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February 15th, 2019

Dear Editor-in-Chief and Editorial Board members of *PNAS*,

Please find enclosed our manuscript titled "***Climate cooling and clade competition likely drove the decline of lamniform sharks***", which we submit for consideration as a Research Article in *PNAS*.

In this work, we address the reasons of why a clade waxed and waned through time, which is a central question in evolutionary biology with long-established hypotheses that often remained untested. Here we test many evolutionary and ecological hypotheses in a single framework by assembling and studying an unprecedented fossil record for two shark orders, spanning their entire evolutionary histories. We quantify the effects of abiotic or biotic factors on the speciation and extinction rates of the iconic lamniform sharks, including the today's great white (*see below for a proposed cover image*) and the extinct megalodon.

Using cutting-edge Bayesian fossil birth-death models, we unveil the past diversity dynamics of lamniform sharks showing a highly dynamic pattern with extinction peaks and a diversity decline in the past 20 million years. Additional models provide strong evidence that the decline of lamniform sharks can be attributed to a combination of abiotic and biotic factors, acting on extinction and speciation, respectively. The extinction is best explained by the fluctuations of past temperatures, with cooling temperature increasing significantly extinction since the Miocene. The speciation is controlled by biotic interactions with other sharks, the ground sharks, that increased in diversity and exerted competitive effects on the speciation of lamniform sharks. We even uncover that ecologically similar clades, as indicated by tooth measurements of 658 extant and extinct species, were more in competition than with other ecological guilds. This strongly suggests that biotic interactions mediated by this novel competitor also triggered the decline of lamniform shark diversity.

These results are striking as we found a remarkable interplay signal of abiotic and biotic factors controlling different diversification processes over 145 Myrs, supported by strong statistical evidence for a climate-driven extinction coupled to a competition-driven speciation model, potentially explaining the proposed low extant diversity of these sharks. These results also imply that long-term biotic interactions can play a more important role on the rise and demise of major organism groups than mass extinction events. We think the originality and novelty of these results will appeal to the broad readership of *PNAS* by touching the marine, fish, and evolutionary biology communities, we and hope that you will share our excitement for the study presented.

We recommend the NAS member Prof. **David Jablonski** at University of Chicago as the Editorial Board member and Prof. **James W. Valentine** as Editor to handle this submission.

For qualified reviewers, we would like to recommend:
- Prof. **Tiago B. Quental**: Universidade de São Paulo, Instituto de Biociências, Departamento de Ecologia, São Paulo, Brasil. Contact details: tbquental@usp.br / https://labmeme.github.io/aboutme/

- Prof. **Charles R. Marshall**: University of California, Berkeley, USA. Contact details : crmarshall@berkeley.edu / http://ib.berkeley.edu/labs/marshall/

- Dr. **Matt Friedman**: University of Michigan, Earth and Environmental Sciences, Ann Arbor, USA. Contact details: mfriedm@umich.edu / https://lsa.umich.edu/earth/people/faculty/matt-friedman.html

- Dr. **Mathias M. Pires**: Universidade Estadual de Campinas, Departamento de Biologia Animal, Brazil. Contact details: mathiasmpires@gmail.com / http://www.mathiasmpires.net.br/

- Dr. **Mark D. Uhen**: George Mason University, Atmospheric, Oceanic and Earth Sciences, Fairfax, USA. Contact details: muhen@gmu.edu / http://uhenlab.weebly.com/

Sincerely yours,

Fabien L. Condamine, On behalf of my co-authors

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