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Pilot Programme for ecosystemic monitoring in Cerro Verde (Uruguay): benthic invertebrates as a tool for conservation.

Full formal report

Pilot Programme for ecosystemic monitoring in Cerro Verde (Uruguay): benthic invertebrates as a tool for conservation

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EXECUTIVE SUMMARY

The aim of this proposal was to develop baseline studies of benthic invertebrates and its plancktonic larval stages at Cerro Verde, Uruguay. Biological samples were taken seasonally and for two years, within a stratified sampling design, in order to determine benthic invertebrate specific richness and annual cycles of studied fauna. To date we completed seven extensive faunistic surveys, collecting more than 50 taxa of benthic invertebrates in the intertidal and subtidal zones of the study area. We are now working in the taxonomic determination of the species recorded, with the aid of specialists in the different taxa and local students. Some previously unreported species of invertebrates were found, increasing the knowledge about the coastal biodiversity of the Atlantic coast of Uruguay. In addition, the role of mussel species as ecosystem engineers is being evaluated. Emerging knowledge will be of outmost importance in the development of managing strategies for this area, which is a well known feeding zone for several endangered vertebrate species. Products will allow detection of environmental impacts in a cheap and rapid way. Divulgation of the preliminary results were driven through presentation of several works in a local meeting in October 2005. Furthermore, two scientific papers were accepted for publication in the international peer-reviewed journals Acta Oecologica and Brazilian Journal of Biology. In addition, we are proud to communicate that Cerro Verde has been finally designed as the first Pilot Protected Marine Area of the National System Of Protected Areas (SNAP) in Uruguay. The fact that several research teams were working in that area, in different aspects of biological conservation, has much to do with this decision.

BACKGROUND

Rapid degradation of the oceans is triggering increasing calls for efforts to protect, maintain, and restore marine ecosystems. Coastal development, land based chemical and nutrient pollution and shipping practices combine to alter the structure and functioning of marine and coastal ecosystems globally. In this sense, fully protected marine reserves are an emerging tool for marine conservation and management. These areas may provide multiple benefits, including protection of habitat, conservation of biodiversity, insurance about environmental uncertainty and sites for scientific investigation, baseline information, education and recreation. However, data on several key ecological and life history features of marine reserves and communities are needed in order to select the placement and extent of an MPA (marine protected area). In this sense, the aim of this project is to determine benthic invertebrate specific richness in the intertidal and subtidal zone, larval supply from the water column and annual cycles of studied fauna at Cerro Verde, Uruguay, in order to provide a baseline for the evaluation of environmental impacts and to contribute to the design of a MPA.

STUDY AREA

The biodiversity and productivity of the coastal ecoregion "Uruguay-Buenos Aires Shelf" (34°- 41° S), summed to the magnitude of antrophogenic activities (tourism, urbanisation, industrial and domestic effluents, fisheries), confer to this coastal ecoregion a high priority for conservation.

Cerro Verde (33° 57'S, 53°30' W) is a rocky cape on the east coast of Uruguay affected by semidiurnal, low-amplitude tides (range < 0.5 m) that are largely controlled by wind conditions (direction and speed). The rocky platforms have a smooth slope, with a width ranging from 15 to 23 m, and are exposed to different degrees of wave action according to its orientation. These platforms follow a classical zonation scheme, in which three zones can be identified: a high intertidal zone dominated by a cyanobacterial film, a middle intertidal zone dominated by barnacles and a low intertidal and shallow subtidal zone characterized by a dense cover of mussels and/or macroalgae. This site harbours a rich hard-substrata benthic fauna, a yet non-defined number of fish species (*e.g.* endangered sharks *Mustelus schmitti*, *M. fasciatus*, *Sphyrna bigelowi*) and marine birds, mammals (*Otaria bryonia, Arctocephalus australis*) and sea turtles (*Chelonya*

mydas). This site has recently been established as the first pilot marine protected area in Uruguay.
For this purpose, quantitative data on species abundance, distribution, and temporal variation are of outmost importance in order to asses reserve effectiveness. In this context, our proposal was based on the urgent need for this relevant information. In this context, we developed a two years research programme in the area, focused in benthic invertebrates and its planktonic larval stages. This will allow us to asses benthic organism biodiversity and its dynamic at Cerro Verde, providing a baseline for the evaluation of environmental impacts and to contribute to the management of the MPA.

THE TEAM

Alvar Carranza is Uruguayan, 33 years old. Four-year BSc, honours in Ecology (2002), Facultad de Ciencias, Universidad de la República, is an advanced MSc student of PEDECIBA (Basic Sciences Development Programme), since 2003. Previous work includes Project PNUD-GEF-RLA 99-G31 (FREPLATA).

Ana Inés Borthagaray is Uruguayan and aged 29 years old. Four-year BSc, honours in Oceanography (2002), Facultad de Ciencias, Universidad de la República, is also an advanced MSc student of PEDECIBA (Basic Sciences Development Programme), since 2002. Previous work includes colaboration with PPNUD-GEF-RLA 99-G31 (FREPLATA). She is currently in charge of the project "Issues in conservation of the benthic biodiversity in rocky intertidal habitats of Uruguay "supported by the Small Grants Program of Cleveland Zoological Society.

Other members of the research team are Dr. Danilo Caliari, who is in charge of plankton sampling and identification. He is currently working at the Oceanography Section, Facultad de Ciencias, Universidad de la República (Uruguay).

MSc. Estela Delgado is helping with crustacean taxonomy. She is developing her PhD. In crustacean ecology at UNDECIMAR, Facultad de Ciencias, Universidad de la República (Uruguay). Dr . Gabriel Genzano (Universidad de Mar del Plata, Argentina) helped with identification of Cnidarians and Pycnogonids.

