Modelling Methods draft 1

To evaluate the influence of time out of water, air temperature, and carapace length on the post-release survival of *P. platyceros* in commercial fisheries, we used generalized linear mixed-effects models (GLMMs) with binomial error structure to model probability of survival.

Some of the prawns for which survival data was collected (n=5053) were excluded from the models (n=4598). 273 prawns lost their coloured band during the release stage. These prawns could not be assigned to a treatment. To ensure we were not confounding our results, we compared the size distribution of these prawns to that of the prawns that retained their band. There was no clear difference, so these individuals were excluded from the data. 215 prawns had damage on their carapace, so their length could not be measured. To determine whether carapace damage was correlated with treatment, and therefore survival, we compared the number of prawns with carapace damage in each treatment. There was no obvious pattern, so we excluded these prawns as well.

Some prawns were lost from the traps during the experiment. We had no data on these individuals. We investigated whether loss was correlated with survival by looking at the percentage of each treatment that was lost. There were slightly more losses at higher treatments times. To ensure that this would not bias our results, we compared the observed survival against ‘true’ survival of a theoretical trial where 20% of prawns are lost. ‘True’ survival was calculated based on three different assumptions: only living prawns were lost, only dead prawns were lost, and dead and living prawns were lost with equal frequency. This analysis showed that even if living or dead prawns were lost more frequently, the effect on the estimated survival was minor.

In our model suite, we included combinations of three fixed effects: time out of water, air temperature, and length, and two-way interaction terms, resulting in 18 candidate models (Table 1) to predict prawn survival. We did not include the three-way interaction term because it is difficult to interpret. All models included a random effect on the intercept to account for variation in survival caused by the trap a prawn was in; there were 123 levels. We expected survival to vary between traps because there were many differences between traps including location, time, and orientation on the ground. Model fitting was done with the lme4 (Gaussian Quadrature) and glmmTMB (Laplace approximation) R packages. To prioritise simplicity and interpretability, we compared models using Bayesian Information Criterion (BIC) (Table 1).