Table S1: Statistical tests corresponding to Fig. 1. Linear mixed effects models (LMM) and generalized linear mixed effects models (GLMM) testing for pCO_2 effects on pre-flexion growth standard length, dry mass, yolk depletion, and feeding activity of larval Pacific herring (*Clupea pallasii*). Bolded *p* values indicate where the intercept or slope of elevated pCO_2 treatments differed significantly from the ambient pCO_2 group (intermediate treatment is abbreviated as inter.).

Standard Length (LMM)					
Factor	**Estimate**	**Std. Error**	**df**	**t value**	***p* value**
Intercept	7.670	0.090	528.18	85.049	<0.001
Inter. pCO_2	-0.258	0.128	528.13	-2.022	**0.044**
High pCO_2	-0.193	0.130	528.12	-1.482	0.139
Age	0.304	0.015	11.87	20.644	<0.001
Age × Inter. pCO_2	-0.014	0.021	11.98	-0.677	0.512
Age × High pCO_2	0.009	0.021	12.19	0.432	0.673

Log[Dry mass] (LMM)					
Factor	**Estimate**	**Std. Error**	**df**	**t value**	***p* value**
Intercept	-2.718	0.049	5.92	-55.438	<0.001
Inter. pCO_2	-0.066	0.070	6.10	-0.950	0.378
High pCO_2	0.001	0.070	6.21	0.009	0.993
Age	0.083	0.008	6.02	10.296	<0.001
Age × Inter. pCO_2	-0.008	0.011	6.09	-0.693	0.514
Age × High pCO_2	0.001	0.011	6.11	0.087	0.934

Yolk sac depletion status (GLMM)				
Factor	**Estimate**	**Std. Error**	**z value**	***p* value**
Intercept	6.322	1.663	3.8.02	<0.001
Inter. pCO_2	-2.094	1.885	-1.111	0.267
High pCO_2	-2.279	1.877	-1.214	0.225
Age	-2.123	0.538	-4.023	<0.001
Age × Inter. pCO_2	0.877	0.574	1.529	0.126
Age × High pCO_2	0.945	0.570	1.657	0.097

Feeding status (GLMM)				
Factor	**Estimate**	**Std. Error**	**z value**	***p* value**
Intercept	-0.325	0.652	-0.499	0.618
Inter. pCO_2	0.232	0.846	0.274	0.784
High pCO_2	-1.050	0.967	-1.086	0.278
Age	0.323	0.099	3.277	<0.001
Age × Inter. pCO_2	-0.166	0.115	-1.435	0.151
Age × High pCO_2	0.145	0.157	0.920	0.358

Table S2: Statistical tests for long-term growth traits of juvenile Pacific herring (*Clupea pallasii*). Statistical tests corresponding to Fig. 2. Results of linear mixed effect models (LMMs) testing for pCO_2 effects on long-term growth (1-98 DPH) for standard length and log transformed dry mass, and a generalized additive model testing for pCO_2 effects on the length to mass relationship. Bolded p values indicate where the intercept or slope of elevated pCO_2 treatments differed significantly from the control group (intermediate treatment is abbreviated as inter.).

Standard Length (LMM)					
Factor	**Estimate**	**Std. Error**	**df**	**t value**	***p* value**
Intercept	6.781	0.289	6.037	23.454	<0.001
Inter. pCO_2	-0.406	0.410	6.075	-0.992	0.359
High pCO_2	0.397	0.411	6.148	0.968	0.370
Age	0.381	0.016	5.666	24.257	<0.001
Age × Inter. pCO_2	0.014	0.022	5.669	0.646	0.544
Age × High pCO_2	-0.023	0.022	5.674	-1.021	0.349
Log[Dry Mass] (LMM)					
Factor	**Estimate**	**Std. Error**	**df**	**t value**	***p* value**
Intercept	-2.635	0.036	6.833	-73.056	<0.001
Inter. pCO_2	-0.121	0.051	7.015	-2.364	**0.049**
High pCO_2	0.079	0.052	7.111	1.542	0.166
Age	0.088	0.002	6.777	46.970	<0.001
Age × Inter. pCO_2	0.003	0.003	6.793	0.984	0.359
Age × High pCO_2	-0.004	0.003	6.802	-1.567	0.162
Length to mass relationship (Generalized additive model)					
Factor	**Estimate**	**Std. Error**	**t value**	***p* value**	
Intercept	-2.273	1.363	-1.667	0.097	
Inter. pCO_2	-0.017	0.098	-0.169	0.866	
High pCO_2	-0.024	0.102	-0.232	0.817	

