

# OutputComplete.R

2025-02-21

## Setup

```
knitr::opts_chunk$set(echo = TRUE)
source('IHA/IHAPackages.r') # Inputs necessary packages
IHAPackages()

## Loading required package: tidyverse

## -- Attaching core tidyverse packages ----- tidyverse 2.0.0 --
## v dplyr      1.1.4      v readr      2.1.5
## v forcats    1.0.0      v stringr   1.5.1
## v ggplot2    3.5.1      v tibble    3.2.1
## v lubridate  1.9.3      v tidyr     1.3.1
## v purrr      1.0.2
## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()     masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
## Loading required package: IHA
##
## Loading required package: zoo
##
##
## Attaching package: 'zoo'
##
##
## The following objects are masked from 'package:base':
##
##      as.Date, as.Date.numeric
##
## Loading required package: dataRetrieval
## Warning: package 'dataRetrieval' was built under R version 4.3.3
## Loading required package: plyr
## -----
## You have loaded plyr after dplyr - this is likely to cause problems.
## If you need functions from both plyr and dplyr, please load plyr first, then dplyr:
## library(plyr); library(dplyr)
## -----
##
## Attaching package: 'plyr'
##
## The following objects are masked from 'package:dplyr':
##
```

```
##      arrange, count, desc, failwith, id, mutate, rename, summarise,
##      summarize
##
## The following object is masked from 'package:purrr':
##
##      compact
##
## Loading required package: exactRankTests
## Package 'exactRankTests' is no longer under development.
## Please consider using package 'coin' instead.
##
## Loading required package: eseis
## Loading required package: plot.matrix
## Loading required package: writexl
## Warning: package 'writexl' was built under R version 4.3.3
```

## User Inputs

```
gauge_number <- '02331000' # USGS gauge code
gauge_name <- 'LEAF' # USGS gauge location name

# Dates for analysis
start_date <- as.Date('1940-02-21') # Date when gauge started recording
break1_date <- as.Date('1950-03-01') # Date of end of time 1 and start of time 2
break2_date <- as.Date('1956-02-01') # Date of end of time 2 and start of time 3
end_date <- as.Date('2024-11-12') # Current date or end of gauge record
                                     # Can be set as current date is streamgauge is
                                     # ongoing

#Stats output location
stats_export_path <-
  '~/Library/CloudStorage/OneDrive-BowdoinCollege/Bowdoin/Honors/DAMS Outputs'

# Years split into two different time periods
inc_yr1 <- format(start_date, '%Y')
inc_yr2 <- format(break1_date, '%Y')
inc_yr3 <- format(break2_date, '%Y')
inc_yr4 <- format(end_date, '%Y')
```

