SEVENTH FRAMEWORK PROGRAMME
THEME 6

Environment (Including Climate Change)

Climate and anthropogenic drivers workshop, Faro, Portugal

Proposal Acronym: **MEECE**

Proposal full title: **Marine Ecosystem Evolution in a Changing Environment**

Grant agreement no: **212085**

Date of preparation of report: **03/2012**

MEECE Faro workshop

6th – 10th February 2012 Faro, Portugal

Contents

Meeting Summary and list of Actions

The purpose of the workshop was to monitor the progress of the project, and to identify areas where integration between project partners and activities could be improved (see annex 1 for the agenda). The meeting opened with a report from each partner on the status of the work at their institute along with future plans and identification of any deviations from the description of work. The status of each incomplete deliverable was then discussed and proposals made for completion of the work. The remainder of the workshop was focused on discussing strategies for ensuring integration across the project, focusing on the completion of work in the modelling WPs (3&4), the transfer of model outputs and information to WP5, expanding the scope of WP5 to cover a wider range of drivers. Finally the legacy of MEECE was discussed and proposals made. It was proposed that a 6 month contract extension was required. The following list of actions was taken generated from the meeting (Table 1) along with a revised Gantt chart based on a contract extension (Figure 1.)

Table 1. List of actions from the MEECE Faro workshop.

No.	Action	Responsible	Completion date	Comments
1	Apply for 6 month no cost contract extension	I Allen (PML)	March 2011	Need agreement of general assembly
2	Revise D1.4/D2.5 with further details of the acidification experiments and rerun 1-D ERSEM (comment – this is because of an imminent EUROBASIN cruise – we have no time to do this so quickly	R Bellerby (UiB)	April 2012	In response to 2nd consolidated report
3	Update D1.5 with details of the anthropogenic driver experiments in wp4 by region and model	I Allen (PML), L Bopp (CNRS)	March 2012	M Zavatarelli (UNiBO) to compile information in response to 2nd consolidated report
4	Update D2.9 with ERSEM cocolithophore model	T Tyrell (NERC) M St John (DTU)	March 2012	T Tyrell to define generic calefaction module. Y Artioli (PML) to provide code In response to 2nd consolidated report
5	Update D2.11 with generic description of IBM models	M St John (DTU)	March 2012	Extra fish IBM model supplied by Huse (IMR) (Feb 2011).

6	Completion of D2.12 ecotoxicological parameterisations	M St John (DTU)	March 2012	A Christiansen (DTU) to provide IMP parameterisations. M Zavatarelli (UNibo) to update Herbicides.
7	Completion of D3.4 a. Reporting template b. Simulations complete (Hindcast, 2080-2100) c. Deliverable complete	G Chust (AZTI)	a. March 2012 b. April 2012 c. July 2012	**Regional responsibilities** Global Ocean (Bopp) Barents Sea (Schrum / Skogen / Bellerby) NE Atlantic / N Sea (Holt, Mackinson, Butenschon, Schrum) Baltic Sea (Schrum, A Christiansen(DTU) Black Sea (Salihoglu) Biscay Sea (Chust) Adriatic Sea (Zavatarelli, Shin) Aegean Sea (Triantafyllou, Shin) Benguela Upwelling (Garcon, Shin, Machu)
8	Completion of D3.3 (publications)	G Chust (AZTI)	Feb 2013	Partners responsible for sending wp3 relevant papers to G Chust / J Heard
9	D3.4 MEECE atlas part 1 Climate driver a. Finalise atlas layout and content b. Define data Template (formats and output frequency etc) c. Model data delivered to PML d. Final atlas	Overall G Chust (AZTI) a. G Chust (AZTI) b. M Butenshcon (PML) c. Responsible regional partners d. G Chust	a. Feb 2012 b. March 2012 c. May 2012	Regional responsibles PML Y Artoli UBI U Deawal. UBI, G Nodal/ R Bellerby IMR Solfrid AZTI M Chifflet IRD E Machu/ Y Shin HCMR Kostas Tsaris

			d. August 2012	NERC S Wakelin UNIBO M Zavatarelli DTU A Christensen Cefas J Beecham METU H Cannaby CNRS L Bopp
10	Completion of D4.1 a. Reporting template b. Simulations complete (Hindcast, 2080-2100) c. Deliverable complete	M Zavatarelli (UNIBO) a. M Zavatarelli b. Regional responsible c. M Zavatarelli	a. March 2012 b. May 2012 c. July 2012	Regional responsibilities Global Ocean (Bopp) Barents Sea (Schrum / Skogen / Bellerby) NE Atlantic / N Sea (Holt, Mackinson, Butenschon, Schrum) Baltic Sea (Schrum, A Christiansen(DTU)) Black Sea (Salihoglu) Biscay Sea (Chust) Adriatic Sea (Zavatarelli, Shin) Aegean Sea (Triantafyllou, Shin) Benguela Upwelling (Garcon, Shin, Machu)
11	Completion of D4.2 (publications)	M Zavatarelli (UNIBO)	Feb 2013	Partners responsible for sending wp3 relevant papers to M Zavatarelli & J heard
12	Completion of D4.3 a Multiple driver simulations b Reporting template Simulations complete (t, 2030-2040) c Deliverable complete	M Zavatarelli (UNIBO)	a May 2012 b July 2012 c September 2012	**Regional responsibilities** Global Ocean (Bopp) Barents Sea (Schrum / Skogen / Bellerby) NE Atlantic / N Sea (Holt, Mackinson, Butenschon, Schrum) Baltic Sea (Schrum, A

				Christiansen(DTU)) Black Sea (Salihoglu) Biscay Sea (Chust) Adriatic Sea (Zavatarelli, Shin) Aegean Sea (Triantafyllou, Shin) Benguela Upwelling (Garcon, Shin, Machu)
13	D4.4 MEECE atlas part 2 Anthropogenic drivers a. Finalise atlas layout and content b. Define data Template (formats and output frequency etc.) c. Model data delivered to PML d. Final atlas	Overall M Zavatarelli (UNIBO) a. M Zavatarelli (UNIBO) b. M Butenshcon (PML) c. Responsible regional partners d. M Zavatarelli Chust	a. Feb 2012 b. March 2012 c. June2012 d. August 2012	Regional responsible PML Y Artoli UBI U Deawal. UBI, G Nodal/ R Bellerby IMR Solfrid AZTI M Chifflet IRD E Machu/ Y Shin HCMR Kostas Tsaris NERC S Wakelin UNIBO M Zavatarelli DTU A Christensen Cefas J Beecham METU H Cannaby
14	D5.2 Decision Support Tools a) Define data requirements b) Completion of report bar model indicators c) Completed report	G Piet (IMARES) a. J Holt (NERC) b. G Piet c. G Piet	a. March 2012 b. May 2012 c. September 2012	Responsible partner to complete components by April 2012, IMARES, DTU , Cefas, AZTI, KUCORPI, U PIED Key Model outputs • SST • pH • Nutrients • oxygen • net PP • Phytoplankton

				• Zooplankton • HTL's
15	D5.3 and 5.4 (MSE)	M Eero (DTU)		Combine D5.3 and 5.4 (MSE) to make the delivery more consistent Expand to discuss all drivers, focus on the manageable , fisheries, eutrophication, pollution Model examples on fisheries, eutrophication and discussion of the limitation approaches to pollution models
16	D5.5 Indicators	Y Shin (IRD).	Jan 2013	Delay delivery till after the Nov 2012 Indiseas workshop Need to include section on pollution (U Pied) and invasive (Korpi)
17	D6.4 Meece summer school report	J Heard (PML)	Feb 2012	
18	D6.5 Volume of factsheets a. Descriptor fact sheets b. Final volume	J Heard (PML) a) Descriptor responsible b) J heard	a. June 2012 b. Nov 2012	<u>Descriptor Fact Sheets: June 2012</u> **Pollutants:** Mike St. John/Tanja St. John and A. Viarengo **Eutrophication:** Yuri (with Corrina, George T and Marco Z.) **Biodiversity:** Jonathan Beecham **Invasive species:** Sergej and Yuri **Commercial species:** GerJan P. and Steve M. **Food webs:** Guillem C.

				and AZTI **Hydrography (climate change):** Jason H. Laurent B. and Corrina S.
19	D6.6 Summary of inputs form user groups	M Barange (PML)	Feb 2013	
20	Final science meeting	I Allen / J Heard (PML)	June 2012	Istanbul
21	Synthesis workshop	I Allen (PML), G Piet (IMAREES)	Oct 2130	To maximise synergy between WP 3 4 and WP5
22	Management reports	JI Allen / J Heard (PML)	May, August, November 2012 Feb 21013	
23	Final periodic report	JI Allen / J Heard (PML)	April 2013	WP reports coordinated by WP leaders. Individual partners responsible for reporting activities
24	Final report	JI Allen / J Heard (PML)	April 2013	WP reports coordinated by WP leaders. Individual partners responsible for reporting activities

Deviations from the Workplan

Justification for merging of deliverables 5.3 and 5.4: Deliverables 5.3 and 5.4 should report on Tasks 5.2 and 5.3. Under these tasks, management strategies to achieve long-term ecological objectives and strategic goals in relevant policy areas are developed and tested, which involves the development and application of Management Strategy Evaluation Tools. Thus, these two tasks involve an iterative process, where MSE tools are applied in order to test the existing and new management strategies. Therefore, merging the deliverables 5.3 and 5.4 would facilitate a logic flow in the presentation of the results in a single comprehensive document with clear scientific findings from the entire MSE procedure including messages relevant for the policy. Separate deliverables is obviously possible but would require applying fairly artificial thresholds throughout each of the contributions in order to draw apart what should go in D5.3 and in D5.4. The merging of the deliverables will not result in any reduction of the work reported.

