
Οι κοραλλιγενείς οικότοποι, αποτελούν ένα ιδιαίτερο υποβρύχιο τοπίο, που απαντά αποκλειστικά στη θάλασσα της Μεσογείου. Αναπτύσσεται πάνω σε σκληρούς βραχώδεις πυθμένες, κυρίως από ενασβεστιωμένα ροδοφύκη των τάξεων Corallinales και Peyssonneliales, οι αλλεπάλληλες αποθέσεις των οποίων μπορούν σε βάθος χρόνου να σχηματίσουν πολυδιάστατες υποβρύχιες δομές και υφάλους. Πλήθος άλλων ειδών-βιοκατασκευαστών συμμετέχουν σε αυτή τη βιογενή διεργασία οικοδομώντας (π.χ. γοργονίες, σκληρακτίνια, σπόγγοι, βρυόζωα, πολύχαιτα) ή αποδομώντας (ψαροδαβρωτές, π.χ. σπόγγοι του γένους Cliona που διατρυπούν, ή αχινοί που θρυμματίζουν το ασβεστώδες υπόστρωμα), αυξάνοντας διαρκώς τη δομική πολυπλοκότητα των κοραλλιγενών σχηματισμών. Ακριβώς λόγω της πολυπλοκότητας τους, οι δομές αυτές αποτελούν σημαντικό καταφύγιο για μεγάλο αριθμό ασπονδύλων (π.χ. καρκινοειδή, εχινόδερμα, μαλάκια, ασκίδια) και ψαριών, γεγονός που τις καθιστά πυρήνες θαλάσσιας βιοποικιλότητας. Κατά κανόνα, οι κοραλλιγενείς οικότοποι χαρακτηρίζονται από υψηλή αισθητική αξία αλλά και υψηλή ευπάθεια λόγω των εξαιρετικά αργών ρυθμών αύξησης των επιμέρους ειδών τους.

Γιατί μελετούμε τους κοραλλιγενείς οικοτόπους;

Οι θαλάσσιοι αυτοί οικότοποι είναι μοναδικοί σε παγκόσμιο επίπεδο και κατατάσσονται μεταξύ των ομορφότερων και πλουσιότερων σε ζωή θαλάσσιων τοπίων που μπορεί κανείς να προσεγγίσει με αυτόνομη κατάδυση, λόγω της δομικής πολυπλοκότητας που παρουσιάζουν, φιλοξενούν πλήθος ειδών μεγάλης οικολογικής, αισθητικής και εμπορικής αξίας, ορισμένα από τα οποία προστατεύονται από την Εθνική αλλά και τη Διεθνή νομοθεσία. Οι κοραλλιγενείς οικότοποι συχνά απειλούνται από τις ανθρώπινες δραστηριότητες. Η ανεξέλεγκτη αγκυροβολία, η κατάδυση με έλλειψη περιβαλλοντικής ευαισθητοποίησης, η υπεραλίευση και τα απορρίμματα, σε συνδυασμό με την εισβολή αλλόχθονων ειδών και την αύξηση της θερμοκρασίας της θάλασσας (λόγω κλιματικής αλλαγής), αποτελούν τις κυριότερες απειλές που μπορεί να υποβαθμίσουν σημαντικά την κατάσταση των κοραλλιγενών οικοτόπων.

c) Organizing and realizing the testing of CIGESMED citizen science protocol in the field. The aim of this activity was to test the effectiveness of one of the proposed citizen science protocol (i.e. tablet with a specific data form, practical guidelines) that was developed in the framework of CIGESMED project, in the National Marine Park of Zakynthos (NMPZ). To this end, volunteering experienced SCUBA divers (local recreational and/or professional divers, instructors and owners of local diving centres) participated in this study. The citizen science protocol was tested in selected study sites of CIGESMED within the NMPZ, during July and September 2015. Further testing will be also carried out during the summer of 2016. The methodology, results, conclusions and suggestions of this initiative were thoroughly presented in the following interim report (attached to the deliverables of the current reporting period):

Dimitriadis C., Gerovasileiou V., Dailianis T., Sini M., Kalli E., Sourbes L., Arvanitidis C., Koutsoubas D. 2015. Testing CIGESMED citizen science protocol in the field: assessment and results. CIGESMED project internal report, NMPZ, Zakynthos, Greece. 10p.



d) Participation in the testing of the webpage of Citizen Scientists for CIGESMED.