download streamgaugage data and subset by date

Daily flow to zoo for IHA

IHA package functions

Field Measurements Functions

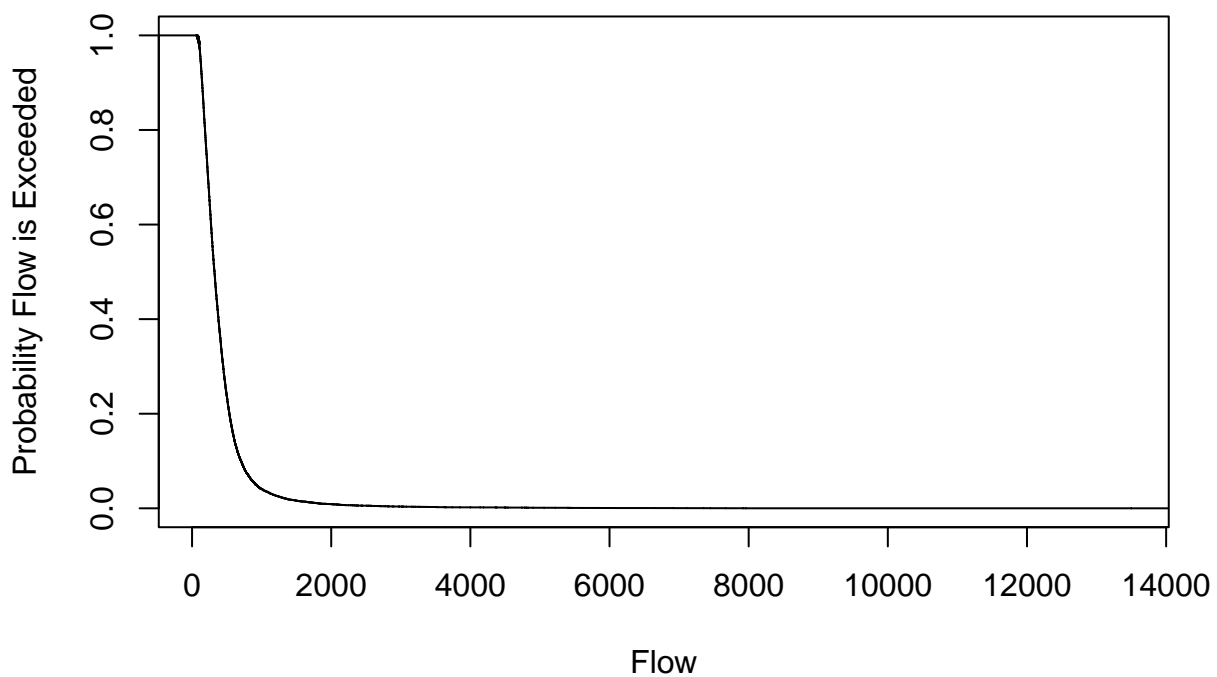
Annual Measure of Center Functions

Annual Peak Flow Functions

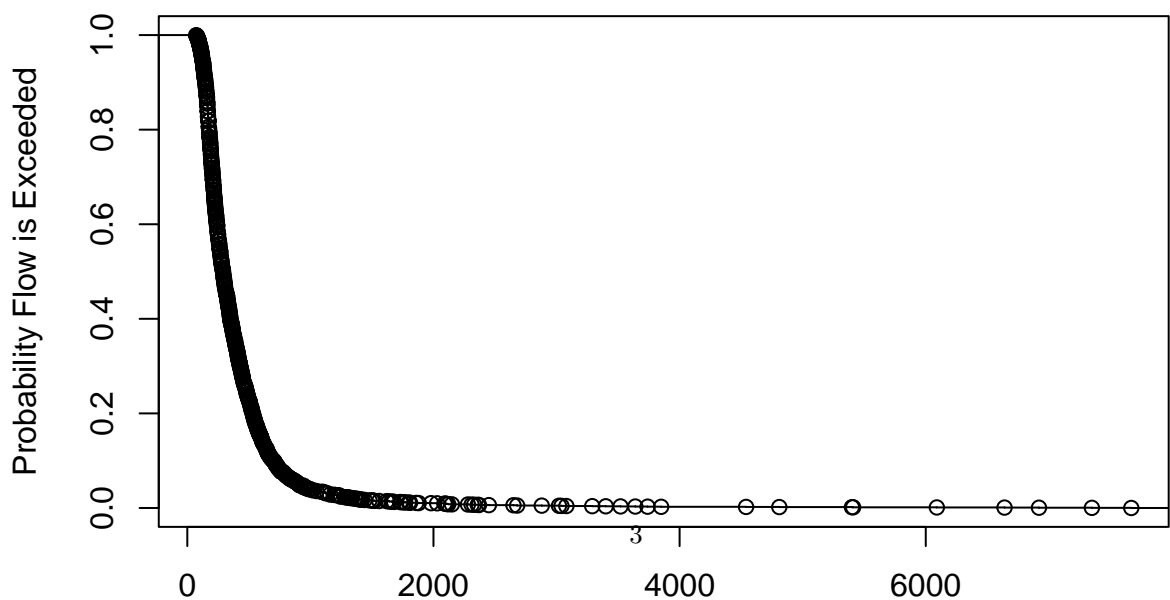
Annual High Flow Functions

IHA Manipulation and Visualization

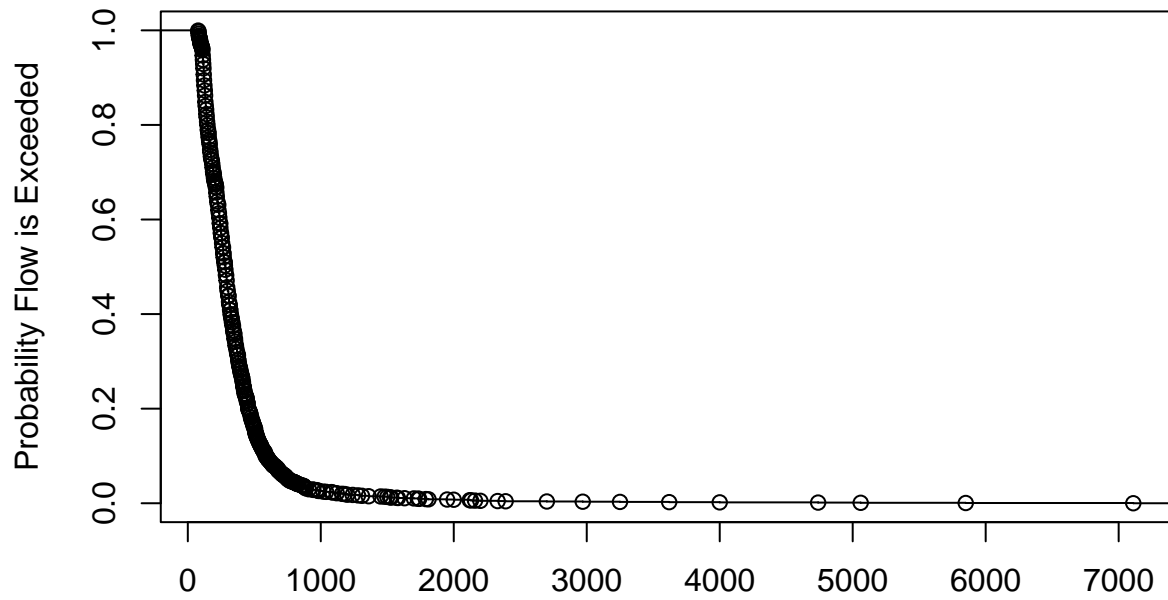
### Flow duration curve



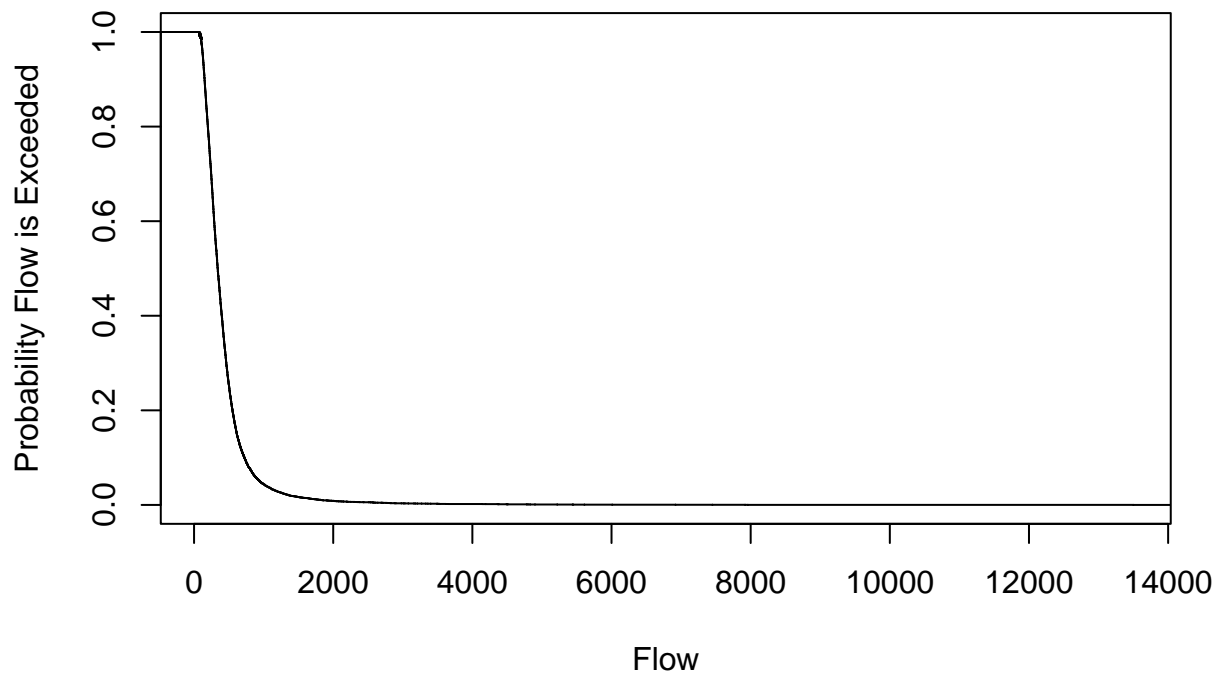
### Flow duration curve



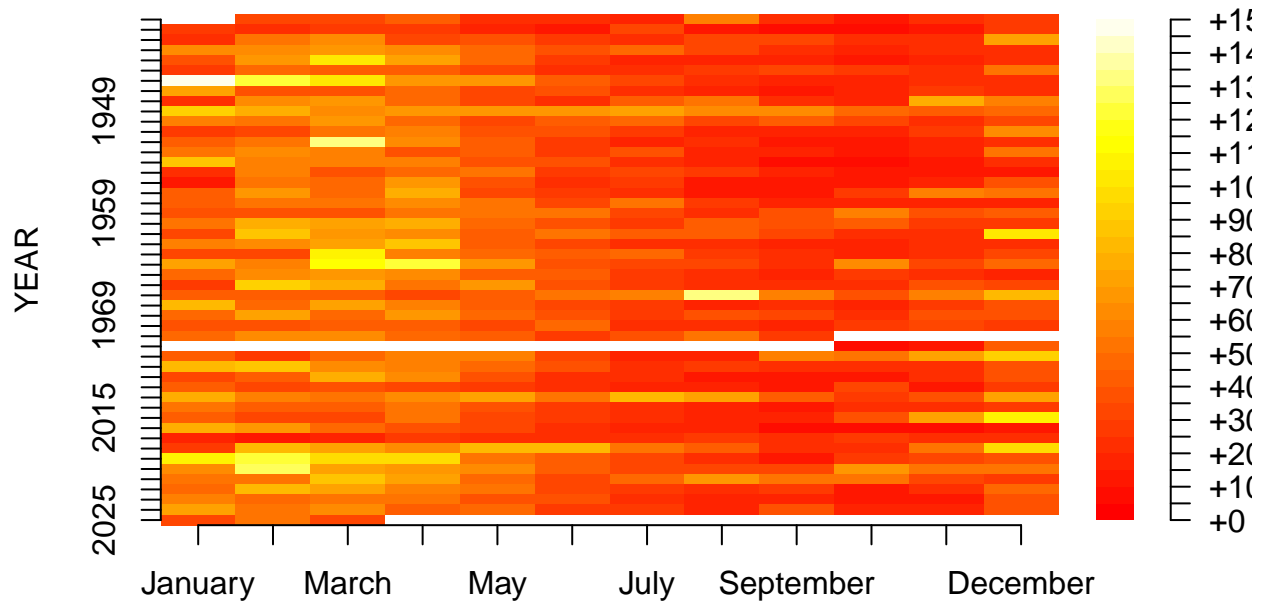
**Flow duration curve**



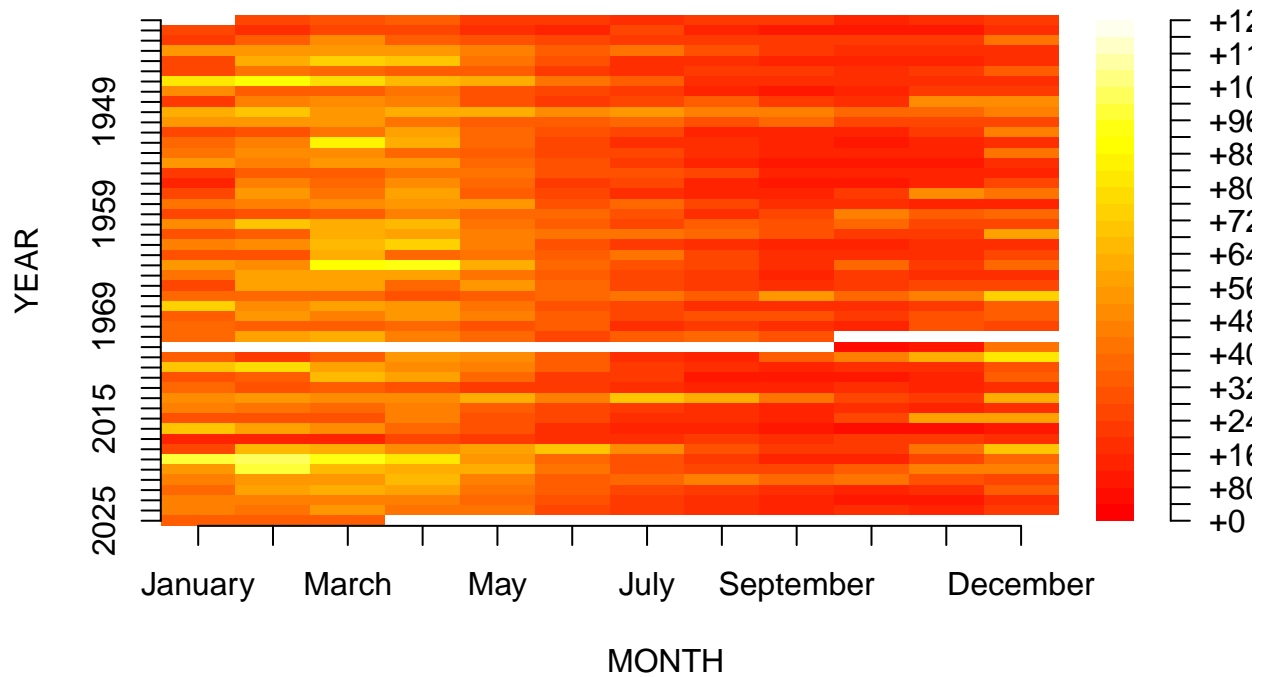
**Flow duration curve**



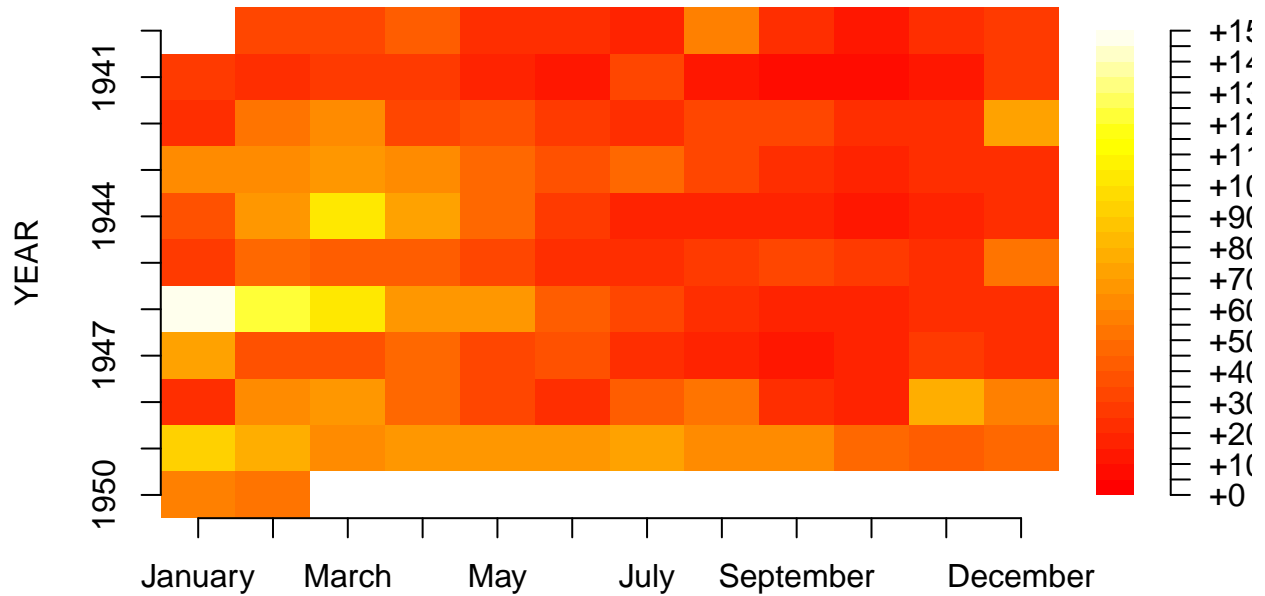
## GROUP 1 MEAN FULL TIME



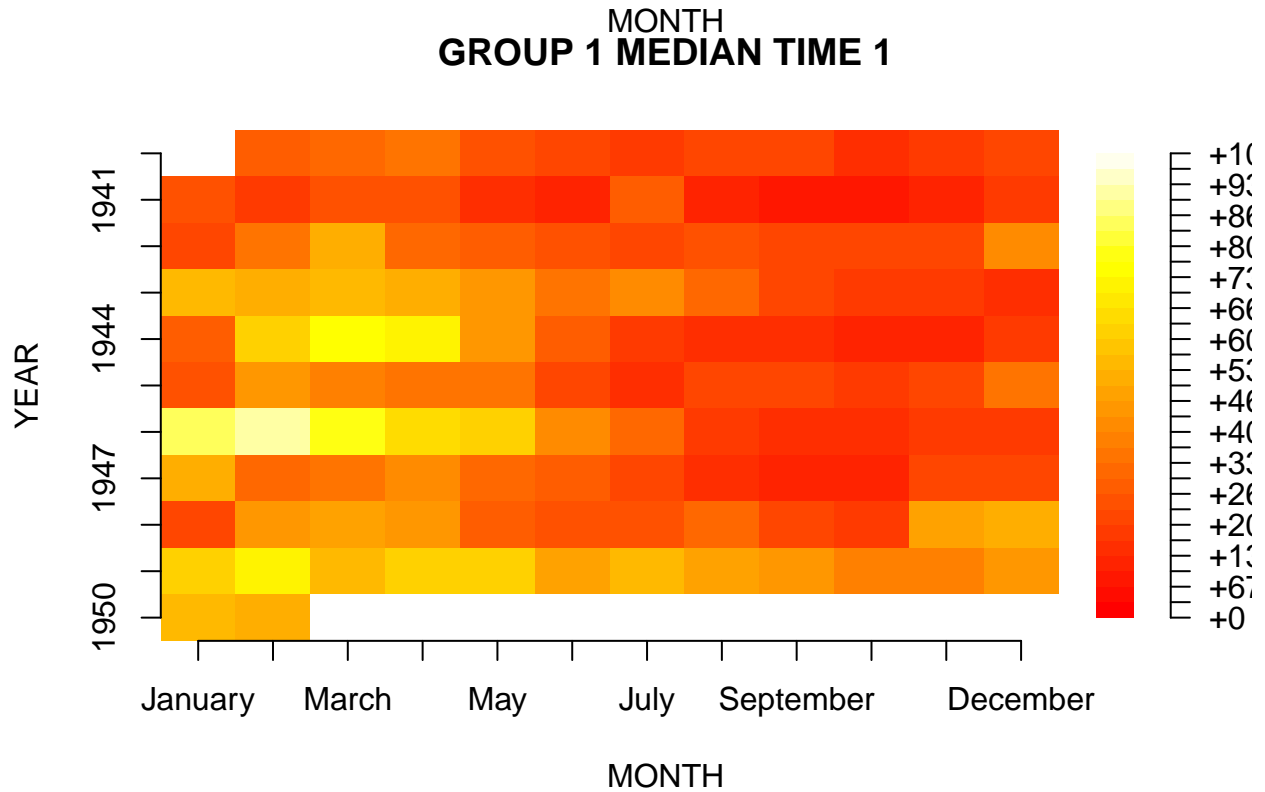
## GROUP 1 MEDIAN FULL TIME



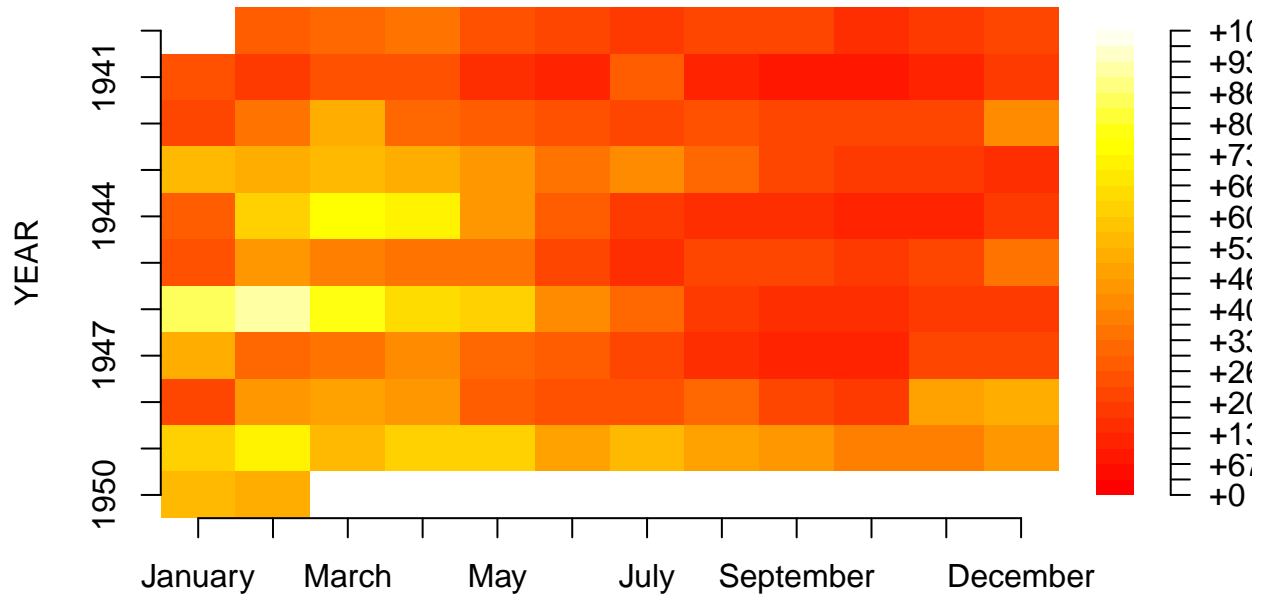
# GROUP 1 MEAN TIME 1



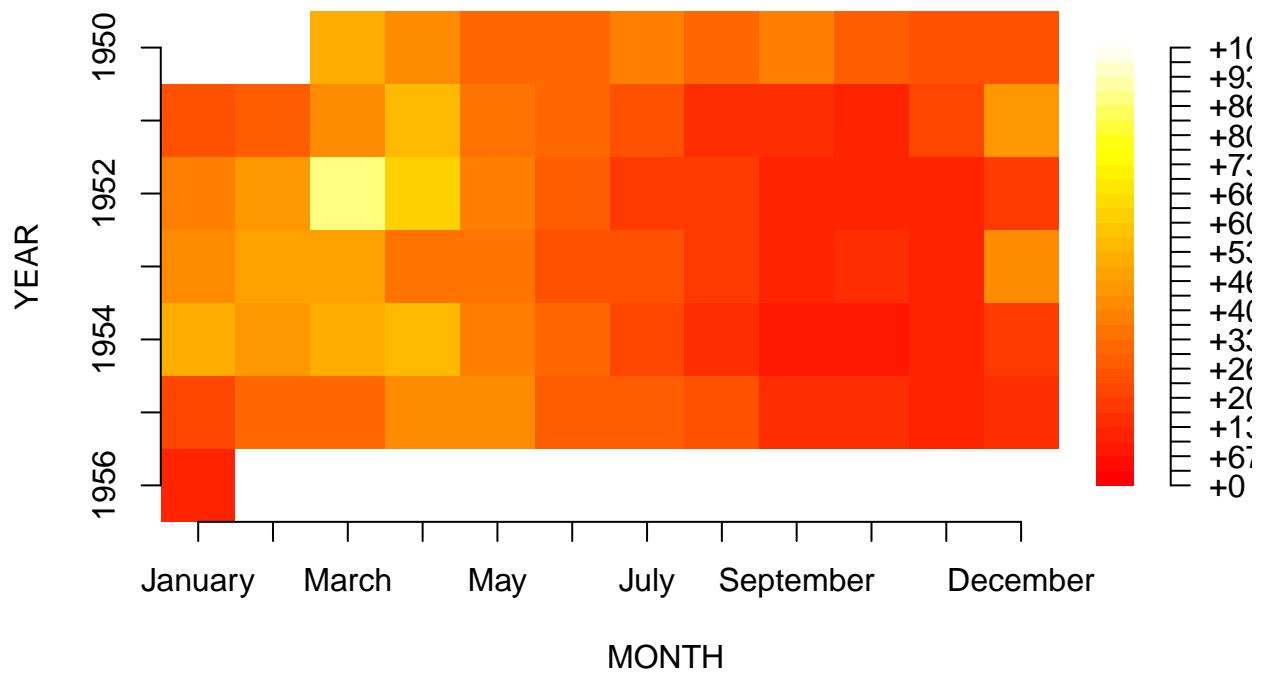
# GROUP 1 MEDIAN TIME 1



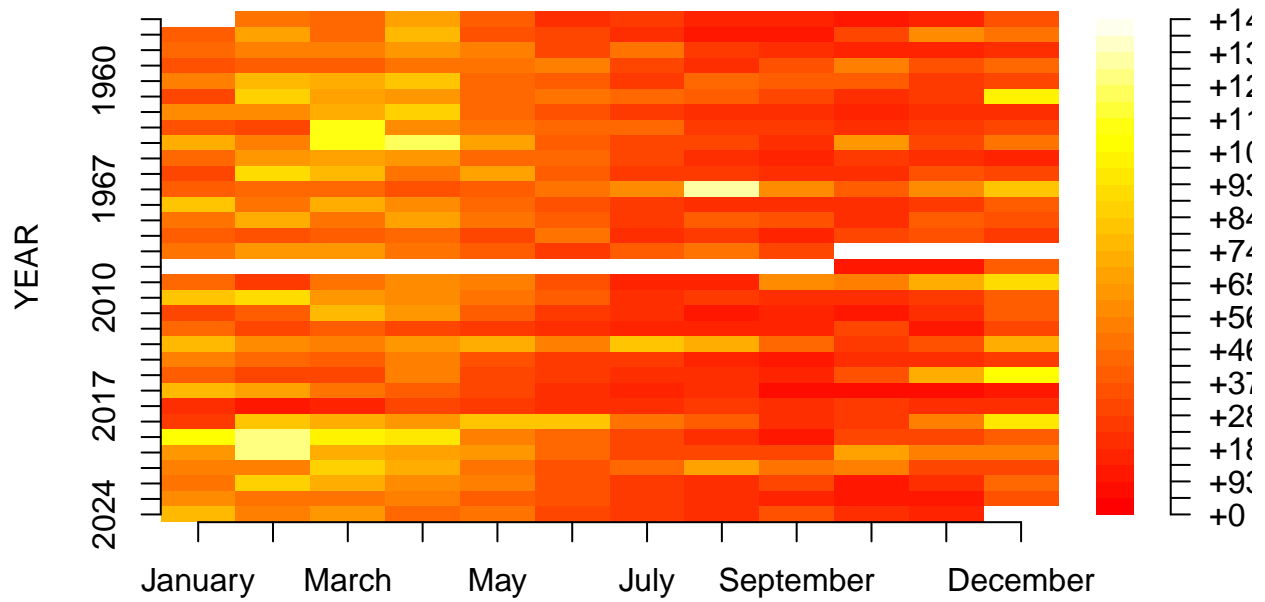
## GROUP 1 MEAN TIME 2



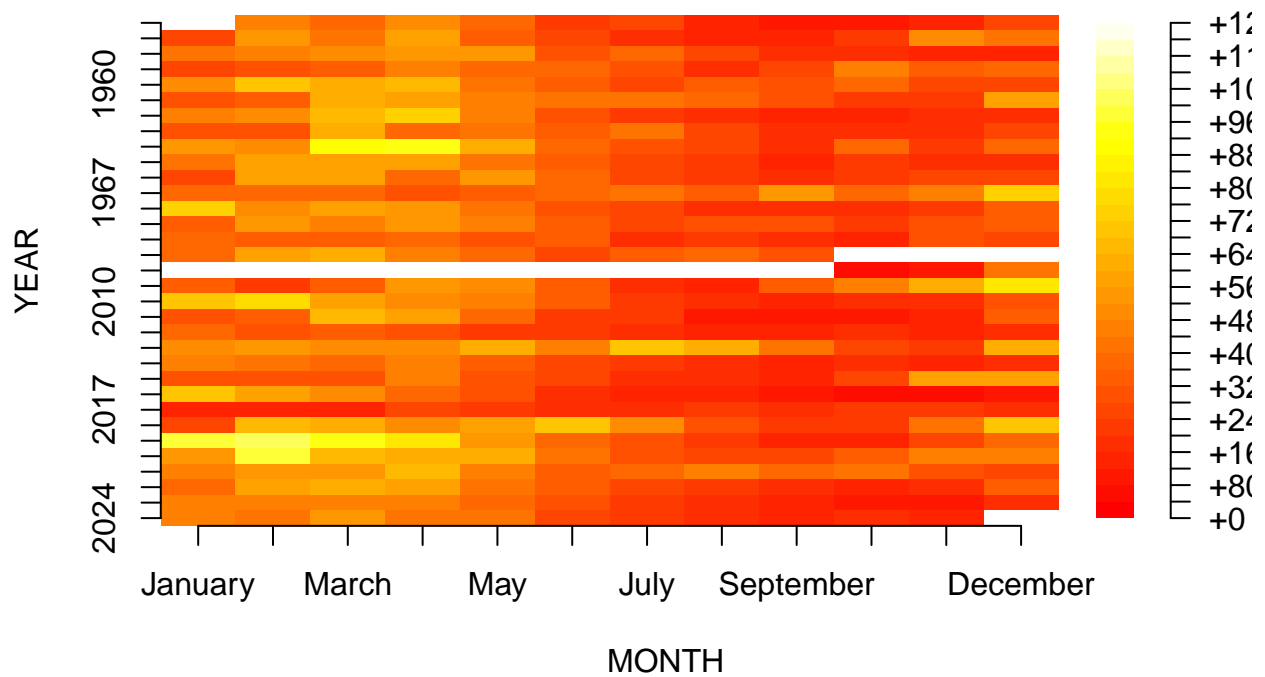
## GROUP 1 MEDIAN TIME 2



### GROUP 1 MEAN TIME 3



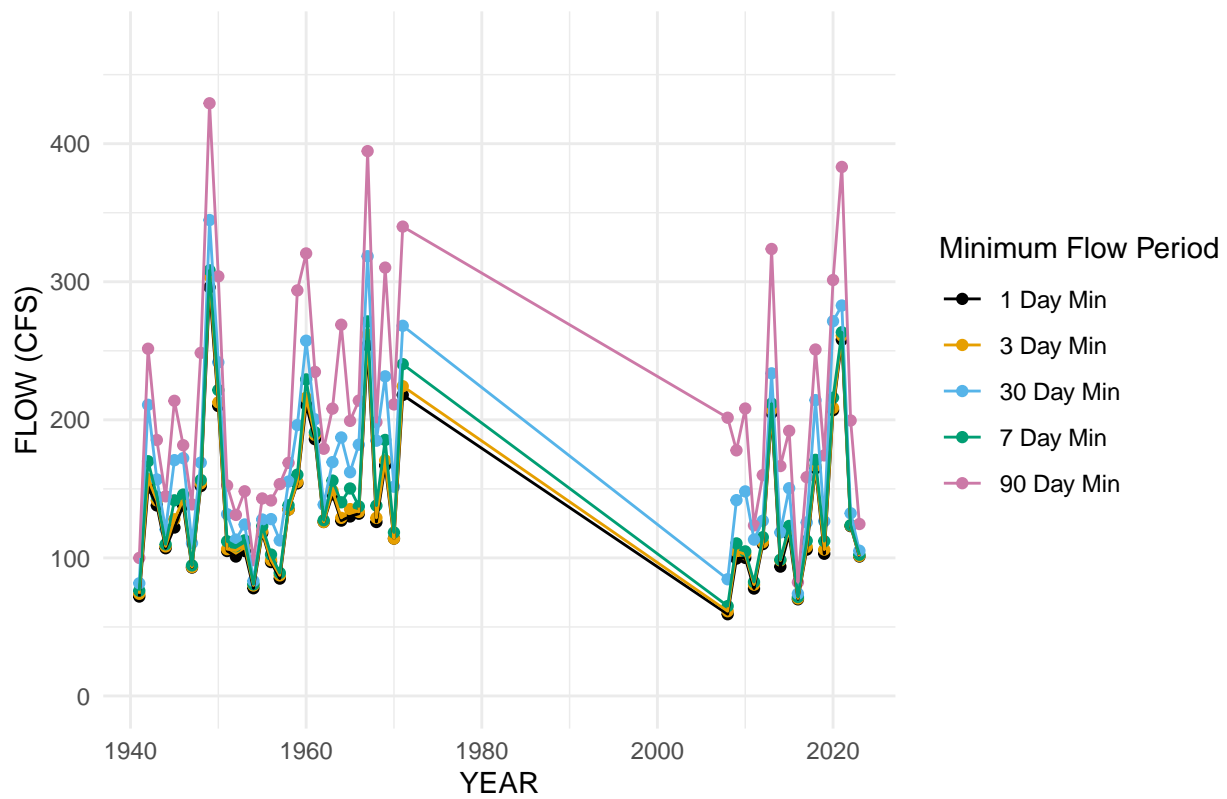
### GROUP 1 MEDIAN TIME 3



## \$group2\_min\_full\_plot

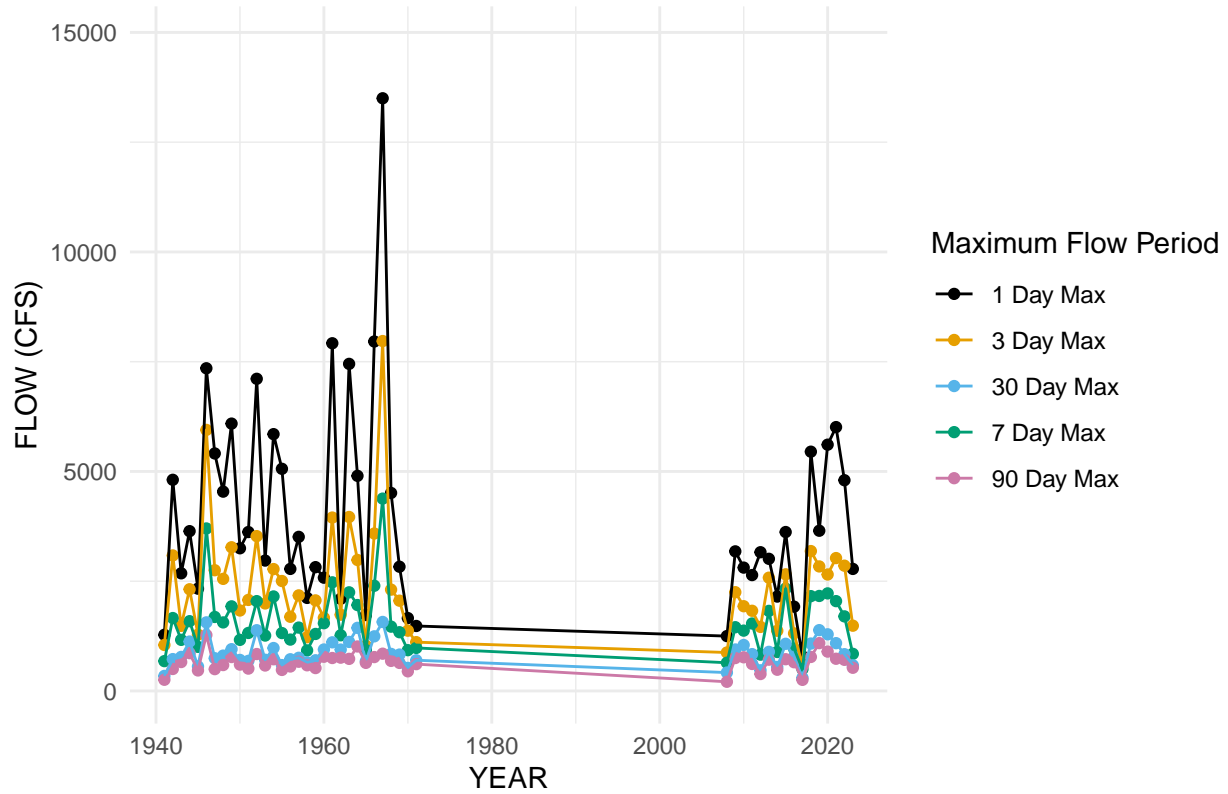


## GROUP 2 MINIMUM FULL TIME



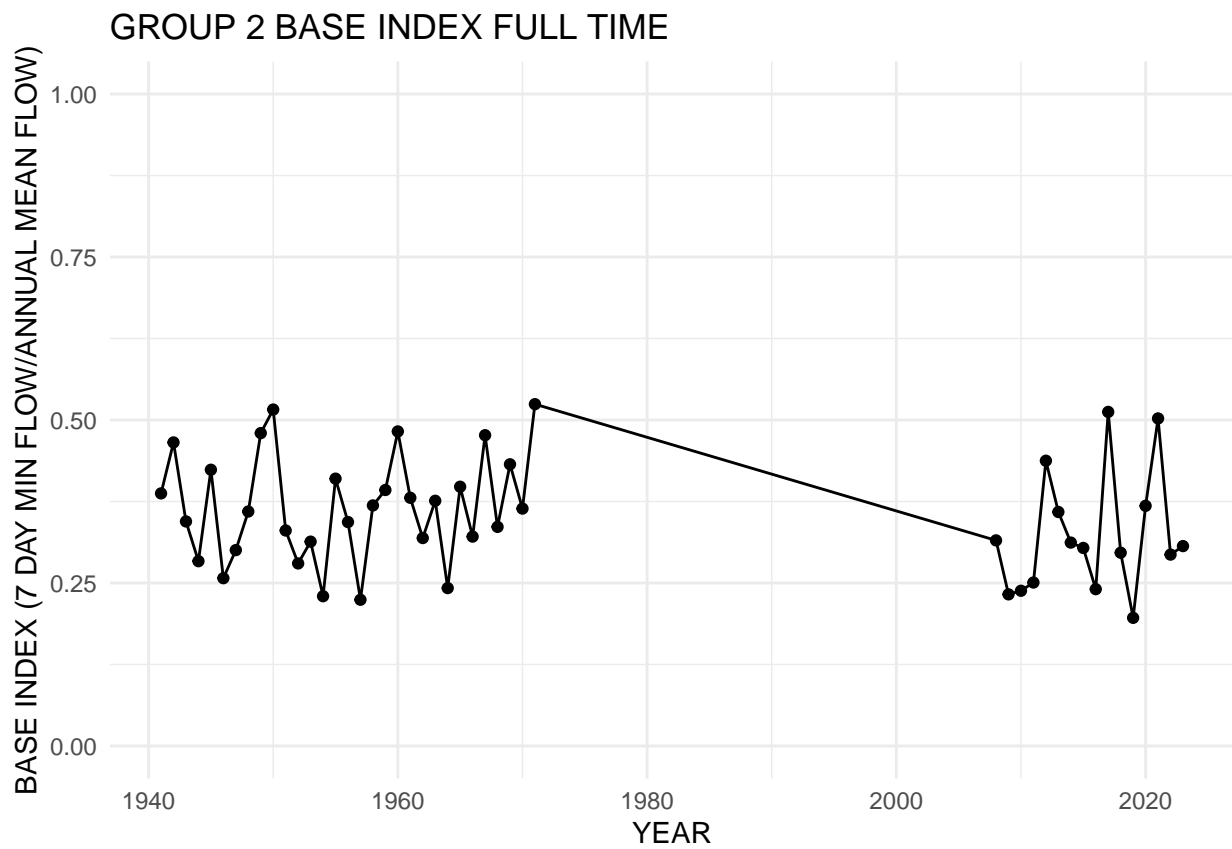
```
##  
## $group2_max_full_plot
```

## GROUP 2 MAXIMUM FULL TIME

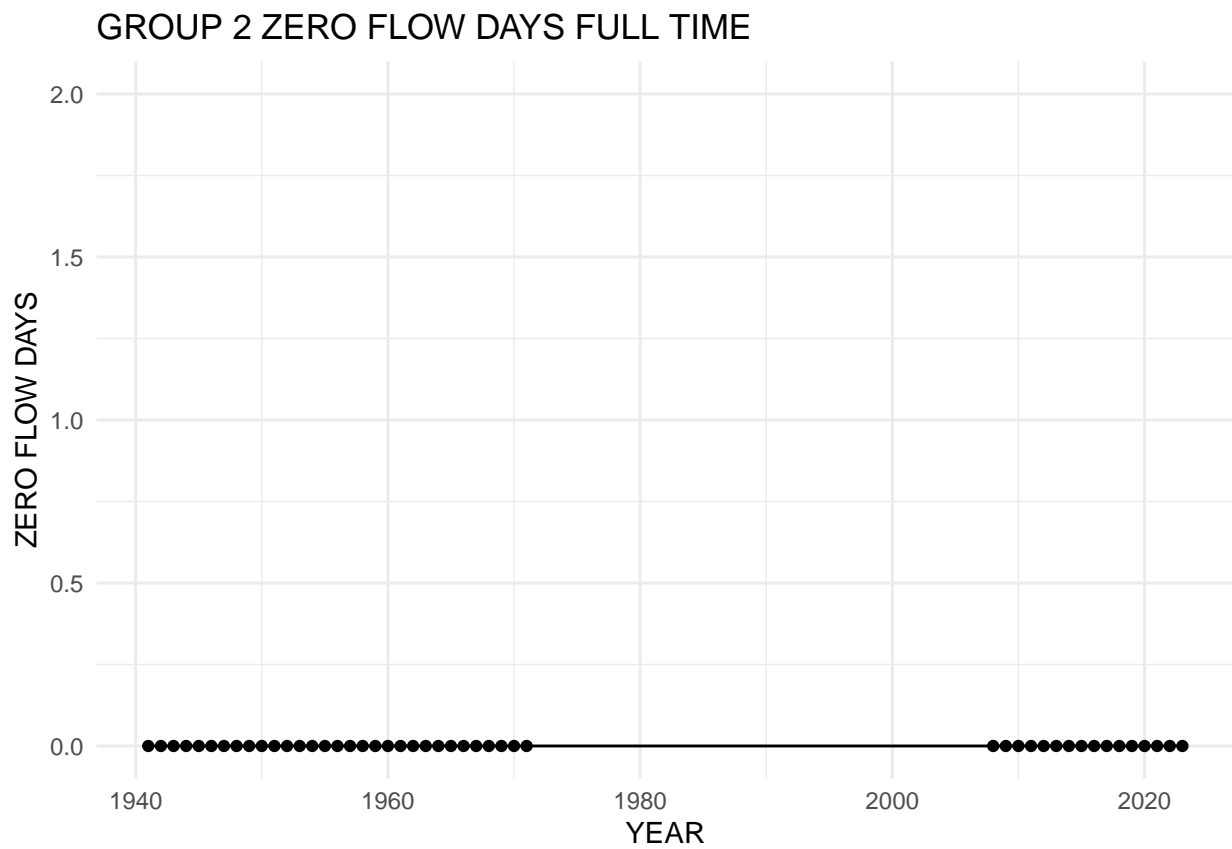


##

## \$group2\_BI\_full\_plot

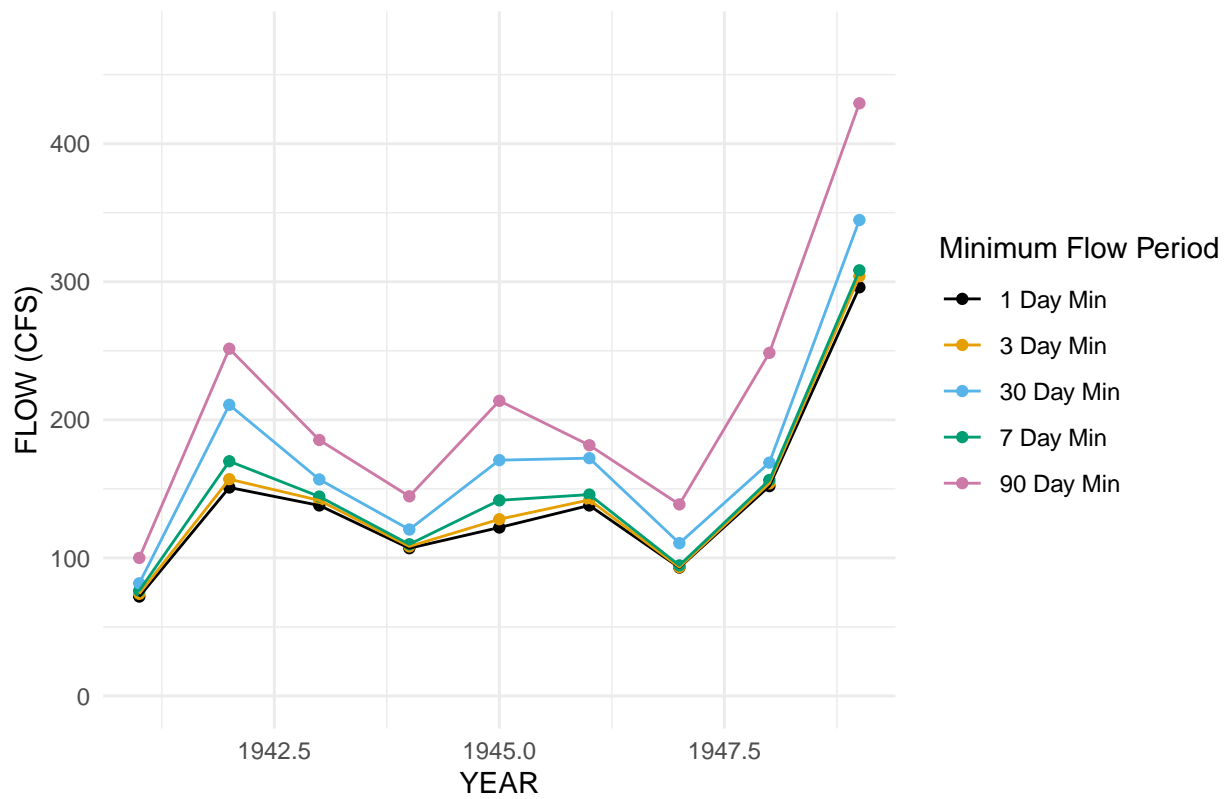


```
##  
## $group2_zero_full_plot
```

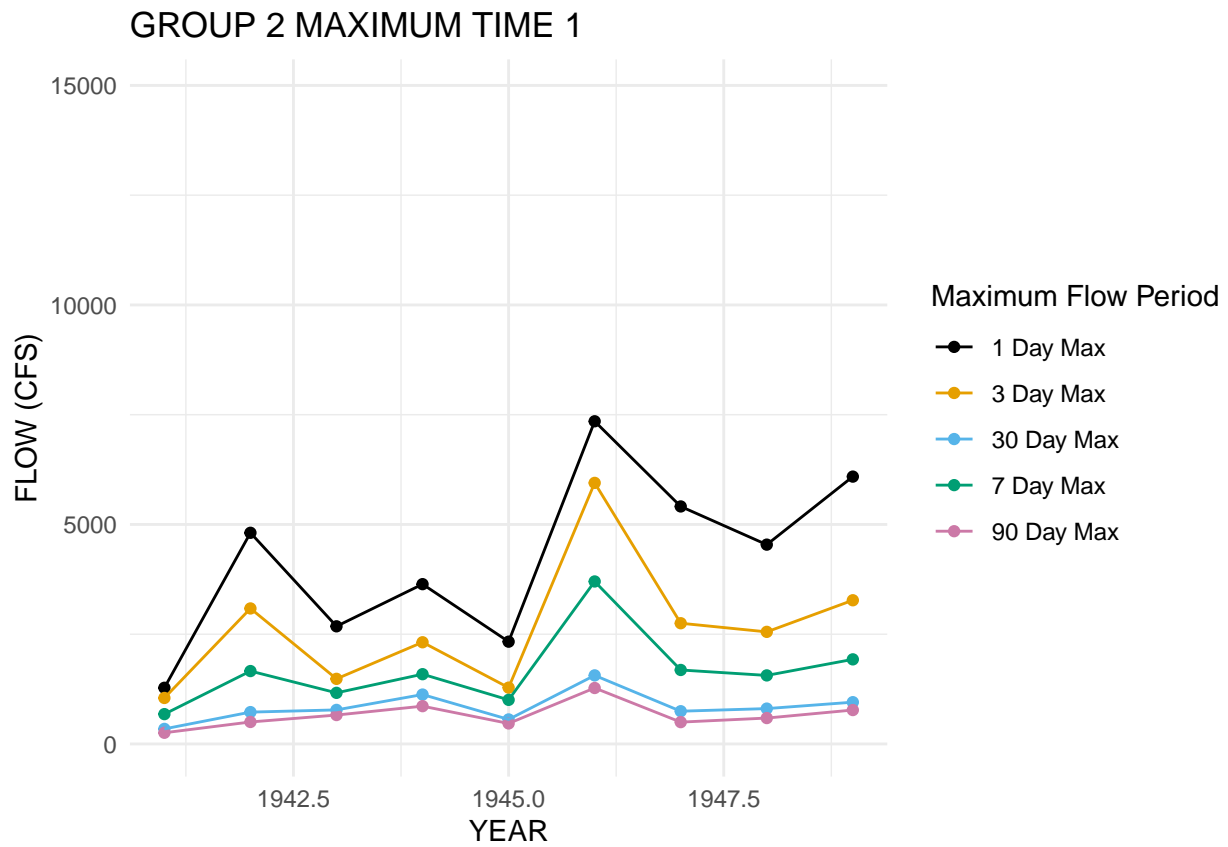


```
##  
## $group2_min_time1_plot
```

