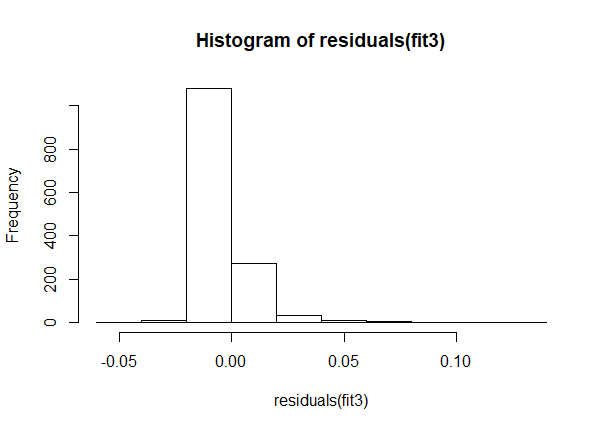
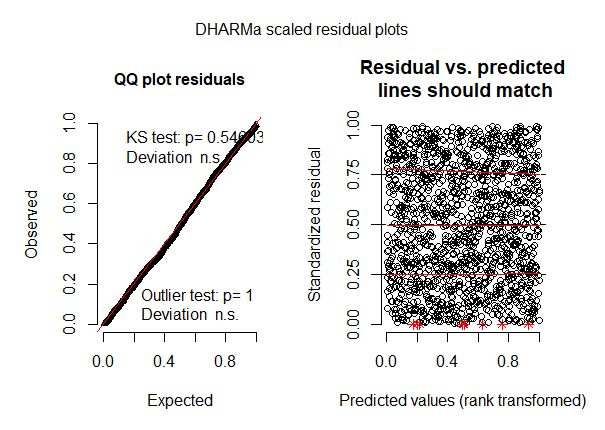
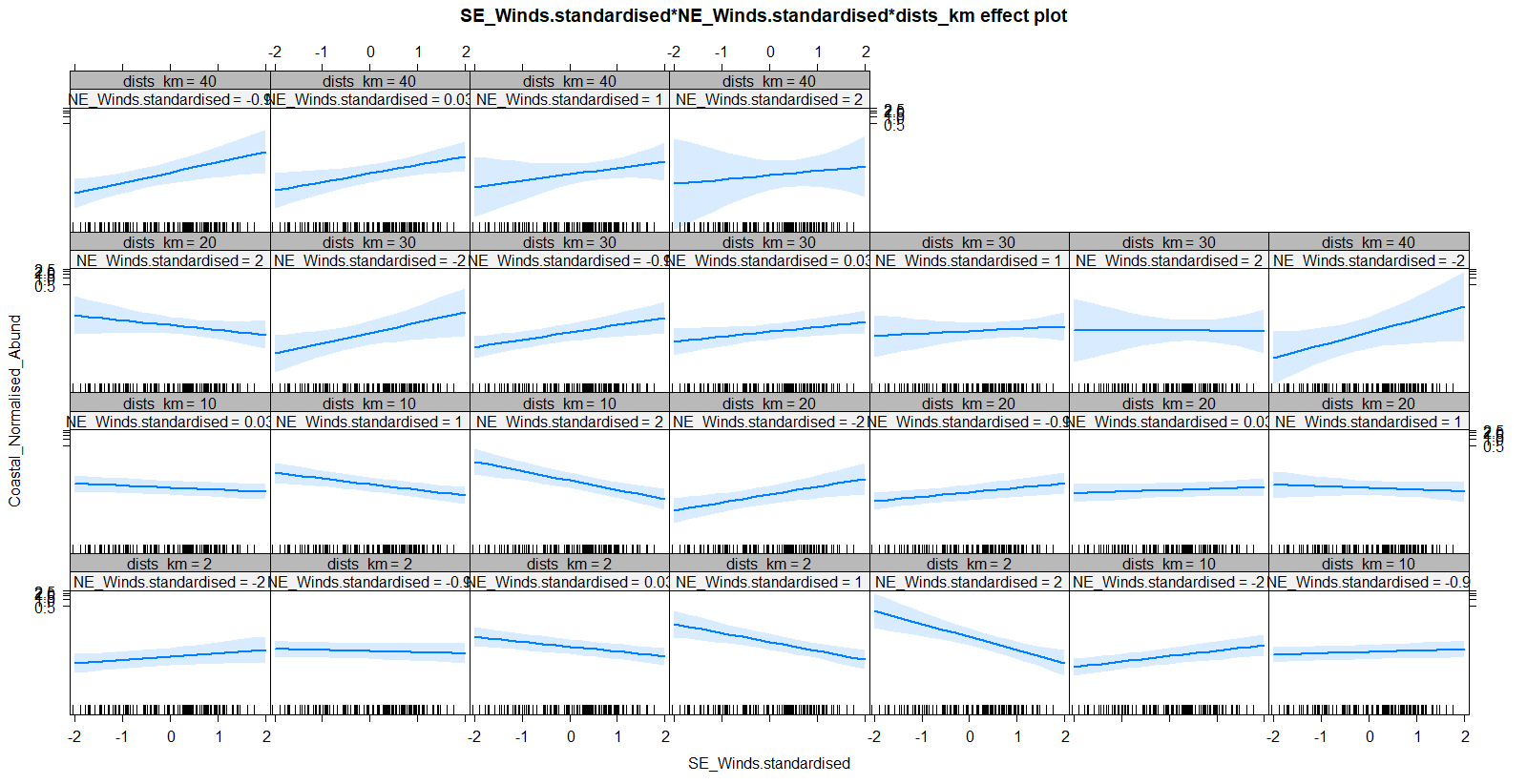
**Model outputs**

**Larval fish and wind mechanism (14 day prior winds)**

Model assumptions = good





Summary:

summary(fit3)

Family: tweedie ( log )

Formula: Coastal\_Normalised\_Abund ~ SE\_Winds.standardised \* NE\_Winds.standardised \*

dists\_km + (1 | Project\_ID)

Data: fish\_data

AIC BIC logLik deviance df.resid

-5380.1 -5322.3 2701.0 -5402.1 1408

Random effects:

Conditional model:

Groups Name Variance Std.Dev.

Project\_ID (Intercept) 0.7274 0.8529

Number of obs: 1419, groups: Project\_ID, 6

Overdispersion parameter for tweedie family (): 0.509

Conditional model:

Estimate Std. Error z value Pr(>|z|)

(Intercept) -4.844590 0.404381 -11.980 < 2e-16 \*\*\*

SE\_Winds.standardised -0.571385 0.157223 -3.634 0.000279 \*\*\*

NE\_Winds.standardised 0.543651 0.132782 4.094 4.23e-05 \*\*\*

dists\_km -0.025355 0.011185 -2.267 0.023401 \*

SE\_Winds.standardised:NE\_Winds.standardised -0.442855 0.138997 -3.186 0.001442 \*\*

SE\_Winds.standardised:dists\_km 0.036557 0.011743 3.113 0.001851 \*\*

NE\_Winds.standardised:dists\_km -0.016022 0.010560 -1.517 0.129209

SE\_Winds.standardised:NE\_Winds.standardised:dists\_km 0.005561 0.011930 0.466 0.641103

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Anova:

Anova(fit3,type="II",test="Chisq")

Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Coastal\_Normalised\_Abund

Chisq Df Pr(>Chisq)

SE\_Winds.standardised 0.1291 1 0.719405

NE\_Winds.standardised 22.3683 1 2.251e-06 \*\*\*

dists\_km 5.6680 1 0.017278 \*

SE\_Winds.standardised:NE\_Winds.standardised 22.1906 1 2.469e-06 \*\*\*

SE\_Winds.standardised:dists\_km 10.2819 1 0.001343 \*\*

NE\_Winds.standardised:dists\_km 2.1363 1 0.143847

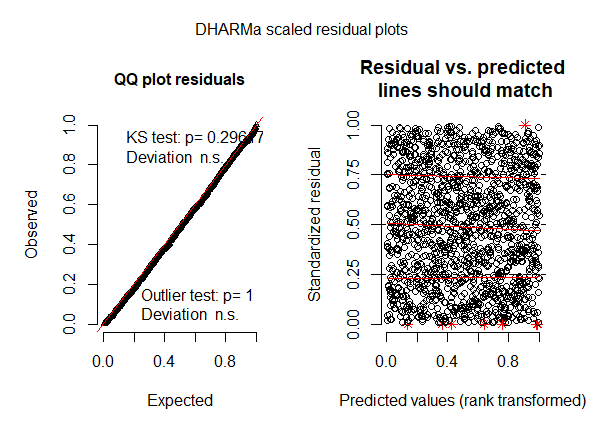
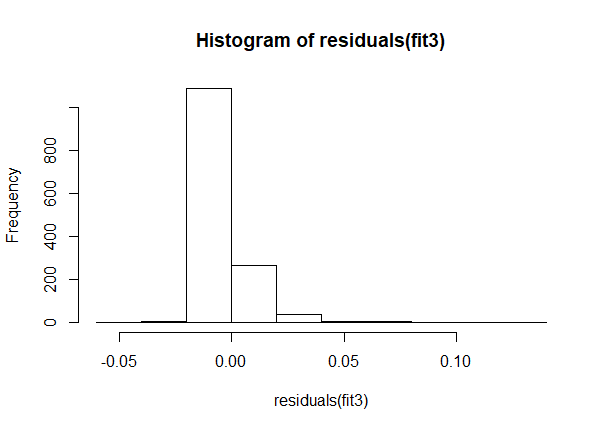
SE\_Winds.standardised:NE\_Winds.standardised:dists\_km 0.2173 1 0.641103

