D8.3: Recording and long-term archiving of 5 industry-focused webinars and final report on the outcomes of the webinar series

Marine Ecosystem Restoration in Changing European Seas MERCES

Grant agreement n. 689518

COORDINATOR: UNIVPM

LEAD BENEFICIARY: 17 - NIVA

AUTHORS: David Billett (DSES), Eva Ramirez-Llodra (NIVA), Martina Milanese (GAIA), Cristina Gambi (UNIVPM), Johan van der Koppel (NIOZ), Rolf Groeneveld (WU), Wenting Chen (NIVA), Cristina Linares (UB), Joaquim Garrabou (CSIC), Marina Carreiro Silva (IMAR-UAz), Andrew Gates (NOC)

SUBMISSION DATE: 31/03/2020

DISSEMINATION LEVEL

PU	Public	X

INDEX

Long-term archiving of webinars on YouTube and views as at March 2020

Webinar 1 – https://www.youtube.com/watch?v=5r0vO2ww5pA (263 views)

Webinar 2 – https://www.youtube.com/watch?v=wmF5cRbQvdc (169 views)

Webinar 3 – https://www.youtube.com/watch?v=Opl9-U6i1Xw&t=25s (220 views)

Webinar 4 – https://www.youtube.com/watch?v=WakLhV9dgd8 (155 views)

Webinar 5 – https://www.youtube.com/watch?v=sWlczFrNoqY (82 views)

1. Summary

Webinars provide a cost effective and time saving method for communicating with European businesses, especially SMEs. Many businesses do not have the budget or the time for extensive travelling to short meetings and conferences to gather intelligence to develop their work and products. Webinars allow the latest approaches to be aired and to influence business and policy directions. At the same time, webinars contribute to reducing the carbon footprint of research, and the MERCES project in particular, by considerably decreasing travel needs for such small meetings. The webinars helped reduced the carbon footprint of MERCES without impacting on its communication and dissemination potential. The greater use of webinars in European projects in the future should be encouraged.

The webinars were organised to address hot topics in marine ecosystem restoration and to appeal to businesses, policy makers and scientists. Consequently the webinar series opened with '*Getting Better Value from Our Coasts*' by taking full account of all values, including ecosystem services, in coastal zone management. A particular issue was identified of how the increasing need for projects in marine ecosystem restoration were to be funded, especially as local authorities had so many demands on their finances, so a particular focus was made on '*Private Finance in Marine Ecosystem Restoration*'. The coastal zone is not the only region of European seas in need of ecosystem restoration measures. In deeper waters there are pressing need to address the health of ecosystems especially in relation to fishing activities, the decommissioning of North Sea oil rigs and pipelines and, increasingly, in relation to deep-sea mining. The webinar on '*Ecosystem Restoration in Deeper Waters*' addressed these topics. The webinar series then returned to issues in making convincing cases for marine ecosystem restoration, notably for salt marshes, seagrass meadows and mangrove forests, in '*Building a Business Case for Marine Ecosystem Restoration*'. The final MERCES webinar addressed the issue of scale in ecosystem restoration, as required in the original call for projects by the European Commission, in '*Moving to Industrial-Scale Coral Habitat Restoration*'.

2. Approach

The MERCES Project faced a challenge at its inception as to how to develop Blue Growth in a topic, which, at the time, was only just starting and only in a few countries. The challenge was to broaden the knowledge and uptake of marine ecosystem restoration, a practice more common in terrestrial environments, to develop possible markets globally and to showcase European businesses with services in the management of the marine environment.

It was imperative for MERCES to put the greatest emphasis, and therefore funding, on developing new large-scale methods for habitat restoration and to demonstrate these with actual field studies across a wide variety of ecosystems. The resources available from the MERCES project for engaging with businesses and developing new Blue Growth opportunities, therefore, was necessarily limited. The project, therefore, decided to focus on electronic means of communication to allow as the greatest engagement with businesses, policy makers, local municipal authority decision takers and scientists across all European countries, and globally, while keeping costs low. A first step was to identify business sectors which might benefit from

greater knowledge of marine ecosystem restoration and especially companies that could develop knowledge-based services in marine ecosystem management, mainly SME environmental consultancies. A Business Club was formed to act as the main source of information (MERCES Deliverable D8.1) on business interests and real-world needs. As a first step, a variety of business developments were highlighted in the annual business focussed newsletters (MERCES Deliverable 8.2). These developments were then featured on the MERCES web pages as best practice for a variety of environmental settings. A particular focus was given to the value of ecosystem services and how investing in marine ecosystem restoration might generate better outcomes in the coastal zone and deep waters. The final step was to host a series of webinars for a global audience in order to spread knowledge in Europe and develop new opportunities in Europe and abroad, especially in developing countries.

The webinars were held in association with the Marine Ecosystem Services Partnership (MESP), which had been hosting a series of successful webinars from Duke University, USA, but which also had links to GRID Arendal in Norway. GRID Arendal possessed the necessary ZOOM software and licence to host webinars and had a professional scientific and technical support team for webinar activities. GRID-Arendal is a Norwegian foundation working closely with the United Nations Environment Programme. Its mission is to create environmental knowledge that encourages positive change through science-based information products and innovative communication. MERCES worked closely with Tanya Bryan (Programme Leader Ecosystems, Economies and Sustainable Development) and Rob Barnes (Digital Communications Expert) at GRID Arendal to deliver the webinars. We are very grateful for their professional support.

