D10.5: Minutes of the third Annual Meeting (internal WP meetings SC, GA, AB)

Marine Ecosystem Restoration in Changing European Seas MERCES

Grant agreement n. 689518

COORDINATOR: UNIVPM

LEAD BENEFICIARY: 1. UNIVPM

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DISSEMINATION LEVEL

CO	CO Confidential, only for members of the consortium (including the Commission Services)	X

Content

1. Summary

The MERCES third annual meeting took place in Paris, at the Sorbonne University from the 21st to the 24th May 2019. Overall 50 participants including members of the Consortium and members of the project Advisory Board attended to the meeting. Thirty oral contributions and 6 posters were presented during the sessions dedicated to the project's WPs:

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;
WP4: Restoration of deep-sea habitats.
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.

The meeting has been an excellent occasion to present the progress of the project's activities of the last year, to open fruitful discussions and develop new collaborations among the partners of the Consortium, within WPs and between WPs in order to finalise the deliverables expected by the end of the project .

On behalf of the MERCES coordinator Roberto Danovaro, Cristina Gambi, as scientific project manager, presented an overview of the progress of the project in the last three years. This overview was the useful occasion to present the MERCES project to the new EU Project Advisor Victoria Beaz Hidalgo, nominated at the beginning of May 2019. After the project introduction, Dr Hidalgo provided some comments and feed-backs on the activities carried out until this third annual meeting and presented some suggestions for the last year of the MERCES project.
After these two contributions, the meeting started with the presentation of all WPs with the contributions of the WPs co-leaders for an overview of the WP and of the presentations of the results achieved by the partners involved in each WP.
The second day of the meeting opened with the meeting of the Advisory board, followed by the Steering Committee and the General Assembly. The annual meeting was concluded by a half-day WP5 workshop that saw a large participation of members from all WPs.

2. Conference programme

Tuesday 21st May 2019

13:00 - 13:45	**Participants registration**
13:45 - 14:00	**Roberto Danovaro** Welcome and General Introduction to the 3rd MERCES annual meeting
14:00 - 14:30	**Dr Victoria Beaz Hidalgo,** EU Project Adviser
14.30 - 16.00	**WP1: *European marine habitats, degradation and restoration***
	Chairs: Nadia Papadopoulou (HCMR), Anthony Grehan (NUIG)
14:30 - 14:45	**Papadopoulou & Grehan**: WP1 overview
14:45 - 15:00	**Papadopoulou et al.** Linking activities and pressures to restoration and mitigation options
15:00 - 16:00	**General discussion**
16:00 - 16:30	**Coffee break**
16:30 - 18:00	**WP2: *Restoration of marine, shallow soft bottoms habitats***
	Chairs: Christoffer Boström (ÅAU) - Johan van de Koppel (NIOZ)
16:30 - 16:45	**Boström & van de Koppel**: WP2 overview
16:45 - 17:00	**Gagnon et al.** Co-restoring eelgrass and mussels to increase restoration success – challenges and implementation
17:00 - 17:15	**Gambi et al.** Seagrass restoration in the Adriatic Sea: the Gabicce case study
17:15 - 17:30	**Siteur et al.** Patchiness as indicator for seagrass meadow restoration success and resilience
17:30 - 18:00	**General discussion**
18:00 - 19:30	**WP3: *Restoration of coastal shallow hard bottoms and mesophotic habitats***
	Chairs: Joaquim Garrabou (CSIC), Simonetta Fraschetti (CoNISMa)
18:00 - 18:15	**Garrabou & Fraschetti**: WP3 overview
18:15 - 18:30	**Guarnieri et al.** Large-scale sea urchin culling to support the recovery of disturbed infralittoral rocky habitats in the Mediterranean Sea
18:30 - 18:45	**Ledoux et al.** Enhancing the effectiveness of restoration actions in coralligenous habitats: insights from a transregional thermotolerance experiment
18:45 - 19:00	**Kipson et al.** Can facilitation processes enhance the effectiveness of restoration actions in the coralligenous habitat? Insights from a 15 month field experiment
19:00 - 19:15	**Cerrano et al** Experimental techniques for the restoration of coralligenous assemblages. A focus on habitat forming species
19:15 - 19:30	**General discussion**
20:30	**Social dinner:** La Barge du Crous de Paris, Paris

Wednesday 22nd May 2019

9:00 - 9:30	**Advisory Board meeting**
9:30 - 10:00	**Steering Committee meeting**
10:00 - 11:00	**General Assembly**
11:00 - 11:30	**Coffee break**
11:30 - 13:00	**WP4: *Restoration of deep-sea habitats***
	Chairs: Telmo Morato (IMAR-Uaz), Andrew K. Sweetman (HWU)
11:30 - 11:45	**Morato & Sweetman**: WP4 overview
11:45 - 11:55	**Harbour et al** Trophic structure surrounding wood and kelp falls in deep Norwegian fjords
11:55 - 12:05	**Marticorena et al.** Towards a restoration approach in the deep sea: ecological and molecular approaches of a disturbance experiment in the Lucky Strike hydrothermal vent field
12:05 - 12:15	**Gambi et al.** Resilience of the Palinuro Seamount ecosystem after mechanical disturbance
12:25 - 12:35	**Bilan et al.** Natural regeneration of seamount fauna and colonization of artificial substrates in the Azores
12:15 - 12:25	**Montseny et al.** Restoration of cold-water gardens on the Mediterranean continental shelf: The Cap de Creus case study
12:35 - 12:45	**Carreiro-Silva et al.** Feasibility of cold-water corals transplantation techniques for the restoration of degraded deep-sea coral gardens in the Azores
12:45 - 13:00	**General discussion**
13:00 - 14.30	**Lunch break**
14:30 - 16:00	**WP5: *Effects of restoration on the recovery of ecosystem services***
	Chairs: Hazel Thornton (WCMC) - Trine Bekkby (NIVA)
14:30 - 14:45	**Thornton & Bekkby**: WP5 overview
14:45 - 15:00	**Thornton et al** MERCES WP5 – how are we translating data from 130+ restoration sites to inform policy-makers and practitioners?
15:00 - 15:15	**Coll & Horn** Determination of ecological effects of restoration using dynamic food web modelling
15:15 - 15:30	**Bekkby & Andersen** Presenting the model framework for assessing the recovery potential for different habitats and ecosystem service restoration success and the plan for a webinar on new restoration methods and best practices (MERCES WP5)
15:30 - 16:00	**General discussion**
16:00 - 17:00	**WP6: *Legal governance and policy***
	Chairs & introduction: Jan P.M. van Tatenhove (WU) - Ronan Long (MLOPRS)
16:00 -16:30	**van Tatenhove & Long**: WP6 overview
16:30 - 17:00	**General discussion**
17:00 - 17:30	**Coffee break**
17:30 - 18:30	**WP9: *Dissemination, communication and public engagement***
	Chairs: Martina Milanese (GAIA) - Silvia Bianchelli (ECOREACH)
17:30 - 18:00	**Bianchelli & Milanese**: WP9 overview
18:00 -18:30	**General discussion**

Thursday 23rd May 2019

9:00 - 10:00	**WP7: *Socio-economic impacts of restoration***
	Chairs: Wenting Chen (NIVA) - Stephen Hynes (NUIG)
9:00 - 9:30	**Chen & Hynes:** WP7 overview
9:30 - 10:00	**General discussion**
10:00 - 11:00	**WP8: *Putting Business at the Heart of the Restoration Agenda***
	Chairs: David Billett (DSES) - Eva Ramirez-Llodra (NIVA)
10:00 - 10:30	**Billett et al** MERCES WP8 - Putting Industry at the Heart of the Marine Ecosystem Agenda
10:30 - 11:00	**General discussion**
11:00 - 11:30	**Coffee break**
11:30 - 12:30	**WP2** workshop: Christoffer Boström (ÅAU) - Johan van de Koppel (NIOZ)
12:30 - 13:30	**WP3** workshop: Joaquim Garrabou (CSIC), Simonetta Fraschetti (CoNISMa)
13:30 - 14.30	**Lunch break**
14:30 - 15:30	**WP4** workshop: Telmo Morato (IMAR-Uaz), Andrew K. Sweetman (HWU)
15:30 - 16:00	**WP6** workshop: Jan P.M. van Tatenhove (WU) - Ronan Long (MLOPRS)
16:00 - 16:30	**WP7** workshop: Wenting Chen (NIVA) - Stephen Hynes (NUIG)
16:30 - 17:00	**Coffee break**
17:00 - 18:30	**Meeting conclusions**

Friday 24th May 2019

9:00 - 11:00	**WP5 workshop:** Hazel Thornton (WCMC) - Trine Bekkby (NIVA): inputs from all WPs
11:00 - 11:30	**Coffee break**
11:30 - 13:00	**WP5 workshop:** Hazel Thornton (WCMC) - Trine Bekkby (NIVA): inputs from all WPs

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

3.Minutes

3.1 Annual Meeting

21st May 2019

Dr Cristina Gambi, the MERCES scientific project manager, welcomed all participants to the third Annual meeting. She reported the excellent progress of the project activities in the third year in terms of MERCES products for each WP such as field works, deliverables and milestones achieved, publications, workshops, outputs, and international events.

A brief summary of the overview:

1. WP1 delivered 3 deliverables and 2 catalogues on current marine pressures and mechanisms, European marine habitats and degraded habitat maps. Two papers related to these products have been published in Marine Policy.
2. WP2 carried out field activities along the Mediterranean basin and Nordic Seas testing different marine restoration methods. The results will be included in the three deliverables of this WP expected by M42.
3. WP3 conducted pilot studies in hard bottom and mesophotic habitats in different Mediterranean sites. Three deliverables have been already submitted whereas one deliverable is expected by the end of M36.
4. WP4 is focussed on pilot studies in deep-sea habitats including abyssal plain, fjord, canyon, seamount, coral gardens and hydrothermal vents. One deliverable has been submitted, the last two deliverables are in preparation and expected by M42.
5. WP5 aimed to assess the effects of restoration on the recovery of the ecosystem services. Data inputs are based on the different field work activities. Three deliverables are expected between M40 and M45, including a policy brief.
6. WP6 has already submitted three deliverables and one contribution has been published in Marine Policy. The last deliverable, a policy brief, is expected by the end of the project (M48).
7. WP7 realised a questionnaire on Social acceptance of marine restoration for stakeholders. The collected results have been included in one deliverable whereas three contributions are expected between M40 and M47. Recently MERCES has been cited in the Future Science Brief by the European Marine board in the section dedicated to Financing Marine Ecosystem Service Delivery.
8. WP8 submitted one deliverable and organised two MERCES business Club webinars, both available in the website. Three deliverables are expected by the end of the project.
9. WP9 dissemination, communication and public engagement included activities dedicated to experts and no- experts and general public with Ocean literacy, Training, Networking, Citizen Science.

Overall, 24 deliverables have been submitted, 27 milestones achieved and 5 newsletters published (3 scientific- and 2 business-focused) in the first three years of the project. The newsletter 6 is expected by the end of May 2019. Two webinars focussed on Business have been carried out and the access is available in the MERCES website. MERCES consortium is also very active in the presentation of the project in the framework of several national and international meetings and conferences (>90 in the last 24 months).

Some members of the Consortium released interviews to TV, radio and newspapers. Recently MERCES has been cited in Horizon, the EU Research and Innovation Magazine. More than 35 contributions have already been published in high impact factor journals and more are expected by the end of the project. The collection of all publications in the MERCES repository in Zenodo is also recommended to all members of the consortium.

MERCES, together with ATLAS and SponGES, was presented at the World Conference on Marine Biodiversity 2018 (Montreal, Canada 13-16 May 2018). MERCES has been also presented during the SER Europe Conference 2018 in Reykjavik, the Deep-sea Biology Symposium in San Diego (September 2018) and the Marine Key Habitats & NIS Symposia in Ankara (January 2019). MERCES will be also presented in the framework of a dedicated symposium during the next SER World conference in South Africa scheduled in September 2019. Six presentations have been accepted:

1. MERCES: Marine Ecosystem Restoration İn Changing European Seas (H2020 Funded Project), Roberto Danovaro et al
2. Marine restoration and MERCES Key Habitats/Species: approaches, timescales, bottlenecks and up-scaling, Chris Smith et al.
3. Success stories in restoration actions across coastal-marine ecosystems: the potential for synergies, Simonetta Fraschetti et al.
4. Principles and key concepts for ecological restoration in the deep-sea, Telmo Morato et al
5. Effects of marine restoration on ecosystem services, Hazel Thornton et al
6. Stakeholder perceptions on marine restoration: beliefs, preferences and supporting actions, Nadia Papadopoulou et al.

Other partners will be present with poster contributions and oral presentations in the framework of other symposia.

After the overview of the progress of the project, the agenda of the meeting has been presented to all the General Assembly.