9. PROGRESS OF REALIZED ACTIONS

The progress of the activities that the Management Agency of the National Marine Park of Zakynthos carried out in relation to CIGESMED work packages is provided in the following table.

NMPZ Activities	CIGESMED WP's	NMPZ PROGRESS
Activity 1 *Coralligenous assessment and monitoring*	**WP2** - *Coralligenous assessment and threats in the different basins* **WP3** - *Indicators' development and test*	**Completed** (field work, testing and implementation of protocols, data gathering, processing and analysis)
Activity 2 *Management tools*	**WP4** - *Innovative monitoring tools* **WP6** - *Data management, mapping and assimilation tools*	**Completed** (establishment of research station for the long term monitoring of coralligenous habitat, data management and assimilation tools)
Activity 3 *Participatory process- Promotion - Public awareness activities*	**WP5** - *Citizen science network implementation* **WP7** - *Outreach, dissemination and stakeholder engagement*	**Completed** (involvement in CS network implementation, involvement in the development of the CS protocols and informational material, implementation and evaluation/testing of CS protocol in the NMPZ with divers, production of educational/promotional leaflet, engagement of stakeholders, communication of CIGESMED actions to other NetWorks)

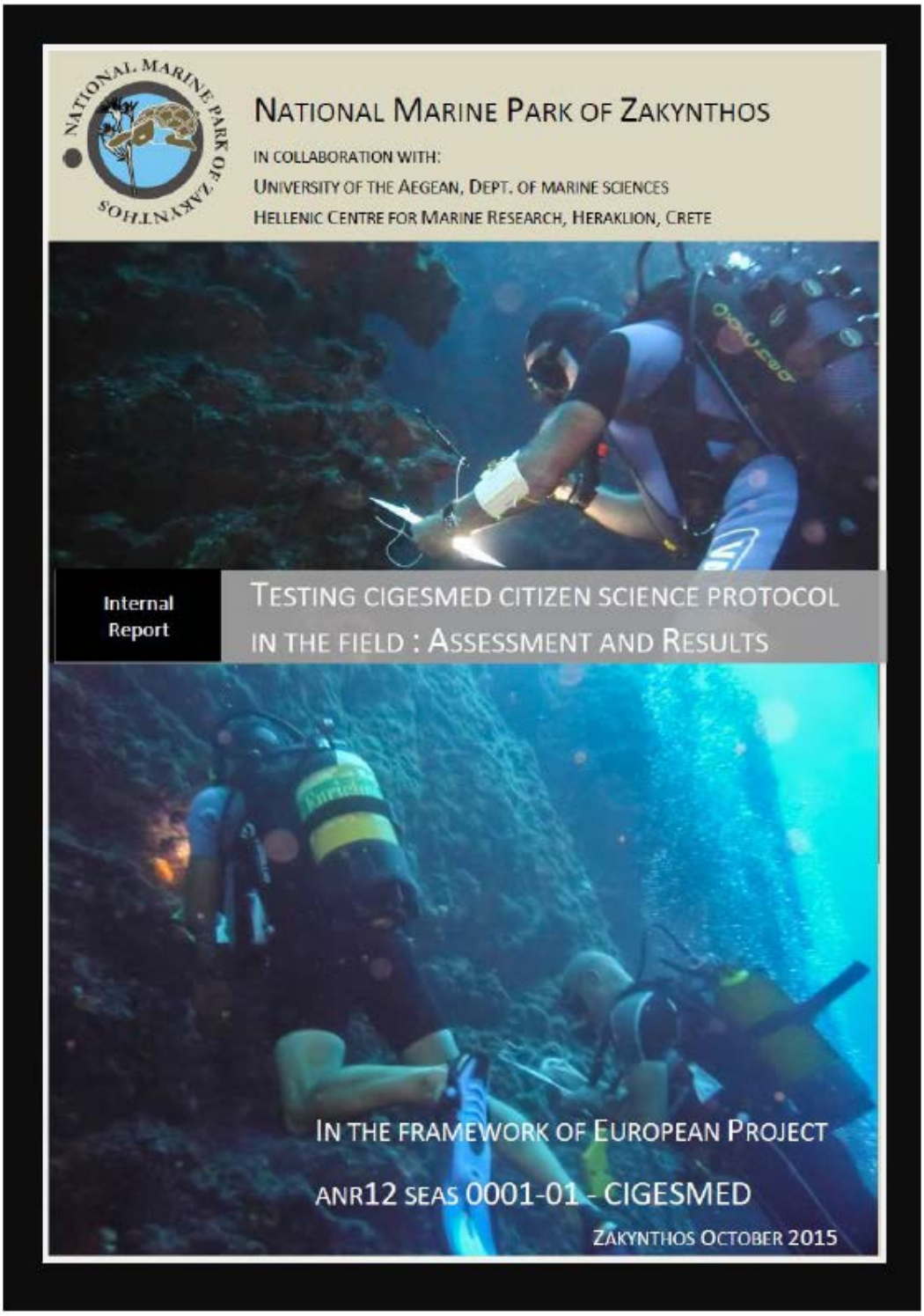
9. FINAL GENERAL ASSEMBLY 2016

The member of NMPZ/University of Aegean working group Koutsoubas D. participated to the final general assembly of CIGESMED project which was held from 27 to 29 of June 2016 at Marseille, France.

Supplementary material

Dissemination – Promotional leaflet

Internal Report: *Testing CIGESMED citizen science protocol in the field: assessment and results*



TESTING OF THE CIGESMED CITIZEN SCIENCE PROTOCOL IN THE FIELD: ASSESSMENT AND RESULTS

Internal Report

Authors:
Dimitriadis C. [1], Gerovasileiou V. [1,3], Dailianis T. [3], Sini M. [1,2], Kalli E. [1], Sourbes L. [1], Arvanitidis C. [3]., Koutsoubas D. [1,2]

[1]**NATIONAL MARINE PARK OF ZAKYNTHOS**
HTTP://www.nmp-zak.org

[2]**DEPT. OF MARINE SCIENCES, UNIVERSITY OF AEGEAN**

HTTP://www.mar.aegean.gr

[3]**Hellenic Centre for Marine Research, Heraklion, Crete**

HTTP://www.hcmr.gr/

Front page photos: C. Dimitriadis

1. INTRODUCTION

The aim of this study was to test the effectiveness of one of the proposed citizen science protocol (i.e. tablet with a specific data form) that was developed in the framework of CIGESMED project, in the National Marine Park of Zakynthos (NMPZ). To this end, 9 volunteering experienced SCUBA divers (local recreational and/or professional divers, instructors and owners of local diving centres) participated in this study. The citizen science protocol was tested in selected study sites of CIGESMED within the NMPZ, during July and September 2015 according to the following steps:

Preparatory Actions

- ✓ Identification of participating divers
- ✓ Providing the guidelines of the protocol to the divers for reading (and evaluation)

Field Work

- ✓ Implementation of the protocol with divers at specified locations (marked with labels) in selected study sites of CIGESMED within the NMPZ. At this particular locations a survey was initially conducted by expert scientists in order to fill in the CIGESMED protocol few days before the field trials with the divers. The answers provided by the experts were used to verify the validity of the ones provided by the divers.
- ✓ Divers were accompanied during their dives by scientific personnel of the NMPZ in order to collect information about the implementation of the protocol underwater.
- ✓ Interviews with the divers were conducted after their dive so as to gather their comments about the implementation of the protocol.

