Vulnerability - belief in climate change

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##exploring how vulnerability varies depending on responses to a few questions regarding belief in climate change and harms that may come from it ##figures saved in vulnerability folder

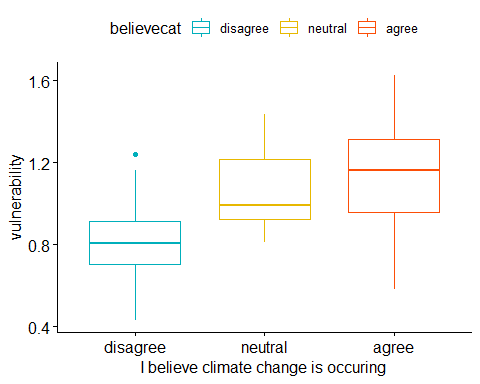
#load data #need to have run vulnerability code before this

##varibility in vulnerability depending on if you think climate change is happening or not

responses$believecat = responses$believe  
  
responses <- responses %>%   
 mutate(believecat = case\_when(  
 believecat == "strongly\_agree" ~ "agree",  
 believecat == "somewhat\_agree" ~ "agree",  
 believecat == "neutral" ~ "neutral",  
 believecat == "somewhat\_disagree" ~ "disagree",   
 believecat == "strongly\_disagree" ~ "disagree"))  
  
#components of vulnerability and belief in climate change  
responses %>%  
 group\_by(believecat) %>%  
 dplyr::summarise(meanex = mean(indv\_exposure, na.rm = TRUE),  
 sdex = sd(indv\_exposure, na.rm = TRUE),  
 meansen = mean(indv\_sensitivity, na.rm = TRUE),  
 sdsen = sd(indv\_sensitivity, na.rm = TRUE),  
 meanac = mean(indv\_ac, na.rm = TRUE),  
 sdac = sd(indv\_ac, na.rm = TRUE),  
 meanvuln = mean(indv\_vulnerability\_euc, na.rm = TRUE),  
 sdvuln = sd(indv\_vulnerability\_euc, na.rm = TRUE),  
 count = n())

## # A tibble: 3 x 10  
## believecat meanex sdex meansen sdsen meanac sdac meanvuln sdvuln count  
## <chr> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <int>  
## 1 agree 0.752 0.218 0.560 0.225 0.425 0.167 1.13 0.248 107  
## 2 disagree 0.543 0.149 0.311 0.191 0.490 0.142 0.824 0.182 26  
## 3 neutral 0.641 0.211 0.541 0.151 0.443 0.186 1.06 0.199 29

belief\_vuln<-ggboxplot(responses, x = "believecat", y = "indv\_vulnerability\_euc",  
 color = "believecat", palette = c("#00AFBB", "#E7B800", "#FC4E07"),  
 order = c("disagree", "neutral", "agree"),  
 ylab = "vulnerability", xlab = "I believe climate change is occuring")  
  
ggsave(plot = belief\_vuln, file = paste0("../figures/vulnerability/belief\_vuln.png"))  
  
belief\_vuln



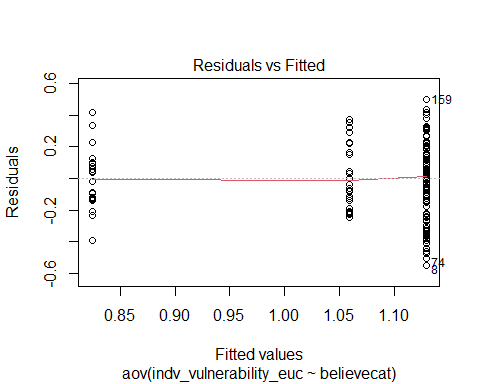
#anova  
beliefvuln\_aov<-aov(indv\_vulnerability\_euc ~ believecat, data = responses)  
summary(beliefvuln\_aov)

## Df Sum Sq Mean Sq F value Pr(>F)   
## believecat 2 1.756 0.8780 16.3 0.000000387 \*\*\*  
## Residuals 152 8.189 0.0539   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## 7 observations deleted due to missingness

#tukey HSD of vulnerability  
beliefvuln\_tukey<-TukeyHSD(beliefvuln\_aov)  
beliefvuln\_tukey

## Tukey multiple comparisons of means  
## 95% family-wise confidence level  
##   
## Fit: aov(formula = indv\_vulnerability\_euc ~ believecat, data = responses)  
##   
## $believecat  
## diff lwr upr p adj  
## disagree-agree -0.30437815 -0.43075310 -0.17800320 0.0000002  
## neutral-agree -0.06957956 -0.18981440 0.05065529 0.3593574  
## neutral-disagree 0.23479859 0.07753418 0.39206299 0.0015664

#test for assumptions about anovas  
#this is the only place this is coded but should be added where ever the stats may be used outside of exploration  
  
#are the variances homogenous?  
plot(beliefvuln\_aov, 1)



leveneTest(indv\_vulnerability\_euc ~ believecat, data = responses)

## Levene's Test for Homogeneity of Variance (center = median)  
## Df F value Pr(>F)   
## group 2 2.9766 0.05395 .  
## 152   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

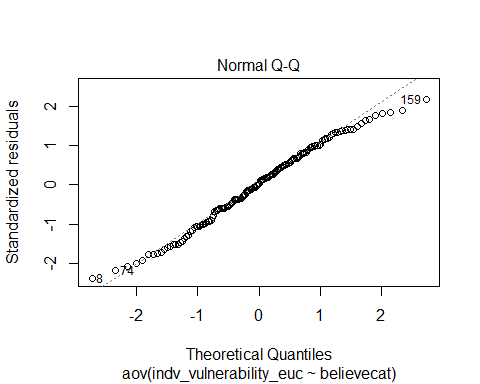
#if not, use welch one way test  
  
oneway.test(indv\_vulnerability\_euc ~ believecat, data = responses)

##   
## One-way analysis of means (not assuming equal variances)  
##   
## data: indv\_vulnerability\_euc and believecat  
## F = 22.75, num df = 2.000, denom df = 49.625, p-value = 0.00000009733

