# Crystal Lake Perch Exploratory Analysis

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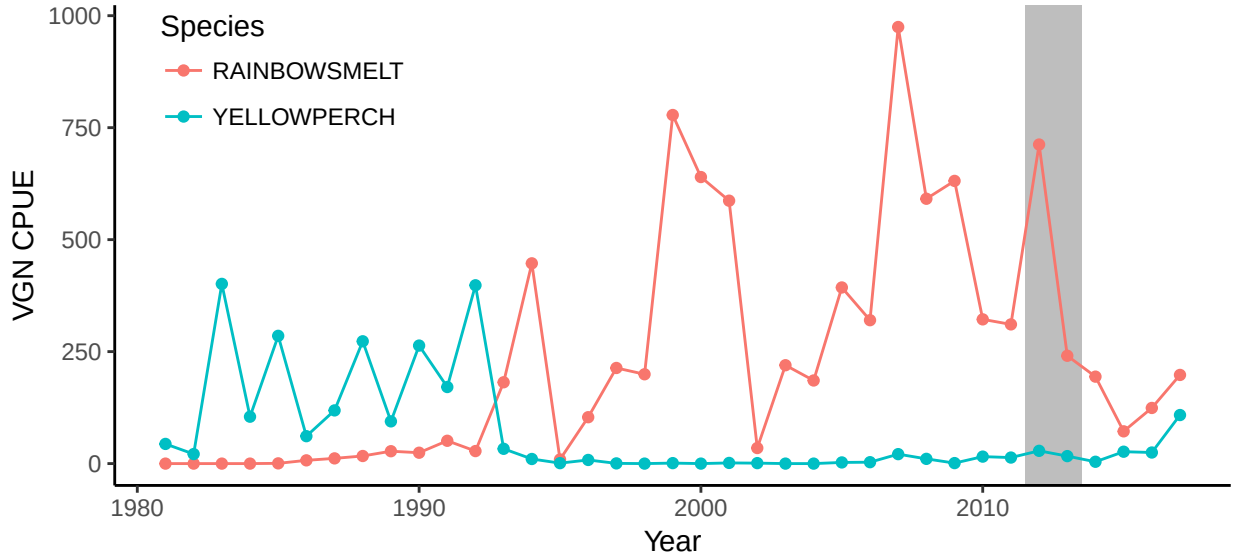
## Crystal Lake Perch

Preliminary analysis of long-term LTER data in Crystal Lake examining patterns in Perch and Smelt following the whole-lake mixing project. In late July 2017 NRL and LTER fish crew observed that perch CPUE appeared to be higher than ever recalled (NRL involved in fish crew since 2009).

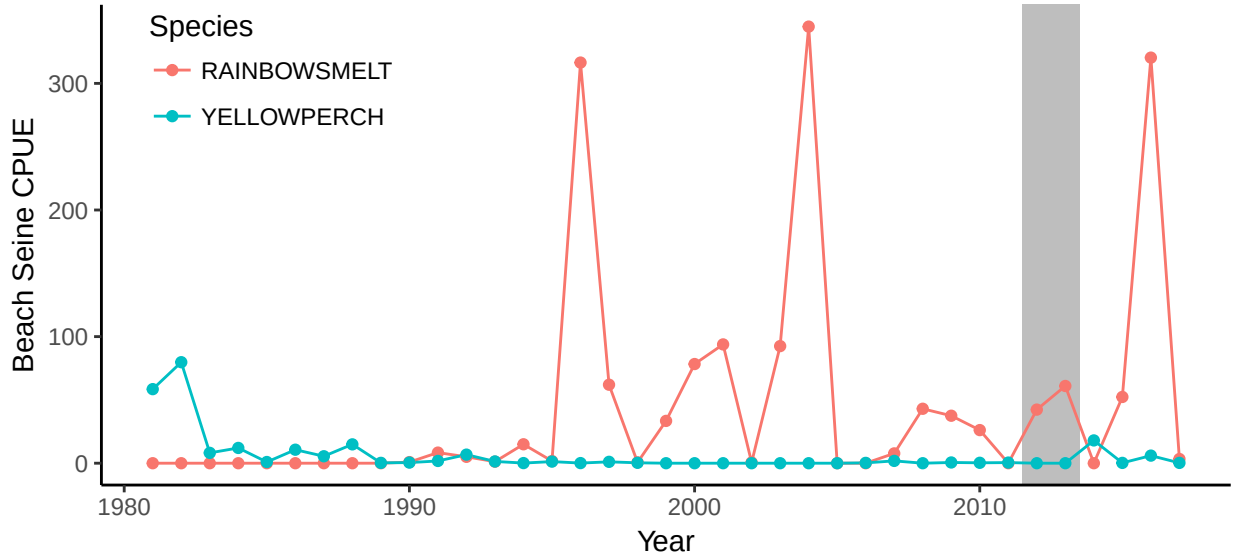
```
CR_Fish = lter_fish %>% filter(lakeid=="CR") %>%
    filter(spname =="YELLOWPERCH" | spname == "RAINBOWSMELT")
CR_Fish$CPUE = round(CR_Fish$total_caught/CR_Fish$effort,digits=3)
CR_Fish$spname = as.factor(CR_Fish$spname)
```

