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November 24th, 2020

Dr. Magdalena Skipper
Editor-in-Chief
Nature

Dear Dr. Skipper,

Please find our manuscript entitled "Global drivers and vulnerability of coral reef fish functions" for consideration as a research article in *Nature*.

Understanding the processes that underpin ecosystem functioning is paramount to preserving healthy ecosystems for future generations. Coral reefs support the livelihoods of 500 million people worldwide, but they are threatened by a host of anthropogenic stressors. Beyond proxies such as reef fish biomass or coral cover, we lack even basic information about the drivers and vulnerability of ecosystem functions on coral reefs.

In our paper, we provide the first quantification of five key ecosystem functions across coral reefs worldwide. Specifically, we examine how nitrogen cycling, phosphorous cycling, biomass production, herbivory, and piscivory vary across global reefs, then we investigate the drivers and vulnerability of these five functions.

Our global analysis reveals a striking trade-off between different functions, challenging the classic, agro-economic view that 'healthy' ecosystems can maximize all functions. Furthermore, across different locations, each function is dominated by a few key species. Yet, no species consistently performs a key role across regional or global scales, thus challenging the applicability of conservation practices founded on concept of keystone species. Finally, we reveal the vulnerability of several functions to two major anthropogenic stressors, overfishing and coral loss.

Using a novel, integrative approach across the world's coral reefs, our paper 1) provides the first global analysis of ecosystem functioning on reefs; 2) identifies the key drivers of coral reef functioning, and 3) challenges the traditional management paradigm in which all ecosystem functions are maximized. Thus, our paper offers a bold new perspective on biological conservation in a time when maximizing ecosystem functioning is heralded as a primary management objective.

In light of the fundamental importance of coral reefs for humanity, we believe this study will be of great interest to a wide array of scientists, policy makers, conservation practitioners, and the general public. As such, we believe it is ideally suited for the wide exposure granted by publication in *Nature*.

We wish to participate in the double-blinded peer review. Therefore, all required elements containing author information are added below. We also provide a list of potential reviewers for our manuscript below.

Thank you for your consideration. We look forward to your response.

Kind regards,

Nina M. D. Schiettekatte, on behalf of all co-authors

Suggested reviewers:

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- Stuart Sandin (ssandin@ucsd.edu)
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Acknowledgements

We thank the staff at CRIOBE, Moorea for field support. We would also like to thank Jérémy Carlot, Beverly French, Titouan Roncin, Yann Lacube, Camille Gache, Gabrielle Martineau, Kailey Bissell, Benoit Espiau, Calvin Quigley, Kaitlyn Landfield and Tommy Norin for their help in the field, Sophie Schiettekatte for proof-reading the manuscript, and Guillemette de Sinéty and Jérémy Wicquart for their contribution to otolith analyis.

Funding

This research was funded by the BNP Paribas Foundation (Reef Services Project) and the French National Agency for Scientific Research (ANR; REEFLUX Project; ANR-17-CE32-0006). This research is product of the SCORE-REEF group funded by the Centre de Synthèse et d'Analyse sur la Biodiversité (CESAB) of the Foundation pour la Recherche sur la Biodiversité (FRB) and the Agence Nationale de la Biodiversité (AFB). VP was supported by the Institut Universitaire de France (IUF) and JMC was supported by a Make Our Planet Great Again Postdoctoral Grant (mopga-pdf-0000000144).

Data and code availability

All data and code to reproduce figures are available online through GitHub (https://github.com/nschiett/global_proc) and figshare (https://figshare.com/s/f789aec2c20492c4f0f9). All data on individual fish traits are available from the corresponding author on reasonable request.

Author contributions

NMDS and VP conceived the idea and NMDS, VP, SJB, and JMC designed methodology; NMDS, JMC, SJB, AM, FM, VP, KSM, JEA and DEB collected the data; All authors shared existing data. NMDS analyzed the data and led the writing of the manuscript. All authors contributed significantly to the drafts and approved the final version for publication.

Competing interests: None declared.

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Ethics statement: All protocols related to the capture and handling of fish complied to the ethical standards of CRIOBE and EPHE, and the University of California Santa Barbara's Institutional Animal Care and Use Committee (IACUC #915 2016-2019). Extraction and transport of samples were approved by the government of French Polynesia.