The American lobster, *Homarus americanus*, inhabits a large oceanic range spanning from Labrador, Canada, to North Carolina, USA. This geographic range varies in temperature by as much as 25oC, and daily temperature fluctuations of up to 12oC may occur at a single location depending on season, water depth, and tides. The cardiac system of the lobster is sensitive to these temperature changes and has been shown to adjust its functioning over a large temperature range. A previous study shows that various cardiac factors have different patterns of temperature dependence, resulting in stable cardiac output over the range of 2–20oC. At this point, the mechanism of temperature-dependent functioning is unknown. It has been hypothesized that feedback pathways present in the whole heart, but absent in the isolated ganglion, would provide protection against thermal stress. However, our results indicate that the cardiac ganglion can withstand higher temperatures when isolated than when in the intact heart, before it suffers from functional failure. These data suggest that the intact heart contains other feedback mechanisms that facilitate cardiac failure. Specifically, with increasing temperature, the burst frequency and spike frequency of the cardiac ganglion significantly increase, while the burst duration, duty cycle, and number of spikes per burst significantly decrease. The changes in these functional parameters interact such that the ganglion suffers loss of bursting rhythmicity or activity; the temperature at which this occurs varies by individual, but is usually above temperatures lobsters normally encounter. The ganglion recovers fully if the temperature is returned to baseline.