Project "Karumbe-CIID", an NGO working with sea turtles conservation and ecology in Uruguay provided facilities and contacts with the local community. This NGO is currently developing conservation projects in "Cerro Verde". (http://www.karumbe.8k.com/). Facultad de Ciencias, Universidad de la República in agreement, with the organisation I+D ("Investigación y Desarrollo") is providing facilities for laboratory work.

RESEARCH ACTIVITIES

Field work

The Field work is being performed with the help of local fishermen and local students. Biological samples were obtained by means of 2 days seasonally field trips to Cerro Verde, from January to November 2005. Sampling was carried out on intertidal and shallow subtidal (i.e. depth< 1.5 m) rocky platforms of the Cerro Verde area. Three sampling sites 500 m apart were chosen along the coast: (1) wave-exposed (Orientation S-SW), (2) intermediately exposed and (3) protected, (Orientation NE). At each site, we randomly selected sampling points in both MEP and NMEP. These points were separated 2 to 10 m from each other. In each point we placed a 20 x 20 cm sampling unit and collected all macrofauna and algae present.

Subtidal (i.e. depth<10 m) faunal and sediment samples were taken in the soft-bottoms between Cerro Verde and Verde Islands. In each field trip, one Zodiac neumatic boat carried two or three SCUBA divers to three randomly selected points, within a stratification taking into account the thre zones above mentioned: (1) wave-exposed, (2) intermediately exposed and (3) protected. At each point, the boat anchored and SCUBA divers collected, by means of a 15 cm diameter plastic core, up to 15 replicated samples. Eventually, 5´hauls were made with an epibenthic dredge for qualitative sampling.

Plankton samples were taken by means of 100m tows with a plankton collector, at both sides of the rocky cape.

Laboratory work

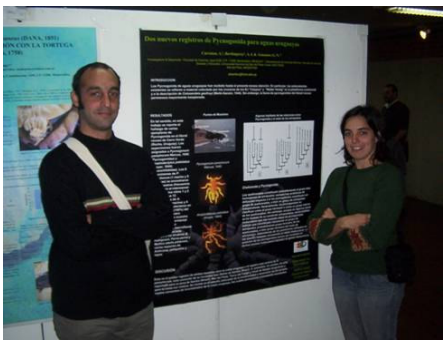
Organisms fixed were identified and counted in the laboratory. In addition, all the mussels collected were counted, measured (shell length to the nearest 0.1 mm), oven-dried (40ºC during 48 h) and weighed to the nearest 0.01 g. Taxonomic determination is being made for most of the macrofaunal invertebrates collected since no comprehensive inventory of the benthic fauna is available yet. These imply the collaboration with regional researchers specialized in particular zoological groups, to avoid misidentifications and/or erroneuous taxononmic determination. It I remarkable that two new species were first recorded for the Uruguayan coast by means of this strategy (see attached material).

RESULTS

To date, we completed the surveys corresponding to summer, autumn, winter and spring 2005, collecting more than 140 quantitative samples. In particular, we evaluated the contribution of mussels (*Brachidontes rodriguezii, Mytilus edulis platensis, and Perna perna*) on the benthic species richness of intertidal and shallow subtidal communities at Cerro Verde

(Uruguay), by comparing the richness of macrobenthic species between mussel-engineered patches and patches without mussels but dominated by algae or barnacles.
We found a net increase in species richness at samples with mussels (34 species), in contrast to samples where mussels were naturally absent or scarce (17 species). Within the mussel-engineered patches, the richness of total and sessile macrofauna was positively correlated with mussel abundance. The richness of mobile macrofaunal species was not correlated with mussel abundance but positively correlated with the standard deviation of mussel dry weight. All these evidence indicate that the mussel beds studied here are important in maintaining species richness at the landscape level, pointing out that beds of shelled bivalves should not be neglected as conservation targets in marine benthic environments.

RESULT DISSEMINATION



To date, two scientific papers were submitted to international peer-reviewed journals (Acta Oecologica and Brazilian Journal of Biology). These papers deal with two new records of marine invertebrates for the Uruguayan coast and with the ecological importance of the mussel beds present in Cerro Verde. Further, at least one more publication will be submitted to an international peer-reviewed journal.

Divulgation of the results were driven also trough the presentations of posters and abstracts at two local meetings (local schools and university) and presentations in regional or local congresses.

Final results will also be presented to the Uruguayan committee of the IUCN and all he people implicated, in different ways, in coastal management In the last time the Uruguayan committee of the IUCN have started working in local meeting about marine issues. In this context, the main objective of the IUCN is "to contribute to the design, creation and management of Protected Areas in Uruguay". In July 2003 at a local meeting where four national organizations (3 NGO and 1 governmental) participated, Cerro Verde has been proposed as a potential site to create a MPA. Currently, and after the meeting that developed a "National Biodiversity Strategy", Cerro Verde was finally chosen to implement the first Pilot MPA in Uruguay. Our team proudly participated of that instance (see attached material).

EXPENDITURES

All expenditures were related to the acquisition of material necessary for the development of the project and /or field trips costs. We detail the amount of the funding utilized. We have purchased all necessary equipment.

ITEMS	Amount requested (£)	Amount utilized (£)
Laptop	650	650
Digital camera	150	150
Travel to and from sampling sites, seasonally, for two years (petrol and viatics for 6 persons, including SCUBA divers and rental of a small boat)	3200	3200
Formalin	100	100
Alcohol	200	200
Plastic bags	50	50
Petri dishes	50	50
Computer disks, paper, ink and mail post expenses	100	100
Bibliographic actualisation	200	200
Computer disks, paper, ink and mail post expenses	250	250
Total	4950	4950

Table: Detail of the amount utilized.