Table 2. Habitat Restrictions of Submerged Aquatic Vegetation (SAV)

SAV Species	U.S. Native Species?	Factor Leading to Decline in SAV Habitat	Thresholds	Source(s)	Notes
Chesapeake Bay Seagrasses *Zostera marina* and *Ruppia maritima*	Yes (both species)	Light Extinction Coefficient	< 1.5 m^{-1}	Boynton et al. 1996	Adapted from McLaughlin and Sutula 2007
Chesapeake Bay Seagrasses *Zostera marina* and *Ruppia maritima*	Yes (both species)	Chlorophyll a	Concentration of < 15 µg L^{-1}	Boynton et al. 1996	Adapted from McLaughlin and Sutula 2007
Chesapeake Bay Seagrasses *Zostera marina* and *Ruppia maritima*	Yes (both species)	TN	Concentration of < 10 µM	Boynton et al. 1996	Adapted from McLaughlin and Sutula 2007
Halodule wrightii and *Zostera marina*	Yes (both species)	Light Limitation	> 8%–18% surface light > 10%–20% surface light > 5–6 hours of light saturated irradiance	Duarte 1991; Dunton 1994; Zimmerman 1994; Zimmerman et al. 1995	Adapted from McLaughlin and Sutula 2007
Halodule wrightii and *Syringodium filiforme*	Yes (both species)	Light Limitation	Between 24 and 37% iridescent	Kenworthy and Fonseca 1996	Adapted from Krause-Jensen et al. 2008
Halodule wrightii and *Zostera marina*	Yes (both species)	Light Limitation	Minimum growing season light requirement: 20% surface light (±13%)	Steward et al. 2005	Adapted from McLaughlin and Sutula 2007
Posidonia pectinatus	No	Sulfide Toxicity	0.48–1.27 mg g^{-1} sediment sulfide	van Wijck et al. 1992	Adapted from McLaughlin and Sutula 2007
SAV habitat	N/A	Sediment Grain Size	< 20% silt and clay	Koch 2001	Adapted from McLaughlin and Sutula 2007
SAV habitat	N/A	Sediment Organic Carbon	< 5 %	Koch 2001	Adapted from McLaughlin and Sutula 2007
Seagrass meadow: *Thalassia testudinum* (turtle grass), *Halodule wrightii* (shoal grass), and *Syringodium filiforme* (manatee grass)	Yes (all species)	Macroalgal Biomass Cover	Macroalgae patches > 0.25 m diameter	Holmquist 1997	Adapted from McLaughlin and Sutula 2007
Vallisneria americana	No	Light Limitation	Low Salinity: 9% surface light High Salinity: 14% surface light	Dobberfuhl 2007	Adapted from McLaughlin and Sutula 2007
Zostera marina	Yes	Macroalgal Canopy Height	Canopy height > 9–12 cm	Hauxwell et al. 2001	Adapted from McLaughlin and Sutula 2007
Zostera marina	Yes	Ammonia Toxicity	25 µm in 5 weeks, 125 µm in 2 weeks	van Katwijk et al. 1997	Adapted from McLaughlin and Sutula 2007
Zostera marina	Yes	Sulfide Toxicity/Dissolved Oxygen Concentrations	water column DO < 6.3-7.3 kPa (30%–35% saturation)	Pedersen et al. 2004	Adapted from McLaughlin and Sutula 2007
Zostera marina	Yes	Sulfide Toxicity	< 0.4 mM sediment sulfide	Goodman et al. 1995	Adapted from McLaughlin and Sutula 2007
Zostera noltii	No	Ammonia Toxicity	16 µm in 16 days instantaneous 200 µm	Brun et al. 2002	Adapted from McLaughlin and Sutula 2007
Zostera marina	No	Light Limitation	Minimum light requirement threshold between 155.76 and 20.12 µmol photons m^{-2} d^{-1} or 5.61 and 0.73 mol photons m^{-2} d^{-1} under experimental conditions	Bertelli and Unsworth 2018	A mesocosm experiment artificially shaded *Z. marina* to find its minimum light requirement (MLR) and assess the value of bioindicators for low light conditions. The study concluded that the plant has a MLR of above 20.12 µmol photons m^{-2} d^{-1} under experimental conditions and that photophysical responses were the first affected by light stress (shoot growth, alpha, Ek, ETRmax). Reduction to 20 µmol photons m^{-2} d^{-1} for 10 hours per day for 4–6 weeks will result in reduced production and eventual mortality for this species.