Table S3: Analysis of variance **(**ANOVA) results testing pCO_2 effects on long-term survival (1 – 98 DPH) and mixed-effect ANOVA testing maximum swim speed (N = 45) of Pacific herring (*Clupea pallasii*) corresponding to Fig. 3. Bolded *p* values indicate significant effects of pCO_2 treatment or a tested covariate (intermediate treatment is abbreviated as inter.). Numerator and denominator degrees of freedom are abbreviated as NumDF and DenDF, respectively.

Long term survival 1-98 DPH (ANOVA)					
Factor	**df**	**Sum Sq**	**Mean Sq**	**F value**	***p* value**
pCO_2	2	0.023	0.011	0.36	0.712
Residuals	6	0.193	0.32		

Maximum Swim Speed (mixed-effect ANOVA)						
Factor	**Sum Sq**	**Mean Sq**	**NumDF**	**DenDF**	**F value**	***p* value**
pCO_2	809.8	404.9	2	37	2.048	0.143
Standard length	351.0	351.0	1	37	1.776	0.191
Condition factor	36.3	36.3	1	37	0.184	0.671
Age (days)	206.8	206.8	1	37	1.046	0.313
Hour of Day	354.2	354.2	1	37	1.792	0.189
Temperature	49.0	49.0	1	37	0.248	0.621

Table S4: Statistical results corresponding to Fig. 5. Analysis of variance (ANOVA) was used to test for pCO_2 effects on the ratio (logit transformed) of Pacific herring (*Clupea pallasii*) survivors and mortalities that were infected with viral hemorrhagic septicemia virus (VHSV). Bolded *p* values indicate a significant effect pCO_2 treatment.

VHSV Positive Mortalities (ANOVA)					
Factor	**DF**	**Sum sq**	**Mean sq**	**F value**	***p* value**
pCO_2	2	0.069	0.034	0.064	0.939
Residuals	6	3.255	0.542		
VHSV Positive Survivors (ANOVA)					
Factor	**DF**	**Sum sq**	**Mean sq**	**F value**	***p* value**
pCO_2	2	0.300	0.150	0.500	0.630
Residuals	6	1.797	0.300		

Table S5: Statistical results corresponding to Fig. 6. Mixed-effect analysis of variance (ANOVA) was used to test for pCO$_2$ effects on the standard length (SL), wet mass (WM), and condition factor (k) of Pacific herring (*Clupea pallasii*) mortalities and survivors that were exposed to viral hemorrhagic septicemia (VHS). NumDF and DenDF stand for numerator and denominator degrees of freedom, respectively. Bolded p values indicate a significant effect pCO$_2$ treatment.

VHS Mortalities (mixed-effect ANOVA)							
Trait	**Factor**	**Sum Sq**	**Mean Sq**	**Numdf**	**DenDF**	**F value**	***p* value**
SL (mm)	pCO$_2$	613	307	2	5.4	9.005	**0.019**
WM (g)	pCO$_2$	4.5	2.3	2	252	13.037	**<0.001**
k	pCO$_2$	0.013	0.007	2	4.6	0.568	0.603
VHS Survivors (mixed-effect ANOVA)							
Trait	**Factor**	**Sum Sq**	**Mean Sq**	**Numdf**	**DenDF**	**F value**	***p* value**
SL (mm)	pCO$_2$	518	259	2	5.3	8.145	**0.024**
WM (g)	pCO$_2$	15.9	7.9	2	283	27.814	**<0.001**
k	pCO$_2$	0.306	0.153	2	5.7	13.385	**0.007**

Table S6: Results of Cox regression analysis assessing the impact of pCO$_2$ rearing treatment on the survival of juvenile Pacific herring (*Clupea pallasii*) exposed to viral hemorrhagic septicemia virus with residual standard length (SL) and condition factor (k) as covariates. Data from the negative control group are not tested in this model. Two models are presented with ambient and intermediate pCO$_2$ (abbreviated as inter.) as references treatments to test all treatment comparisons. Model outputs include factorial change to hazard ratio (HR) relative to the reference level. HRs are presented as 95% confidence intervals (CIs) and effects that reached statistical significance are indicated by bolded p values.