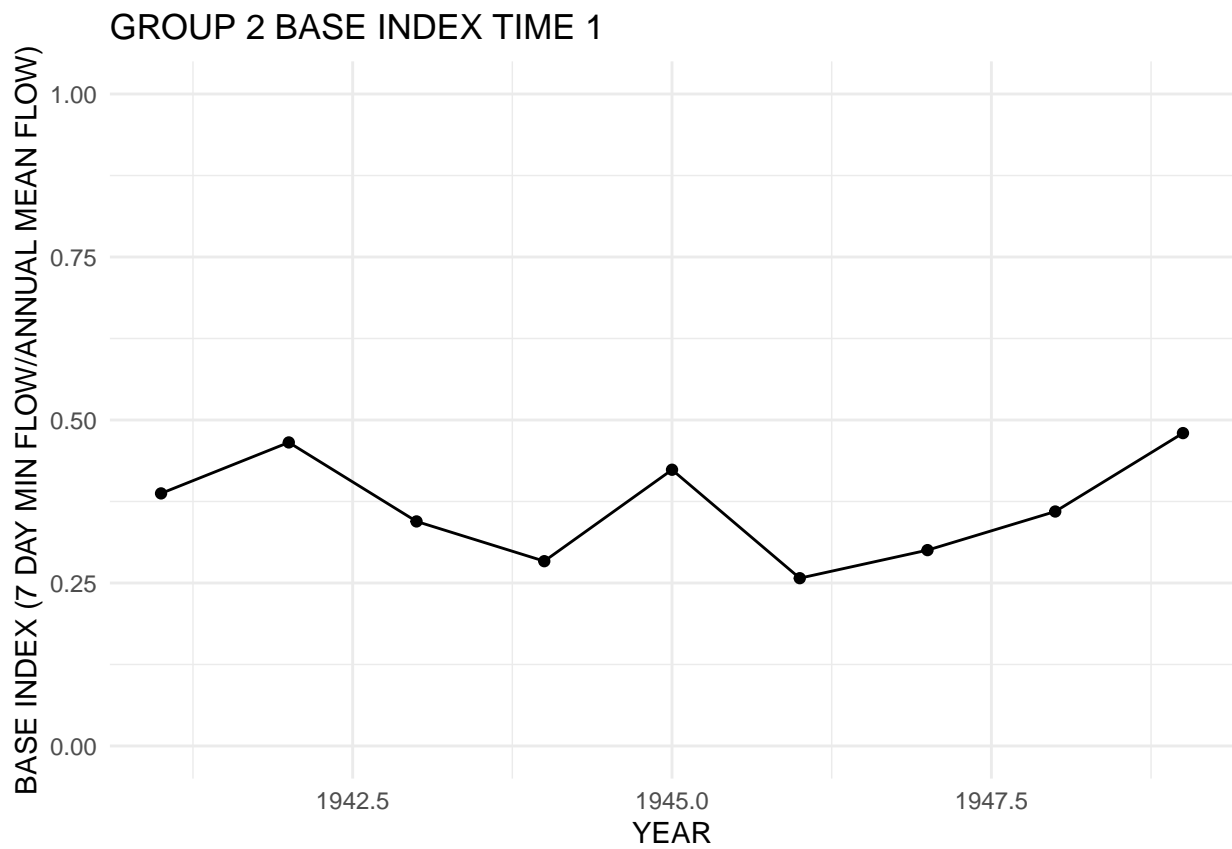
## GROUP 2 MINIMUM TIME 1



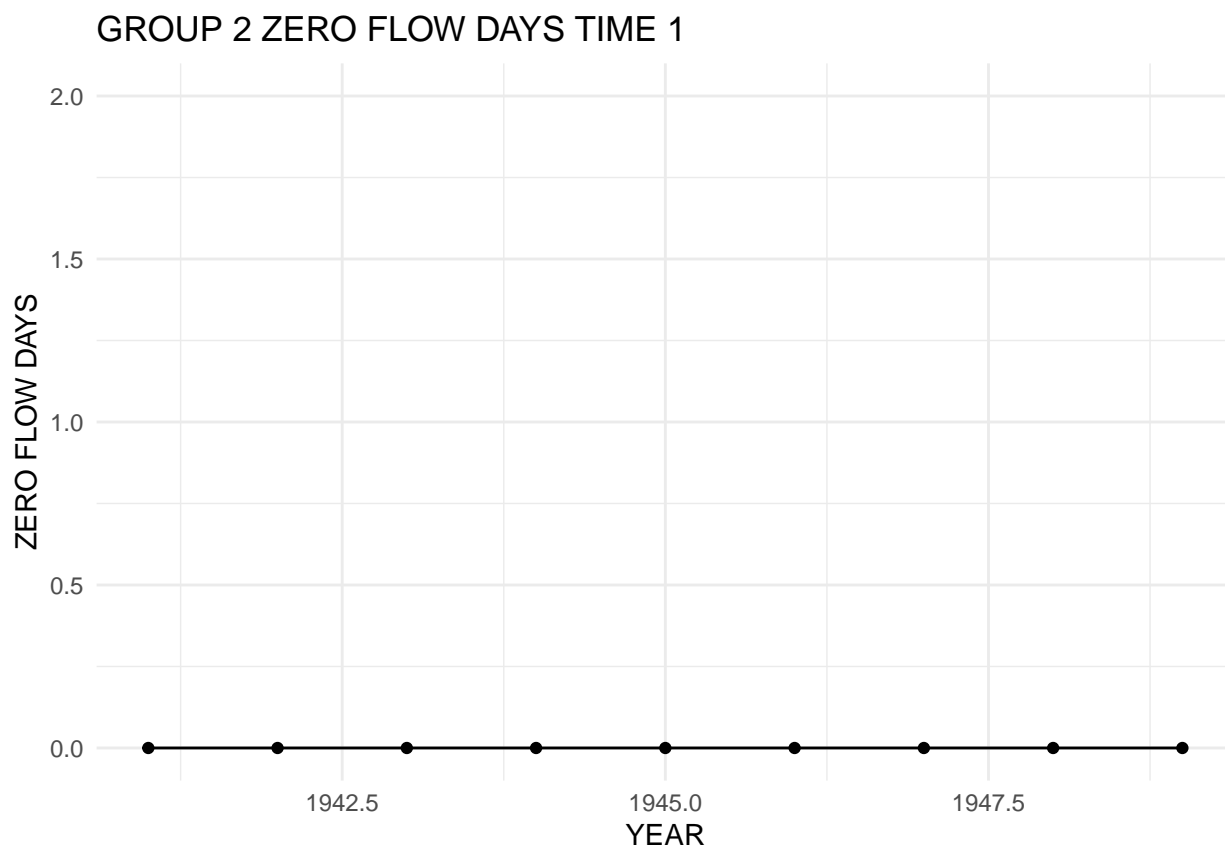
```
##
## $group2_max_time1_plot
```



```
##  
## $group2_BI_time1_plot
```



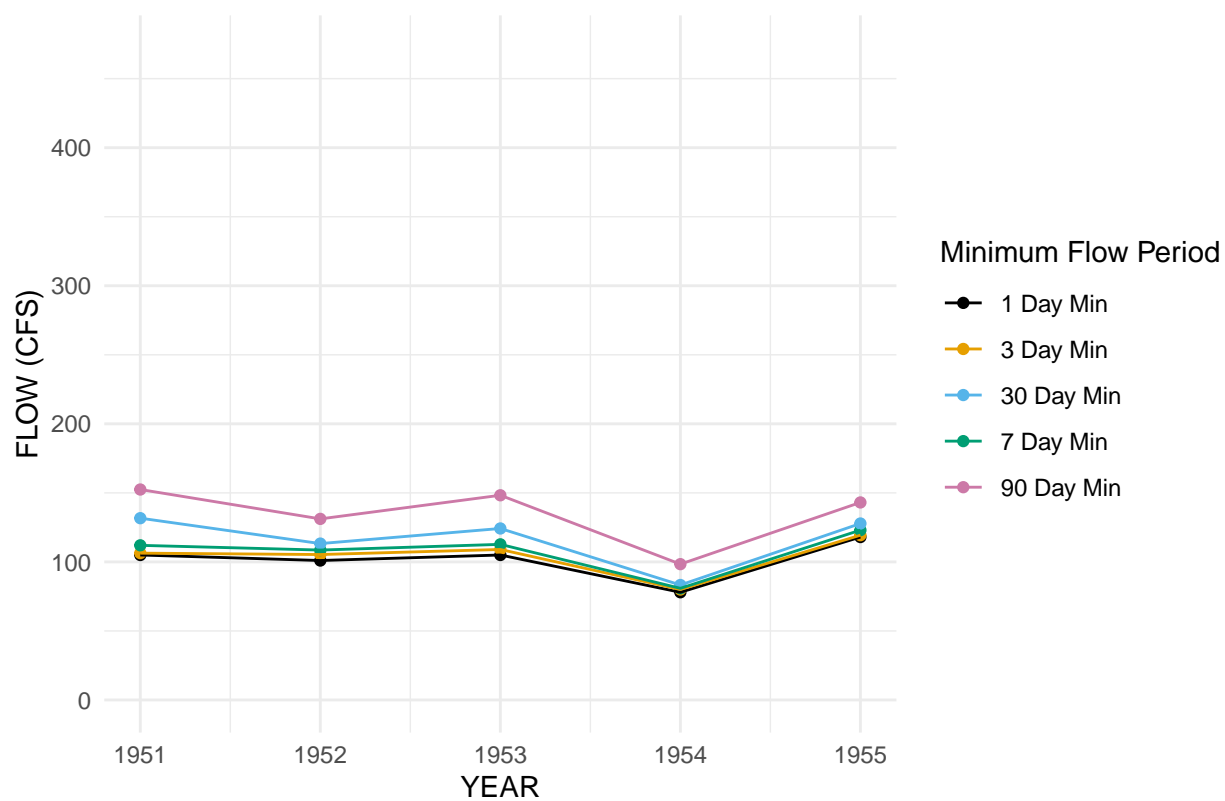
```
##  
## $group2_zero_time1_plot
```



```
##  
## $group2_min_time2_plot
```



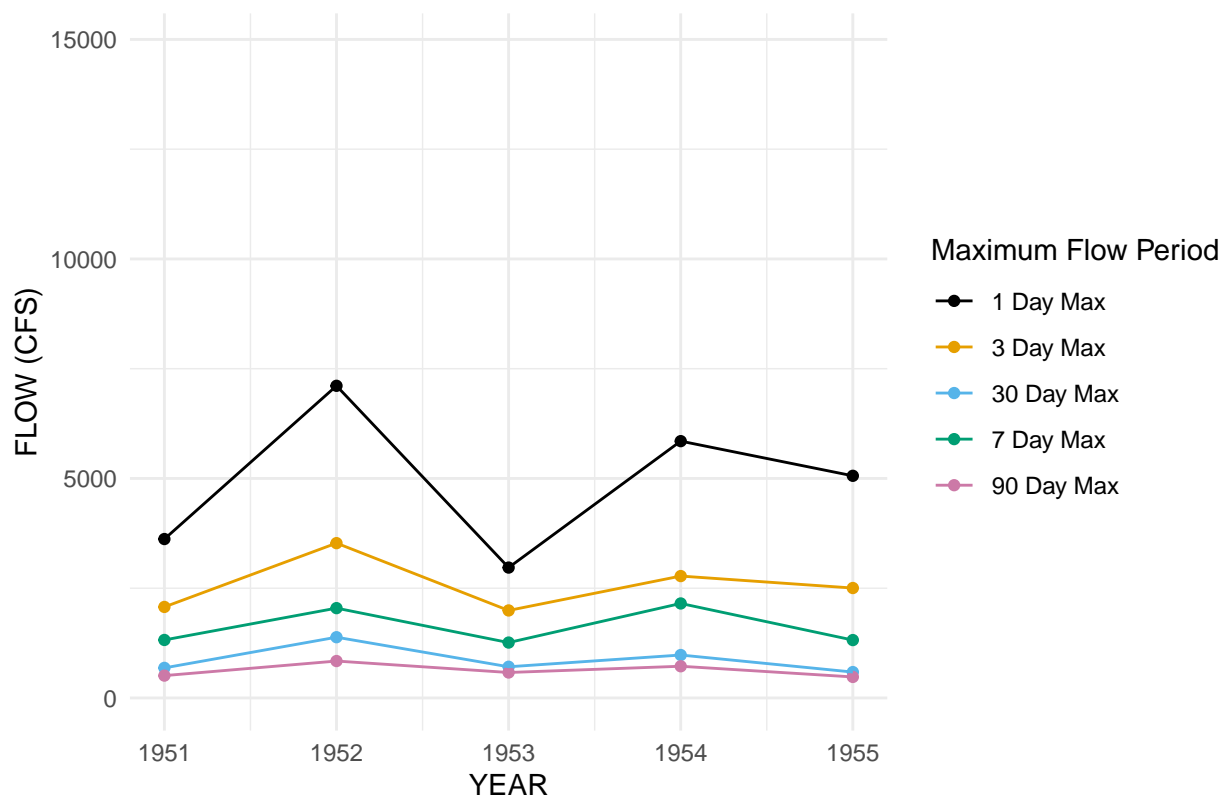
## GROUP 2 MINIMUM TIME 2



##

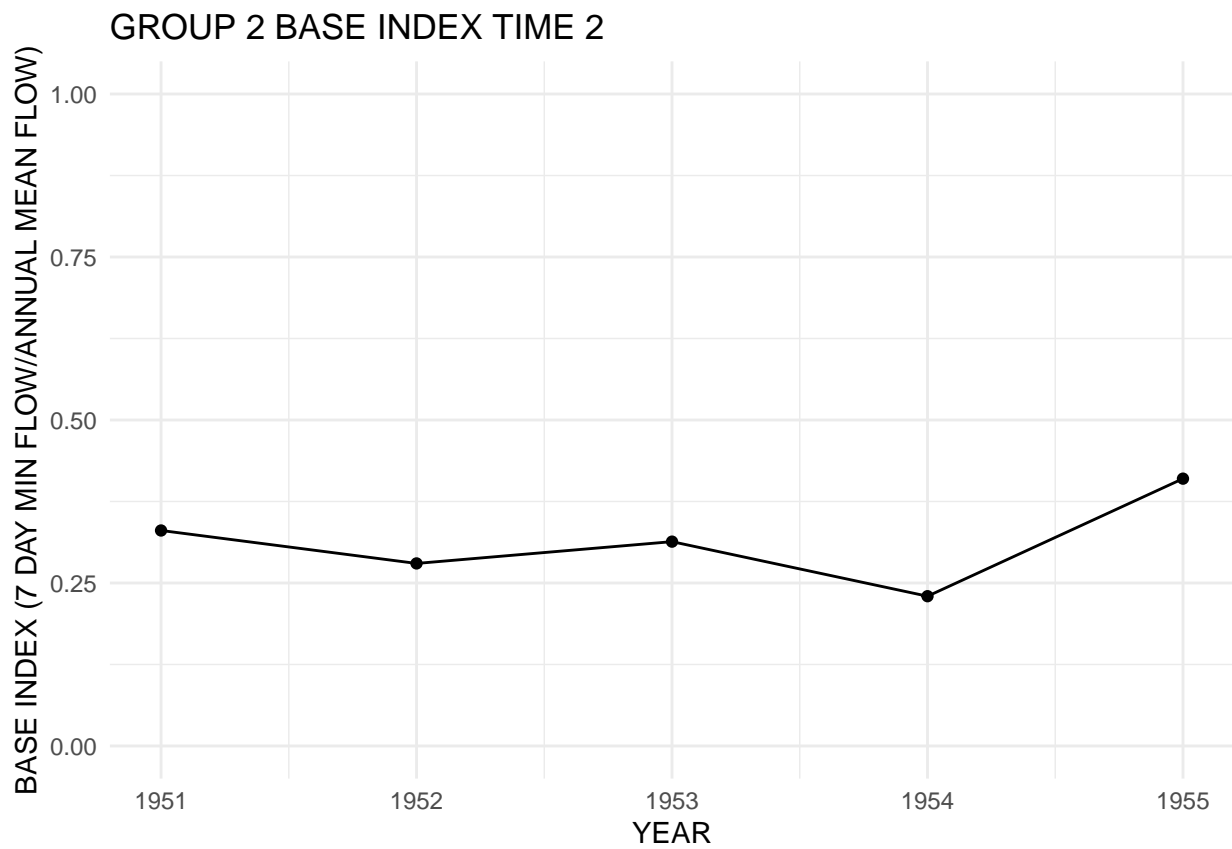
## \$group2\_max\_time2\_plot

## GROUP 2 MAXIMUM TIME 2

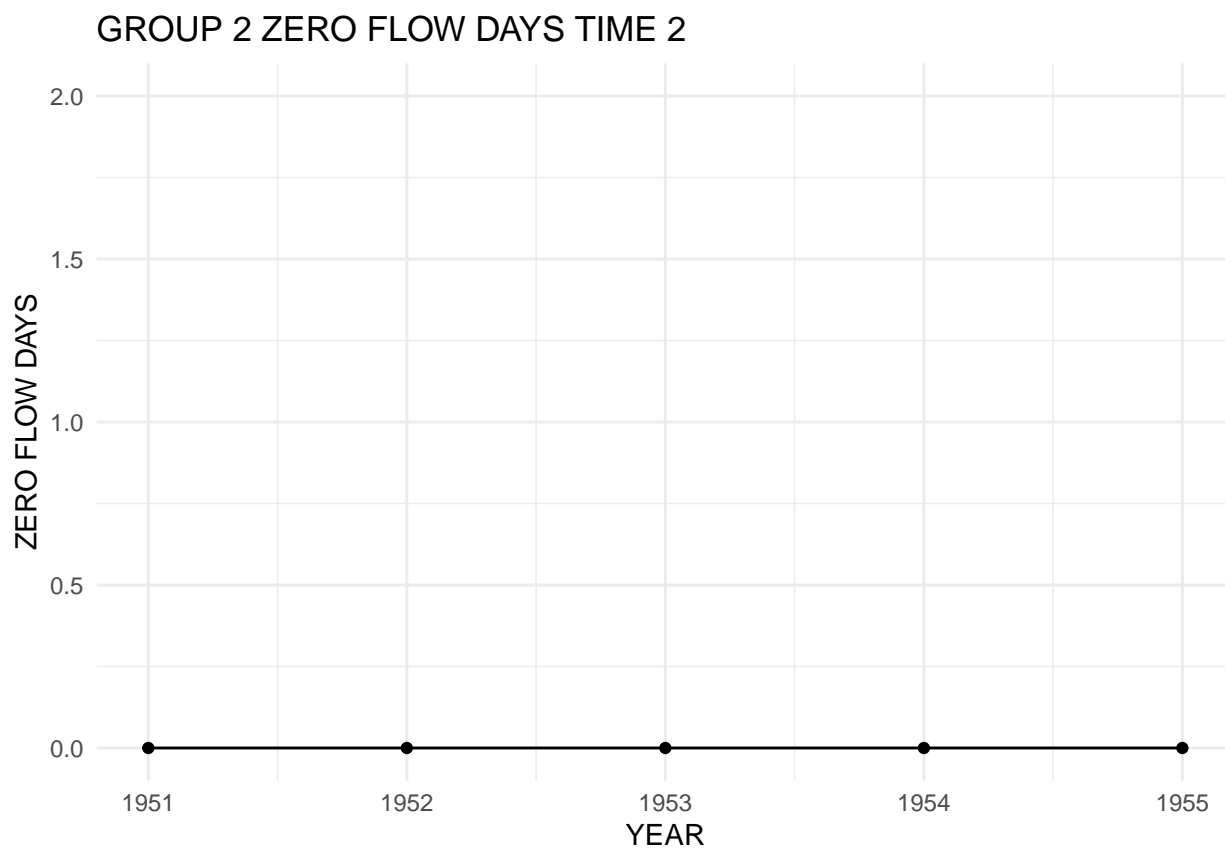


##

## \$group2\_BI\_time2\_plot

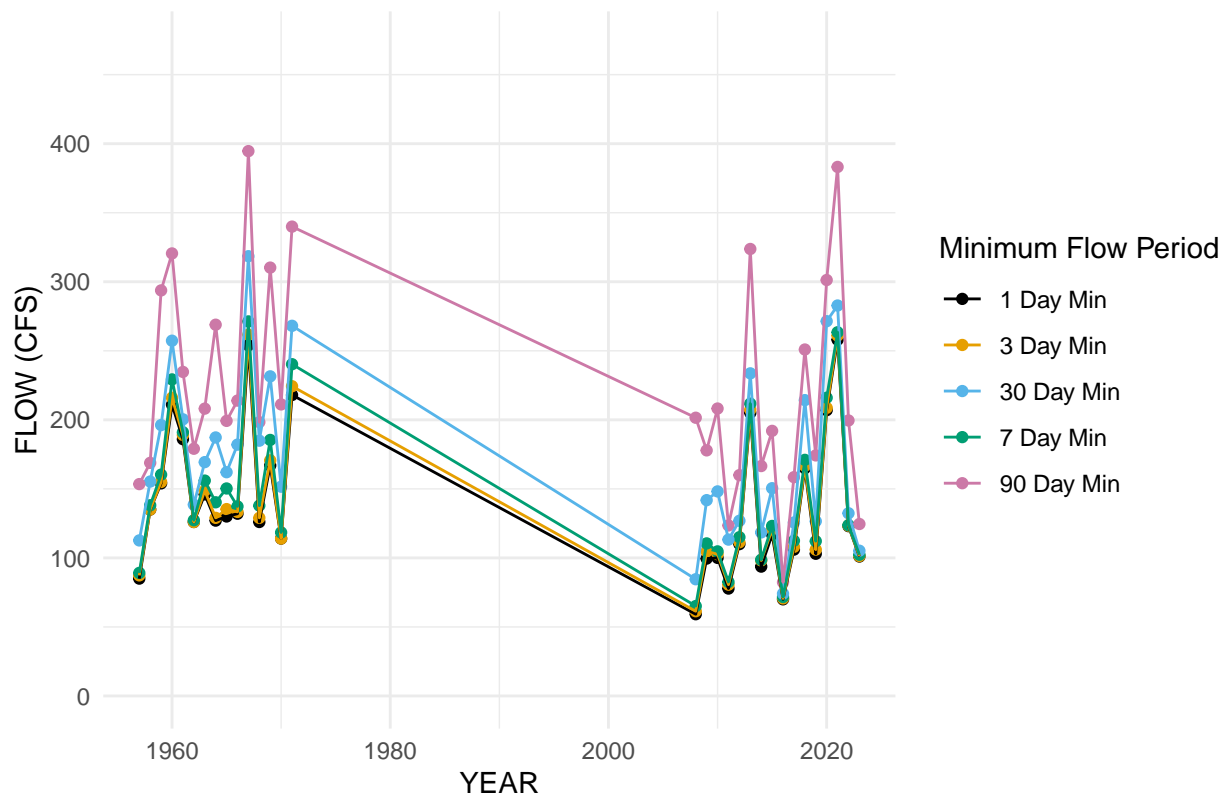


```
##  
## $group2_zero_time2_plot
```



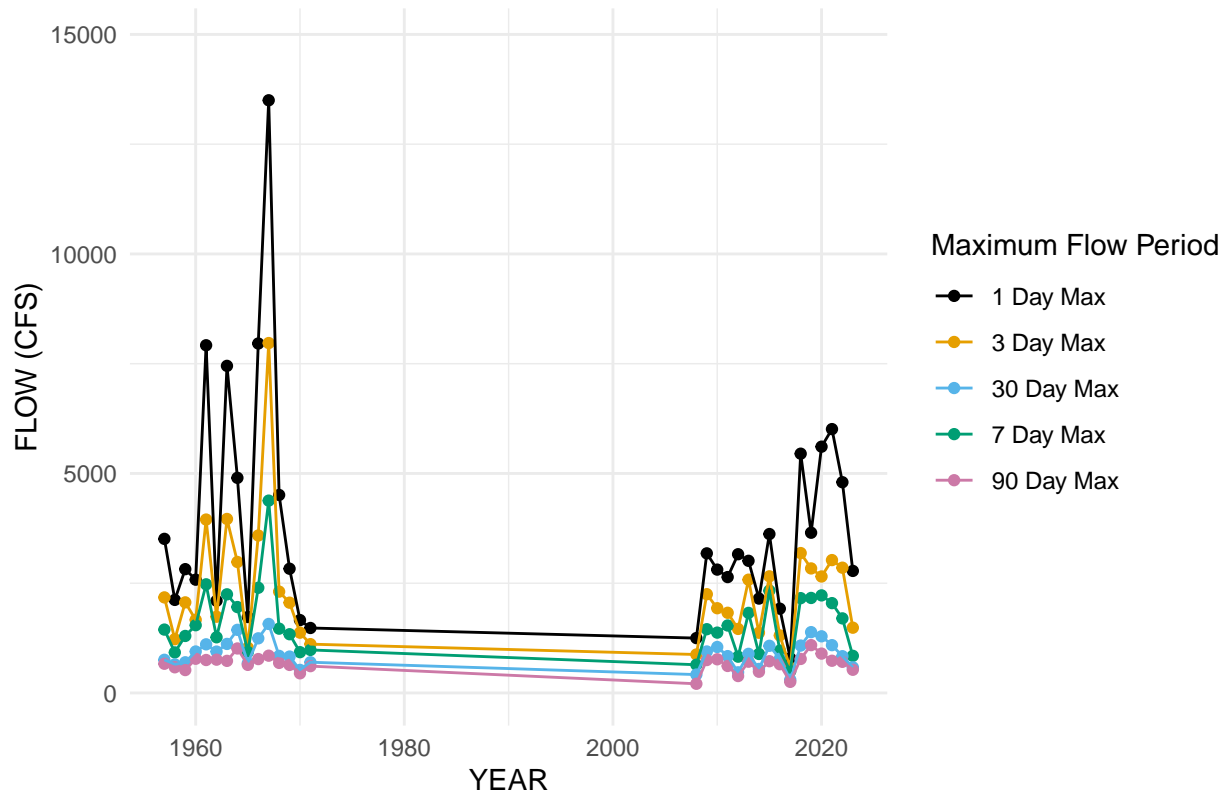
```
##  
## $group2_min_time3_plot
```

## GROUP 2 MINIMUM TIME 3

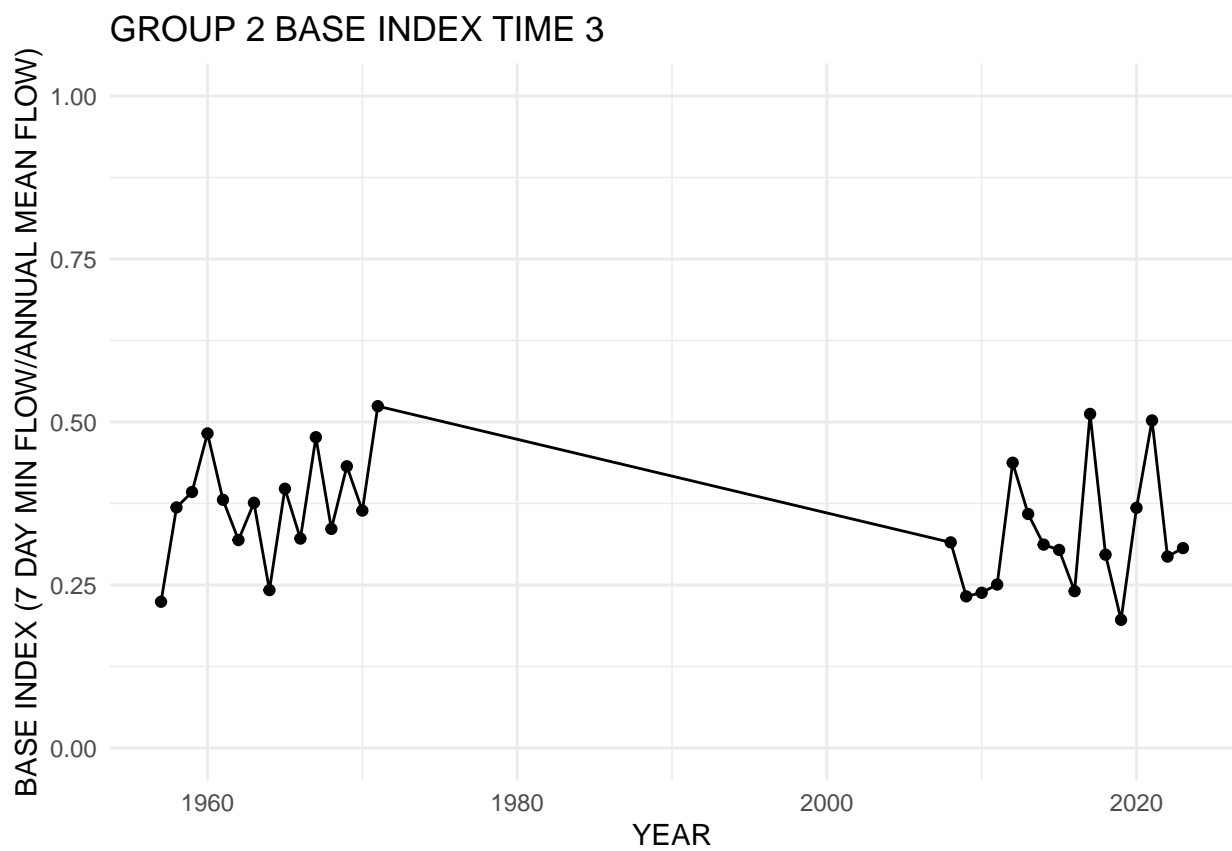


```
##  
## $group2_max_time3_plot
```

