

Supplementary Materials- Additional Figures and Tables

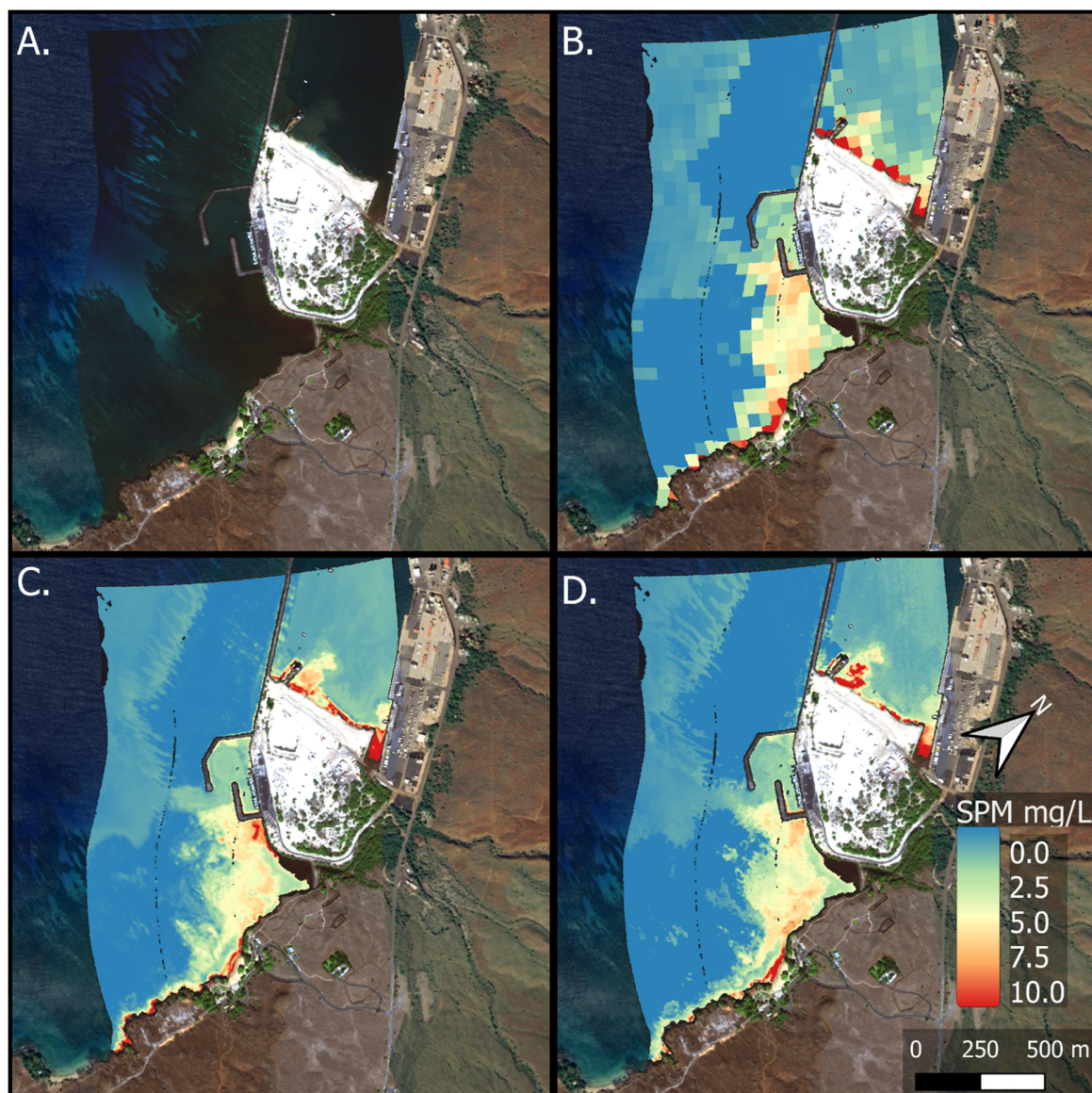


Figure S1. Four stages of water quality mapping at the Pelekane Bay example site: a) Input deglinted reflectance, b) Superpixel suspended particulate matter (SPM) values, c) Interpolated high-res SPM values from superpixel approach, and d) High-res SPM values from the pixel-by-pixel approach.