Apecosm: There are on-going technical difficulties with implementing APECOSM in regionally downscaled models. IRD didn't find the right postdoc at the beginning of the project to couple APECOSM to ROMS-PISCES, the task requiring good skills in scientific programming and marine biological knowledge, particularly for a short period of 7 or 8 months of funding. IRD continue to work on the problem but it takes more time than initially attributed to the project. This impacts the regional modelling activities in the Biscay and Benguela regions

The Biscay region (AZTI) has switched and implemented the OSMOSE model instead. The proposed HTL simulations in WP3 and WP5 will be completed with this. The level of delivery to MEECE remains the same.

In the Benguela region the emphasis of the HTL modelling will be place on OSMOSE. Apecosm may yet be used is the technical issues are resolved in time. As an additional delivery simulation with the global APECOMS model will be provided (CNRS, IRD) to compensate (the global model has no open boundary conditions).

Figure 1. Revised Gannt chart for MEECE based on a no cost contract extension to February 2013.

		Original Project				Project meeting			Extension	Synthesis workshop					Final Report	
		2012											2013			
	Action	Feb	March	April	May	June *	July	August	September	October	Novembe	Decembe	January	February	March	April
	Number															
Contract Extension	1															
WP1																
D1.4	2															
D1.5	3	a	b													
WP2																
D2.5	2															
D2.9	4															
D2.11	5															
D2.12	6															
WP3																
D3.3	7		a		b			c								
D3.4	8															
D3.5	9	a	b		c				d							
WP4																
D4.1	10		a		b			c								
D4.2	11															
D4.3	12				a			b			c					
D4.4	13	a	b		c				d							
WP5																
D5.2	14	a			b				c							
D5.3	15															
D5.4	15															
D5.5	16															
WP6																
D6.4	17															
D6.5	18															
D6.6	19					a								b		
Meeting and Reporting Activites																
M1	20															
M2	21															
M3	22															
M4	23															
M5	24															

Pollution Simulations in the Black Sea: The pollution simulations will not be completed for the Black Sea because of the mismatch in timing between the completion of D2.12 and the employment of the MEECE post doc at METU. To compensate METU have included the following work. To address the invasive species' driver simulations have been made with a Jellyfish Model and to address the fisheries driver simulations have been made with and IBM anchovy model. METU has also completed extra work by developing the EwE, for the Black Sea.

Light Driver: UNIBO are unable to complete the light driver simulations in the Adriatic Sea because they have exhausted the supercomputer time available to the MEECE project, undertaking the main simulations.

Benguela Downscaled simulations: The Benguela region will be unable to complete the time slice 2030-2040 due to limited computing time. This is a knock on effect from the implementation of the regional downscaling in WP3. As the IPSL climate forced regional solution was severely biased in the present scenario, we decided to run two present day scenarios, one with raw forcing and one with downscaled winds. It was consequently making much sense to then conduct the same experiments in the future scenario to be able to appreciate if introducing an improved forcing in the future configuration would also improve the representation of the Benguela system in a warmer climate . Based on our limited computing time and man power, we took this option on scientific grounds. The delivery to MEECE in terms of the number of simulations completed remains the same, but the emphasis has changed.

Summary of progress by each Beneficiary

Each participating beneficiary gave a presentation of the status of their work are reported in Annex 2. The accompanying PowerPoint presentations can be found on the meece website. http://www.meece.eu/meetings/faro/faro_pt.html

Progress with deliverables

Each participating deliverable responsible gave a presentation of the status of their work as follows. The accompanying PowerPoint presentations can be found on the meece website, http://www.meece.eu/meetings/faro/faro_pt.html .

The following completion dates were defined (more detailed discussion of the Model Atlas and WP5 deliverables follows)

- D2.12/2.11 delivered March 15
- D3.4 August 2012 (April all info gathered from climate and lower trophic levels, May 2012 for higher trophic levels)
- D3.5/4.3 June all information sent to PML, Online atlas October 2012
- D4.1 Simulations, 1st May 2012
- D4.3 Simulations, 1st August.
- D5.2 May 2012 (+ model based indicators later)
- D5.3 /D5.4 – merge – because it integrative process. November 2012.
- D5.5 January 2012

Integration activities

This part of the meeting investigated how well the linkages between workpackages were working in the project. The discussion focused on a) the uptake of MEECE models from WP2 in WP3 and WP4 (see table 2), b) the definition and content of the MEECE modelling deliverables and the MEECE Atlas products and c) the improving the linkages with WP5 in particular emphasising the broad range of drivers covered by MEECE.

Table 2: Uptake of the WP2 sub models in the MEECE regions.

Region	Global	Barents	North	Baltic	Biscay	Adriatic	Aegean	Black	Bengeula
WP 2Module									
Co3 (D2.2)	x	x	x	x		x	x		x
C enhancement (D2.5, D1.4, D1.6))	x	x	x						
Coccoliths (D2.9)			x						
Structured Zoo (D2.10)									
IMB (D2.11)		x	x	x			x	x	
OSMOSE (D2.3)					x	x	x		x
APECOSM (D2.4)	x								?
ECOPATH (D2.8)			x	x				x	
SMS (D2.6)				x					
Pollution (D2.12 / D1.4 / D1.6))		x	x	x		x			
IS – Habitat (D2.13 / D1.4, D1.6))			x	x					
IS – Darwin (D2.13 / D1.4, D1.6))		x	x	x		x		x	

Integrating WP3 and 4

To address the issues of reporting quality and the approach we have defined detail reporting proformas for D3.3 and D4.1 (see annex 3 and 4). This has the additional benefit of demonstrating which information has been used from other WP's, and identifying the policy relevance of the work.

MEECE Marine Atlas

The content and format of the Atlas was discussed at great length. Actions were taken as follows, (those responsible for data supply are identified in table 3);
Circulate a plan/template to fix details included content, data format to Icarus Allen, M. Butschenson and Yuri Artoli end of Feb 2012 **M. Zavatarrelli and G. Chust.**

The outline of the common metrics and variable is defined as follows.

Common metrics (consistent with D3.2)
Climate: Scenario A1B (change at 2080-2100 relative to 1980-2000) (D3.2)
Anthropogenic: change at 2030-2040 relative to 1980-2000
Change Metrics:

1. Absolute difference (for SST)
2. Fractional difference (for other variables)
3. Trend lines for hindcast

Statistic:

1. Annual Mean (for maps)
2. Monthly mean (for changes in the seasonal cycle)

Variables:

1. SST (ºC)
2. pH (at sea surface)
3. Net Primary Production Depth integrated (g C m^{-2})
4. Zooplankton (biomass depth integrated)
5. HTL (total biomass of all fish species considered in the region)

Data template circulated to WP3/4 leaders. Beginning March 2012 M. Butschenon
Completed template for Atlas with technical requests for information needed to build the Atlas, including periods and scenario. Sent to Modelling group contacts by March 2012. Marco Z./Guillem C. (draft template in Annex 5)

Table 3. Modelling groups contact persons to lead input into Atlas templates

Modelling group	Main Contact for delivery of Atlas info
PML	Yuri Artoli
UiB	Ute D.
UiB	Gisel Nodal/Richard Bellerby
IMR	Solfrid
AZTI	Marina Chifflet
IRD	Eric Machu/Yunne Shin
HCMR	Kostas Tsaris
NERC	Sarah Wakelin
Unibo	Marco Zavatarelli
DTU	Asbjorn Christensen
Cefas	Jonathan Beecham
METU	Heather Cannaby
CNRS	Laurent Bopp

Modelling groups to deliver information by May 2012.

1. Agreed and fixed table of Model library (indicator list) to be circulated to entire group. February 2012. Jess Heard/ Ivo Grigorov

Transfer of information from WP3/4 to WP5

Set of indicators to cover a few descriptors to produce time series outputs analysed by WP5 to show how the models contribute to MSFD.

2. One set of instructions for data delivery – get action from **Jason Holt February 2012**
3. Talk to S. Olenin about including future climate information into BINPAS – to summaries basin wide responses. **Icarus Allen March 2012**
4. Extracting information on eutrophication which illustrates to management evaluation process. ??
5. Circulate email requesting information into anthropogenic scenarios. M. Zavatarelli 15th February delivered to Icarus Allen end of Feb 2012
6. Written explanation as to why did AZTI change models? **Marina Chifflet March 2012**
7. Circulate publications list for WP3 and WP4 for partners to check **April 2012 J. Heard**

8. Descriptor Fact Sheets: June 2012
   - **Pollutants:** Mike St. John/Tanja St. John and A. Viarengo
   - **Eutrophication:** Yuri (with Corrina, George T and Marco Z.)
   - **Biodiversity:** Jonathan Beecham
   - **Invasive species:** Sergej and Yuri
   - **Commercial species:** GerJan P. and Steve M.
   - **Food webs:** Guillem C. and AZTI
   - **Hydrography (climate change):** Jason H. Laurent B. and Corrina S.