The webinar work plan aimed to hold 5 webinars during the second half of the 4-year period of the MERCES project. The aim was to focus on hot topics evident in the different work packages in MERCES (WPs 2, 3, 4, 5 and 7) possibly with a synthesis of results generated by MERCES in the final webinar. In the event, it was decided to focus the final webinar on 1) the scale of ecosystem restoration (as originally called for in the European Commission's original workplan) and 2) field studies in MERCES on shallow- and deep-water coral habitats. Topics for the webinars were selected to appeal to a broad audience, to cover the habitats being addressed by the MERCES project and to address major business areas requiring marine ecosystem restoration. Where possible, one speaker was selected from the MERCES Business Club community and one from the MERCES project partnership. The webinar series also aimed to achieve gender balance in the presenters.

The webinars were organised by Eva Ramirez-Llodra (NIVA, MERCES Partner 17) and David Billett (DSES, MERCES Partner 22). Each webinar started with a brief description of the MERCES Project and the aims of the MERCES Business Club. The funding from the European Commission for the MERCES webinar series was acknowledged on the title page for each webinar.

Experience from previous MESP webinars hosted by GRID Arendal had shown that a one-hour webinar with two talks of 20 minutes each and 20-minutes for discussion worked well.

Webinars were held approximately every 5 months. This seemed to be appropriate timing for engaging speakers, finding alternates where necessary, publicising and holding the webinar,

advertising the archived webinar and writing a report. While every effort was made to stick to the original plan, some small changes in the timing of the webinars had to be made to take into account summer and Christmas holiday periods as well as speakers' availability. The fourth webinar was delayed further by a late change in one of the speakers and had a knock-on effect on the timing of the fifth webinar.

The webinars were all held at 15.00 ECT in order to allow participants in Europe, as well as South America, the Caribbean and the east coast of North America to attend, as well as not being too late for those in the Middle East and Africa to participate. In addition to the ZOOM transmission all webinars were live streamed in YouTube. The webinars were then archived on YouTube and made available on-line within 1 week of the event (see the Index page above with the number of hits for each webinar made on YouTube). The links to the archived webinars were sent to all registrants for that webinar. The links were also included in all subsequent webinar notifications. To give the webinars greater visibility they were all archived in the Society of Ecological Restoration (SER) Restoration Resource Centre, where they made a distinct and unique contribution to the SER collection of knowledge which, otherwise, related at that time almost exclusively to terrestrial ecosystem restoration.

The ZOOM software worked well and allowed a record to be made of those registering for the webinar, the names of registrants who attended and how long they remained online. A practice session was held with the two speakers and with GRID Arendal in advance of the official webinar in order to iron out any potential problems, and to make sure the systems used remotely by the speakers were functioning correctly. All questions posed during and after the webinar presentations were recorded, and if it was not possible to answer all questions during the webinar, the questions were replied to later and, in two cases, published online on the MERCES web pages.

The webinars were advertised through contacts made by the MERCES Business Club, MERCES partnership, GRID Arendal, the Commonwealth Secretariat, London, the Marine Research Information Network on Biodiversity, the EuroMarine Network, the EurOceans network, the United Nations Environment Programme (UNEP), the International Network for scientific investigation of DEEP-sea ecosystems (INDEEP), the Deep Ocean Stewardship Initiative (DOSI), the International Seabed Authority, the International Oil and Gas Producers, the Blue Carbon Initiative, seagrass networks, the 'Restoring Estuarine and Coastal Habitats (REACH)' network, previous MERCES webinars and various coastal management networks in the USA. Working closely with WP9 the webinars were also promoted to the general public through Twitter and Facebook. WP9 also ensured the webinar series was given particular prominence on the MERCES website with direct links to the archived webinars.

This MERCES approach is similar to another successful webinar series organised by the Ecosystem-Based Management (EBM) Tools Network in the USA (http://www.ebmtools.org).

Where possible MERCES only used speakers the organising team had heard making presentations at meetings in order to ensure the quality of the speakers, both in terms of the talk content and the speakers' presentation skills. As a further guarantee of the quality of the presentations a practice session was organised a couple of days before the transmission of the

webinar to check the connections to the speakers, the lighting and office appearance of each speaker and the sound quality. Each speaker was requested to run through their slides briefly, especially to check that any animations and videos presented worked efficiently, and that the talks would not over-run in time. Strict control was made on the length of the presentations to 20 minutes in order to allow sufficient time at the end of the webinar for discussions. The practice also helped to introduce the speakers to each other and to the webinar team.

MERCES webinar 1 - "Getting Better Value from Our Coasts"

The first MERCES webinar "Getting Better Value from Our Coasts" took place on 15 February 2018 (https://news.grida.no/getting-better-value-from-our-coasts). The webinar focussed on issues in MERCES Work Packages 2 and 5. The webinar started with a brief introduction of the MERCES project and the MERCES Business Club, followed by the 2 main presentations. The webinar lasted 1 hour.

There were two talks:

1) **Dr Scott Cole, EnviroEconomics Sweden Consultancy** on "*Valuing Multiple Eelgrass Ecosystem Services*"

2) **Dr Johan van de Koppel, Royal Netherlands Institute for Sea Research (NIOZ)** on "*Using 3D Computer graphics to convey restoration goals to decision makers and the general public*".

EnviroEconomics Sweden is a member of the MERCES Business Club and Prof van der Koppel leads MERCES WP2.

