



WP 10

Deliverable 10.3

D10.3: Minutes of the first Annual Meeting (internal WP meetings SC, GA, AB)

Marine Ecosystem Restoration in Changing European Seas MERCES

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COORDINATOR: UNIVPM

LEAD BENEFICIARY: 1. UNIVPM

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DISSEMINATION LEVEL

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1. Summary



The MERCES 1st annual meeting took place in Heraklion (Crete, Greece) from 20 to 22 June 2017. A large audience (more than 60 participants) including members of the Consortium, members of the project Advisory Board, invited speakers and the EU Project Officer attended the meeting. All work-packages were presented into plenary sessions including 30 oral talks on the specific progress of the different cases study, covering the WP1: European marine habitats, degradation and restoration; WP2: Restoration of marine, shallow soft bottoms habitats; WP3: Restoration of coastal shallow hard bottoms and mesophotic habitats; and WP4: Restoration of deep-sea habitats. The other WPs (WP5: Effects of restoration on the recovery of ecosystem services; WP6: Legal governance and policy; WP7: Socio-economic impacts of restoration; WP8: Putting Business at the Heart of the Restoration Agenda; WP9: Dissemination, communication and public engagement; and WP10: Project Management) were presented by an overview on the own progresses, followed by a general discussion with the audience. Overall 18 posters illustrated the different topics of the MERCES project, spreading from WP1 to WP9. The second day of the meeting opened with an Open Science Session with Prof Roberto Danovaro, the MERCES coordinator, who welcomed all participants and introduced the MERCES project, followed by the talks of different experts on ecological restoration (James Aronson from the Society for Ecological Restoration), representatives of the H2020 projects ATLAS and

SponGES, the EU Project Officer Ariana Nastaseanu and Eleni Hatziyianni from the Region of Crete.

The Open Science Session stimulated a rich discussion on the ecological restoration in marine ecosystems among different experts going from scientists with different background to socio-economists and politicians. During the meeting, the General Assembly met for the 2nd time, as well as the Steering Committee and the Advisory Board. The annual meeting was preceded by a two-days WP4 workshop and was followed by two-days WP5 and 6 workshops.

2. Conference programme

Tuesday 20th June 2017

08:45 - 09:00	Participants registration
09:00 - 09:15	Roberto Danovaro: Welcome and General Introduction to MERCES annual meeting
09:15 - 09:45	Keynote talk – Cindy Van Dover: Restoration frameworks for environmental management: Scope for development in the deep sea
09.45 - 10.45	WP1: <i>European marine habitats, degradation and restoration</i> Chairs: Nadia Papadopoulou (HCMR), Anthony Grehan (NUIG)
9:45 - 10:05	Papadopoulou & Grehan: WP1 overview
10:05 - 10:15	Gerovasileiou et al. Cataloguing habitat map resources in the European Seas: highlighting limitations and gaps for future habitat mapping and restoration initiatives (MERCES WP1)
10:15 - 10:25	Bekkby et al. Key features and considerations for restoration; identifying commonalities and differences between case studies
10:25 - 10:35	Dailianis et al. Human activities and pressures acting on marine habitats in the European Seas; compiling and analysing data in the framework of MERCES Pressure Catalogue
10:35 - 10:45	Papadopoulou et al. Human activities and pressures acting on key MERCES habitats, impacts and consequences for restoration
10:45 - 11:15	Coffee break
11:15 - 12:15	WP2: <i>Restoration of marine, shallow soft bottoms habitats</i> Chairs: Christoffer Boström (ÅAU) - Johan van de Koppel (NIOZ)
11:15 - 11:30	Boström & van de Koppel: WP2 overview
11:30 - 11:40	Christianen et al. Regenerating cross-habitat interactions by combined mussel and seagrass bed restoration using Biodegradable structures (BESE)
11:40 - 11:50	Carugati et al. Long-term changes of restored seagrass meadows in the Adriatic Sea
11:50 - 12:05	Gagnon et al. A global review of plant-bivalve interactions: implications for marine ecosystem restoration
12:05 - 12:15	Discussion on the Microbial sampling
12:15 - 13:15	WP3: <i>Restoration of coastal shallow hard bottoms and mesophotic habitats</i> Chairs: Joaquim Garrabou (CSIC), Simonetta Fraschetti (CoNISMa - UniSALENTO)
12:15 - 12:35	Garrabou & Fraschetti: WP3 overview
12:35 - 12:55	Garrabou et al. State of knowledge on key eco-evolutionary processes and factors enhancing the resilience in coralligenous habitats: insights for efficient restoration protocols
12:55 - 13:05	Hereu et al. State of knowledge on key eco-evolutionary processes and factors driving the resilience of macroalgal habitats

13:05 - 13:15	Linares et al. Life history traits and modelling tools to assess the success and timescales of restoration actions
13:15 - 14:30	Lunch break
14:30 - 15:40	WP4: <i>Restoration of deep-sea habitats</i> Chairs: Telmo Morato (IMAR-Uaz), Andrew K. Sweetman (HWU)
14:30 - 14:40	Morato & Sweetman: WP4 overview
14:40 - 14:50	Jones & Gates Insights for restoration from deep-sea communities colonising existing structures
14:50 - 15:00	Sarrazin et al. Response of active vent communities to an induced disturbance: a case studies on hydrothermal vents from the MAR
15:00 - 15:10	Gambi et al. Restoration of deep-sea ecosystems: the Palinuro Seamount case study
15:10 - 15:20	Gori et al. Ecological Restoration of Deep Mediterranean Gorgonian Populations
15:20 - 15:30	Carreiro-Silva et al. Methodologies and tools for restoration of degraded deep-sea coral gardens in the Azores
15:30 - 15:40	Bilan et al. Fishermen meet scientists: essential collaboration for deep-sea coral restoration
15:40 - 16:30	WP5: <i>Effects of restoration on the recovery of ecosystem services</i> Chairs: Chris McOwen (WCMC) - Trine Bekkby (NIVA)
15:40 - 16:10	McOwen & Bekkby: WP5 overview
16:10 - 16:30	Discussion
16:30 - 17:00	Coffee break
17:00 - 18:00	WP6: <i>Legal governance and policy</i> Chairs & introduction: Jan P.M. van Tatenhove (WU) - Ronan Long (MLOPRS)
17:00 - 17:30	van Tatenhove & Long: WP6 overview
17:30 - 18:00	Discussion
18:00 - 19:00	MERCES publications, events, books and special issues
19:00 - 19:30	Advisory Board meeting
20:30	Social dinner on the Roof Taratsa

Wednesday 21st June 2017

9:00-11:00	Open Science Session
9:00 - 9:05	Roberto Danovaro: Welcome and Introduction to the Open Science Session & MERCES
09:05 - 09:25	James Aronson: Links between global trends in (terrestrial) ecological restoration and the MERCES project
09:25 - 09:45	General discussion on what's different between marine and terrestrial ecological restoration?
09:45 - 10:00	Fraschetti et al. Meta-analysis of marine ecosystem restoration worldwide
10:00 - 10:15	Georgios Kazanidis: introducing ATLAS project
10:15 - 10:30	Martina Milanese: introducing SponGES project
10:30 - 10:45	General discussion on common initiatives and contributions of MERCES, ATLAS and SponGES projects working together
10:45 - 11:15	Coffee break
11:15 - 11:35	Eleni Hatziyianni, Region of Crete: Blue Growth, MSP, regional policies and marine restoration
11:35-12:00	Ariana Nastaseanu, Project Officer: MERCES's support to EU policies, synergies with other related H2020 projects and administrative aspects
12:00 - 13:00	WP7: Socio-economic impacts of restoration Chairs: Wenting Chen (NIVA) - Stephen Hynes (NUIG)
12:00 - 12:30	Wenting Chen: WP7 overview
12:30 - 13:00	Discussion
13:00 - 14:00	Lunch break
14:00 - 15:00	WP8: Putting Business at the Heart of the Restoration Agenda Chairs: David Billett (DSES) - Eva Ramirez-Llodra (NIVA)
14:00 - 14:30	Billett & Ramirez-Llodra: WP8 overview
14:30 - 15:00	Discussion
15:00 - 16:00	WP9: Dissemination, communication and public engagement Chairs: Martina Milanese (GAIA) - Silvia Bianchelli (ECOREACH)
15:00 - 15:30	Martina Milanese: WP9 overview
15:30 -16:00	Discussion
16:00 - 16:15	WP10: Project Management Cristina Gambi -Emmanuelle Girardin (UNIVPM)
16:15 - 16:45	Coffee break
16:45 - 18:00	WPs prepare the wrap-up and plan joint work for the next year
18:00 - 19:00	Steering Committee meeting
19:00 - 19:45	General Assembly

Thursday 22nd June 2017

9:00-11:00	Wrap-up Session
9:00 - 9:15	WP1 synthesis of the working group and future work: Nadia Papadopoulou (HCMR), Anthony Grehan (NUIG)
9:15 - 9:30	WP2 synthesis of the working group and future work: Christoffer Boström (ÅAU) - Johan van de Koppel (NIOZ)
9:30 - 9:45	WP3 synthesis of the working group and future work: Joaquim Garrabou (CSIC), Simonetta Frascetti (CoNISMa - UniSALENTO)
9:45 - 10:00	WP4 synthesis of the working group and future work: Telmo Morato (IMAR-Uaz), Andrew K. Sweetman (HWU)
10:00 - 10:15	WP5 synthesis of the working group and future work: Chris McOwen (WCMC) - Trine Bekkby (NIVA)
10:15 - 10:30	WP6 synthesis of the working group and future work: Jan P.M. van Tatenhove (WU) - Ronan Long (MLOPRS)
10:30 - 11:00	Coffee break
11:00 - 11:15	WP7 synthesis of the working group and future work: Wenting Chen (NIVA) - Stephen Hynes (NUIG)
11:15 - 11:30	WP8 synthesis of the working group and future work: David Billett (DSES) - Eva Ramirez-Llodra (NIVA)
11:30 - 11:45	WP9 synthesis of the working group and future work: Martina Milanese (GAIA) - Silvia Bianchelli (ECOREACH)
11:45 - 12:00	Conclusions
13:00 - 14:30	Lunch

The abstracts of oral presentation and posters are reported in Annex 1.

3. Minutes

3.1 Annual Meeting

20th June 2017

Prof Roberto Danovaro, the MERCES coordinator, welcomed all participants to the first Annual meeting. He reported the excellent progress of the project activities in the first year and his satisfaction towards the collaborative approach demonstrated by the MERCES partnership reflecting the multidisciplinary nature of the Consortium (skills on marine ecology, spatial modelling, marine ecosystem restoration, law, policy and governance, socio-economics, knowledge transfer, dissemination and communication) and the different objectives of the 10 WPs.

The coordinator commented also the excellent scientific production developed from the beginning of the project with several publications in high impact factor journals that have received a large acknowledgment in terms of press release. He also reported that the paper published in Science (Danovaro et al 2017) dealing with the importance of deep-sea ecosystems monitoring and ecological restoration has been cited at the meeting of United Nations (New York, last 7 June 2017) as a priority topic to include in the international agenda for the environment. This paper was also cited during the G7 event on the environment in Naples (Italy).

The coordinator presented the agenda of the meeting and the keynote talk by Cindy Van Dover on the Restoration frameworks for environmental management: Scope for development in the deep sea. The MERCES project represents a new era for the deep-sea ecology and a progress from the theory reported in the paper by Van Dover et al. (2014) on the ecological restoration in the deep sea: desiderata to the practical exercise in the pilot cases study. Two important topics should be considered in the challenge of the restoration in marine ecosystems: to improve the awareness of the need of the restoration of deep-sea degraded habitats and the importance of the socio-economic benefits that these practices might have for the human well-being.

A general discussion highlighted that the major problem for the restoration is related to the high costs (i.e., ship time). A proposal is that these high costs can be reduced with a robust engagement of companies/industries whose interests are in the marine ecosystems and offshore. These companies could offer the necessary economic support to allow restoration projects. Another important issue is the support of a robust legislation and regulatory that can facilitate the application of restoration protocols and methods in marine ecosystems including deep sea, the largest and remote ecosystem in the Planet. International initiatives on jurisdiction are welcomed.

Following is the presentation of the WPs.

WP1: general overview introduced by Nadia Papadopoulou. Good progress of the WP with the submission of two important deliverables D1.1 and D1.2 and relative catalogues obtained by the revision of the literature on census of degraded habitats along the European seas, identification of major pressures, restoration actions, methodologies, approaches and costs of the marine restoration.

The introduction was followed by the presentations dedicated to the main finding of the Deliverables D1.1 and D1.2: *Gerovasileiou et al.* Cataloguing habitat map resources in the European Seas: highlighting limitations and gaps for future habitat mapping and restoration initiatives (MERCES WP1); *Bekkby et al.* Key features and considerations for restoration; identifying commonalities and differences between case studies; *Dailianis et al.* Human activities and pressures acting on marine habitats in the European Seas; compiling and analysing data in the framework of MERCES Pressure Catalogue; *Papadopoulou et al.* Human activities and pressures acting on key MERCES habitats, impacts and consequences for restoration.

WP2: general overview introduced by Boström & van de Koppel. Good progress on the plan of the field activities in different soft bottom habitats along the European seas, including survey and, in some areas, the starting of the restoration experiments. The introduction was followed by the presentation on the progress of specific case studies and the preliminary results of the review on the plant-bivalve interactions: *Christianen et al.* Regenerating cross-habitat interactions by combined mussel and seagrass

bed restoration using Biodegradable structures (BESE); *Carugati et al.* Long-term changes of restored seagrass meadows in the Adriatic Sea; *Gagnon et al.* A global review of plant-bivalve interactions: implications for marine ecosystem restoration. At the end, a discussion on the microbial sampling was opened to a joint collaboration among the members of the WP2 to investigate the role on microbiota on the survival of seagrass and on the success of the restoration practices.

WP3: general overview introduced by Garrabou on the good progress of the WP3 in term of collaborations among partners, including a field training on the discussion and application of restoration protocols in hard bottom habitats. The literature review dedicated to the state of knowledge on key eco-evolutionary processes and factor driving the resilience of the shallow hard bottoms and mesophotic habitats allowed the submission of the Deliverable 3.1. The introduction was followed by the presentation on the progress of specific case studies: *Garrabou et al.* State of knowledge on key eco-evolutionary processes and factors enhancing the resilience in coralligenous habitats: insights for efficient restoration protocols; *Hereu et al.* State of knowledge on key eco-evolutionary processes and factors driving the resilience of macroalgal habitats; and *Linares et al.* Life history traits and modelling tools to assess the success and timescales of restoration actions.

Lunch break

WP4: general overview introduced by Sweetman on the progress of the multiple activities carried out in this WP. A special attention was dedicated to the interesting discussion that occurred on the principles of the restoration in the deep sea during the WP4 workshop that preceded the annual meeting. The introduction was followed by the presentation of different approaches of active and passive restoration in different deep-sea habitats: *Jones & Gates* Insights for restoration from deep-sea communities colonising existing structures; *Sarrazin et al.* Response of active vent communities to an induced disturbance: a case studies on hydrothermal vents from the MAR; *Gambi et al.* Restoration of deep-sea ecosystems: the Palinuro Seamount case study; *Gori et al.* Ecological Restoration of Deep Mediterranean Gorgonian Populations; *Carreiro-Silva et al.* Methodologies and tools for restoration of degraded deep-sea coral gardens in the Azores; *Bilan et al.* Fishermen meet scientists: essential collaboration for deep-sea coral restoration.

WP5: general overview introduced by McOwen and Bekkby on the data collection of the case studies in WP2, WP3 and WP4 to analyse the potential recovery of ecosystem services in relation to the restoration actions. The introduction was followed by a general discussion with the suggestion of the member of the Advisory board James Aronson to consider the literature available from terrestrial ecosystems to have a robust support on the selection of the best approaches to use and data/info useful for the assessment of the ecosystem services recovery following restoration actions. A priority is the need of univocal definitions of ecosystem services. Another important suggestion was to define some common case studies with other WPs: 6 for legal and governance and 7 for the socio-economic benefits with a good coverage from the Atlantic to the Mediterranean Sea.

WP6: general overview introduced by van Tatenhove and Long. The importance of a robust regulatory is a priority as well as an important contribution to facilitate the application of restoration protocols in marine ecosystems. The restoration of marine ecosystems is an important topic that can support different EU directives and initiatives: GOAL 14, AICHI biodiversity targets 14 and 15. Telmo Morato suggested to write a comment as MERCES project to the International Seabed Authority on the topic related to the deep-sea mining.

Following is a general discussion on MERCES events, books, special issues and publications

Joint event: MERCES and the Society for Ecological Restoration (SER)

The coordinator reported James Aronson's suggestion to organize the third MERCES annual meeting and to have a symposium dedicated to the restoration of marine ecosystems during the 8th World Conference on Ecological Restoration organized by the Society for Ecological Restoration (SER), which is to be held in South Africa between August-September 2019. This international event is an excellent occasion to build a global community on marine ecosystem restoration. A symposium – or even two symposia - of the conference could be dedicated to different aspects of marine ecosystem restoration, and they should be open to all researchers working in this field (some of them identified in the review WP3). This is an

important occasion for MERCES (just before the end of the project in 2020 and with an excellent progress of the results) to gain visibility at international level. Roberto Danovaro asked directly to the PO on the possibility to organize the third MERCES annual meeting inside the SER World Conference in 2019. The PO would be in favour of such a joint event, and invited the PMO to prepare a justification to be addressed to the EC. The PMO will prepare the request as soon as possible and submit it to the EC. James Aronson informed participants that grants are always available for students attending the SER Conference to allow the possibility to join the meeting with an economic support. If the EC answers to our request before the next SER World Conference (at the end of August 2017), he may be able to start planning the joint event with the organizing staff.

MERCES final product: a book on marine ecological restoration including protocols, methodologies, set up of best practices (Spring 2020)

The coordinator reported the idea to write a book on marine ecological restoration including protocols, methodologies, set up of best practices. The book could include also aspects related to the legislation and other EU directives and initiatives. This book can be a final product of the MERCES project. The following potential index was proposed:

Background

Restoration of marine habitats: selection of habitats according the guidelines of Natura 2000, Marine Strategy Framework Directive; Marine Spatial Planning

Legislation objectives: links and according to the aims of different conventions (i.e., Barcelona)

Ecological Restoration in different habitats

Description of selected habitats;

Identification of indicators for the assessment of the environmental status;

Definition of best methodologies and protocols for the ecological restoration;

Definition of best methodologies and protocols to verify the effectiveness of a “family of restorative activities”;

Evaluation of the marine restoration actions for socio-economic cost-benefits.

Conclusions

Bibliography

The General Assembly was generally favourable to this idea and different contributions in different topics are expected.

Another proposal is a *Special issue in Philosophical transactions of the Royal Society B (Biological Sciences) dedicated on the marine restoration*.

The coordinator was invited to submit a theme proposal by the Philosophical transactions of the Royal Society B (Biological Sciences) and he would like to propose the topic of marine restoration and the MERCES project as a potential theme issue.

The upcoming dates to submit a theme proposal are:

- Submission by 17th July for a decision in September 2017;
- Submission by 16th October for a decision in December 2017;
- Submission by 15th January for a decision in March 2018.

The Coordinator suggested to consider the end of this year to propose a special issue dedicated to the marine restoration and to have the possibility to publish this issue in the 2019.

