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

lepmodspecies.full_dredge = MuMIn::dredge(lepmodspecies.full)

calmodspecies.full_dredge = MuMIn::dredge(calmodspecies.full)

lepmodspecies.full_dredge

## Global model call: glmmTMB(formula = all.leps ~ spp + year - 1 + (1 | coll
ection),
##      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):
## 'cnd(1 | collection)'

calmodspecies.full_dredge

## Global model call: glmmTMB(formula = all.cal ~ spp + year - 1 + (1 | colle
ction),
##      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):
## 'cnd(1 | collection)'
```
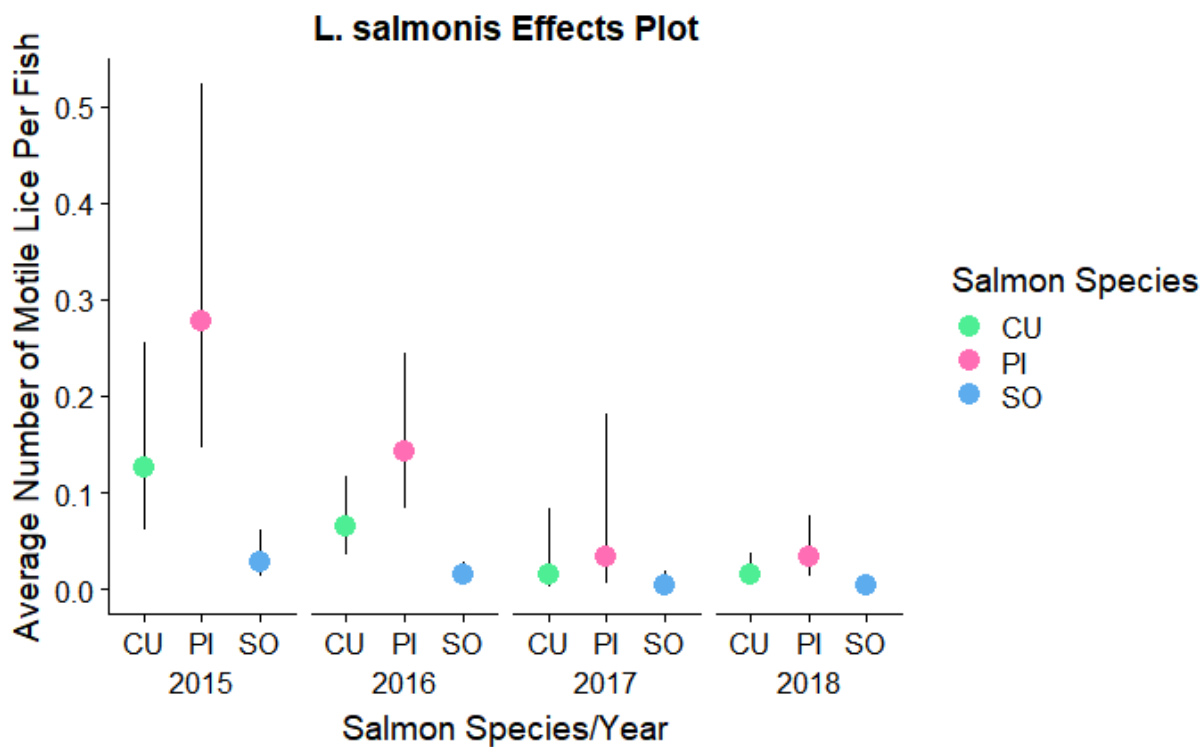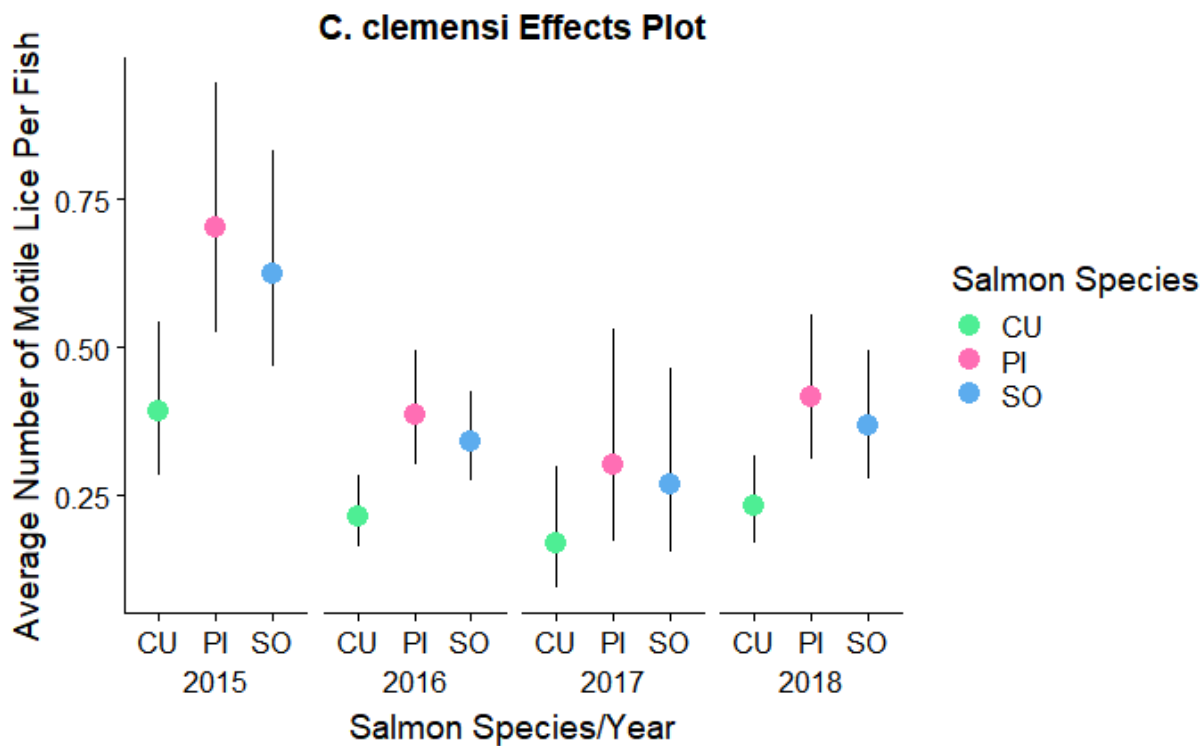
40   ## Species Level Effects Plots

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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
```

