MESM 2014-2015 Group Project Proposal
Expansion of the Galápagos Marine Reserve: A Bio-economic Analysis for
Maximization and Redistribution of Net Benefits

Proposers:
Alexandra Vasquez, MESM – (805) 335-0628 – ahvasquez@umail.ucsb.edu
Jesse Goldstein, MESM – (760) 812-0033 – jgoldstein@bren.ucsb.edu
Juan Mayorga, MESM – (818) 877-2410 – jmayorga@bren.ucsb.edu

Client: Enric Sala, National Geographic Society – esala@ngs.org

Project Objectives
The ecological benefits of marine reserves and the conditions under which these benefits are obtained have been thoroughly documented in peer-reviewed literature.1-8 Similarly, considerable economic benefits have been associated with well-designed and well-managed marine reserves. For the tourism industry, higher biodiversity, fish density, and abundance of large predators may increase the number of tourists (e.g., divers, snorkelers and recreational fishing) and their willingness to pay.6-8 For the fishers, reserves can create higher yields in adjacent areas and long-term profitability.9-15 Despite these benefits, the way in which profits are distributed among stakeholders and the differences in their temporal distribution are sources of conflict which result in strong opposition to the implementation of marine reserves. While both fishing and tourism sectors can potentially benefit in the long term, closing areas to extractive uses will adversely affect fishers in the short term.16 Examining which management strategies can efficiently offset negative impacts on fishers and increase acceptance of marine reserves is an active research field in marine conservation. In this context, and with an emphasis on enhancing conservation outcomes, this project aims to analyze the bio-economic implications of expanding No-Take Zones (hereafter: marine reserves) in Galápagos. More specifically, the project will explore the following questions:

- Under different marine reserve expansion scenarios, how and to what extent will the tourism industry benefit?
- Under different marine reserve expansion scenarios, what are the costs to fisheries in both the short and the long term?
- Can different tourism models increase the net benefits to society from expanding the marine reserve?
- Can the potential benefits offset potential losses? If so, what mechanisms could help redistribute benefits among different stakeholders?

Significance
The Galápagos Islands are widely regarded as one of the most universally valued natural sites on Earth today.17 Often referred to as a living laboratory, Galápagos embodies unique oceanographic and ecological characteristics that have shaped a rich and intricate network of endemism within this relatively small region.18 This oceanic archipelago is unique in that it has remained relatively free of anthropogenic degradation and retains 95% of its original species.19 However, the unique biodiversity of the Galápagos has come under increasing threat by the current development model.17 These concerns precipitated the listing of Galápagos as World Heritage in Danger in 2007 by the United Nations Educational, Scientific and Cultural Organization.17 Disagreement about the distribution of the benefits of local resources among stakeholders has been a major barrier to expanding conservation efforts of marine species in the Galápagos.20 Particularly contentious is the conflicting valuation of different marine reserve designations between tour operators and fishers.20 While tour operators covet No-Take Zones, fishers are excluded from these areas. The significance of performing a quantitative analysis and developing recommendations on how to extract the greatest good for all, while facilitating an increase in biodiversity and biomass, cannot be understated. By satisfying the concerns of fishers and tour operators and reconciling their differences, it becomes possible to move forward with efforts to improve conservation practices in Galápagos. Global oceans are on the verge of a possible mass extinction event.21 As one of the only remaining regions on the planet that has not had its evolutionary and ecological processes
severely altered by human activity, it is crucial that every effort is made to effectively conserve and foster proliferation of the unique biodiversity of the Galápagos Islands.

The National Geographic Society’s (NGS) vision fully aligns with this view. This project will implement and test the viability of a bio-economic model recently developed by NGS in collaboration with Dr. Chris Costello at the Bren School. Additionally, the nonprofit scientific institution will benefit via potentially improved ecological conditions for two education-based expeditions it sponsors in Galápagos and through its efforts to document the natural world of the archipelago.

Background

The Galápagos Marine Reserve (GMR) is located 1,000 km off the coast of continental Ecuador, surrounding 127 islands, islets, and rocks. Spanning 135,000 km², it is the second largest marine reserve in the world. The GMR underwent significant socioeconomic and political turmoil in the mid 1990’s due to large increases in fishery exploitation (e.g., sea cucumber), tourism, and human population immigration to the region from continental Ecuador. In order to preserve the integrity of the islands while sustaining the socioeconomic well-being of human inhabitants, the Galápagos Special Law and the Galápagos Marine Reserve Management Plan (GMRMP) were created. The GMRMP zoning scheme was developed through a participatory process that included fishers, tour operators, non-governmental organizations, and Galápagos National Park (GNP) members from 1997 to 2000 with the goals to: ease conflicts that existed amongst the various stakeholders due to human activities within marine reserve zones, preserve biodiversity, sustain economic interests within the GMR, and enforce the regulations set forth by the GSL and GMRMP.

The GMR was subsequently divided into three main zones: port, multiple-use and limited-use. The limited-use zone is associated with shallow waters (<300 meters) and was divided into the following subzones: conservation, tourism, fishing, and areas of special temporary management. Only artisanal fishing is permitted in the GMR, with Spiny lobster being the most profitable fishery. Other target species include albacore tuna, wahoo and Galápagos grouper. Due to conflicting stakeholder interests, the distribution and boundaries for the limited-use zones were not agreed upon and a provisional zoning plan was created. A zoning proposal was finally established in 2000 after incentivizing fishers with alternative livelihoods. The final proposal included 45 fishing zones and 14 conservation zones. However, because offshore boundaries were never agreed upon, the total area of each zone was not established for another 6 years. This created a great deal of conflict and confusion amongst stakeholders, namely fishers. Enforcement from the GNP was lacking during that time due to a lack of infrastructural components for surveillance and monitoring. According to a study conducted in 2000 and 2001, Edgar et. al found that the zones were highly biased toward specific stakeholder groups.

