**Overview**

Decadal variability of Pacific sea surface temperatures (SSTs) plays an important role in terrestrial climate anomalies as well as global temperature trends. Unfortunately, the character of this variability is poorly constrained by instrumental data, which is particularly sparse in the South Pacific. Few in-situ SST proxies extend the instrumental records in higher latitudes, however, Pacific geoduck records from the North Pacific demonstrate a new pathway to filling these data gaps. The New Zealand geoduck shows similar promise, with previous shell collections from fisheries research readily available and a pilot chronology proving both crossdating viability and broad spatial SST correlations. The proposed research will first develop several New Zealand geoduck chronologies from existing shell collections to determine the prime location for a multiproxy, annual climate reconstruction. We will then collect fossil shell samples from the sea floor to extend the geoduck climate archive into previous centuries. We will reconstruction pan-Pacific SST patterns utilizing this new SST reconstruction alongside corals and trees to provide insights into the range and spectral character of past variability. We will use this pan-Pacific reconstruction alongside continental climate proxies to assess the strength and stability of teleconnection patterns for economically and societally important regions. Finally, we will harness these new insights to test model skill in the pre-instrumental Pacific and provide an assessment of likely future behavior based on skillful models.

**Intellectual Merit**

Instrumental records are particularly short in the South pacific, where decadal variability is strong, and our new reconstruction will extend the SST record in a region where continuous monitoring only began in 1953. We have already produced the first evidence of crossdating and climate-growth relationships for the species and will continue to leverage the experience and tools gained from the related work with Pacific geoduck. We will leverage the Pacific and New Zealand geoduck chronologies alongside tropical corals to reconstruct pan-Pacific SSTs using annually resolved, multicentennial, in-situ marine SST proxies. Where disagreement among models as well as previous reconstructions is pronounced, this new reconstruction, defined by rigorous selection criteria, will add to our understanding of the natural variability in this system.

**Broader Impacts**

We're collaborating with the New Zealand government statistics agency and NIWA to create educational content based on our new climate data. This project will also benefit New Zealand's geoduck fishery by providing insights into species longevity. We've established connections with leading P. zelandica researchers and commercial fishers, fostering information exchange and ongoing collaboration.

Additionally, this work supports undergraduates at Iowa State University and Northern Arizona University, enabling their intellectual contributions and potential co-authorship. The project also aids early career researchers PI Thatcher and collaborator Edge.

PI Erb and collaborator Edge will engage with the public through the Flagstaff Festival of Science, promoting science to K-12 students and the wider community. Furthermore, PI Thatcher has been actively involved with Gilbert, IA high school students, teaching them about natural logs and their application in radiometric dating since 2017.