



CoCiBio

Programa de cooperación para la investigación orientada a la aplicación sobre la biodiversidad y cambio climático

Reef ecosystem restoration of Esmeraldas, Ecuador, following damages caused by ghost gears and other unsustainable fishing practices (Short version: Ghost fishing Esmeraldas, Ecuador)

Project partners: University of Bremen/ ZMT (Centre for tropical marine Research, Germany); Universidad San Francisco de Quito (Ecuador)

The challenge

Worldwide, marine ecosystems are increasingly affected by human activities. Both industrial and artisanal fisheries fleets, impacting pelagic and benthic ecosystems degrade continental shelves, where most of the global fisheries concentrate, in different ways. Fishing gear is frequently lost or discarded in the oceans, where nets continue fishing as ghost nets and continue to catch marine species for 600 years until the nets are transformed into micro plastic. Per year more than 5400 sharks, turtles, birds or marine mammals are estimated to be caught in these nets, which form 10% of all the plastic floating in the oceans. In the tropics where rocky reefs are covered by coral, sponges and numerous sessile organisms, ecosystems are destroyed where these nets stuck on rocky bottoms or sweep over the rocks and avoid that corals and sponges can grow and provide shelter for fish and other marine species.

Rocky reef systems are widely distributed off the coast of Esmeraldas and Atacames in Ecuador and are important nursery and feeding grounds for many invertebrate and fish species. Of a total area of 1012 ha, rocky reefs giving home to a wide diversity of species cover approximately 30%. So far 174 fish species and 238 mollusks have been reported in the area. Since 2006 the activity of net fisheries has increased in the Esmeraldas and Atacames areas. As a consequence, these fishing nets that have been lost during former fishing operations now cover most of the rocky reefs. Esmeraldas is one of the poorest provinces in Ecuador, where people rely on tourism and fisheries as their main livelihood. However, fisheries

management is still in its infancy and few studies on catch rates and stock status have been conducted. Moreover, the regulation of fisheries by the national authorities in the area has been historically poor or non-existent. By 2004 sandy bottoms in between the reefs were covered with *Spondylus*, a conch used for food and famous for artisan jewelry due to intense fishery exploitation, *Spondylus* disappeared from the area and with it an enormous potential to filter ocean waters and provide substrate and shelter for numerous invertebrates. Now the rocky reefs with its sessile organisms that provide shelter and breeding places for fishes face the same risk due to derelict fishing gear from the fishing fleets operating in these areas. The present project, therefore aims to preserve, sustainably manage and restore marine resources in rocky reef areas of the Esmeraldas coastal region of Ecuador through research, sustainable economy and education.

Our approach

Through the use of Georeferenced ROV (Remote Operated Vehical) imaging of the sea bottom we shall obtain detailed information about the area impacted by ghost nets. Hotspots, where a high density of nets is present, will be defined as focal areas for the project activity. Fish density and diversity will be assessed prior to net retrieval as well as density and diversity of sessile and mobile invertebrates. Discarded fishing gear on these hotspots will be retrieved and all nets and gear will be classified and weighed. All information will then be listed on a georeferenced data base. Fish abundance and diversity will be measured by strip transects following established protocols. Density and diversity of sessile organisms will be measured using quadrats and digital photography. After net retrieval surveys of fish and invertebrates will be carried out to assess the recovery of the subtidal community. To assess the sustainability of the artisanal fishery in Esmeraldas a participatory fishery-monitoring scheme will be implemented during one year. The main landings places in this coast will be monitored for fish and invertebrate catches. The data collected will help to characterize the artisanal fishery in Esmeraldas. Analyses on different ecological indicators of the fishery (mean trophic level of the catch, proportion of threatened species, mean body size of the catch) will be analyzed with respect



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to the principal fishing gears used in this region. Recovered fishing gear will be sold to recycling companies where it will be upcycled. Generated Income will be used to improve control of gear loss and ghost gear retrieval in the area. Hereby, local recycling companies will be involved in the project and marketing for products produced from lost fishing gear will promote the market nationally and internationally. Education programs will be carried out with the local governments and environmental ministries. Educational material will be developed in form of booklets and digitally to educate local and general public Workshops with representatives of local authorities will help to develop measures to protect reefs from damage by discarded fishing gear. Efficient regulations to avoid collisions of fishing gear with rocky reefs and entanglement of marine fauna will be developed and included in local and regional government regulations. Workshops with local fishermen will increase their awareness about the importance of healthy marine ecosystems in order to create awareness of the threat of lost fishing gear to marine resources and fishermen are encouraged to cooperate actively in gear retrieval, monitoring and recycling processes.

Intended Impact

In the process of the restoration of subtidal marine ecosystems different sectors of the society shall be involved and an economy around

discarded gear will be developed. Thus, the society will directly benefit by supporting the restoration of reef ecosystems. Once rocky reefs are freed from ghost nets, sessile organisms can settle and reestablish suitable habitat conditions for mobile invertebrates and fishes. Through the protection of sensitive habitats where fish find shelter and can reproduce, local fisheries will also be enhanced. Ecosystem services with filter feeding invertebrates will be recovered, carbon intake in the food chain will increase and shall help mitigate the effect on carbon emissions for our global climate. Furthermore, healthy, diverse subtidal reef systems will be more resistant to invasive species and anthropogenic change.

German-Ecuadorian Cooperation

On behalf of the Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ), the German Academic Exchange Service (DAAD) is supporting the "**German-Ecuadorian Research Co-operation Programme on Biodiversity and Climate Change**". Over a term of 18 months, the German-Ecuadorian research co-operation in the fields of biodiversity and climate change will be intensified as part of the DAAD-GIZ co-operation and the conditions for the application of the results of bilateral research projects will be improved. The central implementing partner in Ecuador is the Ecuadorian Ministry of the Environment MAE with its *National Institute of Biodiversity* (INABIO).

Information	
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