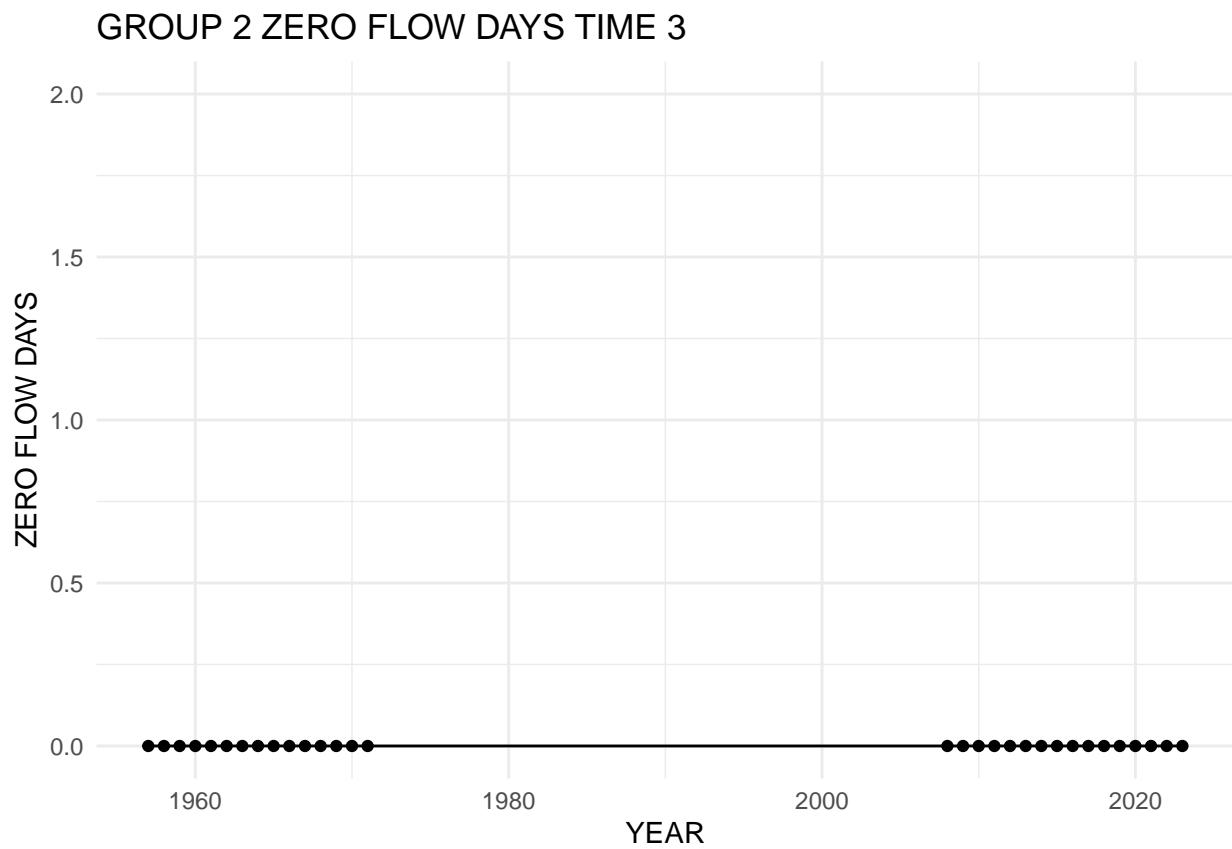
## GROUP 2 MAXIMUM TIME 3



```
##  
## $group2_BI_time3_plot
```



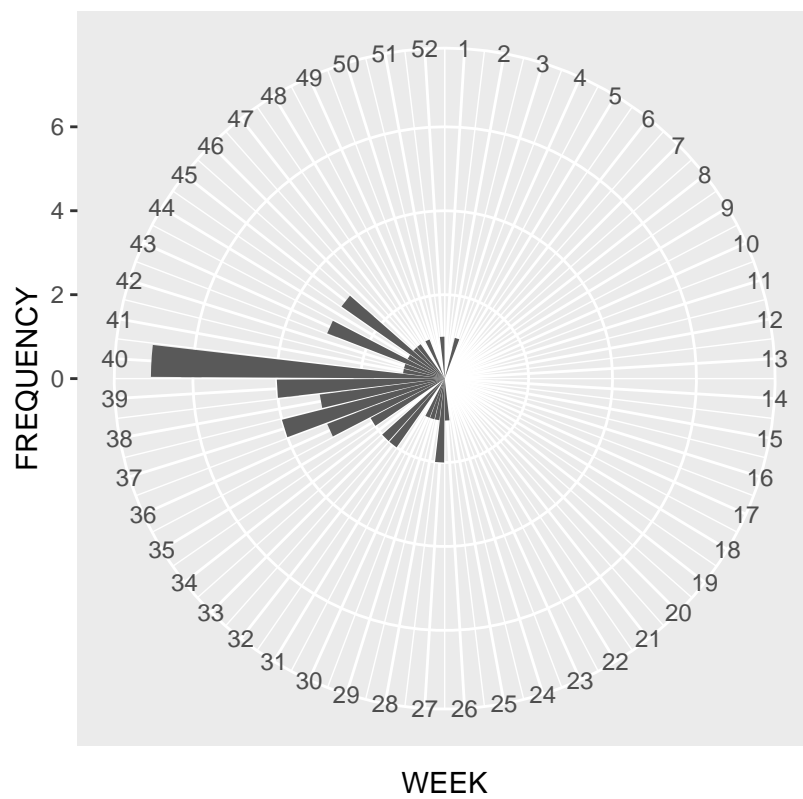
```
##  
## $group2_zero_time3_plot
```



## \$group3\_min\_full\_week\_plot

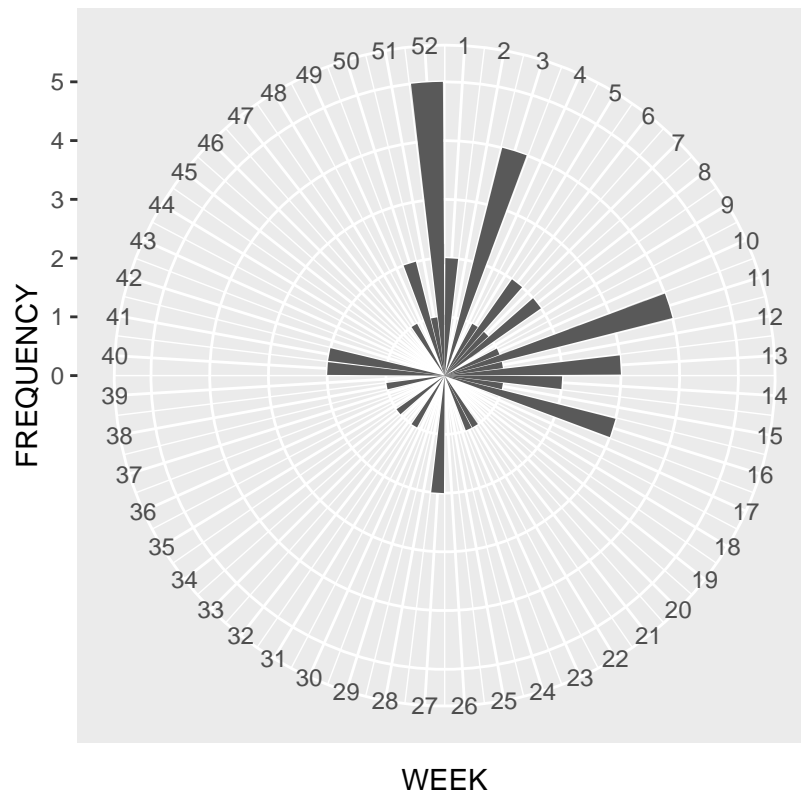


# GROUP 3 MIN FULL TIME WEEK FREQUENCY

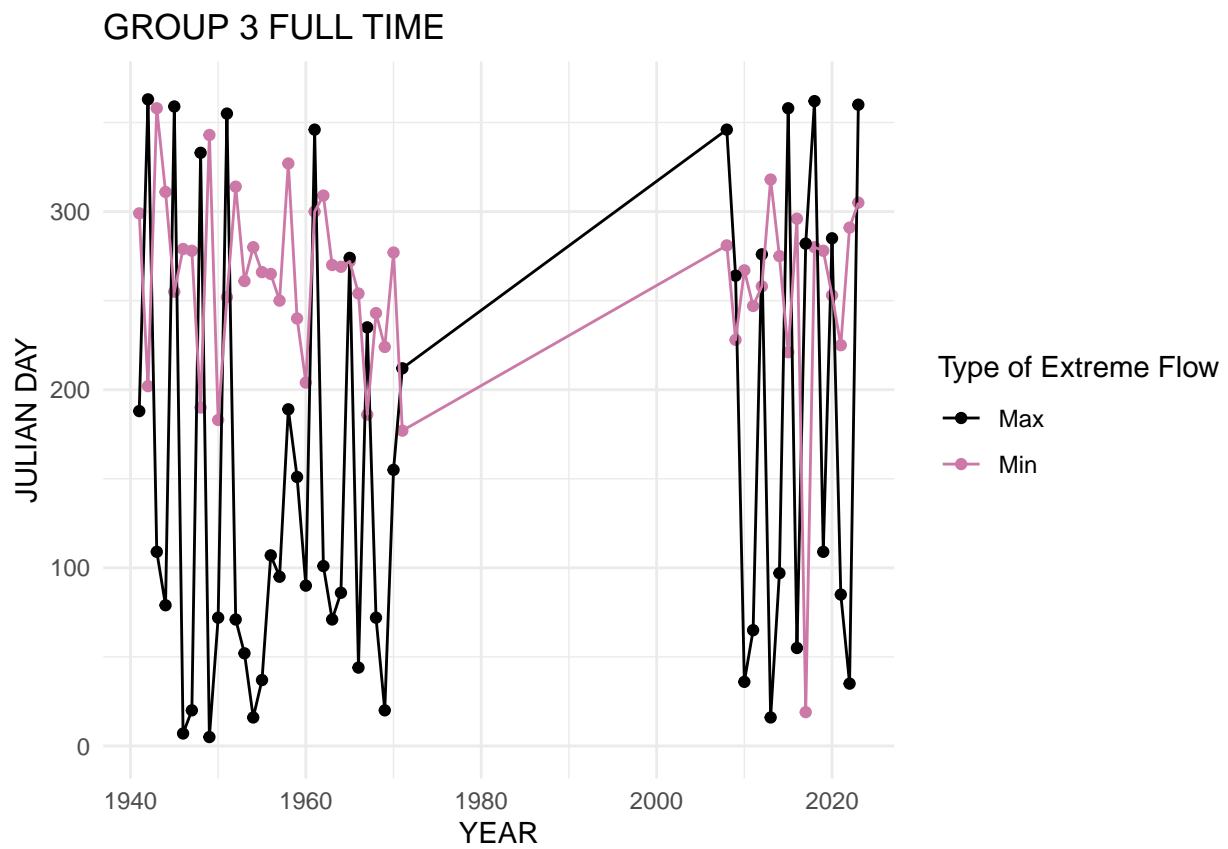


```
##
## $group3_max_full_week_plot
```

# GROUP 3 MAX FULL TIME WEEK FREQUENCY

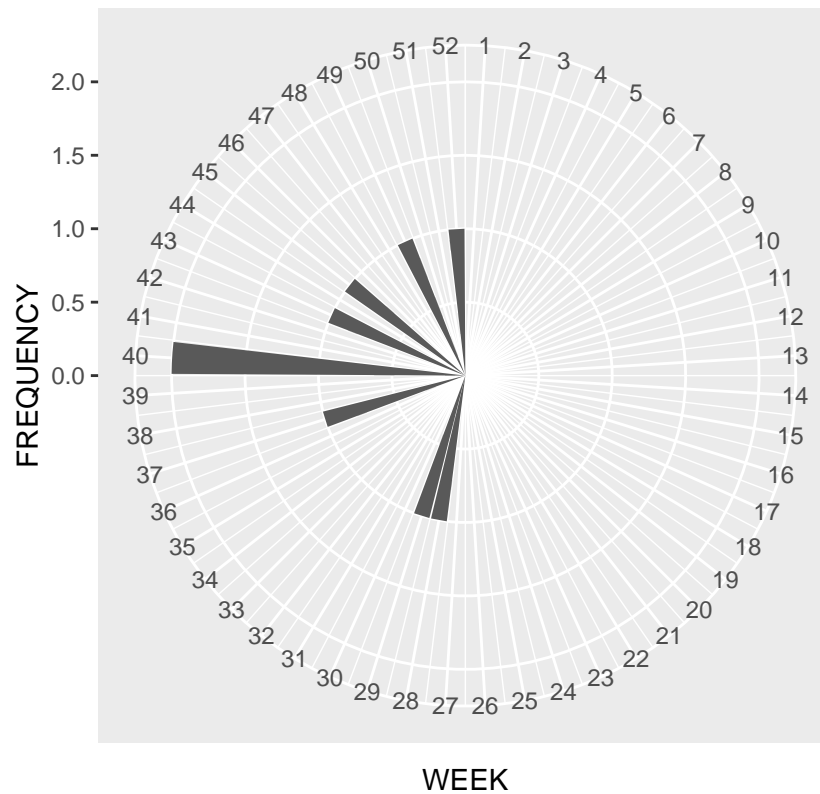


```
##
## $group3_full_julian_day_plot
```



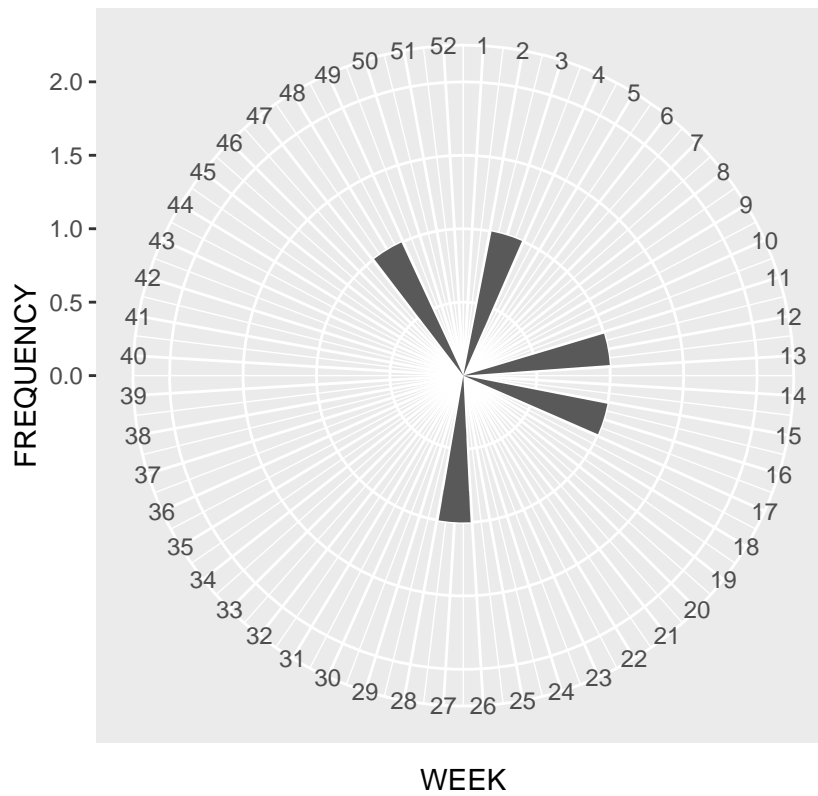
```
##
## $group3_min_time1_week_plot
```

## GROUP 3 MIN TIME 1 WEEK FREQUENCY

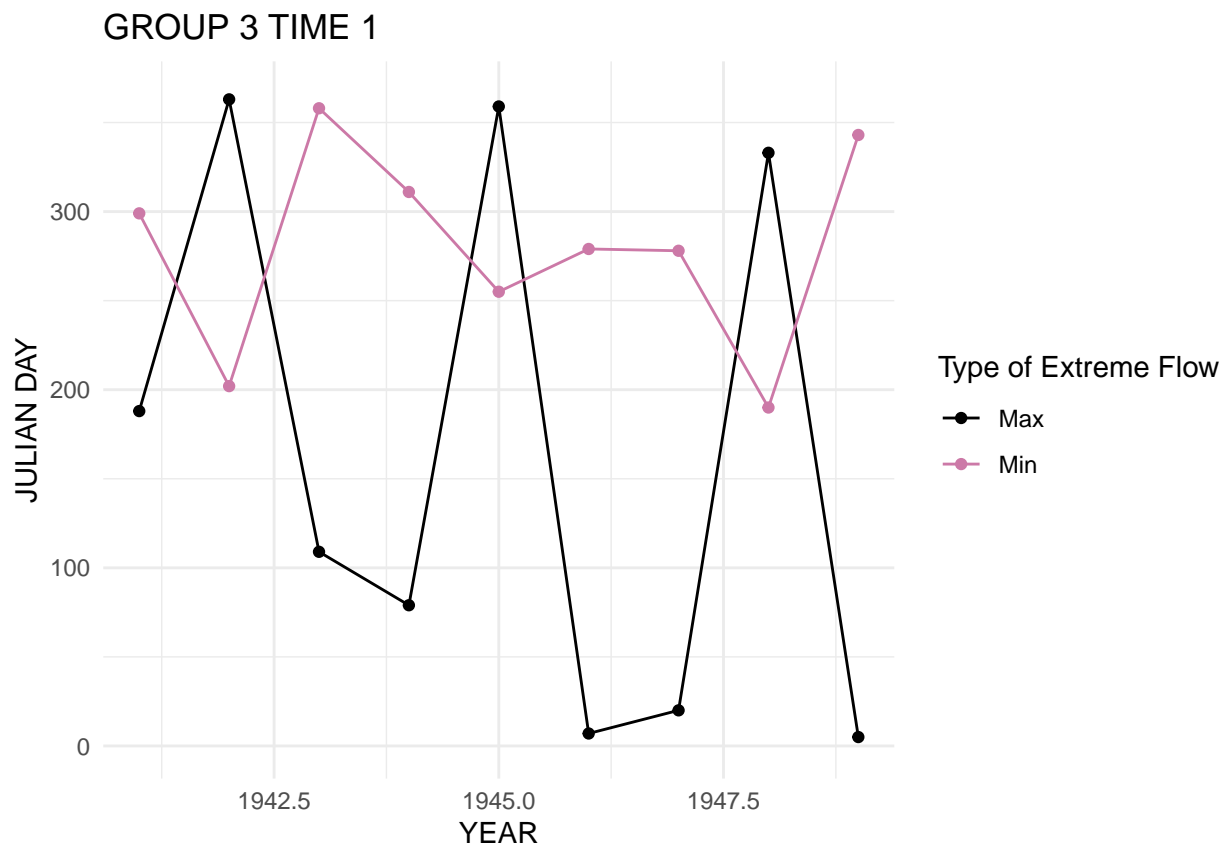


```
##
## $group3_max_time1_week_plot
## Warning: Removed 2 rows containing missing values or values outside the scale range
## (`geom_bar()`).
```

# GROUP 3 MAX TIME 1 WEEK FREQUENCY

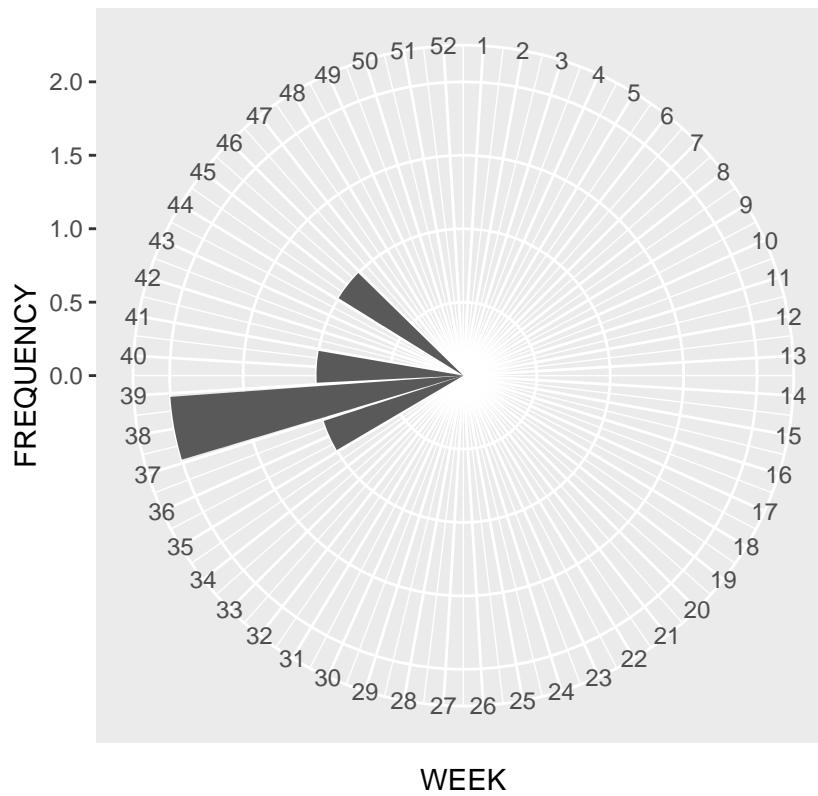


```
##
## $group3_time1_julian_day_plot
```



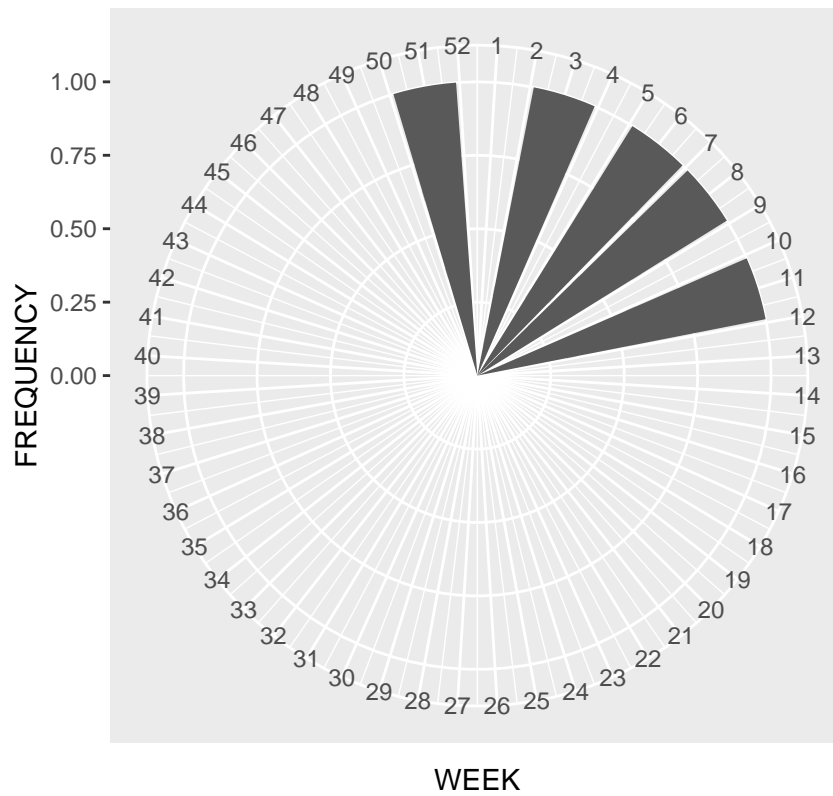
```
##
## $group3_min_time2_week_plot
```

