

Supplemental Table 1. Ocean Acidification and Reproduction studies cited in this review

Species	pH	Life Stage Exposed	Exposure Duration	Reproductive Stage	Key Findings	Study Type	Collection Location Marine Ecoregion	Reference
Cnidaria								
<i>Acropora palmata</i> (coral)	8.00*, 7.85, 7.72	Eggs & sperm	4 hours - a few minutes	Fertilization	Low pH reduced percent fertilization, exacerbated by decreases in sperm concentration but no effect pH on sperm velocity.	Laboratory	Tropical Atlantic	Albright (2011)
<i>Orbicella faveolata</i> (coral)	8.00*, 8.94, 7.88, 7.74	Eggs & sperm	7 hours - a few minutes	Fertilization	Low pH reduced percent fertilization, exacerbated by decreases in sperm concentration but no effect pH on sperm velocity.	Laboratory	Tropical Atlantic	Albright (2011)
<i>Acropora tenuis</i> (coral)	7.97*, 8.01, 7.78, 7.74	Eggs & sperm	3 hours	Fertilization	Low pH increased minimum sperm concentration required to obtain half of maximum fertilization vastly but no effect of pH on fertilization success.	Laboratory	Central Indo-Pacific	Albright et al. (2013)
<i>Balanophyllia europaea</i> (coral) [§]	8.10*, 7.9, 7.7	Adults	8 months	Gametogenesis and gamete quality; Fecundity and reproductive output	No effect of pH on distribution and morphology of female and male germ cell maturation stages, fertility, egg and spermary abundance, or gonadal index.	Field	Temperate Northern Atlantic	Caroselli et al. (2019)

<i>Acropora tenuis</i> (coral)	8.18*, 8.06	Eggs & sperm	2 hours	Fertilization	No effect of pH on fertilization rate.	Laboratory	Central Indo-Pacific	Chua et al. (2013)
<i>Acropora millepora</i> (coral)	8.12*, 8.18*, 8.06, 8.00	Eggs & sperm	2 hours	Fertilization	No effect of pH on fertilization rate.	Laboratory	Central Indo-Pacific	Chua et al. (2013)
<i>Oculina patagonica</i> (coral)	8.00 - 8.30*, 7.30 - 7.60	Adults	12 months	Gametogenesis and gamete quality	No effect of pH on gametogenesis.	Laboratory	Temperate Northern Atlantic	Fine et al. (2007)
<i>Madracis pharensis</i> (coral)	8.00 - 8.30*, 7.30 - 7.60	Adults	12 months	Gametogenesis and gamete quality	No effect of pH on gametogenesis.	Laboratory	Temperate Northern Atlantic	Fine et al. (2007)
<i>Leptopsammia pruvoti</i> (coral) ^B	8.07*, 7.87 - 7.40	Adults	3 months	Gametogenesis and gamete quality; Fecundity and reproductive output	No effect of pH on distribution and morphology of female and male germ cell maturation stages, diameter of spermaries or eggs, egg and spermary abundance, fertility, or gonadal index.	Field	Temperate Northern Atlantic	Gizzi et al. (2017)
<i>Acropora digitifera</i> (coral)	7.94 - 7.99*, 7.64 - 7.68	Eggs & sperm	6 hours	Fertilization	No effect of pH on fertilization rate.	Laboratory	Temperate Northern Pacific	Iguchi et al. (2015)
<i>Pocillopora damicornis</i> (coral) ^B	ambie nt*, ambie nt + 365 µatm	Adults	6 months	Fecundity and reproductive output	No effect of pH on number of spawned bundles, number of eggs within spawned bundles, or total number of spawned eggs.	Mesocosm	Eastern Indo-Pacific	Jokiel et al. (2008)

<i>Montipora capitata</i> (coral)	ambient*, ambient + 365 μ atm	Adults	6 months	Fecundity and reproductive output	No effect of pH on number of spawned bundles, number of eggs within spawned bundles, or total number of spawned eggs.	Mesocosm	Eastern Indo-Pacific	Jokiel et al. (2008)
<i>Astroides calycularis</i> (coral) ^B	8.07*, 7.87 - 7.40	Adults	3 months	Gametogenesis and gamete quality; Fecundity and reproductive output	Low pH delayed spermary development and led to a persistence of mature oocytes in the fertilization period. No effect of pH on abundance, gonadal index, and diameters of eggs or spermaries. No embryos were found in colonies from the most acidic sites.	Field	Temperate Northern Atlantic	Marchini et al. (2021)
<i>Acropora digitifera</i> (coral)	8.00*, 7.77 - 6.55	Sperm	Not specified	Fertilization	Low pH reduced sperm motility.	Laboratory	Temperate Northern Pacific	Morita et al. (2010)
<i>Acropora digitifera</i> (coral)	8.05*, 8.17, 7.74	Sperm	3 minutes	Fertilization	Low pH reduced sperm motility.	Laboratory	Temperate Northern Pacific	Nakamura et al. (2012)
<i>Orbicella faveolata</i> (coral)	8.20*, 8.00	Eggs & sperm	3 hours	Fertilization	No effect of pH on fertilization success.	Laboratory	Tropical Atlantic	Pitts et al. (2020)
<i>Pocillopora damicornis</i> (coral) ^B	7.81 - 8.06*, 7.51 - 7.74	Adults	105 days	Timing of reproduction and synchronization	Low pH delayed release of planula during the peak month of planulation.	Mesocosm	Eastern Indo-Pacific	Putnam et al. (2020)

<i>Primnoa pacifica</i> (coral)	7.75*, 7.55	Adults	8 months	Gametogenesis and gamete quality; Fecundity and reproductive output	Low pH reduced egg diameters and female fecundity but increased oosorption and advancement of spermatogenesis.	Laboratory	Temperate Northern Pacific	Rossin et al. (2019)
<i>Acropora hyacinthus</i> (coral)	8.15*, 7.85	Eggs & sperm	3 hours	Fertilization	No effect of pH on percent fertilization.	Laboratory	Temperate Northern Pacific	Schutter et al. (2015)
<i>Favites abdita</i> (coral)	8.15*, 7.85	Eggs & sperm	3 hours	Fertilization	No effect of pH on percent fertilization.	Laboratory	Temperate Northern Pacific	Schutter et al. (2015)
<i>Platygyra contorta</i> (coral)	8.15*, 7.85	Eggs & sperm	3 hours	Fertilization	No effect of pH on percent fertilization.	Laboratory	Temperate Northern Pacific	Schutter et al. (2015)
<i>Orbicella faveolata</i> (coral)	8.15*, 7.85	Eggs & sperm	3 hours	Fertilization	No effect of pH on percent fertilization.	Laboratory	Temperate Northern Pacific	Schutter et al. (2015)
<i>Acropora tenuis</i> (coral)	8.15*, 7.85	Eggs & sperm	3 hours	Fertilization	No effect of pH on percent fertilization.	Laboratory	Temperate Northern Pacific	Schutter et al. (2015)
<i>Acropora palmata</i> (coral)	8.15*, 7.85	Eggs & sperm	3 hours	Fertilization	No effect of pH on percent fertilization.	Laboratory	Temperate Northern Pacific	Schutter et al. (2015)

<i>Goniastrea edwardsi</i> (coral)	8.10*, 7.90, 7.70	Eggs & sperm	4 hours	Fertilization	Low pH reduced fertilization success.	Laboratory	Central Indo-Pacific	Striewski (2012)
<i>Orbicella faveolata</i> (coral)	8.10*, 7.90, 7.70	Eggs & sperm	4 hours	Fertilization	Low pH caused variation in hybridization success but no effect of pH on fertilization success.	Laboratory	Central Indo-Pacific	Striewski (2012)
<i>Orbicella annularis</i> (coral)	8.10*, 7.90, 7.70	Eggs & sperm	4 hours	Fertilization	Low pH caused variation in hybridization success.	Laboratory	Central Indo-Pacific	Striewski (2012)
Crustacea								
<i>Eurytemora affinis</i> (copepod) ^B	8.24- 8.02*, 8.02 - 7.52	Adults	7, 14, 21, and 48 weeks	Fecundity and reproductive output	No effect of pH on hatch rate.	Laboratory	Temperate Northern Atlantic	Almén (2016)
<i>Gammarus locusta</i> (amphipod) ^B	8.10*, 7.70	Adults	1 - 2 months	Mating Behavior	Low pH reduced long-distance mate tracking in males and mate guarding duration.	Laboratory	Temperate Northern Atlantic	Borges et al. (2018)
<i>Gammarus locusta</i> (amphipod) ^B	8.10*, 7.70	Adults	1 - 2 months	Fecundity and reproductive output	Low pH reduced egg production but no effect of pH on embryonic development.	Laboratory	Temperate Northern Atlantic	Borges et al. (2018)