#pairwise t.test with no assumption of equal variances  
pairwise.t.test(responses$indv\_vulnerability\_euc, responses$believecat,  
 p.adjust.method = "BH", pool.sd = FALSE)

##   
## Pairwise comparisons using t tests with non-pooled SD   
##   
## data: responses$indv\_vulnerability\_euc and responses$believecat   
##   
## agree disagree  
## disagree 0.000000091 -   
## neutral 0.13587 0.00012   
##   
## P value adjustment method: BH

#is the data normally distributed?  
plot(beliefvuln\_aov, 2)



#confirm with shapiro-wilk test on anova residuals  
  
# Extract the residuals  
aov\_residuals <- residuals(object = beliefvuln\_aov )  
# Run Shapiro-Wilk test  
shapiro.test(x = aov\_residuals )

##   
## Shapiro-Wilk normality test  
##   
## data: aov\_residuals  
## W = 0.98728, p-value = 0.1702

#can use the kruskal-wallis test if normality assumption is not met  
#repeat for any stats that will appear in results  
  
#anova exposure  
beliefex\_aov<-aov(indv\_exposure ~ believecat, data = responses)  
summary(beliefex\_aov)

## Df Sum Sq Mean Sq F value Pr(>F)   
## believecat 2 0.970 0.4849 11.18 0.0000292 \*\*\*  
## Residuals 155 6.725 0.0434   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## 4 observations deleted due to missingness

#tukey HSD of exposure  
beliefex\_tukey<-TukeyHSD(beliefex\_aov)  
beliefex\_tukey

## Tukey multiple comparisons of means  
## 95% family-wise confidence level  
##   
## Fit: aov(formula = indv\_exposure ~ believecat, data = responses)  
##   
## $believecat  
## diff lwr upr p adj  
## disagree-agree -0.20860221 -0.31993009 -0.097274331 0.0000516  
## neutral-agree -0.11045406 -0.21661003 -0.004298091 0.0393354  
## neutral-disagree 0.09814815 -0.04013313 0.236429426 0.2162568

#agree different than both, neutal and disagree not different  
  
#anova of sensitivity  
beliefsen\_aov<-aov(indv\_sensitivity ~ believecat, data = responses)  
summary(beliefsen\_aov)

## Df Sum Sq Mean Sq F value Pr(>F)   
## believecat 2 1.270 0.6349 14.52 0.00000165 \*\*\*  
## Residuals 156 6.823 0.0437   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## 3 observations deleted due to missingness

#tukey HSD of sensitivity  
beliefsen\_tukey<-TukeyHSD(beliefsen\_aov)  
beliefsen\_tukey

## Tukey multiple comparisons of means  
## 95% family-wise confidence level  
##   
## Fit: aov(formula = indv\_sensitivity ~ believecat, data = responses)  
##   
## $believecat  
## diff lwr upr p adj  
## disagree-agree -0.24861354 -0.3586407 -0.13858641 0.0000009  
## neutral-agree -0.01846615 -0.1236157 0.08668342 0.9092657  
## neutral-disagree 0.23014739 0.0939791 0.36631568 0.0002869

#neutral and agree the same, both different than disagree  
  
#anova of adaptive capacity  
beliefac\_aov<-aov(indv\_ac ~ believecat, data = responses)  
summary(beliefac\_aov)

## Df Sum Sq Mean Sq F value Pr(>F)  
## believecat 2 0.090 0.04476 1.609 0.203  
## Residuals 159 4.423 0.02782

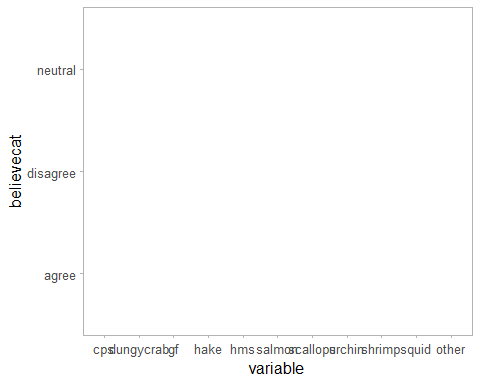
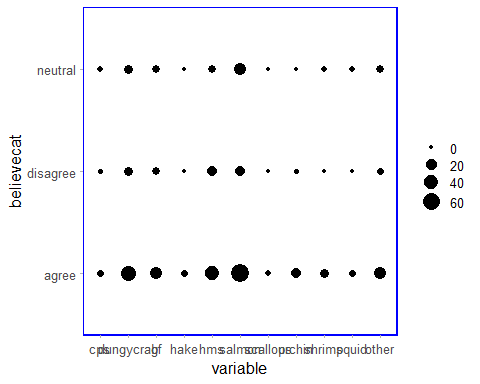
#tukey HSD of vulnerability  
beliefac\_tukey<-TukeyHSD(beliefac\_aov)  
beliefac\_tukey

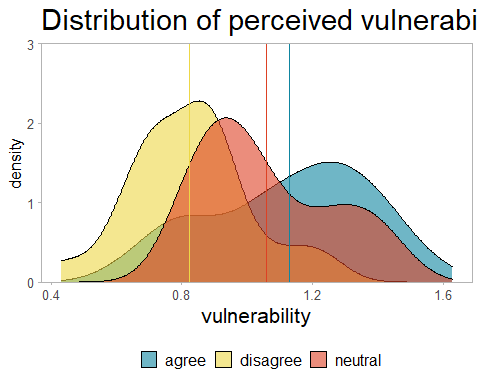
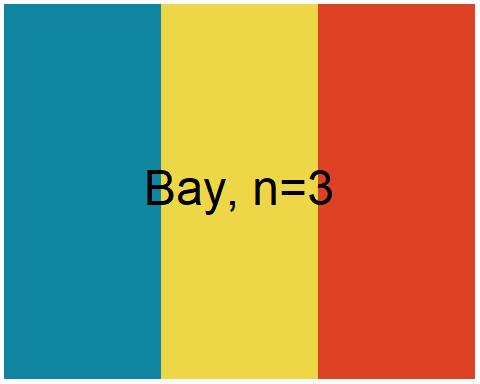
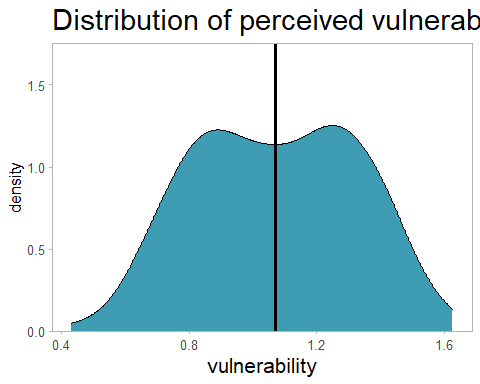
## Tukey multiple comparisons of means  
## 95% family-wise confidence level  
##   
## Fit: aov(formula = indv\_ac ~ believecat, data = responses)  
##   
## $believecat  
## diff lwr upr p adj  
## disagree-agree 0.06515097 -0.02112254 0.15142448 0.1773510  
## neutral-agree 0.01825295 -0.06435252 0.10085841 0.8603254  
## neutral-disagree -0.04689803 -0.15346579 0.05966974 0.5520752

