Supplementary Materials

Table S1. Summary of test conditions, physical properties of test oils, and dispersion effectiveness measurements.

Oil*	Viscosity (cSt)	Oil Density (g/cm³)	Water Temp. (°C)	Salinity (ppth)	Oil Mass (g)	Oil thickness (mm)	Dispersant	DOR	DE (%)
Heidrun	107	0.9177	8.0	26.5	244	2.12	none		3.9
Heidrun	110	0.9182	7.3	27.2	243	2.11	none		1.6
Heidrun	109	0.9181	7.5	27.6	243	2.11	none		2.5
Heidrun	67	0.9124	15.6	29.3	238	1.99	none		3.1
Heidrun	64	0.9120	16.1	29.2	240	2.00	none		4.2
Heidrun	63	0.9117	16.6	28.9	241	2.10	none		5.7
Heidrun	107	0.9177	8.0	29.4	242	2.10	COREXIT	1:20	72.2
Heidrun	118	0.9187	6.6	29.0	243	2.11	COREXIT	1:20	70.6
Heidrun	118	0.9187	6.6	29.8	240	1.99	COREXIT	1:20	68.9
Heidrun	64	0.9120	16.2	29.0	245	2.14	COREXIT	1:20	73.6
Heidrun	67	0.9124	15.6	29.1	246	2.15	COREXIT	1:20	70.1
Heidrun	56	0.9103	18.6	28.7	249	2.18	COREXIT	1:20	84.3
Synbit	4505	0.9205	4.0	29.9	241	2.01	none		1.1
Synbit	4228	0.9202	4.5	29.9	240	1.99	none		7.0
Synbit	4682	0.9207	3.7	30.3	242	2.01	none		4.5
Synbit	932	0.9521	18.0	29.1	242	2.02	none		2.4
Synbit	900	0.9518	18.4	29.0	243	2.03	none		5.6
Synbit	932	0.9521	18.0	28.7	246	2.06	none		3.9
Synbit	4281	0.9202	4.4	30.4	243	2.03	COREXIT	1:20	43.6
Synbit	4175	0.9201	4.6	30.2	242	2.02	COREXIT	1:20	48.4
Synbit	3872	0.9197	5.2	30.3	240	1.99	COREXIT	1:20	53.2
Synbit	893	0.9518	18.5	28.7	238	1.99	COREXIT	1:20	58.6
Synbit	1264	0.9546	14.5	28.7	243	2.03	COREXIT	1:20	62.4
Synbit	1097	0.9534	16.1	29.0	244	2.04	COREXIT	1:20	56.6
WCS	4094	0.9604	6.2	28.0	241	2.00	none		2.9
WCS	3969	0.9602	6.5	27.8	240	1.99	none		1.0
WCS	3769	0.9598	7.0	27.3	242	2.01	none		4.1
WCS	1154	0.9508	19.7	29.3	244	2.04	none		2.4
WCS	1214	0.9512	19.1	29.1	241	2.02	none		4.3
WCS	1398	0.9524	17.5	29.3	242	2.02	none		3.8
WCS	4137	0.9603	6.1	27.5	248	2.06	COREXIT	1:20	36.4
WCS	4010	0.9601	6.4	27.5	238	1.97	COREXIT	1:20	43.7

WCS	3655	0.9595	7.3	25.5	241	2.00	COREXIT	1:20	43.8
WCS	1633	0.9536	15.7	28.8	240	2.00	COREXIT	1:20	49.2
WCS	1633	0.9536	15.7	28.7	237	1.98	COREXIT	1:20	54.0
WCS	1535	0.9531	16.4	29.1	240	2.00	COREXIT	1:20	57.2
AWB	8212	0.9646	8.0	29.5	247.8	2.05	none		0.0
AWB	6806	0.9635	9.7	27.9	264.8	2.19	none		3.1
AWB	6956	0.9636	9.5	27.5	293.8	2.43	none		1.9
AWB	4553	0.9611	13.5	28.8	230.7	1.91	none		1.2
AWB	4370	0.9308	13.9	29.1	236.3	1.96	none		1.2
AWB	2482	0.9571	19.7	28.1	238.4	1.98	none		3.1
AWB	9846	0.9656	6.4	29.2	253.6	2.09	COREXIT	1:20	28.1
AWB	7349	0.9670	9.0	29.4	252.3	2.08	COREXIT	1:20	33.7
AWB	8687	0.9649	7.5	29.4	276.1	2.28	COREXIT	1:20	30.1
AWB	3178	0.9578	17.1	23.7	239.2	1.99	COREXIT	1:20	56.9
AWB	4370	0.9608	13.9	28.7	233.2	1.93	COREXIT	1:20	50.4
AWB	3403	0.9592	16.4	28.7	238.5	1.98	COREXIT	1:20	52.3

