

Hakai-Lice-Models-Overview

Initial Model Set

The first set of models from this past school year (region removed from initial model and fit by itself)

Species Level Models

#models and dredge them

```
lepmospecies.full <- glmmTMB(all.leps ~ spp + year - 1 + (1|collection),
                             data = mainlice, family=nbinom2)
calmospecies.full <- glmmTMB(all.cal ~ spp + year - 1 + (1|collection),
                             data = mainlice, family=nbinom2)
```

```
lepmospecies.full_dredge = MuMIn::dredge(lepmospecies.full)
```

```
calmospecies.full_dredge = MuMIn::dredge(calmospecies.full)
```

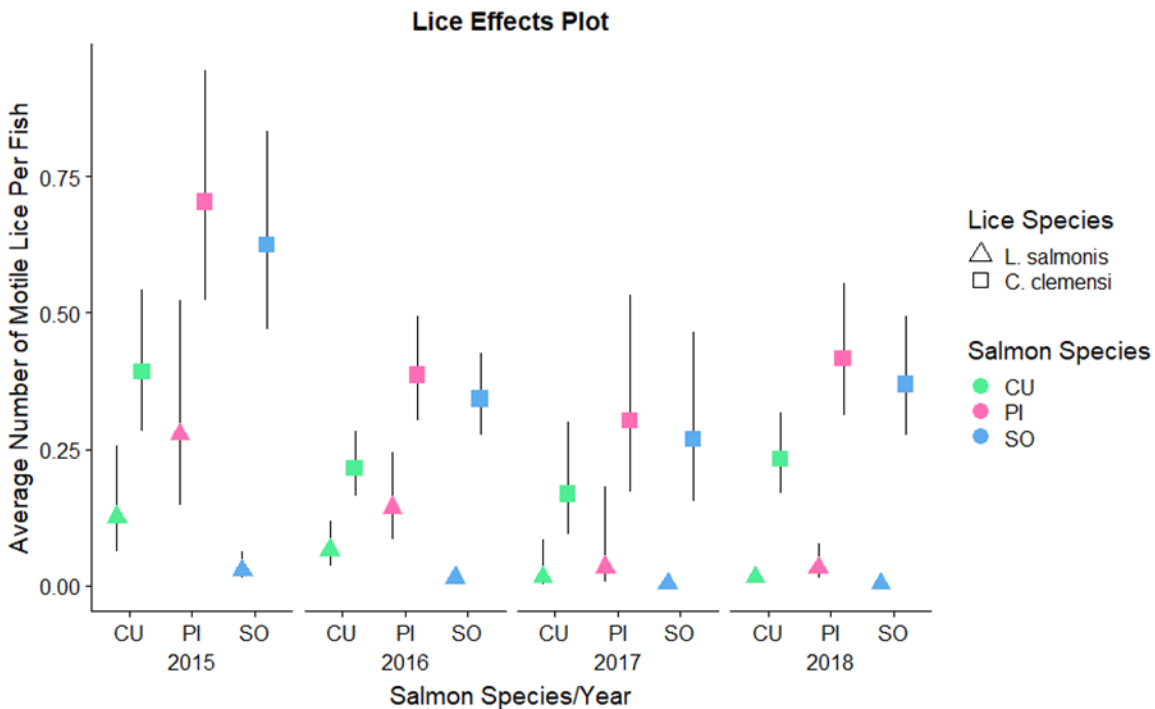
lepmospecies.full_dredge

```
## Global model call: glmmTMB(formula = all.leps ~ spp + year - 1 + (1 | coll
##      data = mainlice, family = nbinom2, ziformula = ~0, dispformula = ~1)
## ---
## Model selection table
##   dsp((Int)) cnd(spp) cnd(yer) df   logLik   AICc delta weight
## 4           +         +       + 8 -418.419 852.9  0.00  0.998
## 2           +         +       5 -427.833 865.7 12.78  0.002
## 3           +         +       6 -452.366 916.8 63.86  0.000
## Models ranked by AICc(x)
## Random terms (all models):
## 'cond(1 | collection)'
```

calmospecies.full_dredge

```
## Global model call: glmmTMB(formula = all.cal ~ spp + year - 1 + (1 | colle
##      data = mainlice, family = nbinom2, ziformula = ~0, dispformula = ~1)
## ---
## Model selection table
##   dsp((Int)) cnd(spp) cnd(yer) df   logLik   AICc delta weight
## 4           +         +       + 8 -1490.784 2997.6  0.00  0.971
## 2           +         +       5 -1497.330 3004.7  7.04  0.029
## 3           +         +       6 -1502.828 3017.7 20.06  0.000
## Models ranked by AICc(x)
## Random terms (all models):
## 'cond(1 | collection)'
```

