



**atlas**  
UNDERSTANDING DEEP ATLANTIC ECOSYSTEMS



## WP3: Biodiversity and Biogeography

**ATLAS 2nd General Assembly, Maiorca, April 2017**

IMAR, Portugal; IEO, Spain; HWU, UK



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## Vision

- To bring together existing and new **biodiversity** data along with results from analysis of **North Atlantic circulation** (WP1) and **ecosystem functioning** (WP2)
- With the main goal to **deepen the understanding** of the biodiversity and biogeographic patterns in the deep North Atlantic and **forecast changes** under future scenarios of water mass structure and ocean currents



## **Task 3.1 Improve the understanding of biodiversity and biogeography in the deep N Atlantic (M1-M36)**

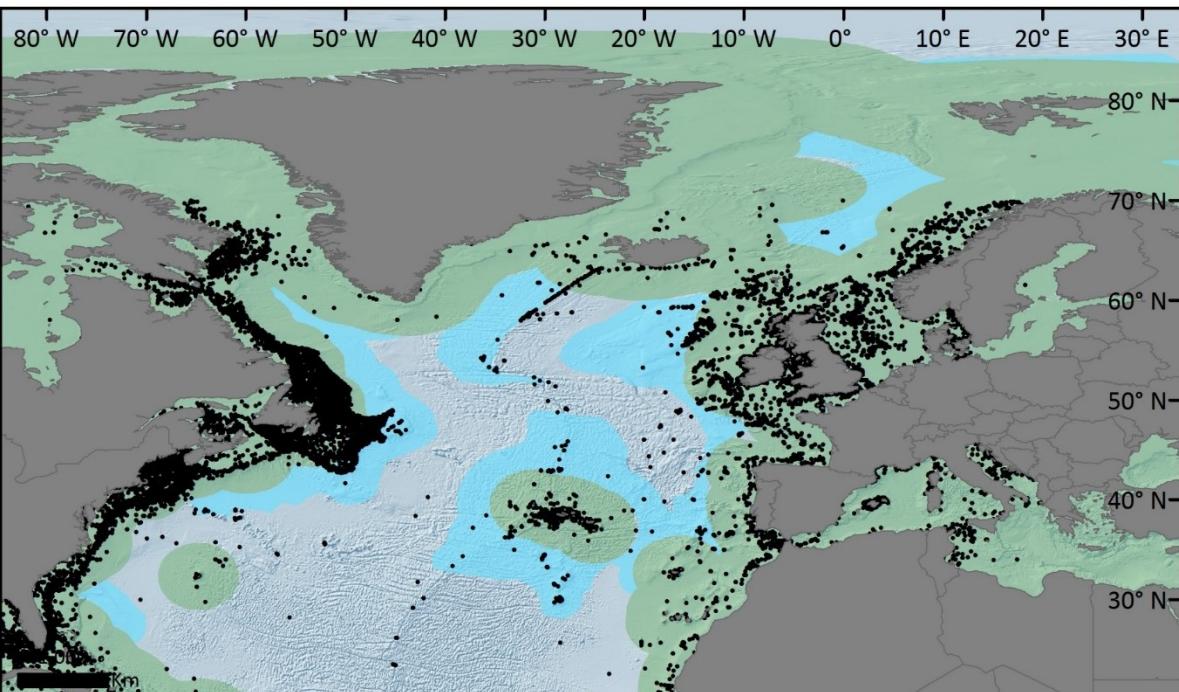
- Compile existing and new ATLAS data for biodiversity, biogeography, mapping and modelling activities
- Synthesise data on influence of AMOC, N Atlantic gyres, and water mass properties on deep-water biodiversity
- Refine GOODS biogeographic classification scheme