Zoning was to be made permanent after two years and a large-scale assessment of its socioeconomic and ecological sustainability, as of yet, this assessment has not been carried out, resulting in a zoning plan that has not been formally established. The available research suggests that the co-management scheme is not sufficient in preventing overexploitation of shellfish fisheries.

Tourism is the greatest contributor to the growing economy of Galápagos, contributing to 95% of the archipelago’s economy. Revenues contribute to conservation in the form of funding from NGOs and park entrance fees. Tourist numbers in Galápagos grew exponentially from 1995-2011, averaging an annual growth rate of approximately 9%. Visitors amounted to 204,395 in 2013. Tourism in Galápagos is divided into two main types: land-based tourism and the boat-based tourism. The difference between land and boat-based tourists is highly relevant in terms of anthropogenic impact. A relatively new tourism concept which has allowed fishers to segue into the tourism industry is “Pesca Artesanal Vivencial” where fishers take tourists out for a day to showcase their way of life as artisanal fishers. Available information concerning this type of tourism exists in the rudimentary phase but shows little ecological impact and high revenue potential.

Proposed Approaches and Available Data

In the initial stage of the project we will conduct a thorough literature review with three main objectives: 1) to critically analyze Galápagos’ recent history of marine spatial planning, 2) to examine various models and approaches that have dealt with the interlinked effects of no-take zones on conservation, tourism and fisheries and 3) to determine and obtain key data and to identify data gaps that need to be filled.

By looking into various approaches and models, we intend to complement and build upon the bio-economic model developed by Sala et al (2013). This model is based on the link between the positive biological effects of marine
reserves, the derived benefits to tourism (e.g., divers) and the short-term losses and long-term benefits to fishers. Sala et al (2013) used biomass as the biological parameter linked to tourism and assumed a linear relationship between the marginal value to tourists and fish biomass. The model is parameterized so that it can be adapted for different species and regions with different fishing and tourism characteristics. Sala et al (2013) applied the model in the Medes Islands and concluded that total value after implementing the reserve is greater within 5 years. They observed a short term loss in fishery profit but a steady increase in tourism value. They argue that these distributional effects can be addressed with appropriate management and/or financial mechanisms that would not only facilitate implementation but also make the reserve self-sustainable.

A preliminary assessment of available secondary data includes but is not limited to:

- Database of biological and catch data for the lobster fishery for the years 1995-2011 collected by GNP and Charles Darwin Foundation (CDF), and compiled by Mauricio Castrejón from Dalhousie University.
- Data for prices in the lobster fisheries from 2002-2006 from the CDF
- Field data from surveys conducted to fishermen, restaurants, boat operators and tourists in San Cristobal by Debevec et al (2014)
- Database of tourism statistics over the past six years from the CDF

We believe that access to these data won’t be an obstacle given that past group projects have used some of it and that Alexandra Vasquez has good connections with CDF and other institutions in Galápagos. Moreover, with the expertise and experience that the Bren School and the Sustainable Fisheries Group (SFG) have on Galápagos, we are confident that data gaps can be minimized, and that primary information can be obtained during summer internships.

After fine-tuning the model to the Galápagos, we will simulate the effects of different expansion scenarios on conservation outcomes, the fishing sector and the tourism industry. These scenarios will range from current conditions to complete closure of the GMR to fishing; taking into account the effects of spatial variability. These simulations will allow us to identify under which scenarios, if any, the benefits to tourism can offset the losses to fishers. Alternative tourism models (e.g., modification of park entry, diving fees or capping tourism) will also be evaluated to explore ways in which the net benefits can be maximized. Finally, we will examine the suitability and viability of various management and policy mechanisms that could help redistribute profits, offset short-term losses and facilitate the expansion of the marine reserve. Examples of these mechanism are, but are not limited to, increases in taxes on tourism activities for redistribution across stakeholders and providing opportunities for fishermen to become shareholders in the tourism sector (e.g., Pesca Vitencial).

**Deliverables**

The project’s main deliverable will be a suite of spatial configuration scenarios for the expansion of No-Take Zones in the GMR that yield the greatest bioeconomic net benefits to society under different tourism models. We will also present a detailed analysis of the management and policy mechanisms that can potentially be applied to redistribute benefits across stakeholders, emphasizing the conditions under which these mechanisms would work.

**Internships**

The National Geographic Society has committed to providing $25,000 in funding for summer internships, travel and any other project expenses.
References


27 Taylor Debevec, Katie Westfall, and Steven Gaines. Galápagos Lobster for the red spiny lobster shery in the Galápagos Islands Project Members. 2014.


Dear Steve,

I am pleased to let you know that I am very enthusiastic about your project to conduct a bio-economic analysis of the expansion of the no-take areas within the Galapagos Marine Reserve. At Pristine Seas, we are very committed to this project, because of its value for our efforts in Galapagos to increase the number and size of no-take areas, and also for the broader National Geographic efforts to develop a sustainable tourism industry that contributes to the conservation of the unique biodiversity of the archipelago. Our ongoing project in Galapagos will facilitate data collection and field logistics. The data obtained by the students will be essential to support the models that the Galapagos National Park leadership will use to re-zone the Galapagos Marine Reserve.

We will provide funding and internship support, including travel, for this project – at the $25,000 level.

All the best,

Enric Sala