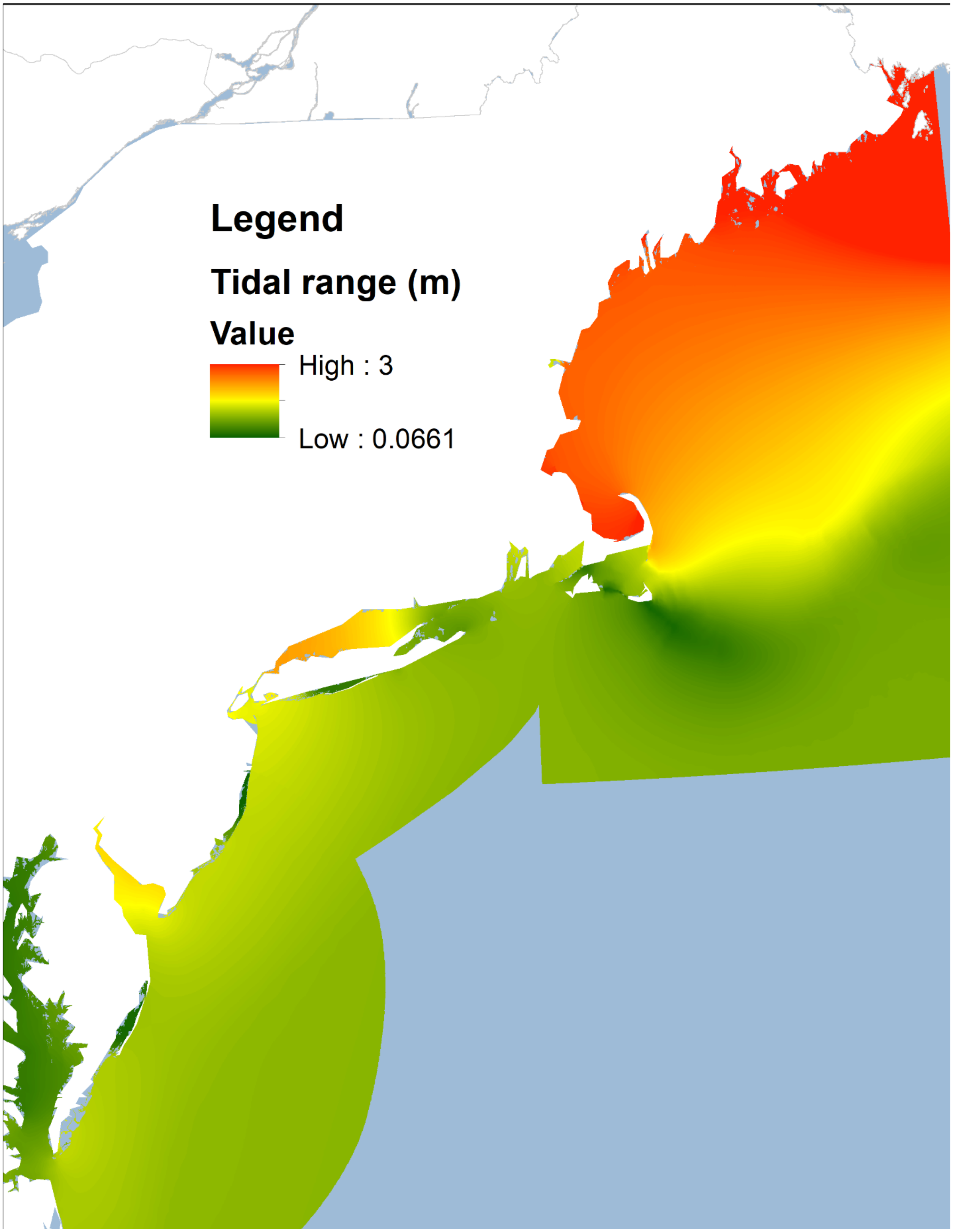

Figure S1. Tidal range values derived from VDATUM for the study area

Figure S2. Examples of marsh coverage above (green) and below (purple) MHHW within 500m diameter sample circles. Panel A is a sample circle of unditched marsh in Southern Delmarva dominated by low marsh with few ponds. Panel B is a sample circle of unditched marsh in southern New Jersey dominated by high marsh with both isolated and tidal ponds present.