Species Level Effects Plots



Region-Level Models

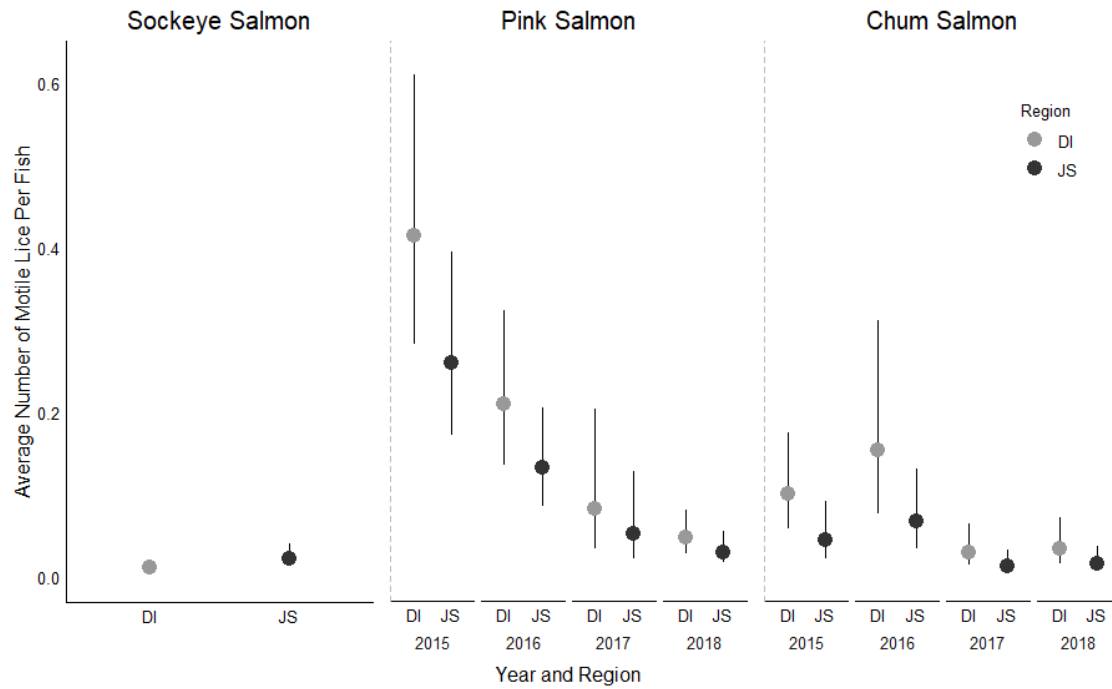
```
#region-level models
regionlice <- read.csv('Hakai_lice_data_all_fish_CB_edits.csv')

chumrmod.calnb <- glmmTMB(all.cal ~ site.region + year - 1 + (1|week),
                          data = chum.region, family=nbinom2)
chumrmod.lepsnb <- glmmTMB(all.leps ~ site.region + year - 1 + (1|week),
                          data = chum.region, family=nbinom2)
pinkrmod.calnb <- glmmTMB(all.cal ~ site.region + year - 1 + (1|week),
                          data = pink.region, family=nbinom2)
pinkrmod.lepsnb <- glmmTMB(all.leps ~ site.region + year - 1 + (1|week),
                          data = pink.region, family=nbinom2)
sockrmod.calnb <- glmmTMB(all.cal ~ site.region + year - 1 + (1|week),
                          data = sock.region, family=nbinom2)
sockrmod.lepsnbsr <- glmmTMB(all.leps ~ site.region - 1 + (1|week),
                             data = sock.region, family=nbinom2)Region Level
```

