Supplementary Information

Table S1. Papers used in fertilisation and survivorship analysis.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Author** | **Year** | **Paper Title** | **Species** | **Factor** | **Life History Stage** | **Common Environmental Source of Pollutant** |
| Baird, A. H., Gilmour, J. P., Kamiki, T. M., Nnaka, M., Pratchett, M. S., Yamamoto, H. H. and Yamasaki, H. | 2006 | Temperature tolerance of symbiotic and non-symbiotic coral larvae | *Acropora muricata* | Temperature | Survivorship | Rising global temperature as a result of climate change (greenhouse effect) |
| Bassim, K. M. and Sammarco, P. W | 2003 | Effects of temperature and ammonium on larval development and survivorship in a scleractinian coral (*Diploria strigosa*) | *Diploria strigosa* | Temperature and ammonium | Survivorship | Temperature – increase global temperatures from climate change  Ammonium – as run-off from agricultural activity (fertilisers, organic matter) |
| Chua, CM., Leggat, W., Moya, A. and Baird, A. H. | 2013 | Near-future reduction in pH will have no consistent ecological effects on the early life-history stages of reef corals | *Acropora tenuis, Acropora millepora* | Acidification | Survivorship | Increased atmospheric carbon dioxide from burning fossil fuels (climate change) |
| Chua, CM., Leggat, W., Moya, A. and Baird, A. H. | 2013 | Temperature affects the early life history stages of corals more than near future ocean acidification | *Acropora tenuis, Acropora millepora* | Acidification | Fertilisation | Increased atmospheric carbon dioxide from burning fossil fuels (climate change) |
| Cox, E. F. and Ward, S. | 2002 | Impact of elevated ammonium on reproduction in two Hawaiian | *Pocillopora damicornis* | Ammonium | Survivorship | Agricultural run-off from excessive use of fertilisers, untreated manure and organic matter |
| Erftemeijer, P. L. A., Hagedorn, M., Laterveer, M., Craggs, J. and Guest, J. R. | 2012 | Effects of suspended sediment on fertilisation success in the scleractinian coral *Pectinia lactuca* | *Pectnia lactuca* | Suspended sediment | Fertilisation | Increased urbanisation and agriculture has led to more run-off carrying sediment into the ocean |
| Farina, O., Ramos, R., Bastidas, C. and Garcia, E. | 2008 | Biohemical reposne of cnidarian larvae to mercury and benzo(a)pyrene exposure | *Porites astreoides* | Mercury | Survivorship | Sourced from industry in coal-fired plants and in sewerage |
| Gilmour, J. | 1999 | Experimental investigation into the effects of suspended sediment on fertilisation, larval survival and settlement in a scleractinian coral | *Acropora digitfera* | Suspended sediment | Fertilisation | Increased urbanisation and agriculture has led to more run-off carrying sediment into the ocean |
| Harrison, P. L. and Ward, S. | 2001 | Elevated levels of nitrogen and phosphorus reduce fertilisation success of gametes from scleractinian reef corals | *Acropora longicyathus*  *Goniastrea aspera* | Ammonium, phosphorous, ammonium and phosphorous | Fertilisation | Agricultural run-off from fertilisers, manure and organic matter |
| Hartman, A. C., Marhaver, K. L., Chamberland, V. F., Sandin, S. A. and Vermeij, M. J. A. | 2013 | Large birth size does not reduce negative latent effects of harsh environments across life stages in two coral species | *Montastraea faveolata*  *Agaricia humilis* | Salinity and temperature | Survivorship | Salinity - Increased freshwater influxes from increased storm occurrences as a result of climate change  Temperature - Rising global temperature as a result of climate change (greenhouse effect) |
| Humphrey C., Weber, M., Lott, C., Cooper, T., Fabricius, K. | 2008 | Effects of suspended sediments, dissolved inorganic nutrients and salinity on fertilisation and embryo development in the coral *Acropora millepora* | *Acropora millepora* | Sediment, salinity, nitrate and ammonium | Fertilisation | Suspended sediment – increased run-off from urban areas  Salinity – increased freshwater influxes from increased storm occurrences as a result of climate change  Nitrates and ammonium – run-off from agriculture and the use of fertilisers |
| Nakamura, M., Ohki, S., Suzuki, A. and Sakai, K. | 2011 | Coral Larvae under Ocean Acidification- Survival, Metabolism, and Metamorphosis | *Acropora digitfera* | Acidification | Survivorship | Increased atmospheric carbon dioxide from burning fossil fuels (climate change) |
| Negri, A. P. and Heyward, A. J. | 2001 | Inhibition of coral fertilisation and larval metamorphosis by tributyltin and copper | *Acropora millepora* | Copper and tributyltin | Fertilisation | From their use in marine anti-fouling paints as well as from industry (smelters) |
| Randall, C. J. and Szmant, A. M. | 2009 | Elevated temperature reduces survivorship and settlement of the larvae of the Caribbean scleractinian coral, *Favia fragum (Esper)* | *Favia fragum* | Temperature | Survivorship | Rising global temperature as a result of climate change (greenhouse effect) |
| Reichelt-Brushett, A. J.and Harrison, P. L. | 1999 | The Effect of Copper, Zinc and Cadmium on Fertilisation Success of Gametes from Scleractinian Reef Corals | *Goniastrea aspera* | Copper, zinc and cadmium | Fertilisation | Copper – industrial uses in smelters, run-off from land waste and anto-fouling paint  Zinc – industrial uses in mining and the manufacture of zinc  Cadmium – manufacturing and use in disposable products (electronics) |
| Reichelt-Brushett, A. J. and Harrison, P. L. | 2004 | Development of a Sublethal Test to Determine the Effects of Copper and Lead on Scleractinian Coral Larvae | *Goniastrea aspera* | Copper and lead | Survivorship | Copper – industrial uses in smelters and anti-fouling paints  Lead – extracted from gasoline, aerosols and smelters |
| Reichelt-Brushett, A. J. and Harrison, P. L. | 2005 | The effect of selected trace metals on the fertilisation success of several scleractinian coral species | *Goniastrea retiformis, Goniastrea aspera, Acropora tenius, Acropora longicyathus* | Copper, cadmium, nickel, zinc | Survivorship | Copper – industrial uses in smelters, run-off from land waste and anti-fouling paint  Cadmium – manufacturing and use in disposable products (electronics)  Nickel – combustion of coral and oil, sewerage, mining and steel manufacture  Zinc – industrial uses in mining and the manufacture of zinc |
| Scott, A., Harrison, P. L. and Brooks, L. O. | 2013 | Reduced salinity decreases the fertilisation success and larval survival of two scleractinian coral species | *Acropora millepora, Platygyra daedalea* | Salinity | Fertilisation and survivorship | Increased freshwater influxes from increased storm occurrences as a result of climate change |
| Vermeij, M. J. A., Fogarty, N. D. and Miller, M. W. | 2006 | Pelagic conditions affect larval behaviour, survival and settlement patterns in the Caribbean coral *Montastraea faveolata* | *Montastraea faveolata* | Salinity | Survivorship | Increased freshwater influxes from increased storm occurrences as a result of climate change |
| Victor, S. and Richmond, R. H. | 2005 | Effect of copper on fertilisation success in the reef coral *Acropora surculosa* | *Acropora surcolosa* | Copper | Fertilisation | Industrial uses in smelters, run-off from land waste and anti-fouling paint |

