

**International Workshop on Marine & Atmospheric Sciences in West Africa  
Blue Growth and the RealityLab Cape Verde  
Friday 17 November 2017, Ocean Science Centre Mindelo – Cape Verde**

**Blue Growth and the ‘Cabo Verde RealityLab’**

Ocean Science Centre Mindelo, Hangar

**09:00 – 10:00 Opening of Future Ocean Dialogue Exhibition**



09:00 **Arne Körtzinger**, GEOMAR, Kiel/Germany: *Opening*

09:10 **Frederike Tirre**, Kiel University, Cluster of Excellence “Future Ocean”, Kiel/Germany:  
*Understanding the ocean – Sustaining our future*

With this motto the travelling exhibition of the Cluster of Excellence “The Future Ocean”, based on six scientific topics, presents the challenges with which modern ocean research is confronted and the opportunities that arise from these. The exhibits cover the topics fisheries, coastal research, ocean observation, waste in the oceans, ocean acidification and marine resources. Together they offer visitors the possibility to gain a comprehensive overview of the current issues in the marine sciences.

09:30 **Press tour**

10:00 **Coffee break**

**10.30 – 12.30 Case Studies for Applied Sciences (Plenary session)**

Keynotes:

10:30 **George Wiafe**, University of Ghana, Legon/Ghana: *Earth Observation (EO) services in support of combatting Illegal, Unregulated and Unreported (IUU) fishing in West Africa*

10:45 **Tatiana Cabral**, Fazenda de Camarão de Cabo Verde, Mindelo/Cabo Verde: *Aquaculture as a tool for Blue Growth Initiative – The Sustainable Shrimp-Tilapia Juveniles Farm, A Vision to a New Horizon, Island of S.Vicente, Cabo Verde*

11:00 **Christine Merk**, IfW, Kiel/Germany: *Impacts of regional changes in beach wrack composition on visitors' valuation of visits to the beach*

11:15 **Malte Winkler**, IfW, Kiel/Germany: *Wave Energy Conversion in the North Sea - An analysis of the economically most feasible locations and technologies with regard to energy output*

11:30 **Oscar Melicio**, RME, Mindelo/Cabo Verde: *Resolute Marine Energy – At the nexus of energy and water - Implementing the Wave2O in Cabo Verde for improved access to potable water and sustainable energies*

11:45 **Sören Harrs**, IfW, Kiel/Germany: *Stakeholder Engagement on Marine Litter – How to carry out a survey*

12:00 **Carlos Evora Rocha**, DNEM, Mindelo/Cabo Verde –Cabo Verde - Blue Growth and Blue Economy

**12:30 Lunch Break**

**14:00 – 16:30 Cabo Verde RealityLab (Discussion Session)**

The session will be moderated by Jörn Schmidt, Kiel University - Cluster of Excellence "Future Ocean"

14:00 Discussion Session

16:00 Wrap-Up

**2 – 4.30 p.m. Afternoon Session – RealityLab Cape Verde**

A RealityLab is a place of transformative research – an experiment in a practice solution. Complex transformation processes require design spaces in order to be better understood and concreted. Real experiments express in a special way the scientific connection of socially relevant questions with new methodological approaches in changed institutional settings (RealityLab). They are "Boundary Objects" in a transdisciplinary research process, in means a place of reference that allows different actors and disciplines to relate their knowledge to each other and thus to create transformative knowledge. The RealityLab Cape Verde offers a great possibility

The RealityLab Cape Verde is intended to be a platform, which brings together science, society and industry to develop common research questions of local interest (co-design), and making use of the different sectors' and scientific expertise and knowledge to carry out joint projects (co-production) to develop solutions and ways of implementation. The RealityLab should serve as an international communication and collaboration platform and is open for everyone.

The session should focus on answering the following questions:

- How can complex social transformation processes be better understood and scientifically supported?
- How to define common research questions with focused on local challenges?
- How to develop appropriate continuous communication tools to reach out to stakeholders and to the wider society on topic areas?
- How to identify stakeholders?
- Possible ways of co-working (workshops, project and communication plans)
- How to improve social competence?
- How to guarantee success and transformation? Results will ideally be solutions for societal challenges.