Following is the presentation of the WPs.

WP1: general overview introduced by Nadia Papadopoulou.
WP1 Overall Objectives: Review the current knowledge base, gather information and set the framework for the project work packages.
Specific tasks included:

- State of knowledge of European habitat mapping and degraded habitats;
- State of knowledge of habitat pressures and restoration potential;
- Critical review of habitat restoration technologies, tools and best practice and literature review of the economics of marine and coastal ecosystem service restoration

All tasks have been successfully completed by M18 according to the MERCES Grant Agreement.
Two papers have been accepted in Marine Policy:

- Gerovasileiou et al. Habitat mapping in the European Seas - is it fit for purpose in the marine restoration agenda?
- Dailianis et al. Human activities and resultant pressures on key European marine habitats: an analysis of mapped resources. This work has been cited by ICES working groups related to MSFD seafloor integrity issues.

Other papers are close to the submission.

WP2: general overview introduced by Christoffer Boström & Johan van de Koppel.
The summary of the WP's tasks.

- Task 2.1 Conduct a field survey and identify sites for experimental work;
- Task 2.2 Experimentally test addition of ecosystem engineers on seagrass establishment and recovery on experimental and case study sites;
- Task 2.3 Develop numerical models of the interactions between seagrasses and other engineering species.

All WP2's partners are conducting field experiments using different approaches:

- ✓ Applying biodegradable establishment structures for mussel and seagrass restoration;
- ✓ Mytilus-Zostera Experiments;
- ✓ Exploring interactions between the bivalve *Pinna nobilis* and seagrasses: implications for the restoration.

The aim of the Task 3 is the development of a numerical model using patchiness as indicator for seagrass meadow restoration success and resilience.
The WP2 introduction has been followed by three oral contributions summarising the main field activities based on common approaches/experiments using different seagrass species and bivalves.

WP3: general overview introduced by Simonetta Fraschetti on the good progress of the WP3
Main goals:

- Increasing the understanding of the role of macroalgal and animal mesophotic forests in the marine systems, to identify key processes and mechanisms influencing restoration success;
- Improve existing and set new restoration protocols to support general approaches for the successful restoration across Europe;
- Testing the effectiveness of restoration actions under a changing ocean scenario;
- Providing indicators to assess the performance of restoration actions.

Main activities:

1. Identify key processes for restoration success Task 3.1
2. Restoration in a changing ocean Task 3.2
3. Define protocols for restoration action Task 3.3
4. Scale-up - Pilot actions Task 3.4

The large geographical representation featuring this WP3 is allowing the development of restoration experiments on the same processes, independently from the species used. Nine papers have been already published on data related to WP3. The session included 4 oral presentations on different case studies.

End of the day

Wednesday 22nd May 2019
Advisory Board, Steering Committee and General Assembly meetings (minutes are reported below).

WP4 vision: to build upon the groundwork laid by restoration activities in other ecosystems, to develop principles, guidelines and tools for deep-sea restoration, including pilot projects..
Objectives

- to apply the lessons learned from terrestrial and coastal ecosystems to develop principles of deep-sea restoration;
- to promote the integration of the deep-sea 'restoration agenda' into policy objectives;
- to develop conceptually coherent tools and methodologies for deep-sea restoration;
- to assess the ecological benefits of cost-effective restoration activities in the deep-sea.

Task 4.1 Improve principles of deep-sea restoration (M3-M42):

- ✓ Adapt lessons learned from terrestrial and shallow water restoration to deep-sea ecosystems to improve principles of deep-sea restoration (IMAR, HCMR, DSES)

- ✓ Promote the engagement of the wider community in the discussion of deep-sea restoration and promote the integration of deep-sea 'restoration agenda' into policy objectives (all partners).

Task 4.2 Unassisted restoration in the deep-sea (M3-M42):

- ✓ Spontaneous generation of deep-sea soft sediment communities impacted by rock drilling (UNIVPM);
- ✓ Assess the rate and success of spontaneous restoration of active hydrothermal vent communities impacted by mining (IFREMER);
- ✓ Assess if land-based activities help in the spontaneous regeneration of deep-sea benthic communities that have been exposed to altered food-input (HW);
- ✓ Role of oil and gas infrastructure in the spontaneous regeneration of deep-sea benthic communities (NOC).

Task 4.3 Restoration activities in the deep-sea (M3-M42):

- ✓ 1. Assess the feasibility of cold-water corals and temperate gorgonians transplantation techniques and the deployment of artificial substrates for the active restoration of populations impacted by fishing (CSIC-UB, IMAR-UAZ);
- ✓ 2. Assess the feasibility of fish transplantation for active restoration of deep-sea fish stocks impacted by fishing (IMAR-UAZ).

The WP4 introduction has been followed by 6 oral contributions summarising the main activities carried out in each study area. Some papers dedicated to the deep sea have been already published.

WP5: general overview introduced by Hazel Thornton & Trine Bekkby.
WP5 will analyse the effects of habitat restoration identified in WPs 2-4 on the recovery of ecosystem services.

- Open question: Find the relationship between habitat features/characteristics, pressures, restoration methods, environmental conditions and the level of restoration success.

Data input:
case study specific information (from WP2-4) on

- ✓ habitat features/characteristics;
- ✓ pressures, restoration methods and the level of recovery success;
- ✓ contextual information (collected by WP5), regional scale (transnational) data and maps for the purposes of context and as the basis of modelling.

- Open question: What determines the recovery potential of ecosystem services.
- ✓ Investigate the different ecosystem services provided by habitats when they are intact and when they are degraded by different combinations of pressures typically found in the EU;
- ✓ Linking habitat features/characteristics, pressures, restoration methods, ecosystem change and recovery potential to ecosystem service restoration.

Data input
Case study specific information:

- ✓ Contextual information/maps;
- ✓ Case study specific information and literature knowledge on ecosystem service in intact and degraded habitats;
- ✓ Knowledge of the links between the level of restoration success and ecosystem service recovery;
- ✓ If possible, GIS layers will be used to identify spatially, (i.e. on a map) areas with increased probability of being suitable for restoration of habitats and ecosystem services.

The relationships identified will be visualized (in infographics) and presented at a MERCES webinar in order to enable communication of the results to the public, stakeholders and marine governance professionals.

Collation of details from 131 sites:
WP2: 63 sites from 7 countries; WP3: 45 sites from 6 countries; WP4: 23 sites from 5 countries.
Ecological effects of restoration using dynamic food-web modelling:

1. Quantitative ecological modelling approach;
2. Tracks path of energy and biomass through the food web components;
3. Different applications → Ecopath with Ecosim and Ecospace*;
4. Static, temporal and spatial-temporal dynamic model;
5. Requires (relatively) few and (mostly) available input data;
6. Includes environment and human activities (fisheries);
7. Trophic (prey-predation) and non-trophic (mediation, facilitation) interactions.

WP6: general overview introduced by Jan van Tatenhove
Task 6.3 (D6.4)

- Aim of task 6.3 (M30-48) is to provide input to the development and design of legitimate and effective governance arrangements and to restore and recover marine ecosystems in the selected cases.

These arrangements reflect both regulatory and policy imperatives under EU and international law.
Based on literature review, an analysis of best practices within other (marine) policies, and if needed key-informant interviews.

Plans for the coming year
Period June – December 2019
Analysis of Marine Restoration Governance Arrangements, Legitimacy and Effectivity:

- ✓ *Pinna nobilis*
- ✓ Red Coral
- ✓ Rigs to Reef (RtR)

Period January 2020 – May 2020
Comparative analysis of the cases
Writing the Policy brief (D6.4 M48)

Followed a presentation performed by Ronan Long.
Policy context: 2030 Agenda for sustainable development.
Target 13.1 & 13.2: Strengthen resilience and adaptive capacity to climate related hazards;
Target 14.2 &14.4: by 2020, sustainably manage and protect marine ecosystems and taken action for their restoration in order to achieve healthy and productive oceans;
By 2020 end destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible.

Within the 2030 Agenda for Sustainable Development, goal 14 emphasizes the critical importance of our oceans and calls for the conservation and sustainable use of the oceans, seas and marine resources for S.D.

UN Decade on ecosystem restoration 2021-2030
Encourages Member States:

a) To foster political will, the mobilization of resources, capacity-building, scientific research and cooperation and momentum for ecosystem restoration at the global, regional, national and local levels;
b) To mainstream ecosystem restoration into policies and plans.

The UNGA resolution through which the Decade was proclaimed emphasizes that ecosystem restoration and conservation contribute to the implementation of the 2030 Agenda, the Paris agreement on climate change and the achievement of the Aichi biodiversity targets and the post-2020 global biodiversity framework.

WP9: general overview introduced by Silvia Bianchelli
Objectives of WP9:

- disseminate the MERCES outcomes to the scientific and non-specialized audience for an effective and integrated restoration strategy;
- raise awareness on restoration activities, promoting an innovative and sustainable multidisciplinary approach;
- encourage different stakeholder groups to share knowledge and identify the best practices for restoration;
- create a network with other EU projects on ecosystem restoration;
- promote capacity building for key marine policy makers in Europe,
- engage policy and decision makers throughout the duration of the project.

Some MERCES numbers:

- ✓ 35 scientific papers in 3 years (19 only in 2018);
- ✓ 35 scientific and public events attended in the 3rd year (>90 in the last 24 months);
- ✓ Web site >5500 visits in the 3rd year ;
- ✓ Social media: YouTube (11 videos, 2'561 visualization); Facebook 404 followers, 377 likes, 130 posts; Twitter: 654 followers;
- ✓ 3 press release;
- ✓ 13 articles on newspaper or TVs interview.

Task 9.1 (M1-48) Dissemination Plan and Quality Control Dissemination plan, timeline and stakeholders database revised every year and available on the MERCES website (3rd version available by the end of May 2019).

Task 9.2 (M1-48) E MERCES
- e material available on the MERCES web site: poster, factsheets , brochure, newsletters, photo video material;
- link to the main social networks twitter , Facebook, YouTube;
- link to the Business Club;
- MERCES documents available in the Partners' Area.

Task 9.3 (M13-48) Ocean Literacy: students involvement (starting from the youngest Course on Marine Biology for I level secondary school (Ancona, Italy), March-April 2019; (PON project, UNIVPM & Ecoreach).
In June 2018, during the "World Oceans Day" in Trieste, CONISMA presented the fairy tale for children to the guests of the Bioma Center, involving young people and adults through a discussion on Conservation, Biodiversity, Human Impacts and Restoration. Many copies of the fairy tale were distributed as a gift for children. High school teachers and students at Gabicce (UNIVPM experimental site) and UNIVPM labs in the framework of PLS project (national plan to promote scientific degrees).

During an ERASMUS event, attended by ca 40 students and teachers from 4 countries, HCMR talked about possible ways to reduce marine litter impact, including using biopolymers as in MERCES experiments.
Field work activities organized for students of IMBRSea International Master of Science in Marine Biological Resources jointly to master degree students in Marine Biology (UNIVPM and ECOREACH).
Educational trip at Stazione Zoologica Anton Dohrn of Naples (Italy), June 2018 and April 2019 (UNIVPM, CONISMA, ECOREACH)
Ocean literacy: Fairy tale for children; Underwater guide of the species at risk and overexploited of the Mediterranean Sea (CoNISMa); Teachers' workbook (GAIA).

Task 9.4 (M1-48) Public engagement on pilot restoration actions in coastal habitats via Citizen Science
CONISMA improved 3 questionnaires on the perception of the degradation of marine ecosystems (general public, fishermen and divers in the Adriatic and Ionian sea). The goals of these activities were to raise awareness on themes relevant to MERCES, and to gather data useful to evaluate the outcomes/perception of restoration activities GAIA continued monitoring activities with divers for the restoration in Portofino and Alassio, Gallinara Island and artificial barriers). Activities promotion and divers training (First International Diving Sustainability Workshop organized by Reef Check Italia onlus, October PMF ZAGREB transplanted *Pinna nobilis* nearby Brijuni marine protected area, supported by volunteers from the diving club, who participated in digging, transporting and planting of pen shells as well as in shell measuring while still on board (2017).

Task 9.6 (M24-48) Training
MERCES presented during WWF national training course "Seeds of good Anthropocene" (30 teachers participated, from all levels and 4 Italian regions).
According to the law "The Good School" and "open schools" principles, WWF IT and UNIVPM participate to "Alternating School Work" project. Training sessions and lab activities for high schools (15 classes, 10 Italian institutes).
In June 2018, ONG DeepWill with RESCAP and MERCES projects (UB and CSIC team) organized a cleaning day of ghost fishing lines at Cap de Creus National Park (also in gorgonians and corals habitats).
WU researchers and MSc students participated to an excursion organized for the volunteers by the eNGO that coordinates seagrass restoration activities in the Netherlands. The eNGO was also contacted for the social science perspective on seagrass restoration (volunteers).
Participation of UNIVPM to EUDI 2019 (European Dive Show)
So many other events and articles.

