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Rising climate variability and synchrony in North Pacific ecosystems

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Evidence is growing that climate variability of the northeast Pacific Ocean has increased over the last century, culminating in such events as the record-breaking El Niño years 1983, 1998, and 2016 and the unusually persistent 2014/15 North Pacific Ocean heat wave known as "The Blob." Of particular concern is that rising variability could increase synchrony within and among North Pacific ecosystems, which could reduce the diversity of biological responses to climate (i.e. the "portfolio effect"), diminish resilience, and leave populations more prone to extirpation. To test this phenomenon, we use a network of multidecadal fish otolith growth-increment chronologies that were strongly correlated to records of winter (Jan-Mar) sea level. These biological and physical datasets spanned the California Current through the Gulf of Alaska. Synchrony was quantified as directional changes in running (31-year window) mean pairwise correlation within sea level and then within otolith time series. Synchrony in winter sea level at the nine stations with the longest records has increased by more than 40% over the 1950-2015 interval. Likewise, synchrony among the eight longest otolith chronologies has increased more than 100% over a comparable time period. These directional changes in synchrony are highly unlikely due to chance alone, as confirmed by comparing trends in observed data to those in simulated data (n = 10,000 iterations) with time series of identical number, length, and autocorrelation. Ultimately, this trend in rising synchrony may be linked to increased impacts of the El Niño Southern Oscillation (ENSO) on mid-latitude ecosystems of North America, and may therefore reflect a much broader, global-scale signature.