*AWB, WCS and Synbit weathered (7% w/w) and Heidrun was unweathered prior to dispersion effectiveness testing.

Table S2. Predicted data generated from oil weathering (eq. 2) and dispersion effectiveness (eq. 3) models. Predicted viscosity data for the four oils naturally weathered in the Spring and Summer of Atlantic Canada are taken from King et al., unpublished (all data adjusted to 15 ºC).

Summer			**Spring**		
Heidrun (4.1 mm, 15.5 ºC, 14.9 km/hr)			**Heidrun (4.2 mm, 6.7 ºC, 13.6 km/hr)**		
$v = v_0 + (v_f - v_0)\left(\frac{t}{T+t}\right)^n$ **(eq. 3)** $DE = a\,ln((v_0 + (v_f - v_0)\left(\frac{t}{T+t}\right)^n + b)$ **(eq. 4)**					
$v_0 = 75;\ v_f = 565$	T=250	n=0.36	$v_0 = 75;\ v_f = 345$	T=80	N=0.64
Viscosity	**DE (%)**	**Time (hr)**	**Viscosity**	**DE (%)**	**Time (hr)**
75	76.6	0	75	76.6	0
171	70.1	3	107	73.8	3
210	68.4	8	132	72.1	8
272	66.4	24	179	69.7	24
320	65.1	48	217	68.2	48
351	64.4	72	240	67.4	72
373	63.9	96	255	66.9	96
390	63.6	120	267	66.6	120
404	63.3	144	275	66.3	144
416	63.1	168	282	66.1	168
425	62.9	192	288	66.0	192
434	62.7	216	292	65.8	216
441	62.6	240	296	65.7	240
447	62.5	264	300	65.7	264
453	62.4	288	302	65.6	288
458	62.3	312	305	65.5	312
462	62.2	336	307	65.5	336
466	62.2	360	309	65.4	360
AWB (4.0 mm, 14.3 ºC, 9.0 km/hr)			**AWB (4.0 mm, 5.5 ºC, 16.4 km/hr)**		
$v_0 = 299;\ v_f = 69309$	T=29	n=1.8	$v_0 = 265;\ v_f = 36646$	T=28	n=1.1
299	65.2	0	265	66.6	0
1114	55.3	3	2925	47.6	3
4107	45.0	8	7015	40.7	8
15237	34.6	24	15568	34.4	24
27280	30.0	48	22010	31.7	48
34879	28.1	72	25447	30.6	72
39988	27.0	96	27579	29.9	96
43633	26.3	120	29030	29.5	120
46359	25.8	144	30081	29.2	144
48471	25.5	168	30877	29.0	168

