Life on the Blue Planet:

Biodiversity research and the new European Marine Policies

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Session 1

- Interactions between global change and marine biodiversity – what we know and need to know to protect marine biodiversity to ensure the sustainable use of the marine environment

- the evidence base for the impacts of climate change on marine biodiversity

- linking science to management and policy

- Ocean acidification
- Long-term data sets
- Fisheries
- Rocky shores and estuaries
- Benthic communities
- Pelagic communities
- Science to policy
- Taxonomic capability

Session 2

- Effects of the different measures of mitigation and adaptation to climate change on marine biodiversity

- The role of marine biodiversity and coastal ecosystems in the mitigation of climate change effects

- Coastal defences
- Off-shore renewable developments – Off-shore wind farms
- Alternative energy sources – fuel from algae

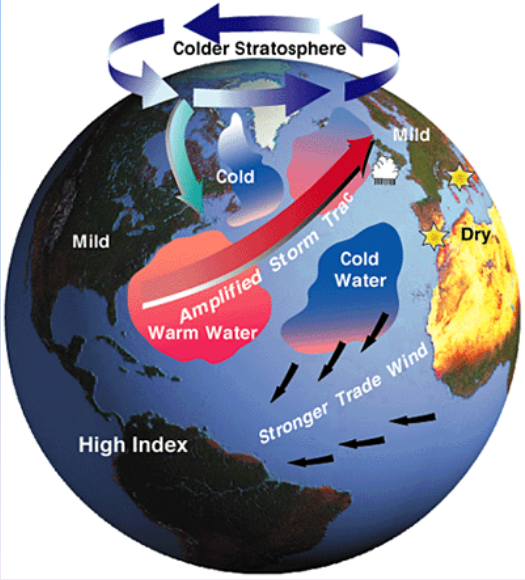
Climate system

- More research on the interdependence between climate phenomena and biodiversity (Jürgen Alheit) e.g.

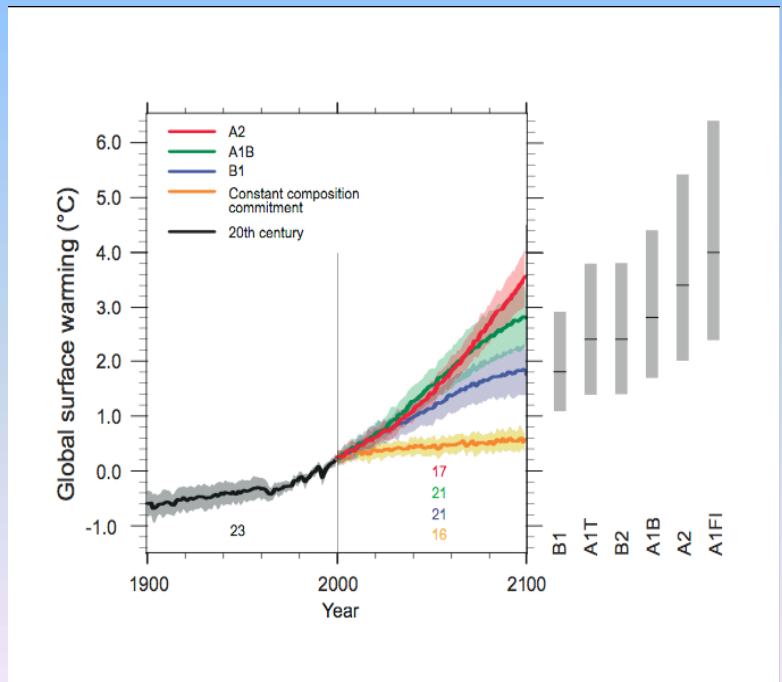
  - North Atlantic Oscillation;

  - the Atlantic Multidecadal Oscillation and;

