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TITLE: Multiscale impacts of armoring on Salish Sea shorelines: Evidence for cumulative and threshold effects

AUTHOR: ['Megan N. Dethier', 'Wendel W. Raymond', 'Aundrea McBride', 'Jason D. Toft', 'Jeffery R. Cordell', 'A. S. Ogston', 'Sarah M. Heerhartz', 'Helen Berry']

ABSTRACT:

Shoreline armoring is widespread in many parts of the protected inland waters of the Pacific Northwest, U.S.A, but impacts on physical and biological features of local nearshore ecosystems have only recently begun to be documented. Armoring marine shorelines can alter natural processes at multiple spatial and temporal scales; some, such as starving the beach of sediments by blocking input from upland bluffs may take decades to become visible, while others such as placement loss of armoring construction are immediate. We quantified a range of geomorphic and biological parameters at paired, nearby armored and unarmored beaches throughout the inland waters of Washington State to test what conditions and parameters are associated with armoring. We gathered identical datasets at a total of 65 pairs of beaches: 6 in South Puget Sound, 23 in Central Puget Sound, and 36 pairs North of Puget Sound proper. At this broad scale, demonstrating differences attributable to armoring is challenging given the high natural variability in measured parameters among beaches and regions. However, we found that armoring was consistently associated with reductions in beach width, riparian vegetation, numbers of accumulated logs, and amounts and types of beach wrack and associated invertebrates. Armoring-related patterns at lower beach elevations (further vertically from armoring) were progressively harder to detect. For some parameters, such as accumulated logs, there was a distinct threshold in armoring elevation that was associated with increased impacts. This large dataset for the first time allowed us to identify cumulative impacts that appear when increasing proportions of shorelines are armored. At large spatial and temporal scales, armoring much of a sediment drift cell may result in reduction of the finer grain-size fractions on beaches, including those used by spawning forage fish. Overall we have shown that local impacts of shoreline armoring can scale-up to have cumulative and threshold effects -- these should be considered when managing impacts to public resources along the coast.

SOURCE: Estuarine, coastal and shelf science

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