# MS3 Database on existing deep-sea biodiversity data in the N Atlantic completed (M10)

Navigation Data								
ID	COLLECTOR	COUNTRY	PROJECT	PUBLICATION	PROJECTION	SOURCE	B/P	MAIN TAXA / POSSE
1.10.300/1745.1000901147450	2010 BIOEEP	Article	B	MAP	HV	The fauna of hydrothermal vents on the Mohn Ridge (Norw.)		
4.10.301/6020.2013.02.003	2013 COMAR	Article	B	MAP	HV	Trawl megafauna vent community of a new deep-water bathyal l.		
4.10.301/6020.2011.11.009	2012 COMAR	Article	B	SI	U	Lower bathyal and abyssal distribution of coral in the axial vol-		
5.10.301/6020.2013.01.003	2013 COMAR	Article	B	MAP	HV	Deep-sea benthic megafauna in the bathyal-abyssal zone of the Mid-Atlan-		
6.10.301/6020.2013.05.009	2013 COMAR	Article	B	MI	U	Deep-sea surface-dwelling anthropods from the Mid-Atlan-		
7.10.301/6020.2012.09.003	2013 COMAR	Article	B	SI	U	Deep-pebble (0–300 m) faunal assemblage structure over the T		
8.10.301/6020.2013.05.001	2013 COMAR	Article	B	MAP	CA	Tracing a northern fur seal from a Scottish nesting site to the		
9.10.301/6020.2013.04.011	2013 COMAR	Article	B	MAP	A	First indications of annual migration routes and destination i-		
10.10.111/1244.2011.04.001	2011 N/A	Article	B	MAP	TS	Structure of deep-sea pelagic fish assemblages in relation to t-		
11.10.301/6020.2014.02.003	2014 COMAR	Article	B	MAP	U	Polychaete abundance, biomass and diversity patterns at the		
12.10.301/6020.2014.03.001	2014 N/A	Article	B	MAP	U	Midwater fishes collected in the vicinity of the Sub-Polar Fr.		
13.10.301/6020.2014.03.002	2014 N/A	Article	B	MAP	U	Bathyal demersal fishes of the Charlie-Gibbs Fracture Zone regi-		
17.10.301/6020.2013.08.002	2013 COMAR	Article	B	MAP	U	Bathyal demersal fishes of the Charlie-Gibbs Fracture Zone regi-		
18.10.301/6020.2013.08.003	2013 COMAR	Article	B	MAP	U	Bathyal demersal fishes of the Charlie-Gibbs Fracture Zone regi-		
18.10.301/6020.2013.08.004	2013 COMAR	Article	B	MAP	U	1888 N/A. Article. Variation in structure and biomass of the benthic commu-		
20.10.355/167121	2000 LUMIREECO	Article	B	MAP	U	Depth constraints and benthic diversity of deep-sea cave-		
21.10.301/6020.2013.05.013	2013 N/A	Article	B	MAP	U	1889 FREIEN Deep. Article. Density of the major user groups of benthic fauna and trophic		
22.10.301/6020.2013.05.013	2013 N/A	Article	B	MAP	U	Structure of deep-sea pelagic fish assemblages in relation to t-		
23.10.357/20022408783/00010070-7	2000 GOMAR	Article	B	MAP	U	Depth of the major user groups of benthic fauna and trophic		
24.10.301/6020.2013.05.013	2013 N/A	Article	B	MAP	U	Structure of deep-sea pelagic fish assemblages in relation to t-		
25.10.301/6020.2011.08.005	2011 N/A	Article	B	SI	CA	Structure of deep-sea pelagic fish assemblages in relation to t-		
						Acoustic survey by fishing nations towards identification of new		