<i>Tigriopus japonicus</i> (copepod) ^B	8.00*, 7.80 - 6.50	Adults	56 days	Fecundity and reproductive output	Low pH reduced hatching success at the lowest pH but there was no effect on the number of broods.	Laboratory	Central Indo-Pacific	Cao et al. (2015)
<i>Gammarus locusta</i> (amphipod) ^B	8.10*, 7.80	Adults	21 days	Fecundity and reproductive output	Low pH reduced hatch rate.	Laboratory	Temperate Northern Atlantic	Cardoso et al. (2016)
<i>Calanoida sp.</i> (copepod) ^B	7.50*, 7.10- 7.30	Adults	12 days	Fecundity and reproductive output	In situ low pH resulted in fewer eggs and reduced hatch rates.	Laboratory	Central Indo-Pacific	Choi et al. (2016)
<i>Paralithodes camtschaticus</i> (crab) ^B	8.00*, 7.70	Adults	49 days	Fecundity and reproductive output, Timing of reproduction and synchronization	Low pH extended hatching duration, but there was no effect on hatch success.	Laboratory	Temperate North Pacific	Christopher Long et al. (2013)
<i>Elasmopus rapax</i> (amphipod) ^B	8.00*, 7.50, 7.00	Adults	22 days	Gametogenesis and gamete quality	Unable to produce eggs in low pH conditions.	Laboratory	Temperate Northern Atlantic	Conradi et al. (2019)
<i>Cyathura carinata</i> (isopod) ^B	8.00*, 7.00, 6.50	Adults	32 days	Gametogenesis and gamete quality	Unable to produce eggs in low pH conditions.	Laboratory	Temperate Northern Atlantic	Conradi et al. (2019)
<i>Acartia tonsa</i> (copepod) ^B	8.20*, 7.92 - 7.15	From egg to adult	30 - 96 hours	Fecundity and reproductive output	Low pH reduced egg production and hatching success when both parents were exposed but no effect of pH on hatching success when only the mother is exposed.	Laboratory	Temperate Northern Atlantic	Cripps et al. (2014)

<i>Echinogammarus marinus</i> (amphipod) ^B	8.00*, 7.50	Eggs	18 days	Fecundity and reproductive output	Low pH increased embryonic development time but no effect of pH on hatch success.	Laboratory	Temperate Northern Atlantic	Egilsdottir et al. (2009)
<i>Acartia bifilosa</i> (copepod) ^B	7.87- 7.60*, 7.47 - 7.15	Adults	24 - 26 hours	Fecundity and reproductive output	Low pH increased egg production.	Laboratory	Temperate Northern Atlantic	Engström-Östa et a. (2014)
<i>Semibalanus balanoides</i> (barnacle) ^B	8.07*, 7.70	Adults	7, 24, 42, 56, 70, 91, and 104 days	Fecundity and reproductive output	Low pH reduced hatching time.	Laboratory	Temperate Northern Atlantic	Findlay et al. (2009)
<i>Tisbe battagliai</i> (copepod) ^B	8.06 - 8.1*, 7.95 - 7.67	Adults	72 hours - 4 months	Gametogenesis and gamete quality; Fecundity and reproductive output	Low pH reduced spermatophore size and increased naupliar production, but no effect of pH on spermatophore attachment or female responses.	Laboratory	Temperate Northern Atlantic	Fitzer et al. (2012)
<i>Menippe mercenaria</i> (crab) ^B	8.00*, 7.50	Adults	12 days	Fecundity and reproductive output	Low pH reduced hatching success.	Laboratory	Tropical Atlantic	Gravinese (2018)
<i>Acartia grani</i> (copepod) ^B	8.17*, 7.96, 7.75	Adults	3 days	Fecundity and reproductive output	No effect of pH on egg production or egg hatching success.	Laboratory	Temperate Northern Atlantic	Isari et al. (2016)
<i>Tigriopus japonicus</i> (copepod) ^B	8.04*, 6.26 - 5.74	Adults	20 days	Fecundity and reproductive output; Sex determination, differentiation, and ratio; Timing of reproduction and synchronization	Extreme low pH reduced hatching success, but there was no effect on sex ratio, timing of mating, or spawning.	Laboratory	Temperate North Pacific	Kita et al. (2013)

<i>Acartia tsuensis</i> (copepod) ^B	8.23*, 7.31	Adults	9 days	Fecundity and reproductive output	No effect of pH on egg production and hatching rate.	Laboratory	Temperate Northern Pacific	Kurihara and Ishimatsu (2008)
<i>Acartia steueri</i> (copepod) ^B	8.14*, 7.40, 6.84	Adults	8 days	Fecundity and reproductive output	Low pH decreased egg production.	Laboratory	Temperate Northern Pacific	Kurihara et al. (2004)
<i>Acartia erythraea</i> (copepod) ^B	8.20*, 7.02, 6.86	Adults	8 days	Fecundity and reproductive output	Low pH decreased hatching rate and increased egg production but no effect of pH on egg production.	Laboratory	Temperate Northern Pacific	Kurihara et al. (2004)
<i>Palaemon pacificus</i> (shrimp) ^B	8.17*, 7.89	Adults	30 days	Fecundity and reproductive output	Low pH reduced the number of females who bore eggs.	Laboratory	Temperate Northern Pacific	Kurihara et al. (2008)
<i>Acartia tonsa</i> (copepod) ^B	8.12- 8.06*, 7.87- 7.49	Adults	41 months	Fecundity and reproductive output; Timing of reproduction and synchronization	No effect of pH on egg production or hatching success. Low pH exposure resulted in earlier hatching in females.	Laboratory	Temperate Northern Atlantic	Langer et al. (2019)
<i>Tigriopus japonicus</i> (copepod) ^B	8.00*, 7.50, 7.30	Adults	7 days	Fecundity and reproductive output	Low pH reduced number of brooding individuals.	Laboratory	Central Indo-Pacific	Lee et al. (2019)
<i>Acartia ohtsukai</i> (copepod) ^B	7.90*, 7.60	Adults	5 days	Fecundity and reproductive output	Low pH affected egg production.	Laboratory	Temperate Northern Pacific	Lee et al. (2020)

<i>Calanus finmarchicus</i> (copepod) ^B	8.23*, 6.95	Adults	72 hours	Fecundity and reproductive output	Eggs remained unhatched at low pH but no effect of pH on egg production and disintegration.	Laboratory	Temperate Northern Atlantic	Mayor et al. (2007)
<i>Centropages typicus</i> and (copepod) ^B	8.04, 7.97*, 7.85 - 6.71	Adults	4 days	Fecundity and reproductive output	Extreme low pH reduced hatching rate and egg production.	Laboratory	Temperate Northern Atlantic	McConville et al. (2013)
<i>Temora longicornis</i> (copepod) ^B	8.04, 7.97*, 7.85 - 6.71	Adults	4 days	Fecundity and reproductive output	No effect of pH on hatching rate or egg production.	Laboratory	Temperate Northern Atlantic	McConville et al. (2013)
<i>Amphibalanus amphitrite</i> (barnacle) ^B	8.20*, 7.40	Adults	11 weeks	Timing of reproduction and synchronization	No effect of pH on egg onset time.	Laboratory	Temperate Northern Atlantic	McDonald et al. (2009)
<i>Chionoecetes bairdi</i> (crab) ^B	8.09*, 7.80, 7.50	Adults	2 years	Gametogenesis and gamete quality; Fecundity and reproductive output	Low pH increased dead hemocyte cells, and resulted in smaller egg clutches, and reduced egg viability.	Laboratory	Temperate Northern Pacific	Meseck et al. (2016)
<i>Cancer magister</i> (crab) ^B	8.00*, 7.50, 7.10	Adults	22 days	Fecundity and reproductive output	Low pH affected hatch time, but no effect of pH on egg hatching probability.	Laboratory	Temperate Northern Pacific	Miller et al. (2016)
<i>Balanus improvisus</i> (barnacle) ^B	8.10*, 7.50	Adults	5 days - 16 months	Gametogenesis and gamete quality; Fecundity and reproductive output	Failed to brood or release embryos in low pH but no effect of pH on gonad development.	Laboratory	Temperate Northern Atlantic	Pansch et al. (2018)

