Top of leaf sheath, which holds the approximately 5 leaves itogether for about 1/3 of leaf length. Shoots were marked for growth rate measurements with two small holes near the top of the leaf sheath.

Primary branch is attached here at node 6 along the rhizome and also contains about 6 nodes along the rhizome of this branch, as leaves are turning over at similar rates to the terminal shoot

Terminal shoot generates a new leaf at a rate equal to the leaf emergence rate, originating from the meristem here, which also marks the division point between above and below ground material. Node 0 is visible as two bumps or short roots.

Primary branch is attached here at node 14 along the rhizome and also contains about 14 nodes

Node 1 and 2 of terminal shoot, where any recent shoot emergence would be evident. These nodes are leaf scars, which are left behind as the rhizome extends, and leaves turn over within the terminal shoot

Figure S1. Architecture of eelgrass (*Zostera marina* L.) shoots.

Text S1: Figure S1 illustrates some of the key components of an eelgrass genet consisting of several shoots branching from a rhizome. Above- and below-ground material was separated at each shoot's most recent node (here termed node 0), where two bumps or short roots were present. Shoot emergence rate (SER) was based on new shoots appearing at nodes 0, 1, and 2. These nodes are shown in the diagram, but in this case, no recent branching has occurred. To standardize SER per day, the fraction of nodes with branches was multiplied by leaf emergence rate (LER), which is equivalent to node production per day. Branches are only possible to form along the rhizome concurrent with leaf production at that node.

Leaf emergence rate was calculated from the number of unmarked leaves extending past a mark near the top of the leaf sheath, standardized to the time between marking and collecting. These unmarked leaves had their tips below the original mark at the time of marking, and then grew by adding length to the base of the leaf. New leaves originate at the center of the leaf bundle and slough off after a few months, once their position has moved to the outside of the leaf bundle because newer leaves have emerged. Leaves are attached on alternating sides of the rhizome, and therefore also have a specific order within the sheath – the newest is at the center, and then older leaves alternate on either side of the newest (Ruesink et al., 2018). When a leaf sloughs off, it leaves behind a node on the rhizome. Rhizome extension tends to be complete after the leaf attached to that node is gone. Rhizome extension essentially pushes the shoots through the sediment.

Text S2: This section of the supplement contains methods and results for flowering and fruiting phenology of eelgrass, *Zostera marina*. The research was carried out at five sites in Willapa Bay, Washington, from May 2019 to October 2020.

Annual populations were followed at two sites above +0.6 m relative to mean lower. Geopositions are presented as N latitude, W longitude. Annual1 (AnnN)= 46.61308, -124.03373; Annual2 (AnnS)= 46.50181, -124.02988

Perennial populations were followed at three sites between 0 and 0.6 m relative to mean lower low water. Upper (PerNsand) = 46.61074, -124.0377; Low (PerSsand) = 46.50181, -124.02587; Muddy (PerNmud) = 46.60885, -124.04025

Data are archived at doi:10.17632/rf8f7sf4cd.1

At two-week intervals in summer, each site was visited and sampled in up to 20 0.25 m^2 quadrats, where eelgrass shoots were counted and distinguished as reproductive or vegetative. Reproductive shoots initially bolt (rapid rhizome internode extension above-ground, resulting in a cylindrical feel to the base of the shoot) and then form inflorescences, initially near the base of the shoot, with inflorescences developing later at more distal positions.

For up to five reproductive shoots per quadrat, shoot length, number of inflorescences, and stage of reproductive phenology were measured. On average at each site and date, 30 shoots were examined in 2019 and 14 in 2020. Stage of reproductive phenology was based on (Infantes & Moksnes, 2018): bolting, spathe (flower) formation, styles upright (stage 1), styles back in spathe (stage 2), pollen released (stage 3), seeds ripening (stage 4), seeds dispersing (stage 5), senescing (spathes gone). Given within-shoot variation in flowering stage (delayed for more distal inflorescences), we recorded the most advanced stage per shoot.

We asked two questions about phenology: First, what fraction of the population is flowering at different times during the year? To answer this question, we calculated the ratio of reproductive to total shoots, first by quadrat, and then averaged by site. These data, as % flowering, are presented in Figure 1 of the published paper, as well as in this supplement as one panel of results. Values fall to 0 at times of year when no sexual reproduction occurs.