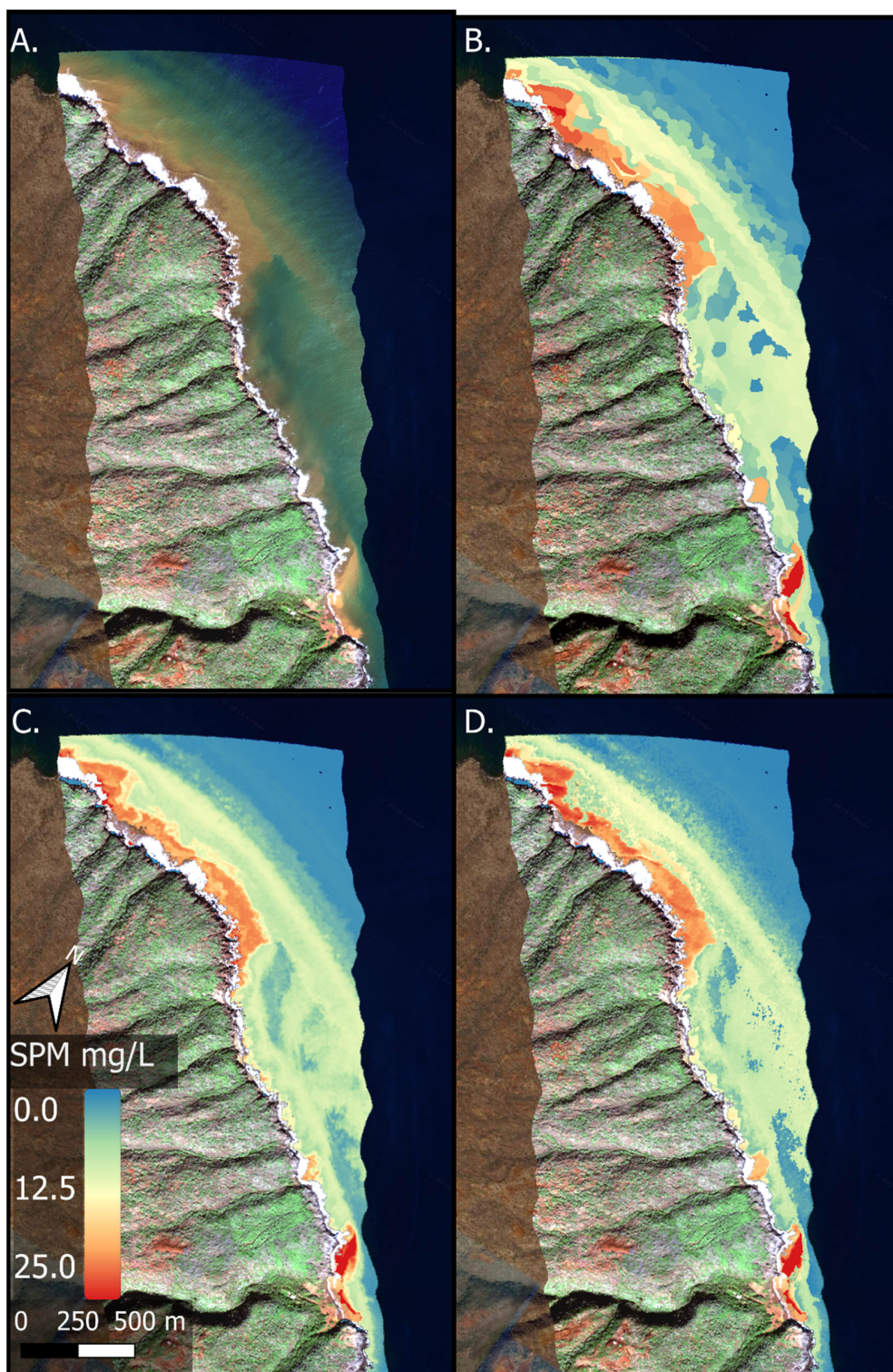


Figure S2. Four stages of water quality mapping at the East Kaho'olawe example site: a) Input deglinted reflectance, b) Superpixel suspended particulate matter (SPM) values, c) Interpolated high-res SPM values from superpixel approach, and d) High-res SPM values from the pixel-by-pixel approach.