Scott Cole highlighted that 60% of eelgrass in NW Sweden has been lost since the 1980s (up to 15,000 hectares). Dr Cole addressed how we can quantify what has been lost noting that failure to value Nature can become costly. He quoted Pavan Sukdev "We use Nature because she is valuable, we lose Nature because she is free". There is a need to put a price on Nature and consider what it really costs when we lose it. Taking seagrass meadows as a test case Dr Cole described the various ecosystem functions found in eelgrass beds, the ecosystem services these functions underpin, who benefits from these services, how converting the benefits to monetary values allows an assessment to be made of what is lost from our pockets per hectare of meadow and, as a corollary, what might be gained through ecosystem restoration.

Eelgrass meadows have a number of key ecosystem functions: primary production, secondary production for benthic organisms and fish, contaminant filtration, sediment trapping, oxygen production, nutrient regulation, wave and current damping, seed production and habitat for unique self-sustaining assemblages. These translate into a number of ecosystem services, such as support of shellfish and fish populations, climate mitigation through carbon sequestration, contaminant regulation, eutrophication mitigation, erosion control, protection against storm surges and flooding, providing recreational amenities, enhancing biodiversity and as an education and scientific research resource. From the ecosystem services arise a number of benefits such as food (fish, shellfish) recreational swimming, sports fishing, protection of property and farmland, cosmetic products, improving physical and mental health and ecological knowledge. A wide variety of people benefit from conserving and restoring eelgrass beds including fishers, sports fishers, seafood consumers, local populations through recreation and income from tourism, land owners, house owners, and non-direct users through global reductions in carbon and just knowing that a healthy environment is achievable.

Dr Cole described how monetary values can be applied to very different types of ecosystem services, such as the direct market value of fish and the biomass of fish lost when a hectare of eelgrass is removed, the value of carbon sequestered by, and without, seagrass meadows, and the

cost of replacing the functions of eelgrass beds such as building a water treatment plant or creating an artificial wetland. The bottom line, calculated from just three of the major ecosystem services was c. $17,500 per hectare of eelgrass meadow on average over a 50-year period.

Dr Cole noted that some valuation methods are better than others and that the limitations of some methods need to be taken into account because they may underestimate the true value of an ecosystem service. He also pointed out that not all seagrass meadows are created equal and some have higher values. The bottom line calculated above is 'on average'. While there are different opinions as to whether Nature should be valued in this way it risks people making the assumption that degradation of the environment is 'free'.

Further information on how multiple ecosystem services provided by eelgrass meadows was calculated is available in an open access article "Valuing multiple eelgrass ecosystem services in Sweden: Fish production and uptake of carbon and nitrogen" by Cole and Moksnes (2016) in Frontiers in Marine Science.

https://www.frontiersin.org/articles/10.3389/fmars.2015.00121/full.

Johan van de Koppel described how it is often difficult for policy makers and the general public to visualise how restoration actions will improve the environment. This is particularly important when local communities have to be engaged to gain support for ecosystem restoration measures, such as converting farmland into intertidal areas to reap the benefits of a wider suite of ecosystem services for the land. In addition, it is often difficult to visualise how the restored ecosystem will develop over decadal timescales.

By using a suite of combined ecosystem models and merging these with computer graphic technologies the improvement of ecosystem services through restoration can be made visible, tangible and even inspirational. A spin-out company from the Netherlands Institute for Sea Research, Mo4Com Visualisations, is developing the system and providing services to companies and Governments. Using models of plant biomass, sediment elevation, flow field and sand/sediment characteristics, a detailed model of the distribution of species and species combinations can be visualised at the scale of the landscape, or seascape, underwater.

The webinar was attended by 64 participants, 58+ on ZOOM and 8 on YouTube. An additional 28 people registered but were unable to attend on the day. All registrants were contacted after the webinar to guide them to the archived screening on YouTube. Participants attended from 18 European countries (Belgium, Bulgaria, Croatia, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Malta, Netherlands, Norway, Portugal, Romania, Sweden and the UK) and included 21 companies (in environmental consultancy, energy and coastal engineering). Eighteen participants were Government policy makers. One member of the European Commission attended.

New members from the UK Environment Agency, Seascape Consultants and ABPMer Consultants joined the MERCES Business Club following the webinar.

The webinar is archived at https://www.youtube.com/watch?v=5r0vO2ww5pA

MERCES webinar 2 - 'Private Finance in Marine Ecosystem Restoration'

The second MERCES webinar "Private Finance in Marine Ecosystem Restoration" took place on 25 September 2018 (https://news.grida.no/private-finance-in-marine-ecosystem-restoration). The webinar focussed on issues being considered in MERCES Work Packages 3 and 7.

The core of the webinar included two talks of 15 minutes each, followed by a discussion with the audience. The talks were by:

1) **Dr Rolf Groeneveld, Wageningen University (WU), Environmental Economics and Natural Resources Group** on '*Identifying private financing mechanisms for marine ecosystem restoration*'

2) **Dr Wenting Chen, Norwegian Institute for Water Research (NIVA)** on '*Private financing potentials for marine ecosystem restoration: a kelp-urchin case in Northern Norway'.*

Both speakers are members of the MERCES project.

Rolf Groeneveld noted that, traditionally, governments have been the dominant source of finance of ecosystem restoration, including marine ecosystems. Recent developments, however, have seen the growth of private sources of finance for restoration and conservation of biodiversity. In the webinar, Dr Groeneveld detailed the major sources of such private finance, the institutional and biophysical obstacles to such finance, and the mechanisms that have been developed to overcome these obstacles.