Data analysis

- ✓ Data were analyzed in order to evaluate the validity of the answers provided by the divers in comparison to those provided by the scientists.
- ✓ The abovementioned comparisons were made at the smallest spatial scale possible (marked locations of a 2x2 m surface within the study site) and were then aggregated to site level.
- ✓ Divers success rate in the identification of species and threats was calculated based on presence/absence data (true/false answers).
- ✓ Divers success rate in the quantification of abundance classes of both species and threats, as well as the intensity of each threat, were also evaluated.
- ✓ Ranking of species and threats according to identification and abundance quantification success was also conducted so as to assist in the improvement of the protocol and the final selection of species and threats.

2. METHODS

2.1 Field work with divers

Field work took place in “Mavros Kavos” area which is located at the SW part of Zakynthos Island (37.647284 N, 20.845715 E), close to the westernmost boundaries of NMPZ. The selected area corresponds to the study site “SC-1” of CIGESMED project (Figure 1).

For the needs of the citizen science protocol testing we used the permanent transect line that was established at a depth range of 15-20 m for the needs of the project. Volunteering divers were assigned to follow the protocol at different segments of the transect line. Each segment had been previously marked with a permanent identification tag (Figure 2) and therefore each diver worked upon a 2 x 2 m observation unit across the transect with the tag marking its center. Each diver took note of the ID number of the location of the unit they worked upon, in order to precisely correlate the observations of the volunteers with the ones previously recorded by the expert scientists. Overall, participants’ observations were implemented at 6 distinct areas along the transect line.

Figure 1: Map of the study area in Zakynthos Island (A) showing the research sites of CIGESMED project in NMPZ (B). The study site CS-1 was used for the needs of citizen science protocol trials.

Figure 2: Permanent tag marking the observation unit along the transect line at the study site (left) and diver filling in the observation form during the testing procedure (right).

2.2 Data analysis

Data concerning the threats and the species section of the protocol were discriminated to the following categories (according to the observations previously recorded by expert scientists) in order to identify trends in the variability of answers provided by volunteering divers:

a) Species/threats which are absent from the study area (including all testing sites) although they are included in the protocol. In this case a false answer implies a misidentification of the target species/threat (i.e. the target species/threat is actually not present and it is falsely recorded as such). In other words, the diver is confusing the target species/threat with something else.

b) Species/threats which are present at the sampling location. In this case a false answer implies the inefficiency of the participant in observing the target species/threat which is *a priori* known to occur in the observation area. In other words, the diver fails to spot the target species/threat.

c) Species/threats with a patchy distribution across the testing sites. In this case a false answer implies the combination of misidentification and/or inefficiency to detect the target species/threat.

Analysis was based on both presence/absence (lower level of complexity that the divers have to deal with) and abundance estimation data (higher level of complexity that the divers have to deal with). The use of presence/absence data served as the basis to understand the level at which the divers can provide reliable information about the occurrence of species (simplest level of information). On the other hand, the use of abundance estimation data provides evidence about

the robustness in the use of quantitative data (abundance estimation) for the study of coralligenous formations (higher level of information).
With respect to presence/absence data analysis, we checked if the observation of the diver at each particular observation unit was correct (true) or mistaken (false) in comparison to the data provided by the expert scientists at each tagged location. Consequently, the frequency of occurrence of true and false answers for each species or threat was calculated and converted to % success score (percentage of correct answers) regarding the total studied area.
Regarding the abundance estimation analysis we developed a distance-based method which calculates how close the estimation provided by the divers is to the one provided by the experts. Moreover, this method allows for the identification of the degree of over- or underestimation of abundance levels obtained by the divers.