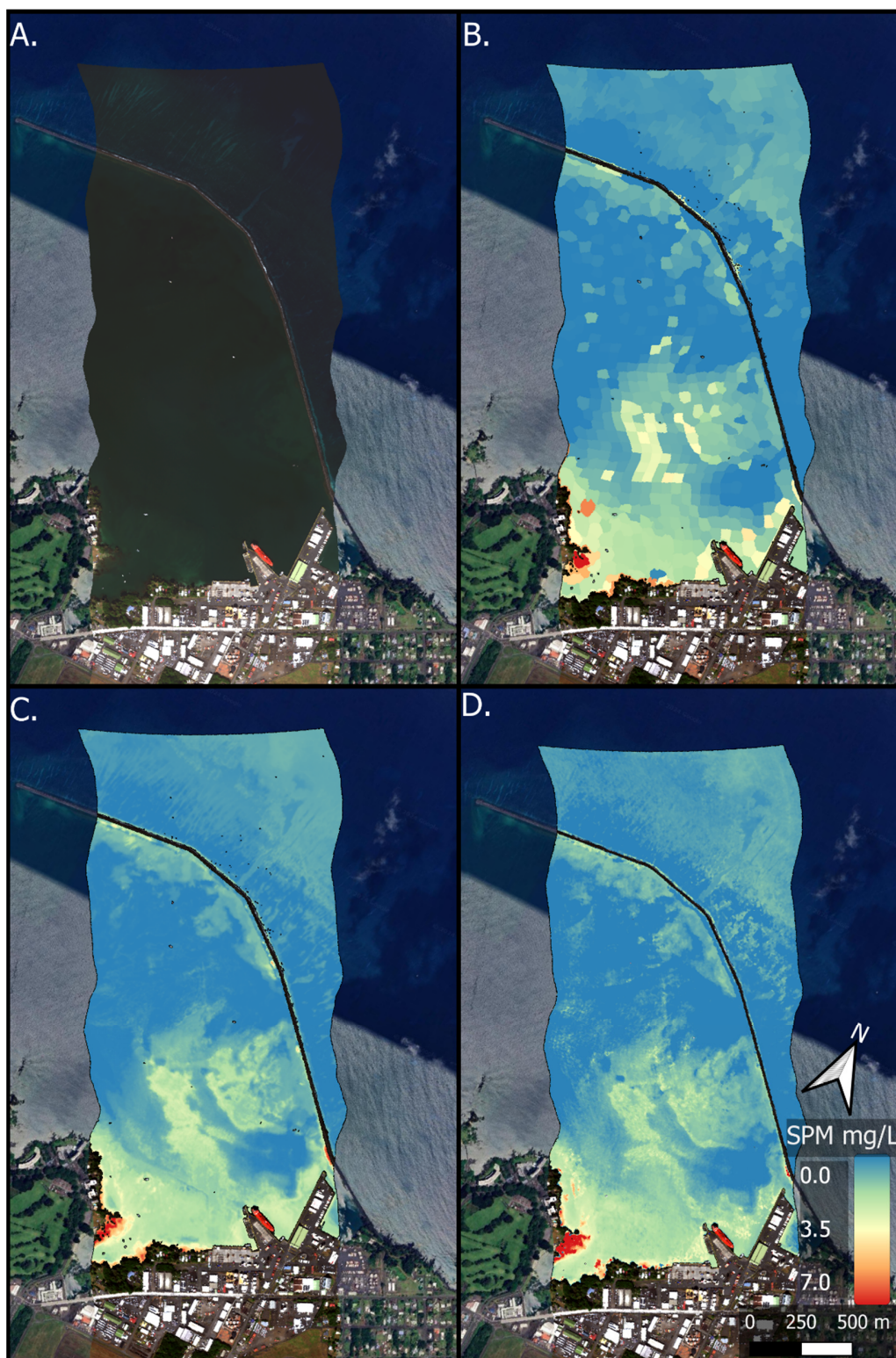


Figure S3. Four stages of water quality mapping at the Hilo Bay example site: a) Input deglinted reflectance, b) Superpixel suspended particulate matter (SPM) values, c) Interpolated high-res SPM values from superpixel approach, and d) High-res SPM values from the pixel-by-pixel approach.