Pre-submission enquiries and submitting

Before submitting a formal proposal the journal strongly encourages to make a pre-submission enquiry to assess whether your proposal would be of interest to our readers. In your email, please include the following:

- a brief summary of the issue and subject background;
- why your issue would be particularly timely in the next 18 months;
- how your issue is novel and how it would advance the research field;
- any implications for the wider scientific community and/or policy;
- a list of potential contributors and subject areas/paper titles.

Theme issues should be no more than 140 pages long, including 12-18 papers. It can often work well if papers are sub-grouped into relevant subject headings in the theme issue - this helps to navigate the context of the work.

A suggestion is to ensure a good mix of review articles and original research. The journal also encourages to think about including other types of paper such as opinion pieces, future perspectives, theory/ideas papers, retrospectives, mini reviews, debates or policy papers to increase interest in the issue and to tie the papers together. You could also consider including short commentaries on the papers by other authors, reviewers or external experts, but this would have to be arranged prior to publication as all content must appear together.

Schedules and deadlines for a theme issue:

An issue tends to take around 10 - 14 months from proposal acceptance to publication.

An example of publication plan:

- Proposal accepted: 1st December
- Draft manuscripts submitted: 1st March
- Peer review: March-May
- Revisions in: 1st August
- Final papers ready for production: 15th September
- Publication: November

The Editorial Office will send reminders to authors and answer author queries, however the guest editor also has an important role in ensuring that the project runs to schedule. Projects can be delayed significantly by one author, allowing other contributions to become outdated and momentum to be lost.

Changes to the line-up

If at any time post-approval you need to make changes (e.g. if an author withdraws and you want to add a replacement paper), please contact the Editorial Office as we need to approve the change.

The coordinator also suggested joint publications: room for a call for joint papers on different topics, new ideas, perspectives, policy and position papers.

Each WP has collected several infos from literature that will be used for review paper in joint collaboration among different partners.

Data collected from the different review carried out can be also used for different analyses and elaborations according to different objectives.

Advisory Board meeting.

End of the day

21st June 2017

The second day of the meeting was opened with an Open Science Session with the Prof Roberto Danovaro who welcomed all participants and introduced the MERCES project, followed by the talks of different experts on ecological restoration (James Aronson from the Society of the Ecological Restoration) and the preliminary results of the literature review on marine restoration (Simonetta Frascchetti, CoNISMa-Unisalento), representatives of the H2020 projects: ATLAS and SponGES, the EU Project Officer Ariana Nastaseanu and Eleni Hatziyianni from the Region of Crete. The Open Science Session stimulated a rich discussion on the ecological restoration in marine ecosystems among different experts going from scientists with different background to socio-economists and politicians.

James Aronson presented a keynote on links between global trends in (terrestrial) ecological restoration and the MERCES project. Three major aspects have been highlighted: the cost of the ecological restoration, the time scale and the spatial scale of the recovery of habitats, from pilot studies to larger spatial scale. Another important issue is the use of common definitions that can help to a better clearness of the topic of the ecological restoration and the objectives and results expected, in particular for ecosystem goods and services that are fundamental for the human well-being.

Followed a general discussion on what's different between marine and terrestrial ecological restoration?. Major issues: the sustainability of restoration initiatives in terms of cost, the spatial and temporal scale, the need of the scaling up from pilot actions to major spatial scale.

Simonetta Frascchetti presented the preliminary results of the review carried out as a joint action carried out by several members of the MERCES Consortium on the status, expectations and gaps on the restoration of marine ecosystems worldwide. The PO asked a question on the potential effects of climate change in the results/efficacy of the restoration initiatives. The coordinator suggested that we have to focus our attention on the identification of the best practices for the success of restoration without stressing the problem of climate change or changing ecosystem due to the pressure of human activities. One of the objective of the project is to set up the best practices for restoration with the awareness that different and unpredictable factors can act on the marine ecosystems.

Followed the presentations of the H2020 projects ATLAS and SponGES by Georgios Kazanidis and Martina Milanese, respectively. Common initiatives among the H2020 projects: habitat mapping, communications and dissemination of the results sharing stakeholders and scientific community, collaborations in the revision of documents (i.e., Deliverable 1.1 by David Johnson), sharing ship time for common initiatives and collaborations in the field work. The PO agreed on common initiatives for communication but at the same time she pointed out that it is important that the common voice maintain the specificity of each project.

After the coffee break the meeting started with the presentation of Eleni Hatziyianni (Region of Crete) on Blue Growth, Marine Spatial Planning, regional policies and marine restoration. She stressed the importance of the connection of policy to support initiatives for the environment.

Followed the presentation of the EU Project Officer Ariana Nastaseanu, Project Officer: MERCES's support to EU policies, synergies with other related H2020 projects and administrative aspects. The PO pointed out the importance of the topic restoration among the EU priority sectors. The restoration is a process and not a destination. The restoration of marine habitats has important implication on several aspects that include social growth, job, immigration, security, health, social cohesion and capital.

There is a great expectation from the results of the MERCES project, in particular to the scaling up of the pilot actions to larger spatial scale. MERCES can be a starting point for the set-up of protocols, actions and best practices and the second step could be a new project dedicated to this scaling up. For scientific problem, we have to wait the new call dedicated to this topic in the new EU funding project FP9. For technical problem (follow-up solutions) there is some other potential EU initiatives: European bank for funding not related to science.

Lunch break

WP7: general overview introduced by Wenting Chen on the progress of the activities carried out in particular in the selection of case studies in WPs2, 3 and 4 for the socio-economic analyses of restoration actions. The introduction was followed by a general discussion with the suggestion of the member of the Advisory board James Aronson to consider the literature available from terrestrial ecosystems for the approaches to use. In addition it was also suggested to consider case studies from different European Seas, from Atlantic to the Mediterranean region both for shallow water and deep-sea ecosystems.

WP8: general overview introduced by Billett, Ramirez-Llodra and Ojaveer. The activities progressed according to Gantt chart. The Business Club was opened and a list of industrial stakeholders has been collected. This list will be implemented during the duration of the project. Special attention was dedicated to the aims of the WP8, link the outputs of the MERCES project to the industrial sector using different tools such as business-focused newsletters and webinars.

The PO commented the first business-focused newsletter suggesting a reduction of the length of the articles (more concise and strict to the point). The WP co-leaders replied that this first business-focused newsletter was conceived in order to present MERCES and its case studies/habitats and working areas. The priority is to present the several options and possibilities of the marine restoration and the first newsletter was also a platform to establish the first contact with the community and stakeholders. The first webinar will be scheduled by the end of the year and any suggestions and contributions are welcomed.

WP9: general overview introduced by Milanese on the multiple activities carried out in terms of communication and dissemination. Special attention was dedicated to the publication and the repository in Zenodo dedicated to the project. The PO appreciated the general overview of the activities carried out in this WP. The visibility of the project is a priority for an international audience.

After the end of the general presentation of the WPs, the members of the consortium were divided in different groups to prepare the WPs wrap-up and plan joint work for the next year. The discussion of the WPs was presented the last day of the meeting.

Followed by the General Assembly and Steering Committee meetings.

End of the day

22nd June 2017

The last part of the meeting was dedicated to the activities plan for the next year. The WPs co-leaders presented the outputs of the internal meetings.

WP1: Nadia Papadopoulou & Anthony Grehan

Summing up WP1 and way forward:

2 reports have been submitted thanks to a great team work based on 15 beneficiaries of the Consortium and over 30 people involved.

Another report is scheduled at Month 18 and 1 Milestone on manuscripts submitted at Month 18.

Moreover:

2 Reports into 6 posters so far

3 Catalogues (existing, degraded, activities)

6 cases FEATURES (restoration potential)

6 cases Pressures (consequences for restoration)

- How many publications and where??
- Ideas: marine policy, marine pollution bulletin, others

Further use of the catalogue data, spatial analyses, GIS (?WP5)

Simonetta joint review manuscript, when? Should be focussed around certain questions and be finished as soon as possible now (WHEN? timeline)

D.1.3. Report: we need to use this analysis to fill the obligations of the description of the work. People have used time to do this...

We will make a timeline for chapters and specific contributions for the papers and of course the D1.3 (Offers?)

WP2: Johan van de Koppel & Christoffer Boström

Overview: Setting up experiments

Up to now established restoration experiments in the:

Northern countries (Fi-No-Est): *Mytilus edulis* and *Zostera marina*;

Netherlands: *Z. marina* seeded behind artificial mussel beds;

Croatia (June): *Pinna nobilis* transplanted into *Cymodocea nodosa*;

Turkey (July): *P. nobilis* & *Posidonia oceanica* and

Italy (September): *P. nobilis* & *Z. marina*.

BESE experiments

Netherlands: BESE experiment setup (*Z. marina*)

Finland: BESE with *Z. marina*

Croatia, July: BESE with *P. oceanica*

Additional activities

Norway: *Z. marina* transplantation in muddy case-study sites

Finland: Adding *Macoma baltica* to transplanted *Z. marina* (next week)

Netherlands: Natural *Z. noltii* establishment behind experimental oysterbeds.

Croatia, July: BESE with *P. oceanica*

Sampling in the coming 6 months:

Seagrass parameters (growth/survival)

Sediment parameters (grain size, carbon/OM, nutrients)

=> Sampling manual is being prepared for all partners.

Case study sites

Norway– Viksfjorden

Ecological engineering => Oxygenation of the sediment

Transplant seagrass in these areas

Estonia – Gulf of Riga

Monitoring

Italy – Gabicce Mare
Restoration of seagrass beds impacted by human pressure
Transplantation of seagrass and translocated *P. nobilis*

Linking to WP5:
Experiments establish mechanistic understanding of seagrass establishment.
Samples can be taken from the experiments for
Biomass
Canopy structure
Biodiversity
Sediment/nutrient/carbon build up (fine grained)
=> But from a m2 scale, meaning: qualitative

Microbiome
Ecological Question:
Do we have different microbiomes in different conditions (biotic/locations)?
Can microbiome explain lack of restoration success?

Setup
Sample microbial community in sediment, leaves, roots, rhizomes.
Treatments: Bare sand, Seagrass, S.+ Bivalves, Ambient Seagrass.
Different seagrasses (*Z. marina*, *C. nodosa*, *Z. noltii*, *P. oceanica*).

Modelling seagrass establishment
Many seagrass beds are patchy Patches can be dynamic
Can we see from the patterns whether restoration is successful: if the system passes a threshold.
Image collection is a focus of coming 6 months

WP3: Joaquim Garrabou & Simonetta Fraschetti

Action plan:
Writing plan for restoration of protocols for targeted species (Factsheets)
Start facilitation experiment: Catalonia, Ligurian Sea, Croatia;
Research Question: Can arborescent species affect the survival and growth of co-occurring encrusting and massive ones?

Perform transregional thermotolerance experiments:
Gorgonian: *Paramuricea clavata*
Macroalgal: *Cystoseira crinita*

Join the WP4 exercise on Applying the Society of Ecological Restoration standards to targeted habitats
Ex situ common garden experiments: 9-12 populations:
Expected results:

- 1) To refine the pattern of the differential responses to thermal stress in *Paramuricea clavata*;
- 2) To characterize the molecular basis of these differential responses
Detection of resistant individuals improving restoration actions.

Start pilot actions. 4 actions
Macroalgal: Norway and Ionian Sea
Coralligenous: Catalonia, Ligurian Sea
Change a title of Deliverable 3.3 GA
Skype meeting WP3 to publication plan.
Synthesis papers + specific papers on specific WP3 restoration activities

WP4: Andrew K. Sweetman, Telmo Morato & Marina Silva

All WP experiments deployed (except fish and vent exp) and on track

3 publications produced so far (Nature Geoscience, Elementa: Science of the Anthropocene, Frontiers in Environmental Science), plus one submitted to Nature Scientific Reports.

PhDs and Post-docs have been recruited

Workshop completed

No deliverables (yet)

2 milestones completed

Task 4.1

The WP4 workshop will contribute to D4.1 "Review report on the principles of the deep-sea restoration and on the ecological benefits of passive and active restoration in the deep-sea".

Skeleton for deliverable prepared by Autumn 2017

Telmo & Andrew = coordinators

We will generate publication(s) to see how we will apply the SER guidelines to 1-3 case studies in the deep sea.

One ms with all CS:

Vents

Nodule province

Cold-water corals

This may be submitted to the MERCES special issue in Phil Trans. Royal Soc.

Tasks 4.2 & 4.3

Norwegian experiments will run through to December 2017. Possibly longer depending on state of kelp material.

Analysis of samples will then begin. Food-web models will be constructed to assess energy flow to high trophic levels (= ecosystem service, therefore links to WP5).

Italian experiments

Dohrn Canyon artificial substrates will be deployed by the end of 2017 for 6 months.

All other samples collected and being analysed

Vent experiments

Deployment of the full experiment during the Momarsat cruise 2017 (8-28 July) onboard the Pourquoi Pas?

Sampling in 2017, 2018 and 2019. Analyses will begin in late 2017

Angola and Faroe-Shetland Channel study is ongoing

All videos in house, Angola analyses half done, F-S study has just started & will be done summer 2018

Condor seamount

More landers to be deployed in 2017, recovery in 2017, 2018 and 2019, analysis will begin in 2017

Fish transplant study, summer 2018? Will link to WP5.

Cap de Creus study

Lander monitoring in Sept 2017 and 2018, recovery of one lander in 2018

Cobble deployment finished, will probably do more experiments with soft corals in late 2017

WP5: Chris McOwen & Trine Bebbky

Unanswered questions:

How to quantify the link between habitat features, pressures, restoration methods, environmental conditions AND restoration success?

How to analyse/investigate/compare the ecosystem services in intact and degraded habitats?

Can we quantify the link between features, pressures, restoration methods, recovery success AND ecosystem service change?

How to analyse the impact for species higher up in the food chain through spatially explicit models and food web modelling?

How to identify ecological bottlenecks and thresholds for effective restoration?

How to quantify and visualize these relationships? Spatial integration and statistical tools.

How to identify linkages to policy recommendations?

Work Package 5 Workshop: 23 – 24 June, at 9.30 am next door!

Collation of site details from 39 sites:

WP 2: 15 sites from 7 countries;

WP 3: 17 sites from 6 countries;

WP 4: 7 sites from 5 countries

Site information:

WP, Site name, Location (Lat/Long), Size of restoration site and surrounding area, Habitat type, Species, Restoration techniques (experimental or established)

Ecosystem services (CICES):

Provisioning, Regulation & Maintenance, Cultural

Indicators of Success:

Restoration dates: 12 month indicator and 24 month indicator

Final change in area / density / height, change in ecosystem service

Plans for the next year

Continue to collect data from WPs 2, 3 and 4

Continue communication with other WPs, especially WP 6 and 7

Mapping restoration sites and pressures (using WP 1 database)

Potential papers to aid our knowledge

Review of the definitions for restoration success in the literature,

Review of features (e.g. structure, function) used in the literature, and may be used, as a proxy for ecosystem services.

WP6: Jan P.M. van Tatenhove & Ronan Long

Starting Task 6.2 (start M16; D6.3 M30)

Ex-post and ex-ante policy evaluation.

Ex-post policy evaluation: evaluation of the policy impacts of existing restoration and remediation policies (MSFD; MSP, Blue Growth, BD and HD) (in the selected cases)

Ex-ante evaluation: based on the ex-post analysis which (additional) restoration policy initiatives, instruments, regulations, etc. (under national, EU and international legislation) should be developed in the near future for those cases/activities and for restoration activities (within different governance arrangements) in general.

Case selection to perform the evaluation

Criteria for selection

Most different case design (governance arrangements). Restoration activities in:

EEZs (Territorial and coastal seas) (Wadden Sea, seagrass or Norwegian Kelp);

Regional seas (??);

High seas (??)

We need our input!!

WP7: Wenting Chen

Work to be done by this year

Surveys on social acceptance start as soon as possible.

Surveys on ecosystem services for kelp forest recovered in Norway will start and end by the end of the year.

Discussion on choice of case studies in deep sea.
Data collection from WP2, WP3 and WP4.
Collaboration with WP5 and WP6 and other WPs.

Task 7.1. Assessment of social acceptance of the restoration activities (I)

We have hold on discussions on social acceptance, which cases and which countries to best target/link, discussions on choice of methodology for social acceptance surveys, in cooperation with WP9 and UNIVPM/ECOREACH.

We are looking at the Q-methodology (requirements, benefits), as there was the possibility of complementarity with another project working on seagrass habitats (although the other project failed to interact with stakeholders or hold any focus groups).

Task 7.1. Assessment of social acceptance of the restoration activities (II)

Background reviewing for social acceptance of restoration activity, economic cost and benefits of costal ecosystem service restoration are ongoing. The possibility of a poll survey (generic or linked to a case study) is being looked at and the design of questionnaire surveys is underway. An extensive excel spreadsheet has been compiled of the relevant literature which includes 300 papers with focus on active restoration.

HCMR has been reviewing the literature for cost/benefits of restoration (in collaboration with WP1) to inform work in other tasks.

Task 7.2. Selection of the pilot studies

Criteria for the selection of the case study sites were laid down an excel spreadsheet developed in conjunction with WP5 and WP6.

Case study leaders were asked to fill up the spreadsheet in terms of the ecosystems present, services generated and over 40 other indicators (criteria).

One specific case from each of the major habitat types, hard bottom shallow, soft bottom shallow and deep sea has now been selected for the economics analysis.

The values of ecosystem services and costs and benefits of ecosystem restoration is being carried out in the context of seagrass ecosystem restoration in the Netherlands, the restoration of kelp forests in Norway, where kelp forests have been grazed by green sea urchins and for restoration around deep sea vents

Task 7.3. Assess the ecosystem service benefits from ecosystem restoration

1. Seagrass restoration in Dutch Wadden Sea
2. Kelp forest restoration in Norway
3. Deep sea

To be further discussed based on data availability and other factors

Task 7.4. Assess the costs of restoration measures

This Task has not yet been officially started, but now that case studies have been selected we can start this Task as planned. Moreover we have made a start with exploring possibilities for private finance of kelp forest restoration.

Task 7.5. Social Cost Benefit Analysis (SCBA)

Collected existing information on socioeconomic studies (including the ecosystem services affected)

An assessment of the values of ecosystem services in both case studies is ongoing.

Work has also begun on examining financing opportunities for marine restoration.

Links with other WPs

WP2: Restoration measures, costs etc

WP3: Restoration measures, costs etc

WP4: Case discussion, selection, data availability, connection to Atlas

WP6: Governmental structure, framework

Progress

According to the GANTT chart, all the activities are progressing as scheduled.

D 7.1 A report, including a policy relevance section, on social acceptance of the restoration activities (HCMR) At Month 20

WP8: David Billett, Eva Ramirez Llodra, Henn Ojaveer & Martina Milanese

The MERCES Business Club future developments

‘Business Club’

Increase membership in all countries

Increase Government Departments, Local Authorities and Regulators

Increase University groups working on marine ecosystem restoration

Other industries and organizations? Your ideas?

MERCES Industry Portal

New front page on MERCES website for the Business Club

Populate the MERCES BC web pages with new industry case studies

Make links from Business Club pages to MERCES WPs’ pages

Add descriptions of recent papers on marine ecosystem restoration listed in Web of Science?

Business targeted newsletters

Prepare new business-focused MERCES newsletter 2018

Reduce the length of articles to better target business readers?

Add a short summary (2-3 sentences) at the start

Input from business about why they should care about marine restoration

what are the legal requirements?

more input from MERCES field studies would be useful

Add languages?

Interactive Webinars

Hold first Industry-focused webinar in December 2017

Topic for webinar

Methods/best practices in a specific case study

Pollution: how does land-based pollution affect restoration success in a specific topic/habitat.

