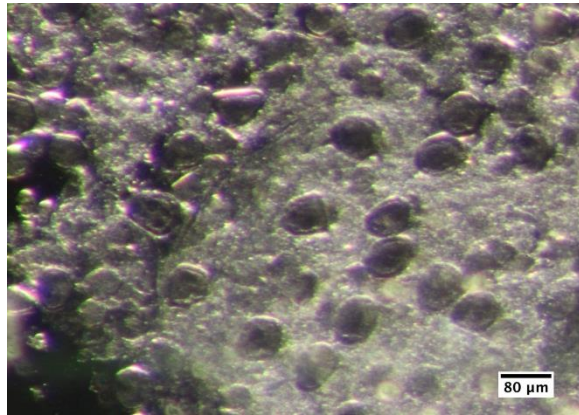
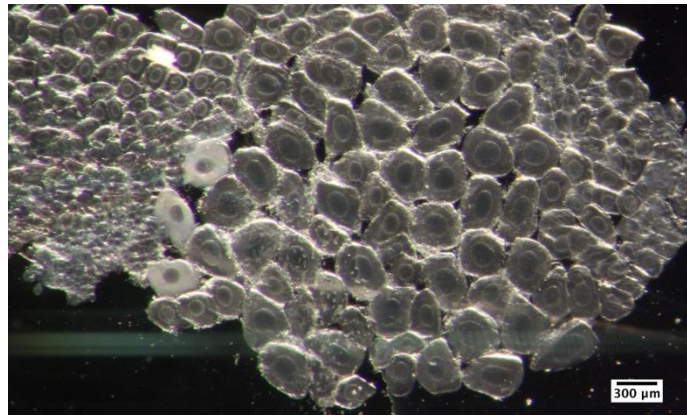


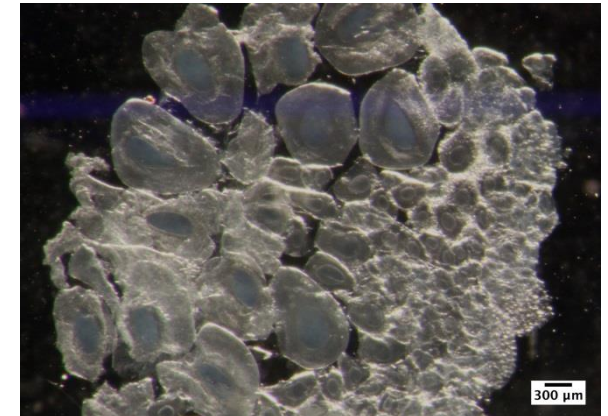
## Supplementary Information



**a. Oogenesis**



**b. Late Previtellogenesis / Early Vitellogenesis**



**c. Vitellogenesis**

**Supplementary Figure 1.** Examples of ovary stages observed in *Euphausia superba*. Ovary stages shown are (a) stage 2, oogenesis (b) stage 4.5, late previtellogenesis/early previtellogenesis and (c) stage 6, vitellogenesis.

**Supplementary Table 1.** Maturity scores (range and mean) for *Euphausia superba* from each CO<sub>2</sub> treatment, sampled during weeks 39, 41, 43 and 46 (October – December 2016). See Supplementary Table 5 for maturity staging key. For each of the 400, 1000, 1500 and 2000  $\mu\text{atm } p\text{CO}_2$  treatments n = 5, and for the 4000  $\mu\text{atm } p\text{CO}_2$  treatment n = 3.

Treatment ( $\mu\text{atm } p\text{CO}_2$ )	Week 39		Week 41		Week 43		Week 46	
	Range	Mean	Range	Mean	Range	Mean	Range	Mean
400	1 – 2	1.6	1 – 2	1.4	1 – 2	1.6	2 – 3	2.2
1000	1 – 2	1.4	1 – 2	1.4	1 – 2	1.4	2	2.0
1500	1 – 2	1.2	1 – 2	1.4	1 – 2	1.6	1 – 2	1.8
2000	1 – 2	1.4	1 – 2	1.4	1 – 2	1.6	1 – 2	1.8
4000	1	1.0	1	1.0	1	1.0	1 – 2	1.5

**Supplementary Table 2.** Measured  $\text{pH}_{\text{NIST}}$  (mean  $\pm$  SD),  $\text{pH}_{\text{total}}$  (mean),  $p\text{CO}_2$  (mean), seawater temperature (mean  $\pm$  SD), alkalinity (mean  $\pm$  SD), dissolved inorganic carbon (mean  $\pm$  SD), salinity (mean  $\pm$  SD), and calcite ( $\Omega_{\text{C}}$ ) and aragonite ( $\Omega_{\text{A}}$ ) saturation of seawater in each  $p\text{CO}_2$  treatment during the 46-week experimental period (January – December 2016). Values with an asterisk were calculated using  $\text{CO}_2\text{SYS}^1$ .