Second, what fraction of the reproductive individuals are at different stages of reproductive development? To answer this question, we divided the reproductive shoots into difference stages and calculated the ratio in each stage to the total number of reproductive shoots. Thus, the fractions in each stage at each time point sum to 1. Consequently, most shoots (high fractions) are in the bolting stage at the beginning of the reproductive season, but in the seed dispersing stage by the end. However, when no annual shoots had bolted yet, all reproductive stages were set to 0.
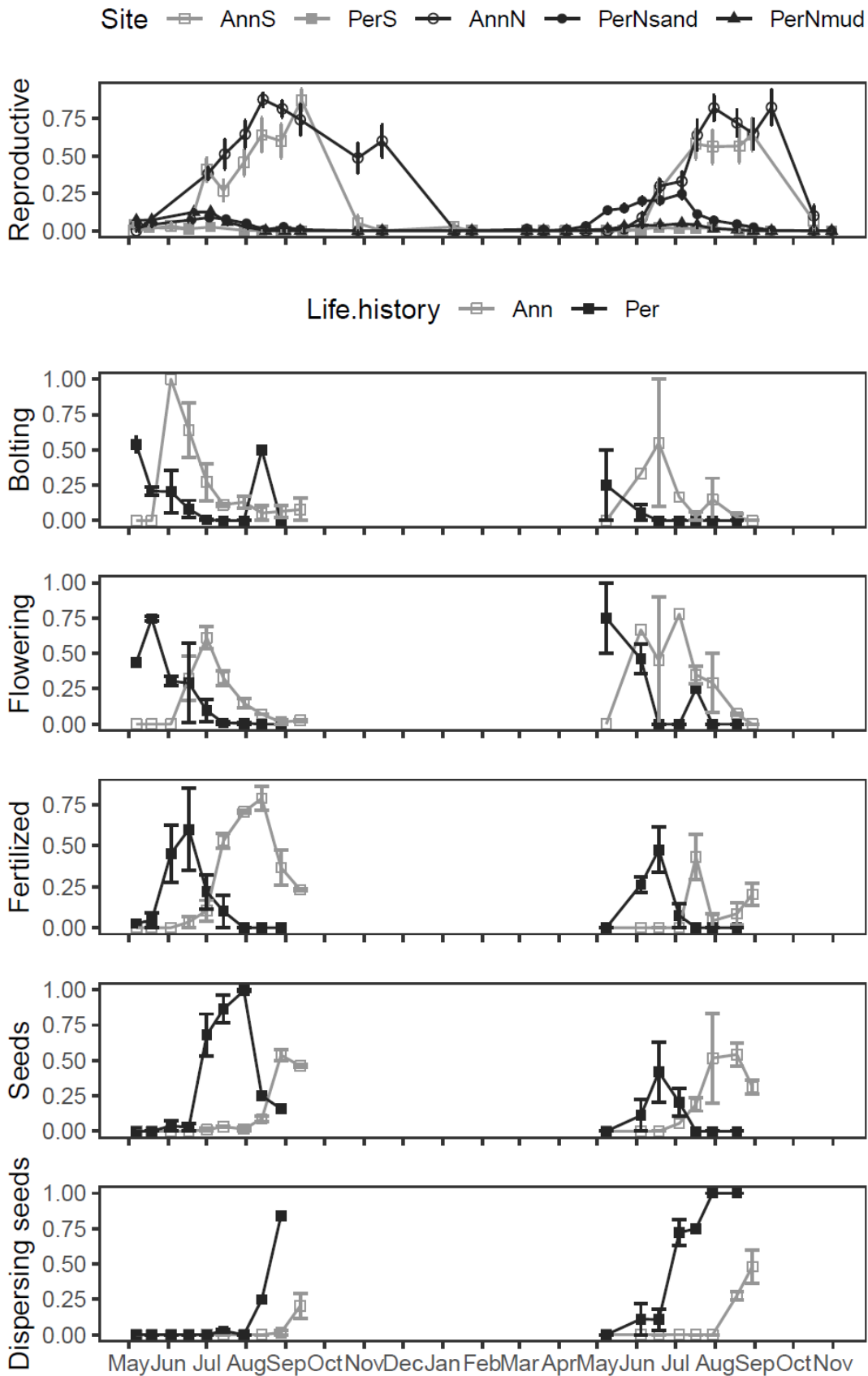
Figure S2. Sexual reproduction in eelgrass (*Zostera marina*) at five sites in Willapa Bay, 2019-2020. Top panel shows fraction of flowering shoots by site (mean + standard error of N=20 quadrats [or fewer due to low-tide time constraints or quadrat with zero shoots]), and remaining panels depict different stages of flower and seed development as a fraction relative to all flowering shoots (mean + standard error of 2 annual sites or 3 perennial sites).

References

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