One case study example: The very successful YooWeedoo concept from the Kiel School of Sustainability ([www.yooweedoo.org](http://www.yooweedoo.org))

The session will be moderated by Dr. Jörn Schmidt, Kiel University - Cluster of Excellence "Future Ocean"

### **Participating Institutions:**

IfW – The **Kiel Institute for World Economy** is an international center for research in global economic affairs, economic policy consulting, and economic education. The Institute engages especially in creating solutions to urgent problems in global economic affairs. On basis of its research, the Institute advises decision makers in policy, business, and society and informs the broader public about important developments in international economic policy. The presented results have the potential of technology transfer for solution-oriented applied science and developing new cooperation with respect to sustainable oceanic development with particular focus on citizen science. Two themes will be focused i) wave energy and ii) societal evaluation of marine litter.

The **Cluster of Excellence "The Future Ocean"** is a network of researchers from eight faculties of Kiel University, three research institutes - GEOMAR Helmholtz Centre for Ocean Research, Kiel Institute for the World Economy (IfW), and Leibniz Institute for Science and Mathematics Education (IPN), as well as the Leibniz Information Centre for Economics (ZBW) and the Muthesius University of Fine Arts and Design.

The Cluster's mission is to use the results of multidisciplinary research to predict the future of the Earth's marine environment and to engage in developing solutions in support of sustainable ocean development. This includes understanding changes to the past and present ocean as well as the interaction between society and the ocean in regard to marine resources, services and risks. This Mission carries with it an obligation to develop and assess scientifically-based global and regional ocean governance options, including their legal, economic and ethical aspects. The Cluster uses innovative and suitable means to exchange its findings with the international scientific community, stakeholders, decision makers, civil society and the public at large. The Cluster also forms a hub for networking, knowledge exchange and co-design to develop integrative approaches to limit and transform human activities to safeguard key marine ecosystem functions and services.

"Future Ocean", with its unique interdisciplinary approach to research, aims to intensify the transfer of technology developed and knowledge gained through research to politics, industry and society in general.

The area of Transdisciplinarity & Knowledge Transfer in the Cluster Office supports this interest. Various activities are developed and offered for industry and politics. Effective research collaborations between scientific institutes and industry form a decisive basis in securing and increasing innovation capability and thus the competitiveness of German Industry. The Cluster of Excellence employs existing instruments of technology transfer such as brokering collaborations between science and industry. In addition discussion between scientists and industry representatives on selected topics from the Cluster of Excellence "Future Ocean" is fostered through informational events – in close cooperation with the Maritime Cluster Schleswig-Holstein.

### **Thematic objects of discussion:**

**Wave energy** is a so far rather untapped, yet energy rich resource, showing less variability than wind energy and providing also energy during nights in comparison to solar energy. Malte Winkler, will present a methodology to assess the suitability of specific regions for the exploitation of wave energy. In his research he has so far focused on the North Sea but will present during the workshop potentials to transfer his method and findings to the specific conditions of the Cape Verde, seeking

also potential collaborations for further research with respect to the application of this technology on the Cape Verde. The feedback during the conference will be important to sharpen the research profile of Malte Winkler and important contribution to its visibility as solution-orientated marine economics.

#### **Resolute Marine** and INDP sign Memorandum of Understanding

Resolute Marine and the Cape Verde National Institute for Fisheries (INDP) today signed a Memorandum of Understanding regarding site characterization and resource assessment studies that will take place at Praia Grande on the island of Sao Vicente. The Praia Grande site has been targeted as an ideal location for a commercial demonstration of Resolute's wave-powered desalination technology, Wave2OTM. These initiatives are funded by a Sustainable Energy for Africa (SEFA) grant from the African Development Bank (AfDB).

Resolute Marine's Cape Verde based Project Coordinator, Oscar Melicio, said, "One of the biggest benefits for Cape Verde is that this project includes personnel training and equipment purchases that will allow INDP to conduct state-of-the-art bathymetric and geotechnical studies as well as wave energy resource assessment in full compliance with international standards."