Thalassia hemprichii	Yes	Light	minimum light requirement = 4%–10% surface irradiance, when light field variable	Browne et al. 2017	Mesocosm experiment tested effects of light reduction on *T. hemprichii* growth. Found that the minimum light requirement was 4%–10% surface irradiance when light field varied, which was lower than previous studies. Concluded that variable light regimes are less damaging than chronic light reduction. Strong effects seen in treatment with consistent 11%-15% light. Seagrass can live for a few weeks at < 30 µmol photons/m/s or 4%–10% surface irradiance.
Amphibolis antartica	No	Light and CO_2	Not given	Burnell et al. 2014	A mesocosm study of *A. antarctica* under varied light treatments and CO_2 levels showed that elevated CO_2 benefitted seagrass growth and biomass, but the benefits were negligible under high light conditions.
Posidonia australis	No	Salinity	Survived 2–4 weeks at salinity of 54 psu	Cambridge et al. 2017	Mesocosm experiment manipulated salinity to test the tolerance of *P. australis* from shallow sites in Fremantle, Australia. Found that plants survived the maximum treatment for 2–4 weeks but showed physiological responses. Suggests that leaf osmolarity, ion, sugar, and amino acid concentration can be used as bioindicators for salinity effects.
Zostera muelleri	No	Light Limitation	> 6 mol photons m^{-2} d^{-1}	Chartrand et al. 2016	Study of *Z. muelleri* in Gladstone Harbor, Australia. This is a port area that suffers light limitation because of dredging. A light threshold above 6 mol photons m^{-2} d^{-1} was part of a management plan that was successfully implemented to protect seagrass in the area.
Halophila decipiens	Yes	Light and Temperature	Survival at 3.2 mol photons m^{-2} d^{-1} Decrease after 2 weeks limited light	Chartrand et al. 2018	Two tropical seagrass species were exposed to light and temperature treatments in a mesocosm experiment. Both species survived at 3.2 mol photons m^{-2} d^{-1} but decreased under more limited light conditions. Altered temperature had no effect.
Halophila spinulosa	No	Light and Temperature	Survival at 3.2 mol photons m^{-2} d^{-1} Decrease after 4 weeks limited light	Chartrand et al. 2018	Two tropical seagrass species were exposed to light and temperature treatments in a mesocosm experiment. Both species survived at 3.2 mol photons m^{-2} d^{-1} but decreased under more limited light conditions. Altered temperature had no effect.
Halodule wrightii	Yes	Light Limitation	25%–27% SI cover and density	Choice et al. 2014	The study identified light requirements for *H. engelmannii*, *H. wrightii*, *S. filiforme*, and *T. testudinum* along the Gulf coast of peninsular Florida and concentrations at which each species was present and absent.

SAV Species	U.S. Native Species?	Factor Leading to Decline in SAV Habitat	Thresholds	Source(s)	Notes
Halodule wrightii	Yes	TN	Present: 439.5 μg L^{-1} Absent: 480.1 μg L^{-1}	Choice et al. 2014	The study identified light requirements for *H. engelmannii*, *H. wrightii*, *S. filiforme*, and *T. testudinum* along the Gulf coast of peninsular Florida and concentrations at which each species was present and absent.
Halodule wrightii	Yes	TP	Present: 17 μg L^{-1} Absent: 35 μg L^{-1}	Choice et al. 2014	The study identified light requirements for *H. engelmannii*, *H. wrightii*, *S. filiforme*, and *T. testudinum* along the Gulf coast of peninsular Florida and concentrations at which each species was present and absent.
Halodule wrightii	Yes	Chlorophyll a	Present: 3.1 μg L^{-1} Absent: 6.6 μg L^{-1}	Choice et al. 2014	The study identified light requirements for *H. engelmannii*, *H. wrightii*, *S. filiforme*, and *T. testudinum* along the Gulf coast of peninsular Florida and concentrations at which each species was present and absent.