The underlying questions were 1) "Who should pay for restoration?" in the light of the many competing demands for national and local government funds raised through taxation, 2) "How might these funds be augmented to undertake restoration at a meaningful scale?", 3) "Should the polluter pay or those who will benefit from the increased benefits form ecosystem services once the impaired ecosystems have been restored?" 4) "How can free-loading on the improved ecosystems be controlled?" 5) "How can collective action be organised?" 6) "What types of investments can be made? 7) What are the risks? and 8) What are the returns?"

There are a number of challenges in seeking private finance for ecosystem restoration. Much depends on whether investors are seeking a large and immediate financial return; or whether the benefits from the restoration project might 1) be realised over a longer time frame and 2) strike a balance between public good and financial return.

It was concluded that the benefits of restoration will have to be defined clearly as well as how benefits will be measured and realised. As investors may have to make a large investment up front they will need to be sure that ongoing maintenance costs will continue to be supported by other partners in the project. Investors will also require returns on the many and varied benefits arising from the improved ecosystem services. A way to turn ecosystem benefits into money will be essential. The way in which the restoration project is managed will need to stop free loading on the system by those who have not paid for the initial restoration activities or who do not contribute to the ongoing maintenance costs. Local laws will be required to protect the

environment and prohibit continued or new impacts which might affect the value of the project. Restoration projects are not set up for profit maximisation may need special management to deliver some financial returns. Often the scales of restoration projects are too small to attract large investors. The returns from restoration investments may be realised only over the long term and by a future generation.

So, how might these challenges be overcome? The financing of a project will depend on a number of factors. If the polluter pays, local laws will be required to enforce payment. The issue may be addressed by up-front environmental liability bonds or insurances, but these may set limits on the scale of response that can be made and may not be sufficient. The environmental liability bonds could be returned to the company with interest if certain thresholds have been met through careful environmental management of the business activity. In some cases it may only be possible to develop a market from the improved ecosystem services to pay investors once those ecosystem services have returned to a certain level. Payments to investors in some projects may be possible only when those users who have not contributed to the restoration project can be excluded from the site.

Not all investors require an immediate and large financial return. Some may be able to be attracted through green bonds which strike a balance between investment return and public good. Green bonds might also be able to attract larger investors for certain types of ecosystems.

It is likely that successful inclusion of private finance in ecosystem restoration will depend on consortia to be formed of different types of organisations involving local governments, NGOs, trust funds, companies and the general public. Engaging with these different stakeholders and maintaining their trust will be a critical role for the central institution engaged to manage to project.

Wenting Chen provided details of a specific case study where private finance had played an important part in restoring kelp forests in Norway. Kelp barrens caused by sea urchin grazing have dominated the northern coast of Norway in the last forty years. There have been various initiatives from private industry to make commercial use of sea urchins while at the same time restoring the kelp forest. In the webinar, Dr Chen discussed the potential of private financing for kelp-forest restoration and the experience NIVA has had in collaborating with businesses.

If the urchins are taken away then the kelp forests will return. However they cannot be made to pay for the damage they cause. Attention has turned therefore to how the benefits from restoration might be charged, such as from 1) the value of the roe of sea urchins harvested and 2) the sustainable use of the restored kelp forests. To realise these advantages, collaboration is needed among multilateral organisations, non-profit organisations, for-profit companies, public resource users, philanthropists and research institutions to realise multiple ecosystem services, such as wave damping, improving coastal fish stocks, carbon sequestration, tourism through wildlife spotting from kayaks, bioremediation through remineralisation processes, and goods such as seafood, medicines and alginates. Multiple beneficiaries were recognised. In addition some companies were drawn to investment opportunities to enhance their corporate reputation.

The webinar was attended by 70 participants, 63+ on ZOOM and 7 on a concurrent You Tube screening. An additional 31 people registered but were unable to attend on the day. All

registrants were informed on how to view the archived webinar. European participants attended from Belgium, Croatia, Denmark, France, Germany, Ireland, Italy, Netherlands, Norway, Portugal, Switzerland and the UK. A particular effort was made to engage with policy makers and decision takers in all United Nations Environment Programme (UNEP) member states. Participants from Tanzania, Japan, Philippines, Nigeria, St Lucia, Kenya, Canada, Madagascar, Costa Rica and Mauritania attended the webinar. In addition, participants from Fiji, Mexico, Ghana, Timor-Leste, Brazil, USA and Australia registered but were unable to attend.

The webinar was attended by 26 companies, mainly SMEs in environmental consultancy, but also relating to offshore renewable energy, finance, seafood provision and coastal engineering. Seventeen participants worked for Government Departments regulating activities in the coastal zone, including international development. New members signed up for the MERCES Business Club following the webinar.

The webinar was archived and can be found in the following link:

https://www.youtube.com/watch?v=wmF5cRbQvdc

MERCES webinar 3 - 'Ecosystem Restoration in Deep Waters'

The third MERCES webinar was held on Thursday 27 June 2019 (https://news.grida.no/ecosystem-restoration-in-deep-waters). The webinar focussed on issues relating to MERCES Work Package 4. The webinar was sponsored by Equinor, Norway, which has interests in both offshore oil and gas operations and in deep-sea mining.

The webinar started with an overview of the MERCES project and the development of the MERCES Business Club.