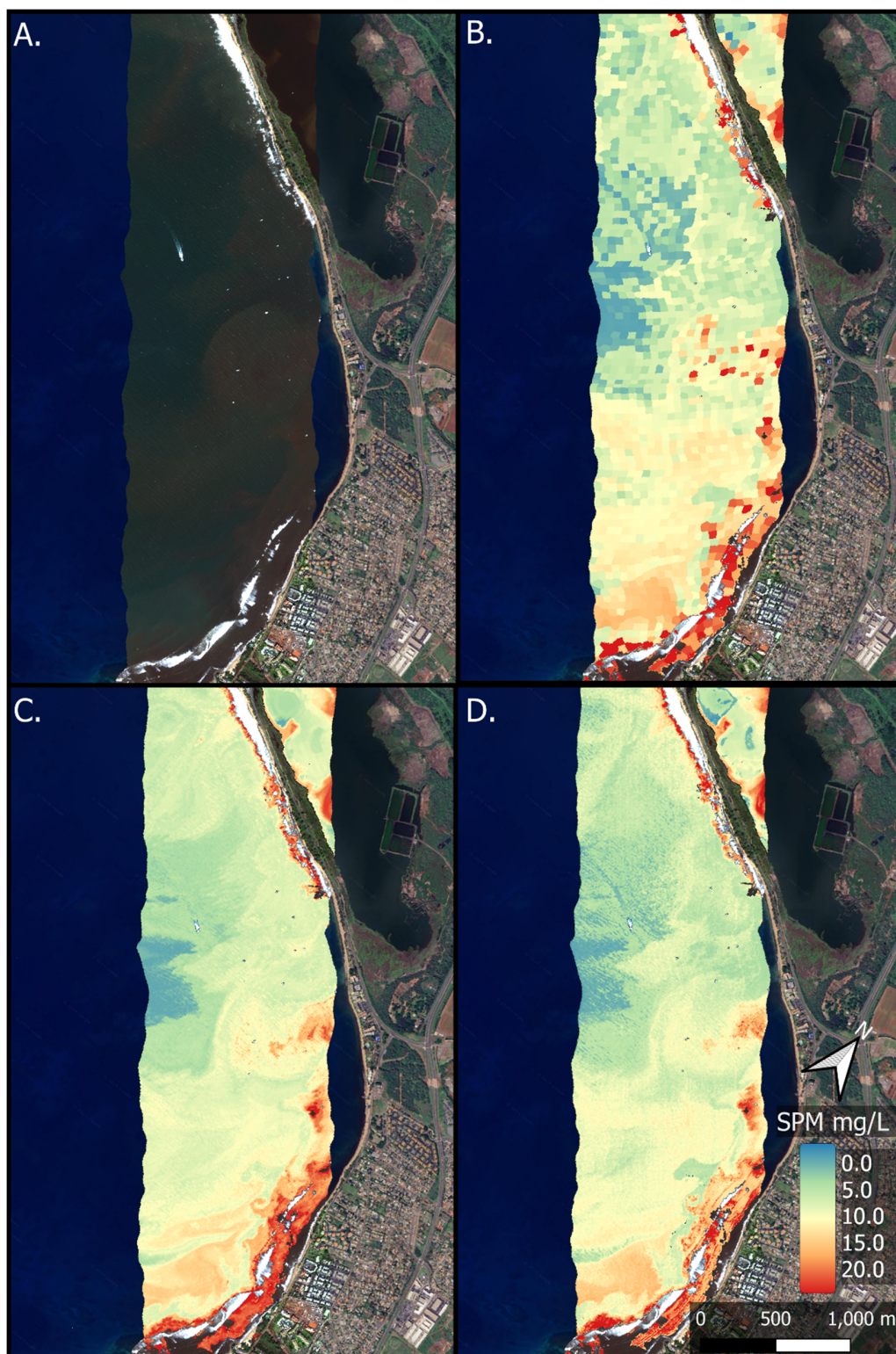


Figure S4. Four stages of water quality mapping at the Mā'alaea example site: a) Input deglinted reflectance, b) Superpixel suspended particulate matter (SPM) values, c) Interpolated high-res SPM values from superpixel approach, and d) High-res SPM values from the pixel-by-pixel approach.