Halodule wrightii	Yes	Color	Present: 16.3 Pt-Co units Absent: 28.9 Pt-Co units	Choice et al. 2014	The study identified light requirements for *H. engelmannii*, *H. wrightii*, *S. filiforme*, and *T. testudinum* along the Gulf coast of peninsular Florida and concentrations at which each species was present and absent.
Halophila engelmannii	Yes	Light Limitation	8%–10% SI cover and density	Choice et al. 2014	The study identified light requirements for *H. engelmannii*, *H. wrightii*, *S. filiforme*, and *T. testudinum* along the Gulf coast of peninsular Florida and concentrations at which each species was present and absent.
Halophila engelmannii	Yes	TN	Present: 426.4 μg L^{-1} Absent: 467.1 μg L^{-1}	Choice et al. 2014	The study identified light requirements for *H. engelmannii*, *H. wrightii*, *S. filiforme*, and *T. testudinum* along the Gulf coast of peninsular Florida and concentrations at which each species was present and absent.
Halophila engelmannii	Yes	TP	Present: 17.8 μg L^{-1} Absent: 28.8 μg L^{-1}	Choice et al. 2014	The study identified light requirements for *H. engelmannii*, *H. wrightii*, *S. filiforme*, and *T. testudinum* along the Gulf coast of peninsular Florida and concentrations at which each species was present and absent.
Halophila engelmannii	Yes	Chlorophyll a	Present: 3.6 μg L^{-1} Absent: 5.0 μg L^{-1}	Choice et al. 2014	The study identified light requirements for *H. engelmannii*, *H. wrightii*, *S. filiforme*, and *T. testudinum* along the Gulf coast of peninsular Florida and concentrations at which each species was present and absent.
Halophila engelmannii	Yes	Color	Present: 16.8 Pt-Co units Absent: 23.5 Pt-Co units	Choice et al. 2014	The study identified light requirements for *H. engelmannii*, *H. wrightii*, *S. filiforme*, and *T. testudinum* along the Gulf coast of peninsular Florida and concentrations at which each species was present and absent.
Syringodium filiforme	Yes	Light Limitation	8%–16% SI cover and density	Choice et al. 2014	The study identified light requirements for *H. engelmannii*, *H. wrightii*, *S. filiforme*, and *T. testudinum* along the Gulf coast of peninsular Florida and concentrations at which each species was present and absent.
Syringodium filiforme	Yes	TN	Present: 404.7 μg L^{-1} Absent: 469.5 μg L^{-1}	Choice et al. 2014	The study identified light requirements for *H. engelmannii*, *H. wrightii*, *S. filiforme*, and *T. testudinum* along the Gulf coast of peninsular Florida and concentrations at which each species was present and absent.
Syringodium filiforme	Yes	TP	Present: 18.6 μg L^{-1} Absent: 28 μg L^{-1}	Choice et al. 2014	The study identified light requirements for *H. engelmannii*, *H. wrightii*, *S. filiforme*, and *T. testudinum* along the Gulf coast of peninsular Florida and concentrations at which each species was present and absent.
Syringodium filiforme	Yes	Chlorophyll a	Present: 3.3 μg L^{-1} Absent: 5.0 μg L^{-1}	Choice et al. 2014	The study identified light requirements for *H. engelmannii*, *H. wrightii*, *S. filiforme*, and *T. testudinum* along the Gulf coast of peninsular Florida and concentrations at which each species was present and absent.
Syringodium filiforme	Yes	Color	Present: 17 Pt-Co units Absent: 23.1 Pt-Co units	Choice et al. 2014	The study identified light requirements for *H. engelmannii*, *H. wrightii*, *S. filiforme*, and *T. testudinum* along the Gulf coast of peninsular Florida and concentrations at which each species was present and absent.
Thalassia testudinum	Yes	Light Limitation	Cover: 18%–23% SI; Density: 20%–25% SI	Choice et al. 2014	The study identified light requirements for *H. engelmannii*, *H. wrightii*, *S. filiforme*, and *T. testudinum* along the Gulf coast of peninsular Florida and concentrations at which each species was present and absent.
