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Triggering an Unexpected Earthquake in an Uncoupled Subduction Zone

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In the 1970's, the Shumagin Islands region of the Alaska subduction zone was identified as a seismic gap expected to host a future great (Mw >8.0) earthquake. More recent geodetic data indicate this region is poorly coupled, and the geologic record shows little evidence of past large events - leading to current thinking of the "Shumagin Gap" as a region of low seismic hazard. From July to October 2020 (with aftershocks continuing through the time of this abstract submission in January), a series of earthquakes occurred in this region, potentially incompatible with this low-coupling interpretation. The initial Mw 7.8 plate interface thrust faulting earthquake on July 21st straddled the eastern edge of the Shumagin Gap, followed by an Mw 7.6 strike-slip earthquake on October 19th within the slab under the eastern side of the Shumagin Gap. Stress modeling indicates that this strike-slip earthquake is in fact favored if the Shumagin Gap has low coupling, whereas a highly coupled Shumagin Gap would inhibit that type and location of earthquake. The initial thrust earthquake and its afterslip significantly enhanced the strike-slip stress loading within the subducting slab, helping to trigger that event. We find that although regions such as the Shumagin Gap have a low seismogenic potential for plate interface thrusting, the existence of this decoupled region increases the potential for intra-plate strike-slip faulting in association with more typical subduction earthquakes on adjacent coupled segments of the plate boundary. Therefore, the seismic and tsunami potential near these uncoupled regions might be greater than previously thought.