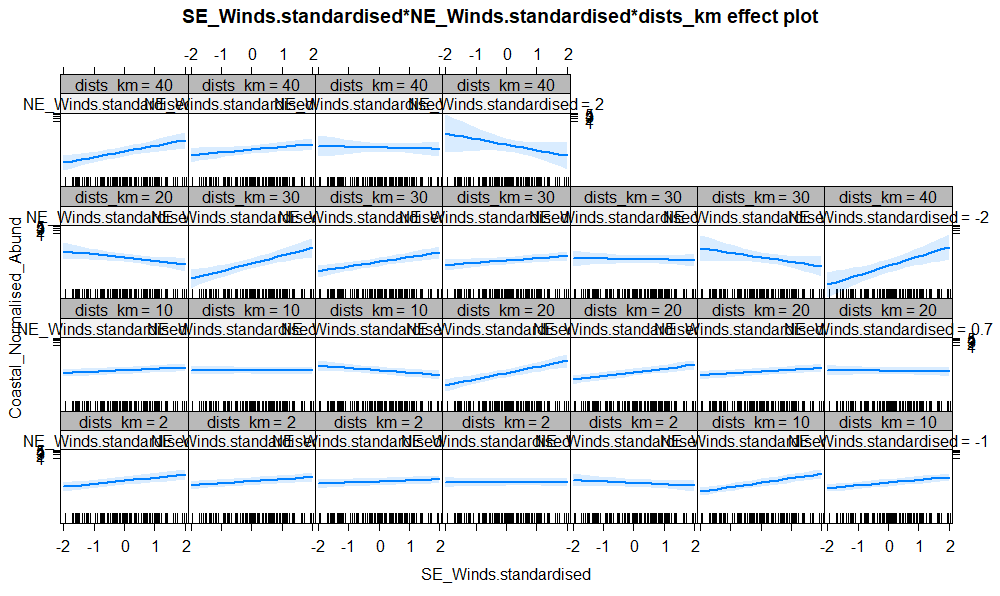
---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

**Larval fish and wind mechanism (3 day prior winds)**

Model assumptions = good



Summary:

summary(fit3)

Family: tweedie ( log )

Formula: Coastal\_Normalised\_Abund ~ SE\_Winds.standardised \* NE\_Winds.standardised \*

dists\_km + (1 | Project\_ID)

Data: fish\_data

AIC BIC logLik deviance df.resid

-5371.0 -5313.2 2696.5 -5393.0 1408

Random effects:

Conditional model:

Groups Name Variance Std.Dev.

Project\_ID (Intercept) 0.6899 0.8306

Number of obs: 1419, groups: Project\_ID, 6

Overdispersion parameter for tweedie family (): 0.517

Conditional model:

Estimate Std. Error z value Pr(>|z|)

(Intercept) -4.881752 0.388848 -12.554 <2e-16 \*\*\*

SE\_Winds.standardised 0.158199 0.111610 1.417 0.1564

NE\_Winds.standardised -0.149041 0.105935 -1.407 0.1595

dists\_km -0.020874 0.009953 -2.097 0.0360 \*

SE\_Winds.standardised:NE\_Winds.standardised -0.203682 0.094451 -2.156 0.0310 \*

SE\_Winds.standardised:dists\_km 0.005927 0.009185 0.645 0.5188

NE\_Winds.standardised:dists\_km 0.015435 0.008330 1.853 0.0639 .

SE\_Winds.standardised:NE\_Winds.standardised:dists\_km -0.014257 0.009497 -1.501 0.1333

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Anova:

Anova(fit3,type="II",test="Chisq")

Analysis of Deviance Table (Type II Wald chisquare tests)

Response: Coastal\_Normalised\_Abund

Chisq Df Pr(>Chisq)

SE\_Winds.standardised 25.2477 1 5.042e-07 \*\*\*

NE\_Winds.standardised 0.7221 1 0.39544

dists\_km 6.0833 1 0.01365 \*

SE\_Winds.standardised:NE\_Winds.standardised 27.9978 1 1.215e-07 \*\*\*

SE\_Winds.standardised:dists\_km 2.3371 1 0.12633

NE\_Winds.standardised:dists\_km 2.4148 1 0.12020

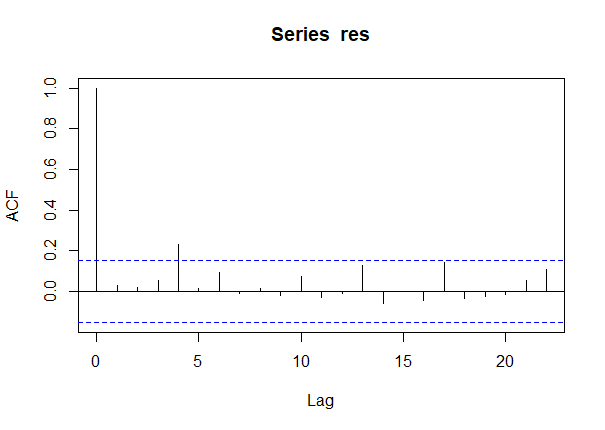
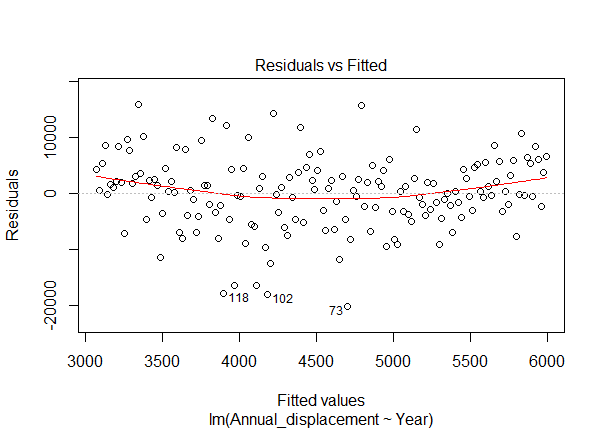
SE\_Winds.standardised:NE\_Winds.standardised:dists\_km 2.2539 1 0.13328

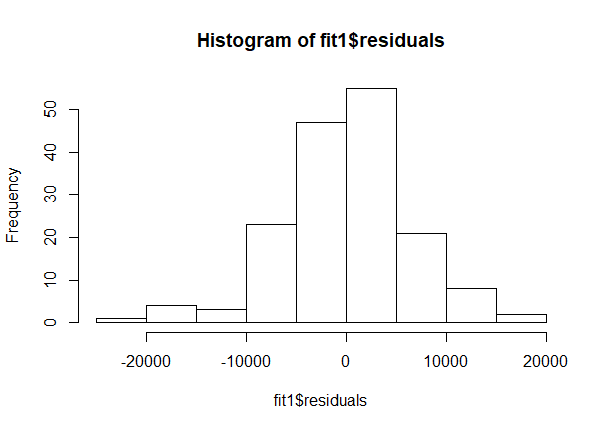
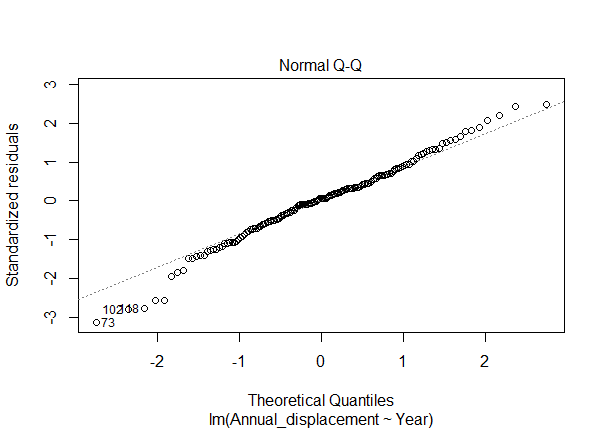
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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

**SE Historical Wind Changes Model**

Model assumptions (OK, not perfect) – **Some Autocorrelation!**?!?!





Summary:

> summary(fit1) # -17.94 decline per year (p = 0.094)

Call:

lm(formula = Annual\_displacement ~ Year, data = dat2)

Residuals:

Min 1Q Median 3Q Max

-20204.9 -3643.3 355.6 3792.9 15931.1

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 39192.49 20582.53 1.904 0.0587 .

Year -17.94 10.65 -1.684 0.0940 .

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 6455 on 162 degrees of freedom

Multiple R-squared: 0.01721, Adjusted R-squared: 0.01115

F-statistic: 2.837 on 1 and 162 DF, p-value: 0.09402

ANOVA:

anova(fit1)

Analysis of Variance Table

Response: Annual\_displacement

Df Sum Sq Mean Sq F value Pr(>F)

Year 1 118233600 118233600 2.8373 0.09402 .