#does belief in climate change vary by fishery?

## cps dungycrab gf hake hms salmon scallops urchin shrimp squid other  
## agree 4 44 25 3 35 73 2 16 9 3 27  
## disagree 1 11 7 0 12 15 0 1 0 0 4  
## neutral 2 9 7 0 6 23 0 0 2 2 6

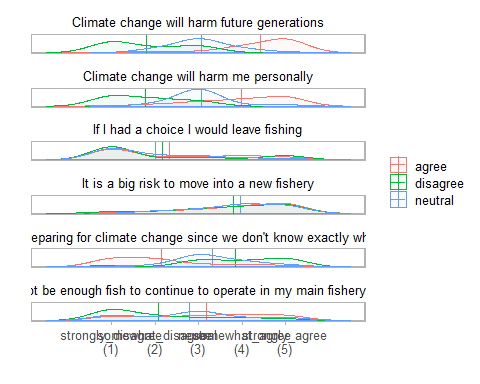
##   
## Pearson's Chi-squared test  
##   
## data: believe\_fishery  
## X-squared = 18.868, df = 20, p-value = 0.5304

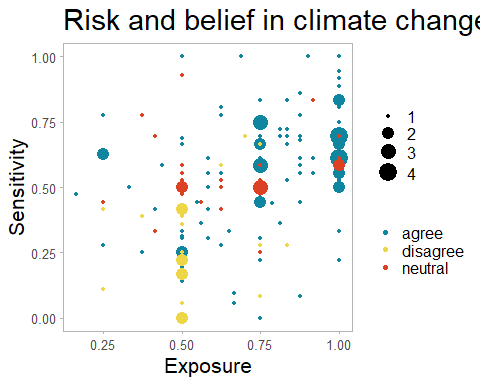


#density plots of overall perceived vulnerability and by responses to I believe that climate change is occuring #plots for tnc talk 

##likert questions about climate and future of fishing ##group by how they responded to first question about believing in climate change

## Group  
## 1 agree  
## 2 agree  
## 3 agree  
## 4 agree  
## 5 agree  
## 6 agree  
## 7 disagree  
## 8 disagree  
## 9 disagree  
## 10 disagree  
## 11 disagree  
## 12 disagree  
## 13 neutral  
## 14 neutral  
## 15 neutral  
## 16 neutral  
## 17 neutral  
## 18 neutral  
## Item  
## 1 Climate change will harm me personally  
## 2 Climate change will harm future generations  
## 3 If I had a choice I would leave fishing  
## 4 It is a big risk to move into a new fishery  
## 5 There is no point in preparing for climate change since we don't know exactly what is going to happen  
## 6 There will not be enough fish to continue to operate in my main fishery in 20 years  
## 7 Climate change will harm me personally  
## 8 Climate change will harm future generations  
## 9 If I had a choice I would leave fishing  
## 10 It is a big risk to move into a new fishery  
## 11 There is no point in preparing for climate change since we don't know exactly what is going to happen  
## 12 There will not be enough fish to continue to operate in my main fishery in 20 years  
## 13 Climate change will harm me personally  
## 14 Climate change will harm future generations  
## 15 If I had a choice I would leave fishing  
## 16 It is a big risk to move into a new fishery  
## 17 There is no point in preparing for climate change since we don't know exactly what is going to happen  
## 18 There will not be enough fish to continue to operate in my main fishery in 20 years  
## low neutral high mean sd  
## 1 11.214953 18.691589 70.09346 3.981308 1.0987240  
## 2 6.542056 4.672897 88.78505 4.429907 0.8913859  
## 3 58.878505 12.149533 28.97196 2.327103 1.5158017  
## 4 13.084112 14.953271 71.96262 3.971963 1.1611473  
## 5 71.962617 10.280374 17.75701 2.149533 1.2270823  
## 6 33.644860 18.691589 47.66355 3.177570 1.4262570  
## 7 76.923077 23.076923 0.00000 1.769231 0.8152395  
## 8 69.230769 30.769231 0.00000 1.807692 0.8952868  
## 9 65.384615 11.538462 23.07692 2.153846 1.6417627  
## 10 15.384615 19.230769 65.38462 3.807692 1.2655190  
## 11 7.692308 30.769231 61.53846 3.846154 1.1896994  
## 12 69.230769 11.538462 19.23077 2.076923 1.3541958  
## 13 10.344828 79.310345 10.34483 3.068966 0.6508804  
## 14 17.241379 62.068966 20.68966 3.068966 0.7036149  
## 15 68.965517 17.241379 13.79310 2.000000 1.2817399  
## 16 10.344828 17.241379 72.41379 3.965517 0.9813532  
## 17 10.344828 55.172414 34.48276 3.310345 0.8905636  
## 18 34.482759 41.379310 24.13793 2.793103 1.3196133



##scatterplot of vulnerability depending on your belief in climate change 

##   
## Call:  
## lm(formula = risk\_euc ~ indv\_ac, data = responses, subset = believecat ==   
## "agree")  
##   
## Coefficients:  
## (Intercept) indv\_ac   
## 1.164 -0.486

