

Fish produced carbonates are derived from metabolic CO₂ and are important to shallow ocean alkalinity cycles and vertical alkalinity profiles.

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Almost all marine fish produce carbonates, “ichthyocarbonates”, in their intestinal lumen and excrete them to the environment. Ichthyocarbonates are derived mainly from metabolic CO₂ and are estimated to contribute 4.50 Pg CaCO₃ yr⁻¹ to global oceanic carbonate production. Ichthyocarbonates are unique among biogenic carbonates by containing high mol%MgCO₃, in some species exceeding 50%, suggesting shallow dissolution but have been documented in sediments from shallow subtropical environments. We aimed to examine the fate of ichthyocarbonate by determining dissolution depths under conditions simulating the Atlantic, Pacific and the Indian Ocean basins using excreted ichthyocarbonates produced by three species of marine fish. By measuring specific gravity, size, and dissolution rate of ichthyocarbonate, we estimate sinking rates and fate for each species. The specific gravity of ichthyocarbonates was lower than expected, ranging from 1.23 to 1.33 g cm⁻³. Based on our new relationship between fish size and excreted ichthyocarbonate diameter, an estimated 50% of ichthyocarbonates produced in global oceans are <0.25 mm, 25% are between 0.25 and 0.36 mm, while 25% are between 0.36 and 0.91 mm in diameter. Ichthyocarbonate dissolution rates are high even at surface ocean aragonite saturation states but differ among the three species examined. Factoring in our determined sinking and dissolution rates, the dissolution depth of ichthyocarbonates <0.36 mm in diameter is generally <200 m for all ocean basins and thus contributes to upper water column alkalinity cycling. However, approximately 25% of global ichthyocarbonate production, (~ 1.1 Pg CaCO₃ yr⁻¹) with a median diameter of 0.91 mm, may reach depths of 500 to 1000 m, with deepest depths of persistence observed in the Atlantic Ocean. Large diameter ichthyocarbonate is anticipated to persist even deeper than the aragonite saturation horizon in the Pacific and Indian Oceans, indicating an important role of marine fish in establishing vertical alkalinity profiles in the oceans. Supported by NSF OCE award # 2319245.