50155	25.2	192	31501	28.9	192
51528	25.0	216	32003	28.7	216
52669	24.8	240	32416	28.6	240
53632	24.7	264	32762	28.6	264
54456	24.5	288	33055	28.5	288
55168	24.4	312	33307	28.4	312
55790	24.4	336	33526	28.4	336
56338	24.3	360	33719	28.3	360
Synbit (4.0 mm, 14.5 ºC, 13.2 km/hr)			**Synbit (4.0 mm, 6.3 ºC, 20.5 km/hr)**		
Viscosity	**DE (%)**	**Time (hr)**	**Viscosity**	**DE (%)**	**Time (hr)**
$v_0 = 242;\ v_f = 10924$	T=52	n=1.3	$v_0 = 240;\ v_f = 4580$	T=40	n=0.98
242	67.3	0	240	67.4	0
454	62.4	3	558	60.7	3
951	56.5	8	986	56.2	8
2494	48.9	24	1891	51.1	24
4173	44.8	48	2623	48.5	48
5299	43.0	72	3039	47.3	72
6093	41.9	96	3308	46.7	96
6682	41.1	120	3496	46.2	120
7134	40.6	144	3634	45.9	144
7492	40.2	168	3741	45.7	168
7783	39.9	192	3825	45.5	192
8023	39.7	216	3894	45.4	216
8225	39.5	240	3951	45.3	240
8397	39.3	264	3999	45.2	264
8545	39.2	288	4040	45.1	288
8675	39.1	312	4075	45.0	312
8788	39.0	336	4106	45.0	336
8889	38.9	360	4133	44.9	360
WCS (4.0 mm, 15.2 ºC, 11.4 km/hr)			**WCS (4.0 mm, 6.3 ºC, 24.7 km/hr)**		
Viscosity	**DE (%)**	**Time (hr)**	**Viscosity**	**DE (%)**	**Time (hr)**
$v_0 = 308;\ v_f = 25073$	T=110	n=0.97	$v_0 = 260;\ v_f = 11053$	T=34	n=1.1
318	65.2	0	260	66.8	0
1254	54.3	3	1032	55.9	3
2642	48.5	8	2152	50.1	8
6281	41.6	24	4533	44.2	24
10274	37.7	48	6411	41.5	48
13180	35.8	72	7451	40.3	72
15395	34.5	96	8110	39.6	96
17141	33.7	120	8566	39.2	120
18552	33.1	144	8899	38.9	144

19717	32.6	168	9154	38.6	168
20696	32.2	192	9355	38.5	192
21529	31.9	216	9517	38.3	216
22247	31.6	240	9651	38.2	240
22872	31.4	264	9764	38.1	264
23422	31.2	288	9860	38.0	288
23909	31.1	312	9942	38.0	312
24343	30.9	336	10014	37.9	336
24732	30.8	360	10077	37.9	360