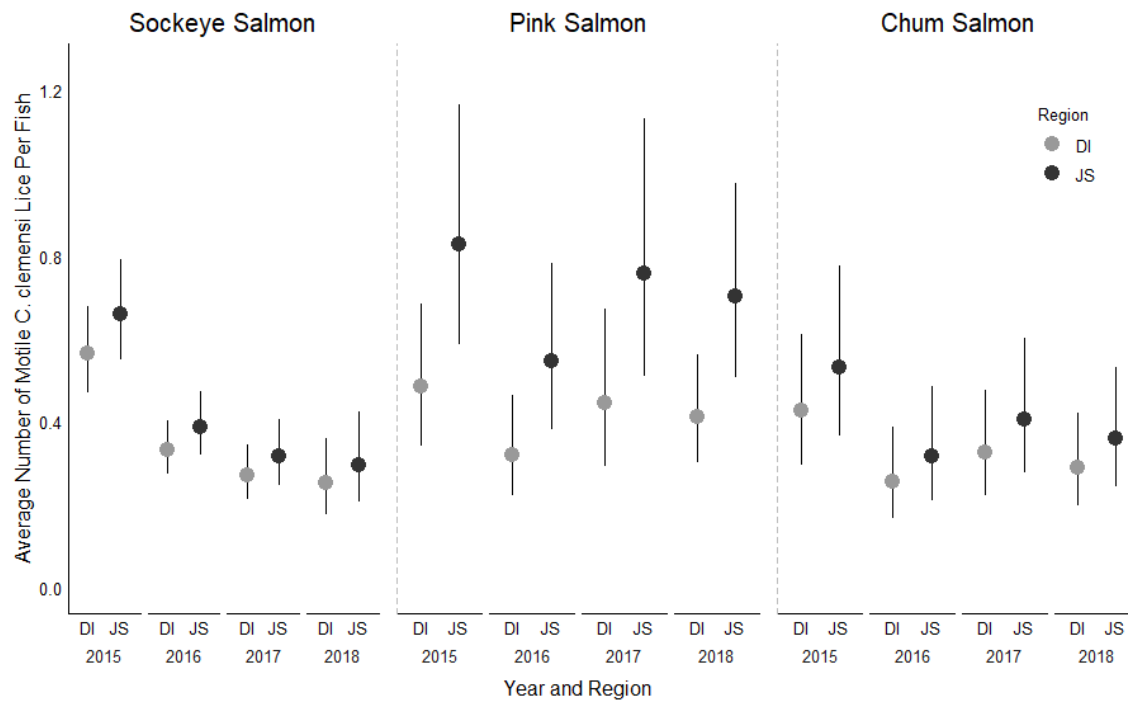
62 Effects Plots

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67 New Set of Models

68 Models (No Crossed Effects)

```
69 lepmo.dysrsp <- glmmTMB(all.leps ~ spp + site.region +  
70   year - 1 + (1|collection), data = mainlice, family=nbinom2)  
71  
72 calmo.dysrsp <- glmmTMB(all.cal ~ spp + site.region +  
73   year - 1 + (1|collection), data = mainlice, family=nbinom2)
```

74 AIC tables

```
75 lepmo.dysrsp_dredge = MuMIn::dredge(lepmo.dysrsp)
```

```
76 calmo.dysrsp_dredge = MuMIn::dredge(calmo.dysrsp)
```

77 lepmo.dysrsp_dredge

```
78 ## Global model call: glmmTMB(formula = all.leps ~ spp + site.region + year -  
79 1 + (1 |  
80 ##   collection), data = mainlice, family = nbinom2, ziformula = ~0,  
81 ##   dispformula = ~1)  
82 ## ---  
83 ## Model selection table  
84 ##   dsp((Int)) cnd(sit.rgn) cnd(spp) cnd(yer) df   logLik  AICc delta weight  
85 ## 7           +           +           +     + 8 -418.419 852.9  0.00  0.706  
86 ## 8           +           +           +     + 9 -418.292 854.7  1.76  0.292  
87 ## 3           +           +           +     5 -427.833 865.7 12.78  0.001  
88 ## 4           +           +           +     6 -427.751 867.5 14.63  0.000  
89 ## 5           +           +           +     + 6 -452.366 916.8 63.86  0.000  
90 ## 6           +           +           +     + 7 -452.342 918.7 65.83  0.000  
91 ## 2           +           +           4 -461.316 930.7 77.74  0.000  
92 ## Models ranked by AICc(x)  
93 ## Random terms (all models):  
94 ## 'cond(1 | collection)'
```

