Patterns of rocky shore dynamics in coastal ecosystems: comparative analysis
SCOR 2011 Call for Working Group Proposals

Scientific Background and rationale:

Compelling evidence signals that our climate is changing (e.g. Gooding et al. 2009) and is driving important shifts in the composition and structure of a diverse array of natural assemblages: terrestrial (e.g. Hughes, 2000), marine (Barry et al., 1995; Roemmich et al., 1995; Parmesan et al., 1999; Sagarin, 1999) and aquatic (Adrian, 1999). Given the close relationship between biodiversity and ecosystem functioning (Loreau et al., 2001; Gessner et al., 2004), any diversity loss will negatively affect the number and quality of services that a particular system might provide (Balvanera et al., 2006). Consequently, it is of paramount importance to be able to detect significant and persistent change in biodiversity within natural ecosystems and quantitatively describe associated effects on ecosystem functioning.

To detect changes in natural communities, and unequivocally relate them to anthropogenic impacts or climate disruptions, proper baseline data are of utmost importance. Obtaining this type of data is not, however, an easy task because: (1) we are dealing with a problem that is relatively new (or at least only recently considered as a problem), (2) the unequivocal establishment of cause-consequence relationships is complicated by the fact that we live in a world that is naturally heterogeneous and variable (Underwood, 1992; 1994), (3) drivers of change occur and operate at different spatial scales (Denny et al., 2004; Benedetti-Cecchi et al., 2010) and (4) it is not yet clear whether those drivers might act cumulatively, synergistically or antagonistically (e.g. Crain, 2008; Darling & Côté, 2008). A good starting point to tackle this problem would be to compare actual distributions of natural populations to long-term and spatially widely distributed datasets. Alternatively, standardized global monitoring programs can be put in place to assess change in biodiversity and relate those changes to possible anthropogenic causes and natural climate fluctuations. Whatever the case, it would be critical to select a suitable system that will allow for these types of comparisons.

Assemblages associated with intertidal rocky shores are particularly appropriate to study changes driven by global-scale anthropogenic impacts and climate change (e.g. Harley et al., 2006; Hawkins et al., 2008). From an ecological point of view, organisms living in these systems have a short life span and are slow-moving or sessile, consequently they respond very quickly to environmental change (e.g. Underwood, 2000). These organisms also are located within a strong terrestrial-marine gradient spanning relatively small spatial scales (Helmuth et al., 2002; Thompson et al., 2002), which exposes them periodically to extreme conditions and ultimately, many intertidal species have to live close to their thermal tolerance limits (e.g. Hawkins et al., 2003). Lastly, spatial and temporal distribution patterns in these systems, and the processes responsible for those patterns are fairly well understood at local scales (Menge & Branch, 2001; Robles & Desharnais, 2002). In addition, from a logistic point of view, intertidal rocky shores are relatively easy to access and to work on (no sophisticated research vessels are necessary, for example) and the surveys of organisms associated with these systems can be easily made because they are macroscopic, slow-moving or sessile, belong to a wide number of functional groups and, most importantly, interact at spatial scales that can be easily handled by scientists (Underwood, 2000; Underwood & Chapman, 1996). Last but definitely not least, coastal rocky shores provide many important ecosystem services and benefits to human populations.