Restoring natural capital in the sea: cross-sectorial issues (James)

How you can help?

Make direct contact with individuals and companies in your country

Invite WP8 members to WP meetings you organize

Participate in the WP8 webinars

Provide articles to the newsletter

Populate web pages on the MERCES website

WP9: Martina Milanese

MERCES is present in Google Scholar: high visibility of the project to the scientific community.

Improvement of the use of different tools (including social media) in order to reach the largest audience for the engagement of different stakeholders, policymakers, industries, scientific and no scientific audience. Best communication among EU, MERCES and the international society.

Major efforts will be spent for the citizen science, with the beginning of the social campaign in the selected areas in which the case studies are performed. Important to stress the output of the WPs and the potential common initiatives. Photos, videos are welcomed to present the field work carried out in different areas and seas. Inform the WP for the participation to meetings, conferences and events in order to allow the publicity of the project. Another important issue is the publication. All members of the Consortium are invited to keep informed the project management and the WP on the scientific publication. Papers should be included in the MERCES repository in Zenodo according to the policy of the journal. Publications in open access journals are strongly suggested. In case no open access, consult

the WP9 co-leaders and they can help you to submit the best format of the publication in the MERCES repository.

Continuous update of the publication in the website.

Conclusions and end of the day

3.2 Advisory Board



Marine Ecosystem Restoration in Changing European Seas **MERCES**

Grant agreement n. 689518

Advisory Board Meeting

20th June 2017 - Heraklion, Crete, Greece
Time: 19.00 – 19.30

Participants:

Project Coordinator: Roberto Danovaro

Project Management Office: Cristina Gambi & Emmanuelle Girardin

Advisory board members: James Aronson, Cindy van Dover & Roberto Cimino

Agenda:

- Welcome and apologies for absence
- Update on the progress of the project
- Comments and suggestions from the Advisory Board
- AB contribution to MERCES
- Annual meetings
- A.O.B

Welcome and apologies for absence

Roberto Danovaro started the meeting welcoming all the Advisory Board members. Unfortunately, Paul Snelgrove was not able to join the meeting since he was engaged in an oceanographic cruise in the Arctic sea. As well as all members of the advisory board, Paul has been informed on the progresses of the project and on the agenda of the annual meeting. Roberto reported Paul's greetings to the Advisory Board and the MERCES Consortium.

Update on the progress of the project

Roberto Danovaro reported the progresses of the project presenting the deliverables submitted and the milestones achieved in the first 12 months of the project.

The list of the first project year deliverables is reported below:

Deliverable number	Title	WP	Lead beneficiary	Month
D11.1	H – POPD – Requirements No. 2	11	UNIVPM	1
KOM	Kick Off Meeting	1	UNIVPM	1
D9.1	Dissemination plan (revised every year)	9	ECOREACH	3
D9.2	MERCES project homepage, MERCES Intranet with project templates and guidelines	3	ECOREACH	3
SCM	Steering Committee Meeting + minutes	10	UNIVPM	6
D10.1	Minutes of the Kick-Off including the establishment of the different bodies (e.g. SC, AB)	10	ECOREACH	6
D10.2	Release of the Data Management plan	10	ECOREACH	6
D3.1	State of knowledge on key eco-evolutionary processes and factors driving the resilience of the shallow hard bottoms and mesophotic habitats	3	CONISMA	10
D1.1	State of the knowledge on European marine habitat mapping and degraded habitats	1	NIVA	12
D1.2	Current marine pressures and mechanisms driving changes in marine habitats	1	NUIG	12
D8.1	Report on consolidated lists by country and by business sector of the European Marine Restoration Business Clubs	8	DSES	12
D9.3	First Year report on networking, public engagement and communication activities including collation of products and e-MERCES tools	9	GAIA	12
D10.3	Minutes of the first Annual Meeting (internal WP meetings, SC, GA, AB)	10	UNIVPM	12

All deliverables have been submitted on time. The submission of the Deliverable 10.3, related to the annual meeting, has been postponed to Month 14 (31 July 2017) with the agreement of the Project Officer.

The first deliverables have been approved by the Project Officer while the deliverables submitted in May 2017 (Month 12) are under the revision of the Project Officer. The approved public deliverables have been published in the public area of the MERCES website.

The list of the first project year milestones is reported below:

Milestone number	Title	WP	Lead Participant	Month	Means of verification
MS29	Open WP8 web-page with communication link for industry	8	DSES	1	WP8 page accessible on the MERCES web pages
MS36	Social network accounts running	9	GAIA	3	MERCES Facebook and Twitter running, YouTube channel including a short video presentation of the project
MS38	Intranet in the website running	10	ECOREACH	3	First management templates, guidelines and DoA available for download in the partners' area
MS39	Project kick off meeting and first meeting of the MERCES Steering Committee	10	UNIVPM	3	Summary available on the webpage for public and media
MS1	Meeting and outline for the D1 Deliverable Report	1	NIVA	6	Meeting minutes available on the MERCES web site restricted area
MS8	Implementation of field actions (bibliographic survey, sampling, experimentation) to define restoration protocols	3	CoNISMa	6	Results of the bibliographic survey, sampling and experiment designs available on the MERCES web site restricted area
MS4	WP2 planning seminar	2	ÅAU	6	Minutes available on the web site
MS20	Meeting and outline for the D6.1	6	AAU-IFM	6	Meeting minutes available on the web site
MS37	Newsletter and Factsheets downloadable from the website	9	ECOREACH	6	Available for download from MERCES website
MS21	Meeting and outline for the D6.2	6	MLOPRS	9	Meeting minutes available on the web site
MS2	Completion of data collation for tasks 1.1-1.3	1	NUIG	10	Applicable datasets available on the MERCES data repository on line
MS9	Implementation of field actions to enhance effectiveness of restoration protocols	3	CoNISMa	12	List of implementation actions provided to the stakeholders community (via the web site)
MS10	Evaluation of efficiency of restoration setups (devices, materials etc..) in shallow hard bottoms and mesophotic habitats	3	CSIC	12	Evaluation presented to the stakeholders community via the web site
MS12	Workshop to discuss the principles of deep-sea restoration, technological gaps and integration of the deep-sea restoration agenda into policy	4	HCMR	12	Minutes available on MERCES web site
MS13	Deep-sea organism to be transplanted for the active restoration pilot studies collected	4	IMAR-UAz	12	Report of activity with photos available on the MERCES web site
MS30	Opening of MERCES Business Clubs	8	DSES	12	Link on MERCES website

MS40	First Annual Meeting	10	UNIVPM	12	Summary available on the webpage for public and media
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All milestones have been achieved on time. The submission of the milestones MS12 and MS40 related to the MERCES WP4 workshop and the annual meeting has been postponed to Month 14 (31 July 2017) with the agreement of the Project Officer.

The coordinator presented also the deliverables and milestones scheduled in the next 6 months:

Deliverable number	Title	WP	Lead Beneficiary	Type	Month
D6.1	Review of existing international governance structures, regarding the conservation, restoration and recovery of marine ecosystems	6	AAU-IFM	Report	15
D11.2	EPQ-A- Requirement No4	11	UNIVPM	Ethics	16
D1.3	State of the knowledge on marine habitat restoration and literature review on the economic cost and benefits of marine and coastal ecosystem service restoration	1	HCMR	Report	18
D3.2	Criteria and protocols for the restoration of shallow hard bottoms and mesophotic habitats	3	CoNISM, CSIC	Report	18
D6.2	Review of current EU and international legal frameworks	6	MLOPRS	Report	18

The deliverables are in progress and all partners are working to complete and submit them on time. The coordinator reported to the Advisory Board a new EC procedure about the public deliverables. The European Commission informed all coordinators that in line with the provisions of Grant Agreement article 38.2.1 on communication activities and in order to raise awareness of EU funded research activities, the project deliverables which are flagged with the dissemination level 'PUBLIC' will be published in our project page in CORDIS. In practical terms, once a public deliverable is approved by the Project Officer in the Continuous Reporting module in SyGMA, the deliverable will be automatically sent to CORDIS for publication with retroactive effect, i.e. all already approved public deliverables will be sent to CORDIS.

Milestone number	Title	WP	Lead Participant	Month	Means of verification
MS16	Technical workshop on ecosystem services restoration efficiency and recovery potential analysis methodology: list of GIS data layers	5	NIVA	15	Meeting minutes available on the MERCES web site restricted area
MS3	Draft manuscript for review paper/s	1	HCMR	18	Manuscript submitted to journal/s
MS5	Workshop on experimental results & planning of case study work	2	NIOZ	18	Minutes available on the website

MS11	Implementation of pilot restoration actions in shallow hard bottoms and mesophotic habitats	3	CSIC	18	List of implementation actions provided to the stakeholders community (via the web site)
MS24	Data and information from interviews and surveys on social acceptance of the restoration activities	7	HCMR	18	Data available in the restricted area of the web site

Comments and suggestions from the Advisory Board

The coordinator asked all members of the Advisory Board comments and suggestions on the MERCES project after the first year of the activities.

Cindy van Dover participated in the WP4 (Restoration of deep-sea ecosystems) workshop on “Discussing principles, concepts and guidelines for ecological restoration of the deep-sea” held in Heraklion (Crete, Greece) on the 18th-19th June 2017, just before the MERCES 1st Annual meeting. She found the workshop very interesting and opened the discussion on the feasibility of the ecological restoration in deep-sea ecosystems. The MERCES project represents a new era for the deep-sea ecology and a progress from the theory reported in the paper by Van Dover et al. (2014) on *the ecological restoration in the deep sea: desiderata* to the practical exercise in the pilot cases study. The study areas presented during the first day of the annual meeting (including WP4) are examples of different approaches and practices to carry out in the deep sea. An important topic is considering also the scaling up of the pilot cases study to a larger spatial scale. This is another important challenge for the MERCES project. We have to consider how we can scale up the cases study and at the same time the economical sustainability of the ecological restoration. A general discussion is related also to the need of identifying the extension and the mapping of habitats and their degradation. The coordinator reported that unfortunately the habitat mapping is still very fragmentary and incomplete due to different level of protection and management of the coastal areas (marine protected areas, areas of special protection) and to the activities carried out (cables deposition, infrastructures and activities). The EU policy aims to improve the number of marine protected areas along the European seas. The habitat mapping is certainly a priority to establish the spatial scale of the degraded habitats. To this regard, the contents of the deliverables D1.1 *State of the knowledge on European marine habitat mapping and degraded habitats* and D1.2 *Current marine pressures and mechanisms driving changes in marine habitats* as well as the review on the papers related to the ecological restoration in marine ecosystems can be useful to better understand the spatial scale of the degraded habitats and at the same time to evaluate potential scaling up of the restoration activities and their costs. The collection of all data and maps available from previous projects is also certainly useful. Generally, the costs to work on the deep sea are very high especially due to the ship-time.

The coordinator reminded the overall budget of the project that represents a limit for a scaling up of the restorations projects in all habitats, including the deep sea. In any case it is also important to have in perspective a vision of the potential of the ecological restoration at a larger scale without remaining to the pilot actions.

James Aronson also participated in the WP4 workshop. He suggested to improve communication between WPs 1-4 and WPs 5 (ecosystem services), 6 (policy and legal), 7 (socio-economical) to allow a better flow of information from the data collected in WP1 and in field works (WPs 2-4), and to define the case study to be selected for the different analyses. He warmly recommended to try to use a common language (check the terminology on the ecological restoration) and definitions (check the definition of the ecosystem services according to the Millennium Ecosystem Assessment). He highlighted how important is the definition of ecosystem services and functioning to avoid any misunderstanding. This requires more collaboration between WPs 2,3 and 4.

James suggested a major effort of WP5 (ecosystem services) to better define the ecosystem services to be analysed in term of their recovery in case of ecological restoration. He strongly suggested to consider the huge literature available for the ecological restoration in terrestrial ecosystems as a starting point for the

analyses of ecosystem services in marine habitats. This will allow to use approaches already defined and accepted by the scientific community. In his opinion WP5 does not need to create any substantially new materials but has to consider the background acquired from the ecological restoration of terrestrial ecosystems and supplement that where appropriate for marine ecosystems restoration.

Roberto Cimino stressed the importance of paying attention to three particular aspects of ecological restoration: the timeline of restoration initiatives (how long is the process?), the legal responsibility for the relevant industries (for how long they be held responsible), and costs.

The offshore industry is moving fast in terms of technological improvement from ROV (Remotely operated underwater vehicle) to AUV (Autonomous underwater vehicle). Costs will decrease, so it is important to define a timeframe. Industries should be informed on the monitoring before (how long?) and after (how long?) their activities and the application of restoration initiatives. At the same time, it is important to have an idea of the costs and the sustainability of the technologies to apply. The legislation aspects are also important to have an idea on which elements are mandatory and, thus, to consider the level of responsibility and the timeframe of this responsibility.

AB contribution to MERCES

The coordinator reported the expectations of the MERCES project from the Advisory board members. The advisory board members should support the scientific publications on the different aspects of the ecological restoration, including synthesis papers, with their expertise. Moreover, the advisory board could help in the preparation of a volume dedicated to the ecological restoration in marine ecosystems that include different practices/methodologies in different habitats (from shallow to deep-sea ecosystems) and a cascade of actions on ecosystem goods and services, with potential interest for a large spectrum of stakeholders (including industries, restoration practitioners).

The coordinator invited the Advisory Board members to visit some laboratories and cases study to have a direct contact with the partners involved in the project and to verify the field works and methodologies used. They are also invited to participate in the workshops to meet the project members and learn more about the specific tasks of the different WPs.

The coordinator reported also James Aronson's suggestion to organize the third MERCES annual meeting and to have a symposium dedicated to the restoration of marine ecosystems during the 8th World Conference on Ecological Restoration organized by the Society for Ecological Restoration (SER), which is to be held in South Africa between August-September 2019. This international event is an excellent occasion to build a global community on marine ecosystem restoration. A symposium – or even two symposia - of the conference could be dedicated to different aspects of marine ecosystem restoration, and they should be open to all researchers working in this field (some of them identified in the review WP3). All AB members agreed that this is an important occasion for MERCES to gain visibility at international level.

Annual meetings

As decided during the kick-off meeting in Rome (July 2016), the MERCES second annual meeting will be held in Barcelona. It is expected between May-June 2018.

The third annual meeting is in stand-by as the coordinator needs to verify with the EC the feasibility of having the annual meeting during the SER conference in South Africa. The previous option was Edinburgh. The EC suggested to have the final meeting in Brussels.

A.O.B

No input

End of the meeting.

3.3 General Assembly



Marine Ecosystem Restoration in Changing European Seas **MERCES**

Grant agreement n. 689518

General Assembly Meeting

21st June 2017 - Heraklion, Crete, Greece

Time: 18.00 – 18.45

Participants:

Project Coordinator: Roberto Danovaro

Project Management Office: Cristina Gambi & Emmanuelle Girardin

All members of the Consortium

Agenda

- Welcome
- Ratification of decisions: amendment submitted on March 15th 2017
- Milestones and deliverables achieved (months 1-12)
- Milestones and deliverables (months 13-18): status & updates
- WP11 Ethics requirements: Deliverable 11.2 (month 16)
- Status of the submission of technical and financial reports for the first reporting period
- New procedure for progress reports
- MERCES website: inputs
- Second annual meeting: confirm of the host partner & date
- A.O.B

Welcome

Roberto Danovaro welcomed all members of the consortium. The agenda of the meeting has been sent to all partners before the meeting and it has been confirmed at the beginning of the General Assembly.

Ratification of decisions: amendment submitted on March 15th 2017

A new amendment to the Grant Agreement has been requested for the addition of 2 case studies: Bagnoli (Mediterranean sea, Naples-Italy) and Angola basin (Atlantic Ocean) and the addition of the Stazione Zoologica Anton Dohrn of Naples (Italy) as a third party providing in-kind contributions free of charge (Article 12) for UNIVPM.

The unanimously consensus of the Consortium was obtained by email. The PMO launched the amendment in the Participant Portal the 15/03/17, it was accepted by the EC and closed the 08/05/17.

Milestones and deliverables achieved (months 1-12)

The Coordinator reported the progresses of the project presenting the deliverables submitted and the milestones achieved in the first 12 months of the project.

The list of the first year project deliverables is reported below:

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D9.2	MERCES project homepage, MERCES Intranet with project templates and guidelines	3	ECOREACH	3
SCM	Steering Committee Meeting + minutes	10	UNIVPM	6
D10.1	Minutes of the Kick-Off including the establishment of the different bodies (e.g. SC, AB)	10	ECOREACH	6
D10.2	Release of the Data Management plan	10	ECOREACH	6
D3.1	State of knowledge on key eco-evolutionary processes and factors driving the resilience of the shallow hard bottoms and mesophotic habitats	3	CONISMA	10
D1.1	State of the knowledge on European marine habitat mapping and degraded habitats	1	NIVA	12
D1.2	Current marine pressures and mechanisms driving changes in marine habitats	1	NUIG	12
D8.1	Report on consolidated lists by country and by business sector of the European Marine Restoration Business Clubs	8	DSES	12
D9.3	First Year report on networking, public engagement and communication activities including collation of products and e-MERCES tools	9	GAIA	12
D10.3	Minutes of the first Annual Meeting (internal WP meetings, SC, GA, AB)	10	UNIVPM	12

All deliverables have been submitted on time. The submission of the Deliverable 10.3, related to the annual meeting, has been postponed to Month 14 (31 July 2017) with the agreement of the Project Officer.

The first deliverables have been approved by the Project Officer while the deliverables submitted in May 2017 (Month 12) are under the revision of the Project Officer. The approved public deliverables have been published in the public area of the MERCES website.

The list of the first year project milestones is reported below:

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MS1	Meeting and outline for the D1 Deliverable Report	1	NIVA	6	Meeting minutes available on the MERCES web site restricted area
MS8	Implementation of field actions (bibliographic survey, sampling, experimentation) to define restoration protocols	3	CoNISM a	6	Results of the bibliographic survey, sampling and experiment designs available on the MERCES web site restricted area
MS4	WP2 planning seminar	2	ÅAU	6	Minutes available on the web site
MS20	Meeting and outline for the D6.1	6	AAU-IFM	6	Meeting minutes available on the web site
MS37	Newsletter and Factsheets downloadable from the website	9	ECOREACH	6	Available for download from MERCES website
MS21	Meeting and outline for the D6.2	6	MLOPRS	9	Meeting minutes available on the web site
MS2	Completion of data collation for tasks 1.1-1.3	1	NUIG	10	Applicable datasets available on the MERCES data repository on line
MS9	Implementation of field actions to enhance effectiveness of restoration protocols	3	CoNISM a	12	List of implementation actions provided to the stakeholders community (via the web site)
MS10	Evaluation of efficiency of restoration setups (devices, materials etc..) in shallow hard bottoms and mesophotic habitats	3	CSIC	12	Evaluation presented to the stakeholders community via the web site

MS12	Workshop to discuss the principles of deep-sea restoration, technological gaps and integration of the deep-sea restoration agenda into policy	4	HCMR	12	Minutes available on MERCES web site
MS13	Deep-sea organism to be transplanted for the active restoration pilot studies collected	4	IMAR-UAz	12	Report of activity with photos available on the MERCES web site
MS30	Opening of MERCES Business Clubs	8	DSES	12	Link on MERCES website
MS40	First Annual Meeting	10	UNIVPM	12	Summary available on the webpage for public and media

All milestones have been achieved on time. The milestones are available in the private or public area of the MERCES website. The submission of the milestones MS12 and MS40 related to the MERCES WP4 workshop and the annual meeting has been postponed to Month 14 (31 July 2017) with the agreement of the Project Officer.