The core of the webinar included two talks of 20 minutes each followed by a discussion with the audience. The talks and speakers were:

1) **Dr Anne-Mette Jørgensen, North Sea Futures (**an independent, not-for-profit company and network organisation based in Denmark) on '*Environmental impacts of decommissioning obsolete oil and gas platforms from our oceans*'

2) **Dr Daphne Cuvelier, Marine and Environmental Sciences Centre, Instituto do Mar, University of the Azores (IMAR-UAz)** on '*The Impact of deep-sea mining activities*'

Anne-Mette Jørgensen noted that issues of decommissioning affect all of us as tax payers because 50% of the costs of decommissioning are to be paid for through taxation, and therefore there are significant societal interests in the process. Decommissioning may also have influence how fisheries are regulated and the planning of marine space for all users (e.g. wind farms). Globally there are greater than 7,500 fixed structures that may be required to be decommissioned in the next 40 to 50 years. In addition there are more than 37,000 wells that need to be plugged and made safe. Many cables and pipelines will have to be removed. A conservative estimate of the cost of decommissioning all these subsea structures is some 210 billion US dollars.

Currently in the North Sea decisions on the best option for decommissioning is decided solely on technical and cost criteria. Only once a method of decommissioning has been chosen is an Environmental Impact Assessment made. So decisions as to whether to leave an installation in place or not are at present not considered in an environmental context. This has led to an approach that focuses on the negative impacts of the installations rather than the potential environmental benefits. In addition, decisions are taken on a case by case basis for each installation rather than groups of installations which may provide a network for ecological restoration.

In considering the baseline to which the environment might be returned it is debatable whether biodiversity at the time when the installations were first put in place is a suitable comparison. Offshore installations alter ecosystems and become part of them. They provide new services, or perhaps services that have been lost in the last century, and influence current ecosystem functions, such as food webs and the connectivity of species (see INSITE North Sea ANChor project featured on the MERCES website as a case study). Decommissioning in the North Sea therefore needs to be considered in the wider context of marine ecosystem restoration using current ecological traits in an Ecosystem Based Approach.

Daphne Cuvelier described the results of an expert workshop organised as part of the EU Framework 7 project MIDAS (Managing Impacts of Deep-Sea Resource Exploitation) and which resulted in a publication of a paper (Cuvelier et al. 2018; *Frontiers in Marine Science*, doi:10.3389/fmars.2018.004670) on "Potential mitigation and restoration actions in ecosystems impacted by seabed mining". An overview was given of the three main mineral types in the deep ocean, the ecosystems which are at risk from deep-sea mining and the main impacts that are expected, such as habitat loss (e.g. the mineral surfaces on which organisms occur), the creation of sediment plumes during mining at the seafloor, the release of a discharge plume once minerals have been dewatered on the mining vessels at the sea surface, and the potential toxicity of the fine particulate material released.

The concept of the 'Mitigation Hierarchy' was introduced for the environmental management of mining activities. This involves considering a strictly sequential series of steps - Avoid, Minimise, Restore and eventually (if possible) Compensate, or Offset, the impacts and habitat/biodiversity loss. Details were provided in the first three of these Mitigation Hierarchy categories. Of particular note were new ideas for the restoration of deep-sea communities once mining has ended, similar to the steps taken when a mine site is closed on land. A specific example was given of work being carried out in the MERCES project by Marina Carreiro Silva and her colleagues at the University of the Azores (IMAR-UAz) on the feasibility of transplanting cold-water corals. This highlighted the need for much greater awareness and support for experiments in cost-effective and practical restoration measures and the need to address restoration actions early during the exploration phases of deep-sea mining.

The webinar was attended by 71 participants. MERCES was informed by one of the webinar participants that 5 attendees from the same organisation were using one link. This suggests that attendance was higher for this webinar and was also greater than reported for the first two MERCES webinars. A total of 111 people registered for the webinar.

European attendees came from Belgium, Germany, Italy, Netherlands, Norway, Portugal, Spain and UK. Additional attendees came from Australia, Brazil, Colombia, Israel, Jamaica and the USA. Additional registrants were located in Canada, Mexico, the Russian Federation, South Africa, and Tonga.

A good discussion was developed using the questions posed by the attendees. All the questions were archived and the webinar speakers were given the opportunity to provide written additions and answers to all questions. The webinar registrants were sent web links to the archived webinar and to the written responses to the questions posed.

The webinar was attended by 14 companies, including large oil and gas companies such as BP and Petrobras, service and survey businesses for offshore oil and gas, environmental consultancies and coastal engineering interests. A number of EU Government departments and international organisations involved in regulating the oceans, such as the International Seabed Authority (ISA) and Fisheries and Agriculture Organisation (FAO), attended also. We were grateful for the participation of the European Commission.

The webinar was archived at https://www.youtube.com/watch?v=Opl9-U6i1Xw&t=25s

MERCES webinar 4 - 'Building a Business Case for Marine Ecosystem Restoration'

The fourth MERCES webinar was held on Monday 18 November 2019 (https://news.grida.no/building-a-business-case-for-marine-ecosystem-restoration). The webinar focused on the valuation of three major ecosystem services relating to seagrass meadows, but which were also relevant to mangrove forests and salt marshes. The webinar focused on MERCES Work Packages 2 and 5.

The webinar started with highlights of the many MERCES deliverables on marine ecosystem restoration available. The speakers were:

1) **Dr. Per-Olav Moksnes, Department of Marine Sciences, University of Gothenburg, Sweden** on '*Seagrass loss and restoration - implications for the value of carbon and nitrogen stocks*'

2) **Dr. Richard Unsworth, Seagrass Ecosystems Research Group, University of Swansea, Wales** on '*The importance of restoring seagrass meadows for global fisheries production*'

Per-Olav Moknsnes described how over 60% of the eelgrass along the Swedish NW coast has vanished since the 1980s. The main cause has been the over-supply of nutrients from land causing eutrophication. Fast-growing algae have smothered the eelgrass. Management actions have reduced eutrophication and have improved water quality. However, surprisingly, this has not led to the natural recovery of seagrass. The disappearance of the eelgrass has led to the loss of its stabilising effect on the sediment. This has led to increase in wind-driven resuspension of the sediment making the water turbid. As a consequence the eelgrass has been unable to regrow resulting in the loss of important ecosystem services, including the long-term storage of carbon and nutrients in the sediment.