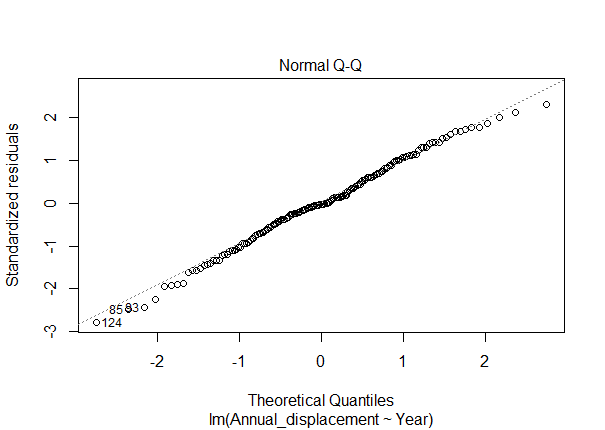
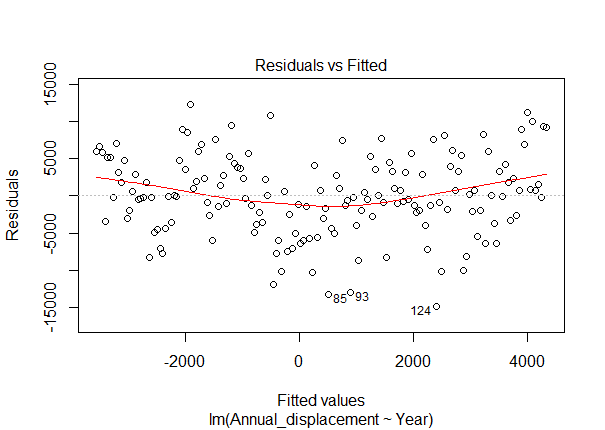
Residuals 162 6750675359 41670836

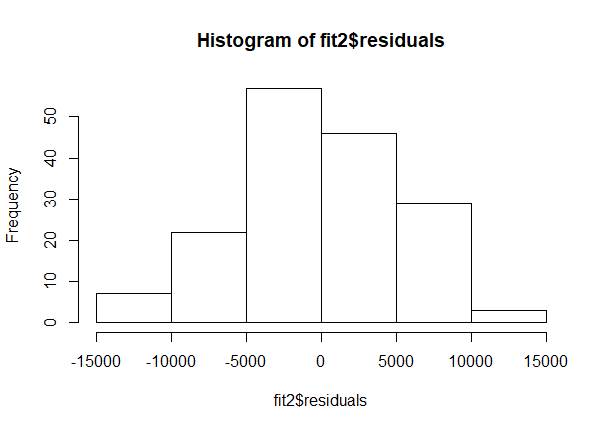
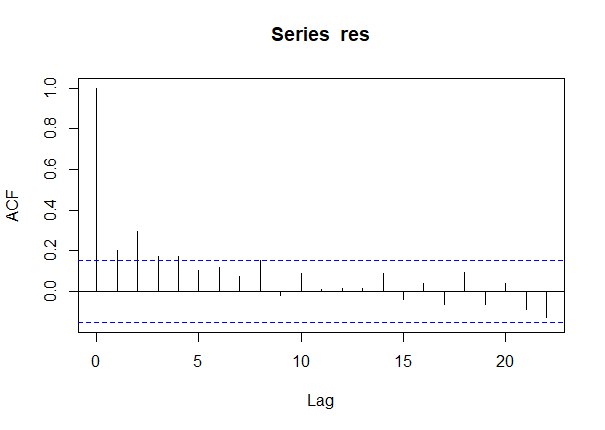
---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

NE Historical Winds

Assumptions (OK)





Summary:

> summary(fit2) # increase by 48.307 per year (p < 0.001)

Call:

lm(formula = Annual\_displacement ~ Year, data = dat2\_NE)

Residuals:

Min 1Q Median 3Q Max

-14850.7 -3302.4 -145.7 3617.1 12281.8

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) -92961.421 17067.386 -5.447 1.87e-07 \*\*\*

Year 48.307 8.829 5.471 1.67e-07 \*\*\*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 5353 on 162 degrees of freedom

Multiple R-squared: 0.156, Adjusted R-squared: 0.1508

F-statistic: 29.94 on 1 and 162 DF, p-value: 1.667e-07

ANOVA:

anova(fit2)

Analysis of Variance Table

Response: Annual\_displacement

Df Sum Sq Mean Sq F value Pr(>F)

Year 1 857728802 857728802 29.935 1.667e-07 \*\*\*

Residuals 162 4641769923 28652901

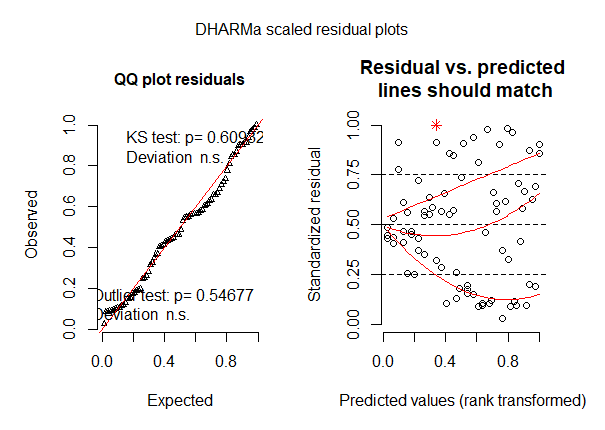
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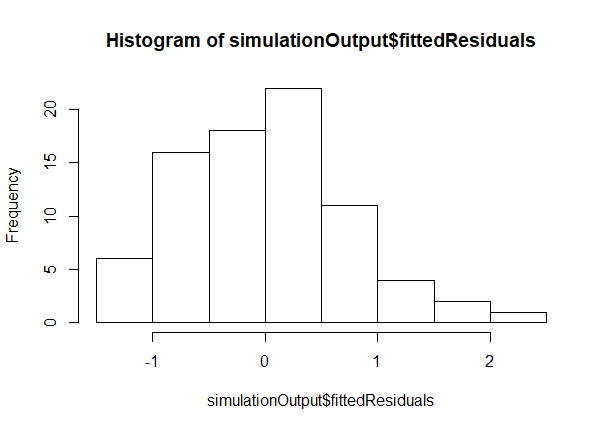
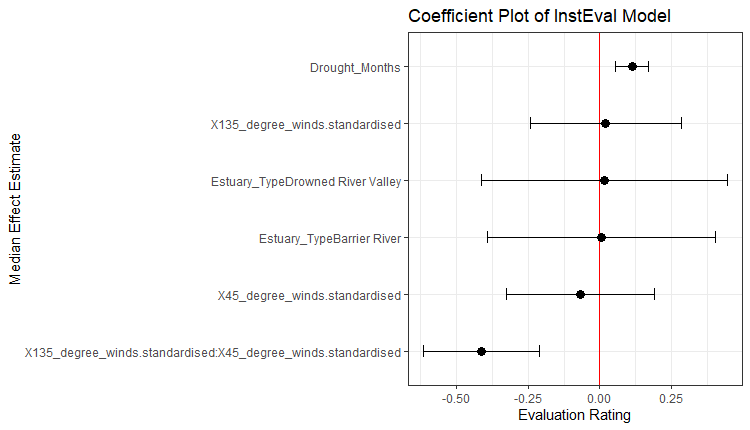
Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Commercial Scale:

Bream:

Assumptions (Not great but acceptable):



Summary:

summary(m1)

Linear mixed model fit by REML. t-tests use Satterthwaite's method ['lmerModLmerTest']

Formula: CPUE.standardised ~ X135\_degree\_winds.standardised \* X45\_degree\_winds.standardised +

Estuary\_Type + Drought\_Months + (1 | Estuary)

Data: bream

REML criterion at convergence: 197.4

Scaled residuals:

Min 1Q Median 3Q Max

-1.92148 -0.72862 -0.01565 0.44937 2.87152

Random effects:

Groups Name Variance Std.Dev.

Estuary (Intercept) 1.479e-32 1.216e-16

Residual 5.934e-01 7.703e-01

Number of obs: 80, groups: Estuary, 8

Fixed effects:

Estimate Std. Error df t value Pr(>|t|)

(Intercept) -0.629337 0.175017 73.000000 -3.596 0.000585 \*\*\*

X135\_degree\_winds.standardised 0.011653 0.130503 73.000000 0.089 0.929095

X45\_degree\_winds.standardised -0.069841 0.127899 73.000000 -0.546 0.586689

Estuary\_TypeBarrier River 0.007481 0.198907 73.000000 0.038 0.970103

Estuary\_TypeDrowned River Valley 0.016831 0.222418 73.000000 0.076 0.939886

Drought\_Months 0.112208 0.029108 73.000000 3.855 0.000247 \*\*\*

X135\_degree\_winds.standardised:X45\_degree\_winds.standardised -0.417629 0.100990 73.000000 -4.135 9.36e-05 \*\*\*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:

(Intr) X135\_d\_. X45\_\_. Es\_TBR E\_TDRV Drgh\_M

X135\_dgr\_w. 0.159

X45\_dgr\_wn. -0.045 0.613

Estry\_TypBR -0.573 -0.003 0.002

Estry\_TyDRV -0.518 -0.005 0.003 0.447

Drght\_Mnths -0.480 -0.265 0.170 0.010 0.020

X135\_\_.:X45 0.253 0.037 0.137 0.002 0.004 0.191

convergence code: 0

boundary (singular) fit: see ?isSingular

Anova:

anova(m1) # bream interaction with winds

Type III Analysis of Variance Table with Satterthwaite's method

Sum Sq Mean Sq NumDF DenDF F value Pr(>F)