# GROUP 3 MIN TIME 2 WEEK FREQUENCY



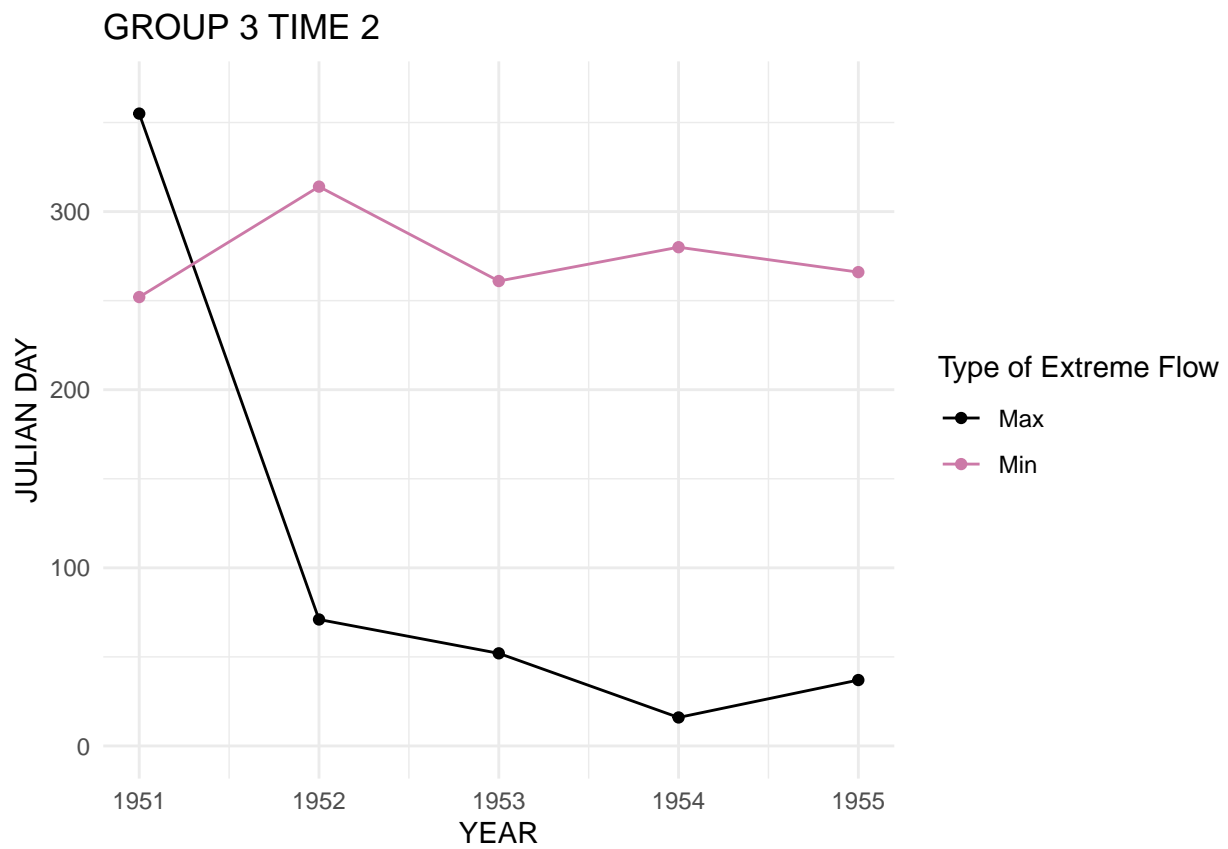
```
##
## $group3_max_time2_week_plot
```

# GROUP 3 MAX TIME 2 WEEK FREQUENCY



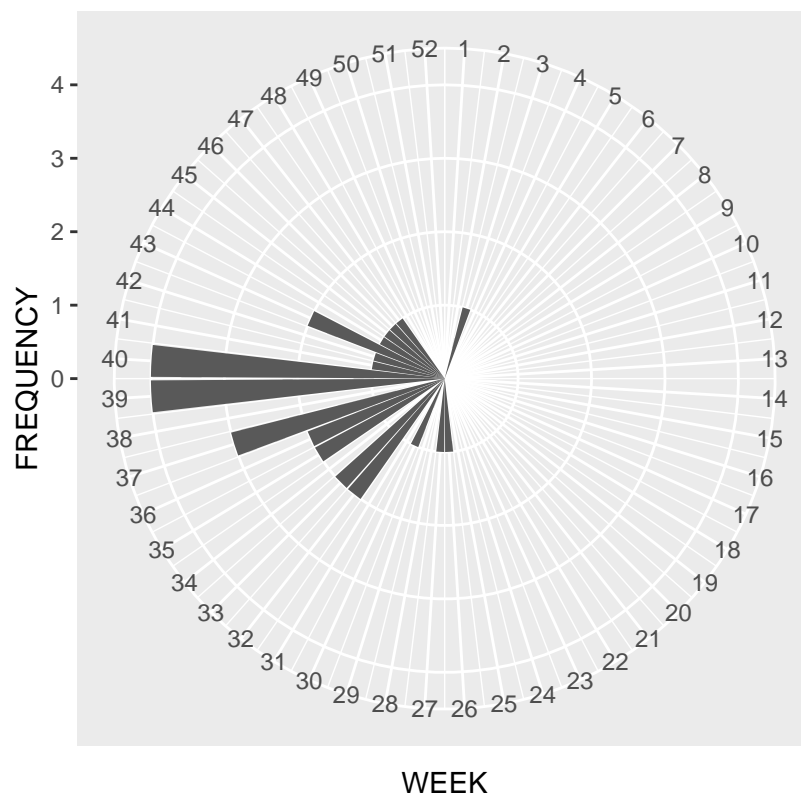
```
##
## $group3_time2_julian_day_plot
```





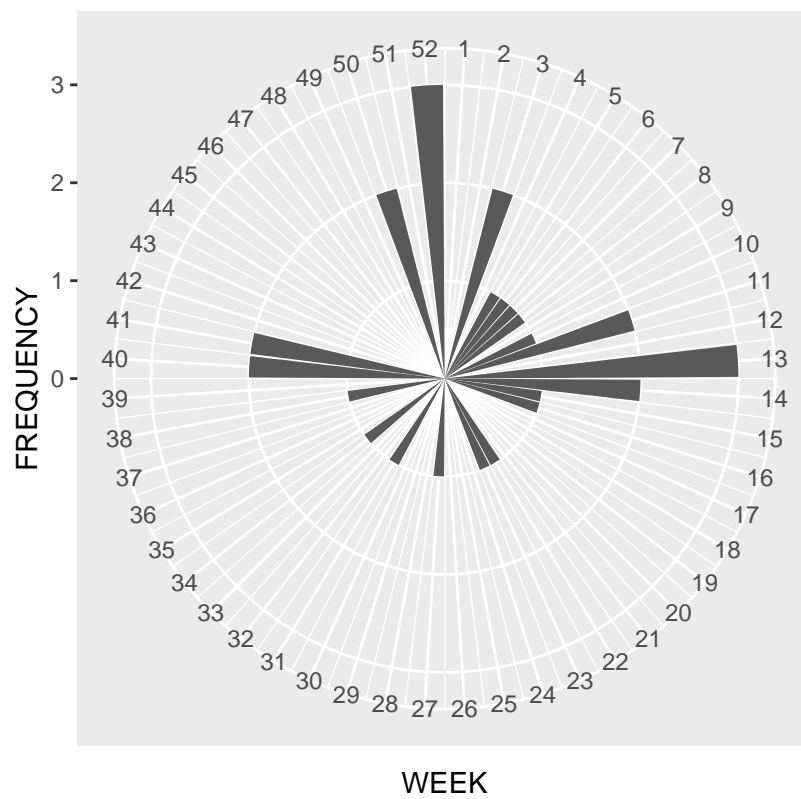
```
##  
## $group3_min_time3_week_plot
```

# GROUP 3 MIN TIME 3 WEEK FREQUENCY

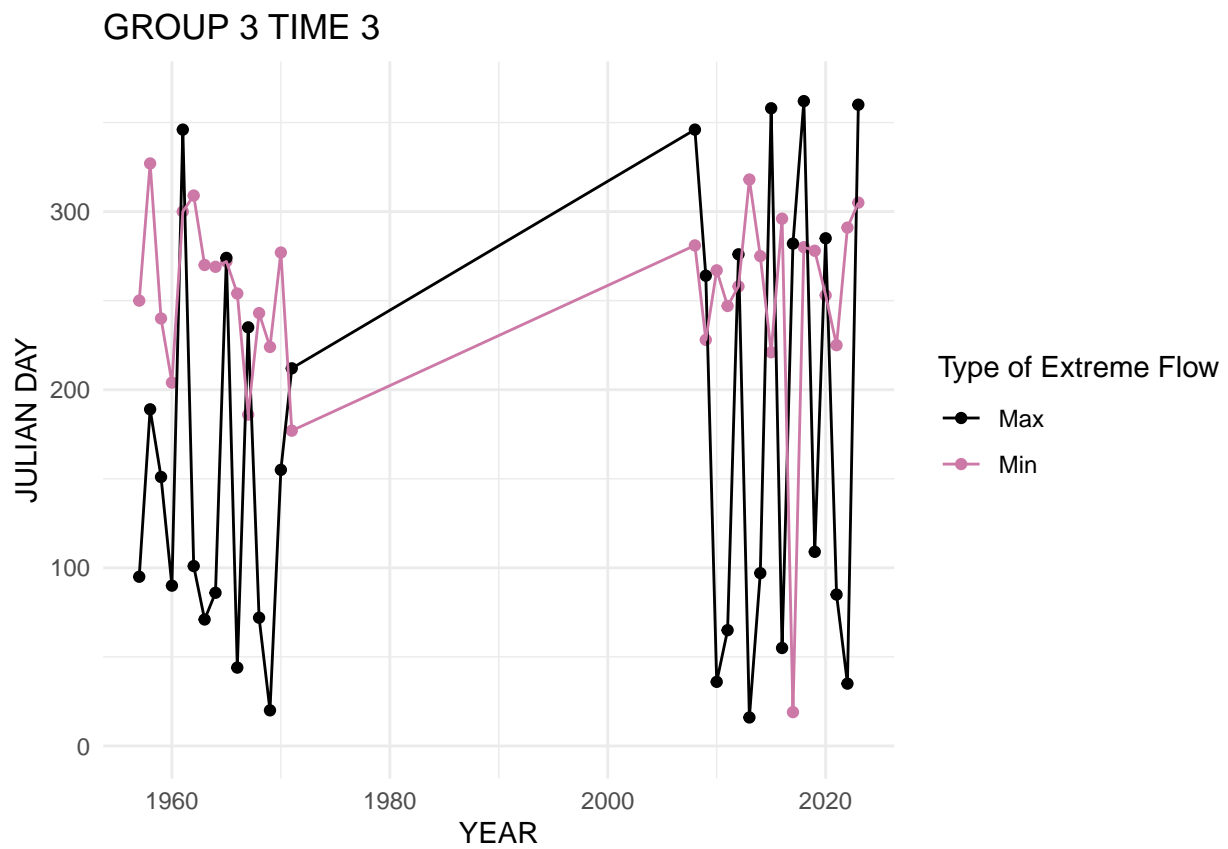


```
##
## $group3_max_time3_week_plot
```

# GROUP 3 MAX TIME 3 WEEK FREQUENCY

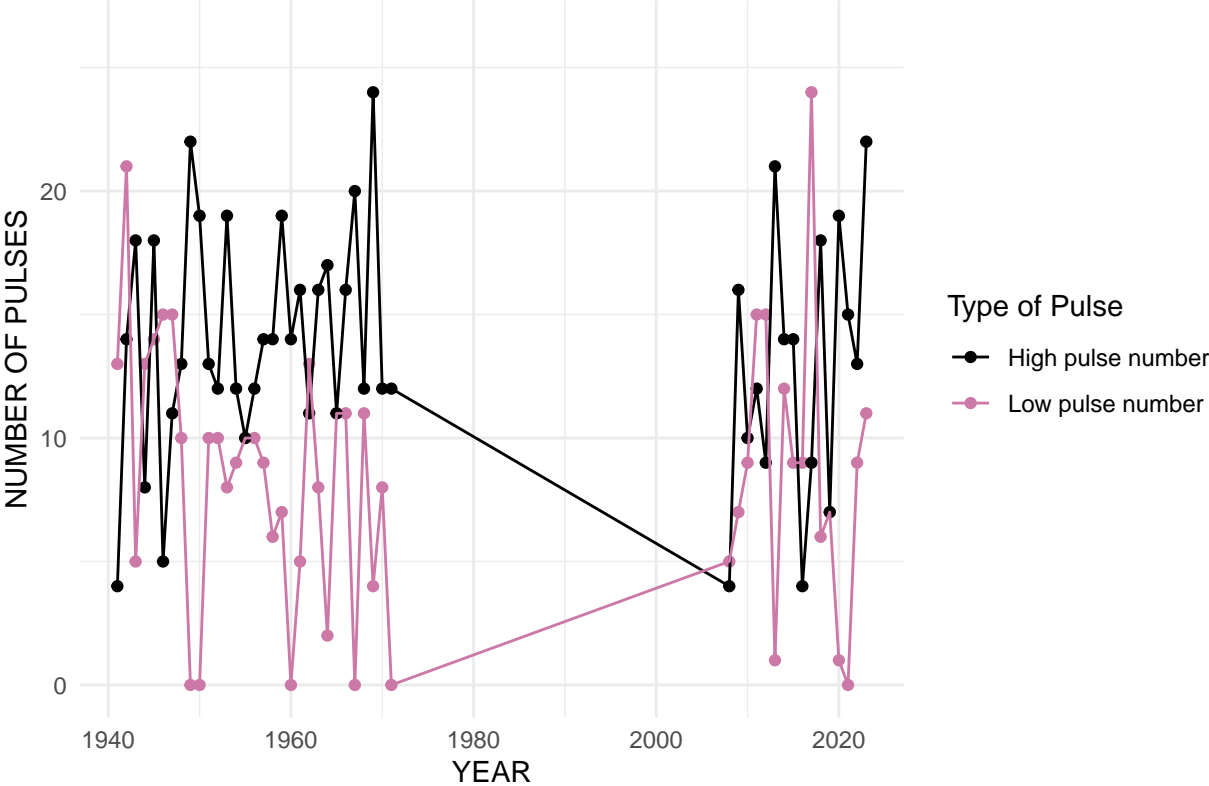


```
##
## $group3_time3_julian_day_plot
```

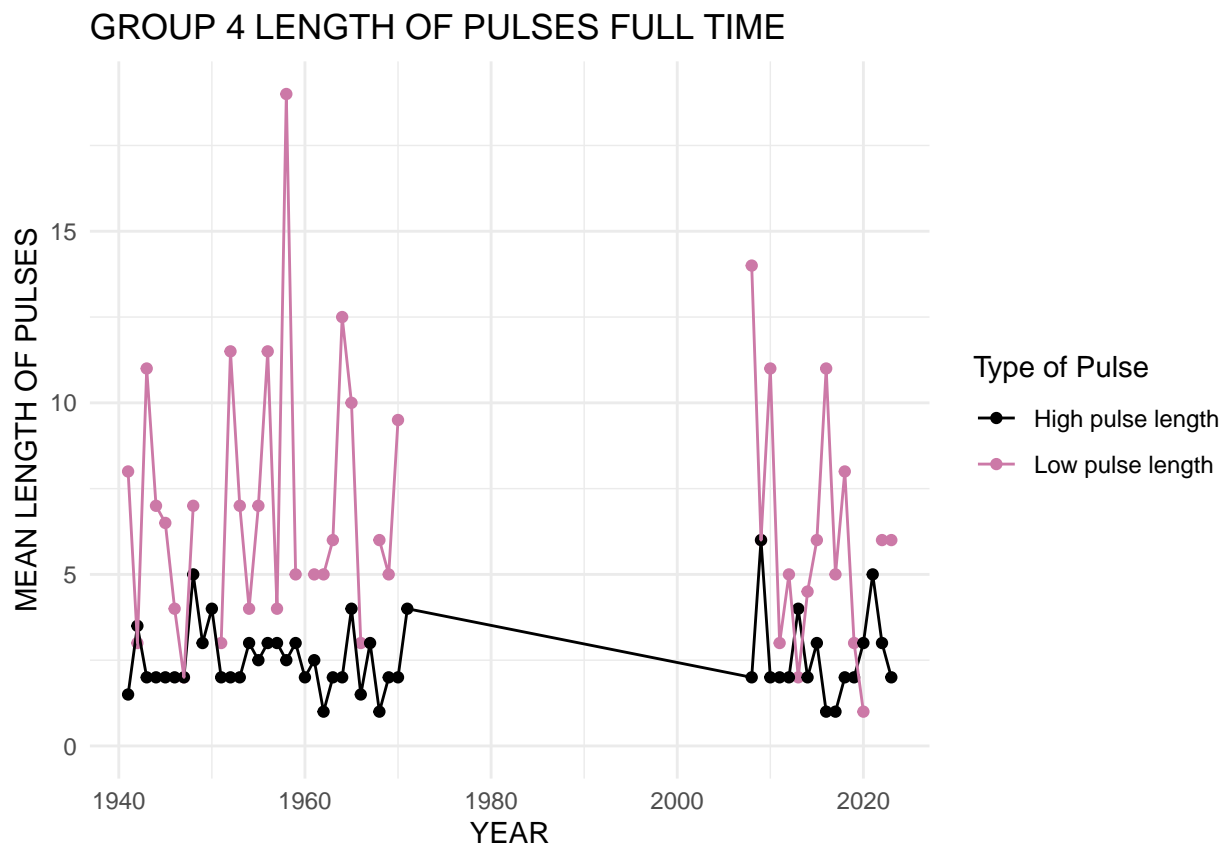


## \$group4\_number\_full\_plot

GROUP 4 NUMBER OF PULSES FULL TIME

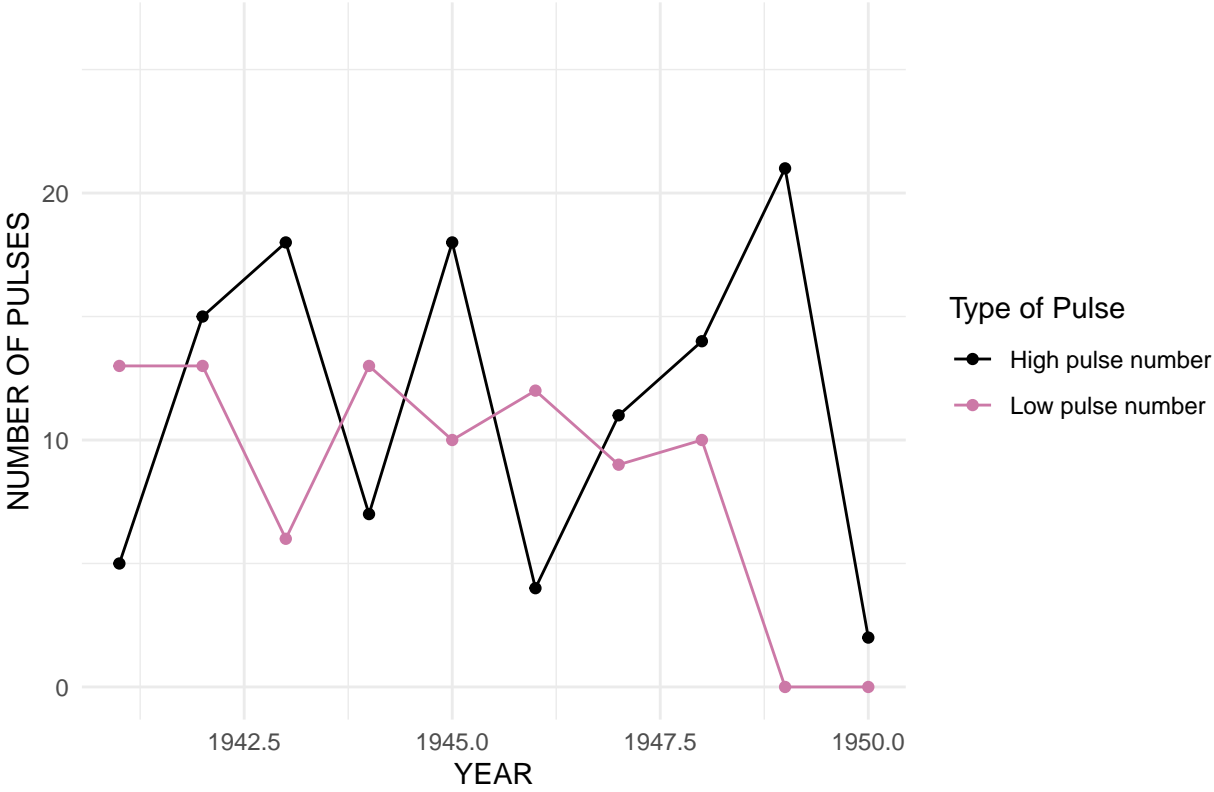


```
##  
## $group4_length_full_plot
```

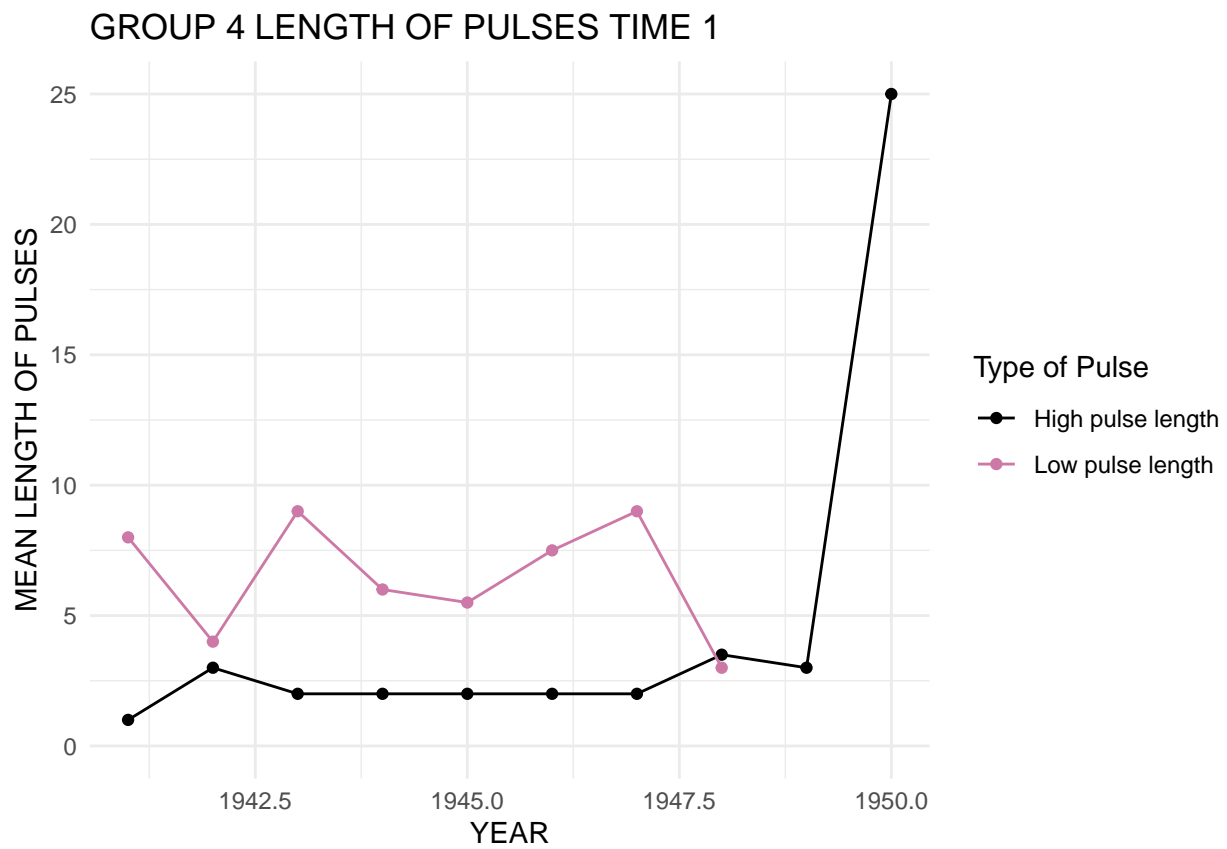


```
##  
## $group4_number_time1_plot
```

GROUP 4 NUMBER OF PULSES TIME 1

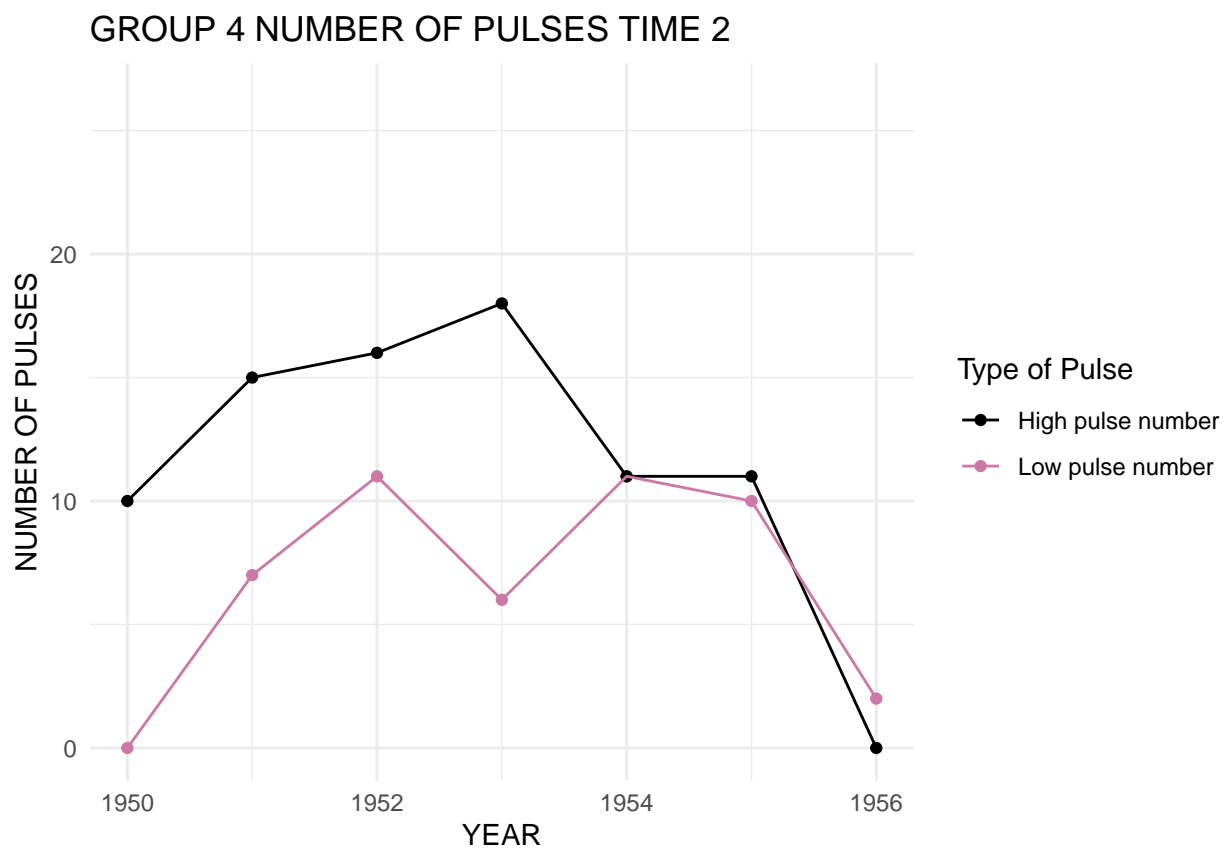


```
##
## $group4_length_time1_plot
```