##   
## Call:  
## lm(formula = risk\_euc ~ inverse\_ac \* believecat, data = responses)  
##   
## Coefficients:  
## (Intercept) inverse\_ac   
## 0.67780 0.48596   
## believecatdisagree believecatneutral   
## -0.18164 0.07841   
## inverse\_ac:believecatdisagree inverse\_ac:believecatneutral   
## -0.18782 -0.29996

## Analysis of Variance Table  
##   
## Response: risk\_euc  
## Df Sum Sq Mean Sq F value Pr(>F)   
## inverse\_ac 1 1.0860 1.08597 22.4650 0.0000049533 \*\*\*  
## believecat 2 1.4984 0.74919 15.4982 0.0000007678 \*\*\*  
## inverse\_ac:believecat 2 0.0563 0.02816 0.5826 0.5597   
## Residuals 149 7.2027 0.04834   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## believecat inverse\_ac.trend SE df lower.CL upper.CL  
## agree 0.486 0.128 149 0.232 0.740  
## disagree 0.298 0.326 149 -0.347 0.943  
## neutral 0.186 0.268 149 -0.343 0.715  
##   
## Confidence level used: 0.95

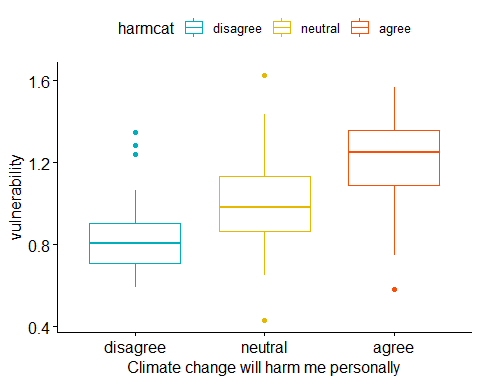
## contrast estimate SE df t.ratio p.value  
## agree - disagree 0.188 0.351 149 0.536 0.8539   
## agree - neutral 0.300 0.297 149 1.010 0.5716   
## disagree - neutral 0.112 0.422 149 0.266 0.9618   
##   
## P value adjustment: tukey method for comparing a family of 3 estimates

##varibility in vulnerability depending on if you think you will be harmed by climate change personally

responses$harmcat = responses$harm\_me  
  
responses <- responses %>%   
 mutate(harmcat = case\_when(  
 harmcat == "strongly\_agree" ~ "agree",  
 harmcat == "somewhat\_agree" ~ "agree",  
 harmcat == "neutral" ~ "neutral",  
 harmcat == "somewhat\_disagree" ~ "disagree",   
 harmcat == "strongly\_disagree" ~ "disagree"))  
  
#components of vulnerability and belief in climate change  
responses %>%  
 group\_by(harmcat) %>%  
 dplyr::summarise(meanex = mean(indv\_exposure, na.rm = TRUE),  
 sdex = sd(indv\_exposure, na.rm = TRUE),  
 meansen = mean(indv\_sensitivity, na.rm = TRUE),  
 sdsen = sd(indv\_sensitivity, na.rm = TRUE),  
 meanac = mean(indv\_ac, na.rm = TRUE),  
 sdac = sd(indv\_ac, na.rm = TRUE),  
 meanvuln = mean(indv\_vulnerability\_euc, na.rm = TRUE),  
 sdvuln = sd(indv\_vulnerability\_euc, na.rm = TRUE),  
 count = n())

## # A tibble: 3 x 10  
## harmcat meanex sdex meansen sdsen meanac sdac meanvuln sdvuln count  
## <chr> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <int>  
## 1 agree 0.809 0.190 0.607 0.201 0.389 0.160 1.20 0.214 78  
## 2 disagree 0.556 0.136 0.334 0.188 0.497 0.164 0.847 0.185 35  
## 3 neutral 0.625 0.232 0.501 0.211 0.477 0.160 1.01 0.220 49

harm\_vuln<-ggboxplot(responses, x = "harmcat", y = "indv\_vulnerability\_euc",  
 color = "harmcat", palette = c("#00AFBB", "#E7B800", "#FC4E07"),  
 order = c("disagree", "neutral", "agree"),  
 ylab = "vulnerability", xlab = "Climate change will harm me personally")  
  
harm\_vuln



ggsave(plot = belief\_vuln, file = paste0("../figures/vulnerability/harm\_vuln.png"))  
  
#anova of vulnerabilty  
harmvuln\_aov<-aov(indv\_vulnerability\_euc ~ harmcat, data = responses)  
summary(harmvuln\_aov)

## Df Sum Sq Mean Sq F value Pr(>F)   
## harmcat 2 3.251 1.625 36.9 0.0000000000000864 \*\*\*  
## Residuals 152 6.695 0.044   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## 7 observations deleted due to missingness

#tukey HSD of vulnerability  
harmvuln\_tukey<-TukeyHSD(harmvuln\_aov)  
harmvuln\_tukey

## Tukey multiple comparisons of means  
## 95% family-wise confidence level  
##   
## Fit: aov(formula = indv\_vulnerability\_euc ~ harmcat, data = responses)  
##   
## $harmcat  
## diff lwr upr p adj  
## disagree-agree -0.3583323 -0.46148523 -0.2551793 0.0000000  
## neutral-agree -0.1996301 -0.29328509 -0.1059752 0.0000038  
## neutral-disagree 0.1587021 0.04431255 0.2730917 0.0036196

#each group is different  
  
#anova exposure  
harmex\_aov<-aov(indv\_exposure ~ harmcat, data = responses)  
summary(harmex\_aov)

## Df Sum Sq Mean Sq F value Pr(>F)   
## harmcat 2 1.896 0.9480 25.34 0.0000000003 \*\*\*  
## Residuals 155 5.798 0.0374   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## 4 observations deleted due to missingness

#tukey HSD of exposure  
harmex\_tukey<-TukeyHSD(harmex\_aov)  
harmex\_tukey

## Tukey multiple comparisons of means  
## 95% family-wise confidence level  
##   
## Fit: aov(formula = indv\_exposure ~ harmcat, data = responses)  
##   
## $harmcat  
## diff lwr upr p adj  
## disagree-agree -0.25338963 -0.3474502 -0.15932908 0.0000000  
## neutral-agree -0.18427198 -0.2693603 -0.09918367 0.0000026  
## neutral-disagree 0.06911765 -0.0343994 0.17263469 0.2573073