Data Archiving

The reduced model data sets which underpin the MEECE atlas will be made available from the Web version of the Atlas. The will be stored in INSPIRE compliant netcdf. The full raw data sets will be available on request from the originator. Approaches will be made to the EMODNET to investigate the possibility of them hosting MEECE model data.

Legacy of MEECE

The following items were proposed as the key components of the legacy of the project.

1) Model Library
2) Simulation data
3) MEECE Atlas
4) Decision support tools
5) Management Strategy Evaluation Tools
6) Descriptor based factsheets
7) Register of Foreground (what and how used with emphasis on policy context and MSFD)

WP5 Workshop

Status of Deliverable D5.2

All planned contributions for D5.2 have been received. Based on the marked diversity of these contributions we noted that a clear framework for DST in the context of marine management as required by the MSFD was required for the finalization of the D5.2. The initial introduction was not considered adequate and therefore this is being redrafted.

Justification for requested shift of "expert systems" from deliverables 5.5 to 5.2

As we are drafting what is intended to be a comprehensive framework for DST it also includes expert systems. Therefore we believe the contributions on expert systems should become part of D5.2. In the report there is also the specific mentioning of expert systems in Task 5.4 (resulting in D5.5) because the main topic in this task (IndiSeas) is effectively an expert system. However we now believe the reporting of any expert system other than IndiSeas should be moved to D5.2 leaving D5.5 to report on IndiSeas only. This move would not only improve the consistency of the deliverables and the logic of WP5 but also facilitate the logistics as this would allow the partner responsible for D5.5 to focus entirely on the IndiSeas results without having to liaise with other partners working on expert systems.

Status of deliverables 5.3 and 5.4

The draft outline for these deliverables has been developed. This includes contributions to various steps in the management strategy evaluation cycle, and examples of the application of MSE tools to

test management strategies. The contributions completed so far include; demonstrating the need for adapting short-term marine resource management strategies to a changing environment, resulting from changes in climate and eutrophication or other drivers, which may influence the productivity of the ecosystems or the sensitivity of ecosystem components to these drivers (e.g. pollution). Reference values under different environmental conditions are being addressed, including those for pollution indicators. Management capabilities to restore depleted populations depending on environmental conditions are demonstrated on the example of the eastern Baltic cod (see Fact Sheet 4); and adaptive harvest control rules taking into account environmental conditions are being developed for anchovy in the Bay of Biscay, using Management Strategy Evaluation framework. Further, MSE tools are being developed and applied for the Baltic and North Sea ecosystems to test the management strategies considering biological interactions and fish communities (MSFD descriptors 3, 4). The on going tasks include a review of management strategies of marine human activities, in relation to spatial planning and a review of different classes of models deployed within MEECE, with respect to their relevance to address management questions. Planned activities include addressing the effectiveness of management actions to control eutrophication and related risks of compromising GES, to be carried out when relevant datasets from scenario simulations become available. Further, analyses of pressure-state relationships and evaluation of indicators emerging from WP3 and 4 simulations are planned. Outcome of these exercises, however, will depend on the indicators emerging from these WPs.

Justification for requested merging of deliverables 5.3 and 5.4

Deliverables 5.3 and 5.4 should report on Tasks 5.2 and 5.3. Under these tasks, management strategies to achieve long-term ecological objectives and strategic goals in relevant policy areas are developed and tested, which involves the development and application of Management Strategy Evaluation Tools. Thus, these two tasks involve an iterative process, where MSE tools are applied in order to test the existing and new management strategies. Therefore, merging the deliverables 5.3 and 5.4 would facilitate a logical flow in the presentation of the results in a single comprehensive document with clear scientific findings from the entire MSE procedure including messages relevant for policy. Separate deliverables are obviously possible but would require applying fairly artificial thresholds throughout each of the contributions in order to draw apart what should go in D5.3 and in D5.4. The merging of the deliverables will not result in any reduction of the work reported.

Outline of the structure of Deliverable 5.3 Management Strategies

1. **Capabilities to manage different drivers (all drivers; by June meeting)**
2. **Review of possible management measures (IMARES: Summer)**
   - 2.1. Marine activities management strategies, spatial planning (links to D 5.1)
3. **Adopting marine resource management to a changing environment, short term management strategies**
   - 3.1 Changes in ecosystem productivity: general implications for resource management strategies (Links to WP2, 3) (DTU: completed) (June) (HCR, ref levels)
   - 3.2 Adaptive harvest control rules taking into account environmental conditions: example of BB anchovy (AZTI: June) Relevance for MSFD, CFP……..l
   - 3.3 Maximum Sustainable Yield of North Sea sandeel (links to WP2,3) (DTU: XX) Relevance for MSFD, CFP…….
   - 3.4 Management capabilities to restore populations depending on environmental conditions: example of the eastern Baltic cod (DTU: completed) (June) Relevance for MSFD, CFP……..
4. **Management considerations for drivers difficult to control (eutrophication, pollution) long term**
   - 4.1 Risks of compromising GES of eutrophication (Eutrophication modellers: PML (Momme) , Corrina(Baltic) , Marco (Adriatic), Kostas (changes over time). Effectiveness of management actions. In relation to thresholds (winter N, summer Chl, N/P) Black Sea (Baris, IMS-METU)
   - 4.2 Empirical analyses of changes in nutrient loads and input of hazardous substances and ecosystem status: time-lags; implications for management (example of the Baltic Sea) DTU (completed)
   - 4.3 Changes in reference values for pollution indicators under changing environment (Upiedmont; June)

Reference levels:
Pollution (Cu dependent on temperature)
Fish: MSY (dependent on envir); healty size-age structure
Relationships anthropogenic driver-ecosystem indicator (WP3/4)

5. Indicators:
Evaluation of indicators (Wp3/4); which is a better indicator, criteria (sensitivity, responsiveness)
Pressure-state relationships (Find out in June) (attribution) (IMARES)
Response in community indicators to management measures (IMARES) depends on model

Outline of the structure of Deliverable 5.4 Management Strategy Evaluation Tools

1. Review of MEECE models with respect to relevance for the management (Generic overview, different classes of models) Steering Committee, which components of the model can be addressed; what the models can do;

- Include the plot by Icarus, about knowledge about the outcome and probability
- List of criteria to assess the models, how useful they are

2. Management Strategies

2.1 Management strategies taking into account biological interactions: example of the Baltic Sea
- (SMS, links to WP 2-4) (DTU: XX)
  - MSY, GES of populations in ecosystem context; under different climate conditions
  - Relevance for MSFD, CFP….

2.2 Management of fish communities: example of North Sea (IMARES: done, possibly to be revised
- Relevance for MSFD, CFP….

Examples of MSE tools and their applicability
- MSE framework for testing management strategies of a single stock
  - (BB anchovy) AZTI: June
- MSE framework to test ecosystem based management strategies
  - 2.2.1 SMS coupled with FLR based MSE framework (Baltic) (DTU: XX)
  - 2.2.2 Community model (North Sea) (IMARES: XX)
- Tools to address multiple human drivers
  - OSMOSE ?? (IMARES: XX)
  - 2.3.2 EwE (CEFAS?)

2.3 Spatial aspects in management strategy evaluation
- Capability of MSE tools to support spatial management strategies, an increasing need
- A method to estimate overlap between a pressure and ecosystem component

Annex 1: Faro Workshop – Agenda

Key topics to be discussed in workshop through plenary and working groups

Day 1
1. Status report by institute of active and proposed work: what are you doing, who are you working with, state of play, when tasks will be completed.
Deliverables: which are you involved with, which have you made use of, how does your active work feed into other deliverables.
(10 mins max per organisation)

Really important to emphasis linkages between WPs

2. Deliverables to complete
Structure and consistency of presentation – **I. Allen**

Summary by lead institute as to state of play, what's needed for completion
D2.12 DTU/Mike or Ivo Grigorov
D4.1 IRD/UNIBO, M. Zavatarelli
D4.2/3.3/6.4/6.5/6.6 J. Heard
D5.2 IMARES, G. Piet
D5.3 DTU, Margit Eero/GerJan
D3.4 AZTI, G. Chust
D3.5/4.4 AZTI and UNIBO
D4.3 UNIBO, M. Zavatarelli
D5.4 DTU Margit Eero/GerJan
D5.5 IRD/Cefas Yunne or Steve Mackinson

Identify working groups as needed per Deliverables

Workshop dinner

Day 2
3. Problems to address
Demonstration of linkages between WP1,2 and 3,4
Demonstration exploitation of 3,4 in 5,6
Changes in perception that WP5 is just about fisheries

4. Clearly engage how we define with the MSFD process, as a project and as individual institutes

5. Clearly define and plan the atlas
Outline a plan
Assign tasks
Fact sheets by descriptor to underpin Atlas

6. Model data access
Particularly with respect to DG En.

Day 3
7. Structure of deliverables and final report
Aim to achieve a more even style of reporting.