Little is known about how the extensive losses in eelgrass have affected the carbon stocks. It is also uncertain if eelgrass restoration can be used to facilitate the recovery of meadows and their ecosystem services. New studies show that eelgrass losses in this system result in extensive release of both carbon and nitrogen; this has a high cost to society (estimated to 100,000 Euros per hectare of eelgrass). Methods for eelgrass restoration in Swedish waters have recently been developed, but large scale recovery is faced by local regime shifts which have resulted from the loss of the eelgrass. On the Swedish coast the best method for restoration in areas where eelgrass can return is by planting the eelgrass shoot by shoot. Areas re-sown at a density of 16 shoots m^{-2} in June 2015 increased to 95 shoots m^{-2} by September 2015 and in the following year had increased to 270 shoots m^{-2}, approaching the densities found in natural eelgrass habitats. However, the method is labour-intensive and slow because it has to be carried out by divers. It costs about 170,000 Euros per hectare. New methods in sand capping sediments to reduce resuspension are being tested.

Richard Unsworth described the significant role seagrass meadows play in supporting fisheries productivity and food security across the globe. Neither seagrass habitat management nor fisheries controls are reflected adequately in the decisions made by authorities with statutory

responsibility for coastal management. This leads to planning decisions that ultimately result in widespread seagrass loss.

Seagrass is an important habitat for fish by providing a complex, 3D, highly productive and well-oxygenated environment. Seagrasses stimulate abundant food resources for juvenile fish and provide shelter from predators. The increase in survival rates and the saving of energy in searching for food or avoiding predators produces healthier young fish. Seagrasses also provide a trophic subsidy to surrounding habitats through export of some of their carbon, even to the deep sea in some areas.

Seagrasses support 20% of the world's biggest fisheries, such as Alaskan pollock, Atlantic cod and Pacific herring. In the Mediterranean Sea seagrass-associated fish species contribute 30 to 40% of the value of commercial fisheries and about 29% to recreational fisheries expenditure, making a direct annual contribution to commercial fisheries of 58-91 M Euros and 112 M Euros to recreational fisheries, and hence to local communities. In Indonesia 60% of the most-favoured fish to eat use the seagrass habitat and two-thirds of the fishing effort occurs within seagrass areas. Many fisheries are unregulated, unmanaged and unsustainable. In Indonesia 26% of the fish caught are under the size of maturation. The use of mosquito nets in East Africa and semi-permanent fish fence structures are leading to significant deleterious reductions in fish populations and increases in by-catch.

Models of fisheries seldom include the loss of habitat as an important factor in their analyses. Failure to include reductions in spawning habitat, the degradation of refuge areas and increases in anoxia are leading to poor management decisions.

There are only a few studies showing fisheries enhancement through marine ecosystem restoration and more studies are required to demonstrate the link. There needs to be better integration of fisheries, biodiversity and environmental management. Seagrass restoration = fisheries recovery.

The webinar was attended by 88 participants. Several registrants came from the same organisation and so it is likely the number of attendees was closer to 100. The attendance was greater than that reported for the first three MERCES webinars. A total of 147 people registered for the webinar. All registrants were contacted to inform them of where they can access the archived webinar.

European registrants for the webinar came from Austria, Belgium, Bulgaria, Croatia, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and UK. Additional registrants came from Bermuda, Brazil, Canada, Colombia, Indonesia, Jamaica, Kenya, Libya, Mexico, Mozambique, Russia, South Africa, Thailand, Tunisia and the USA.

A good discussion was developed using the questions posed by the attendees. The webinar registrants were sent web-links to the archived webinar and the report on the webinar.

The webinar was attended by 26 companies, including environmental SME consultancies, coastal engineering and financial interests. A large number of attendees (31) came from Government Departments and organisations advising government policy. Four members of the

European Commission registered. Twenty four registrants came from NGOs and 57 from research institutions. Five registrants came from organisations involved in international development.

The webinar was archived and can be found in the following link:

https://www.youtube.com/watch?v=WakLhV9dgd8

MERCES webinar 5 - "Moving to Industrial-Scale Coral Habitat Restoration"

The fifth and final MERCES webinar was held on Friday 6 March 2020 (https://news.grida.no/moving-to-industrialscale-coral-habitat-restoration). The webinar featured new methods for the restoration of coral habitats in both tropical and temperate seas, including coastal, continental shelf and deep-water coral communities. A major unknown at the start of the MERCES project was whether restoration measures could be undertaken at a meaningful scale to make a significant difference to the sharp declines in the distributions of many different ecosystems. This webinar addressed some of the methods that might be used in restoration of coral habitats and their applicability at larger scales.

The core of the webinar included two talks of 20 minutes each, followed by a discussion with the audience. The speakers were:

1) **Dr Jesper Elzinga, Van Oord Dredging and Marine Contractors [Van Oord]** on '*The Recovery of Reefs Using Industrial Techniques for Slick Harvesting and Release (RECRUIT)*'

2) **Dr Joaquim Garrabou, Spanish Research Council (CSIC)** on '*Lessons Learned from Coral Restoration in Shallow and Deep Environments*'

Both speakers referred to the multidisciplinary and trans-national teams engaged in their work. Joaquim Garrabou included research by other MERCES partners, most notably from Dr Cristina Linares (University of Barcelona) and Dr Marina Carreiro Silva (IMAR, University of the Azores).

