Hakai-Lice-Models-Overview

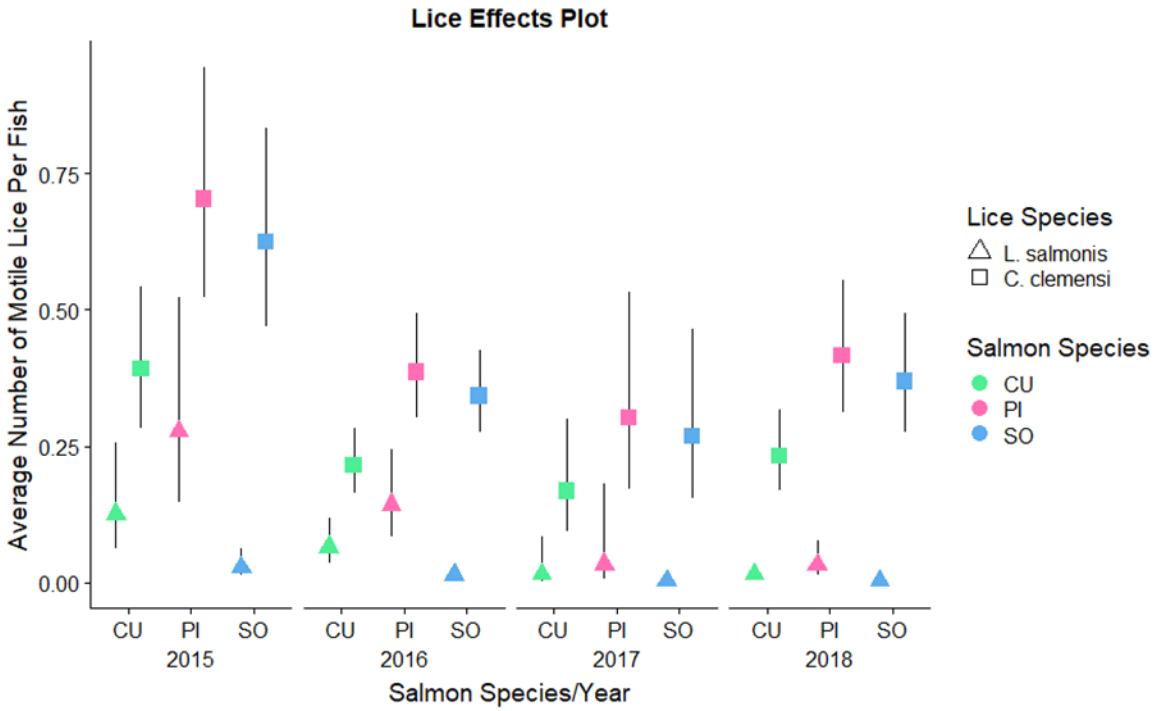
Initial Model Set

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):
## 'cond(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):
## 'cond(1 | collection)'
```

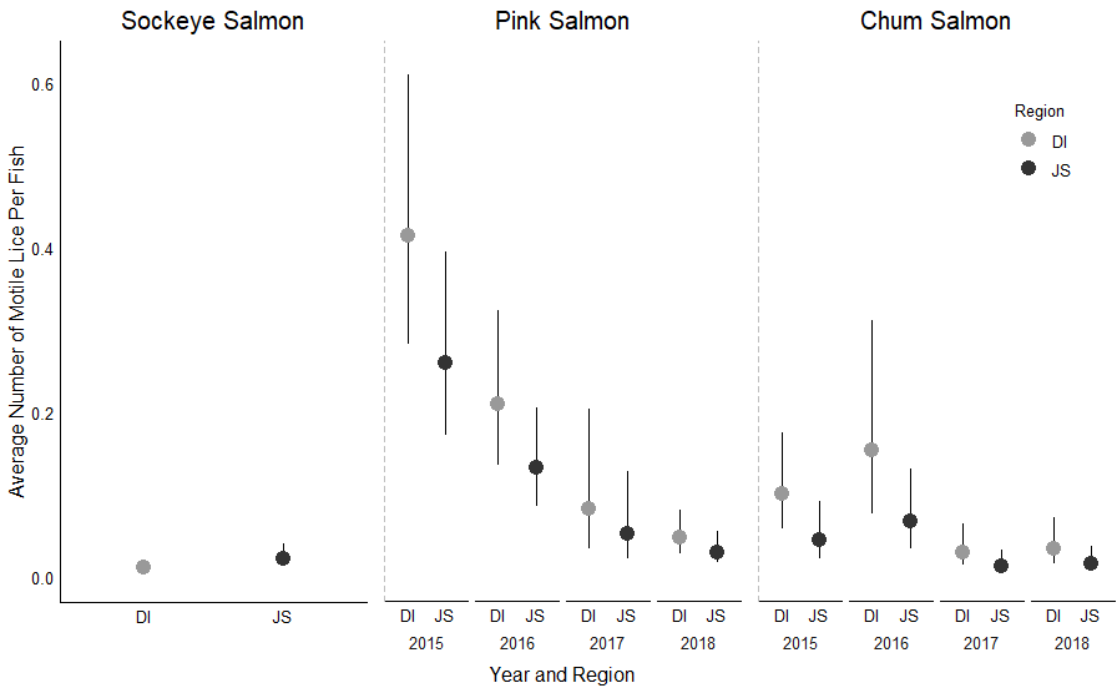
Species Level Effects Plots

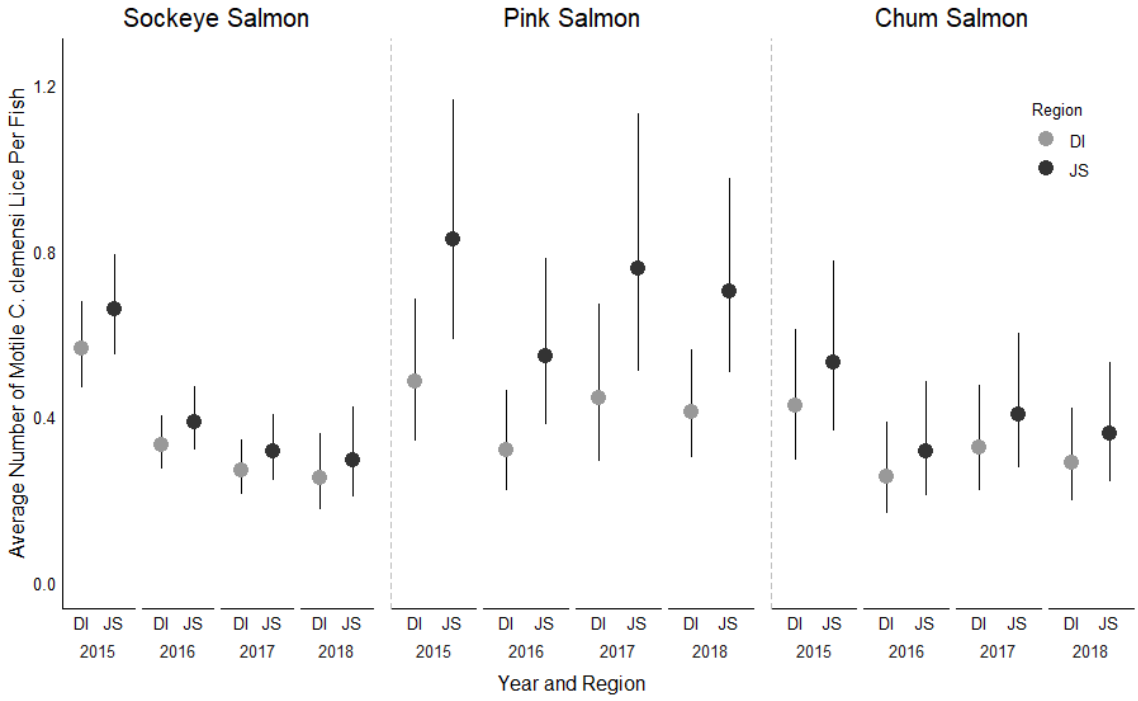


Region-Level Models

```
#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