Milestones and deliverables (months 13-18): status & updates

The coordinator presented the deliverables and milestones scheduled in the next 6 months:

Deliverable number	Title	WP	Lead Beneficiary	Type	Month
D6.1	Review of existing international governance structures, regarding the conservation, restoration and recovery of marine ecosystems	6	AAU-IFM	Report	15
D11.2	EPQ-A- Requirement No4	11	UNIVPM	Ethics	16
D1.3	State of the knowledge on marine habitat restoration and literature review on the economic cost and benefits of marine and coastal ecosystem service restoration	1	HCMR	Report	18
D3.2	Criteria and protocols for the restoration of shallow hard bottoms and mesophotic habitats	3	CoNISM, CSIC	Report	18
D6.2	Review of current EU and international legal frameworks	6	MLOPRS	Report	18

The deliverables are in progress and all partners are working to complete and submit them on time. The coordinator reported to the General Assembly a new EC procedure about the public deliverables. The European Commission informed all coordinators that in line with the provisions of Grant Agreement article 38.2.1 on communication activities and in order to raise awareness of EU funded research activities, the project deliverables which are flagged with the dissemination level 'PUBLIC' will be published in our project page in CORDIS. In practical terms, once a public deliverable is approved by the Project Officer in the Continuous Reporting module in SyGMA, the deliverable will be automatically sent to CORDIS for publication with retroactive effect, i.e. all already approved public deliverables will be sent to CORDIS.

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MS3	Draft manuscript for review paper/s	1	HCMR	18	Manuscript submitted to journal/s
MS5	Workshop on experimental results & planning of case study work	2	NIOZ	18	Minutes available on the website
MS11	Implementation of pilot restoration actions in shallow hard bottoms and mesophotic habitats	3	CSIC	18	List of implementation actions provided to the stakeholders community (via the web site)
MS24	Data and information from interviews and surveys on social acceptance of the restoration activities	7	HCMR	18	Data available in the restricted area of the web site

WP11 Ethics requirements: Deliverable 11.2 (Month 16)

The deliverable D11.2 EPQ (Environmental Protection Quality) – A (Animals)

Requirement No 4.

Details must be provided on the endangered species and protected areas involved in the research and copies of the relevant authorizations must be submitted prior to the start of the respective research. If applicable, copy of project authorization for the use of animals must be submitted. The deadline is September 2017.

Authorizations to perform field work in protected areas or to collect protected species must be obtained before work starts. The PO wants a description/introduction in English. Documents will be collected by UNIVPM and submitted as the deliverable. The PMO invites all partners involved in field works to verify if their working areas need permissions and the type of permissions requested.

According to the guidelines from EC, the content of the deliverable includes:

EPQ (Environmental Protection Quality)

- Does this research involve the use of elements that may cause harm to the environment, to animals or plants?
- Does this research deal with endangered fauna and/or flora and /or protected areas?
- Does this research involve the use of elements that may cause harm to humans, including research staff?

A (Animals)

- Does this research involve animals?
- Are they vertebrate?
- Are they nonhuman primates?
- Are they genetically modified?
- Are they cloned farm animals?
- Are they endangered species?

Status of the submission of technical and financial reports for the first reporting period (1 June 2016 – 31 May 2017)

Status of the technical and financial reports:

Submission of partners' scientific progress reports to the PMO: 26 May 2017;

Submission of relative contributions from the PMO to the WP co-leaders: 12 June 2017;
Submission of WP co-leaders' scientific reports to the PMO: 30 June 2017;
Submission of draft financial statements via the Participant Portal: 30 June 2017;
Submission of all final report documents to the EC by the Coordinator: 15 July 2017.

Payment after the 1st reporting period:

Once the PMO has submitted the Periodic Reporting, both scientific and financial, the EC has 90 days to pay. The interim payment reimburses the eligible costs reported in the Periodic Report. The amount depends on how much beneficiaries spent during the period covered by the periodic reporting.

There is no limit in time to spend the pre-financing.

The only limitation is that the amount of the interim payment(s) cannot exceed 90% of the maximum grant amount minus pre-financing (and minus previous interim payments).

Extract from the AMGA:

21.3 Interim payments

Amount Calculation

Interim payments reimburse the eligible costs incurred for the implementation of the action during the corresponding reporting periods.

The [Commission][Agency] will pay to the coordinator the amount due as interim payment within 90 days from receiving the periodic report (see Article 20.3), except if Articles 47 or 48 apply.

Payment is subject to the approval of the periodic report. Its approval does not imply recognition of the compliance, authenticity, completeness or correctness of its content. The amount due as interim payment is calculated by the [Commission][Agency] in the following steps:

Step 1 - Application of the reimbursement rates

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The next reporting period (scientific and financial) required by the EC is at M30 (November 2018)

New procedures for progress reports

The Project Management Office proposed a new procedure for the scientific progress report.

After the first year of the project, the good progress of the work allows to revise the procedure cancelling the monthly update requested by the WPs co-leaders. Every 3 months, each beneficiary will send an update of all their scientific activities to the WP co-leaders of every work-package they are involved in. The WP co-leaders will send the report to the PMO. A template will be distributed to standardize all WPs' reports.

The 6 months report remains but the information will be collected by the WP co-leaders using the H2020 template for periodic reporting. WP leaders will send the WP reports to the PMO who will generate the final report.

PMO will send an update to the PO every 3 months.

MERCES website: inputs

The contributions and inputs (events, sampling activities, participation to special initiatives) of all partners are still needed! Please inform ECOREACH and the MERCES PMO for a continuous update of the activities.

Call for photos and videos during the events and field works is always open!

Second annual meeting: confirmation of the host partner & date

Location: Barcelona within M24 (May 2018) as agreed during the KOM;

Host partner:

CSIC – Lead Joaquim Garrabou

The General Assembly has identified the last week of May 2018 as the best period for the second annual meeting since the first weeks of May are already busy with international meetings and conferences. The host institution will check and inform the consortium about the feasibility

A.O.B

Participation to the European Commission's Event, "A New Era of Blue Enlightenment".

ATLAS project has a 90-minute session on July 12 to organise a trans-Atlantic session: "Trans North Atlantic research and prospects for South Atlantic partnership" and invited MERCES to participate.

The aim of the session is to allow ATLAS and SponGES to summarise how fully basin-scale issues are addressed, both scientifically and in the policy domain while engaging MERCES.

Ricardo Santos (MEP) will be chairing the session.

Anthony Grehan (NUI Galway, Ireland) will present 'The ATLAS approach towards an Atlantic maritime spatial management plan'

Telmo Morato (IMAR-UaZ) will represent MERCES

SponGES talk

Additional talks by Jose Angel Perez (Universidade do Vale do Itajaí (Univali), Itajaí, Brazil) on 'Deep-sea research in the South Atlantic: experiences from the Rio Grande Rise and SEMPIA process', Matt Gianni (Gianni Consultants) on 'Management of Atlantic deep-water fisheries' and David Johnson (Seascope Consultants, UK) on 'Ocean-scale marine governance'.

Joaquim Garrabou proposed to the coordinator to submit a proposal for an ITN devoted to marine restoration in order to reinforce building the restoration community. WP2-3-4 could be used as background for the proposal (estimated budget requested € 2-3.000.000). The PMO will check the open calls and keep the consortium informed.

During the session "Discussion on publications, events, books & special issue" held the first day of the MERCES Annual Meeting, the coordinator reported James Aronson's suggestion to organize the third MERCES annual meeting and to have a symposium dedicated to the restoration of marine ecosystems during the World Conference on Ecological Restoration of the Society for Ecological Restoration (SER) in South Africa between August-September 2019. This international event could be an excellent occasion to build a global community on marine ecosystem restoration. A symposium of the conference could be dedicated to the marine ecosystem restoration, and open to all researchers working in this field (some of them identified in the WP1-WP3-WP4 reviews). Most of the consortium agreed with this idea. Some participants raised the issue of the cost, which also limits the possibility for students to attend the MERCES meeting. The AB members agreed that this is an important occasion for MERCES to gain visibility at international level.

Roberto Danovaro discussed with the PO the possibility to organize the third MERCES annual meeting inside the SER World Conference in 2019. The PO would be in favour of such a joint event, and invited the PMO to prepare a justification to be addressed to the EC. The PMO will prepare the request as soon as possible and submit it to the EC. James Aronson informed participants that grants are always available for students attending the SER Conference. If the EC answers to our request before the next SER World Conference (at the end of August 2017), he may be able to start planning the joint event with the organizing staff.

The possibility of having two MERCES meetings, one in Edinburgh as decided during the KOM, and one in Cape Town has been definitely excluded. If the EC reject the coordinator's request, the third MERCES Annual Meeting will be held in Edinburgh.

Final recommendation to the General Assembly: **Do not forget to acknowledge MERCES** with: "This research has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 689518 (MERCES: Marine Ecosystem Restoration in Changing European Seas)".

See in the MERCES partner's area "Project downloads", "Acknowledgment" and "Publications".

End of the meeting.

3.4 Steering Committee



Marine Ecosystem Restoration in Changing European Seas **MERCES**

Grant agreement n. 689518

Steering Committee Meeting

21st June 2017 - Heraklion, Crete, Greece
Time: 18.45 – 19.00

Participants:

Project Coordinator: Roberto Danovaro

Project Management Office: Cristina Gambi & Emmanuelle Girardin

WPs co-leaders:

WP1 Nadia Papadopoulou & Anthony Grehan

WP2 Christoffer Boström & Johan van de Koppel

WP3 Simonetta Fraschetti & Joaquim Garrabou

WP4 Telmo Morato & Andrew K. Sweetman

WP5 Chris McOwen

WP6 Jan P.M. van Tatenhove & Ronan Long

WP7 Wenting Chen

WP8 David Billett & Eva Ramirez-Llodra

WP9 Martina Milanese

After the General Assembly, most of the topics reported in the agenda of the Steering Committee meeting were already discussed. The coordinator asked only to fix the period for the next steering committee in November by Skype. A general consensus has been obtained.

Agenda:

- Welcome and apologies for absence
- Contract status and update
- Update of each WP progress activities
- Milestones and deliverables due in months 13-18
- Status of the WP synthesis for the first reporting period
- New procedure for progress reports
- Date for the next Steering Committee meeting by skype
- A.O.B

Welcome and apologies for absence

Stephen Hynes (WP7)

Silvia Bianchelli (WP9)

Contract status and update

A new amendment to the Grant Agreement has been requested for the addition of 2 case studies: Bagnoli (Mediterranean sea, Naples-Italy) and Angola basin (Atlantic Ocean) and the addition of the Stazione Zoologica Anton Dohrn of Naples (Italy) as a third party providing in-kind contributions free of charge (Article 12) for UNIVPM.

The unanimously consensus of the Consortium was obtained by email. The PMO launched the amendment in the Participant Portal the 15/03/17, it was accepted by the EC and closed the 08/05/17.

Update of each WP progress activities

Milestones and deliverables due in months 13-18

The coordinator presented also the deliverables and milestones scheduled in the next 6 months:

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The deliverables are in progress and all partners are working to complete and submit them on time.

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PMO will send an update to the PO every 3 months.

Date for the next Steering Committee meeting by skype

November 2017. The date will be selected using a doodle.

A.O.B

No

Annex 1: Conference Abstracts



Marine Ecosystem Restoration in Changing European Seas

First Annual meeting

Heraklion, Crete, Greece

20-22 June 2017

Abstracts



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 689518. This output reflects only the author's view and the European Union cannot be held responsible for any use that may be made of the information contained therein.



Oral Presentations

Tuesday 20th June 2017

Key Note

Restoration frameworks for environmental management: Scope for development in the deep sea

Cindy Van Dover*

Harvey W Smith Distinguished Professor Division of Marine Science and Conservation Nicholas School of the Environment Duke University, 135 Marine Lab Rd, Beaufort, NC 28516, 252-504-7655

[* clv3@duke.edu](mailto:clv3@duke.edu)

A science of deep-sea restoration is emergent, now led in large part by MERCES Work Package 4. Extractive industries on land and in shallow water include remediation/restoration in the mitigation hierarchy, and there are conventions and codes that call for restoration of deep-water ecosystems, though the efficacy of restoration practices on an industrial scale in the deep sea continues to be questioned. Critical to a nascent field of deep-sea restoration science is definition of the environmental management goals and the feasibility of achieving those goals. Restoration concepts have been suggested for certain deep-sea ecosystems, focused on the benthos; it is not clear what restoration practices might apply to the water column, nor is it evident that restoration practices can be scaled up for industrial activities with demonstrated efficacy at a reasonable cost, or on what timeline. The MERCES community is poised to deliver science-based recommendations about where and when deep-sea restoration practices are feasible, at what scale and cost, and with what metrics for success.

WP1

MERCES WP1 European Marine Habitats Degradation and Restoration

N. Papadopoulou^{1*}, T. Bekkby², A. Grehan³, C.J.Smith¹

1 Hellenic Centre for Marine Research, Greece;

2 Norsk Institutt for vannforskning, Norway;

3 National University of Ireland Galway, Ireland .

*nadiapap@hcmr.gr

During the first year of the project, two of the three WP tasks were completed and a high level of progress made on the third task. The major work of the first two tasks was focused from a Workshop in the Netherlands in late 2017. WP participants contributed to two catalogues concerning European mapped resources for a) habitats maps and degraded habitat maps and b) marine activities and pressures. The catalogues were reviewed. At the workshop initial work was undertaken to firstly define case studies to investigate key habitat features and the consequences for restoration and secondly to look at the their responses to activities and pressures towards an assessment of restoration potential and blue growth. The third task consists an extensive literature review on restoration with original data collected and currently in review. The Work package remains on schedule. In the next six months major efforts will be on finalizing the restoration review and including an analysis of recent restoration projects and works on cost-benefit analysis to be completed by month 18. Other work will then concentrate on publication of the deliverable work.

WP1

Cataloguing habitat map resources in the European Seas: highlighting limitations and gaps for future habitat mapping and restoration initiatives (MERCES WP1)

Gerovasileiou^{1*}, V., Papadopoulou¹, K-N., Sevastou¹, K., Dailianis¹, T., Smith¹, C.J., Amaro², T., Bekkby³, T., Bilan⁴, M., Boström⁵, C., Carreiro-Silva⁴, M., Carugati², L., Cebrian⁶, E., Cerrano², C., Danovaro², R., Eronat⁷, E., Fiorentino⁸, D., Frascchetti⁹, S., Gagnon⁵, K., Gambi², C., Grehan¹⁰, A., Hereu¹¹, B., Kipson¹², S., Kizilkaya⁷, I., Kotta¹³, J., Linares¹¹, C., Milanese¹⁴, M., Morato⁴, T., Ojaveer¹³, H., Orav-Kotta¹³, H., Sarà¹⁴, A., Srimgeour¹⁵, R.

1 Hellenic Centre for Marine Research, Greece; 2 Università Politecnica delle Marche, Italy; 3 Norsk Institutt for vannforskning, Norway; 4 Instituto do Mar Centro da Universidade dos Açores, Portugal; 5 Åbo Akademi University, Finland; 6 Institut d'Ecologia Aquàtica, Universitat de Girona, Spain; 7 Mediterranean Conservation Society, Turkey; 8 Alfred Wegener Institute, Germany; 9 Consorzio Nazionale Interuniversitario per le Scienze del Mare, Italy; 10 National University of Ireland Galway, Ireland; 11 University of Barcelona, Spain, 12 Faculty of Science - University of Zagreb, Croatia; 13 University of Tartu, Estonia; 14 Studio Associato GAIA, Italy; 15 United Nations Environment Programme's World Conservation Monitoring Centre, United Kingdom

*vgerovas@hcmr.gr

Different EU Directives and other international legislation have generated a large number of national initiatives (e.g., marine atlases) and EU programmes on habitat mapping. Yet the outcomes of these initiatives are fragmented and an overall assessment of the type and availability of habitat mapping data in the European seas is still lacking. One of the main goals of MERCES WP1 is to produce a census of available maps for European marine habitats, along with their degradation status and restoration potential, providing a potential basis for future restoration activities. For this, an extensive review yielded a catalogue with mapping sources for marine habitats of conservation interest, covering different levels of the EUNIS habitat classification system, and degraded habitats. Overall, 577 entries were included (376 entries for existing and 201 entries for degraded habitats respectively) with maps from all major European seas as well as global scale maps. Most entries are for the Mediterranean Sea (44%), followed by those from the NE Atlantic Ocean (32%), the Baltic (3%) and the Black (3%) seas, while 8% of the entries concerned non-EU Regional Seas and/or global maps. Sublittoral soft and hard substrate habitats dominated (27%, and 26%, respectively), followed by deep-sea habitats (24%) and broad scale maps (21%). Analysis results revealed differences in habitat type records between seas and MSFD regions/sub-regions, reflecting biogeographical habitat heterogeneity and possibly research efforts and stakeholder focus within the last decades. Although the catalogues included a considerable number of priority and/or protected species and habitats (44%), only 9% of the entries included or originated from Marine Protected Areas (MPAs). The state of habitat degradation has been assessed in only 56 map entries as part of large-scale habitat assessments undertaken by international organizations/commissions, and mainly concern habitats in an unfavourable status in the NE Atlantic and the Mediterranean Sea. Information on habitat status was of descriptive/qualitative nature or absent in most entries while very few sources included information on the recovery/restoration potential of the

habitats, mainly based on expert opinion. Mitigation/removal of activities causing habitat degradation (e.g., restrictions to fishing activities and MPAs) was the most frequently recommended practice while active restoration was rarely suggested (in 11 entries as a sole activity, combined with mitigation in 5 entries), probably due to (a) the logistic constraints and cost for applying active restoration at large scales, (b) the lack of mapping initiatives focusing on restoration activities. Catalogue entries were mainly sourced from grey literature and web sources for existing habitats (61%) and from peer-reviewed papers for degraded habitats (67%). Most sources provided only images of maps (84%), while accessible GIS shapefiles and online map viewers accounted for small percentages (7% and 9%, respectively), limiting the possibility of data extraction and their further use (e.g., in conservation planning initiatives). Our review revealed gaps regarding the thematic, temporal and geographic coverage of map resources and their resolution, availability and data format, which should be considered in future mapping initiatives.

WP1

Key features and considerations for restoration; identifying commonalities and differences between case studies

Bekkby^{1*}, T., Papadopoulou², K-N., Fiorentino³, D., McOwen⁴, C., Amaro⁵, T., Bilan⁶, M., Boström⁷, C., Carreiro-Silva⁶, M., Carugati⁸, L., Cebrian⁹, E., Cerrano⁸, C., Christie¹, H., Dailianis², T., Danovaro⁸, R., Eronat¹⁰, E., Frascchetti¹¹, S., Gagnon⁷, K., Gambi⁸, C., Gerovasileiou², V., Kipson¹², S., Linares⁹, C., Morato⁶, T., Ojaveer¹³, H., Rinde¹, E., Sevastou², K., Smith², C.J.

