

Table S1: Temperature and salinity measurements collected at cage moorings

site ¹	mean ² temperature	maximum temperature	mean salinity	maximum salinity
PSQ	11.2 ± 0.3	12.1	20.2 ± 2.9	26.1
HC	10.9 ± 0.6	11.8	27.6 ± 1.4	30.1
SA	11.0 ± 0.4	12.2	24.8 ± 0.8	27.6
PP	11.0 ± 0.6	13.6	26.7 ± 1.8	30.5
KC	10.9 ± 0.4	12.4	26.4 ± 1.6	29.9

¹Data absent from site SRB due to logger failure

²means ± s.e.m.

Table S2: Macroalgal spawning substrate and spawn density on natural spawn samples sampled in 2008.

site	dates of deposition/date sampled	spawn density ¹	predominant substrate
SA	20-22 Feb/27 Feb	light	<i>Fucus</i>
PP	20-22 Feb/29 Feb	very light-light	mixed, <i>Gracilaria</i> , <i>Fucus</i> , <i>Cryptopleura</i> , <i>Chondrocanthus</i> , <i>Ulva</i>
KC	20-22 Feb/28 Feb	very light-light	mixed, <i>Fucus</i> , <i>Cryptopleura</i> , <i>Chondrocanthus</i> , <i>Gracilaria</i> , <i>Ulva</i>
SRB	17-19 Feb/26 Feb	medium	<i>Fucus</i>

¹Spawn density refers to layers of eggs with light a single layer and medium 3-4 layers
Oiled sites = SA, PP and KC, Non-oiled sites = SRB.

Table S3: Levels of PACs and POPs in adult herring and POPs in natural spawn embryos from San Francisco Bay compared to Puget Sound, WA^{1,5}

Tissue	Region ²	Site ³	Year	Sum PACs ⁴	Sum DDTs	Sum PCBs
Whole body	SF	Richardson Bay (6)	2008	47 ± 11	33 ± 4	12 ± 1
	PS	Port Orchard (56)	1999-2004	NA	19	160
	PS	Quartermaster Harbor (10)	1999-2004	NA	19	120
	PS	Cherry Point (20)	1999-2004	NA	11	41
Ovary	SF	Richardson Bay (6)	2008	12 ± 0.6	2.8 ± 0.3	1.6 ± 0.4
natural spawn	SF	SRB (1)	2008		ND	3.0
		SA (1)	2008		ND	3.9
		KC (2)	2008		ND	1.8 ± 0.5
		PP (2)	2008		ND	2.4 ± 0.2

¹Mean (± s.e.m.) concentration (ng/g, wet weight)

²SF, San Francisco Bay; PS, Puget Sound

³(*n*)

⁴Natural spawn PACs provided in main text Table 3.

⁵Puget Sound data from reference 20.

ND= not determined.

Table S4: Diagnostic PAC ratios for PEMD samples.

Site (description)	MP/P (diagnosis)	FL+PY/C24P (diagnosis)
KC (heavily oiled/residential)	2.6 (petrogenic)	2.1 (least pyrogenic)
PP (lightly oiled/residential)	1.5 (petrogenic/pyrogenic)	2.7 (less pyrogenic)
PSQ (non-oiled/ developed)	1.9 (petrogenic/pyrogenic)	2.9 (intermediate pyrogenic)
SRB (non-oiled/ developed)	1.9 (petrogenic/pyrogenic)	3.0 (intermediate pyrogenic)
HC (oiled/ marina)	1.1 (petrogenic/pyrogenic)	4.2 (high pyrogenic)
SA (oiled marina)	1.0 (petrogenic/pyrogenic)	4.7 (high pyrogenic)

MP/P is the ratio of the sum of alkyl-phenanthrenes to parent non-alkylated phenanthrene; Fl + Py/C24P is the ratio of fluoranthene + pyrene to sum C2- through C4-phenanthrenes.



Figure S1. Detailed satellite images of sampling sites. Blue markers indicate location of natural spawn sample collections. Green markers indicate location of mooring sites for caged embryos, those with a black diamond indicate cages associated with PEMDs. (A) Horseshoe Cove, (B) Sausalito, (C) Peninsula Point, (D) Keil Cove, (E) Point San Quentin, (F) San Rafael Bay.