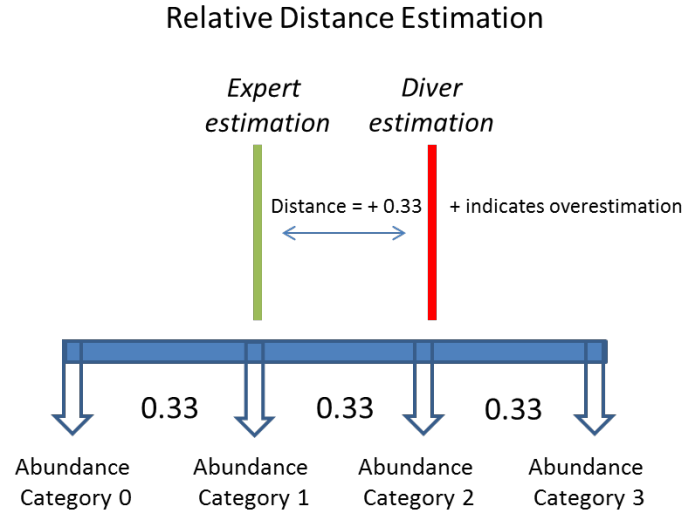


Figure 3: Rationale of the abundance estimation analysis that was developed in the present study.

According to this method we calculated the relative distance between the abundance category provided by the expert and the one provided by the volunteering diver (Figure 3). Expert estimation is the reference point for the calculation of the distance. If the participant's estimation falls to the right of the estimation of the expert (positive sign) then overestimation occurs. If the participant's estimation takes a lower value than that of the expert then underestimation occurs (negative sign). In this respect, the relative distance measures can take values from 0 (100% success score) to 1 (0% success score) with distance intervals of 0.33. The relative distance was calculated for each diver and species/threat and then we calculated the mean distance for the total sample (all divers for each species/threat) and converted it to success percentage. Calculations were performed only for the cases of correctly identified species (information provided by the presence/absence data analysis). For species/threats that were consistently absent in the study area (as it was reported by the expert scientists) we did not perform abundance estimation analysis.
With regard to the species section of the protocol, an additional discrimination of species was employed according to their mobility status. Hence, for both presence/absence and abundance estimation data two groups were formulated: a) mobile and b) sessile species. Mobile species are variable in space and time (e.g. fish species) and therefore the comparison between surveys which are conducted at different days may lead to different results. In this respect, since surveys by expert scientists did not occur simultaneously with those of the citizen scientists, direct comparisons between the obtained results should be handled and interpreted with caution. On the other hand, sessile species provide a safer base for such comparisons, especially since the surveys of expert scientists and citizen scientists were separated by just a few months' interval at greatest.

3. RESULTS & CONCLUSIONS

3.1. Threats

3.1.1. Presence-Absence frequencies

Analysis of the presence – absence data (true and false answers of the divers) is presented for each threat in the graphs of the Appendix while the main results are summarized in Table 1. In short, for the case of the threats that were absent from the total study area (as it was indicated by the experts) fishing gears, litter and anchoring received a 100% success score. Hence, a high level of reliability in the use of these threats in the protocol was detected. With respect to *Asparagopsis* spp. and *Womersleyella setacea*, a success score of 88.89% was found, therefore suggesting that divers mostly manage to understand that these species were absent from the study site. Mucilaginous aggregates received a success score of 88.89% whereas 11.11% of the participants did not answer this question. A considerably lower success rate was evidenced for the cases of *Caulerpa cylindracea* and sedimentation, thus indicating that almost half of the divers confused these threats with something else (these threats were absent while divers thought they were present). For the case of sedimentation it was quite clear that divers were not familiar with this term and further clarification may be needed in the guidelines of the protocol. Divers' recklessness marks and necrosis/mortality events received the lowest recorded success score further suggesting that these threats were largely misidentified by the divers. Hence additional information should again be included in the guidelines.

Table 5: Rank of threats with respect to the success score that each threat received based on presence/absence data (NA = no answer)

Rank of threats that were absent	Success score	NA %
Fishing gears	100	
Litter	100	
Anchoring	100	
Asparagopsis spp.	88	
Womersleyella setacea	88	
Mucilaginous aggregates	88	11
Caulerpa cylindracea	55	
Sedimentation	55	11
Rank of threats that were present or exhibited patchy distribution	**Success score**	**NA %**
Divers recklessness marks	33	11
Necrosis/Mortality events	11	22

3.1.2 Intensity of threats (abundance estimate)

Given that divers mainly failed to identify 'Divers recklessness marks' and 'Necrosis/Mortality events' (see presence - absence data section), a low success rate in abundance estimation was also identified (underestimation pattern) for these threats.