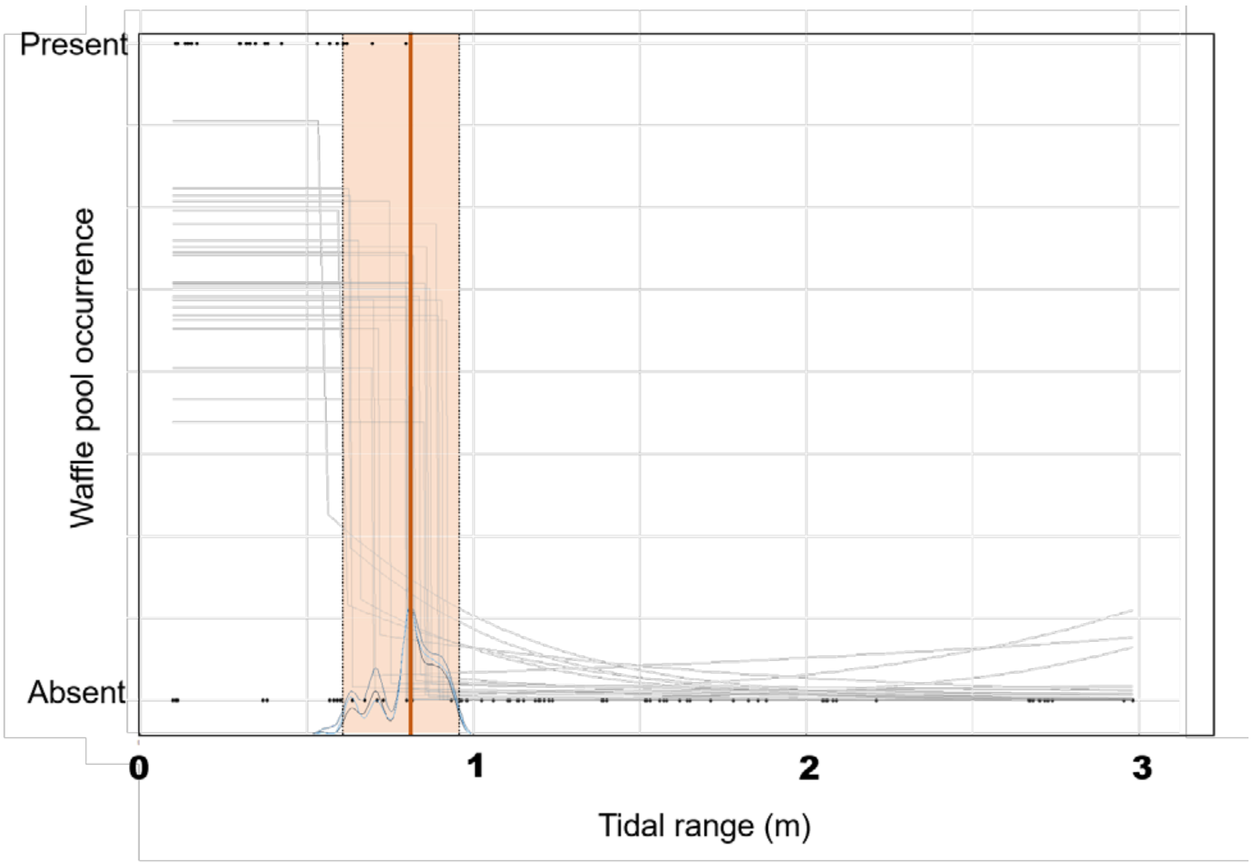

Figure S3. Binomial changepoint analysis to determine the tidal range threshold where waffle pools begin to appear. The orange line is estimated changepoint value and the orange shading is the 95% CI around the estimate.


2011
2020

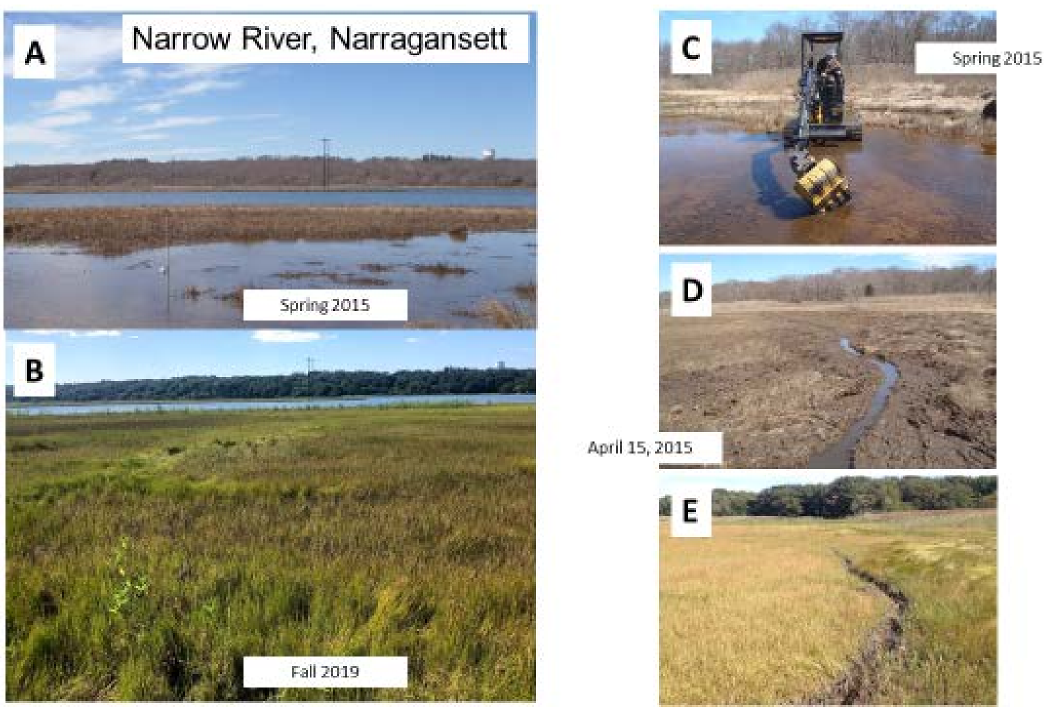
A
Narrow River, Narragansett
Spring 2015
B
Fall 2019
C
Spring 2015
D
April 15, 2015
E