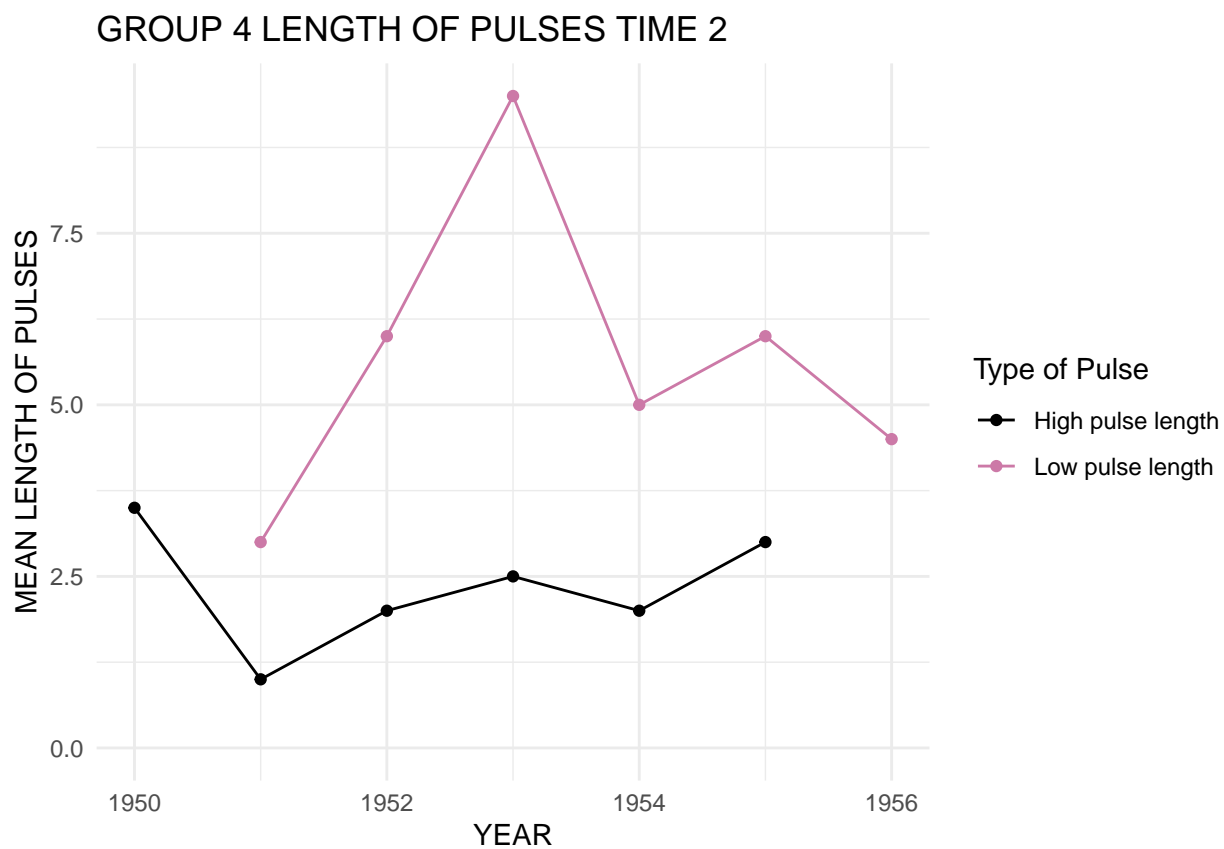


```
##  
## $group4_number_time2_plot
```



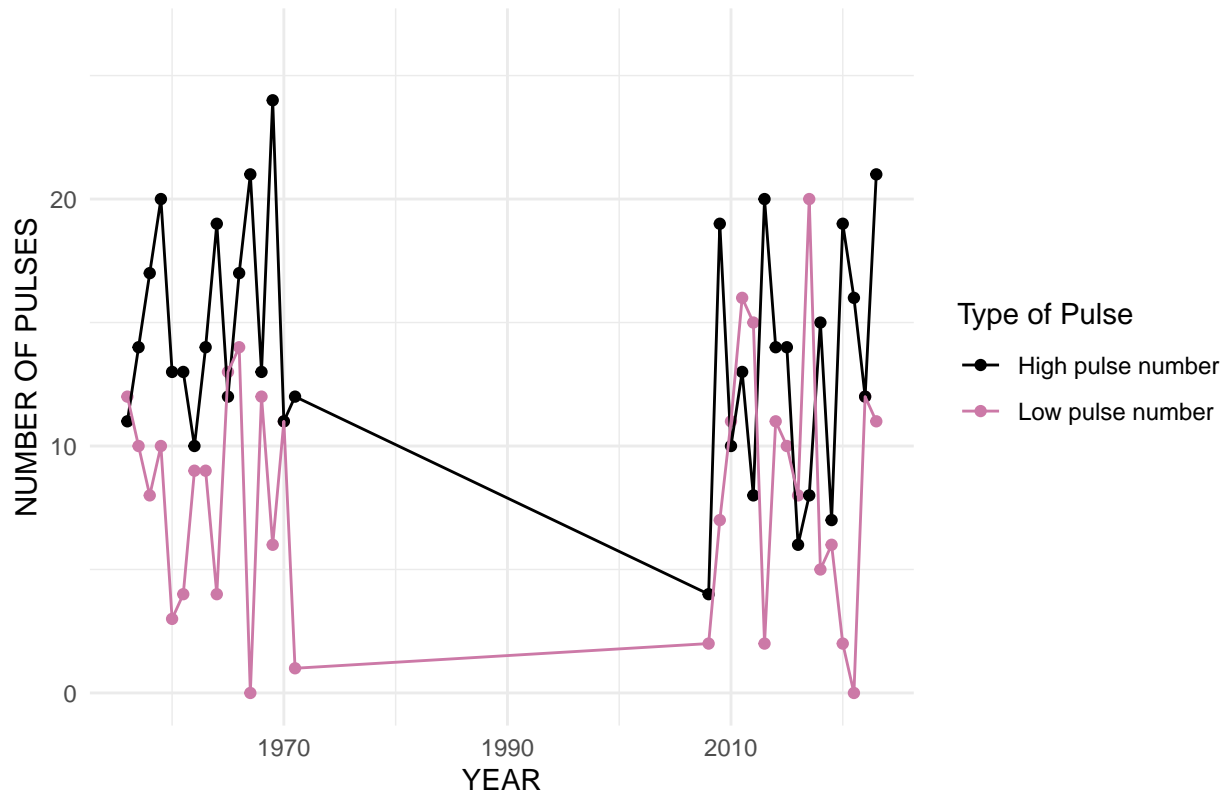


```
##  
## $group4_length_time2_plot
```

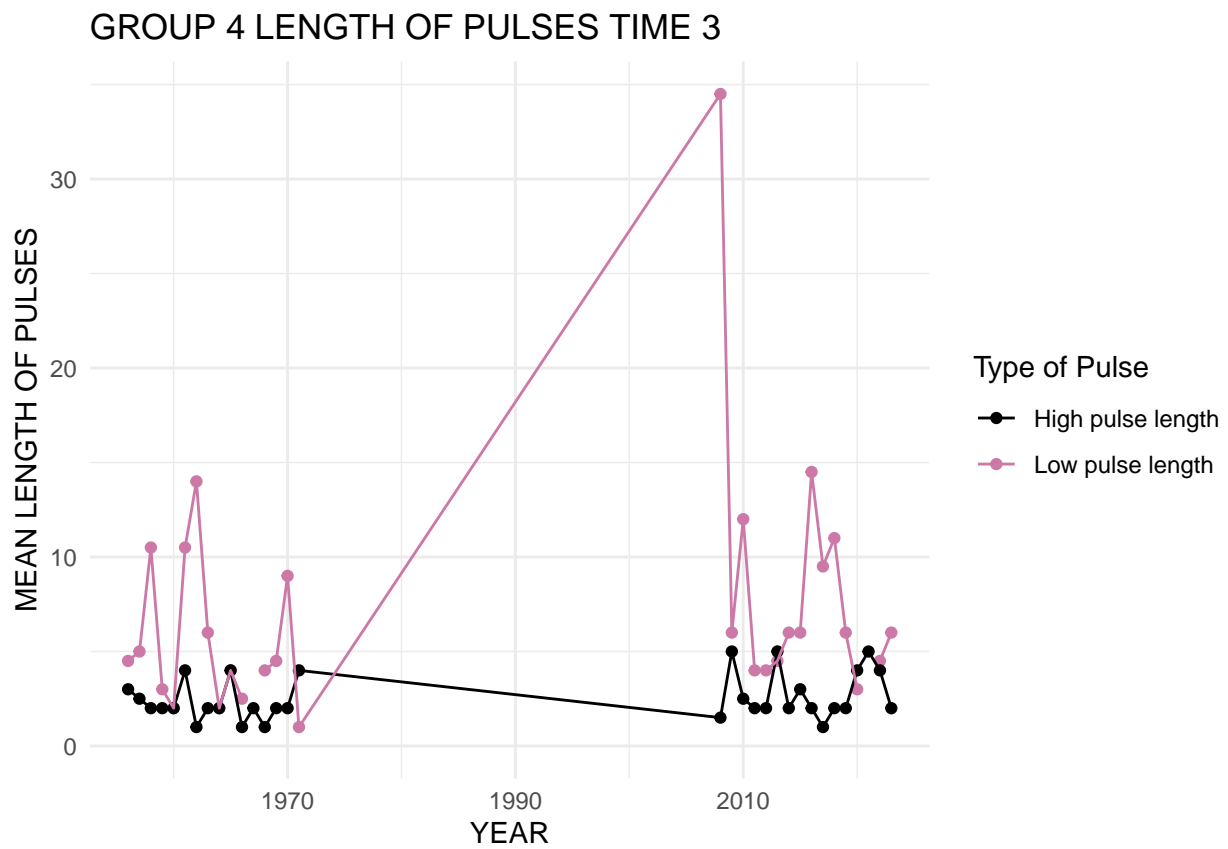


```
##  
## $group4_number_time3_plot
```

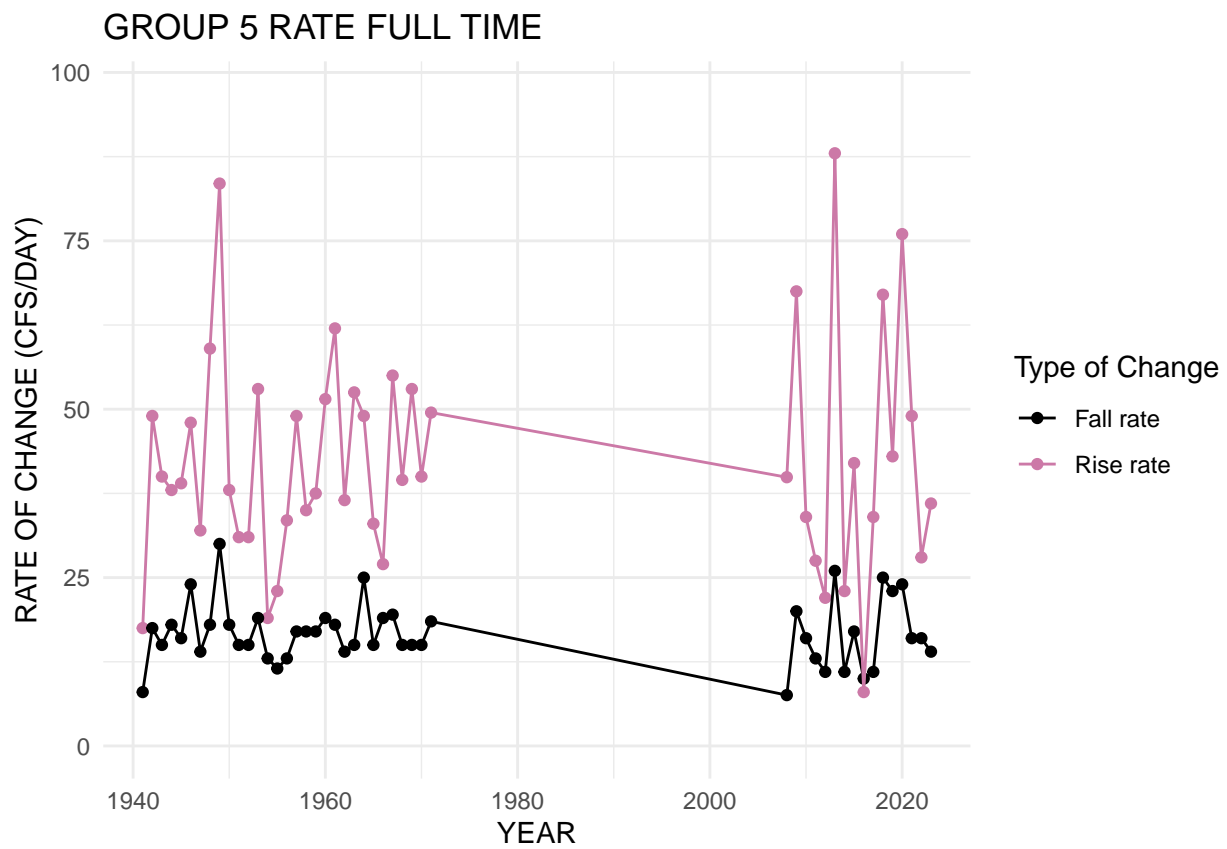
GROUP 4 NUMBER OF PULSES TIME 3



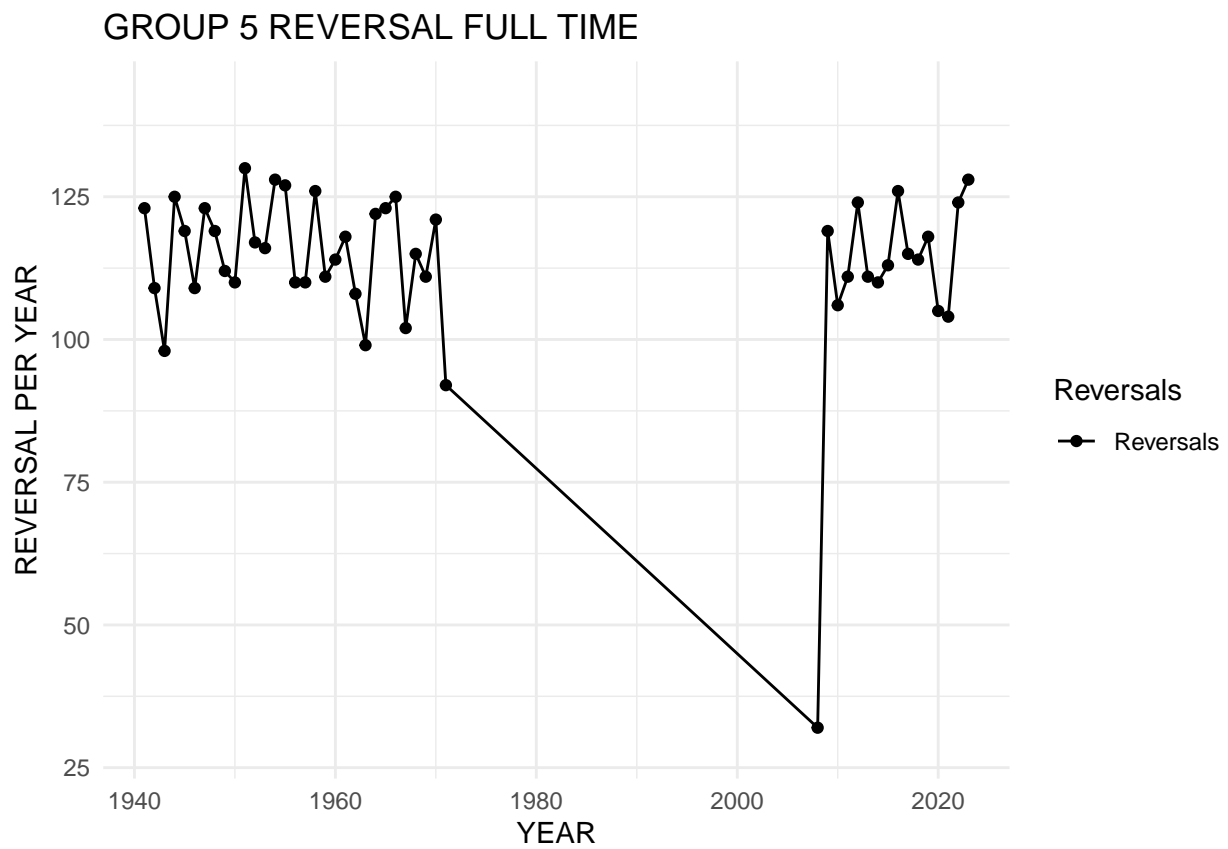
```
##  
## $group4_length_time3_plot
```



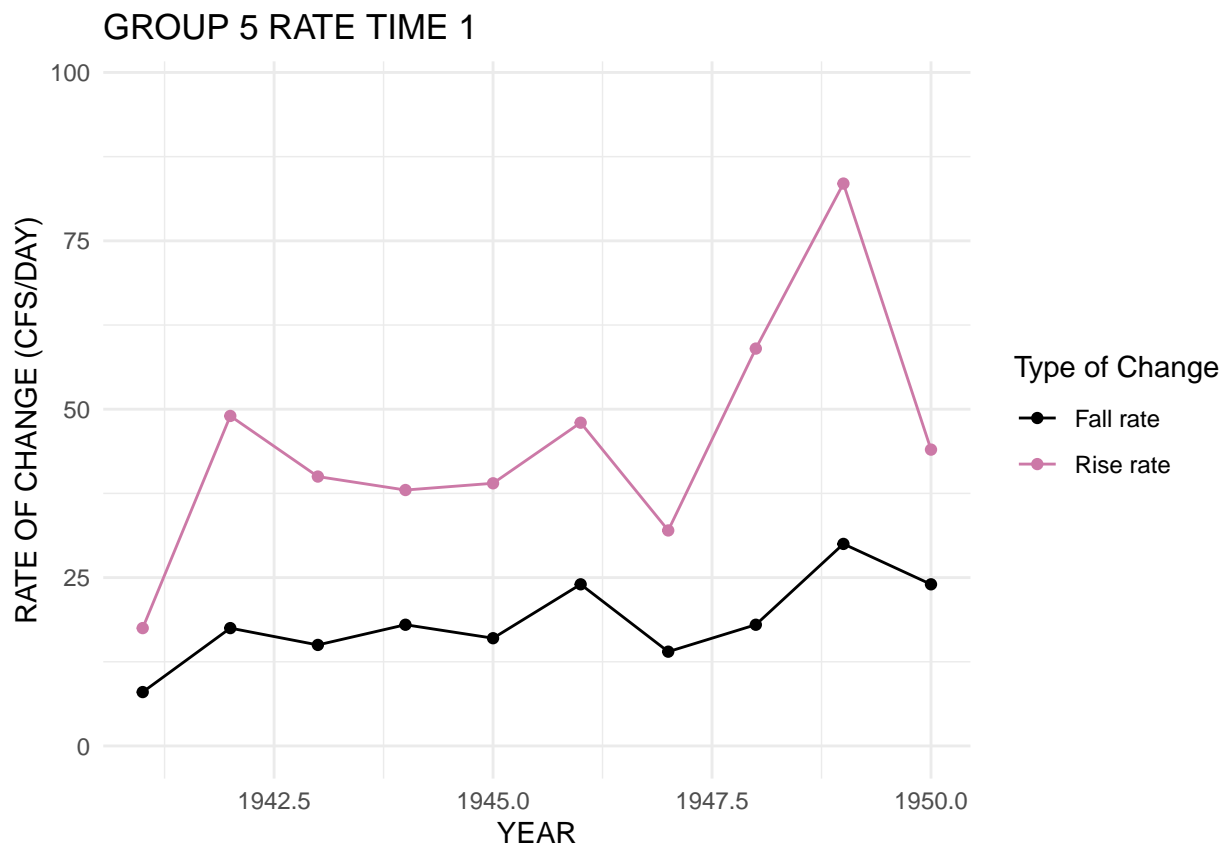
## \$group5\_rate\_full\_plot



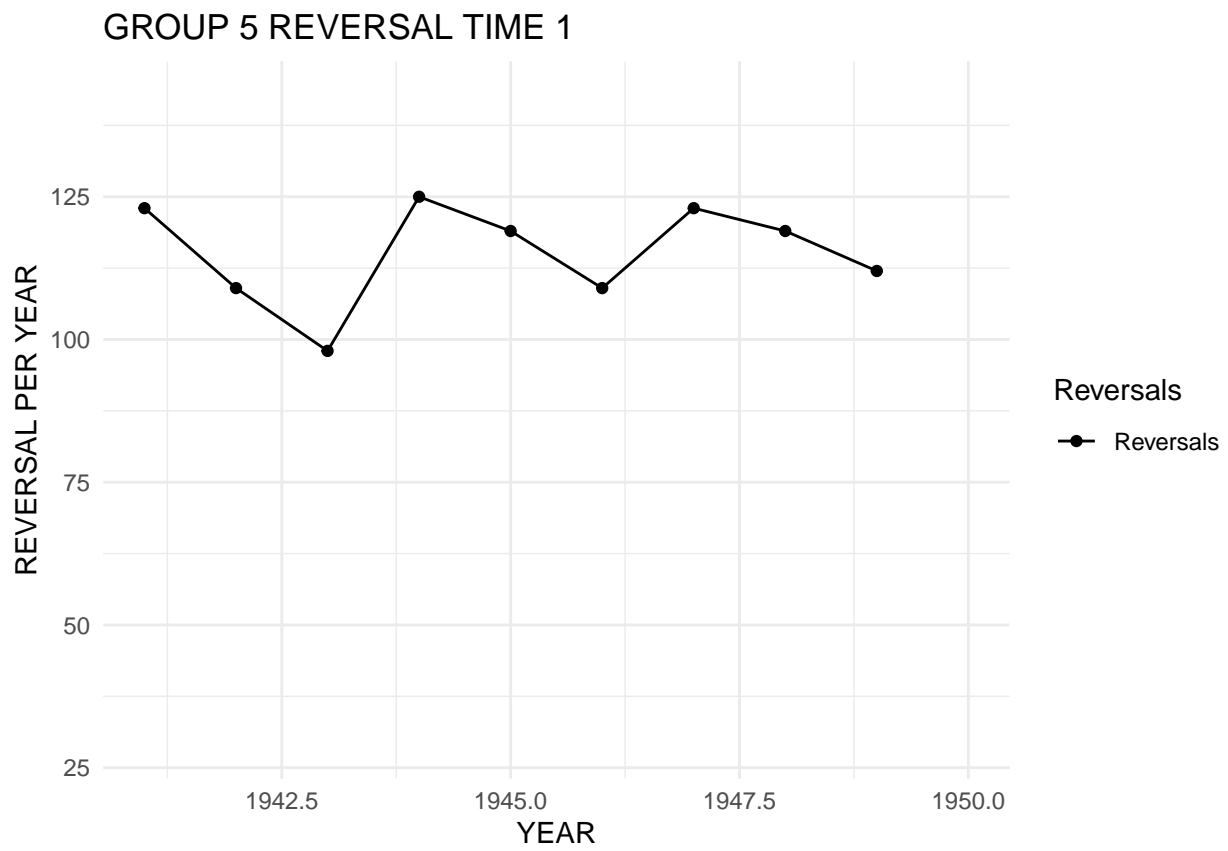
```
##
## $group5_reversal_full_plot
```



```
##  
## $group5_rate_time1_plot
```

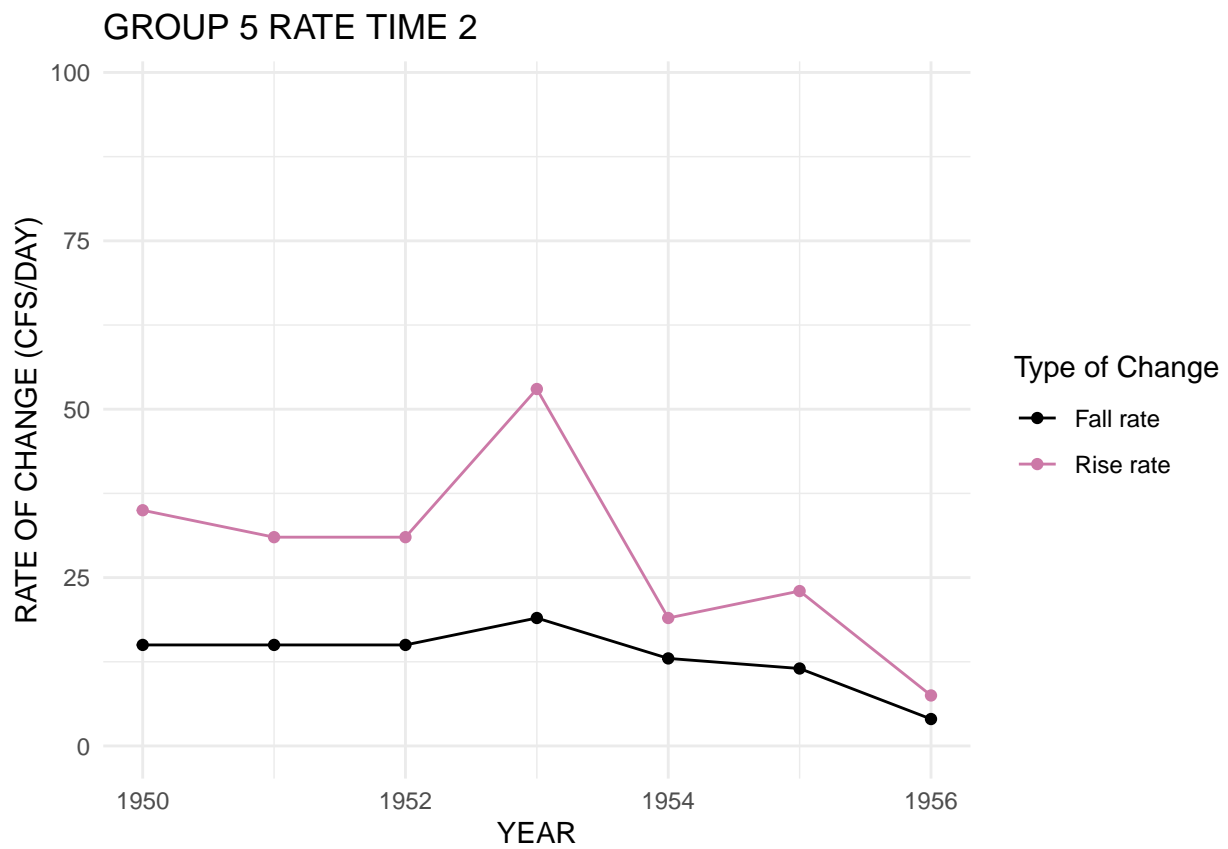


```
##  
## $group5_reversal_time1_plot
```