95 calmo.dysrsp_dredge

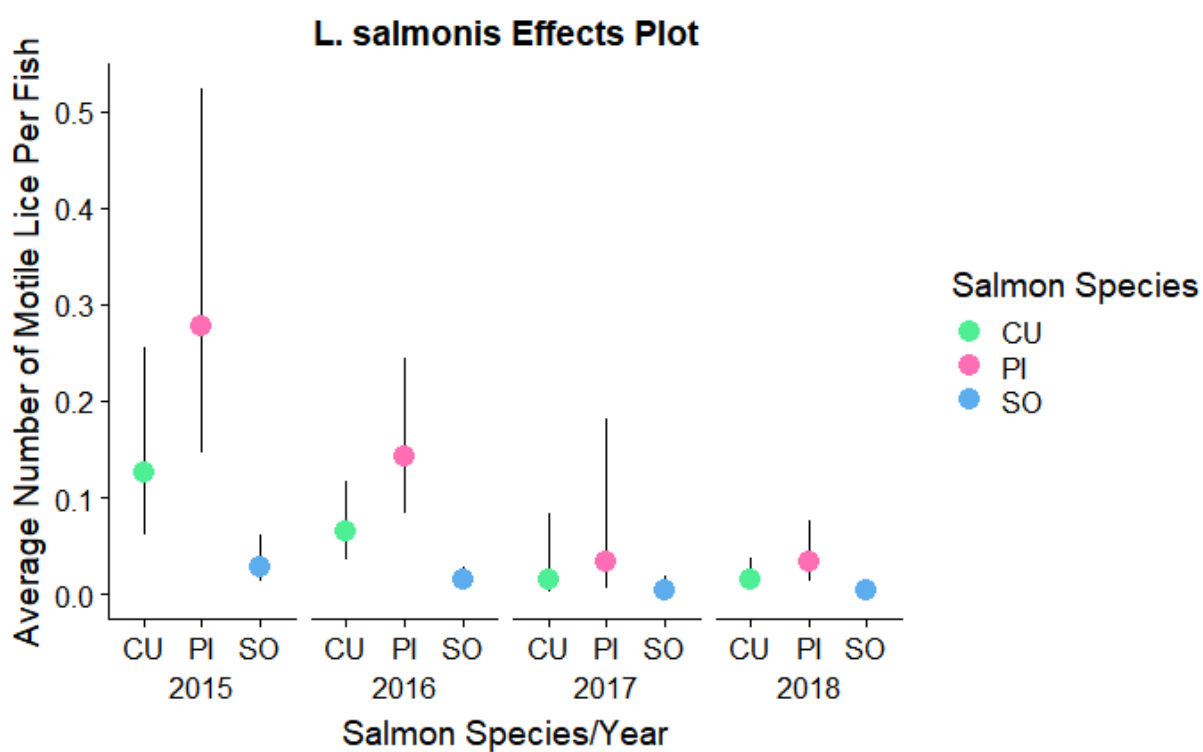
```
96 ## Global model call: glmmTMB(formula = all.cal ~ spp + site.region + year -  
97 1 + (1 |  
98 ##   collection), data = mainlice, family = nbinom2, ziformula = ~0,  
99 ##   dispformula = ~1)  
100 ## ---  
101 ## Model selection table  
102 ##   dsp((Int)) cnd(sit.rgn) cnd(spp) cnd(yer) df   logLik  AICc delta  
103 ## 8           +           +           +     + 9 -1486.158 2990.4  0.00  
104 ## 7           +           +           +     + 8 -1490.784 2997.6  7.23  
105 ## 4           +           +           +     6 -1493.201 2998.4  8.03  
106 ## 3           +           +           +     5 -1497.330 3004.7 14.28  
107 ## 6           +           +           +     + 7 -1498.198 3010.5 20.04  
108 ## 5           +           +           +     + 6 -1502.828 3017.7 27.29  
109 ## 2           +           +           4 -1505.653 3019.3 28.91
```

```

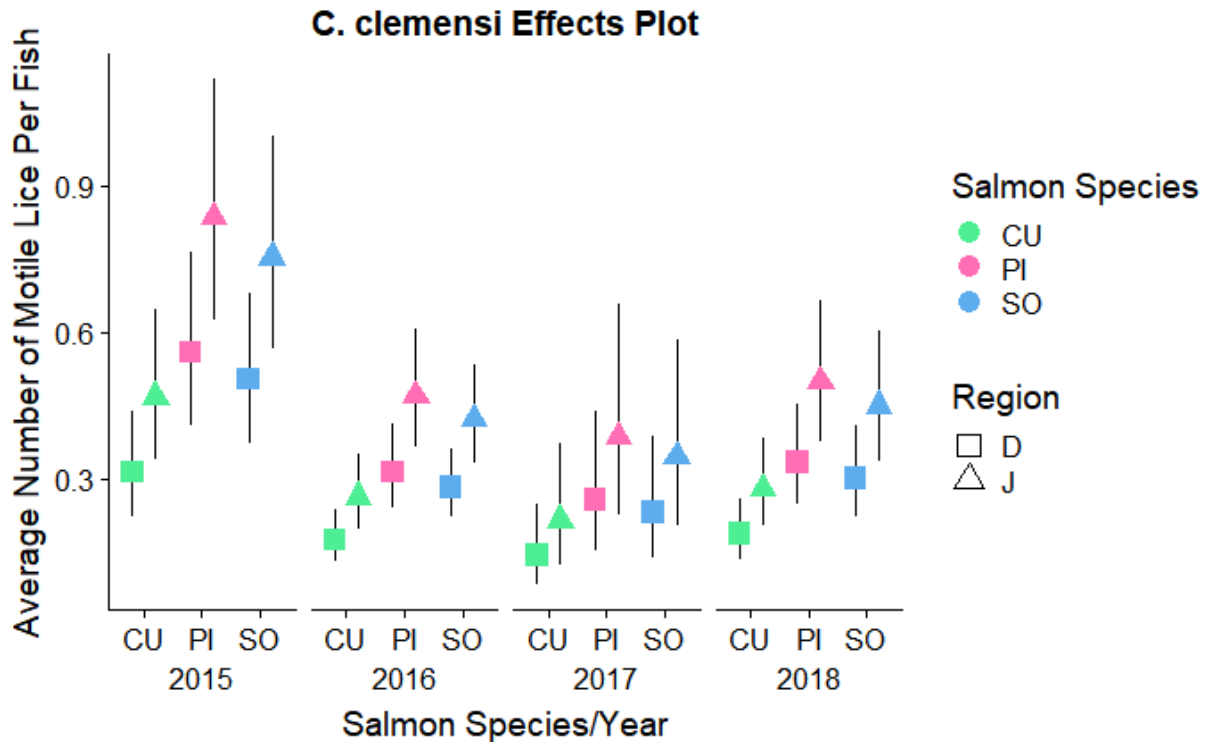
110 ## weight
111 ## 8 0.956
112 ## 7 0.026
113 ## 4 0.017
114 ## 3 0.001
115 ## 6 0.000
116 ## 5 0.000
117 ## 2 0.000
118 ## Models ranked by AICc(x)
119 ## Random terms (all models):
120 ## 'cond(1 | collection)'