Table 2: Rank of threats with respect to the success score that each threat received based on abundance estimation data

Rank of threats that were present or exhibited patchy distribution	Success score (%)	Trend
Divers recklessness marks	68	Underestimation
Necrosis/Mortality events	35	Underestimation

3.1.3 Concluding remarks for the threat section of the protocol

Our results suggested that some threats of the protocol (*Caulerpa cylindracea*, sedimentation, divers recklessness, and necrosis/mortality events) were rather problematic both in identifying them and estimating their intensity. Hence, further measures should be taken for their accurate

quantitative and qualitative assessment (e.g. further instructions in the guidelines, detailed briefing before the dive) or their presence in the protocol should be reconsidered. However, it should be taken into consideration that some of these threats were absent from the study site or had a very low intensity that could presumably only be identified by experts. It would be interesting to evaluate the success score of citizen scientists in areas with a notable presence of such threats.

3.2. Species

3.2.1. Sessile species

3.2.1.1 Presence-Absence frequencies

Leptogorgia sarmentosa and shark eggs received a success score of 100%, a result which implies that divers manage to understand their absence in the study area. In very few cases (1 occassion) divers reported the presence of *Eunicella cavolini*, *E. singularis* and *Corallium rubrum* despite the fact that these species were not present. However, the success score for the former species was rather high (88.89%), indicating that, as a general trend, divers avoided falsely reporting these species as present. *Paramuricea clavata* and *Savalia savaglia* received a success score of 77.78% since 2 out of the 9 divers erroneously indicated this species as present.

Table 3: Rank of sessile species with respect to the success score that each species received based on presence/absence data.

Rank of species that were absent	Success score%
Leptogorgia sarmentosa	100
Shark eggs	100
Eunicella cavolini	88
Eunicella singularis	88
Corallium rubrum	88
Paramuricea clavata	77
Savalia savaglia	77
Rank of species that were present or exhibited patchy distribution	**Success score%**
Calcareous red algae	88
Agelas oroides	88
Myriapora truncata	88
Scleractinians	55
Peyssonnelia spp.	55
Axinella spp.	44
Cliona spp.	33
Other bryozoans	11

Calcareous red algae, *Agelas oroides* and *Myriapora truncata* received a relatively high success score (88.89%) and thus it was evidenced that the majority of divers correctly identified these species. A moderate success rate was evidenced in the identification of Scleractinians, *Peyssonnelia* spp. and *Axinella* spp. as a result of divers' inefficiency in locating them. Divers largely failed to identify *Cliona* spp. and "Other bryozoans" since these species received the lowest recorded success score (33.33% and 11.11%, respectively).

3.2.1.2 Abundance estimates

In the case of species correctly identified by the divers, a general trend for underestimation in species abundance was detected. In this respect, the lowest success score regarding abundance estimation was recorded for "Other bryozoans", *Myriapora truncata* and *Peyssonnelia* spp. For the cases of Scleractinians, *Axinella* spp. and *Cliona* spp., abundance estimation by the divers was

slightly diverging from the estimation provided by the expert scientists. A moderate success rate in abundance estimation was detected for *Agelas oroides* and Calcareous red algae.

Table 4: Rank of species with respect to the success score that each species received based on abundance estimation data

Rank of species that were present or exhibited patchy distribution	Success score %	Trend
Scleractinians	85	Underestimation
Axinella spp.	81	Underestimation
Cliona spp.	78	Underestimation
Agelas oroides	74	Underestimation
Calcareous red algae	66	Underestimation
Peyssonnelia spp.	52	Underestimation
Myriapora truncata	44	Underestimation
Other bryozoans	0	Underestimation