Effects Plots
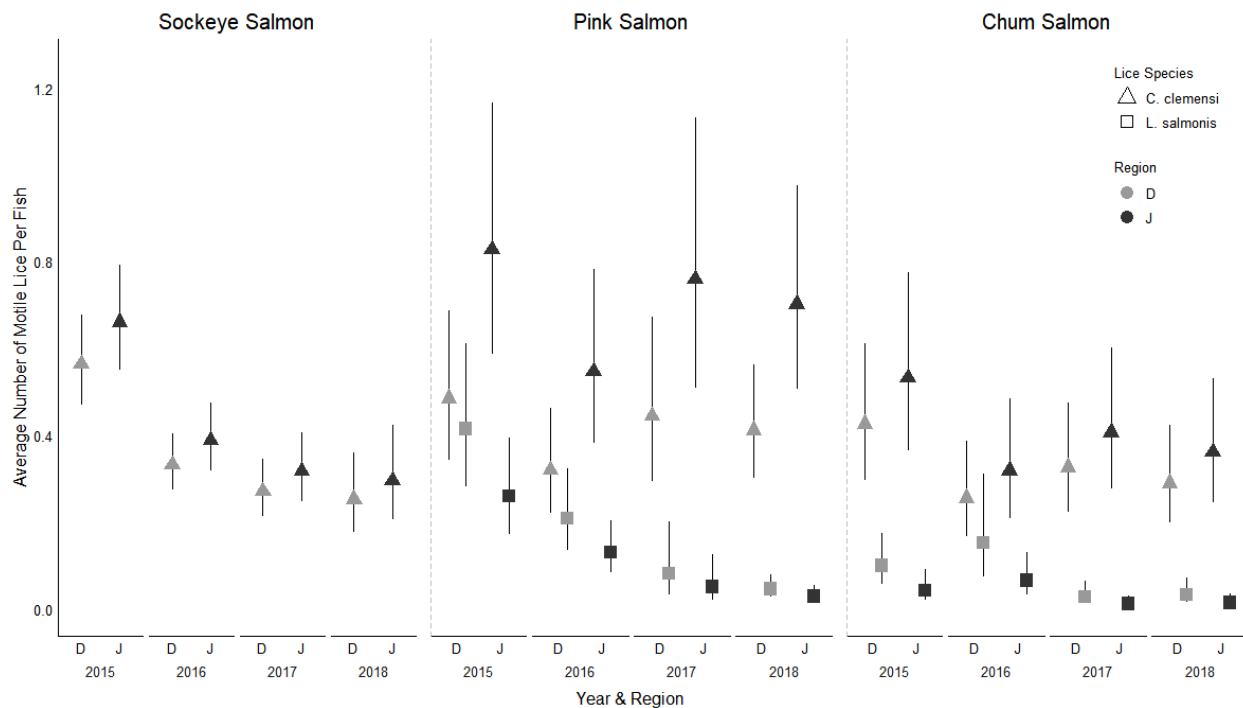
New Set of Models

Models (No Crossed Effects)

```
lepmod.yrsrsp <- glmmTMB(all.leps ~ spp + site.region + year - 1 +        (1|c
ollection),
                    data = mainlice, family=nbinom2)
calmod.yrsrsp <- glmmTMB(all.cal ~ spp + site.region + year - 1 + (1|collecti
on),
                    data = mainlice, family=nbinom2)
```