23rd May 2019

WP7: general overview introduced by Wenting Chen, Stephen Hynes and Rolf Groeneveld
WP7 Objectives:

- Assessment of social acceptance of restoration activities;
- Assessment of direct and indirect economic and social benefits of changing ecosystem services that arise through selected restoration activities;
- Assessment of cost effectiveness of restoration measures;
- Assessment of the net social benefit of restoration activity in the marine environment.

Specific Tasks:

- ✓ Task 7.1 Assessment of social acceptance of the restoration activities;

- ✓ Task 7.2 Framework for the selection of the pilot studies;
- ✓ Task 7.3 Assess the ecosystem service benefits from ecosystem restoration;
- ✓ Task 7.4 Assess the costs of restoration measures;
- ✓ Task 7.5 Carry out full Social Cost Benefit Analysis (SCBA).

Wenting Cheng introduced the ecosystem accounting: a case for Norwegian kelp forest. The talk introduced the change in extent and biomass of the kelp forest with important effects in terms of Carbon deficit; Social cost of carbon; Supporting services and Provisioning services

Rolf Groeneveld reported private financing for marine conservation.
In general the marine conservation finance is inadequate:
Size: GAP: $7 trillion annual gap in global conservation funding;
Duration: 1-5 years, project fragmentation
Philanthropies and government dominate financing sources and determine high risks for project continuity.
Lots of mechanism are available but few in practice.

In-depth interviews with industries (collaborating with WP8 business club):
- To understand the role of the private sectors in marine conservation and restoration;
-To understand the preference and incentives of private sectors for the conservation and restoration financing;
- To highlight what need to be improved.

Stephen Hynes presented preliminary results on a questionnaire on Restoration of the Dohrn Canyon Survey on public acceptance of marine restoration.

WP8: general overview introduced by David Billet & Eva Ramirez-Llodra
Major goal of the WP is building bridges to industry for marine ecosystem restoration.

Main tasks:

- Task 8.1 'Business Club': More than 350 business and policy contacts in 26 European countries; Engage with the companies by promoting their work in the MERCES newsletters and case studies on the MERCES website. Contacts made with 159 United Nations Environment Programme (UNEP) representatives; Developing countries require the skills of MERCES Business Club (BC) partners and the MERCES partnership; Overseas Development Agencies may provide funding, e.g. GIZ in Germany; Use UNEP network to identify challenges being faced by countries in managing the marine environment and its potential restoration.
- Task 8.2 MERCES industry-focused newsletters: the number 6 is scheduled by the end of May 2019.

List of contributors:
Marine Ecosystem Restoration Projects and Issues
The Essex native oyster restoration initiative – Uttley (Blue Marine Foundation and University of Essex);
Urchinomics: The economics of restorative aquaculture – MacDonald and Skala (Urchinomics);
Protection and restoration combined: the experience at the Porto Cesareo MPA – Fraschetti (Università di Napoli Federico II);
Visualizing restoration of intertidal ecosystems – van de Koppel J. (NIOZ);
The feasibility of native oyster restoration in the Belgian part of the North Sea – Degraer and De Mesel;

MERCES Reviews and Reports

Human activities and pressures on key European marine habitats: an analysis of mapped resources – Dailianis and Papadopoulou (HCMR);

Ecological restoration of cold-water coral populations – Gori, Linares, Carreiro-Silva et al. (CSIC, UB, IMAR);

Assessing ecological effects of restoration using dynamic food web modelling – Coll and Horn (MERCES WP5);

An evaluation of restoration policies and practices – van Tatenhove (Univ. Wageningen);

Valuing marine ecosystem services – Hynes (Univ. Galway);

Regional Seas (Black Sea and the Baltic Sea);

River restoration for securing associated marine ecosystem components and the basis for their sustainable use – Jokinen (HELCOM);

Improving the knowledge on the cetaceans populations in the Black Sea;

Horizon 2020 Sister Projects

Algal forest restoration in the Mediterranean Sea (AFRIMED) – Danovaro et al. (UNIVPM)

- Task 8.3 MERCES Interactive Webinars:
  - ✓ Getting better value from our coasts (available in the MERCES website);
  - ✓ Private Finance in Marine Ecosystem Restoration (available in the MERCES website);
  - ✓ Restoration of deep-sea ecosystems, scheduled by the end of June 2019;
  - ✓ in preparation on restoration and carbon sequestration; two potential speakers have been contacted (scheduled in Autumn 2019).

Coffee break

After the coffee break, the assembly decides to have a general discussion on the progress of the MERCES project in order to identify major gaps and potential common strategies. The open discussion allowed to analyse a questionnaire promoted by WP7 on socio-economic impacts of restoration with the support of the experience of partners involved in the pilot restoration actions.

Lunch break

After the lunch break two workshops have been carried out: WP2 and WP4. These workshops were the occasion for the members involved in each WP to have an internal discussion on the progress of the field work activities and to define the structure of the forthcoming deliverables.
The day ended with recommendations on the next deadlines to complete all tasks of the project in time.

Conclusions and end of the day

24th May 2019

WP5: Hazel Thornton & Trine Bekkby

The morning was dedicated to the WP5 workshop that saw a large participation of all WPs members.

Major expectations:

- Knowledge why we have restoration success or failure;
- What determines the recovery potential of ecosystem services;
- Spatial upscaling of the small scale pilot actions.

The importance to collect all info from the pilot studies (WP2, 3 and 4) to allow the submission of the deliverables and papers. The excel files have to be filled by the end of July to allow the proper elaboration for the deliverables scheduled in WP5. One of the product of this WP is also a policy brief. Since other WP6 and WP8 have to release also a policy brief, a common message has to be discussed among WP5, WP6 and WP8.

End of the meeting.

3.2 Advisory Board

Marine Ecosystem Restoration in Changing European Seas
MERCES

Grant agreement n. 689518

Advisory Board Meeting

22nd May 2019 - Paris, France
Time**:** 9.00 – 9.30

Participants:

Project Management Office: Cristina Gambi & Emmanuelle Girardin
Advisory board members: James Aronson, Paul Snelgrove & Cindy Van Dover

Agenda:

- Welcome and apologies for absence;
- Update on the progress of the project: deliverables submitted and milestones achieved;
- Comments and suggestions from the Advisory Board;
- Proposal for Final meeting;
- A.O.B

Welcome and apologies for absence
Cristina Gambi started the meeting welcoming all the Advisory Board members. Unfortunately, Roberto Cimino was not able to join the meeting since he was engaged in Italy for a meeting on Technology Cluster Blue Italian Growth.

Update on the progress of the project
Cristina Gambi reported the progresses of the project presenting the deliverables submitted and the milestones achieved in the first three years of the project.
The list of the deliverables is reported below:

WP1
D1.1 State of the knowledge on European marine habitat mapping and degraded habitats (NIVA) (M12);
D1.2 Current marine pressures and mechanisms driving changes in marine habitats (NUIG) (M12);
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 (HCMR) (M18).

WP3
D3.1 State of knowledge on key eco-evolutionary processes and factors driving the resilience of the shallow hard bottoms and mesophotic habitats (CoNISMa- CSIC) (M10);
D3.2 Criteria and protocols for the restoration of shallow hard bottoms and mesophotic habitats (CoNISMa-CSIC) (M18);
D3.3 Exploring tools to enhance the effectiveness of restoration actions under a changing ocean scenario (CSIC) (M30).

WP4
D4.1 Review on the principles of deep-sea restoration and on the ecological benefits of passive and active restoration (HCMR) (M24)

WP6
D6.1 Review of existing international governance structures, regarding the conservation, restoration and recovery of marine ecosystems (AAU-IFM) (M15);
D6.2 Review of current EU and international legal frameworks (MLOPRS) (M18);
D6.3 Review on restoration, conservation and conservation, restoration and recovering of marine ecosystems (WU and AAU-IFM) (M30).

WP7
D 7.1 Social acceptance of restoration activities (HCMR) (M20).

WP8
D8.1 Report on consolidated lists by country and by business sector of the European Marine Restoration Business Clubs (DSES) (M12).

WP9
D9.1 Dissemination plan (revised every year) (ECOREACH) (M3);
D9.2 MERCES project homepage, MERCES Intranet with project templates and guidelines (ECOREACH) (M3);
D9.3 First Year report on networking, public engagement and communication activities including collation of products and e-MERCES tools (GAIA) (M12);
D9.4 Second Year report on networking, public engagement and communication activities including collation of products and e-MERCES tools (GAIA) (M24).

WP10
D10.1 Minutes of the Kick-Off including the establishment of the different bodies (e.g. SC, AB) (ECOREACH) (M6);
D10.2 Release of the Data Management plan (ECOREACH) (M6);
D10.3 Minutes of the first Annual Meeting (internal WP meetings, SC, GA, AB) (UNIVPM) (M12);

D10.4 Minutes of the second Annual Meeting (internal WP meetings, SC, GA, AB) (UNIVPM) (M24).

All deliverables have been submitted on time or with a short delay always agreed with the Project Adviser.

The list of the first three years project milestones is reported below:

M1.1 Meeting and outline for the D1 Deliverable Report;
M1.2 Completion of data collation for tasks 1.1-1.3;
M1.3 Draft manuscript for review paper/s;
M2.1 WP2 planning seminar;
M2.2 Workshop on experimental results & planning of case study work;
M2.3 Workshop on case study results;
M3.1 Implementation of field actions (bibliographic survey, sampling, experimentation) to define restoration protocols;
M3.2 Implementation of field actions to enhance effectiveness of restoration protocols;
M3.3 Evaluation of efficiency of restoration setups (devices, materials etc..) in shallow hard bottoms and mesophotic habitats;
M3.4 Implementation of pilot restoration actions in shallow hard bottoms and mesophotic habitats;
M4.1 Workshop to discuss the principles of deep-sea restoration, technological gaps and integration of the deep-sea restoration agenda into policy;
M5.1 Technical workshop on ecosystem services restoration efficiency and recovery potential analysis methodology: list of GIS data layers;
M5.2 GIS layers of habitats before after restoration (shallow soft hard bottom and deep-sea habitats).
M6.1 Meeting and outline for the D6.1;
M6.2 Meeting and outline for the D6. 2;
M6.3 Meeting and outline for the D6.3;
M7.1 Data and information from interviews and surveys on social acceptance of the restoration activities;
M8.1 Open WP8 web-page with communication link for industry;
M8.2 Opening of MERCES Business Clubs;
M8.3 Industry Webinar 1: Restoration of soft seafloor and vegetated habitats;
M8.4 Industry Webinar 2. Restoration of hard seafloor and mesophotic habitats;
M9.1 Social network accounts running;
M9.2 Newsletter and Factsheets downloadable from the website;
M10.1 Intranet in the website running;
M10.2 Project kick off meeting and first meeting of the MERCES Project Steering Committee;
M10.3 First Annual Meeting;
M10.4 Second Annual Meeting.

All milestones have been achieved on time.

The coordinator asked all members of the Advisory Board to provide comments and suggestions on the MERCES project after the second year.

Roberto Cimino sent a note relative to his personal contribution to the project by suggesting to organize a dedicated workshop (especially on WP8 Business Club), in the framework of Technology Cluster BIG. "We have a number of Italian companies associated to the Cluster, we might try to involve in the Business Club. The Technology Cluster BIG is, at any rate, at the disposal of the diffusion and dissemination phase of the Project in Italy, should there be any further action the advisory board, together with Roberto Danovaro and the leading researchers, would deem useful".

Report of the MERCES Advisory Board provided by **James Aronson, Paul Snelgrove, Cindy Van Dover,** AB members present at the Paris 2019 General Assembly.
The members of the Advisory Committee able to attend the 2019 MERCES General Assembly found that the MERCES H2020 project is on target to achieve all deliverables. The extensive publications produced

or in preparation will make important contributions to the science, practice, and policy of marine ecosystem restoration. The business thereof remains a fairly black box.

MERCES clearly sits at the forefront of this field in the EU and is well aligned with marine restoration research worldwide. The program has undertaken studies at an impressive number of sites with diverse experiments, generating important new knowledge and insight into what may become best practice for specific ecosystem types within the marine environment. The Advisory board applauded the energy invested and the outcomes gained in all aspects of the project, including research activities, capacity building, public outreach, and the initiation of the business club.

In our role as an Advisory Committee, we offer five observations that may be useful to advance as the work of MERCES wraps up in the coming year and the members contemplate how they envision continuing the work undertaken provided funding can be secured.