```

121 Effects Plots



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124 Models (Crossed Effects)

```
125 lepmod.crossed <- glmmTMB(all.leps ~ spp * site.region + spp * year +
126   site.region * year + (1 | collection),
127   data = mainlice, family=nbinom2)
128 calmod.crossed <- glmmTMB(all.cal ~ spp * site.region + spp * year +
129   site.region * year + (1 | collection),
130   data = mainlice, family=nbinom2)
```

131 AIC Tables

```
132 lepmod.crossed_dredge = MuMIn::dredge(lepmod.crossed, subset = (`cond(site.re
133 gion)` && `cond(year)`))
```

134 lepmod.crossed_dredge

```
135 ## Global model call: glmmTMB(formula = all.leps ~ spp * site.region + spp *
136 year +
137   site.region * year + (1 | collection), data = mainlice, family = nbino
138 m2,
139   ziformula = ~0, dispformula = ~1)
140 ## ---
141 ## Model selection table
142 ##   cnd((Int)) dsp((Int)) cnd(sit.rgn) cnd(spp) cnd(yer) cnd(sit.rgn:spp)
143 ## 24      -1.185          +           +           +           +
144 ## 56      -1.469          +           +           +           +
145 ## 32      -1.125          +           +           +           +
146 ## 64      -1.427          +           +           +           +
```

```

147 ## 8      -1.983      +      +      +      +
148 ## 40     -2.244      +      +      +      +
149 ## 16     -1.957      +      +      +      +
150 ## 48     -2.227      +      +      +      +
151 ## 22     -1.051      +      +      +      +
152 ## 6      -1.939      +      +      +      +
153 ##      cnd(sit.rgn:yer) cnd(spp:yer) df    logLik  AICc  delta  weight
154 ## 24      +                12 -411.452 847.1  0.00  0.529
155 ## 56      +               + 18 -406.204 848.8  1.71  0.225
156 ## 32      +                14 -410.656 849.5  2.47  0.154
157 ## 64      +               + 20 -405.297 851.1  3.98  0.072
158 ## 8                9 -418.292 854.7  7.61  0.012
159 ## 40               + 15 -413.222 856.7  9.63  0.004
160 ## 16               11 -417.618 857.4 10.30  0.003
161 ## 48               + 17 -412.495 859.3 12.25  0.001
162 ## 22      +                10 -444.677 909.5 62.40  0.000
163 ## 6                7 -452.342 918.7 71.67  0.000
164 ## Models ranked by AICc(x)
165 ## Random terms (all models):
166 ## 'cond(1 | collection)'

167 calmod.crossed_dredge = MuMIn::dredge(calmod.crossed, subset = (`cond(site.re
168 gion)` && `cond(year)`))

169 calmod.crossed_dredge

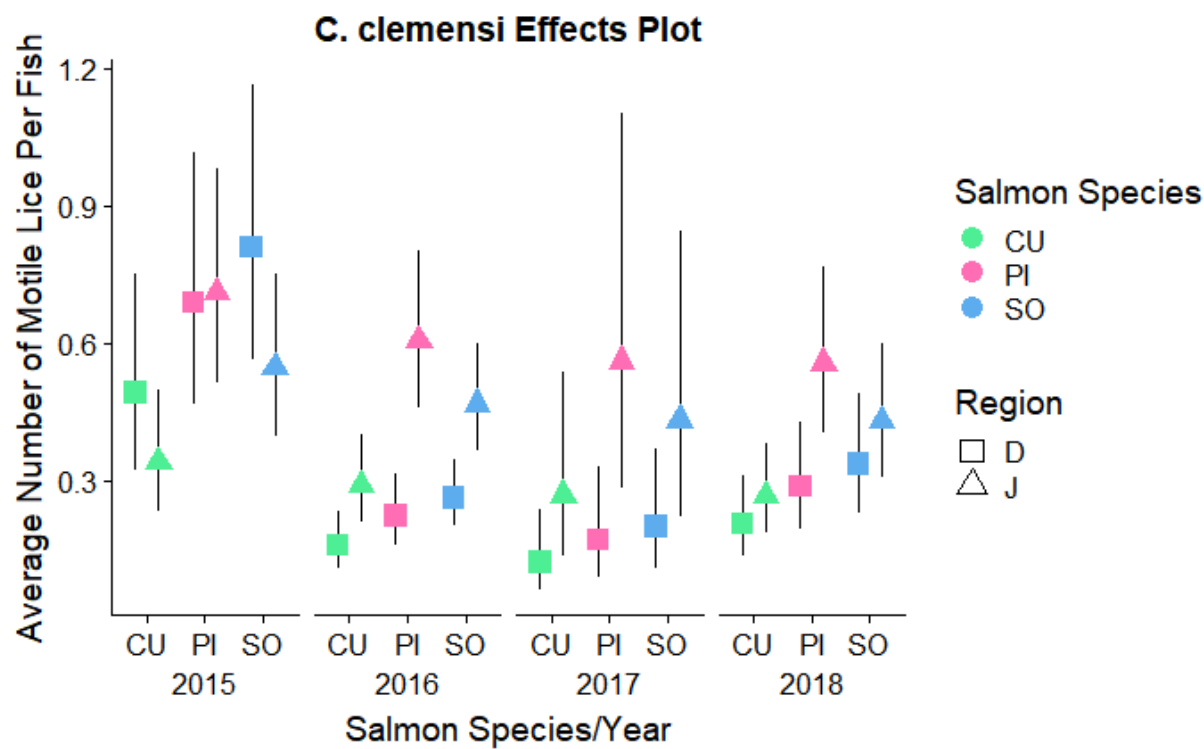
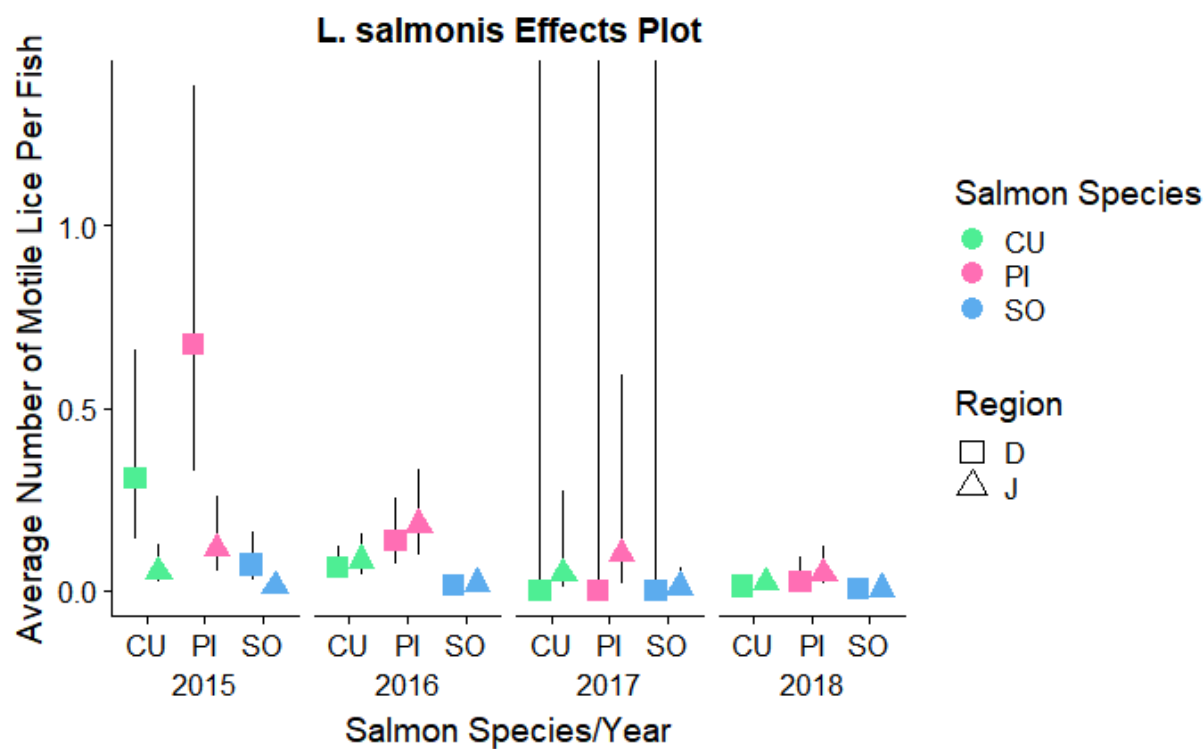
170 ## Global model call: glmmTMB(formula = all.cal ~ spp * site.region + spp * y
