Figures and Supplementary Material

Main text figures

Figure 1:

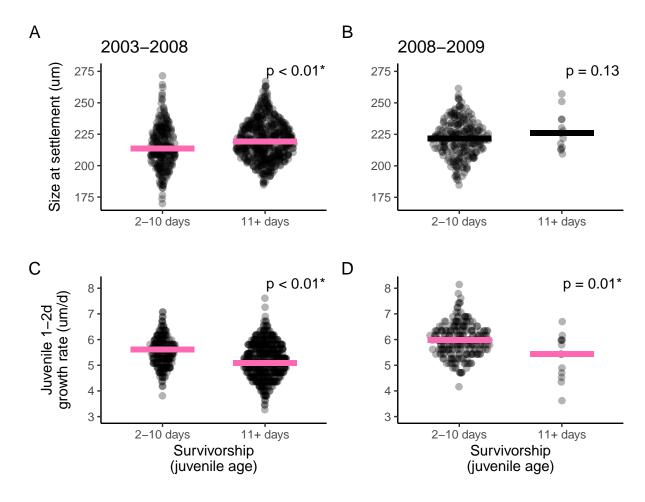


Figure 2:

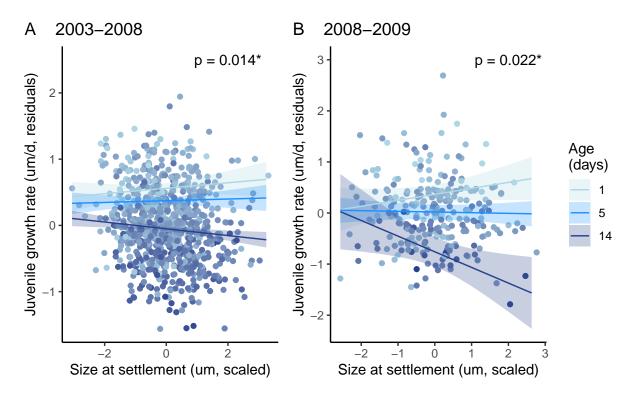


Figure 3:

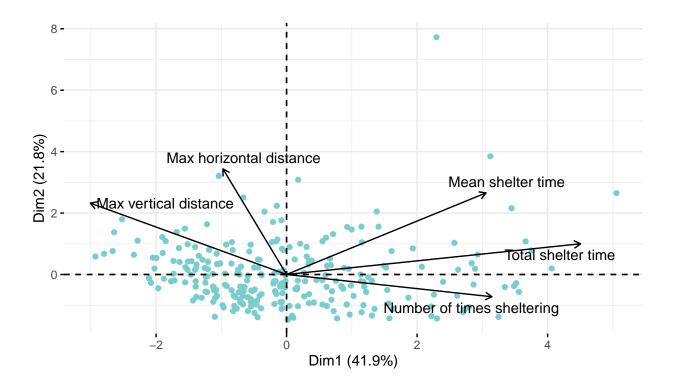
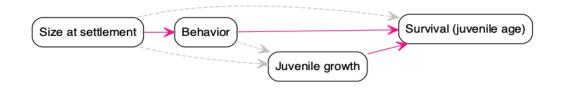


Figure 4:



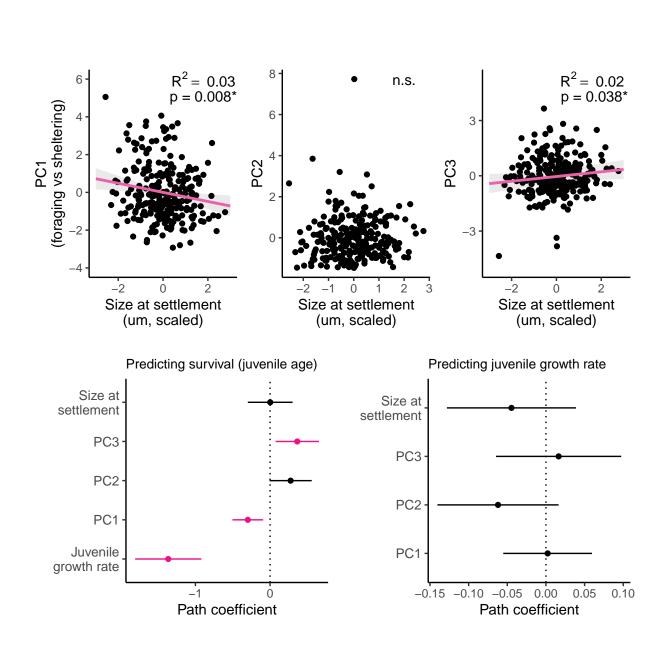
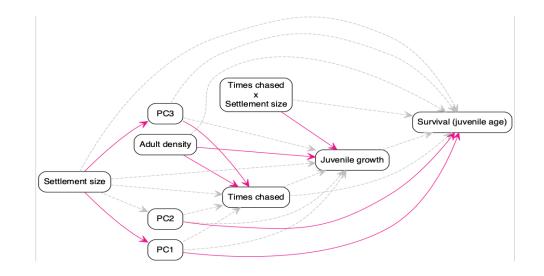
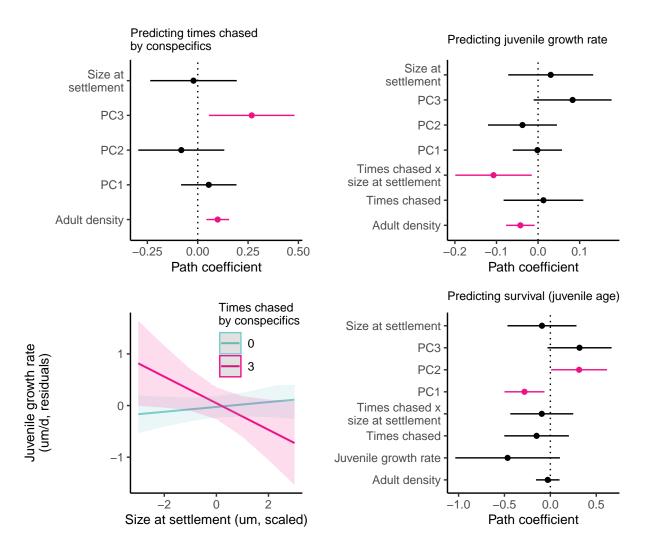


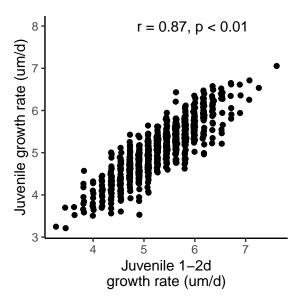
Figure 5:





Supplementary Figures

Figure S1:





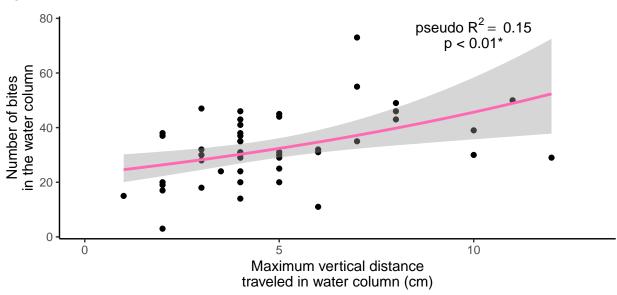


Figure S3:

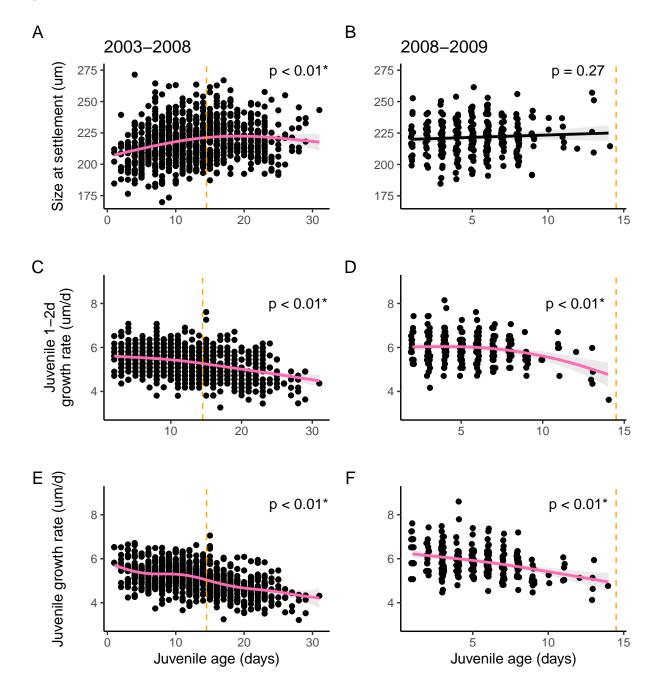


Figure S4:

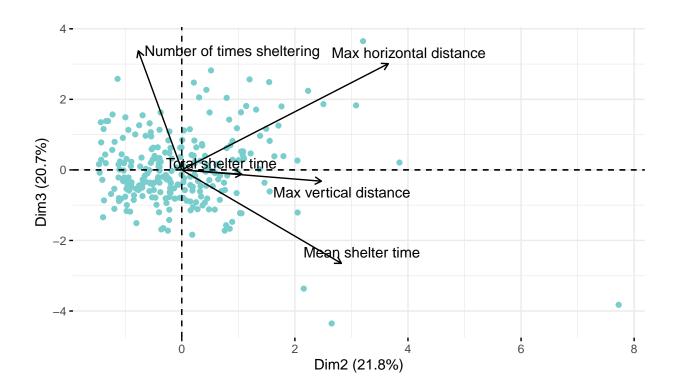
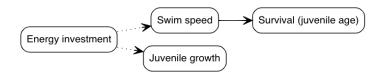
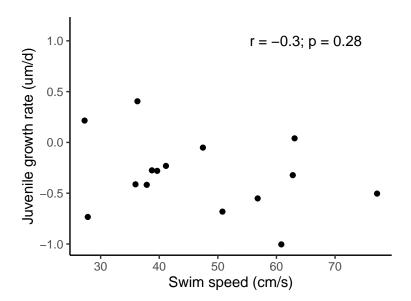


Figure S5:





Supplementary Tables

Table 1: Generalized linear model (GLM) with a negative binomial error structure predicting number of times fish take bites in the water column.

| | Estimate | Std. Error | z value | p value |
|-----------------------|----------|------------|---------|---------|
| (Intercept) | 3.13 | 0.12 | 25.28 | < 0.001 |
| Max vertical distance | 0.07 | 0.02 | 3.08 | 0.002 |

Table 2: Linear mixed effects model (LMM) predicting juvenile growth rate (um/d, residuals) in the 2008-2009 dataset, with random intercepts for collection site.

| | Estimate | Std. Error | df | t value | p value |
|--------------------------------|----------|------------|--------|---------|---------|
| (Intercept) | 0.45 | 0.11 | 4.50 | 4.26 | 0.010 |
| Settlement size | 0.15 | 0.09 | 249.51 | 1.75 | 0.081 |
| Juvenile age | -0.09 | 0.01 | 251.60 | -5.84 | < 0.001 |
| Settlement size x juvenile age | -0.03 | 0.01 | 251.47 | -2.30 | 0.022 |

Table 3: LMM predicting juvenile growth rate (um/d, residuals) in the 2003-2008 dataset, with random intercepts for collection site.

| | Estimate | Std. Error | z value | p value |
|--------------------------------|----------|------------|---------|---------|
| (Intercept) | 0.61 | 0.04 | 14.67 | < 0.001 |
| Settlement size | 0.05 | 0.04 | 1.22 | 0.223 |
| ${f Juvenile\ age}$ | -0.05 | 0.00 | -16.05 | < 0.001 |
| Settlement size x juvenile age | -0.01 | 0.00 | -2.47 | 0.014 |

Table 4: Path coefficients for the DAG in Figure 4A. The model is well fit to the data (C-statistic = 1.33, df = 6, p-value = 0.97). A p-value < 0.05 would indicate that the hypothesized structure in the DAG is not supported by the data. Estimates correspond to partial regression coefficients and can be interpreted as the expected change in the response given a unit change in the predictor. Standardized estimates are calculated by scaling these estimates by the ratio of the standard deviation of the predictor over the standard deviation of the response.

| Response | Predictor | Estimate | Std.Estimate | Std.Error | DF | Crit.Value | P.Value |
|------------------|------------------|----------|--------------|-----------|------------|------------|---------|
| PC1 | Settlement size | -0.24 | -0.17 | 0.09 | 254 | -2.69 | 0.008 |
| PC2 | Settlement size | 0.04 | 0.03 | 0.07 | 254 | 0.54 | 0.591 |
| PC3 | Settlement size | 0.13 | 0.13 | 0.06 | 256 | 2.08 | 0.038 |
| Juvenile age | Juv. growth rate | -1.36 | -0.35 | 0.23 | 250 | -6.03 | < 0.001 |
| Juvenile age | Settlement size | 0.00 | 0.00 | 0.15 | 250 | 0.01 | 0.989 |
| Juvenile age | PC1 | -0.30 | -0.16 | 0.10 | 250 | -2.84 | 0.005 |
| Juvenile age | PC2 | 0.28 | 0.11 | 0.14 | 250 | 1.91 | 0.057 |
| Juvenile age | PC3 | 0.36 | 0.14 | 0.15 | 250 | 2.46 | 0.015 |
| Juv. growth rate | PC1 | 0.00 | 0.00 | 0.03 | 251 | 0.08 | 0.939 |
| Juv. growth rate | PC2 | -0.06 | -0.10 | 0.04 | 251 | -1.55 | 0.123 |
| Juv. growth rate | PC3 | 0.02 | 0.03 | 0.04 | 251 | 0.40 | 0.691 |
| Juv. growth rate | Settlement size | -0.04 | -0.07 | 0.04 | 251 | -1.05 | 0.297 |