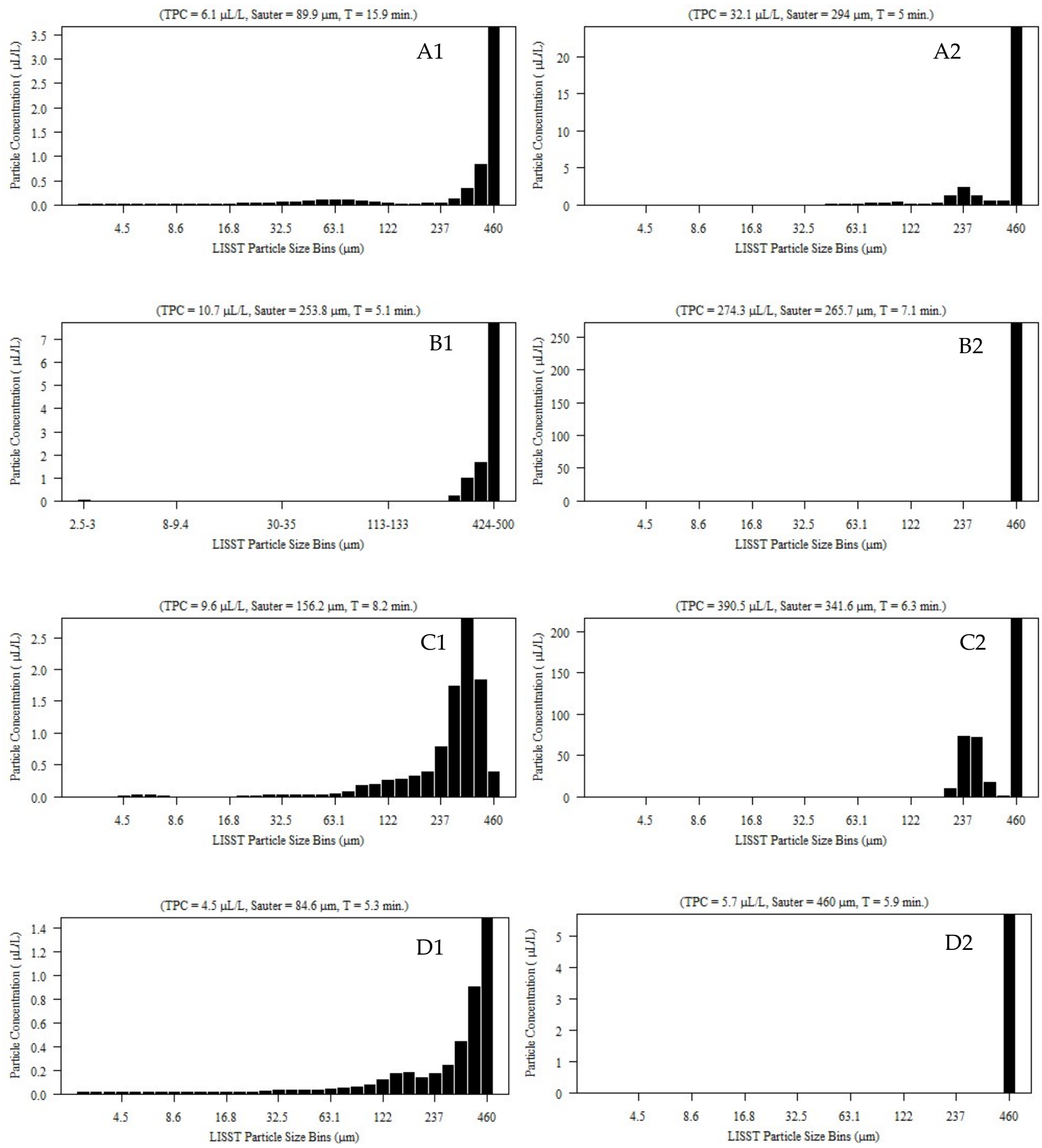

Figure S1. The plot represents the seasonal effect on particle size distribution data (LISST 100X-#1; 1.2 m from oil release) obtained at the point in time of maximum total particle concentration during the natural dispersion of four oils: A1) Heidrun-Spring, A2) Heidrun-Summer, B1) AWB-Spring, B2) AWB-Summer, C1) Synbit-Spring, C2) Synbit-Summer, D1) WCS-Spring, and D2) WCS-Summer. X-axis values represent the 32 logarithmically-spaced particle size bins generated by the LISST100X instrument.