Navigation Data										
ID	COLLECTOR	COUNTRY	INSTITUTE	PROJECT	ST DATE	ST YEAR	END DATE	END YEAR	LINKS	COD
1. James Cook	2008	BODC	ECOMAR	13/07/2007		2007	18/09/2007		2007 https://www.ecomar.be http://www.bodc.ac.uk	1
2. James Cook	X011	BODC	ECOMAR	13/07/2007		2007	04/04/2007		2007 https://www.ecomar.be http://www.bodc.ac.uk	2
3.Purcellus pas	SERFENTINE	IIFIMER	GEODE	26/02/2007		2007	09/04/2007		2007 https://www.sfrs.eu http://www.intech.univ-poitiers.fr	3
4. James Cook	2008	BODC	ECOMAR	13/07/2007		2007	18/09/2007		2007 https://www.ecomar.be http://www.bodc.ac.uk	4
5. James Cook	X028	BODC	ECOMAR	23/05/2008		2008	28/06/2008		2008 https://www.ecomar.be	5
6. James Cook	2008	BODC	ECOMAR	26/02/2007		2007	09/04/2007		2007 https://www.ecomar.be http://www.bodc.ac.uk	6
7. James Cook	VENTURE	MARINER INSTITUTE	VENTURE	13/07/2011		2011	09/09/2011		2011 https://www.marinerventure.com https://www.bodc.ac.uk	7
8. D.G. Sars	Leg 4 AZORES - CHAMFR	MAR-ECO		04/07/2004		2004	08/08/2004		2004 https://www.mareco.no	8
9.10.301/6020.2013.01.003	145.1 ISLAND-ADOC	MAR-ECO		20/06/2007		2007	02/07/2007		2007 https://www.mareco.no	9
10. James Cook	X030	BODC	HERMES	22/06/2007		2007	07/07/2007		2007 https://www.ecomar.be	10
11. James Cook	X030	BODC	HERMONE	20/06/2009		2009	28/07/2009		2009 https://www.ecomar.be	11
12. James Cook	2008	BODC	HERMONE	12/06/2009		2009	28/07/2009		2009 https://www.ecomar.be	12
13. H. Thomassen	HAWAII 2009 CFSF	MANNOSEN		12/06/2009		2009	28/07/2009		2009 https://www.mannosen.no	13
14.Hammer	RAMDEN1995	COMMERCIAL	EC FAIR PROJECT	01/09/1993		1993	09/10/1993		1993 https://www.ecfair.no	14
15.Iuran	DRILLING	COMMERCIAL	EC FAIR PROJECT	01/06/1996		1996	21/09/1996		1996 https://www.ecfair.no	15
16.Baggen	BORGABAGN1996	COMMERCIAL	EC FAIR PROJECT	01/06/1996		1996	21/09/1996		1996 https://www.ecfair.no	16
17.Skarhjem	SKAHEIM1997	COMMERCIAL	EC FAIR PROJECT	02/08/1997		1997	14/08/1997		1997 https://www.ecfair.no	17
18.K. van Hengel	K. van Hengel	COMMERCIAL	EC FAIR PROJECT	01/06/1997		1997	14/08/1997		1997 https://www.ecfair.no	18
19.Abelius	Mountains in the Se			11/07/2003		2003	18/07/2003		2003 https://www.bodc.ac.uk	19
20.Northern H. Brown	North Atlantic Step NOAA			06/08/2005		2005	03/10/2005		2005 https://www.bodc.ac.uk	20
21.Mitro	EUMELI	EUMELI		14/09/1993		1993	20/09/1993		1993 https://www.eumeli.no https://www.eumeli.no	21
22.Mitro	EUMELI	EUMELI		14/09/1991		1991	24/10/1991		1991 https://www.eumeli.no https://www.eumeli.no	22
23.Volante	EUMELI	EUMELI		18/05/1992		1992	30/06/1992		1992 https://www.eumeli.no https://www.eumeli.no	23
24.Mitro	EUMELI	EUMELI		17/05/1993		1993	29/06/1993		1993 https://www.eumeli.no https://www.eumeli.no	24
25.Charette	EUMELI	EUMELI		01/07/1989		1989	28/07/1989		1989 https://www.eumeli.no	25
26.Challenger	CH5/82	BODC		12/02/1982		1982	12/02/1982		1982 https://www.bodc.ac.uk	26



OBIS and published data for benthic VME indicator taxa (WGDEC, 2016)