3.2.1.3 Concluding remarks for the sessile species included in the protocol

Participating divers generally managed to avoid falsely recording species that were actually absent in the study area. On the other hand, half of them failed to identify small-sized taxa with a patchy/scarce distribution in the study site, such as Scleractinians, *Peyssonnelia* spp. and *Axinella* spp. The lowest identification success ratewas recorded for *Cliona* spp. and "Other bryozoans". The presentation of these taxa in the protocol should probably be reconsidered. Further optical clues forthe identification of these species should be provided to the divers through the website and the guidelines of the protocol (e.g. photos, distinctive features/colors/shapes and striking characteristics that will help divers identify the species, provide similar species and highlight the differences with the targeted ones). Finally, the success in the estimation of species abundance by the divers varied considerably depending on the species with a general trend for underestimation. Top-rated species according to success score in abundance estimation (i.e. Scleractinians and *Axinella* spp.) were the ones that received a low identification success score. On the other hand, species that exhibited a high success in their identification (e.g. *Myriapora truncata*), presented at the same time a low success in abundance estimation. Finally, several species presented low success both in their identification and abundance estimation (e.g. *Peyssonnelia* spp.). Therefore, future effort for the improvement of the protocol should primarily focus in helping divers correctly identify the species and provide reliable information about their occurrence (simplest level of information) rather than effectively estimating their abundance (higher level of information).

3.2.2. Mobile species

Divers managed to avoid falsely reporting species that were acually absent in the study area. However, a success score of 66% was recorded for the case of *Anthias anthias* since some divers confused this species with *Apogon imberbis*. Hence, the guidelines of the protocol should highlight the conspicuous morphological features that are discriminative for each species. However the inclusion of *Anthias anthias* in the protocol basically aimed to the verification of the habitat type (flag species of coralligenous communities) and not the species *per se*. The cardinal fish *Apogon imberbis* is typical of cavities, fissures and caves, which are commonly found in coralligenous seascapes as well.

The success score for the mobile species that are known to occur in the study area was quite low (ranged from 11 to 44%). However this fact should not be solely interpreted as participants' failure to identify these species (which are quite striking and well known among divers) but can also be attributed to species mobility (i.e. they were present when the expert scientist surveyed the study area but not so during the volunteers' survey).

Table 5: Rank of mobile species with respect to the success score that each species received based on presence/absence data.

Rank of species that were absent	Success score%	NA %
Homarus gammarus	100	
Palinurus elephas	100	
Anthias anthias	66	
Rank of species that were present or exhibited patchy distribution	**Success score%**	**NA %**
Scorpaena spp.	44	
Epinephelus marginatus	33	
Scyllarides latus	22	
Centrostephanus longispinus	11	11
Other sea urchins	11	

4. Notes from interviews with divers

Comments by the participating divers:

• Guidelines of the protocol are too "scientific" and text too lengthy (comment of 9 out of the 10 divers); most participants actually never reached the end of the document.
• There was a question regarding what exactly should be noted in the protocol: "Do I fill in exactly what I observe during this dive or I am writing down also the species or the threats that I have observed during previous dives at the same location? That question was justified by the fact that most of the participants are visiting the testing site very frequently. (Comment of 2 out of the 10 divers)
• Make images on the tablet larger, cropped to the species of interest (comment of 1 out of the 10 divers)

Comments by the scientific supervisor following and observing the divers during the surveys:
• Some participants omitted filling up some fields during the dive; however, they did so post-dive for information that could easily be recalled from memory.
• A torch and compass are –required; artificial light restores the natural coloring of organisms thus making them more easily recognizable and similar to the photos of the protocol, while without a compass the identification of the orientation of the site is impossible)
• Participants found it difficult to fill in the information about the rugosity and orientation of the sampling site; this could be resolved by providing more thorough guidelines during the pre-dive briefing and stressing the importance of specific required pieces of equipment. .
• Most of them neglected to fill in water temperature data at different depths during their ascent. This information though is not essential and can be easily obtained at the surface by downloading the dive profile from a participant's dive computer.
The actual time needed to fill-in the protocol (not the duration of the whole dive but the exact time participants spend to fill in the data form) ranged between 15 to 20 minutes.This possibly implies some constraints to the maximum depth the divers can implement the protocol at, since 20 minutes spent at the 30-35 m zone is dangerously close or exceeds no-decompression safety limits.