Thalassia testudinum	Yes	TN	Present: 424.5 μg L^{-1} Absent: 477.3 μg L^{-1}	Choice et al. 2014	The study identified light requirements for *H. engelmannii*, *H. wrightii*, *S. filiforme*, and *T. testudinum* along the Gulf coast of peninsular Florida and concentrations at which each species was present and absent.
Thalassia testudinum	Yes	TP	Present: 13.5 μg L^{-1} Absent: 34.3 μg L^{-1}	Choice et al. 2014	The study identified light requirements for *H. engelmannii*, *H. wrightii*, *S. filiforme*, and *T. testudinum* along the Gulf coast of peninsular Florida and concentrations at which each species was present and absent.
Thalassia testudinum	Yes	Chlorophyll a	Present: 2.4 μg L^{-1} Absent: 6.1 μg L^{-1}	Choice et al. 2014	The study identified light requirements for *H. engelmannii*, *H. wrightii*, *S. filiforme*, and *T. testudinum* along the Gulf coast of peninsular Florida and concentrations at which each species was present and absent.
Thalassia testudinum	Yes	Color	Present: 14.8 Pt-Co units Absent: 26.5 Pt-Co units	Choice et al. 2014	The study identified light requirements for *H. engelmannii*, *H. wrightii*, *S. filiforme*, and *T. testudinum* along the Gulf coast of peninsular Florida and concentrations at which each species was present and absent.
Zostera noltei	No	Hydrodynamics	Not given	Cognat et al. 2018	This study produced models to evaluate the relative contributions of environmental factors on seagrass growth in Arcachon Bay, France. The model found that hydrodynamics a more important driver than light in this system, most likely because of the ability of SAV to acclimate to low-light conditions.
Various seagrasses	N/A	TP, Salinity, pH, Turbidity, DIN, Chlorophyll a, Sediment Depth, Seagrass Species	Not given	Cole et al. 2018	This study investigated temporal and spatial trends in macrophyte abundance and water quality at 15 sites in Florida Bay, FL. The study found that sites with high TP, high pH, low DIN:PO_4^{3-}, deep sediment, and homogenous seagrass (primarily *T. testudinum*) cover more frequently exhibited die-off events.

SAV Species	U.S. Native Species?	Factor Leading to Decline in SAV Habitat	Thresholds	Source(s)	Notes
Cymodocea rotundata	Yes	Temperature	Mortality at 43 °C Critical threshold at 40 °C	Collier and Waycott 2014	Mesocosm experiment manipulated temperature for 4 tropical species. Found that the grasses were sensitive to temperature spikes to different extents, more tropical species were more tolerant than others. *H. ovalis* is quickest to recover. All species reached mortality at 43 °C and 40 °C represented a critical threshold as there were strong species differences and there was a large impact on growth and mortality.
Halodule uninervis	Yes	Temperature	Mortality at 43 °C Critical threshold at 40 °C	Collier and Waycott 2014	Mesocosm experiment manipulated temperature for 4 tropical species. Found that the grasses were sensitive to temperature spikes to different extents, more tropical species were more tolerant than others. *H. ovalis* is quickest to recover. All species reached mortality at 43 °C and 40 °C represented a critical threshold as there were strong species differences and there was a large impact on growth and mortality.
Halophila ovalis	No	Temperature	Mortality at 43 °C Critical threshold at 40 °C	Collier and Waycott 2014	Mesocosm experiment manipulated temperature for 4 tropical species. Found that the grasses were sensitive to temperature spikes to different extents, more tropical species were more tolerant than others. *H. ovalis* is quickest to recover. All species reached mortality at 43 °C and 40 °C represented a critical threshold as there were strong species differences and there was a large impact on growth and mortality.
Thalassia hemprichii	Yes	Temperature	Mortality at 43 °C Critical threshold at 40 °C	Collier and Waycott 2014	Mesocosm experiment manipulated temperature for 4 tropical species. Found that the grasses were sensitive to temperature spikes to different extents, more tropical species were more tolerant than others. *H. ovalis* is quickest to recover. All species reached mortality at 43 °C and 40 °C represented a critical threshold as there were strong species differences and there was a large impact on growth and mortality.
Posidonia oceanica	No	CO_2	Not given	Cox et al. 2016	In-situ field experiment in the Mediterranean Sea tested the effects of CO_2 enrichment on growth of *P. oceanica.* Found that any benefits of enrichment will be minimal and difficult to detect.