8. Updating
Model library
Datasets (access free)

9. Working groups on deliverables as needed

10. Any other business

Steering Committee meeting 4:30pm
Allen, Heard, Bellerby, St. John, Chust, Zavatarelli, Piet

Day 4
WP5 workshop: contact G. Piet for further details

Annex 2: Progress Reports

A2.1 Plymouth Marine Laboratory (PML)

WP2: PML has been involved in the development and implementation of different modules.
PML released a plug and play module to solve the carbonate system in coupled physical-biogeochemical model to study Ocean Acidification including different formulation for calcification process. This work resulted from collaboration with NERC-NOC.
Another contribution to WP2 has been the modification of the Low Trophic Level ecosystem model ERSEM (one of the MEECE LTL models – see MEECE Model Library) to address diversity in the phytoplankton component and consequently to simulate the susceptibility of an ecosystem to invasion of a Non Indigenous Species (NIS) of phytoplankton (D2.13). The module is also able to assess the impact of such invasion on the phytoplankton community following as in the BioPollution index (Olenina et al., 2010). This module has been implemented in a 1D set up simulating a coastal station in the Western English Channel (part of the MEECE domain North East Atlantic).
ERSEM has also been modified to include Coccolithophores as a new phytoplankton function group. This new group has been coded following the recommendation included in D2.9 delivered by NERC-NOC.
PML also contributed to D2.12 deriving a parameterisation for the impact of copper on benthic filter feeders. The parameterisation has been derived from the experiment made by U Piedmont and it simulates the changes in growth rate depending on the combined effect of dissolved copper concentration and temperature.

WP3: PML run a 45 years hindcast of the North East Atlantic forcing POLCOMS-ERSEM with reanalysis data and validated the outputs against *in-situ* data of the main biogeochemical variables (temperature, salinity, nutrients, phytoplankton biomass, chlorophyll...) and satellite derived datasets (for temperature and chlorophyll) using the techniques indicated in D2.7. A paper is in preparation on the model validation.
The carbonate system has been validated as well, using the data provided by MEECE in D1.3.
One paper is under second revision in Journal of marine systems.
POLCOMS-ERSEM has been forced also with output from the IPSL climate model, both for present day condition and future scenario (end of the century A1B scenario, as released by CNRS). The causes of changes in primary production have been analysed (see NERC report for more detail). PML focuses in particular on the estimate of Ocean Acidification, its variability and its impact. In particular, the parameterisation proposed by MEECE to study the impact of OA on primary productivity (D2.7 – responsible UiB) has been implemented. A paper is in preparation on this topic.
Finally, the module for Coccolithophores has been implemented in the North Eastern Atlantic domain and the mean annual distribution of this group has been compared with the frequency of dominance of Coccolithophores in PHYSAT climatology (D1.3 contribution by CNRS) showing qualitatively reasonable agreement.

WP4: The module delivered for D2.12 on the impact of copper on filter feeders growth has been tested in the present day run of POLCOMS-ERSEM in the North Eastern Atlantic: given the medium-coarse resolution of the model (approx. 12km) the model is not able to simulate high concentration of the contaminant in the water and consequently almost no difference on filter feeders population has been observed with the standard run, where the contaminant is not simulated. Consequently, this driver will be discarded from next implementation.
The parameterisation delivered in D1.4 about the impact of trawling on the benthic communities has been implemented in the hindcast run of POLCOMS-ERSEM in the NE Atlantic. Data on trawling effort in the North Sea coming from D1.1 (delivered by IMARES) has been used to force the model. Benthic communities resulted significantly affected by trawling, and consequently this driver will be implemented in the future runs for D4.3

Finally, the outputs from POLCOMS-ERSEM on a combined Baltic Sea-North Sea domain have been used to assess how climate change will impact the frequency and the extension of the habitat of a planktonic NIS (*Prorocentrum minimum*). To define the habitat the parameterisation delivered by KUKORPI in D1.4 has been used.

A2.2 University of Bergen

WP1: Databases

•Mesocosm database D1.1 –paper submitted •River boundary conditions D1.2
•CO2 system databases D1.3

New experimentation

•Cruise experimentation has been worked up (CO2 and temperature on plankton) paper submitted
•Mesocosm experimentation has been worked up (CO2, DOC, nutrients) (Many papers for BGD to be submitted for special issue end March)

WP2: Parameterisations

•Carbon phytoplankton (simple C-uptake sensitivity to CO2) D2.5 (Paper in prep) •More complex (realistic) eMLR parameterisations D1.4. (Paper in prep) In response to the reviewers we will redo the D2.5 parametrisation according to the new results from the Ny Ålesund acidification study and we will run new model sensitivity runs to assess the changes to the carbon export, ocean acidification feedbacks and plankton speciation

Wp3: Regional climate change scenarios (T3.3)

The group is responsible to further develop available models and accomplish modelling scenarios in the Barents Sea, North Sea and Baltic Sea.

•IPCC scenarios (A1B, B1; ERA40, REMO) of the Barents Sea and local case studies of Svalbard waters and Røst coral system (climate change, ocean acidification, stoichiometry (from D2.5) with/out boundary conditions forcing and model testing from CARINA dataset (D1.3). River constraints from D1.2. (Papers submitted and in prep)

Lower trophic level (NPZD) simulations ECOSMO

North and Baltic Sea

Hindcast runs with an earlier version of ECOSMO were accomplished earlier, after validations against data from D1.3 and additional data available via ICES and HELCOM, the need for further development of ECOSMO for the Baltic Sea system became obvious. After further developing ECOSMO to adapt to the Baltic Sea requirements and coupling to the carbonate chemistry module D2.2, hindcast runs 1948-2010 were repeated and successfully validated for the coupled North and Baltic Sea system. Climate projections including the period 2080-2100 are compiled for the lower trophic levels as agreed using results from the IPSL AR4 model simulations (D1.5). Additional projections with a number of AR4 and AR5 models were compiled to assess uncertainty in climate change projections. The data are available and were also already provided to co-working institutions. (see collaboration). Climate change projections including the period 2030-2050 (as agreed in D4.5) are under progress. Climate change projections for the carbon chemistry will be accomplished within the next few weeks.

Barents Sea

Earlier accomplished hindcast runs are currently repeated with the new version of ECOSMO including coupled carbonate chemistry (D2.2). Climate change projections including the periods 2030-2040 and 2080-2100 are in progress and will be completed within the next 2 months.

T3.4

Higher trophic level simulations

GFI/UiB is currently able to run mechanistic IBMs for Atlantic cod & sprat early life stages in the North Sea and a statistical plaice IBM in the North and Baltic Sea. Although we were not supposed to run these within MEECE according to the DoW, we agreed to supplement MEECE contracting work with HTL simulations. The hind cast simulation (1980-2008) for Atlantic cod in the North Sea is currently under construction and climate projections will be accomplished within the next few weeks.

Collaborations
The GFI collaborated with other MEECE institutions by providing ECOSMO data to force especially HTL modules:
Baltic Sea:
Partner **DTU:** mechanistic larval IBM for herring; EwE & SMS simulations in the Baltic Sea
Partner **IMR:** HTL and cod IBM simulation in the Barents Sea

WP4 T4.1
Hind cast simulations & validation: see T3.3

T4.2
North and Baltic Sea
Scenario runs were compiled with ECOSMO testing the impact of fisheries and eutrophication on lower trophic levels production for the hind cast period (1948-2008). To address invasive species UiB collaborates with **PML.** Pollution experiments were conducted to model the fate and transport of copper and Nonyhlphenol in the North Sea and Baltic Sea, the final completion of these experiments is planned for the next 2 months including utilization of new source data. The impact of pollution on zooplankton growth and fish larvae will be addressed together with **DTU**.

Barents Sea
Scenario runs addressing the impact of pollution were compiled with ECOSMO testing the impact of fisheries and eutrophication on lower trophic levels production for the hind cast period (1948-2008). They will be repeated with the improved ECOSMO module. Pollution experiments were conducted addressing Mercury and Copper, their completion is planned for April/May.

North and Baltic Sea
Barents Sea
Multi driver scenarios (Climate + anthropogenic) will be conducted within the next months.

A2.3 University of Hamburg

D2.11
Note: DELIVERABLE Accepted in the Previous reporting period.
- ✓ Module and User guide under discussion.

Utilized in Task 3.4/4.2 Implimentation in different systems i.e. Black Sea; North Sea; Med; Baltic.

D2.12
Activities: Ongoing delayed due to delays in the experimental program in D 1.4 D1.6
Note: All submodules are a scaling of existing vital rates (growth, survival, development) in e.g. IBM models or bulk NPZD
Submodule development and utilization:

UNIBO: T.4.5 -Bulk Phytoplankton-Herbicide
-User guide available
-Simulations on going

DTU Aqua: T 4.5 -Small Pelagic IBM: Baltic North Sea
-Validation ongoing user guide completed end February

HCMR: T4.5 - Small Pelagic IBM: Med
- Awaiting DTU user guide

A2.4 University of Bologna

WP1: The planned activities have been completed. The work involved the realisation of Phytoplankton cultures of *Skeletonema Marinoi*, *Gonyaulax Spinifera* and *Prorocentrum Minimum,* carried out at different temperatures and exposed to changing concentrations of herbicide terbuthylazine. A total number of 33 phytoplankton cultures (lasting 15-30 days) have been carried out. Results from the cultures were used to devise a parameterisation of the effect of the herbicide on phytoplankton. The original parameterisation has been tested within the 0D version of the Biogeochemical Flux Model (BFM). Results of the laboratory cultures, as well as a description of the model parameterisation of the herbicide effect is given in Deliverable D1.6 (an updated version of the

deliverable, containing the latest phytoplankton cultures and the latest parameterisation development is being prepared.

WP2: UNIBO is contributing to this WP although there is not any formal commitment.
A FORTRAN90 subroutine coding the herbicide parameterisation devised in WP1 has been prepared and made available along with instructions for incorporation in established biomass based, carbon cycling LTL model. Subroutine description and instruction for use are being included in deliverable D2.12.