X135\_degree\_winds.standardised 0.0047 0.0047 1 73 0.0080 0.9290948

X45\_degree\_winds.standardised 0.1769 0.1769 1 73 0.2982 0.5866895

Estuary\_Type 0.0034 0.0017 2 73 0.0029 0.9971321

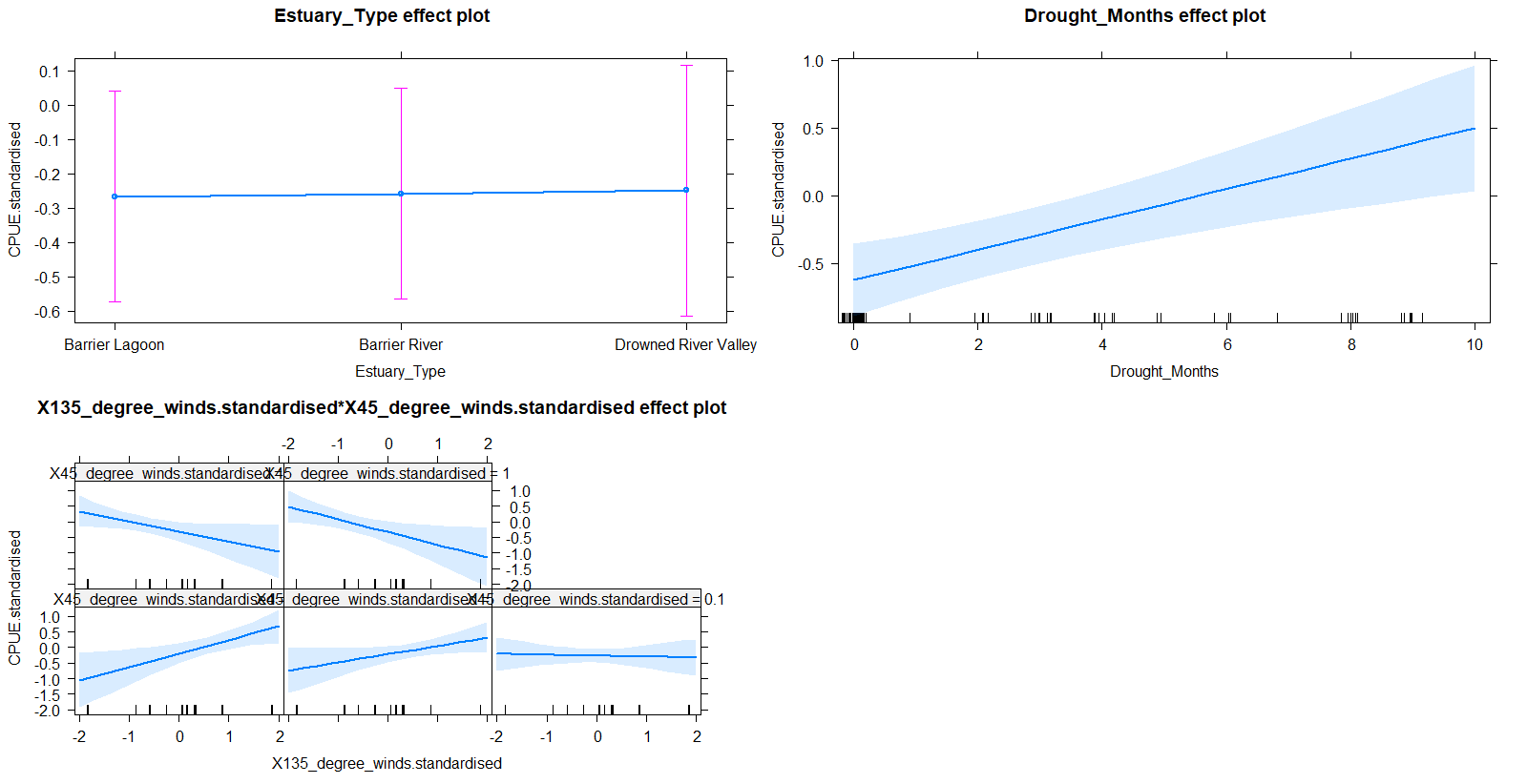
Drought\_Months 8.8182 8.8182 1 73 14.8603 0.0002469 \*\*\*

X135\_degree\_winds.standardised:X45\_degree\_winds.standardised 10.1480 10.1480 1 73 17.1012 9.36e-05 \*\*\*

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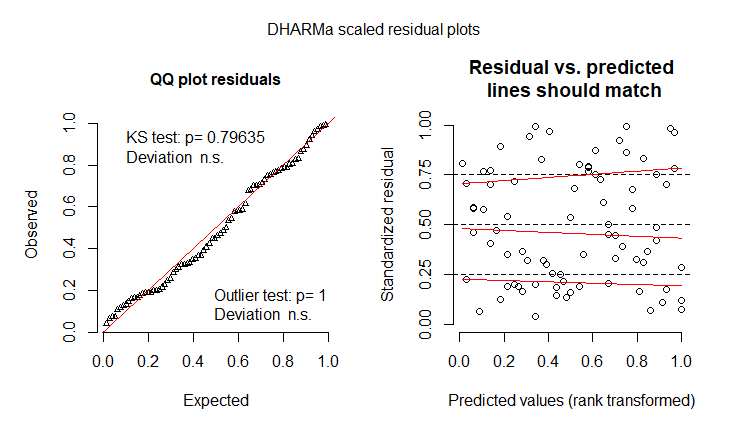
Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

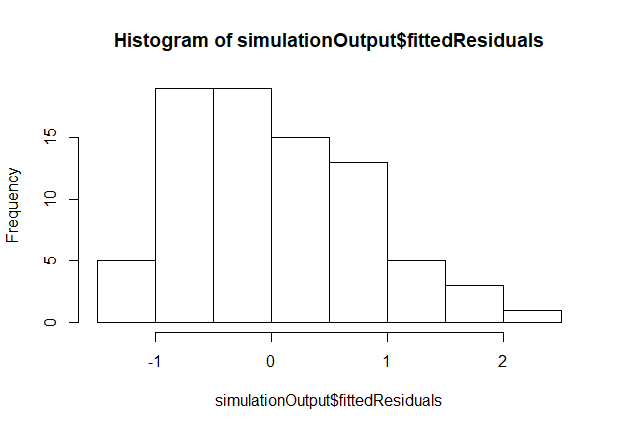
Effects plots (may be dodgy with Random effects but should be OK)

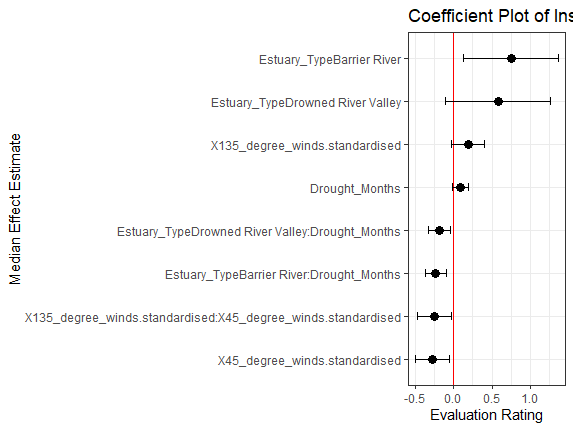


Mullet:

Assumptions (OK):







Summary:

summary(m2)

Linear mixed model fit by REML. t-tests use Satterthwaite's method ['lmerModLmerTest']

Formula: CPUE.standardised ~ X135\_degree\_winds.standardised \* X45\_degree\_winds.standardised +

Estuary\_Type \* Drought\_Months + (1 | Estuary)

Data: mullet

REML criterion at convergence: 219.2

Scaled residuals:

Min 1Q Median 3Q Max

-1.7247 -0.7555 -0.1243 0.6079 2.7082

Random effects:

Groups Name Variance Std.Dev.

Estuary (Intercept) 3.826e-32 1.956e-16

Residual 7.379e-01 8.590e-01

Number of obs: 80, groups: Estuary, 8

Fixed effects:

Estimate Std. Error df t value Pr(>|t|)

(Intercept) -0.23787 0.23383 71.00000 -1.017 0.312475

X135\_degree\_winds.standardised 0.18661 0.10879 71.00000 1.715 0.090660 .

X45\_degree\_winds.standardised -0.26985 0.11009 71.00000 -2.451 0.016706 \*

Estuary\_TypeBarrier River 0.74731 0.30577 71.00000 2.444 0.017010 \*

Estuary\_TypeDrowned River Valley 0.56706 0.34692 71.00000 1.635 0.106564

Drought\_Months 0.08669 0.05137 71.00000 1.687 0.095923 .

X135\_degree\_winds.standardised:X45\_degree\_winds.standardised -0.24422 0.11445 71.00000 -2.134 0.036317 \*

Estuary\_TypeBarrier River:Drought\_Months -0.22934 0.06431 71.00000 -3.566 0.000654 \*\*\*

Estuary\_TypeDrowned River Valley:Drought\_Months -0.17589 0.07551 71.00000 -2.329 0.022693 \*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:

(Intr) X135\_d\_. X45\_\_. Es\_TBR Es\_TDRV Drgh\_M X135\_\_.: E\_TBR:

X135\_dgr\_w. -0.159

X45\_dgr\_wn. -0.145 -0.109

Estry\_TypBR -0.715 0.081 0.002

Estry\_TyDRV -0.619 0.011 0.025 0.471

Drght\_Mnths -0.735 0.226 0.205 0.510 0.437

X135\_\_.:X45 -0.175 -0.049 -0.043 0.011 -0.009 0.108

Est\_TBR:D\_M 0.533 -0.116 0.000 -0.688 -0.344 -0.734 -0.015

Es\_TDRV:D\_M 0.437 -0.008 -0.030 -0.332 -0.699 -0.605 0.017 0.478

convergence code: 0

boundary (singular) fit: see ?isSingular

ANOVA:

anova(m2) # Wind interaction effect

Type III Analysis of Variance Table with Satterthwaite's method

Sum Sq Mean Sq NumDF DenDF F value Pr(>F)

X135\_degree\_winds.standardised 2.1711 2.1711 1 71 2.9421 0.09066 .

