

Dear Editor,

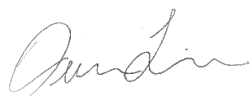
On behalf of my coauthors, I am pleased to submit our manuscript, entitled, “**Mobility and flexibility enable resilience of human harvesters to environmental perturbation**,” for consideration for publication in *PNAS*. Natural systems and the ecosystem services they provide are increasingly threatened by climate change-linked extreme events like heatwaves and wildfires. Indeed, the recently-published IPCC 6th Assessment Report found it is virtually certain that hot extremes have become more frequent and more intense since the 1950s. It is more critical than ever to understand how human resource users embedded in linked social-ecological systems can cope, adapt, and be resilient to the unexpected effects of extreme climate events. Yet, while adaptive behaviors are relatively well-studied in non-human species, it is rarely possible to examine them quantitatively in human harvesters, over long time periods and in response to environmental change.

In our study of human harvesters in the most valuable fishery on the US west coast, we combine satellite-based vessel telemetry (2.2 million satellite geolocations) with fishery market information to investigate adaptive responses to an extreme climate-driven environmental perturbation. Using the record 2014-2016 marine heatwave in the eastern North Pacific as a natural experiment, we demonstrate that behavioral flexibility promoted climate resilience. Specifically, participants in the Dungeness crab fishery that combined spatial mobility (large fishing areas) with higher participation rates in other fisheries (high portfolio diversification) were best able to adapt during the heatwave period. Conversely, participants that specialized in the Dungeness crab fishery and concentrated fishing effort in small spatial areas were less able to adapt to the novel environmental and management conditions driven by the heatwave.

These findings have broad implications for understanding resilience of linked human and natural systems to future extreme events. Our findings align with theory from both economics and ecology literatures, demonstrating empirically how behavioral plasticity in humans is a critical component of sustainability in social-ecological systems. To date few studies of human harvesters have been able to bring this much quantitative information to bear on the question of how people respond to extreme climate events. Our study uses big data analytics to derive metrics of human harvester behavior across more than a decade, which included a broad range of environmental conditions and an unprecedented marine heatwave linked to climate change. Our analysis included information from more than 315,000 fishing trips and >\$2 billion in revenue from a fishery that is a central linchpin in the west coast social-ecological system. Our results illuminate pathways to improve adaptive capacity for human harvesters during an era in which the magnitude, frequency, and intensity of environmental perturbations is increasing; in addition, our methods provide a template for future work in other systems to examine these dynamics more broadly. Together, these characteristics of our paper make it well-suited for the readership of *PNAS*---including conservation biologists, ecologists, economists, and global change biologists---as it employs a cross-disciplinary approach to evaluate the well-being of current and future generations of harvesters within the limits of the natural world.

Our manuscript has been submitted as one document (Figures, Methods, Supplemental Materials all included with the main article text).

Thank you for your consideration,

A handwritten signature in dark ink, appearing to read 'Owen Liu', with a stylized, flowing script.

Owen Liu, Ph.D.