Figure S4. Runnels used to restore marsh surface hydrology were developed in Australia for mosquito control and marsh restoration (Hulsman et al. 1989). Their use as a waffle pool treatment was pioneered in Rhode Island by Save The Bay (Wigand et al. 2015). This figure shows an example of runnel application at Winnapaug Pond, RI with a follow-up photo 9 years later. Vegetation response is usually rapid, often within 2 growing seasons (Ferguson, pers. comm.). But unless runnels are tied into an overall design that breaks processes driving the site along a subsidence trajectory, improvements will be relatively temporary. **Top left** photo shows marsh immediately before runnel installation in 2011. **Top right** photo shows the same location 9 years later with a red dashed line indicating runnel location. Lower panel shows various stages of runnel installment. Photo Credit: W. Ferguson, Save The Bay, RI.

Table S1. Summary of marsh zone attributes across the Northeast U.S. Each column represents the mean frequency of that attribute across a sample (n) of 1km diameter random circles. Greater color intensity corresponds to higher values.

Tidal marsh zone	n	Tidal range	% unditched	% paralell ditched	% intermittent ditched	% marsh below MHHW	% w/ isolated pools	% w/ tidally connected pools	% w/ waffle pools	% w/ OMWM pools	% w/ tidal restrictions
New England north	25	2.81	0.24	0.56	0.20	0.30	0.52	0.40	0.04	0.00	0.28
New England south	22	0.98	0.00	0.45	0.55	0.05	0.32	0.14	0.05	0.09	0.14
Long Island Sound	25	1.95	0.12	0.64	0.28	0.15	0.12	0.12	0.00	0.00	0.44
Long Island South Shore	25	0.85	0.00	0.68	0.32	0.15	0.20	0.48	0.32	0.00	0.12
NY-NJ Bight	24	1.54	0.04	0.29	0.58	0.09	0.17	0.13	0.00	0.00	0.38
Barnegat Bay	26	0.39	0.19	0.54	0.27	0.12	0.42	0.31	0.27	0.65	0.00
Mullica - Egg Harbor - Cape May	30	1.10	0.30	0.43	0.27	0.27	0.57	0.33	0.00	0.10	0.00
Delaware Bay	24	1.70	0.08	0.13	0.79	0.54	0.17	0.08	0.08	0.00	0.08
Delmarva north	26	0.56	0.35	0.35	0.27	0.22	0.35	0.31	0.27	0.04	0.12
Delmarva south	29	1.17	0.83	0.00	0.14	0.86	0.31	0.07	0.00	0.00	0.00

Table S2. Logistic regression analysis of factors associated with isolated pool presence in the marsh interior

Isolated Pools	Estimate	SE	X^2	p- value	lower 95% CI	upper 95% CI
Intercept	0.957	0.743	1.661	0.198	-0.499	2.413
ditched/unditched	-1.924	0.449	18.358	<.0001	-2.804	-1.044
percent of sample marsh area below MHHW	-3.214	0.932	11.901	0.001	-5.040	-1.388
marsh below MHHW *ditched/unditched	3.350	1.161	8.323	0.004	1.074	5.626
marsh area in sample	0.011	0.003	12.038	0.001	0.005	0.017
tidal range	0.108	0.202	0.284	0.594	-0.289	0.504

Table S3. Logistic regression analysis of factors associated with tidally-connected pool presence in the marsh interior