Jesper Elzinga explained how Van Oord is integrating innovative environmental management approaches into the company's core business interests in dredging, reclamation, offshore wind parks, pipelines and subsea rock installations. Through the company's 'Marine Ingenuity' programme, Van Oord has teamed up with the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia, and the University of Delft, to address methods by which coral abundance on the Great Barrier Reef might be boosted at very large scales. The project, called RECRUIT (RECovery of Reefs Using Industrial Techniques), aimed to scale up tropical coral rehabilitation efforts by 2 to 3 orders of magnitude from current practices.

The approach was to use a workboat with a large aft deck equipped with 12 large-volume tanks (4500 L). The boat was used to sample slicks of coral eggs from multiple species spawned during mass fertilisation events. The slicks were located through hydrodynamic modelling and direct airborne observations. A portion of the slicks seen was concentrated within a boom usually used as part of dredging activities. Having pumped the eggs and embryos on board, the embryos and subsequent developing larvae were incubated through to settling competency. The RECRUIT project aimed to determine whether 1) the slicks could be located, concentrated and pumped onto the ship, and 2) the embryos could be held in tanks on board the ship until the larvae were able to settle onto the seabed. The project was successful in all of these aspects. Several papers have been published from the work in the journals *Restoration Ecology* and *Frontiers in Marine Science*.

The full scale application of the method would only sample < 1% of the reproductive slicks and therefore have a negligible effect on the ability of the natural corals to maintain their populations in the region, but at the same time very high concentrations of competent larvae could be incubated and maintained for seeding back into degraded and destroyed areas than might occur through natural processes. Further research is planned to study the efficacy of the method in repopulating corals over large areas affected by coral bleaching and other impacts.

A major benefit of the approach is that a wide variety of coral species which broadcast spawn can be reintroduced to degraded environments at the same time. Different methods, such as transplantation, would have to be devised for brooding species. The method offers up the possibility of translocating larvae from healthy reefs to damaged reefs, perhaps over hundreds of kilometres using the mother vessel, and for facilitating ecological connectivity between populations that may have become isolated through coral bleaching. The method also offers a way in which heat-tolerant coral strains might be selected on board the vessel and translocated to new sites where environmental conditions have changed. It may also be possible to introduce heat-tolerant *Symbiodinium* commensals to the corals if this is considered to be beneficial.

Joaquim Garrabou focused on how temperate coastal, continental shelf and deep-water corals differed from the tropical corals featured in Jesper Elzinga's presentation. The temperate corals live in low-light environments, or depths where no light penetrates, and so do not harbour photosynthetic symbionts. They generally have much slower life-history dynamics and characteristics than shallow tropical coral species. However, the temperate corals play an equally important ecological role as habitat-forming species. The temperate corals are also being impacted by marine heat waves, depending on the depths at which they occur, and direct impacts from fishing and other industries. These species have lower levels of reproductive output, slower growth rates and may live for hundreds of years, which makes them particularly sensitive to repeated impacts.

The temperate species do not spawn in mass events and so different methods will be required to restore these coral habitats. The MERCES project focused on transplanting corals and coral fragments 1) directly onto the seabed using scuba divers and 2) by attaching the coral clusters to artificial structures which were then placed on the seabed.

In the Azores archipelago scientists are working with local fishermen to take coral fragments captured as bycatch in fishing operations, and grow the fragments into larger coral clusters in the laboratory to reach a size that can then be attached to an artificial reef and lowered back to the seabed (ca. 700m depth). Survival in the laboratory aquaria was good. Survival of the transplanted corals on the artificial reefs on the seabed, though, varied between 15 and 100% after 2 years.

A similar method was adopted by CSIC and the University of Barcelona in the Mediterranean Sea continental shelf off the Catalan coast. Scientists were able to work with local fishermen to obtain coral fragments collected during fishing, for growing in the lab and then for reintroduction into areas with Marine Protected Areas, so that theoretically they would not be fished again. The experiment had an 87.5% success rate after 1 year. A second method was also employed for larger gorgonian fragments which were attached to rocks of a suitable size and weight and

deployed over the side of the vessel, sinking to the seabed in the manner of a shuttlecock in the sport of Badminton. This method allows a wide area of sedimented seabed to be covered with recruits.

In water depths within reach of scuba divers transplantation methods have been applied also in a cost effective manner by engaging local diving centres. Fragments of gorgonians were attached to the seabed using epoxy resin. During a dive lasting 40 minutes, 14 people attached more than 400 gorgonian fragments to rocky surfaces on the seabed. However, survival at the time of the experiment was only 20% after 2 years owing to the impact of two marine heatwaves which were experienced in the study area during 2017 and 2018, leading to mass mortalities.

CSIC has also been using genetic methods to identify heat resistant populations of corals across the western Mediterranean Basin and on the Portuguese coast in the Atlantic Ocean in proximity to the Straits of Gibraltar. Heat resistant populations were detected off Italy and Portugal.