Due to these advantages, several comprehensive (spatially and/or temporally) databases related to assemblages associated with intertidal rocky shores have been built in different parts of the world, most notably in: temperate Australia (e.g. Underwood, 2000), Chile (Broitman et al., 2001), Japan (Okuda et al., 2004), Mediterranean (Fraschetti et al., 2005), South Africa (Griffiths et al., 2010), United Kingdom (e.g. Hawkins et al., 2008), and US West Coast (e.g. Blanchette et al., 2008); almost all of these are represented in the present proposal. In addition, under the umbrella of the Census of Marine Life initiative, two additional datasets have been assembled. The first was through the NaGISA project (Natural Geography in Shore Areas) that gathered information of rocky shore systems at a global scale in 182 sites contributing with 60,616 records of 3,972 taxa to the Ocean Biogeographic Information System (OBIS) (e.g. Cruz-Motta et al., 2010). The second was the SARCE regional initiative (South American Research group in Coastal Ecosystems) which formed in 2010 and initiated field campaigns on these types of assemblages along the Atlantic and Pacific coasts of the South American continent. Despite the availability of these valuable datasets, very few attempts have been made to compare or compile them (but see Blanchette et al., 2009) in order to test hypothesis about ecological patterns and or processes at global scales. It is possible that these comparisons of datasets and patterns have been hampered by differing methods and protocols, but it is more likely that this process has not happened yet due to a lack of a formal proposal to bring all of these researchers together within a working group. In this sense, SCOR provides a unique opportunity for this endeavor to take place.

Consequently, we are proposing to form a SCOR working group (detailed below) to pursue the following objectives:

1) Evaluate the possibility to consolidate and compare the results of observations and time series on coastal rocky shore biodiversity from different parts of the world,

2) Examine the methods used to monitor rocky shore biodiversity to provide recommendations about future sampling designs and implementation, and identify pressing scientific questions with social relevance.

If these two objectives are achieved, this proposed working group will generate the necessary information to build up a standardized time series against which future changes, such as shifts in coastal assemblages generated by temperature changes, species outbreaks or introduction of non-native species can be measured. In addition, it might improve capacity building in developing regions. This will facilitate the modeling of IPCC scenarios within the intertidal region and our ability to make predictions at different spatial scales, from local, to regional, and global.

Terms of reference:

Building on the foundation of the Census of Marine Life project NaGISA (Natural Geography in Shore Areas, http://www.nagisa.coml.org/), the SARCE regional initiative (South American Research group in Coastal Ecosystems) and the several long term coastal observations carried out at different locations worldwide, we have established the following terms of reference that will (1) answer scientifically important and socially pressing questions, and (2) build capacity for scientists in developing countries.

- Identify and consolidate globally representative data sets on rocky shore ecosystems: collect and compare results from the monitoring of coastal rocky shore biodiversity [e.g. local/individual initiatives (non Census), global Census (NaGISA), regional SARCE 2010].

- Assess the strengths and weaknesses involved with data/methods/standardization and what should be done by further observational programs.

- Develop and share protocols/techniques that will help the scientific community worldwide on a longer term and connect to policy makers to support environmental impact studies in this area influenced by urban development and other human and climatic impacts (based on the comparative analysis of the methods that have been used and on the questions for future research and continued observation)

- Develop priorities and recommendations for future coastal marine observation efforts and re-analysis of existing datasets, on a global scale.

Products:

The products after developing these terms of reference are envisioned to be:

1) the consolidation of a network of researchers in coastal ecosystems at a global level
2) a special issue of a peer-reviewed journal or a paper in a high-visibility journal
3) a simple version of the paper or set of papers for policy makers explaining protocols and recommendations taking into consideration local/regional capacity and infrastructure

Working group Full Members

We have identified several important datasets around the world that should be represented for discussion in the working group: United Kingdom, US west coast (Oregon, California), Europe (Mediterranean, North Atlantic, and North Sea), East Asia, South Africa, Chile, and Australia, among others such as the global NaGISA and the South American regional SARCE. The work will be carried out by a group of ten Full Members and nine Associate Members. During the first working group meeting, a co-chair will be selected from among the Full Members, and additional Associate Members may be nominated if deemed necessary. The proposed list of members ensures wide geographic coverage, balance between developed and developing countries, and includes expertise in biological oceanography, benthic ecology, marine biology, and modeling. The names, affiliations and expertise of the people that have agreed to serve in the working group are:

Name	Affiliation/contact	Country	Expertise
Patricia Miloslavich (Chair)	Departamento de Estudios Ambientales and Centro de Biodiversidad Marina Universidad Simón Bolívar pmilos@usb.ve	Venezuela	Biological oceanography and marine biology and biogeography
Juan José Cruz-Motta	Departamento de Estudios Ambientales and Centro de Biodiversidad Marina Universidad Simón Bolívar juancruz@usb.ve	Venezuela	Benthic ecology in tropical ecosystems, Quantitative Ecology
Tim Glasby	Aquatic Ecosystems Unit (NSW) Port Stephens Fisheries Institute tim.glasby@industry.nsw.gov.au	Australia	Marine ecology in temperate ecosystems, large-scale monitoring of algae and invertebrates on rocky reefs, impacts of invasive seaweeds on native biota
Gray Williams	Swire Institute of Marine Science University of Hong Kong hrsbwga@hkucc.hku.hk	Hong Kong	Marine benthic ecology in tropical ecosystems, algal - herbivore interactions and the role of herbivore behavior influencing rocky shore community structure
Angela Mead	MA-RE Basics program University of Cape Town angela.mead@uct.ac.za	South Africa	Marine ecology – biogeography, bioinvasive species and spatio-temporal modeling of environmental and ecological data
Lisandro Benedetti-Cecchi	Dipartimento di Biologia University of Pisa lbenedetti@biologia.unipi.it	Italy	Marine ecology - processes influencing patterns of diversity, distribution, and abundance
Sergio Navarrete	Estación Costera de Investigaciones Marinas, Las Cruces Pontifica Universidad Católica de Chile snavarrete@bio.puc.cl	Chile	Marine community ecology, predator-prey interactions, recruitment and dispersal, biogeography and macroecology of marine

			ecosystems.
Stephen Hawkins	Marine Biological Association of the UK, The Laboratory S.J.Hawkins@soton.ac.uk sjha@mba.ac.uk	United Kingdom	Biodiversity and marine ecology, behavioral ecology, taxonomy, and phylogeography
Masahiro Nakaoka	Akkeshi Marine Station Field Science Center for Northern Biosphere Hokkaido University nakaoka@fsc.hokudai.ac.jp	Japan	Marine ecology in coastal ecosystems, dynamics of marine populations and communities, and ecosystem function
Carol Blanchette	Marine Science Institute University of California carol.blanchette@lifesci.ucsb.edu	USA	Community marine ecology, processes controlling community structure at different scales and importance of benthic-pelagic linkages

Working group Associated Members

The working group will also benefit from a network of researchers with expertise in intertidal benthic ecology from around the world who are already engaged in research activities related to benthic dynamics in coastal ecosystems. Since this working group acts on a global scale, a relatively large number of Associate Members is beneficial to contribute from many countries and regions. Associate Members have been selected by their expertise and involvement in the implementation of research methods in rocky shores, publication history in the field, and capacity to move projects forward. Researchers of this network that have agreed to contribute with the proposed SCOR's working group are:

Name	**Affiliation/contact**	**Country**	**Expertise**
Anthony Underwood	Centre for Research on Ecological Impacts of Coastal Cities Marine Ecology Laboratories A 11 University of Sydney tony.underwood@sydney.edu.au	Australia	Experimental marine ecology, experimental and sampling designs. Monitoring and detection of environmental impacts.
Rafael Riosmena-Rodríguez	Universidad Autónoma de Baja California Sur riosmena@uabcs.mx	Mexico	Communities associated to rhodolite beds
Fabio Bulleri	Dipartimento di Biologia Università di Pisa fbulleri@biologia.unipi.it	Italy	Marine benthic ecology and modeling

Katrin Iken	Institute of Marine Science University of Alaska, Fairbanks iken@ims.uaf.edu	USA	Trophic interactions between organisms and food web structures in polar regions
Gabriela Palomo	Museo Argentino de Ciencias Naturales gpalomo@macn.gov.ar	Argentina	Experimental marine ecology
Judith Gobin	Department of Life Sciences University of West Indies Judith.Gobin@sta.uwi.edu	Trinidad & Tobago	Marine ecology and polychaete taxonomy
Camilo Mora	Dalhousie University	Canada	Marine ecosystem modeling
Rosana Rocha	Universidade Federal do Paraná rmrocha@ufpr.br	Brazil	Tunicate and sponge taxonomy
Yoshihisa Shirayama	Japan Agency for marine earth science and technology (JAMSTEC), Natsushima Kanagawa	Japan	Marine ecology and biology. Taxonomy of meiobenthos