<i>Labidocera spp.</i> (copepod) ^B	8.00*, 7.80	Adults	10 days	Gametogenesis and gamete quality	No effect of pH on oocyte maturation.	Laboratory	Central Indo-Pacific	Smith et al. (2017)
<i>Chionoecetes bairdi</i> (crab) ^B	8.10*, 7.80, 7.50	Adults	2 years	Fecundity and reproductive output	Low pH reduced hatching success.	Laboratory	Temperate North Pacific	Swiney et al. (2016)
<i>Calanus glacialis</i> (copepod) ^B	8.00*, 7.50	Adults	7 days	Gametogenesis and gamete quality; Fecundity and reproductive output	No effect of pH on oogenesis or hatching success.	Laboratory	Temperate Northern Atlantic	Thor et al. (2018)
<i>Pseudocalanus acuspis</i> (copepod) ^B	8.05*, 7.75, 7.54	Adults	2 weeks	Fecundity and reproductive output	Low pH reduced fecundity.	Laboratory	Temperate Northern Atlantic	Thor and Dupont (2014)
<i>Acartia bifilosa</i> (copepod)	267 - 565 µatm* , 867 - 1525 µatm	Adults	45 days	Fecundity and reproductive output	Low pH affected hatch success but no effect of low pH on egg production.	Laboratory	Temperate Northern Atlantic	Vehmaa et al. (2016)
<i>Acartia sp.</i> (copepod) ^B	8.30 - 7.65*, 7.60 - 7.31	Adults	5 days	Fecundity and reproductive output	Low pH reduced hatch rate and egg production	Laboratory	Temperate Northern Atlantic	Vehmaa et al. (2012)
<i>Acartia bifilosa</i> (copepod) ^B	8.00*, 7.60	Adults	24- 38 hours	Gametogenesis and gamete quality; Fecundity and reproductive output	No effect of pH on egg production or egg viability.	Laboratory	Temperate Northern Atlantic	Vehmaa et al. (2013)

<i>Calanus glacialis</i> (copepod) ^B	8.20*, 7.60, 6.90	Adults	7 days	Fecundity and reproductive output	Low pH reduced hatching success but no effect of pH on egg production	Laboratory	Temperate Northern Atlantic	Weydmann et al. (2012)
<i>Acartia clausi</i> (copepod) ^B	8.02*, 7.95 - 7.71	Adults	20 days	Fecundity and reproductive output	No effect of pH on egg abundance.	Laboratory	Temperate Northern Atlantic	Zervoudaki et al. (2017)
<i>Centropages typicus</i> (copepod) ^B	8.02*, 7.95 - 7.71	Adults	20 days	Fecundity and reproductive output	No effect of pH on egg abundance.	Laboratory	Temperate Northern Atlantic	Zervoudaki et al. (2017)
<i>Acartia clausi</i> (copepod) ^B	8.09*, 7.83	Adults	24 hours	Fecundity and reproductive output	Low pH reduced egg production.	Laboratory	Temperate Northern Atlantic	Zervoudaki et al. (2014)
<i>Acartia pacifica</i> (copepod) ^B	8.17*, 7.84 - 6.92	Adults	8 days	Fecundity and reproductive output	No effect of pH on egg production or hatching success.	Laboratory	Central Indo-Pacific	Zhang et al. (2011)
<i>Acartia spinicauda</i> (copepod) ^B	8.17*, 7.84 - 6.92	Adults	8 days	Fecundity and reproductive output	Low pH reduced egg production and hatching success.	Laboratory	Central Indo-Pacific	Zhang et al. (2011)
<i>Centropages tenuiremis</i> (copepod) ^B	8.17*, 7.84 - 6.92	Adults	8 days	Fecundity and reproductive output	Low pH reduced egg production and hatching success.	Laboratory	Central Indo-Pacific	Zhang et al. (2011)

Echinodermata								
<i>Salmacis virgulata</i> (sea urchin)	8.20*, 8.00 - 7.60	Adults	14 days	Gametogenesis and gamete quality	Low pH damaged ovarian cells.	Laboratory	Western Indo-Pacific	Anand et al. (2021)
<i>Paracentrotus lividus</i> (sea urchin)	8.00*, 7.50 - 6.00	Eggs & sperm	90 minutes	Fertilization	Low pH reduced fertilization.	Laboratory	Temperate Northern Atlantic	Basallote et al. (2017)
<i>Strongylocentrotus droebachiensis</i> (sea urchin)	8.13*, 8.05 - 7.20	Eggs & sperm	1 - 3 hours	Fertilization	Low pH conditions decreased egg intracellular pH, increased polyspermy risk, and reduced fertilization rate	Laboratory	Arctic †	Bögner et al. (2014)
<i>Heliocidaris erythrogramma</i> (sea urchin)	8.20*, 7.60 - 7.90	Eggs & sperm	20 hours	Fertilization	No effect of pH on fertilization.	Laboratory	Temperate Australasia	Byrne et al. (2009)
<i>Centrostephanus rodgersii</i> (sea urchin)	8.25*, 7.90 - 7.60	Eggs & sperm	15 minutes	Fertilization	No effect of pH on percent fertilization.	Laboratory	Temperate Australasia	Byrne et al. (2010)
<i>Heliocidaris erythrogramma</i> (sea urchin)	8.25*, 7.90 - 7.60	Eggs & sperm	2 hours	Fertilization	No effect of pH on fertilization.	Laboratory	Temperate Australasia	Byrne et al. (2010)

<i>Heliocidaris erythrogramma</i> (sea urchin)	8.25*, 7.90 - 7.60	Eggs & sperm	15 minutes	Fertilization	No effect of pH on percent fertilization.	Laboratory	Temperate Australasia	Byrne et al. (2010)
<i>Heliocidaris tuberculata</i> (sea urchin)	8.25*, 7.90 - 7.60	Eggs & sperm	15 minutes	Fertilization	No effect of pH on percent fertilization.	Laboratory	Temperate Australasia	Byrne et al. (2010)
<i>Patiriella regularis</i> (sea star)	8.25*, 7.90 - 7.60	Eggs & sperm	2 hours	Fertilization	No effect of pH on percent fertilization.	Laboratory	Temperate Australasia	Byrne et al. (2010)
<i>Tripneustes gratilla</i> (sea urchin)	8.25*, 7.90 - 7.60	Eggs & sperm	15 minutes	Fertilization	No effect of pH on percent fertilization.	Laboratory	Temperate Australasia	Byrne et al. (2010)
<i>Patiriella regularis</i> (sea star)	8.15*, 7.80, 7.60	Eggs & sperm	15 minutes	Fertilization	No effect of pH on fertilization.	Laboratory	Temperate Australasia	Byrne et al. (2013)
<i>Acanthaster</i> spp. (sea star)	8.20, 8.00 - 7.40	Eggs & sperm	30 minutes	Fertilization	Low pH reduced sperm speed and motility, and fertilization.	Laboratory	Central Indo-Pacific	Caballes et al. (2017)
<i>Echinometra lucunter</i> (sea urchin)	8.20*, 7.50	Eggs & sperm	N/A	Fertilization	No effect of pH alone on fertilization.	Laboratory	Tropical Atlantic	Caetano et al. (2021)