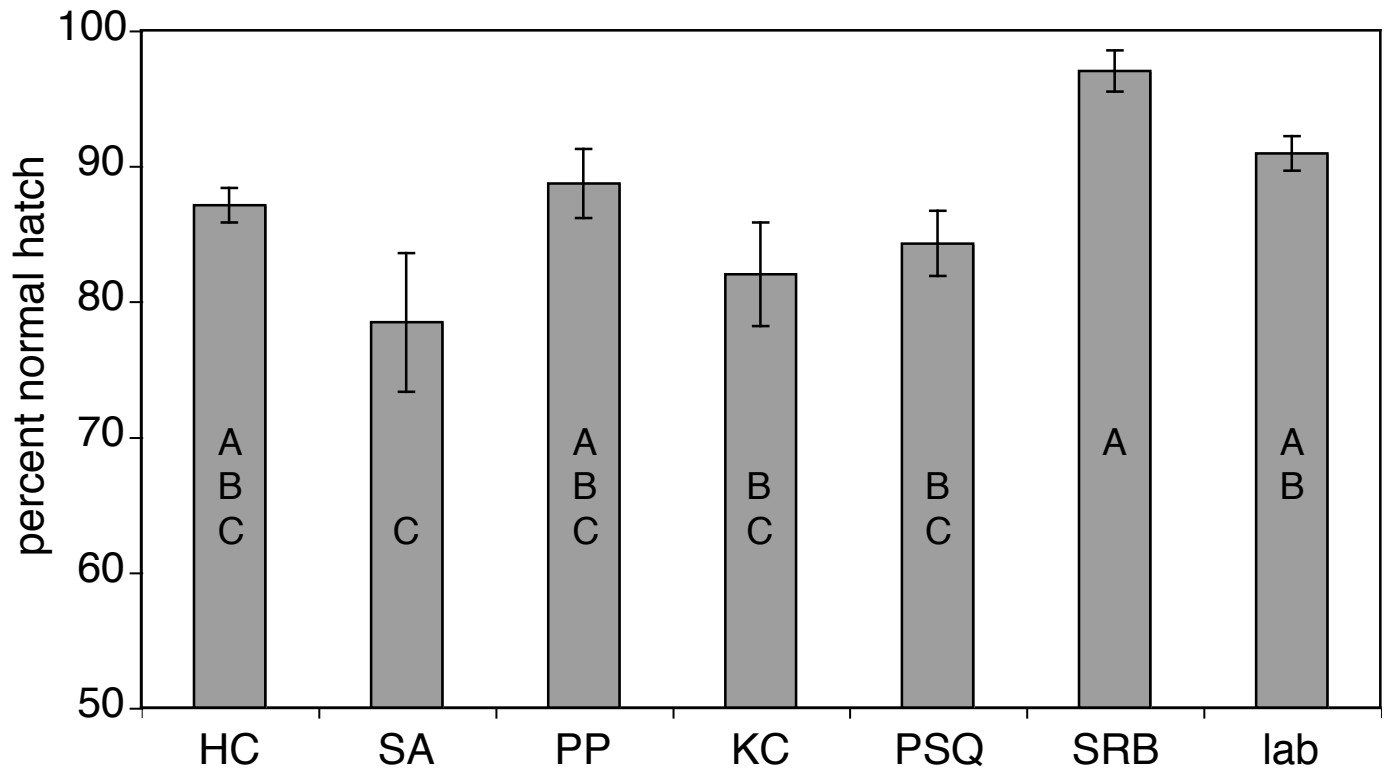


Figure S2: Hatching rates of larvae from caged eggs. Values represent mean \pm s.e.m. normal hatch rates, calculated as percent morphologically normal larvae (all abnormality types pooled) hatched from total eggs in 5 cages per site, except for sites SRB and PP ($N = 4$). The laboratory sample is the mean from embryos held in a laboratory incubator that were from fertilizations used in the 6 different cage deployments. Grand totals of eggs assessed for each site were 539 (HC), 351 (SA), 232 (PP), 484 (KC), 308 (PSQ), 252 (SRB), 622 (laboratory). Oiled sites are HC, SA, PP, KC; reference sites PSQ, SRB. A nested ANOVA showed an effect of site ($P < 0.01$) and oiled state ($P < 0.01$). Letters indicate statistically different groups identified in post-hoc means comparisons with the Tukey-Kramer HSD test.