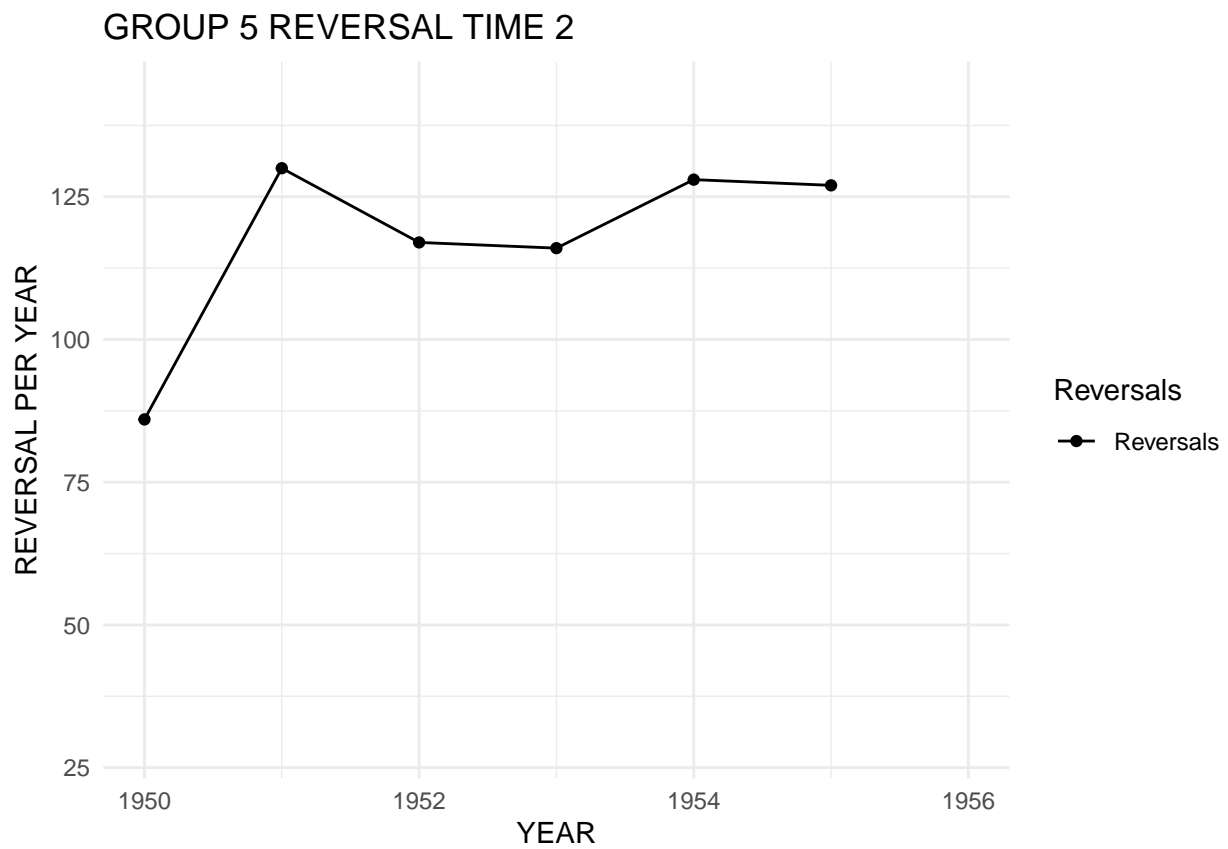


```
##  
## $group5_rate_time2_plot
```

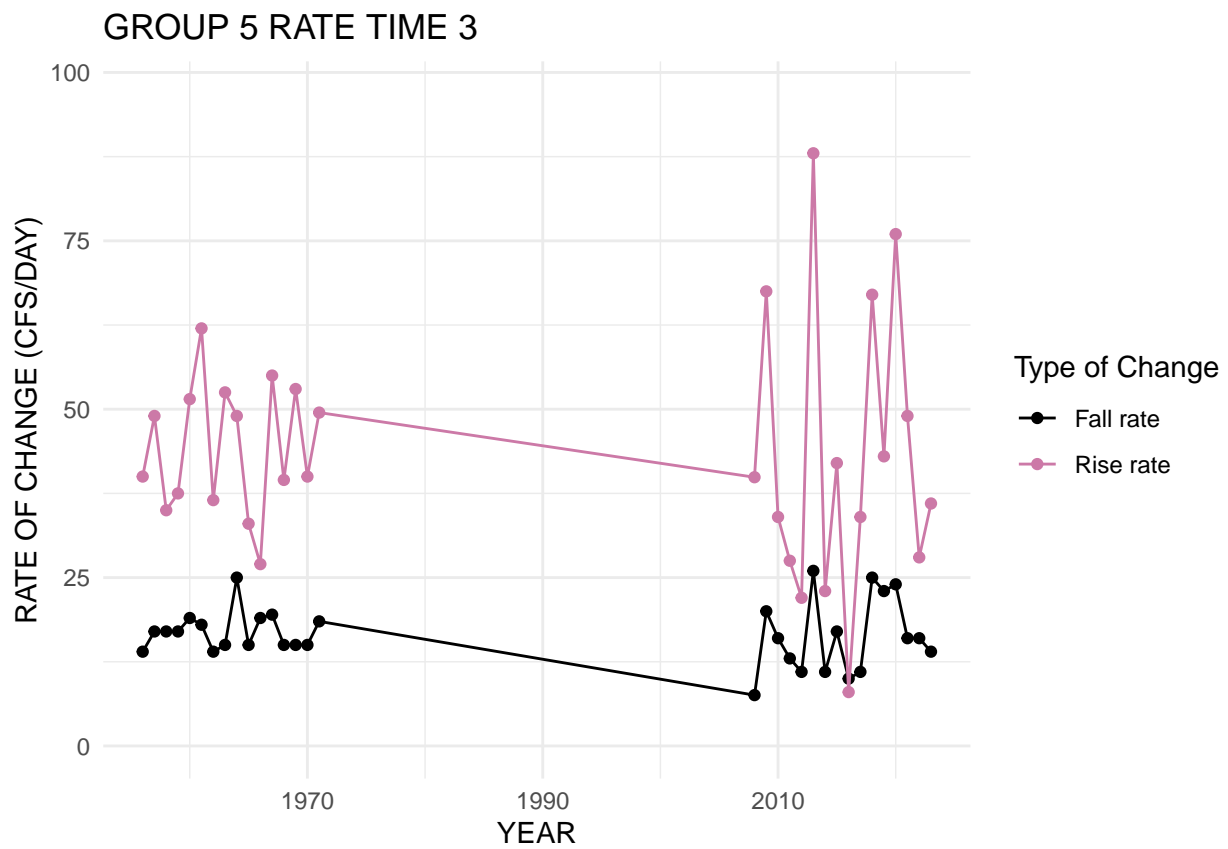




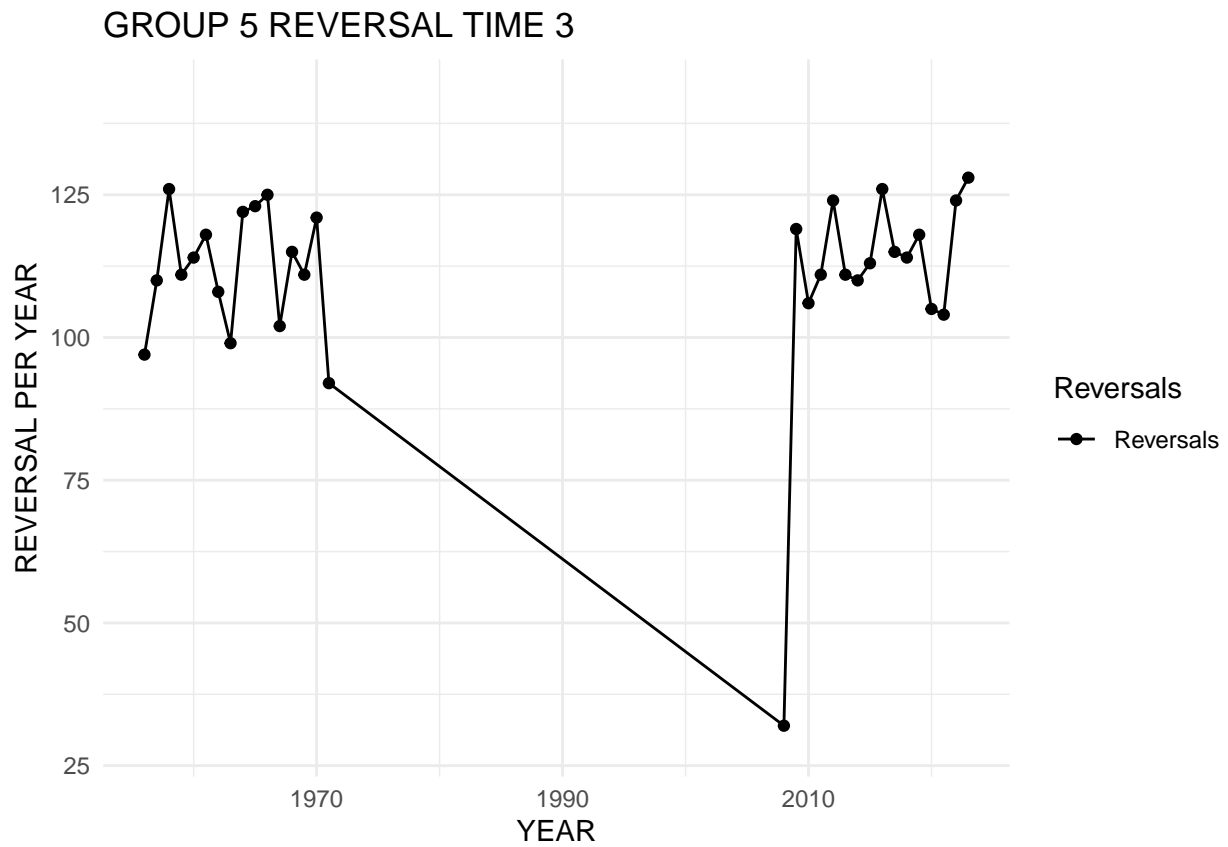
```
##  
## $group5_reversal_time2_plot
```



```
##  
## $group5_rate_time3_plot
```

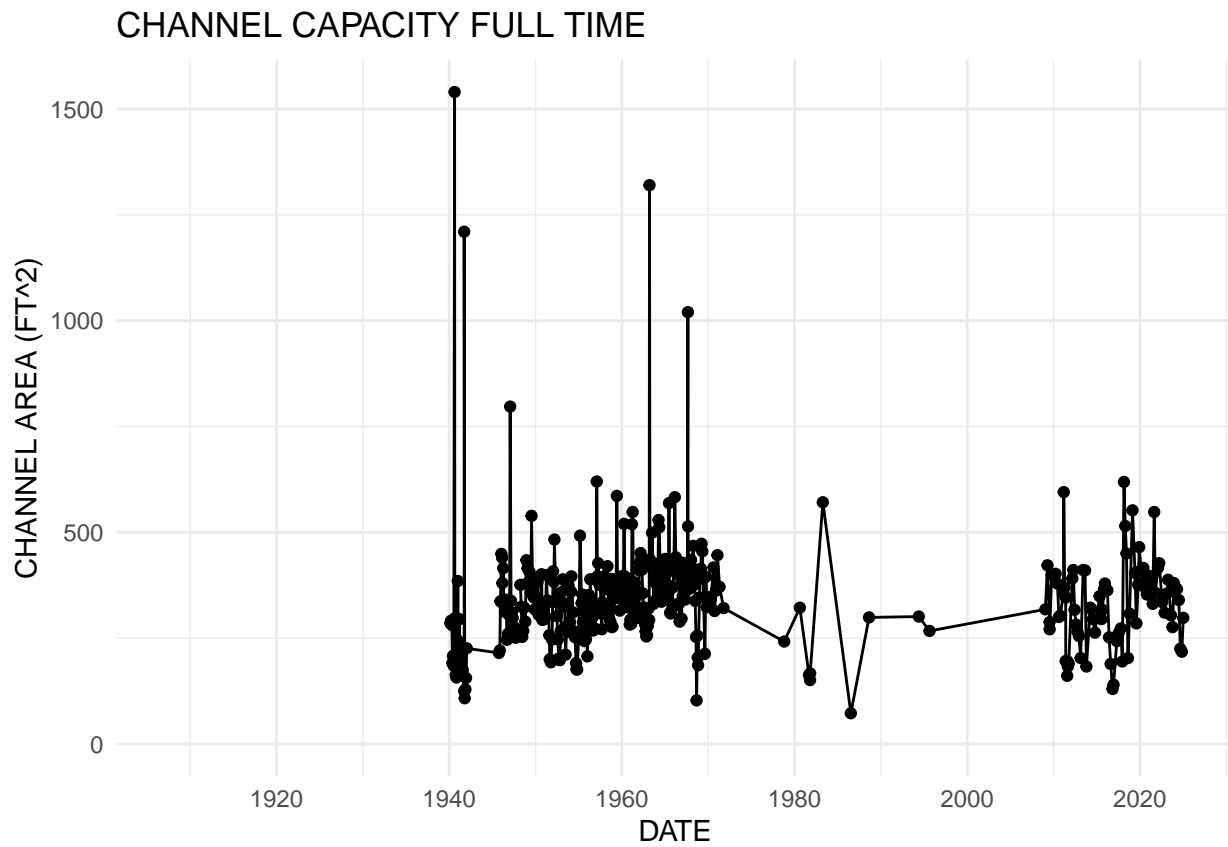


```
##  
## $group5_reversal_time3_plot
```

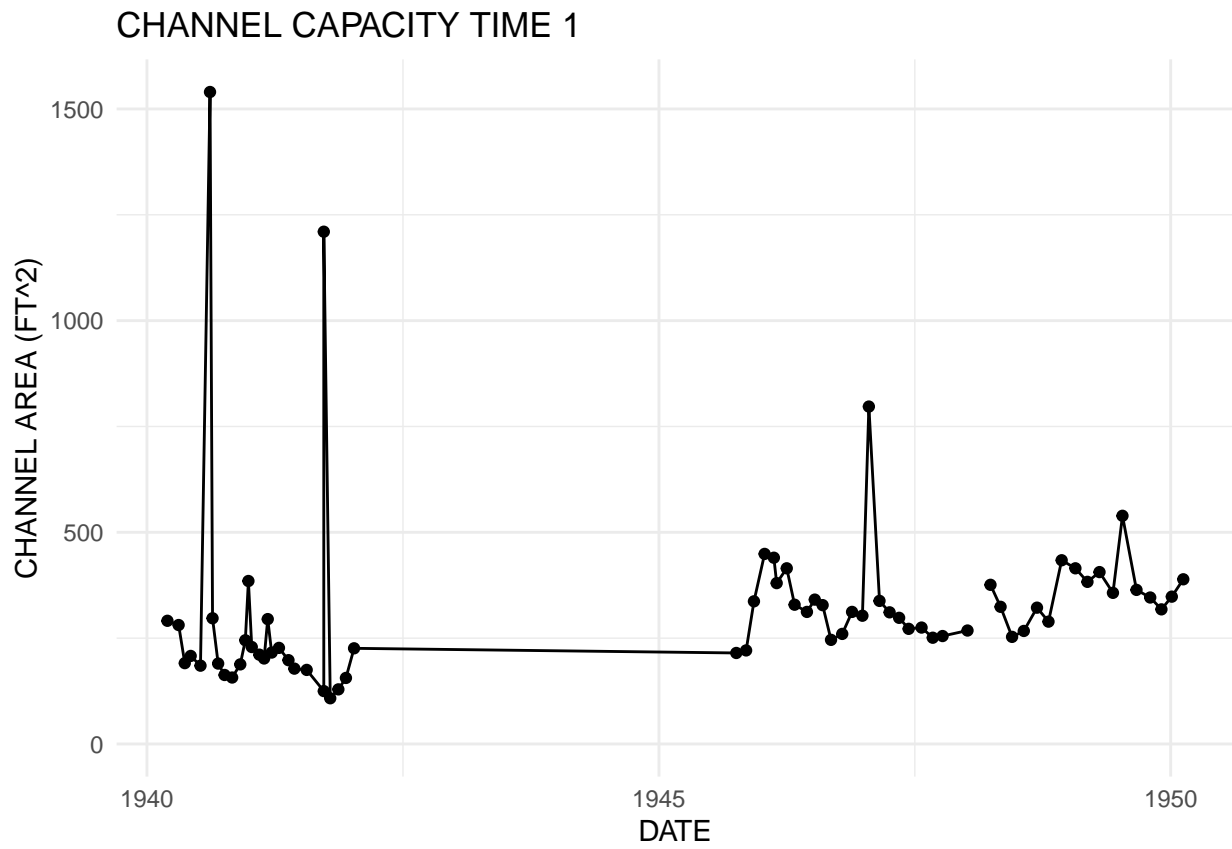


## Field Measurements Manipulation and Visualization

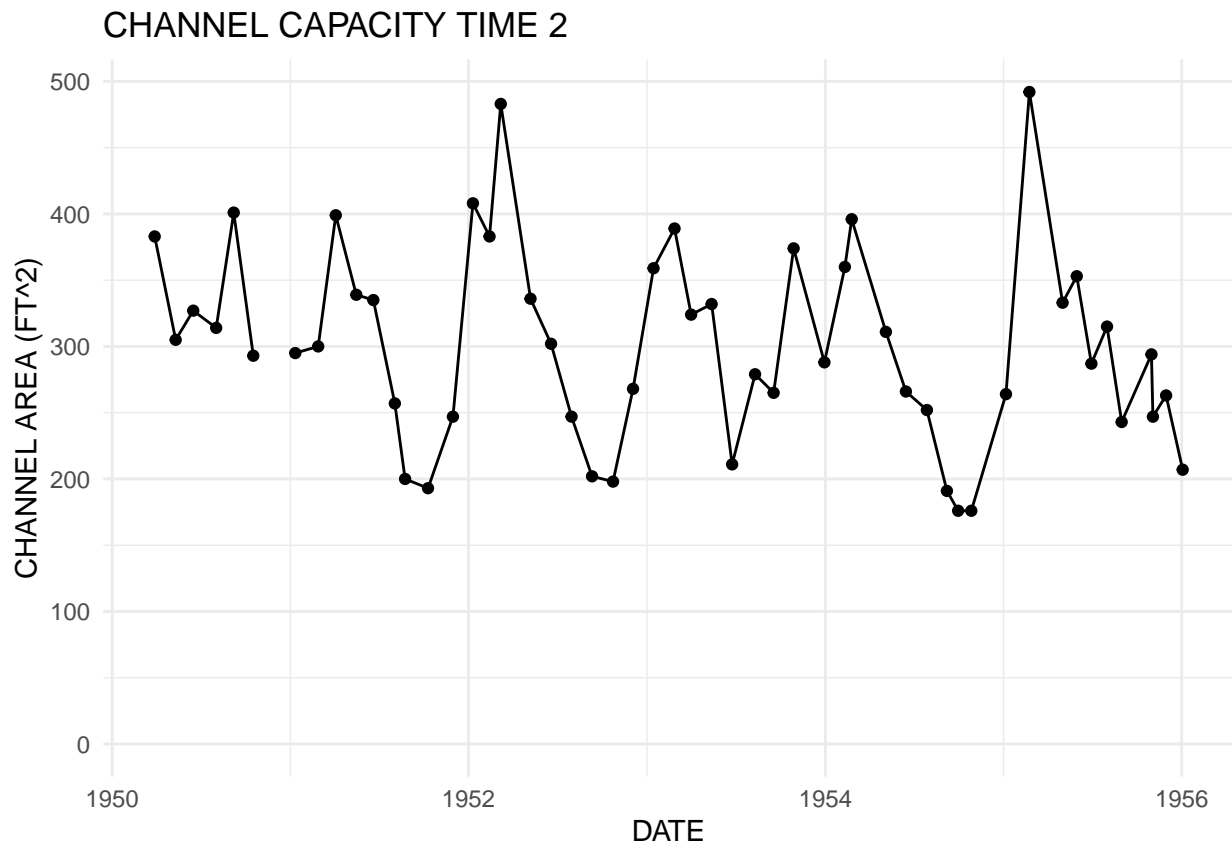
```
## $chan_capacity_full_plot
```



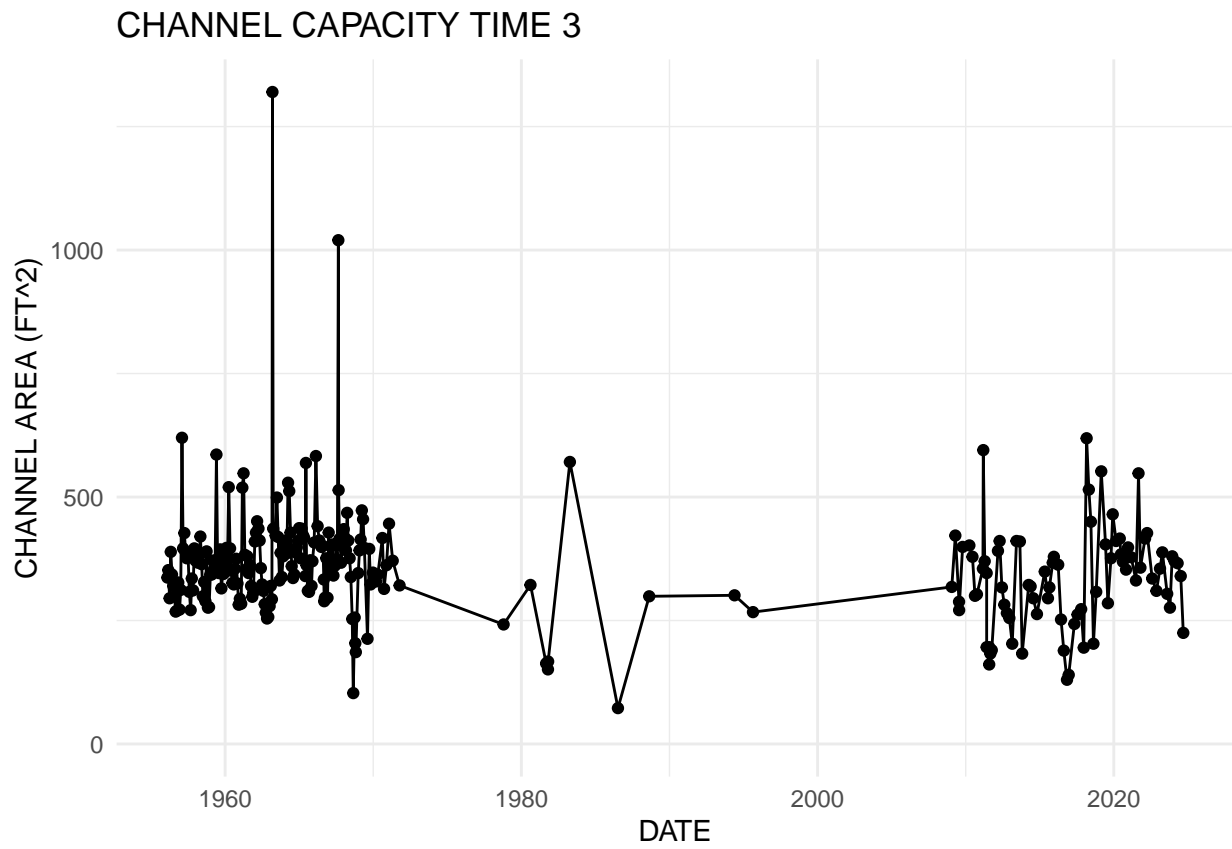
```
##  
## $chan_capacity_time1_plot
```



```
##  
## $chan_capacity_time2_plot
```

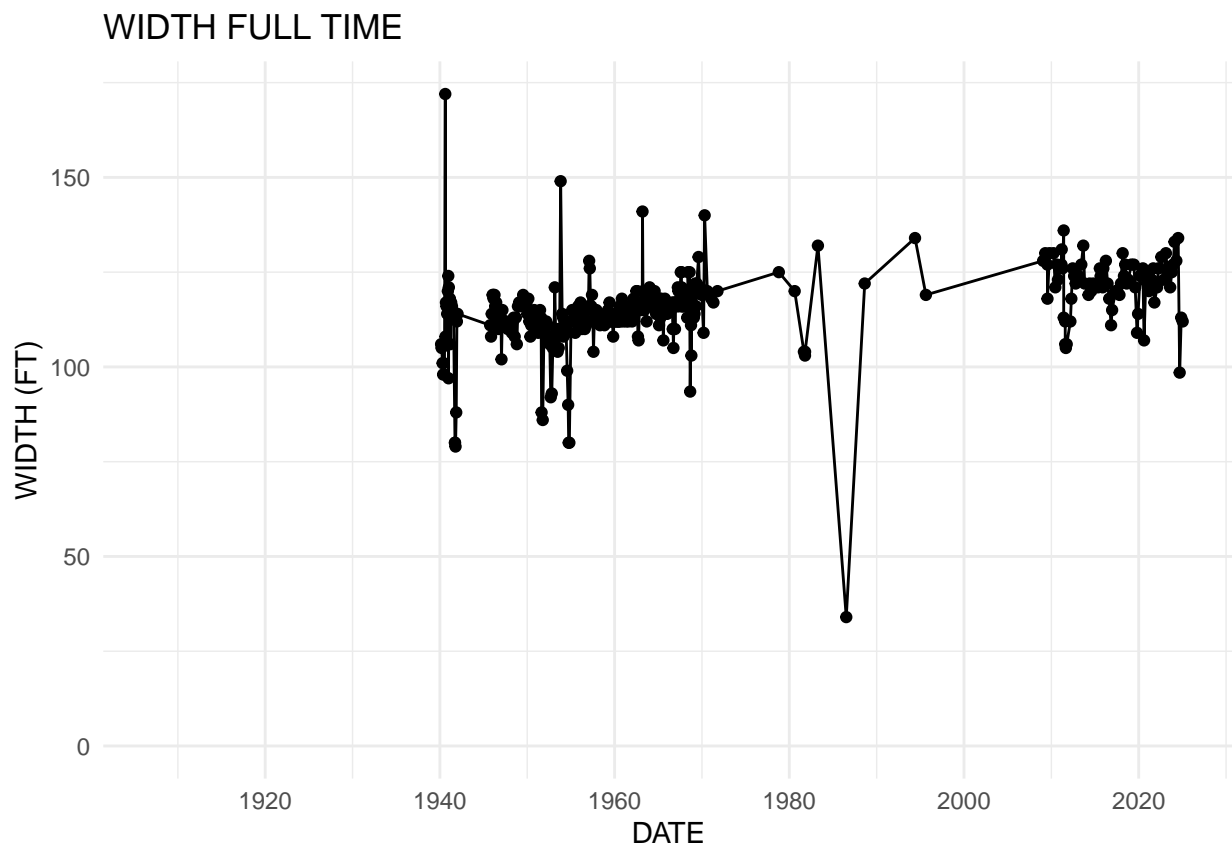


```
##  
## $chan_capacity_time3_plot
```

