



BREN SCHOOL OF ENVIRONMENTAL SCIENCE & MANAGEMENT

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Dear Nature Editors,

On behalf of my coauthors Christopher Costello and John Lynham, I am pleased to submit our manuscript "Well-Designed Environmental Markets Enable Large-Scale Marine Conservation" for consideration as an Article in Nature.

International goals aim to protect 30% of the ocean by 2030, but today less than 3% of our oceans are strongly protected. If nations are to meet these ambitious goals, sudden large-scale conservation will need to be implemented in countries' territorial waters. This paper addresses the critical question of how countries can be incentivized to enact these protections, even when it implies a large loss in fishery revenues.

We show that a kind of environmental market, where countries trade fishing rights, can help solve this problem. To do so, we develop a novel spatial bioeconomic model to simulate different market designs and show how market design features, such as allocation and trading across countries, can allow a country to capture the spillover benefits of their conservation, thus helping finance the conservation.

We then confront our predictions with vessel-level satellite tracking data from the Phoenix Islands Protected Area (PIPA) implemented in 2015 by Kiribati. This is one of the world's largest Marine Protected Areas and is embedded in a fishery managed with fishing effort markets. We track the position and activity of 313 tuna purse seiners between 2012 and 2018 and quantify their time spent in Kiribati and other nations' waters, and measure effort redistribution after the implementation of PIPA. Consistent with the model's predictions, we find that fishing vessels that had fished in PIPA largely moved outside of Kiribati, but that because fishing rights were transferable across countries, the cost of conservation to Kiribati were substantially reduced. This is an important lesson for other Pacific Island nations currently considering large scale marine conservation, such as Palau's commitment to soon protect 80% of its waters.

Our findings are of great interest to managers, policy makers, conservation scientists, and economists. Target 11 of the Convention on Biological Diversity aims to protect 10% of the oceans by 2020, and The Global Deal for Nature and the International Union for Conservation of Nature call for 30% protection by 2030. Our work shows how environmental markets can be leveraged to attain these ambitious but much-needed goals.

All authors contributed equally and accept responsibility for this work. The manuscript has not been published elsewhere and is not under consideration by another journal. We have no conflicts of interest. Five suggested referees with expertise in fisheries, marine conservation, and property rights include: Jane Lubchenco, Enric Sala, Ana Parma, Jeremy Collie, and Kailin Kroetz.

Thank you for your consideration. We look forward to hearing from you.
Sincerely,

Juan Carlos Villaseñor-Derbez
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