  - global warming



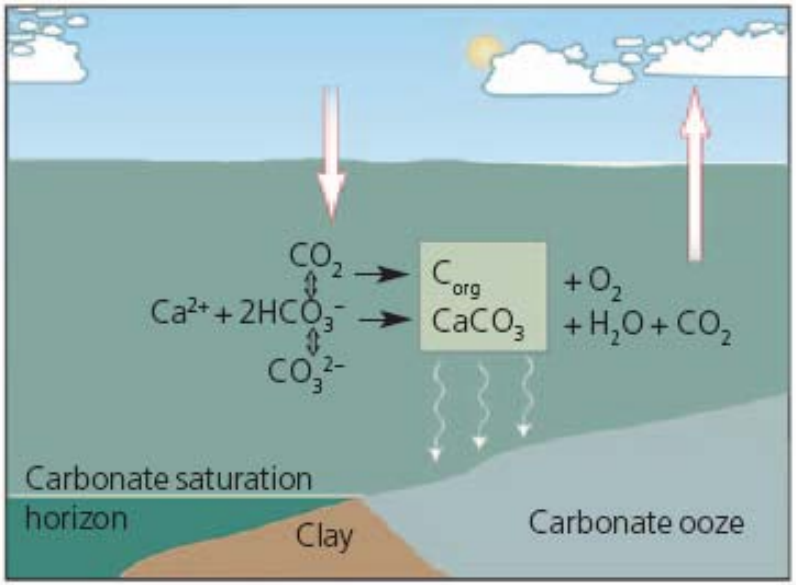
North Atlantic Oscillation Index



Multi-model global averages of surface warming, IPCC 2007

Ocean Acidification

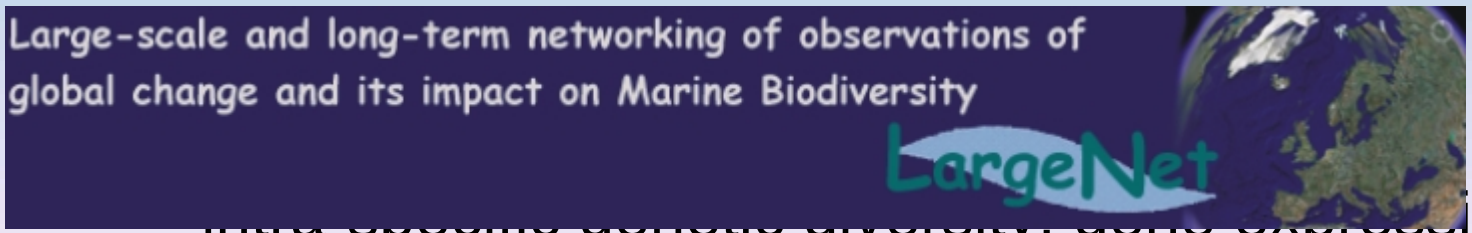
- If global emissions of CO_2 continue the average pH of the oceans could fall by 0.5 units by the year 2100 (Royal Society, 2005).



- Need to better understand the mechanisms by which ocean acidification affect organisms
- Knowledge on pH and thermal tolerances of organisms is outdated and little work has been done on the interactive effects of temperature and pH
- Need to quantify effects in relation to future scenarios of anthropogenic CO_2 and ocean warming

(Hans-Otto Pörtner & Steve Widdicombe)

Monitoring and long-term research (sustained observations)

- More baseline assessments and long-term studies to understand the impact of current changes
- Need for environmental data retrieval from historical sources e.g. notebooks, published literature and reports especially those collected at a pan European level (Monika Kedra)
- Make this data available and compatible to enable future scientific analyses (Doris Schiedek)
- 

ion &
morphological diversity

Sustained observations

• Require monitoring to be undertaken at appropriate spatial and temporal scales to:

- allow biodiversity dynamics to be linked with global scale atmospheric and oceanographic processes (Antonio Terlizzi).