<b>Treatment</b>	<b><math>\text{pH}_{\text{NIST}}</math></b> (measured)	<b><math>\text{pH}_{\text{total}}^*</math></b> (mol/kg SW)	<b><math>p\text{CO}_2^*</math></b> ( $\mu\text{atm}$ )	<b>Temp</b> ( $^{\circ}\text{C}$ )	<b>Alkalinity (<math>A_{\text{T}}</math>)</b> ( $\mu\text{mol/kg SW}$ )	<b>DIC</b> ( $\mu\text{mol/kg SW}$ )	<b>Salinity</b> (PSU)	<b><math>\Omega_{\text{C}}^*</math></b>	<b><math>\Omega_{\text{A}}^*</math></b>
400	8.12 ( $\pm$ 0.05)	8.07	392	0.5 ( $\pm$ 0.2)	2456 ( $\pm$ 61)	2320 ( $\pm$ 52)		2.55	1.60
1000	7.79 ( $\pm$ 0.07)	7.73	898	0.5 ( $\pm$ 0.2)	2456 ( $\pm$ 61)	2432 ( $\pm$ 69)		1.25	0.79
1500	7.61 ( $\pm$ 0.06)	7.54	1430	0.5 ( $\pm$ 0.2)	2455 ( $\pm$ 62)	2491 ( $\pm$ 62)	35.3	0.82	0.51
2000	7.48 ( $\pm$ 0.07)	7.44	1831	0.5 ( $\pm$ 0.2)	2466 ( $\pm$ 69)	2537 ( $\pm$ 80)	( $\pm$ 0.6)	0.65	0.41
4000	7.09 ( $\pm$ 0.08)	7.09	4123	0.5 ( $\pm$ 0.2)	2456 ( $\pm$ 60)	2690 ( $\pm$ 126)		0.30	0.19

**Supplementary Table 3.** Light regime used during each month of the one-year ocean acidification experiment on adult *Euphausia superba*. Experimental weeks corresponding to each month are also shown in brackets.

<b>Experimental Month</b>	<b>Time lights on</b>	<b>Time lights off</b>	<b>Maximum Lux</b>
January (Week 1)	03:30	20:30	82
February (Weeks 2 – 5)	24 hr daylight	-	100
March (Weeks 6 – 9)	03:30	20:30	82
April (Weeks 10 – 14)	05:30	18:30	64
May (Weeks 15 – 18)	06:00	18:00	45
June (Weeks 19 – 22)	07:30	16:30	27
July (Weeks 23 – 27)	09:30	14:30	9
August (Weeks 28 – 31)	24 hr darkness	-	0
September (Weeks 32 – 36)	09:30	14:30	9
October (Weeks 37 – 40)	07:30	16:30	27
November (Weeks 41 – 44)	06:00	18:00	45
December (Weeks 45 – 46)	05:30	18:30	64

**Supplementary Table 4.** Sample sizes (n) for *Euphausia superba* (a) total length data and (b) triacylglycerol data for each  $p\text{CO}_2$  treatment and experimental week.

$p\text{CO}_2$ Treatment	Week 1	Week 2	Week 4	Week 5	Week 26	Week 39	Week 41	Week 43	Week 46
<b>(a) Total Length</b>									
400 $\mu\text{atm}$	4	4	4	5	4	10	9	9	5
1000 $\mu\text{atm}$	6	4	6	6	5	9	10	10	5
1500 $\mu\text{atm}$	4	5	5	7	4	9	9	9	5
2000 $\mu\text{atm}$	4	5	6	5	4	9	9	9	5
4000 $\mu\text{atm}$	4	4	5	4	5	6	6	6	2
<b>(b) Triacylglycerol</b>									
400 $\mu\text{atm}$	4	4	4	4	4	5	4	5	n/a
1000 $\mu\text{atm}$	5	4	4	5	5	4	5	5	n/a
1500 $\mu\text{atm}$	4	5	4	5	4	4	4	4	n/a
2000 $\mu\text{atm}$	4	5	5	5	4	4	4	4	n/a
4000 $\mu\text{atm}$	4	4	5	4	5	3	3	3	n/a

**Supplementary Table 5.** Maturity stages of subadult and adult *Euphausia superba* and their associated maturity scores. Modified from Seigel<sup>2</sup>.

<b>Maturity Stage</b>	<b>Description</b>	<b>Maturity Score</b>
<b>Male</b>		
IIA3	subadult male – petasma is two lobed, wing present	1
IIIA	adult male – petasma fully developed	2
<b>Female</b>		
IIB	subadult female – developing thelycum present, colour is feeble or absent	1
IIIA	adult female – thelycum fully developed, red in colour, no spermatophores present, body not swollen	2
IIID	gravid female – thorax and first and second abdominal segment swollen by enlarged ovary	3

**Supplementary Table 6.** Ovary phases and stages of *Euphausia superba* determined from their cell type, cell size ( $\mu\text{m}$ ) and squash appearance. Modified from tables and keys in Cuzin-Roudy & Amsler<sup>3</sup>.

<b>Cell Type</b>	<b>Cell Size (<math>\mu\text{m}</math>)</b>	<b>Squash appearance</b>	<b>Physiological Phase</b>	<b>Ovary Stage</b>
yoc	50 - 150	clear	Oogenesis	2
oc1	150 - 200	translucent	Previtellogenesis	3
	200 - 450	translucent	Previtellogenesis	4
oc2	250 - 450	cloudy and whitish	Early Vitellogenesis	5
oc3	over 450	granular and whitish	Vitellogenesis	6

## Supplementary References

1. Pierrot D., Lewis E. & Wallace, D. W. R. MS Excel program developed for CO<sub>2</sub> system calculations. Carbon Dioxide Information Analysis Center, Oak Ridge, 10.3334/CDIAC/otg.CO2SYS\_XLS\_CDIAC105a (2006).
2. Siegel, V. Introducing Antarctic Krill *Euphausia superba* Dana, 1850 in *Biology and Ecology of Antarctic Krill. Advances in Polar Ecology* (ed. Siegel, V.) 1–19 (Springer International Publishing, 2016).
3. Cuzin-Roudy, J. & Amsler, M. O. Ovarian development and sexual maturity staging in Antarctic krill *Euphausia superba* Dana (Euphausiacea). *J Crustac Biol.* **11**, 236–249 (1991)