Zostera marina	Yes	Light and Temperature	Not given	Eriander et al. 2017	In a mesocosm experiment, light and temperature were manipulated to assess how eelgrass would cope under different conditions. The study found that eelgrass can acclimatize to changes in light regimes, but is more susceptible to shading during peak growth season when water is warmest. Additionally, the study concluded that restoration of seagrasses should be performed early in the growth season.
Various seagrasses	N/A	Suspended Sediments, CDOM, Chlorophyll a	Not given	Fernandes et al. 2018	Study in Adelaide, Australia, to refine a model used to predict seagrass habitat requirements in an urbanized coastline. The study examined water constituents (CDOM, Chl a, suspended sediment) to explain Kd in a model. It found that fine suspended sediment (fine contributed 6x more light attenuation than coarse), then CDOM, and finally Chl a were correlated with light attenuation. In shallow inshore regions, particulates had the most impact, whereas CDOM had greater impact in deep offshore regions.
Halodule wrightii	Yes	Salinity	Survival without changing growth rate at salinity of 25–45 psu Best tolerates salinity below 35 psu	Ferreira et al. 2016	Mesocosm experiment using seagrass from a shallow site at Lagoa da Conceicau, Brazil, manipulated salinity to test the tolerance of *H. wrightii.* Found stress at salinity of 25 and 45psu with optimal cell viability at 35 psu.
Zostera muelleri	No	Temperature and Herbivory	Not given	Garthwin et al. 2014	Study of seagrass living in a thermal plume was used to show the effect of warming on herbivory. The study found that tolerance to herbivory is not affected by warming. Plants maintained growth rates regardless of temperature.
Cymodocea serrulata	Yes	Temperature and Biomass	Impacts to photosynthesis at 40–45 °C Impacts to biomass at 34-45 °C	George et al. 2018	Mesocosm experiment tested effect of temperature stress on 4 tropical species. Prolonged thermal stress of temperatures above 40 °C will cause extensive loss in biomass. At temperatures of up to 36 °C, all species could maintain full photosynthetic rates, however, past 45°C all species showed significant effects.
Enhalus acoroides	Yes	Temperature and Biomass	Impacts to photosynthesis at 40–45 °C Impacts to biomass at 40-45 °C	George et al. 2018	Mesocosm experiment tested effect of temperature stress on 4 tropical species. Prolonged thermal stress of temperatures above 40 °C will cause extensive loss in biomass. At temperatures of up to 36 °C, all species could maintain full photosynthetic rates, however, past 45°C all species showed significant effects.
Thalassia hemprichii	Yes	Temperature and Biomass	Impacts to photosynthesis at 40–45 °C Impacts to biomass at 40-45 °C	George et al. 2018	Mesocosm experiment tested effect of temperature stress on 4 tropical species. Prolonged thermal stress of temperatures above 40 °C will cause extensive loss in biomass. At temperatures of up to 36 °C, all species could maintain full photosynthetic rates, however, past 45°C all species showed significant effects.
Thalassodendron cilatum	No	Temperature and Biomass	Impacts to photosynthesis at 36–40 °C Impacts to biomass at 40-45 °C	George et al. 2018	Mesocosm experiment tested effect of temperature stress on 4 tropical species. Prolonged thermal stress of temperatures above 40 °C will cause extensive loss in biomass. At temperatures of up to 36 °C, all species could maintain full photosynthetic rates, however, past 45°C all species showed significant effects.
Zostera muelleri	No	Biomass	Sites with seagrass biomass from 140–285 gDW m^{-2} experienced loss of resilience	Gladstone-Gallagher et al. 2018	Field study of an intertidal harbor in New Zealand manipulated N-concentrations and showed that seagrass biomass and macrofaunal diversity are the most important variables for predicting resilience to eutrophication.
Zostera noltei	No	Porewater Sulfide Toxicity	>1000 µmol L^{-1} prevents patch expansion	Govers et al. 2014	Experiment tested the *in situ* effects of sediment quality on seagrass patch dynamics using four sediment treatments. The study concluded that patch survival and expansion are constrained at high loads of nutrients or organic matter as a result of porewater toxicity. It also concluded that denser vegetation is better able to cope with toxins and shows higher growth rates, and implies that sparse and patchy vegetation can be expected to be more vulnerable to ammonium and sulfide toxicity than densely vegetated seagrass beds.