1) Climate change should be integrated front and center as a driving factor for changes in ecosystem health and in consideration of restoration activities. This is true for marine ecosystem restoration, just as it is for terrestrial ecosystems.
2) MERCES WPs recognize the importance of scaling-up (feasibility, cost, improved outcomes, metrics), but how they propose to integrate 'scaling up' into the various work packages and what they will propose in the final synthesis in this respect remains to be worked out. This may represent the single greatest challenge for any restoration activity in the marine environment, particularly but by no means exclusively, in the deep sea.
3) We encourage a high-level synthesis of MERCES results that exceeds the sum of the parts. For example, what has MERCES learned that could help in decision-making and policy regarding the scaling-up of experiments for systems (e.g., deep sea)? Is it possible to adopt and adapt the so-called landscape approach to ecological restoration in terrestrial environments to marine ecosystem restoration? An example of such a landscape system might be kelp forests (or/and other land-sea intersection)-to canyons and other deep-sea systems.
4) As noted during the Paris meeting, another synthesis opportunity for MERCES would be to capture and share lessons learned. "Failed" restoration experiments may tell us as much as "successful" ones. Such a synthesis might include an overview of restoration activities that build on the WP1 review and consider the global state-of-the-art and gaps in knowledge and practice. One useful strategy might be to develop hypotheses regarding mechanisms of success or failure and formulate clear research horizons for the near future, e.g., in the area of assisted nucleation in seagrass meadow or coral fragment transplanting, among other interventions, , use of indicators of habitat quality in the design of restoration experiments, etc.).
5) How could the role of business be developed in the emerging field of marine ecosystem action? Growing attention is being given to business in terrestrial ecosystem restoration, across a wide spectrum of political and legislative settings (e.g., in Brazil, South Africa, and elsewhere). What can be developed or proposed for the important area of marine ecosystem restoration in European waters, and worldwide?

In addition, we have some general comments and operational suggestions arising from presentations and discussions with MERCES colleagues:
1) The field projects where diversity measures are key metrics might consider use of functional biodiversity as well as species richness metrics. Functional diversity metrics have the potential to inform the (changing) status of ecosystem services. We learned that functional diversity metrics are to be advanced by at least one project; others may benefit as well from this approach.
2) We encourage experimental projects to be conservative regarding what can be accomplished in terms of restoration success – don't promise more than can be delivered.
3) MERCES members noted the potential to enhance the economic and ecosystem service piece, but this will require strong interaction among work packages.
4) MERCES could make better use of integration of ecosystem services in cost-benefit analyses of restoration activities.
a. As discussed during the meeting, consider using The Economics of Ecosystems and Biodiversity (TEEB study) classification of Ecosystem Services in addition to that of the Common International Classification of Ecosystem Services (CISES) V5.1.

5) Board members were unclear on the degree to which the Business Club has actually enabled meaningful engagement with industry, and whether the approach has been effective and will prove enduring. Active engagement of industries involved with restoration, perhaps bringing their experiences to MERCES (as through the suggested use of industry-developed podcasts or short videos) rather than relying only on the MERCES newsletters, may contribute to the success of this objective.
6) A 2-page executive summary highlighting major findings would be very useful as a calling card for the EU Commission, the Advisory Board, industry, etc. and wherever MERCES members engage with the public.
7) When planning communication efforts, emphasize the general importance of restoration in marine ecosystems to the public, above and beyond specific experimental results and studies. The Advisory Board members valued the 'deep dives' into restoration activities and review, but as the project closes, it will be important to clarify and communicate the MERCES headlines and take-home messages for the European Commission, citizens, administrators, and business leaders.
8) MERCES could develop some plain language Policy Briefs tailored/packaged for specific audiences, as was done in the TEEB Study; these Briefs would speak to broader marine restoration principles, standards, priorities, risks, and constraints, rather than individual project results.

Like the EU Project Advisor, Dr. Victoria Beaz Hidalgo, who attended the first day of the Paris meeting, the Advisory Board sees MERCES as superbly well-positioned to lead the next decade of EU marine restoration research. This is a status well earned. In our side conversations with MERCES members, we gave this more thought and offer the following:

The concurrent UN Decade of Ecosystem Restoration and Decade of Ocean Science, both slated for 2021 to 2030, is an opportunity to develop a new phase of the MERCES consortium. With additional partners added, MERCES might seek to fund linkages and cooperation of EU restoration scientists and practitioners with colleagues in North America, Brazil, and South Africa through the Galway Statement and Belém Agreement as part of the new era of 'Blue Enlightenment'. The overall concept will need to be bold with links directly to EU and international policymakers. Such a strategy might include pelagic systems, multi-habitat systems (e.g., benthic and pelagic) as well as multi-species systems. Scaling-up might feature centrally in this effort and take the MERCES+ community to the next level of impact.

Annual meetings
Proposal for the last annual meeting of the MERCES project:
Location: Brussels
Duration: 2 days, the 1st day dedicated to the internal final meeting and the 2nd day dedicated to an open session with an opening provided by the members of the Advisory board, followed by WPs co-leaders presentations summarizing the results achieved in the project, then a conclusions and perspectives section.
The meeting is completed by a round table with policy makers, stakeholders and EU representatives.

James Aronson suggested to have an opening with all members of the Advisory Board.

A.O.B
No input

End of the meeting.

3.3. Steering Committee

Marine Ecosystem Restoration in Changing European Seas MERCES

Grant agreement n. 689518

Steering Committee Meeting

22nd May 2019 - Paris, France
Time: 9.30 – 10.00

Participants:

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 Hazel Thornton & Trine Bekkby (invited)

WP6 Jan P.M. van Tatenhove & Ronan Long

WP7 Wenting Chen & Stephen Hynes (both invited)

WP8 David Billett & Camila With Fagerli

WP9

Agenda:

- Welcome and apologies for absence;
- Update of each WP progress activities;
- Milestones and deliverables due in months 36 and M37-48;
- Final meeting;
- Update on the technical and financial reports for the second reporting period;
- Update on MERCES symposium at SER Conference – South Africa September 2019;
- Update on MERCES special issue;
- Date for the next Steering Committee meeting by skype;
- A.O.B

Welcome and apologies for absence
Unfortunately, Martina Milanese was not able to join the meeting since she was participating in the same dates to the SPONGES General Assembly. Silvia Bianchelli was not able to join the meeting for a sudden flight cancellation, due to a strike in Italian airports.

Update of each WP progress activities
A quick update was given by the WP leaders during the meeting.

WPs:
WP1 Nadia Papadopoulou & Anthony Grehan
WP2 Christoffer Boström & Johan van de Koppel
WP3 Simonetta Fraschetti & Joaquim Garrabou
WP4 Telmo Morato &Andrew Sweetman
WP5 Chris McOwen
WP6 Jan P.M. van Tatenhove & Ronan Long
WP7 Stephen Hynes & Wenting Chen
WP8 David Billett & Camila With Fagerli

Joaquim Garrabou informed the audience about the initiative of a summer school dedicated to *theory and field practices on the ecological restoration in hard bottom and mesophotic habitats* in collaboration with Carlo Cerrano (UNIVPM) and Simonetta Fraschetti (CoNISMa). He asked also for the possible participations of other WPs involved in the policy and legal frameworks (WP6) and ecosystem services (WP5) and social acceptance (WP7).

Milestones and deliverables due in month 36
Cristina Gambi reported the list of the deliverables and milestones due to M36 to reminder the close deadline and to ask if there were any problems.

The list of the deliverables is reported below:

WP3
D3.4 Evaluation of the effectiveness of pilot restoration actions under a changing ocean scenario (CoNISMa-CSIC);
WP9
D9.5 Third year report on networking, public engagement and communication activities including collation of products and e-MERCES tools (GAIA);
WP10
D10.5 Minutes of the third annual meeting (internal WP meetings, SC, GA, AB) (UNIVPM).

The list of the milestones is reported below:
WP4
MS14 Passive restoration pilot studies completed (HWU);
MS15 Active restoration pilot studies completed (IMAR-Uaz);
WP7
MS25 Data and information on social cost-benefit analysis for the selected cases study (NIVA);
WP8 (postponed in June)
M33 Industry Webinar 3. Restoration of deep-sea habitats (NIVA);
WP10
M42 Third Annual Meeting (UNIVPM).

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

Cristina Gambi reported the list of the deliverables and milestones due to M37-48 to remind deadlines and members responsibility.
The Milestone M33 on "Industry Webinar 3. Restoration of deep-sea habitats" has been postponed to June 2019 due to health problem related to one of the WP8 co-leaders and the availability of the invited

speakers identified and presented during the WP8 overview.

WP2
D2.1 Manual of restoration measures in soft bottoms based on surveys and experiments (ÅAU) (M42);
D2.2 Restoration results in the case study sites (UTARTU) (M42);
D2.3 Mathematical model of the interactions between seagrass and other engineering species (NIOZ) (M42).
WP4
D4.2 Effectiveness of passive restoration in fjord ecosystems, hydrothermal vents and in cold water corals (HWU) (M42);
D4.3 Development and effectiveness of tools and techniques for active restoration in the deep-sea (UB) (M42);
WP5
D5.1 Maps (in GIS format) showing case study sites and variation in the recovery potential of different ecosystem services; and, information on changes in ecosystem services provision following habitat restoration (as metadata). (WCMC-NIVA) (M40);
D5.2 Visual representation (e.g. infographic) of relationships between habitat characteristics, pressures, restoration methods, ecosystem change, and recovery potential (NIVA) (M42);
D5.3 Policy briefing summarizing the key transferable findings from Tasks 5.1-3 (WCMC) (M45).
WP6
D6.4 Policy brief providing input and options for the development of legitimate governance arrangements and effective regimes regulating the conservation, restoration and recovering of marine ecosystems (WU and AAU-IFM) (M48).
WP7
D7.2 Popularized mainstream or industry article on social benefits of marine restoration activities (NUIG) (M40);
D7.3 Use of Choice Experiment to estimate number of ecosystem service values from restoration project (NUIG) (M40);
D7.4 Popularized mainstream or industry article on social costs of marine restoration activities and cost – effective analysis of restoration measures by case study (WU) (M40);
D7.5 Report, including a policy relevance section, on full social cost-benefit analysis for the selected case studies (NIVA) (M47).
WP8
D8.2 Annual publication of business-focused e-newsletters and final report synthesizing the MERCES business-focus e-newsletters as industry brief (UTARTU) (M46);
D8.3. Recording and long-term archiving of 5 industry webinars and final report on the webinars outcomes (NIVA) (M46);
D8.4. Final report summarizing industry and authorities engagement in MERCES through the Business Club and Industry Portal and highlighting any tangible outcomes (e.g. new methods and new projects) created from these interactions (DSES) (M46).
WP9
D9.6 Four year report on networking, public engagement and communication activities including collation of products and e-MERCES tools (GAIA).
WP10
D10.6 Restoration of marine ecosystems: a manual for users (UNIVPM) (M47);
D10.7 Summary of the final meeting (UNIVPM) (M48).

MS7 Case study sites work final sampling/check (NIOZ) (M42);
MS18 Model of recovery efficiency and potential of different habitats shared with technical group (NIVA) (M41);
MS19 Draft visualizations of relationships between habitat characteristics, pressures, restoration methods, ecosystem change, and recovery potential created and shared for review (NIVA) (M42);
MS23 Meeting and outline for the D6.4 (WU) (M40);
MS26 Database of value estimates from previous marine related restoration studies (NUIG) (M40);
MS27 Data and information on social costs of marine restoration activities and cost –effective analysis of restoration measures by case study (WU) (M40);

MS28 Data and information on use of Choice Experiment to estimate number of ecosystem service values from restoration project (NUIG) (M40);
MS34 Industry Webinar 4. Socio-economic issues of marine restoration (NIVA) (M38);
MS35 Industry Webinar 5. A synthesis of new restoration methods and best practices (NIVA) (M43).

As MS34 is due at M38, which occurs during the summer time, the lead partner requested to postpone it to September/October (M40/41). This request has been transferred to the interim PO Christophe COUDUN who was favourable and suggested to add this deviation of work in the progress report.
Milestones are in progress and all partners are working to complete and achieve them on time.

Final annual meeting
Proposal for the last annual meeting of the MERCES project:
Location: Brussels
Duration: 2 days, the 1st day dedicated to the internal final meeting and the 2nd day dedicated to an open session with an opening provided the members of the Advisory board, followed by WPs co-leaders presentations summarizing the results achieved in the project, then a conclusions and perspectives section.
The meeting is completed by a round table with policy makers, stakeholders and EU representatives.

The Project Adviser during an informal discussion with the project management suggested that the annual meeting could be carried out during the European Maritime Day to reach the largest audience including policy makers, stakeholders and other economic sectors. The meeting location is already scheduled in Cork (Ireland) but the dates are not confirmed yet. This could be a limit since the MERCES project has to be completed by May 2020.