### Long-term Vertical Gill Net CPUE

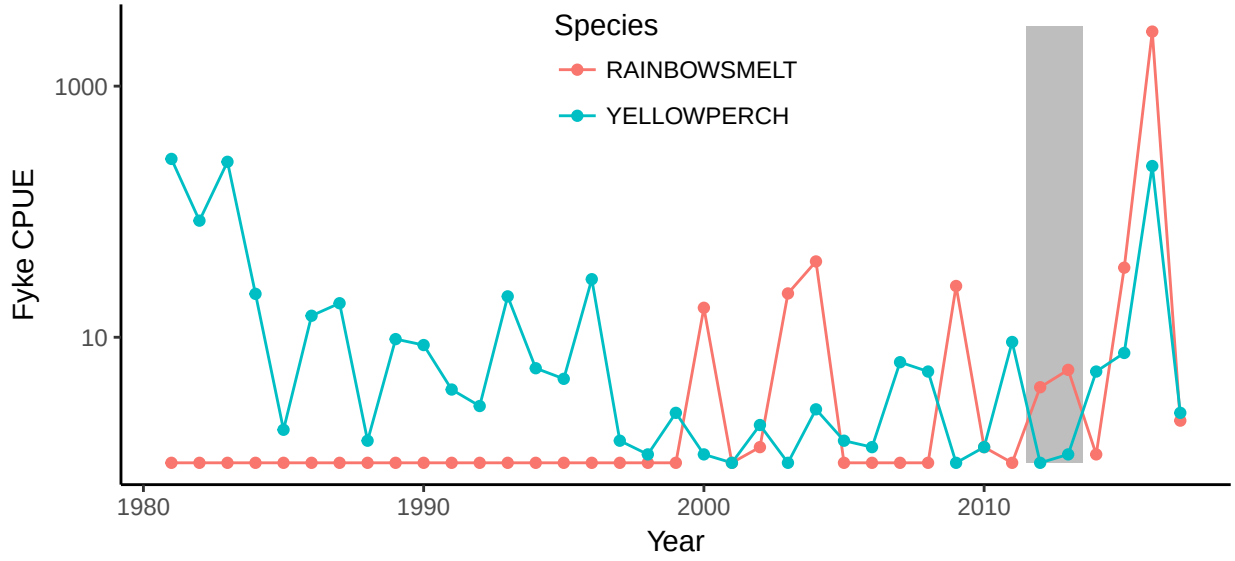



CPUE is summed across all gill nets. Grey bar denotes CR Mixing Exp.