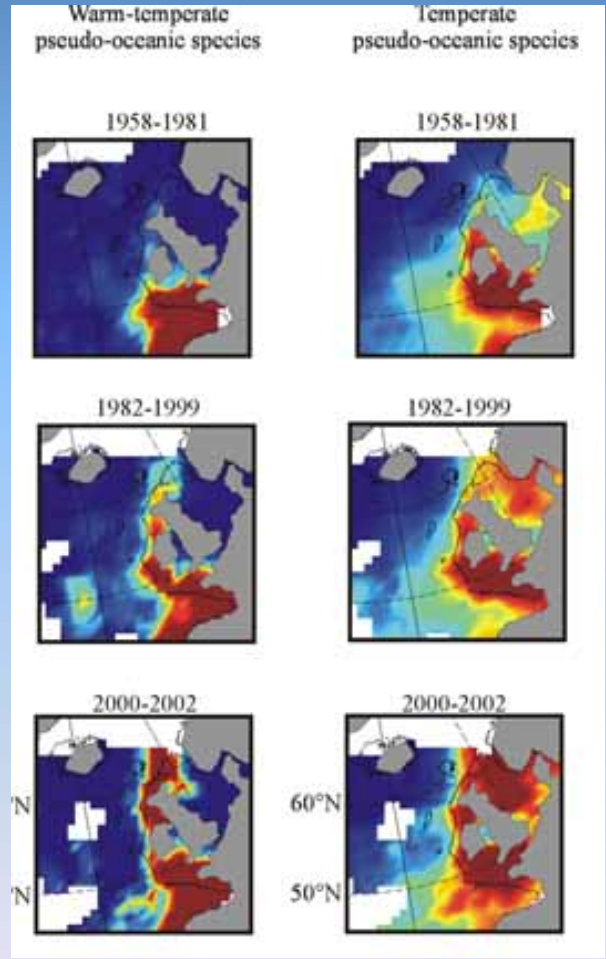
- separate small scale and natural population fluctuations from those associated with climate change.

- separate the simultaneous influence of global scale processes and regional to local scale processes e.g. pollution, invasive species, fishing.

- to allow the development of new models to map the results of small-scale studies to larger– important for creation of networked MPAs (Lisandro Benedetti-Cecchi)

Plankton & pelagic communities

- Impact of climate change at multi-trophic levels e.g. planktonic, benthic and nektonic communities.
- More research into the interactive effects of climate change on biodiversity e.g. trophic miss-matches, competition, facilitation, recruitment pathways and indirect effects
- Use of indicator species were suggested including:
  - intertidal species for changes off-shore (Alan Southward)
  - top predators as indicators of pelagic diversity, heterogeneity and oceanographic processes (Maurizo Wurtz).



Off-shore benthic communities

• Too little known to predict or detect the effects of climate change (Paul Sommerfield).

- little data
- difficult to harmonise data held
- time-series data is very rare
- data on physiology and life histories out of date
- work on acclimation non-existent
- more work needed on ecosystem functioning

• Interactive effects of climate on “low-dissolved-oxygen” events (hypoxia and anoxia)– more needs to be known on impacts and mitigation (Michael Stachowitsch).

Modelling

- Need to develop reliable global climate models stemming from various social and economic scenarios for the 21st Century (Ricardo Lemos et al).
- Creation of fit-for-purpose models to manage marine environment (Katja Philippart)
- Need to develop systems that are better able to track, forecast and control uncertainties regarding biodiversity loss
- Tools to validate predictions (Ricardo Lemos et al).
- Information should feed into the building of mechanism based models of organism and ecosystem functioning in response to climate change

Taxonomic capability

- **Lack of funding for taxonomy**

  - resulting in taxonomists not being replaced when they retire

  - little is being done on revision of taxa

  - little exploration of understudied regions

  - no compilation of flora and fauna

- **A new wave of taxonomists is needed**

  - traditional approach

  - molecular tools to allow population and community level genetic analyses







Coastal defence structures

(Laura Airoldi)

- Increase in the number of coastal defence structures leading to:

  - loss of natural habitat

  - artificial hard substratum species proliferating resulting in changes in species composition, abundance and diversity

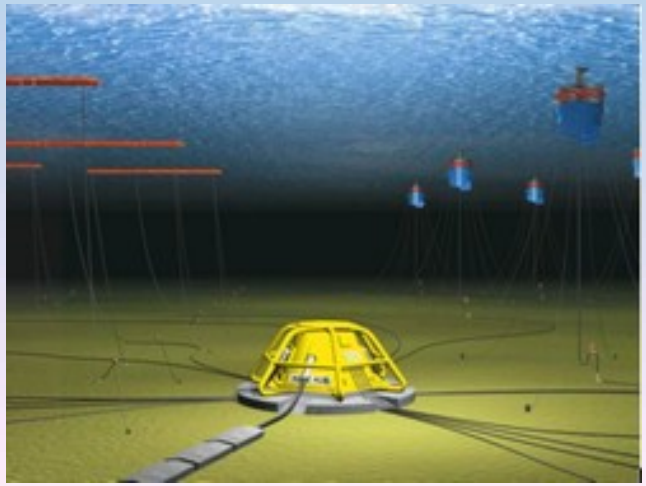
  - downstream effects through expansion of introduced species

  - stepping stones for range expansion in response to climate change

- monitoring before and after construction required to assess their effectiveness of meeting management goals

Off-shore wind farms

- Direct and indirect impacts of off-shore wind farms were discussed
- call for negative impacts of wind farms to be off-set by positive ones e.g. creation of effective no-take zones (Doris Diembeck)
- more research into the effects of cabling between turbines and shore on fish and cetacean behaviour (Andy Gill)
- the need to think of the impacts of other OREDs (Magdalena Muir)



Off-shore renewable energy developments

- How will OREDs be integrated with other marine users?
- What are the most likely effects of off-shore installations on marine biota?
- How can science and decision makers best interact to support optimal environmental management decisions?

(Benjamin Burkhard)

Alternative energy sources

Fuel from marine sources

(Carol Llewellyn & Stephen SKill)

- microalgae can produce up to 30x more oil per unit of growth than land plants
- producing a clean alternative energy source
- area shows great potential but,

  -more molecular and biochemical research required

  - more research into optimising algal production and harvesting

Plymouth Marine Laboratory's bioreactor in the House of Commons 2007

Science to policy

- more mechanisms by which science can inform policy and practice more rapidly – good example MarClim project (Larissa Naylor)
- need to create evidence based policies – long-term monitoring (Katja Philippart)
- link natural heritage with cultural heritage (Jan Jensen)
- create a network such as Natura 2000 for onshore areas (Jan Jansen)
- encourage cross-disciplinary research to create a solid theoretical framework

Science Funding

- fierce competition for funding generally results in essential, but unglamorous science being un(der)-funded e.g. taxonomy (Ferdinando Boero)

- funding still very much geared to producing knowledge rather than communication of that knowledge to a broader audience

- more interdisciplinary research with funding that extends beyond the average 3-5 years.

Science communication

• Increasing the level of communication between scientists, managers, policymakers and stakeholders was a key theme to come out.

- more training opportunities for scientists wanting to learn to communicate their science to a broader audience

- need intermediaries between scientists, stakeholders and policymakers who can interpret the data and provide an ‘economical’ value on and identify the risk factors e.g. invasive species (Frederico Cardigos).

Conclusions

- long-term monitoring is vital and needs to be undertaken at appropriate temporal and spatial scales.
- more multi-disciplinary studies incorporating taxonomy, ecology, evolutionary ecology, molecular techniques, biogeography, systems ecology and modelling is required.
- interactions between natural variability and anthropogenically driven change on biodiversity need to be understood
- research is needed into the design and construction of networked MPAs
- loss of taxonomic skills and incomplete species lists are a major limitation.
- a need for better data access, data archives and data sharing.
- Better communication between scientists and managers, policymakers and stakeholders