The Steering Committee considers that an one day final internal meeting could not be enough due to the large numbers of WPs and expected results achieved. Some members suggest a two days meeting before the open meeting expected at the last day of the annual meeting.
Other members suggest having the internal annual meeting separated from the open meeting. The internal meeting for all members of the consortium could be arranged in another cheaper city (e.g. Edinburgh or Lisbon) while the open meeting with a small representative of the consortium (with only WPs co-leaders presenting) could be carried out in Brussels. This option found less consensus from the members of the consortium. Although an advantage was seen if the internal meeting could serve as a test run for the final Brussels meeting. There was no formal voting on this.
The different proposals will be discussed with the Coordinator and soon the project management will submit a proposal for the final meeting and circulate a doodle with potential dates.

Update on the technical and financial reports for the second reporting period (M13-M30)
Emmanuelle Girardin, reported that the technical and financial reports have been accepted by the EU Commission; Only few revisions about some costs for some beneficiaries have been requested;
In date 30/04/19 final approval of the Financial Report. WELL DONE!!!
EUR 1 343 069,43 has been paid by the EC and we are working to send the relative contribution to all partners
(CONDITION: the amount of the interim payment(s) cannot exceed 90% of the maximum grant amount minus pre-financing and minus previous interim payments).

Update on MERCES symposium at SER Conference – South Africa 24-28 September 2019
A MERCES symposium has been accepted by the organisation committee. The symposium consists of 1 hour and half dedicated to the results and achievements of different WPs of the project. Here below the list of contributions already scheduled:
1. MERCES: Marine Ecosystem Restoration İn Changing European Seas (H2020 Funded Project); Roberto Danovaro et al
2. Marine restoration and MERCES Key Habitats/Species: approaches, timescales, bottlenecks and up-scaling; Chris Smith et al.
3. Success stories in restoration actions across coastal-marine ecosystems: the potential for synergies; Simonetta Fraschetti et al.

4. Principles and key concepts for ecological restoration in the deep-sea; Telmo Morato et al
5. Effects of marine restoration on ecosystem services; Hazel Thornton et al
6. Stakeholder perceptions on marine restoration: beliefs, preferences and supporting actions; Nadia Papadopoulou et al.

Other partners from Croatia and Finland have been involved in another symposia dedicated to coastal ecosystems. Moreover, other partners will be present with poster contributions.

Update on MERCES special issue
MERCES proposal has been rejected from
Philosophical transactions of the Royal Society B Biological Sciences
Frontiers in Ecology and the Environment

The project management will explore soon the interest of Restoration Ecology.

Other partners suggest to explore Marine Ecology Progress Series and/or Frontiers in Marine Science.
Comments raised by the members of the Steering Committee are related to the cost for publication in this journals and the need of a strict deadline to have the issue published by the end of the MERCES project. (May 2020)

Date of the next Steering Committee by skype
The next SC meeting will be held at M42, November 2019. A doodle will be sent next September to the SC members to decide the exact date. Some members of the Consortium suggested to have the meeting during the South Africa conference since some partners will participate to this event. The decision will be taken after discussion with the coordinator.

A.O.B
Change of Project Adviser:
Ariana NASTASEANU left MERCES last October 2018
Christophe COUDUN was appointed early 2019
Victoria BEAZ HIDALGO new PA since May 1st, 2019

End of the meeting.

3.4 General Assembly

Marine Ecosystem Restoration in Changing European Seas
MERCES

Grant agreement n. 689518

General Assembly Meeting

22nd May 2019 - Paris, France
Time: 10.00 – 11.00

Participants:

Project Management Office: Cristina Gambi & Emmanuelle Girardin
All members of the Consortium

Agenda

- Welcome;
- Deliverables and Milestones due in months 36 and M37-48;
- Final annual meeting;
- Update on the technical and financial reports for the second reporting period (M13-M30);
- Update on MERCES symposium at SER Conference – South Africa September 2019;
- Update on MERCES special issue;
- A.O.B

Welcome
Cristina Gambi welcomed all members of the consortium. The agenda of the meeting was presented and approved by the General Assembly.

Milestones and deliverables due in month 36
Cristina Gambi reported the list of the deliverables and milestones due to M36 to reminder the close deadline and to ask if there were any problems.

The list of the deliverables is reported below:
WP3
D3.4 Evaluation of the effectiveness of pilot restoration actions under a changing ocean scenario (CoNISMa-CSIC)
WP9
D9.5 Third year report on networking, public engagement and communication activities including collation of products and e-MERCES tools (GAIA)
WP10
D10.5 Minutes of the third annual meeting (internal WP meetings, SC, GA, AB) (UNIVPM)

The list of the milestones is reported below:
WP4
M14 Passive restoration pilot studies completed (HWU);
M15 Active restoration pilot studies completed (IMAR-Uaz)
WP7
MS25 Data and information on social cost-benefit analysis for the selected cases study (NIVA);
WP8 (postponed in June)
M33 Industry Webinar 3. Restoration of deep-sea habitats (NIVA)
WP10
M42 Third Annual Meeting (UNIVPM)

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

Cristina Gambi reported the list of the deliverables and milestones due to M37-48 to remind deadlines and members responsibility.

The Milestone M33 on "Industry Webinar 3. Restoration of deep-sea habitats" has been postponed to June 2019 due to health problem related to one of the WP8 co-leaders and the availability of the invited speakers identified and presented during the WP8 overview.

WP2
D2.1 Manual of restoration measures in soft bottoms based on surveys and experiments (ÅAU) (M42);
D2.2 Restoration results in the case study sites (UTARTU) (M42);
D2.3 Mathematical model of the interactions between seagrass and other engineering species (NIOZ) (M42);
WP4
D4.2 Effectiveness of passive restoration in fjord ecosystems, hydrothermal vents and in cold water corals (HWU) (M42);
D4.3 Development and effectiveness of tools and techniques for active restoration in the deep-sea (UB) (M42);
WP5
D5.1 Maps (in GIS format) showing case study sites and variation in the recovery potential of different ecosystem services; and, information on changes in ecosystem services provision following habitat restoration (as metadata). (WCMC-NIVA) (M40);
D5.2 Visual representation (e.g. infographic) of relationships between habitat characteristics, pressures, restoration methods, ecosystem change, and recovery potential (NIVA) (M42);
D5.3 Policy briefing summarizing the key transferable findings from Tasks 5.1-3 (WCMC) (M45).
WP6

D6.4 Policy brief providing input and options for the development of legitimate governance arrangements and effective regimes regulating the conservation, restoration and recovering of marine ecosystems (WU and AAU-IFM) (M48)

WP7

D7.2 Popularized mainstream or industry article on social benefits of marine restoration activities (NUIG) (M40);

D7.3 Use of Choice Experiment to estimate number of ecosystem service values from restoration project (NUIG) (M40);

D7.4 Popularized mainstream or industry article on social costs of marine restoration activities and cost – effective analysis of restoration measures by case study (WU) (M40);

D 7.5 Report, including a policy relevance section, on full social cost-benefit analysis for the selected case studies (NIVA) (M47).

WP8

D8.2 Annual publication of business-focused e-newsletters and final report synthesizing the MERCES business-focus e-newsletters as industry brief (UTARTU) (M46);

D8.3. Recording and long-term archiving of 5 industry webinars and final report on the webinars outcomes (NIVA) (M46);

D8.4. Final report summarizing industry and authorities engagement in MERCES through the Business Club and Industry Portal and highlighting any tangible outcomes (e.g. new methods and new projects) created from these interactions (DSES) (M46).

WP9

D9.6 Four year report on networking, public engagement and communication activities including collation of products and e-MERCES tools (GAIA).

WP10

D10.6 Restoration of marine ecosystems: a manual for users (UNIVPM) (M47);

D10.7 Summary of the final meeting (UNIVPM) (M48).

MS7 Case study sites work final sampling/check (NIOZ) (M42);

MS18 Model of recovery efficiency and potential of different habitats shared with technical group (NIVA) (M41);

MS19 Draft visualizations of relationships between habitat characteristics, pressures, restoration methods, ecosystem change, and recovery potential created and shared for review (NIVA) (M42);

MS23 Meeting and outline for the D6.4 (WU) (M40);

MS26 Database of value estimates from previous marine related restoration studies (NUIG) (M40);

MS27 Data and information on social costs of marine restoration activities and cost -effective analysis of restoration measures by case study (WU) (M40);

MS28 Data and information on use of Choice Experiment to estimate number of ecosystem service values from restoration project (NUIG) (M40);

MS34 Industry Webinar 4. Socio-economic issues of marine restoration (NIVA) (M38);

MS35 Industry Webinar 5. A synthesis of new restoration methods and best practices (NIVA) (M43);

As MS34 is due at M38, which occurs during the summer time, the lead partner requested to postpone it to September/October (M40/41). This request has been transferred to the interim PO Christophe COUDUN who was favourable and suggested to add this deviation of work in the progress report.

The milestones are in progress and all partners are working to complete and achieve them on time.

Final annual meeting

Proposal for the last annual meeting of the MERCES project:

Location: Brussels

Duration: 2 days, the 1st day dedicated to the internal final meeting and the 2nd day dedicated to an open session with an opening provided the members of the Advisory board, followed by WPs co-leaders presentations summarizing the results achieved in the project, then a conclusions and perspectives section.

The meeting is completed by a round table with policy makers, stakeholders and EU representatives.

The Project Adviser during an informal discussion with the project management suggested that the annual

meeting could be carried out during the European Maritime Day to reach the largest audience including policy makers, stakeholders and other economic sectors. The meeting location is already scheduled in Cork (Ireland) but no dates are confirmed yet. This could be a limit since the MERCES project has to be completed by May 2020.

The Steering Committee suggests that an one day final internal meeting could be not enough due to the large numbers of WPs and expected results achieved. Some members suggest a two days meeting before the open meeting expected at the last day of the annual meeting.
Other members suggest to having the internal annual meeting separated by the open meeting. The internal meeting for all members of the consortium could be arranged in another cheaper city while the open meeting with a small representative of the consortium (only WPs co-leaders presenting) could be carried out in Brussels. This option found perhaps less consensus from the members of the consortium although advantages were seen in the internal meeting serving as a test run for the final meeting. There was no formal voting on this.

The different proposals will be discussed with the Coordinator and soon the project management will circulate a doodle with potential dates and a final solution of the final meeting.

Update on the technical and financial reports for the second reporting period (M13-M30)
Emmanuelle Girardin, reported that the technical and financial reports have been accepted by the EU Commission;
Only few revisions about some costs for some beneficiaries have been requested;
In date 30/04/19 final approval of the Financial Report. WELL DONE!!!
EUR 1 343 069,43 has been paid by the EC and we are working to send the relative contribution to all partners
(CONDITION: the amount of the interim payment(s) cannot exceed 90% of the maximum grant amount minus pre-financing and minus previous interim payments).

Update on MERCES symposium at SER Conference – South Africa 24-28 September 2019
A MERCES symposium has been accepted by the organisation committee. The symposium consists of 1 hour and half dedicated to the results and achievements of different WPs of the project. Here below the list of contributions already scheduled:

1. MERCES: Marine Ecosystem Restoration İn Changing European Seas (H2020 Funded Project); Roberto Danovaro et al
2. Marine restoration and MERCES Key Habitats/Species: approaches, timescales, bottlenecks and up-scaling; Chris Smith et al.
3. Success stories in restoration actions across coastal-marine ecosystems: the potential for synergies; Simonetta Fraschetti et al.
4. Principles and key concepts for ecological restoration in the deep-sea; Telmo Morato et al
5. Effects of marine restoration on ecosystem services; Hazel Thornton et al
6. Stakeholder perceptions on marine restoration: beliefs, preferences and supporting actions; Nadia Papadopoulou et al.

Other partners from Croatia and Finland have been involved in another symposium dedicated to coastal ecosystems. Moreover, other partners will be present with poster contributions.

Update on MERCES special issue
MERCES proposal has been rejected from
Philosophical transactions of the Royal Society B Biological Sciences;
Frontiers in Ecology and the Environment.

The project management will explore soon the interest of Restoration Ecology.

Other partners suggest to explore Marine Ecology Progress Series and/or Frontiers in Marine Science.
Comments raised by the members of the Steering Committee are related to the cost for publication in this journals and the need of a strict deadline to have the issue published by the end of the MERCES project.

A.O.B
Change of Project Adviser:
Ariana NASTASEANU left MERCES last October 2018
Christophe COUDUN was appointed early 2019
Victoria BEAZ HIDALGO new PA since May 1st, 2019

End of the meeting.

Annex 1: Conference abstracts

Marine Ecosystem Restoration in Changing European Seas

Third Annual meeting

Paris, France
21st-24th May 2019

Conference 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 21st May 2019

WP1

Linking activities and pressures to restoration and mitigation options

Papadopoulou, K-N.[1*]**,** Smith, C.J., Dailianis, T Gerovasileiou, V., Sevastou, K., Grehan, A., Billett, B., McOwen, C., Amaro, T., Bakran-Petricioli, T., Bekkby, T., Bilan, M., Boström, C., Carriero-Silva, M., Carugati, L., Cebrian, E., Cerrano, C., Christie, H., Danovaro, R., Eronat, E., Fiorentino, D., Fraschetti, S., Gagnon, K., Gambi, C., Kipson, S., Kotta, J., Linares, C., Morato, T., Ojaveer, H., Orav-Kotta, H., C. Pham, Rinde, E., Sarà, A., Scrimgeour, R.