## Long-term Beach Seine CPUE

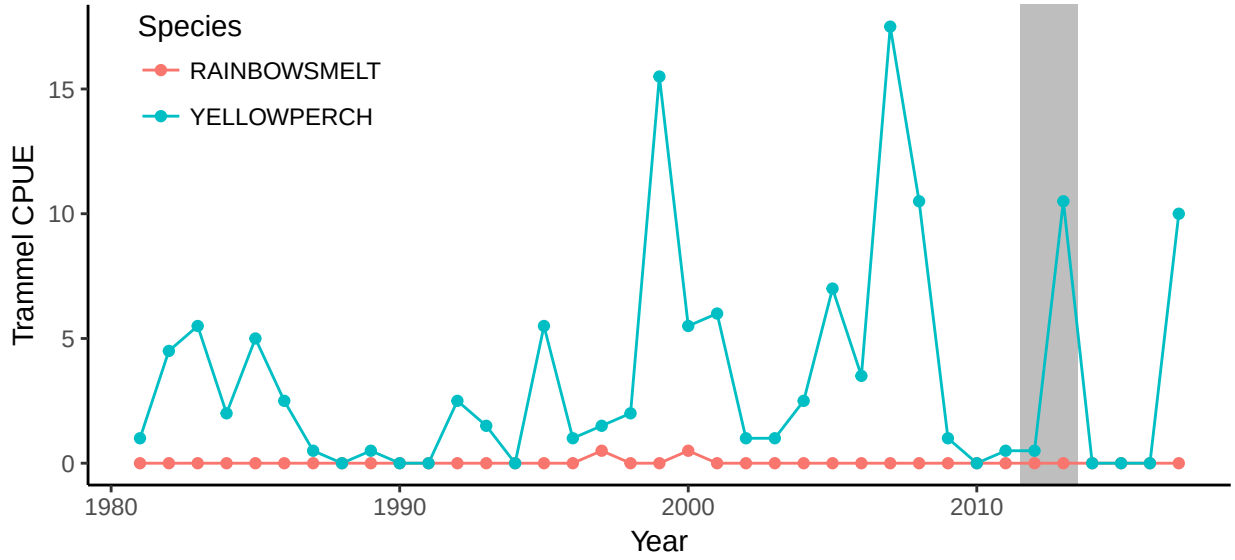



## Long-term Fyke Net CPUE



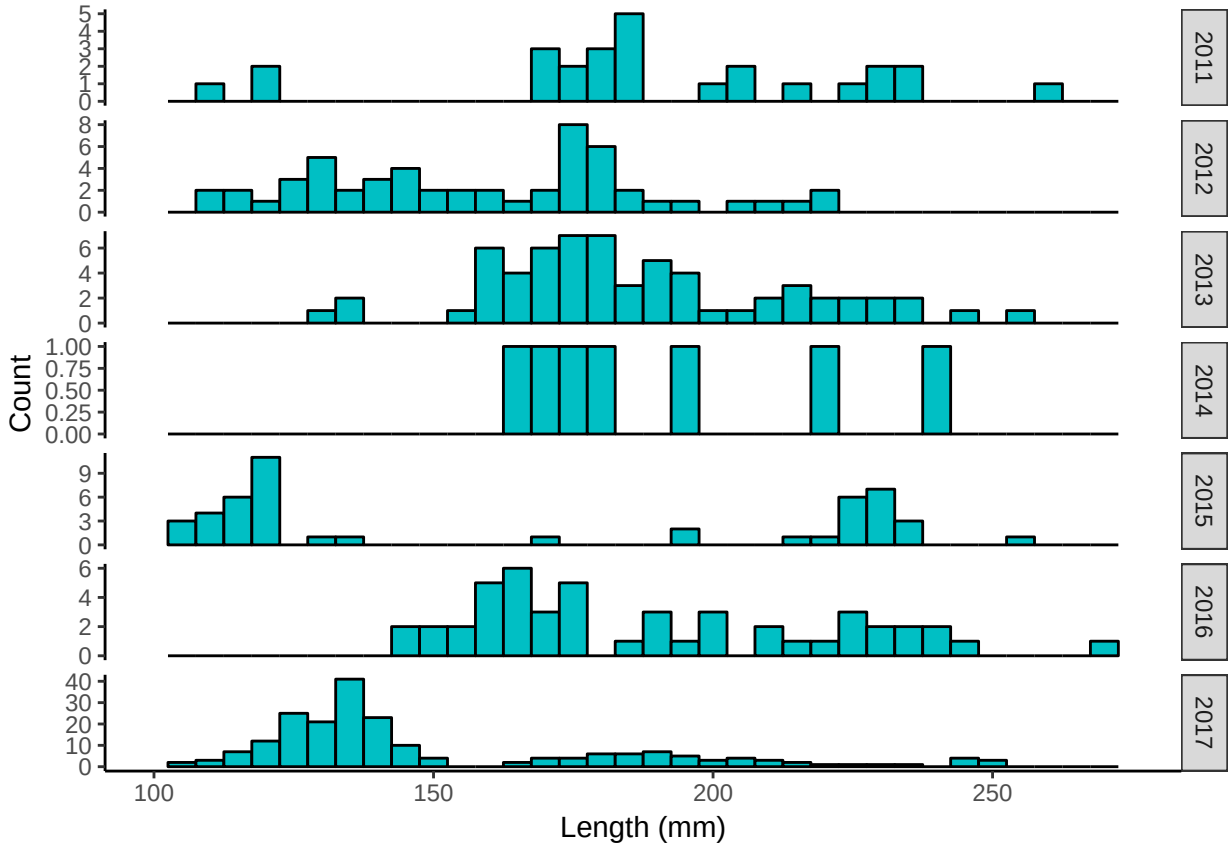

Note the extremely high CPUE for RS in 2016. NRL actually was on the crew that pulled a fyke net with estimated 11k RS. The fyke had over 2kg of RS (approx weight of yoy RS 0.2g). Note that the y-axis is log10 scaled.

## Long-term Trammel Net CPUE



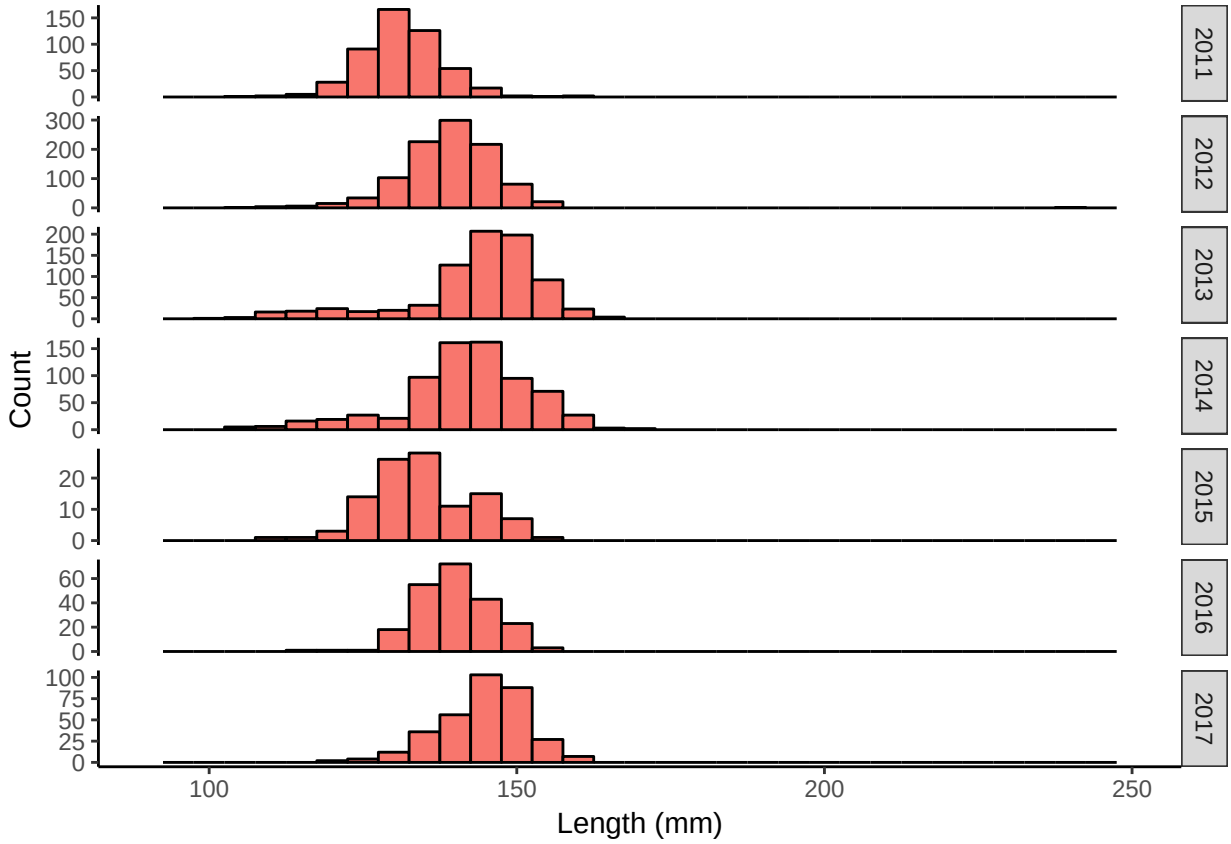
## Size Frequency Distributions

```
myplot = ggplot(CR.length %>% filter(spname=="YELLOWPERCH" & year4 >=2011),aes(x=length)) +
    geom_histogram(binwidth=5,colour="black",fill="#00BFC4") +
    facet_grid(year4 ~ .,scales="free")
myplot + theme_bw() + theme(panel.border = element_blank(),
    panel.grid.major = element_blank(),panel.grid.minor = element_blank(),
    axis.line = element_line(colour = "black"),legend.position = c(0.15, 0.85)) +
    labs(x="Length (mm)",y="Count ") + xlim(c(100,275))
```