X45\_degree\_winds.standardised 4.4335 4.4335 1 71 6.0079 0.01671 \*

Estuary\_Type 4.6297 2.3148 2 71 3.1369 0.04949 \*

Drought\_Months 1.6168 1.6168 1 71 2.1910 0.14325

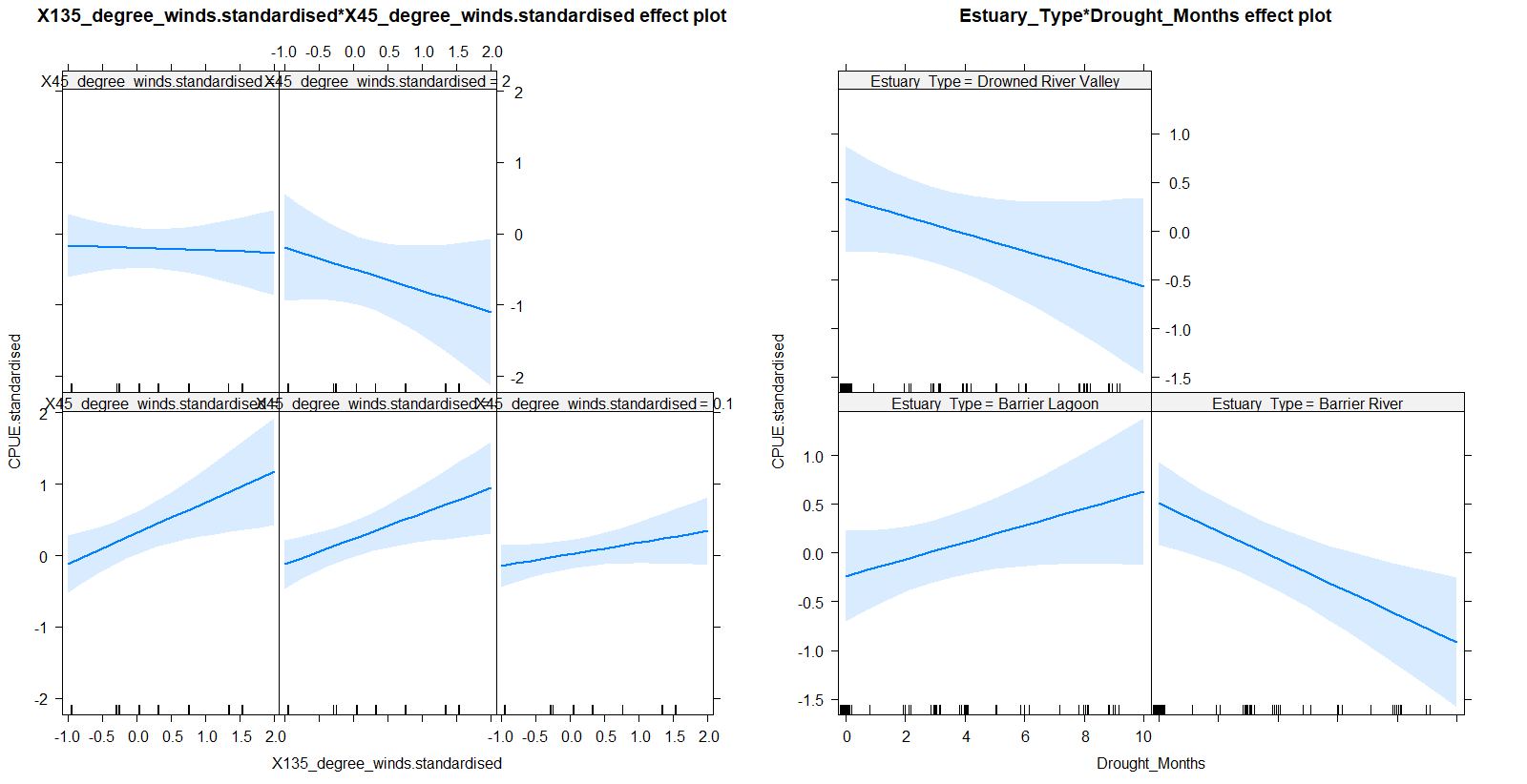
X135\_degree\_winds.standardised:X45\_degree\_winds.standardised 3.3598 3.3598 1 71 4.5530 0.03632 \*

Estuary\_Type:Drought\_Months 9.7555 4.8778 2 71 6.6100 0.00233 \*\*

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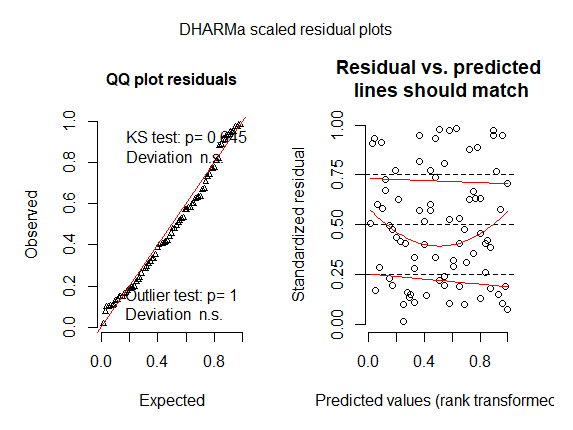
Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

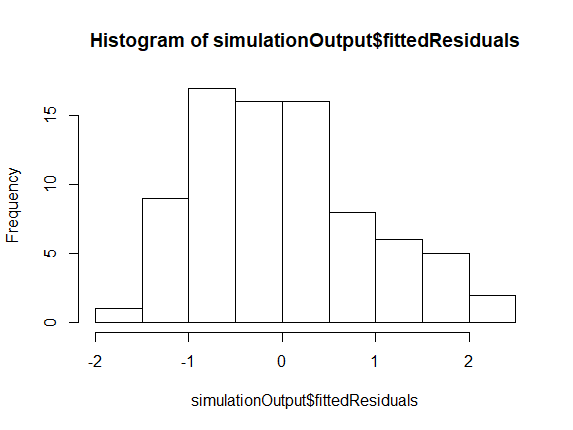
Effects plot:

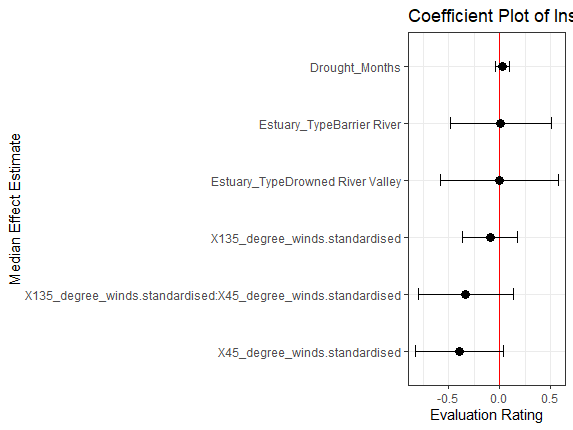


Luderick:

Assumptions (OK)







Summary:

summary(m4)

Linear mixed model fit by REML. t-tests use Satterthwaite's method ['lmerModLmerTest']

Formula: CPUE.standardised ~ X135\_degree\_winds.standardised \* X45\_degree\_winds.standardised +

Estuary\_Type + Drought\_Months + (1 | Estuary)

Data: luderick

REML criterion at convergence: 230.4

Scaled residuals:

Min 1Q Median 3Q Max

-2.0159 -0.7633 -0.1248 0.5555 2.3030

Random effects:

Groups Name Variance Std.Dev.

Estuary (Intercept) 2.378e-32 1.542e-16

Residual 9.424e-01 9.708e-01

Number of obs: 80, groups: Estuary, 8

Fixed effects:

Estimate Std. Error df t value Pr(>|t|)

(Intercept) -0.233835 0.236470 73.000000 -0.989 0.3260

X135\_degree\_winds.standardised -0.098035 0.135623 73.000000 -0.723 0.4721

X45\_degree\_winds.standardised -0.384057 0.211818 73.000000 -1.813 0.0739 .

Estuary\_TypeBarrier River 0.001675 0.250668 73.000000 0.007 0.9947

Estuary\_TypeDrowned River Valley 0.003769 0.280291 73.000000 0.013 0.9893

Drought\_Months 0.025128 0.034180 73.000000 0.735 0.4646

X135\_degree\_winds.standardised:X45\_degree\_winds.standardised -0.332987 0.241998 73.000000 -1.376 0.1730

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:

(Intr) X135\_d\_. X45\_\_. Es\_TBR E\_TDRV Drgh\_M

X135\_dgr\_w. 0.143

X45\_dgr\_wn. 0.464 0.461

Estry\_TypBR -0.534 -0.001 -0.002

Estry\_TyDRV -0.483 -0.003 -0.005 0.447

Drght\_Mnths -0.472 -0.149 -0.258 0.009 0.018

X135\_\_.:X45 0.459 0.155 0.734 0.000 0.000 0.010

convergence code: 0

boundary (singular) fit: see ?isSingular

ANOVA:

anova(m4) Weak effect of NE Winds

Type III Analysis of Variance Table with Satterthwaite's method

Sum Sq Mean Sq NumDF DenDF F value Pr(>F)

X135\_degree\_winds.standardised 0.49243 0.49243 1 73 0.5225 0.47208

X45\_degree\_winds.standardised 3.09826 3.09826 1 73 3.2875 0.07392 .

