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Cultural transmission, the social learning of information or behaviors from conspecifics [1–5], is believed to occur in a number of groups of animals, including primates [1, 6–9], cetaceans [4, 10, 11], and birds [3, 12, 13]. Cultural traits can be passed vertically (from parents to offspring), obliquely (from the previous generation via a nonparent model to younger individuals), or horizontally (between unrelated individuals from similar age classes or within generations) [4]. Male humpback whales (*Megaptera novaeangliae*) have a highly stereotyped, repetitive, and progressively evolving vocal sexual display or “song” [14–17] that functions in sexual selection (through mate attraction and/or male social sorting) [18–20]. All males within a population conform to the current version of the display (song type), and similarities may exist among the songs of populations within an ocean basin [16, 17, 21]. Here we present a striking pattern of horizontal transmission: multiple song types spread rapidly and repeatedly in a unidirectional manner, like cultural ripples, eastward through the populations in the western and central South Pacific over an 11-year period. This is the first documentation of a repeated, dynamic cultural change occurring across multiple populations at such a large geographic scale.