<i>Psammechinus miliaris</i> (sea urchin)	8.06*, 7.96 - 7.67	Sperm	N/A	Fertilization	Low pH increased sperm swimming speed.	Laboratory	Temperate Northern Atlantic	Caldwell et al. (2011)
<i>Paracentrotus lividus</i> (sea urchin)	8.18*, 7.71	Eggs & sperm	N/A	Fertilization	Low pH reduced sperm speed, count, motility, path linearity, and straightness.	Laboratory	Temperate Northern Atlantic	Campbell et al. (2016)
<i>Lytechinus variegatus</i> (sea urchin)	8.10*, 7.70	Adults	98 days	Gametogenesis and gamete quality	Low pH increased soluble protein storage.	Laboratory	Temperate Northern Atlantic	Challener et al. (2014)
<i>Paracentrotus lividus</i> (sea urchin)	8.00*, 7.70	Eggs & sperm	15 minutes, 100 minutes, and 200 minutes	Fertilization	Low pH reduced fertilization.	Laboratory	Temperate Northern Atlantic	Cohen-Rengifo et al. (2013)
<i>Echinometra lucunter</i> (sea urchin)	8.50*, 8.00 - 7.00	Eggs & sperm	40 minutes	Fertilization	Low pH reduced fertilization.	Laboratory	Tropical Atlantic	da Silva Souza et al. (2019)
<i>Odontaster validus</i> (sea star)	8.12*, 7.80, 7.60	Adults	2 months	Gametogenesis and gamete quality	No effect of pH on gonadosomatic index and individual variability.	Laboratory	Southern Ocean	Dell'Acqua et al. (2019)
<i>Sterechinus neumayeri</i> (sea urchin)	8.12*, 7.80, 7.60	Adults	1 month	Gametogenesis and gamete quality	No effect of pH on gonadosomatic index but variability exists between individuals.	Laboratory	Southern Ocean	Dell'Acqua et al. (2019)

<i>Strongylocentrotus droebachiensis</i> (sea urchin)	8.07*, 7.69	Adults	4 - 16 months	Gametogenesis and gamete quality; Fecundity and reproductive output	Low pH reduced egg production but had no effect on egg quality.	Laboratory	Temperate Northern Atlantic	Dupont et al. (2013)
<i>Tripneustes gratilla</i> (sea urchin)	8.10*, 7.80, 7.60	Larval phase through adulthood	140 days	Gametogenesis and gamete quality	Low pH reduced gonad index.	Laboratory	Temperate Australasia	Dworjanyn and Byrne (2018)
<i>Sterechinus neumayeri</i> (sea urchin)	8.00*, 7.70, 7.50	Eggs & sperm	4 hours	Fertilization	No effect of pH on fertilization at ambient temperature.	Laboratory	Southern Ocean	Ericson et al. (2012)
<i>Sterechinus neumayeri</i> (sea urchin)	8.01*, 7.70 - 7.00	Eggs & sperm	7 hours	Fertilization	Low pH reduced fertilization, but the effect was dependent on sperm concentration.	Laboratory	Southern Ocean	Ericson et al. (2010)
<i>Pseudoboletia indiana</i> (sea urchin)	8.12*, 7.85, 7.69	Eggs & sperm	1 hour	Fertilization	Low pH reduced fertilization but there was mating pair variability.	Laboratory	Temperate Australasia	Foo et al. (2014)
<i>Centrostephanus rogersii</i> (sea urchin)	8.10*, 7.60	Eggs	1 - 30 minutes	Fertilization	Low pH reduced jelly coat area more quickly.	Laboratory	Temperate Australasia	Foo et al. (2015)
<i>Echinometra mathaei</i> (sea urchin)	8.10*, 7.60	Eggs	1 - 30 minutes	Fertilization	Low pH reduced jelly coat area more quickly.	Laboratory	Temperate Australasia	Foo (2015)

<i>Heliocidaris erythrogramma</i> (sea urchin)	8.10*, 7.80, 7.60	Eggs & sperm	10 min	Fertilization	No effect of pH on fertilization.	Laboratory	Temperate Australasia	Foo et al. (2016)
<i>Arbacia lixula</i> (sea urchin)	8.00*, 7.70, 7.50	Eggs	5 min	Fertilization	Low pH reduced egg jelly coat size from control vents but was robust for urchins from low pH vents.	Laboratory	Temperate Northern Atlantic	Foo et al. (2018)
<i>Heliocidaris erythrogramma</i> (sea urchin)	8.00, 7.80, 7.60	Eggs	30 min	Fertilization	No effect of pH on egg jelly coat.	Laboratory	Temperate Australasia	Foo et al. (2018)
<i>Heliocidaris tuberculata</i> (sea urchin)	8.00, 7.80, 7.60	Eggs & sperm	30 min	Fertilization	Low pH reduced egg jelly coat size, leading to increased sperm motility, velocity, and path linearity.	Laboratory	Temperate Australasia	Foo et al. (2018)
<i>Strongylocentrotus franciscanus</i> (sea urchin)	7.99 - 8.00*, 7.36 - 7.94	Eggs & sperm	20 minutes	Fertilization	Low pH had an effect on fertilization sensitivity depending on sperm:egg ratios	Laboratory	Temperate Northern Pacific	Frieder (2014)
<i>Strongylocentrotus purpuratus</i> (sea urchin)	7.99 - 8.00*, 7.36 - 7.94	Eggs & sperm	20 minutes	Fertilization	Low pH had an effect on fertilization sensitivity depending on sperm:egg ratios	Laboratory	Temperate Northern Pacific	Frieder (2014)
<i>Arbacia lixula</i> (sea urchin)	8.10*, 7.70, 7.40	Eggs & sperm	15 minutes, 105 minutes, 210 minutes	Fertilization	Low pH decreased fertilization rate after 15 min. At other time points, the trend was only significant at low temperatures.	Laboratory	Temperate Northern Atlantic	García et al. (2018)

<i>Diadema africanum</i> (sea urchin)	8.10*, 7.70, 7.40	Eggs & sperm	210 minutes	Fertilization	Low pH decreased fertilization.	Laboratory	Temperate Northern Atlantic	García et al. (2018)
<i>Paracentrotus lividus</i> (sea urchin)	8.10*, 7.70, 7.40	Eggs & sperm	15 minutes	Fertilization	Low pH increased fertilization rate after 15 min.	Laboratory	Temperate Northern Atlantic	García et al. (2018)
<i>Sphaerechinus granularis</i> (sea urchin)	8.10*, 7.70, 7.40	Eggs & sperm	15 minutes	Fertilization	No effect of pH on fertilization.	Laboratory	Temperate Northern Atlantic	García et al. (2018)
<i>Arbacia lixula</i> (sea urchin)	8.20*, 7.90	Eggs & sperm	N/A	Fertilization	No effect of pH on fertilization.	Laboratory	Temperate Northern Atlantic	Gianguzza et al. (2014)
<i>Arachnoides placenta</i> (sand dollar)	8.10*, 7.80 - 7.00	Eggs & sperm	17 hours	Fertilization	Low pH reduced fertilization.	Laboratory	Temperate Australasia	Gonzalez-Bernat et al. (2013)
<i>Odontaster validus</i> (sea star)	8.10*, 7.80 - 7.00	Eggs & sperm	17 hours	Fertilization	Low pH only impacted percent fertilization at low sperm concentrations.	Laboratory	Temperate Australasia	Gonzalez-Bernat et al. (2013)
<i>Paracentrotus lividus</i> (sea urchin)	8.08*, 7.93	Adults; Eggs & sperm	2 hours - 6 months	Fertilization	Low pH increased sperm swimming speed but decreased fertilization success.	Mesocosm	Temperate Northern Pacific	Graham et al. (2016)

