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Living with uncertainty: genetic imprints of climate shifts in east Pacific Anchovy *(Engraulis mordax)* and sardine *(Sardinops sagax)* population

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In the upwelling zone of the northeastern Pacific, cold nutrient-rich conditions alternate with warm nutrient-poor intervals on timescales ranging from months to millennia. In this setting, the abundances of Pacific sardine (*Sardinops sagax*) and northern anchovy (*Engraulis mordax*) fluctuate by several orders of magnitude, with sardine dominating during warm conditions and anchovy dominating during cool conditions. Two population models can explain the response of these fishes to adverse conditions. Under the basin model, species distributions contract to a central (optimal) range during population crashes. Expectations of this model may include a single range-wide population with a decline in genetic diversity on both sides of a central refuge. In contrast, the self-recruitment model invokes a series of local oceanographic domains that maintain semi-isolated subpopulations. During adverse conditions, some subpopulations cannot complete the life cycle within the local environment and are extirpated. Expectations of this model include some degree of population genetic structure and no clear gradient in genetic diversity. We examined mitochondrial DNA cytochrome *b* sequences to assess these competing models for anchovy (N = 196; 539 bp) and sardine (N = 107; 425 bp). The mitochondrial DNA gene genealogies are shallow but diverse for both species. Haplotype frequencies are homogeneous among subpopulations, but genetic diversities peak for both species along Baja California and adjacent southern California. Mismatch distributions and Tajima's *D*-values reveal distinctive signatures of population bottlenecks and expansions. Sardine haplotypes coalesce at ~241 000 years bp, with an initial female effective population size N_{f0} = 0 followed by exponential growth to N_{f1} = 115 million. Anchovy haplotypes coalesce at ~282 000 years bp, with an initial population size of N_{f0} = 14 000, followed by exponential growth to N_{f1} = 2.3 million. These results indicate a founder event for sardine and a severe population decline for anchovy in the California Current during the late Pleistocene. Overall, these data support the basin model on decadal timescales, although local recruitment may dominate on shorter timescales.

Palabras clave: Recruitment, coalescence, basin model, climate change, mtDNA, fish