**Marine litter** is an increasing (marine) environmental problem with far-reaching consequences for the environment, health, and development of the society. Dr. Christine Merk and Sörren Harrs (PostDoc and student assistant in our group, respectively) will prepare a new research project with respect to marine litter and present an already finished study with relevance for the marine litter theme. Implementing sustainable waste management strategies in developing countries requires taking into account the potential local social and political barriers and to provide evidence on the importance of waste management strategies. Sörren Harrs will conduct initial stakeholder interviews during the conference to identify research gaps and to increase our understanding of the existing Cape Verde attitude to waste management. The activity will be coordinated by Dr. Merk who is an expert in the assessment of public perception of environmental topics. The aim of the information collection is to i) summarize the initial findings in a Kiel Policy Brief and ii) to develop a larger-scale field study in collaboration with Cape Verde partners. The larger-scale field study is supposed to inform stakeholders on the economic cost of unmitigated plastic pollution, taking into account in particular the tourism sector. The prospects of such a more detail study will be outlined by Christine Merk in her talk during the workshop in the Blue Growth Session, entitled "Impacts of regional changes in beach wrack composition on visitors' valuation of visits to the beach". In her talk Christine Merk will present an already completed transdisciplinary research experiment which brought together benthos-ecologists, environmental economists, behavioral economists, local tourist managers, and community leaders. The insights from this study will then discussed within the workshop with respect to the potential of further studies on tourist evaluation of marine litter on the Cape Verde.

Both themes, will contribute to the development of the envisaged RealityLab which is supposed to support Cape Verde in building up capacity on solution oriented marine research, fostering international communication, stakeholder interaction, and dissemination of best practice examples to the wider public.

**Illegal, Unregulated and Unreported (IUU)** fishing has created large declines in commercially important fish populations and is thus recognized as a major threat, with the potential to cause an irreversible change in marine ecosystems. It has been estimated that IUU fishing accounts for about

20% of world catches, representing a global loss up to US\$23.5 billion annually. In West Africa alone, IUU fishing costs the region over \$7 billion each year. Such losses are detrimental to socio-economic development of the region, where over 3 million people engage in fishing and fishery-related ventures. For a region that its per capita consumption of fish as animal protein exceeds global average, and where up to 30% of GDP in some countries comes from fishery export revenues, IUU fishing must be considered an enemy to development. The difficulty in combatting IUU fishing stems from inadequate human and infrastructural capacity to enforce fishery regulation, problem of internal conflict and political strife, and priorities other than fishery management requiring governmental attention. Inability to police the extent of the EEZ also makes it possible for large factory ships, stationed within the high seas, to carry out indiscriminate poaching. In support of national and regional efforts to address the issue of IUU fishing, the Regional Coastal and Marine Resources Management Centre located in the University of Ghana, implemented a project to utilize earth observation data to provide intelligence on fishing vessel traffic in western Africa. The project was supported by the European Commission under the 10th EDF program. This presentation will showcase how the Centre is helping to fight IUU fishing in 14 West African countries, primarily using satellite AIS data and other oceanographic data received via a GEONETCast architecture. All the 14 countries have been provided with the GEONETCast architecture to receive operational EO products for decision making towards effective fisheries management.

**Shrimp Farming** - In Cape Verde the entire yearly consumption of at least 60 tons shrimps in Cape Verde is imported. With a growing tourist sector in Cape Verde and a worldwide trend to fulfil protein demand increasingly with seafood, a good market opportunity has arisen. A Brazilian company has joined hands with those in Cape Verde and in 2009 a joint venture to implement a shrimp farm on Sao Vicente of open ponds and expect to replace shrimp import in short term and to export the surplus production has been developed.

#### Abstracts of Session 1:

1. Prof. George Wiafe: Earth Observation (EO) services in support of combatting Illegal, Unregulated and Unreported (IUU) fishing in West Africa

Globally, Illegal, Unregulated and Unreported (IUU) fishing has created large declines in commercially important fish populations and is thus recognized as a major threat, with the potential to cause an irreversible change in marine ecosystems. It has been estimated that IUU fishing accounts for about 20% of world catches, representing a global loss up to US\$23.5 billion annually. In West Africa alone, IUU fishing costs the region over \$7 billion each year. Such losses are detrimental to socio-economic development of the region, where over 3 million people engage in fishing and fishery-related ventures. For a region that its per capita consumption of fish as animal protein exceeds global average, and where up to 30% of GDP in some countries comes from fishery export revenues, IUU fishing must be considered an enemy to development. The difficulty in combatting IUU fishing stems from inadequate human and infrastructural capacity to enforce fishery regulation, problem of internal conflict and political strife, and priorities other than fishery management requiring governmental attention. Inability to police the extent of the EEZ also makes it possible for large factory ships, stationed within the high seas, to carry out indiscriminate poaching. In support of national and regional efforts to address the issue of IUU fishing, the Regional Coastal and Marine Resources Management Centre located in the University of Ghana, implemented a project to utilize