SAV Species	U.S. Native Species?	Factor Leading to Decline in SAV Habitat	Thresholds	Source(s)	Notes
Zostera noltei	No	Porewater Ammonia Toxicity	>2000–4000 μmol L^{-1} prevents patch expansion	Govers et al. 2014	Experiment tested the in situ effects of sediment quality on seagrass patch dynamics using four sediment treatments. The study concluded that patch survival and expansion are constrained at high loads of nutrients or organic matter as a result of porewater toxicity. It also concluded that denser vegetation is better able to cope with toxins and shows higher growth rates, and implies that sparse and patchy vegetation can be expected to be more vulnerable to ammonium and sulfide toxicity than densely vegetated seagrass beds.
Posidonia oceanica	No	Light and Temperature	Not given	Hendriks et al. 2017	In this mesocosm experiment, elevated CO_2 did not affect seagrass growth, but light limitation and increased temperature inhibited growth.
Zostera marina	Yes	Nutrient Pollution	Not given	Jones and Unsworth 2016	This was the first extensive study of seagrasses in the British Isles. The study found that seagrass plots are declining due to anthropogenic nutrient pollution. C:N, C:P, leaf length, and leaf width were good indicators of ecosystem health.
Zostera marina	Yes	Temperature and Nitrogen Supply	Not given	Kaldy 2014	Mesocosm experiment using eelgrass from Yaquina Bay, OR. growth of plants increased with increasing concentrations of NH_4, but did not respond to increasing NO_3. Eelgrass showed a broad thermal tolerance and there was a clear correlation between temperature and metabolism. Temperature exerts a stronger control than nitrate concentration, showed minimal evidence for interactive effects.
Zostera japonica	Yes	Temperature	Not given	Kaldy et al. 2015	Field and mesocosm experiments tested the effect of temperature on growth of *Z. japonica* from the Pacific Coast of North America. The study found that the seagrass is temperature limited and will most likely continue its southerly range extension due to its ability to colonize at warm temperatures.
Zostera marina	Yes	Light and Temperature	Decreased growth when %SI was reduced, to 10% of natural value of biomass	Kim et al. 2015	This experiment tested the seasonal growth responses of *Z. marina* to severe light reduction conditions. The plants were most susceptible to shading events during summer and fall months when water temperature was highest. The study examined only control vs. 10% irradiance, not a range of values.
Various seagrasses of the Chesapeake Bay	N/A	Land Use	Not given	Landry and Golden 2018	Shoreline armoring (focus here on riprap) and watershed land use degrade the quality and resilience of local SAV habitat with decreased percent cover, diversity, and evenness.
Halodule wrightii	Yes	Salinity	> 70% cover when salinity < 10 Absent at mean salinity 32.4 ± 5	Lirman et al. 2014	This study evaluated whether the restoration efforts of the Comprehensive Everglades Restoration Plan in Biscayne Bay, FL will be effective. The study found that *Thalassia* has a competitive advantage over *Halodule* when both species are present (at salinities of 15–20) and that increased extent of mesohaline habitats will achieve restoration goals.
Syringodium filiforme	Yes	Salinity	> 70% cover when salinity 25–30 Present only when salinity 20-40 Absent at mean salinity 30 ± 5.8	Lirman et al. 2014	This study evaluated whether the restoration efforts of the Comprehensive Everglades Restoration Plan in Biscayne Bay, FL will be effective. The study found that *Thalassia* has a competitive advantage over *Halodule* when both species are present (at salinities of 15–20) and that increased extent of mesohaline habitats will achieve restoration goals.
Thalassia testudinum	Yes	Salinity	> 80% cover when salinity 25–30 Absent at mean salinity 23.8 ± 6.6	Lirman et al. 2014	This study evaluated whether the restoration efforts of the Comprehensive Everglades Restoration Plan in Biscayne Bay, FL will be effective. The study found that *Thalassia* has a competitive advantage over *Halodule* when both species are present (at salinities of 15–20) and that increased extent of mesohaline habitats will achieve restoration goals.