1 Norsk Institutt for vannforskning, Norway; 2 Hellenic Centre for Marine Research, Greece; 3 Alfred Wegener Institute, Germany; 4 United Nations Environment Programme's World Conservation Monitoring; 5 Interdisciplinary Centre of Marine and Environmental Research, Portugal; 6 Instituto do Mar Centro da Universidade dos Açores, Portugal; 7 Åbo Akademi University, Finland; 8 Università Politecnica delle Marche, Italy; 9 University of Barcelona, Spain; 10 Mediterranean Conservation Society, Turkey; 11 Consorzio Nazionale Interuniversitario per le Scienze del Mare, Italy; 12 Faculty of Science - University of Zagreb, Croatia; 13 University of Tartu, Estonia

* trine.bekkby@niva.no

The MERCES project is reviewing key and degraded habitats to identify properties of key habitats, including their considerations for the recovery potential, to assist with the concise identification/categorisation of degraded habitats and their chances for restoration. To do this MERCES has selected 6 case study habitats: Mediterranean Sea, Baltic Sea and North-East Atlantic seagrass meadows, North-East Atlantic kelp forests (i.e. the two forest building species in Norway, *Laminaria hyperborea* and *Saccharina latissima*), Mediterranean Sea macroalgal forests (i.e. shallow and deep *Cystoseira*), Mediterranean Sea coralligenous assemblages, coral gardens of the Azores and deep-sea bottom communities (i.e. open slopes, submarine canyons, deep sea basins and seamounts) in the Mediterranean basin and central-northern Atlantic. Each habitat is described in relation to key important, but generic features that were selected following a dedicated MERCES WP1 workshop including; Dynamics, Connectivity, Spatial distribution, Vulnerability/fragility, Structural complexity and Diversity. Consequences for restoration, trade-offs and likelihood of restoration success are compared between habitats and discussed for different environmental conditions. Deep-sea coral habitats are likely to be the most challenging to restore (due to their slow growth rates, low levels of connectivity, high vulnerability and many logistic considerations), while shallow-water hard-bottom kelp forests are probably the easiest to restore owing to their fast growth rates and high levels of connectivity.

WP1

Human activities and pressures acting on marine habitats in the European Seas; compiling and analysing data in the framework of MERCES Pressure Catalogue

Dailianis^{1*} T., Gerovasileiou¹ V., Papadopoulou¹ N., Sevastou¹ K., Smith¹ C.J., Bekkby² T., Bilan³ M., Boström⁴ C., Cerrano⁵ C., Danovaro⁵ R., Fiorentino⁶ D., Gagnon⁴ K., Gambi⁵ C., Grehan⁷ A., Kipson⁸ S., Linares⁹ C., Morato³ T., Ojaveer¹⁰ H., Orav-Kotta¹⁰ H., Sarà¹¹ A., Scrimgeour¹² R.

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* thanosd@hcmr.gr

The overall scope of MERCES Deliverable 1.2 is to review current knowledge regarding the major marine pressures placed upon marine ecosystems in EU water and the mechanisms by which they impact habitats to determine potential restoration pathways. Towards this end, the MERCES Pressures Catalogue was compiled from a semi-structured literature search on mapping sources for (a) maritime activities, (b) endogenous pressures (i.e. those applying locally, resulting from a specific activity), and (c) exogenous pressures (i.e. those deriving from large-scale phenomena) that could potentially drive key-habitat changes. The completed inventory includes 264 entries covering mostly broad-scale habitats. Sources include published records (49%), web resources (19%), and grey literature (31%). Mapping resources have been screened for a total of 13 types of activities and 34 pressures acting on the marine realm. Fisheries, coastal marine infrastructure and transport are the most featured activities at the broad scale maps. Aquaculture and tourism rank high at the sublittoral habitats maps and research/conservation at the deep-sea records. Chemical pressures and biological invasions rank high at the broad scale followed by litter, abrasion and extraction of species. These last 3 pressures seem to be the most mapped pressures in deep-sea records. A visual summary of all compiled metadata will be presented and discussed, categorised according to source type, geographical distribution, and habitat representation. The key findings of this analysis will be also presented and discussed, along with examples of good practices, major deficiencies and gaps, as well as future recommendations.

WP1

Human activities and pressures acting on key MERCES habitats, impacts and consequences for restoration

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The MERCES project has reviewed current knowledge on major human activities and pressures impacting marine habitats and how this relates to potential restoration pathways. To do this MERCES has selected 6 case study habitats: Mediterranean Sea, Baltic Sea and North Atlantic seagrass meadows, North-East Atlantic kelp forests (i.e. the two forest building species in Norway, *Laminaria hyperborea* and *Saccharina latissima*), Mediterranean Sea macroalgal forests (i.e. shallow and deep *Cystoseira*) Mediterranean Sea coralligenous assemblages, coral gardens of the Azores and deep-sea bottom communities (i.e. open slopes, submarine canyons, deep sea basins and seamounts) in the Mediterranean basin and central-northern Atlantic. Each habitat is described in relation to major relevant human activities and pressures, and to impacts and consequences for mitigation and restoration options. Multiple activities and physical, chemical, biological and hydrological pressures act on most case studies habitats causing progressive state changes with effects extending from the population to the ecosystem level. The analysis of the cases shows consistent patterns in impacts and required management responses. Key considerations for restoration of damaged ecosystems include; 1) the choice of the restoration site (restore away from problems and pressure hot spots, restore in areas that recover quickly), and 2) the reduction of activities/pressures and sources of degradation including working with technological solutions, employing less harmful practices and using less destructive sampling in newly restored areas.

WP2

Regenerating cross-habitat interactions by combined mussel and seagrass bed restoration using Biodegradable structures (BESE)

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Once extensive mussel beds and seagrass meadows formed important habitats at the intertidal mudflats of the Dutch Wadden Sea, but these have almost disappeared in the last century. So far, restoration attempts have been largely unsuccessful, most likely due to establishment threshold dynamics in the intertidal. In the spring of 2017 we setup a cross-habitat experiment in which we applied biodegradable structures (BESE) to restore mussel beds and seagrass meadows at a landscape scale (24 musselbeds of 20*9m, 400m² seagrass seeds), at the island of Griend, The Netherlands. Within the MERCES project, we study whether (1) the combined mussel-seagrass restoration approach enhances the potential for seagrass restoration success, and (2) whether seagrass restoration may be enhanced by the application of BESE. We hypothesize that mussel beds will facilitate seagrass growth and survival by attenuating waves and currents. In addition, BESE elements may also facilitate seagrass seed germination, growth and survival through sediment stabilization and protection from predation, hydrodynamics and macroalgae. Furthermore, mussel beds and seagrass meadows are expected to affect geomorphology beyond the borders of their structures, perhaps as far as far as the foreshore of the nearby island. More specifically, restoration of intertidal seagrass and mussel habitat may even help enhance the stability of the island. In this presentation, we present the setup of this experiment and the first preliminary data. This experiment is a collaborative effort of three projects: MERCES, OBN-Griend project, and STW Bridging Thresholds

WP2

Long-term changes of restored seagrass meadows in the Adriatic Sea.

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Seagrass meadows play crucial roles in coastal ecosystems, creating shelter and sediment stabilization, resulting in lower water turbidity and amelioration of wave action. Seagrass beds represent the basis of key ecosystem services, including erosion control, carbon sequestration for climate change mitigation, fish stock and high biodiversity, including iconic and highly endangered species. Restoration of seagrass habitat for improving coastal environmental quality has been recognized as crucial to prevent further seagrass losses and facilitate recovery of ecosystem goods and services provided by the meadows. Quantitative analysis on the performance of seagrass restoration is lacking and the processes influencing success or failure of restoration programmes have not been systematically assessed. In 2002, a pilot experiment of seagrass transplanting has been carried out in Gabicce Mare (Western coast of the Adriatic Sea), an area of highly valuable natural resources (bordering a regional Park) and subjected to anthropogenic pressures (seasonal touristic activities and artificial structures: breakwaters). Gabicce Mare represents a case study to analyze the long-term changes of the restored seagrass meadows in the Central Mediterranean Sea. We will i) evaluate the success of seagrass restoration (in terms of adult plant density, number of leaves, leaves length, % survival of seagrass transplants) after 15 years from the first pilot experiments and ii) assess the effects of the relocation of breakwaters on the biodiversity and ecosystem functioning of seagrass meadows. In order to achieve these objectives we will combine data obtained from historical aerial photography, field observations, in situ sediment and water sampling. Here we present the preliminary results of the field surveys conducted during the last year (2016-2017). The seagrass meadows consist of *Zostera marina* Linnaeus 1753, *Nanozostera noltii* (Hornemann) Tomlinson & Posluszny and *Cymodocea nodosa* (Ucria) Ascherson 1870. Preliminary data confirm the presence of seagrass meadow in previous replanting sites and green macroalgae, mussels and actinians are dominant in the seafloor outside the breakwater structures. Further analyses of the historical aerial photos, sediment and water samples are ongoing.

WP2

A global review of plant-bivalve interactions: implications for marine ecosystem restoration

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In marine ecosystems, the success of ecosystem restoration projects has been mixed. A number of processes appear to be important for ensuring restoration success, including interactions and feedbacks between foundation species. In this review, we analysed 364 studies (from 184 papers) on **plant-bivalve interactions** in intertidal and subtidal seagrass meadows, salt marshes, and mangrove forests. We categorised these studies by type of study (experimental or correlative), bivalve species (infaunal or epifaunal), habitat, and native/non-native status. For each study, we determined whether the overall interaction was positive, negative, mixed (both positive and negative effects recorded), or neutral (no significant effects recorded), as well as the positive and negative mechanisms involved. Overall, 50% of the studies showed positive interactions between plants and bivalves, while 25% showed negative interactions and 13% were mixed, showing the importance of interactions between foundation species in coastal systems. However, the relative prevalence of different effects varied between habitats and species types. Epifaunal bivalves generally showed more positive interactions than infaunal bivalves. Similarly, interactions were mostly positive in subtidal seagrass meadows, but mostly mixed or negative in intertidal seagrass meadows. In salt marsh and mangrove habitats, correlative studies showed nearly even positive and negative interactions, but experimental work showed mostly positive interactions. Finally, 60% of studies involving native species found positive interactions, but only 15% of studies involving at least one non-native species. A number of different mechanisms were found to be involved in these interactions, and in many cases, several mechanisms were involved at the same time. The most important positive mechanisms of plants on bivalves were offering shelter from predators, providing substrate, and stabilising the sediment, while the most important negative mechanism was reducing food availability. On the other hand, the positive mechanisms of bivalves on plants included nutrient enrichment, increasing light penetration, providing protection from physical disturbances, and reducing sediment sulfides, while the most important negative mechanisms included increasing sulfide accumulation and space competition. While interactions between plants and bivalves are clearly of great importance in different habitats, very few of the studies were in a restoration context (<5%), indicating a knowledge gap. The critical role of these mechanisms and resulting feedbacks must be studied and taken into account when planning restoration efforts to maximise the chances of success.

WP3

State of knowledge on key eco-evolutionary processes and factors enhancing the resilience in coralligenous habitats: insights for efficient restoration protocols

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Coralligenous assemblages are hard bottoms of biogenic origin that are mainly produced by the accumulation of calcareous encrusting algae growing at low irradiance levels. Coralligenous harbour approximately 10% of marine Mediterranean species, most of them are long-lived algae and sessile invertebrates, which exhibit low dynamics and belong to various taxonomic groups such as sponges, corals, bryozoans and tunicates. This habitat is extended around all the Mediterranean coasts with a bathymetrical distribution ranging from 20 to 120 m depth depending on the local environmental variables, mainly light conditions. Coralligenous is affected by several pressures such as nutrient enrichment, invasive species, increase of sedimentation, mechanical impacts, mainly from fishing activities, as well as climate change. In WP3 restoration actions on coralligenous are focused on different habitat forming species including three main taxonomic groups Cnidaria/Anthozoa (*Paramuricea clavata*, *Corallium rubrum* and *Eunicella spp.*), Porifera/Demospongiae (*Aplysina spp.*, *Spongia spp.*, *Petrosia ficiformis*) and Bryozoa (*Pentapora fascialis*; *Myriapora truncata*). We conducted a literature review to summarize the information available for the selected species focusing on six main topics relevant for restoration activities: i) Reproduction – Recruitment - Population dynamics, ii) Impacts and Mortality, iii) Functional role - Biodiversity, iv) Trophic interactions, v) Population genetics and vi) Previous restoration activities. The compiled information provided key reference data to design restoration settings and to define robust indicators to monitor restoration actions as well as to evaluate expected timescales to fulfill the restoration of the habitat. Considering the life-history traits, population dynamics and genetics of the selected species the implementation of restoration action should be mainly based on transplants of small medium individuals collected from donor specimens. The spatial arrangements of transplants may include relatively small patches (0.2-1 m in diameter) separated by distances similar to the sizes of the transplant patches. The density within the transplant patches may be moderate-high in order to fit natural densities while enhancing the reproductive success and recruitment rates. Finally, bearing in mind the tradeoff between initial transplantation efforts and the speed of recovery. Transplantation efforts will require lower initial effort due to higher survival after transplanting, but the period required to fully recover habitat complexity will tend

to be far longer, i.e. decades. Survival and growth of transplants and recruitment would be the most suitable indicators of the success of the restoration actions.

WP3

State of knowledge on key eco-evolutionary processes and factors driving the resilience of macroalgal habitats

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In this study we focused on reviewing several main topics relevant for restoration actions of algal communities, including the life history of species, their population dynamics, ecology, functional role and conservation aspects, as soon as the previous restoration experiences. The knowledge of key ecoevolutionary processes and factors that drives the macroalgal communities is a key aspect to guide the development of novel and efficient restoration actions. Despite of the key role of macroalgae in coastal ecosystems, our knowledge about most species and their population dynamics is still scarce. Most studies have used a functional approach, based on morphological characteristics of species, rather than taking into account their life history and population dynamics. Nevertheless, despite the similarities between species and even between furoids and kelps, species with distinct life cycles and dynamics may have very different responses to disturbances. Understanding these differences is fundamental to design effective management and restoration tools. Moreover, the factors and perturbations that drive algal communities, such as pollution, climate change, physical perturbations and even interactions with other species may act at different spatial and temporal scales, highlighting the need to combine restoration actions with long term management tools to fully achieve fully restored habitats. A more complete knowledge of the processes and factors that determine the viability of algal communities is essential not only for restoring communities but also to assess the restoration actions.

WP3

Life history traits and modelling tools to assess the success and timescales of restoration actions

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Understanding the role of life history traits on restoration outcomes can provide sound insights the potential relationship between life-history traits and restoration success. We conducted a literature review that showed a consistent trade-off between survival and growth across different taxa with contrasting life history and functional traits, which in turn drives a trade-off between the transplantation effort and the speed of ecosystem recovery. This highlights the importance of increasing our knowledge on the life-history of marine sessile species. On the other hand, in general, habitat forming species are long-lived and slow growing species which make more difficult to assess the long-term viability of restoration actions. Within Mercés we applied demographic models to reveal the period needed for restored populations to recover their functionality. We will show some results on red coral *Corallium rubrum* and the fucoid *Cystoseira zosteroides* to point out the relevance of combining life history theories and modelling tools to assess the success of restoration actions. Applying this approach to other targeted species within Mercés could be is crucial for a better prediction of the success and timescales of restoration efforts.

WP4

Insights for restoration from deep-sea communities colonising existing structures

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This presentation introduces the work of the National Oceanography Centre in MERCES. We have used data obtained from working in collaboration with oil and gas companies to understand the role of new structures in driving deep-water community dynamics. Understanding how communities respond to introduced structures has important implications for evaluation of restoration actions in deep-waters as well as informing debate around decommissioning of infrastructure. We introduce two case studies: one assessing the short-term (< 1 yr) response of bathyal benthic communities (700 – 1800 m depth) to the introduction of a pipeline off Angola, West Africa; the other assessing the community response (over 2 yrs) to a structure placed on the seabed at 150m depth, in the Faore-Shetland Channel, UK. In both cases we focus on determining community-level metrics - faunal density, diversity and community structure – on, near and off the structure based on ROV imagery data. In the Angola case study we are able to analyse spatial changes in the community response (with depth along the 56km long pipeline). In the Faroe-Shetland Channel case study we can evaluate community dynamics over time, from imagery data obtained at three time points (before, 1 year and 2 years after installation). In this case study we also have faunal samples from the structure itself, enabling additional insight over imagery material alone by improving taxonomic resolution and allowing determination of changes in biomass. Both case studies will be introduced, the initial results presented and we will outline our plans for completing these studies.

WP4

Response of active vent communities to an induced disturbance: a case studies on hydrothermal vents from the MAR.

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Our knowledge of the natural dynamics of hydrothermal vent ecosystems is still scarce and limits our ability to predict the resilience of these ecosystems to natural (geological) or anthropogenic (mining) disturbances. Deep sea mineral resources, and particularly those linked with massive deposits of polymetallic sulphides, are increasingly coveted and in this context, it becomes urgent to increase our efforts to understand the natural dynamics of communities associated with hydrothermal vents. This innovative experimental project is based on a three year *in situ* experimentation. The objectives are to (1) evaluate the response of vent faunal assemblages and their habitats to a significant induced disturbance (clearance experiment) through time and (2) to evaluate the role of large predators on faunal recolonisation patterns. A third objective, in line with the MERLIN Abyss project (internal Ifremer project) is to (3) evaluate and compare the diversity of the fauna through the double taxonomy/metabarcoding approach. To our knowledge, this experiment is a first of its kind in deep-sea hydrothermal vents. It will be developed and conducted during the pluri-annual Momarsat cruises on the Mid-Atlantic ridge (2017-2020). Results will be used to characterize the natural recolonization patterns of the fauna after a disturbance as well as to evaluate the resilience of deep-sea vent communities. This fundamental knowledge will be used to elaborate management and impact monitoring protocols in the context of mineral resource exploitation.

WP4

Restoration of deep-sea ecosystems: the Palinuro Seamount case study

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Seas and oceans are drivers for the European Economy and have great potential for innovation and growth. Blue Growth is the long-term strategy promoted by the EU to support sustainable growth in the marine and maritime sectors along the European Seas. Among the develop sectors identified as priorities in the next future the mining activities for exploitation of mineral resources in deep-sea habitats are an emerging issue. In the last decade, the rock-drilling and dredging activities on the top of the Palinuro seamount (Tyrrhenian Sea) related to the presence of mineral deposits severely affected the benthic ecosystem functioning and biota due to the substrate removal and plume re-deposition along with habitat modification. The Palinuro seamount can represent a case study to investigate the effect of unassisted restoration on benthic ecosystem after the end of the disturbance comparing impacted vs. un-impacted sites. The results obtained in this study can provide the first insights on the potential of the unassisted ecological restoration on benthic ecosystem affected by deep-sea mining.

WP4

Ecological Restoration of Deep Mediterranean Gorgonian Populations

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Gorgonians from the Mediterranean continental shelf are among the most frequent species of the bottom nets and longlines bycatch. Since deep gorgonians are usually long-lived and slow-growing species, the impacts caused by fishing activities can have far-reaching and long-lasting effects on their populations. In order to initiate or enhance their recovery, it is thus highly desirable to actively improve the natural recovery by means of mitigation and ecological restoration actions. To test the viability of the recovery of deep Mediterranean gorgonian populations, gorgonians obtained from bycatch were transplanted on artificial structures deployed at 85 m depth on the continental shelf in Cap de Creus (Spain). High survival of transplanted gorgonians (93%) was observed after one year by means of regular monitoring performed with a remotely operated vehicle (ROV). Subsequently, in order to explore the viability of large-scale restoration actions of deep gorgonian populations, gorgonians obtained from bycatch were transplanted on small rocky cobbles and deployed at 30 m depth. Almost all the gorgonians (85%) remained in upright position after 3 months from the deployment. These results demonstrate the viability of mitigation and restoration actions aimed at the reduction of fishing impacts on deep Mediterranean gorgonian populations.