Size frequency distributions for Yellow Perch caught in VGN each year since the Crystal lake mixing experiment (mixed in 2012 and 2013)

```
myplot = ggplot(CR.length %>% filter(spname=="RAINBOWSMELT" & year4 >=2011),aes(x=length)) +
    geom_histogram(binwidth=5,colour="black",fill="#F8766D") +
    facet_grid(year4 ~ .,scales="free_y")
myplot + theme_bw() + theme(panel.border = element_blank(),
    panel.grid.major = element_blank(),panel.grid.minor = element_blank(),
    axis.line = element_line(colour = "black"),legend.position = c(0.15, 0.85)) +
    labs(x="Length (mm)",y="Count ") + xlim(c(90,250))
```




Size frequency distributions for Rainbow Smelt caught in VGN each year since the Crystal lake mixing experiment (mixed in 2012 and 2013)

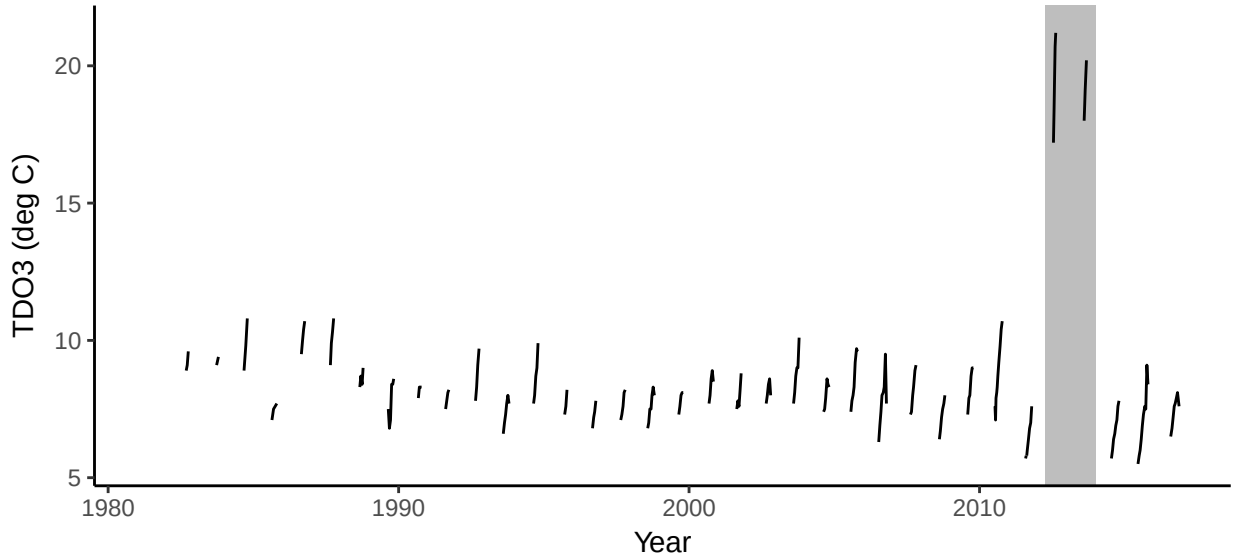
## TDO3 and Thermocline Dynamics

```
## Warning in as.POSIXlt.POSIXct(x, tz): unknown timezone 'zone/tz/2017c.1.0/
## zoneinfo/America/Menominee'
```

```
## Joining, by = "sampledate"
```