```

Effects Plots





New Set of Models

Models (No Crossed Effects)

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

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

AIC tables

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

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

lepmod.yrsrsp_dredge
```

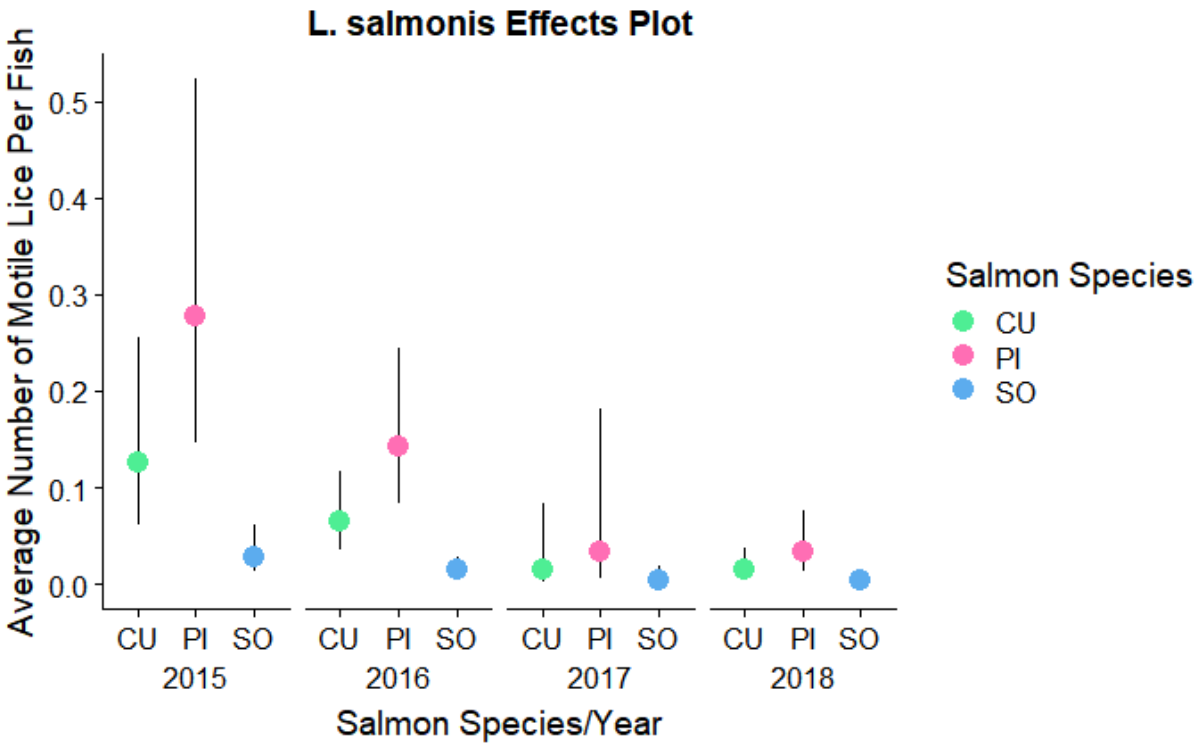
```
## Global model call: glmmTMB(formula = all.leps ~ spp + site.region + year -
## 1 + (1 |
##     collection), data = mainlice, family = nbinom2, ziformula = ~0,
##     dispformula = ~1)
## ---
## Model selection table
##   dsp((Int)) cnd(sit.rgn) cnd(spp) cnd(yer) df   logLik  AICc delta weight
## 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)'
```

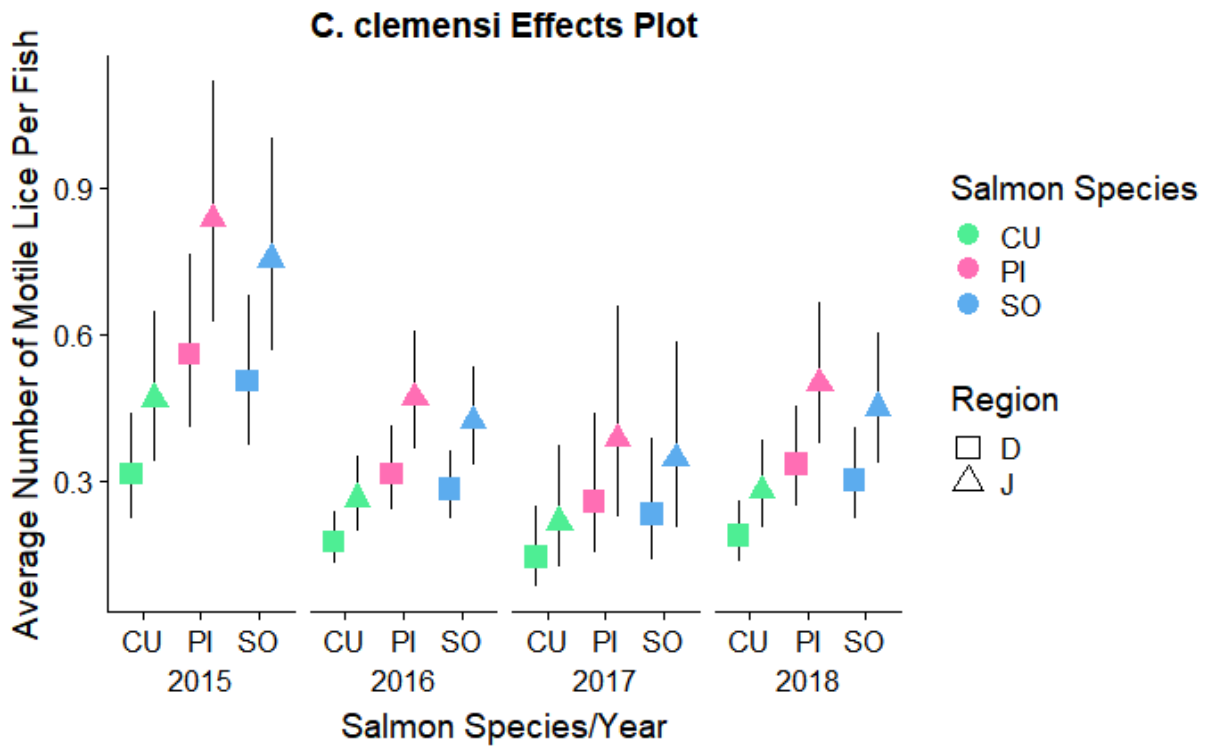
```
calmod.yrsrsp_dredge
```

```
## 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





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)`))
```

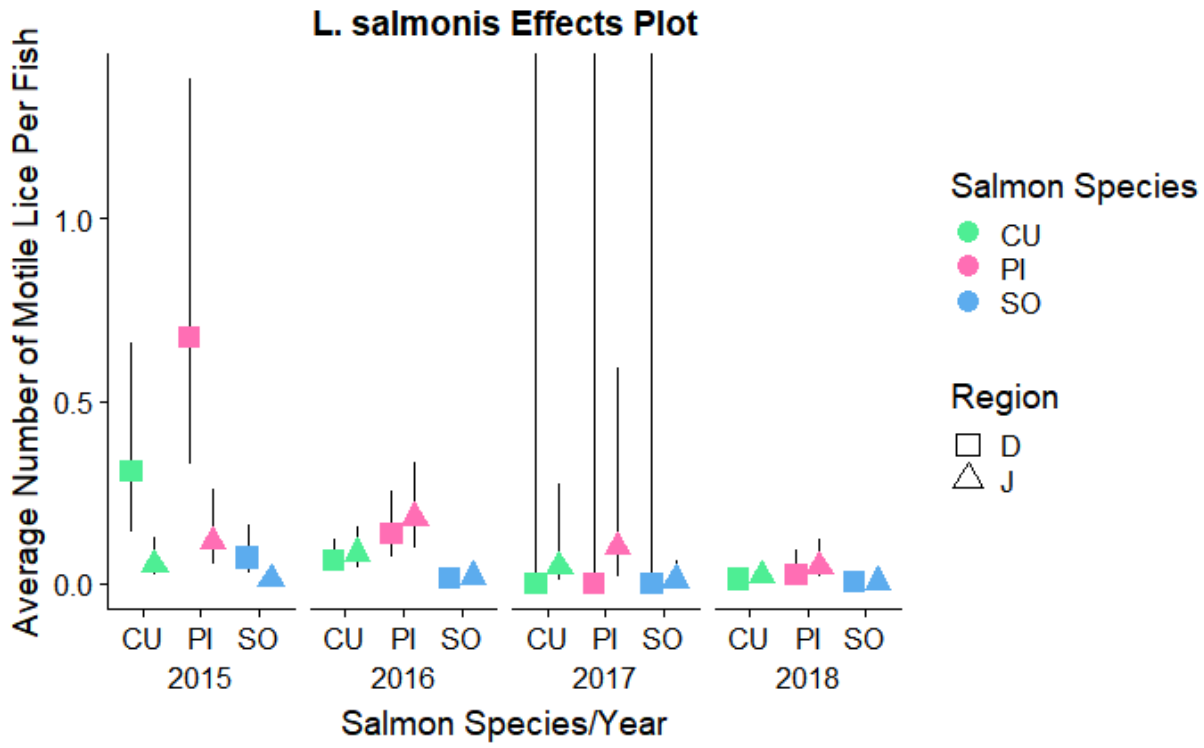
```
lepmod.crossed_dredge
```

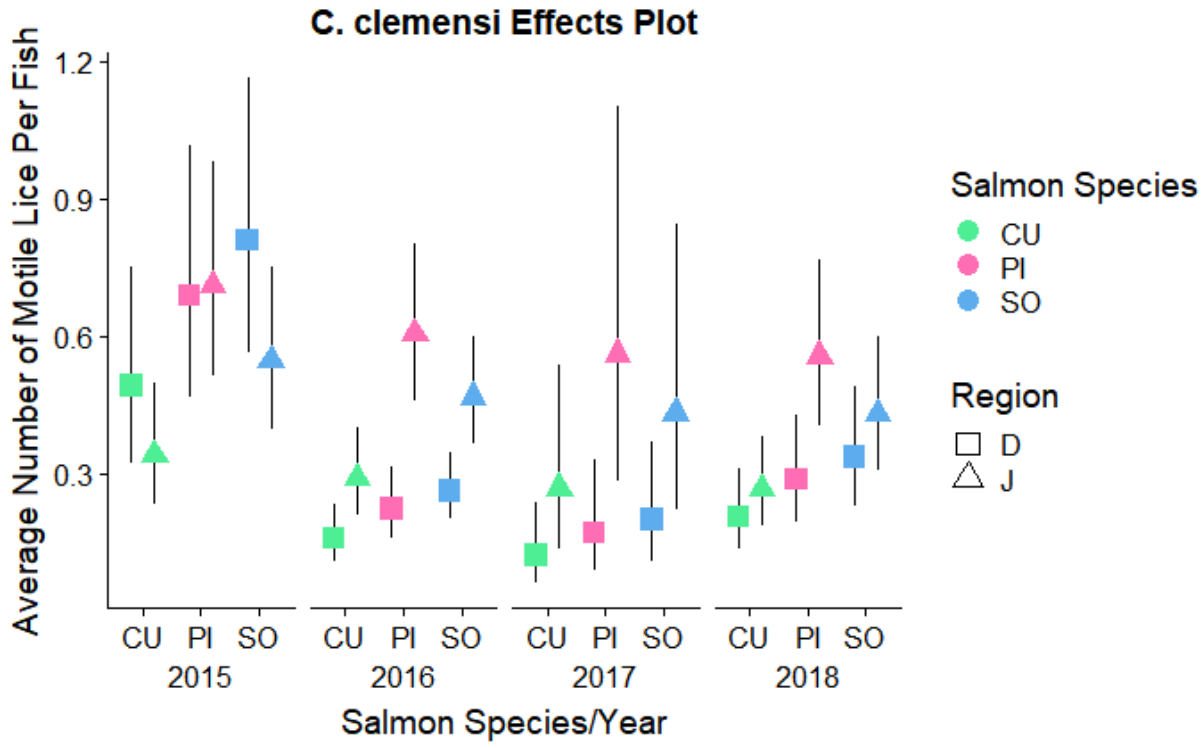
```
## Global model call: glmmTMB(formula = all.leps ~ spp * site.region + spp *
year +
##     site.region * year + (1 | collection), data = mainlice, family = nbino
m2,
##     ziformula = ~0, dispformula = ~1)
## ---
## Model selection table
##    cnd((Int)) dsp((Int)) cnd(sit.rgn) cnd(spp) cnd(yer)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

```
## 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
```

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

Effects Plots





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

```
##  Family: nbinom2  ( log )
## Formula:          all.cal ~ site.region + year - 1 + (1 | week)
## Data: chum.region
##
##      AIC      BIC   logLik deviance df.resid
##   2120.8   2157.3  -1053.4   2106.8     1358
##
## Random effects:
##
## Conditional model:
##  Groups Name        Variance Std.Dev.
##  week   (Intercept) 0.2548   0.5048
## Number of obs: 1365, groups:  week, 12
##
## Overdispersion parameter for nbinom2 family (): 2.12
##
## Conditional model:
##              Estimate Std. Error z value Pr(>|z|)
## site.regionD  -0.8537     0.1846  -4.624 3.76e-06 ***
## site.regionJ  -0.6314     0.1926  -3.279  0.00104 **
## year2016      -0.5131     0.1637  -3.133  0.00173 **
## year2017      -0.2677     0.1306  -2.051  0.04031 *
## year2018      -0.3880     0.1352  -2.870  0.00410 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##  Family: nbinom2  ( log )
## Formula:          all.leps ~ site.region + year - 1 + (1 | week)
## Data: chum.region
##
##      AIC      BIC   logLik deviance df.resid
##    510.6    547.1   -248.3    496.6     1358
##
## Random effects:
##
## Conditional model:
##  Groups Name        Variance  Std.Dev.
##  week   (Intercept) 2.132e-08 0.000146
## Number of obs: 1365, groups:  week, 12
##
## Overdispersion parameter for nbinom2 family (): 0.0749
##
## Conditional model:
##              Estimate Std. Error z value Pr(>|z|)
## site.regionD  -2.3025     0.2821  -8.162 3.28e-16 ***
## site.regionJ  -3.1487     0.3838  -8.205 2.31e-16 ***
## year2016       0.4227     0.4203   1.006  0.31464
```

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

##  Family: nbinom2  ( log )
## Formula:          all.cal ~ site.region + year - 1 + (1 | week)
## Data: pink.region
##
##      AIC      BIC   logLik deviance df.resid
##   1795.5   1829.5   -890.8   1781.5      932
##
## Random effects:
##
## Conditional model:
##  Groups Name        Variance Std.Dev.
##  week   (Intercept) 0.1967   0.4435
## Number of obs: 939, groups:  week, 12
##
## Overdispersion parameter for nbinom2 family (): 5.85
##
## Conditional model:
##              Estimate Std. Error z value Pr(>|z|)
## site.regionD -0.72429    0.17729  -4.085  4.4e-05 ***
## site.regionJ -0.18910    0.17509  -1.080  0.28014
## year2016     -0.41514    0.15914  -2.609  0.00909 **
## year2017     -0.08654    0.16465  -0.526  0.59916
## year2018     -0.16441    0.12203  -1.347  0.17788
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

##  Family: nbinom2  ( log )
## Formula:          all.leps ~ site.region + year - 1 + (1 | week)
## Data: pink.region
##
##      AIC      BIC   logLik deviance df.resid
##    728.2    762.1   -357.1    714.2      932
##
## Random effects:
##
## Conditional model:
##  Groups Name        Variance  Std.Dev.
##  week   (Intercept) 2.314e-09 4.81e-05
## Number of obs: 939, groups:  week, 12
##
## Overdispersion parameter for nbinom2 family (): 0.318
##
## Conditional model:
##              Estimate Std. Error z value Pr(>|z|)
## site.regionD  -0.8806     0.1975  -4.459 8.22e-06 ***
```

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

```
##  Family: nbinom2  ( log )
## Formula:          all.cal ~ site.region + year - 1 + (1 | week)
## Data: sock.region
##
##      AIC      BIC   logLik deviance df.resid
##   6467.4   6510.9  -3226.7   6453.4     3687
##
## Random effects:
##
## Conditional model:
##  Groups Name        Variance Std.Dev.
##  week   (Intercept) 0.05698  0.2387
## Number of obs: 3694, groups:  week, 11
##
## Overdispersion parameter for nbinom2 family (): 0.974
##
## Conditional model:
##              Estimate Std. Error z value Pr(>|z|)
## site.regionD -0.57222    0.09288  -6.161 7.25e-10 ***
## site.regionJ -0.41522    0.09257  -4.486 7.27e-06 ***
## year2016     -0.52957    0.07103  -7.456 8.92e-14 ***
## year2017     -0.73482    0.10118  -7.262 3.81e-13 ***
## year2018     -0.80543    0.16844  -4.782 1.74e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##  Family: nbinom2  ( log )
## Formula:          all.leps ~ site.region - 1 + (1 | week)
## Data: sock.region
##
##      AIC      BIC   logLik deviance df.resid
##    783.8    808.7   -387.9    775.8     3690
##
## Random effects:
##
## Conditional model:
##  Groups Name        Variance Std.Dev.
##  week   (Intercept) 0.3741   0.6116
## Number of obs: 3694, groups:  week, 11
##
## Overdispersion parameter for nbinom2 family (): 0.142
##
## 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
```