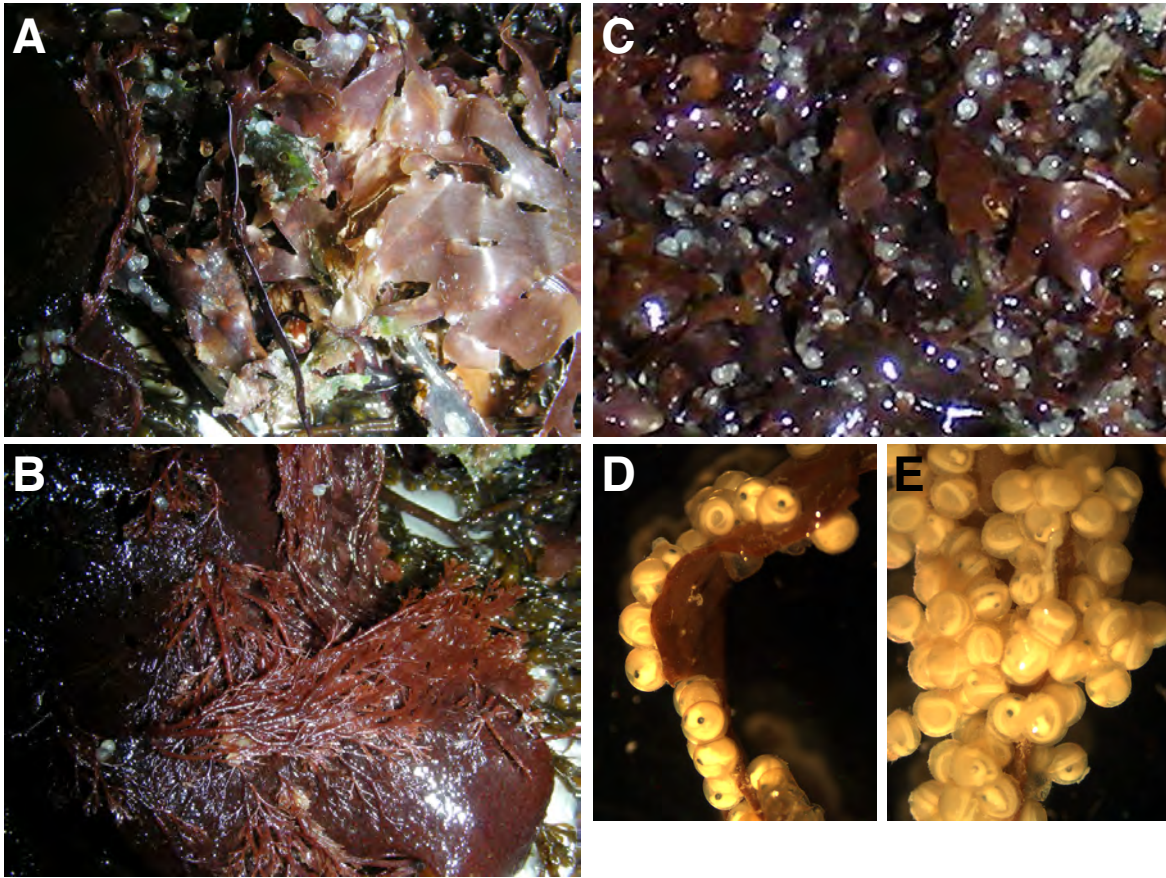
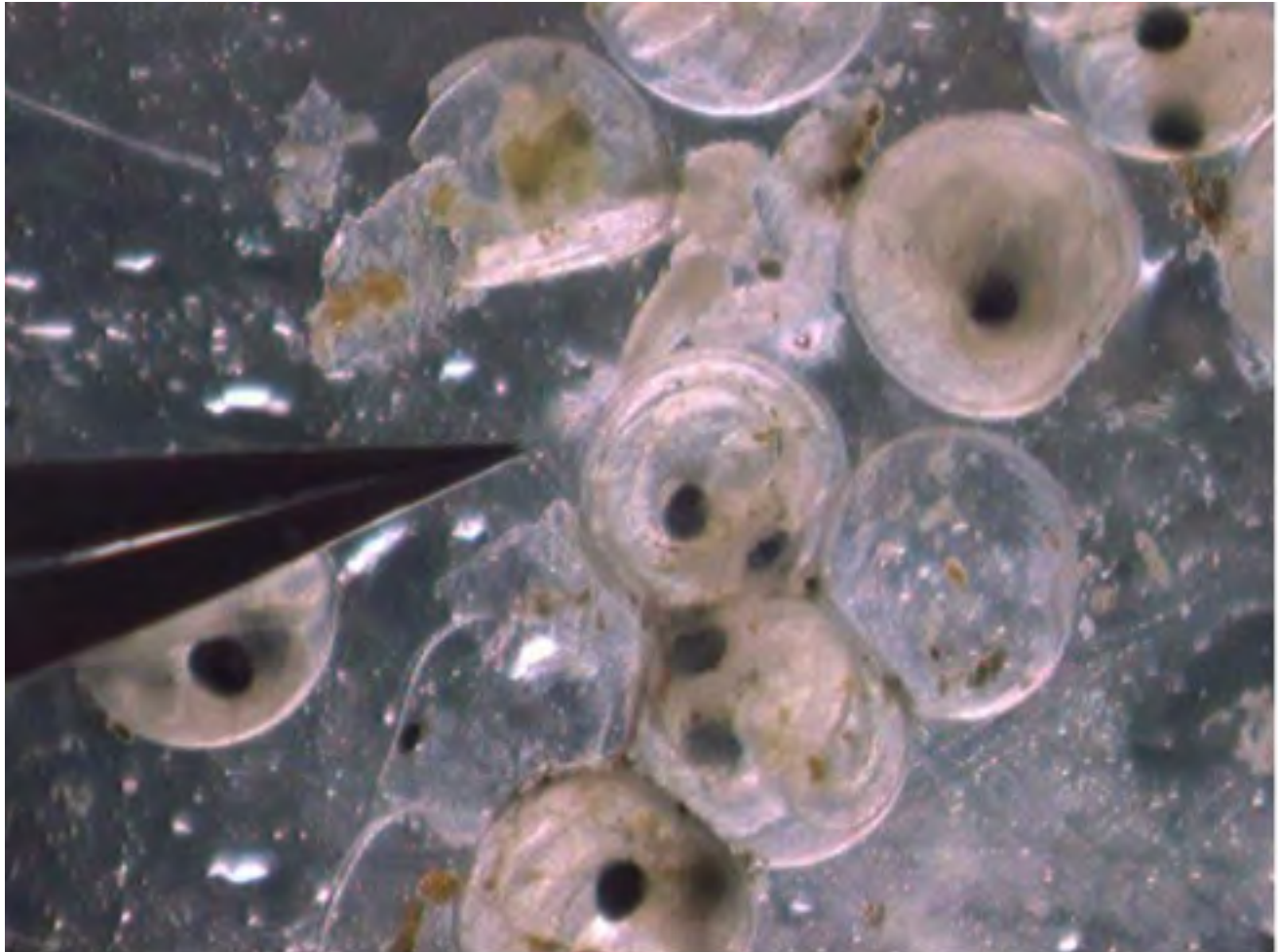


Figure S3. Representative natural spawn samples on macroalgal substrates. (A) and (B) mixed algae typical of Peninsula Point and Keil Cove. (C) Close-up of fresh natural spawn sample from Peninsula Point with "salt-and-pepper" density. (D) Light single-layer spawn sample from Keil Cove fixed in Stockard's. (E) Medium density spawn from San Rafael Bay fixed in Stockard's, up to four embryos deep at points.



Movie S1. Immotility of naturally spawned embryos from oiled site sampled in 2008 and normal motility in 2010 repeat samples from the same location. Three video segments first show (A) immotile and opaque embryos within the chorions from oiled site PP in 2008, (B) uncoiled, dechorionated embryos showing lack of touch response, and (C) viable embryos with normal motility within the chorions from site PP in 2010.