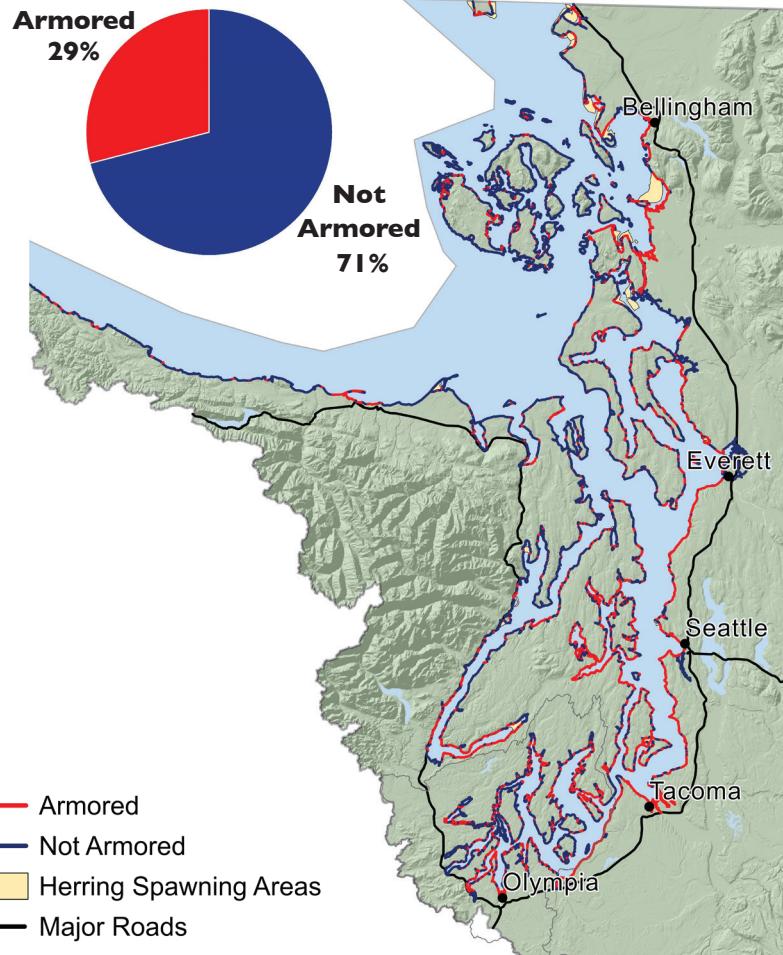


Shoreline Armoring Continuing to Threaten Salmon and Forage Fish Spawning Habitat

Of the total 2,460 miles of shoreline within the Puget Sound Region, 715 miles (or 29%) is armored.¹ Hydraulic project permits issued between 2015 and 2018 showed a net reduction of about 1 mile of armor and replacement of 6.7 miles of existing armor in the Puget Sound Region.²



Ala Spit before and after 160 feet of riprap and 400 feet of cement wall armor were removed in 2015.



Forage fish, such as Pacific herring (*Clupea pallasi*), surf smelt (*Hypomesus pretiosus*), and Pacific sand lance (*Ammodytes hexapterus*), spawn along intertidal and/or subtidal beaches composed of sand and gravel. Surf smelt and Pacific sand lance are a key link in the Puget Sound food web between zooplankton and larger predatory fish and wildlife, such as salmonids.^{3,4}

It is widely understood that shoreline armor (also known as bulkheads or seawalls) negatively affects nearshore habitats. Armoring significantly degrades or eliminates a variety of vital nearshore ecological processes and habitats, including sediment input and transport, riparian fringe habitat quantity, estuarine connectivity and water quality.⁵ A significant amount of herring, surf smelt and sand lance habitat has been impacted by armoring in the PSR,^{6,7} posing a threat to their survival.

Of the total miles of shoreline in the Puget Sound Region (PSR), 29% is armored. The two counties in the region with the highest percentages of shoreline armored are King (55%) and Pierce (53%) counties. The lowest percentage armored are San Juan (6%) and Jefferson (14%) counties.

A modified and armored nearshore environment results in diminished protection from predators, reduced prey abundance and contaminated water, all of which is detrimental to achieving salmon recovery goals. Alternatively, natural shorelines form migratory pathways for juvenile salmon and forage fish, who rely on pocket estuaries for their abundant insect prey, freshwater input, and protective shallow waters.⁸ Additionally, salmon fry feed on forage fish that spawn along natural shorelines.⁹

The Washington Department of Fish and Wildlife (WDFW) has been permitting shoreline armoring and modification activities through the Hydraulic Project Approval (HPA) program. Permitted projects from 2015-2018 included 421 HPAs within the PSR, resulting in 1.6 miles of new armor, 2.6 miles of removed armor and 6.7 miles of armor maintenance projects.¹⁰ Although over a quarter mile of new armoring was established in 2018, this is 904 feet less than the amount of new armoring established in 2015 (which was nearly 0.5 miles). This decline in new armor construction within HPA projects offers some encouragement, though more research needs to be done into the long-term impacts of the armor maintenance projects that prolong the impacts of armoring on the shoreline and the species that rely on it.