<i>Heliocidaris erythrogramma</i> (sea urchin)	8.10*, 7.70	Eggs & sperm	4 hours	Fertilization	Low pH reduced sperm swimming speed, motility, and fertilization success.	Laboratory	Temperate Australasia	Havenhand et al. (2008)
<i>Echinometra</i> sp. EE (sea urchin)	8.10*, 7.70	Adults	11 months	Gametogenesis and gamete quality	No effect of pH on gametogenesis.	Laboratory	Temperate Northern Atlantic	Hazan et al. (2014)
<i>Sterechinus neumayeri</i> (sea urchin)	8.00*, 7.80, 7.60	Eggs & sperm	30 minutes	Fertilization	No effect of pH on fertilization at any sperm concentration.	Laboratory	Southern Ocean	Ho et al. (2013)
<i>Asterias rubens</i> (sea star)	7.90*, 7.50, 7.20	Adults	85 days	Gametogenesis and gamete quality	Lowest pH reduced gonad weight.	Laboratory	Temperate Northern Atlantic	Hu et al. (2018)
<i>Acanthaster</i> spp. (sea star)	8.01*, 7.74	Adults; Eggs & sperm	130-145 days	Gametogenesis and gamete quality; Fertilization	Low pH reduced egg volume but there was no effect of pH on gonadosomatic index or fertilization.	Laboratory	Central Indo-Pacific	Hue et al. (2020)
<i>Strongylocentrotus purpuratus</i> (sea urchin)	8.03, 7.87, 7.76, 7.61	Eggs & sperm	30 seconds	Fertilization	Low pH increased fertilization success, but this effect varied by site.	Laboratory	Temperate Northern Pacific	Kapsenberg et al. (2017)
<i>Acanthaster planci</i> (sea star)	8.10*, 7.80, 7.60	Eggs & sperm	2 hours	Fertilization	No effect of pH on fertilization.	Laboratory	Central Indo-Pacific†	Kamya et al. (2014)

<i>Tripneustes gratilla</i> (sea urchin)	8.00*, 7.77	Adults	N/A	Gametogenesis and gamete quality	No effect of pH on egg size.	Laboratory	Central Indo-Pacific†	Karelitz et al. (2019)
<i>Hemicentrotus pulcherrimus</i> (sea urchin)	7.80	Adults	8 months	Gametogenesis and gamete quality	Low pH delayed gonad development and shortened spawning period.	Laboratory	Temperature Northern Pacific	Kurihara 2008
<i>Echinometra mathaei</i> (sea urchin)	8.11*, 7.82, 7.71, 7.33, 7.12, 6.79	Eggs & sperm	15 minutes	Fertilization	Lowest two pH conditions reduced fertilization rate.	Laboratory	Temperature Northern Pacific	Kurihara and Shirayama 2004
<i>Hemicentrotus pulcherrimus</i> (sea urchin)	8.01*, 7.77, 7.61, 7.38, 7.03, 6.83	Eggs & sperm	15 minutes	Fertilization	Lowest pH reduced fertilization rate.	Laboratory	Temperature Northern Pacific	Kurihara and Shirayama 2004
<i>Hemicentrotus pulcherrimus</i> (sea urchin)	7.61, 7.03	Adults	9 months	Gametogenesis and gamete quality	No effect of pH on gametogenesis.	Laboratory	Temperature Northern Pacific	Kurihara et al. 2013
<i>Lytechinus variegatus</i> (sea urchin)	8.10*, 7.80	Eggs & sperm	1 hour	Fertilization	No effect of pH on fertilization.	Laboratory	Tropical Atlantic	Lenz et al. (2019)
<i>Paracentrotus lividus</i> (sea urchin)	8.00*, 7.40, 7.70	Eggs & sperm	20 minutes	Fertilization	Low pH compromised egg actin dynamics but there was no effect of pH on sperm induction.	Laboratory	Temperate Northern Atlantic	Limatola et al. (2020)

<i>Paracentrotus lividus</i> (sea urchin)	8.00*, 7.40, 7.70	Adults	60 days	Gametogenesis and gamete quality	Low pH increased gonadosomatic index in females and decreased in males.	Laboratory	Temperate Northern Atlantic	Marčeta et al. (2020)
<i>Paracentrotus lividus</i> (sea urchin)	8.10*, 7.90, 7.70, 7.50, 7.25, 7.00	Eggs & sperm	3 days	Fertilization	No effect of pH on fertilization.	Laboratory	Temperate Northern Atlantic	Martin et al. (2011)
<i>Holothuria</i> spp. (sea cucumber)	8.00, 7.80, 7.70, 7.60, 7.30, 6.60	Sperm	N/A	Fertilization	Low pH decreased sperm motility.	Laboratory	Temperate Northern Pacific	Morita et al. (2010)
<i>Paracentrotus lividus</i> (sea urchin)	8.00*, 7.60, 6.80	Eggs & sperm	2 hours	Fertilization	Lower pH decreased fertilization but those collected from tidepools with higher pH fluctuations were less impacted.	Laboratory	Temperate Northern Atlantic	Moulin et al. 2011
<i>Centrostephanus rodgersii</i> (urchin)	8.10*, 7.80 - 7.04	Eggs & sperm	30 minutes	Fertilization	Low pH decreased fertilization.	Laboratory	Temperate Australasia	Pecorino et al. (2013)
<i>Echinometra lucunter</i> (sea urchin)	8.00*, 7.70, 7.40	Eggs & sperm	40 minutes	Fertilization	Low pH decreased fertilization.	Laboratory	Tropical Atlantic	Pereira et al. (2020)
<i>Strongylocentrotus franciscanus</i> (sea urchin)	8.04*, 7.81, 7.55	Eggs & sperm	30 seconds	Fertilization	Low pH reduced ability to block polyspermy.	Laboratory	Temperate Northern Pacific	Reuter et al. (2011)

<i>Paracentrotus lividus</i> (sea urchin)	8.00*, 7.50, 7.00, 6.50, 6.00	Eggs & sperm	N/A	Fertilization	Low pH reduced fertilization.	Laboratory	Temperate Northern Atlantic	Riba et. al (2016)
<i>Strongylocentrotus fragilis</i> (sea urchin)	7.69*, 7.63 - 7.57	Adults	N/A	Gametogenesis and gamete quality	Low pH reduced gonad index.	Field	Temperate Northern Pacific	Sato et al. (2018)
<i>Heliocidaris erythrogramma</i> (sea urchin)	8.12*, 7.80, 7.60	Eggs & sperm	10 minutes	Fertilization	Low pH reduced sperm motility, with inter-individual variability in fertilization.	Laboratory	Temperate Australasia	Schlegel et al. (2012)
<i>Centrostephanus rogersii</i> (sea urchin)	8.12*, 7.80, 7.60	Sperm	2 seconds	Fertilization	No effect of pH on sperm swimming behavior.	laboratory	Temperate Australasia	Schlegel et al. (2015)
<i>Sterechinus neumayeri</i> (sea urchin)	8.05*, 7.97, 7.83	Eggs & sperm	18-24 hours	Fertilization	Low pH increased time for complete block to polyspermy but response to fertilization success varied between mating pairs.	Laboratory	Southern Ocean	Sewell et al. (2014)
<i>Strongylocentrotus droebachiensis</i> (sea urchin)	8.10*, 6.98	Adults	56 days	Gametogenesis and gamete quality	Low pH hindered gonad growth.	Laboratory	Temperate Northern Atlantic	Siikavuopio et al. (2007)
<i>Arbacia</i> sp. (sea urchin)	8.15, 7.60, 7.40, 7.30, 7.20, 7.10, 7.00, 6.90, 6.80,	Eggs & sperm	5 minutes	Fertilization	Lower pH treatments blocked fertilization.	Laboratory	N/A	Smith and Clowes (1924)