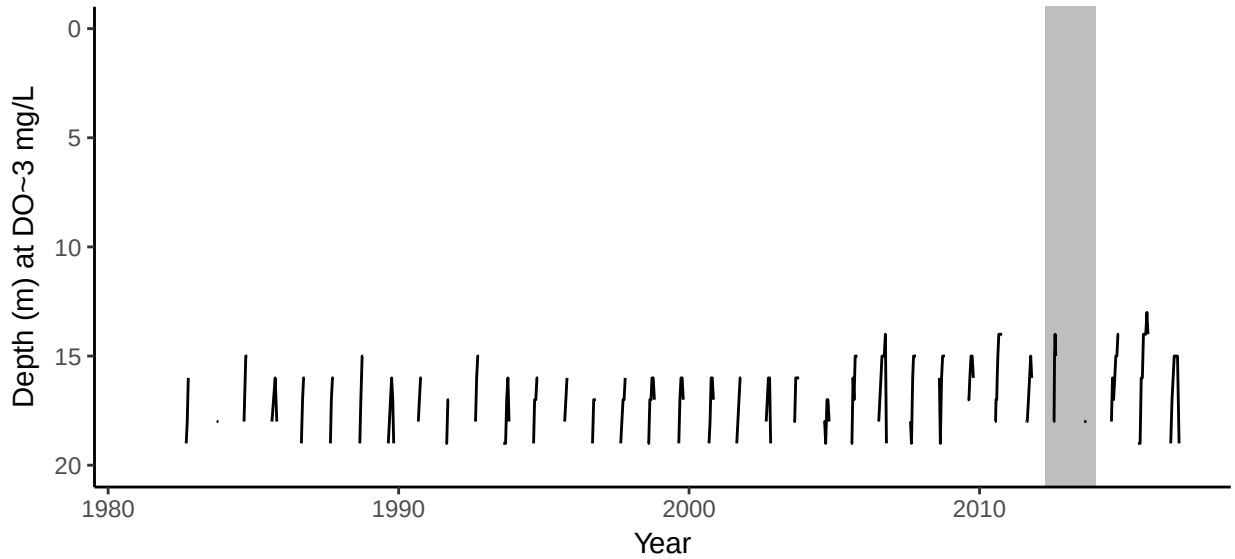
```
## Warning in as.POSIXlt.POSIXct(x, tz): unknown timezone 'zone/tz/2017c.1.0/
## zoneinfo/America/Menominee'
```

```
## Warning: Removed 25 rows containing missing values (geom_path).
```




TDO3 was estimated using temp/do profiles collected by LTER. TDO3 identified for each sampling event represents the water temperature value closest to 3 mg/L but less than 4 mg/L. For example, 15m was 5.2 mg/L DO and 16m was 1.8mg/L... TDO3 was reported as the water temperature at 16m.

```
## Warning: Removed 25 rows containing missing values (geom_path).
```




Depth at DO~3 mg/L estimated the same way as described for TDO3

**Nutrients and Water Clarity**