■ ECS Submissions

■ World's EEZ

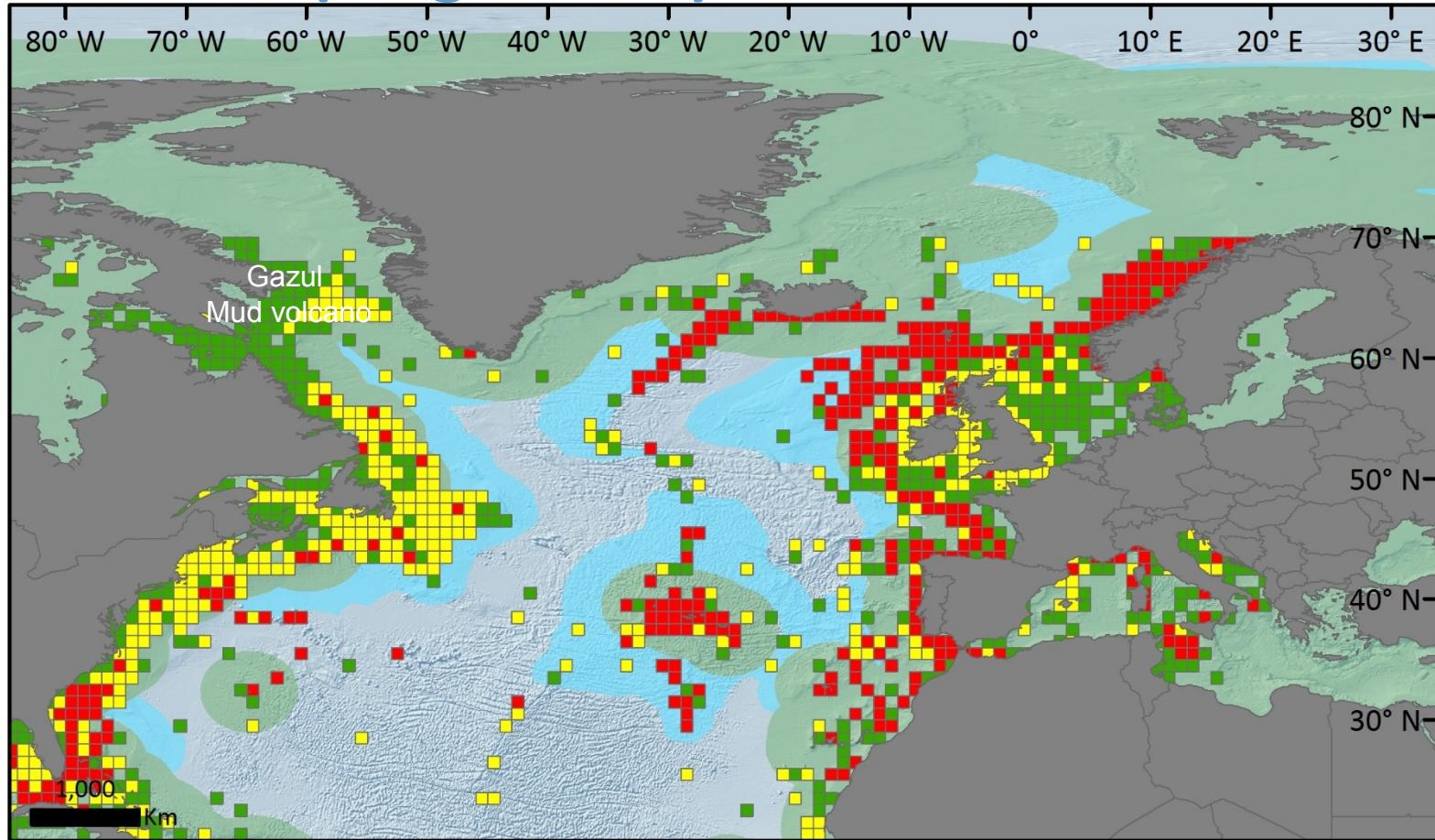


# MEDWAVES Cruise





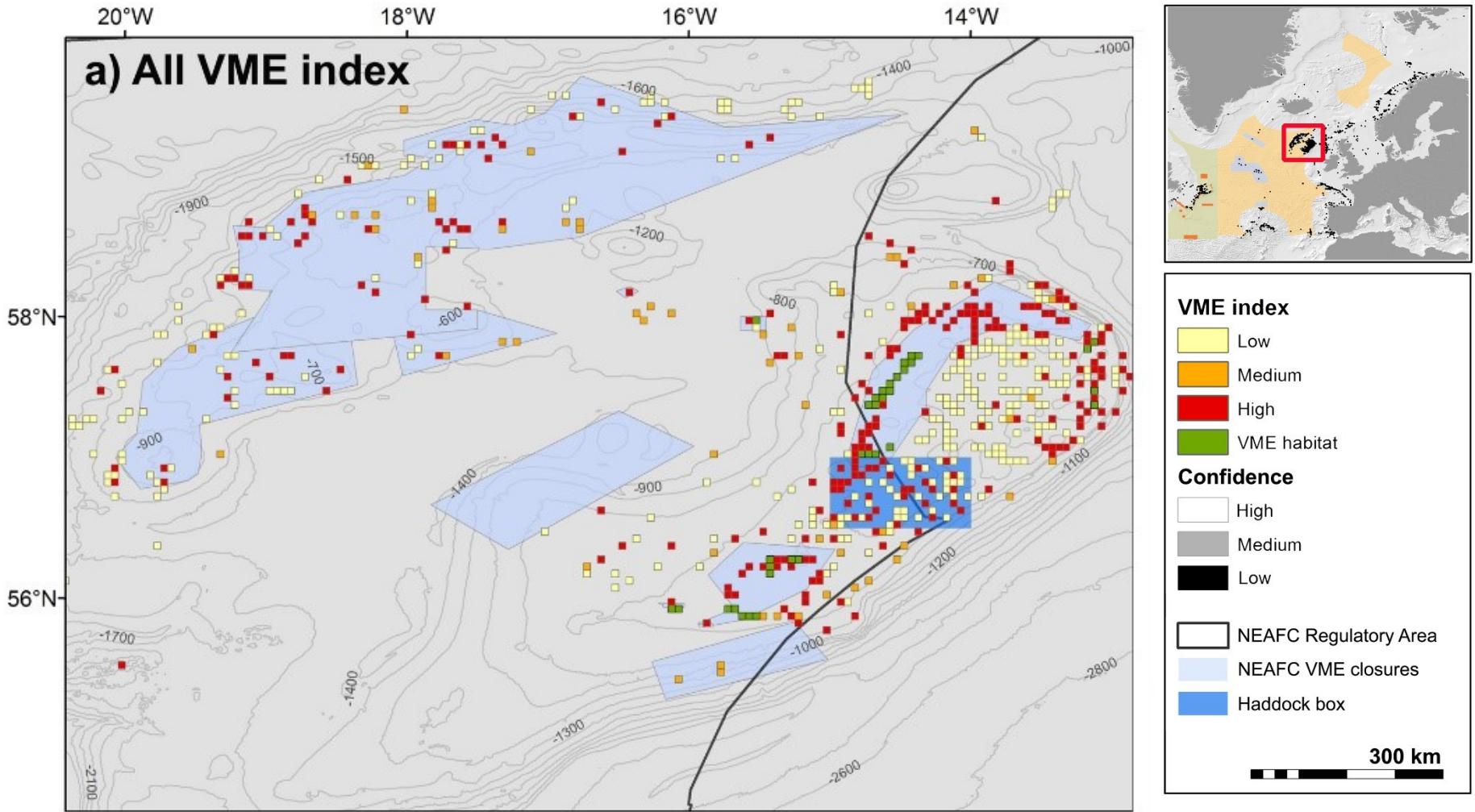
## VME Index (Large-scale)



VME Index █ 1.3 - 2.6 █ 2.7 - 3.7 █ 3.8 - 4.0



## VME Index (Smaller-scale; Rockall Hatton Bank)





## Task 3.2 Validate eDNA methods for monitoring and screening deep-sea biodiversity (M1-M36)

- Evaluate the performance of next-generation genomic tools (meta-barcoding of eDNA) for assessing biodiversity
- Evaluate quantitative qPCR (plankton samples) as a sensitive tool to detect and quantify biomass of target species
- Validate the accuracy and sensitivity of meta-barcoding and qPCR on samples assessed using classical taxonomy in selected Case Studies



## Task 3.2 Validate eDNA methods for monitoring and screening deep-sea biodiversity (M1-M36)

Mar Biol (2017) 164:112  
DOI 10.1007/s00227-017-3141-x

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METHOD

**Development of a sensitive detection method to survey pelagic biodiversity using eDNA and quantitative PCR: a case study of devil ray at seamounts**

Laura M. Gargan<sup>1,2</sup>  · Telmo Morato<sup>3</sup> · Christopher K. Pham<sup>3</sup> · John A. Finarelli<sup>2</sup> ·  
Jeanette E. L. Carlsson<sup>1,2</sup> · Jens Carlsson<sup>1,2</sup>



