Supramolecular recognition of phosphates in water has applications in biology, chemistry, and industry from energy transport to drug delivery to wastewater remediation. Due to the high hydration energies of phosphates and the plethora of competing anions found in the studied media such as bicarbonates and carboxylates, selective binding of phosphates over these competing anions is a challenge. Two different approaches have been pursued in the design of such phosphate receptors. The first utilizes organic, biologically-inspired synthetic receptors that employ intermolecular hydrogen bonding and electrostatic interaction. In aqueous media, such interactions are relatively weak and require accurate tuning of the hydrophobic cavity and directionality of the interactions. The second utilizes strong metal to ligand bonding that can overcome the hydration energies to design metal complexes as receptors. Hard metals such as Zn(II), Cu(II), and lanthanides, Ln(III). Lanthanides additionally provide useful signaling characteristics such as luminescence, proton relaxivity, and NMR induced shift that can allow for monitoring of binding. By changing the ligand of a lanthanide complexes known to selectively bind phosphate with high affinity, we have shown that selectivity for phosphate over other common anions can be tuned. Five different Gd(III) complexes incorporating a maltol, hydroxypyridinone, hydroxamic acid, (hydroxyethyl)picolinate, or carbamoylmethylphosphine oxide chelating moiety spanning a range of basicities were tested for their affinity and selectivity for phosphate over other common anions in neutral aqueous media. Each of the five ligands were tripodal hexadentate to ensure the same geometry and open coordination site, with two water molecules occupying the open site for each. Understanding how changes to ligand influence the anion binding capabilities of metal complexes can allow for better design of anion probes for detection and capture.