WP3: UNIBO performed LTL simulations of the Adriatic Sea ecosystem dynamics in both the hindcast and the prediction mode. The hindcast time slice was for 1980-2010 and it was carried out under downscaled high space-time resolution atmospheric forcing for the Mediterranean region and under hindcast (via hydrological modelling) river runoff and nutrient load.
The prediction time slice was 2080-2100 and it was carried out under downscaled atmospheric forcing considering the IPCC A1b CO2 emission scenario. Similarly, the hydrological model providing river runoff and nutrient load was forced by the same atmospheric boundary conditions, while the parameters describing anthropogenic (policy implementation mediated) impact were obtained considering the "Business as Usual (BaU)" assumption (extrapolation of current trends).
Although climate oriented, these hindcast and prediction mode simulations represent a good example of "multidriver" simulations, as they address the sensitivity of the Adriatic ecosystem to simultaneous variability of atmospheric and land based forcing conditions. WP4.
Results of such simulations are being validated (consistently with deliverable 2.7), described and discussed in deliverable D3.4.

WP4 The influence of the direct anthropogenic drivers on the Adriatic Sea LTL biogeochemical dynamics has been addressed for the time slice 2025-2030. The drivers addressed were eutrophication and pollution and were studied in both the "isolated" and "multidriver" mode.

Eutrophication
Eutrophication scenarios, considering variable runoff and were taken from the SESAME Project set of scenarios. The adopted quantitative scenarios were:
"*Business as Usual"*
"Policy target"
"Deep Blue"
The adoption of such scenarios represents a deviation from the ELME based scenarios recommended by MEECE. However:
The "Deep Blue" scenario can be considered as very similar to the ELME "*Local Responsibility*" scenario, while the "*Policy Target*" scenario can be considered as comparable to the ELME "*Global Community*" Scenario.
The advantage of adopting the SESAME derived scenarios lies in the fact that they are quantitative rather than qualitative scenarios, as they provide estimates of the runoff and nutrient loads occurring under given climatic and anthropogenic pressure assumptions. Therefore they represent another example of "multidriver" simulation.

Pollution (Herbicides)
The pollution scenario simulations were carried out implementing in the LTL model the parameterisation of the herbicide effects on phytoplankton devised and tested in WP1 (D1.6) and coded in WP2 (D2.12). Scenarios assuming a progressively increase of herbicide concentration in the coastal areas of the Adriatic Sea were performed under the "Business as Usual" eutrophication scenario. Results from the eutrophication and pollution simulations are being described and discussed in deliverables D4.1 and D4.3.

Activities still pending
- Completion of the Model validation procedure with the development of a wavelet based method.
- Linking the LTL (BFM-POM) model with the HTL OSMOSE model in the one-way off-line mode. The links between the two models has been achieved in the framework of cooperation Between UNIBO and IRD. Some "un-calibrated" run has been performed. Calibration is under way despite problems raised by the lack of data.

Unachievable activities
UNIBO was expected to carry out also scenario based sensitivity tests of the Adriatic Sea ecosystem to variations in "Colored Dissolved Organic Matter (CDOM)" concentration that affects light penetration in the water column. The POM-BFM system is already equipped to resolve this effect. However, performance of sensitivity tests were not possible because the realisation of the other simulations completely exhausted the computer time bought with the project money.

A2.5 AZTI

WP3:

- **T3.3** Regional LTL Simulations for the Bay of Biscay, the task is on-going
- **T3.4** Regional HTL Simulations for the Bay of Biscay region. For technical and calendar reasons (availability of the model and regional calibration), APECOSM is replaced by OSMOSE model (which still needs calibration by IRD)

Leading:

- **T3.5** Synthesis report for all regions (is on-going)
    - Synthesis of simulation results:→ **D3.4** (to deliver in August). Structure and calendar are proposed
    - Web-based Atlas: → **D3.5** (to deliver in August) Design, and metrics and Plan are proposed (collaboration with UNIBO and PML)

WP4, involved in Tasks:

- **T4.1** Calibration and hindcast validation (June 2011). *Delayed. In progress. End by Feb 2012. Feed to* → **D4.1, D3.4**
- **T4.2** Multiple drivers simulations (May 2012) (*is ongoing;* → **D3.4, D4.2, D4.3, D4.4**)
- **T4.3** Relative impact of climate and direct anthropogenic drivers (*In progress,* August 2012) (→ **D4.3, D4.4**)

WP5, involved in the following Tasks:

- **T5.1**: Integrated assessment of marine resources – Finished (→ **D5.1**)
- **T5.2**: Testing management strategies – In progress (→ **D5.3**, expected deliver Oct 2011 but postponed)
- **T5.3**: Management Strategy Evaluation Tools - In progress (→ **D5.4**, for August)

A2.6 IMARES

IMARES is work is divided over several tasks:
We are finalizing D5.2. For which we received several contributions covering different DST (MCDA, expert systems, scenario planning), regions (Baltic, North sea, Mediterranean, South Africa) and drivers (Fisheries, Pollution, Climate, Non-indigenous species) but when collating them into one report we felt that the introduction required an overarching framework that ties the different contributions together. This is currently being drafted based on a literature review and when this is completed D5.2 is finished.
For D5.3 we have created a database of possible management measures linked to the sectors, pressures that occur in the Integrated Ecosystem Assessment of D5.1 so that identification of the mains sectors or pressures that compromise GES can be translated into potential management measures.
For D5.4 we applied MSE using a size-based community model to evaluate measures aimed at achieving MSFD and CFP objectives. We combined this with a D5.2 DST in order to determine the preferred management strategies based on stakeholder preferences. This work was completed but now there turn out to be issues related to the tuning of the model we used. He final analyses can only be done after these issues are resolved.
IMARES is involved in the IndiSeas work and participated in the November meeting where some analyses based on the IndiSeas indicators were planned.

Finally we have parameterized OSMOSE for the North Sea and conducted some preliminary runs. If time and resources allow OSMOSE will be used as part of the MSE work.

A2.7 NERC

Completed:

- Suite of WP3 simulations complete
  - ERA40 reference (45yr)
  - IPSL direct forced (23yr; A1B, CNTRL, A1Bb (WODC values on boundary), A1Bt (ecosystem exposed to constant temperature)
- WP4 river nutrient perturbation experiments (6yr)
  - 1st set (ERA40 forced) complete, global common + World Markets, changes following OSPAR ICG-EMO experiments (+/- 50%)
- Publications
  - Holt, J., Butenschon, M., Wakelin, S.L., Artioli, Y., & Allen, J.I. (2012) Oceanic controls on the primary production of the northwest European continental shelf: model experiments under recent past conditions and a potential future scenario. *Biogeosciences, 9, 97-117.*
  - Holt, J., Hughes, S., Hopkins, J., Wakelin, S.L., Holliday, N.P., Dye, S., González-Pola, C., Hjøllo, S.S., Mork, K.A., Proctor, R., Read, J., Shammon, T., Smyth, T., Tattersall, G., Ward, B., & Wiltshire, K. (In review) Multi-decadal variability of the temperature of the northwest European continental shelf: a model-data synthesis. *Progress in Oceanography.*
- Deliverables
  - D3.1 MEECE scenarios
  - D3.2 MEECE Common Metrics

On-going:

- Analysing climate drivers
  - Temperature, Light, Stratification, etc.
  - Coupled and non-linear effects (e.g. 'nutrient capture' by changes to community structure)
  - Presentation at Yeosu 2012
- Further anthropogenic driver experiments
  - Rivers loading + trawling + climate
  - Effects of IOPs; +climate forcing 2030-2050 and 2080-2100
- Uncertainty and experiment design:
  - Small AR4 ensemble using Delta approach
  - HadCM3 forcing (as available) as second direct forced data set
  - Transient v's timeslice simulations
    - Timescales of adjustment benthic/pelagic system
  - Presentation at Yeosu 2012
- Contribution to D3.4, 4.3 (synthesis reports) and 4.4 (Atlases)

A2.8 HCMR

Summary for HCMR work/presentation in Faro workshop

The fishing driver scenario Deliverable (D1.5 part) was completed, allowing for the parameterization of A1 and B1 scenarios using the fishing mortalities (F). The Fmsy (Maximum Sustainable Yield) was adopted for A1 and Fpa (precautionary approach) for the B1 scenario. Specific values were identified for key species in Northern waters, Adriatic and Aegean seas, while generic values are provided for unknown data in other areas.

The N. Aegean hydrodynamic/biogeochemical model (POM-ERSEM) has been coupled to the carbonate system module (D2.2) and two high-trophic level models, OSMOSE (D2.3) and anchovy IBM (D2.11).
Hindcast simulations (T4.1) have been performed allowing for the model validation considering D1.3 (available datasets) and D2.7 (validation methodology). The OSMOSE parameterization for the Aegean was obtained from D1.4.
The climate (T3.3, T3.4) simulations (1980-2000, 2080-2100, A1B scenario) have been completed and are currently analyzed for LTL/carbonate/OSMOSE models and are underway for the anchovy IBM. Deliverables 1.2 (forcing, global model), 3.1 (set of scenario forcing), 1.5 (driver response envelope) have been used, while new parameterizations (D1.4) for acidification and metabolic theory are currently tested.