WP4

Methodologies and tools for restoration of degraded deep-sea coral gardens in the Azores

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The main objective of the Azores case study in the MERCES project is to develop methodologies and tools for restoration of degraded deep-sea coral gardens. The main pilot action consists in testing the use of cold-water coral transplantation techniques as an active restoration tool, also called assisted regeneration, to aid the recovery of coral gardens potentially impacted by human activities (e.g. seafloor mining, deep-sea fishing). In this talk, we will present an overview of the progress made towards this goal. Fragments of the octocoral *Dentomuricea meteor*, a common species in coral gardens in the Azores, were collected, maintained in the lab, and transplanted to the summit of Condor seamount using fauna landers. This first trial started in July 2016 during a field cruise onboard the RV Pelagia to the Condor Seamount, funded by the FP7 MIDAS project (Managing Impacts of Deep-sea Resource exploitation). Landers were deployed in three areas of differing cold-water coral densities (low, medium, high) with the objective of determining the effect of proximity to natural populations on the transplanted cold-water coral survival, growth, physiological condition, and ability to attract associated fauna, thus restoring natural ecosystem functioning. Additional to the assisted regeneration methodologies, the potential of natural regeneration (or passive restoration) of cold-water communities impacted by deep-sea mining, fishing and both is being assessed by deploying landers with *Dentomuricea meteor* intoxicated with cooper (the main trace metal present in SMS sediment plumes), injured with superficial scratches (to mimic fisheries impact), and with both impacts. The survival rates and physiological condition of coral fragments were assessed with ROV video and photography 1 week and 8 months after coral deployment, while the remaining sets of landers will be collected in 1-3 years. Results of these studies are currently being processed and will be briefly presented. Finally, we will also present the progress made towards the transplantation of a larger and more representative number of cold-water coral species. This work resulted from a close collaboration with local fisherman and fisheries observers who are bringing different species of cold-water corals accidentally caught as bycatch during their hook-and-line fisheries operations. These specimens are maintained at the Deep-Sea Lab aquaria facilities at IMAR-UAz to measure the survival of different species in captivity and to evaluate what species could potentially be transplanted back to the deep-sea. The deployment of artificial substrates to enhance coral larvae settlement and recruitment for the restoration of impacted areas is an additional tool being considered. The proposed restoration actions will be discussed in terms of their challenges, benefits and weaknesses for the recovery of deep-sea coral gardens, and in terms of defining achievable metrics to measure restoration success.

WP4

Fishermen meet scientists: essential collaboration for deep-sea coral restoration

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The joint efforts of H2020 projects MERCES, ATLAS, SponGES, DiscardLess and the Azores fisheries observer program (POPA) have led to a successful collaboration between artisanal fishermen and scientists working in the Azores. The purpose of this collaboration is to collect data and biological samples that will help informing future management plans of deep-sea living marine resources in the Azores. Among the most important deep sea habitats in Azores are cold water coral (CWC) gardens formed mainly by octocorals and black corals, occurring predominantly between 300 and 900m depth. The structural complexity of coral gardens provides essential habitat for many different organisms, including commercially important fish species. Thus, coral gardens are often found in traditional fishing grounds and specimens are accidentally caught as bycatch during fisheries operations. Due to their life history traits, such as slow growth, high longevity and low fecundity, coral gardens are highly susceptible to impacts from human activities, and have therefore been classified as Vulnerable Marine Ecosystems (VMEs). The joint fisheries observer program has provided MERCES cold water coral samples to develop tools for active restoration of impacted deep-sea ecosystems in the Azores. Corals collected by the fisheries observer program, have been maintained at the Deep-Sea Lab aquaria facilities at IMAR-UAz and will be transplanted back to the deep-sea using landers. In this talk we will report our research activities to test the feasibility of CWC transplantation as a tool for active restoration of impacted CWC populations. We will present an overview of the CWC species that have been successfully maintained, their survival rates, and discuss which species will likely be suitable for transplantation. We will also shortly refer to the new lander systems being developed for coral re-deployment.

Wednesday 21st June 2017

Open Science Session

MERCES

Marine Ecosystem Restoration in Changing European Seas

H2020 project GA 689518: 01/06/2016 – 31/05/2020

Coordinator: Roberto Danovaro (Università Politecnica delle Marche, Italy)

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The project MERCES is focused on the restoration of different degraded marine habitats, with the aim of: 1) assessing the potential of different technologies and approaches; 2) quantifying the returns in terms of ecosystems services and their socio-economic impacts; 3) defining the legal-policy and governance frameworks needed to optimize the effectiveness of the different restoration approaches. Specific aims include: a) improving existing, and developing new, restoration actions of degraded marine habitats; b) increasing the adaptation of EU degraded marine habitats to global change; c) enhancing marine ecosystem resilience and services; d) conducting cost-benefit analyses for marine restoration measures; e) creating new industrial targets and opportunities. To achieve these objectives MERCES created a multi-disciplinary consortium with skills in marine ecology, restoration, law, policy and governance, socio-economics, knowledge transfer, dissemination and communication. MERCES will start from the inventory of EU degraded marine habitats (WP1), conduct pilot restoration experiments (WP2- Shallow, soft-bottom habitats; WP3- Shallow, hard-bottom habitats and WP4- Deep-sea habitats), assess the effects of restoration on ecosystem services (WP5). The legal, policy and governance outputs will make effective the potential of marine restoration (WP6) and one dedicated WP will assess the socioeconomic returns of marine ecosystems' restoration (WP7). The transfer of knowledge and the links with the industrial stakeholders will be the focus of WP8. The results of MERCES will be disseminated to the widest audience (WP9). The project will be managed through a dedicated management office (WP10). MERCES will contribute to the Blue Growth by: i) improving the EU scientific knowledge on marine restoration, ii) contributing to EU Marine Directives; iii) implementing the Restoration Agenda, iv) enhancing the industrial capacity in this field, v) increasing the competitiveness of EU in the world market of restoration, and vi) offering new employment opportunities.

Web-site: www.merces-project.eu

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Links between global trends in (terrestrial) ecological restoration and the MERCES project

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To date, science-based ecological restoration (ER) and related activities on marine habitats and ecosystems is less developed than comparable activities in terrestrial environments. Therefore, a review of global trends and hot topics in terra firma ER may raise useful questions and underline critical gaps to be addressed to improve the effectiveness and the scaling up of ER in European waters. What's more, many of the core concepts, principles, and international conventions related to ER, developed as they were with primary focus on terrestrial ecosystems, probably require serious modification before they can effectively be deployed in the oceans and seas. In contrast, key concepts such as biodiversity, ecosystem services, 'recovery debt', and natural capital can and should be useful with little or no modification whatsoever.

Some key questions for discussion are these:

- 1) How to simultaneously address the imperatives of maintaining biodiversity / ecosystem functioning (alias renewable natural capital), and sustainable provision of ecosystem goods and services, in the context of marine world ER?
- 2) How to scale up and integrate ecological restoration related, ameliorative activities in oceans and seas, in today's rapidly changing world?
- 3) Should we accept the inevitability of "novel ecosystems" as a "new ecological world order" or instead step up our efforts at conservation and ecological restoration?
- 4) Can we calculate the 'recovery debt' for the various marine habitats and ecosystems to be addressed by MERCES?
- 5) Vis a vis the term "Forest and Landscape Restoration", widely used by the IUCN, FAO, and WRI for large-scale terra firma ER, what might be the equivalent in the marine world? Does "restoring natural capital" suffice, provided an explicit spatial component is provided?
- 6) How may we combine ecological engineering, adaptive management, and ecological restoration activities at larger spatial scales?
- 7) Should we be thinking of "restoration, creation, and recreation of marine habitats", instead of just ER alone? And
- 8) How can society transition from "business as usual" and "boom and bust" habits to a "family of restorative activities" paradigm?

I will talk about these eight questions to open a discussion on key issues to consider from a marine restoration perspective in the specific context of EU legislation and priorities.

Meta-analysis of marine ecosystem restoration worldwide

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The conservation of nature and the management of human activities are considered effective approaches to limit the degradation of marine ecosystems and the services they provide. Current practices are clearly inadequate to reverse present trajectories of change. Marine restoration is still at its infancy, due to many gaps among current implementation methods and a substantial inconsistency in the evaluation of restoration strategies. The MERCES scientific community made a review of studies on restoration published in the last 25 years at global scale, including from very shallow to deep sea habitats, to assess how, where, at which spatial and temporal scales restoration was carried out and with what outcomes. A total of 573 studies were analysed (out of an initial collection of 3829 titles). Despite the increasing recognition that active restoration can have a critical role in the recovery of disturbed systems, results highlight the heterogeneity of targets, implementation methods, approaches and standards across habitats. With the exception of wetlands, most restoration projects cover too small areas (< 1 ha) to match the scale of human disturbance. In addition, short project duration (one – two years), frequent lack of consideration of control areas and knowledge of baselines, largely impair the potential for showing robust success stories. Finally, response variables (e.g. survival rates, mortality, growth, cover, propagule production, biomass partitioning) are rather heterogeneous and too often vaguely reported. Despite some success stories are described, most studies report high costs, also in terms of labour, and idiosyncratic outcomes. Our results further show the importance of the project MERCES to set the stage (e.g. protocol availability, monitoring of the effects, reasons for failure) in marine restoration for the development of best practices to apply at spatial and temporal scales so as to answer to present disturbance regimes.

ATLAS

A trans-Atlantic assessment and deep-water ecosystem-based spatial management plan for Europe

Project Coordinator: J.Murray Roberts (murray.roberts@ed.ac.uk)

Project Manager: Katherine Simpson (Katherine.simpson@ed.ac.uk)

Speaker: Georgios Kazanidis

ATLAS is an EU Horizon2020 funded project which was launched in May 2016. ATLAS brings together a unique group of scientists, policy-makers, NGOs, SMEs, and the industries engaged in the exploitation of deep ocean resources. ATLAS's 25 partners from across Europe, Canada, and the USA are collecting new information on ocean circulation, sensitive Atlantic ecosystems (e.g., VMEs and EBSAs) and deep-sea fish populations to produce a step-change in our understanding of their functioning, diversity, connectivity, and ecosystem services now, and under future climate change and human activity scenarios. Using the North Atlantic's substantial coverage of oceanographic arrays as the foundations of its science, ATLAS will scale-up our capacity to monitor and predict the functioning, biodiversity and genetic connectivity of fish stocks and ecosystems such as cold-water coral reefs, coral gardens, sponge grounds, hydrothermal vents and cold seeps. By scaling up this science, ATLAS can then scenario-test science-led, cost-effective adaptive management strategies that stimulate Blue Growth and protect sensitive ecosystems and populations at spatial scales relevant to management and industry. An intensive schedule of 25 research cruises is planned, with 12 trans-Atlantic case studies offering opportunities for more in-depth analyses and roll-out of new spatial management plans.

The four overarching objectives of ATLAS are to:

- Advance our understanding of deep Atlantic marine ecosystems and populations
- Improve our capacity to monitor, model and predict shifts in deep-water ecosystems and populations
- Transform new data, tools and understanding into effective ocean governance
- Scenario-test and develop science-led, cost-effective adaptive management strategies that stimulate Blue Growth

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<https://zenodo.org/communities/atlas>

SponGES

Deep-sea Sponge Grounds Ecosystems of the North Atlantic: an integrated approach towards their preservation and sustainable exploitation

H2020 project GA 679849: 01/03/2016 – 29/02/2020

Project Coordinator: Hans Tore Rapp (Hans.Rapp@uib.no)

Scientific Project Manager: Joana R. Xavier (Joana.Xavier@uib.no)

Speaker: Martina Milanese

The objective of SponGES is to develop an integrated ecosystem-based approach to preserve and sustainably use vulnerable sponge ecosystems of the North Atlantic. The SponGES consortium, an international and interdisciplinary collaboration of research institutions, environmental non-governmental and intergovernmental organizations, will focus on one of the most diverse, ecologically and biologically important and vulnerable marine ecosystems of the deep-sea - sponge grounds – that to date have received very little research and conservation attention. Our approach will address the scope and challenges of EC's Blue Growth Call by strengthening the knowledge base, improving innovation, predicting changes, and providing decision support tools for management and sustainable use of marine resources. SponGES will fill knowledge gaps on vulnerable sponge ecosystems and provide guidelines for their preservation and sustainable exploitation. North Atlantic deep-sea sponge grounds will be mapped and characterized, and a geographical information system on sponge grounds will be developed to determine drivers of past and present distribution. Diversity, biogeographic and connectivity patterns will be investigated through a genomic approach. Function of sponge ecosystems and the goods and services they provide, e.g. in habitat provision, benthic-pelagic coupling and biogeochemical cycling will be identified and quantified. This project will further unlock the potential of sponge grounds for innovative blue biotechnology namely towards drug discovery and tissue engineering. It will improve predictive capacities by quantifying threats related to fishing, climate change, and local disturbances. SponGES outputs will form the basis for modeling and predicting future ecosystem dynamics under environmental changes. SponGES will develop an adaptive ecosystem-based management plan that enables conservation and good governance of these marine resources on regional and international levels.

Web-site: www.deepseasponges.org

Facebook: @DeepSeaSponges

Twitter: @DeepSea_Sponges

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Poster abstracts

WP1

Linking habitat degradation to human activities and pressures; map inventories and outputs from the EU MERCES project

Papadopoulou^{1*} N., Dailianis¹ T., Gerovasileiou¹ V., Sevastou¹ K., Smith¹ C.J., Amaro² T., Bekkby³ T., Bilan⁴ M., Boström⁵ C., Cebrian⁶ E., Cerrano² C., Danovaro² R., Fiorentino⁷ D., Frascchetti⁸ S., Gagnon⁵ K., Gambi² C., Grehan⁹ A., Hereu¹⁰ B., Kipson¹¹ S., Kotta¹² J., Linares¹⁰ C., Milanese¹³ M., Morato⁴ T., Ojaveer¹² H., Orav-Kotta¹² H., Sarà¹³ A., Scrimgeour¹⁴ R., Tunka-Eronat¹⁵ E.G.

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Despite increased conservation efforts and new policy instruments aiming to safeguard biodiversity, to halt further loss and to protect and restore the marine environment, many European habitats maintain unfavorable conservation status while habitat degradation is still ongoing in a number of areas. Several initiatives and policy drivers call for extensive mapping of the marine environment, particularly for key, priority and vulnerable habitats along with information on their status and existing threats and pressures (e.g. as required by the Habitats Directive and the MSFD). The Marine Spatial Planning directive also requires the mapping of human activities acting on marine habitats, to support sustainable development of the oceans and blue growth opportunities operating under the ecosystem approach to marine management. One of the goals of the H2020 MERCES project (<http://www.merces-project.eu/>) is to produce an inventory of maps of degraded marine habitats and a catalogue of maps of activities and pressures acting on marine habitats in the European Seas with the overall aim to link habitat degradation with mitigation and restoration potential. To achieve this, an extensive review was undertaken and catalogues were compiled with mapping sources for: (a) key habitats in decline or assessed as degraded, (b) maritime activities (e.g. fishing, transport, carbon sequestration, and research/conservation), (c) pressures (including locally acting chemical, physical, hydrological and biological pressures such as abrasion and alien invasions, as well as larger scale pressures related to climate change). The catalogues currently include over 750 entries covering all European Seas and various key shallow soft and hard substrate habitats, as well as deep-sea habitats. The findings show differences in mapping efforts by region and habitat type. Sources include published scientific literature, web resources, mapping portals, and grey literature such as project deliverable reports. Despite progress made in the recent years, mapping efforts still lack the required coverage, resolution and detail while mapping outputs have limited usability for planning, restoration and conservation purposes.

WP1

Human activities and pressures acting on marine habitats in the European Seas; a meta-analysis of map resources for the marine restoration project MERCES

Dailianis Thanos^{1*}, Vasilis Gerovasileiou¹, Nadia Papadopoulou¹, Katerina Sevastou¹, Christopher J. Smith¹, Trine Bekkby², Meri Bilan³, Christoffer Boström⁴, Carlo Cerrano⁵, Roberto Danovaro⁵, Dario Fiorentino⁶, Karine Gagnon⁴, Cristina Gambi⁵, Anthony Grehan⁷, Silvija Kipson⁸, Cristina Linares⁹, Telmo Morato³, Henn Ojaveer¹⁰, Helen Orav-Kotta¹⁰, Antonio Sarà¹¹, Rachael Scrimgeour¹²

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Pressures on marine ecosystems are often derived from human activities, either near the coast or through mobilities and inter-connections to the open ocean. Facilities permanently located on land or fixed platforms are straightforward to map, while mobile activities pose a greater challenge for researchers and managers. One of the goals of the ongoing Horizon 2020 MERCES project (<http://www.merces-project.eu/>) is to produce a thorough census of available maps for activities and pressures with impacts on marine habitats in the European Seas. To this end, we performed an extensive review and compiled a catalogue with mapping sources for (a) maritime activities, (b) endogenous pressures (i.e. those applying locally, resulting from a specific activity), and (c) exogenous pressures (i.e. those deriving from large-scale phenomena) that could potentially drive key-habitat changes. Currently the inventory includes approximately 300 entries covering several key coastal and deep sea habitats. Sources include published records, web resources, and grey literature. A substantial amount of the records regard maritime mobilities, such as fisheries and transport (included in 52% and 39% of the entries, respectively), as compared to coastal and marine infrastructure which is included in 42% of the entries. A similar trend is apparent in the records mapping pressures to ecosystems, where those linked to mobile maritime activities, such as abrasion of the seafloor, rank high on the list (23%). Whilst marine litter (mixed maritime and urban sources) is well mapped, an array of other pressures linked to mobile activities (e.g. underwater noise) are present but may be underestimated, due to their less frequent assessment. Mapping the location and intensity of maritime mobile activities has been facilitated in the past years, mainly through broad employment of satellite monitoring systems; these data, especially when overlaid on available habitat maps, can produce meaningful information aiding habitat assessments, conservation and restoration efforts.

WP1

A meta-analysis of map resources for the distribution, degradation status and threats to sponge and anthozoan assemblages in the European Seas

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One of the main goals of MERCES project (<http://www.merces-project.eu/>) is to produce a census of available maps for marine habitats, along with their degradation status and restoration potential in the European Seas. To achieve this goal, we performed an extensive review and compiled a catalogue with mapping sources for (a) marine key-habitats, (b) degraded marine habitats, and (c) pressures and mechanisms that could potentially drive key-habitat changes. In its current form, the MERCES WP1 catalogue includes 841 entries with meta-data regarding various marine habitats, assemblages and marine areas. These entries include published records, web resources, and grey literature (i.e. project reports, technical documents, and unpublished data). A considerable portion of the catalogue's entries (148 entries: 18%) concern sponges and anthozoans, of which 54 report degraded habitats/assemblages, impacted by different activities and pressures. Available mapping sources for these assemblages mainly concern the deep-sea (44%) and sublittoral hard substrate habitats (43%) of the Mediterranean Sea (53%) and the North-East Atlantic (34%). However, most of the examined sources (52% of the entries) did not include any type of information about the recovery/restoration potential of these assemblages but there is a general concern that impacted coral colonies are unlikely to recover (28% of the entries) due to their slow growth rate, coupled with the increasing degree of human-induced impacts. Mitigation or removal of activities/impacts was the most frequently suggested restoration action (28% of the entries). The most frequently highlighted activities reported to affect these assemblages were: extraction of living resources (i.e. bottom trawling and longlining), scientific research and coastal and marine structure and Infrastructure. The most frequently highlighted pressures reported to affect these assemblages were: abrasion, changes in siltation and light regime, thermal regime change and smothering. Interestingly, half of the entries (51%) were derived from grey literature and web sources, showing that they both can be a valuable source

of information and underlining the importance of cataloguing information sources on data repositories.

