Resonant magnetic scattering of multiferroic HoMnO$_3$ S. NANDI, A. KREYSSIG, L. TAN, J.-W. KIM, J.Q. YAN, R.J. MCQUEENEY, P.C. CANFIELD, A.I. GOLDMAN, Dept. of Physics, Iowa State University, IA 50011, A. BARCZA, Institute for Phy. Chem., University Vienna, Austria — The multiferroic material HoMnO$_3$ displays electrical polarization below the Curie temperature $T_C = 875$ K and antiferromagnetic Mn$^{3+}$ ordering at Néel temperature, $T_N = 75$ K. The ferroelectric phase possesses hexagonal P6$_3$cm symmetry with polarization $P_c = 5.6$ $\mu$C cm$^{-2}$ along the hexagonal c axis. In order to shed further light on the magnetic order in this compound, element specific X-ray resonant magnetic scattering was performed at the Ho L$_{III}$ absorption edge. Resonance enhancement was observed in both quadrupole and dipole channels below 40 K. Measurement of (00l) and (h0l) (l odd) reflections have resolved contradictions present in the literature regarding the magnetic order of Ho$^{3+}$ moments. From 40 K down to 6 K, Ho$^{3+}$ moments order according to magnetic space group P6$_3$cm with different values for the ordered moment on the Wyckoff sites 2a and 4b. According to this space group, Ho moments are ferromagnetically correlated in the a-b plane and antiferromagnetically correlated in the c-direction. The coincidence of the transition temperature (40 K) for Ho$^{3+}$ moment ordering, spin rotation for Mn$^{3+}$ moments, and sharp anomaly in dielectric constant indicates that the interplay between ferroelectricity and magnetism is strongly related to the Ho magnetic order.