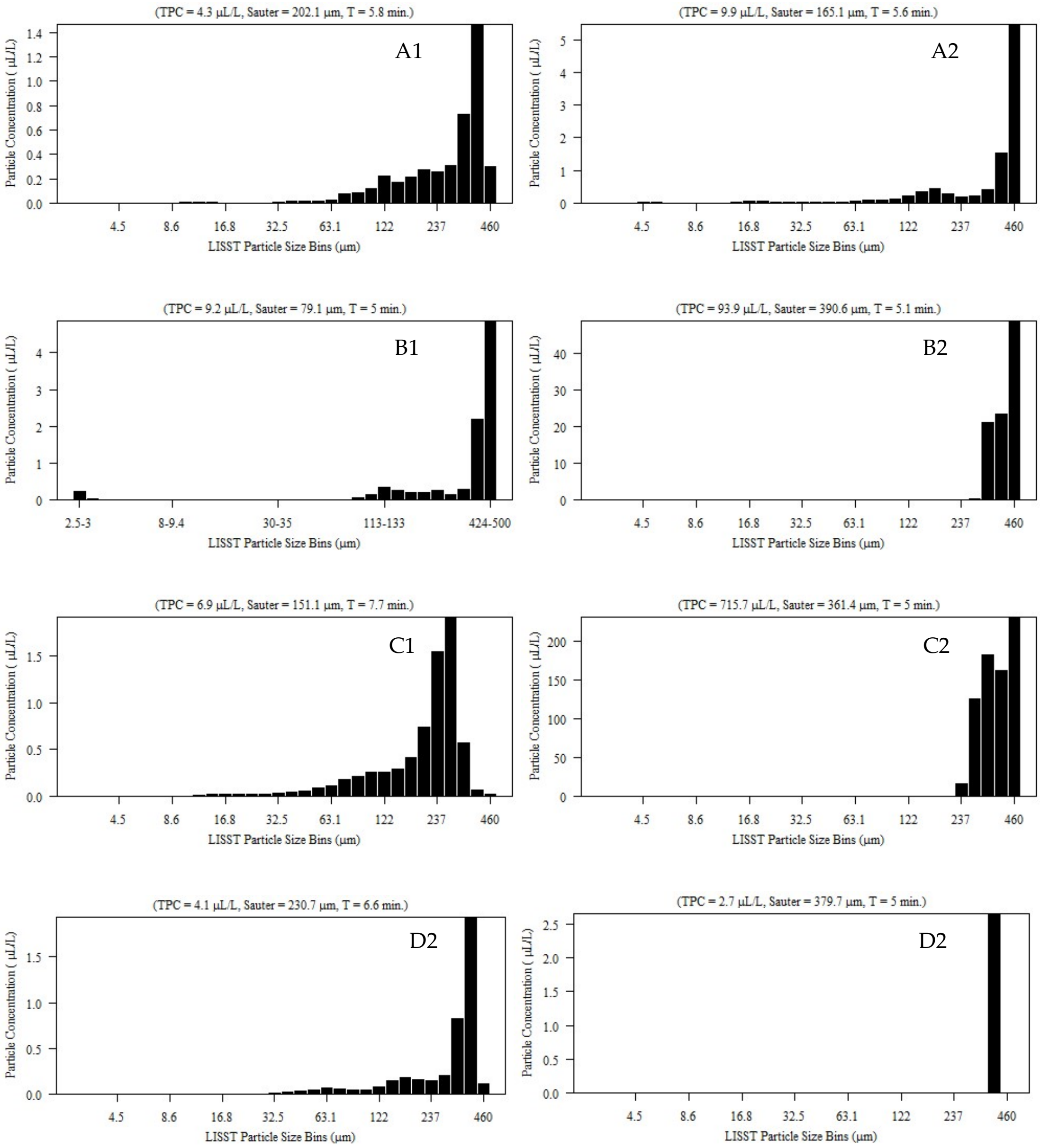

Figure S2. The plot represents the seasonal effect on particle size distribution data (LISST 100X-#2; 12 m from oil release) obtained at the time point of maximum total particle concentration during the natural dispersion of four oils: A1) Heidrun-Spring, A2) Heidrun-Summer, B1) AWB-Spring, B2) AWB-Summer, C1) Synbit-Spring, C2) Synbit-Summer, D1) WCS-Spring, and D2) WCS-Summer. X-axis values represent the 32 logarithmically-spaced particle size bins generated by the LISST100X instrument.