## Task 3.3 Conduct biodiversity assessments to measure GES in European Case Studies (M1-M36)

- Improve the definition of GES in the context of deep-sea, and define and agree on descriptor indicators and methodological standards
- Applications of the indicators to data compiled
- Apply the Ecosystem Evaluation Framework to identify locations in the Atlantic that may constitute an EBSA and assign conservation categories as a precursor to the development of an Atlantic wide MPA network

## Task 3.3 Conduct biodiversity assessments to measure GES in European Case Studies (M1-M36)





## Task 3.4 Predict changes in GOODS and GES under future scenarios of dynamics of N. Atlantic water masses (M24-M48)

- Test the hypothesis that ocean dynamics impact biodiversity and biogeography through three Case Studies
- Conduct SDM and HSM under IPCC 21<sup>st</sup> scenarios (*or environmental data from WP1 and physiological responses from WP2*) and compare outputs with those created under current ocean conditions
- Predict changes in GOODS biogeography under future scenarios of dynamics of the North Atlantic (*Predict changes in GES of VMEs under future scenarios of dynamics of the North Atlantic*)



## Task 3.4 Predict changes in GOODS and GES under future scenarios of dynamics of N. Atlantic water masses (M24-M48)



Sweetman, AK et al 2017 Major impacts of climate change on deep-sea benthic ecosystems. *Elem Sci Anth*, 5: 4, DOI: <https://doi.org/10.1525/elementa.203>

### REVIEW

#### Major impacts of climate change on deep-sea benthic ecosystems

Andrew K. Sweetman\*, Andrew R. Thurber†, Craig R. Smith‡, Lisa A. Levin§,  
Camilo Mora||, Chih-Lin Wei¶, Andrew J. Gooday\*\*, Daniel O. B. Jones\*\*, Michael Rex††,  
Moriaki Yasuhara‡‡, Jeroen Ingels§§, Henry A. Ruhl\*\*, Christina A. Frieder§,|||,  
Roberto Danovaro¶¶\*\*\*, Laura Würzberg†††, Amy Baco‡‡‡, Benjamin M. Grupe§,§§§,  
Alexis Pasulka||||, Kirstin S. Meyer¶¶¶\*\*\*\*, Katherine M. Dunlop\*, Lea-Anne Henry†††† and  
J. Murray Roberts††††

