Iterated rippled noise (IRN) is produced by delaying a broadband noise by time $d$, multiplying by gain $g$, adding the delayed noise to the original, and repeating this process for $n$ iterations. When $g=+1$ IRN has a well-defined pitch at $1/d$ Hz. If $g=-1$ the pitch can be ambiguous. A gain of -1 is equivalent to applying a frequency-independent phase shift $\phi$ of $\pi$ rads to the delayed noise ($g=+1 \equiv \phi=0$). We recorded spike-trains from single units in the ventral cochlear nucleus in response to IRN with varying $\phi$. Units with high best frequencies represented waveform envelope modulation (independent of $\phi$), however, units in the phase-locking range of best frequencies represented stimulus fine structure (which varies with $\phi$). Fine structure responders show a gradual transition from a well-defined peak in the interspike interval distribution at $d$ when $\phi=0$ to two equal-amplitude peaks flanking $d$ when $\phi=\pi$, and a gradual shift back to a well-defined peak at $d$ as $\phi$ approaches $2\pi$. Within the dominance region for pitch interspike interval distributions account for psychophysical pitch matches of $1.07/d$ and $0.94/d$ Hz for $\phi=\pi/2$ and $3/2\pi$ respectively, as well as the ambiguous pitches of $0.88/d$, $1.14/d$, and $1/2d$ Hz heard when $\phi=\pi$ rads.