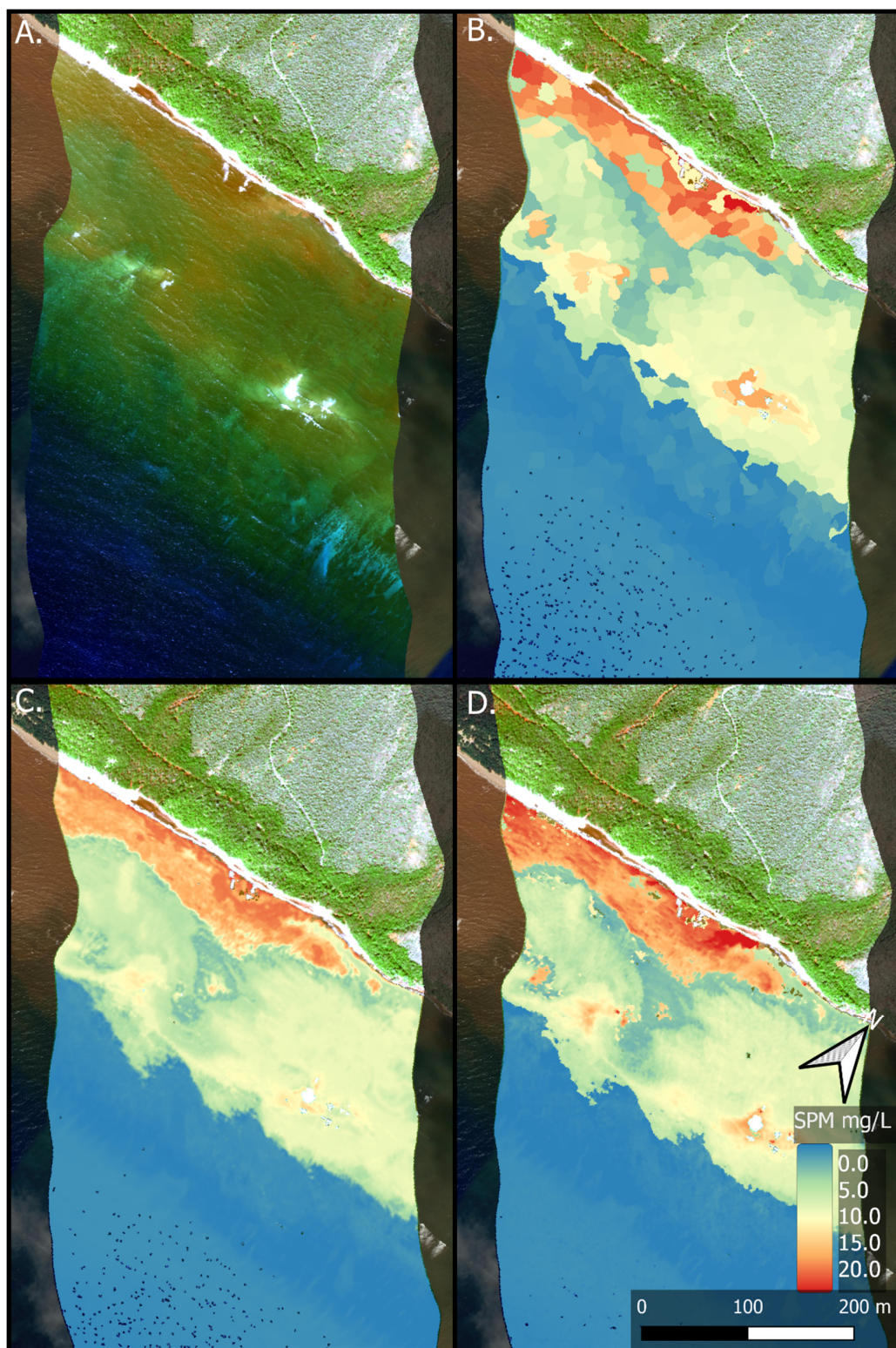


Figure S5. Four stages of water quality mapping at the South Moloka'i example site: a) Input deglinted reflectance, b) Superpixel suspended particulate matter (SPM) values, c) Interpolated high-res SPM values from superpixel approach, and d) High-res SPM values from the pixel-by-pixel approach.