	6.70, 6.60							
<i>Asterias</i> sp. (sea star)	8.15, 7.60, 7.40, 7.30, 7.20, 7.10, 7.00, 6.90, 6.80, 6.70, 6.60	Eggs & sperm	5 minutes	Fertilization	Lower pH treatments blocked fertilization.	Laboratory	N/A	Smith and Clowes (1924)
<i>Heliocidaris erythrogramma</i> (sea urchin)	8.00*, 7.90, 7.70	Eggs & sperm	10 minutes	Fertilization	Low pH caused inter-individual variability in fertilization success.	Laboratory	Temperate Australasia	Smith et al. (2019)
<i>Lytechinus pictus</i> (sea urchin)	8.00*, 7.90, 7.70	Eggs & sperm	10 minutes	Fertilization	Low pH caused inter-individual variability in fertilization success.	Laboratory	Temperate Australasia	Smith et al. (2019)
<i>Strongylocentrotus purpuratus</i> (sea urchin)	8.20*, 7.90, 7.60	Eggs & sperm	20 minutes	Fertilization	No impact of pH alone on fertilization.	Laboratory	Temperate Northern Pacific	Stavroff (2014)
<i>Strongylocentrotus droebachiensis</i> (sea urchin)	7.80*, 7.51, 7.10	Adults	10 - 45 days	Gametogenesis and gamete quality	Low pH reduced energy expenditure on developing gonads.	Laboratory	Temperate Northern Atlantic	Stumpp et al. (2012)

<i>Psammechinus miliaris</i> (sea urchin)	7.98*, 7.70	Adults	70 days	Gametogenesis and gamete quality; Fertilization	Low pH resulted in smaller eggs but higher fertilization rates.	Microcosm	Temperate Northern Atlantic	Suckling et al. (2014)
<i>Sterechinus neumayeri</i> (sea urchin)	7.99*, 7.70, 7.54	Adults	6 - 17 months	Gametogenesis and gamete quality	Low pH reduced egg size, but after some time eggs were larger at low pH.	Microcosm	Southern Ocean†	Suckling et al. (2015)
<i>Hemicentrotus pulcherrimus</i> (sea urchin)	7.99*, 7.96, 7.92, 7.78, 7.69, 7.59	Eggs & sperm	N/A	Fertilization	No effect of pH on sperm motility and speed.	Laboratory	Temperate Northern Pacific	Sung et al. (2014)
<i>Strongylocentrotus nudus</i> (sea urchin)	7.99*, 7.96, 7.92, 7.78, 7.69, 7.59	Eggs & sperm	N/A	Fertilization	Sperm and eggs exposed to low pH had reduced fertilization rates but there was no effect of pH on sperm motility and speed.	Laboratory	Temperate Northern Pacific	Sung et al. (2014)
<i>Acanthaster planci</i> (sea star)	8.10*, 7.90, 7.60	Eggs & sperm	2 seconds - 10 minutes	Fertilization	Low pH reduced sperm motility, velocity, and fertilization.	Laboratory	Central Indo-Pacific†	Uthicke et al. (2013)
<i>Echinometra mathaei</i> (sea urchin)	8.10*, 7.90, 7.70, 7.50	Adults	15 minutes - 7 weeks	Gametogenesis and gamete quality	No effect of pH on egg size.	Laboratory	Central Indo-Pacific†	Uthicke et al. (2013)
<i>Echinometra</i> sp. A (sea urchin)	8.10*, 7.90	Adults	77 days	Gametogenesis and gamete quality	No effect of pH on gonad weight and condition.	Laboratory	Central Indo-Pacific†	Uthicke et al. (2014)

<i>Echinometra</i> sp. A (sea urchin)	8.06*, 7.89, 7.79	Adults	20 months	Gametogenesis and gamete quality	No effect of pH on gamete development	Mesocosm	Central Indo-Pacific†	Uthicke et al. (2020)
<i>Cucumaria frondosa</i> (sea cucumber)	8.03*, 7.63	Adults	19 weeks	Gametogenesis and gamete quality; Timing of reproduction and synchronization	Low pH and time affected male gonad index, gonad maturation, and spawning events. Low pH affected female egg shape, spawning success, and lipid profile.	Laboratory	Temperate Northern Atlantic	Verkaik et al. (2016)
<i>Strongylocentrotus purpuratus</i> (sea urchin)	7.87, 7.57	Adults	4 months	Gametogenesis and gamete quality	Females exposed to low pH had wider egg variability and reduced lipid content but no effect of low pH on egg size and protein content.	Laboratory	Temperate Northern Pacific	Wong et al. (2019)
<i>Amphiura filiformis</i> (brittle star)	8.00*, 7.70, 7.30, 6.80	Adults	40 days	Gametogenesis and gamete quality	No effect of pH on gametogenesis but experiment was conducted during a period generally classified with latent reproductive growth	Mesocosm	Temperate Northern Atlantic	Wood et al. (2008)
<i>Strongylocentrotus intermedius</i> (sea urchin)	8.00*, 7.71 - 7.51	Eggs & sperm	5 minutes, 15 minutes, 30 minutes, 60 minutes	Fertilization	No effect of pH on fertilization.	Laboratory	Temperate Northern Pacific	Zhan et al. (2016)
<i>Hemicentrotus pulcherrimus</i> (sea urchin)	8.06*, 7.76 - 7.55	Eggs & sperm	15 minutes	Fertilization	No effect of pH on fertilization.	Laboratory	Temperate Northern Pacific	Zhan et al. (2017)
<i>Glyptocidaris crenularis</i> (sea urchin)	7.98*, 7.68 - 7.48	Eggs & sperm	15 minutes	Fertilization	Low pH decreased fertilization rate and increased percentage of abnormal fertilized eggs.	Laboratory	Temperate Northern Pacific	Zhan et al. (2018)

Mollusca								
<i>Tridacna maxima</i> (clam)	8.10*, 7.60	Eggs & sperm	2 hours	Fertilization	No effect of low pH on fertilization.	Laboratory	Eastern Indo-Pacific	Armstrong et al. (2019)
<i>Crassostrea gigas</i> (oyster)	8.09*, 7.76, 7.37	Eggs & sperm	4 hours	Fertilization	Low pH decreased fertilization rate.	Laboratory	Temperate North Atlantic	Barros et al. (2013)
<i>Mytilus edulis</i> (mussel)	8.10*, 7.60	Eggs & sperm	2 hours	Fertilization	No effect of low pH on fertilization.	Laboratory	Temperate North Atlantic	Bechmann et al. (2011)
<i>Haliotis rufescens</i> (abalone)	7.90*, gradient from ~7.15 to 7.95	Eggs & sperm	10 minutes	Fertilization	Low pH decreased fertilization rate.	Laboratory	Temperate Northern Pacific	Boch et al. (2017)
<i>Crassostrea virginica</i> (oyster)	7.9*, 7.5, 7.1, 6.7	Adults	5 weeks	Gametogenesis and gamete quality; Fertilization; Sex determination, differentiation, and ratio	Low pH reduced or inhibited gametogenesis rate and female prevalence but no effect of pH on fertilization.	Laboratory	Temperate North Atlantic	Boulais et al. (2017)
<i>Laternula elliptica</i> (clam)	7.98*, 7.65 - 7.80	Eggs & sperm	4 - 48 hours	Fertilization	Low pH increased fertilization rate as a sole stressor.	Laboratory	Southern Ocean †	Bylenga et al. (2015)