The impact of fishing and eutrophication anthropogenic drivers (T4.2) was adressed by performing future scenario simulations (2030-2040 A1b) under different future scenarios. For river nutrient loads, three scenarios have been adopted from SESAME project: “business as usual”, “policy target” and “deep blue”, while for fisheries the A1 and B1 scenarios were parameterized based on fishing mortalities (Fmsy for A1 and Fpa for B1) that have been identified for N. Aegean species in D1.4. Simulations with the OSMOSE HTL model have been carried out for the above river load/fisheries scenarios.
In order to adress the pollution driver, Copper was introduced in the coupled model as a conservative tracer using available data for river inputs. Sensitivity simulations were performed with increased river Copper inputs. The impact on phytoplankton growth was parameterized and tested based on D1.4/pollution. The impact of Copper on anchovy larval mortality will be parameterized using D2.12 (new parameterization for ecotoxicology).

A2.9 DTU

Task 3.4/4.2 HTL Activities: SMS

Model development finished:

- Cod recruitment in forecast dependent on salinity and oxygen conditions
- Sprat recruitment dependent on temperature

Test scenarios have been run, but not with MEECE data

For future scenarios, have received temperature data from ECOSMO , future action salinity and oxygen data/(alternatively) reproductive volumes for cod

Currently (internal deadline April 1st):

- Model and implement cod consumption depending on temperature;
- Model and implement growth of all three species depending on temperature;

After April 1st, Scenario completion with MEECE data shortly after environmental scenario data are received.

North Sea IBM: progresses and plans

Task 3.4/4.2 HTL Activities: Ecopath with Ecosim

- Model development completed. Hydrohraphic data from ECOSMO to be used to calibrate the model
- Future scenarios: Activities to involve the ustilization of primary production and environmental forcing data from ECOSMO

- Coupling North Sea = IBM(sandeel) + POLCOMS-ERSEM:
- Coupling IBM(sandeel) + POLCOMS-ERSEM has been run offline on full POLCOMS-ERSEM hindcast 1970-2004
- To address driver fisheries, the IBM + POLCOMS-ERSEM setup has been coupled to SPAM (Sandeel Population Analysis Model) setup which has been parameterized for high spatial resolution

Plans 2012

- An online version of the IBM + POLCOMS-ERSEM are planned before summer 2012 along with update of sandeel growth model of early life stages
- Direst impact from other drivers may be assessed, pending data for impact parameterization
- Indirect impact from other driver (via changes in zooplankton availability) may be assessed if impact from other drivers is parameterized in POLCOMS-ERSEM

Modelling activities (WP 2-4)

- SMS: Model development has been finalized. Cod recruitment in forecast dependent on salinity and oxygen conditions; sprat recruitment dependent on temperature. Test scenarios have been run. Current activities include modelling and implementing cod consumption depending on temperature and modelling and implement growth of all three species depending on temperature. Activities for running future scenarios with environmental forcing from ECOSMO are on-going.
- EwE: model development is completed. Activities for running future scenarios with environmental forcing from ECOSMO are on-going.

- IBM for the North Sea: Coupling IBM (sandeel) + POLCOMS-ERSEM has been run offline on full POLCOMS-ERSEM hindcast 1970-2004. To address driver fisheries, the IBM + POLCOMS-ERSEM setup has been coupled to SPAM (Sandeel Population Analysis Model) setup which has been parameterized for high spatial resolution. An online version of the IBM + POLCOMS-ERSEM are planned before summer 2012 along with update of sandeel growth model of early life stages. Direst impact from other drivers may be assessed, pending data for impact parameterization. Indirect impact from other driver (via changes in zooplankton availability) may be assessed if impact from other drivers is parameterized in POLCOMS-ERSEM.
- IBM for the Baltic: Coupling Baltic = IBM (sprat) + ECOSMO. Sprat bioenergetic model validated on climatology and reference data; coupling IBM + ECOSMO tested on ECOSMO physics + biogeochemistry; hindcast sample full ECOSMO hindcast physics + biogeochemistry fields 1948-2007 transferred to DTU Aqua ultimo Jan 2012. Based on MEECE experiments, the following impact have been parameterized in IBM: i) copper concentration influence of egg survival chance as function of temperature; ii) copper concentration influence on larval hatch size as function of temperature. IBM (ecotox) + ECOSMO is in validation and thereafter ready to run

WP5:
Contributions to D 5.1 and D 5.2 completed. Activities and coordination of contributions to D 5.3 and 5.4 are on-going. The contributions completed so far include demonstrating the need for adapting short-term marine resource management strategies to a changing environment, resulting from changes in climate, eutrophication or other drivers. Management capabilities to restore depleted populations depending on environmental conditions are demonstrated on the example of the eastern Baltic cod. On-going activities include considering spatial aspects in developing management strategies and development and application of MSE tools (using SMS) for the Baltic Sea ecosystem to test the management strategies considering biological interactions (MSFD descriptors 3, 4). The coordination of activities for synthesizing the WP3,4 results in a management context will start once these results are becoming available.

A2.10 IMR
At present the IMR activities are divided between WP3 and WP4. In WP3 a paper on present and future climate drift of cod larvae using an IBM are about to be submitted (D3.3). In addition the simulations on control and future climate including the acidification module (T2.2) is done, and a paper is in preparation and planned submitted June 2012 (D3.3). In WP4 a first hindcast using a cod IBM is done (D4.1). This will be further developed by including fisheries and climate impact and will appear as one or two publications before August 2012 (D3.3 and D4.2). A simulation hindcast using the IBMs for calanus and pelagic fish (T2.2.4 and T2.2.5.1) is now running (D4.1), and a publication will be submitted June 2012 (D4.2).

A2.11 IMS_METU
The physical model and coupled NPZD and anchovy models are running for the Black Sea environment. A 30 year coupled physical-LTL hindcast (1971-2001) has been performed. The LTL-anchovy coupled model has been tested in a 1D multi-layer setting. Validation of the physical model has been completed. Seasonal and interannual variability and trends in modelled physical parameters of relevance to Black Sea ecosystem functioning (e.g. water temperatures, mixed-layer depth, cold intermediate layer thickness and ring current velocity [a cyclonic current associated with the shelf edge which forms a dominant component of the basin scale circulation in the Black Sea]) are found to closely resemble trends and variability in observational data records. Validation of modelled ecosystem and biochemical parameters is currently on going and will be completed in the coming months. The anchovy model will be run off-line for the full 30 year period of the physical-LTL model run during the next 6 months.

A2.12 IRD + UCT
To respond for the Benguela, the simulations for the LTLs are:

- Recent present with raw IPSL forcing: 1980-1999 completed.
- Recent present with IPSL forcing where winds have been downscaled using Goubanova's approach: 1980-1999 completed.

- Scenario with raw IPSL forcing: 2080-2089 completed.
- Scenario with downscaled wind: 2080-2089 completed

For the HTLs:
For Osmose, the main time constraint for Yunne concerns the calibration for interannual hindcast simulations (she has climatologies for 1980s and 1990s) forced with observations. Then she can use the interval of confidence of the estimated parameters to run the hindcast in one-way coupled mode (Roms-Biobus-Osmose). It should be completed by September 2012. Then, for the "future" runs, the main concern is the meaning of such scenarios, but there is not much additional time nor technical constraints. We should be able to produce results of future coupled runs for the final report, in early 2013. If you think the timeline is not in accordance with other Meece regions, Yunne could also use her present configuration (climatology) to run the forecast simulations using Roms-BioBus-Osmose. But it will add more bias on the runs which will be already affected by the "biased" physics. Obviously there is a delay which can be explained by two maternity leaves and a strong involvement in WP5 with indiseas, thing that wasn't planned at the launch of the project and which took significant amount of time at the expense of modelling activities.

For APECOSM:
We didn't find the right profile at the beginning of the project to couple APECOSM to ROMS-PISCES, the task requiring good skills in scientific programming and marine biological knowledge, particularly for a short period of 7 or 8 months of funding. Therefore I work on it but it takes more time than initially attributed to the project. I also took a 8 month leave during the project. I don't think it is written somewhere in the proposal that we would run both OSMOSE and APECOSM in hindcast and future experiments.

For the non-completion of the time slice 2030-2040, here is the argumentation:
- As the regional solution was severely biased in the present scenario, we decided to run two present scenario, one with raw forcing and one with downscaled winds. It was consequently making much sense to then conduct the same experiments in the future scenario to be able to appreciate if introducing an improved forcing in the future configuration would also improve the representation of the Benguela system in a warmer climate . We can then argue that being limited by computing time and man power, we took this option on scientific bases.

- All the same, this second simulation can be considered as a sensitivity experiment. The Benguela is not part of European waters so we could think that the time slice of 2030-2040 related to management aspects doesn't necessarily apply in the same way for the Benguela.

A2.13 UPiedmont
Current status of the activities in the framework of MEECE project
In the MEECE project, UPiedmont was principally involved in the activities of WP1 and WP5.

Concerning WP1, activities ended at M36. The laboratory exposure with mussels and protozoa to different pollutants (i.e. Cu, Ni, oxytetracycline) and to climate change drivers (i.e. temperature) were completed as well as the estimations of the biological responses. A complete report of the obtained results was delivered in the second scientific report.
Similarly, WP1 activities concerning the realization of a database with copper data and the parameterization of the biological response to copper and climate change drivers were delivered and a complete report was part of the second scientific report.
At the end of the laboratory activities, UPiedmont researchers are now preparing some papers that will be submitted to scientific international journals in the next months.
A list of the papers in preparation is given below.