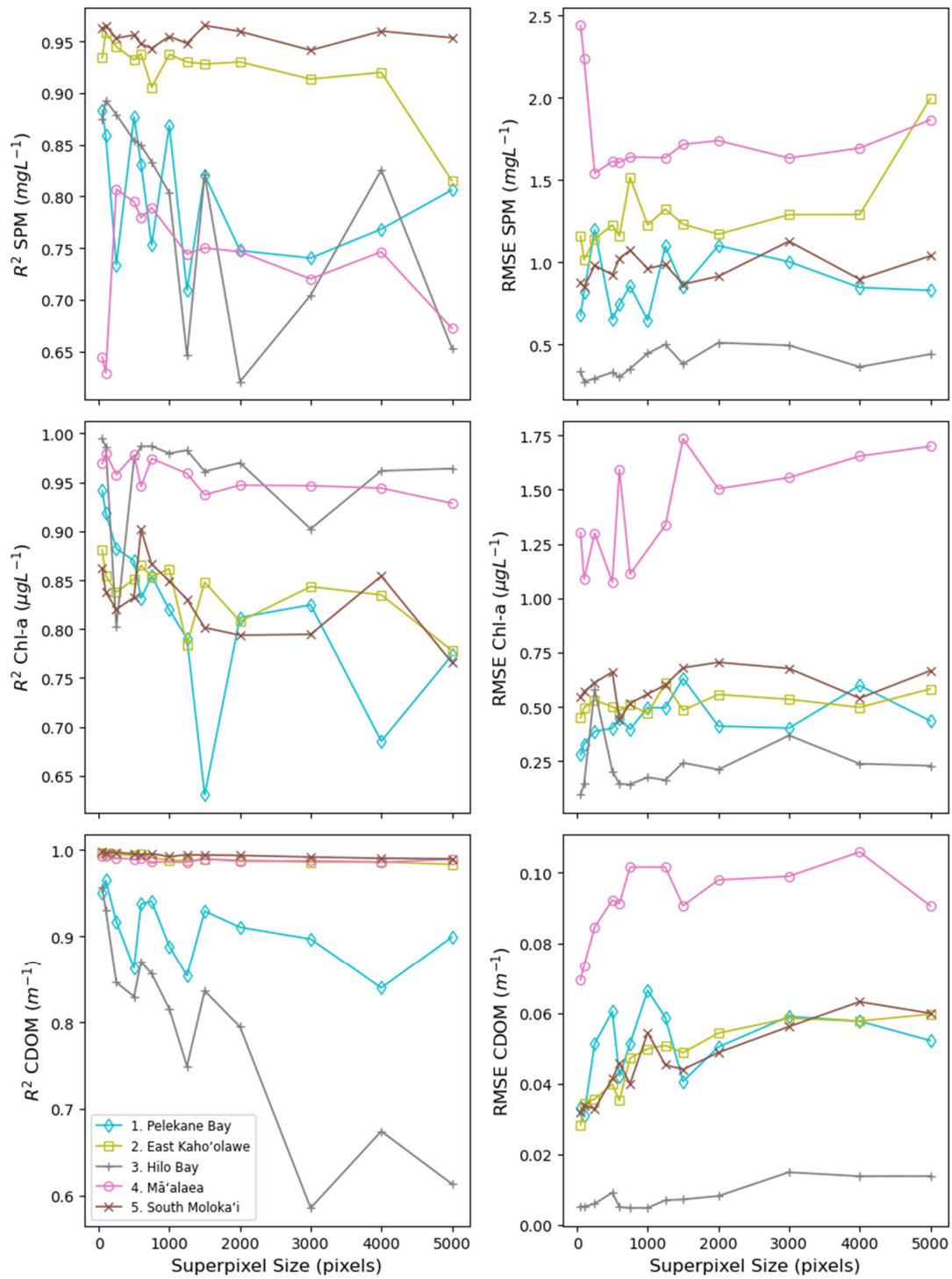


Figure S6. Plots of the change in R-squared and RMSE values with increasing superpixel size settings by example site for regressions between 1000 random locations in superpixel and pixel-by-pixel output maps for suspended particulate matter (SPM; top row), Chlorophyll-a (Chl-a; middle row), and colored dissolved organic matter (CDOM; bottom row).

Table S1. Information about all pixel-by-pixel (PX) and superpixel (SPX) approach comparisons described in the manuscript. Inversions are individual runs of the bio-optical model to retrieve estimates of suspended particulate matter (SPM), Chlorophyll-a (Chl-a), and colored dissolved organic matter (CDOM). RMSE and R^2 are statistics from regressions between PX and SPX output map values at 1000 random locations at each example site. Run time is equivalent time needed to complete the process on a single CPU core.