Tidally-connected pools	Estimate	SE	X^2	p- value	lower 95% CI	upper 95% CI
Intercept	0.832	0.709	1.376	0.241	-0.558	2.221
ditched/unditched	-1.799	0.413	18.972	<.0001	-2.608	-0.989
percent of sample marsh area below MHHW	-3.475	0.979	12.606	0.000	-5.393	-1.557
marsh below MHHW *ditched/unditched	3.394	1.254	7.325	0.007	0.936	5.851
marsh area in sample	0.007	0.003	4.251	0.039	0.000	0.014
tidal range	0.019	0.214	0.008	0.928	-0.400	0.438

Table S4. Logistic regression analysis of factors associated with waffle pool presence in the marsh interior

Waffle pools	Estimate	SE	X^2	p- value	lower 95% CI	upper 95% CI
Intercept	1.227	0.655	3.509	0.061	-0.057	2.510
paralell ditched/not paralell ditched	-12.235	48.485	0.064	0.801	-107.263	82.793
percent of sample marsh area below MHHW	3.008	1.853	2.634	0.105	-0.625	6.641
marsh below MHHW *paralell ditched/not paralell ditched	-1.778	147.943	0.000	0.990	-291.741	288.184
marsh area in sample	0.000	0.006	0.000	0.995	-0.011	0.011
tidal range	-3.082	0.710	18.843	<.0001	-4.473	-1.690

Table S5. Logistic regression analysis of factors associated with OMWM pool presence in the marsh interior

OMWM pools	Estimate	SE	X^2	p- value	lower 95% CI	upper 95% CI
Intercept	-0.237	1.308	0.033	0.856	-2.802	2.327
ditched/unditched	2.687	2.719	0.976	0.323	-2.643	8.016
percent of sample marsh area below MHHW	-11.056	11.721	0.890	0.346	-34.029	11.918
marsh below MHHW *ditched/unditched	10.596	11.829	0.802	0.370	-12.589	33.781
marsh area in sample	0.020	0.006	10.825	0.001	0.008	0.032
tidal range	-3.695	0.795	21.617	<.0001	-5.252	-2.137

Table S6. Summary of marsh zone attributes and change dynamics between 1970-74 and 2015-2017 along the Atlantic coast of NJ and Long Island, NY. Statistical tests are chi-square statistics for differences in the point intercept frequency of the attribute between the two time frames.

Tidal marsh zone	Tidal range	% ditched	1970-74 vegetated marsh (ha)	2015-17 vegetated marsh (ha)	Interior					Edge				
					% marsh loss	% marsh gain	Net % change	X^2	p- value	% marsh loss	% marsh gain	Net % change	X^2	p-value
Long Island South Shore, NY	0.3	0.99	5,929	5,244	-7.8 ± 0.8	0.4 ± 0.1	-7.4	30.4	< 0.0001	-12.7 ± 1.1	None	-12.7	133.5	< 0.0001
Long Island Sound, NY	2.05	0.99	1,170	906	-0.6 ± 0.2	1.1± 0.1	0.5	8.9	0.003	-22.1 ± 1.4	None	-22.1	247.5	< 0.0001
N. Barnegat Bay, NJ	0.11	0.73	2,030	1,614	-9.5 ± 2.0	None	-9.5	17.9	< 0.0001	-10.0 ± 2.1	1.0 ± 0.7	-9	13.89	0.0002
S. Barnegat Bay, NJ	0.3	0.78	1,892	1,733	-5.5 ± 1.3	None	-5.5	8.32	0.0039	-4.4 ± 1.5	None	-4.4	6.26	0.007
Manahawkin Bay, NJ	0.6	0.77	3,308	3,011	-5.7 ± 1.2	None	-5.7	17.6	< 0.0001	-5.7 ± 1.2	0.3 ± 0.3	-5.4	14.89	0.0001
Mullica River, NJ	0.95	0.47	9,032	8,765	-2.1 ± 0.5	0.22 ± 0.1	-1.9	12.3	0.0004	-3.3 ± 0.6	1.6 ± 0.4	-1.7	5.13	0.024
Atlantic City, NJ	1.08	0.72	7,755	6,933	-6.1 ± 0.9	4.5 ± 0.7	-1.6	1.83	0.18	-11.1 ± 1.1	1.4 ± 0.4	-9.7	62.88	< 0.0001
Egg Harbor River, NJ	1.15	0.53	7,478	7299	-0.9 ± 0.4	0.3 ± 0.2	-0.6	1.79	0.18	-2.5 ± 0.6	0.3 ± 0.2	-2.2	12.36	0.0004
Cape May, NJ	1.25	0.38	9,151	8,488	-3.4 ± 0.6	2.1 ± 0.4	-1.3	2.3	0.13	-8.4 ± 0.9	1.3 ± 0.4	-7.1	49.8	< 0.0001