Timeline:

If approved by SCOR's Executive Committee, the group will meet three times between 2012 and 2014. To minimize costs, meetings will be held in conjunction with major conferences related to the field which many of the full members are already planning to attend. An opportunistic meeting will be organized with the group members attending the Second World Conference on Marine Biodiversity to be held in Aberdeen, Scotland on 26-30 September 2011. This first informal meeting will allow some working group members to initiate discussions about their scientific activities in coastal ecosystems and the databases associated to this topic. If the working group is approved, formal meetings will begin in 2012. The first meeting of the group is envisioned to take place during the XVII Simposio Ibérico de Estudios de Biología Marina, SIEBM-2012 (http://www.siebm.org/) that will take place either in Spain or Portugal. Another possible venue for this first workshop would be in conjunction with the 2012 Symposium on the Ocean in a High CO2 world that will be held in Monterrey, California. During this first meeting, working group members will make short presentations about their scientific activities related to the coastal ecosystem dynamics followed by (1) agreement on how the terms of reference will be met and assign responsibilities, (2) establish a detailed timeline for product delivery (e.g. publications) and workshops, and (3) discussion of potential funding sources for the group activities, including workshops.

For the 2013 meeting, there are three options for venues:

1. the 10th International Temperate Reefs Symposium: this symposium is convened every two years, and in 2011 it is being held in Plymouth, UK in late June; the 2013 location is yet unknown.
2. the XV Congreso Latinoamericano de Ciencias del Mar, which is also convened every two years, always in a Latin-American country (in 2011 it will be held in Santa Catarina, Brazil in November).
3. the 11th INTECOL 2013 to be held in August in London, UK with the theme “Ecology: into the next 100 years” to be held in conjunction with the 100 years of the British Ecological Society (BES).

During this second workshop, we will discuss progress and update on products and activities. The final meeting of the group will be held in 2014 along with the Third World Conference on Marine Biodiversity, the venue to be determined this year in Aberdeen. Another possible venue for this last workshop would be in conjunction with the 2014 meeting of the Ecological Society of America (ESA). This last meeting will be focused on the completion of publications and will provide additional opportunities for capacity building.

One of the responsibilities of the full members will be to actively search for funding opportunities within their countries/regions. For example, the TOTAL Foundation has been approached to sponsor research activities and workshops in the Caribbean and South American regions. The activities of this working group will be useful for several global ocean research projects, including the new initiative entitled *Life in a Changing Ocean* born as a legacy of the Census of Marine Life. This initiative forms the mandate of the Global Marine Biodiversity Consortium, an international collaboration of scientists committed to expanding marine biodiversity knowledge to support healthy and sustainable ecosystems, which is envisioned to consolidate during the Second World Marine Biodiversity Conference. Other programs/initiatives that will benefit from the outcomes of this working group are the IPCC, PISCO (US), the IOC (through data input in the open access database on marine biogeography OBIS), Monitoring Sites 1000 (Japan), SARCE (South America), among others. The working group will ensure the establishment of links to other global coastal ocean projects.

Capacity building

The group will contribute to capacity building in three ways:

1) by developing protocols/techniques that will be shared with the scientific community worldwide not only for research but also for education on a longer term as well as establish the connection with policy makers to support environmental impact studies in this increasingly impacted rocky shore environment
2) by having three representatives from developing countries as Full Members of the group who work within the academia as lecturers in their home institutions teaching courses related to marine biology and ecology. In the same way, four representatives from the Associate Members are from developing countries; and
3) by having at least one and maybe two of the workshops in developing countries.

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