<i>Haliotis coccoradiata</i> (abalone)	8.25*, 7.90 - 7.60	Eggs & sperm	15 minutes	Fertilization	No effect of low pH on fertilization.	Laboratory	Temperate Australasia	Byrne et al. (2010)
<i>Crassostrea virginica</i> (oyster)	7.90*, 7.70, 7.50	Adults	14, 28 days	Gametogenesis and gamete quality; Sex determination, differentiation, and ratio	Low pH increased percentage of mature gametes and reproductive tissue but no effect of pH on sex ratio.	Laboratory	Temperate Northern Atlantic	Clements et al. (2021)
<i>Adamussium colbecki</i> (scallop)	8.12*, 7.80, 7.60	Adults	34 days	Gametogenesis and gamete quality	Low pH resulted in more advanced gametes and higher prevalence of anomalous gonad tissue.	Laboratory	Southern Ocean	Dell'Acqua et al. (2019)
<i>Elysia clarki</i> (sea slug) ^B	8.00*, 7.60	Adults	4 weeks	Fecundity and Reproductive Output	Low pH reduced number of egg masses laid by adults.	Laboratory	Tropical Atlantic †	Dionísio et al. (2017)
<i>Mytilus galloprovincialis</i> (mussel)	8.00*, 7.60, 7.80	Eggs & sperm	10 minutes - 2 hours	Fertilization	Low pH decreased fertilization rate and sperm motility.	Laboratory	Temperate Australasia	Eads et al. (2016)
<i>Perna canaliculus</i> (mussel)	8.30*, 8.10*, 7.70, 7.30	Eggs & sperm	4 - 6.5 hours (varied by trial)	Fertilization	Low pH reduced fertilization rate, depending on sperm concentration.	Laboratory	Temperate Australasia	Ericson (2010)
<i>Mytilus galloprovincialis</i> (mussel)	8.10*, 7.80	Sperm	4 hours	Fertilization	Low pH decreased sperm motility, mitochondrial activity and pH _i but no effect of pH on sperm vitality and oxidative state.	Laboratory	Temperate North Atlantic	Esposito et al. (2020)

<i>Crassostrea gigas</i> (oyster)	8.03*, 7.86, 7.74	Sperm	10 minutes	Fertilization	Low pH increased sperm motility in an established population but no effect of pH in a recently invaded population.	Laboratory	Temperate North Atlantic	Falkenberg et al. (2019)
<i>Mytilus galloprovincialis</i> (mussel)	8.10*, 7.80	Adults	21 days	Fertilization	Low pH increased percent abnormal sperm in both settings; sperm motility, mitochondrial membrane potential, intracellular pH, and lipid peroxidation differed temporally and among settings.	Field & Laboratory (microcosm)	Temperate North Atlantic	Gallo et al. (2020)
<i>Saccostrea glomerata</i> (oyster)	8.10*, 7.80	Adults	8 weeks	Gametogenesis and gamete quality	Low pH increased egg lipid content.	Laboratory	Temperate Australasia	Gibbs et al. (2021a; 2021b)
<i>Crassostrea gigas</i> (oyster)	8.10*, 7.80	Adults	8 weeks	Gametogenesis and gamete quality	No effect of low pH on egg lipid content.	Laboratory	Temperate Australasia	Gibbs et al. (2021a; 2021b)
<i>Crassostrea angulata</i> (oyster)	8.20*, 7.90 - 7.60	Eggs & sperm	2 hours	Fertilization	Low pH did not affect fertilization rate as a sole stressor.	Laboratory	Central Indo-Pacific	Guo et al. (2020)
<i>Haliotis discus hannai</i> (abalone)	8.20*, 7.90 - 7.60	Eggs & sperm	2 hours	Fertilization	Low pH did not affect fertilization rate as a sole stressor.	Laboratory	Central Indo-Pacific	Guo et al. (2020)
<i>Tegillarca granosa</i> (clam)	8.10*, 7.80, 7.40	Eggs	1 hour prior to insemination	Fertilization	Low pH increased polyspermy rate.	Laboratory	Temperate Northern Pacific	Han et al. (2021)

<i>Crassostrea gigas</i> (oyster)	8.15*, 7.85	Eggs & sperm	1 hour	Fertilization	No effect of low pH on sperm swimming speed, motility, or fertilization rate.	Laboratory	Temperate North Atlantic	Havenhand and Schlegel (2009)
<i>Haliotis discus hannai</i> (abalone)	8.02*, 7.96 - 7.73	Eggs & sperm	15 hours	Fertilization	Low pH decreased fertilization rate only at severe treatments (pH ≤ 7.49) compared to control (pH 8.02)	Laboratory	Temperate Northern Pacific	Kimura et al. (2011)
<i>Babylonia japonica</i> (snail) ^B	8.10*, 7.60 - 6.70	Adults	80 days	Fecundity and Reproductive Output	No effect of low pH on the number of spawning events or number of egg capsules produced.	Laboratory	Temperate Northern Pacific	Kita et al. (2013)
<i>Mytilus edulis</i> (mussel)	8.10*, 7.70, 7.30	Adults only, Adults & gametes	8 hours - 4 weeks	Fertilization	Low pH decreased fertilization rate but effect was mitigated by parental exposure.	Laboratory	Temperate Northern Pacific	Kong et al. (2019)
<i>Pinctada margaritifera</i> (oyster)	8.20*, 7.80, 7.40	Adults	100 days	Gametogenesis and gamete quality	No effect of low pH on the gametogenic stage.	Laboratory	Eastern Indo-Pacific	Le Moullac et al. (2016)
<i>Mytilus galloprovincialis</i> (mussel)	8.00*, 7.60	Sperm & eggs (only sperm pre- exposed)	10 minutes - 2 hours	Fertilization	Low pH increased fertilization rate in the presence of egg-derived chemicals.	Laboratory	Temperate Australasia	Lymbery et al. (2019)
<i>Crepidula onyx</i> (snail) ^B	8.0*, 7.7, 7.3	From veliger larvae to sexual maturity	>36 months	Fecundity and Reproductive Output	Long-term low pH exposure reduced the number of brooded larvae released per individual.	Laboratory	Central Indo-Pacific	Maboloc & Chan (2021)

<i>Limacina helicina antarctica</i> (pteropod)	8.00*, 7.80, 7.60	Adults	8 days	Fecundity and Reproductive Output	Low pH resulted in fewer eggs which were smaller and had less carbon content. Low pH increased number of spawning events.	Laboratory	Southern Ocean	Manno, Peck & Tarling (2016)
<i>Crassostrea gigas</i> (oyster)	8.10*, 7.50, 7.80	Adults	4 weeks	Fertilization	Low pH decreased sperm motility and increased the prevalence of ruptured eggs when spawned.	Laboratory	Temperate Southern Africa	Omoregie et al. (2019)
<i>Turbo cornutus</i> (snail)	8.00*, 7.8 - 7.4	Eggs & sperm	2 hours	Fertilization	No effect of low pH on fertilization.	Laboratory	Temperate Northern Pacific	Onitsuka et al. (2014)
<i>Saccostrea glomerata</i> (oyster)	375 μ atm*, 600 μ atm, 750 μ atm, 1000 μ atm	Eggs & sperm	2 hours	Fertilization	Low pH decreased fertilization rate.	Laboratory	Temperate Australasia	Parker et al. (2009)
<i>Saccostrea glomerata</i> (oyster)	8.20*, 7.91	Adults	8 weeks	Gametogenesis and gamete quality	No effect of low pH on egg lipid content or egg size.	Laboratory	Temperate Australasia	Parker et al. (2017)
<i>Saccostrea glomerata</i> (oyster)	8.20*, 7.91	Adults	8 weeks	Gametogenesis and gamete quality; Fecundity and reproductive output; Sex determination, differentiation, and ratio; Timing of reproduction and synchronization	Low pH decreased gametogenesis, gonad area, and fecundity but increased female prevalence.	Laboratory	Temperate Australasia	Parker et al. (2018)

<i>Saccostrea glomerata</i> (oyster)	8.20*, 7.8	Adults	5 weeks	Gametogenesis and gamete quality	No effect of low pH on egg size.	Laboratory	Temperate Australasia	Parker et al. (2021)
<i>Saccostrea glomerata</i> (oyster)	8.20*, 8.00 - 7.83	Eggs & sperm	2 hours	Fertilization	Low pH decreased fertilization rate.	Laboratory	Temperate Australasia	Parker, Ross and O'Connor (2010)
<i>Crassostrea gigas</i> (oyster)	8.2*, 8.00 - 7.83	Eggs & sperm	2 hours	Fertilization	Low pH decreased fertilization rate.	Laboratory	Temperate Australasia	Parker, Ross and O'Connor (2010)
<i>Astarte crenata</i> (mussel)	~7.85 - 7.95*, ~7.75 -7.85	Adults	135 days	Gametogenesis and gamete quality	No effect of low pH on egg size frequency distribution.	Laboratory	Arctic †	Reed et al. (2021)
<i>Bathyarca glacialis</i> (mussel)	~7.85 - 7.95*, ~7.75 -7.85	Adults	120 days	Gametogenesis and gamete quality	No effect of low pH on egg size frequency distribution.	Laboratory	Arctic †	Reed et al. (2021)
<i>Mytilus edulis</i> (mussel)	8.00*, 6.00, 6.50, 7.00, 7.50	Eggs & sperm	N/A	Fertilization	Low pH decreased or inhibited fertilization rate, but only at severely low pH (6.0).	Laboratory	Temperate North Atlantic	Riba et al. (2016)
<i>Crassostrea gigas</i> (oyster)	8.00*, 6.00, 6.50, 7.00, 7.50	Eggs & sperm	N/A	Fertilization	Low pH decreased or inhibited fertilization rate, but fertilization was not fully inhibited in severely low pH (6.0).	Laboratory	Temperate North Atlantic	Riba et al. (2016)