Estuary\_Type 0.00017 0.00009 2 73 0.0001 0.99991

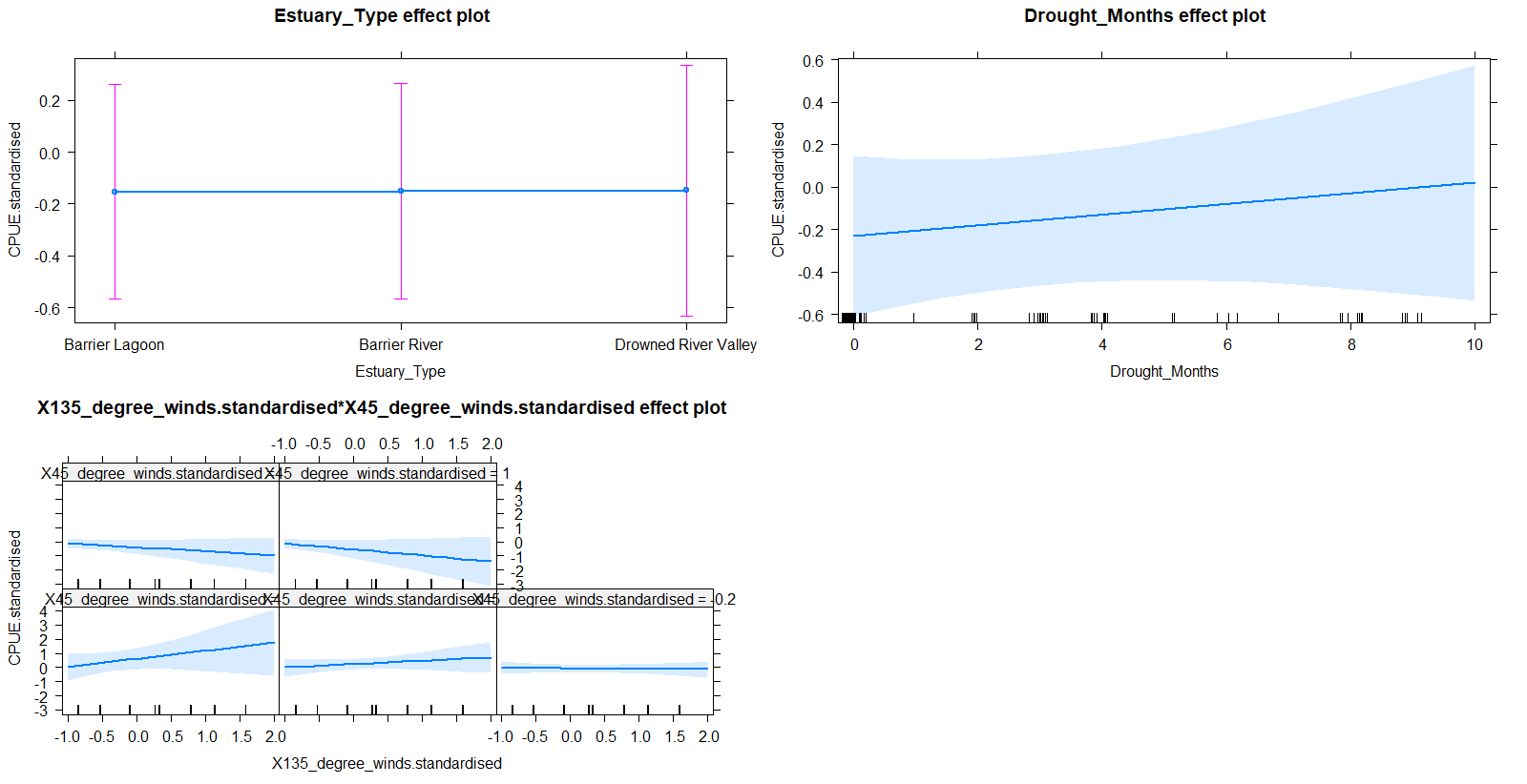
Drought\_Months 0.50934 0.50934 1 73 0.5404 0.46460

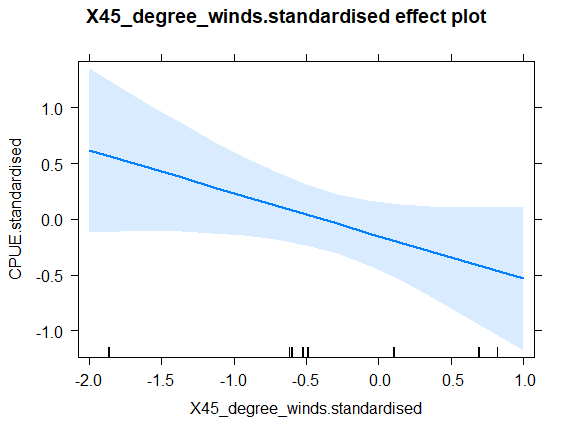
X135\_degree\_winds.standardised:X45\_degree\_winds.standardised 1.78437 1.78437 1 73 1.8933 0.17303

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

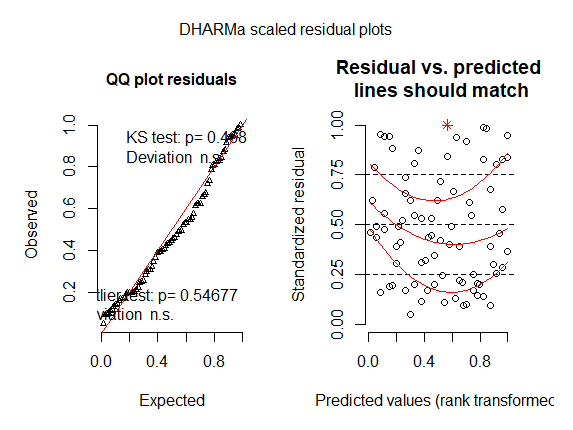
Effects Plot:

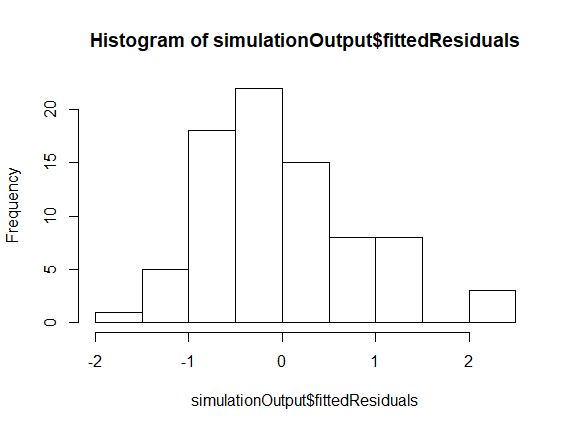


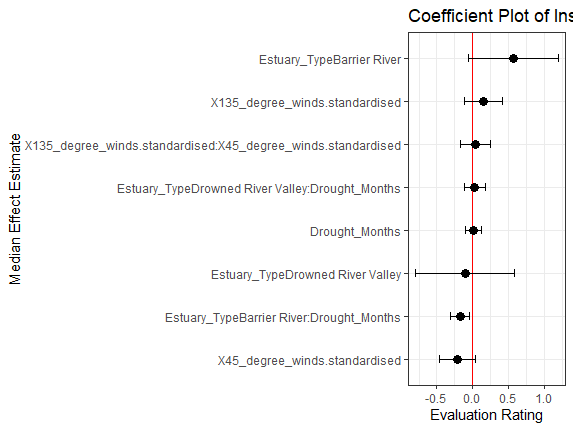


Flathead:

Assumptions (OK):







Summary:

summary(m3)

Linear mixed model fit by REML. t-tests use Satterthwaite's method ['lmerModLmerTest']

Formula: CPUE.standardised ~ X135\_degree\_winds.standardised \* X45\_degree\_winds.standardised +

Estuary\_Type \* Drought\_Months + (1 | Estuary)

Data: flathead

REML criterion at convergence: 221.3

Scaled residuals:

Min 1Q Median 3Q Max

-1.8006 -0.7549 -0.1434 0.4871 2.7583

Random effects:

Groups Name Variance Std.Dev.

Estuary (Intercept) 4.130e-32 2.032e-16

Residual 7.615e-01 8.726e-01

Number of obs: 80, groups: Estuary, 8

Fixed effects:

Estimate Std. Error df t value Pr(>|t|)

(Intercept) -0.016148 0.255928 71.000000 -0.063 0.94987

X135\_degree\_winds.standardised 0.152840 0.129728 71.000000 1.178 0.24267

X45\_degree\_winds.standardised -0.207991 0.130864 71.000000 -1.589 0.11642

Estuary\_TypeBarrier River 0.562550 0.310593 71.000000 1.811 0.07434 .

Estuary\_TypeDrowned River Valley -0.097747 0.352299 71.000000 -0.277 0.78224

Drought\_Months 0.007201 0.058105 71.000000 0.124 0.90172

X135\_degree\_winds.standardised:X45\_degree\_winds.standardised 0.038686 0.109524 71.000000 0.353 0.72497

Estuary\_TypeBarrier River:Drought\_Months -0.173836 0.065284 71.000000 -2.663 0.00958 \*\*

Estuary\_TypeDrowned River Valley:Drought\_Months 0.031374 0.076679 71.000000 0.409 0.68366

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:

(Intr) X135\_d\_. X45\_\_. Es\_TBR Es\_TDRV Drgh\_M X135\_\_.: E\_TBR:

X135\_dgr\_w. 0.313

X45\_dgr\_wn. 0.350 0.401

Estry\_TypBR -0.686 -0.059 -0.061

Estry\_TyDRV -0.575 0.004 -0.010 0.471

Drght\_Mnths -0.779 -0.410 -0.416 0.482 0.390

X135\_\_.:X45 0.346 0.073 0.447 -0.060 -0.014 -0.349

Est\_TBR:D\_M 0.525 0.080 0.081 -0.688 -0.344 -0.691 0.082

Es\_TDRV:D\_M 0.399 -0.021 0.000 -0.331 -0.699 -0.532 0.007 0.477

convergence code: 0

boundary (singular) fit: see ?isSingular

ANOVA:

anova(m3) # No effects for Flathead

Type III Analysis of Variance Table with Satterthwaite's method

Sum Sq Mean Sq NumDF DenDF F value Pr(>F)

X135\_degree\_winds.standardised 1.0570 1.0570 1 71 1.3881 0.242667

X45\_degree\_winds.standardised 1.9236 1.9236 1 71 2.5261 0.116420

Estuary\_Type 3.7473 1.8736 2 71 2.4605 0.092644 .