Ruppia maritima	Yes	Temperature	Rapid 4–5 °C increase	Moore et al. 2014	A rapid 4–5 °C increase can result in widespread diebacks and allow colonization of *R. maritima* and other less sensitive species.
Zostera marina	Yes	Temperature	Rapid 4–5 °C increase	Moore et al. 2014	Z. marina in the Chesapeake Bay is susceptible to diebacks in the event of rapidly warming water temperatures. A rapid 4–5 °C increase can result in widespread diebacks and allow colonization of less sensitive species like *R. maritima*.
Halophila stipulacea	No	Salinity	Not given	Oscar et al. 2018	Mesocosm experiment tested two seagrass' response to changes in salinity. Found that *H. stipulacea* is remarkably tolerant to hypo- and hyper-salinity, while *V. americana* is not.
Vallisneria americana	No	Salinity	Not given	Oscar et al. 2019	Mesocosm experiment tested two seagrass' response to changes in salinity. Found that *H. stipulacea* is remarkably tolerant to hypo- and hyper-salinity, while *V. americana* is not.
Cymodocea serrulata	Yes	DIC and Light	Not given	Ow et al. 2016	Mesocosm experiment of two seagrass species manipulated carbon concentrations (DIC) and light levels. Found that *C. serrulata* responded to changes in both DIC and light levels with increased growth, while *H. uninervis* responded to light only. Light availability influenced productivity responses to DIC enrichment (carbon fixation and acquisition).
Halodule uninervis	Yes	DIC and Light	Not given	Ow et al. 2016	Mesocosm experiment of two seagrass species manipulated carbon concentrations (DIC) and light levels. Found that *C. serrulata* responded to changes in both DIC and light levels with increased growth, while *H. uninervis* responded to light only. Light availability influenced productivity responses to DIC enrichment (carbon fixation and acquisition).
Various seagrasses of the Chesapeake Bay	N/A	Land Use	< 5.4% rip rap	Patrick et al. 2014	SAV has increased in sub estuaries with less than 5.4% riprap since 1984.
Enhalus acoroides	Yes	Temperature	Critical threshold of 40–45 °C Damage to the photosynthetic apparatus at 45 °C Ideal temperature 33.3 °C Shoots exposed to 40 °C for 4 h showed recovery of photosynthesis and respiration capabilities 45 °C resulted in leaf damage	Pedersen et al. 2015	A study of two tropical seagrasses in the macro-tidal Kimberly region of Australia showed the impacts of heat stress on respiration and photosynthesis. The study found that the response of photosynthesis was more sensitive than that of respiration.

SAV Species	U.S. Native Species?	Factor Leading to Decline in SAV Habitat	Thresholds	Source(s)	Notes
Thalassia hemprichii	Yes	Temperature	Critical threshold of 40–45 °C Damage to the photosynthetic apparatus at 45 °C Ideal temperature 32.8 °C Shoots exposed to 40 °C for 4 h showed recovery of photosynthesis and respiration capabilities 45 °C resulted in leaf damage	Pedersen et al. 2015	A study of two tropical seagrasses in the macro-tidal Kimberly region of Australia showed the impacts of heat stress on respiration and photosynthesis. The study found that the response of photosynthesis was more sensitive than that of respiration.
Posidonia oceanica	No	Depth and Light	Not given	Pergent et al. 2015	Long-term study of 15 sites along the coast of Corsica showed a decline in seagrass abundance potentially due to rising sea levels and a decrease in the amount of light that reached the bed.
Zostera marina	Yes	Temperature	Not given	Potouroglou et al. 2014	Long-term study of *Z. marina* around the Isles of Scilly, UK, showed that sea surface temperature is positively correlated with mean number of flowering shoots.
Halophila spp.	Yes (*Halophila decipiens*) No (*Halophila spinulosa*)	Depth	Not given	Rasheed et al. 2014	A study of two seagrass colonies in N. Queensland, Australia showed that recovery from disturbance largely depends on life history. The deeper-dwelling colony (below 6 m mean sea level) had a higher capacity for recovery following disturbance, while the shallow colony did not.