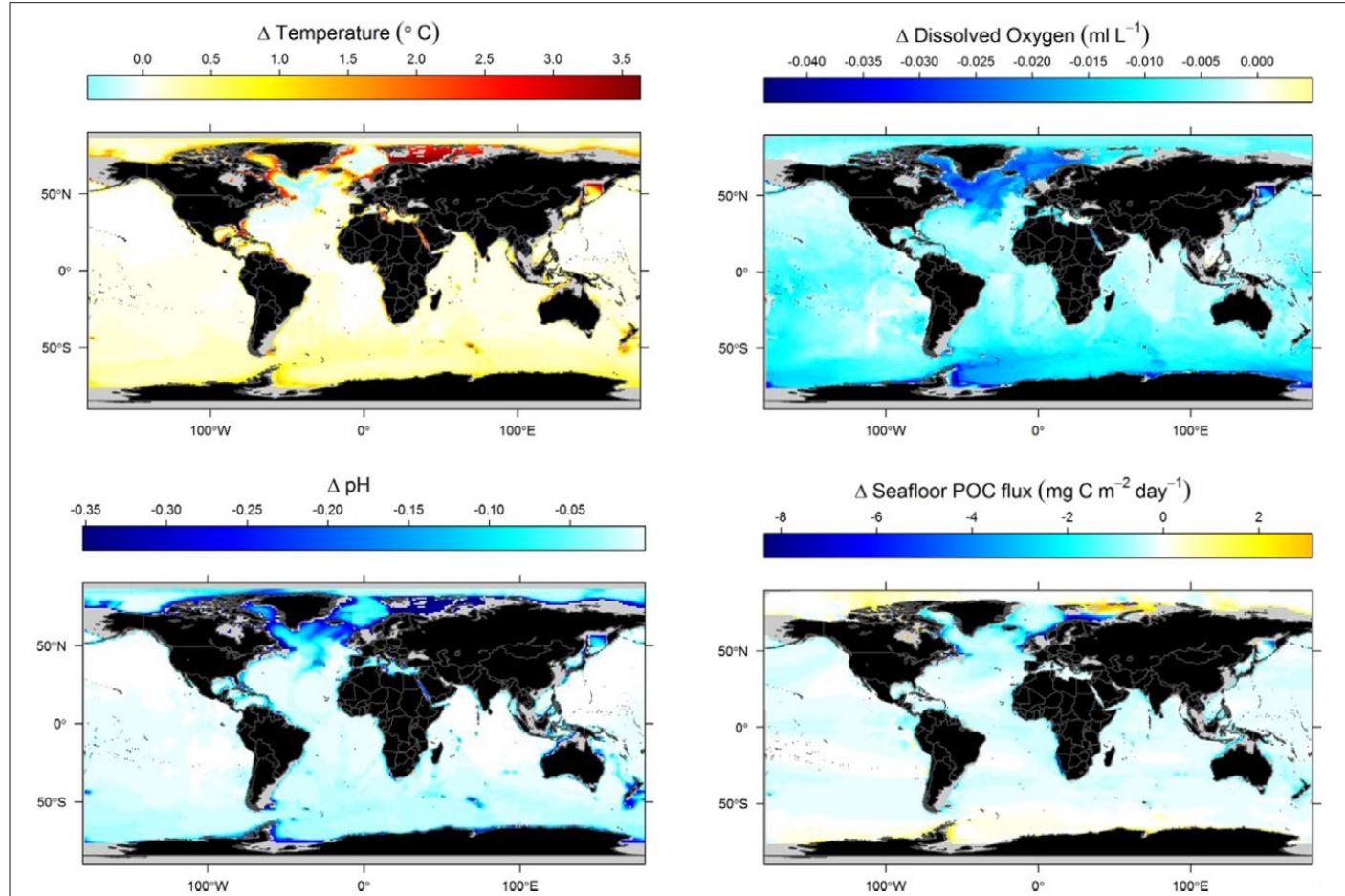


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## Task 3.4 future sc masses (



REVIEW  
Major  
ecosys  
Andre  
Camilo  
Morial  
Rober  
Alexis  
J. Mur



**Figure 2: Modelled environmental changes at the deep seafloor in the year 2100.** Modeled changes in temperature ( $^{\circ}\text{C}$ ), dissolved oxygen ( $\text{mL L}^{-1}$ ), pH, and seafloor POC flux ( $\text{mg C m}^{-2} \text{ d}^{-1}$ ) conditions that could be seen at the deep (> 200 m) seafloor by 2100 relative to present-day conditions. DOI: <https://doi.org/10.1525/elementa.203.f2>



## Breakout sessions

Thursday 27 April 2017

12:30 – 13:30 Breakout Session 3

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### GROUP 1: Planning and standardising SDM and HSM in the context of ATLAS

Lead: Telmo Morato

Location: Sala Es Trenc

ATLAS WP3 will develop SDM and HSM for multiple deep-sea species, biotopes or VMEs under current and future climate scenarios, and at different spatial scales. This breakout group aims at planning ongoing and future SDM/HSM related work, discuss possibilities for standardizing techniques (occurrence data, environmental information and modelling approaches), establish collaborations within the consortium, and discuss possible collaborations outside the consortium.



# Breakout sessions

Thursday 27 April 2017

14:15 – 15:15 Breakout Session 4

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GROUP 1: Developing an approach for assessing GES in the deep-sea

Lead: Cova Orejas

Location: Sala Es Trenc

Discussion points:

- The Main constraints to addressing GES in the Deep sea:
  - 1) the lack of baseline data
  - 2) the remoteness of the DS ecosystems,
  - 3) the limitations of the sampling methods currently available.
- Defining spatial and temporal scale to assess GES in the Deep Sea.
- Define the type of indicators to be used in the deep sea: previous ones already identified, e.g. in DEVOTES, which can be apply in the DS and specific ones.

# Special thanks to all WP3 members



**Marina Carreiro Silva**



**Covadonga Orejas**



**Lea-Anne Henry**



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# MapGES Cruise