| *Ambient pCO$_2$ as reference treatment*				
Factor	**HR**	**HR 95% CI**	**z**	***p* value**
Ambient vs Inter. pCO$_2$	0.84	0.61–1.15	-1.105	0.269
Ambient vs High pCO$_2$	1.48	1.09–1.203	2.477	**0.013**
Residual SL	1.00	0.98–1.02	0.160	0.873
k	2.18	0.90–5.28	1.716	0.086
Intermediate pCO$_2$ as reference treatment				
Inter. vs Ambient pCO$_2$	1.19	0.87–1.64	1.105	0.269
Inter. vs. High pCO$_2$	1.77	1.27–2.46	3.391	**<0.001**
Residual SL	1.00	0.98–1.02	0.160	0.873
k	2.18	0.90–5.28	1.716	0.086
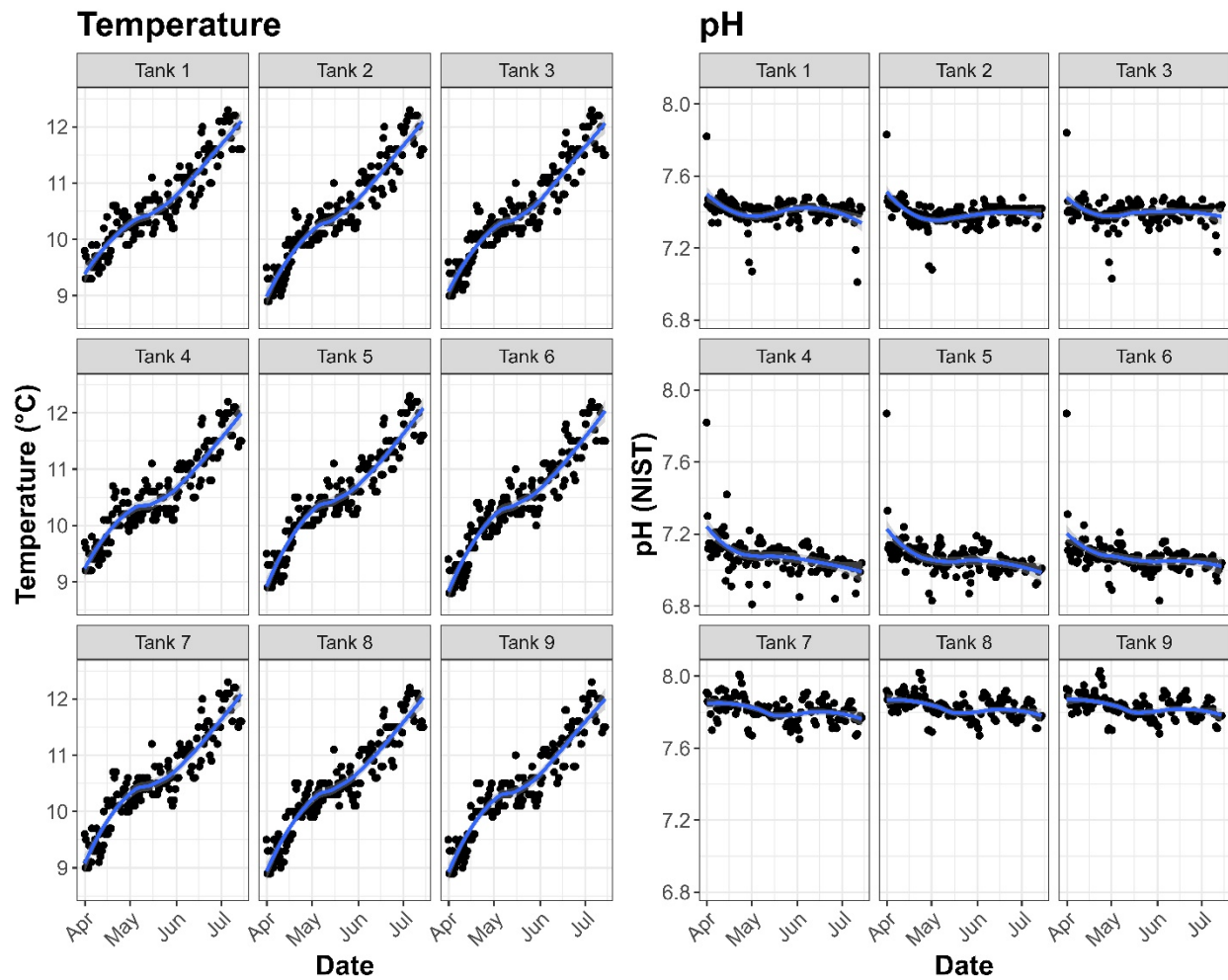
Fig. S1: Daily temperature (°C) and pH$_{NIST}$ daily recordings for nine replicate rearing tanks. Individual measurements (black points) are fit with a LOESS smoother (blue line). Tanks 1-3 are intermediate pCO$_2$, tank 4-6 are high pCO$_2$, and tanks 7-9 are ambient pCO$_2$.