AIC tables

```
lepmod.yrsrsp_dredge = MuMIn::dredge(lepmod.yrsrsp)

calmod.yrsrsp_dredge = MuMIn::dredge(calmod.yrsrsp)

lepmod.yrsrsp_dredge

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

calmod.yrsrsp_dredge

## Global model call: glmmTMB(formula = all.cal ~ spp + site.region + year -
1 + (1 |
##     collection), data = mainlice, family = nbinom2, ziformula = ~0,
##     dispformula = ~1)
## ---
## Model selection table
##   dsp((Int)) cnd(sit.rgn) cnd(spp) cnd(yer) df    logLik   AICc delta
## 8          +            +     +        + 9 -1486.158 2990.4  0.00
## 7          +                  +        + 8 -1490.784 2997.6  7.23
## 4          +            +     +          6 -1493.201 2998.4  8.03
## 3          +                  +          5 -1497.330 3004.7 14.28
## 6          +            +                + 7 -1498.198 3010.5 20.04
## 5          +                           + 6 -1502.828 3017.7 27.29
```
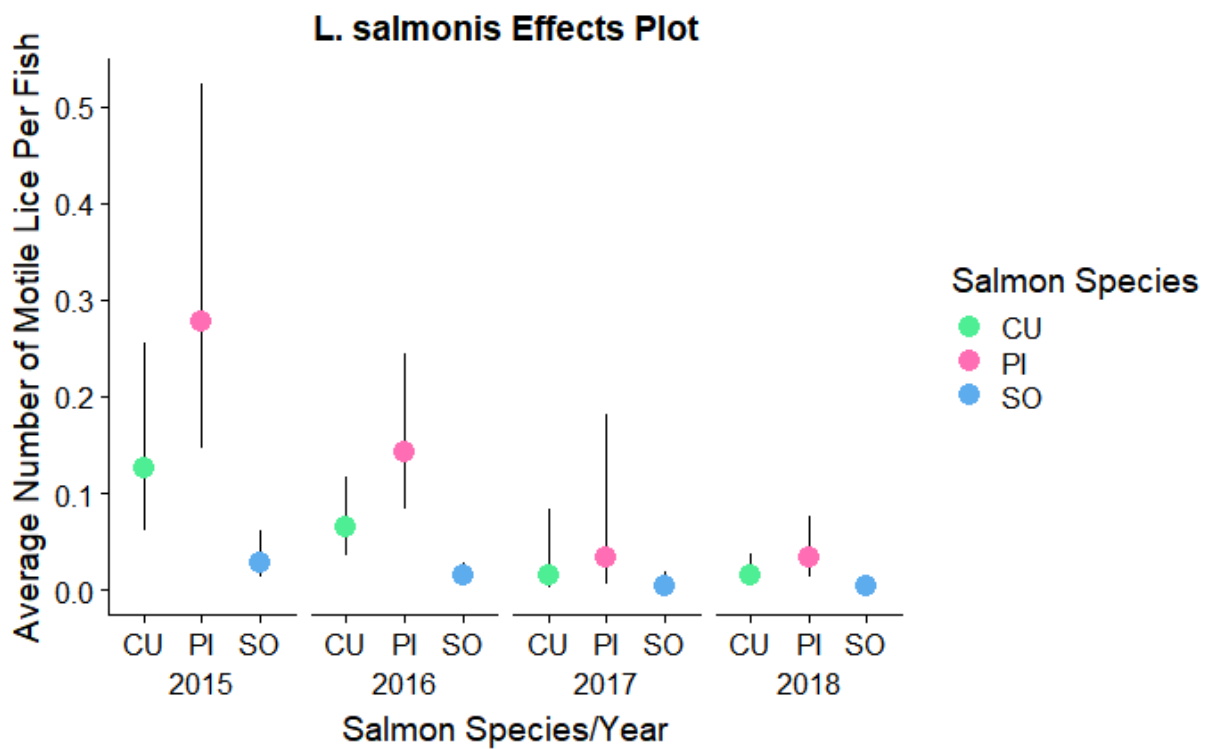
```
## 2              +              +                    4 -1505.653 3019.3 28.91
##   weight
## 8  0.956
## 7  0.026
## 4  0.017
## 3  0.001
## 6  0.000
## 5  0.000
## 2  0.000
## Models ranked by AICc(x)
## Random terms (all models):
## 'cond(1 | collection)'
```
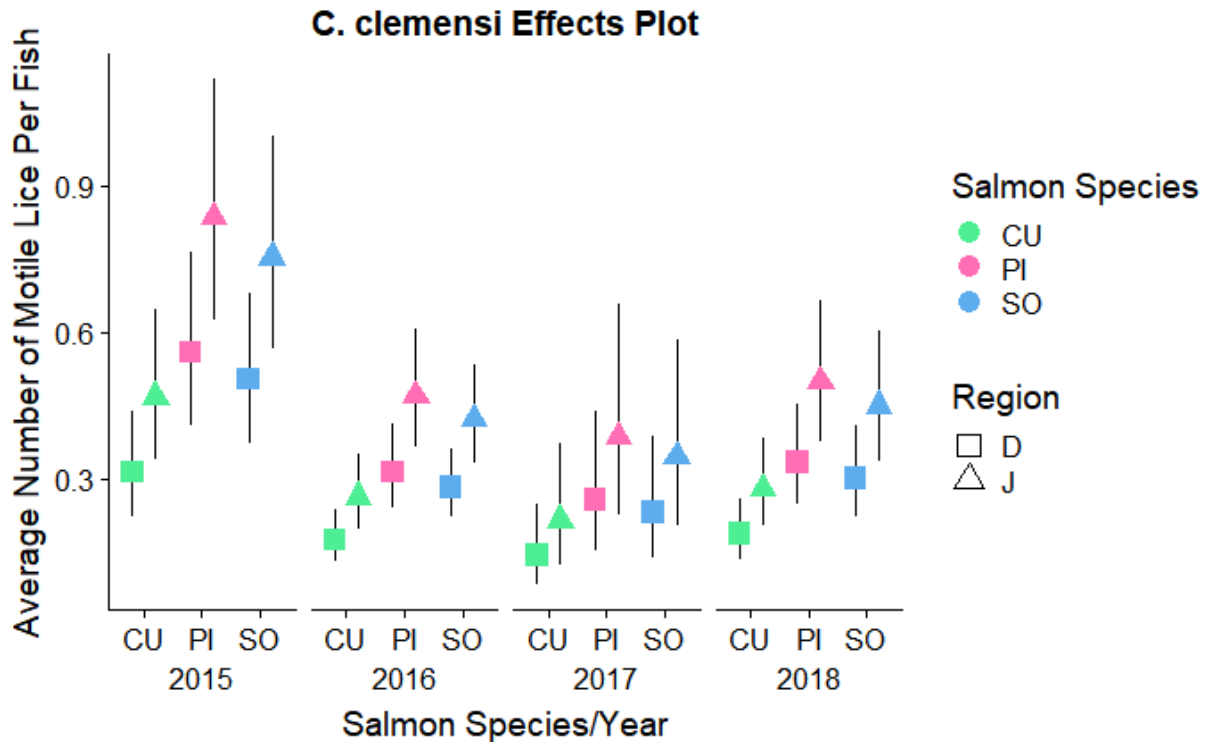
Effects Plots

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Models (Crossed Effects)

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

AIC Tables

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

lepmod.crossed_dredge

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

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

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

calmod.crossed_dredge

## Global model call: glmmTMB(formula = all.cal ~ spp * site.region + spp * y
ear +
##     site.region * year + (1 | collection), data = mainlice, family = nbino
m2,
##     ziformula = ~0, dispformula = ~1)
## ---
## Model selection table
##    cnd((Int)) dsp((Int)) cnd(sit.rgn) cnd(spp) cnd(yer) cnd(sit.rgn:spp)
## 32    -0.7104           +            +        +        +                +
## 24    -0.7910           +            +        +        +
## 64    -0.8636           +            +        +        +                +
## 56    -0.9259           +            +        +        +
## 8     -1.1610           +            +        +        +
## 16    -1.0900           +            +        +        +                +
## 40    -1.2760           +            +        +        +
## 48    -1.2170           +            +        +        +                +
## 22    -0.3716           +            +                 +
## 6     -0.7379           +            +                 +
##      cnd(sit.rgn:yer) cnd(spp:yer) df   logLik   AICc delta weight
## 32                  +              14 -1478.419 2985.1  0.00  0.410
## 24                  +              12 -1480.773 2985.7  0.65  0.297
## 64                  +            + 20 -1473.480 2987.4  2.35  0.126
## 56                  +            + 18 -1475.829 2988.0  2.97  0.093
## 8                                  9 -1486.158 2990.4  5.35  0.028
```