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In WP1 we have reviewed degraded habitats mapping and activities and pressures mapping and their usefulness and suitability for restoration purposes (Dailianis et al. 2018, Gerovasileiou et al. 2019), as well as key habitat characteristics linked to restoration potential for 6 marine habitats (D1.1. Bekkby et al. 2017, Bekkby et al. 2019 in prep.) and considerations of barriers, timescales and up-scaling (Papadopoulou et al. 2017). In this work we are revisiting D1.2. 'Current marine pressures and mechanisms driving changes in marine habitats' and six case studies (from shallow kelp forests in Norway to deep sea corals in the Azores) looking at specific activity-pressure combinations and the ways they impact the ecosystem (e.g. loss of species and structural complexity) and restoration and mitigation options.

WP2

Co-restoring eelgrass and mussels to increase restoration success – challenges and implementation

Karine Gagnon[1], Hartvig Christie[2], Max Gräfnings[1,3,4], Georg Martin[5], Liina Pajusalu[5], Eli Rinde[2], Tjisse van der Heide[3,4,6], Christoffer Boström[1]

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WP2 partners in Estonia, Finland, Netherlands, and Norway experimentally tested how to implement facilitative interactions between eelgrass *Zostera marina* and blue mussels *Mytilus edulis* into restoration projects across northern Europe. In theory, eelgrass should protect mussels from physical disturbance and predators, while mussels should facilitate eelgrass growth by providing nutrients and filtering water. In aquarium pilot experiments in Finland, we found that mussels did indeed fertilize eelgrass and increase growth. We then tested different co-restoration methods in the field. Our first attempts in 2017 involved adding mussels to restoration plots, but these mostly failed because of either mussel loss in highly hydrodynamic conditions, or seagrass loss due to eutrophication and filamentous algae. In 2018, we first attached mussels to biodegradable structures (BESEs) to create substrate, then planted eelgrass in the middle. Early results indicate this method was much more effective in retaining mussels (and attracting new mussel recruits), and that mussels increased eelgrass survival and growth after one growing season. Further sampling will determine if co-restoration ensures the long-term persistence of plots and facilitates higher associated biodiversity and ecosystem services.

WP2

Seagrass restoration in the Adriatic Sea: the Gabicce case study

Gambi Cristina[1*], Da Ros Zaira[1], Carugati Laura[1], Lo Martire Marco[1], Danovaro Roberto[1,2]

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Ecosystem engineers play a key role in many coastal systems. Along the European Seas, recent investigations have highlighted a simultaneous and rapid disappearing of ecosystem engineers including seagrass meadows (Zostera spp, *Posidonia oceanica*), and mussel reefs (*Mytilus spp, Pinna nobilis*, *Serripes spp and Ostrea spp*). In the framework of the H2020 MERCES (Marine Ecosystem Restoration in Changing European Seas) project, we have improved our knowledge on the performance of restoration practices of the seagrass Zostera and Cymodocea spp. in the Western Adriatic Sea (Central Mediterranean). This area has been selected as a deputy system where testing interactions between the transplantation of seagrass (Zostera and Cymodocea spp.) beds and *Pinna nobilis*, the large endemic bivalve of the Mediterranean Sea. *P. nobilis* can be considered an ecosystem engineer and plays a key ecological role influencing the faunal biomass and diversity. The area under scrutiny is characterized by the co-occurrence of highly valuable natural resources (bordering a regional Park), seasonal touristic pressures and anthropogenic structures (breakwaters aimed at preserving the beach), whose management has at times involved temporary damages to the seagrass beds. The experiment of the ecological restoration of seagrass started in October 2017 and is actually ongoing. The first results of this study suggest that high efficiency of the new restoration methods applied in the study area with an increasing of seagrass density up to 80% after 5 months from the transplanting and positive effects of the presence of the *P. nobilis* on benthic biodiversity attracting rare taxa.

WP2

Patchiness as indicator for seagrass meadow restoration success and resilience

Koen Siteur[1,2], Quan-Xing Liu[2], Tjisse van der Heide[1] & Johan van de Koppel[1]

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Positive feedbacks between seagrasses and their biotic and abiotic environment are thought to play a key role in seagrass restoration success. Within WP2 we aim to determine the spatial scale of restoration efforts required to overcome these positive feedbacks, and to provide indicators for restoration success and for the resilience of restored meadows. I will present the results of a model study on seagrass meadows, whose dynamics are governed by the interplay of grazing, nutrient limitation and sediment deprivation. The model highlights that competition between seagrass patches controls the spatio-temporal dynamics of establishing and established seagrass meadows. Patch size and proximity of patches determines the outcome of competition. A critical patch size, below which patches will shrink over time, can be estimated from field data. The modelled patch dynamics result in characteristic patch-size distributions which can be used to assess the resilience of restored seagrass meadows using aerial imagery.

WP3

Large-scale sea urchin culling to support the recovery of disturbed infralittoral rocky habitats in the Mediterranean Sea

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Increasing anthropogenic pressures are causing long-lasting regime shifts from high-diversity ecosystems to low-diversity ones. In the Mediterranean Sea, large extensions of rocky subtidal habitats characterized by high diversity have been completely degraded to barren grounds, featured by the dominance of sea urchins whose grazing combines with the impact of overfishing. The identification of specific actions aimed to reverse this trajectory of change is fundamental for the development and implementation of large-scale management strategies. Some studies shown a positive effect of sea urchin removal on the recovery of overexploited subtidal rocky habitats. To date, the practice of extensive sea urchins culling has been already applied in some areas of the world, but never in the Mediterranean Sea. During the project MERCES we test this approach in the no-take zone of the MPA of Porto Cesareo, covering an area of 1.2 hectares. The consequences of sea urchin removal, carried out in spring 2015, were monitored at regular intervals, covering a time span of 3 years, and compared with two controls, external to the fully protected area. Results show a high recovery after the beginning of the experiment, with a progressive reduction of the barren grounds in the fully protected area driven to algal colonization (mostly erect and turf forming algae). By contrast, very low recolonization of sea urchins was observed in the time frame covered by the experiment, so that any additional culling was necessary. The obtained outcomes make the approach promising also due to limited costs of the intervention. The same approach could be exported to other areas affected by similar socio-ecological conditions, thus having relevant ecological consequences at a seascape scale.

WP3

Enhancing the effectiveness of restoration actions in coralligenous habitats: insights from a transregional thermotolerance experiment

Jean-Baptiste Ledoux[1,2], Daniel Gomez Gras[1], Tyler S. Alioto[3], Tatjana Bakran-Petricioli[4], Joana Boavida[5], Javier del Campo[1], Carlo Cerrano[6], Eliana Ferreti[7], Marta Gut[3], Silvija Kipson[4], Cristina Linares[8], Paula López-Sendino[1], Angel López-Sanz[1], Ramon Massana[1], Martina Milanese[7], Ignasi Montero-Serra[8], Diogo Paulo[5], Ester Serrão[5], Joaquim Garrabou[1,9]

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Understanding the response of organisms facing climate change is critical to buffer the on-going biodiversity crisis. The Mediterranean coralligenous habitats are among the richest but also most threatened habitats of the Mediterranean. Indeed, these habitats, dominated by long-lived species such as octocoral or sponges, were affected by recent warming-induced large-scale mortality events. Considering the slow dynamics of many impacted species, these events question the future of coralligenous habitats and restoration actions appeared as one of the most relevant tools to buffer these biodiversity losses. To be efficient, restoration actions should rely on an understanding of the interactions among the organisms to be restored and their local environment in order to allow the identification of relevant donor populations to restore vulnerable and degraded populations. The main aim of the present study was to characterize the interactions between *Paramuricea clavata*, a habitat forming octocoral severely but differentially impacted by mortality events, and its thermal environment. We carried out a common garden experiment in aquaria focusing on the response to thermal stress of 12 populations from five different regions (Catalunya, Corsica, Northern Italy, Croatia and Southern Portugal) within the North Western Mediterranean, the Adriatic and the Atlantic. The objectives of this study were: 1) to further the acquisition of basic information about the thermotolerance features of *P. clavata*; 2) to evaluate the role of biological processes in the differential responses to thermal stress by conducing whole genome sequencing analyses; 3) to characterize the micro-eukaryotic and prokaryotic communities associated to the targeted populations. Here, we will present the first results of the different objectives. We will discuss their implications for restoration actions of the coralligenous habitats dominated by *P. clavata* in the context of on-going climate change.

WP3

Can facilitation processes enhance the effectiveness of restoration actions in the coralligenous habitat? Insights from a 15 month field experiment

Kipson S[1], Cerrano C[2], Torsani F[2], Linares C[3], Bakran-Petricioli T[1], Ferretti E[4], Gomez-Gras D[5], Ledoux JB[5], López-Sanz A[5], Montero-Serra I[3], Pagès M[3], Sarà A[4], Garrabou J[5,6]

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The coralligenous outcrops are slow-dynamic habitats exhibiting high structural complexity. If these valuable habitats are degraded, relatively long time is required to recover their structure and full functionality. In order to reduce recovery times restoration actions can focus on target habitat forming species and facilitation processes (i.e. positive species interactions), rarely considered to date, may be further explored to enhance the effectiveness of coralligenous restoration initiatives. Here we test if arborescent habitat-forming species, putatively modifying light penetration and/or water movement, can affect the survival and growth of co-occurring encrusting and massive ones. For that purpose, we designed an experiment using the red gorgonian *Paramuricea clavata* and bryozoans, important coralligenous animal builders, as model organisms. The experiment, replicated in Spain, Italy and Croatia, is based on the comparison between series of 0.25 m^2 experimental plots. Four experimental treatments are considered, including addition of bryozoan recruitment-enhancing devices (plastic grids) with and without gorgonian colonies and controls (empty and artefact ones) for a total of 4 replicates per treatment. 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 of bryozoan colonies onto grids within the experimental plots and enhance their survival and growth. Although our focus was primarily on bryozoans, we were additionally interested in the recruitment and succession of the entire early-stage sessile assemblage on experimentally set substrate inside and outside of the gorgonian forest. In this contribution we present and discuss our findings after 15 months of field experimentation..

WP3

Experimental techniques for the restoration of coralligenous assemblages. A focus on habitat forming species

Carlo Cerrano[1], Tatjana Bakran-Petricioli[2], Eliana Ferretti[4], Andrea Gari[5], Daniel Gomez-Gras[6], Andrea Gori[6], Bernat Hereu[5], Silvija Kipson[2], Martina Milanese[4], Jean-Baptiste Ledoux[6,7], Cristina Linares[5], Àngel López-Sanz[6], Paula López-Sendino[6], Ignasi Montero-Serra[5], Marta Pagès[5], Daniela Pica[1], Antonio Sarà[4], Fabrizio Torsani[1], Núria Viladrich[6], Joaquim Garrabou[6]

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The temperate coralligenous bioconcretions are mainly built by the accumulation of calcareous encrusting algae growing in dim light conditions. They harbour approximately 10% of marine Mediterranean species (about 1600 species), including long-lived algae and invertebrates. Enhanced by climate change, several pressures affect coralligenous assemblages, leading to recurrent mass mortalities and dramatic loss of habitat complexity and biodiversity. The EU-funded project MERCES is developing innovative methodologies to restore macroinvertebrate habitat-forming species from three key taxonomic groups: Cnidaria / Anthozoa, Porifera / Demospongiae and Bryozoa. The applied restoration methodologies have combined transplants from donor organisms using different techniques and recruitment-enhancing devices designed for habitat-forming species. Considering the life-history traits, population dynamics and population genetics of the selected species, restoration actions should be mainly based on transplants of small to medium size 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 to create functional reproductive units. The density within the transplant patches may be moderate to high in order to enhance the reproductive success and recruitment rates. Bearing in mind that survival of transplants is higher in species with slow growth rates such as those dwelling in the coralligenous than in more dynamic species, transplantation efforts in these assemblages will require a low initial effort but a long period for the fully recover of the habitat complexity, i.e. decades. We identified survival and growth of transplants and recruitment as the most suitable short-term indicators of the success of the restoration actions. Collaboration with volunteers (divers and diving operators) in several phases of field activities are being explored to cost-effective scaling up the restoration actions and to increase the sense of stewardship in a major users' segment.