#agree different than both, neutal and disagree not different  
  
#anova of sensitivity  
harmsen\_aov<-aov(indv\_sensitivity ~ harmcat, data = responses)  
summary(harmsen\_aov)

## Df Sum Sq Mean Sq F value Pr(>F)   
## harmcat 2 1.772 0.8862 21.88 0.00000000422 \*\*\*  
## Residuals 156 6.320 0.0405   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## 3 observations deleted due to missingness

#tukey HSD of sensitivity  
harmsen\_tukey<-TukeyHSD(harmsen\_aov)  
harmsen\_tukey

## Tukey multiple comparisons of means  
## 95% family-wise confidence level  
##   
## Fit: aov(formula = indv\_sensitivity ~ harmcat, data = responses)  
##   
## $harmcat  
## diff lwr upr p adj  
## disagree-agree -0.2722687 -0.37014724 -0.17439012 0.0000000  
## neutral-agree -0.1054266 -0.19337426 -0.01747901 0.0142223  
## neutral-disagree 0.1668420 0.05961127 0.27407282 0.0009255

#neutral and agree the same, both different than disagree  
  
#anova of adaptive capacity  
harmac\_aov<-aov(indv\_ac ~ harmcat, data = responses)  
summary(harmac\_aov)

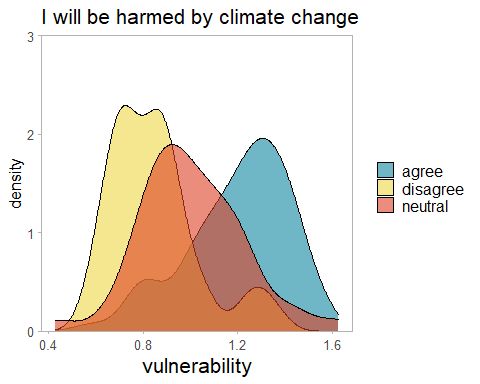
## Df Sum Sq Mean Sq F value Pr(>F)   
## harmcat 2 0.385 0.19243 7.413 0.000835 \*\*\*  
## Residuals 159 4.127 0.02596   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

#tukey HSD of vulnerability  
harmac\_tukey<-TukeyHSD(harmac\_aov)  
harmac\_tukey

## Tukey multiple comparisons of means  
## 95% family-wise confidence level  
##   
## Fit: aov(formula = indv\_ac ~ harmcat, data = responses)  
##   
## $harmcat  
## diff lwr upr p adj  
## disagree-agree 0.10793651 0.03038697 0.18548605 0.0034830  
## neutral-agree 0.08843537 0.01895249 0.15791826 0.0084645  
## neutral-disagree -0.01950113 -0.10385965 0.06485738 0.8482015

#most demographics dont seem to matter, how does fishery impact feeling like you may be harmed by climate change?

##   
## Pearson's Chi-squared test  
##   
## data: harm\_fishery\_sum  
## X-squared = 16.724, df = 20, p-value = 0.6708

#density plots of overall perceived vulnerability and by belief of being harmed by climate change 

##so what are the differences between those that think they will be harmed by climate change and the whole group?

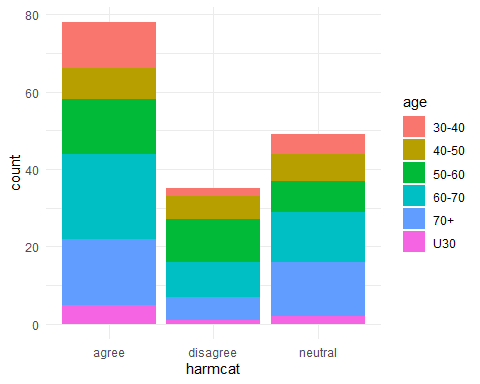
#is there a difference in the mean vulnerability of the agree belive group and the will be harmed group?  
aa<- responses %>%  
 select(harmcat, believecat, indv\_vulnerability\_euc)  
  
ab<- aa %>%  
 filter(harmcat =="agree")  
  
ac<- aa%>%  
 filter(believecat == "agree")  
  
t.test(ab$indv\_vulnerability\_euc, ac$indv\_vulnerability\_euc)

##   
## Welch Two Sample t-test  
##   
## data: ab$indv\_vulnerability\_euc and ac$indv\_vulnerability\_euc  
## t = 2.2277, df = 177.5, p-value = 0.02716  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## 0.008687651 0.143556548  
## sample estimates:  
## mean of x mean of y   
## 1.204926 1.128804

#subset of those who feel they will be harmed by climate change  
harmed<- responses%>%  
 filter(harmcat == "agree")   
  
responses$harm\_binary = responses$harmcat  
  
responses <- responses %>%   
 mutate(harm\_binary = case\_when(  
 harmcat == "agree" ~ "1",  
 harmcat == "neutral" ~ "0",  
 harmcat == "disagree" ~ "0"))  
  
#summary of age by response all 3 categories  
table(responses$harmcat, responses$age)

##   
## 30-40 40-50 50-60 60-70 70+ U30  
## agree 12 8 14 22 17 5  
## disagree 2 6 11 9 6 1  
## neutral 5 7 8 13 14 2

#visualize above  
ggplot(responses) +  
 aes(x = harmcat, fill = age) +  
 geom\_bar() +  
 scale\_fill\_hue() +  
 theme\_minimal()



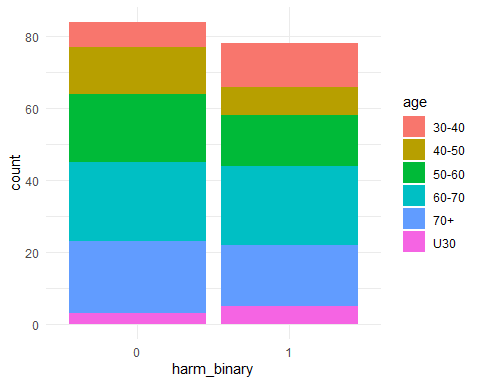
#chi squared test, is there difference in ages between responses  
age\_test<-chisq.test(table(responses$harmcat, responses$age))  
age\_test