- The use of multiple endpoints to assess cellular responses to environmental contaminants in the interstitial marine ciliate *Euplotes crassus* (submitted to *Aquatic Toxicology*).
- The use of protists in ecotoxicology: application of multiple endpoint tests in the epibenthic, free crawling ciliate *E. crassus* for the evaluation of sediment quality in marine and coastal ecosystems (submitted to *Environmental International*).
- Effects of Cu and temperature on the physiology of the ciliate *E. crassus* (in preparation).
- Transcriptional and biochemical markers of oxidative stress in *Mytilus galloprovincialis* exposed to nickel and temperature (in preparation).

- Transcriptomic effects on mussel exposed to copper and temperature (in preparation).
- Effects of inorganic and organic pollutants and temperature on key genes and proteins (in preparation).
- Effects of copper and temperature on proteomics and EP protein concentration in mussel's haemolymph (in preparation).
- Metabolomic effects in mussel's haemolymph after exposure to copper and temperature (in preparation).

Concerning WP5, the main target was to develop an expert decision support system for the management of pollution in marine coastal ecosystems. A first draft version of the expert decision support system was presented during the MEECE Science Meeting 2011, held in San Sebastian, Spain, in June 2011.
The main features of the expert decision support system will be described in the Deliverable 5.2, while an example of application of this tool in a real case of study will be included in Deliverable 5.3.
The expert decision support system has been reviewed on the light of the most recent indications of the European Commission about the application of the Marine Strategy Framework Directive, in which the use of sub-lethal biomarkers in the assessment of good environmental status has been recommended.
The final version of the expert decision support system will be presented as platform presentation at the next SETAC Europe (Society of Environmental Toxicology and Chemistry) meeting that will be held in Berlin, Germany, in May 2012. The title of the presentation is "Managing environmental risk in marine coastal systems: development of an innovative expert decision support system" and it has been accepted as oral presentation in the session A13 - Marine environmental chemistry and ecotoxicology.
This last version of the expert decision support system will incorporate the most recent inputs from international organizations involved in the management of marine coastal ecosystem, such as the United Nations Environmental Program UNEP-MAP. In fact the application of this management system in the monitoring activities of the Mediterranean sea has been discussed in the last UNEP-MAP Consultation Meeting to review MED POL monitoring activities, held in Athens, Greece, in November 2011.
A paper concerning the expert decision support system is in preparation and it will be submitted to the opportune scientific international journal in the next months.

A2.14 KUCORPI

Further work in MEECE:
Develop functionality of BINPAS (online Bioinvasion impact / Biopollution Assessment System) in order to assist estimation of ecological indicators related to marine invasive alien species impacts (biopollution index, BPL)
Present the results at the at the first European Conference on Research and Ecosystem-Based Management Strategies in Support of the Marine Strategy Framework Directive (Marine Strategy 2012) to be held Copenhagen, Denmark, 14-16 May 2012
Systematize and analyze data on invasive planktonic dinoflagellate Prorocentrum minimum in order to assess the environmental conditions triggering the "impact threshold", i.e. the level of abundance at which that species starts to cause strong biopollution effect (BPL>2).

2011 publications related to MEECE

Zaiko A., Olenin S. et al., 2011. Assessment of bioinvasion impacts on a regional scale: a comparative approach. Biological Invasions. DOI 10.1007/s10530-010-9928-z
Olenin S., Olenina I., et al. 2011. Recommendations on methods for the detection and control of biological pollution in marine coastal waters. Marine Pollution Bulletin. doi:10.1016/j.marpolbul.2011.08.011
Narščius A., S. Olenin, A. Zaiko, D. Minchin. 2012. Biological invasion impact assessment system: From idea to implementation. Ecological Informatics 7, 46–51
Zaiko A., Daunys D. 2012. Density effects on the clearance rate of the zebra mussel Dreissena polymorpha: flume study results. Hydrobiologia 680:79-89, DOI 10.1007/s10750-011-0904-0
Vaičiūtė D., Bresciani M., Bučas M. (submitted). Validation of MERIS bio-optical products with in situ data in turbid Lithuanian Baltic Sea coastal waters. Journal of Applied Remote Sensing.

A2.15 SAHFOS

The discussion/interaction with the modellers to which data has been for model validation has been very little so far. In the remaining time, while discussing the results that could be included in the publications, we will have the opportunity to discuss more about how the models reproduce the actual observations. SAHFOS will contact individually those partners that had CPR data to have some feedback about the state of the work and to see if I can be of further help.

A2.16 CNRS See PowerPoint presentation no written report provided.

http://www.meece.eu/meetings/faro/faro_pt.html .

A2.17 Cefas See PowerPoint presentation no written report provided.

http://www.meece.eu/meetings/faro/faro_pt.html .

Note Burchard and Bolding (BB), Instituto Español de Oceanografía (IEO) and the Southern Danish University (SDU) have already completed their participation in MEECE and that CEA has no active part.

Annex 3. Draft Reporting structure for D3.4 Synthesis report for Climate Simulations

Aim: To scenario test the impacts of climate drivers on the structure and functioning of marine ecosystems.

Overall synthesis of results

a) Policy relevant summary: what is the value of this work to policy / management with specific emphasis on the MSFD.
b) High level summary of key results.

Divide by regions not by Model system

1) Global Ocean (Bopp, L-Urritta)
2) Barents Sea (Schrum / Skogen / Bellerby)
3) NE Atlantic / N Sea (Holt, Mackinson, Butenschon, Artioli, Schrum, Skogen?)
4) Baltic Sea (Schrum, A Christiansen(DTU))
5) Black Sea (Saligolou)
6) Biscay Sea (Chust, Machu)
7) Adriatic Sea (Zavatarelli, Shin)
8) Aegean Sea (Triantafyllou, Shin)
9) Benguela Upwelling (Garcon, Shin, Machu)

For each region (partners….)

1) Policy relevant summary
    a. How does this work relate to MSFD (which descriptors, characteristics / indicators addressed, what has been learnt
    b. Access to model results.
2) Science questions addressed for your region
    a.
3) Models *used (see tables 4 &5) in DoW*
    a. Model a LTL
    b. Model b HTL
4) Scenarios run
    a. Hindcast (outline of scenario) *see D1.5*
    b. Climate forced.. present /future *see D1.5*
    c. Downscaling methods
5) Metrics considered
    a. D3.2 e.g. Chl, No3, pH, etc…. identifying which descriptors they help to address.
    b. Validation techniques …..
6) Table of linkages with MEECE deliverables

Note: each region should use at least one of D2.2, D2.5, D2.9, each region should have at least on couple HTL model (2 way coupled where possible)

Deliverable	Comments
D3.1 Validation data	Which data used and why…
D1/5	
D2.x	Which C module?
D3.1	
D3.2	

7) Results
   a. Hindcast validation
      i. LTL – demonstration of spatial and temporal skill of key metrics – timeseries, Thresholds?
      ii. HTL - demonstration of spatial and temporal skill of key metrics - timeseries
   b. Climate forced simulations
      i. LTL – focus on chosen metrics – statistical tests to demonstrate change
      ii. HTL - focus on chosen metrics – statistical tests to demonstrate change

8) Discussion and conclusions.
   a. What changes occurs
   b. How is climate driving these changes?

Annex 4: Draft reporting structure for D4.1 Simulations of Isolated anthropogenic drivers

Aim: To scenario test the impacts of anthropogenic drivers on the structure and functioning of marine ecosystems.

Overall synthesis of results

a) Policy relevant summary: what is the value of this work to policy / management with specific emphasis on the MSFD.
b) High level summary of key results.

Divide by regions not by Model system

1) Barents Sea (Schrum / Skogen)
   a. Fishing,
   b. Pollution
2) NE Atlantic (Holt, Butenschon)
   a. Eutrophication,
   b. Optical props,
   c. Demersal trawling
3) N Sea (Mackinson, Artioli, Schrum, A Christiansen)
   a. Eutrophication,
   b. Fisheries
4) Baltic Sea (Schrum, A Christiansen)
   a. Eutrophication optical props,
   b. pollutants,
   c. fishing,
5) Black Sea (Salihoglu, Cannaby, Akoglu)
   a. Eutrophication,
   b. fishing,
6) Biscay Sea (Chust, Machu)

a. fishing

7) Adriatic Sea (Zavatarelli, Shin)
    a. Eutrophication,
    b. fishing,
    c. optical props,
    d. pollution,
8) Aegean Sea (Triantafyllou, Shin)
    a. Eutrophication,
    b. optical properties
    c. pollutants,
    d. fishing
9) Benguela Upwelling (Garcon, Shin, Machu, Jarre)
    a. Fishing

For each region (partners….)