WP2

Spatial patterns in seagrass meadows as indicator restoration success and resilience

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Spatial patterns can be found in many different ecosystems, ranging from arid ecosystems to peatlands and from mussel beds to seagrass meadows. Theory suggests that these spatial patterns can be used as indicators for ecosystem resilience. We apply this theory to, and develop new theory for seagrass meadows to understand and predict restoration success and to determine their resilience.

WP3

Developing restoration techniques to restore Mediterranean bryozoans populations

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The effects of human impacts on marine ecosystems highlight the importance to develop restoration and conservation measures to ensure the viability of their populations. Bryozoans are among the commonest sessile invertebrates in hard-rock bottom ecosystems and are considered habitat forming species, and because of their fragility are very vulnerable to perturbations. Most of the studies on bryozoan populations have been focused on the effects of physical impacts, such as diving. Nevertheless, restoration actions have been rarely explored. The main goal of this study was to examine different restoration techniques for two common Mediterranean bryozoan, *Pentapora fascialis* and *Myriapora truncata*, in Medes Islands MPA. Restoration techniques were focused on two processes: recruitment and adult colonies transplantation. On one hand, we installed different types of recruitment substrates for both species in their suitable habitat. The results showed different preferences between species, being more effective three dimensional structures for *P. fascialis*, and plain-surface settlement plates for *M. truncata*. On the other hand, we carried out adult transplants for both species in their habitat. The results revealed that the survival of transplanted *M. truncata* colonies were higher than *P. fascialis* ones, which showed to be highly sensitive to manipulation. The obtained results reveal the importance of understanding the biology and life history traits of target species to effectively restore and conserve bryozoan populations. This study represents the first attempt to develop restoration measures for Mediterranean bryozoan species.

WP3

Assessing the feasibility of different restoration techniques for infralittoral *Cystoseira* forests

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Different restoration techniques for infralittoral *Cystoseira* forests were tested in Medes Islands MPA. The study species were *Cystoseira* sp., inhabiting from 5 to 20 m depth and *Cystoseira zosteroides*, inhabiting below 15 m depth. Both species are the most abundant *Cystoseira* species in this protected area and display different life history traits. First, in situ and ex situ culture techniques were developed for both species. By providing artificial and natural substrates, we tested in situ the capacity of natural populations to harbor new recruits, their dispersion capability and their survival. Moreover, settled individuals were monitored to study their growth and phenology, and finally were used as reproductive individuals to restore new habitats. In the laboratory, similar techniques were applied at controlled temperature conditions to determine the tolerance range of those parameters. Second, we tested different techniques in situ to evaluate their feasibility to restore *Cystoseira* populations. In order to provide a reliable comparison, all the techniques were used at the same time and same area. For *Cystoseira zosteroides*, adult, juvenile stands (obtained from the first experiments) and fertile apexes were transplanted from natural and well-preserved populations to new potentially adequate locations at the same depth range (20-25m depth). We estimated the viability of restored populations and the success of the different techniques tested (adults, juveniles, and fertile apexes transplants) quantifying the mortality, growth and recruitment rates as well as their physiological condition. Besides, the same techniques were tested for *Cystoseira* sp. between 5 to 10m depth in the same area, adding the sea-urchin eradication effect. Taking advantage of these experimental setups, we also tested the natural capacity of the restored localities to harbor new recruits from both species, providing cleaned, artificial and natural substrates. The results will help us to design pilot restoration actions to preserve *Cystoseira* forests and to minimize the impact of restoration actions on the few well-preserved populations.

WP3

Restoration techniques for coralligenous gorgonian forests

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Gorgonians are habitat-forming octocorals dwelling in marine hard-bottom communities worldwide. In the Mediterranean, these slow-growing, long-lived species are increasingly threatened by disturbances such as destructive fishing practices, anchoring, uncontrolled and over-frequent diving, mucilagenous algal aggregates, algal invasions, and mass mortalities caused by anomalous seawater temperature increases. As a result, gorgonian forests are in decline and associated hard-bottoms are faced with the loss of structural complexity and biodiversity. Hence, the development of efficient restoration techniques is urgently needed. Based on previous experiences, transplantation of gorgonian fragments is considered as an appropriate method, due to its low impact on the donor colonies, generally high survival rates of transplants and ability to bypass sensitive early life stages. Studies to date confirm the feasibility of the method on the local spatial scale. Here we present details of the gorgonian transplantation, indicating required material and methods as well as the recommended size and density of transplants. The proposed approach ensures fast and efficient fixation method, easily applicable by divers.

WP3

Drastic effects of Temperature and UV radiation in Mediterranean Marine Forests

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Macroalgal forests of the order of Fucales and Laminariales, have gone missing from most temperate rocky shore during last decades, where they have been replaced by simpler and less productive habitats and thus triggering an important biodiversity lost. Species of genus *Cystoseira* (O. Fucales) are some of the most important marine habitat-forming species on photophilic Mediterranean rocky bottoms. As other species of this genus typical of shallow habitats with low hydrodynamism *Cystoseira crinita*. is extinct or almost extinct of the Mediterranean Catalan-Provençal coasts, until now, related with habitat destruction and overgrazing. This work, shows for the first time, a regression of a relict population of *C. crinita* due to thermal anomaly events. Additionally, the impact of high temperature and UV radiation (UVA+UVB), to which were exposed these natural populations, is experimentally proved on adult and settler individuals. Because of the important ecological role of these populations and of their low natural recovery capacity, determine the response of different *Cystoseira* species face to future scenarios of climate change (temperature and UV radiation increase), is essential to design appropriate management and restoration plans to their optimal conservation, as well as determine the most vulnerable areas to climate change impacts.

WP3

Active or passive management in overgrazed seaweed populations?: a tale on the relationship between *Cystoseira balearica* and *Paracentrotus lividus*.

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Marine herbivores control seaweed populations from temperate to tropical rocky bottoms. Sea urchins are major herbivores in several subtropical environments and it is well-known their devastating effects on erect algal dominated shallow Mediterranean rocky bottoms when their biomass increases above certain thresholds. The habitat forming species *Cystoseira balearica* is an endangered species still common on several well-preserved Western Mediterranean areas. However, sea urchin outbreaks are a major cause of concern for the survival of several of the remaining populations. This is the case for some areas in the Scandola MPA (Corsica, France) where we observed in 1999 the decline of *Cystoseira balearica* forests due to a sudden increase in sea urchin (*Paracentrotus lividus*) densities. Being Scandola a no-take, highly protected area where no large-scale manipulations were allowed, we started a small-scale, experimental study of sea urchin exclusion. Three different habitats were considered: barren, mixed barren-forest, and forest. The experiment consisted in excluding sea urchins in four 20 m² plots of the three different habitats, with four control plots for each habitat. The experiment started in 1999 and ended in 2014. The 24 plots were monitored in October each year for sea urchin abundance, sea urchin biomass and *Cystoseira* coverage. Sea urchin eradication in eradicated plots was also performed again and again each year (October) until 2010, but plots were left untouched from 2011 to 2014. Even performed once a year, eradication was effective as sea urchin biomass was kept in low numbers. Coverage of *Cystoseira* recovered in 5 years in sea-urchin excluded barren plots and remained undistinct to the other plots from 2004 to the end of the experiment. However, sea urchin abundance and biomass also declined in untouched barren and mixed barren-forest plots, with a subsequent increase in *Cystoseira* cover, which attained forest levels 10 years after the start of the experiment. Thus, (1) *Cystoseira balearica* coverage can be recovered in 5 years after sea urchin exclusion when high densities of sea urchins are responsible for the decay of its populations and (2) the shift from barren areas to *Cystoseira balearica* forests can naturally occur in well-preserved, good water quality environments, suggesting that sea urchin barrens and *Cystoseira balearica* forests can coexist and turn from one to another and back in a dynamic way with time lapses of 10 to more years. These results have to be taken into account both for the recovery of *Cystoseira balearica* populations whose decline is due to sea urchin outbreaks, and for the management of *Cystoseira balearica* forests in well-preserved areas.

WP3

Enhancing the effectiveness of restoration actions in a changing ocean: insights from a transregional thermotolerance experiment.

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In the last decades, large-scale mass mortality events (MMEs) due to positive thermal anomalies linked to climate change dramatically impacted many habitat-forming species from the coralligenous communities, some of the richest communities of the Mediterranean Sea. These events, which extended for thousands of kilometers along the North Western Mediterranean coasts, had a differential impact on individuals, populations and species. For instance, populations of the red gorgonian, *Paramuricea clavata*, separated by few kilometers showed highly contrasted numbers of damaged colonies. This suggests that individuals within and among populations may respond differentially to the thermal stress driving the MMEs. Understanding the processes underlying these differential responses is thus a crucial step to design efficient restoration actions for coralligenous habitats impacted by MMEs. Previous works conducted on *Paramuricea clavata* demonstrated that 25°C was a thermal threshold above which necrosis started to be observed. Population genetics approaches gave a first insight in the differential responses to thermal stress questioning the role of local thermal regime. These findings call for a thorough characterization of the potential for adaptation in this species in order to enhance restoration actions. Within MERCES project, we will combine transregional common garden thermotolerance experiments in aquaria and population genomics analyses to disentangle the processes driving the population responses to thermal stress in the temperate habitat forming coral *Paramuricea clavata*. With this experiment, we will address two main objectives: i) to characterize the patterns of differential responses in *Paramuricea clavata*; ii) to explore the molecular basis of the differential responses. This experiment is one of the largest common garden experiments planned to date in the marine realm. Indeed, we will focus on 10 to 12 populations from different parts of the Mediterranean Sea including the Catalan Sea, the Ligurian Sea and the Adriatic Sea. Using novel high throughput sequencing analyses, we will formally characterize the relative role of neutral (migration, genetic drift) and selected (local adaptation) processes on the differential response to thermal stress. Overall, this integrated approach between experimental ecology and the population genomics should allow us to identify resistant populations and colonies that may be used as sources for restoration actions.

WP3

Restoration actions to enhance the recovery of *Cystoseira* spp. on Mediterranean rocky shores

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Macroalgal forests such as kelps and fucoids are dominant habitat-forming species in the rocky intertidal and subtidal along the Mediterranean coasts. Recognized as hot spot of biodiversity, macroalgae provide food and habitat to diversified assemblages of understory species, reducing physical stress due to aerial exposure and enhancing coastal primary productivity. Despite their recognized ecological role, there are increasing evidences of the decline or disappearance of *Cystoseira* forests due to multiple stressors. Loss of *Cystoseira*, either by natural or anthropogenic disturbances, generally results in severe habitat transformations, with the loss of tri-dimensional structures and increasing turfs and/or barren grounds. For these reasons, concrete actions should be urgently implemented in order to face these trajectories of change. Studies regarding the development of specific ecological knowledge to support protocols and best practices for the restoration of *Cystoseira* are still largely lacking. To cope with this gap, an experiment will be carried out on the rocky shores of Apulia (SE, Italy), to explore the feasibility of transplanting on this species, the effectiveness of the selected response variables, the costs and the potential for large scale restoration implementation. The experiments will focus on the species *Cystoseira amentacea*. Transplanting of this species will be conducted in three locations in the Adriatic and Ionian Seas, with two sites for location, separated by 10s of meters. In each site, quadrats of 50 x 50 cm will be used to test the effectiveness of transplanting on adult and juveniles cultured in aquaria for about 3 weeks before transplanting. To test the potential for improving the survival of juveniles, quadrats in which adults and juveniles will be transplanted together will be included. Cages will be used to avoid the pressure of grazing from herbivores. The potential for artifacts associated with the use of cages and with the use of the transplanting technique will be also adopted. Consistency of the results, assessments of the survival of adults and juveniles and the occurrence of future recruitment events will be relevant outcomes of the experiment.

WP3

Facilitation processes in the effectiveness of restoration actions using monospecific vs. multi-specific transplants assemblages

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Studies on competition, predation and abiotic factors in driving ecological and evolutionary processes are well explored in marine ecosystems. Nevertheless the exploration of the role of facilitation (i.e. positive species interactions) received much less attention. Here we explore how multispecific settings actions could enhance the effectiveness of restoration actions. The complexity and heterogeneity of coralligenous assemblages can be schematized by four layers of colonization structured by i) cryptic/boring, ii) encrusting, iii) massive, and iv) arborescent organisms. The internal layer may affect the interface water/substrate also playing a role in its accretion or erosion, the encrusting and massive specimens help to trap and stabilize sediments, erect organisms reduce light penetration and water movement. The integrity of these layers is subject to anthropic activities in different ways, which can alter their structural complexity leading to the fragmentation of benthic populations. To test if arborescent species can affect the survival and growth of co-occurring encrusting and massive ones, an experiment has been designed using the red gorgonian *Paramuricea clavata* and the bryozoan *Pentapora fascialis* as model species. The experiment, to be replicated in Spain, Italy and Croatia, is based on the comparison between series of 0,25 m² experimental plots. Four controls (no gorgonians no and bryozoans) and bryozoans with and without gorgonian colonies for a total of 4 replicas per treatment will be considered. The hypothesis is that the arborescent layer (15 *P. clavata* fragments up to 20 cm in maximal height per experimental plot) could facilitate the settlement, growth and survival of bryozoan colonies settled on a plastic grid set in the experimental plots. Biological and ecological processes in coralligenous habitats are generally slow, and it can take long before structured populations and communities can be restored. The appropriate identification of species able to facilitate such processes is an important step to enhance the effectiveness of restoration approaches.

WP3

Transplantation techniques for the restoration of sponge populations

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Fragmentation is one of the strategies for asexual reproduction displayed by marine modular organisms. This strategy has been extensively leveraged upon to develop propagation techniques for sponges (Porifera), mostly in the frame of aquaculture approaches. Sponge aquaculture has been pursued for commercial purposes, e.g. to rear bath sponges or to produce new biomass for the extraction of natural compounds of interest to the pharmaceutical industry. While techniques developed in the frame of sponge aquaculture have had different degrees of success, such approaches have usually not been focused on the restoration of natural populations. So far, the goal has essentially been to maximise the production of biomass minimising rearing efforts. To such an end, in general, sponge fragments are maintained in the column water or just above the seafloor - in cages, nets or necklaces. When re-thinking sponge-propagation techniques in the perspective of restoration, aims and approaches change substantially. One key difference is that transplants need to be fixed to the substrate, in order to play their structural (e.g. increase of habitat complexity) and functional (filtering activity – linked to benthic-pelagic coupling) roles within the community and to ultimately release new larvae able to rebuild a local population. Sponges have a high phenotypic plasticity clearly evident regarding their morphology, growth pattern, skeletal structure, etc. These aspects strongly influence the design of transplantation techniques. Sponges with a highly structured skeleton resulting in a “hard” body (e.g. *Petrosia ficiformis*) can be easily cut to generate transplants with quite rough surfaces. These are directly glued to the substrate using two-component epoxy putty. However, other species with a structured skeleton have a more “rubber-like” texture, such as *Spongia officinalis* and *S. lamella*. These require more manipulation to be cut into transplants and such transplants are less amenable to be directly glued to the substrate given their smooth surfaces. In this case, plastic dowels are inserted in the transplants, providing better hold when glued to the substratum with the putty. Sponges with a less structured skeleton but displaying high plasticity (such as *Chondrilla nucula*) can be transplanted without using putty. For these species, transplants can be kept in place using rubber nets until adherence to the substratum has been naturally achieved, which may occur in as little as one week. All these techniques are being used and refined in different WP3 restoration actions in order to determine the optimal restoration procedure for each target species.

WP3

Assessing the effectiveness of transplantation actions for the restoration of key Mediterranean gorgonians in the Catalan Sea

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In the current context of rapid environmental change, ecological restoration can aid to recover the structural complexity and functionality of coastal marine ecosystems. Long-lived and modular marine species such as corals and gorgonians generally display high survival rates and limited reproductive success. Therefore, transplantation of branches obtained from adult colonies fragmentation has been proposed as an effective strategy for the restoration of damaged or locally extinct populations. Here, we used multiple field experiments to assess the effectiveness of transplantation actions for three key Mediterranean gorgonians: the red coral *Corallium rubrum*, the red gorgonian *Paramuricea clavata* and the white gorgonian *Eunicella singularis*. Taking advantage of a poaching red coral event intercepted by local authorities, around 300 red coral colonies were transplanted in Medes Islands protected area in 2011. Over a 4-years period, transplanted red coral colonies displayed high survival rates, re-growth of new branches and high reproductive output. Compared to the demographic rates observed on an adjacent natural population, transplanted red coral colonies displayed similar demographic traits to natural colonies. On the other hand, similar transplantation actions were tested for the red gorgonian *P. clavata* using branches of different size at two sites within the Medes Islands. Finally, thanks to a collaboration with local artisanal fishermen, 20 adult colonies of *E. singularis* obtained from bycatch were transplanted in 2016 on a shallow rocky bottom within the protected area of Cap de Creus. Transplanted and adjacent natural *E. singularis* colonies were individually tagged to assess the success of these experimental restoration actions and quantify demographic traits.

Overall, the transplantation of long-lived gorgonians often show success in terms of high survival of transplanted branches. However, important factors such as working depth and the prevalence of thermal anomalies linked to current warming trend must also be considered when designing future restoration actions.

WP4

Recovery of the red coral *Corallium rubrum* following simulated plume deposition due to mining activities

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Due to the progressive depletion of mineral resources in terrestrial ecosystems, the exploitation of mineral deposits, such as manganese nodules, cobalt-rich manganese crusts, and polymetallic sulfide deposits on the deep ocean floor, are receiving great attention to cope the increased mineral demands. Thus, it is expected that in the near future the anthropogenic exploitation of mineral resources in the deep oceans will represent a major threat for benthic deep-sea habitats. Indeed, deep-sea mining, causing substrate removal and plume deposition can determine significant impacts on benthic biodiversity and ecosystem functioning. In this study we investigated the recovery of the red coral *Corallium rubrum* following simulated plume deposition due to mining activities. Nubbins of the red coral (5-7 cm each) were exposed for 2 weeks to hydrothermal polymetallic particles (25 mg/L and 100 mg/L) obtained by grinding a hydrothermal chimney collected around the hydrothermal vent field of Basiluzzo island. During the experiment, polyp activity, feeding rates and tissue integrity were analysed and compared to responses of un-exposed nubbins. Our findings revealed that hydrothermal polymetallic particles determine a decrease of polyp activity and feeding rates and a damage of coral tissues. However, the corals, once reported in clean conditions (i.e. seawater without polymetallic particles), were highly resilient. Overall results from this study provide new information to define mitigation measures for the ecologically sustainable exploitation of deep-sea mineral resources able to minimise as much as possible the effects of plume deposition on benthic biota and to increase their recovery capacity.