##   
## Pearson's Chi-squared test  
##   
## data: table(responses$harmcat, responses$age)  
## X-squared = 7.79, df = 10, p-value = 0.6493

#no difference  
  
#if its just harm vs both others  
#summary of age by response all 3 categories  
table(responses$harm\_binary, responses$age)

##   
## 30-40 40-50 50-60 60-70 70+ U30  
## 0 7 13 19 22 20 3  
## 1 12 8 14 22 17 5

#visualize above  
ggplot(responses) +  
 aes(x = harm\_binary, fill = age) +  
 geom\_bar() +  
 scale\_fill\_hue() +  
 theme\_minimal()



#chi squared test, is there difference in ages between responses  
age\_test2<-chisq.test(table(responses$harm\_binary, responses$age))  
age\_test2

##   
## Pearson's Chi-squared test  
##   
## data: table(responses$harm\_binary, responses$age)  
## X-squared = 3.7901, df = 5, p-value = 0.58

#state that they live in?  
table(responses$harmcat, responses$state\_code)

##   
## AK CA OR WA  
## agree 1 21 13 43  
## disagree 0 5 9 21  
## neutral 0 10 9 30

state\_test<-(chisq.test(responses$harmcat, responses$state\_code))  
state\_test

##   
## Pearson's Chi-squared test  
##   
## data: responses$harmcat and responses$state\_code  
## X-squared = 4.1951, df = 6, p-value = 0.6503

state\_test2<-(chisq.test(responses$harm\_binary, responses$state\_code))  
state\_test2

##   
## Pearson's Chi-squared test  
##   
## data: responses$harm\_binary and responses$state\_code  
## X-squared = 3.2696, df = 3, p-value = 0.3519

#region they fish in?  
#need to maybe get this to be one region instead of list  
table(responses$harmcat, responses$listofregions)

##   
## Cen Cal Cen Cal, So Cal Columbia River Columbia River, OR coast  
## agree 2 1 8 2  
## disagree 0 0 4 1  
## neutral 1 0 6 1  
##   
## Columbia River, OR coast, Cen Cal  
## agree 0  
## disagree 0  
## neutral 1  
##   
## Columbia River, OR coast, Nor Cal, Cen Cal Nor Cal Nor Cal, Cen Cal  
## agree 1 1 2  
## disagree 0 1 2  
## neutral 1 1 0  
##   
## OR coast OR coast, Nor Cal OR coast, Nor Cal, Cen Cal  
## agree 9 1 3  
## disagree 4 1 0  
## neutral 6 0 0  
##   
## OR coast, So Cal Puget Sound SJF Puget Sound SJF, Cen Cal, So Cal  
## agree 0 16 1  
## disagree 0 7 0  
## neutral 1 7 1  
##   
## Puget Sound SJF, Columbia River  
## agree 1  
## disagree 0  
## neutral 1  
##   
## Puget Sound SJF, Columbia River, OR coast Puget Sound SJF, OR coast  
## agree 1 1  
## disagree 0 1  
## neutral 0 0  
##   
## Puget Sound SJF, WA coast Puget Sound SJF, WA coast, Columbia River  
## agree 1 2  
## disagree 3 1  
## neutral 2 1  
##   
## Puget Sound SJF, WA coast, Columbia River, OR coast So Cal WA coast  
## agree 1 4 3  
## disagree 0 1 5  
## neutral 0 0 10  
##   
## WA coast, Columbia River WA coast, Columbia River, OR coast  
## agree 3 4  
## disagree 0 1  
## neutral 3 2  
##   
## WA coast, Columbia River, OR coast, Nor Cal  
## agree 1  
## disagree 2  
## neutral 0  
##   
## WA coast, Columbia River, OR coast, Nor Cal, Cen Cal  
## agree 0  
## disagree 0  
## neutral 1  
##   
## WA coast, Columbia River, OR coast, Nor Cal, Cen Cal, So Cal  
## agree 1  
## disagree 0  
## neutral 0  
##   
## WA coast, OR coast WA coast, OR coast, Nor Cal  
## agree 8 0  
## disagree 1 0  
## neutral 1 1  
##   
## WA coast, OR coast, Nor Cal, Cen Cal  
## agree 0  
## disagree 0  
## neutral 1

region\_test<-(chisq.test(responses$harmcat, responses$listofregions))  
region\_test

##   
## Pearson's Chi-squared test  
##   
## data: responses$harmcat and responses$listofregions  
## X-squared = 52.916, df = 58, p-value = 0.6643

region\_test2<-(chisq.test(responses$harm\_binary, responses$listofregions))  
region\_test2

##   
## Pearson's Chi-squared test  
##   
## data: responses$harm\_binary and responses$listofregions  
## X-squared = 29.436, df = 29, p-value = 0.4425

#something about this doesnt work with knitr but the code works

#more tests

#income from outside fishing?  
table(responses$harmcat, responses$income)

##   
## 10-25 25-50 50+ none U10  
## agree 6 5 20 27 20  
## disagree 2 3 11 13 6  
## neutral 2 6 15 18 8

income\_test<-(chisq.test(responses$harmcat, responses$income))  
income\_test

##   
## Pearson's Chi-squared test  
##   
## data: responses$harmcat and responses$income  
## X-squared = 3.8618, df = 8, p-value = 0.8694

income\_test2<-(chisq.test(responses$harm\_binary, responses$income))  
income\_test2

##   
## Pearson's Chi-squared test  
##   
## data: responses$harm\_binary and responses$income  
## X-squared = 3.4427, df = 4, p-value = 0.4867

#years fishing?  
table(responses$harmcat, responses$yrs\_fishing)

##   
## 0-5 15-25 25+ 5-15  
## agree 2 9 51 16  
## disagree 3 5 24 3  
## neutral 5 4 33 7

(chisq.test(responses$harmcat, responses$yrs\_fishing))

##   
## Pearson's Chi-squared test  
##   
## data: responses$harmcat and responses$yrs\_fishing  
## X-squared = 6.2996, df = 6, p-value = 0.3905