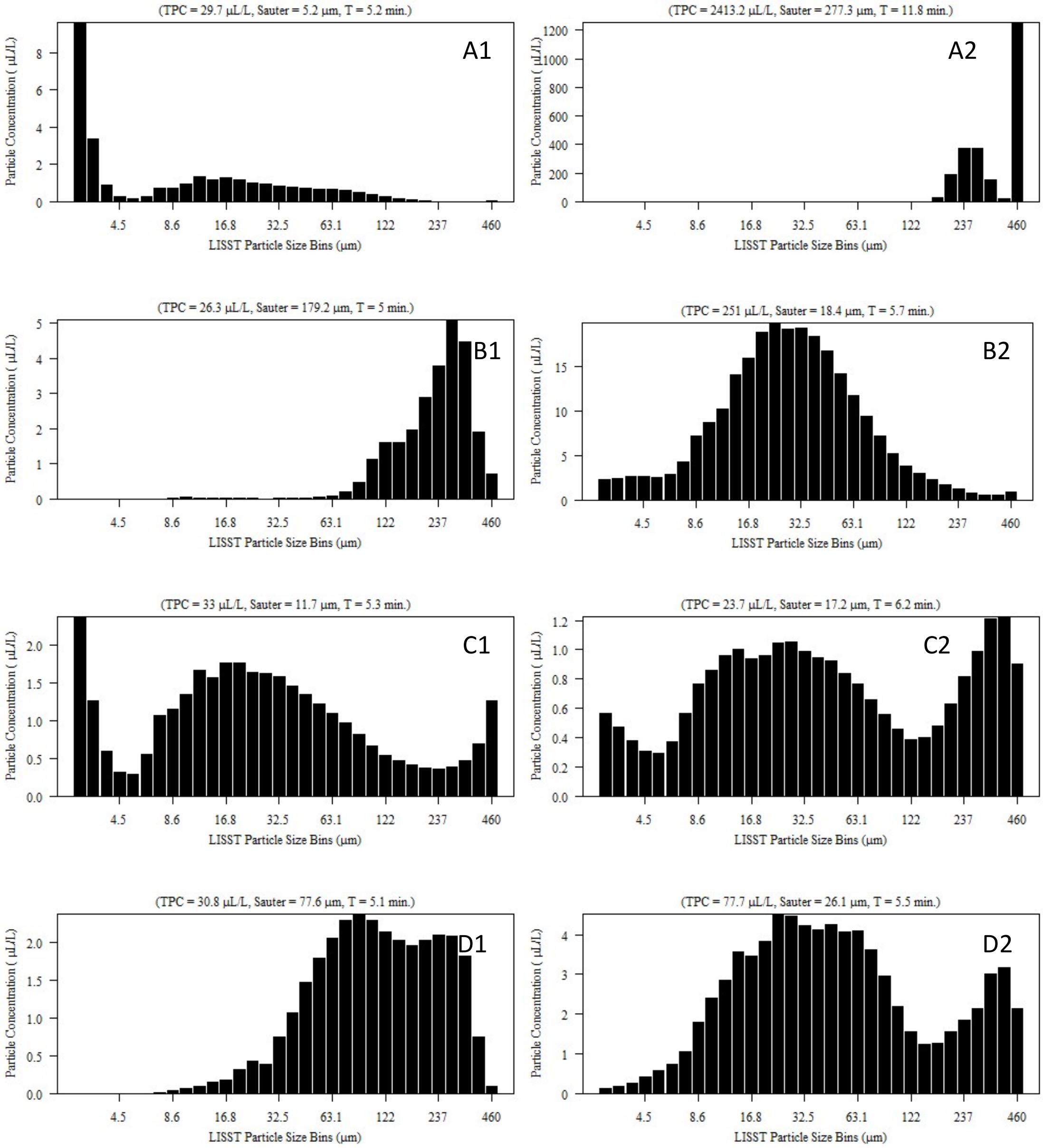

Figure S3. The plot represents the seasonal effect on particle size distribution data (LISST 100X-#1; 1.2 m from oil release) obtained at the time point of maximum total particle concentration during the chemically enhanced dispersion of four oils: A1) Heidrun-Spring, A2) Heidrun-Summer, B1) AWB-Spring, B2) AWB-Summer, C1) Synbit-Spring, C2) Synbit-Summer, D1) WCS-Spring, and D2) WCS-Summer. X-axis values represent the 32 logarithmically-spaced particle size bins generated by the LISST100X instrument.