Table 5: R-squared values for component models for the DAG in Figure 4A.

| Response | Family | Link | Mixed model | Marginal R2 | Conditional R2 |
|----------------------|----------|----------|-------------|-------------|----------------|
| PC1 | Gaussian | identity | No | 0.03 | NA |
| PC2 | Gaussian | identity | No | 0.00 | NA |
| PC3 | Gaussian | identity | Yes | 0.02 | 0.08 |
| Juvenile age | Gaussian | identity | No | 0.19 | NA |
| Juvenile growth rate | Gaussian | identity | No | 0.01 | NA |

Table 6: Path coefficients for the DAG in Figure 5A. The model is well fit to the data (C-statistic = 13.55, df = 12, p-value = 0.33). A p-value < 0.05 would indicate that the hypothesized structure in the DAG is not supported by the data. Estimates correspond to partial regression coefficients and can be interpreted as the expected change in the response given a unit change in the predictor. Standardized estimates are calculated by scaling these estimates by the ratio of the standard deviation of the predictor over the standard deviation of the response.

| Response | Predictor | Estimate | Std.Estimate | Std.Error | DF | Crit.Value | P.Value |
|------------------|---------------------|----------|--------------|-----------|-----|-------------|---------|
| Times chased | Adult density | 0.10 | 0.13 | 0.03 | 162 | 3.44 | 0.001 |
| Times chased | Settlement size | -0.02 | -0.01 | 0.11 | 162 | -0.19 | 0.848 |
| Times chased | PC1 | 0.05 | 0.04 | 0.07 | 162 | 0.78 | 0.435 |
| Times chased | PC2 | -0.08 | -0.04 | 0.11 | 162 | -0.75 | 0.454 |
| Times chased | PC3 | 0.27 | 0.14 | 0.11 | 162 | 2.47 | 0.014 |
| Juv. growth rate | Adult density | -0.04 | -0.19 | 0.02 | 159 | -2.43 | 0.016 |
| Juv. growth rate | Times chased | 0.01 | 0.02 | 0.05 | 159 | 0.26 | 0.792 |
| Juv. growth rate | Settlement size | 0.03 | 0.05 | 0.05 | 160 | 0.58 | 0.560 |
| Juv. growth rate | PC3 | 0.08 | 0.14 | 0.05 | 145 | 1.74 | 0.084 |
| Juv. growth rate | PC1 | 0.00 | 0.00 | 0.03 | 160 | -0.05 | 0.959 |
| Juv. growth rate | PC2 | -0.04 | -0.07 | 0.04 | 159 | -0.89 | 0.375 |
| Juv. growth rate | Chased:Settlmt size | -0.11 | -0.19 | 0.05 | 159 | -2.29 | 0.024 |
| Juvenile age | Juv. growth rate | -0.47 | -0.13 | 0.29 | 159 | -1.60 | 0.111 |
| Juvenile age | Times chased | -0.15 | -0.06 | 0.18 | 158 | -0.84 | 0.404 |
| Juvenile age | Settlement size | -0.09 | -0.04 | 0.19 | 159 | -0.48 | 0.634 |
| Juvenile age | PC3 | 0.32 | 0.14 | 0.18 | 157 | 1.78 | 0.076 |
| Juvenile age | PC2 | 0.31 | 0.15 | 0.16 | 158 | 2.01 | 0.046 |
| Juvenile age | PC1 | -0.28 | -0.20 | 0.11 | 159 | -2.54 | 0.012 |
| Juvenile age | Adult density | -0.03 | -0.03 | 0.07 | 158 | -0.43 | 0.665 |
| Juvenile age | Chased:Settlmt size | -0.09 | -0.04 | 0.17 | 158 | -0.54 | 0.593 |
| PC1 | Settlement size | -0.26 | -0.16 | 0.12 | 166 | -2.11 | 0.036 |
| PC2 | Settlement size | -0.01 | -0.01 | 0.09 | 166 | -0.08 | 0.936 |
| PC3 | Settlement size | 0.21 | 0.20 | 0.08 | 168 | 2.68 | 0.007 |

Table 7: R-squared values for component models for the DAG in Figure 5A.

| Response | Family | Link | Mixed model | Marginal R2 | Conditional R2 |
|----------------------|----------|----------|-------------|-------------|----------------|
| Times chased | Poisson | log | No | 0.13 | NA |
| Juvenile growth rate | Gaussian | identity | Yes | 0.08 | 0.10 |
| Juvenile age | Gaussian | identity | Yes | 0.09 | 0.13 |
| PC1 | Gaussian | identity | No | 0.03 | NA |
| PC2 | Gaussian | identity | No | 0.00 | NA |
| PC3 | Gaussian | identity | Yes | 0.04 | 0.10 |