171 ear +
172 ##      site.region * year + (1 | collection), data = mainlice, family = nbino
173 m2,
174 ##      ziformula = ~0, dispformula = ~1)
175 ## ---
176 ## Model selection table
177 ##      cnd((Int)) dsp((Int)) cnd(sit.rgn) cnd(spp) cnd(yer) cnd(sit.rgn:spp)
178 ## 32      -0.7104      +      +      +      +      +
179 ## 24      -0.7910      +      +      +      +      +
180 ## 64      -0.8636      +      +      +      +      +
181 ## 56      -0.9259      +      +      +      +      +
182 ## 8       -1.1610      +      +      +      +      +
183 ## 16      -1.0900      +      +      +      +      +
184 ## 40      -1.2760      +      +      +      +      +
185 ## 48      -1.2170      +      +      +      +      +
186 ## 22      -0.3716      +      +      +      +      +
187 ## 6       -0.7379      +      +      +      +      +
188 ##      cnd(sit.rgn:yer) cnd(spp:yer) df    logLik  AICc  delta  weight
189 ## 32      +                14 -1478.419 2985.1  0.00  0.410
190 ## 24      +                12 -1480.773 2985.7  0.65  0.297
191 ## 64      +               + 20 -1473.480 2987.4  2.35  0.126
192 ## 56      +               + 18 -1475.829 2988.0  2.97  0.093
193 ## 8                9 -1486.158 2990.4  5.35  0.028

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194 ## 16          11 -1484.199 2990.5  5.47  0.027
195 ## 40          + 15 -1481.158 2992.6  7.51  0.010
196 ## 48          + 17 -1479.200 2992.7  7.67  0.009
197 ## 22          + 10 -1493.316 3006.8 21.68  0.000
198 ## 6           7  -1498.198 3010.5 25.39  0.000
199 ## Models ranked by AICc(x)
200 ## Random terms (all models):
201 ## 'cond(1 | collection)'

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```

233 summary(chumrmod.calnb); summary(chumrmod.lepsnb); summary(pinkrmod.calnb); s
234 ummary(pinkrmod.lepsnb); summary(sockrmod.calnb); summary(sockrmod.lepsnbsr)

235 ## Family: nbinom2 ( log )
236 ## Formula:          all.cal ~ site.region + year - 1 + (1 | week)
237 ## Data: chum.region
238 ##
239 ##      AIC      BIC   logLik deviance df.resid
240 ##  2120.8   2157.3  -1053.4   2106.8     1358
241 ##
242 ## Random effects:
243 ##
244 ## Conditional model:
245 ##   Groups Name      Variance Std.Dev.
246 ##   week   (Intercept) 0.2548   0.5048
247 ## Number of obs: 1365, groups:  week, 12
248 ##
249 ## Overdispersion parameter for nbinom2 family (): 2.12
250 ##
251 ## Conditional model:
252 ##              Estimate Std. Error z value Pr(>|z|)
253 ## site.regionD -0.8537      0.1846  -4.624 3.76e-06 ***