(chisq.test(responses$harm\_binary, responses$yrs\_fishing))

##   
## Pearson's Chi-squared test  
##   
## data: responses$harm\_binary and responses$yrs\_fishing  
## X-squared = 5.1027, df = 3, p-value = 0.1644

#industry role?  
table(responses$harmcat, responses$captain)

##   
## 0 1  
## agree 13 65  
## disagree 3 32  
## neutral 12 37

(chisq.test(responses$harmcat, responses$captain))

##   
## Pearson's Chi-squared test  
##   
## data: responses$harmcat and responses$captain  
## X-squared = 3.6588, df = 2, p-value = 0.1605

table(responses$harmcat, responses$industry\_role)

##   
## captain captain, crew captain, other captain, vessel owner  
## agree 8 2 0 41  
## disagree 1 1 0 23  
## neutral 3 2 1 21  
##   
## captain, vessel owner, crew captain, vessel owner, crew, other  
## agree 9 2  
## disagree 6 1  
## neutral 9 1  
##   
## captain, vessel owner, other crew crew, other other vessel owner  
## agree 3 6 1 1 4  
## disagree 0 0 1 0 2  
## neutral 0 3 0 4 3  
##   
## vessel owner, crew  
## agree 1  
## disagree 0  
## neutral 2

(chisq.test(responses$harmcat, responses$industry\_role))

##   
## Pearson's Chi-squared test  
##   
## data: responses$harmcat and responses$industry\_role  
## X-squared = 23.033, df = 22, p-value = 0.3999

#who are the people that believe in climate change but dont think they’ll be harmed

#add column, 1 for those who believe in climate change but don't think they will be harmed by it  
responses$bnh = as.numeric(NA, length(nrow(responses)))  
  
responses <- responses %>%   
 mutate(bnh = case\_when(  
 harmcat != "agree" & believecat =="agree" ~ "1",  
 harmcat == "agree" ~ "0",  
 believecat == "neutral" ~ "0",  
 believecat == "disagree" ~ "0"))  
  
#do they just think they're better able to adapt?  
t.test(responses$indv\_vulnerability\_euc ~ responses$bnh)

##   
## Welch Two Sample t-test  
##   
## data: responses$indv\_vulnerability\_euc by responses$bnh  
## t = 3.8701, df = 51.058, p-value = 0.0003101  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## 0.08495561 0.26808852  
## sample estimates:  
## mean in group 0 mean in group 1   
## 1.1072714 0.9307494

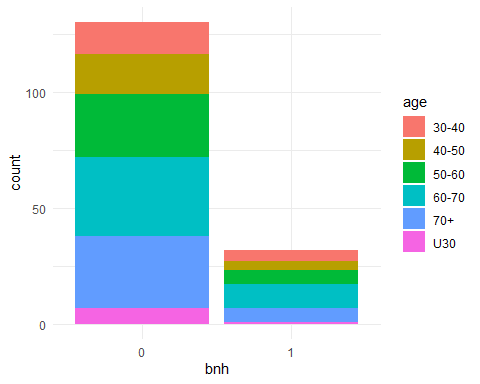
t.test(responses$indv\_ac ~ responses$bnh)

##   
## Welch Two Sample t-test  
##   
## data: responses$indv\_ac by responses$bnh  
## t = -3.0719, df = 48.937, p-value = 0.003469  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## -0.15983077 -0.03341175  
## sample estimates:  
## mean in group 0 mean in group 1   
## 0.4198718 0.5164931

#summary of age by response all 3 categories  
table(responses$bnh, responses$age)

##   
## 30-40 40-50 50-60 60-70 70+ U30  
## 0 14 17 27 34 31 7  
## 1 5 4 6 10 6 1

#visualize above  
ggplot(responses) +  
 aes(x = bnh, fill = age) +  
 geom\_bar() +  
 scale\_fill\_hue() +  
 theme\_minimal()



#chi squared test, is there difference in ages between responses  
age\_test<-chisq.test(table(responses$bnh, responses$age))  
age\_test

##   
## Pearson's Chi-squared test  
##   
## data: table(responses$bnh, responses$age)  
## X-squared = 1.3773, df = 5, p-value = 0.9268

#state that they live in?  
table(responses$bnh, responses$state\_code)

##   
## AK CA OR WA  
## 0 1 27 26 76  
## 1 0 9 5 18

state\_test<-(chisq.test(responses$bnh, responses$state\_code))  
state\_test

##   
## Pearson's Chi-squared test  
##   
## data: responses$bnh and responses$state\_code  
## X-squared = 1.1499, df = 3, p-value = 0.765

#region they fish in?  
#need to maybe get this to be one region instead of list  
table(responses$harmcat, responses$listofregions)

##   
## Cen Cal Cen Cal, So Cal Columbia River Columbia River, OR coast  
## agree 2 1 8 2  
## disagree 0 0 4 1  
## neutral 1 0 6 1  
##   
## Columbia River, OR coast, Cen Cal  
## agree 0  
## disagree 0  
## neutral 1  
##   
## Columbia River, OR coast, Nor Cal, Cen Cal Nor Cal Nor Cal, Cen Cal  
## agree 1 1 2  
## disagree 0 1 2  
## neutral 1 1 0  
##   
## OR coast OR coast, Nor Cal OR coast, Nor Cal, Cen Cal  
## agree 9 1 3  
## disagree 4 1 0  
## neutral 6 0 0  
##   
## OR coast, So Cal Puget Sound SJF Puget Sound SJF, Cen Cal, So Cal  
## agree 0 16 1  
## disagree 0 7 0  
## neutral 1 7 1  
##   
## Puget Sound SJF, Columbia River  
## agree 1  
## disagree 0  
## neutral 1  
##   
## Puget Sound SJF, Columbia River, OR coast Puget Sound SJF, OR coast  
## agree 1 1  
## disagree 0 1  
## neutral 0 0  
##   
## Puget Sound SJF, WA coast Puget Sound SJF, WA coast, Columbia River  
## agree 1 2  
## disagree 3 1  
## neutral 2 1  
##   
## Puget Sound SJF, WA coast, Columbia River, OR coast So Cal WA coast  
## agree 1 4 3  
## disagree 0 1 5  
## neutral 0 0 10  
##   
## WA coast, Columbia River WA coast, Columbia River, OR coast  
## agree 3 4  
## disagree 0 1  
## neutral 3 2  
##   
## WA coast, Columbia River, OR coast, Nor Cal  
## agree 1  
## disagree 2  
## neutral 0  
##   
## WA coast, Columbia River, OR coast, Nor Cal, Cen Cal  
## agree 0  
## disagree 0  
## neutral 1  
##   
## WA coast, Columbia River, OR coast, Nor Cal, Cen Cal, So Cal  
## agree 1  
## disagree 0  
## neutral 0  
##   
## WA coast, OR coast WA coast, OR coast, Nor Cal  
## agree 8 0  
## disagree 1 0  
## neutral 1 1  
##   
## WA coast, OR coast, Nor Cal, Cen Cal  
## agree 0  
## disagree 0  
## neutral 1

