

Raimondi, P.T., C.M. Wilson, R.F. Ambrose, J.M. Engle, and T.E. Minchinton. 2002. Continued declines of black abalone along the coast of California: are mass mortalities related to El Niño events? *Marine Ecology Progress Series* 242:143-152.

Abstract: The intertidal black abalone *Haliotis cracherodii* has experienced mass mortalities along the coast of California, USA, since the mid-1980s. Mortality is due to infection by a pathogen that leads to a fatal wasting disease called Withering syndrome¹, where the foot of the abalone atrophies until it can no longer adhere to the substratum. Massive die-offs due to withering syndrome were first noted on the Channel Islands in 1986, and by 1992 withering syndrome was observed near Point Conception on the mainland and was suspected to be spreading northward up the coast of California. The timing of the initial mass mortalities following the strong 1982 to 1983 El Niño and an isolated outbreak of withering syndrome in 1988 at Diablo Cove, north of Point Conception, following warm water discharge from a power plant, led to the hypothesis that the onset of mass mortalities due to withering syndrome may be triggered by elevated seawater temperatures. We surveyed black abalone populations at 7 sites along the mainland coast of California (including 3 where withering syndrome was already present) from 1992 to 2001, a period spanning 2 El Niño events, to determine whether (1) withering syndrome and associated declines of black abalone were spreading northward up the coast; and (2) these mass mortalities of black abalone could be related to elevated seawater temperatures during El Niño events. Mass mortalities of black abalone due to withering syndrome were observed at the 5 most southern sites (>90% decline in numbers in all size classes), but not at the 2 most northern sites, and there was a clear pattern of decline from south to north over time. Massive die-offs of abalone were not exclusively associated with times of elevated sea surface temperatures due to El Niño. Nevertheless, rapid declines of abalone at 2 sites coincided with the strong 1997 to 1998 El Niño, and declines during El Niño events were faster than those during non-El Niño years. Abalone at the 2 most northern sites, where only slight declines occurred during the 1997 to 1998 El Niño, may not have been infected by disease. It appears, therefore, that in the presence of the pathogen, warm water conditions associated with El Niño may accelerate the development of withering syndrome and the rate of decline of black abalone. Consequently, anthropogenic disturbances, such as discharges of heated water or global warming, may increase the incidence of this fatal disease.