Drought\_Months 0.7245 0.7245 1 71 0.9514 0.332669

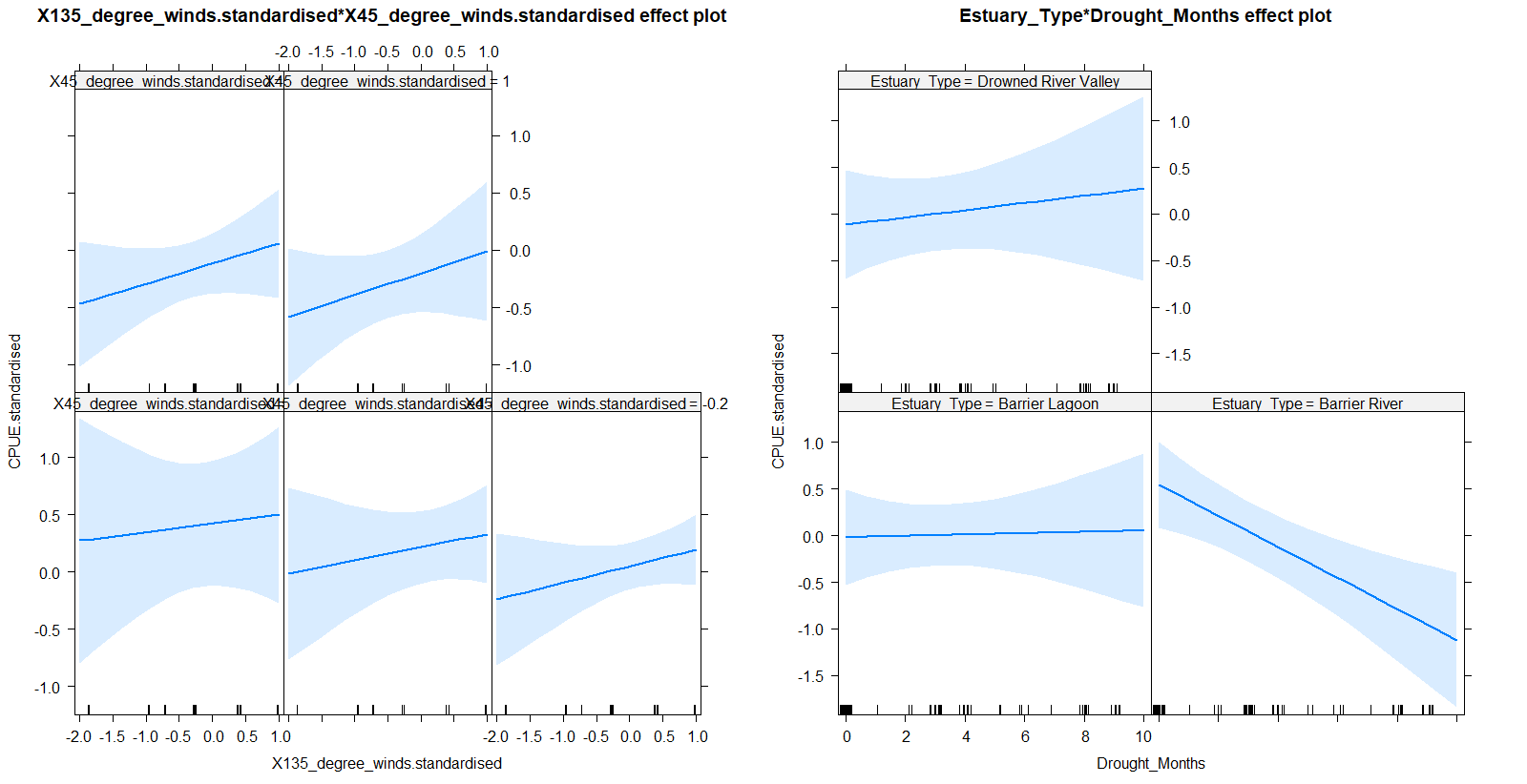
X135\_degree\_winds.standardised:X45\_degree\_winds.standardised 0.0950 0.0950 1 71 0.1248 0.724971

Estuary\_Type:Drought\_Months 8.1794 4.0897 2 71 5.3708 0.006729 \*\*

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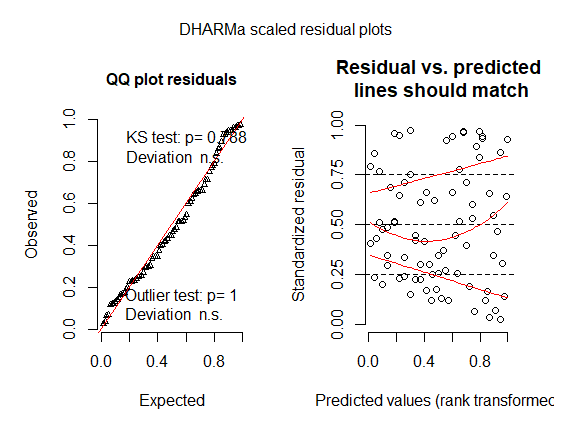
Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

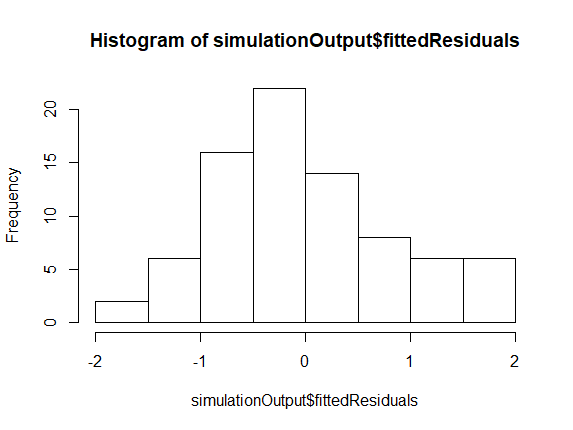
Effects Plot:

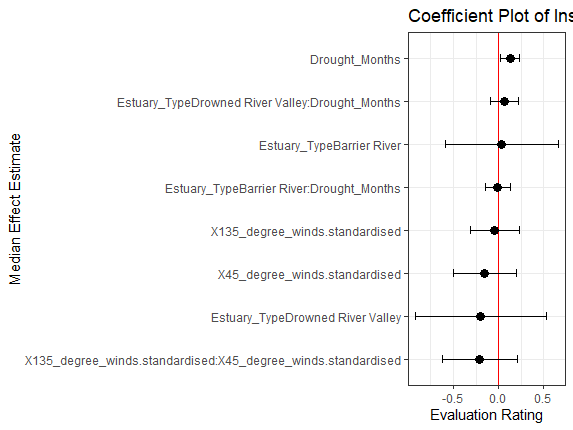


Whiting:

Assumptions (OK):







Summary:

summary(m5)

Linear mixed model fit by REML. t-tests use Satterthwaite's method ['lmerModLmerTest']

Formula: CPUE.standardised ~ X135\_degree\_winds.standardised \* X45\_degree\_winds.standardised +

Estuary\_Type \* Drought\_Months + (1 | Estuary)

Data: whiting

REML criterion at convergence: 220.9

Scaled residuals:

Min 1Q Median 3Q Max

-1.9949 -0.7047 -0.1234 0.5698 1.9383

Random effects:

Groups Name Variance Std.Dev.

Estuary (Intercept) 8.651e-33 9.301e-17

Residual 7.703e-01 8.776e-01

Number of obs: 80, groups: Estuary, 8

Fixed effects:

Estimate Std. Error df t value Pr(>|t|)

(Intercept) -0.50815 0.26669 71.00000 -1.905 0.0608 .

X135\_degree\_winds.standardised -0.04521 0.13597 71.00000 -0.332 0.7405

X45\_degree\_winds.standardised -0.14221 0.18206 71.00000 -0.781 0.4374

Estuary\_TypeBarrier River 0.04286 0.31338 71.00000 0.137 0.8916

Estuary\_TypeDrowned River Valley -0.17043 0.35433 71.00000 -0.481 0.6320

Drought\_Months 0.12715 0.05190 71.00000 2.450 0.0168 \*

X135\_degree\_winds.standardised:X45\_degree\_winds.standardised -0.20086 0.21555 71.00000 -0.932 0.3546

Estuary\_TypeBarrier River:Drought\_Months -0.01063 0.06615 71.00000 -0.161 0.8728

Estuary\_TypeDrowned River Valley:Drought\_Months 0.06016 0.07713 71.00000 0.780 0.4380

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:

(Intr) X135\_d\_. X45\_\_. Es\_TBR Es\_TDRV Drgh\_M X135\_\_.: E\_TBR:

X135\_dgr\_w. 0.313

X45\_dgr\_wn. 0.428 0.586

Estry\_TypBR -0.682 -0.059 -0.096

Estry\_TyDRV -0.547 -0.008 0.005 0.467

Drght\_Mnths -0.720 -0.294 -0.252 0.520 0.435

X135\_\_.:X45 0.496 0.348 0.746 -0.113 0.012 -0.217

Est\_TBR:D\_M 0.537 0.081 0.136 -0.691 -0.339 -0.746 0.162

Es\_TDRV:D\_M 0.378 0.002 -0.015 -0.328 -0.699 -0.602 -0.024 0.471

convergence code: 0

boundary (singular) fit: see ?isSingular

ANOVA:

anova(m5) # drought increases catch of Whiting, no wind effects

Type III Analysis of Variance Table with Satterthwaite's method

Sum Sq Mean Sq NumDF DenDF F value Pr(>F)