region\_test<-(chisq.test(responses$harmcat, responses$listofregions))  
region\_test

##   
## Pearson's Chi-squared test  
##   
## data: responses$harmcat and responses$listofregions  
## X-squared = 52.916, df = 58, p-value = 0.6643

region\_test2<-(chisq.test(responses$harm\_binary, responses$listofregions))  
region\_test2

##   
## Pearson's Chi-squared test  
##   
## data: responses$harm\_binary and responses$listofregions  
## X-squared = 29.436, df = 29, p-value = 0.4425

#number of fisheries they're in?  
#table(responses$bnh, responses$num\_fisheries)  
  
#num\_test<-(chisq.test(responses$bnh, responses$num\_fisheries))  
#num\_test  
  
#plot this one to visualize residuals  
  
#mosaic(~ bnh + num\_fisheries,  
 # direction = c("v", "h"),  
 #data = responses,  
 #shade = TRUE)  
  
#income from outside fishing?  
table(responses$bnh, responses$income)

##   
## 10-25 25-50 50+ none U10  
## 0 6 9 40 47 28  
## 1 4 5 6 11 6

income\_test<-(chisq.test(responses$bnh, responses$income))  
income\_test

##   
## Pearson's Chi-squared test  
##   
## data: responses$bnh and responses$income  
## X-squared = 6.2605, df = 4, p-value = 0.1805

#years fishing?  
table(responses$bnh, responses$yrs\_fishing)

##   
## 0-5 15-25 25+ 5-15  
## 0 6 13 91 20  
## 1 4 5 17 6

(chisq.test(responses$bnh, responses$yrs\_fishing))

##   
## Pearson's Chi-squared test  
##   
## data: responses$bnh and responses$yrs\_fishing  
## X-squared = 4.5955, df = 3, p-value = 0.2039

#industry role?  
table(responses$bnh, responses$industry\_role)

##   
## captain captain, crew captain, other captain, vessel owner  
## 0 12 4 1 70  
## 1 0 1 0 15  
##   
## captain, vessel owner, crew captain, vessel owner, crew, other  
## 0 18 2  
## 1 6 2  
##   
## captain, vessel owner, other crew crew, other other vessel owner  
## 0 3 7 2 3 7  
## 1 0 2 0 2 2  
##   
## vessel owner, crew  
## 0 1  
## 1 2

(chisq.test(responses$bnh, responses$industry\_role))

##   
## Pearson's Chi-squared test  
##   
## data: responses$bnh and responses$industry\_role  
## X-squared = 12.922, df = 11, p-value = 0.2985

#fishery  
table(responses$bnh, responses$salmon)

##   
## 0 1  
## 0 39 91  
## 1 12 20

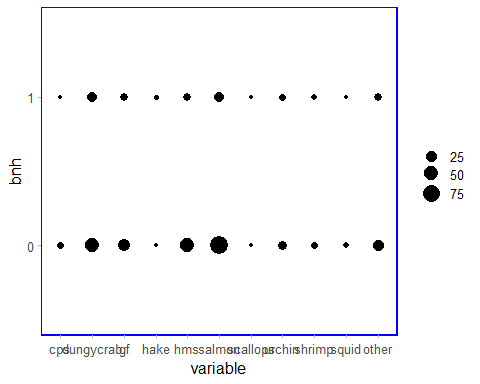
(chisq.test(responses$bnh, responses$salmon, correct = F))

##   
## Pearson's Chi-squared test  
##   
## data: responses$bnh and responses$salmon  
## X-squared = 0.66963, df = 1, p-value = 0.4132

(chisq.test(responses$bnh, responses$dungeness\_crab, correct = F))

##   
## Pearson's Chi-squared test  
##   
## data: responses$bnh and responses$dungeness\_crab  
## X-squared = 4.6779, df = 1, p-value = 0.03055

bnh\_exploration<-responses%>%  
 select(CPS, dungeness\_crab, groundfish, hake, HMS, salmon, scallops, urchin, shrimp, squid, other, bnh)  
  
fish\_bnh <-bnh\_exploration %>% group\_by(bnh) %>%  
 summarise(  
 cps = sum(CPS),  
 dungycrab = sum(dungeness\_crab),  
 gf = sum(groundfish),  
 hake = sum(hake),  
 hms = sum(HMS),  
 salmon = sum(salmon),  
 scallops = sum(scallops),  
 urchin = sum(urchin),  
 shrimp = sum(shrimp),  
 squid = sum(squid),  
 other = sum(other))  
  
fish\_bnh\_melted<-melt(fish\_bnh)  
  
p <- ggplot(fish\_bnh\_melted, aes(x =variable, y = bnh))   
p+geom\_point( aes(size=value))+theme(panel.background=element\_blank(), panel.border = element\_rect(colour = "blue", fill=NA, size=1))



##bar plots of belief in climate change by geopgraphy or age ##moved from data exploration ##use likert package to view by percentage

##Belief in climate change by State

##Believe that climate change will harm them by State

##Believe that climate change will harm future generations by State

##Belief in climate change by age

##Believe that climate change will harm them by age

##Believe that climate change will harm future generations by age