<i>Bathymodiolus septemdirum</i> (mussel)	NA*, 5.20, 5.80, 5.90, 7.00, 7.30	Adults	NA	Gametogenesis and gamete quality	No effect of extreme low pH at hydrothermal vents on egg size or gametogenesis.	Field	Central Indo-Pacific	Rossi & Tunnicliffe (2017)
<i>Mimachlamys asperima</i> (scallop)	8.20*, 7.89 - 7.69	Eggs & sperm	2- 24 hours	Fertilization	Low pH decreased fertilization rate.	Laboratory	Temperate Australasia	Scanes et al. (2014)
<i>Saccostrea glomerata</i> (oyster)	8.12*, 7.83	Adults	8 weeks	Gametogenesis and gamete quality	No effect of low pH on egg size or lipid content.	Laboratory	Temperate Australasia	Scanes et al. (2018)
<i>Tegillarca granosa</i> (clam)	8.10*, 7.80, 7.40	Eggs & sperm	30 - 60 minutes	Fertilization	Low pH decreased fertilization rate and sperm velocity.	Laboratory	Temperate Northern Pacific	Shi et al. (2017a)
<i>Tegillarca granosa</i> (clam)	8.07*, 7.80, 7.40	Eggs only, sperm only, eggs & sperm	1 hour	Fertilization	Low pH decreased fertilization rate when eggs or sperm were exposed, and effects were amplified when both gametes were exposed, and similar effects were found for HCL- and pCO ₂ -modulated water. Sperm motility decreased with increasing pCO ₂ -modulated water only.	Laboratory	Temperate Northern Pacific	Shi et al. (2017b)
<i>Idiosepius pygmaeus</i> (squid)	8.05*, 7.78	Breeding adult pairs	14 days	Gametogenesis and gamete quality, Fecundity and reproductive output; Mating behavior	Low pH decreased egg clutch size and vitelli size but increased egg swelling when breeding pairs were exposed. No effect of low pH on fertilization rate or egg area. Females laid more dense egg clutches in low pH, but no other mating behaviors were affected.	Laboratory	Central Indo-Pacific	Spady et al. (2019)

<i>Ostrea lurida</i> (oyster) ^B	7.80*, 7.30	Adults	2 days	Gametogenesis and gamete quality; Fecundity and Reproductive Output; Sex determination, differentiation, and ratio; Timing of reproduction and synchronization	Winter exposure to low pH decreased spermatogenesis rate and increased brood size but there was no effect of pH on timing of spawning, total reproductive output, oogenesis, or sex ratio.	Laboratory	Temperate Northern Pacific	Spencer et al. (2020)
<i>Cyclina sinensis</i> (clam)	8.20*, 7.80, 7.40	Eggs & sperm	2 days	Fertilization	Low pH decreased fertilization rate.	Laboratory	Temperate Northern Pacific	Sui et al. (2019)
<i>Limecola balthica</i> (clam)	7.70*, 7.00, 6.30	Eggs & sperm	1 hour	Fertilization	Low pH decreased fertilization rate.	Laboratory	Temperate North Atlantic	Świeżak et al. (2018)
<i>Perna perna</i> (mussel)	8.10*, 7.60, 7.00, 6.50, 6.00	Eggs & sperm	1 hour	Fertilization	Low pH decreased fertilization rate.	Laboratory	Temperate South America	Szalaj et al. (2017)
<i>Macoma balthica</i> (clam)	8.10*, 7.80, 7.50	Eggs & sperm	24 hours	Fertilization	Low pH decreased fertilization rate.	Laboratory	Temperate North Atlantic	Van Colen et al. (2012)
<i>Crassostrea gigas</i> (oyster)	7.82*, 7.31	Adults	52 days	Gametogenesis and gamete quality; Sex determination, differentiation, and ratio	No effect of pH on gametogenesis or sex ratio.	Laboratory	Temperate Northern Pacific	Venkataraman et al. (2019)

<i>Mytilus galloprovincialis</i> (mussel)	8.00*, 7.60	Sperm	a few minutes	Fertilization	Low pH decreased sperm motility and swimming speed.	Laboratory	Temperate North Atlantic	Vihtakari et al. (2013)
<i>Macoma calcaria</i> (clam)	380 μ atm*, 1000 μ atm	Sperm	up to 1 hour	Fertilization	Low pH decreased sperm swimming speed decreased but no effect of pH on fertilization rate or sperm motility.	Laboratory	Temperate North Atlantic	Vihtakari et al. (2016)
<i>Mytilus galloprovincialis</i> (mussel)	380 μ atm*, 1000 μ atm	Sperm	up to 4.5 hours	Fertilization	Low pH decreased fertilization success, sperm motility and swimming speed.	Laboratory	Temperate North Atlantic	Vihtakari et al. (2016)
<i>Argopecten irradians</i> (scallop)	8.30*, 7.60	Eggs & sperm	15 minutes	Fertilization	Low pH decreased fertilization rate.	Laboratory	Temperate Northern Pacific	Wang et al. (2016)
<i>Mytilus coruscus</i> (mussel)	8.10*, 7.70, 7.30	Eggs & sperm	2 hours	Fertilization	Low pH decreased fertilization rate.	Laboratory	Temperate Northern Pacific	Wang et al. (2020)
<i>Mytilus coruscus</i> (mussel)	8.10*, 7.70, 7.30	Adults	20 days	Gametogenesis and gamete quality	Low pH reduced gonadosomatic index (GSI) and sex steroid concentration.	Laboratory	Temperate Northern Pacific	Wang et al. (2021)
<i>Argopecten irradians</i> (scallop)	7.96*, 7.30	Eggs & Sperm, Adults during spawning	45 minutes - 24 hours	Fertilization	Low pH decreased fertilization rate in one experiment, had no effect in another.	Laboratory	Temperate North Atlantic	White et al. (2014)

<i>Ostrea lurida</i> (oyster) ^B	8.00*, 8.00, 7.50	Adults	~50 days	Fecundity and Reproductive Output; Timing of reproduction and synchronization	Low pH resulted in fewer larvae released and delayed release time in one trial (not sign.).	Laboratory	Temperate Northern Pacific	Wippel (2017)
<i>Ruditapes philippinarum</i> (clam)	8.00*, 7.70, 7.40	Adults	70 days	Gametogenesis and gamete quality, Timing of reproduction and synchronization	Low pH reduced number of animals to successfully spawn.	Laboratory	Temperate Northern Pacific	Xu et al. (2016)
<i>Musculista senhousia</i> (mussel)	8.10*, 7.70	Adults	40 days	Gametogenesis and gamete quality	Low pH decreased spawning rate (when induced) and increased egg size.	Laboratory	Temperate Northern Pacific	Zhao et al. (2019)

The subscript ^B after the species name indicates that the species is a brooder (copulation using ovipositor in the case of the squid or lay fertilized egg masses in the case of the sea slug).

*An asterisk next to a pH level indicates control or ambient conditions.

† The obelisk symbol next to the collection location indicates that the collection Ecoregion is different from the experimental Ecoregion.

In the case where pH was not reported, pCO₂ values were used in this table.