254 ## site.regionJ -0.6314      0.1926  -3.279 0.00104 **
255 ## year2016     -0.5131      0.1637  -3.133 0.00173 **
256 ## year2017     -0.2677      0.1306  -2.051 0.04031 *
257 ## year2018     -0.3880      0.1352  -2.870 0.00410 **
258 ## ---
259 ## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

260 ## Family: nbinom2 ( log )
261 ## Formula:          all.leps ~ site.region + year - 1 + (1 | week)
262 ## Data: chum.region
263 ##
264 ##      AIC      BIC   logLik deviance df.resid
265 ##   510.6   547.1  -248.3   496.6     1358
266 ##
267 ## Random effects:
268 ##
269 ## Conditional model:
270 ##   Groups Name      Variance Std.Dev.
271 ##   week   (Intercept) 2.132e-08 0.000146
272 ## Number of obs: 1365, groups:  week, 12
273 ##
274 ## Overdispersion parameter for nbinom2 family (): 0.0749
275 ##
276 ## Conditional model:
277 ##              Estimate Std. Error z value Pr(>|z|)
278 ## site.regionD -2.3025      0.2821  -8.162 3.28e-16 ***
279 ## site.regionJ -3.1487      0.3838  -8.205 2.31e-16 ***
280 ## year2016      0.4227      0.4203   1.006 0.31464

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281 ## year2017      -1.2784      0.4857  -2.632  0.00848 **
282 ## year2018      -1.1277      0.4742  -2.378  0.01740 *
283 ## ---
284 ## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

285 ## Family: nbinom2 ( log )
286 ## Formula:      all.cal ~ site.region + year - 1 + (1 | week)
287 ## Data: pink.region
288 ##
289 ##      AIC      BIC    logLik deviance df.resid
290 ##    1795.5    1829.5    -890.8    1781.5      932
291 ##
292 ## Random effects:
293 ##
294 ## Conditional model:
295 ##   Groups Name      Variance Std.Dev.
296 ##   week (Intercept) 0.1967   0.4435
297 ## Number of obs: 939, groups:  week, 12
298 ##
299 ## Overdispersion parameter for nbinom2 family (): 5.85
300 ##
301 ## Conditional model:
302 ##              Estimate Std. Error z value Pr(>|z|)
303 ## site.regionD -0.72429    0.17729  -4.085  4.4e-05 ***
304 ## site.regionJ -0.18910    0.17509  -1.080  0.28014
305 ## year2016     -0.41514    0.15914  -2.609  0.00909 **
306 ## year2017     -0.08654    0.16465  -0.526  0.59916
307 ## year2018     -0.16441    0.12203  -1.347  0.17788
308 ## ---
309 ## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

310 ## Family: nbinom2 ( log )
311 ## Formula:      all.leps ~ site.region + year - 1 + (1 | week)
312 ## Data: pink.region
313 ##
314 ##      AIC      BIC    logLik deviance df.resid
315 ##    728.2    762.1    -357.1    714.2      932
316 ##
317 ## Random effects:
318 ##
319 ## Conditional model:
320 ##   Groups Name      Variance Std.Dev.
321 ##   week (Intercept) 2.314e-09 4.81e-05
322 ## Number of obs: 939, groups:  week, 12
323 ##
324 ## Overdispersion parameter for nbinom2 family (): 0.318
325 ##
326 ## Conditional model:
327 ##              Estimate Std. Error z value Pr(>|z|)
328 ## site.regionD -0.8806     0.1975  -4.459 8.22e-06 ***

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329 ## site.regionJ -1.3489      0.2128 -6.340 2.30e-10 ***
330 ## year2016      -0.6860      0.2576 -2.663 0.00775 **
331 ## year2017      -1.6262      0.4798 -3.389 0.00070 ***
332 ## year2018      -2.2009      0.3248 -6.777 1.23e-11 ***
333 ## ---
334 ## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

335 ## Family: nbinom2 ( log )
336 ## Formula:      all.cal ~ site.region + year - 1 + (1 | week)
337 ## Data: sock.region
338 ##
339 ##      AIC      BIC   logLik deviance df.resid
340 ##   6467.4   6510.9  -3226.7   6453.4     3687
341 ##
342 ## Random effects:
343 ##
344 ## Conditional model:
345 ##   Groups Name      Variance Std.Dev.
346 ##   week   (Intercept) 0.05698  0.2387
347 ## Number of obs: 3694, groups:  week, 11
348 ##
349 ## Overdispersion parameter for nbinom2 family (): 0.974
350 ##
351 ## Conditional model:
352 ##              Estimate Std. Error z value Pr(>|z|)
353 ## site.regionD -0.57222    0.09288  -6.161 7.25e-10 ***
354 ## site.regionJ -0.41522    0.09257  -4.486 7.27e-06 ***
355 ## year2016     -0.52957    0.07103  -7.456 8.92e-14 ***
356 ## year2017     -0.73482    0.10118  -7.262 3.81e-13 ***
357 ## year2018     -0.80543    0.16844  -4.782 1.74e-06 ***
358 ## ---
359 ## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

360 ## Family: nbinom2 ( log )
361 ## Formula:      all.leps ~ site.region - 1 + (1 | week)
362 ## Data: sock.region
363 ##
364 ##      AIC      BIC   logLik deviance df.resid
365 ##   783.8    808.7  -387.9    775.8     3690
366 ##
367 ## Random effects:
368 ##
369 ## Conditional model:
370 ##   Groups Name      Variance Std.Dev.
371 ##   week   (Intercept) 0.3741   0.6116
372 ## Number of obs: 3694, groups:  week, 11
373 ##
374 ## Overdispersion parameter for nbinom2 family (): 0.142
375 ##
376 ## Conditional model:

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377 ##           Estimate Std. Error z value Pr(>|z|)
378 ## site.regionD  -4.5724      0.3222  -14.19   <2e-16 ***
379 ## site.regionJ  -3.8232      0.2959  -12.92   <2e-16 ***
380 ## ---
381 ## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

382