Zostera marina	Yes	Epiphyte Biomass	Not given	Ruesink 2016	Microalgae affect *Z. marina* in the Willapa Bay, WA estuary. This study experimentally reduced epiphyte biomass on the leaves of *Z. marina* to study its impacts. The study found that removal of epiphytes did not accelerate the growth of eelgrass.
Zostera caulescens	No	Light Limitation	Minimum light requirement 6.3%–11.6% SI	Sakanishi and Komatsu 2017	Study in Honshu, Japan. Species is not found in U.S. Study found that deeper-dwelling species need less light than shallow-dwelling species.
Zostera marina	Yes	Light Limitation	Minimum light requirement 11.0%–29.4% SI	Sakanishi and Komatsu 2017	Study found that deeper-dwelling species need less light than shallow-dwelling species.
Zostera marina	Yes	Salinity and Temperature	Not given	Salo and Pedersen 2014	Mesocosm experiment tested the effect of changes in temperature and salinity on seagrass. The study found that altered salinity and temperature have negative synergistic effects that are most harmful to seedlings.
Zostera marina	Yes	Salinity	6–20 psu ideal value for low salinity population 2–4 psu critical value for growth of low salinity population 10–25 psu ideal value for high salinity population 9–12.5 psu critical value for high salinity population	Salo et al. 2014	*Z. marina* populations from a low salinity location and a high salinity location within the Baltic Sea were assessed for salinity tolerance in a mesocosm experiment. The study found that altered salinity can severely impact productivity, but responses might vary depending on the origin of the plant. Some populations may have better chances to adapt to future environmental changes than others.
Cymodocea serrulata	Yes	Light Limitation	Not given	Statton et al. 2018	Mesocosm experiment manipulated light for 3 tropical species. The study demonstrated the importance of multi-species assemblage research for mitigation in addition to the study of individual species. Increased shading resulted in declines in growth across all species. *H. ovalis* was most impacted, followed by *H. uninervis*, and then *H. serratulata*.
Halodule uninervis	Yes	Light Limitation	Not given	Statton et al. 2018	Mesocosm experiment manipulated light for 3 tropical species. The study demonstrated the importance of multi-species assemblage research for mitigation in addition to the study of individual species. Increased shading resulted in declines in growth across all species. *H. ovalis* was most impacted, followed by *H. uninervis*, and then *H. serratulata*.
Halophila ovalis	Yes	Light Limitation	Not given	Statton et al. 2018	Mesocosm experiment manipulated light for 3 tropical species. The study demonstrated the importance of multi-species assemblage research for mitigation in addition to the study of individual species. Increased shading resulted in declines in growth across all species. *H. ovalis* was most impacted, followed by *H. uninervis*, and then *H. serratulata*.
Posidonia australis	No	Light Limitation	Not given	Strydom et al. 2018	Mesocosm experiment manipulated wavelengths of light to test the effect of light quality on *P. australis.* The study found that the species can adapt to and survive many wavelengths of light and that light quantity, not quality, is important for survival.
Posidonia oceanica	No	Depth	Not given	Vacchi et al. 2014b	Study of sites in the Mediterranean to create a model to predict the upper limit of seagrass meadows. The model was validated and successfully predicted the upper limit of meadows using only physical parameters in sties without human interference (breaking depth is upper limit). In sites with human pressure, seagrass upper limit is deeper. 2016 study found that sites may be able to colonize at shallower depths than predicted here.
Posidonia oceanica	No	Substrate Type and Depth	Not given	Vacchi et al. 2016	Study of *P. oceanica* in the Mediterranean revealed that species will preferentially colonize on rocky substrates instead of sandy ones in high-energy conditions. Additionally, survival may only be possible where rocky substrate is available.
Halophia ovalis	No	Light Limitation and Light History	Mortality at turbid sites at average levels of 18 µmol photons m^{-2} s^{-1} Survival at clear sites at levels as low as 11 µmol photons m^{-2} s^{-1}	Yaakub et al. 2014	Study of *H. ovalis* conducted at two sites—one clear and another turbid. Plants were shaded to test the effects of light reduction on plants of different light history. Seagrass at clear sites adapted to light reduction while plants at turbid sites died at the same levels of light reduction This study demonstrates the importance of life history when determining minimum light reduction levels for species.