Birds evolved a diversity of head shapes, feeding behaviors and jaw muscles which drive the feeding apparatus. Capturing the anatomical diversity of these muscles remains challenging and we know little about how jaw muscles develop, function and evolve among lineages. Here we use contrast imaging and 3D muscle fiber tracking to explore the morphological and functional significance of the jaw muscles of birds to highlight the potential of these approaches. First, we show differences in functional morphology of jaw muscles between a hatchling and adult Mallard duck (Anas platyrhynchos). Ducks show a marked change in adductor chamber shape during ontogeny including an elongated postorbital process, quadrate orbital process and retroarticular process which likely track with changes in muscle function and cranial kinesis. Indeed, we found m. depressor mandibulae in baby and adult ducks shifts from a rostrocadual orientation to a more dorsoventral orientation that offers additional mechanical advantage to jaw opening and propalinal mandible movement as well as concomitant changes in the 3D resultant and pennation of other jaw muscle bellies. Second, we show differences between a long- and short-faced, dabbling birds (mallard, green-wing teal), long faced orthally-biting bird (belted kingfisher) and a short-faced, hard-biting bird, the grey parrot (Psittacus erithacus). We expected position, architecture and biomechanics of homologous muscles to differ substantially between these avian species given their different behaviors and overall cranial morphology. Although some muscles showed marked differences in resultant and pennation, others were remarkably similar in morphology suggesting a mosaic of changes happening during avian evolution. Together, these 3D high fidelity anatomical data on jaw muscle functional morphology in birds will not only better illuminate ecomorphological evolution but also illustrate how clades of birds and vertebrates adapt their muscle architecture to meet functional demands.