Example Site	SPX Size	SPX Inversions	PX Inversions	CDOM R^2	CDOM RMSE	Chl-a R^2	Chl-a RMSE	SPM R^2	SPM RMSE	SPX Run Time	PX Run Time	Speed Mult.
	<i>pixels</i>	<i>N</i>	<i>N</i>	--	<i>m⁻¹</i>	--	<i>μg L⁻¹</i>	--	<i>mg L⁻¹</i>	<i>seconds</i>	<i>seconds</i>	--
1. Pelekane Bay	50	7346	354231	0.951	0.0332	0.941	0.279	0.883	0.678	37131.5	1373389.0	36.99
2. East Kaho‘olawe	50	15126	769855	0.996	0.0283	0.881	0.448	0.934	1.158	69781.2	2984804.8	42.77
3. Hilo Bay	50	14158	709184	0.956	0.0053	0.995	0.095	0.875	0.334	61328.6	2749577.3	44.83
4. Mā‘alaea	50	26520	1313666	0.993	0.0694	0.969	1.302	0.645	2.441	230876.1	5093214.4	22.06
5. South Moloka‘i	50	14011	700016	0.998	0.0319	0.862	0.546	0.962	0.878	59835.9	2714032.0	45.36
1. Pelekane Bay	100	3684	354231	0.965	0.0311	0.919	0.328	0.859	0.820	20801.7	1373389.0	66.02
2. East Kaho‘olawe	100	7143	769855	0.995	0.0345	0.855	0.496	0.958	1.015	32675.3	2984804.8	91.35
3. Hilo Bay	100	6762	709184	0.931	0.0051	0.987	0.145	0.893	0.272	37941.1	2749577.3	72.47
4. Mā‘alaea	100	12796	1313666	0.993	0.0736	0.980	1.089	0.629	2.240	118095.9	5093214.4	43.13
5. South Moloka‘i	100	6529	700016	0.997	0.0339	0.838	0.570	0.965	0.846	38403.1	2714032.0	70.67
1. Pelekane Bay	250	1432	354231	0.917	0.0513	0.882	0.387	0.734	1.196	6688.5	1373389.0	205.34
2. East Kaho‘olawe	250	2732	769855	0.995	0.0356	0.838	0.530	0.945	1.140	14865.6	2984804.8	200.79
3. Hilo Bay	250	2592	709184	0.846	0.0060	0.802	0.579	0.879	0.292	11944.8	2749577.3	230.19
4. Mā‘alaea	250	4951	1313666	0.991	0.0846	0.958	1.300	0.807	1.541	39358.0	5093214.4	129.41
5. South Moloka‘i	250	2427	700016	0.997	0.0329	0.820	0.612	0.953	0.980	10726.9	2714032.0	253.01
1. Pelekane Bay	500	780	354231	0.863	0.0604	0.870	0.401	0.877	0.652	4251.3	1373389.0	323.05
2. East Kaho‘olawe	500	1443	769855	0.994	0.0399	0.851	0.500	0.932	1.226	8614.8	2984804.8	346.47
3. Hilo Bay	500	1347	709184	0.829	0.0092	0.974	0.203	0.854	0.329	6364.3	2749577.3	432.03
4. Mā‘alaea	500	2651	1313666	0.989	0.0923	0.978	1.074	0.795	1.613	24387.2	5093214.4	208.85
5. South Moloka‘i	500	1267	700016	0.995	0.0414	0.832	0.660	0.956	0.923	6464.6	2714032.0	419.83
1. Pelekane Bay	600	658	354231	0.937	0.0422	0.831	0.447	0.831	0.741	3442.5	1373389.0	398.95
2. East Kaho‘olawe	600	1232	769855	0.995	0.0352	0.865	0.481	0.938	1.159	8092.0	2984804.8	368.86
3. Hilo Bay	600	1036	709184	0.870	0.0051	0.987	0.145	0.849	0.300	5410.8	2749577.3	508.16
4. Mā‘alaea	600	2256	1313666	0.990	0.0912	0.946	1.593	0.780	1.607	23147.0	5093214.4	220.04