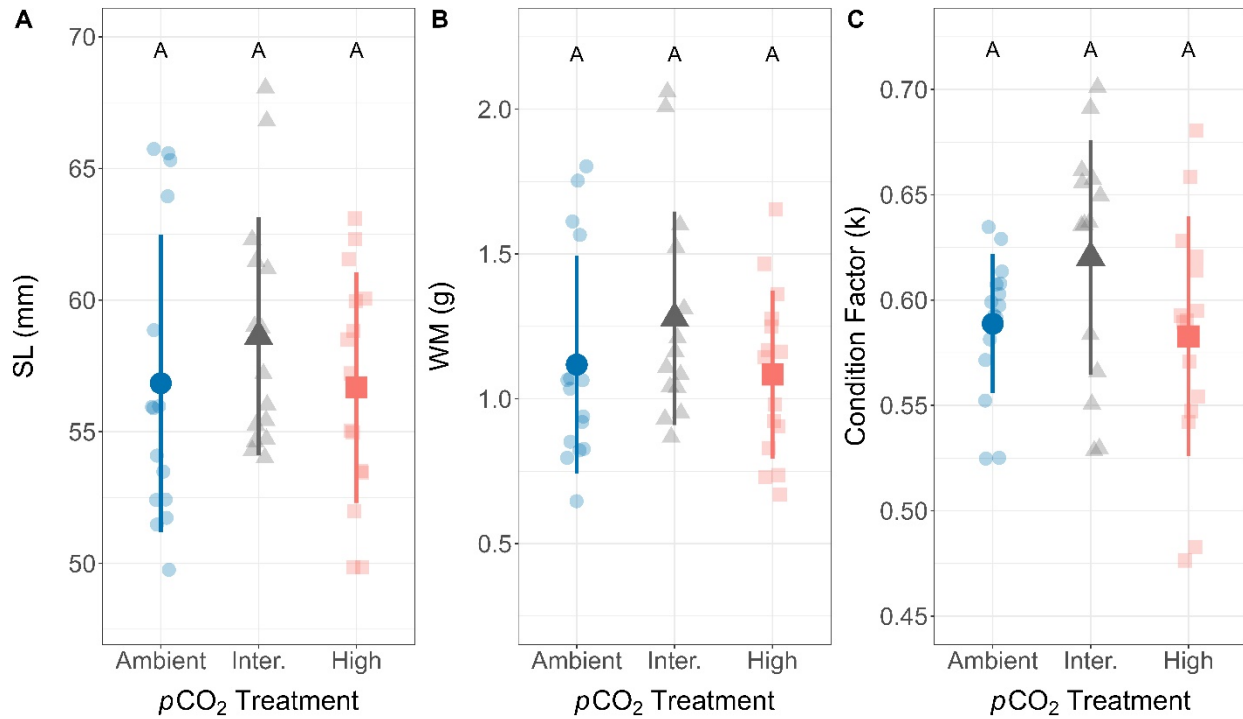
Fig. S2: Morphometric traits of juvenile Pacific herring (*Clupea pallasii*) that performed in maximum swim speed trails. (A) Standard length (SL), (B) wet mass (WM), and (C) condition factor (k). Large circles denote treatment means and vertical lines indicate ± standard deviation. Small circles show measurements of individual fish (N = 45). Results of pairwise comparison post hoc tests are shown as letters above bars, where differing letters indicate significant differences between treatment groups (Tukey's honest significant difference). However, analysis of variance showed pCO$_2$ treatment had no statistical effect on any trait (SL: p =0.829; WM: p = 0.669; k: p = 0.097). Intermediate pCO$_2$ is abbreviated as inter.