X135\_degree\_winds.standardised 0.0852 0.0852 1 71 0.1106 0.7405

X45\_degree\_winds.standardised 0.4699 0.4699 1 71 0.6101 0.4374

Estuary\_Type 0.3071 0.1535 2 71 0.1993 0.8197

Drought\_Months 14.9978 14.9978 1 71 19.4709 3.568e-05 \*\*\*

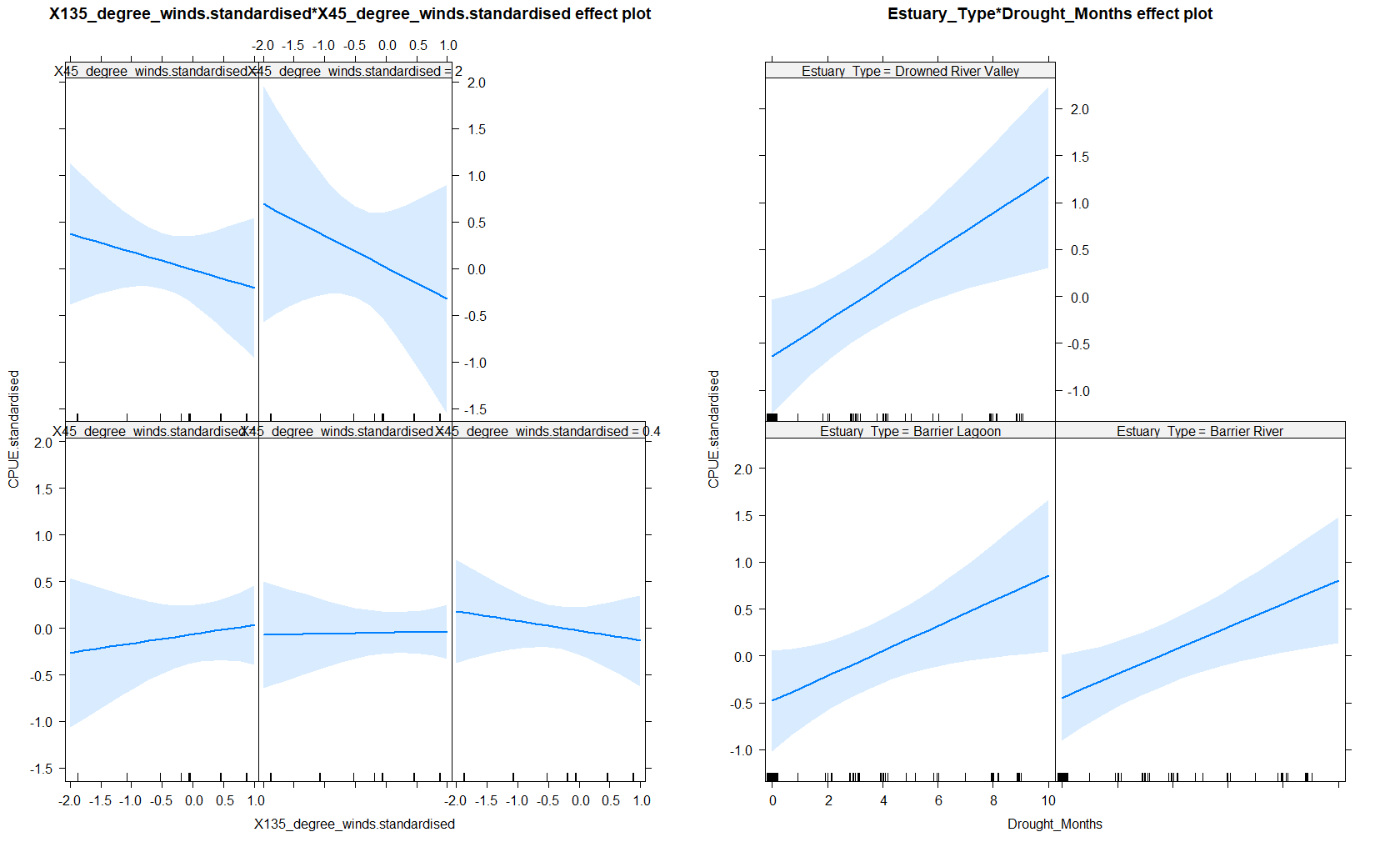
X135\_degree\_winds.standardised:X45\_degree\_winds.standardised 0.6689 0.6689 1 71 0.8683 0.3546

Estuary\_Type:Drought\_Months 0.7444 0.3722 2 71 0.4832 0.6188

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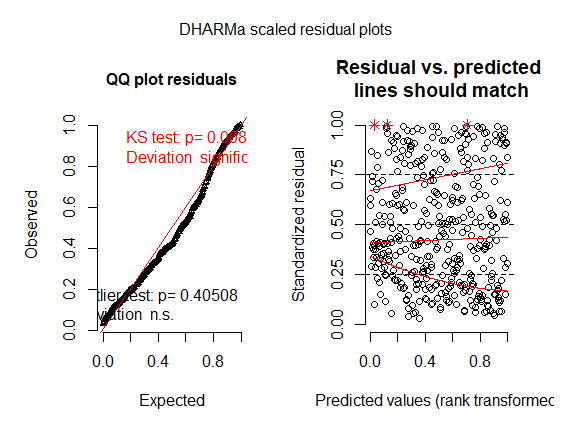
Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

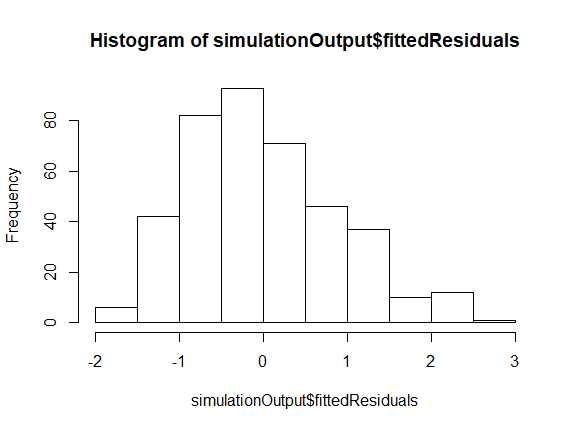
Effects Plot:

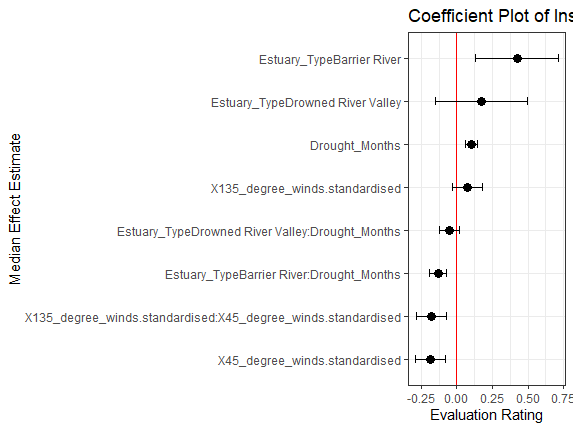


Single Model – Species as Random Effect

Assumptions (OK – Not great)







Summary:

summary(m7)

Linear mixed model fit by REML. t-tests use Satterthwaite's method ['lmerModLmerTest']

Formula: CPUE.standardised ~ X135\_degree\_winds.standardised \* X45\_degree\_winds.standardised +

Estuary\_Type \* Drought\_Months + (1 | Estuary) + (1 | Species)

Data: my.df

REML criterion at convergence: 1079.7

Scaled residuals:

Min 1Q Median 3Q Max

-2.1747 -0.7275 -0.1830 0.5814 2.9937

Random effects:

Groups Name Variance Std.Dev.

Estuary (Intercept) 3.503e-33 5.919e-17

Species (Intercept) 2.238e-33 4.731e-17

Residual 8.070e-01 8.983e-01

Number of obs: 400, groups: Estuary, 8; Species, 5

Fixed effects:

Estimate Std. Error df t value Pr(>|t|)

(Intercept) -0.39534 0.10556 391.00000 -3.745 0.000207 \*\*\*

X135\_degree\_winds.standardised 0.07784 0.05123 391.00000 1.520 0.129444

X45\_degree\_winds.standardised -0.18825 0.05209 391.00000 -3.614 0.000341 \*\*\*

Estuary\_TypeBarrier River 0.43903 0.14250 391.00000 3.081 0.002210 \*\*

Estuary\_TypeDrowned River Valley 0.18203 0.16218 391.00000 1.122 0.262376

Drought\_Months 0.10339 0.02266 391.00000 4.563 6.78e-06 \*\*\*

X135\_degree\_winds.standardised:X45\_degree\_winds.standardised -0.17892 0.05217 391.00000 -3.429 0.000669 \*\*\*

Estuary\_TypeBarrier River:Drought\_Months -0.13365 0.02987 391.00000 -4.475 1.00e-05 \*\*\*

Estuary\_TypeDrowned River Valley:Drought\_Months -0.05286 0.03529 391.00000 -1.498 0.134995

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:

(Intr) X135\_d\_. X45\_\_. Es\_TBR Es\_TDRV Drgh\_M X135\_\_.: E\_TBR:

X135\_dgr\_w. 0.064

X45\_dgr\_wn. 0.046 0.304

Estry\_TypBR -0.725 -0.007 -0.003

Estry\_TyDRV -0.637 0.001 0.005 0.472

Drght\_Mnths -0.703 -0.108 -0.010 0.519 0.455

X135\_\_.:X45 0.126 -0.078 0.259 0.005 -0.002 0.033

Est\_TBR:D\_M 0.531 0.008 0.005 -0.686 -0.345 -0.750 -0.006

Es\_TDRV:D\_M 0.449 -0.004 -0.007 -0.333 -0.699 -0.634 0.003 0.481

convergence code: 0

boundary (singular) fit: see ?isSingular

ANOVA:

anova(m7) # Sig wind effects

Type III Analysis of Variance Table with Satterthwaite's method

Sum Sq Mean Sq NumDF DenDF F value Pr(>F)

X135\_degree\_winds.standardised 1.8633 1.8633 1 391 2.3089 0.1294437

X45\_degree\_winds.standardised 10.5410 10.5410 1 391 13.0618 0.0003407 \*\*\*

Estuary\_Type 7.7734 3.8867 2 391 4.8162 0.0085842 \*\*

Drought\_Months 7.3168 7.3168 1 391 9.0666 0.0027722 \*\*

X135\_degree\_winds.standardised:X45\_degree\_winds.standardised 9.4907 9.4907 1 391 11.7604 0.0006695 \*\*\*

Estuary\_Type:Drought\_Months 16.6093 8.3046 2 391 10.2906 4.411e-05 \*\*\*

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Effects plots:

