Forest and Funnel plots

Juliette Jacquemont

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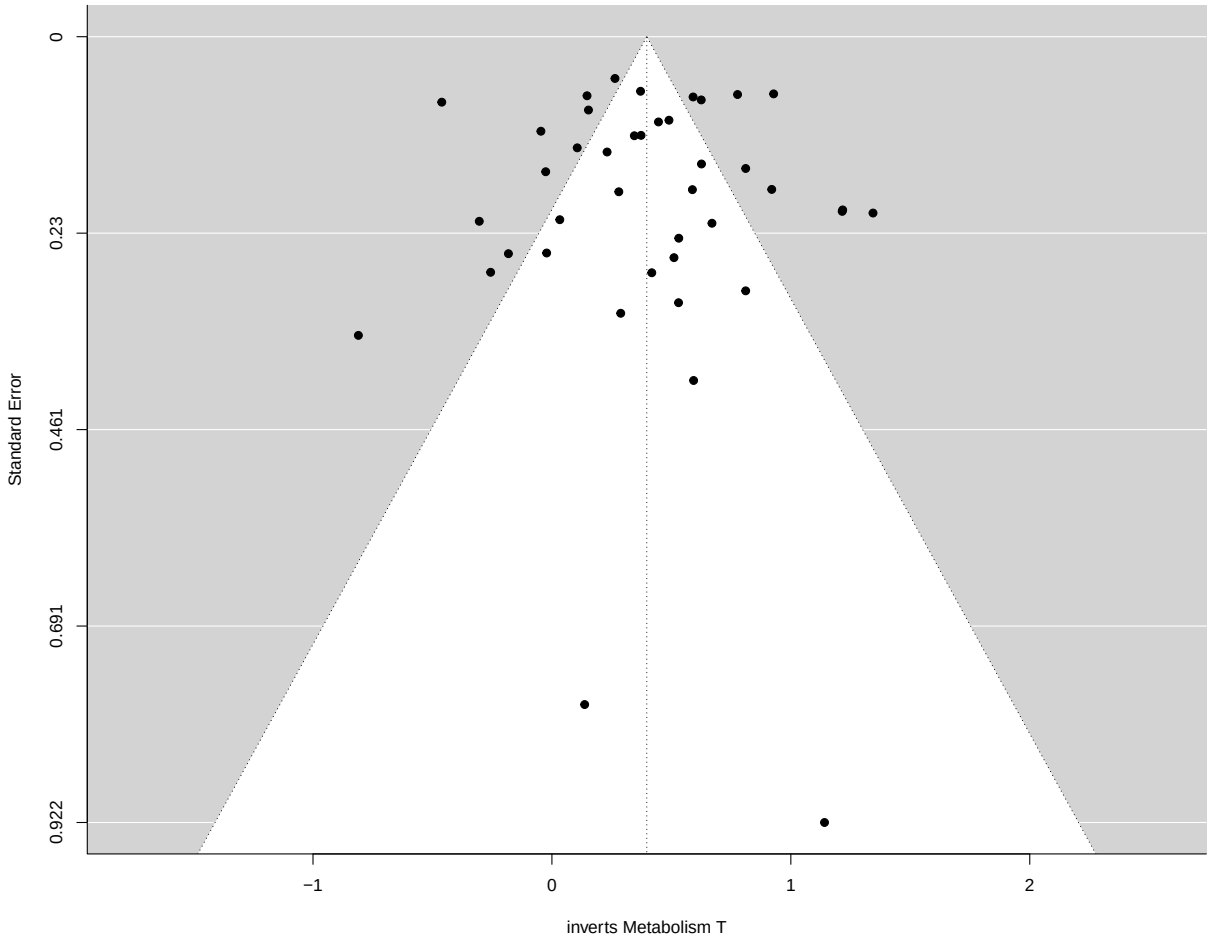
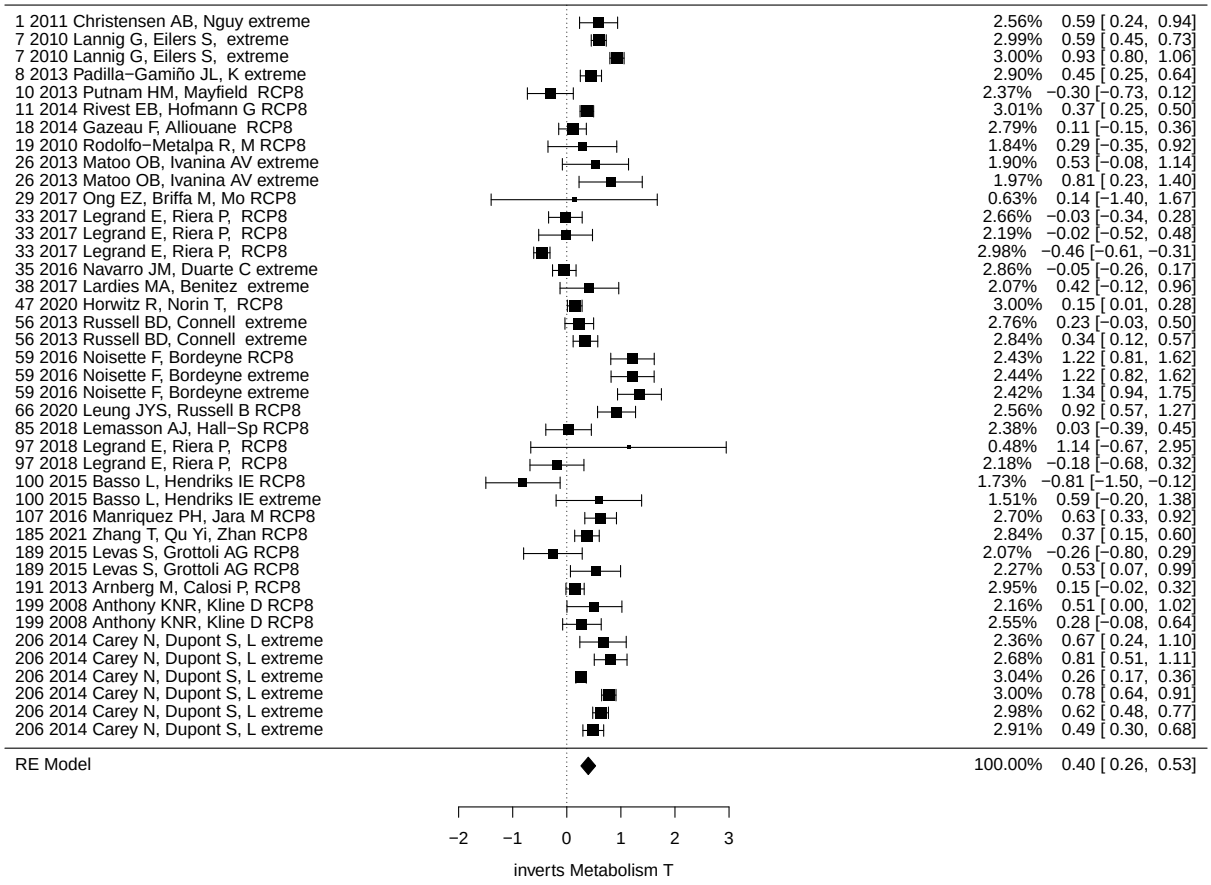
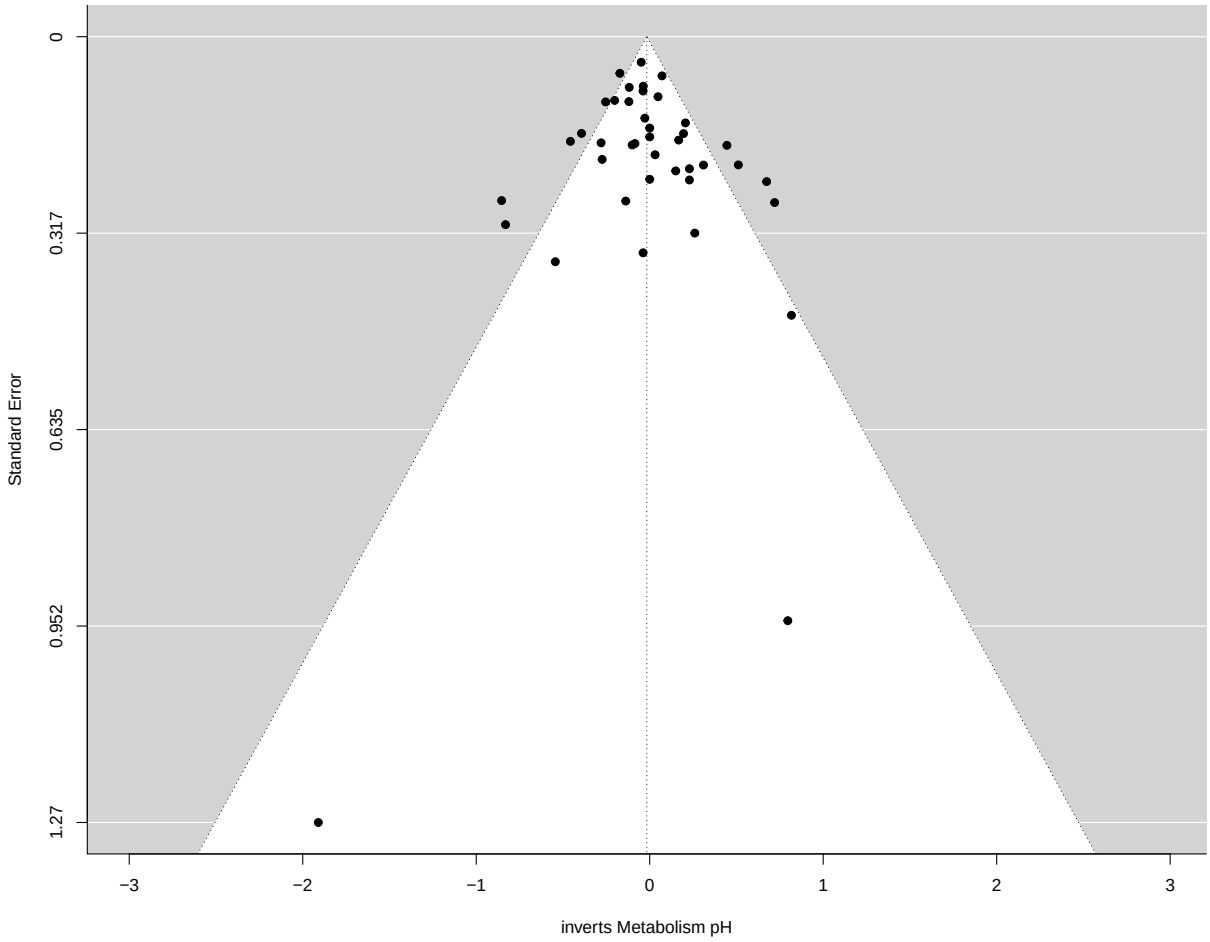
```
## Sensitivity analysis table
sensitivity <- tibble(taxa=character(), stressor=character(), metric=character(),Rosenthal=numeric(),thr

## Inverts, Metabolism
InvertMetabolism <- Inverts[Category %in% c("Routine respiration","Aerobic scope respiration")]
InvertMetabolism$Category <- c("Metabolism")
InvertMet <- MA_TpH("inverts","Metabolism",InvertMetabolism,sensitivity)
```

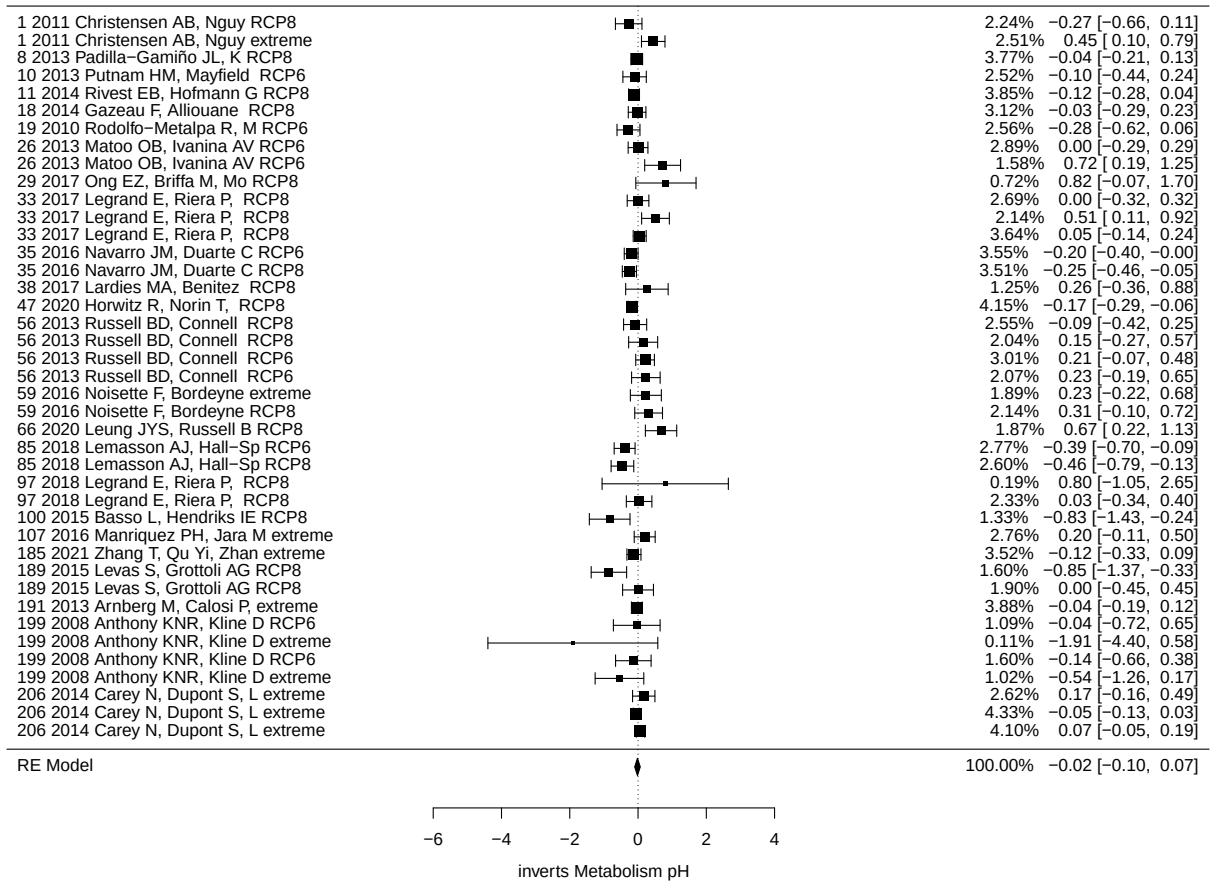
```
##
## Random-Effects Model (k = 41; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.1562 (SE = 0.0431)
## tau (square root of estimated tau^2 value):      0.3952
## I^2 (total heterogeneity / total variability):   91.76%
## H^2 (total variability / sampling variability):  12.14
##
## Test for Heterogeneity:
## Q(df = 40) = 412.0536, p-val < .0001
##
## Model Results:
##
## estimate      se    zval    pval   ci.lb   ci.ub
##   0.3971  0.0694  5.7188  <.0001  0.2610  0.5332  ***
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```


Standard Error
0
0.23
0.461
0.691
0.922
−1
0
1
2
inverts Metabolism T

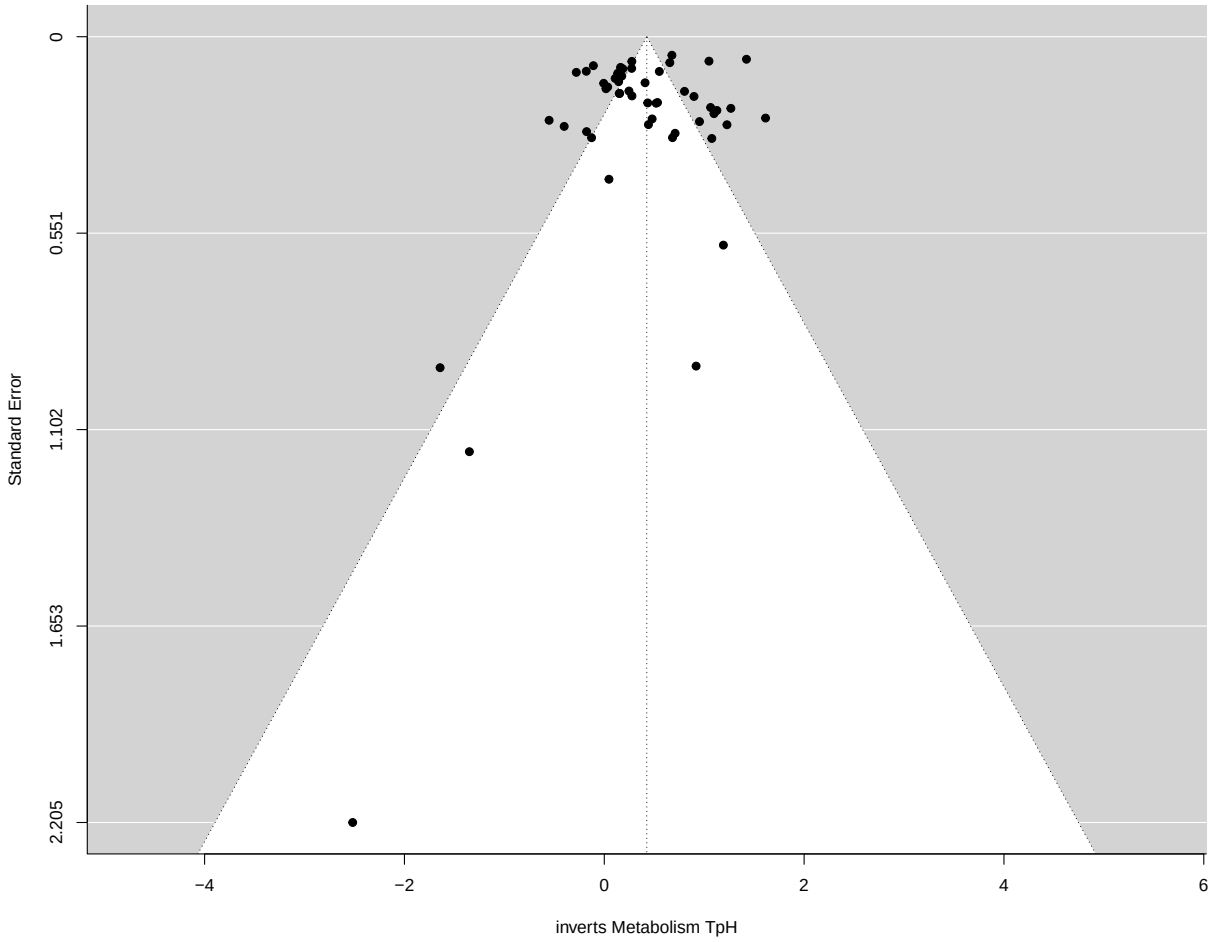


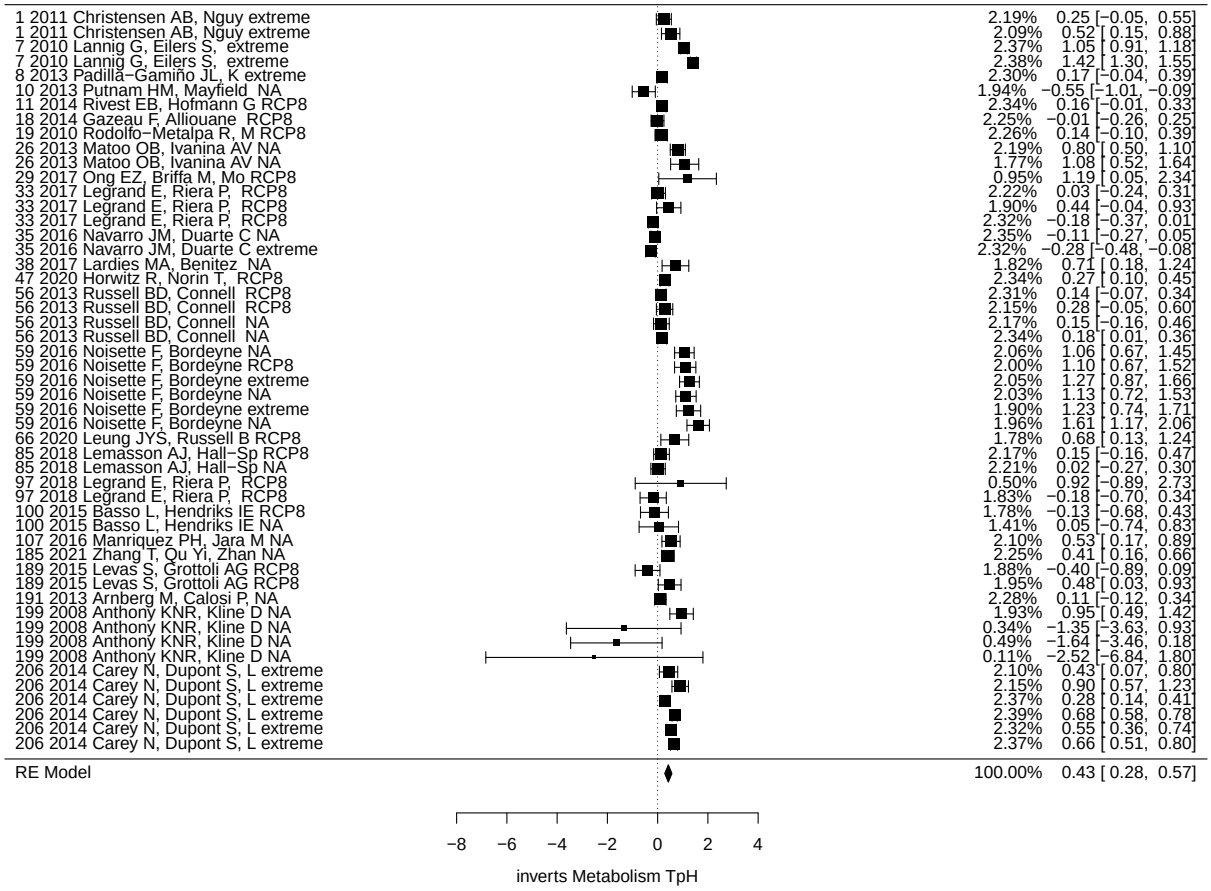

```
##
## Random-Effects Model (k = 41; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0385 (SE = 0.0147)
## tau (square root of estimated tau^2 value):      0.1961
## I^2 (total heterogeneity / total variability):   70.42%
## H^2 (total variability / sampling variability):  3.38
##
## Test for Heterogeneity:
## Q(df = 40) = 103.2966, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb   ci.ub
##  -0.0168  0.0417  -0.4017  0.6879  -0.0985  0.0650
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```


Standard Error
0
0.317
0.635
0.952
1.27
−3
−2
−1
0
1
2
3
inverts Metabolism pH




```
##
## Random-Effects Model (k = 51; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.2212 (SE = 0.0528)
## tau (square root of estimated tau^2 value):      0.4703
## I^2 (total heterogeneity / total variability):   93.15%
## H^2 (total variability / sampling variability):  14.61
##
## Test for Heterogeneity:
## Q(df = 50) = 739.6382, p-val < .0001
##
## Model Results:
##
## estimate      se    zval    pval   ci.lb   ci.ub
##   0.4255  0.0732  5.8133  <.0001  0.2821  0.5690  ***
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

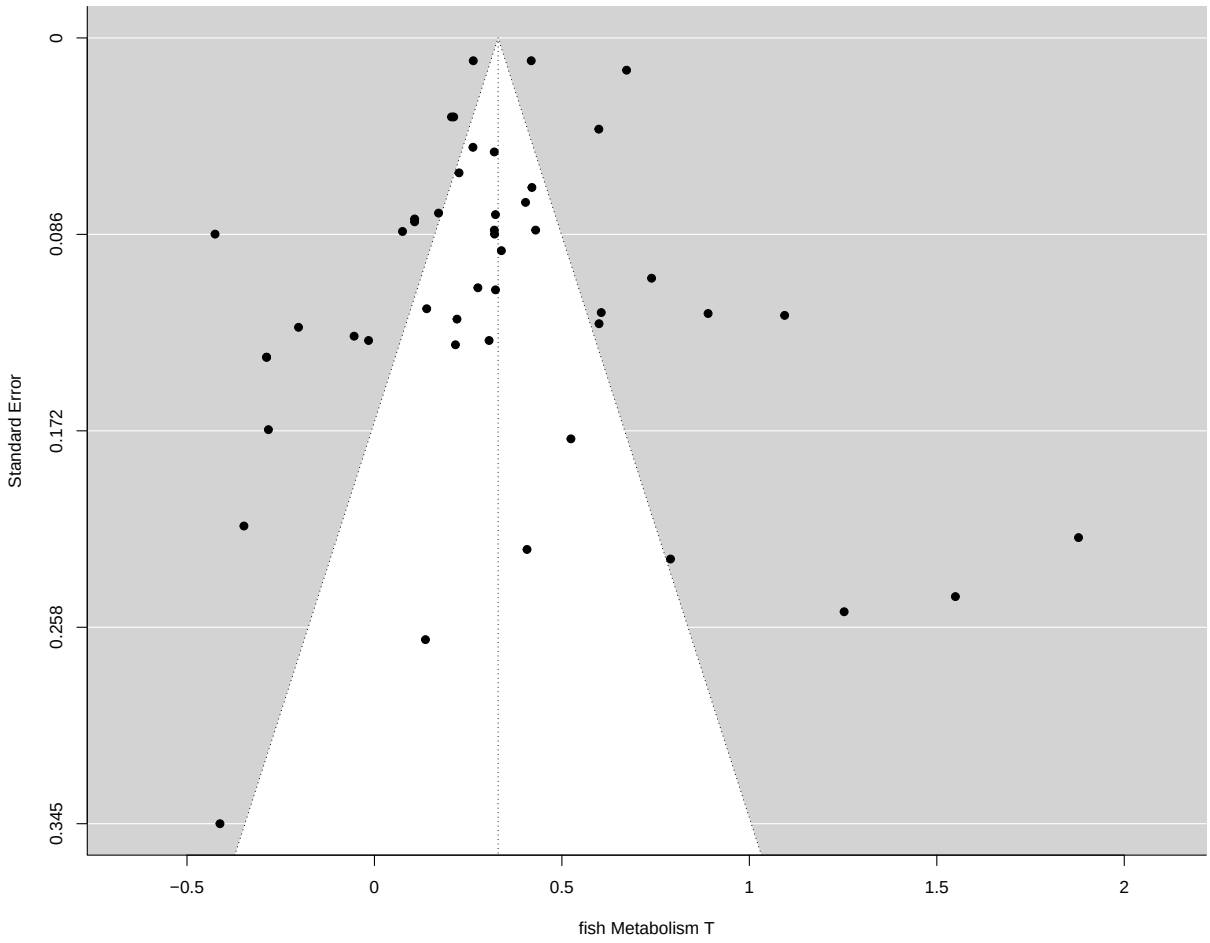

Standard Error
0
0.551
1.102
1.653
2.205
−4
−2
0
2
4
6
inverts Metabolism TpH

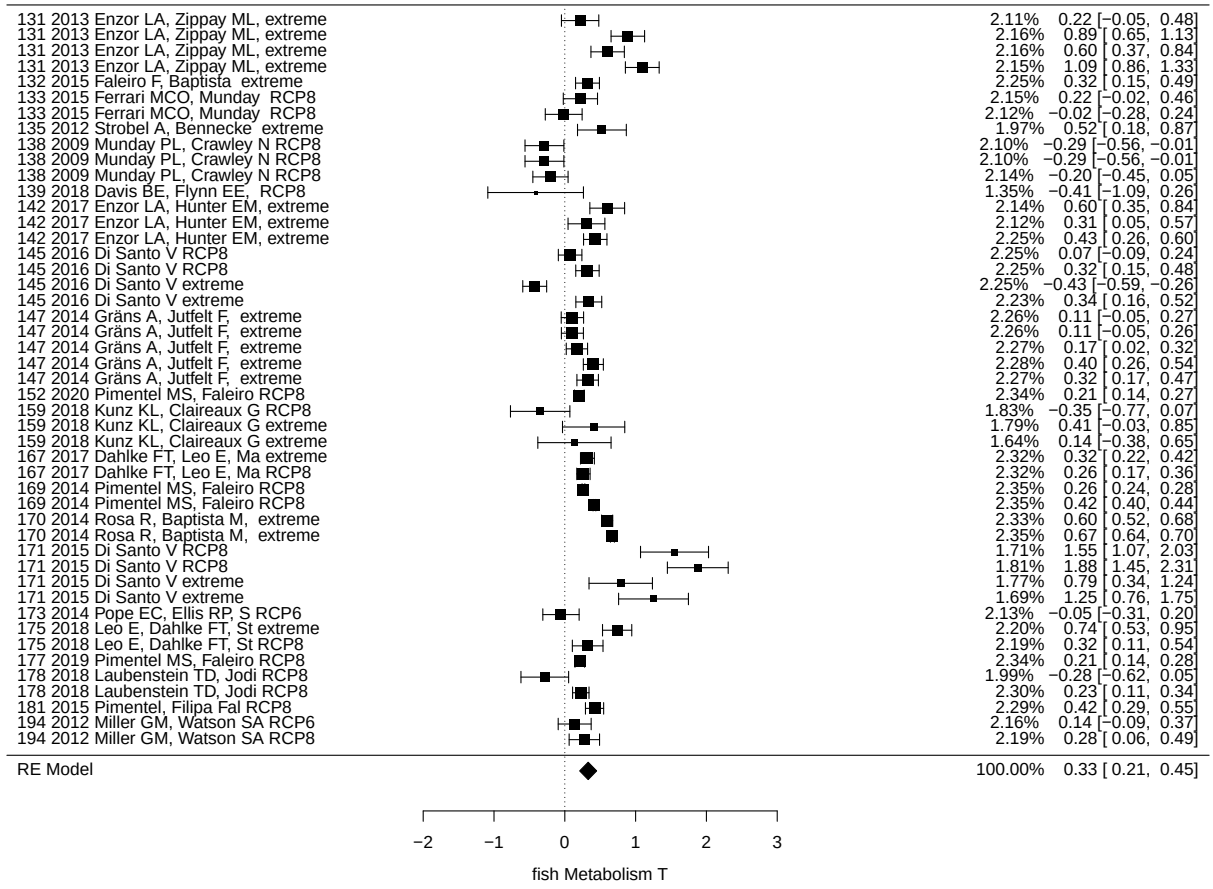



```
Abs_InvertMet <- MA_TpH_abs("inverts","Metabolism",InvertMetabolism)


## Fish, Metabolism
FishMetabolism <- Fish[Category %in% c("Routine respiration","Aerobic scope respiration")]
FishMetabolism$Category <- c("Metabolism")
FishMet <- MA_TpH("fish","Metabolism",FishMetabolism,sensitivity)
```

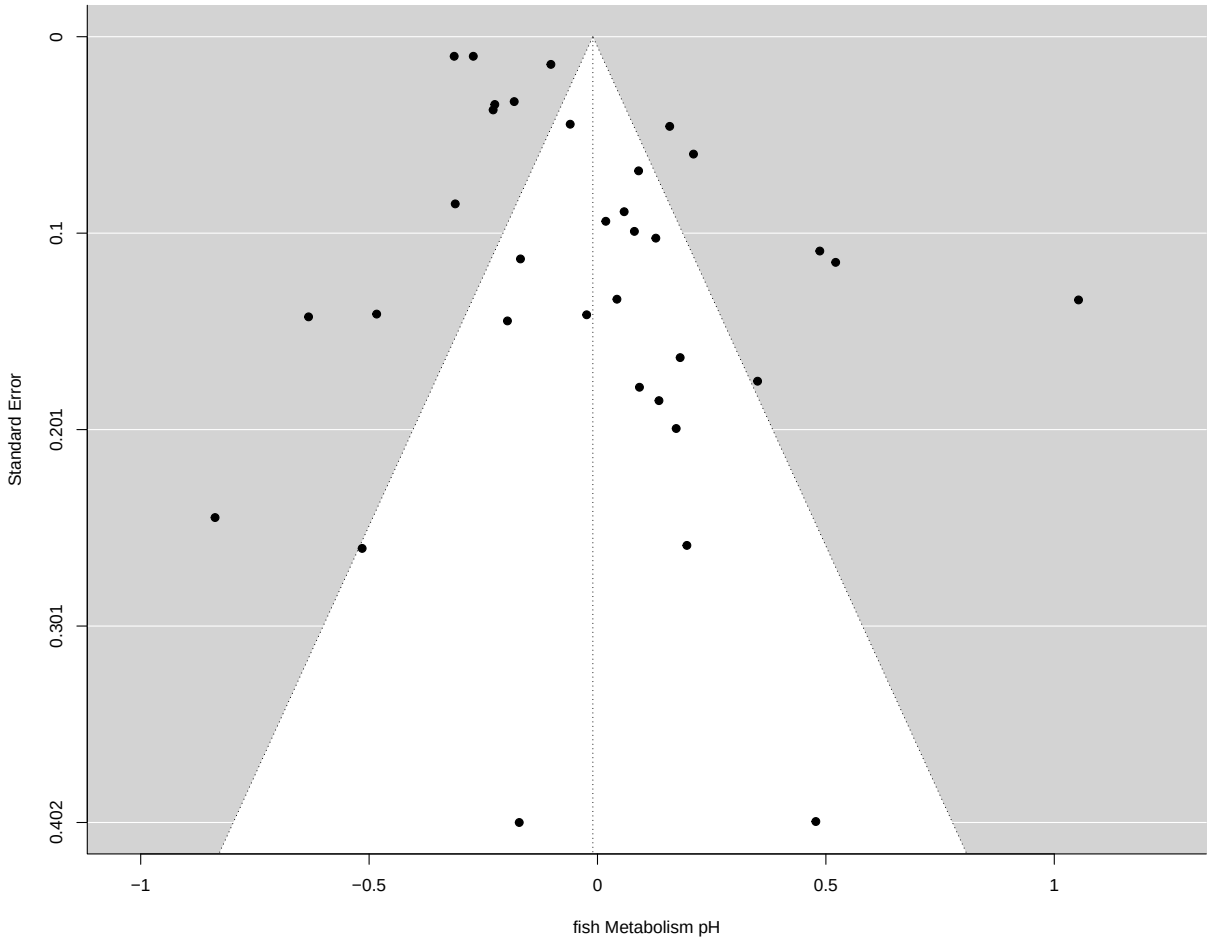
```
##
## Random-Effects Model (k = 47; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.1594 (SE = 0.0366)
## tau (square root of estimated tau^2 value):      0.3993
## I^2 (total heterogeneity / total variability):   98.83%
## H^2 (total variability / sampling variability):  85.32
##
## Test for Heterogeneity:
## Q(df = 46) = 1088.2175, p-val < .0001
##
## Model Results:
```

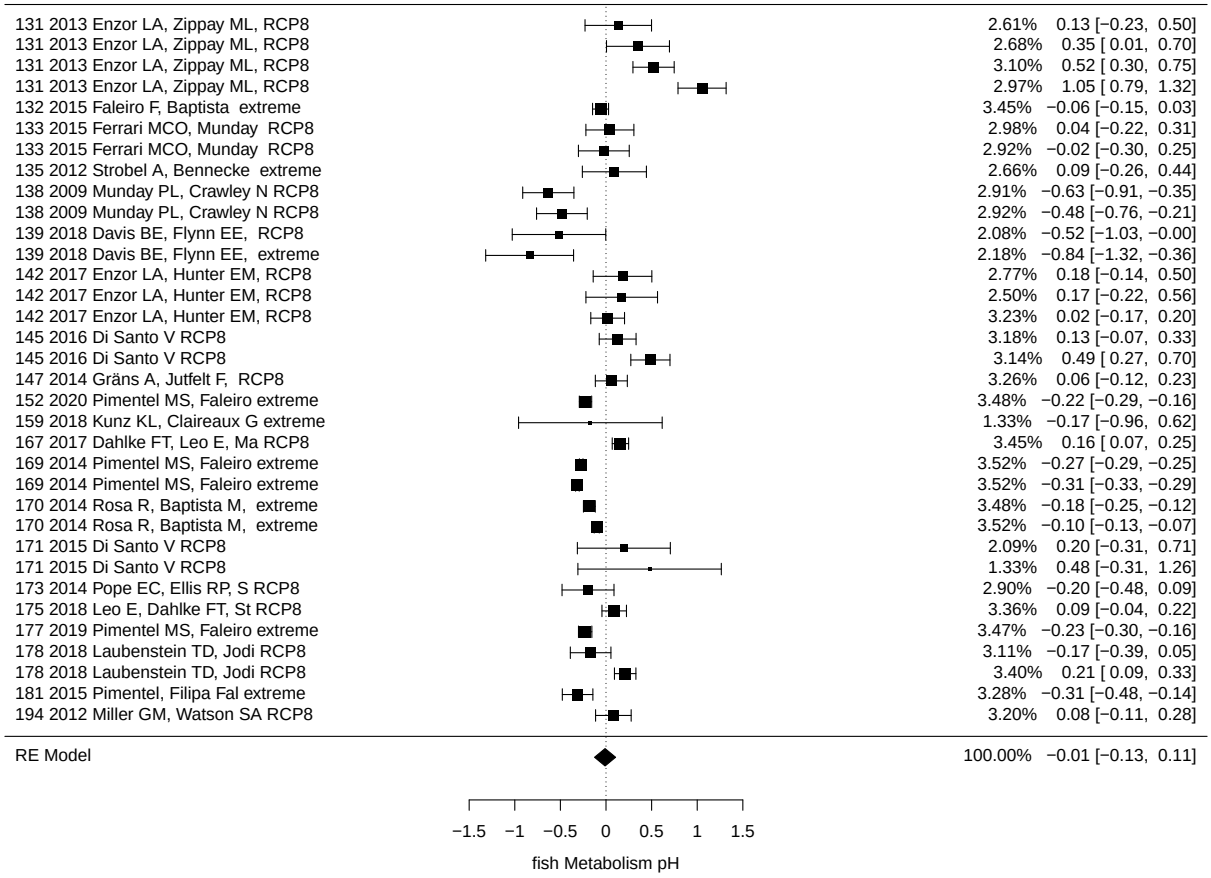
```
##
## estimate      se    zval    pval   ci.lb   ci.ub
##   0.3298  0.0613  5.3835  <.0001  0.2097  0.4499  ***
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



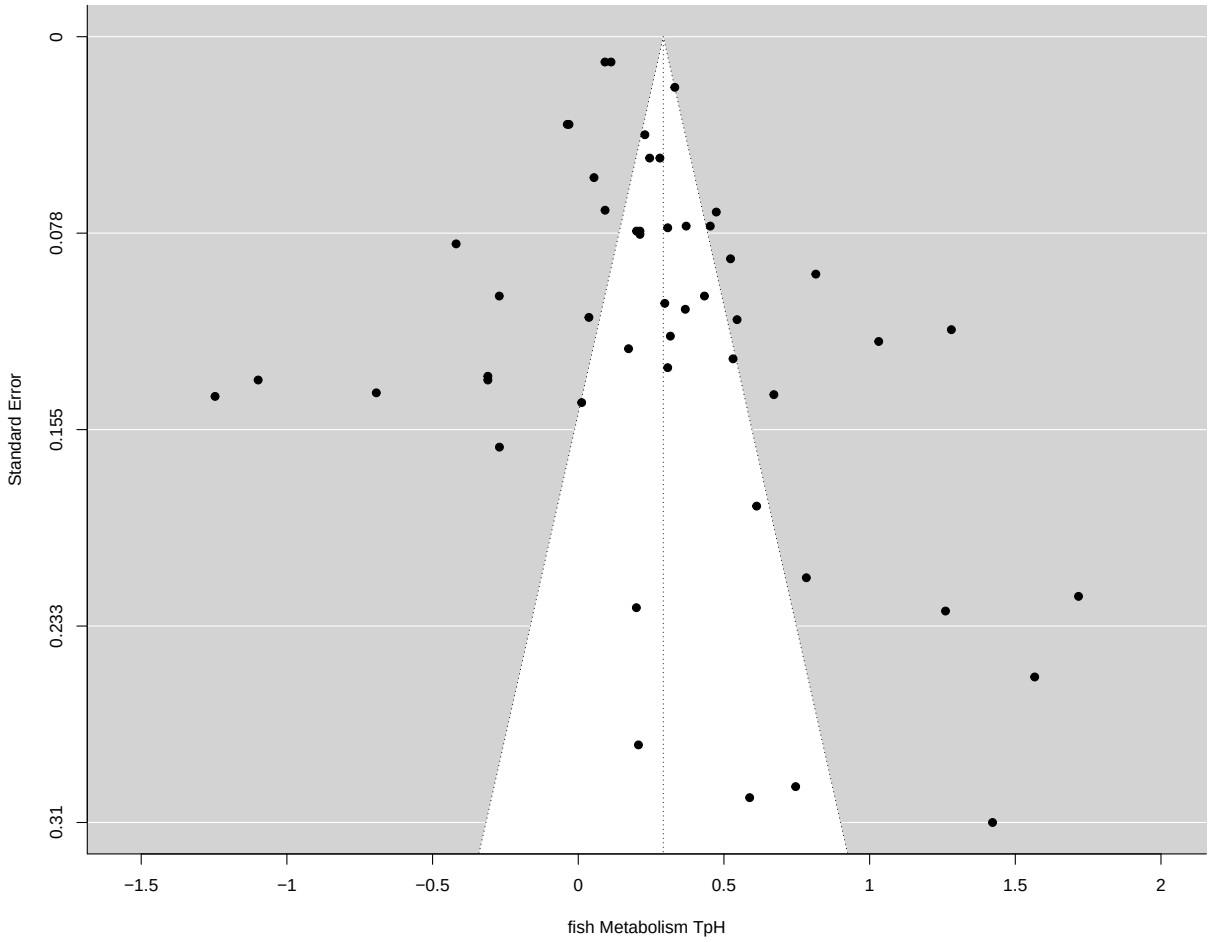


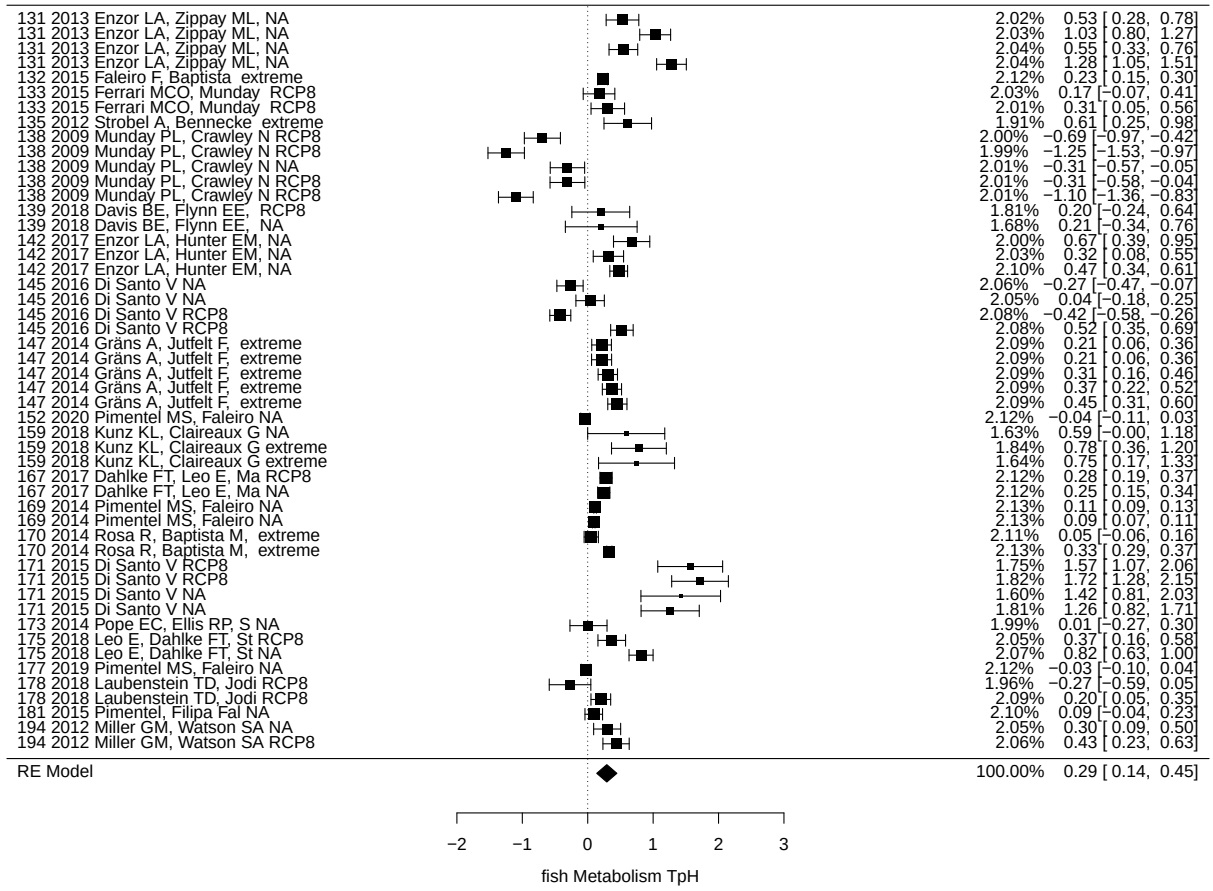

```
##
## Random-Effects Model (k = 34; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0981 (SE = 0.0284)
## tau (square root of estimated tau^2 value):      0.3132
## I^2 (total heterogeneity / total variability):   98.54%
## H^2 (total variability / sampling variability):  68.54
##
## Test for Heterogeneity:
## Q(df = 33) = 606.5580, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb   ci.ub
##  -0.0101  0.0588  -0.1723  0.8632  -0.1254  0.1051
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```


Standard Error
0
0.1
0.201
0.301
0.402
−1
−0.5
0
0.5
1
fish Metabolism pH




```
##
## Random-Effects Model (k = 50; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.2894 (SE = 0.0622)
## tau (square root of estimated tau^2 value):      0.5380
## I^2 (total heterogeneity / total variability):   99.25%
## H^2 (total variability / sampling variability):  132.50
##
## Test for Heterogeneity:
## Q(df = 49) = 983.1153, p-val < .0001
##
## Model Results:
##
## estimate      se    zval    pval   ci.lb   ci.ub
##   0.2918  0.0786  3.7134  0.0002  0.1378  0.4458  ***
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

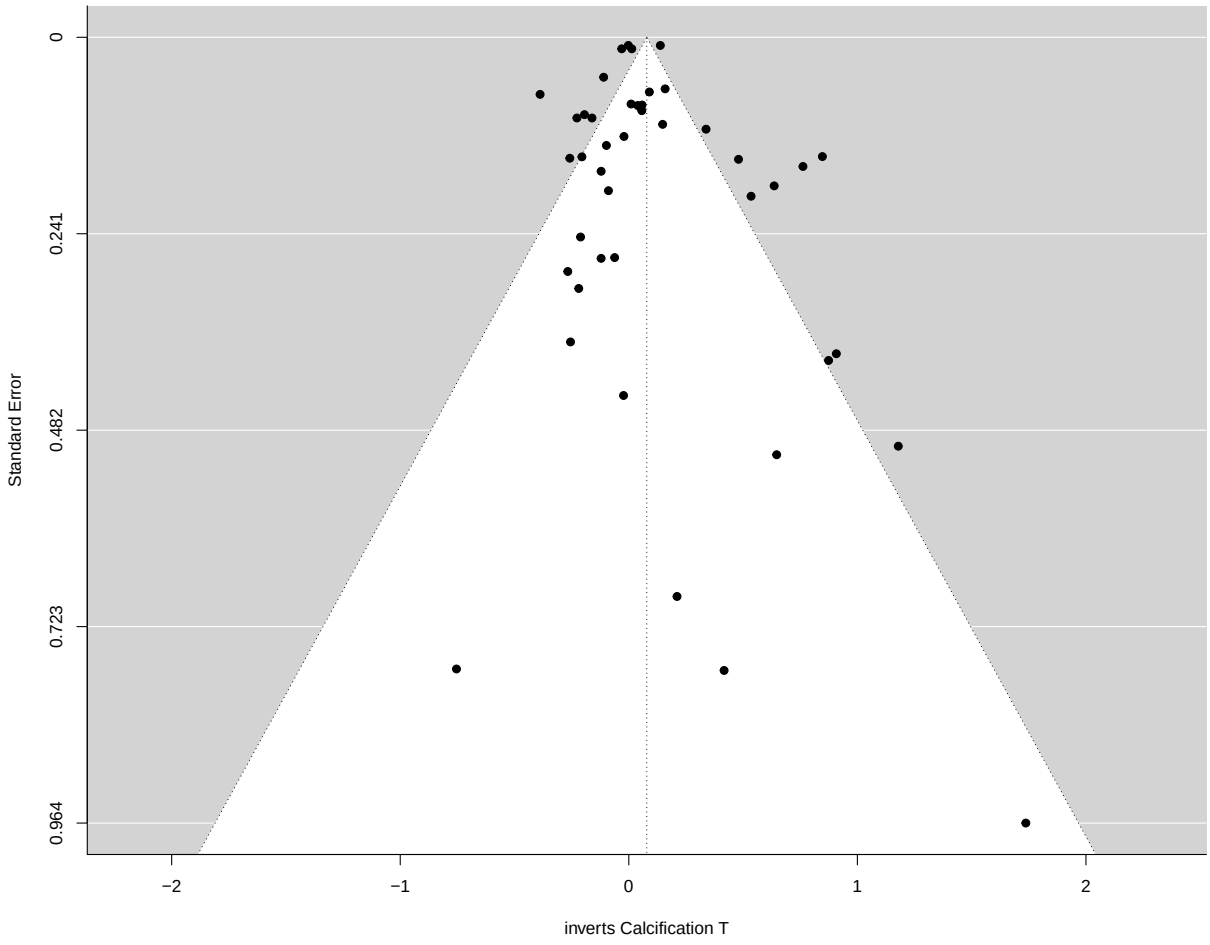

Standard Error
0
0.078
0.155
0.233
0.31
−1.5
−1
−0.5
0
0.5
1
1.5
2
fish Metabolism TpH

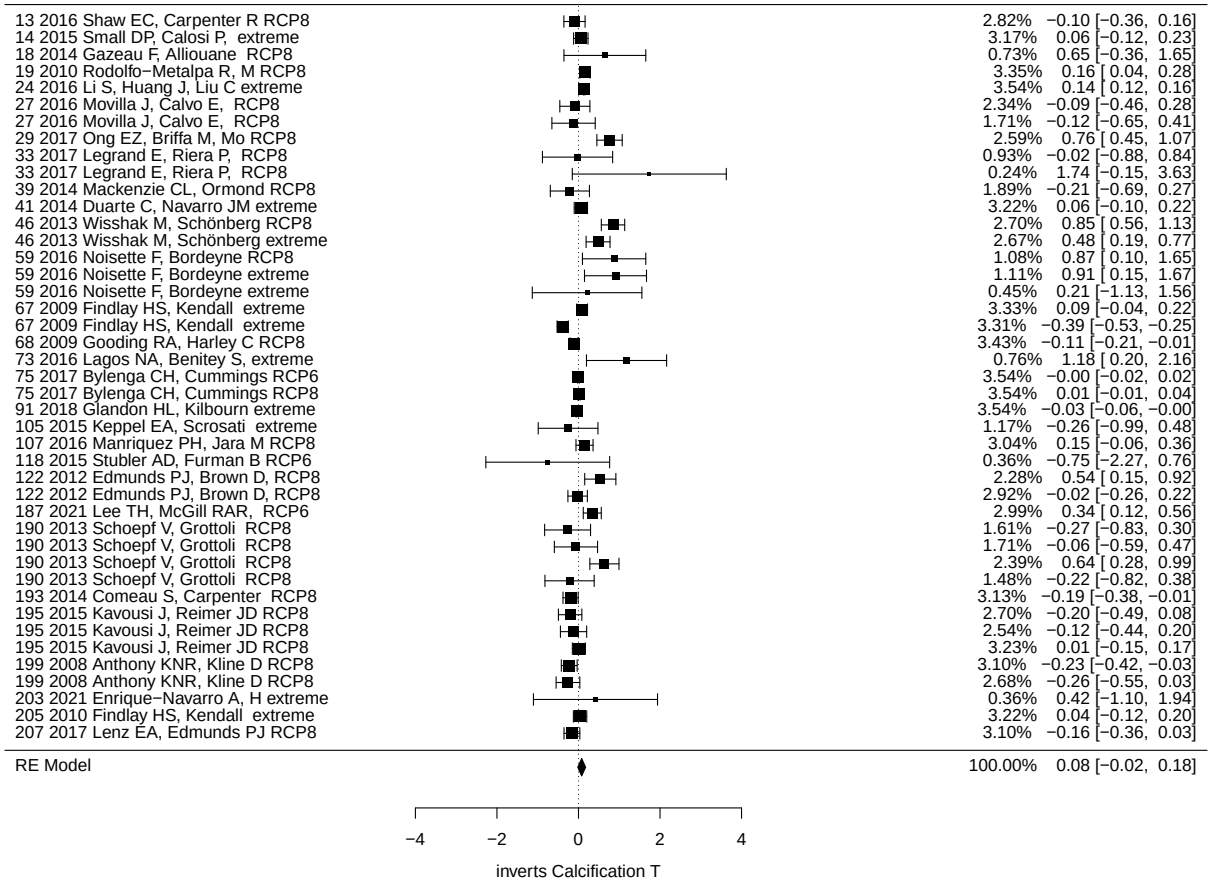



```
Abs_FishMet <- MA_TpH_abs("fish","Metabolism",FishMetabolism)

## Invertebrates, Calcification
InvertCalci <- MA_TpH("inverts","Calcification", Inverts,sensitivity)
```

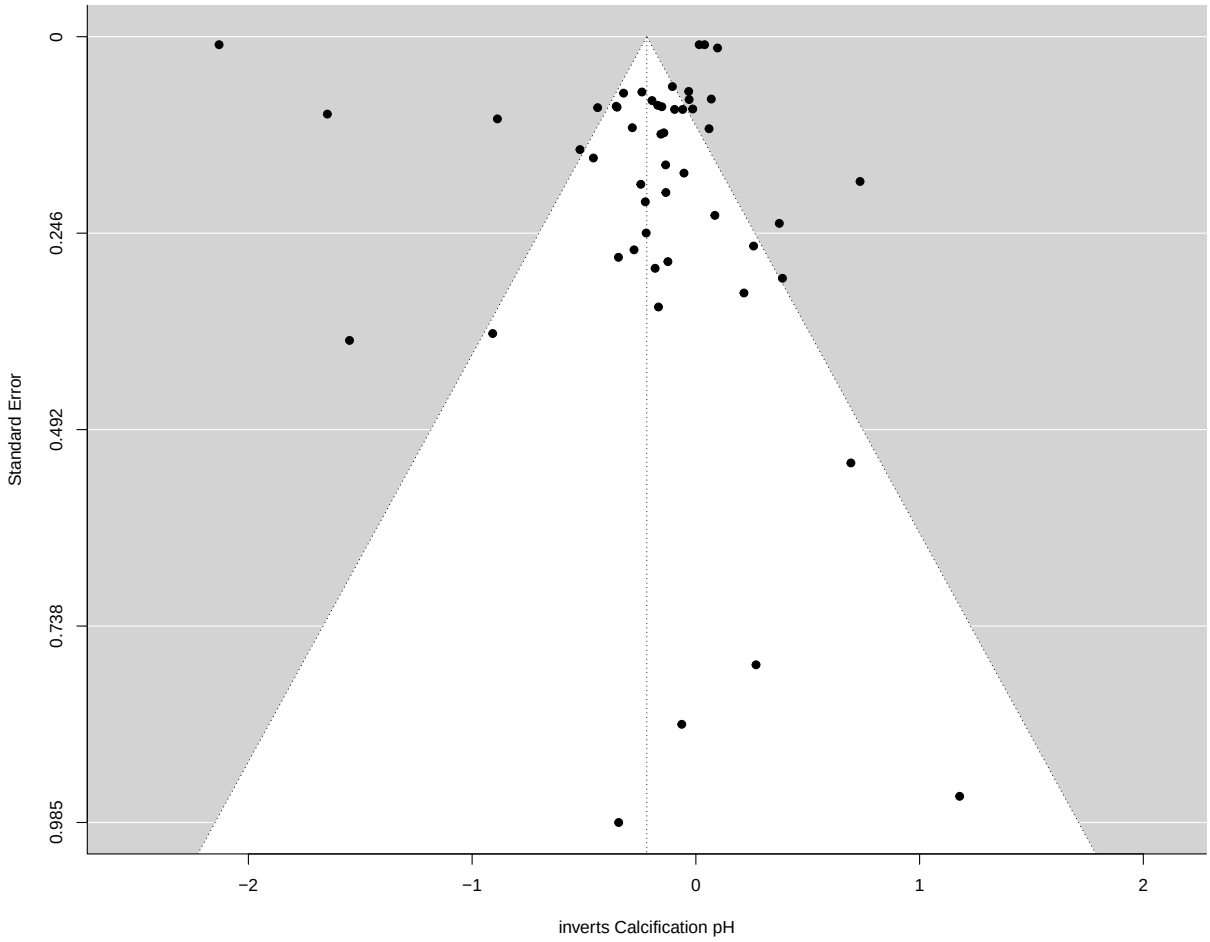
```
##
## Random-Effects Model (k = 43; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0683 (SE = 0.0209)
## tau (square root of estimated tau^2 value):      0.2614
## I^2 (total heterogeneity / total variability):   97.61%
## H^2 (total variability / sampling variability):  41.76
##
## Test for Heterogeneity:
## Q(df = 42) = 330.1670, p-val < .0001
##
## Model Results:
##
## estimate      se    zval    pval    ci.lb   ci.ub
##   0.0787  0.0492  1.5992  0.1098  -0.0178  0.1752
```

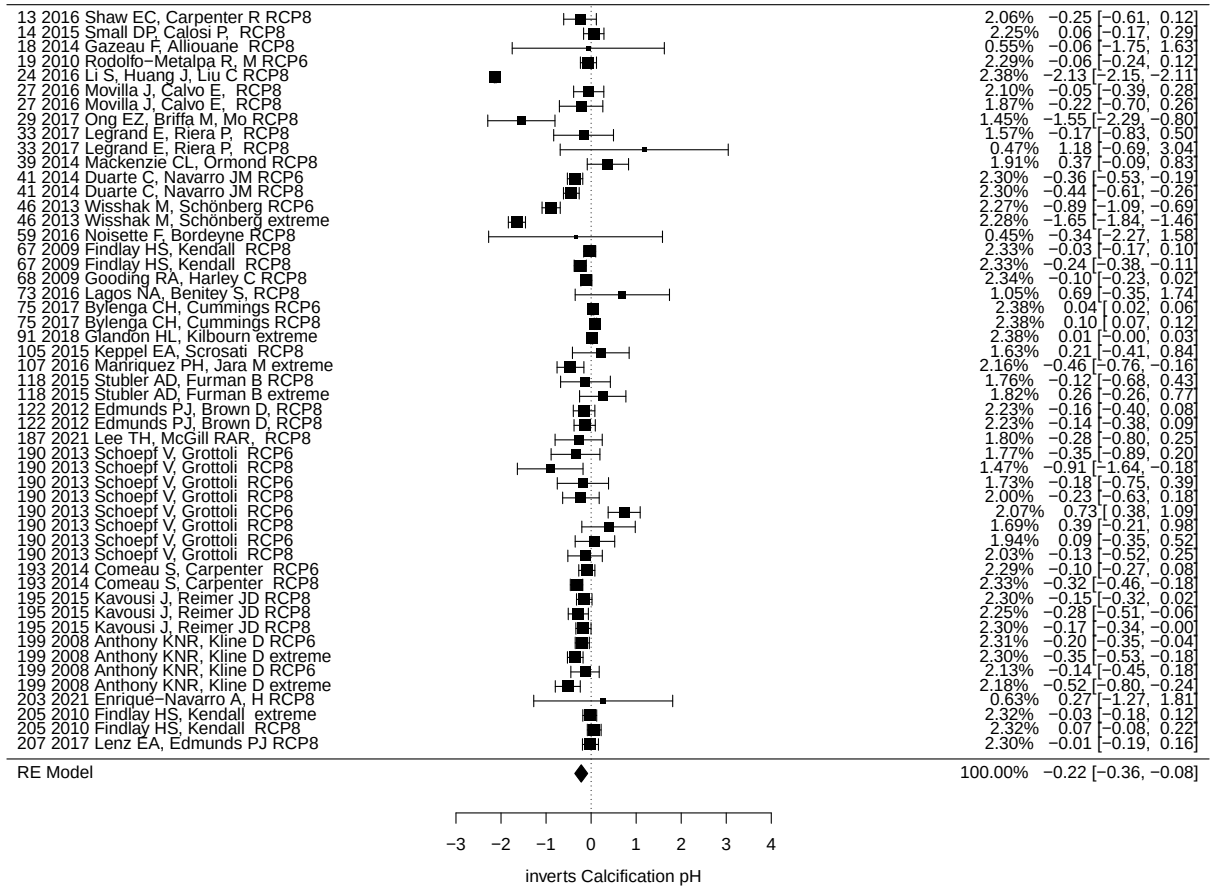
```
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



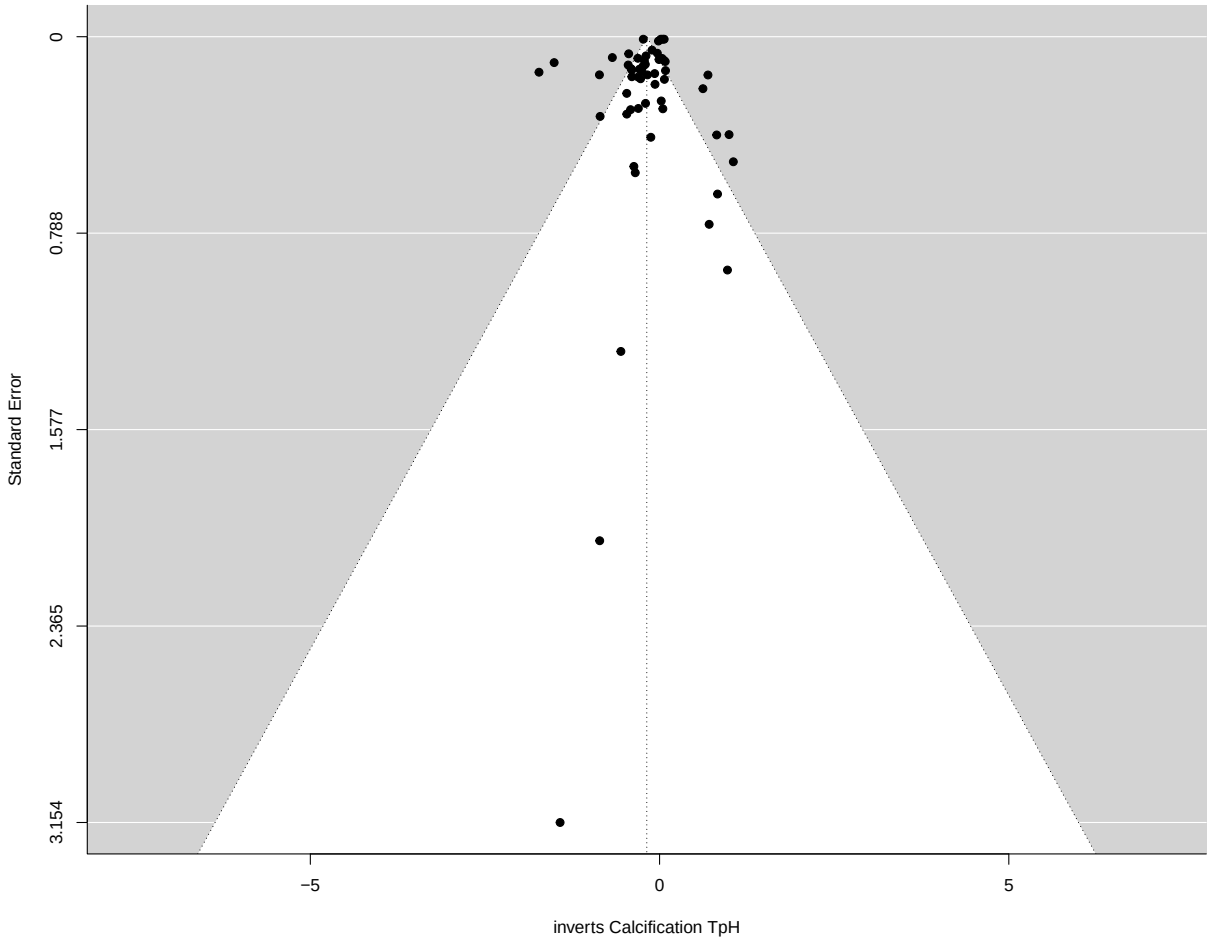


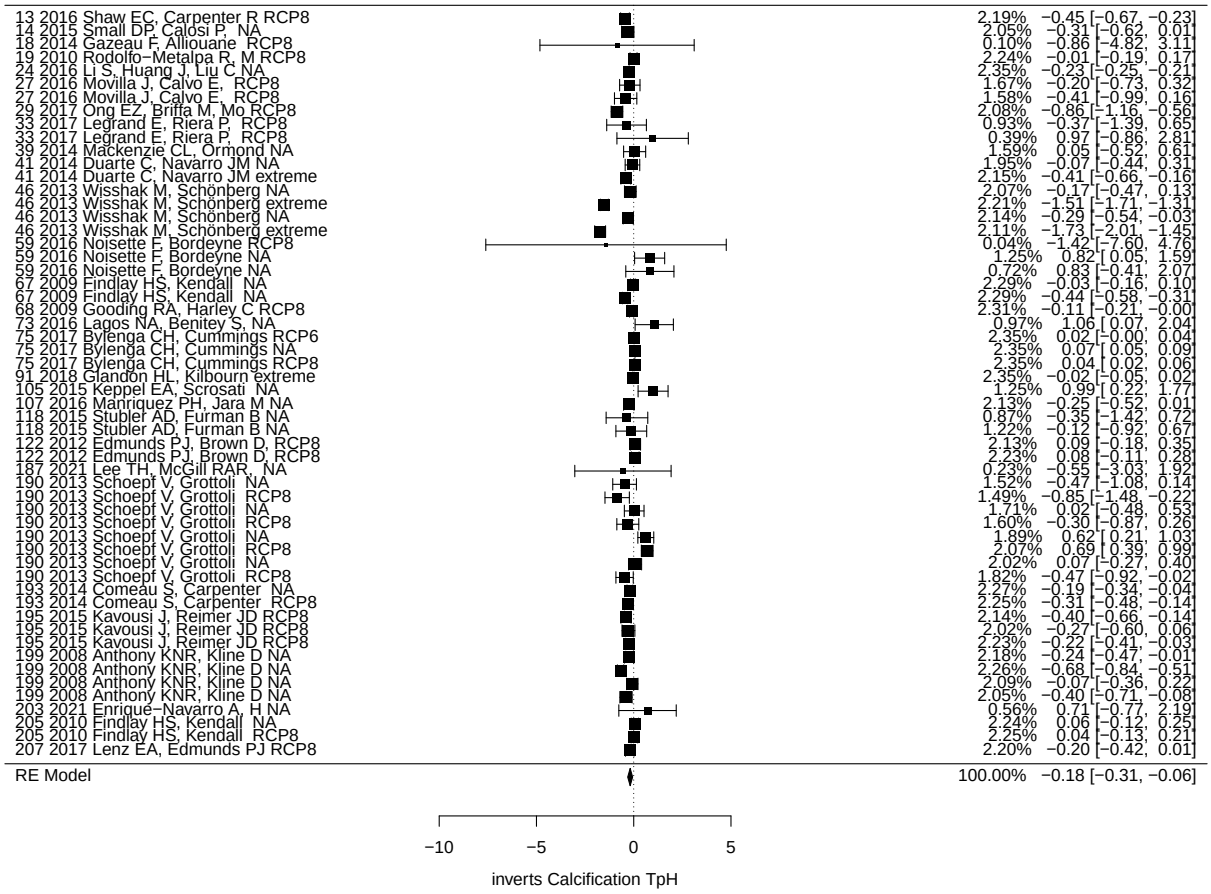

```
##
## Random-Effects Model (k = 51; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.2240 (SE = 0.0527)
## tau (square root of estimated tau^2 value):      0.4733
## I^2 (total heterogeneity / total variability):   99.26%
## H^2 (total variability / sampling variability):  134.60
##
## Test for Heterogeneity:
## Q(df = 50) = 34498.9208, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.2193  0.0730  -3.0036  0.0027  -0.3624  -0.0762  **
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```


Standard Error
0
0.246
0.492
0.738
0.985
−2
−1
0
1
2
inverts Calcification pH




```
##
## Random-Effects Model (k = 56; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.1765 (SE = 0.0418)
## tau (square root of estimated tau^2 value):      0.4201
## I^2 (total heterogeneity / total variability):   99.17%
## H^2 (total variability / sampling variability):  121.08
##
## Test for Heterogeneity:
## Q(df = 55) = 1194.6217, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.1829  0.0644  -2.8391  0.0045  -0.3091  -0.0566  **
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

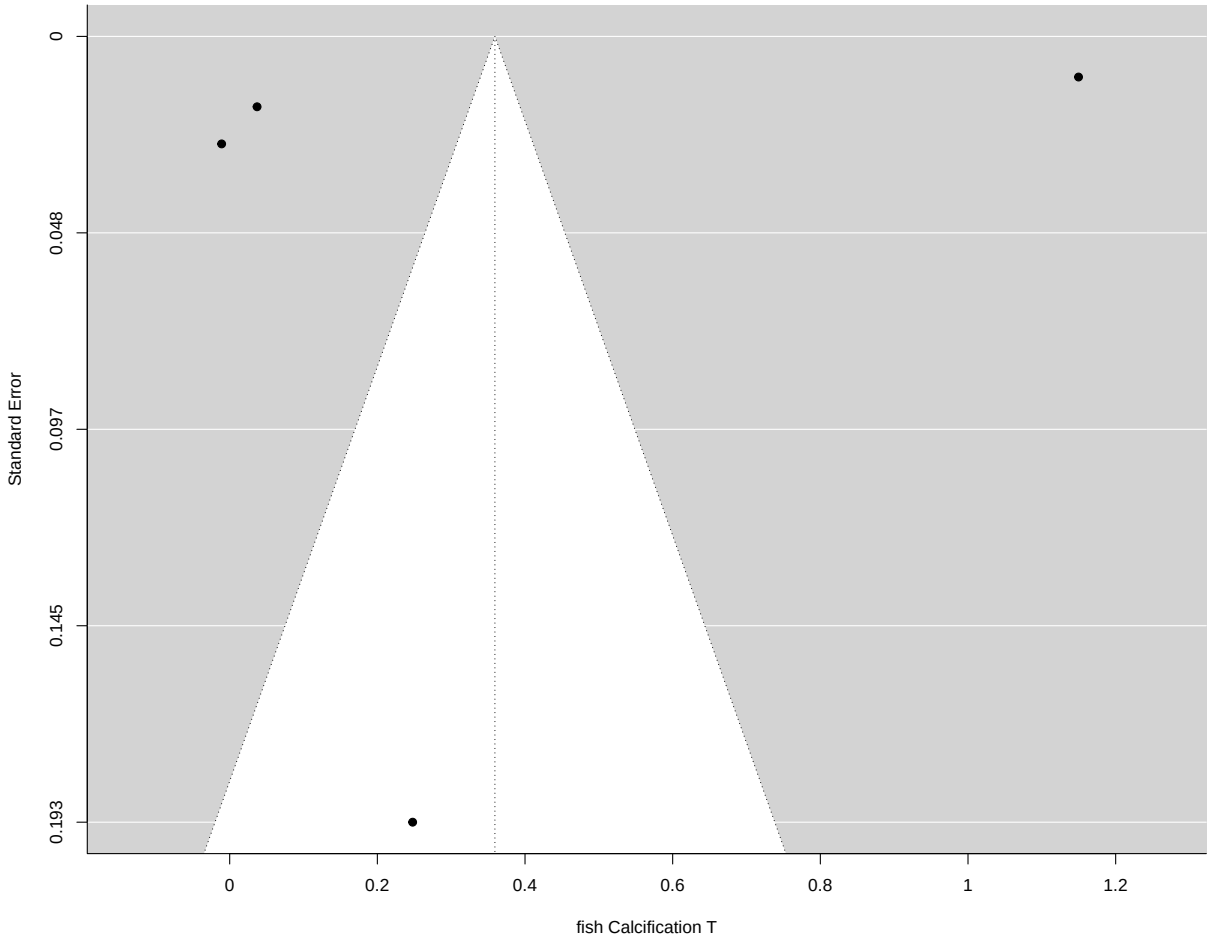

Standard Error
0
0.788
1.577
2.365
3.154
−5
0
5
inverts Calcification TpH

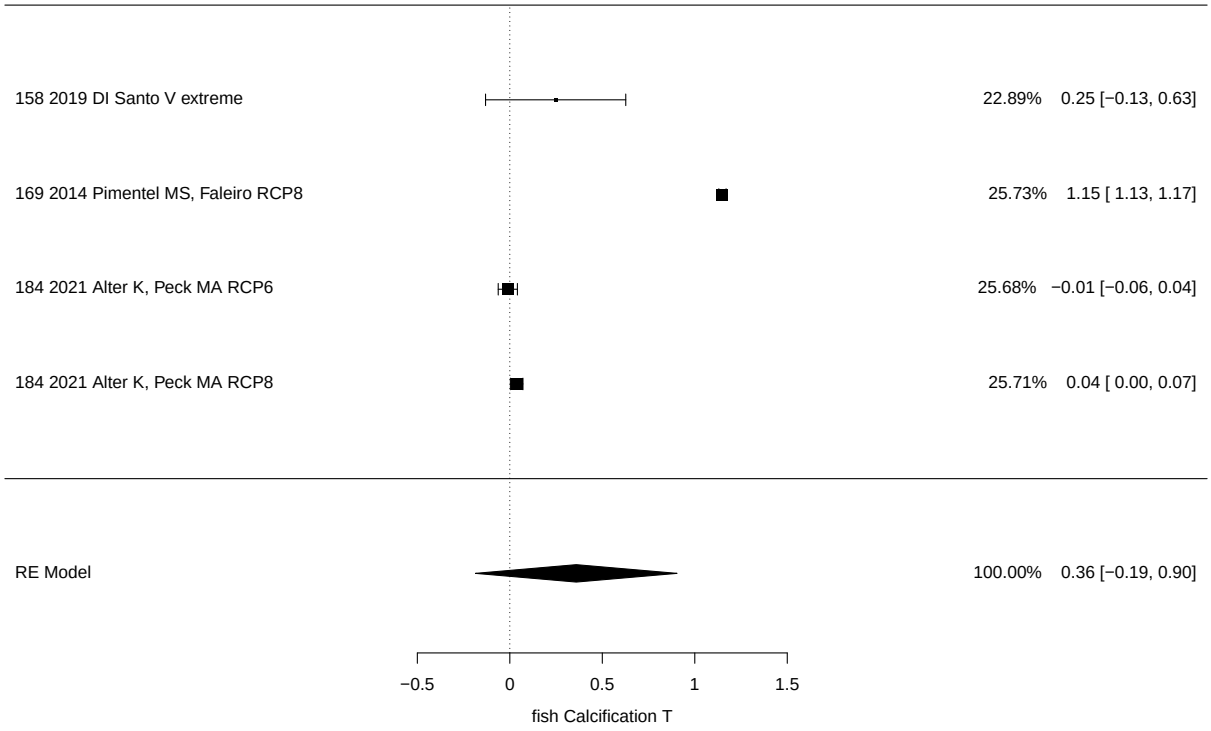



```
Abs_InvertCalci <- MA_TpH_abs("inverts","Calcification", Inverts)
## Fish, Calcification
FishCalci <- MA_TpH("fish","Calcification", Fish,sensitivity)
```

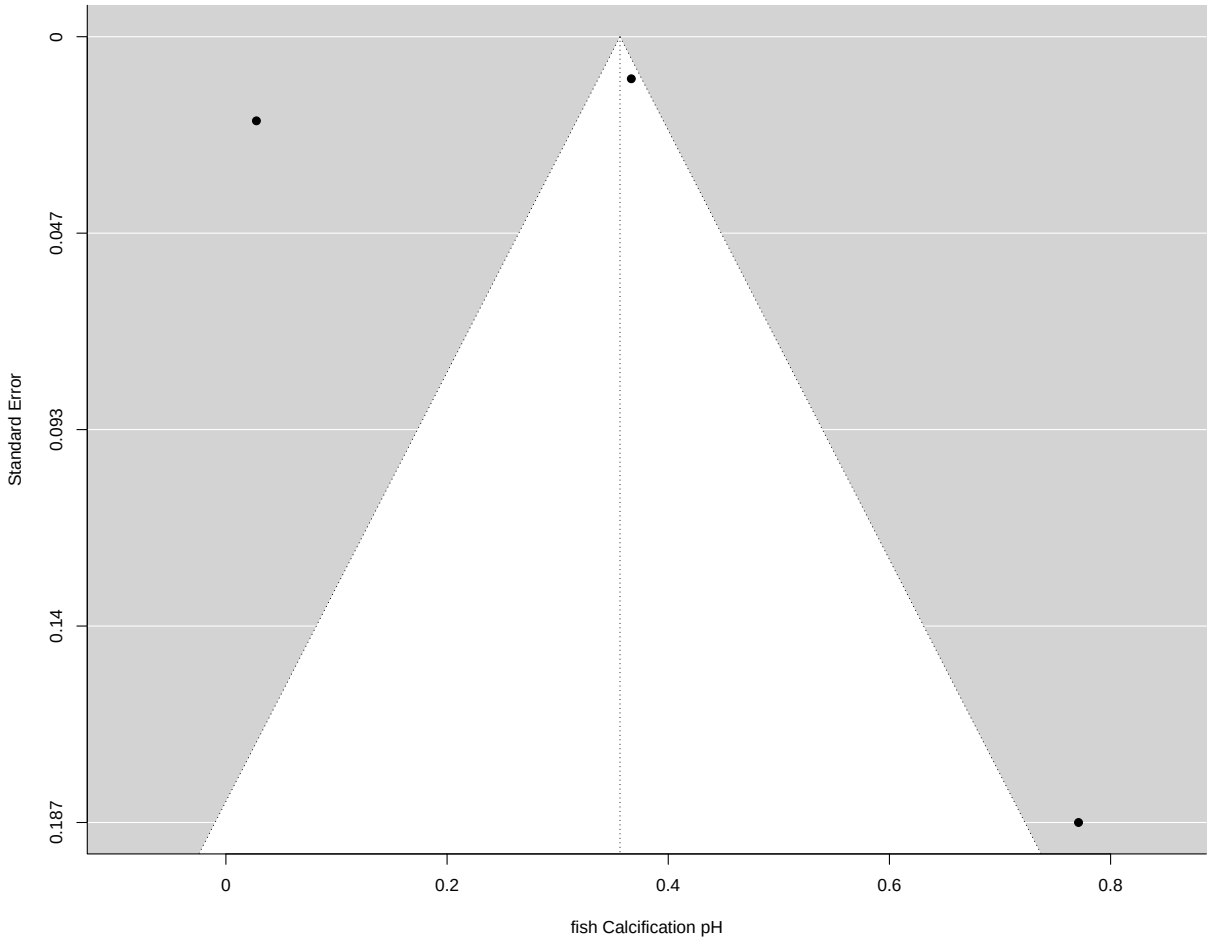
```
##
## Random-Effects Model (k = 4; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.3002 (SE = 0.2523)
## tau (square root of estimated tau^2 value):      0.5479
## I^2 (total heterogeneity / total variability):   99.86%
## H^2 (total variability / sampling variability):  715.23
##
## Test for Heterogeneity:
## Q(df = 3) = 4107.2296, p-val < .0001
##
## Model Results:
##
## estimate      se    zval    pval    ci.lb   ci.ub
##   0.3592  0.2780  1.2924  0.1962  -0.1856  0.9040
##
```

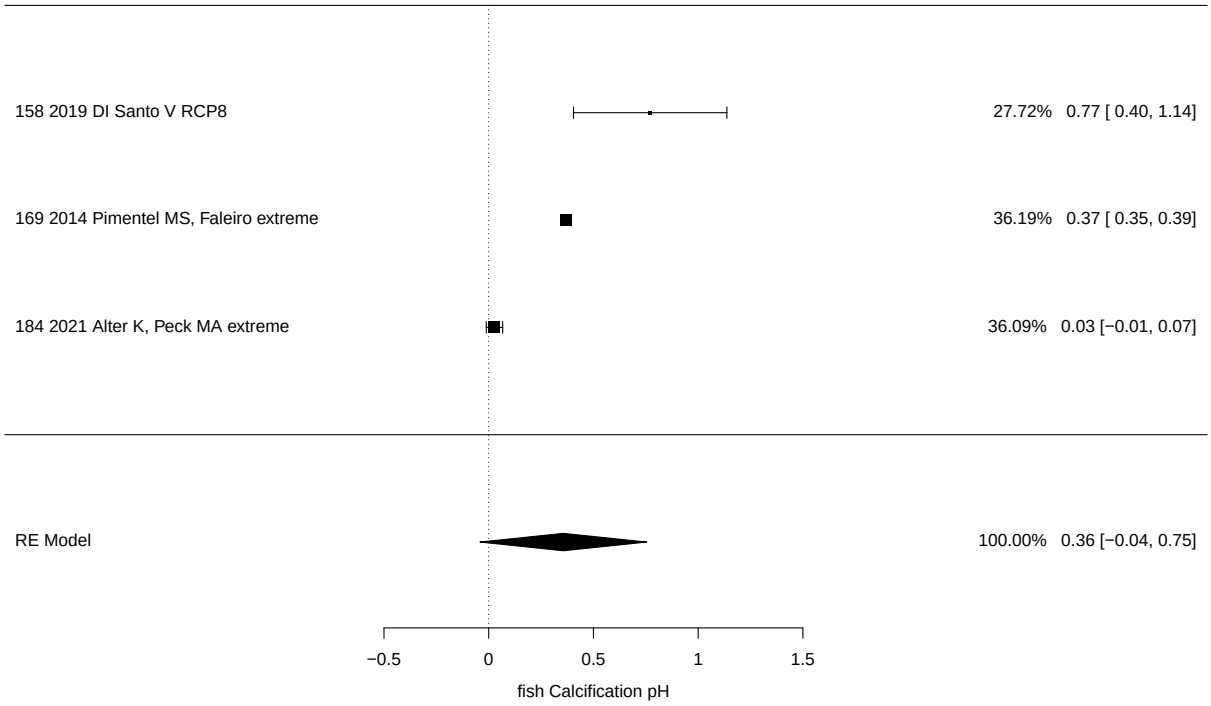
```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



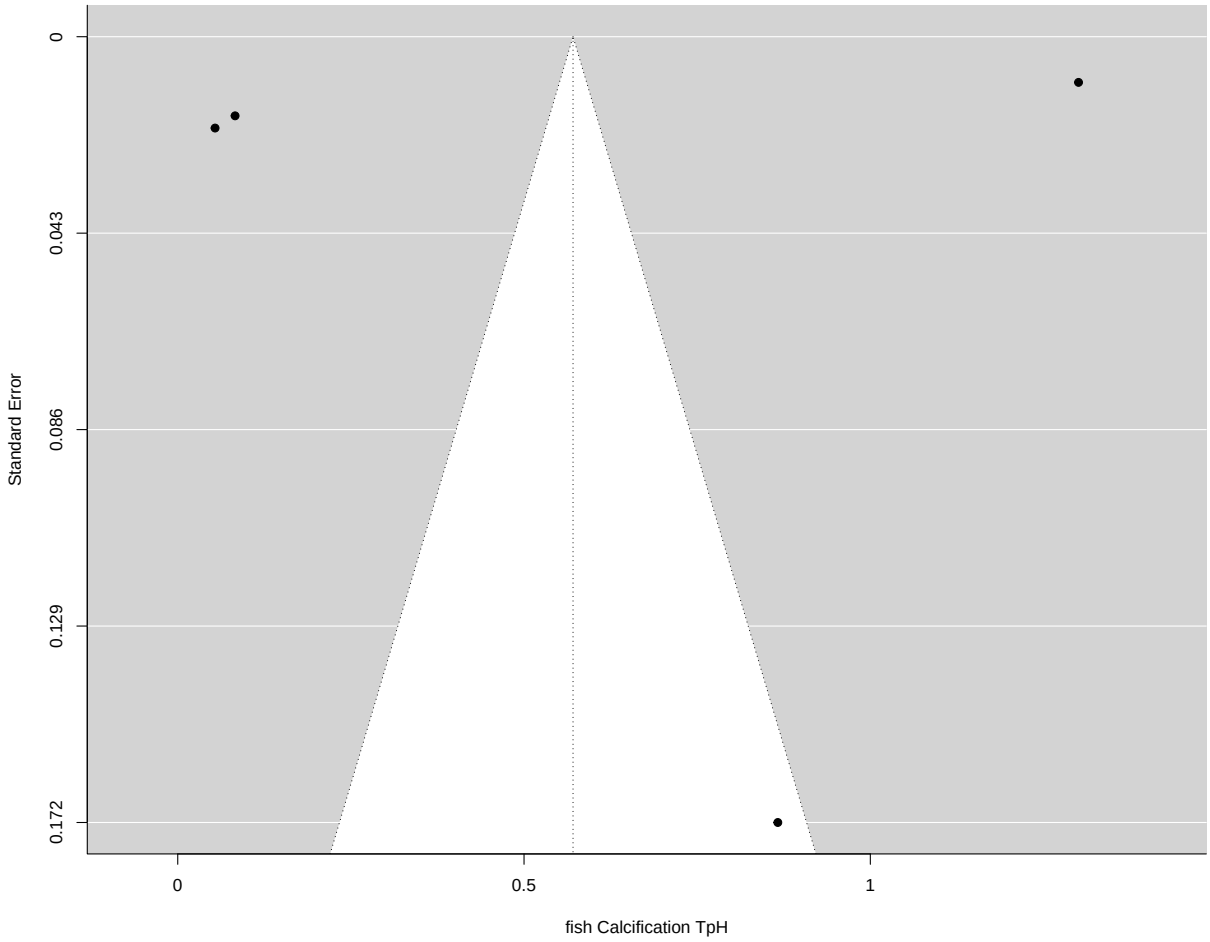


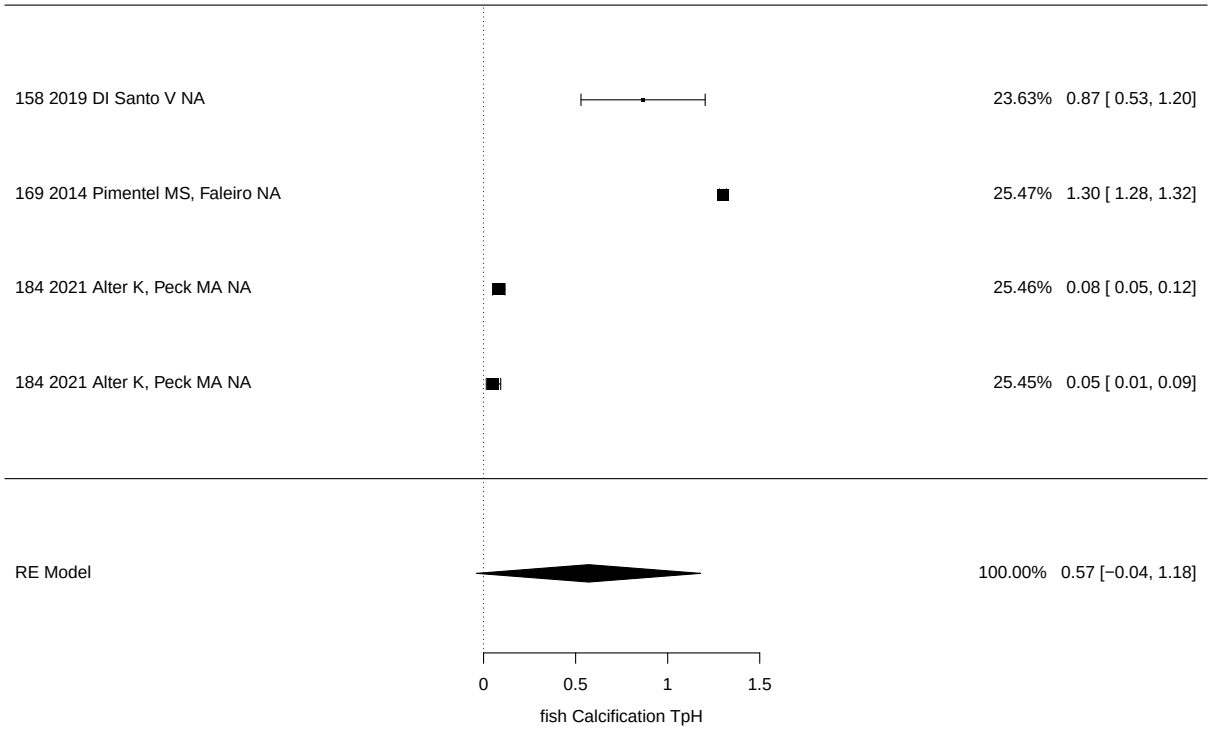

```
##
## Random-Effects Model (k = 3; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.1139 (SE = 0.1241)
## tau (square root of estimated tau^2 value):      0.3375
## I^2 (total heterogeneity / total variability):   99.57%
## H^2 (total variability / sampling variability):  231.53
##
## Test for Heterogeneity:
## Q(df = 2) = 236.2163, p-val < .0001
##
## Model Results:
##
## estimate      se    zval    pval    ci.lb   ci.ub
##   0.3564  0.2031  1.7546  0.0793  -0.0417  0.7544  .
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```


Standard Error
0
0.047
0.093
0.14
0.187
0
0.2
0.4
0.6
0.8
fish Calcification pH




```
##
## Random-Effects Model (k = 4; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.3778 (SE = 0.3143)
## tau (square root of estimated tau^2 value):      0.6147
## I^2 (total heterogeneity / total variability):   99.91%
## H^2 (total variability / sampling variability):  1067.74
##
## Test for Heterogeneity:
## Q(df = 3) = 5576.7308, p-val < .0001
##
## Model Results:
##
## estimate      se    zval    pval    ci.lb   ci.ub
##   0.5707  0.3102  1.8397  0.0658  -0.0373  1.1788  .
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

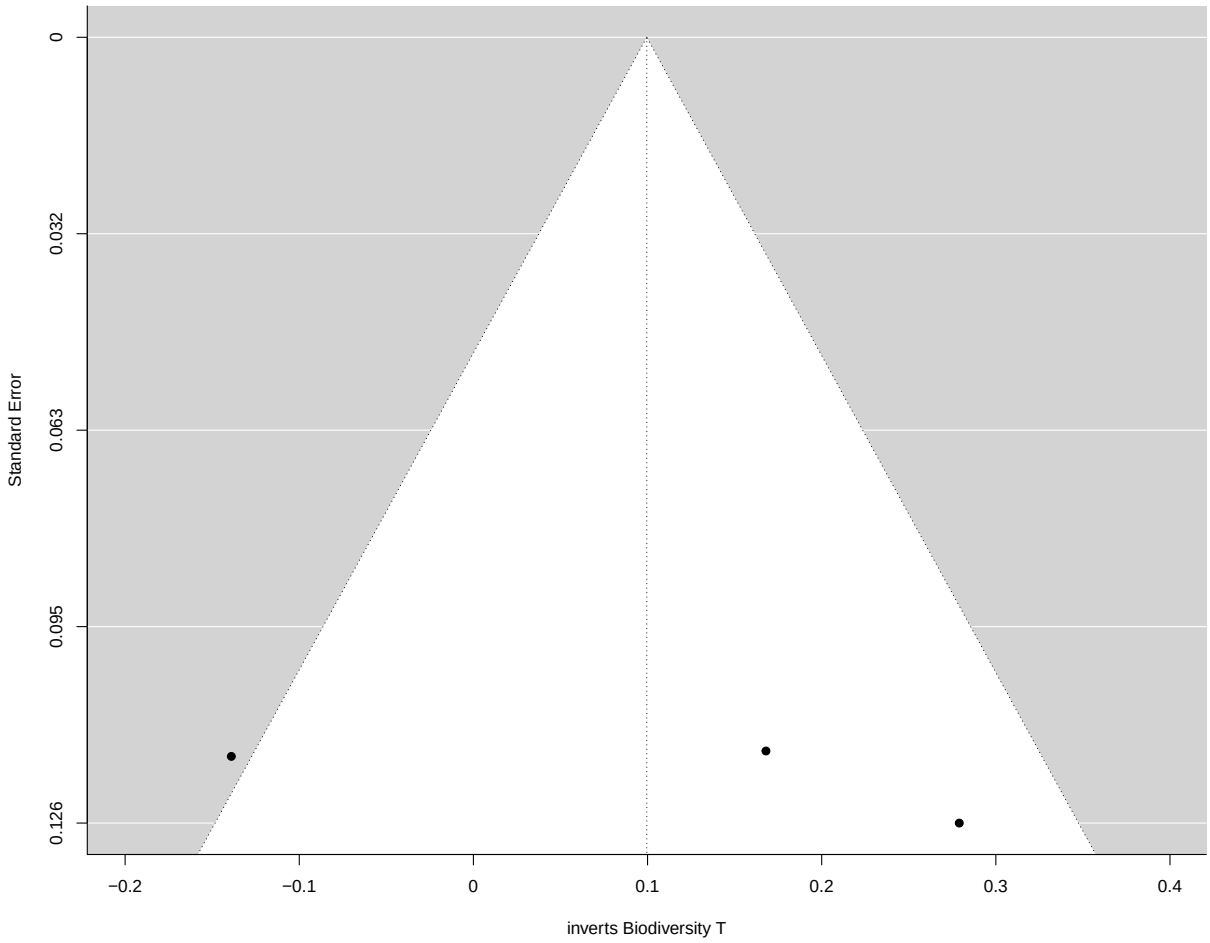

Standard Error
0
0.043
0.086
0.129
0.172
0
0.5
1
fish Calcification TpH

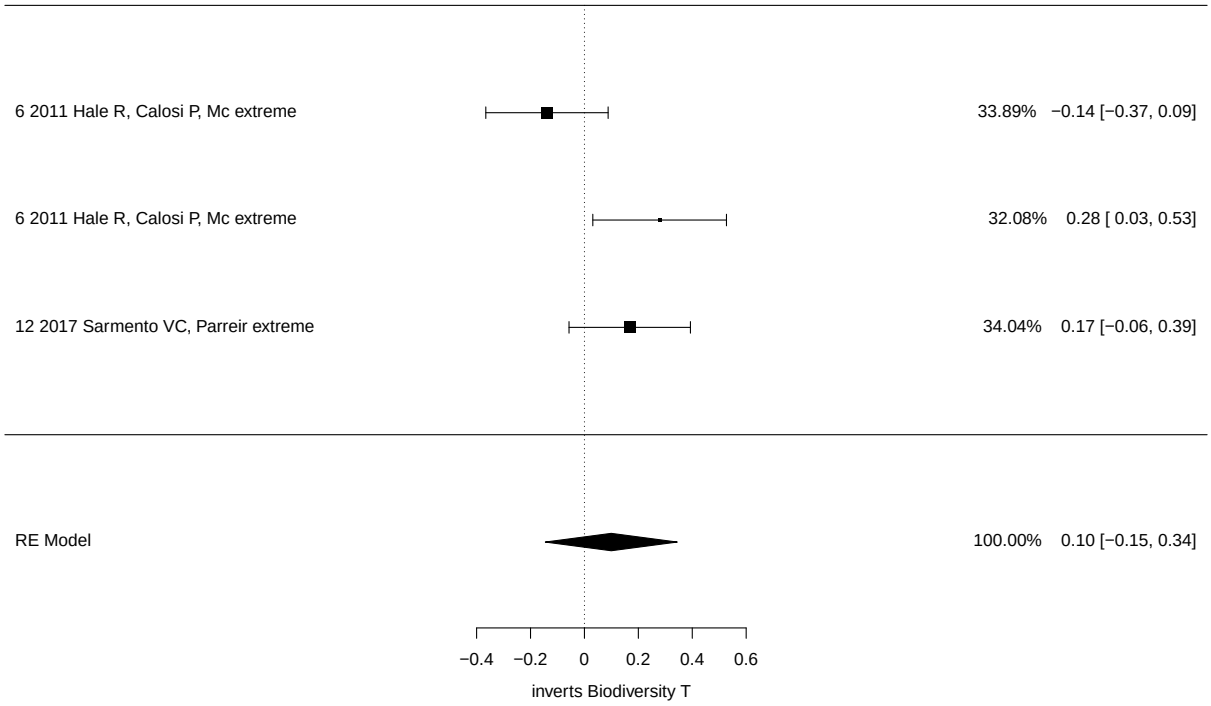



```
Abs_FishCalci <- MA_TpH_abs("fish","Calcification", Fish)

## Invertebrate, Biodiversity
InvertBiodiv <- MA_TpH("inverts","Biodiversity", Inverts,sensitivity)
```

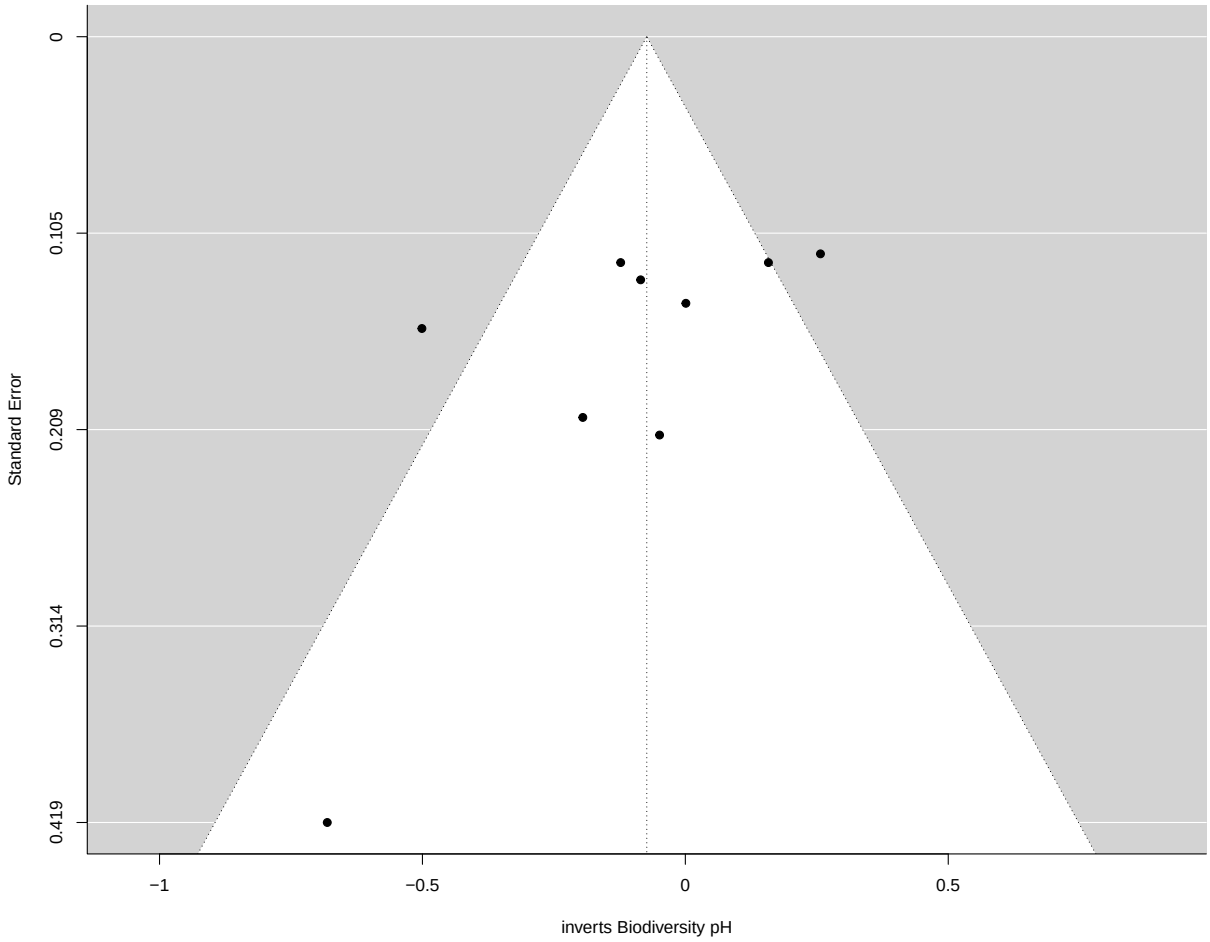
```
##
## Random-Effects Model (k = 3; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0326 (SE = 0.0468)
## tau (square root of estimated tau^2 value):      0.1806
## I^2 (total heterogeneity / total variability):   69.75%
## H^2 (total variability / sampling variability):  3.31
##
## Test for Heterogeneity:
## Q(df = 2) = 6.6051, p-val = 0.0368
##
## Model Results:
##
## estimate      se    zval    pval    ci.lb   ci.ub
##   0.0996  0.1249  0.7974  0.4252  -0.1452  0.3443
```

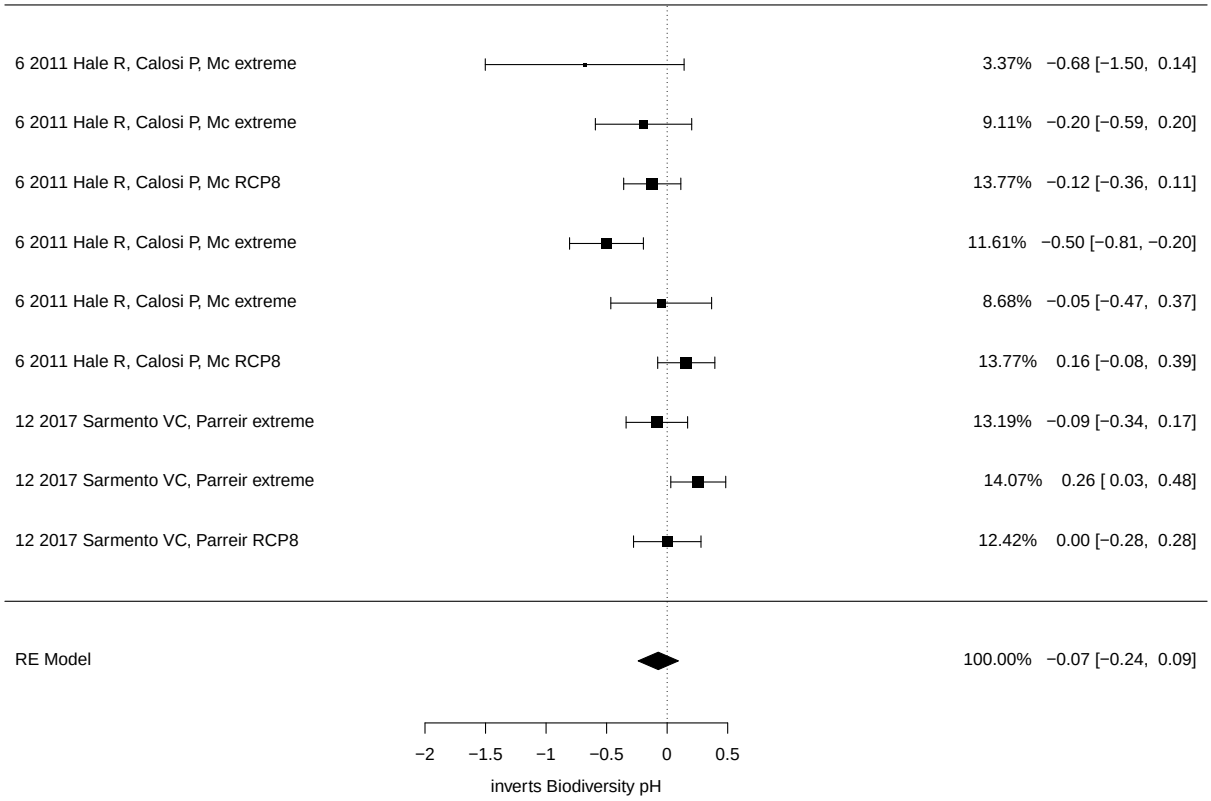
```
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



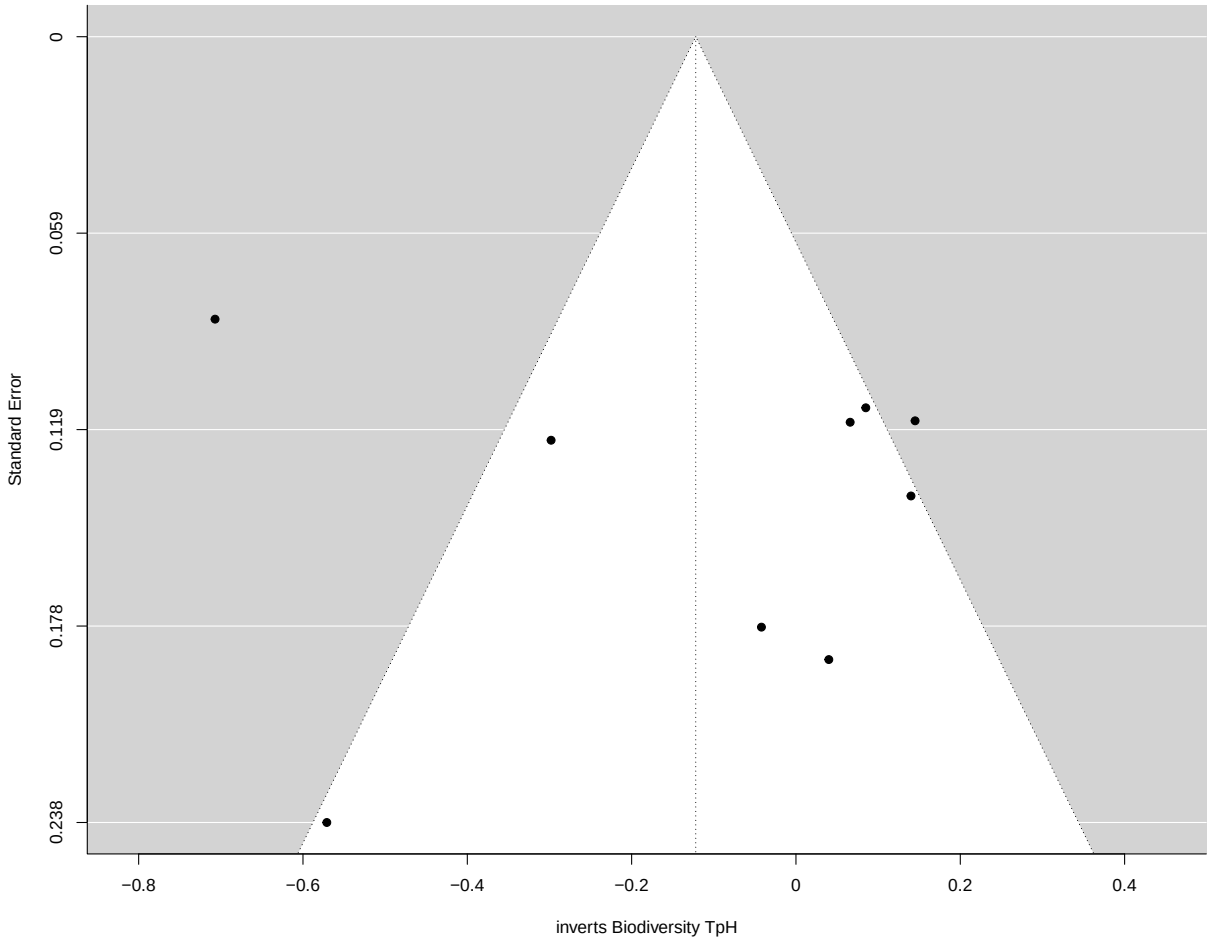


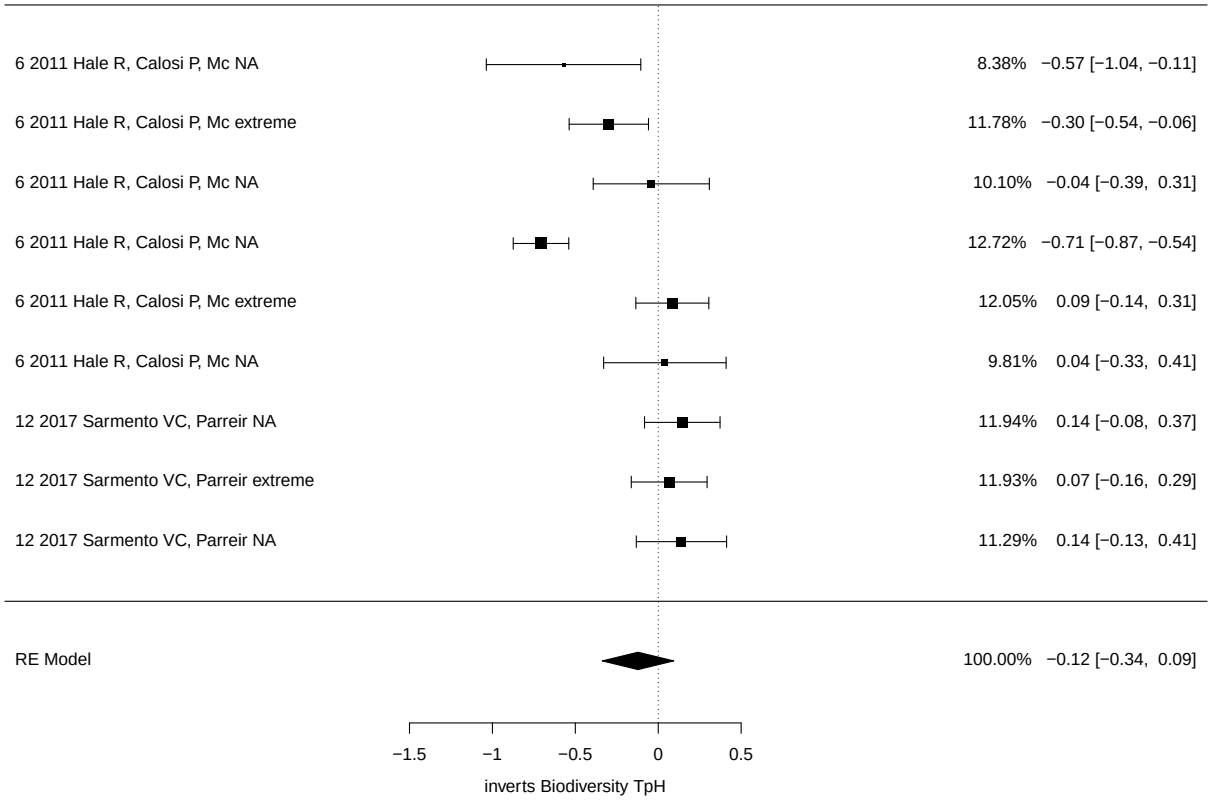

```
##
## Random-Effects Model (k = 9; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0377 (SE = 0.0314)
## tau (square root of estimated tau^2 value):      0.1943
## I^2 (total heterogeneity / total variability):   62.77%
## H^2 (total variability / sampling variability):  2.69
##
## Test for Heterogeneity:
## Q(df = 8) = 21.6547, p-val = 0.0056
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb   ci.ub
##  -0.0733  0.0848  -0.8643  0.3874  -0.2395  0.0929
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```


Standard Error
0
0.105
0.209
0.314
0.419
−1
−0.5
0
0.5
inverts Biodiversity pH




```
##
## Random-Effects Model (k = 9; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0876 (SE = 0.0541)
## tau (square root of estimated tau^2 value):      0.2961
## I^2 (total heterogeneity / total variability):   84.00%
## H^2 (total variability / sampling variability):  6.25
##
## Test for Heterogeneity:
## Q(df = 8) = 66.7796, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb   ci.ub
##  -0.1220  0.1099  -1.1097  0.2671  -0.3374  0.0934
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

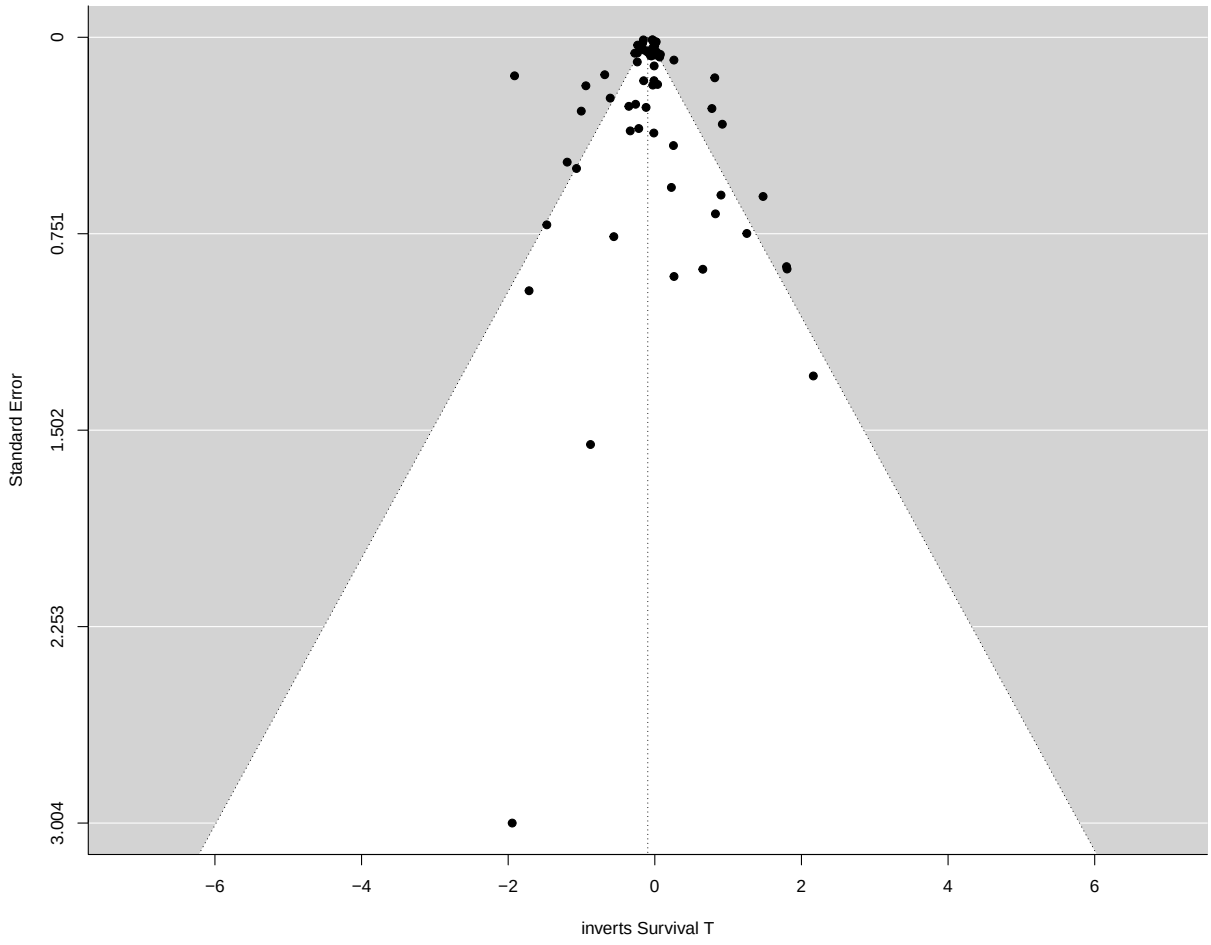

Standard Error
0
0.059
0.119
0.178
0.238
−0.8
−0.6
−0.4
−0.2
0
0.2
0.4
inverts Biodiversity TpH



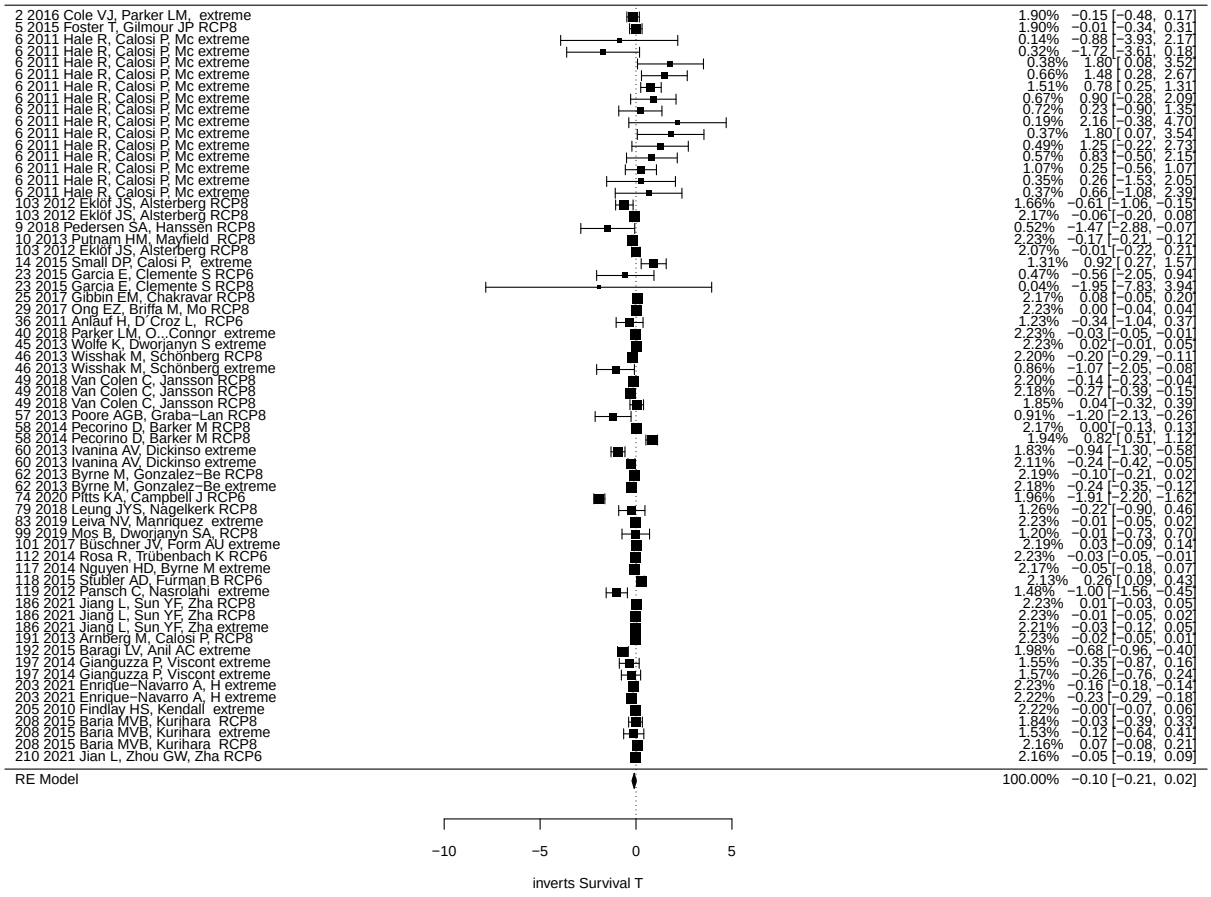

```
Abs_InvertBiodiv <- MA_TpH_abs("inverts","Biodiversity", Inverts)

## Invertebrate, Survival
InvertSurvi <- MA_TpH("inverts","Survival", Inverts,sensitivity)
```

```
##
## Random-Effects Model (k = 64; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.1563 (SE = 0.0362)
## tau (square root of estimated tau^2 value):      0.3954
## I^2 (total heterogeneity / total variability):   99.22%
## H^2 (total variability / sampling variability):  128.45
##
## Test for Heterogeneity:
## Q(df = 63) = 605.9582, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb   ci.ub
##  -0.0956  0.0591  -1.6185  0.1056  -0.2115  0.0202
```

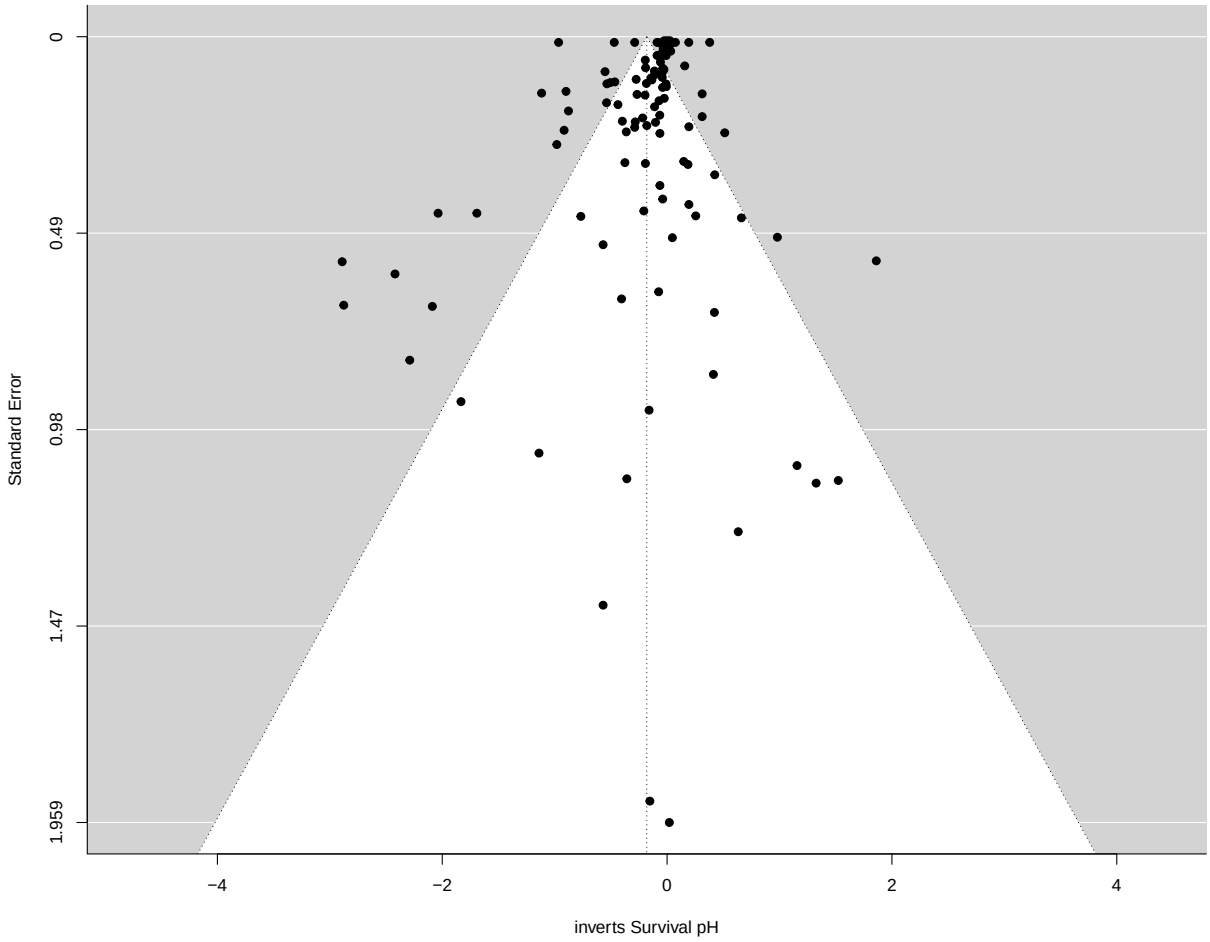
```
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



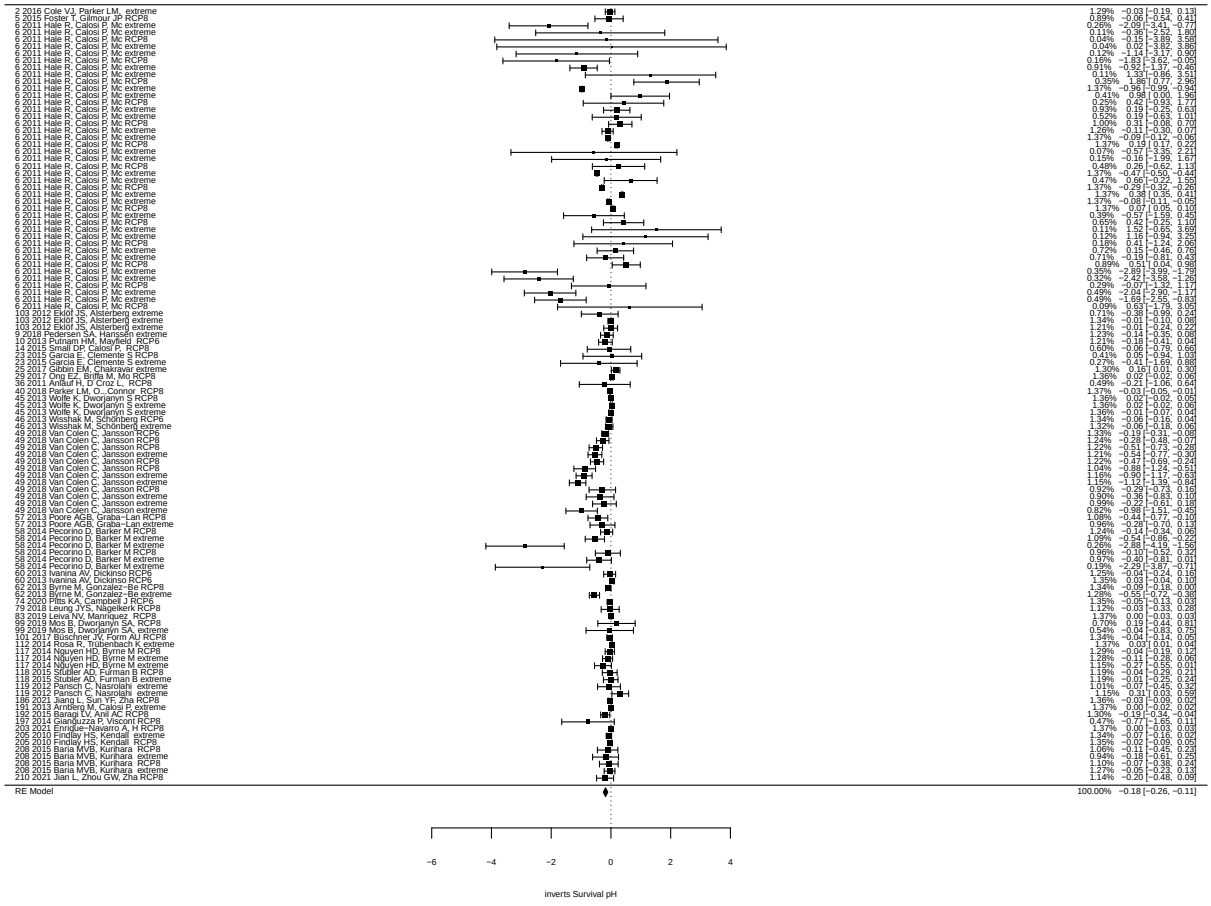

```
## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <99>
```



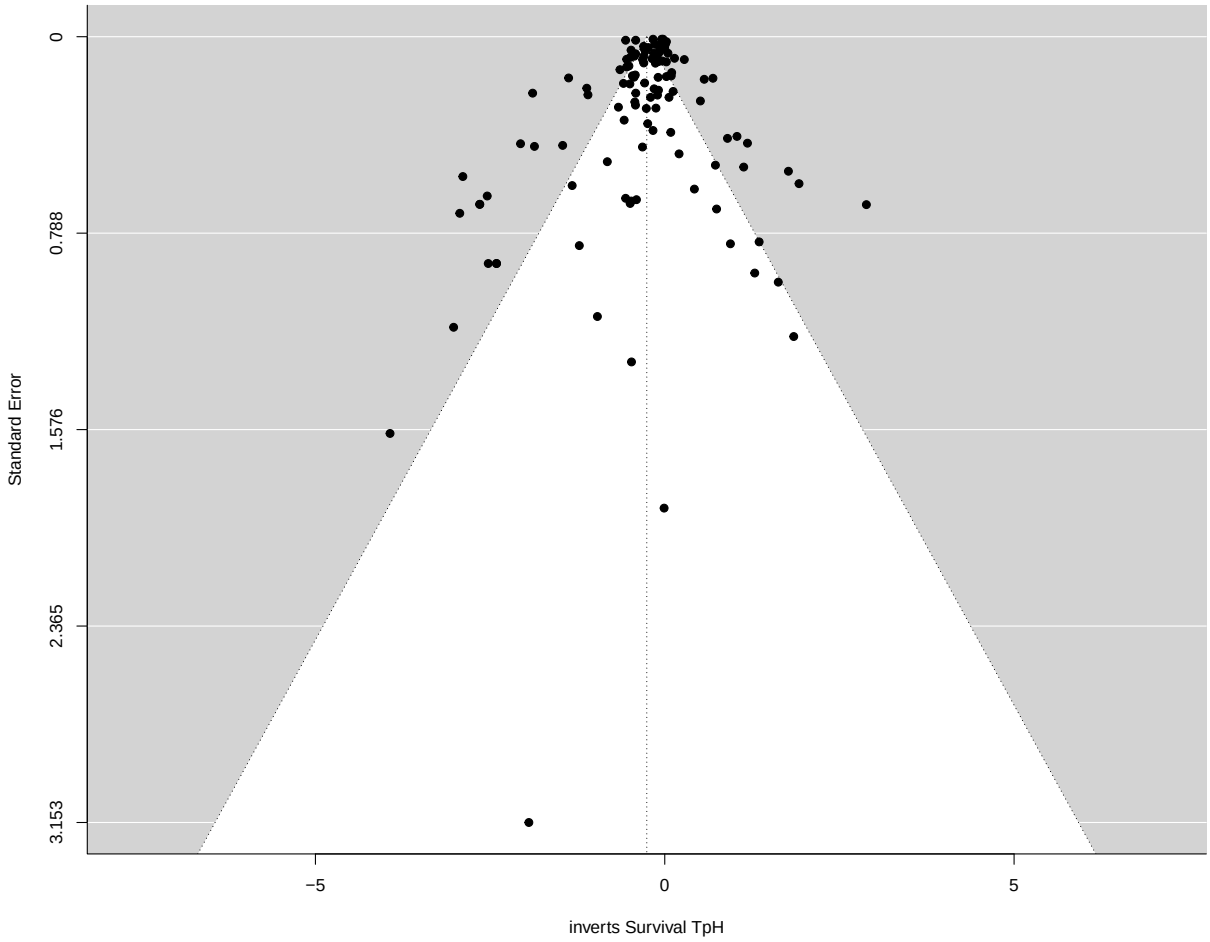

```
##
## Random-Effects Model (k = 110; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.1066 (SE = 0.0195)
## tau (square root of estimated tau^2 value):      0.3265
## I^2 (total heterogeneity / total variability):   98.91%
## H^2 (total variability / sampling variability):  91.50
##
## Test for Heterogeneity:
## Q(df = 109) = 7212.3271, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.1805  0.0382  -4.7256  <.0001  -0.2553  -0.1056  ***
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



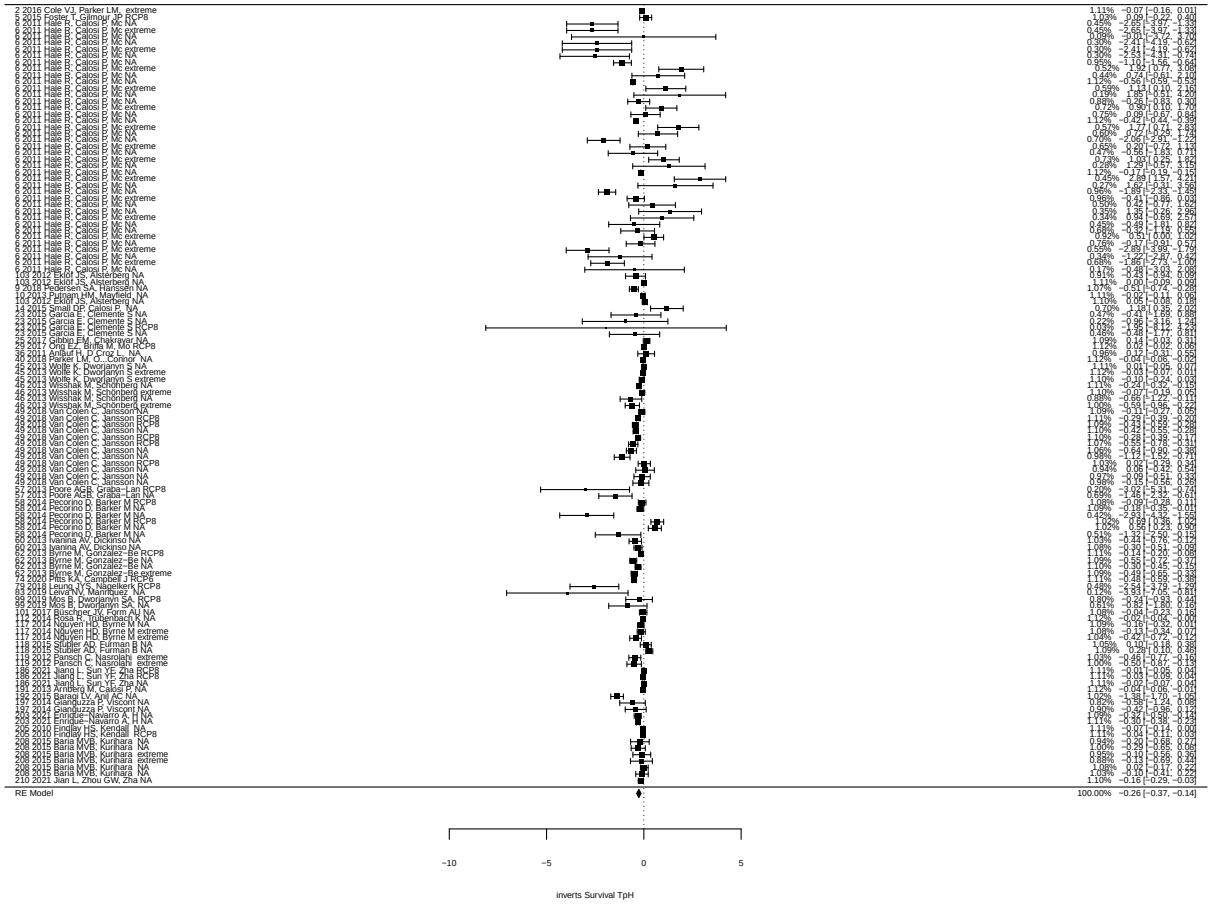

```
## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <99>
```




```
##
## Random-Effects Model (k = 120; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.3052 (SE = 0.0497)
## tau (square root of estimated tau^2 value):      0.5524
## I^2 (total heterogeneity / total variability):   99.35%
## H^2 (total variability / sampling variability):  154.36
##
## Test for Heterogeneity:
## Q(df = 119) = 2513.0332, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.2570  0.0584  -4.4023  <.0001  -0.3714  -0.1426  ***
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



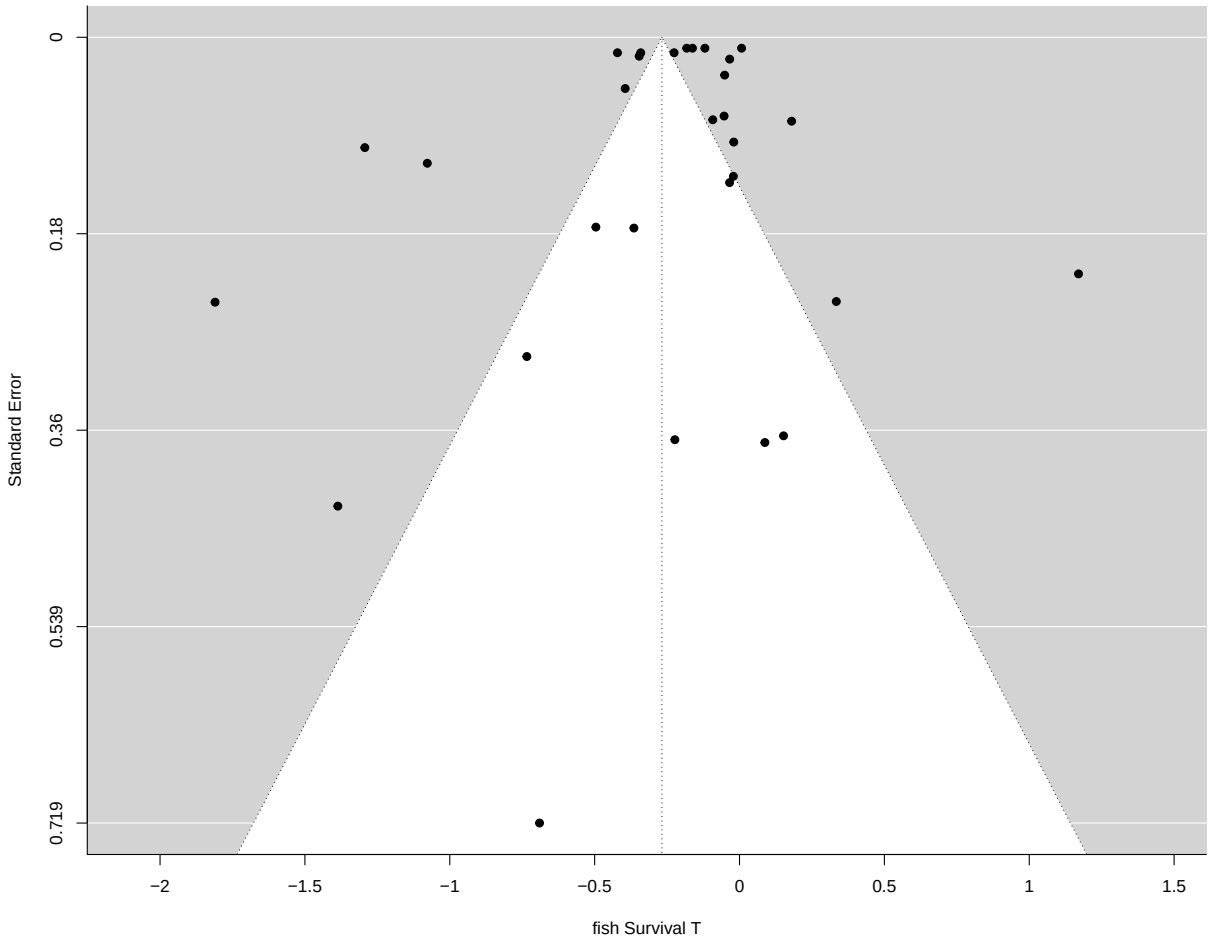

```
## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <99>
```

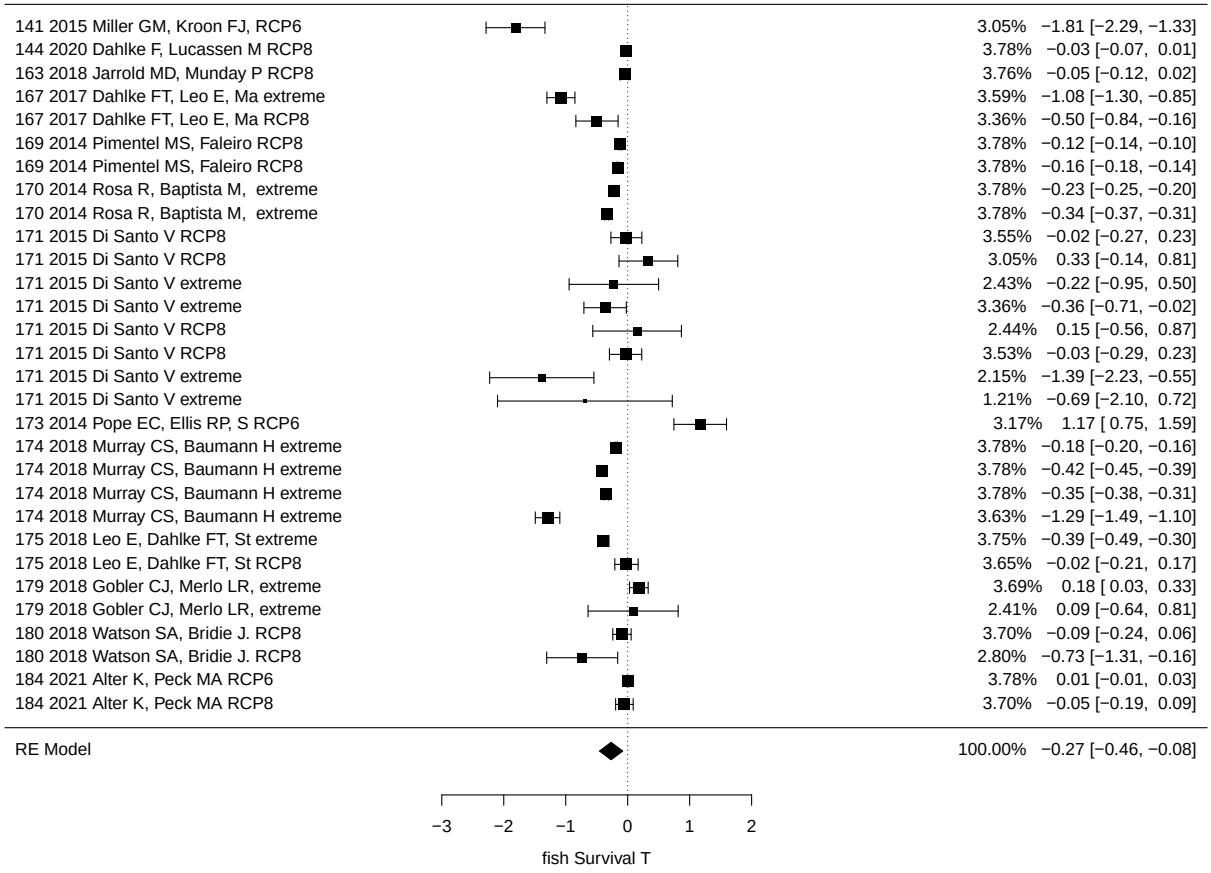



```
Abs_InvertSurvi <- MA_TpH_abs("inverts","Survival", Inverts)

## Fish, Survival
FishSurvi <- MA_TpH("fish","Survival", Fish,sensitivity)
```

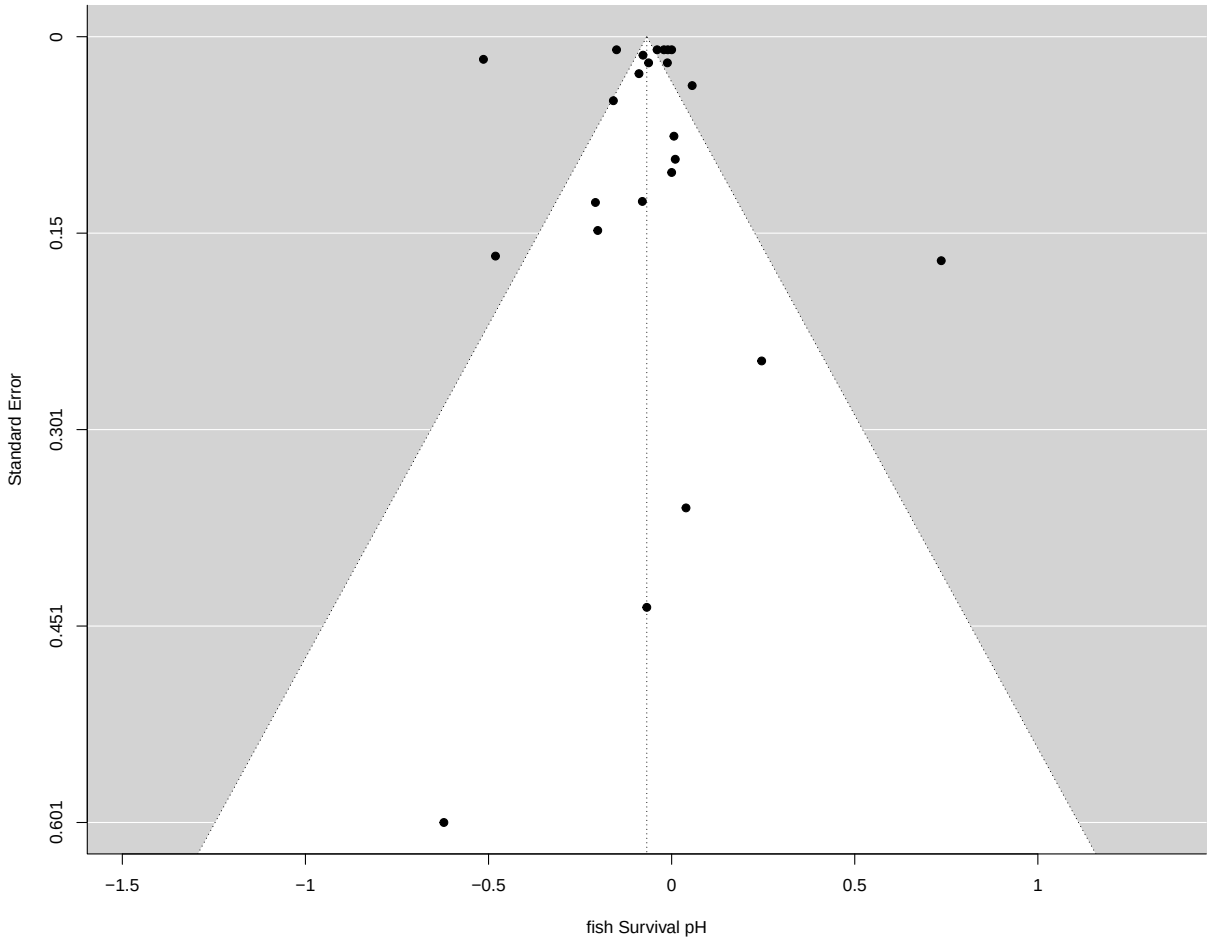
```
##
## Random-Effects Model (k = 30; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.2427 (SE = 0.0712)
## tau (square root of estimated tau^2 value):      0.4927
## I^2 (total heterogeneity / total variability):   99.78%
## H^2 (total variability / sampling variability):  464.80
##
## Test for Heterogeneity:
## Q(df = 29) = 1320.9327, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.2678  0.0958  -2.7945  0.0052  -0.4556  -0.0800  **
```

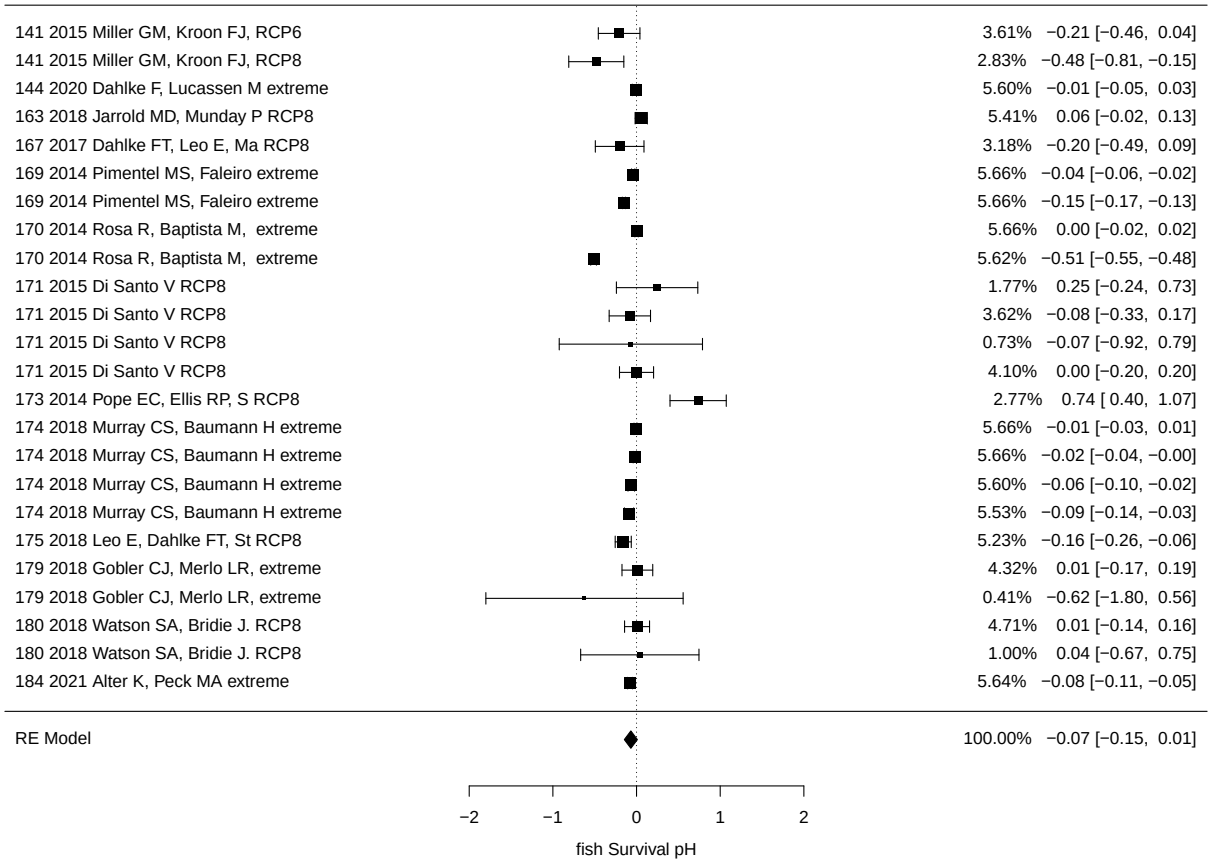
```
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



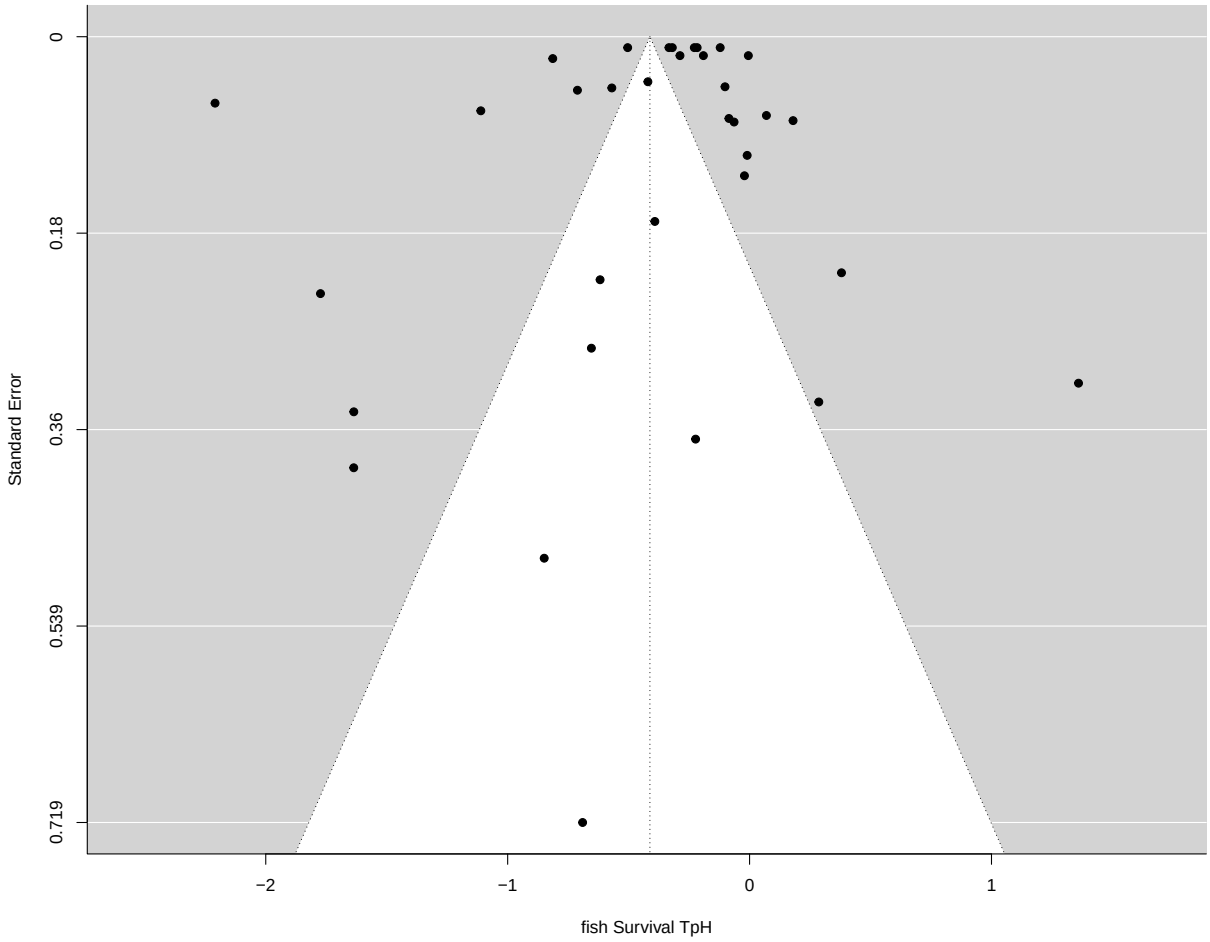


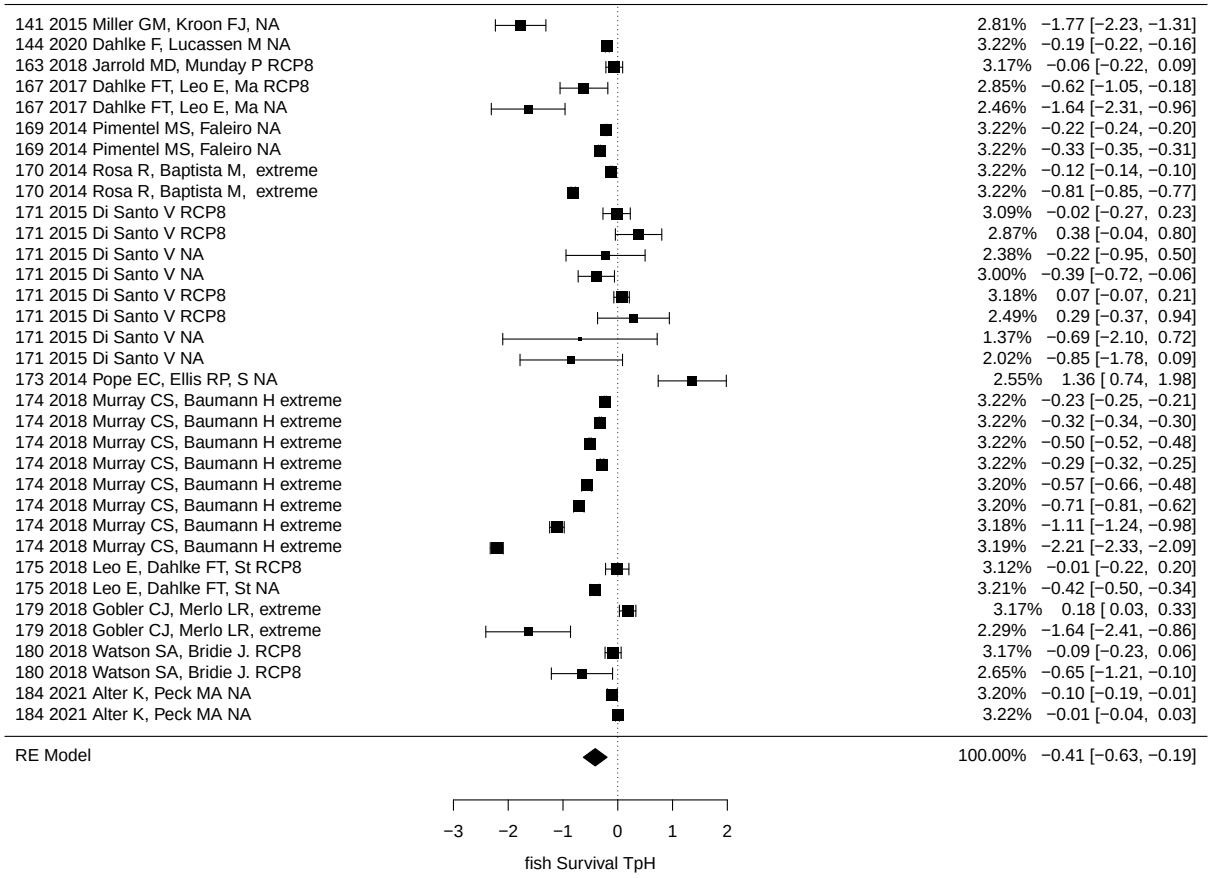

```
##
## Random-Effects Model (k = 24; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0279 (SE = 0.0104)
## tau (square root of estimated tau^2 value):      0.1671
## I^2 (total heterogeneity / total variability):   98.60%
## H^2 (total variability / sampling variability):  71.51
##
## Test for Heterogeneity:
## Q(df = 23) = 897.8871, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb   ci.ub
##  -0.0678  0.0398  -1.7028  0.0886  -0.1459  0.0102  .
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```


Standard Error
0
0.15
0.301
0.451
0.601
−1.5
−1
−0.5
0
0.5
1
fish Survival pH




```
##
## Random-Effects Model (k = 34; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.3813 (SE = 0.1018)
## tau (square root of estimated tau^2 value):      0.6175
## I^2 (total heterogeneity / total variability):   99.87%
## H^2 (total variability / sampling variability):  780.74
##
## Test for Heterogeneity:
## Q(df = 33) = 3324.9838, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.4120  0.1108  -3.7178  0.0002  -0.6291  -0.1948  ***
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

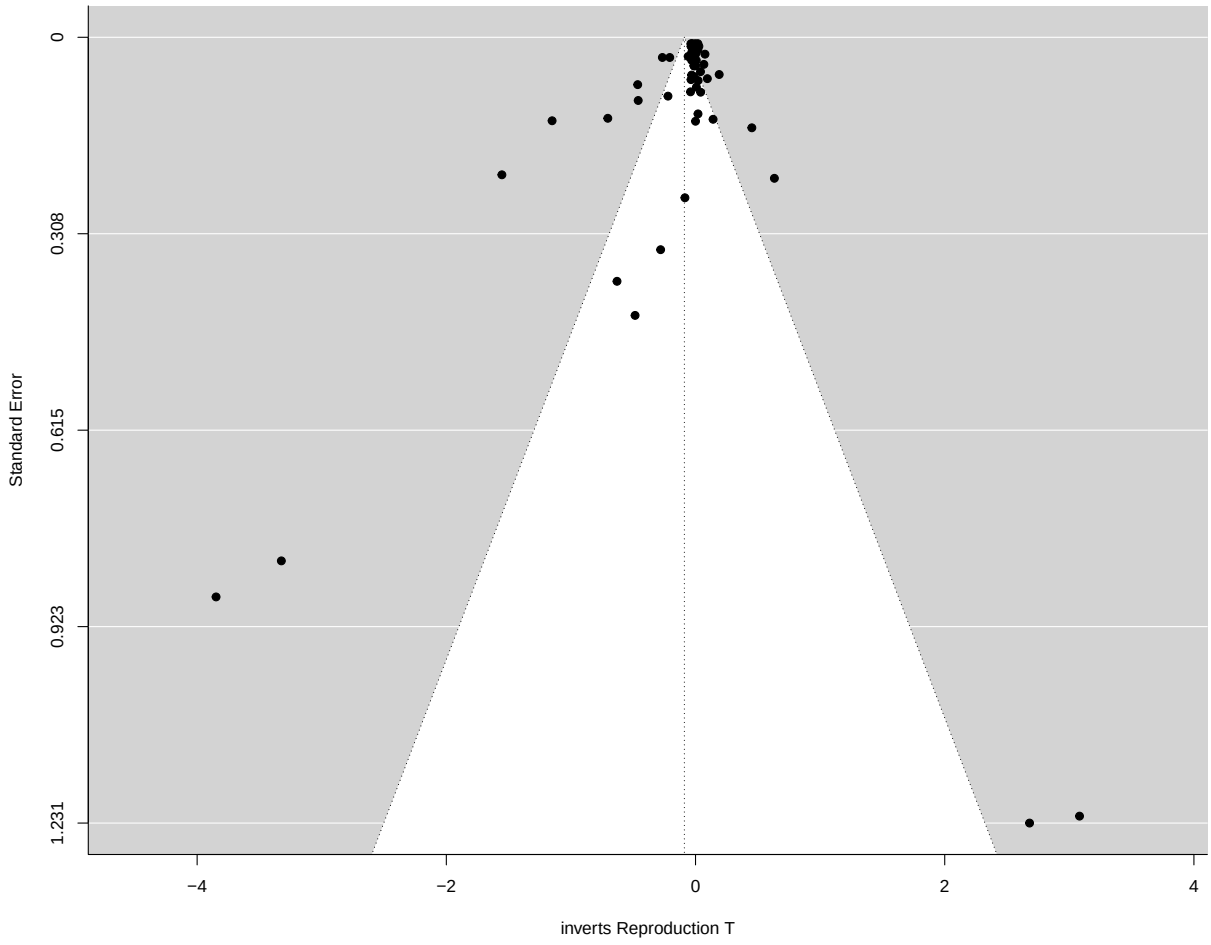

Standard Error
0
0.18
0.36
0.539
0.719
−2
−1
0
1
fish Survival TpH



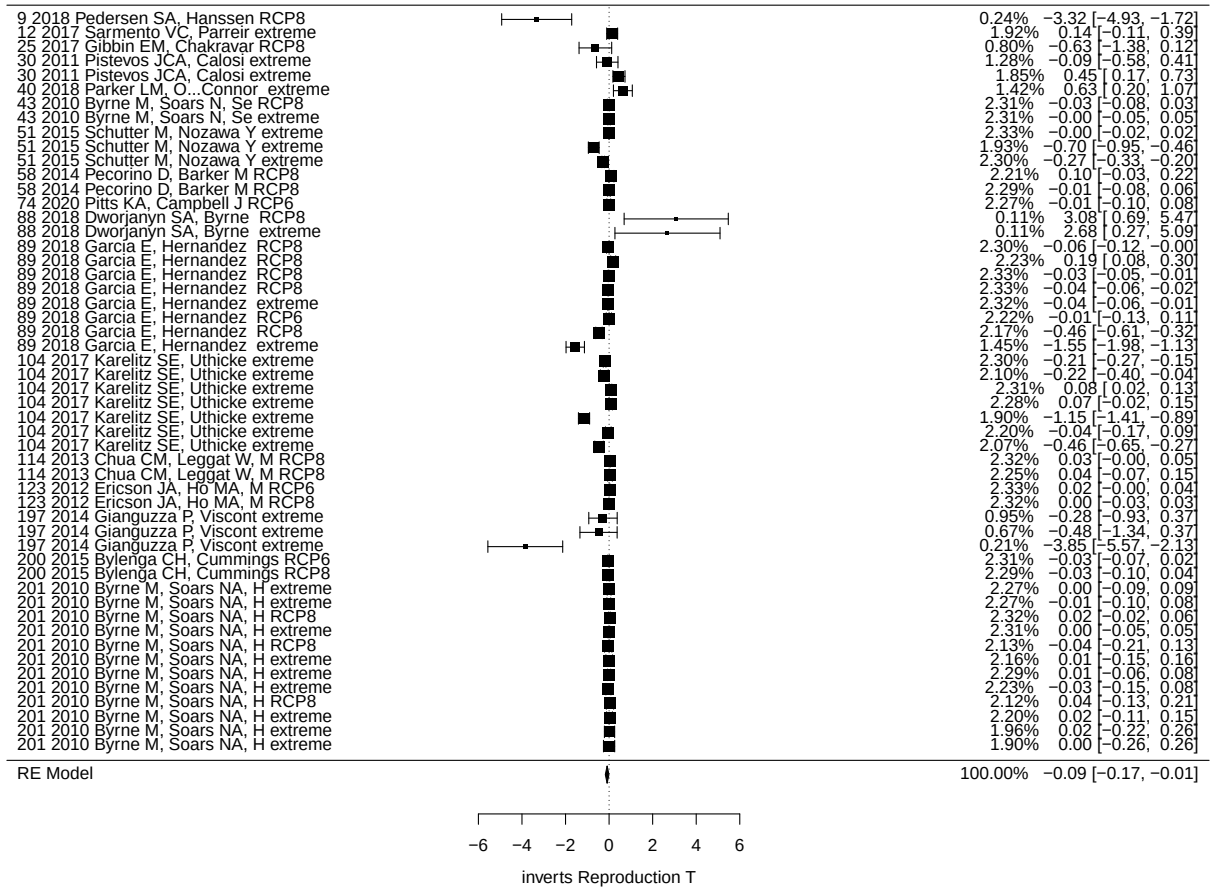

```
Abs_FishSurvi <- MA_TpH_abs("fish","Survival", Fish)

## Invertebrate, Reproduction
InvertRepro <- MA_TpH("inverts","Reproduction", Inverts,sensitivity)
```

```
##
## Random-Effects Model (k = 52; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0766 (SE = 0.0175)
## tau (square root of estimated tau^2 value):      0.2768
## I^2 (total heterogeneity / total variability):   99.05%
## H^2 (total variability / sampling variability):  104.78
##
## Test for Heterogeneity:
## Q(df = 51) = 460.5345, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.0896  0.0423  -2.1214  0.0339  -0.1725  -0.0068  *
```

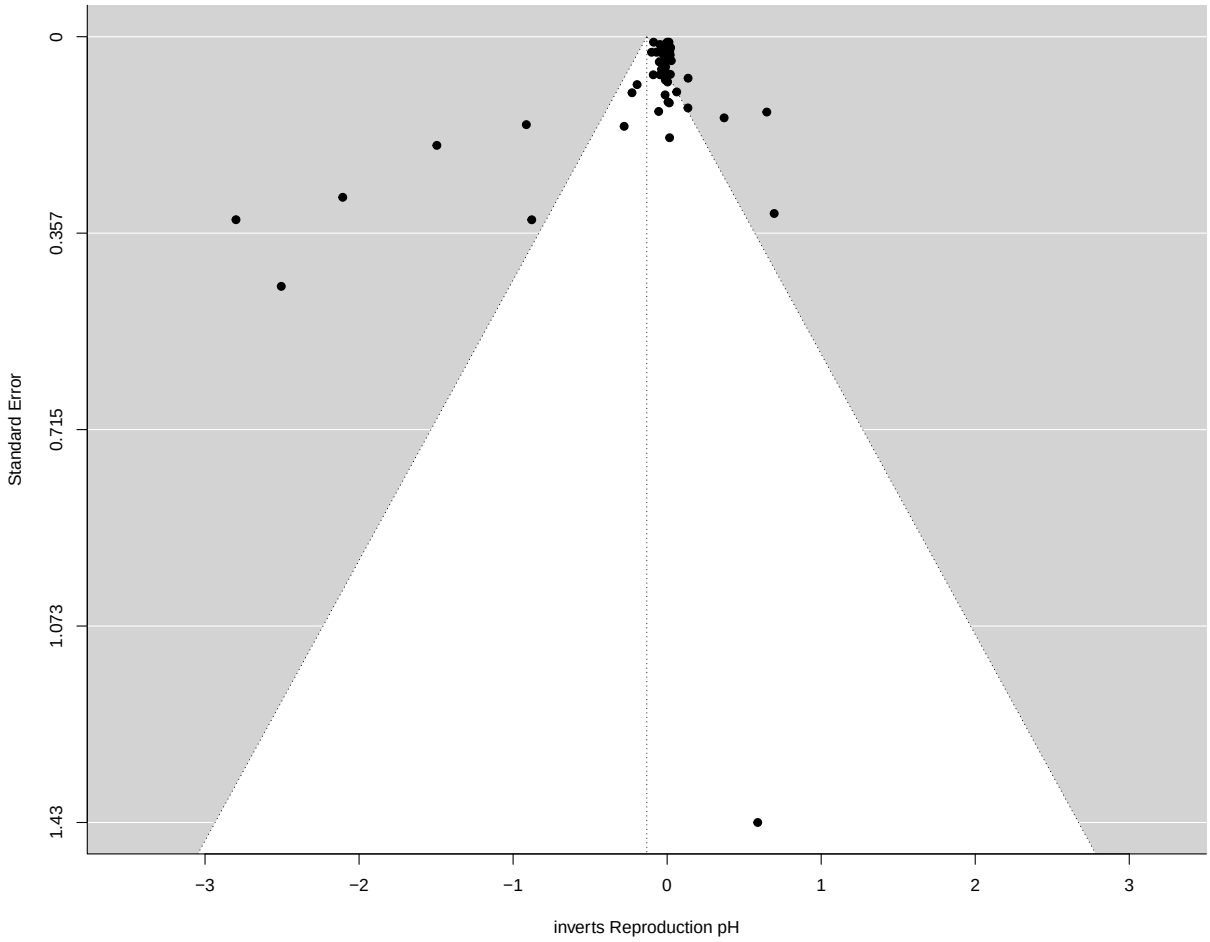
```
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



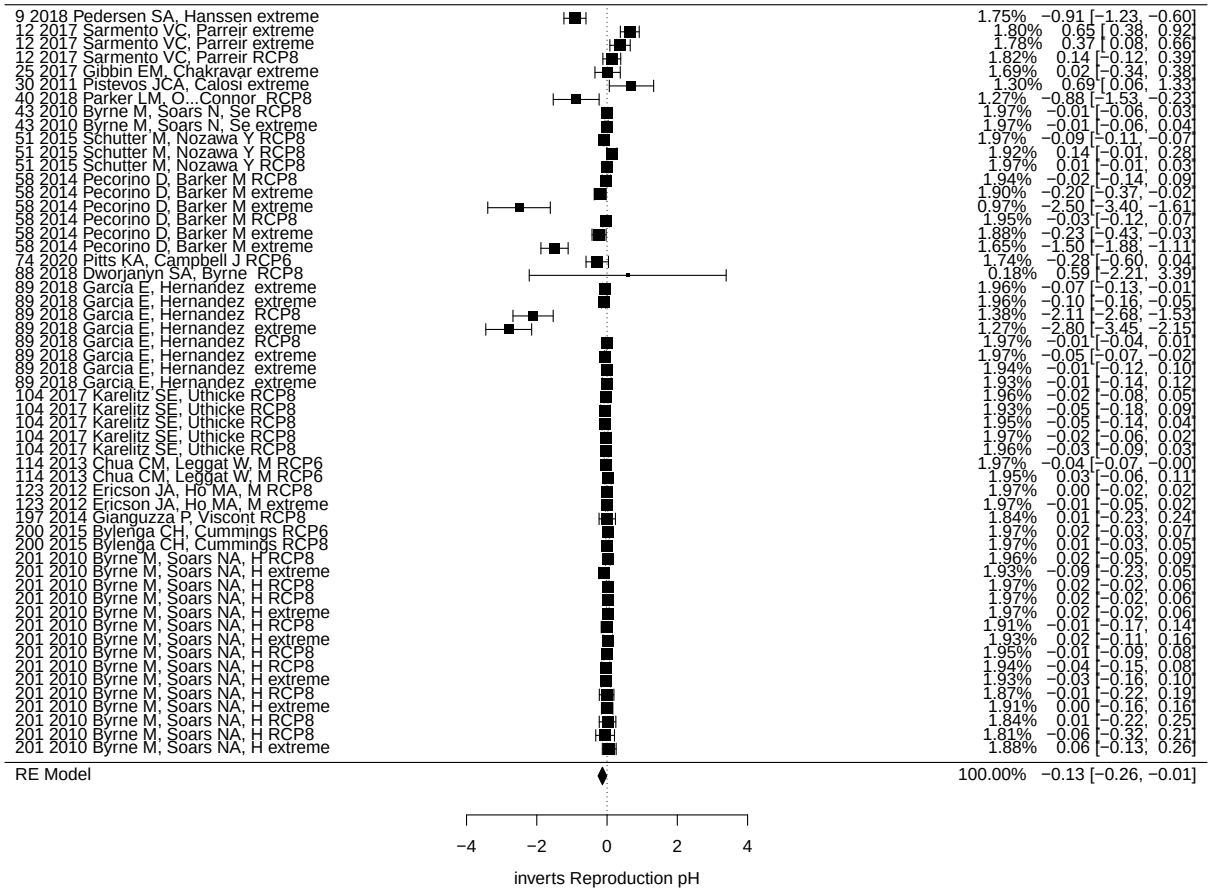

```
## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <99>
```



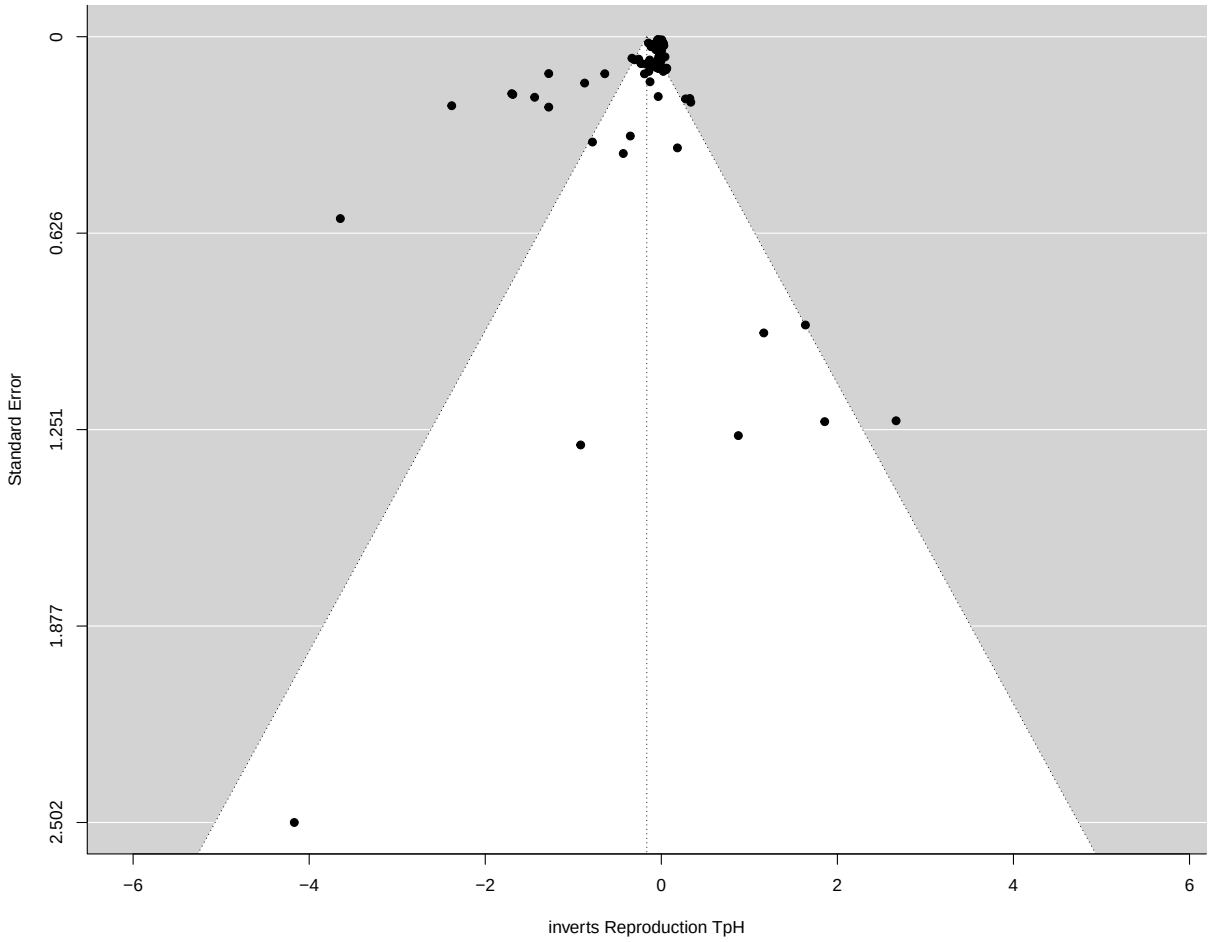

```
##
## Random-Effects Model (k = 55; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.2011 (SE = 0.0414)
## tau (square root of estimated tau^2 value):      0.4485
## I^2 (total heterogeneity / total variability):   99.61%
## H^2 (total variability / sampling variability):  256.06
##
## Test for Heterogeneity:
## Q(df = 54) = 395.3632, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.1321  0.0630  -2.0970  0.0360  -0.2555  -0.0086  *
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



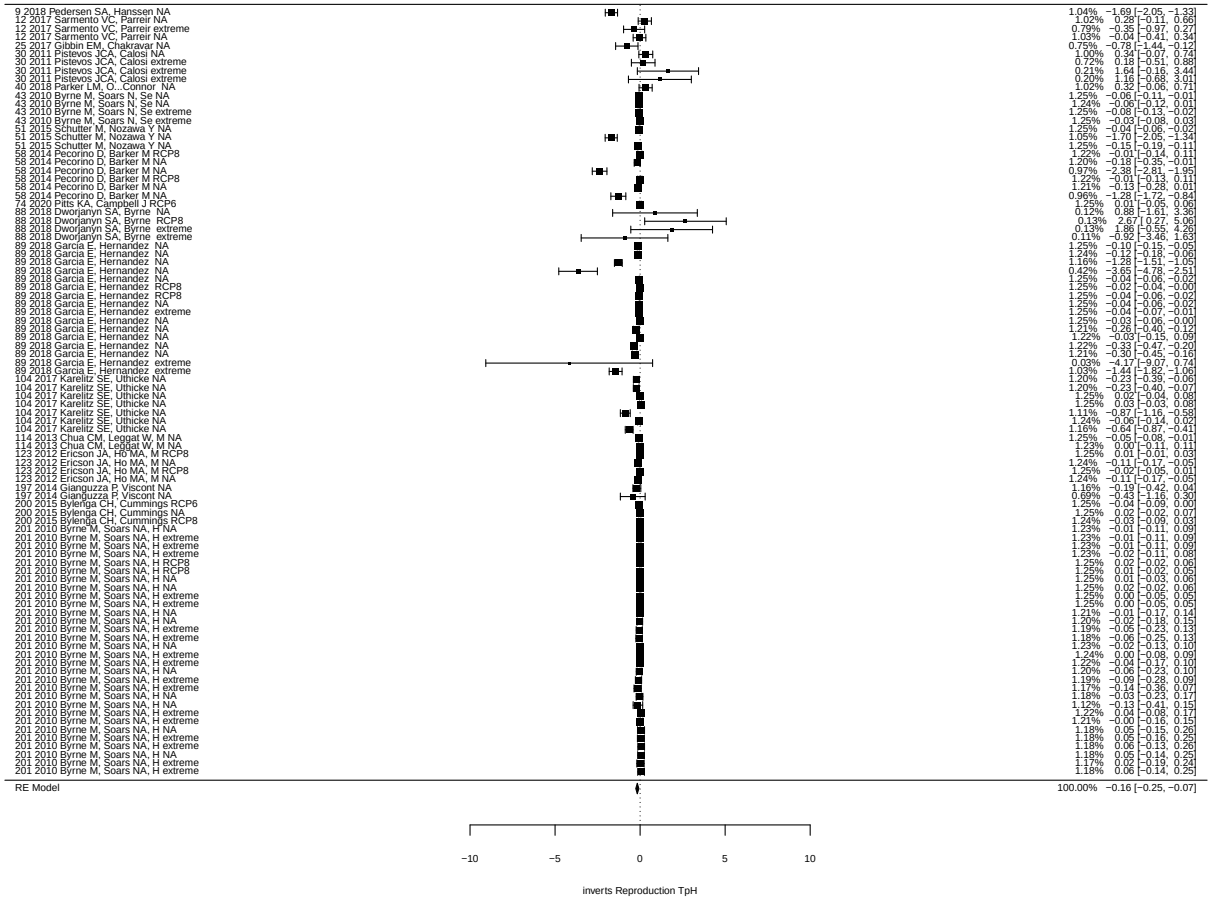

```
## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <99>

## Warning in sqrt(varSr): NaNs produced
```




```
##
## Random-Effects Model (k = 92; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.1688 (SE = 0.0277)
## tau (square root of estimated tau^2 value):      0.4109
## I^2 (total heterogeneity / total variability):   99.52%
## H^2 (total variability / sampling variability):  209.40
##
## Test for Heterogeneity:
## Q(df = 91) = 805.9601, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.1648  0.0460  -3.5863  0.0003  -0.2549  -0.0748  ***
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



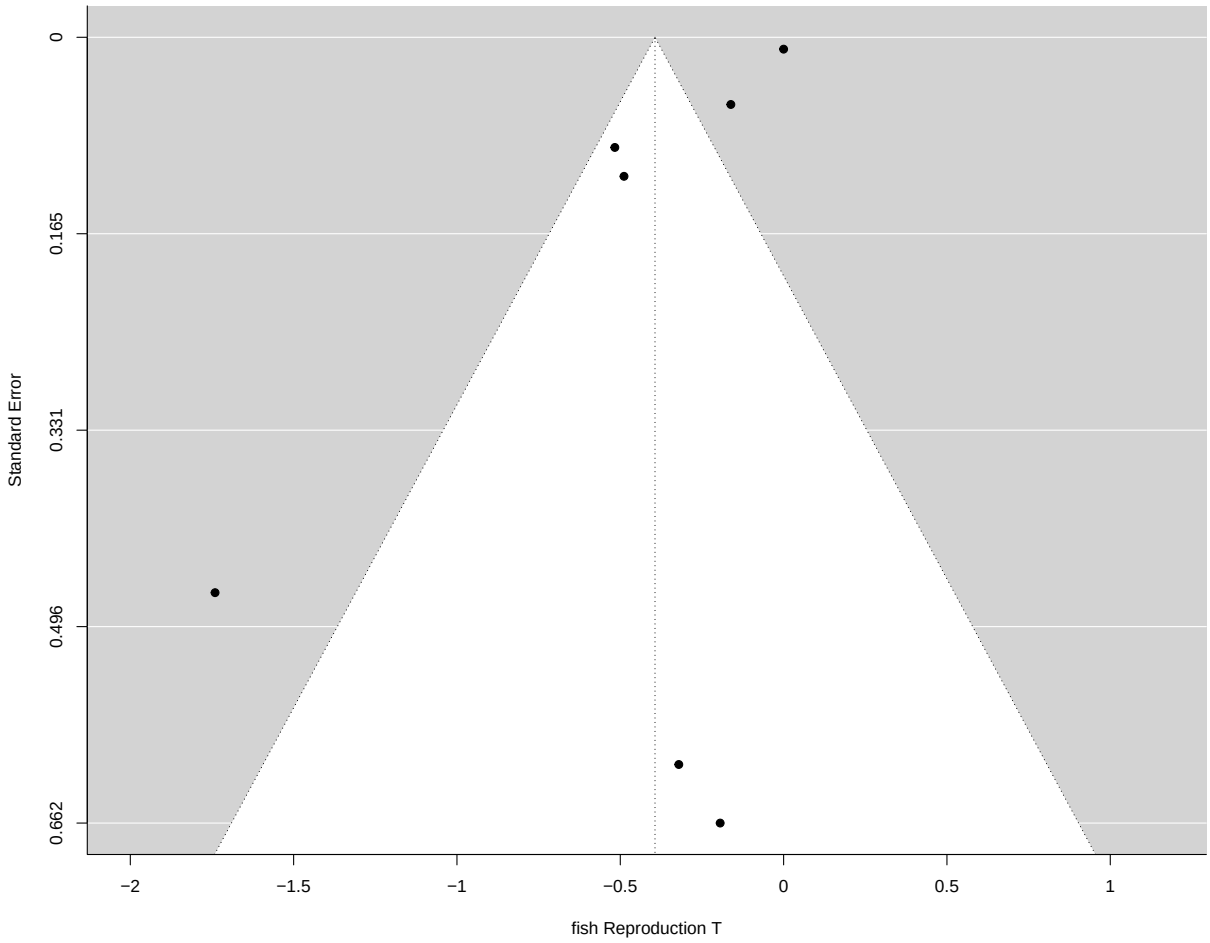

```
## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <99>

## Warning in sqrt(varSr): NaNs produced
```

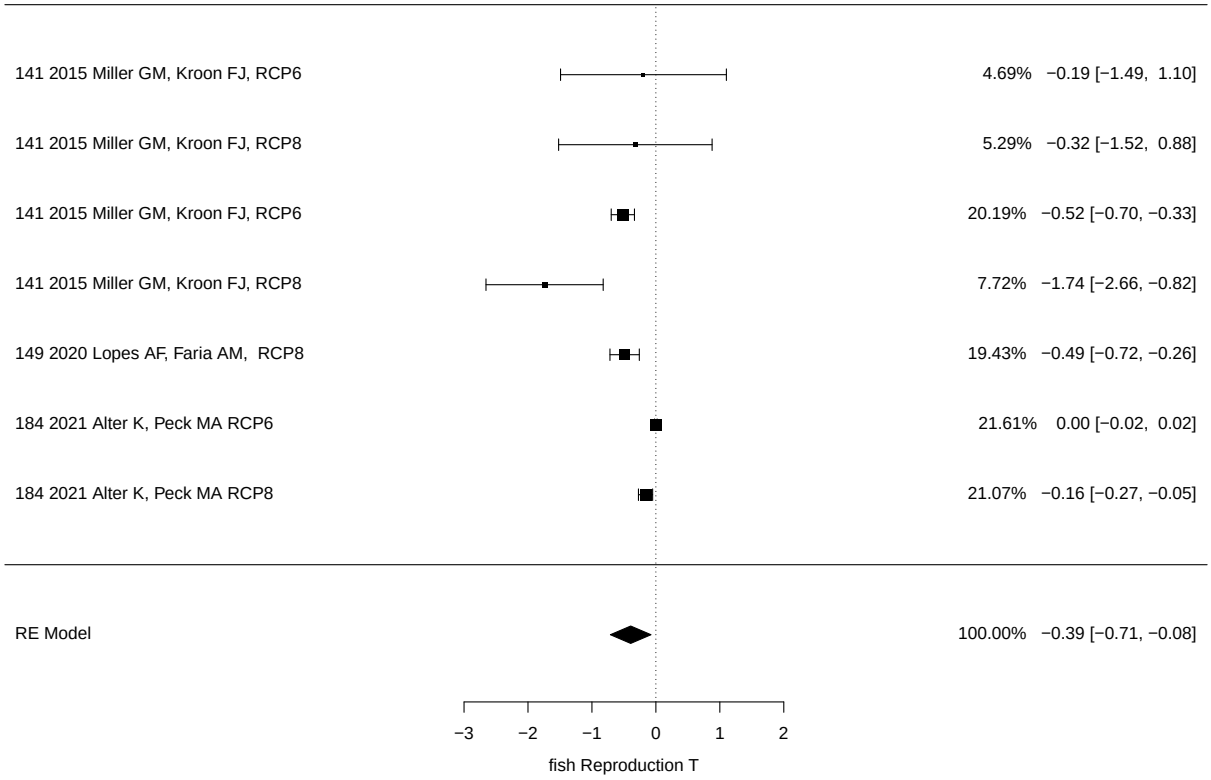



```
Abs_InvertRepro <- MA_TpH_abs("inverts","Reproduction", Inverts)

## Fish, Reproduction
FishRepro <- MA_TpH("fish","Reproduction", Fish,sensitivity)
```

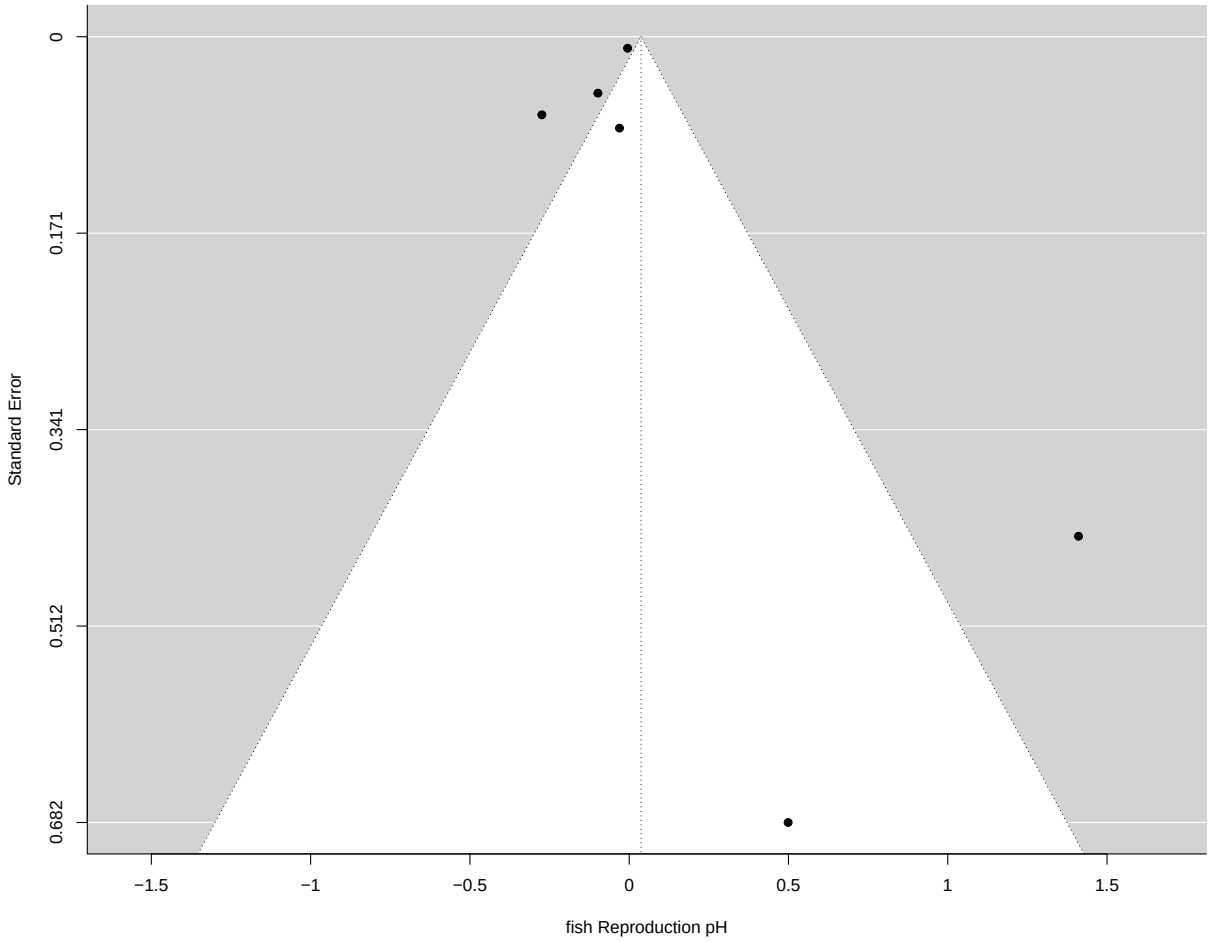
```
##
## Random-Effects Model (k = 7; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.1213 (SE = 0.0985)
## tau (square root of estimated tau^2 value):      0.3483
## I^2 (total heterogeneity / total variability):   95.23%
## H^2 (total variability / sampling variability):  20.94
##
## Test for Heterogeneity:
## Q(df = 6) = 68.5394, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.3937  0.1620  -2.4310  0.0151  -0.7111  -0.0763  *
```

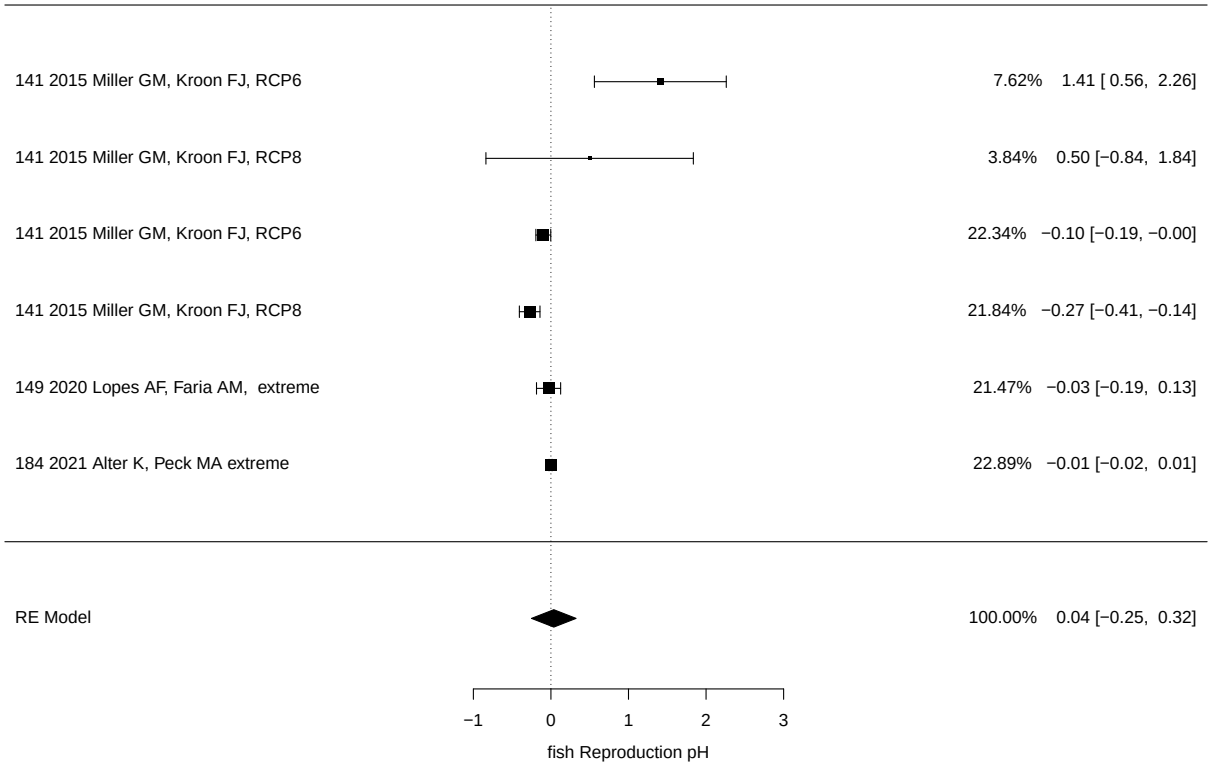
```
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



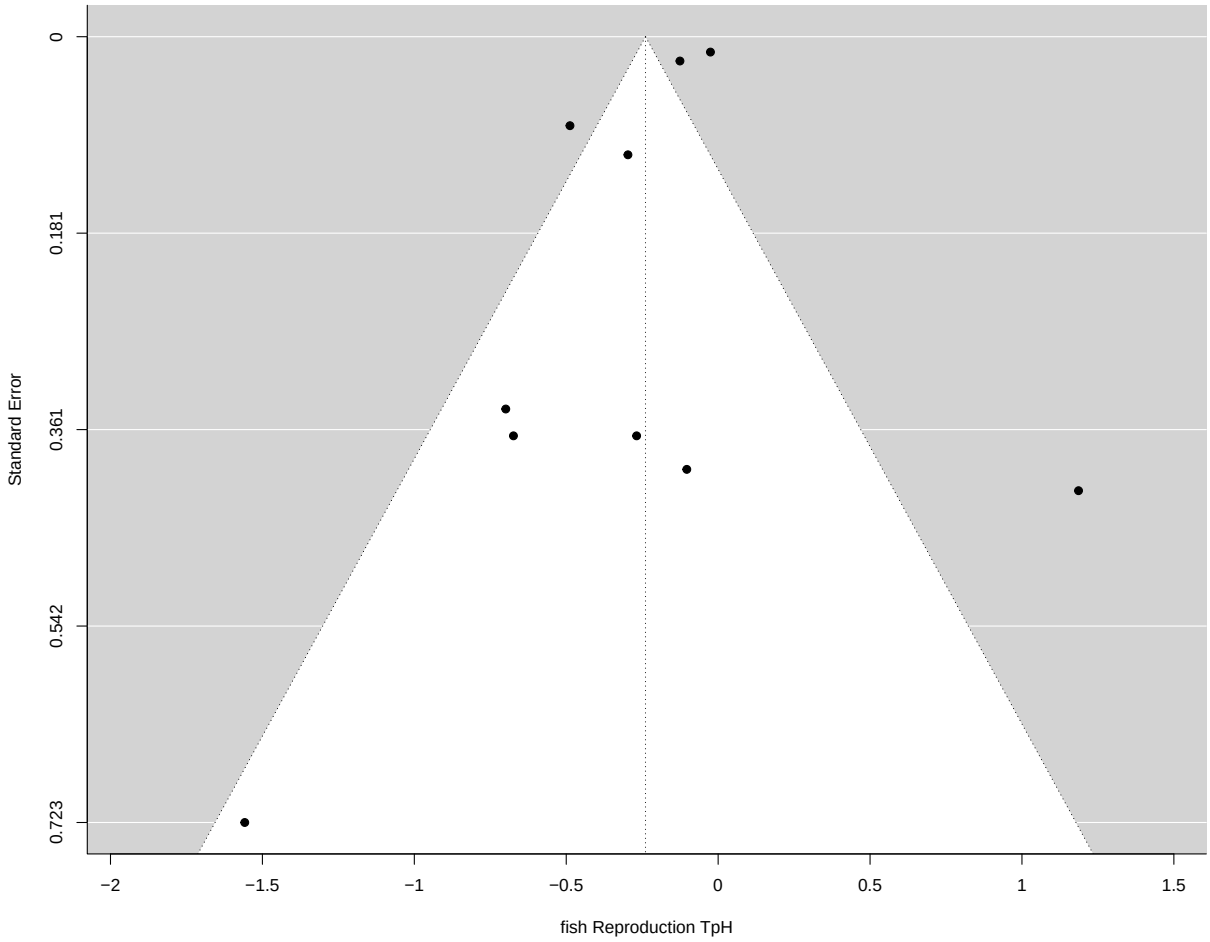


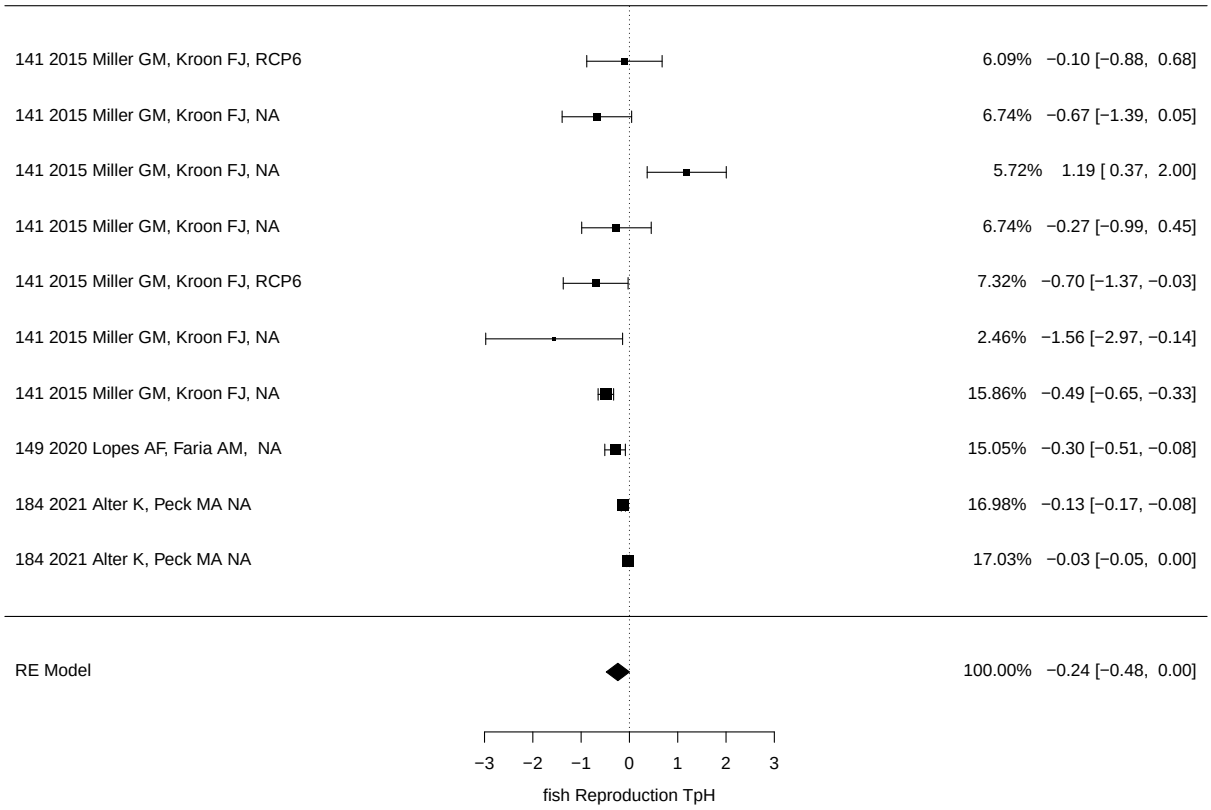

```
##
## Random-Effects Model (k = 6; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0937 (SE = 0.0767)
## tau (square root of estimated tau^2 value):      0.3061
## I^2 (total heterogeneity / total variability):   96.60%
## H^2 (total variability / sampling variability):  29.45
##
## Test for Heterogeneity:
## Q(df = 5) = 29.8652, p-val < .0001
##
## Model Results:
##
## estimate      se    zval    pval    ci.lb   ci.ub
##   0.0371  0.1465  0.2535  0.7999  -0.2500  0.3243
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```


Standard Error
0
0.171
0.341
0.512
0.682
−1.5
−1
−0.5
0
0.5
1
1.5
fish Reproduction pH




```
##
## Random-Effects Model (k = 10; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0879 (SE = 0.0650)
## tau (square root of estimated tau^2 value):      0.2966
## I^2 (total heterogeneity / total variability):   96.97%
## H^2 (total variability / sampling variability):  33.04
##
## Test for Heterogeneity:
## Q(df = 9) = 66.1860, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb   ci.ub
##  -0.2391  0.1225  -1.9510  0.0511  -0.4792  0.0011  .
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

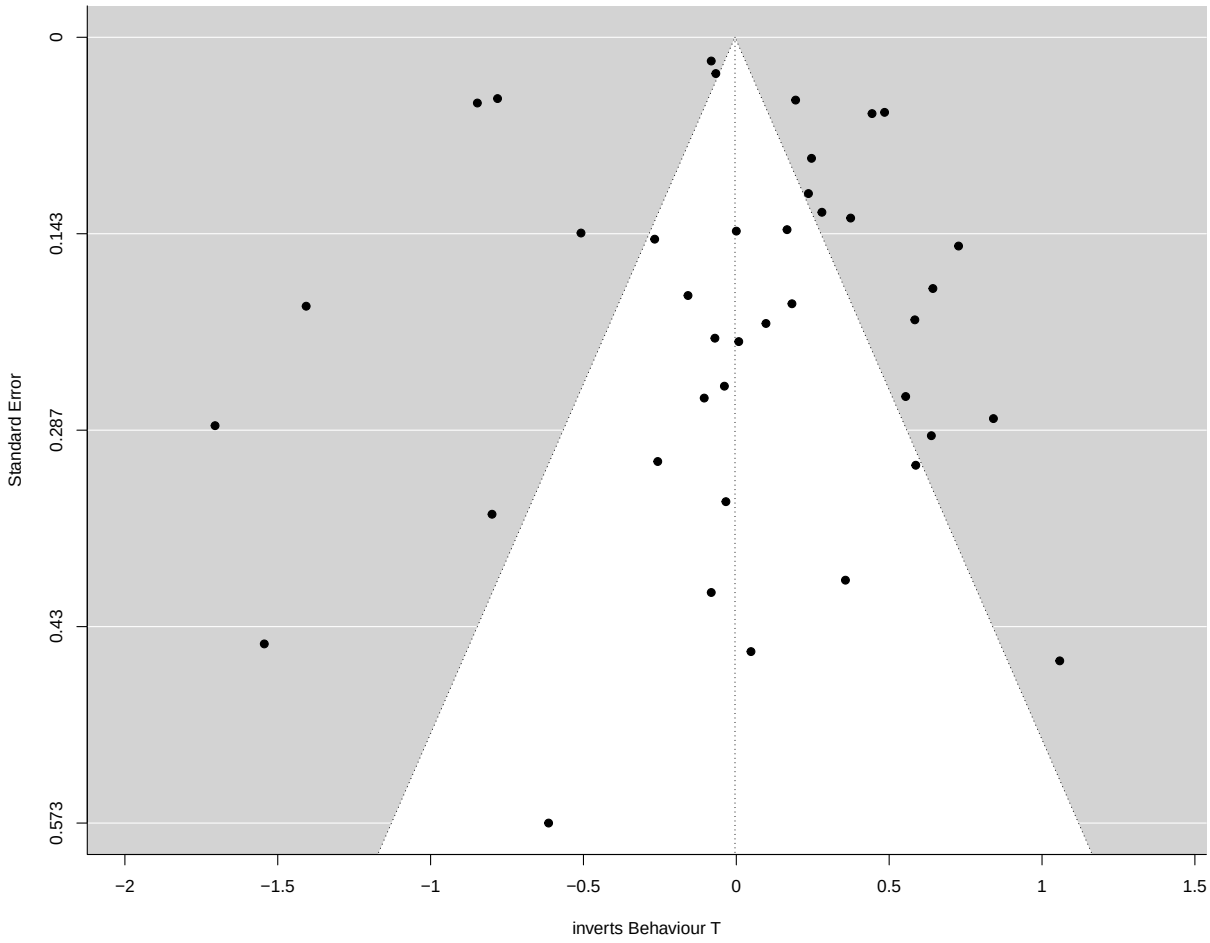

Standard Error
0
0.181
0.361
0.542
0.723
−2
−1.5
−1
−0.5
0
0.5
1
1.5
fish Reproduction TpH

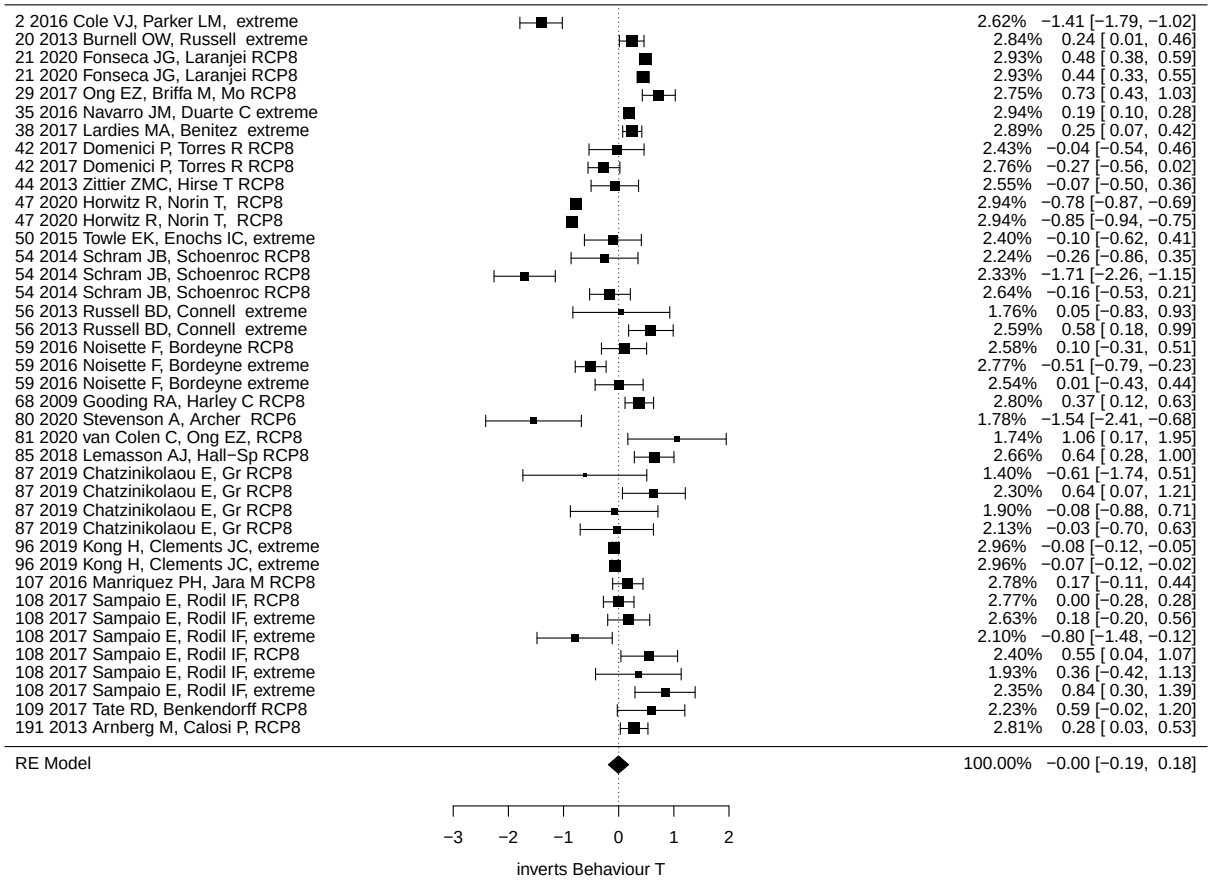



```
Abs_FishRepro <- MA_TpH_abs("fish","Reproduction", Fish)

## Invertebrate, Behaviour
InvertBehav <- MA_TpH("inverts","Behaviour", Inverts,sensitivity)
```

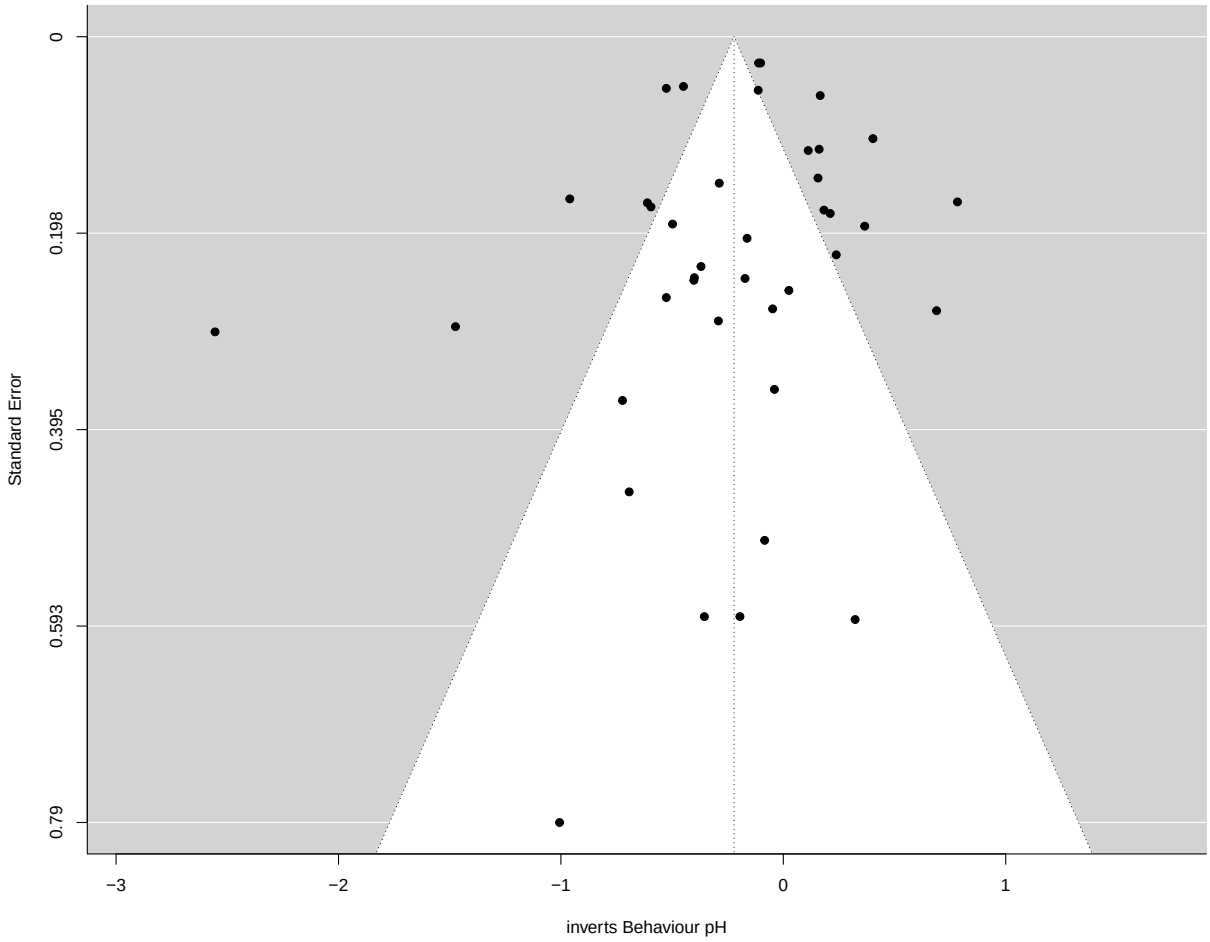
```
##
## Random-Effects Model (k = 40; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.2946 (SE = 0.0781)
## tau (square root of estimated tau^2 value):      0.5427
## I^2 (total heterogeneity / total variability):   97.81%
## H^2 (total variability / sampling variability):  45.71
##
## Test for Heterogeneity:
## Q(df = 39) = 974.4411, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb   ci.ub
##  -0.0043  0.0934  -0.0460  0.9633  -0.1874  0.1788
```

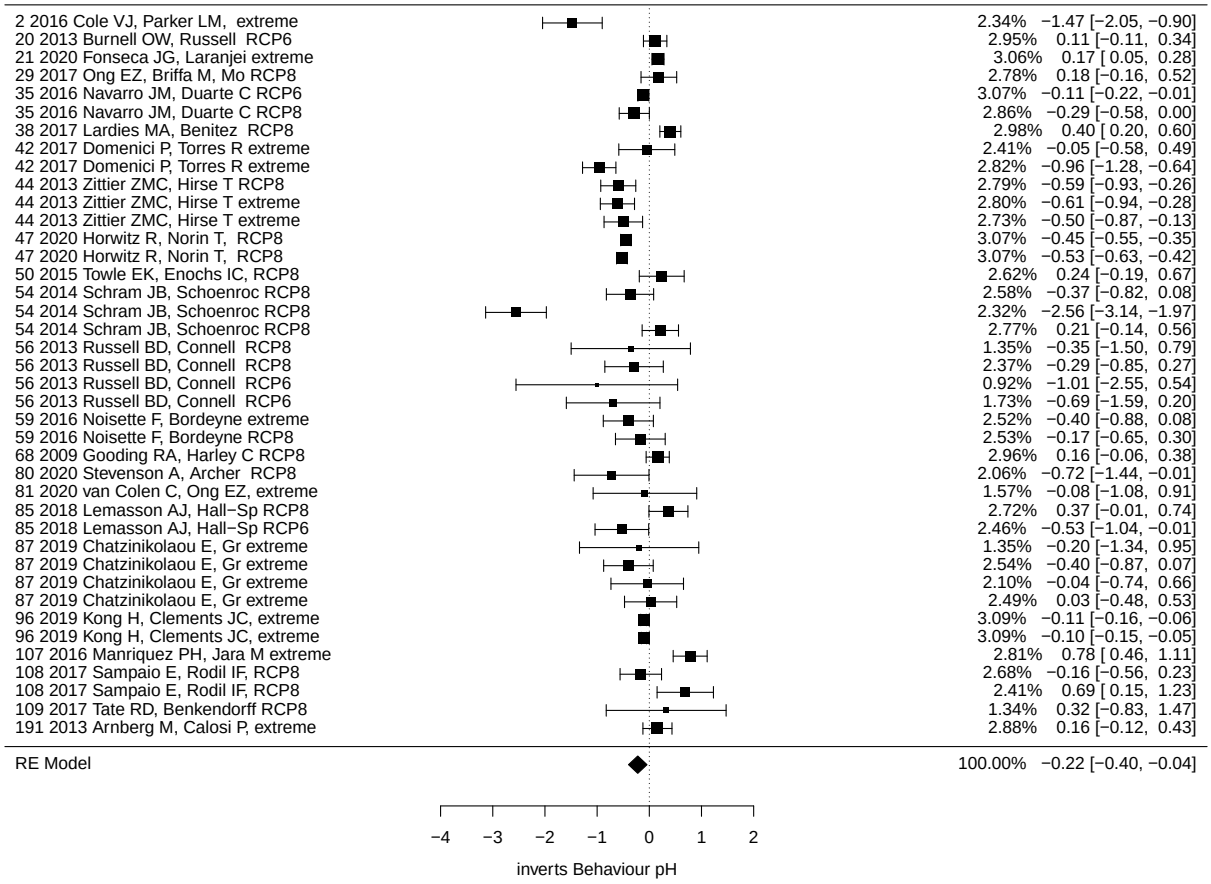
```
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



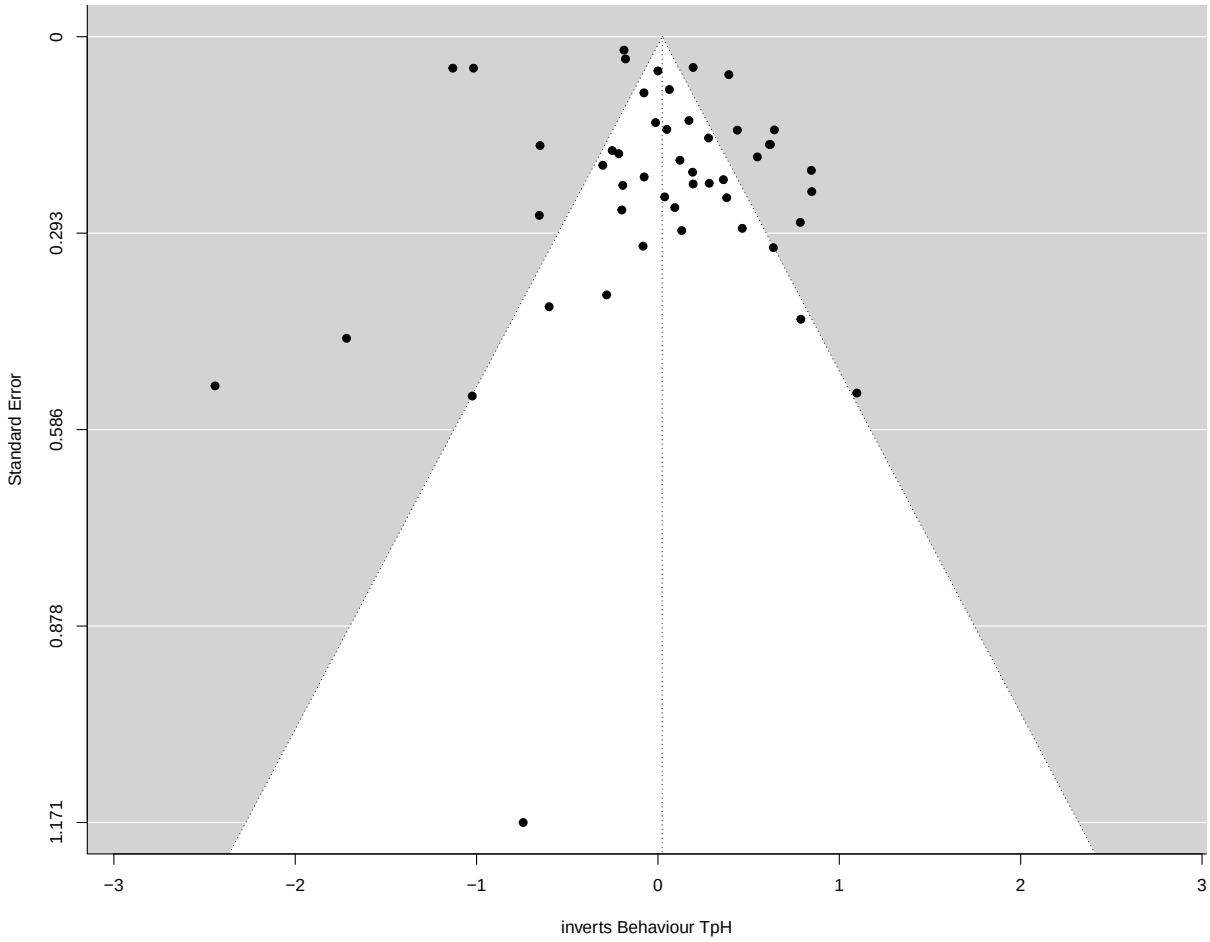


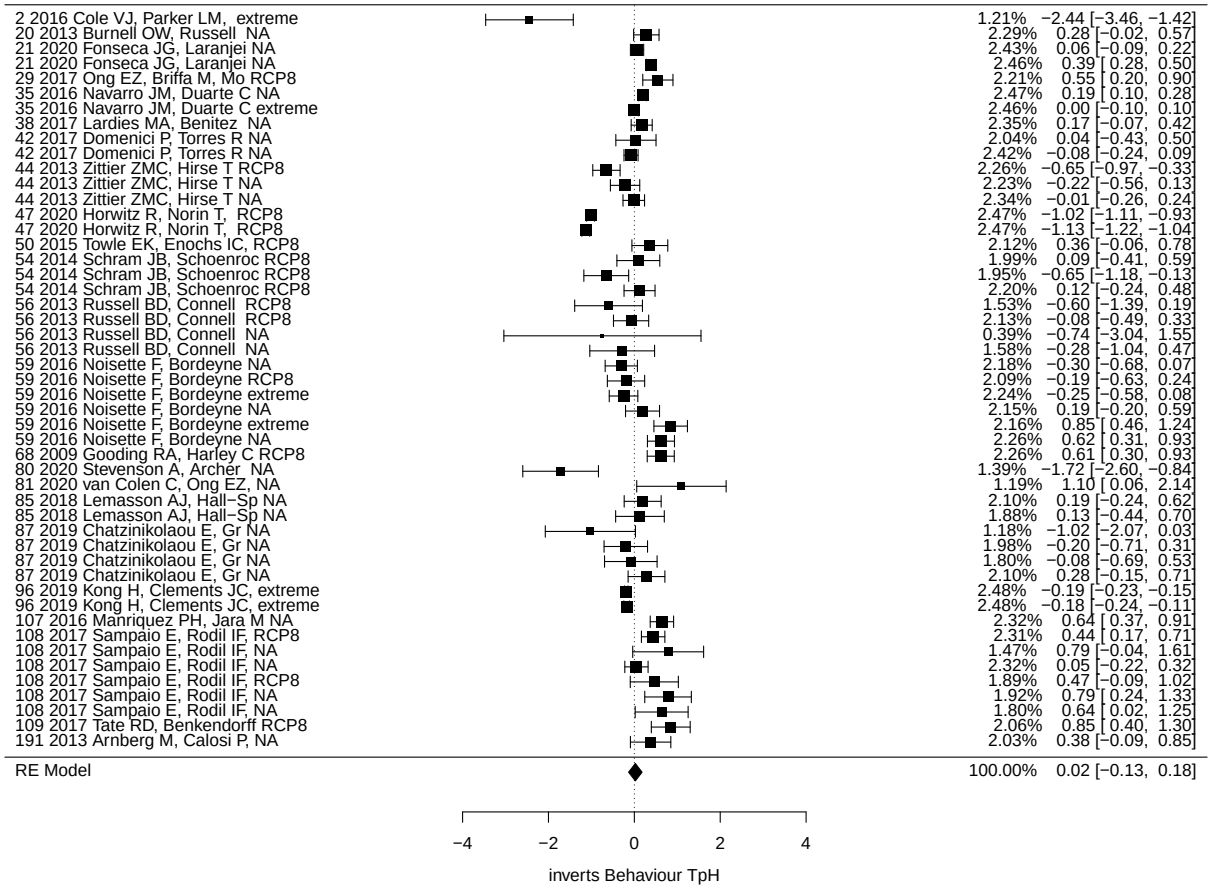

```
##
## Random-Effects Model (k = 40; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.2631 (SE = 0.0723)
## tau (square root of estimated tau^2 value):      0.5129
## I^2 (total heterogeneity / total variability):   96.59%
## H^2 (total variability / sampling variability):  29.36
##
## Test for Heterogeneity:
## Q(df = 39) = 369.5507, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.2214  0.0903  -2.4513  0.0142  -0.3984  -0.0444  *
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```


Standard Error
0
0.198
0.395
0.593
0.79
−3
−2
−1
0
1
inverts Behaviour pH




```
##
## Random-Effects Model (k = 49; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.2571 (SE = 0.0627)
## tau (square root of estimated tau^2 value):      0.5071
## I^2 (total heterogeneity / total variability):   96.74%
## H^2 (total variability / sampling variability):  30.70
##
## Test for Heterogeneity:
## Q(df = 48) = 1220.5124, p-val < .0001
##
## Model Results:
##
## estimate      se    zval    pval    ci.lb   ci.ub
##   0.0233  0.0800  0.2918  0.7704  -0.1334  0.1801
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

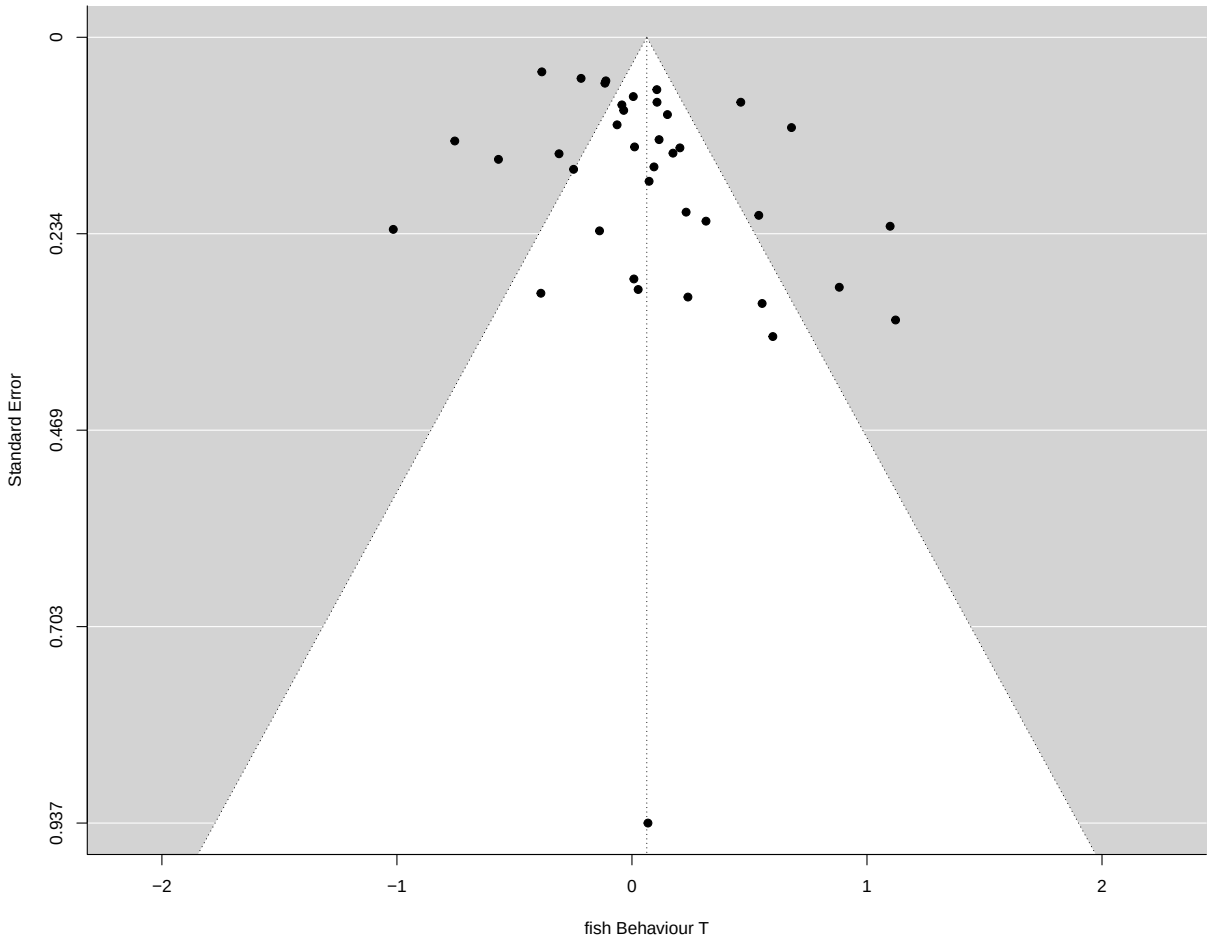

Standard Error
0
0.293
0.586
0.878
1.171
−3
−2
−1
0
1
2
3
inverts Behaviour TpH

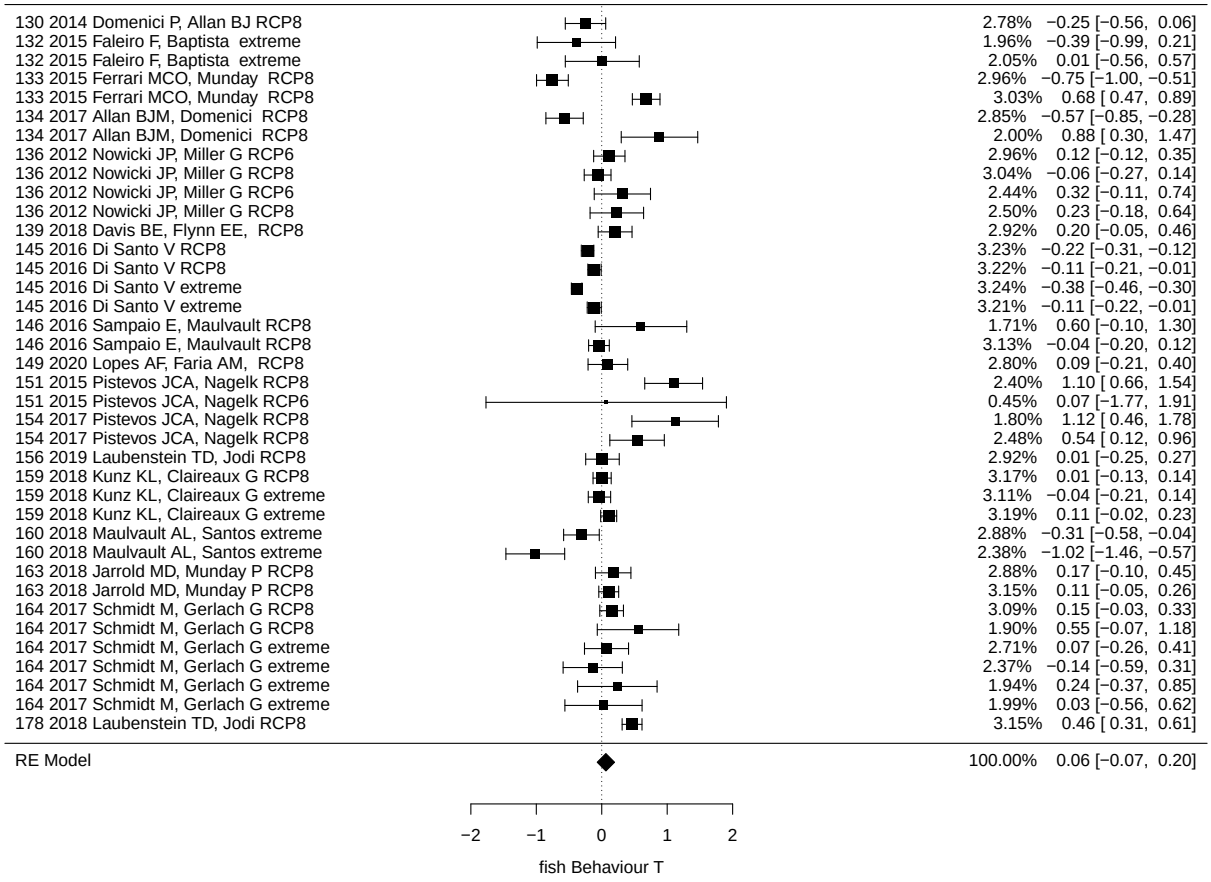



```
Abs_InvertBehav <- MA_TpH_abs("inverts","Behaviour", Inverts)

## Fish, Behaviour
FishBehav  <- MA_TpH("fish","Behaviour", Fish,sensitivity)
```

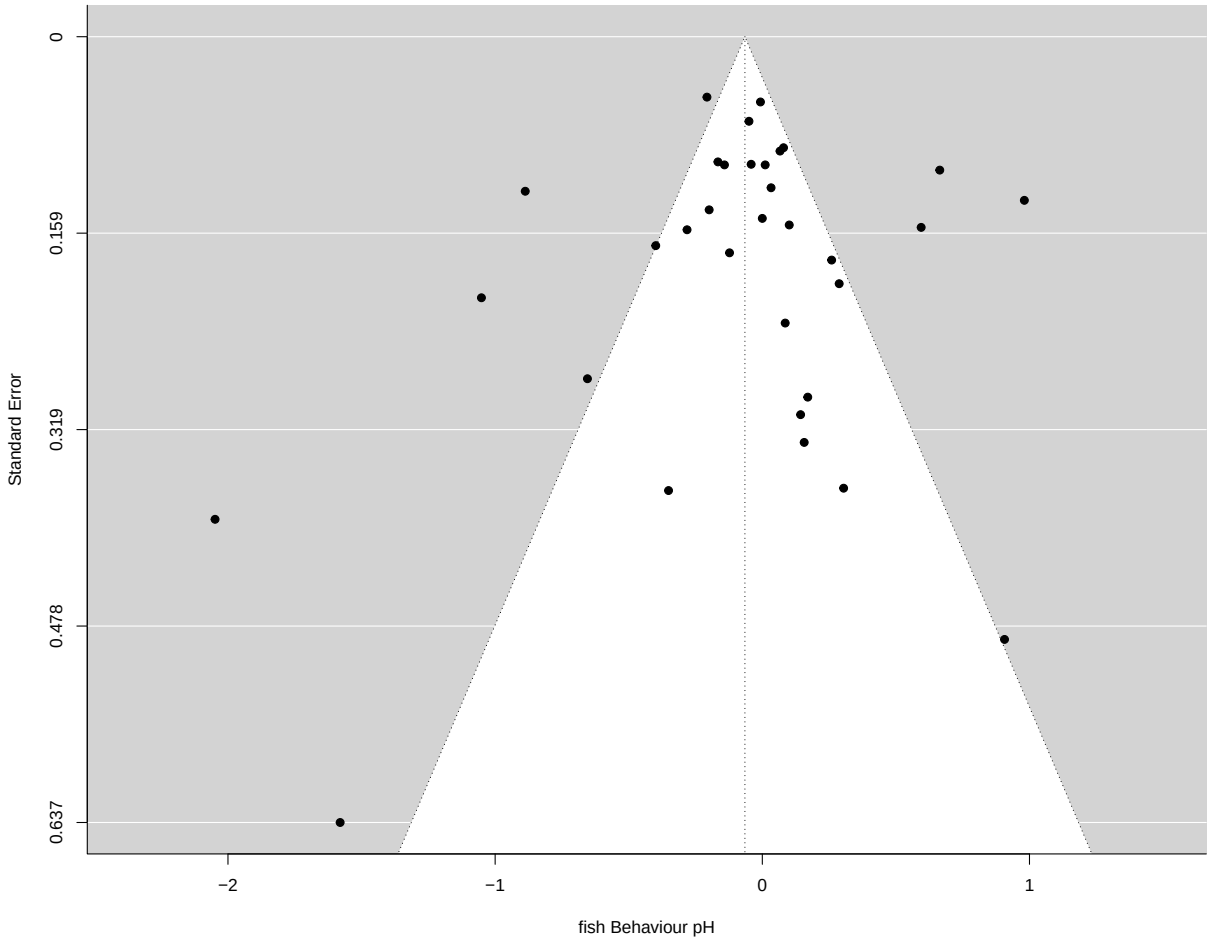
```
##
## Random-Effects Model (k = 38; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.1389 (SE = 0.0394)
## tau (square root of estimated tau^2 value):      0.3727
## I^2 (total heterogeneity / total variability):   92.99%
## H^2 (total variability / sampling variability):  14.26
##
## Test for Heterogeneity:
## Q(df = 37) = 331.8272, p-val < .0001
##
## Model Results:
##
## estimate      se    zval    pval    ci.lb   ci.ub
##   0.0632  0.0675  0.9358  0.3494  -0.0692  0.1955
```

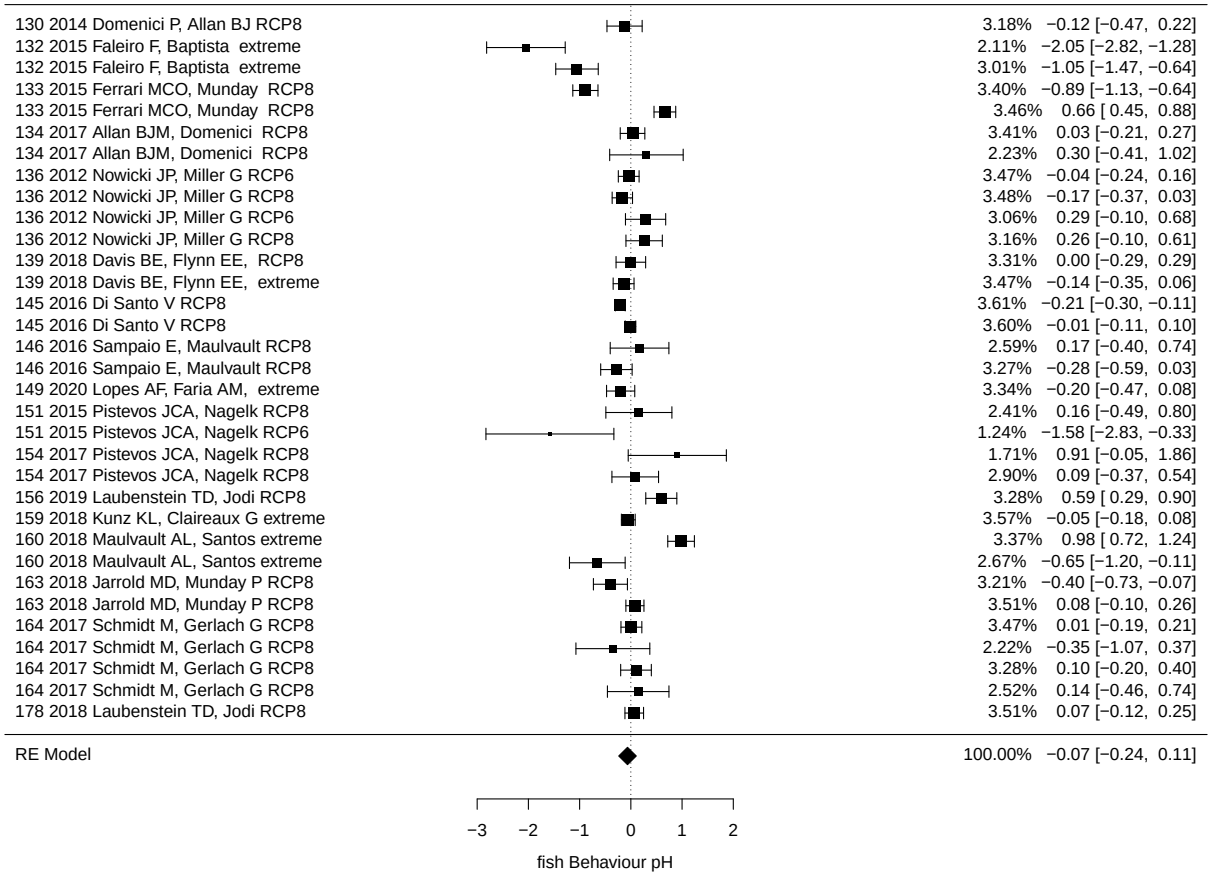
```
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



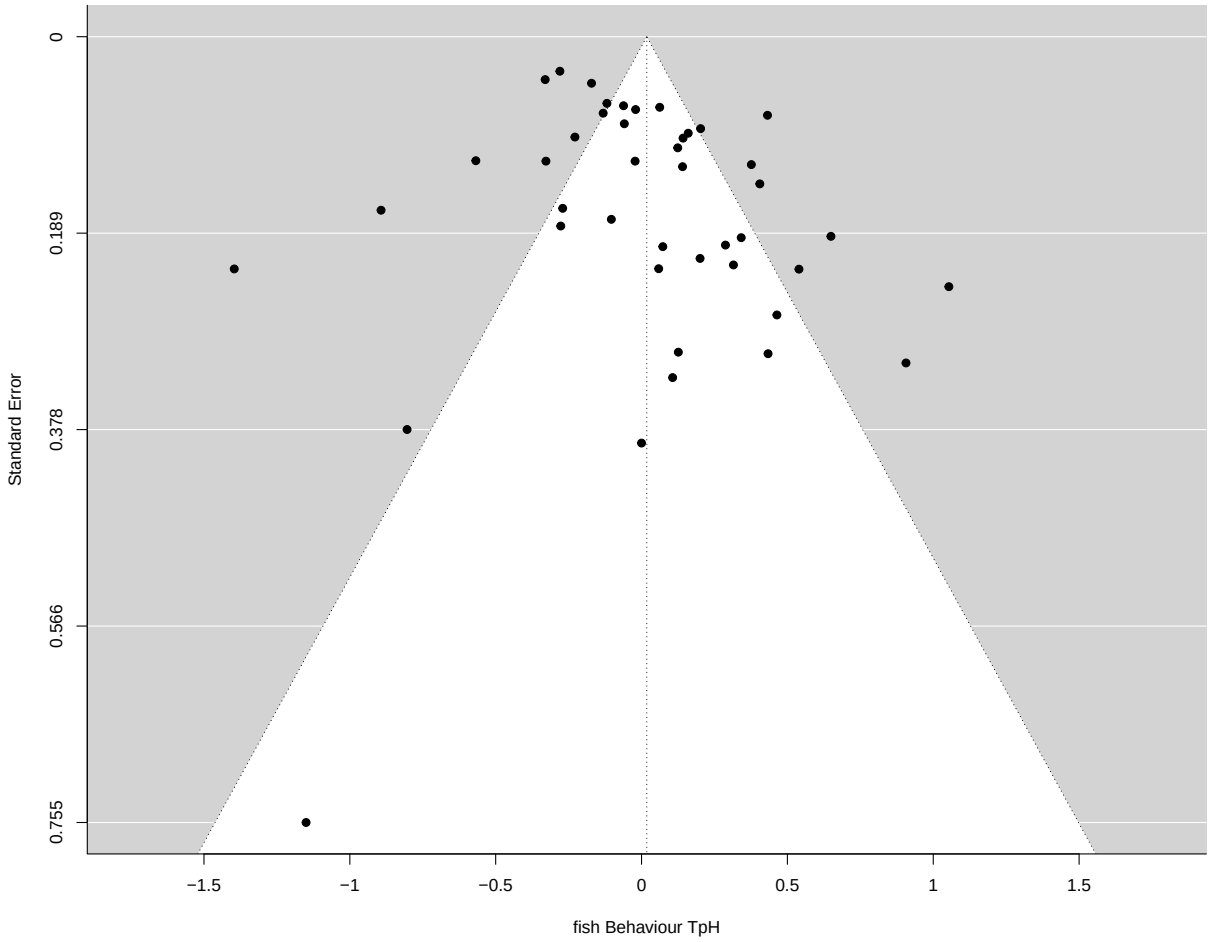


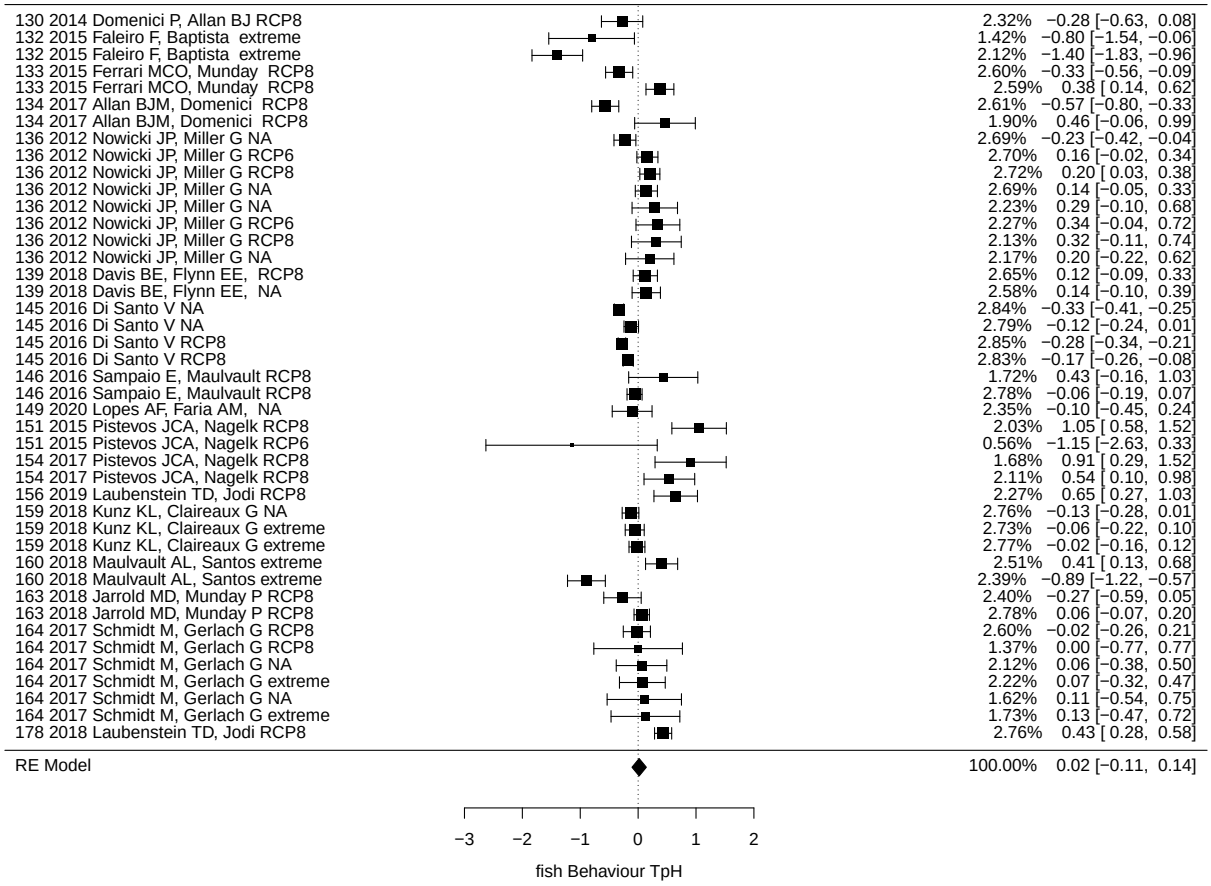

```
##
## Random-Effects Model (k = 33; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.2096 (SE = 0.0620)
## tau (square root of estimated tau^2 value):      0.4578
## I^2 (total heterogeneity / total variability):   93.35%
## H^2 (total variability / sampling variability):  15.03
##
## Test for Heterogeneity:
## Q(df = 32) = 263.9107, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb   ci.ub
##  -0.0651  0.0875  -0.7447  0.4565  -0.2365  0.1063
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```


Standard Error
0
0.159
0.319
0.478
0.637
−2
−1
0
1
fish Behaviour pH




```
##
## Random-Effects Model (k = 43; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.1394 (SE = 0.0368)
## tau (square root of estimated tau^2 value):      0.3733
## I^2 (total heterogeneity / total variability):   93.56%
## H^2 (total variability / sampling variability):  15.53
##
## Test for Heterogeneity:
## Q(df = 42) = 348.5382, p-val < .0001
##
## Model Results:
##
## estimate      se    zval    pval    ci.lb   ci.ub
##   0.0180  0.0633  0.2851  0.7756  -0.1060  0.1420
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

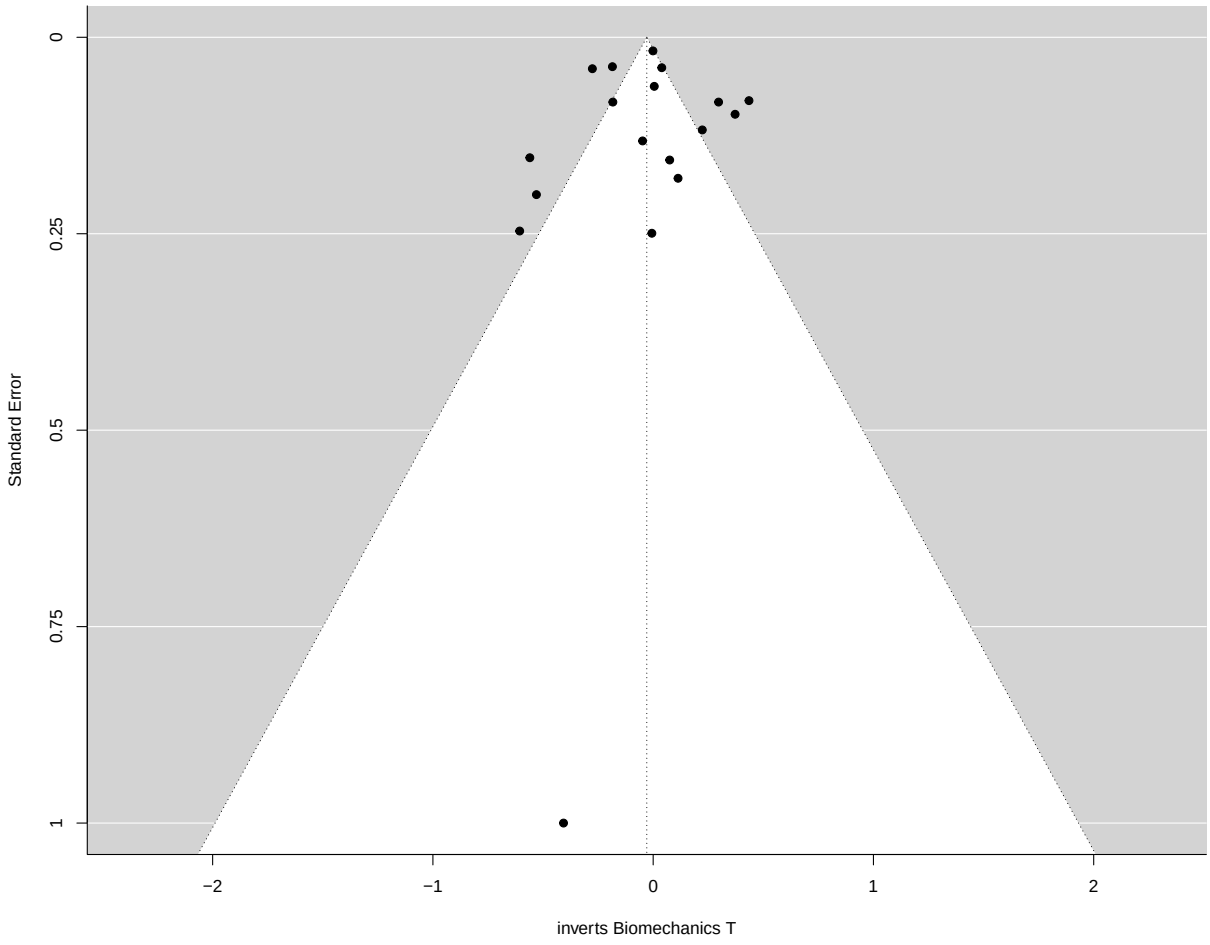

Standard Error
0
0.189
0.378
0.566
0.755
−1.5
−1
−0.5
0
0.5
1
1.5
fish Behaviour TpH

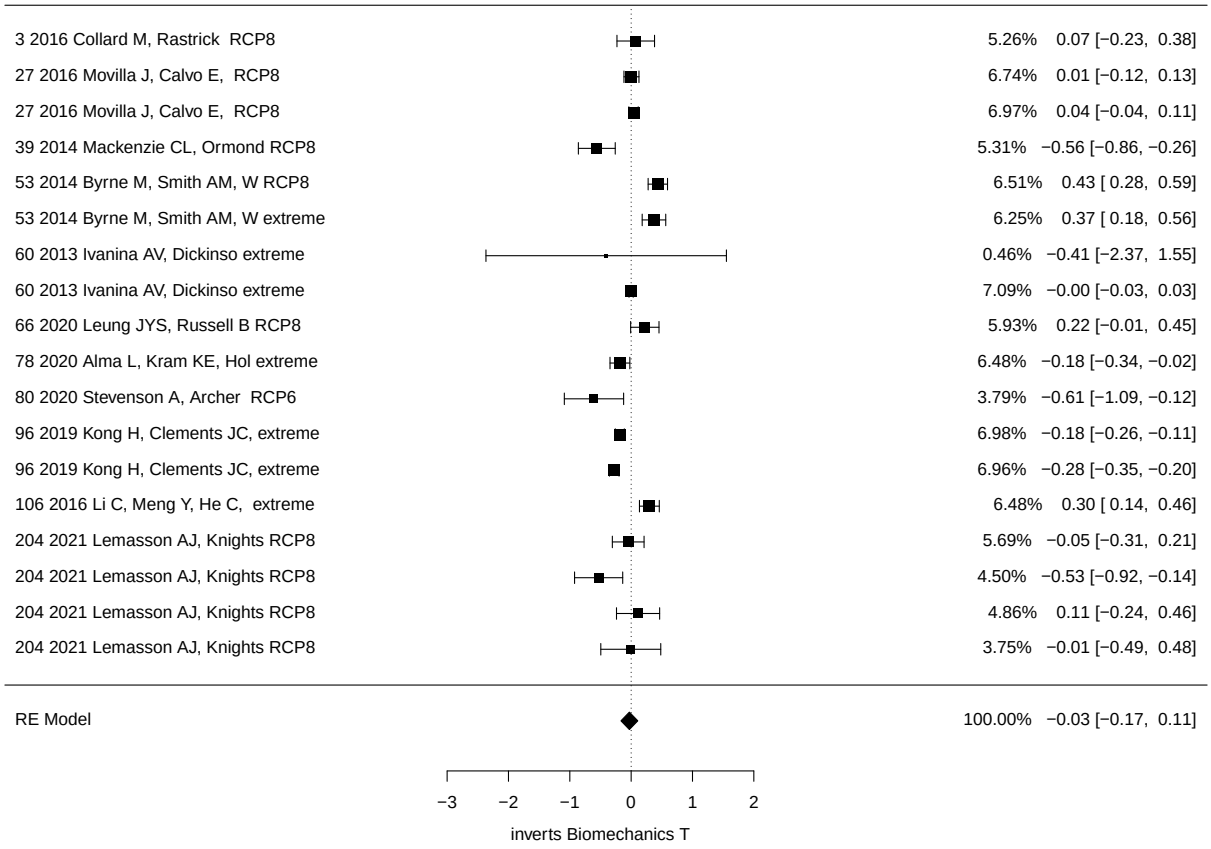



```
Abs_FishBehav  <- MA_TpH_abs("fish","Behaviour", Fish)

## Invertebrate, Biomechanics
InvertBio <- MA_TpH("inverts","Biomechanics", Inverts,sensitivity)
```

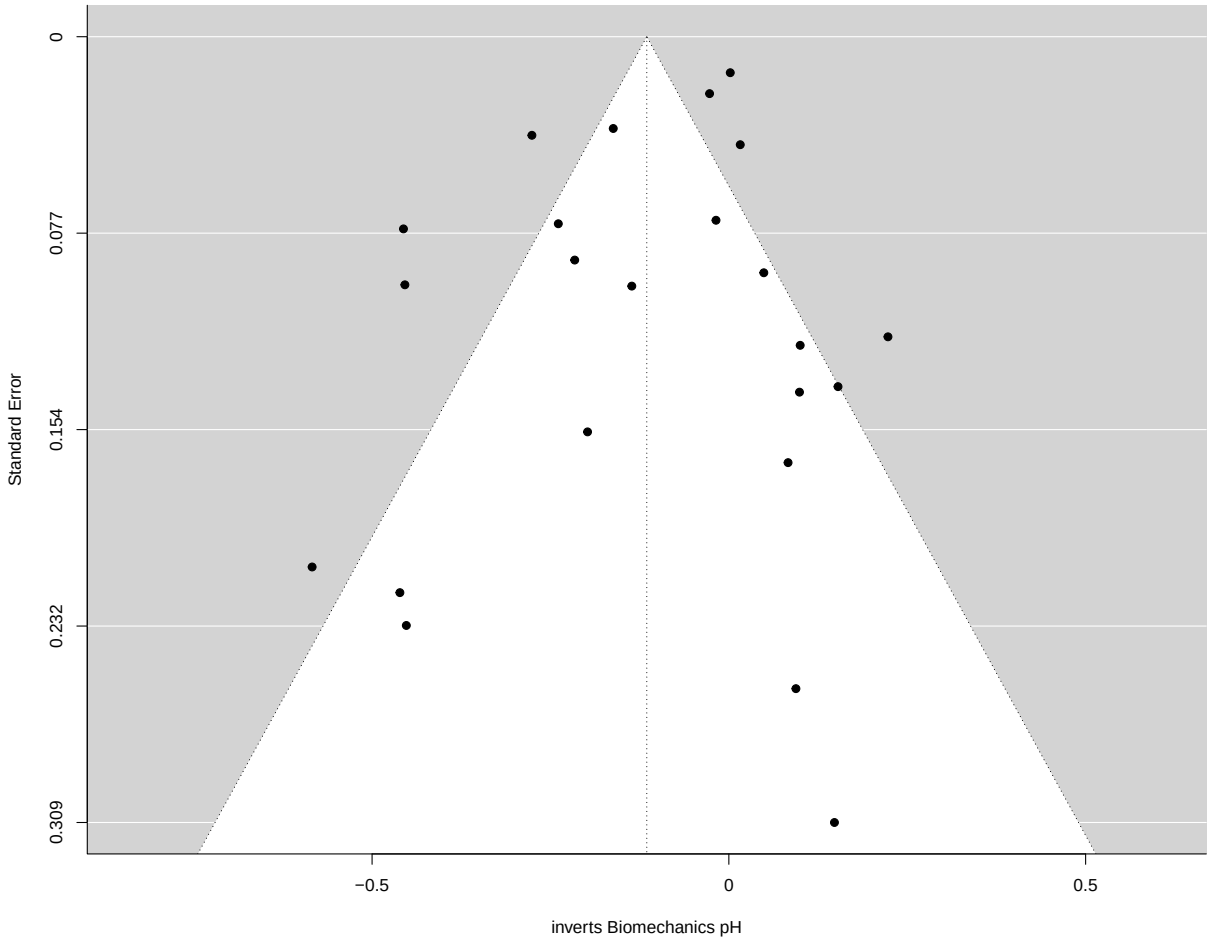
```
##
## Random-Effects Model (k = 18; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0690 (SE = 0.0293)
## tau (square root of estimated tau^2 value):      0.2627
## I^2 (total heterogeneity / total variability):   94.81%
## H^2 (total variability / sampling variability):  19.25
##
## Test for Heterogeneity:
## Q(df = 17) = 160.0385, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb   ci.ub
##  -0.0289  0.0701  -0.4125  0.6800  -0.1663  0.1085
```

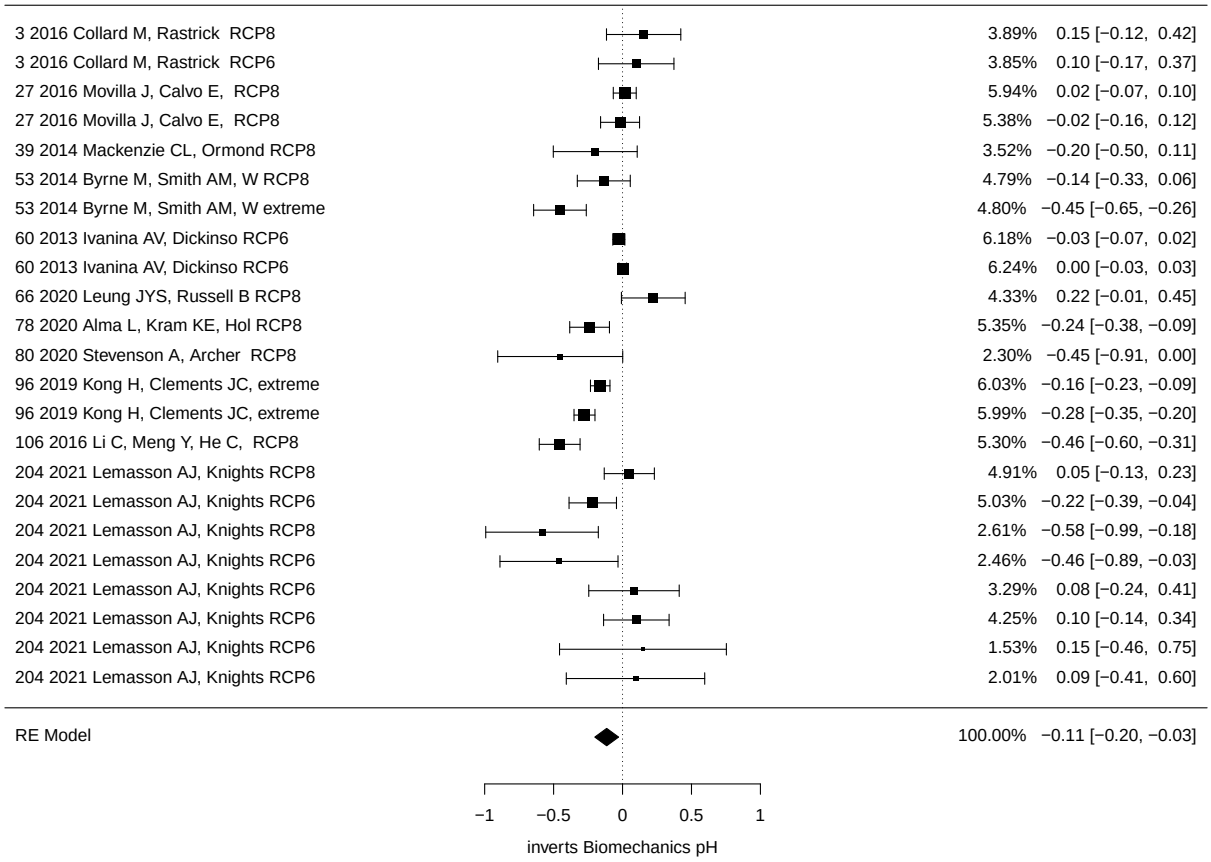
```
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



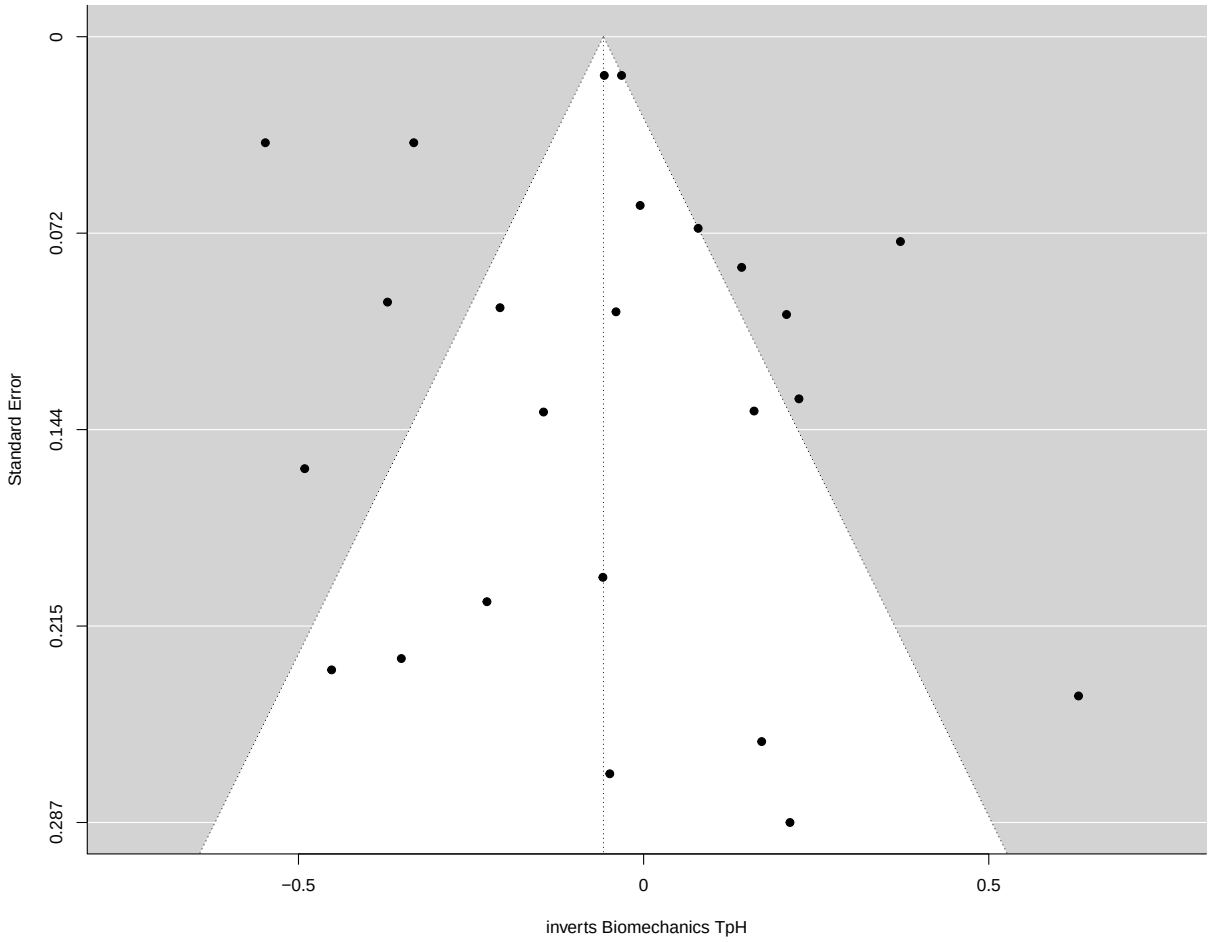


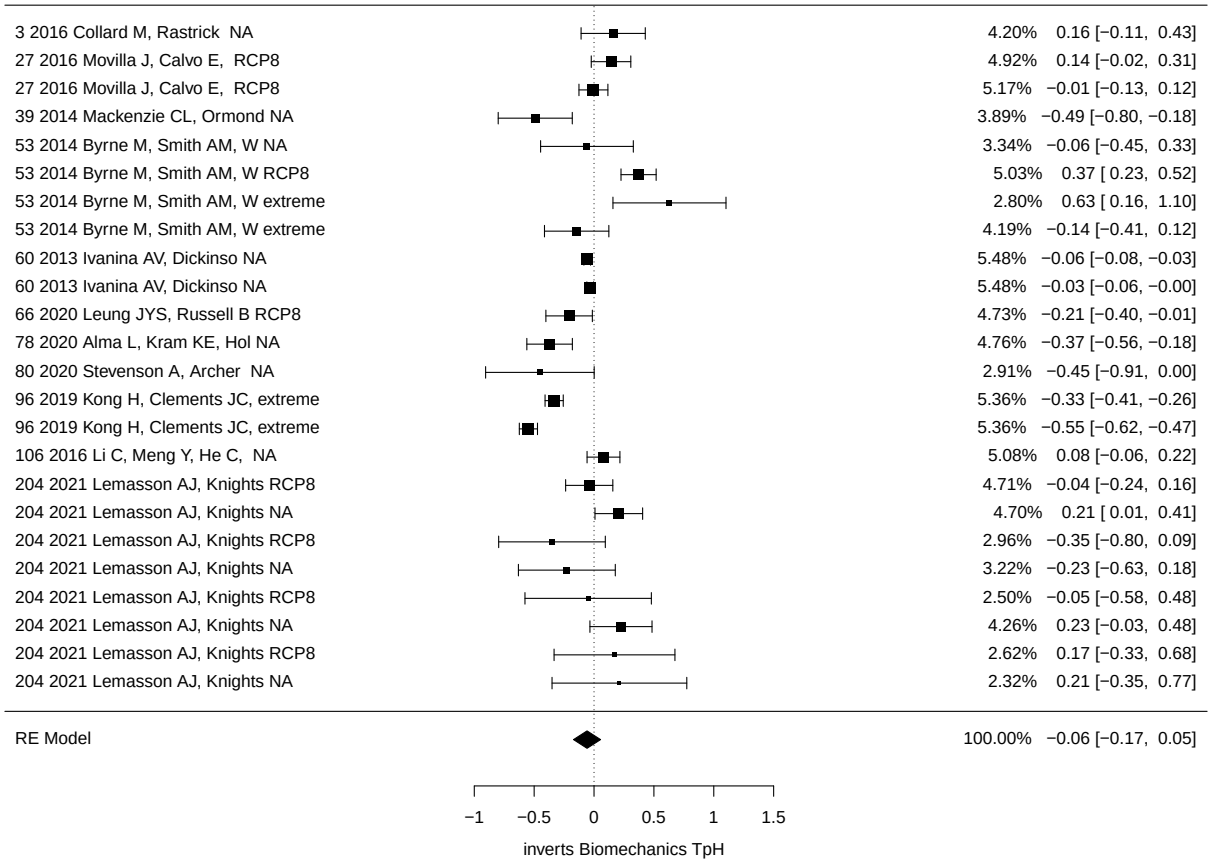

```
##
## Random-Effects Model (k = 23; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0308 (SE = 0.0128)
## tau (square root of estimated tau^2 value):      0.1754
## I^2 (total heterogeneity / total variability):   91.27%
## H^2 (total variability / sampling variability):  11.46
##
## Test for Heterogeneity:
## Q(df = 22) = 144.6044, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.1150  0.0440  -2.6147  0.0089  -0.2012  -0.0288  **
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```


Standard Error
0
0.077
0.154
0.232
0.309
−0.5
0
0.5
inverts Biomechanics pH




```
##
## Random-Effects Model (k = 24; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0603 (SE = 0.0228)
## tau (square root of estimated tau^2 value):      0.2456
## I^2 (total heterogeneity / total variability):   95.89%
## H^2 (total variability / sampling variability):  24.35
##
## Test for Heterogeneity:
## Q(df = 23) = 302.2425, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb   ci.ub
##  -0.0582  0.0576  -1.0111  0.3120  -0.1711  0.0546
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

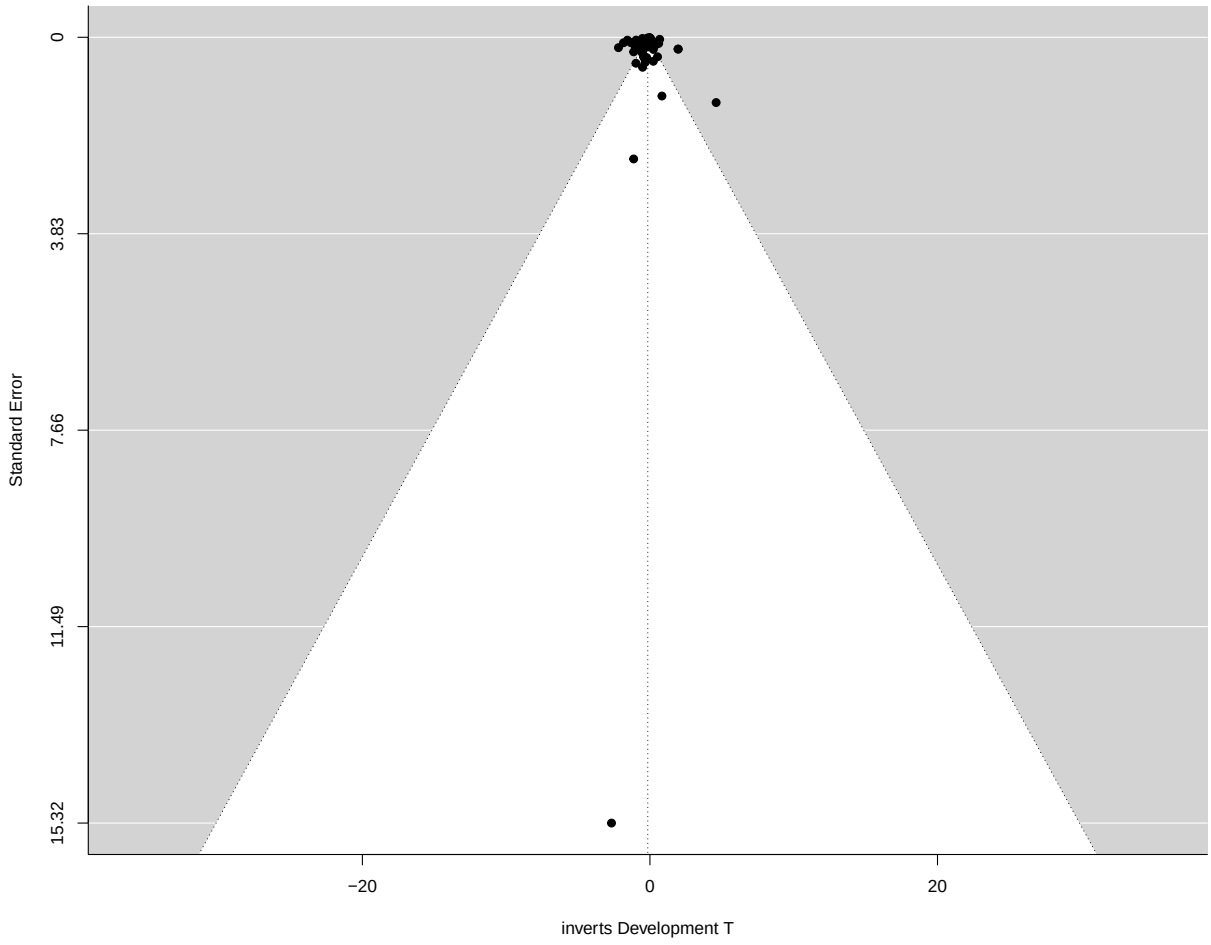

Standard Error
0
0.072
0.144
0.215
0.287
−0.5
0
0.5
inverts Biomechanics TpH



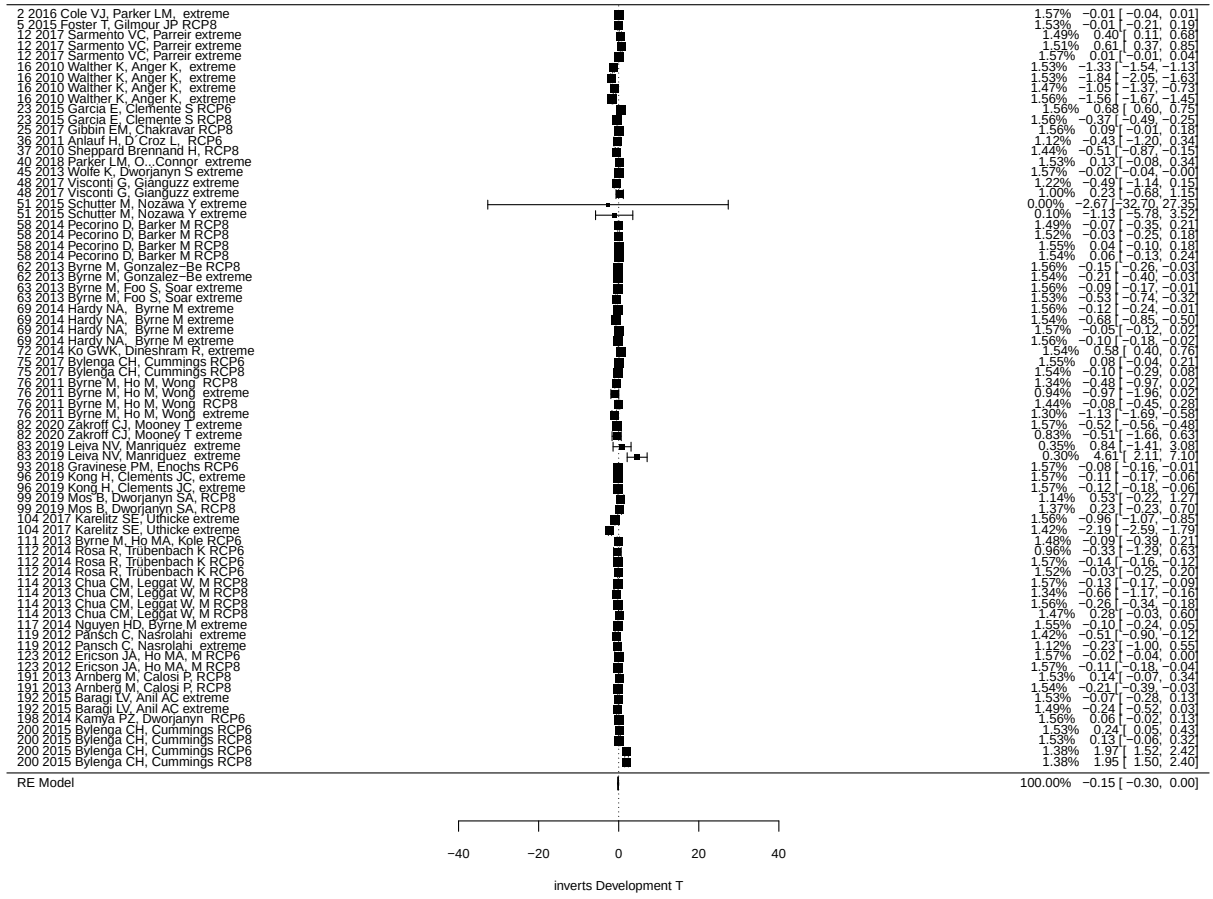

```
Abs_InvertBio <- MA_TpH_abs("inverts","Biomechanics", Inverts)

## Invertebrate, Development
InvertDev <- MA_TpH("inverts","Development", Inverts,sensitivity)
```

```
##
## Random-Effects Model (k = 72; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.3822 (SE = 0.0706)
## tau (square root of estimated tau^2 value):      0.6182
## I^2 (total heterogeneity / total variability):   99.63%
## H^2 (total variability / sampling variability):  272.67
##
## Test for Heterogeneity:
## Q(df = 71) = 2933.6282, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb   ci.ub
##  -0.1487  0.0775  -1.9188  0.0550  -0.3006  0.0032  .
```

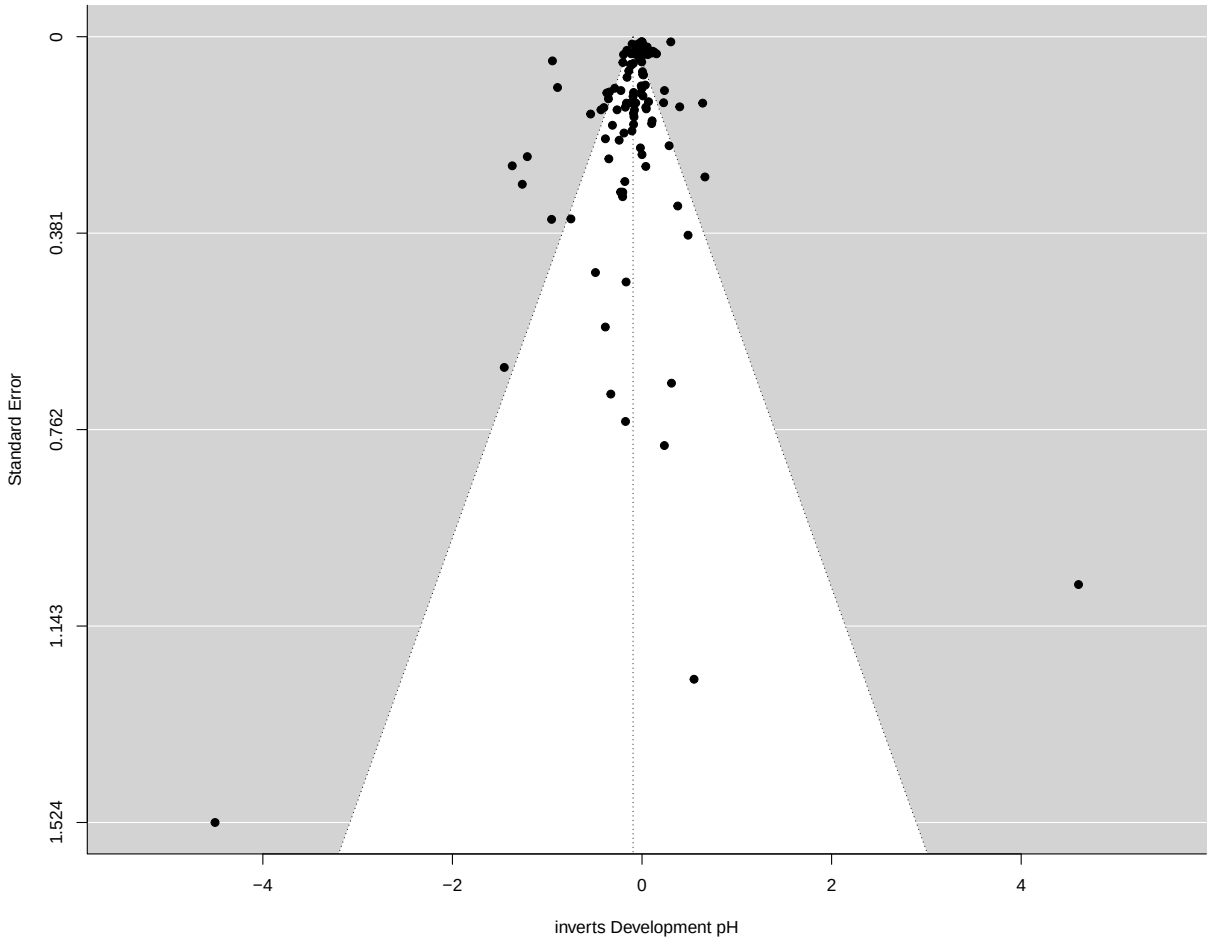
```
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



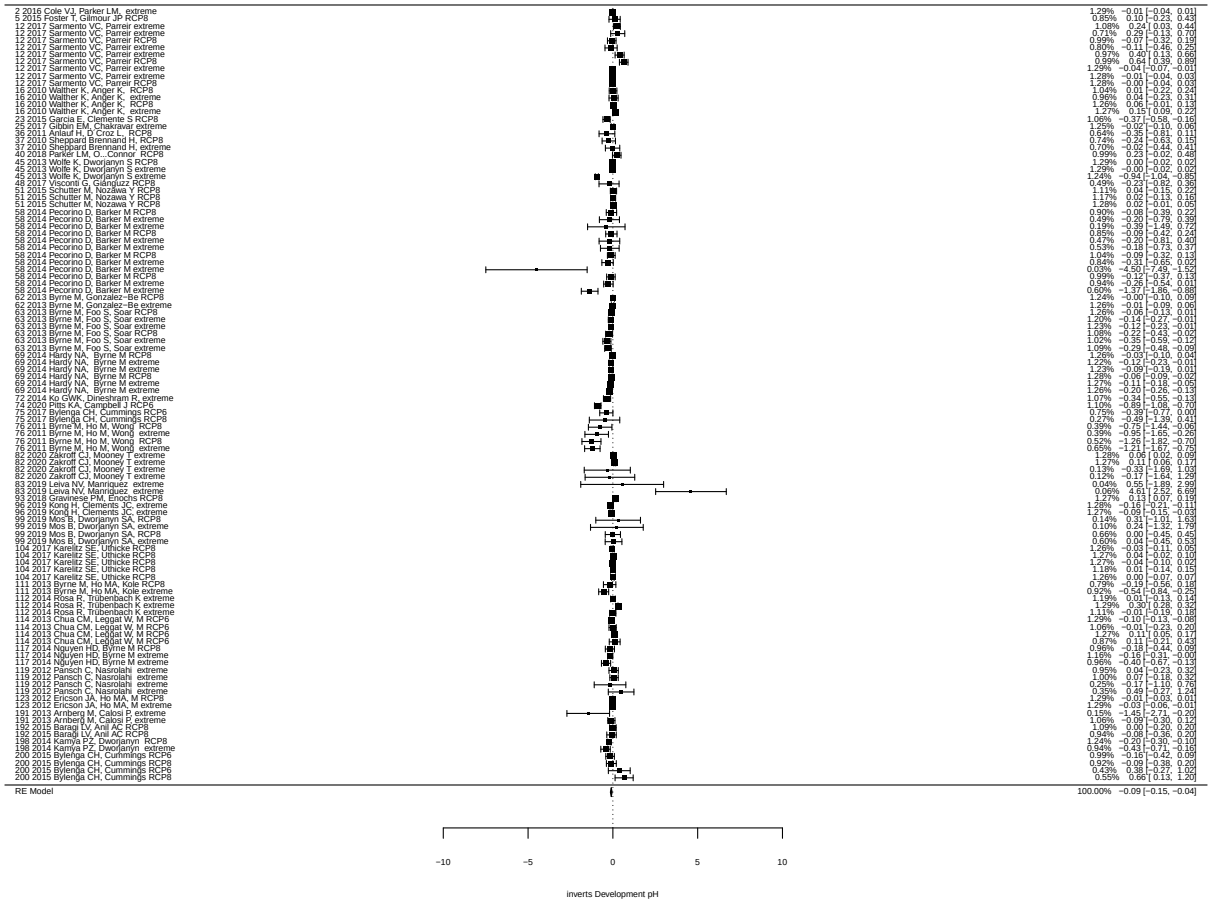

```
## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <99>
```



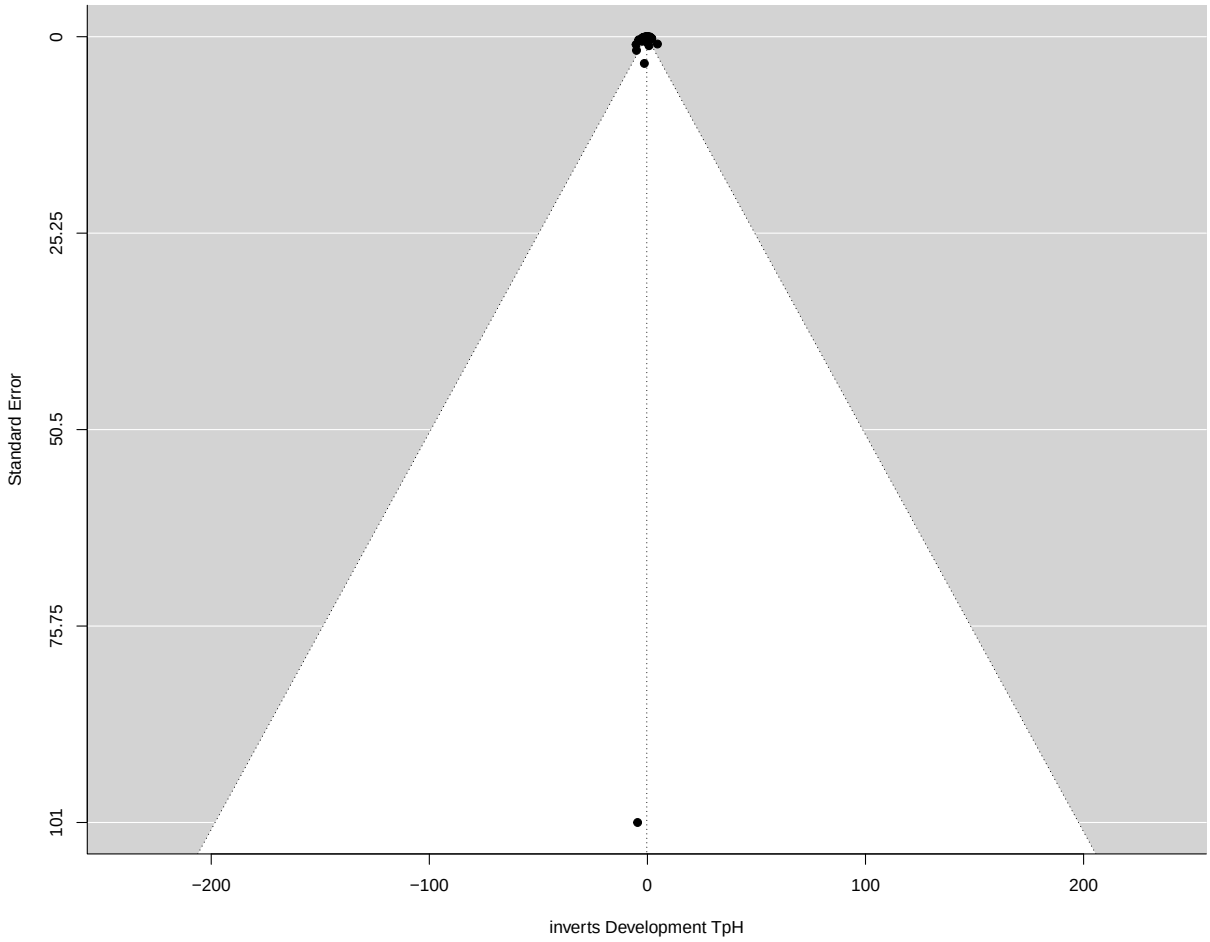

```
##
## Random-Effects Model (k = 108; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0547 (SE = 0.0097)
## tau (square root of estimated tau^2 value):      0.2338
## I^2 (total heterogeneity / total variability):   97.89%
## H^2 (total variability / sampling variability):  47.43
##
## Test for Heterogeneity:
## Q(df = 107) = 1972.8062, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.0946  0.0266  -3.5614  0.0004  -0.1467  -0.0426  ***
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



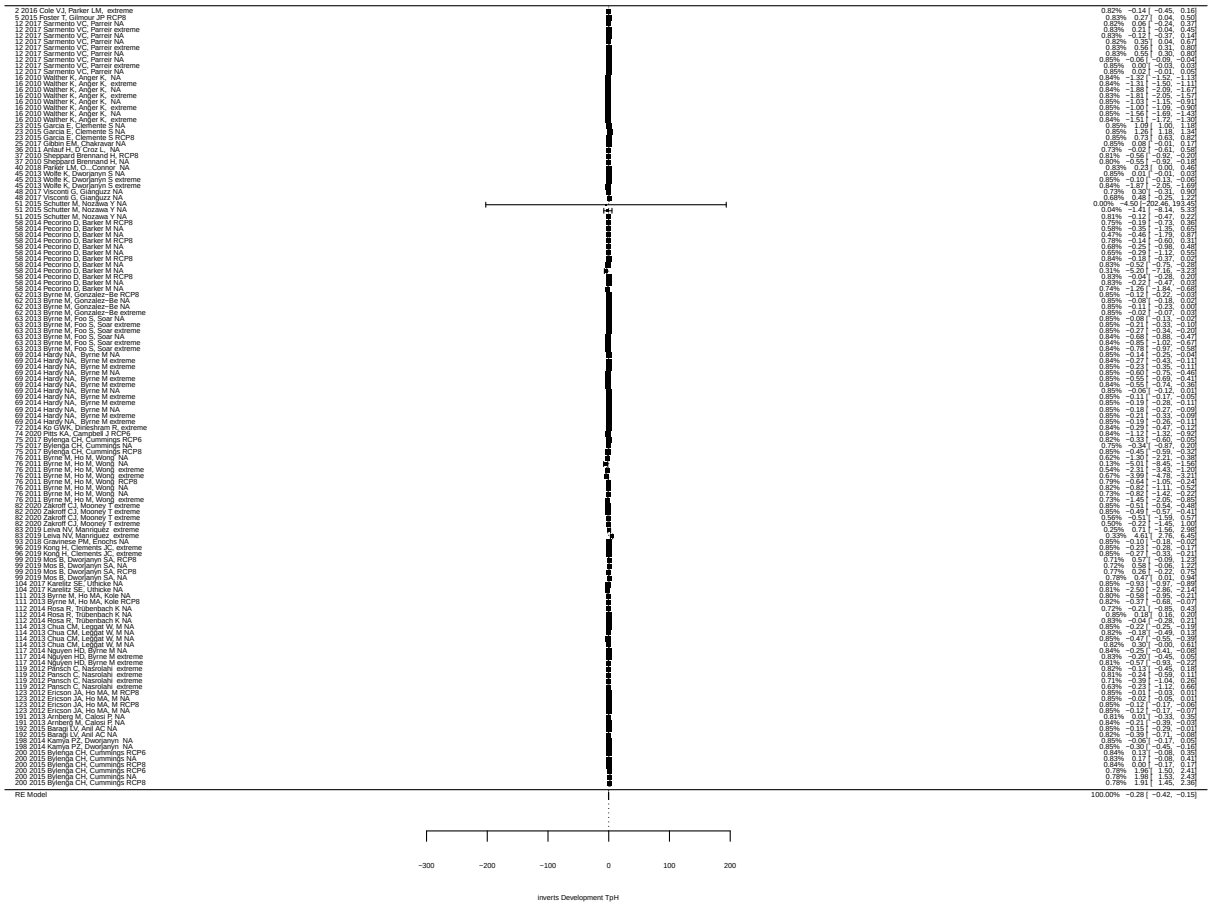

```
## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <99>

## Warning: Ratio of largest to smallest sampling variance extremely large. May not
## be able to obtain stable results.
```




```
##
## Random-Effects Model (k = 129; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.5652 (SE = 0.0763)
## tau (square root of estimated tau^2 value):      0.7518
## I^2 (total heterogeneity / total variability):   99.73%
## H^2 (total variability / sampling variability):  377.32
##
## Test for Heterogeneity:
## Q(df = 128) = 9737.9184, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.2827  0.0695  -4.0705  <.0001  -0.4189  -0.1466  ***
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```




```
## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <99>

## Warning: Ratio of largest to smallest sampling variance extremely large. May not
## be able to obtain stable results.
```



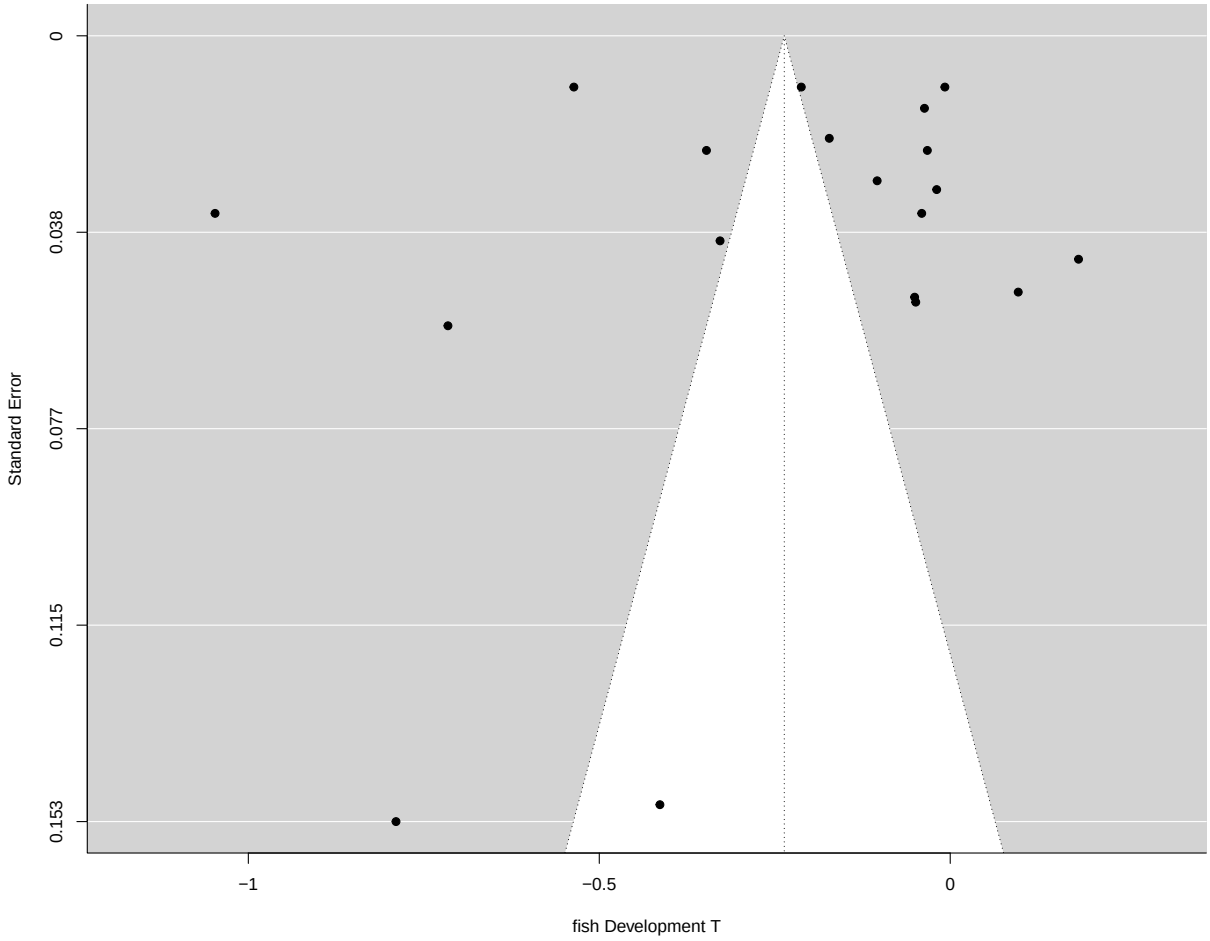

```
Abs_InvertDev <- MA_TpH_abs("inverts","Development", Inverts)
```

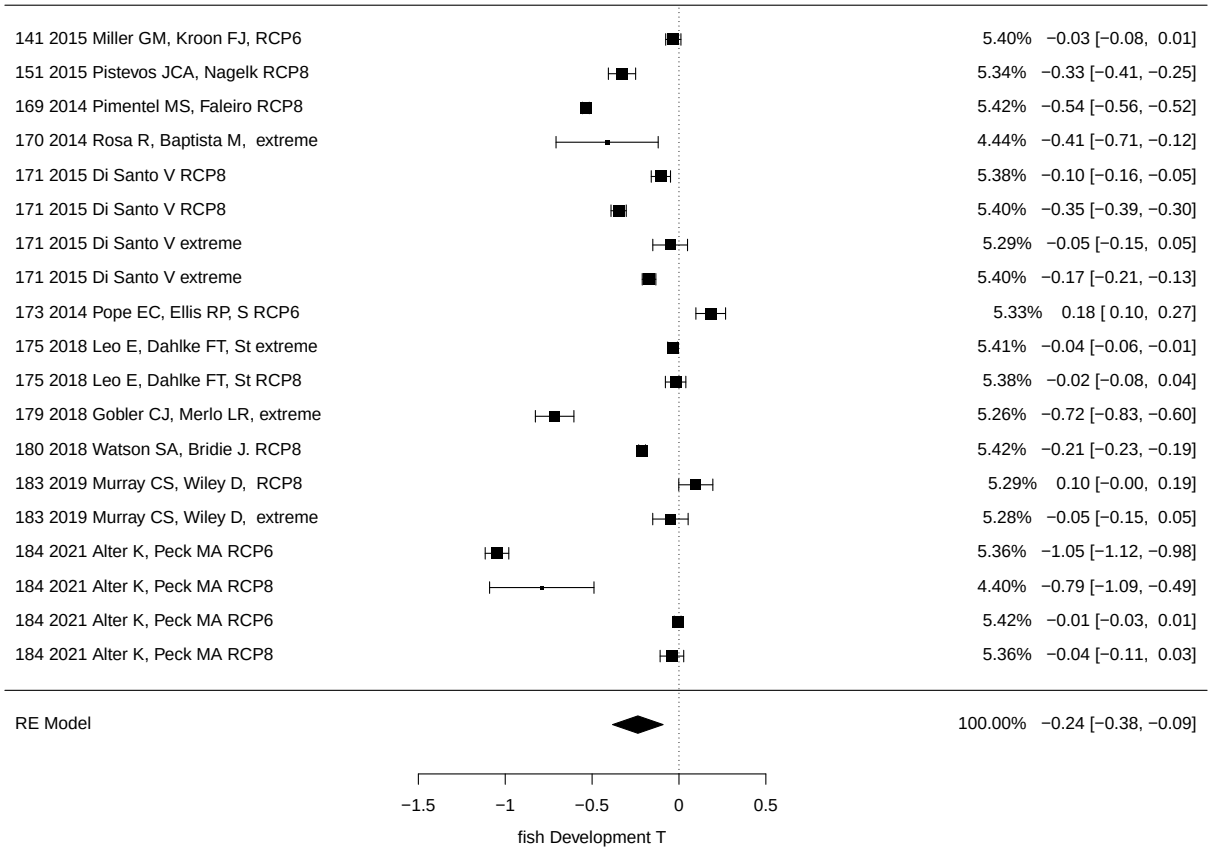
```
## Warning: Ratio of largest to smallest sampling variance extremely large. May not
## be able to obtain stable results.
```

```
## Fish, Development
FishDev  <- MA_TpH("fish","Development", Fish,sensitivity)
```

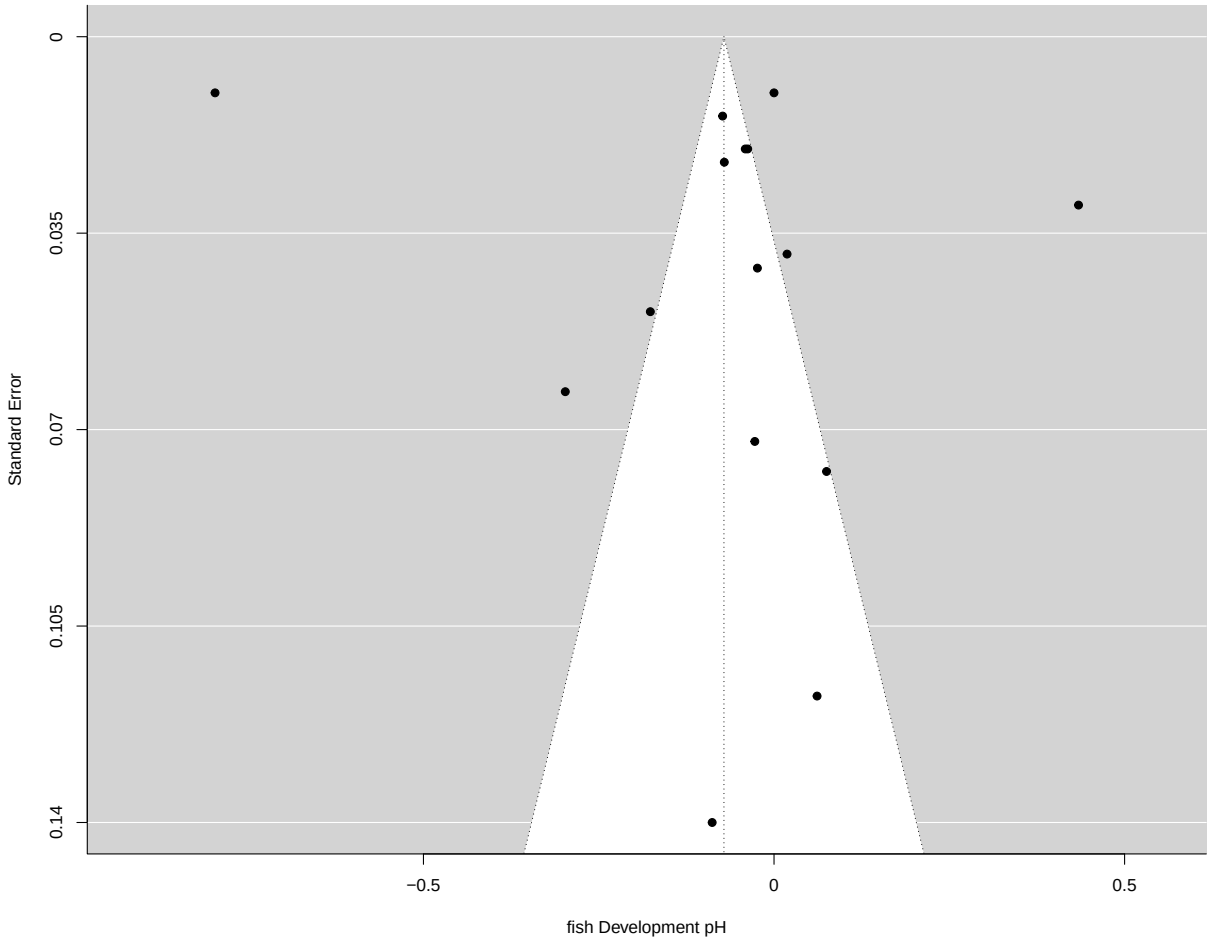
```
##
## Random-Effects Model (k = 19; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.1014 (SE = 0.0348)
## tau (square root of estimated tau^2 value):      0.3185
## I^2 (total heterogeneity / total variability):   99.57%
## H^2 (total variability / sampling variability):  232.54
##
## Test for Heterogeneity:
## Q(df = 18) = 2632.5175, p-val < .0001
##
```

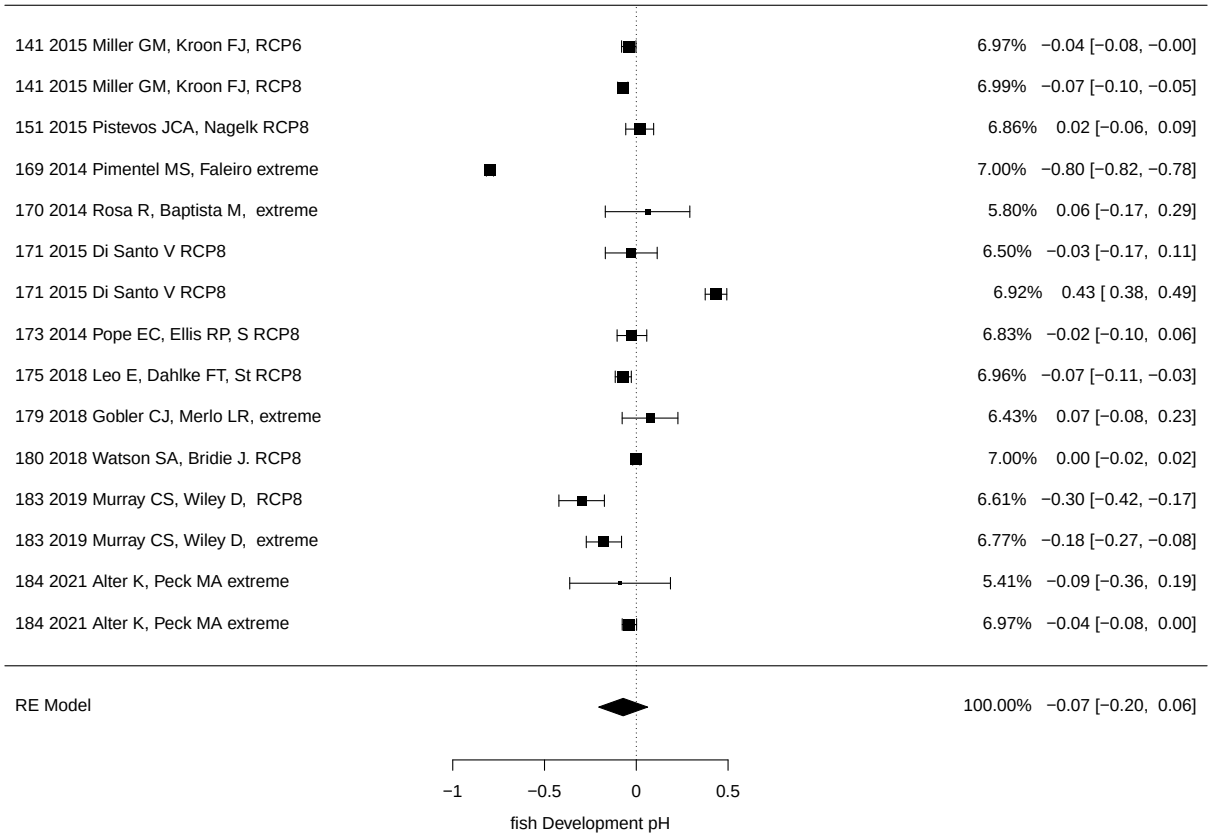
```
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.2365  0.0742  -3.1876  0.0014  -0.3819  -0.0911  **
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



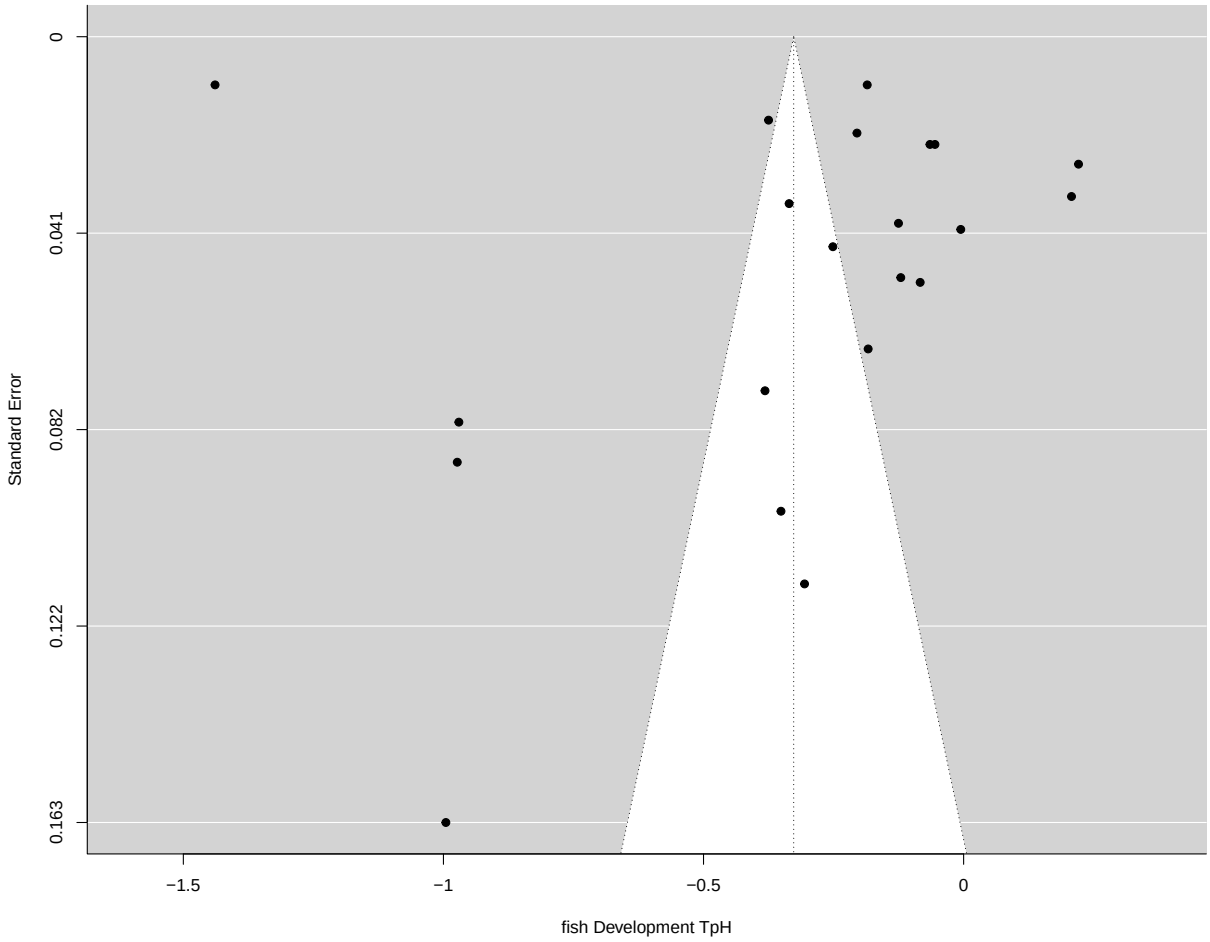


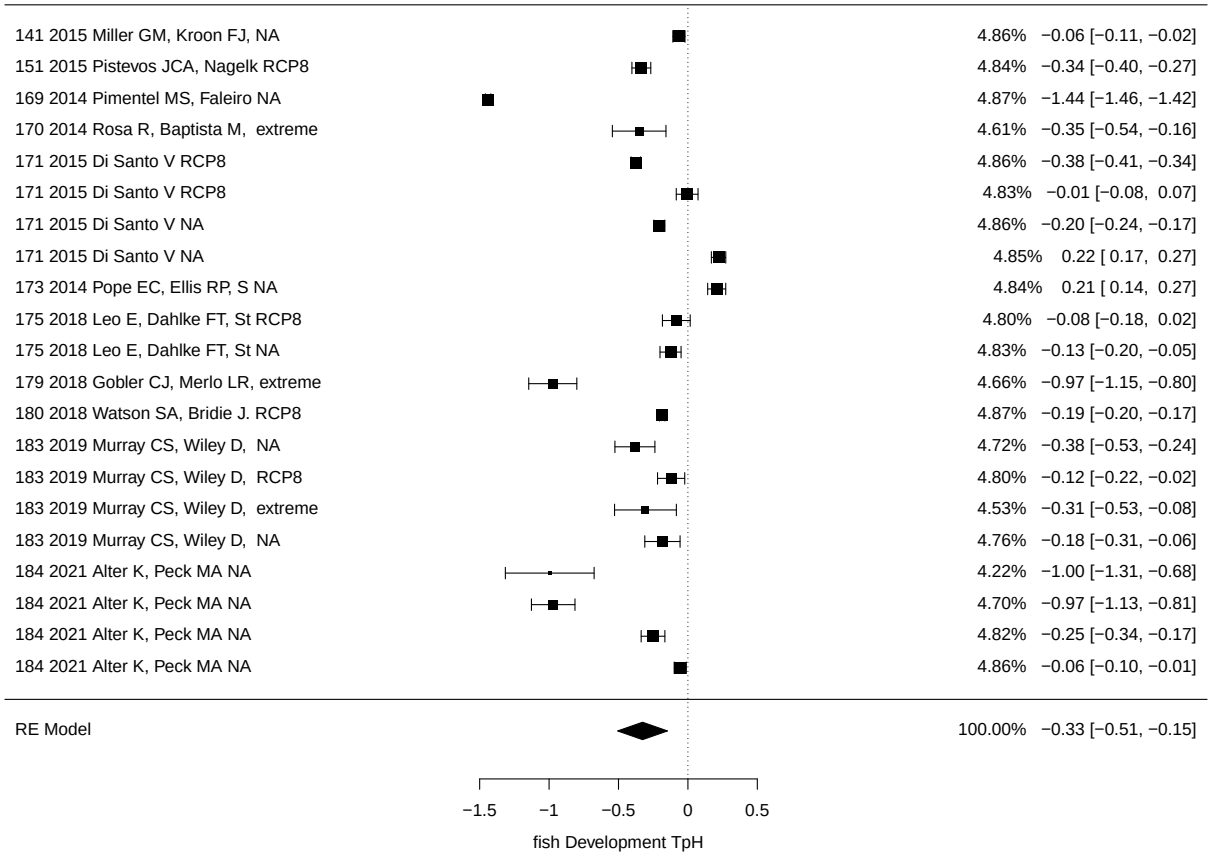

```
##
## Random-Effects Model (k = 15; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0660 (SE = 0.0262)
## tau (square root of estimated tau^2 value):      0.2570
## I^2 (total heterogeneity / total variability):   99.27%
## H^2 (total variability / sampling variability):  136.14
##
## Test for Heterogeneity:
## Q(df = 14) = 4690.1818, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb   ci.ub
##  -0.0714  0.0680  -1.0498  0.2938  -0.2048  0.0619
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```


Standard Error
0
0.035
0.07
0.105
0.14
−0.5
0
0.5
fish Development pH




```
##
## Random-Effects Model (k = 21; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.1722 (SE = 0.0557)
## tau (square root of estimated tau^2 value):      0.4150
## I^2 (total heterogeneity / total variability):   99.62%
## H^2 (total variability / sampling variability):  261.20
##
## Test for Heterogeneity:
## Q(df = 20) = 12571.3841, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.3266  0.0916  -3.5658  0.0004  -0.5061  -0.1471  ***
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

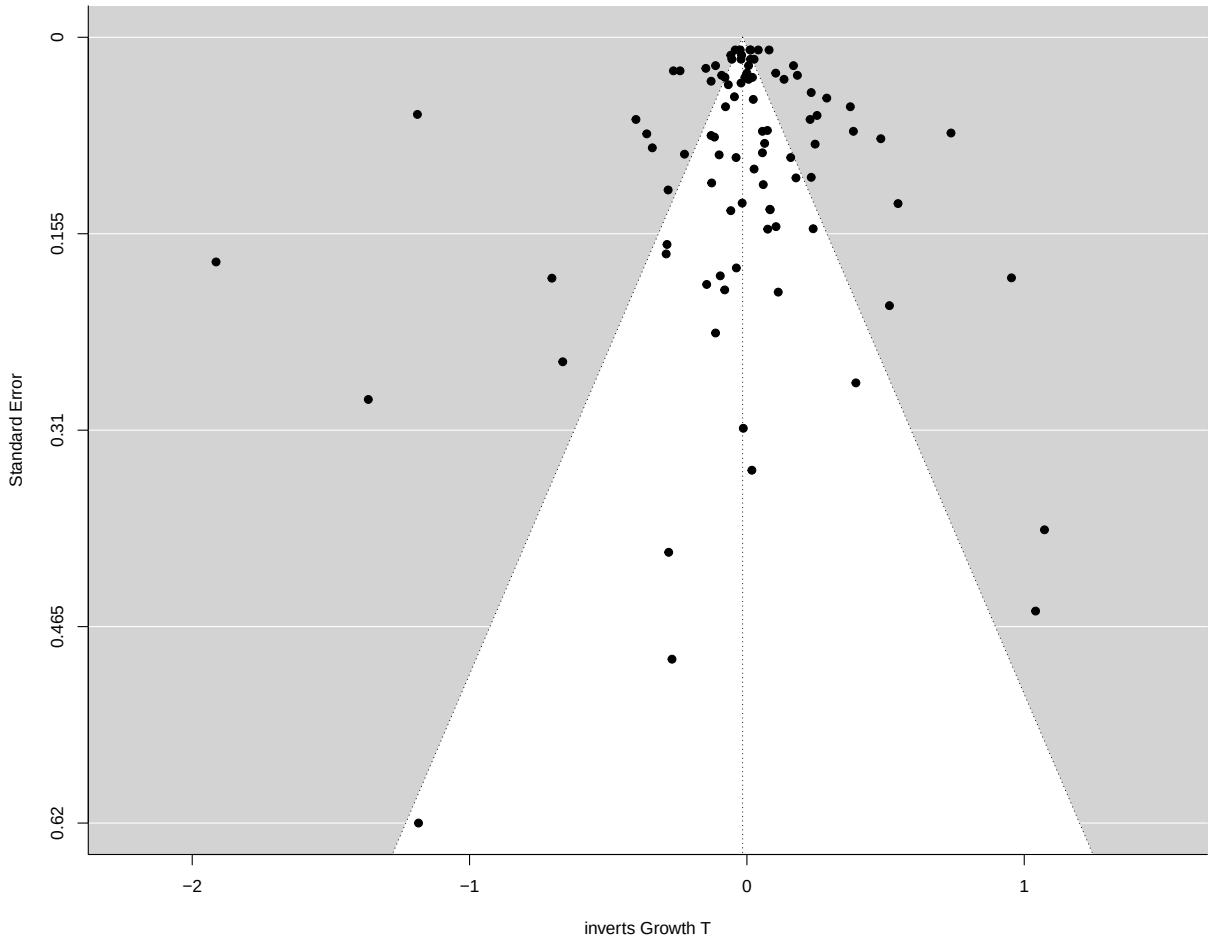

Standard Error
0
0.041
0.082
0.122
0.163
−1.5
−1
−0.5
0
fish Development TpH




```
Abs_FishDev  <- MA_TpH_abs("fish","Development", Fish)

## Invertebrate, Growth
InvertGrowth <- MA_TpH("inverts","Growth", Inverts,sensitivity)
```

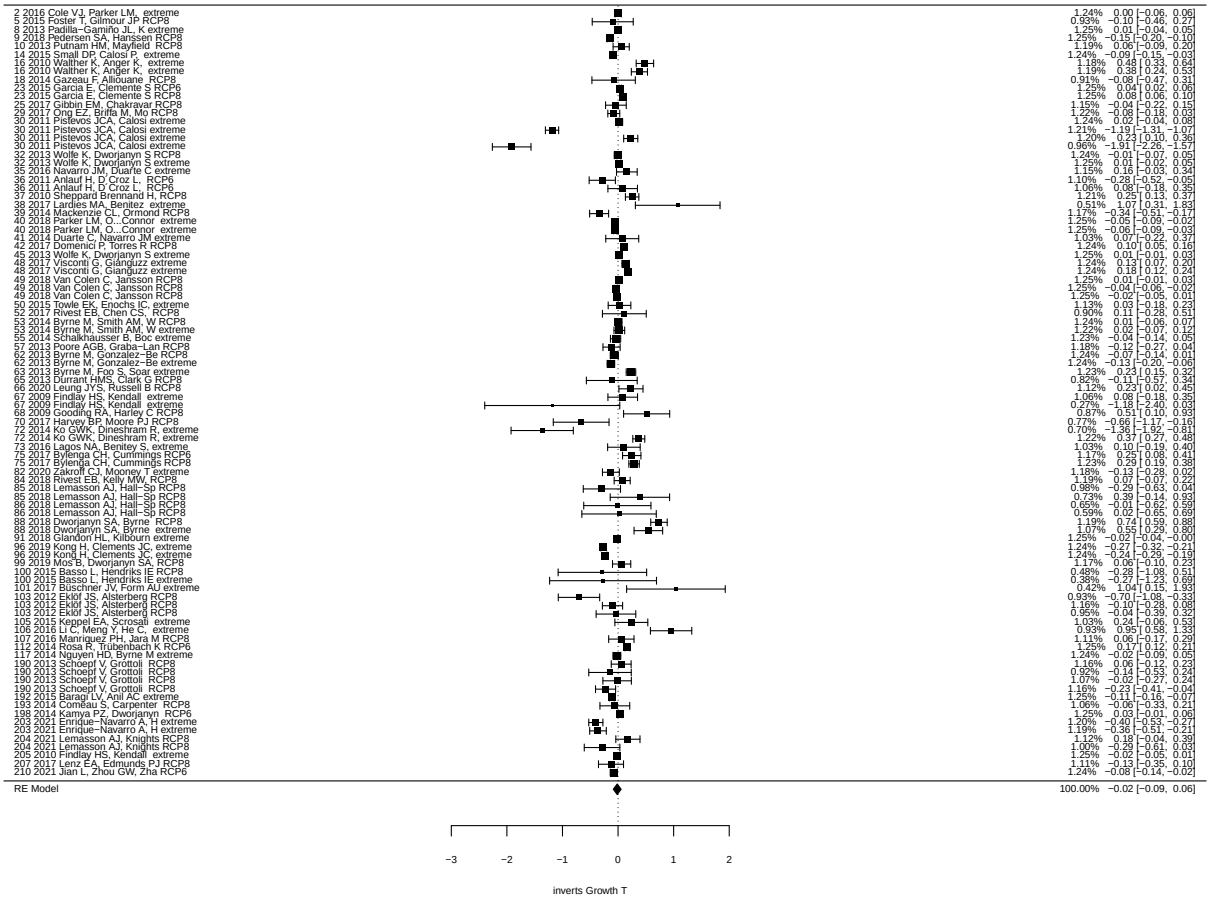
```
##
## Random-Effects Model (k = 92; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.1034 (SE = 0.0173)
## tau (square root of estimated tau^2 value):      0.3216
## I^2 (total heterogeneity / total variability):   99.18%
## H^2 (total variability / sampling variability):  122.02
##
## Test for Heterogeneity:
## Q(df = 91) = 1579.8303, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb   ci.ub
##  -0.0153  0.0360  -0.4260  0.6701  -0.0859  0.0552
```

```
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



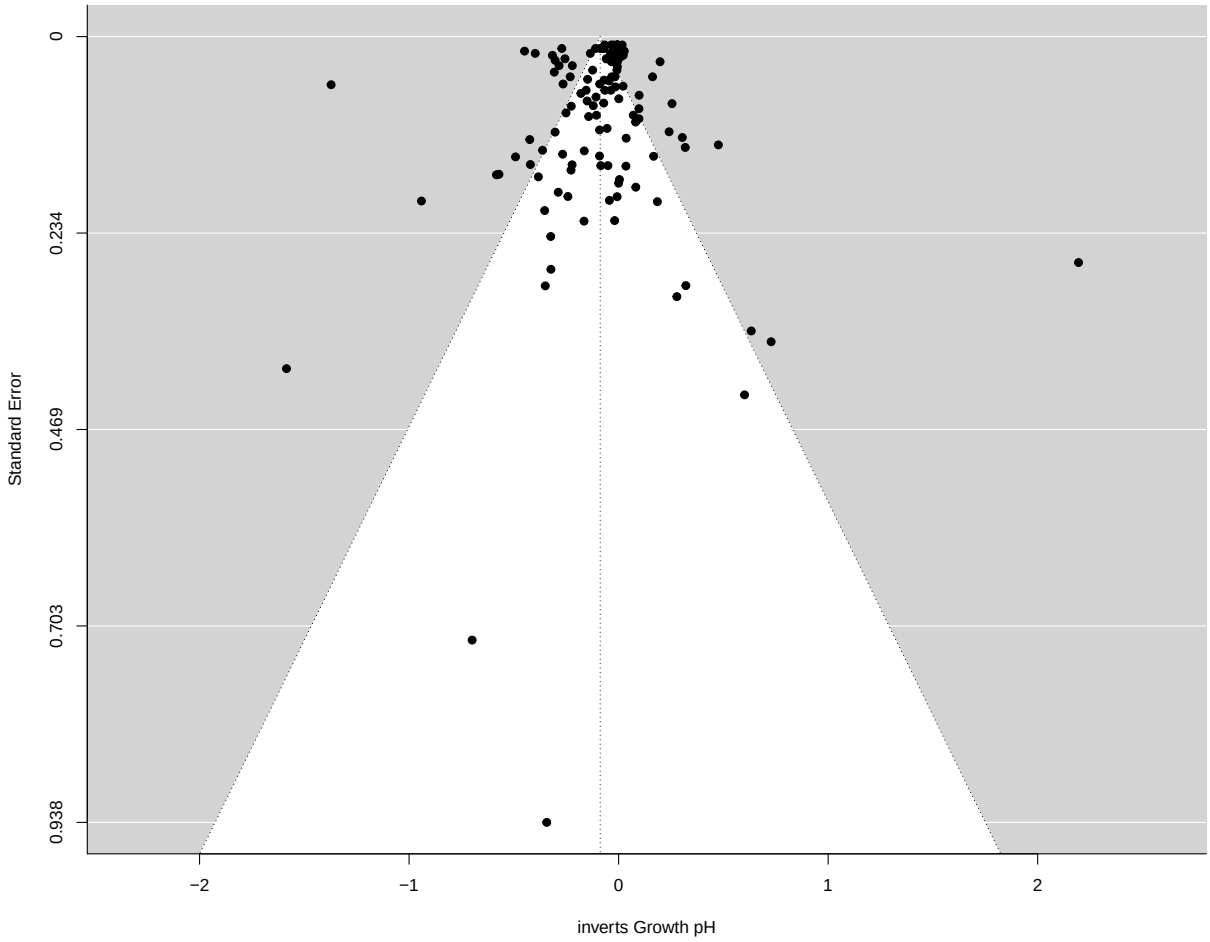

```
## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <99>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <80>
```

```
## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <99>
```

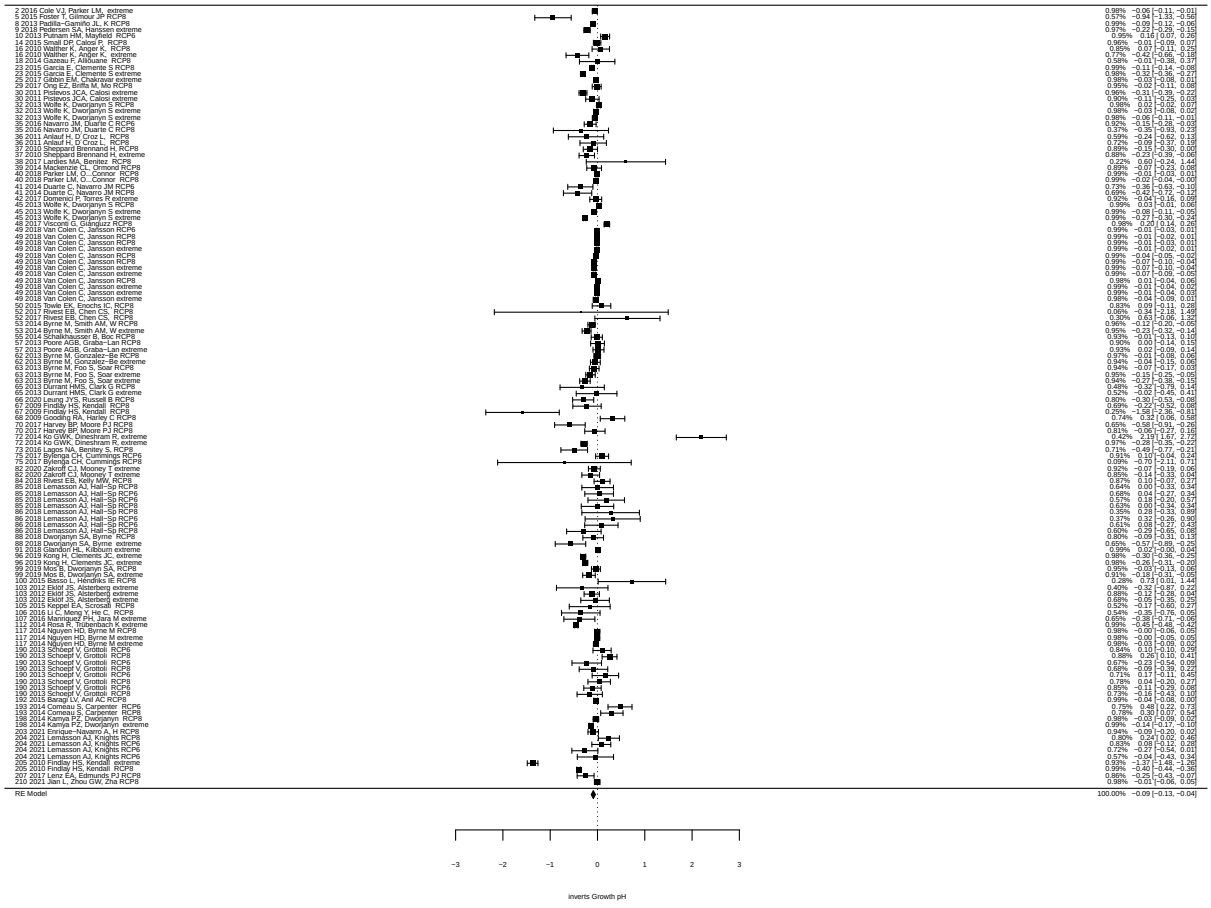



```
##
## Random-Effects Model (k = 124; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0524 (SE = 0.0079)
## tau (square root of estimated tau^2 value):      0.2289
## I^2 (total heterogeneity / total variability):   98.66%
## H^2 (total variability / sampling variability):  74.78
##
## Test for Heterogeneity:
## Q(df = 123) = 2658.0458, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.0880  0.0228  -3.8597  0.0001  -0.1327  -0.0433  ***
##
## ---
```

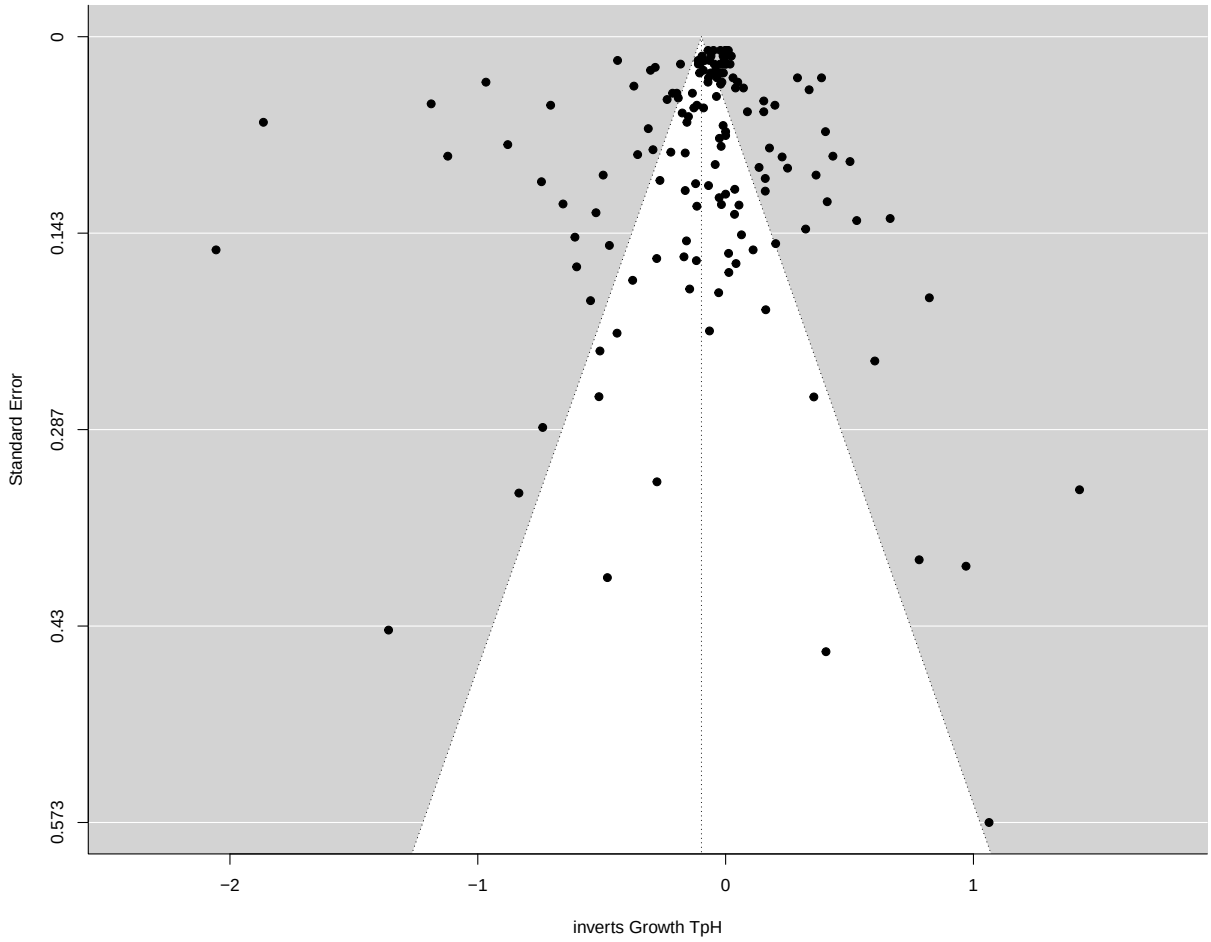
```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



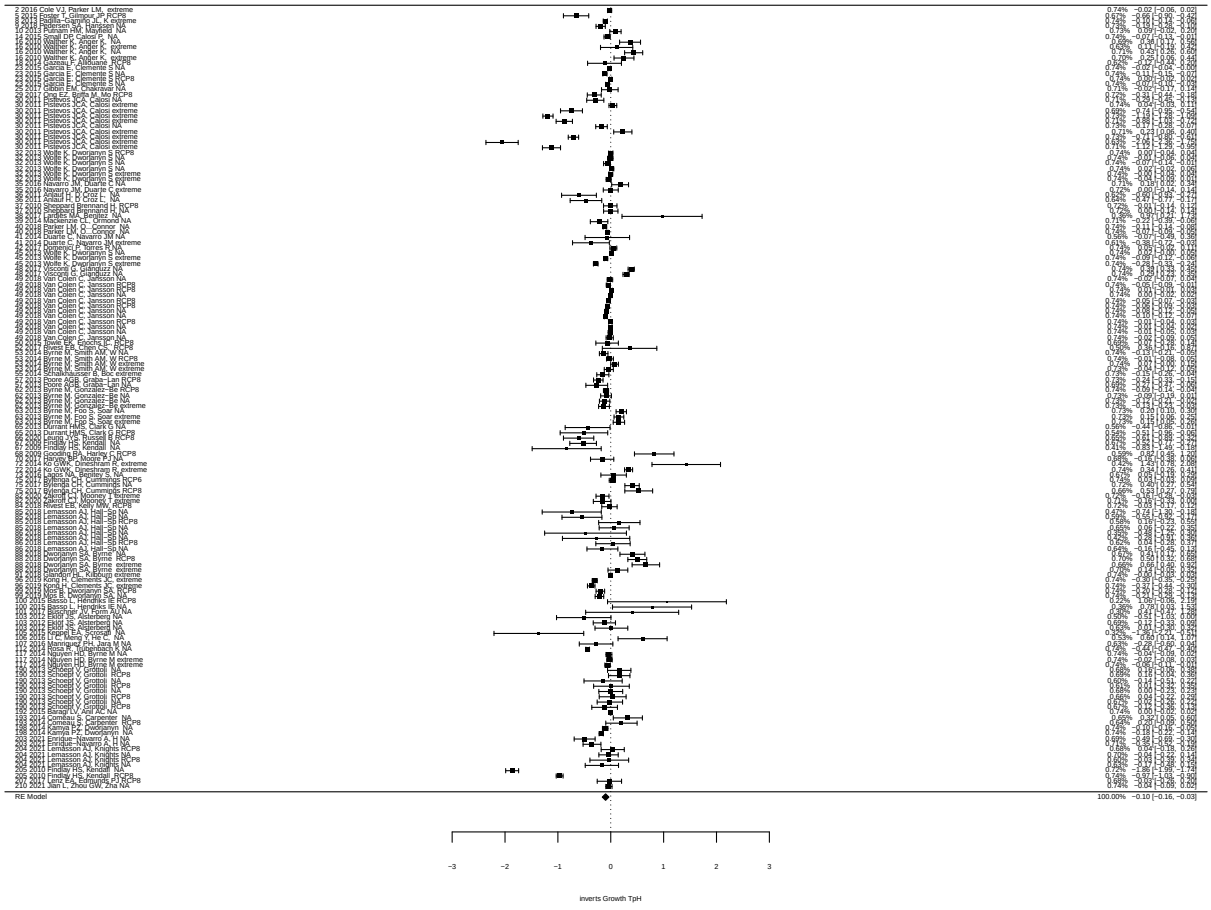

```
## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <99>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <99>
```




```
##
## Random-Effects Model (k = 148; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.1394 (SE = 0.0177)
## tau (square root of estimated tau^2 value):      0.3734
## I^2 (total heterogeneity / total variability):   99.40%
## H^2 (total variability / sampling variability):  165.90
##
## Test for Heterogeneity:
## Q(df = 147) = 5006.4575, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.0975  0.0322  -3.0277  0.0025  -0.1607  -0.0344  **
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



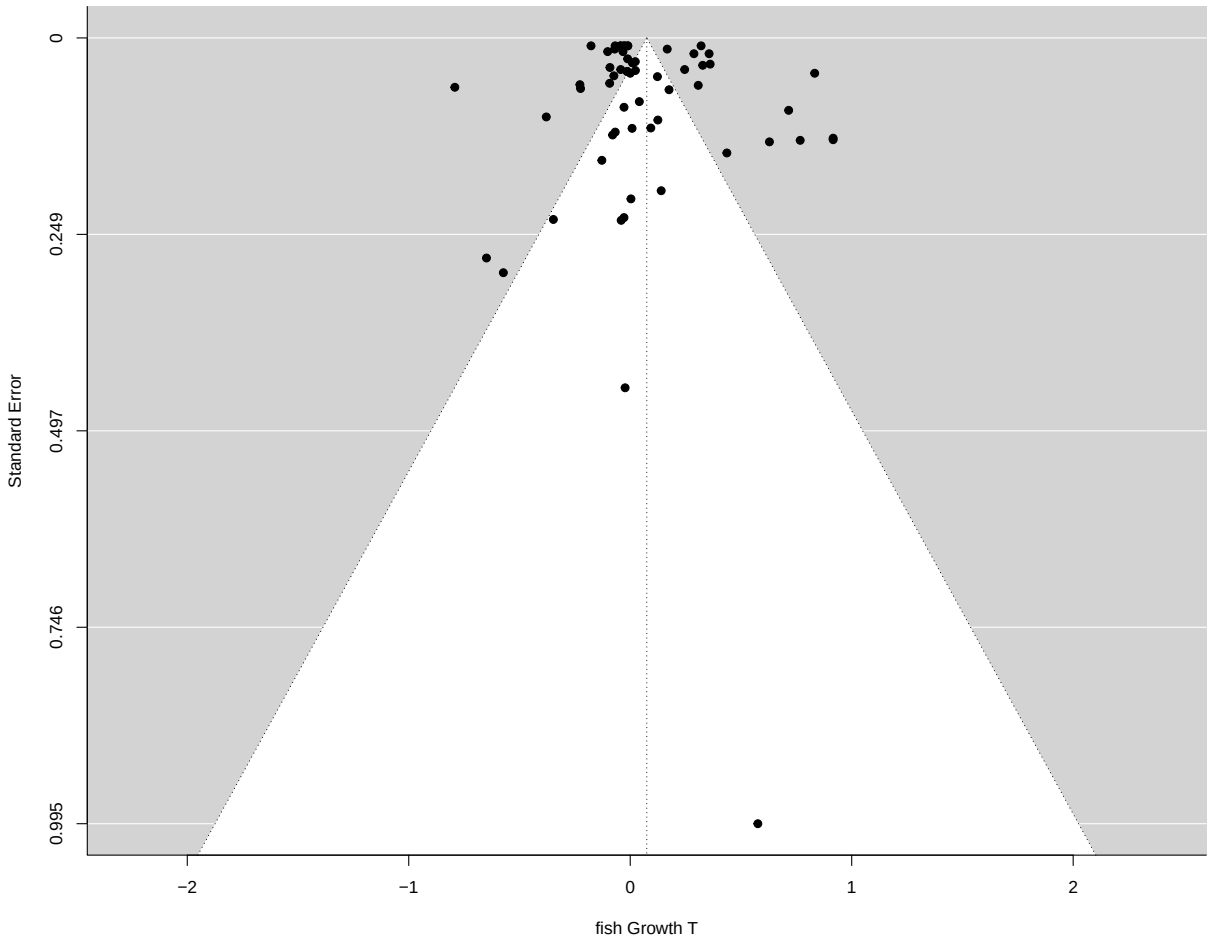

```
## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <99>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <99>
```

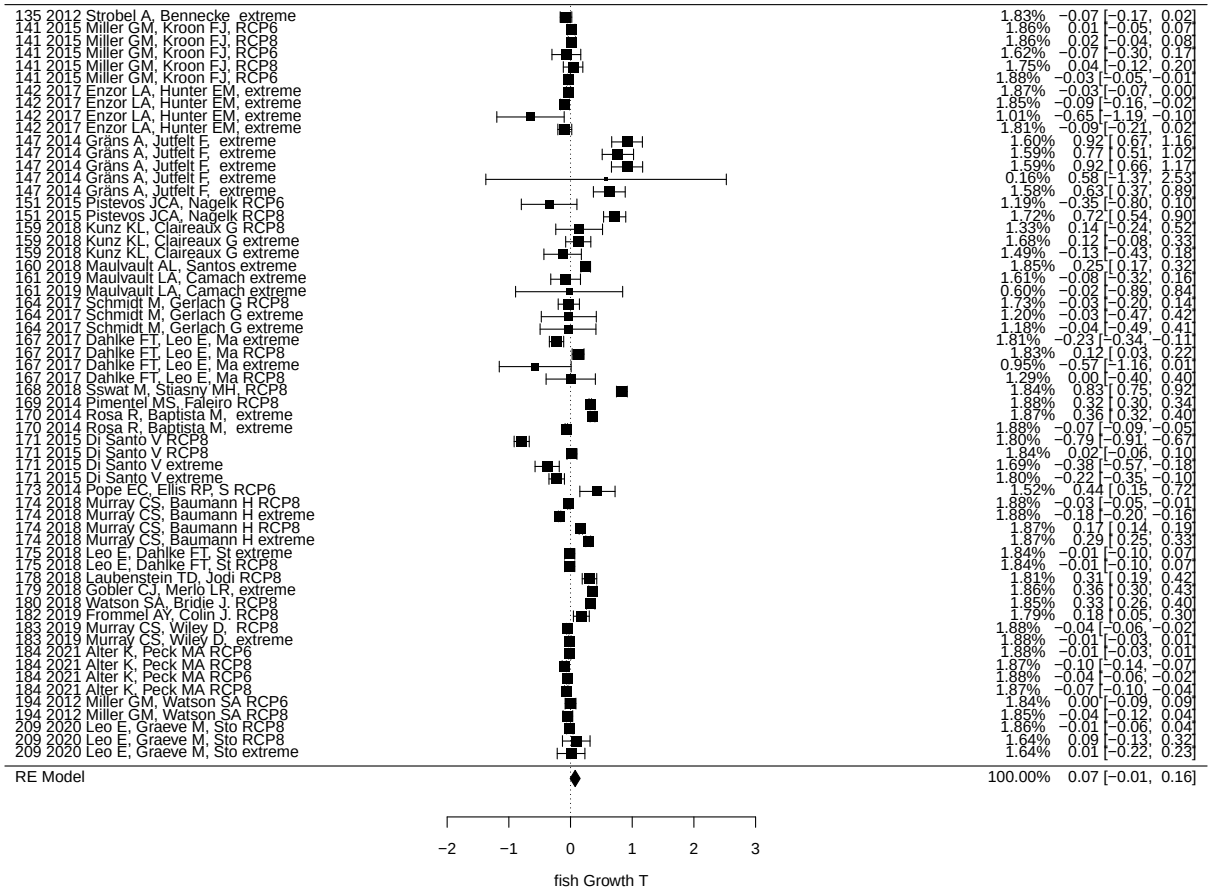



```
Abs_InvertGrowth <- MA_TpH_abs("inverts","Growth", Inverts)

##Fish, Growth
FishGrowth <- MA_TpH("fish","Growth", Fish,sensitivity)
```

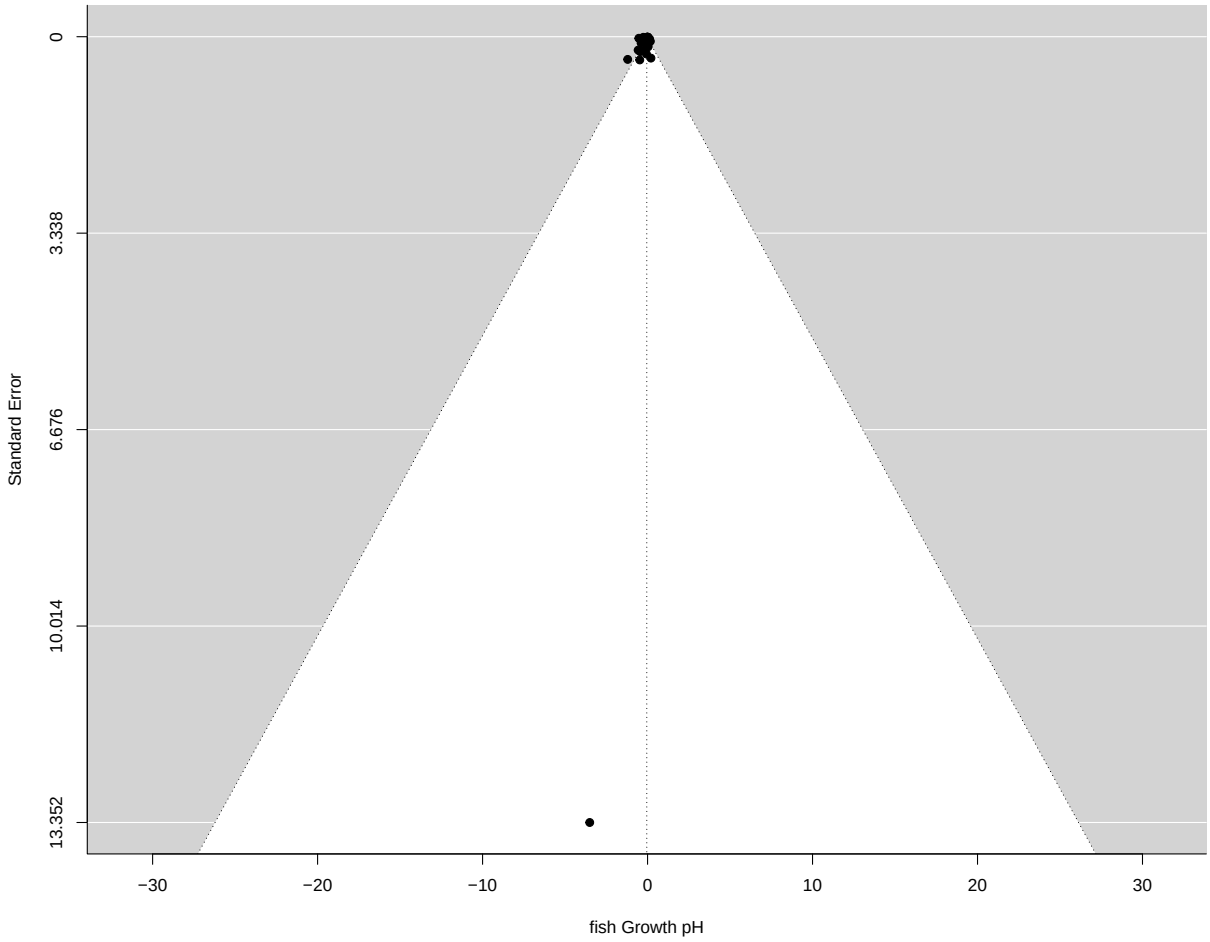
```
## Warning: Fisher scoring algorithm may have gotten stuck at a local maximum.
## Setting tau^2 = 0. Check the profile likelihood plot with profile().

##
## Random-Effects Model (k = 60; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0910 (SE = 0.0185)
## tau (square root of estimated tau^2 value):      0.3017
## I^2 (total heterogeneity / total variability):   99.45%
## H^2 (total variability / sampling variability):  182.24
##
## Test for Heterogeneity:
## Q(df = 59) = 3230.4106, p-val < .0001
##
## Model Results:
```

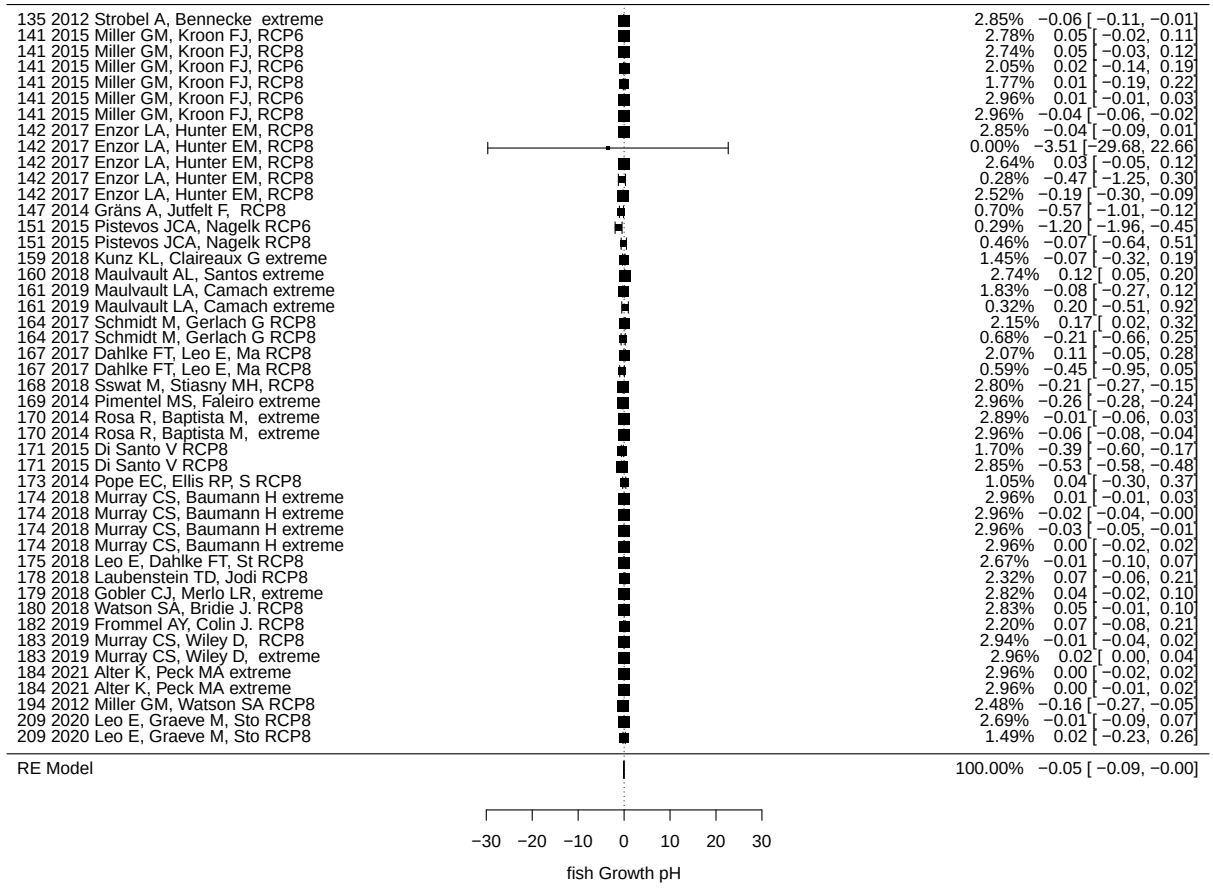
```
##
## estimate      se    zval    pval    ci.lb   ci.ub
##   0.0749  0.0413  1.8108  0.0702  -0.0062  0.1559  .
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



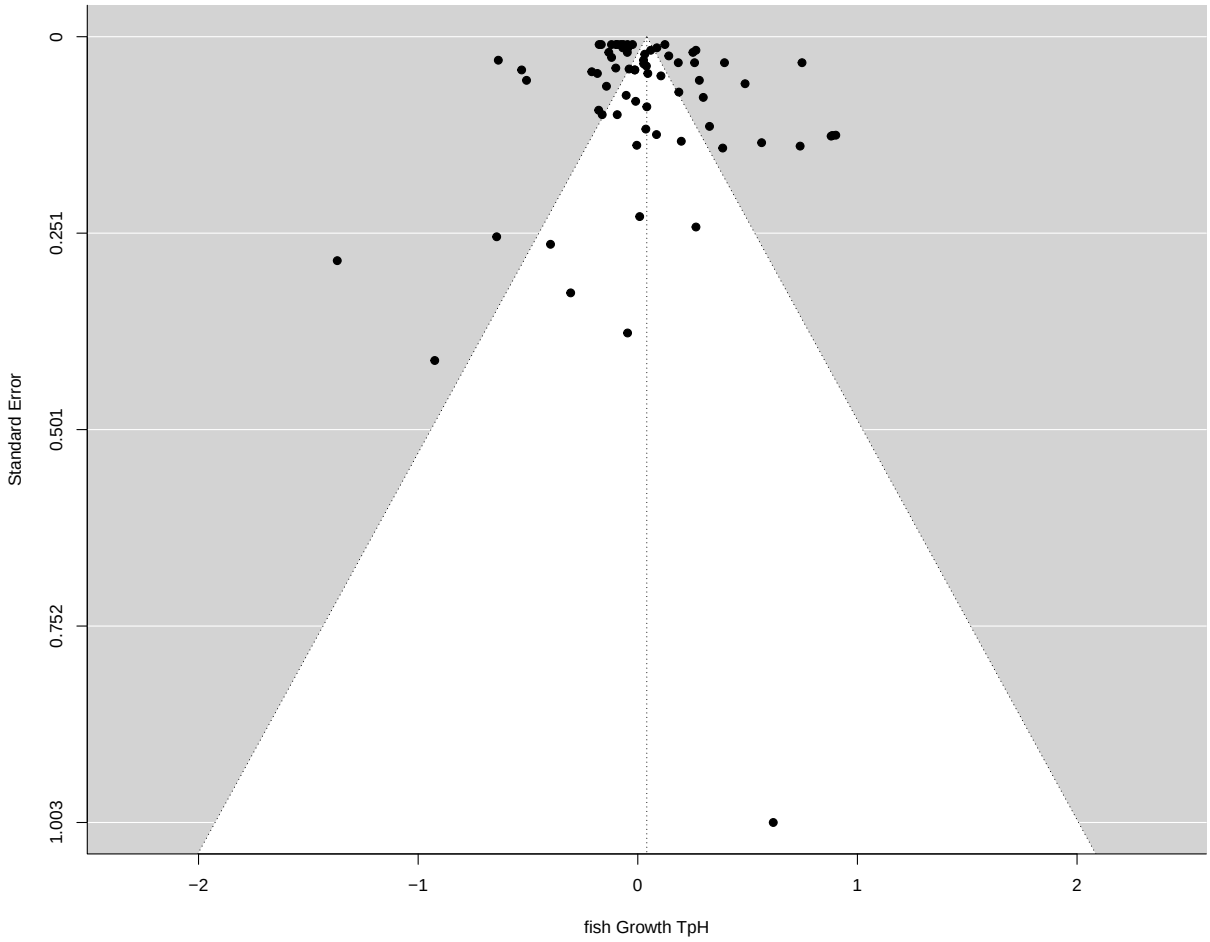


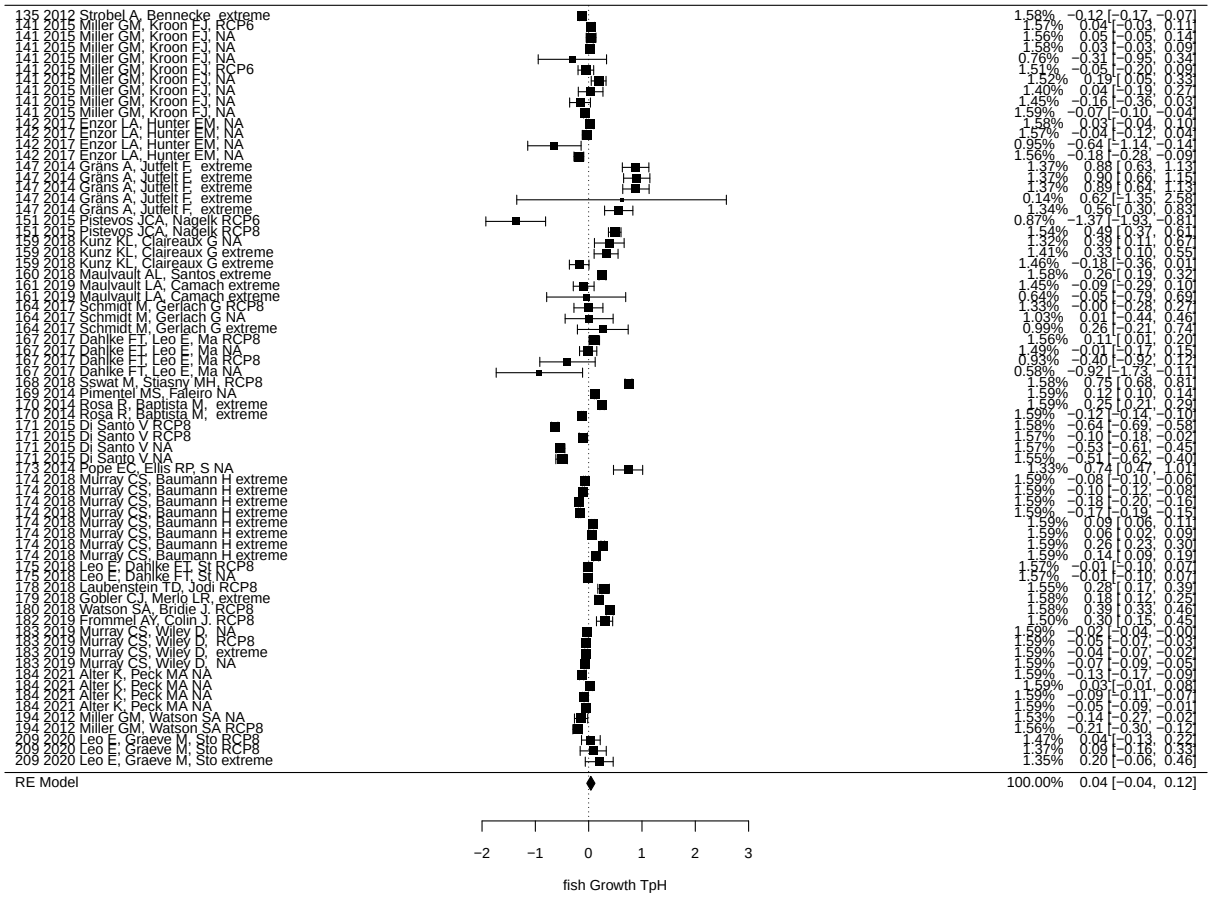

```
##
## Random-Effects Model (k = 46; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0159 (SE = 0.0042)
## tau (square root of estimated tau^2 value):      0.1261
## I^2 (total heterogeneity / total variability):   97.73%
## H^2 (total variability / sampling variability):  44.11
##
## Test for Heterogeneity:
## Q(df = 45) = 1113.9392, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb    ci.ub
##  -0.0460  0.0218  -2.1160  0.0343  -0.0887  -0.0034  *
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```


Standard Error
0
3.338
6.676
10.014
13.352
−30
−20
−10
0
10
20
30
fish Growth pH