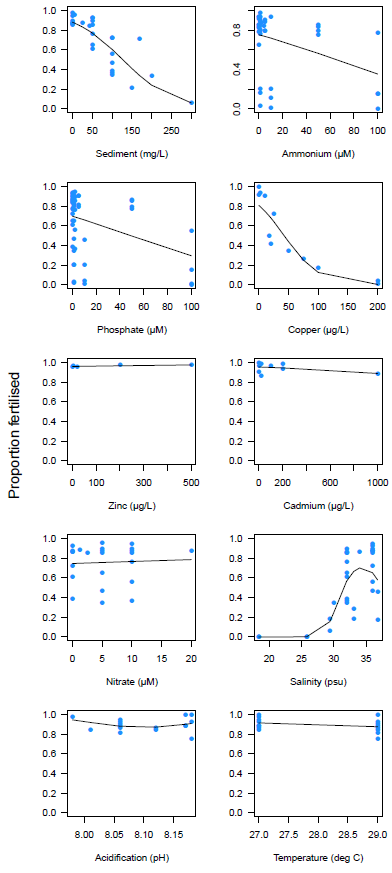
Figure S1.

Figure S1. Fertilisation success as a function of each factor used to test for normality prior to being input into the full GLMM.

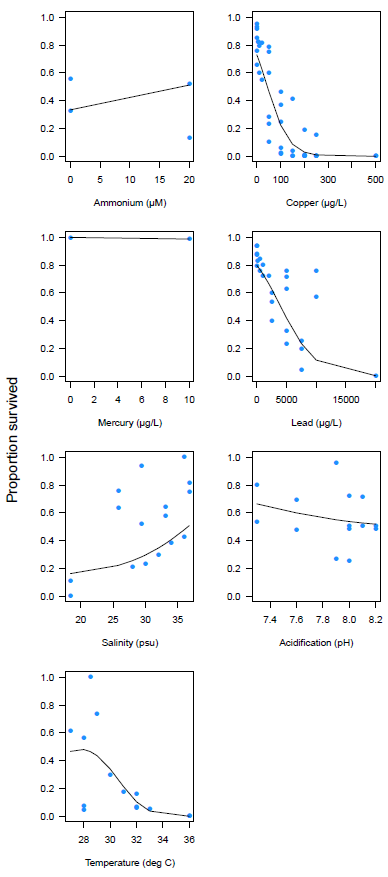
Figure S2.

Figure S2. Larval survivorship as a function of each factor used to test for normality prior to being input into the full GLMM.

Equations

**Fertilisation success - Equation 1**

-6.4783

**Larval survivorship - Equation 2**

**Equation 3 – Inverse logit for both Fertilisation success and larval survivorship**

P =

**Key – Equations 1 and 2**

|  |  |
| --- | --- |
| **Symbol** | **Factor** |
| S | Sediment |
| A | Ammonium |
| P | Phosphate |
| C | Copper |
| Sa | Salinity |
| L | Lead |

The above equations further explain the models used with our study and highlight the use of rescaling to better represent the data used. The values used within these equations are the coefficients that can be found in Tables 2 and 3 as the results of each model. It is important to note that new factors can be added if more data is included within the larger sample. For further explanation of the model access our Github page. This page will also allow you to import your own water analysis results for varying sites.