The work carried out in the MERCES Project indicates that transplantation is a successful technique for certain species when used at local scales and in environments where the original drivers of environmental degradation have been controlled. Transplantation can also ensure that coral clusters can be sited at distances where reproductive processes between clusters can still occur. While the use of scuba divers and artificial reefs makes these methods difficult to use at a large scale they are very important in engaging with influential stakeholders and educating local communities in the benefits of ecosystem restoration. While transplantation may be used to restore corals in Marine Protected Areas (MPAs), the success of the method depends on how well the MPAs are enforced. The use of coral fragments, and perhaps many fragments from the original coral captured, could lead to a reduction in genetic diversity and further research is required on this aspect.

Prior to the webinar a large number of different organisations were contacted with details on the webinar and information on the wider MERCES project outputs. The contact list included MERCES Business Club members, focal points for the United Nations Environment Programme (UNEP), the EurOceans Network, EU Government contacts, coral interest groups on Twitter and Facebook, mailing lists of coral researchers and sports divers and the MERCES partnership, all with requests for them to publicise the webinar through their national networks.

The webinar was attended by 78 participants. It is possible participation was higher in places where several attendees shared one connection. Contact was made from universities in Colombia and Mexico for the webinar to be used as part of their courses in Marine Biology and it is likely this webinar, and previous ones, have been used by a wide variety of educational establishments worldwide. A total of 135 people registered for the webinar. All registrants were contacted following the webinar to inform them of where the archived webinar can be accessed.

European registrants for the webinar came from Belgium, Croatia, Cyprus, Denmark, France, Greece, Italy, Malta, Netherlands, Portugal, Spain, Sweden, Switzerland and UK. Additional registrants came from Argentina, Australia, Brazil, Colombia, Jamaica, Madagascar, Mexico, Sri Lanka and the USA.

Of the registrants, 40 were representatives from companies, including environmental SME consultancies, coastal engineering, offshore oil and gas, dredging and financial interests. Seventeen of these came from non-European companies, including environmental consultancies in Colombia, Brazil, Argentina and Jamaica. A large number of registrants (50) were from educational establishments. Only 8 registrants came from Government Departments and organisations advising government policy. Five members of the European Commission registered. Fifteen registrants came from NGOs.

The webinar was archived and can be found in the following link:

https://www.youtube.com/watch?v=sWlczFrNoqY

3. Overview

The MERCES webinars proved to be highly successful, allowing a wide variety of stakeholders (including academia, industry, authorities and NGOs) to participate. This greatly increased the dissemination value of MERCES and allowed the project to reach a much wider audience through the archived webinars than might have otherwise been achieved. Not only were the webinars archived on the MERCES website but also online at the Restoration Resource Centre of the international Society for Ecological Restoration (SER). Indeed, the MERCES webinars have made an important contribution in broadening the scope of the SER in providing the first real materials in the Resource Centre on marine ecosystem restoration.

The number of registrants and attendees for each webinar increased during the webinar series and held steady for webinars 4 and 5, despite dealing with very different habitats. The engagement with the United Nations Environment Programme (UNEP) introduced the MERCES project with a worldwide audience and each webinar announcement included links to the previous webinars in the series. Several registrants for the fifth webinar enquired about the links to the previous webinars.

The collaboration with GRID Arendal, Norway, and the Marine Ecosystem Services Partnership (MESP) as hosts for the webinar series proved to be very beneficial and the MERCES project received excellent support from Tanya Bryan and Rob Barnes at GRID Arendal. It was a distinct advantage working with an institution with proven technical expertise in webinar management to ensure the webinars worked well from the first one aired. The ZOOM software provided by GRID Arendal worked very well. MERCES attracted large audiences of 70 to 90 participants, equivalent to a large audience at a large scientific symposium. GRID Arendal streamed the webinar simultaneously on YouTube in case there was any problem in the number of attendees at the webinar.

The ZOOM software provided a user-friendly interface for speakers and audience, and the Question and Answer box facility allowed for a dynamic moderated discussion to be generated with the speakers. The engagement of the audience throughout the webinar was evident in 1) the number of questions generated and 2) that the count of the number of attendees remained steady right to the end of the transmission.

The webinars were held at the standard time of 15.00 CET, for one hour. This allowed participation in the webinar for attendees in the Caribbean, South America and the East coast of North America, was well as countries ahead in time of Europe as far as India. Contacts were advised to register for the webinar even if they lived in parts of the world outside a convenient time to attend the webinar in order to receive a notification of when and where the archived webinar would be available. This explains in part why in some cases 135 people registered for the webinars, but fewer (80-90) were able to attend the actual webinar. However, the number of participants was probably underestimated, as we were made aware that some participants registered on behalf of a group (e.g. colleagues or classroom).

As explained in the ‘Approach’ section above, it was planned that the webinar series would be organised during the second half of the MERCES project. It was envisaged that the webinars would feature different aspects of the MERCES project and, as this related to field experiments,

it would be some time before the MERCES fieldwork would be completed and the results worked up. The webinar series, however, turned out to be one of the best ways of the project connecting with industry and policy makers. It is advised therefore that, where possible, webinars should be held in the early stages of a research project also to help with visibility of the project. One aspect of attempting to build a Business Club in a project very few companies had heard of, was the lack of compelling information available at the start of the project to convince companies to join the 'cluster'. Hosting webinars on hot topics at the start of the MERCES project may have helped in creating the cluster rather than seeing it develop over a number of years.

Overall, the webinar series played an important part of promoting a scientific approach to marine ecosystem restoration and in publicising the work of the MERCES project. Of critical importance in these times, and especially for projects dealing with environmental matters, was the reduction in travel and therefore carbon footprint within the MERCES project. In addition, it freed up time for MERCES partners and it probably attracted a much wider audience, especially from developing countries, than would have otherwise attended.