```
##
## Random-Effects Model (k = 70; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0968 (SE = 0.0181)
## tau (square root of estimated tau^2 value):      0.3111
## I^2 (total heterogeneity / total variability):   99.50%
## H^2 (total variability / sampling variability):  199.98
##
## Test for Heterogeneity:
## Q(df = 69) = 3426.5911, p-val < .0001
##
## Model Results:
##
## estimate      se    zval    pval    ci.lb   ci.ub
##   0.0410  0.0393  1.0439  0.2965  -0.0360  0.1181
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

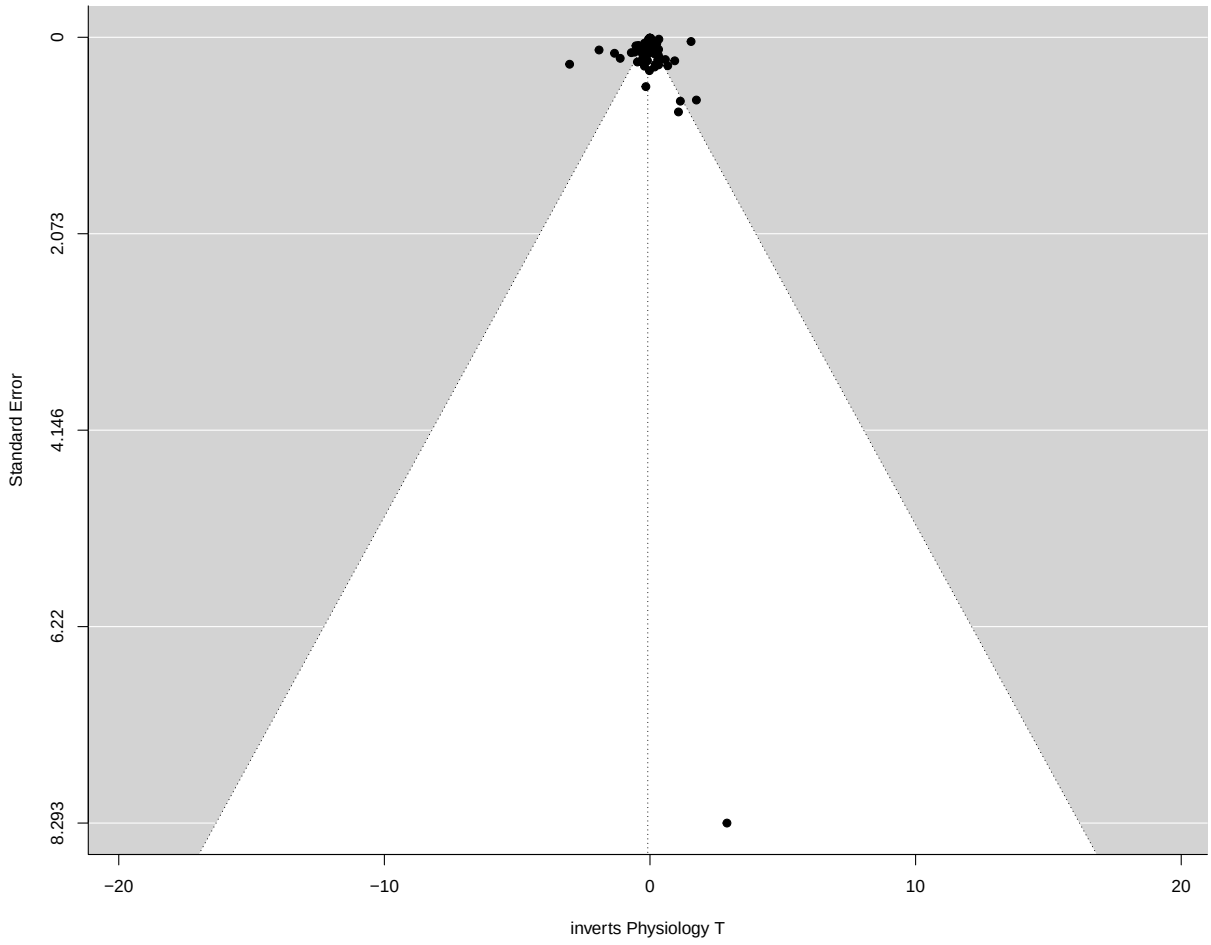

Standard Error
0
0.251
0.501
0.752
1.003
−2
−1
0
1
2
fish Growth TpH




```
Abs_FishGrowth <- MA_TpH_abs("fish","Growth", Fish)

## Invertebrate, Physiology
InvertPhys <- MA_TpH("inverts","Physiology", Inverts,sensitivity)
```

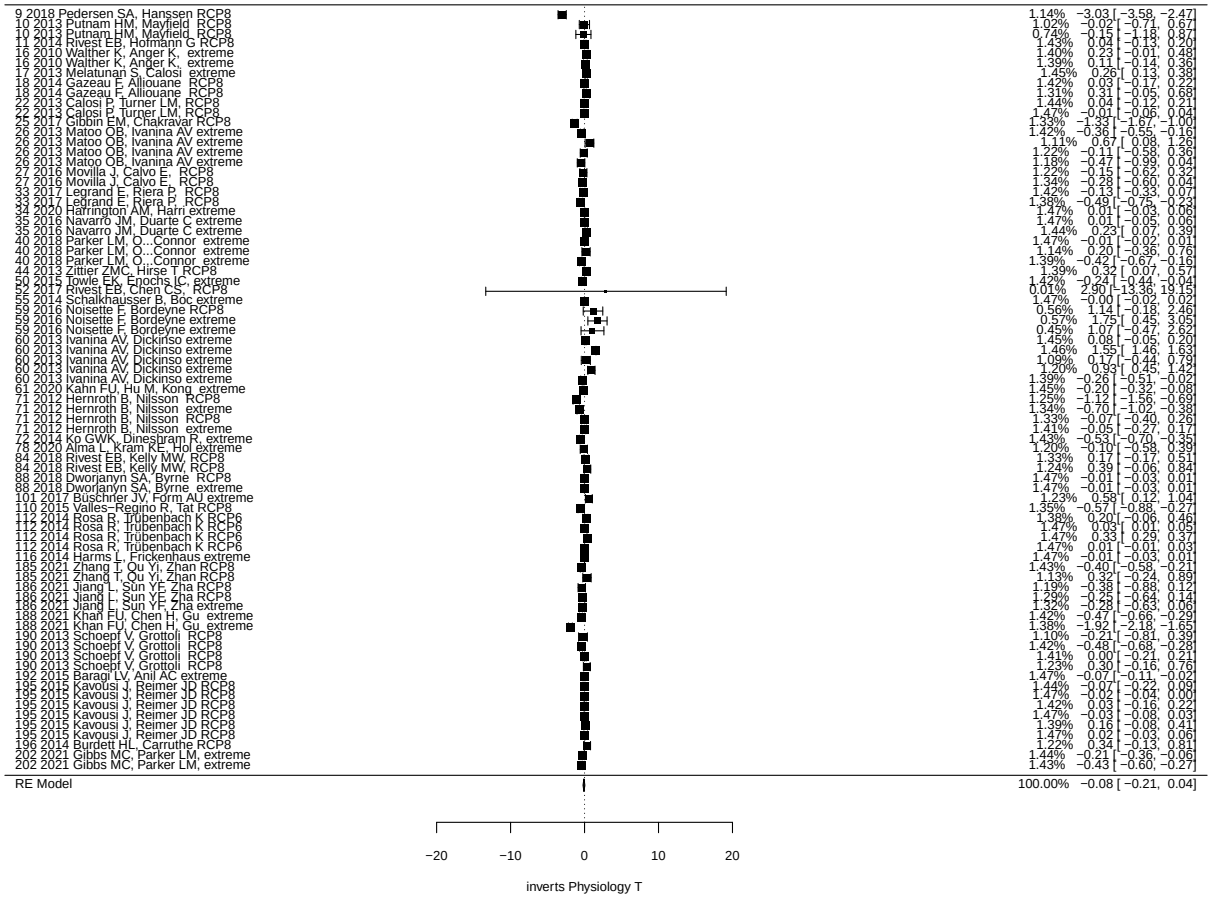
```
##
## Random-Effects Model (k = 77; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.2768 (SE = 0.0500)
## tau (square root of estimated tau^2 value):      0.5261
## I^2 (total heterogeneity / total variability):   99.69%
## H^2 (total variability / sampling variability):  323.66
##
## Test for Heterogeneity:
## Q(df = 76) = 2229.1894, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb   ci.ub
##  -0.0823  0.0638  -1.2895  0.1972  -0.2074  0.0428
```

```
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



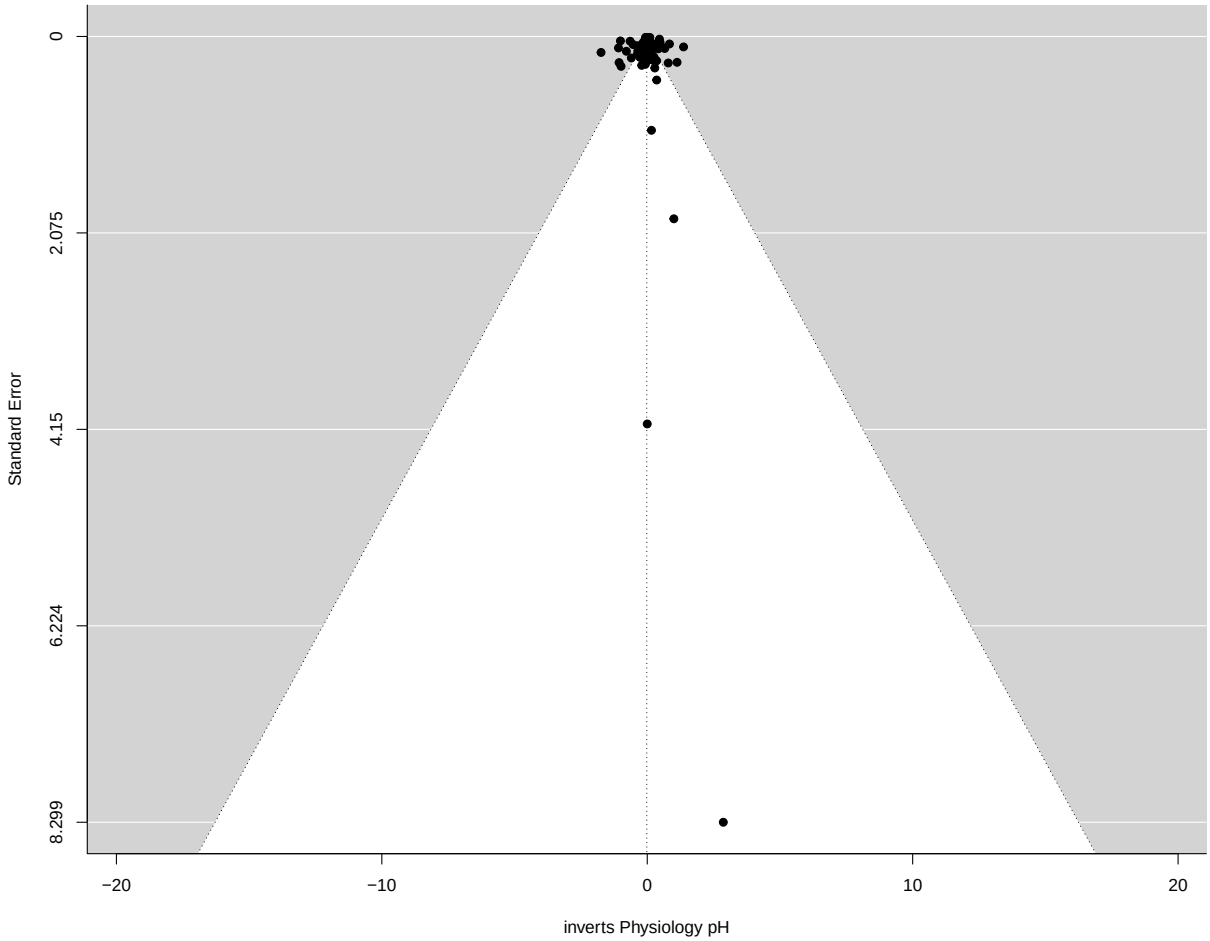

```
## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <99>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <80>
```

```
## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <99>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## extreme' in 'mbcsToSbcs': dot substituted for <99>
```



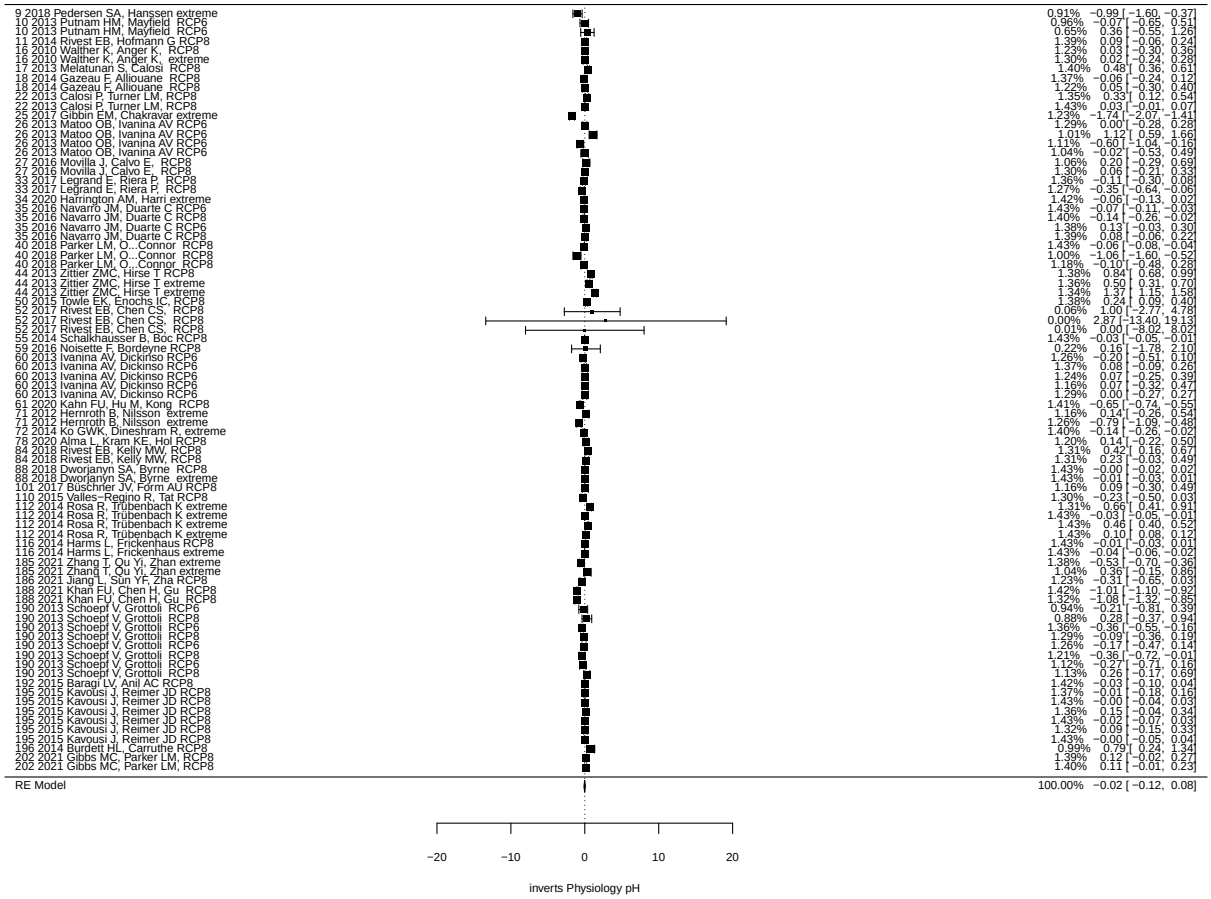

```
##
## Random-Effects Model (k = 82; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.1750 (SE = 0.0314)
## tau (square root of estimated tau^2 value):      0.4183
## I^2 (total heterogeneity / total variability):   99.50%
## H^2 (total variability / sampling variability):  199.39
```

```
##
## Test for Heterogeneity:
## Q(df = 81) = 1861.8240, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb   ci.ub
##  -0.0169  0.0501  -0.3370  0.7361  -0.1150  0.0813
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

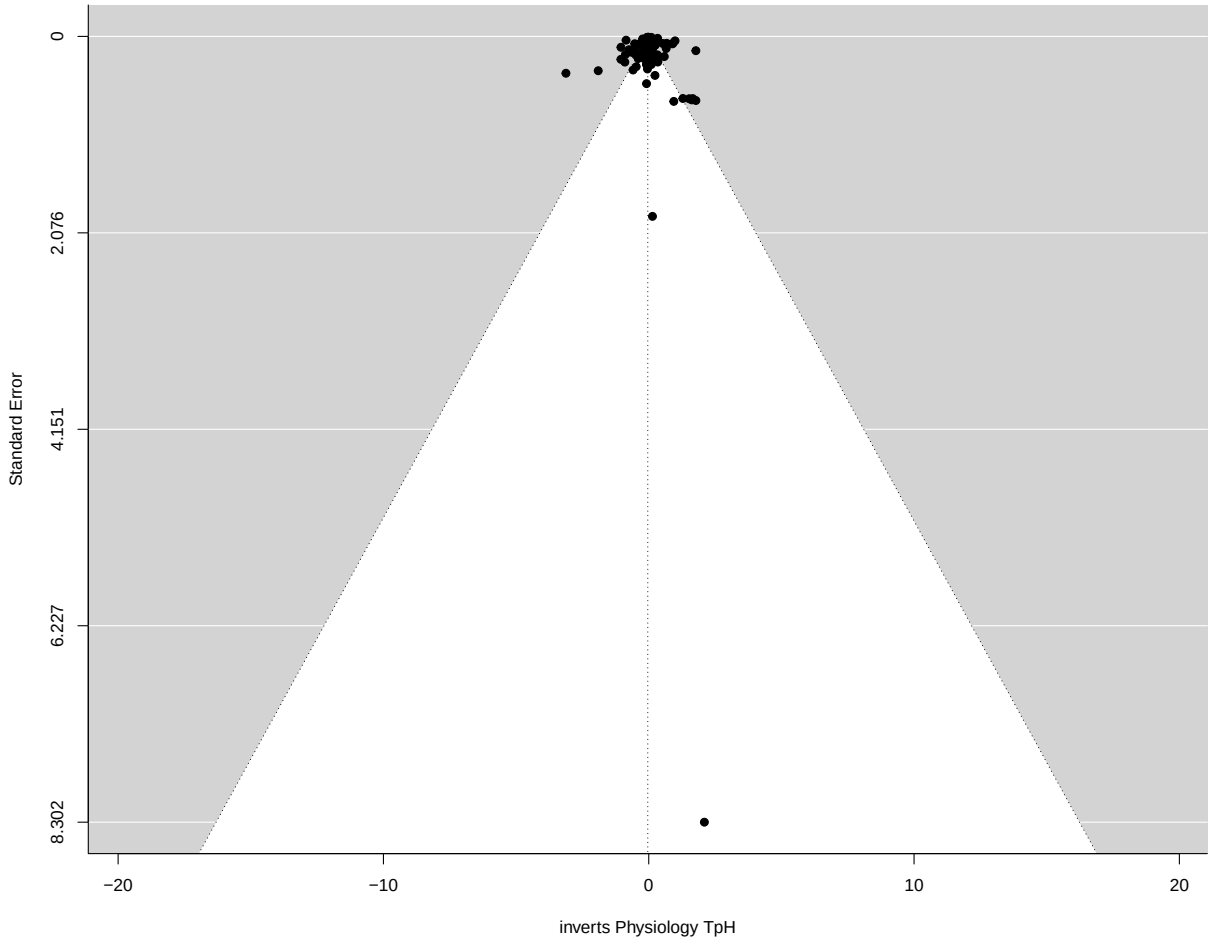



```
## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <99>
```

```
## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <99>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## RCP8' in 'mbcsToSbcs': dot substituted for <99>
```

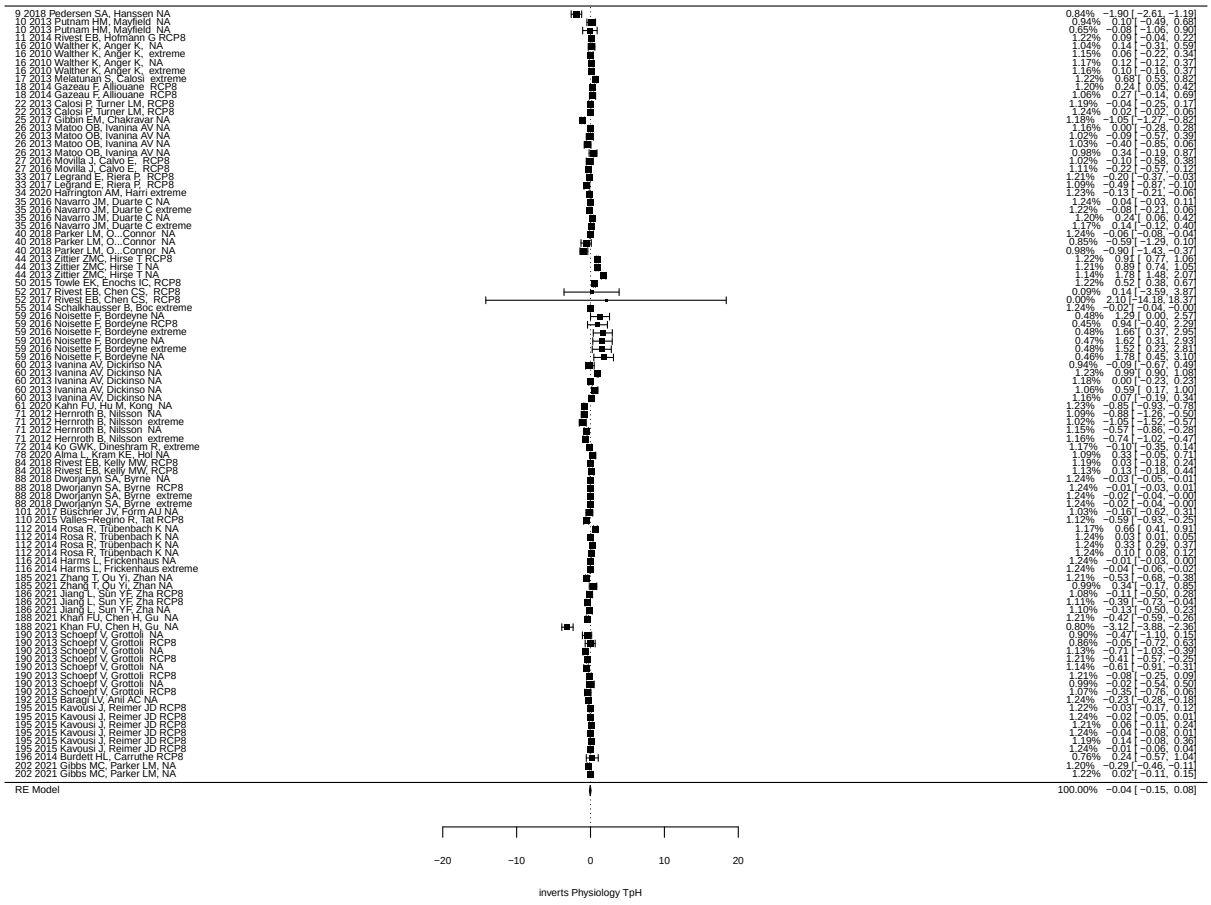


```
##
## Random-Effects Model (k = 94; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.2726 (SE = 0.0454)
## tau (square root of estimated tau^2 value):      0.5221
## I^2 (total heterogeneity / total variability):   99.70%
## H^2 (total variability / sampling variability):  332.79
##
## Test for Heterogeneity:
## Q(df = 93) = 2565.6087, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb   ci.ub
##  -0.0356  0.0581  -0.6124  0.5403  -0.1496  0.0784
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```




```
## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
```

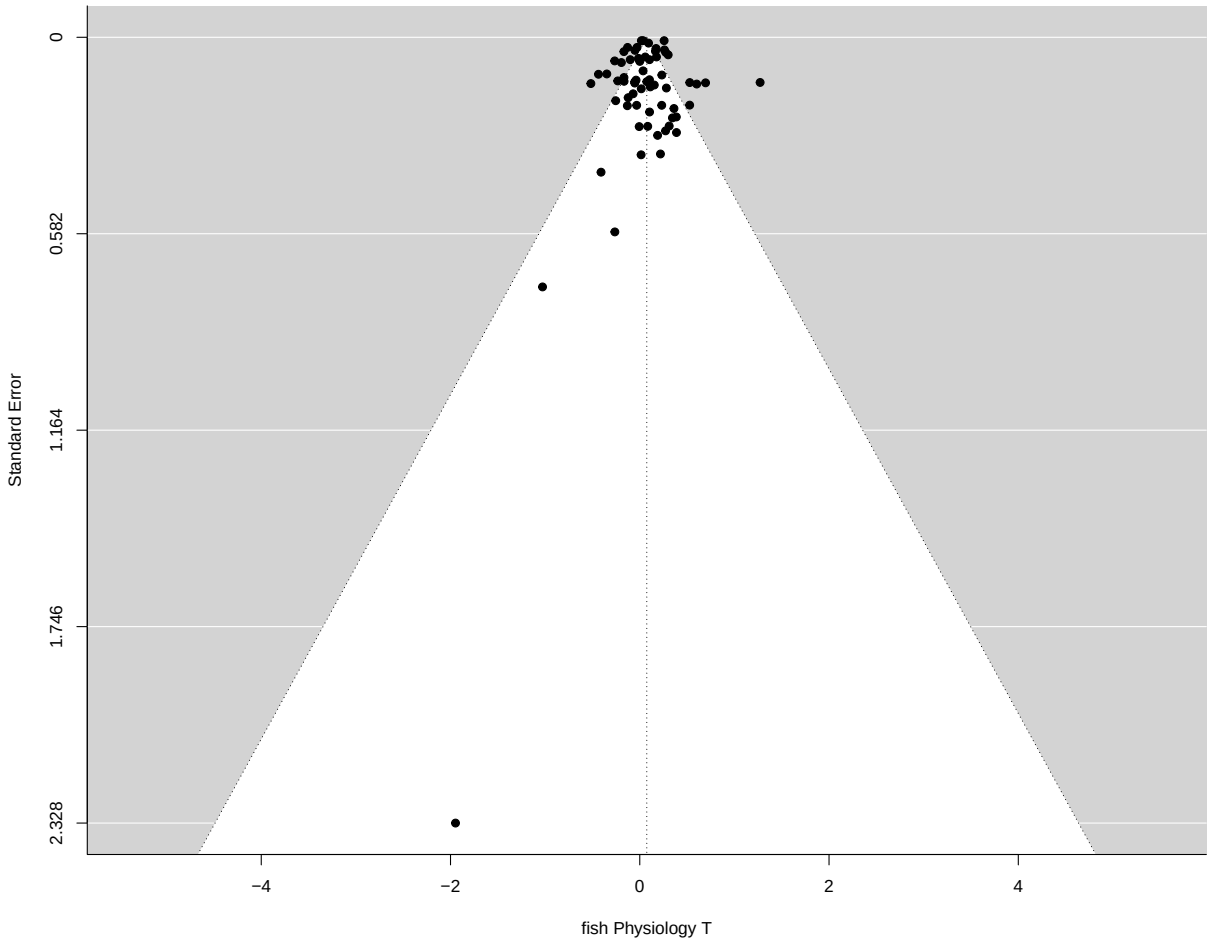
```
## NA' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <99>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <99>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <e2>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <80>

## Warning in text.default(...): conversion failure on '40 2018 Parker LM, O'Connor
## NA' in 'mbcsToSbcs': dot substituted for <99>
```

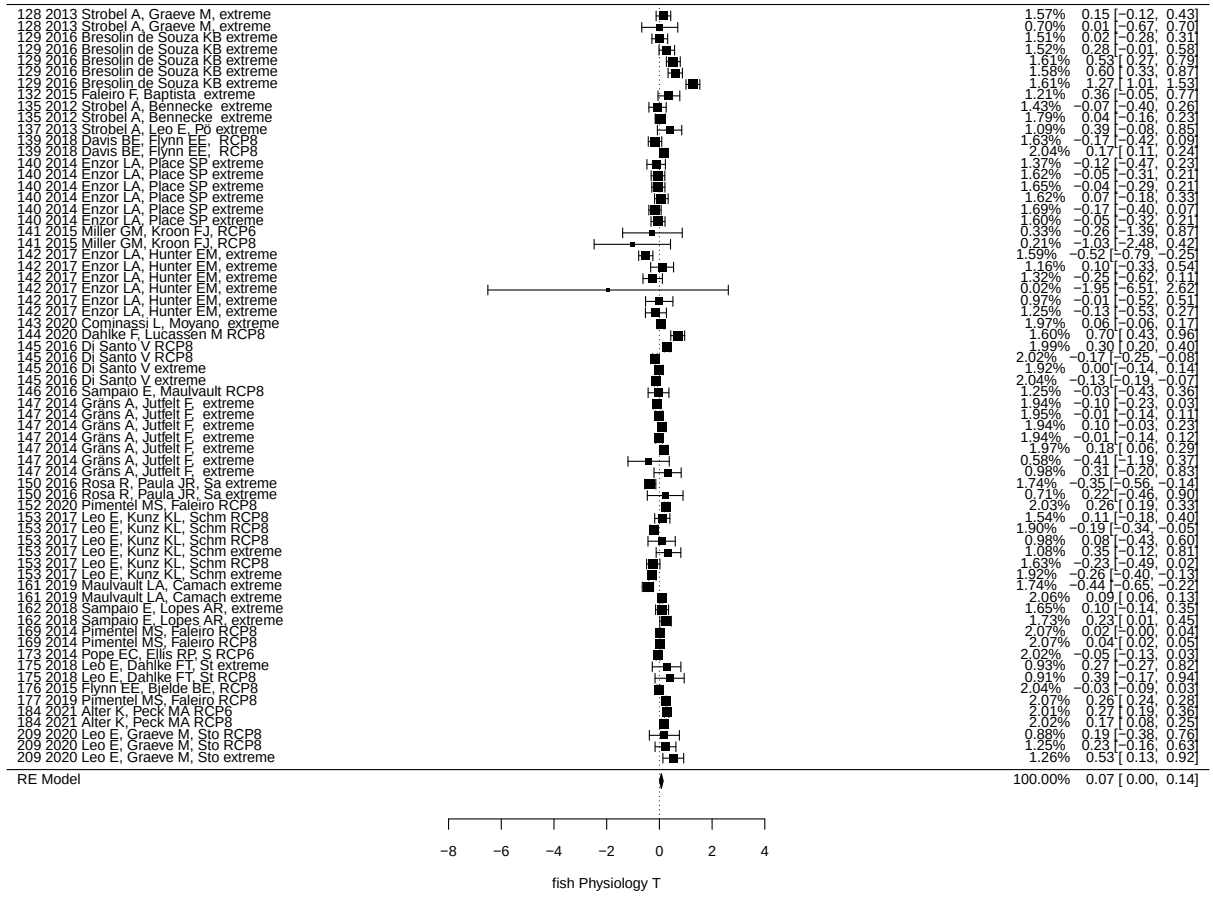



```
Abs_InvertPhys <- MA_TpH_abs("inverts","Physiology", Inverts)

## Fish, Physiology
FishPhys <-  MA_TpH("fish","Physiology", Fish,sensitivity)
```

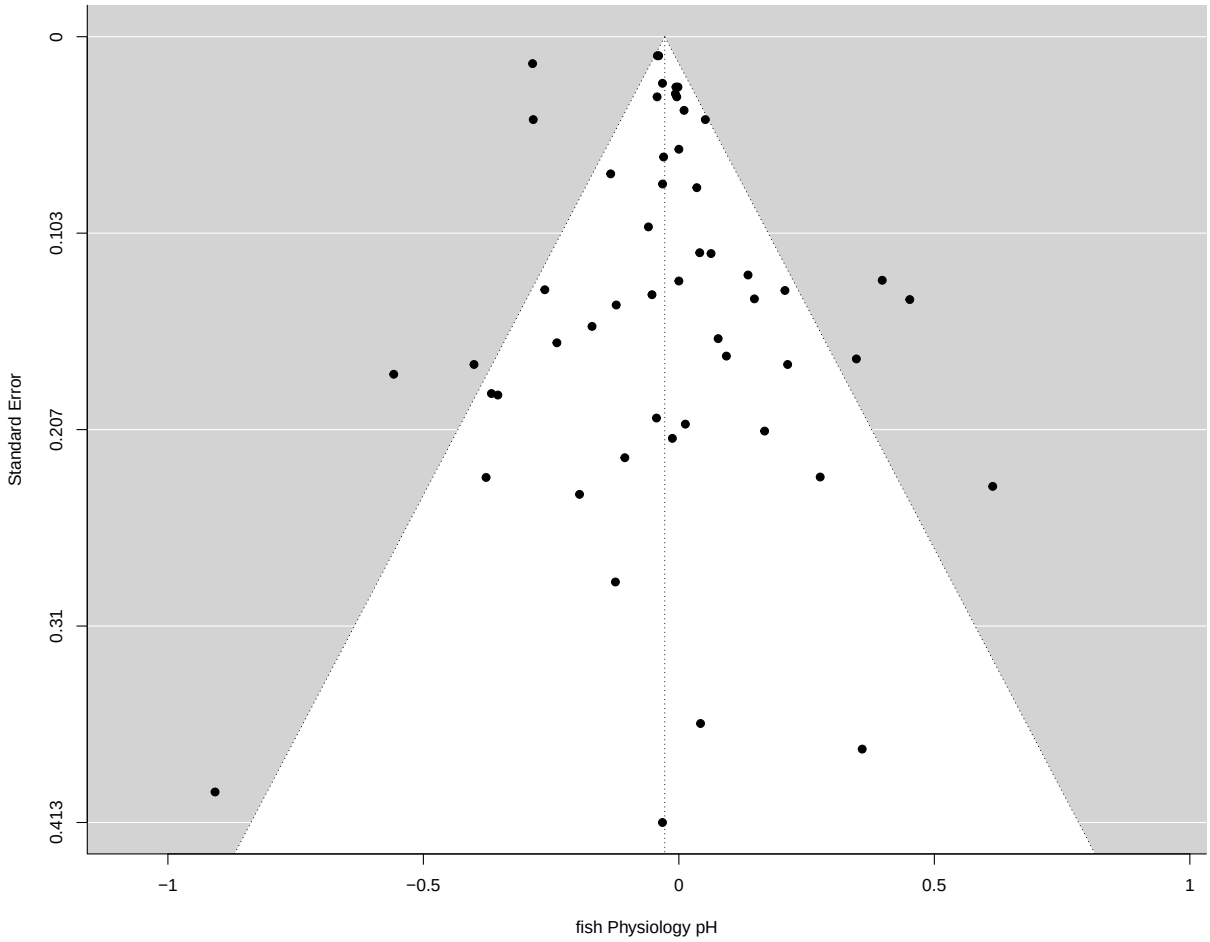
```
##
## Random-Effects Model (k = 66; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0620 (SE = 0.0142)
## tau (square root of estimated tau^2 value):      0.2491
## I^2 (total heterogeneity / total variability):   97.20%
## H^2 (total variability / sampling variability):  35.71
##
## Test for Heterogeneity:
## Q(df = 65) = 832.0468, p-val < .0001
##
## Model Results:
##
## estimate      se    zval    pval   ci.lb   ci.ub
##   0.0743  0.0359  2.0716  0.0383  0.0040  0.1446  *
```

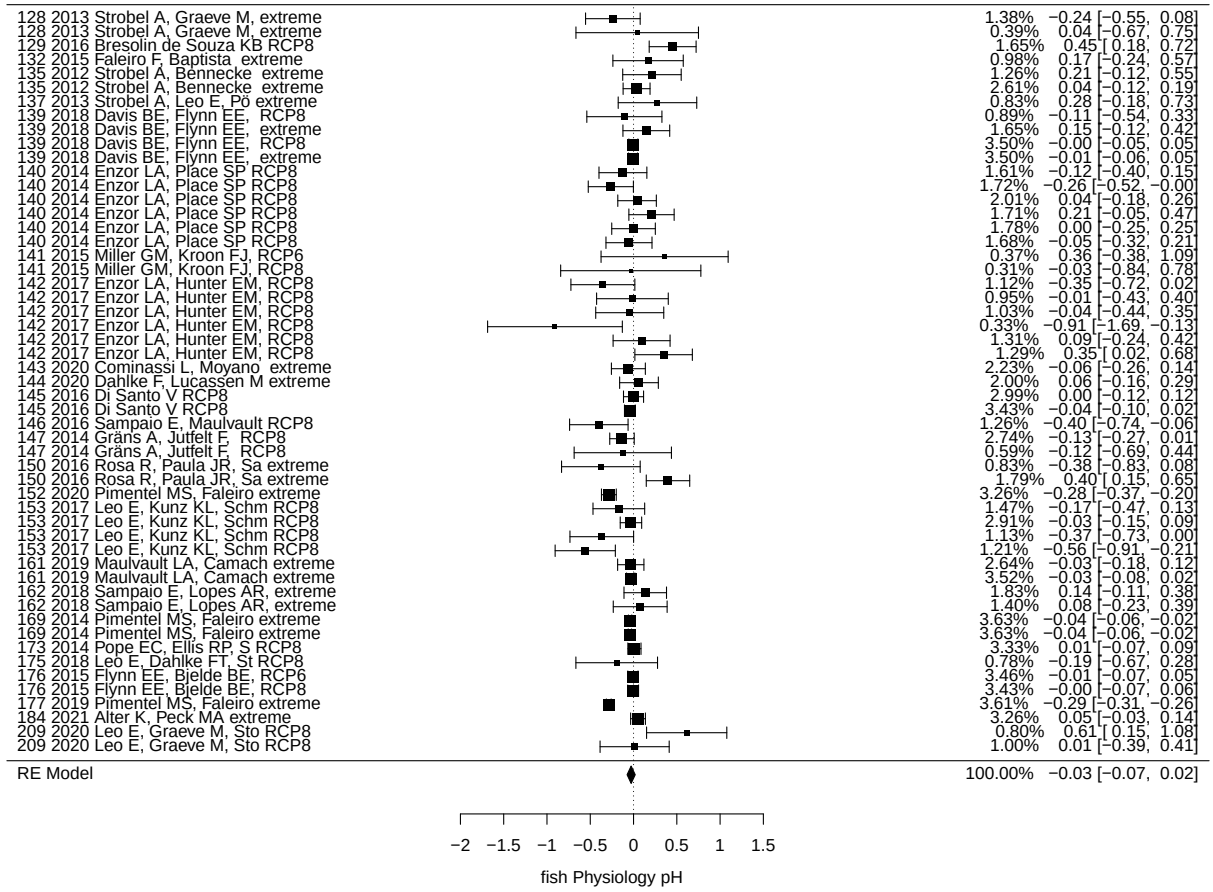
```
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



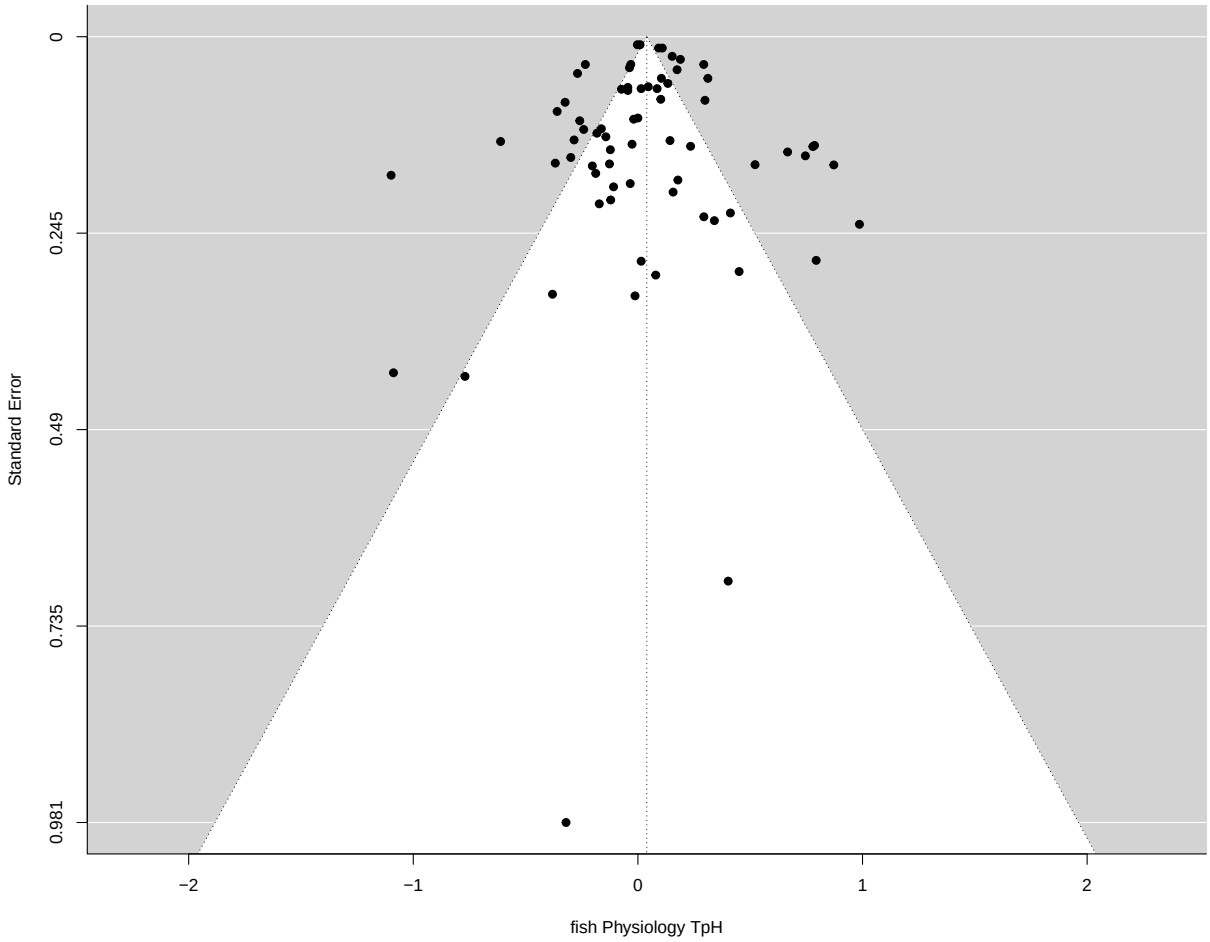


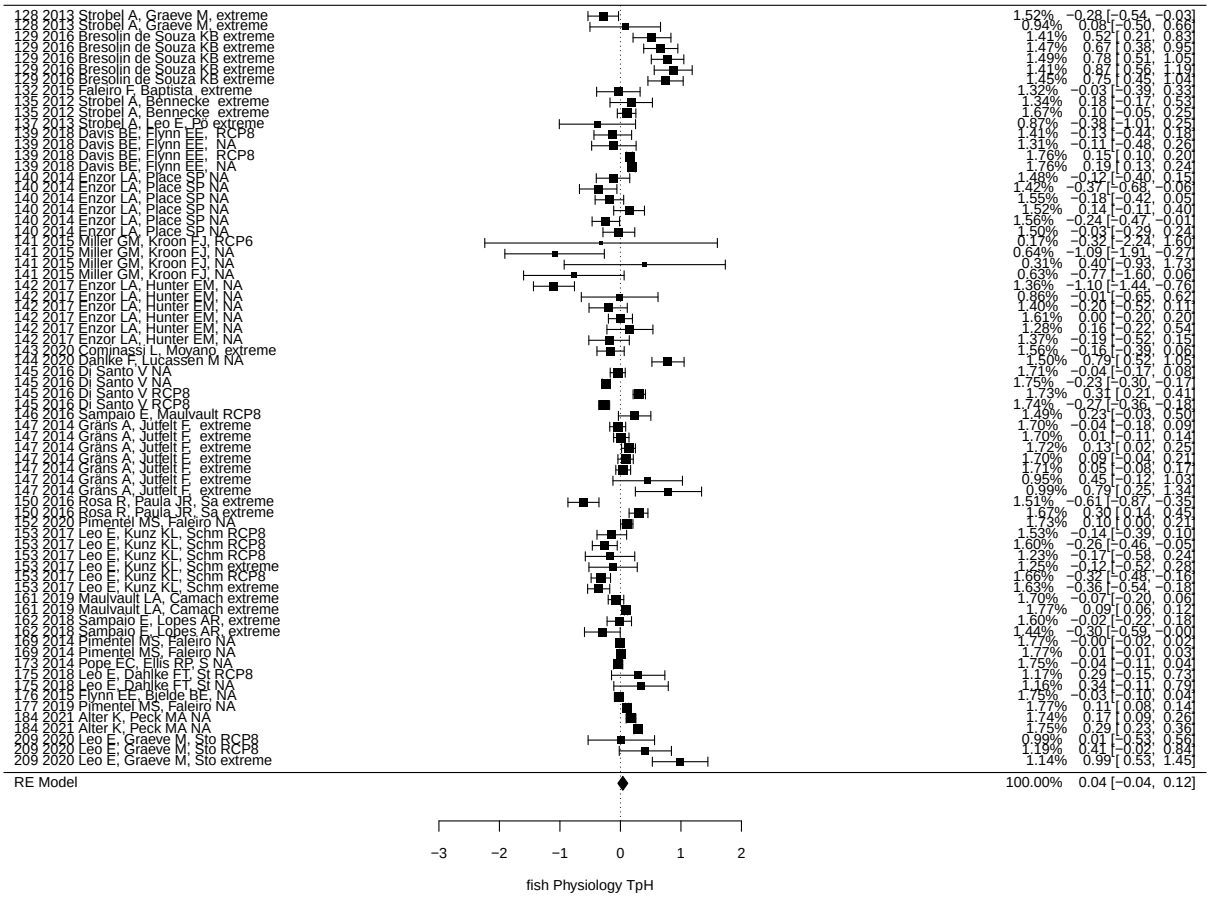

```
##
## Random-Effects Model (k = 53; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0157 (SE = 0.0052)
## tau (square root of estimated tau^2 value):      0.1253
## I^2 (total heterogeneity / total variability):   90.15%
## H^2 (total variability / sampling variability):  10.15
##
## Test for Heterogeneity:
## Q(df = 52) = 406.5981, p-val < .0001
##
## Model Results:
##
## estimate      se     zval    pval    ci.lb   ci.ub
##  -0.0276  0.0239  -1.1529  0.2489  -0.0745  0.0193
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```


Standard Error
0
0.103
0.207
0.31
0.413
−1
−0.5
0
0.5
1
fish Physiology pH




```
##
## Random-Effects Model (k = 70; tau^2 estimator: REML)
##
## tau^2 (estimated amount of total heterogeneity): 0.0987 (SE = 0.0203)
## tau (square root of estimated tau^2 value):      0.3142
## I^2 (total heterogeneity / total variability):   98.08%
## H^2 (total variability / sampling variability):  52.20
##
## Test for Heterogeneity:
## Q(df = 69) = 685.0445, p-val < .0001
##
## Model Results:
##
## estimate      se    zval    pval    ci.lb   ci.ub
##   0.0396  0.0418  0.9473  0.3435  -0.0424  0.1217
##
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```


Standard Error
0
0.245
0.49
0.735
0.981
−2
−1
0
1
2
fish Physiology TpH




```
Abs_FishPhys <-  MA_TpH_abs("fish","Physiology", Fish)

colnames(sensitivity) <- c("taxa","stressor","metric","Rosenthal nb","threshold","original pval","trim p
write.csv(sensitivity,"file_sensitivity.csv")
```