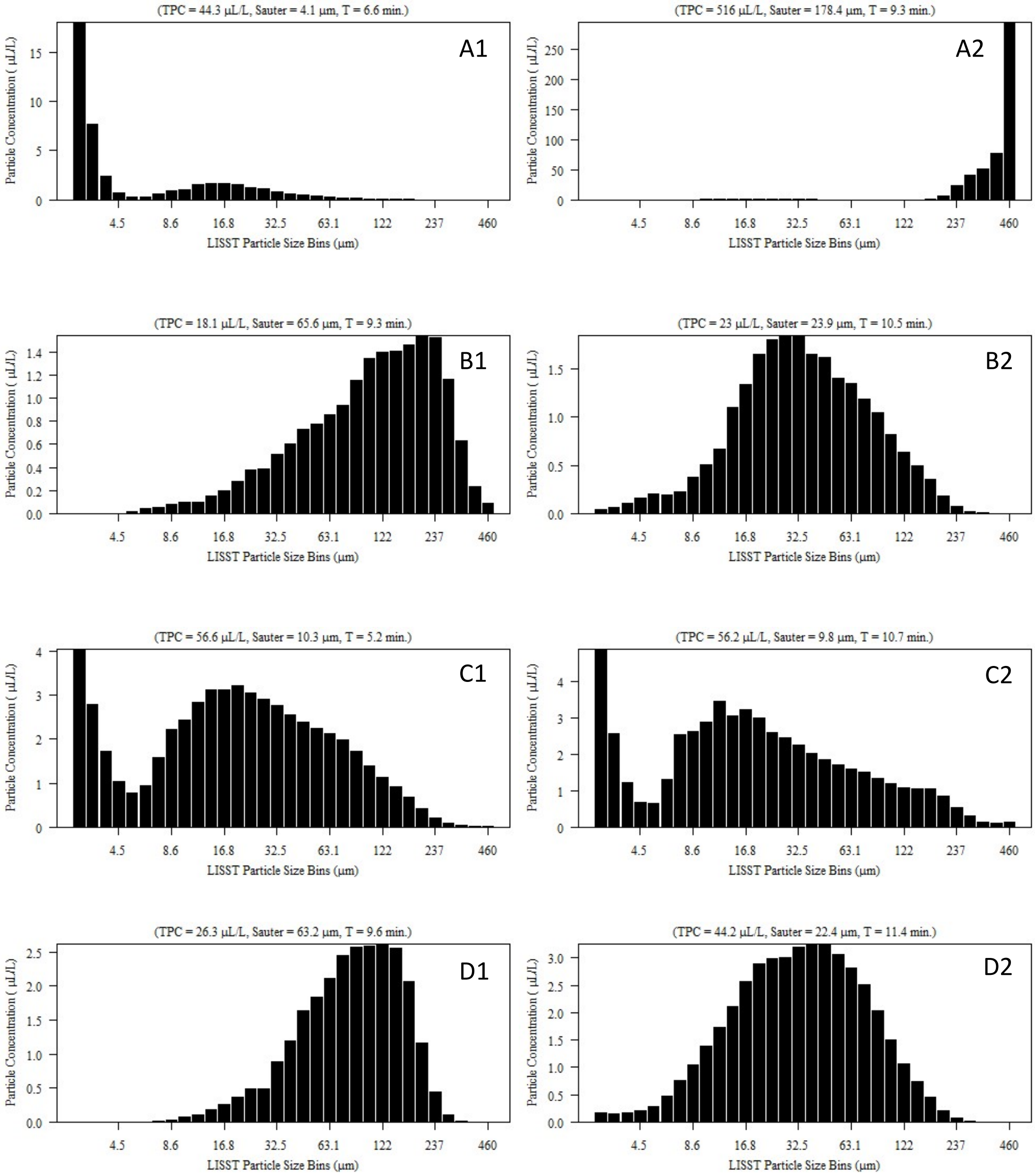

Figure S4. The plot represents the seasonal effect on particle size distribution data (LISST 100X-#2; 12 m from oil release) obtained at the time point of maximum total particle concentration during the chemically enhanced dispersion of four oils: A1) Heidrun-Spring, A2) Heidrun-Summer, B1) AWB-Spring, B2) AWB-Summer, C1) Synbit-Spring, C2) Synbit-Summer, D1) WCS-Spring, and D2) WCS-Summer. X-axis values represent the 32 logarithmically-spaced particle size bins generated by the LISST100X instrument.

