Theme session G

Ocean basin-scale research and management: challenges and opportunities

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This session explored the themes emerging as both the marine scientific and management communities embrace assessments of ecosystem connectivity, biogeography, and function at broader geographical scales. Research and policy development at ocean basin scale has been driven by the realization that climatic change and human impacts are rapidly altering marine ecosystems at the same time as governments seek to promote increased economic output from the marine environment. This broad context sets a considerable challenge and opportunity for marine science, industry, management and policy to shape the frameworks through which Blue Growth can be achieved.

The session brought together key advances relevant to ocean basin-scale research and management and fully met our expectations for addressing these topics. While a relatively small session (7 oral presentations and 4 posters with several late cancellations) the presentations were of high quality and addressed a range of important topics within the thematic. The session opened with a review and analysis of existing MPAs management in light of deep-sea marine genetic resources – a topic currently being hotly debated at the United Nations. Deep-sea biodiversity hot spots such as hydrothermal vents are expected to be rich in this type of resource, but these same hot-spots are the areas where human activities such as fishing, mining and bioprospecting are increasing. Thus these areas are where ecosystem-based management for the sustainable use of the natural resources is particularly necessary. The opening presentation set the stage for following talks which addressed specific research topics.

Those speakers built upon new discoveries from poorly-understood ecosystems (e.g., recent advances in the reproductive biology of key deep-sea sponge species) and highlighted opportunities for science to create a new evidence base for management using multidisciplinary research. For example, advances in oceanographic data availability, modelling resolution and understanding of larval biology and dispersal are fostering more partnerships between physicists and biologists. This was shown with a poster on how models of larval aggregation of the deep-water rose shrimp in the Strait of Sicily where results were used to re-examine stock boundaries. An oral presentation showed the results where a high-resolution hydrodynamic model for the Northwest Atlantic shelf was used to force a Lagrangian Individually-Based Model (IBM) to simulate the effects of inter-annual variability in ocean dynamics on the dispersal of eggs and larvae of Atlantic mackerel (*Scomber Scombrus*) from their optimal spawning habitats. They demonstrated how the effect of real position of mackerel eggs, timing of spawning, and oceanographic conditions affect the growth, dispersal and larval recruitment patterns. The spatial paths of larvae differed dramatically from year

to year, and suggest potential nursery grounds inside and outside the study area in the Gulf of St. Lawrence through larval connectivity. We also saw how such connectivity analyses can now be ground-truthed by population genetic approaches with the example of the cosmopolitan calanoid copepod *Pleuromamma xiphias*, opening the window to a new understanding of connectivity (or lack thereof) between the North and South Atlantic.

Alongside community ecology and taxonomic assessments, the improved understanding of connectivity set the stage to better define biogeographic patterns at regional and full ocean basin scales. Better understanding connectivity and biogeography lays the foundation for a new generation of predictive models better tuned to reflect the presence of key species and make inferences about their future distributions under changing conditions. We saw how the species distributions of two cold-water coral species, *Lophelia pertusa* and *Acanthagorgia armata* are expected to change across the North Atlantic with climate change. In another study, it was shown that for vulnerable first-feeding larval fish, the ability to match their prey begins with parental spawning time, a life-history trait shown previously to vary with space for a wide-ranging species (Atlantic cod, *Gadus morhua*). Novel thermal metrics were shown to estimate timing of unobserved stages of both predators and prey, as well as make predictions about timing (and trophic dynamics) under future ocean conditions.

Finally, the policy and management landscape is currently evolving rapidly, with policies needed in response to climate change and use of the ocean from established and emerging sectors. This session sought contributions that explore the industrial and policy landscape at ocean basin scale. For example, how may existing frameworks of offshore marine protected areas based upon national or European legislation interact with assessments made of vulnerable marine ecosystems and Ecologically or Biologically Significant Areas? How might the present United Nations deliberations on a new instrument to manage biodiversity in areas beyond national jurisdiction evolve and shape offshore management in the future? An integrated analysis of the Atlantic governance dynamic, an evaluation of the governance mechanisms that most contribute to the performance of the Atlantic MPA networks and a screen of the scope and scale of possible tradeoffs and synergies between and among MPA networks was presented. The results revealed that the Atlantic MPA networks work as regional hubs of marine conservation actions and their performance largely depends on human networks that follows the ecological ones. Regional mechanisms, such as OSPAR, also determine MPA network performance offering an opportunity to move forward with an Atlantic coordination of MPA networks.

This session sought to capture the drive to grow the scale of marine research and management activities to ocean basin scale and to that end we feel this was achieved.