5. South Moloka'i	600	1063	700016	0.994	0.0459	0.902	0.441	0.948	1.023	5450.1	2714032.0	497.98
1. Pelekane Bay	750	519	354231	0.940	0.0513	0.854	0.397	0.753	0.855	2788.2	1373389.0	492.57
2. East Kaho'olawe	750	975	769855	0.991	0.0472	0.854	0.509	0.906	1.515	5237.9	2984804.8	569.84
3. Hilo Bay	750	877	709184	0.856	0.0048	0.987	0.143	0.833	0.351	5283.4	2749577.3	520.42
4. Mā'alaea	750	1766	1313666	0.986	0.1016	0.974	1.111	0.789	1.640	14155.5	5093214.4	359.80
5. South Moloka'i	750	838	700016	0.996	0.0399	0.866	0.516	0.943	1.071	4135.3	2714032.0	656.31
1. Pelekane Bay	1000	390	1313666	0.888	0.0664	0.820	0.497	0.869	0.645	2859.1	5093214.4	1781.43
2. East Kaho'olawe	1000	705	769855	0.988	0.0499	0.862	0.468	0.937	1.226	3797.9	2984804.8	785.90
3. Hilo Bay	1000	642	709184	0.815	0.0048	0.980	0.175	0.803	0.444	3213.8	2749577.3	855.55
5. South Moloka'i	1000	598	700016	0.992	0.0544	0.849	0.559	0.955	0.961	4875.5	2714032.0	556.67
1. Pelekane Bay	1250	314	354231	0.854	0.0587	0.790	0.495	0.709	1.097	2093.6	1373389.0	656.00
2. East Kaho'olawe	1250	580	769855	0.987	0.0508	0.784	0.609	0.930	1.323	4793.4	2984804.8	622.69
3. Hilo Bay	1250	517	709184	0.749	0.0070	0.983	0.163	0.646	0.499	2859.1	2749577.3	961.69
4. Mā'alaea	1250	1061	1313666	0.986	0.1016	0.959	1.336	0.744	1.635	11376.3	5093214.4	447.70
5. South Moloka'i	1250	493	700016	0.994	0.0453	0.830	0.600	0.948	0.985	2872.0	2714032.0	945.01
1. Pelekane Bay	1500	250	1313666	0.929	0.0406	0.631	0.630	0.821	0.846	1683.3	5093214.4	3025.74
2. East Kaho'olawe	1500	461	769855	0.989	0.0488	0.848	0.484	0.928	1.231	4140.3	2984804.8	720.91
3. Hilo Bay	1500	414	709184	0.836	0.0072	0.961	0.242	0.821	0.380	2403.2	2749577.3	1144.16
4. Mā'alaea	1500	851	1313666	0.989	0.0906	0.937	1.735	0.750	1.717	8414.1	5093214.4	605.32
5. South Moloka'i	1500	390	700016	0.994	0.0440	0.802	0.679	0.965	0.865	2221.4	2714032.0	1221.79
1. Pelekane Bay	2000	192	354231	0.910	0.0504	0.812	0.411	0.748	1.100	1044.0	1373389.0	1315.51
2. East Kaho'olawe	2000	346	769855	0.988	0.0543	0.808	0.557	0.930	1.170	3700.3	2984804.8	806.65
3. Hilo Bay	2000	311	709184	0.795	0.0082	0.970	0.211	0.621	0.509	1759.8	2749577.3	1562.42
4. Mā'alaea	2000	654	1313666	0.987	0.0980	0.947	1.504	0.747	1.740	5544.0	5093214.4	918.69
5. South Moloka'i	2000	293	700016	0.994	0.0488	0.794	0.705	0.960	0.913	1731.0	2714032.0	1567.87
1. Pelekane Bay	3000	140	354231	0.897	0.0590	0.825	0.402	0.740	1.002	794.5	1373389.0	1728.70
2. East Kaho'olawe	3000	254	769855	0.986	0.0585	0.843	0.534	0.914	1.289	1522.7	2984804.8	1960.24
3. Hilo Bay	3000	203	709184	0.586	0.0149	0.902	0.368	0.704	0.493	1060.8	2749577.3	2591.93
4. Mā'alaea	3000	467	1313666	0.987	0.0990	0.947	1.556	0.720	1.634	3902.0	5093214.4	1305.29
5. South Moloka'i	3000	195	700016	0.992	0.0561	0.795	0.677	0.941	1.127	1075.0	2714032.0	2524.63
1. Pelekane Bay	4000	100	354231	0.840	0.0577	0.685	0.598	0.768	0.845	681.0	1373389.0	2016.83

2. East Kaho‘olawe	4000	172	769855	0.986	0.0577	0.835	0.497	0.920	1.289	1134.9	2984804.8	2630.02
3. Hilo Bay	4000	148	709184	0.674	0.0138	0.962	0.238	0.826	0.362	1251.4	2749577.3	2197.24
4. Mā‘alaea	4000	331	1313666	0.986	0.1059	0.944	1.655	0.746	1.694	3792.4	5093214.4	1343.02
5. South Moloka‘i	4000	140	700016	0.990	0.0632	0.854	0.540	0.960	0.895	1059.1	2714032.0	2562.53
1. Pelekane Bay	5000	78	354231	0.899	0.0522	0.773	0.435	0.806	0.828	779.1	1373389.0	1762.70
2. East Kaho‘olawe	5000	139	769855	0.983	0.0597	0.778	0.582	0.815	1.996	1058.7	2984804.8	2819.41
3. Hilo Bay	5000	119	709184	0.613	0.0138	0.964	0.228	0.653	0.440	958.1	2749577.3	2869.94
4. Mā‘alaea	5000	259	1313666	0.989	0.0906	0.929	1.700	0.672	1.866	2282.3	5093214.4	2231.61
5. South Moloka‘i	5000	112	700016	0.990	0.0599	0.766	0.666	0.954	1.038	787.7	2714032.0	3445.39