WP5

Historical changes of the Mediterranean Sea ecosystem: modelling the role and impact of primary productivity and fisheries changes over time

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The Mediterranean Sea has been defined “under siege” because of intense pressures from multiple human activities; yet there is still insufficient information on the cumulative impact of these stressors on the ecosystem and its resources. We evaluate how the historical (1950–2011) trends of various ecosystems groups/species have been impacted by changes in primary productivity (PP) combined with fishing pressure. We investigate the whole Mediterranean Sea using a food web modelling approach. Results indicate that both changes in PP and fishing pressure played an important role in driving species dynamics. Yet, PP was the strongest driver upon the Mediterranean Sea ecosystem. This highlights the importance of bottom-up processes in controlling the biological characteristics of the region. We observe a reduction in abundance of important fish species (~34%, including commercial and non-commercial) and top predators (~41%), and increases of the organisms at the bottom of the food web (~23%). Ecological indicators, such as community biomass, trophic levels, catch and diversity indicators, reflect such changes and show overall ecosystem degradation over time. Since climate change and fishing pressure are expected to intensify in the Mediterranean Sea, this study constitutes a baseline reference for stepping forward in assessing the future management of the basin.

WP9

Marine habitats - value, threats and restoration potential: awareness-raising activities for general public

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Environmental education and awareness-raising are key activities to foster a positive change in society related to the well-being of the oceans. In line with MERCES goals to distribute knowledge to a series of target groups outside the project's consortium, we have developed several activities for general public with the aim to raise awareness on the importance of marine habitats, emphasizing their function and provision of ecosystem services, as well as on disturbances leading to their degradation and finally on the potential for their restoration. Here we present a short overview of several easy-to-make, low-cost interactive games, adjustable for all age groups, which were developed in collaboration with the biology students and presented during an "Open doors" event at the Faculty of Science in Zagreb. These ideas could inspire other partners to design their awareness-raising activities within the WP9, aimed to general public.

WP9

Disseminating knowledge on seagrass restoration: the case study of Gabicce Mare (Central Adriatic Sea)

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In order to increase awareness of the importance of conservation and restoration of degraded marine habitats and to disseminate scientific results of the MERCES research activities, we planned a series of dissemination events dealing with threats, protection and restoration of marine environments. These activities will be conducted concurrently with the manipulative experiments led by UNIVPM on seagrass ecosystems in the Western-Central Adriatic Sea. The site, located at Gabicce Mare, is characterized by the presence of a long sandy beach, bathhouses and family tourism. Tailored communication and dissemination strategy have been developed to reach different layers of the targeted audience and will include: i) the distribution of informative material to the general public dealing with MERCES project, its aims, specific actions and geographical context; ii) the distribution of a fable to children in order to increase their knowledge of the marine life and to make them aware of the need to protect the sea and iii) practical activities dedicated to families, as guided snorkelling and walks along the shoreline. In addition, questionnaires on the perception of the marine habitats alteration and restoration will be distributed to citizens and tourists. For all activities, books, printed and digital material, as well as MERCES social media, will be used, in order to spread the dissemination activities as wide as possible.

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WP1: European marine habitats, degradation and restoration

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WP2: Restoration of marine, shallow soft bottoms habitats

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WP3: Restoration of coastal shallow hard bottoms and mesophotic habitats

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WP4: Restoration of deep-sea habitats

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WP5: Effects of restoration on the recovery of ecosystem services

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WP6: Legal governance and policy

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WP7: Socio-economic impacts of restoration

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WP8: Putting Business at the Heart of the Restoration Agenda

David Billett (Deep Seas Environmental Solutions Ltd) & **Eva Ramirez-Llodra** (Norsk Institutt for Vannforskning)

WP9: Dissemination, communication and public engagement

Silvia Bianchelli (Ecoreach Srl) & **Martina Milanese** (Studio Associato GAIA)

WP10: Project management

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Information about Heraklion

Special thanks to HCMR as local host: Nadia, Chris, Katerina, Vasilis & Thanos

Dear all

We have put together for you all an info pack! Where to go, eat, drink, see and more (shopping hours, museums, places to go and how to book a secure taxi pick up from the airport).

We have also arranged free entrance to our cretaquarium to those interested.

Looking forward to seeing you all in Crete

Your local hosts Nadia, Chris, Katerina, Vasilis, Thanos

Venue, climate, shopping, antiquities, eating out

1) Venue & Accommodation

Capsis Astoria Heraklion Hotel, Heraklion Crete (<http://www.capsishotels.gr/en/heraklion-en>)

The hotel is situated on the main square (Eleftheria Square) in Heraklion town centre, downtown centre (Google Earth 35 20.305 25 08.186).

2) Travel

- Athens is directly accessible from all major European cities and is the portal to Crete. During the meeting period, direct flights may be available from many European cities (seasonal and charter).
- Heraklion in Crete has regular daily 50 minute flights from Athens by either Olympic or Aegean Airlines.
- Heraklion is also serviced daily by ferries (MINOAN LINES or SUPERFAST) from Piraeus harbour (10 km from Athens centre), which are afternoon or overnight and take 6–8 hours.
- The Astoria Hotel is approximately 4 km west of the airport. The taxi drivers know the hotel, and the cost from the airport to the hotel is approximately 10 Euro.

3) A few relevant web pages

<http://www.heraklion.gr/en>

Information about Heraklion city & municipality

<http://odysseus.culture.gr/h/3/eh30.jsp>

Information about Great Greek Archaeological Sites including Knossos and Phaistos Palaces in Crete)

<http://www.theacropolismuseum.gr/?pname=Home&la=2>

For those passing through Athens and having time to visit the New Acropolis Museum

4) Climate

June is the comfy beginning of a true summer, and brings about the island's signature summer sun. June-July are virtually rain free and the midday hotness is mitigated by cool winds that drop temperatures in the evenings. Average daytime temperatures at a warm 24 degrees Celsius, with high peaks up to 28 degrees (or more in hot summers) and lows never really going below 20 degrees. Seawater temperatures are equally inviting, with averages reaching 22 degrees. June-July are sunniest months of the year in Crete, with sunshine hours reaching a whopping 11–13 each day on average. Umbrellas are for providing shade only!

<http://www.holiday-weather.com/crete/averages/june/>

Local weather:

http://www.hnms.gr/hnms/english/forecast/forecast_city_html?&dr_city=Heraklion

5) Eating Out

Traditional Greek cuisine is a country-style simple cuisine. It ranges from prepared foods (mousaka, pastichio, stifado, oven cooked goat, lamb, chicken, pork, chicken) to grilled-to-order meats, or mezes – multiple small dishes similar to Spanish tapas, vegetables, salad, meats or seafood). Influences are ancient Greek, Turkish, Middle Eastern and Turkish, but also general Mediterranean. Whilst vegetarianism is not a traditional concept, it is extremely easy to find a variety of non-meat dishes – just ask, whilst repeatedly using the word “Chortofagos”.

Heraklion has a wide range of tavernas and meze-bars, but there is also one well-hidden Indian and a couple of Chinese restaurants. There are many places to eat and have a coffee/snack or a cool drink around the ASTORIA hotel! We put together **a map/list with suggestions for places to try out around the hotel, see 2nd file!**

6) Shopping

Whilst some shops are open 09:00-20:30, most local shops shut at 14:30 and are open in the evenings on Tuesday/Thursday/Friday from 17:30-20:30. Banks are open Mon-Fri 08:30-14:30 (Friday 13:30 closing). Main shopping streets Daedalou and Dikaiosinis are very close to the hotel.

7) Antiquities & Museums

The Palace of Knossos (Labyrinth, Minotaur, Daedalus, Icarus, Ariadne, Theseus, King Minos, Pasiphae) is 5 km south of the city centre, reachable by city bus or taxi and the Archaeological Museum <http://www.heraklion.gr/en/ourplace/archeological-museum/archeological-museum.html> is next to the Astoria hotel. Both should be open 08:00-20:00. The historical museum is open 09:00-17:00 <http://www.historical-museum.gr/eng/> (Sunday and public holidays is closed). Knossos is particularly uncrowded and beautiful in the late afternoon. There are many other sites of ancient cultural interest around the island of Crete (Phaistos, Gortys, Ag. Triada, Malia, Matala).

Other museums: Natural History Museum of Crete (<http://www.nhmc.uoc.gr/en>)

8) Cretaquarium

Cretaquarium (<http://www.cretaquarium.gr/en>) is located just next to HCMR – Thalassocosmos, in Gournes (14 km from the city of Heraklion). It is easily accessible and the national road connects it with the most important destinations of the area. It is connected to a rich route network from the city of Heraklion (every 30' during summer) (www.ktelherlas.gr for buses). It remains open 365 days a year, even during festive periods and holidays, from 9.30 till 21:00.

MERCEs workshop have free admission to Cretaquarium providing that you will inform the local organizing committee about the day and time of your visit.

9) Local Meeting Information

If you need any further local information please contact Chris Smith or Nadia Papadopoulou at Hellenic Centre for Marine Research (<http://www.hcmr.gr>), csmith@hcmr.gr, nadiapap@hcmr.gr

10) Taxi

There are plenty of taxis at Heraklion airport and several places around the town. Nevertheless, if you would like to plan your drive in advance we recommend the agency HeraklionCrete.Taxi (booking@heraklioncrete.taxi). They are English speaking, super-efficient and polite, you can book by email, they reply by email, and they will be waiting for you at arrivals with your name on a card. You can ask for Mr Michalis Ximeris (**use our names!!!**) He is the one we use all the time for all our travels. Around 15 euros one way, payment by cash at destination, he will give you a receipt. Of course, you can decide to do your own thing, up to you.

Suggestions for Coffee/Drinks and Eating out

Please see map (at the end of the document)

Eating IN

ASTORIA roof top bar (with swimming pool and sea views) and SIN 1966 Bistro and Drink Easy bar on the ground floor.

Eating OUT: walking distance from ASTORIA hotel

You have a couple of free nights in Heraklion and a chance to sample another restaurant or two. It's always been a great place for food and choice and value have improved greatly in the past few years. Prices are a very rough guide based on a 3 course meal + ½ bottle of modest wine. Now that it's warm and they nearly all have tables outside, reservations are not necessary.

Cretan/Greek/Mediterranean cuisine

PESKESI restaurant (E20-25) https://www.tripadvisor.com/Restaurant_Review-g189417-d6513925-Reviews-Peskesi-Heraklion_Crete.html

Authentic Cretan cuisine, a traditional "Cretan House" in the centre of Heraklion, in the restored historical mansion of captain Polyxigkis, an aesthetically outstanding place with a modern way of operation that fully reflects the high standards of the place. Kapetan Charalampi 6-8

PLANI (E15-20) https://www.tripadvisor.co.uk/Restaurant_Review-g189417-d5982408-Reviews-Plani-Heraklion_Crete.html

Opposite LATO hotel, welcoming environment, back yard, very good meze and prices. Ariadnis 5

ΠΑΡΑΣΤΙΕΣ "PARASTIES" (E20-25) https://www.tripadvisor.co.uk/Restaurant_Review-g189417-d817489-Reviews-Parasies-Heraklion_Crete.html

At the bottom of Handakos street. Very good for char-grilled meats. Just order a steak and a salad. Huge, well-priced, mostly Greek wine list. Handakos 81

ANTIPODAS (E15-20) https://www.tripadvisor.com/Restaurant_Review-g189417-d7079543-Reviews-Antipodas-Heraklion_Crete.html

Greek cuisine, good and pleasant place with little meze, on the little square (Korai) behind Daedalou str. Korai 13

KOUZINERIE (E25) https://www.tripadvisor.co.uk/Restaurant_Review-g189417-d2223553-Reviews-Kouzinerie-Heraklion_Crete.html

Renowned for his "Kotsi" (pork shank, slow-cooked for 5 hours). With a couple of salads, one "kotsi" is enough for 4 people. Plenty of other interesting dishes. Meats (T-bone) always good. In the little square behind Agios Dimitrios Church. Head down 25th August St. towards the sea and turn left at the Starbucks, then immediately right and then go past the church to the right. Marineli 11

PRASSEIN ALOGA (E20-25) https://www.tripadvisor.com/Restaurant_Review-g189417-d837447-Reviews-Prassein_Aloga-Heraklion_Crete.html

From the Lion's Square, take the pedestrian Handakos street heading west behind the fountain. Head down about 150m and there's a little turning to the right. It's immediately on your right. Fine Mediterranean cuisine, in a cosy, open-air place. Handakos 21

PERI OREXEOS (E15-E25) https://www.tripadvisor.com/Restaurant_Review-g189417-d1098968-Reviews-Peri_Orexeos-Heraklion_Crete.html

Simple and not so simple food, traditional and new, main dishes and mezes/tapas, welcoming environment, very close to hotel. Korai 10

ERGANOS (E15) https://www.tripadvisor.com/Restaurant_Review-g189417-d836533-Reviews-Erganos-Heraklion_Crete.html

Authentic Cretan cuisine in a traditional atmosphere; a great list of the most intriguing Cretan specialties are offered a bit further away from the city centre, next to the city walls. Georgiou Georgiadi 5

Sea food

IPPOKAMPOS (E10-15) https://www.tripadvisor.com/Restaurant_Review-g189417-d1098956-Reviews-Ippokambos-Heraklion_Crete.html

The best place for seafood. The first of the tavernas on the coast road, just after the old port. It does not take reservations, so get there by 19.30 – after 20.00, it's sure to be full! Sofokli Venizelou 3

LADOKOLLA (E20-25) https://www.tripadvisor.com/Restaurant_Review-g189417-d2098714-Reviews-Ladokolla-Heraklion_Crete.html

Greek cuisine, seafood and pasta dishes, Marinelli 13

VRAKAS Ouzeri (E10-15) https://www.tripadvisor.com/Restaurant_Review-g189417-d1098962-Reviews-O_Vrakas-Heraklion_Crete.html

Sea food place with lots of meze, little place on the road, at the end of 25 Augustou str, by the sea. Marineli 1

Taverns/Kafenia

SIGA-SIGA (E10-15) https://www.tripadvisor.co.uk/Restaurant_Review-g189417-d4225463-Reviews-Siga_Siga-Heraklion_Crete.html

Simple, welcoming place frequented by young people. It offers standard Greek and Cretan dishes using the freshest of locally-sourced ingredients. Just off the north-west corner of Theotokopoulos park. Minotavrou 1

Kafenion (E10)

Traditional local tavern for Cretan raki and meze, in one of the most beautiful squares of the city centre, alive throughout the year. Idomeneos 28

Bistro & Wine restaurants

CROP Roastery Brewery (15-20) https://www.tripadvisor.com/Restaurant_Review-g189417-d9736412-Reviews-Crop_Roastery_Brewery-Heraklion_Crete.html

Perhaps the best coffee in the city, with an all-day multi-cuisine and real local vibes, located at a beautiful square downtown, a couple of minutes from the venue hotel. Aretousas 4

626 All Day Lounge & City Garden (E20) https://www.tripadvisor.com/Restaurant_Review-g189417-d11773322-Reviews-626_All_Day_Lounge_City_Garden-Heraklion_Crete.html

At a cozy and chic setting, enjoy breakfast, brunch, lunch or dinner. Miramvelou & Aretousas

OPUS Wine Bar (E20) https://www.tripadvisor.com/Restaurant_Review-g189417-d4134653-Reviews-Opus_Wine_Bar-Heraklion_Crete.html

Charming wine bar with a short but delicious list of Mediterranean dishes, in a restored building with a beautiful yard, just next to Peskesi restaurant. Kapetan Charalampi 3

International fancy

BRILLANT (E40) [https://www.tripadvisor.com/ShowUserReviews-g189417-d228908-r56895137-Lato Boutique Hotel-Heraklion Crete.html](https://www.tripadvisor.com/ShowUserReviews-g189417-d228908-r56895137-Lato_Boutique_Hotel-Heraklion_Crete.html)

If you fancy ...fancy then Brilliant at Lato hotel offers plenty of excellent dishes from which to choose, all using the freshest of local ingredients. Epimenidou 15

SNACKS & DRINKS

TO ROVYTHI – The Chickpea (E5-10) [https://www.tripadvisor.com/Restaurant_Review-g189417-d12106068-Reviews-The chickpea-Heraklion Crete.html](https://www.tripadvisor.com/Restaurant_Review-g189417-d12106068-Reviews-The_chickpea-Heraklion_Crete.html)

Falafel, kefte, soups and a small variety of vegetarian snacks. Meramvelou 9

GEORGIADI PARK CAFÉ (E10-15) <https://cretazine.com/en/heraklion/city-guide/where-to-have-fun/item/1739-cafe-georgiadi>

Café and snack bar inside the Georgiadis Park, one of the most favourite hangouts for the local alternative community. Georgiadi park

Crumb [https://www.tripadvisor.com/Restaurant_Review-g189417-d8466316-Reviews-Crumb-Heraklion Crete.html](https://www.tripadvisor.com/Restaurant_Review-g189417-d8466316-Reviews-Crumb-Heraklion_Crete.html)

Good coffee and handmade snacks and sweets, tables on the square. Kallergon Square 11 (Lions Square)

Samaria Delizioso [https://www.tripadvisor.com/Restaurant_Review-g189417-d8017506-Reviews-Samaria Delizioso-Heraklion Crete.html](https://www.tripadvisor.com/Restaurant_Review-g189417-d8017506-Reviews-Samaria_Delizioso-Heraklion_Crete.html)

A delicatessen coffee place with a variety of handmade pastries, sweets and ice-cream. Kantanoleon 17

Biscotto Cafe [https://www.tripadvisor.com/Restaurant_Review-g189417-d8875386-Reviews-Biscotto Cafe-Heraklion Crete.html](https://www.tripadvisor.com/Restaurant_Review-g189417-d8875386-Reviews-Biscotto_Cafe-Heraklion_Crete.html)

All day cafe, with a wide variety of coffee drinks, tea and deserts. A genuine non-smoking place at a quiet spot of Handakos pedestrian street. Handakos 36

FIX (café-bar) <https://www.facebook.com/FIX-CAFE-801885153207761/>

If you just want a nightcap or maybe a drink and a club sandwich, then FIX (a friend calls this his 2nd home) offers a welcoming atmosphere with low-volume music. It's on the northwest corner of the little park located at Aretousa street – a 5 minute walk from the venue hotel. Aretousas 2

Halavro Open Bar (E15-20)

[https://www.tripadvisor.co.uk/Restaurant_Review-g189417-d12373660-Reviews-Xalavro OpenBar-Heraklion Crete.html](https://www.tripadvisor.co.uk/Restaurant_Review-g189417-d12373660-Reviews-Xalavro_OpenBar-Heraklion_Crete.html)

A charming yard in an old historic building in the centre of Heraklion, very popular for drinks/coffees/snacks. Milatou 10

TRITO BAR <https://www.facebook.com/tritobar/>

An alternative place offering multi-cultural music sounds, innovative cocktail drinks and changing art exhibitions that decorate the walls. Merambellou 3

The Whistler [https://www.tripadvisor.co.uk/Restaurant_Review-g1746299-d7187939-Reviews-The Whistler Espresso Bar Food-Heraklion Prefecture Crete.html](https://www.tripadvisor.co.uk/Restaurant_Review-g1746299-d7187939-Reviews-The_Whistler_Espresso_Bar_Food-Heraklion_Prefecture_Crete.html)

Espresso- wine bar and snacks, by the St Titos square. Ag. Titou 12

PAGOPOIEION https://www.tripadvisor.com/Restaurant_Review-g189417-d1098967-Reviews-Pagopoieion-Heraklion_Crete.html

By the big Church St Titos square, all-day coffee, snacks, drinks. Papagiamali 1



Walking distances from Capsis ASTORIA hotel to:

- Lions Square: 5 minutes
- St Titos square: 10 minutes
- O Vrakas (end of 25th August str by the sea) 15 minutes

Main shopping streets Daedalou, Dikaosinis, Kalokairinou & 25th August (the pedestrian road from the Lions square to the sea)

<https://www.google.com/maps/placelists/list/1s3sVFUp3j7fbi0Ax9vgW8gvm9k>