Wednesday 22nd May 2019

WP4

Trophic structure surrounding wood and kelp falls in deep Norwegian fjords

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Norway's extensive kelp forests have recently been subject to a resurgence in mechanised harvesting, which is likely to reduce transport of this material to deep-sea fjords. In contrast, the density of boreal forest in Norway is increasing due to reforestation programmes and land clearance bans, inevitably leading to greater transport of wood and other organic forest detritus into fjord systems. The influx of terrestrial organic detritus and kelp-derived organic material to the seafloor is known to increase localised stocks of organic carbon, generate chemosynthetic conditions, and lead to the propagation of chemosynthetic C through the food-web. To investigate the food-web structure of fauna inhabiting and feeding on kelp and wood-falls and assess if terrestrial material can act as a substitute for declining kelp-derived organic matter, we sampled fauna from wood and kelp falls deployed on benthic landers for 10 months at 550m depth in Osterfjorden, Norway. ∂13C and ∂15N stable isotope analysis was used to investigate the trophic relationships between the animals found on each type of substrate, and this data will be presented. We also hope to showcase biodiversity data which is still in progress at the time of writing.

WP4

Towards a restoration approach in the deep sea: ecological and molecular approaches of a disturbance experiment in the Lucky Strike hydrothermal vent field

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Deep ocean hydrothermal vent ecosystems face physical disturbances from natural tectonic activities and are at increasing risk of mineral resource exploitation, raising concerns about the resilience of endemic biological communities. Following destructive events, efficient and rapidly applicable surveys of organisms are required to monitor a possible return of communities to baseline status. In the present study, we tracked the passive recolonization of benthic metazoan communities living on the Montségur edifice within the Lucky Strike vent field (Mid-Atlantic Ridge), after an induced disturbance. A quantitative description (composition, diversity and density) of macrofaunal assemblages associated to mussel beds of the engineer species *Bathymodiolus azoricus* have been carried out using 2 different approaches. On one hand, faunal samples, collected before the induced disturbance, have been sorted and organisms identified morphologically under stereomicroscope giving an idea of the macrofaunal diversity on the Montségur edifice. In addition, DNA extraction have been performed on these associated species to generate a DNA barcoding inventory, based on some targeted genes. On the other hand, sediment samples were collected during the disturbance and one year later, for environmental DNA (eDNA) screening using metabarcoding of four genetic markers, including mitochondrial gene Cytochrome Oxidase I (COI) and nuclear 18S ribosomal RNA, V1V2 region (18S-V1V2). Evaluation of the environmental datasets allowed us to examine the influence of time, predator presence and habitat types (active vent, periphery and inactive) on community recolonization efforts. In total, 42 taxa belonging to 33 family and 9 phyla have been identified morphologically in the baseline samples. Faunal assemblages are characterized by high densities of organisms that can reach more than 400 ind/dm² and exhibit the same pattern of dominance with *Bathymodiolus azoricus, Branchipolynoe seepensis, Amphisamytha lutzi, Lepetodrilus atlanticus and Protolira valvatoides* dominating all samples. DNA assignation with COI dataset produced 560 OTUs and the 18S-V1V2 dataset produced 414 OTUs, which included most of the common species found in the Lucky Strike vent field. Baseline DNA data collected at the start of the experiment identified higher species richness at sites peripheric to the active edifice, as well as inactive sites farther off. Taxonomic compositions of biological communities were found to be dissimilar among the habitats in relation to differing environmental conditions. One year following the initial disturbance, analysis of recolonization data found no statistical difference from baseline communities, nor communities with or without the cages used to limit predator access. Our technical protocols provide a reproducible and sensitive strategy for improved understanding of the biotic and abiotic variables influencing benthic habitat restoration at Lucky Strike. Continued monitoring of these sites is currently ongoing,

with the purpose of informing conservation and management decisions relating to the protection of hydrothermal vent ecosystems..

WP4

Resilience of the Palinuro Seamount ecosystem after mechanical disturbance

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In the last decade, the rock-drilling and dredging activities on the top of the Palinuro seamount (Tyrrhenian Sea – Mediterranean Sea), related to the presence of mineral deposits, severely affected the benthic ecosystem functioning and biota due to the substrate removal and re-deposition along with habitat modification. The Palinuro seamount can represent a case study to investigate the effect of unassisted restoration (i.e., natural regeneration) on benthic ecosystem after the end of the disturbance comparing impacted vs. un-impacted sites. We investigated impacted vs un-impacted sites after 7 and 10 years from the end to disturbance to follow the progress of the resilience of benthic fauna inhabiting the Palinuro seamount. Our results suggest that A recovery in term of number of meio/macrofaunal taxa and species richness is also observed; However major differences between impacted and control areas remain in terms of assemblages composition and temporal variability might influence the potential recovery of different attributes of the ecosystem. The results obtained in this study can provide the first insights on the potential and progress of the unassisted ecological restoration on benthic ecosystem affected by deep-sea mining.

WP4

Natural regeneration of seamount fauna and colonization of artificial substrates in the Azores

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Natural regeneration is a process of ecosystem recovery after degradation without significant anthropogenic interference. This activity is mostly applicable in areas where degradation isn't extensive and where there are sufficient numbers of target species that can rebuild the ecosystem composition, structure and functions. Natural regeneration processes in the deep sea are not well understood but are expected to be extremely slow since most deep-sea organisms are slow growing, have low recruitment rates and are long-lived. Here, we evaluated the recovery and colonization capacity of deep-sea fauna in the Azores using the recently implemented Condor marine protected area and a 40 years old underwater telecommunications cable as case studies. The Condor seamount has been closed for demersal fisheries since 2010. The recovery capacity (natural regeneration) of deep-sea benthic and fish species was analysed by comparing densities and abundances of selected species evaluated through video imagery before (in 2010) and 6 years after the fisheries closure (2016). The colonization was analysed by identified, counting and, when possible, measuring cold-water coral species attached to the underwater telecommunications cable that was laid down on the Atlantic seabed for over 40 years. This information will help improving our understanding of natural regeneration processes in the deep sea and can inform future work in planning restoration activities in the deep sea and prolonging monitoring programs of existing protected areas.

WP4

Restoration of cold-water gardens on the Mediterranean continental shelf: The Cap de Creus case study

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Gorgonians are among the most frequent by-catch taxa on the Mediterranean continental shelf. These species have traits, such as long lifespans and slow growth, that make them highly vulnerable to the impacts caused by fishing activities, which can have far-reaching and long-lasting effects for these highly biodiverse communities. Hence, restoration and mitigation actions are crucial to enhance and speed up the natural recovery of impacted populations. Based on the demonstrated capability of by-catch gorgonians to survive after their transplantation back into their natural environment, we explored the possibility to scale up restoration actions at deep environments through the search of a large-scale and cost-effective restoration method. This method called "badminton method" consisted in gently throwing gorgonian transplants directly from the sea surface. First, the best substrate type and gorgonian size were evaluated to maximize the correct landing of the transplants and their subsequent maintenance in upward position. Subsequently, this method was applied during an entire fishing season in the marine area of Cap de Creus, where 450 by-catch gorgonians were recovered and returned to the continental shelf (80–100 m depth). Few months later, an Autonomous Underwater Vehicle (AUV) survey showed that the majority of the transplants remained upward and survived. The success of this method highlights the feasibility of large-scale and cost-effective restoration actions with promising results for the conservation and recovery of mesophotic and cold-water coral gardens.

WP4

Feasibility of cold-water corals transplantation techniques for the 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 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. During MERCES we performed two pilot studies: (1) one study testing the feasibility of transplanting the gorgonian Dentomuricea meteor, a common species in coral gardens in the Azores, after the simulated impacts of deep-sea mining and fishing; (2) a second study testing the feasibility of transplanting multiple species of cold-water corals accidentally caught during hook-and-line fisheries operations. In the first pilot study, fragments of D. meteor were collected with an ROV, maintained in the lab, and transplanted to the summit of Condor seamount using landers in July 2016. 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. Transplanted corals were intoxicated with cooper (the main trace metal present in polymetallic sulphide sediment plumes resulting from mining), injured with superficial scratches (to mimic fisheries impact), and with both impacts. The survival, growth rates, reproductive output and physiological fitness of coral fragments under these different conditions were assessed 8 months and 1 year after coral deployment. For the second pilot study we transplanted five gorgonian species to the Condor Seamount. This work resulted from a close collaboration with local fisherman and fisheries observers who brought cold-water corals accidentally caught as bycatch during their hook-and-line fisheries operations. Corals were maintained at the Deep-Sea Lab aquaria facilities and deployed at Condor using landers in October 2017. Landers were subsequently visited using a manned submersible 10 months after deployment to assess survival and growth rates of the different species. 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.

WP5

MERCES WP 5 – how are we translating data from 130+ restoration sites to inform policy-makers and practitioners?

Hazel Thornton[1], Chris McOwen[1], Trine Bekkby[2], Rachael Scrimgeour[1], Osgur McDermott-Long[1], Holly Brooks[1], Marta Coll[3] & Sabine Horn[4]

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Overview of oral presentation content:

- Introductory overview of WP 5 – aims, deliverables, partners and timeframes
- Overview of the data collected from over 130 restoration sites in 12 countries
- Opportunity for discussion about data collection and presentation
- Findings from the WP 5 literature review into marine and coastal ecosystem restoration, including changes in ecosystem services, indicators of success
- Next steps: What we be doing over the next 12 months, including:
    - Deliverable 5.1 (M40, Sept 2019) – Spatial maps showing variation in the recovery potential of different ecosystem services for case studies, and metadata on changes in ecosystem services provision following habitat restoration
    - Deliverable 5.3 (M47, April 2020) - Policy briefing summarizing the key transferable findings from WP 5

- Q and A with MERCES project partners

WP5

Determination of ecological effects of restoration using dynamic food web modelling

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One of the major aims of WP5 is to assess the restoration efficiency of the target sites and to understand the influence of restoration on whole ecosystems. Holistic approaches such as food web models and ecological networks have become useful tools to study the complex interactions within an ecosystem and its reactions to changes in external stressors (de la Vega et al., 2018; Heymans et al. 2016). Three case studies applying food web modelling methodologies are being developed under WP5, following a latitudinal gradient and targeting different habitat-forming species: Coastal areas of the NW Mediterranean Sea: This region hosts a rich marine biodiversity and many coastal areas that encompass a variety of habitats, including habitat-forming species such as seagrass meadows and coralligenous habitats. Several small marine protected areas are in place to protect such habitat mosaic. We are developing a modelling approach using network and Ecopath with Ecosim (EwE) to study three coastal Mediterranean MPAs and surrounding areas (Cerbere-Banyuls, Cap de Creus and Medes Islands). The models represent integrated spatial information about habitats, including key habitat-forming species. The scenario models will be used to assess the effects of management and climate change on benthic habitats including potential restoration success. Seagrass meadows in the Wadden Sea: In contrast to the global trend, seagrass beds in the northern Wadden Sea have been increasing in extent and density presumably due to a decrease of anthropogenic pressures (Dolch et al., 2017). Therefore, the area is an ideal study site to determine the effect of large-scale seagrass recovery in the long-run using monitoring data of the seagrass bed extension and development. We use the dynamic EwE modelling approach to study the effect of seagrass recovery on food web level. The aim is to assess the influence of increasing seagrass beds on the different components of the Wadden Sea ecosystem and to investigate if the recovery of seagrass induces changes in the system's structure and functioning. Deep-sea Arctic Norway: Deep-sea ecosystems host important amounts of marine biodiversity but are poorly known (Ramirez-Llodra et al. 2011). We are studying a deep-sea ecosystem in the Arctic Norway, at depths of 300 to 450 metres and located at the Malangen fjord, 30 km southwest of Tromsø. The model considers the dynamics of the water column and is the first attempt to model a deep-sea ecosystem with special emphasis on its kelp detritus imports coming from coastal adjacent ecosystems. The model has allowed us to quantify the major structural and functional traits of the Arctic deep ecosystem associated with kelp exports and assess the ecological role of kelp export in this system. We plan to develop scenarios of habitat-forming species recovery and climate change to evaluate potential impacts to

ecosystem services in deep-sea ecosystems linked to coastal areas and habitat-forming species dynamics.

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WP5

Presenting the model framework for assessing the recovery potential for different habitats and ecosystem service restoration success and the plan for a webinar on new restoration methods and best practices (MERCES WP 5)

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Case study specific information on habitat features/characteristics, pressures, restoration methods, the level of recovery success and the ecosystem services provided by the habitats will be integrated together with GIS layers on contextual information. Based on these data we will analyse which factors determine ecosystem change and the level of recovery success. We will investigate the range of ecosystem services provided by different habitats when they are intact and compare that to the range of ecosystem services delivered by degraded ecosystems influenced by different combinations of pressures typically found in the EU. Methodology will be developed for linking ecosystem service change and the recovery success. The plan for a webinar on new restoration methods and best practices will be presented.