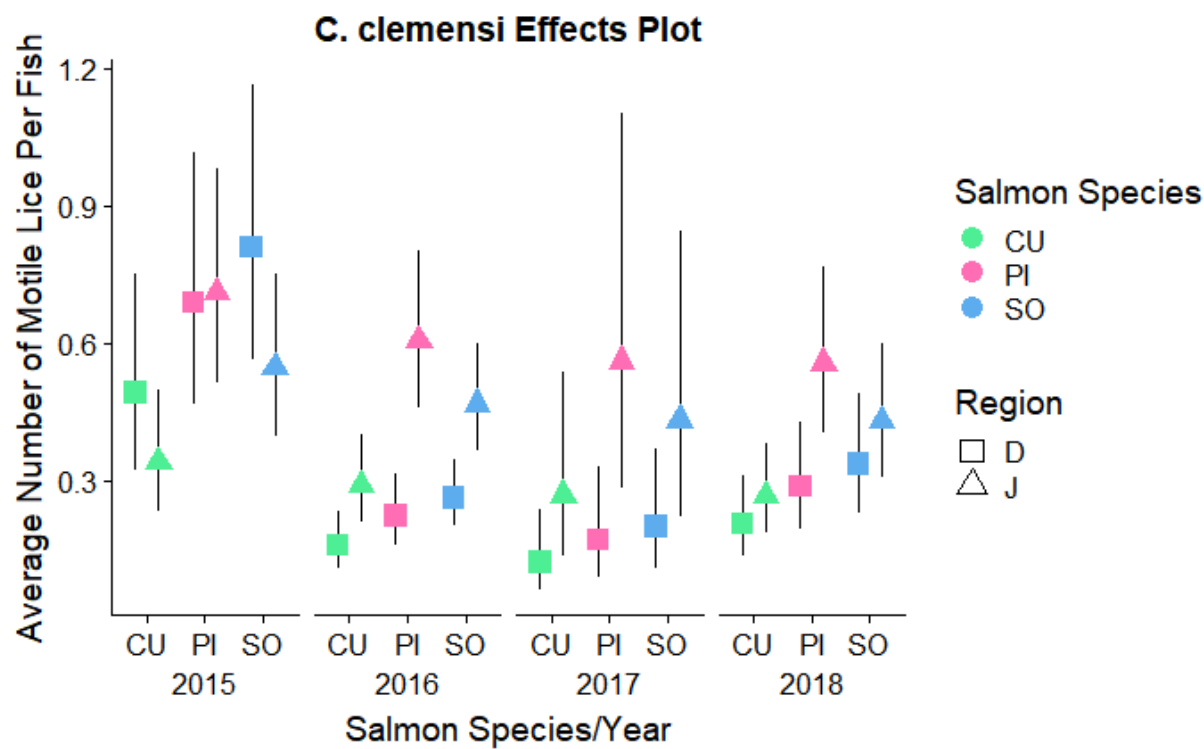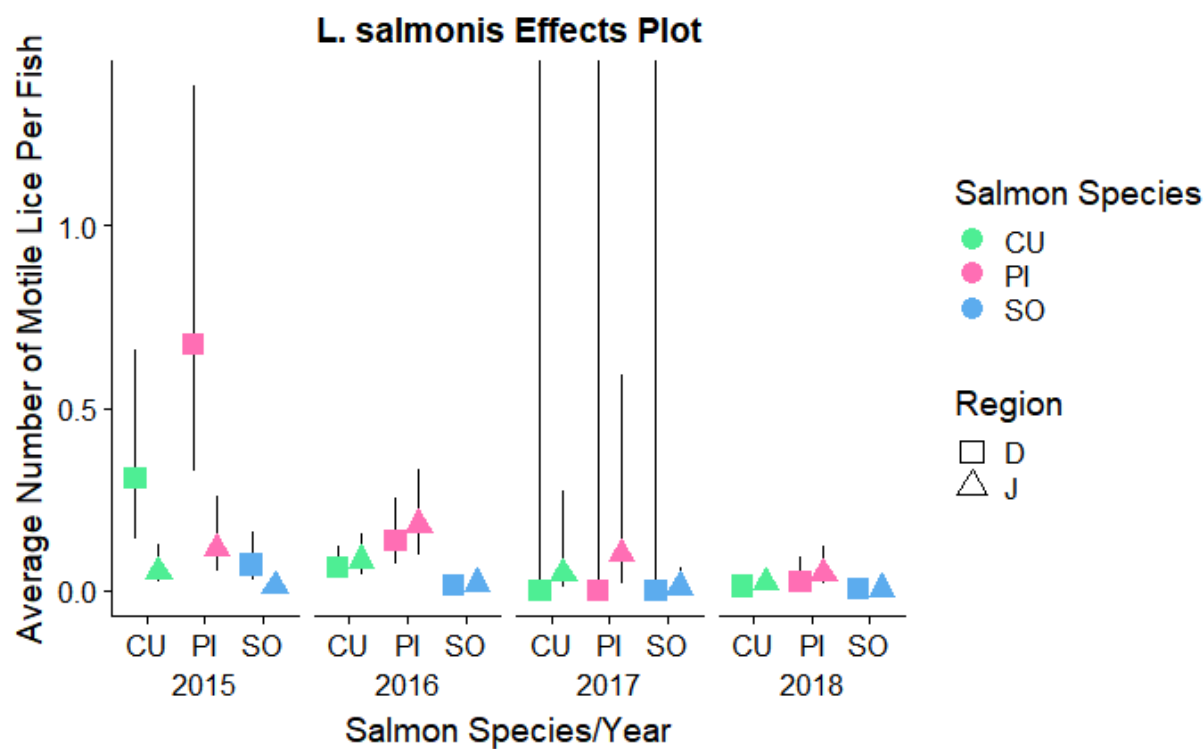
```
191  ## 16                                    11 -1484.199 2990.5  5.47  0.027
192  ## 40                                 + 15 -1481.158 2992.6  7.51  0.010
193  ## 48                                 + 17 -1479.200 2992.7  7.67  0.009
194  ## 22                    +               10 -1493.316 3006.8 21.68  0.000
195  ## 6                                     7 -1498.198 3010.5 25.39  0.000
196  ## Models ranked by AICc(x)
197  ## Random terms (all models):
198  ## 'cond(1 | collection)'
```

Effects Plots

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```
230  summary(chumrmod.calnb); summary(chumrmod.lepsnb); summary(pinkrmod.calnb); s
231  ummary(pinkrmod.lepsnb); summary(sockrmod.calnb); summary(sockrmod.lepsnbsr)

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

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

```
278   ## year2017      -1.2784      0.4857  -2.632  0.00848 **
279   ## year2018      -1.1277      0.4742  -2.378  0.01740 *
280   ## ---
281   ## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

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

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

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

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

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

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