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2. Tatiana Cabral: Aquaculture as a tool for Blue Growth Initiative – The Sustainable Shrimp-Tilapia Juveniles Farm, A Vision to a New Horizon, Island of S.Vicente, Cabo Verde.

Cabo Verde imports up to 120 tons of shrimp per year, failing to produce or fish any, resulting in currency losses of up to one million euros per year. Sustainable aquaculture using pristine ocean water, low densities farming techniques and renewable energy is pointed out as a good solution to produce a true low carbon footprint bio product.

Lack of live-bait has also been a historical bottleneck for tuna fisheries using the traditional pole and line technique, the only real sustainable tuna fishing technique (one man – one fish). Sustainable aquaculture will be used to farm tilapia juveniles to be used as live-bait in the pole and line fisheries. In Calhau, 17 km from the City of Mindelo, a Shrimp and Tilapia Farm is being built, entering operation January 2018. The farm, which will incorporate in the future its own nursery facility, will grow *Litopenaeus vannamei* to the size of 12gr., being able to produce up to 200 tons of shrimp per year, covering the internal market demand and exporting a low carbon footprint bio product to the European market. The same facility will produce all-male tilapia juveniles to the size of 8 to 10 cm to be used in the pole and line tuna fisheries.

The aquaculture facility will be the first to use 100% renewable energies in a combination of wave and solar power. For this an award-winning patented Wave Energy Converter to harness the energy of the ocean. The kinetic energy of ocean waves is converted to electricity providing clean energy night and day thus saving up to 60 tons of fuel and emissions of 130 tons of carbon dioxide.

3. Christine Merk: Impacts of regional changes in beach wrack composition on visitors' valuation of visits to the beach

Results and experiences from an interdisciplinary, transdisciplinary research experiment will be presented. The project brought together benthos-ecologists, environmental economists, behavioral economists, local tourist managers, and community leaders. Observational data from 1977 and 2012/13 shows increases in the amount of beach wrack and changes in the composition of algae types. There is an increase in opportunistic red algae. When these algae decay they smell differently compared to non-opportunistic varieties. Via on-site surveys we assess the implications of changes in beach wrack composition on visitors' perceptions of the beaches. People find that the smell of decaying opportunistic red algae is perceived more intensely and less pleasurably compared to the smell of non-opportunistic varieties. Results imply that changes in algae composition caused by eutrophication and climate change in the future might have negative impacts on visitors' valuation of their recreational time at affected beaches and might thus necessitate changes in beach management practices. On a meta-level, the researchers learned that stakeholders' expectations can be very high and researchers cannot necessarily provide the answers practitioners need.



4. Malte Winkler: Wave Energy Conversion in the North Sea - An analysis of the economically most feasible locations and technologies with regard to energy output

Mitigation of climate change requires that the rising global energy demand should be increasingly satisfied by renewable energy technologies. Wave energy is a so far untapped, yet energy rich resource. An important question is whether wave energy is economically viable also in a relatively calm wave climate. Here we present a methodology to identify suitable spatial and technological installation options, using the North Sea as an example. Using Geographical Information systems, we identify two suitable installation areas: one in the relatively calm southern North Sea, one in the more severe northern North Sea. We select four technologies based on their physical applicability, development status, and availability of power matrices. We rank these devices with regard to their economic performance. Based on the available data, energy could be produced at a cost of  $\approx 0.16$  €/kWh in both southern and northern North Sea. This value is comparable to that of wind energy, and combining wave and wind energy could further reduce costs. These results indicate that wave energy conversion is economically viable in both northern and southern North Sea, despite a calm wave climate in the latter. We discuss how these results can be transferred to other regions, focusing in particular on the Capo Verde archipelago.