WP9

Dissemination, communication and public engagement in MERCES

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In the overview of dissemination, communication and public engagement activities conducted in MERCES (in the framework of Work package 9), the results of the applied outreach strategy will be presented. The activities conduced in all tasks will be described in details, comprising the produced materials available for the whole consortium and the cross-cut activities carried out with other Work packages. A specific focus will be dedicated to the network build up in the last year with other ongoing projects and initiatives. The future activities, already planned and foreseen for the last year of MERCES, will be also presented. An open discussion is also foreseen, in order to collect feedback from the partners on previous actions as well as new inputs, ideas and suggestions for the incoming ones.

Thursday 23rd May 2019

WP8

MERCES WP8 - Putting Industry at the Heart of the Marine Ecosystem Agenda

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In supporting Blue Growth in Europe the MERCES project has formed the MERCES Business Club. The Business Club provides a meeting place for companies in Europe to find out about the latest research in marine ecosystem restoration and to showcase their latest innovations. In developing the Business Club it is clear that the new 'industry' of marine ecosystem restoration is of greatest interest to the many different knowledge-based, environmental consultancy SMEs around Europe. With the development of the MERCES website, newsletters, Business Club case studies and webinars it is now possible to demonstrate to industry the new business opportunities in marine ecosystem restoration. In seeking to promote greater commerce and job growth for European companies and the MERCES partnership WP8 has contacted all the nominated representatives of the United Nations Environment Programme (UNEP), working with them to disseminate information on the value of marine ecosystems and the benefits of enhancing ecosystem services through marine ecosystem restoration, including carbon sequestration, tourism, flood protection and inshore fisheries. This strategy proved successful with participants from Tanzania, Japan, Philippines, Nigeria, St Lucia, Kenya, Canada, Madagascar, Costa Rica and Mauritania attending the MERCES webinar on 'Private Finance in Marine Ecosystem Restoration' in September 2018. Participants from Fiji, Mexico, Ghana, Timor-Leste, Brazil, USA and Australia registered for the seminar and but were unable to attend. They were sent the link to the archived webinar. A similar strategy will be used to stimulate attendance at the next webinar which it is hoped will be on the value of carbon sequestration in mangrove forests, seagrass meadows and salt marshes, and their possible importance for carbon trading. In the meantime a new business focussed newsletter has been produced including an article following up on the last MERCES webinar describing a pioneering aquaculture venture that aims to turn ecologically destructive sea urchins into high valued seafood products, thereby allowing the kelp forests an opportunity to recover. During the WP8 session at the MERCES AGM we will discuss the themes of the upcoming webinars and engage with the MERCES partnership on how you can help in achieving the aims of WP8.

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List of posters

WP1

- **Grehan & Grehan** Shipwrecks acting as artificial reefs demonstrate the potential for cold-water coral restoration in Irish waters

WP2

- **Bengil et al.** Marine Habitat restoration: Cymodocea transplantation and cage experiment design
- **Gambi et al.** Impact of historical contamination on meiofaunal assemblages in the Bagnoli-Coroglio bay (Southern Tyrrhenian Sea)
- **Badalamenti et al.** Experimental transplantation of *Posidonia oceanica* rhizomes and seedlings using hard substrates aimed at meadow restoration

WP4

- **Da Ros et al.** Trophic requirements and feeding rates of Mediterranean Cold-Water Corals

WP5

- **Vilas et al.** Plausible futures of an artic deep-sea ecosystem connected to coastal kelp forests

Poster abstracts

WP1

Shipwrecks acting as artificial reefs demonstrate the potential for cold-water coral restoration in Irish waters

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Over 4000 shipwrecks have been located off the coast of Ireland by the Irish national seafloor multibeam mapping programme Infomar. We were interested in examining shallow shipwrecks to look for colonies of *Lophelia pertusa*, the reef forming cold-water coral that is usually found in depths below 500 metres in Irish waters. We identified two candidate World War 1 wrecks lying in around 160 m depth off the west coast of Kerry. In January this year, we surveyed these two wrecks using a University of Limerick Remotely Operated Vehicle. One of the wrecks was indeed colonised by *Lophelia pertusa* with one large colony visible hanging from the apex of two sundered hull plates that formed a type of shelter protecting the colony from fishing impacts while still ensuring a plentiful food supply. This demonstrates that *Lophelia* can survive in much shallower waters in Ireland than was previously thought with implications for the design and management of marine protected areas and habitat restoration. The wrecks, as well as providing refugia, may act as 'stepping stones' promoting species colonisation and re-colonisation of impacted areas. This in turn may contribute to improved species' resilience to human impacts and climate change by increasing population connectivity. With an estimated 18000 shipwrecks in Irish waters, they likely contribute to the 'ocean sprawl' of anthropogenic structures described by Henry et al. (2018) in relation to oil and gas infrastructure.

Reference

Henry et al. (2018) Ocean sprawl facilitates dispersal and connectivity of protected species, Scientific Reports (2018) 8:11346.

WP2

Marine Habitat restoration: Cymodocea transplantation and cage experiment design

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Turkish coasts are particularly under pressure from the Red Sea invasive marine organisms. The pressures cause significant damage to marine habitats and in some cases, habitat lost. The aim of the experiment is to try a different restoration method, cages, on damaged seagrasses to determine the suitable method both on regional and species basis. Especially, pressure by species migrated from Red Sea and human activities have severely damaged seagrass *P. oceanica* and bring to the brink of extinction in some areas throughout the coasts of Aegean and Mediterranean Sea of Turkey. In scope of MERCES project WP2, to test prevention abilities against negative factors cage frames made by PVC pipes covered with plastic mesh, were placed in different depths as experimental stations and next to these PVC frames were placed without coverage. Stations were setup 1 in Foca Special Environmental Protection Area and 3 in Gokova No Fishing Zone each with 3 replicates. Data on growth, spreading, grazing ratio etc. is being collected.

Keywords: Restoration, transplantation, Posidonia oceanica, MPAs, MERCES

WP2

Impact of historical contamination on meiofaunal assemblages in the Bagnoli-Coroglio bay (Southern Tyrrhenian Sea)

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Sediments are probably the major source of contamination for benthic organisms and therefore have been historically investigated to assess the effects of heavy metals and hydrocarbons on benthic ecosystems. One of the major problems associated with heavy metals contamination is their persistence in the environment: unlike organic pollutants they do not decay, thus proving that they have a high potential for bioaccumulation and biomagnification along the benthic food web. The use of meiofauna in biomonitoring studies gives many advantages over macroinvertebrates due to their high abundance and diversity, small size, short life cycles, rapid development, limited mobility, absence of pelagic life stages and the presence of both tolerant and sensitive species. The coastal areas of Bagnoli-Coroglio (western coastal area of Naples, Tyrrhenian Sea) represents a typical example of a heavy metals historically-contaminated site, along with hydrocarbon pollution possibly due to the tankers and vessels operating in the bay during industrial activities ended in 1990. Here we present the first results of an extensive investigation carried out to test the null hypothesis by which benthic fauna do not vary with the increasing distance from the source of contamination after ca 30 years from the end of the industrial activities. These data represent the baseline to assess the historical impact and to plan restoration activities to promote the resilience of benthic ecosystem.

WP2

Experimental transplantation of *Posidonia oceanica* rhizomes and seedlings using hard substrates aimed at meadow restoration

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In the Bagnoli area (Naples, Tyrrhenian Sea) industrial activities and long-term discharge of contaminants led to the disappearance of the *Posidonia oceanica* meadow once thriving in the bay and to its replacement by non-vegetated sandy and muddy bottoms. A growing body of literature highlights that successful setting and recruiting of *P. oceanica* vegetative and sexual propagules need firm substrates displaying levels of topological complexity that match the size of the propagules. Following these evidences, in the framework of the environmental restoration of Bagnoli-Coroglio area, we pointed at restore the features of the habitat in which *P. oceanica* is naturally able to achieve spontaneous recovery. potential. The proper settlement for *P. oceanica* restoration was created placing two group of rocky mattresses of 6 m2 surface at 15 m depth. The mattresses were made of cages of metallic grids filled with rocks of selected size inside which seagrass vegetative fragments were inserted and fixed using wire-net pockets. Mattresses grant a stable basement for propagule settlement, while crevices between rocks offer shelter from hydrodynamic disturbance and allow rhizomes and roots to grow inside the assembled rocks reaching firm anchorage to the substrate. Moreover new born plantlets were indoor reared from seeds on rocky supports specifically designed. Adhesive properties of *P. oceanica* seedling roots allowed the young plantlets to achieve strong anchorage to the supports without the use of additional anchoring devices. Six-month old plantlets attached to their supports were transferred inside the mattresses and placed between the rocks. The effect of propagule type (sexual, vegetative and mixture of both) and of vegetative propagule planting density on transplantation success are being tested. After four months the mean percent survival of vegetative fragments reached 97.22±1.05 (mean±1SE), and the mean percent seedling survival was 83.33±5.79.

WP4

Trophic requirements and feeding rates of Mediterranean Cold-Water Corals

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Cold-water coral (CWC) ecosystems are hot spots of biodiversity and require special efforts of protection in the light of the increasing human pressure and global climate change. However, protection alone can be insufficient to reverse pervasive habitat degradation in the deep sea and restoration actions are urgently needed. Restoration of degraded deep-sea coral reefs can be based on transplantation of nubbins of CWCs, following their maintenance in appropriate laboratory conditions. In the present study, food preferences of CWCs were investigated to establish the optimum feeding conditions to rear CWCs in captivity. To do so, colonies of *Desmophyllum pertusum*, *Madrepora oculata* and *Dendrophyllia cornigera* collected during different oceanographic campaigns were nourished in aquaria with 4 different food sources: nauplii of *Artemia salina*, the green algae Tetraselmis, two species of rotifers (*Brachionus plicatilis* and *B. rotundiformis*) and frozen mysids of genus Mysis sp. A comparable total biomass from each food source was provided two times a week for *D. pertusum* and *M. oculata* and three times a week to *D. cornigera*. Our results revealed that Mysis followed by living Artemia were the preferred food items for all the coral species investigated. Further, the maintenance of controlled environmental conditions and the provisioning of Mysis also during the transportation seemed to be essential factors for maintaining deep-sea corals in captivity.

WP5

Plausible futures of an artic deep-sea ecosystem connected to coastal kelp forests

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The flow of non-living carbon (detritus) is considered an important process because it connects ecosystems and fuels benthic communities. In Norwegian kelp forests, 90% of the kelp production is exported to adjacent ecosystems where it can play a significant role in shaping benthic communities. In this study, we assessed the trophic and non-trophic ecological role of kelp detritus export into an Arctic deep-sea ecosystem. First, we developed a food-web Ecopath model using the Ecopath with Ecosim (EwE) approach to represent the state of the deep-sea (450 m) ecosystem of the Malangen fjord (Northern Norway) in 2017. Subsequently, we used the temporal dynamic Ecosim model to evaluate the potential impacts of kelp detritus change in the deep-sea ecosystem and to explore future scenarios for major drivers of the ecosystem, mainly a change in kelp POM production but also including a king crab invasion, changes in fishing, sea warming, and a cumulative effect scenario. Overall, our findings revealed that the temporal future simulations projecting a decrease of kelp detritus biomass reaching the deep-sea ecosystem would have important impacts that would be different depending on the consideration of non-trophic effects of Kelp detritus (e.g. habitat structure). The non-trophic effects allow capturing how the presence of kelp detritus influences trophic interactions between two other groups due to mediation or facilitation. When mediating effects were applied, simulations showed important changes on the biomass of some functional groups when kelp detritus declined: biomass increased for benthopelagic shrimps and suprabenthos groups and decreased for rays and skates, velvet belly, rabbitfish, and other commercial demersal fishes under low kelp detritus scenarios. Ecological indicators and biomass trends of several functional groups revealed noticeable impact on the deep-sea ecosystem structure under future scenarios. These results illustrate the important role that kelp communities have on deep-sea ecosystems, especially due to providing non-trophic ecosystem services to the

deep sea and call for further research in this field. Also, results highlighted the importance of including additional such as fisheries, climate change and biological invasions, in an ecosystem-based management context.

Keywords: Kelp community, Kelp detritus, Arctic ecosystem, ecosystem structure, mediation effects, Artic Norway, Ecopath with Ecosim, Future simulations

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WP1: European marine habitats, degradation and restoration

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WP2: Restoration of marine, shallow soft bottoms habitats

Christoffer Boström (Åbo Akademi University) & ***Johan van de Koppel*** (Royal Netherlands Institute for Sea Research)

WP3: Restoration of coastal shallow hard bottoms and mesophotic habitats

Joaquim Garrabou (Agencia Estatal Consejo Superior de Investigaciones Científicas) & ***Simonetta Fraschetti*** (CoNISMa)

WP4: Restoration of deep-sea habitats

Telmo Morato (Instituto do Mar Centro da Universidade dos Açores) **&** ***Andrew K. Sweetman*** (Heriot-Watt University)

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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