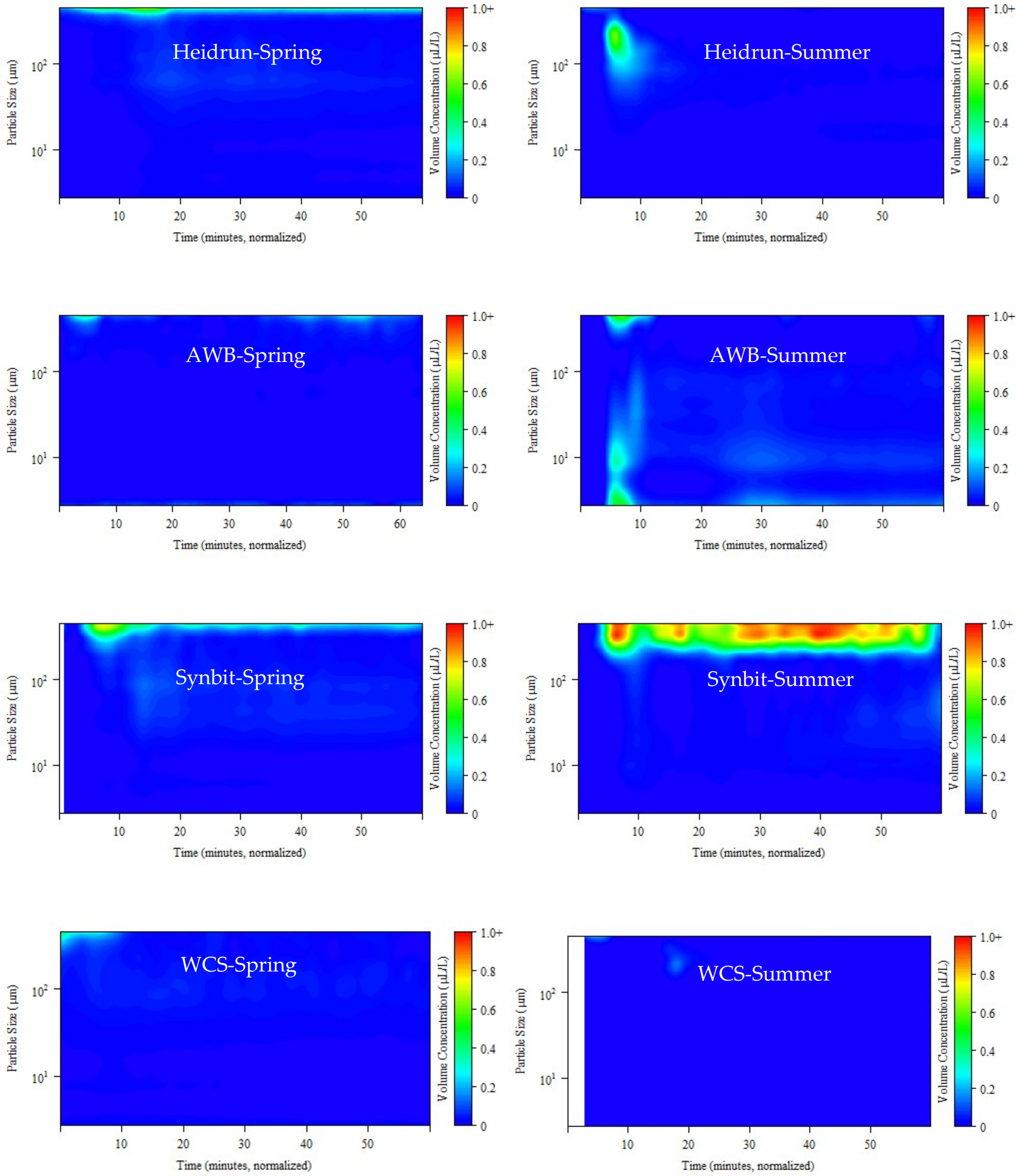

Figure S5. Contour plots (LISST 100X-#1 data, 1.2 m from oil release) illustrating seasonal effect on the concentration of oil particle sizes simulated in the wave tank for natural dispersion of four oil types.