1) Policy relevant summary
    a. How does this work relate to MSFD (which descriptors, characteristics / indicators addressed. What has been learnt
    b. Access to model results.
2) Science questions addressed for your region
    a.
3) Models *used (see tables 4 &5) in DoW*
    a. Model a LTL
    b. Model b HTL
4) Scenarios run
    a. Hindcast (outline of sensitivity tests (links to ELME etc..) see D1.5
    b. Downscaling methods
5) Metrics considered
    a. D3.2 e.g. Chl, No3, pH, Fish biomass etc…. identifying which descriptors they help to address.
    b. Statistical tests for sensitivity
6) Table of linkages with MEECE deliverables

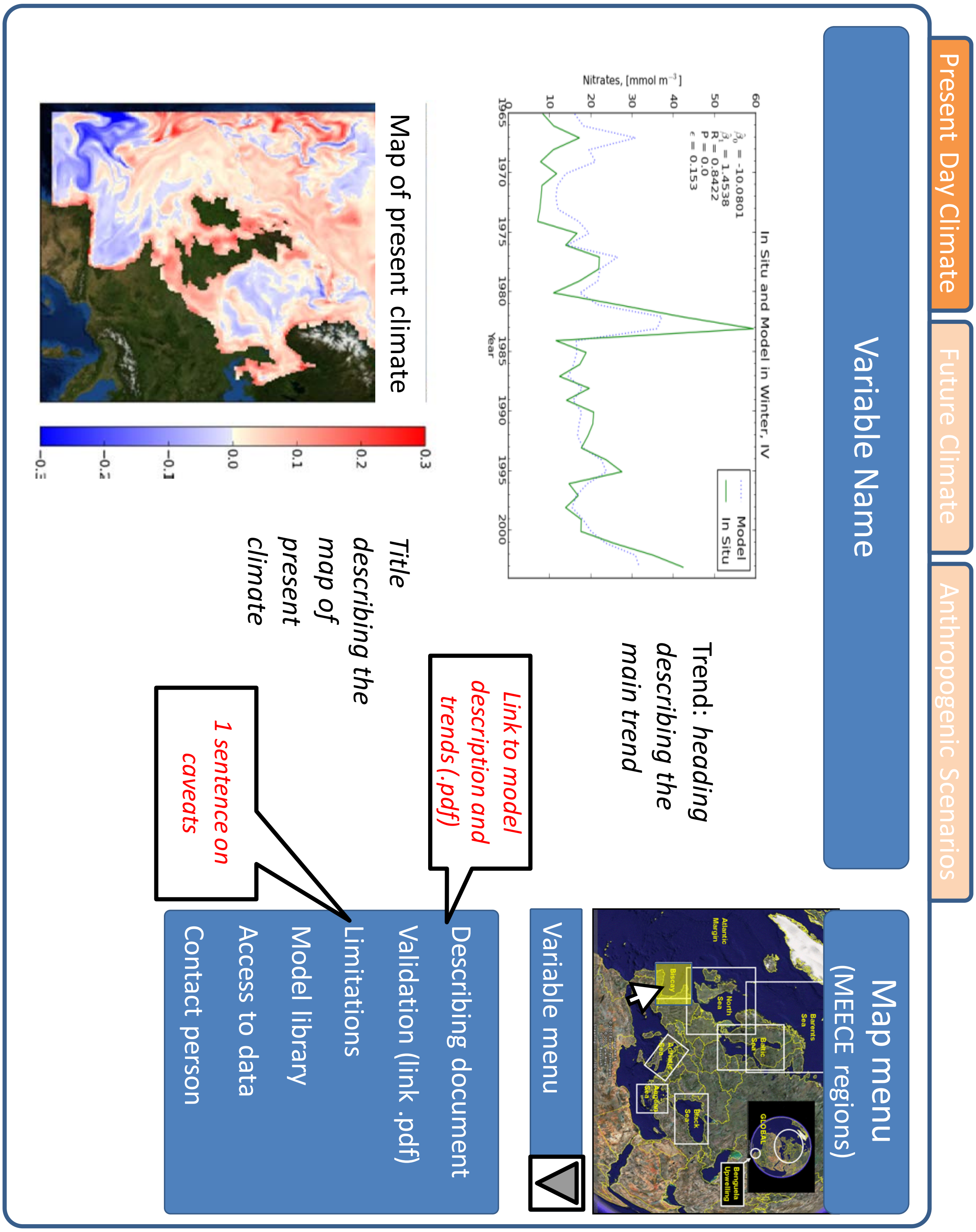
Note: each region should use at least one of D2.2, D2.5, D2.9, each region should have at least on couple HTL model (2 way coupled where possible)

Deliverable	Comments, *what's be used and why.*
D3.1 Validation data	
D1/5	
D2.x	
D3.1	
D3.2	

7) Results
    a. Hindcast sensitivity
        i. LTL – demonstration of spatial and temporal sensitivity – time series, Thresholds?
        ii. HTL - demonstration of spatial and temporal sensitivity - time series

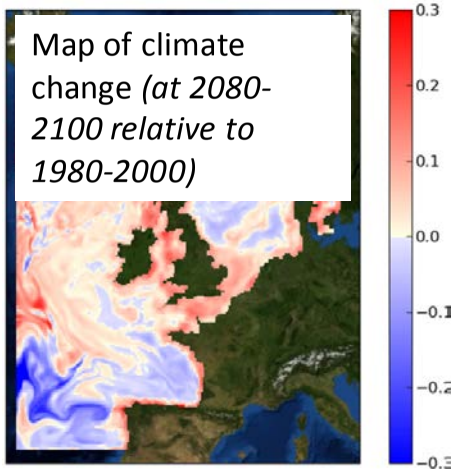
8) Discussion and conclusions.
    a. What changes occurs
    b. How are changes in anthropogenic drivers causing these changes?

Annex 5 Draft Atlas layouts

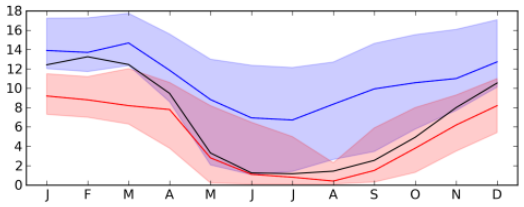


Present Day Climate | Future Climate | Anthropogenic Scenarios

Variable Name



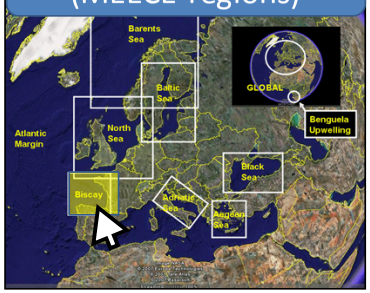
Trend: *heading describing the main changes within the region*



Title describing the main changes on the seasonal cycle

Seasonal cycle
present (1980-2000) & Future (2080-2100)
If no change in season cycle then put just a sentence

Map menu
(MEECE regions)

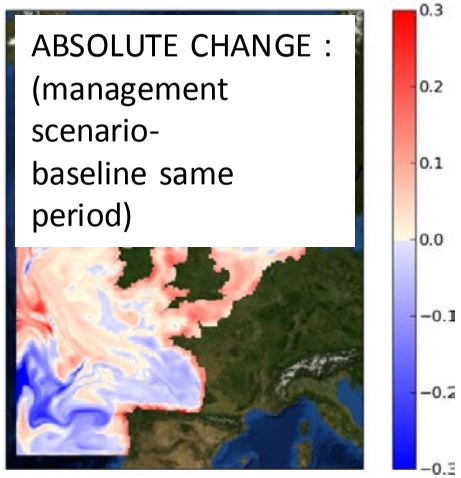


Variable menu

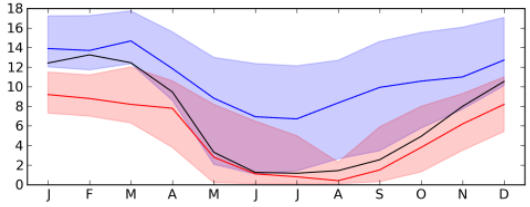
- Describing document
- Validation (link .pdf)
- Limitations
- Model library
- Access to data
- Contact person

Present Day Climate | Future Climate | Anthropogenic Scenarios

Variable Name



Trend: *heading describing the main changes within the region*

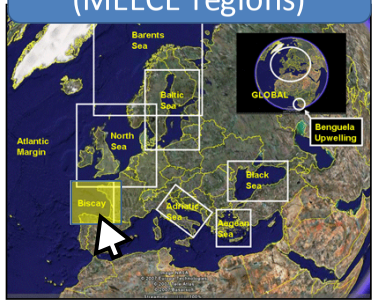


Title describing the main changes on the seasonal cycle

Seasonal cycle
present (1980-2000) & Future (2030-2040)
If no change in season cycle then put just a sentence

Marco: is that correct?

Map menu
(MEECE regions)



Variable menu

- Describing document
- Validation (link .pdf)
- Limitations
- Model library
- Access to data
- Contact person

Annex 6 participant list (scanned list with signatures)

MEECE Faro Workshop 7-10 February 2012

Name	Institute	07.02.12	08.02.12	09.02.12	10.02.12
Aldo Viarengo	Upiedmont				
Alessandro Dag	Upiedmont				
Chris Smith	HCMR				
Eider Andonegi	AZTI				
Eric machu	IRD				
GerJan Piet	IMARES				
Guillem Chust (	AZTI				
Heather Cannal	METU				
Icarus Allen	PML				
Ivo Grigorov	DTU				
James Harle	NERC				
Jason Holt	NERC				
Jessica Heard	PML				
Jonathan Beech	Cefas				
Kostas Tsiaras	HCMR				
Laurent Bopp	CNRS				
Marco Zavatare	UNIBO				
Margit Eero	DTU				
Marina Chifflet	AZTI				
Mike St John	DTU				
Momme Buten	PML				
Nadia Papadop	HCMR				
Richard Bellerb	uiB				
sarah wakelin	NERC				
Solfrid Sætre H	IMR				
Sonia Sánchez (	AZTI				
Ute Daewel	UiB				
Yuri Artoli	PML				
Javier Ruiz	CSIC				
Corrina Schrum	UiB				