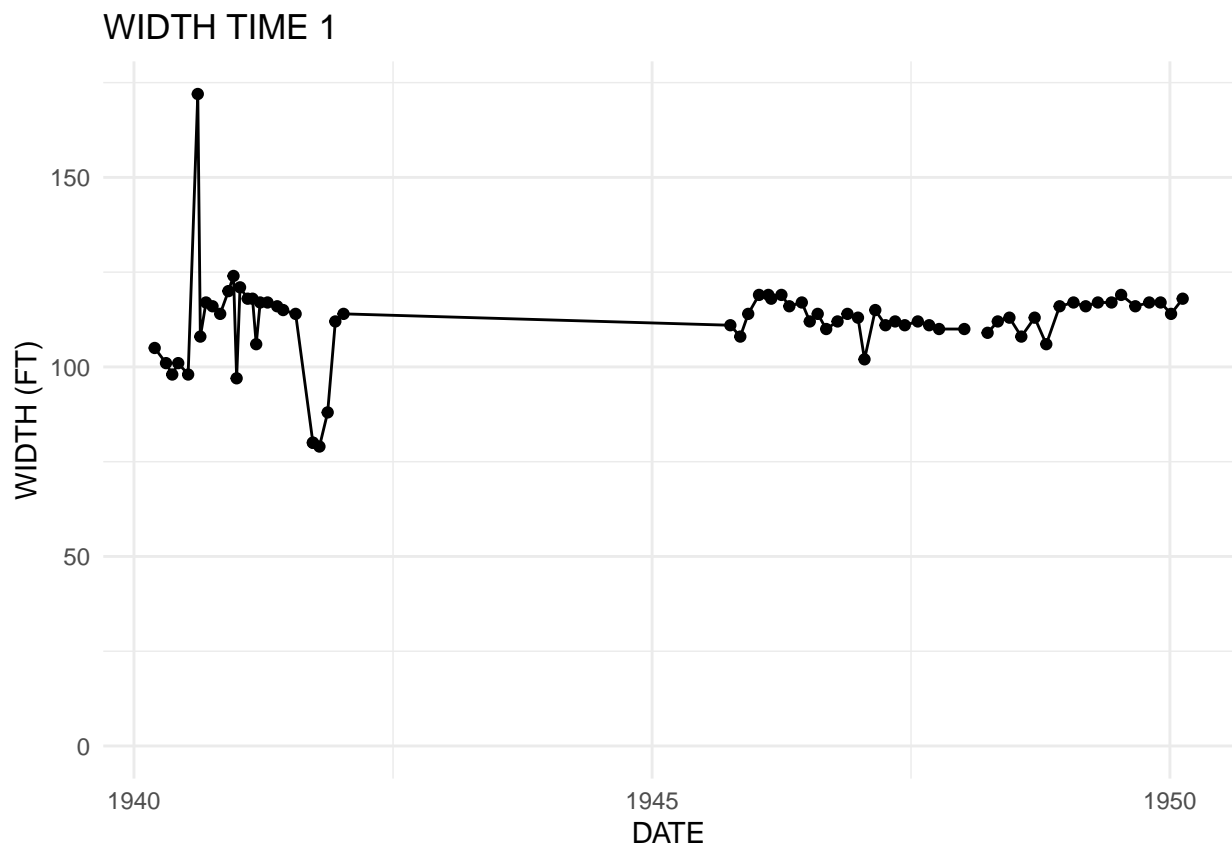


```
##  
## $width_full_plot
```

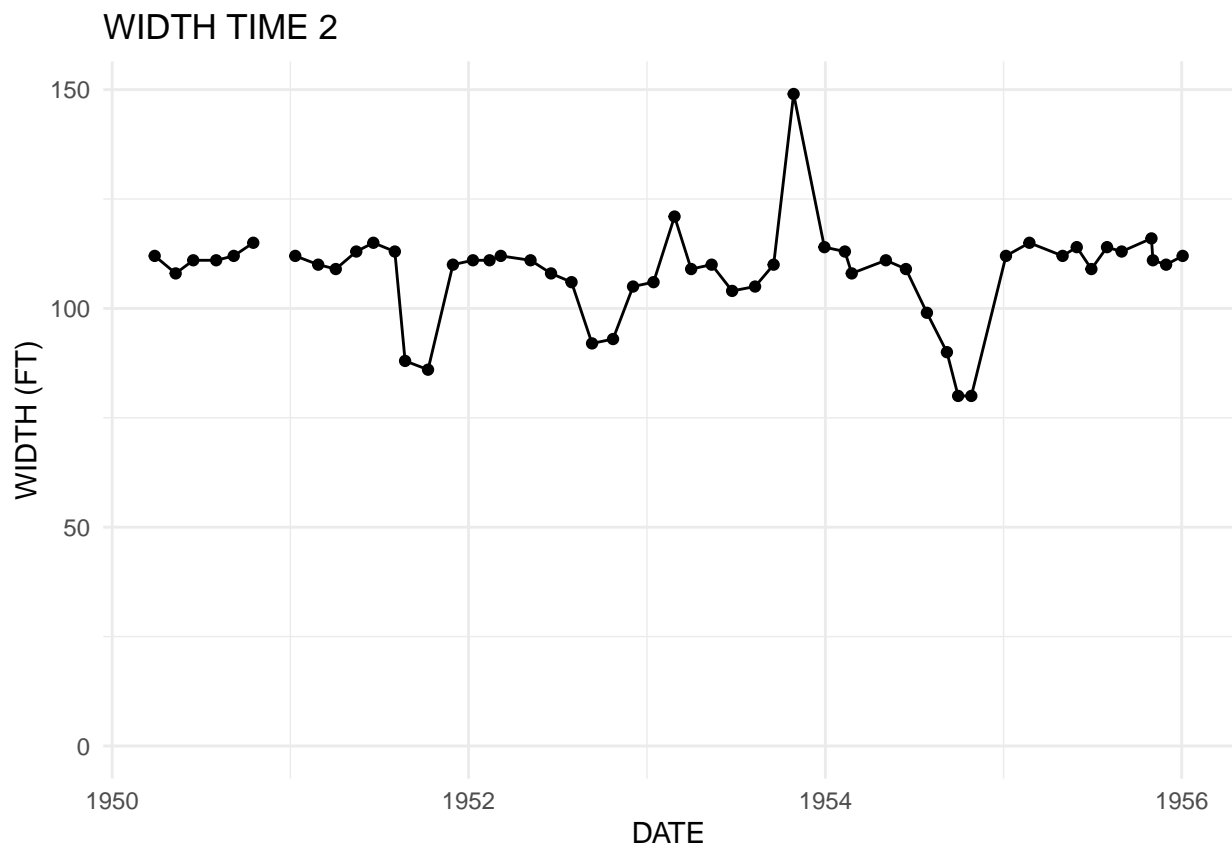




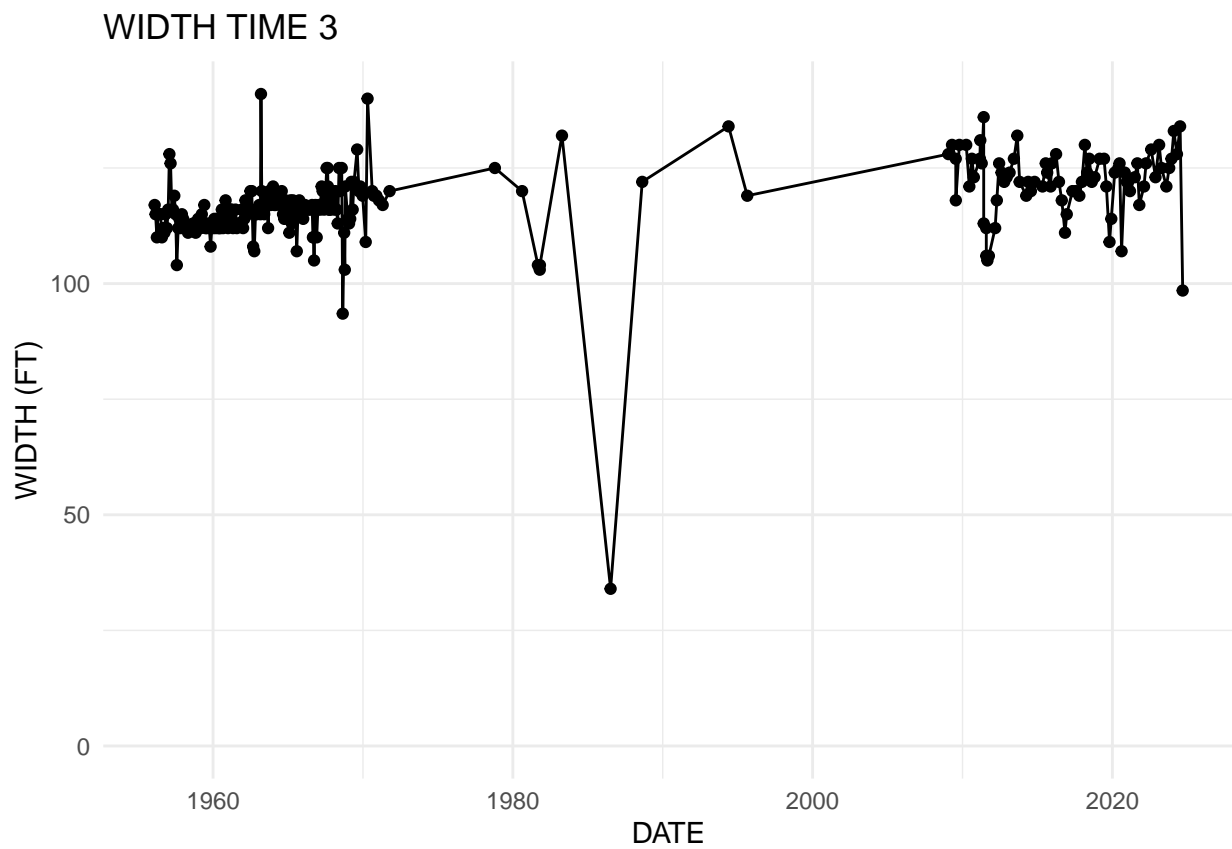
```
##  
## $width_time1_plot
```



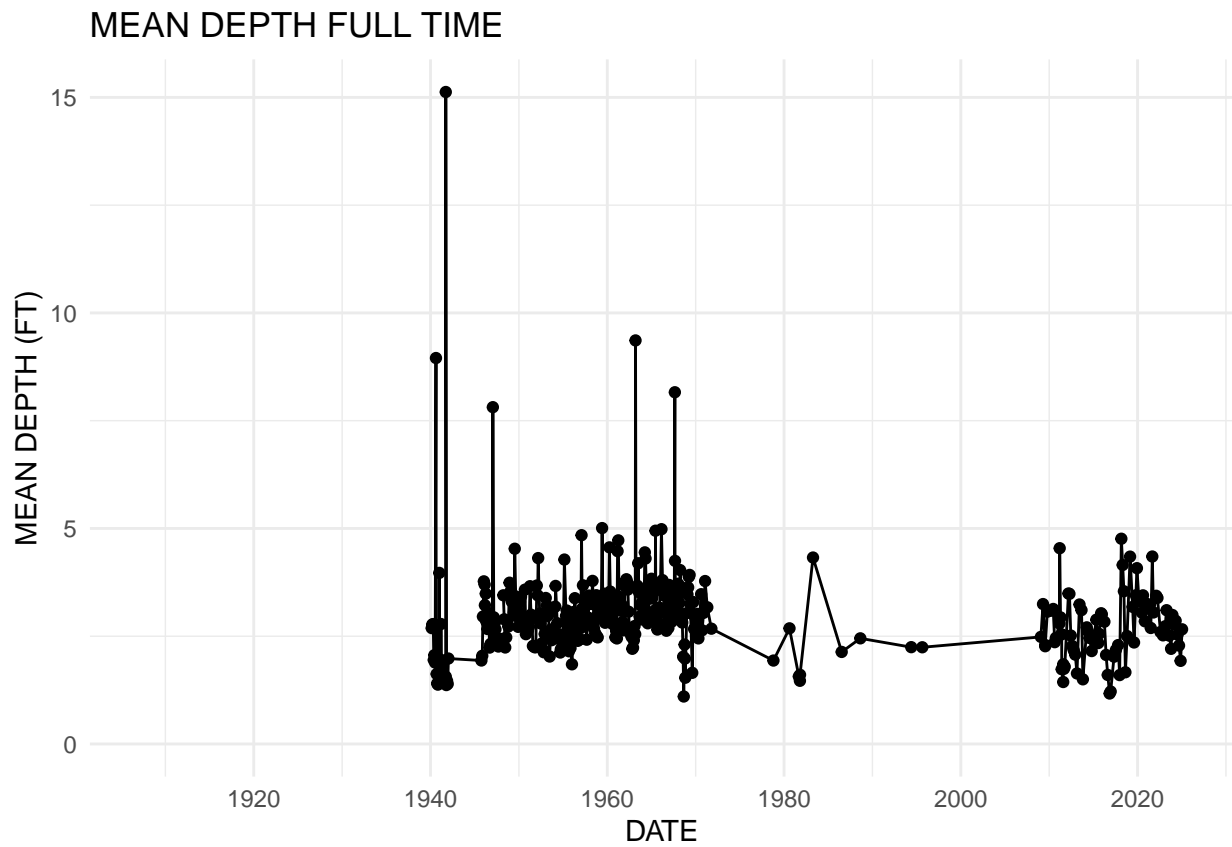
```
##  
## $width_time2_plot
```



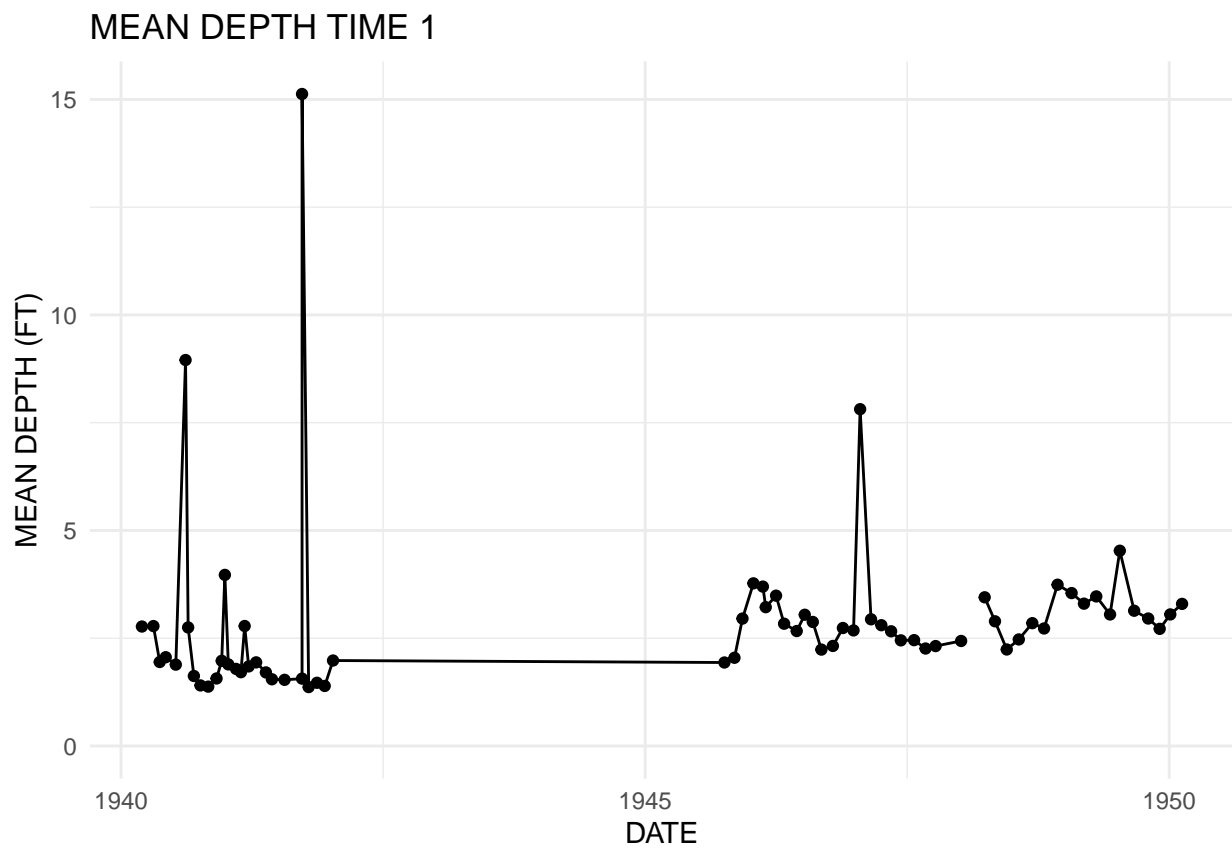
```
##  
## $width_time3_plot
```



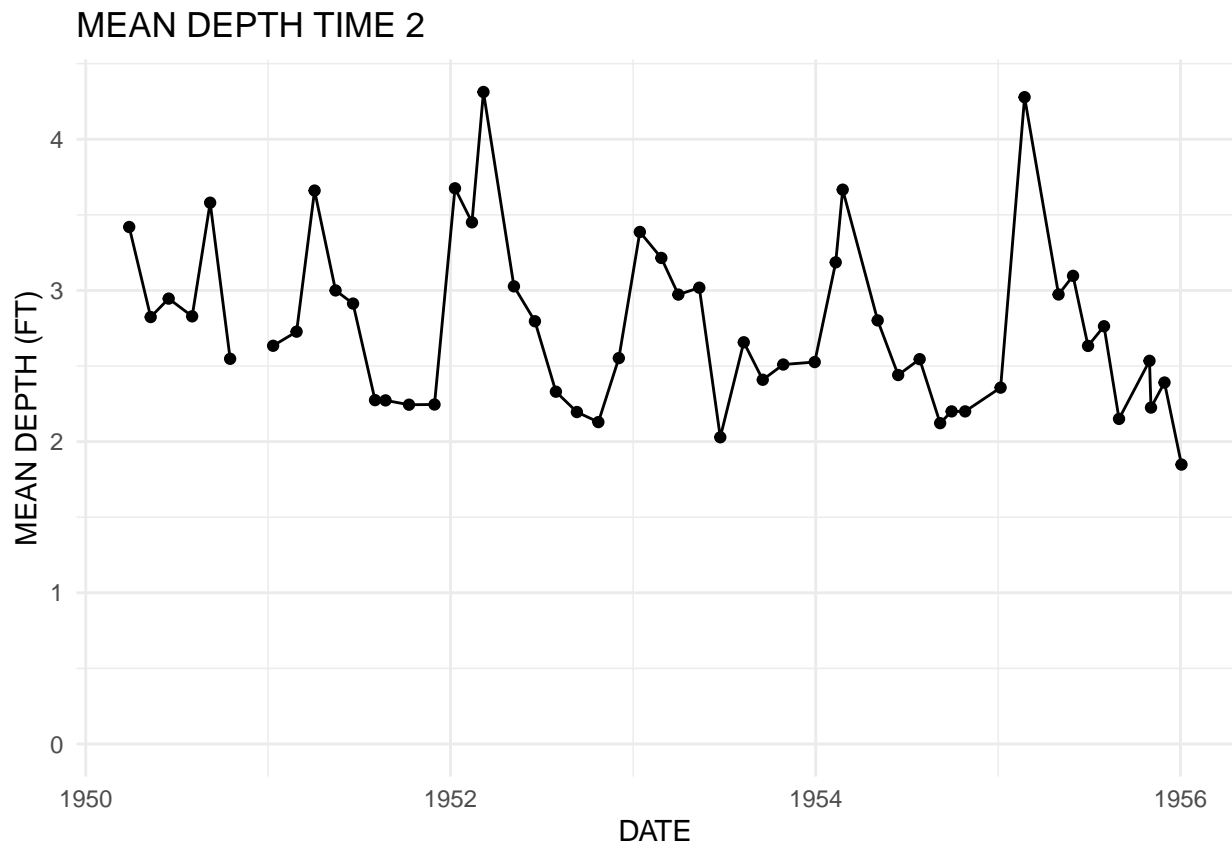
```
##  
## $mean_depth_full_plot
```



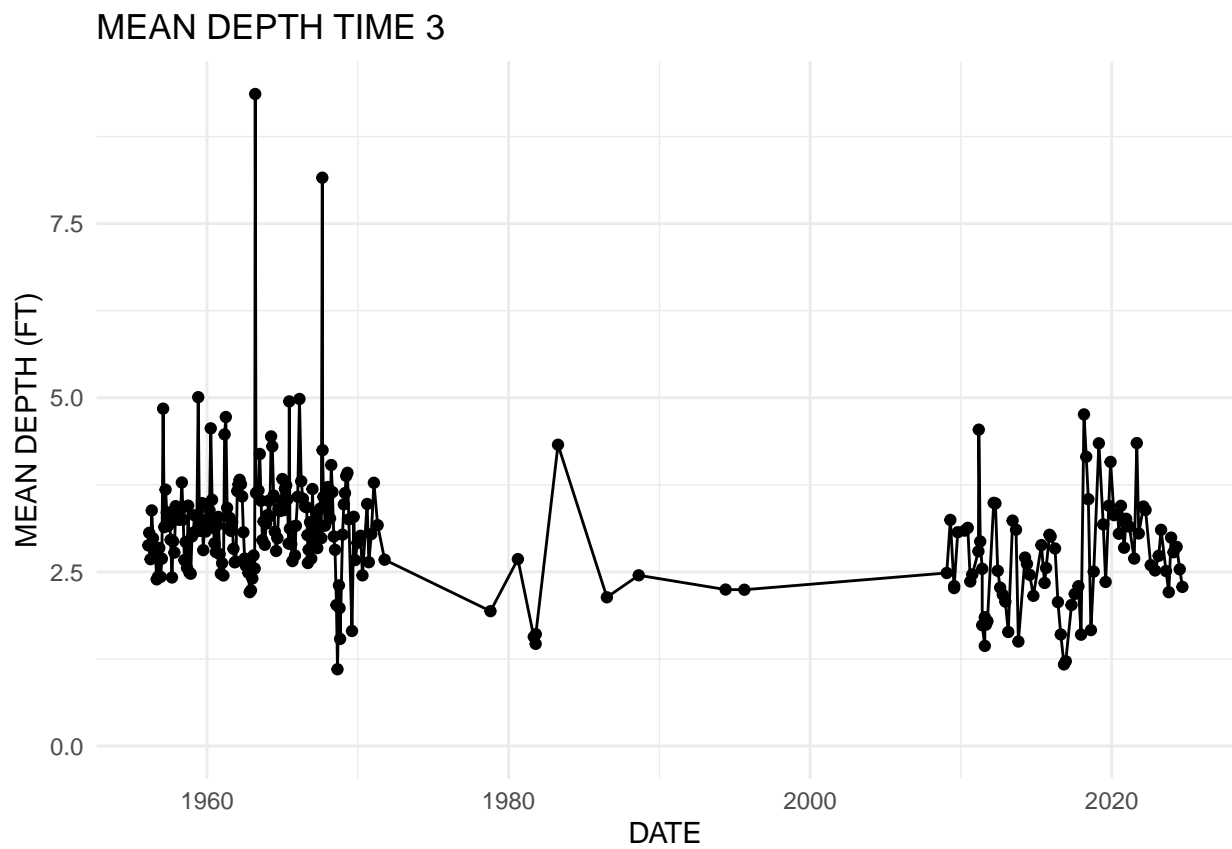
```
##  
## $mean_depth_time1_plot
```



```
##  
## $mean_depth_time2_plot
```

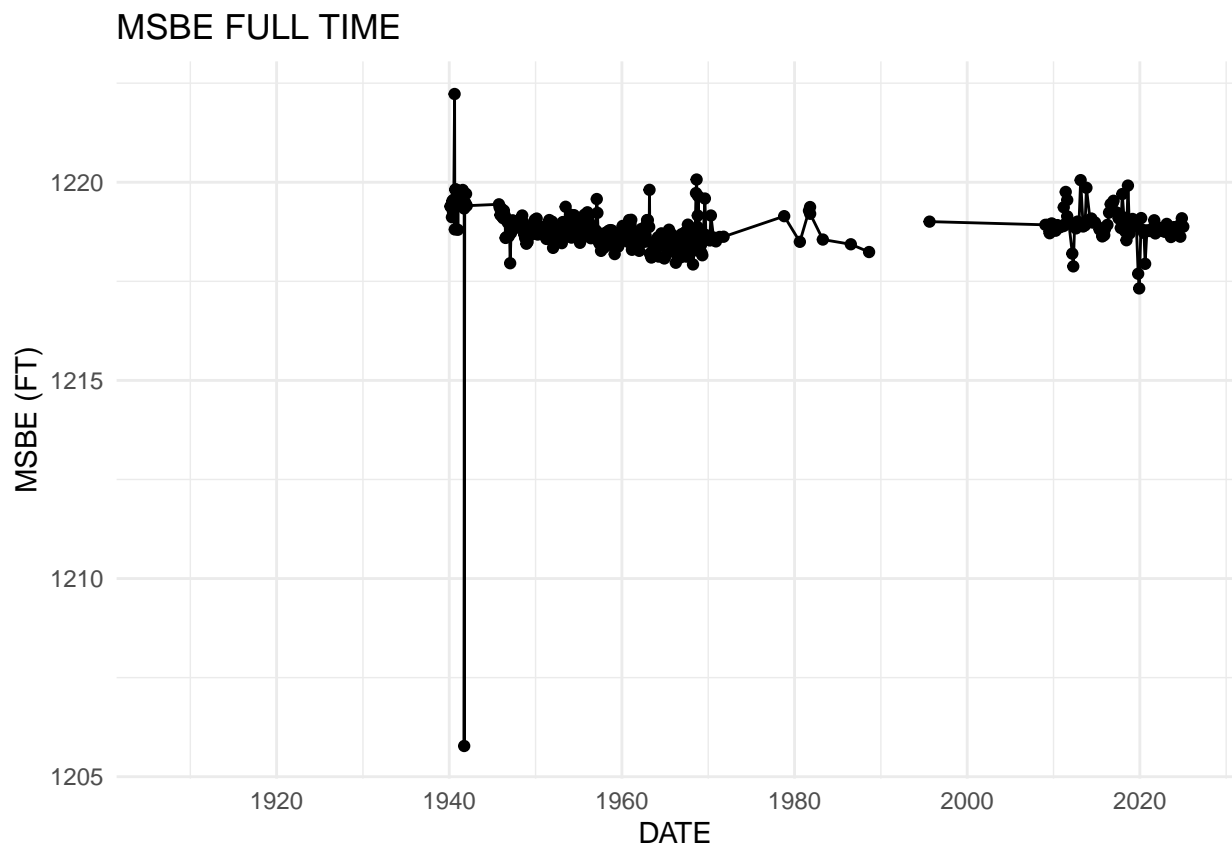


```
##  
## $mean_depth_time3_plot
```

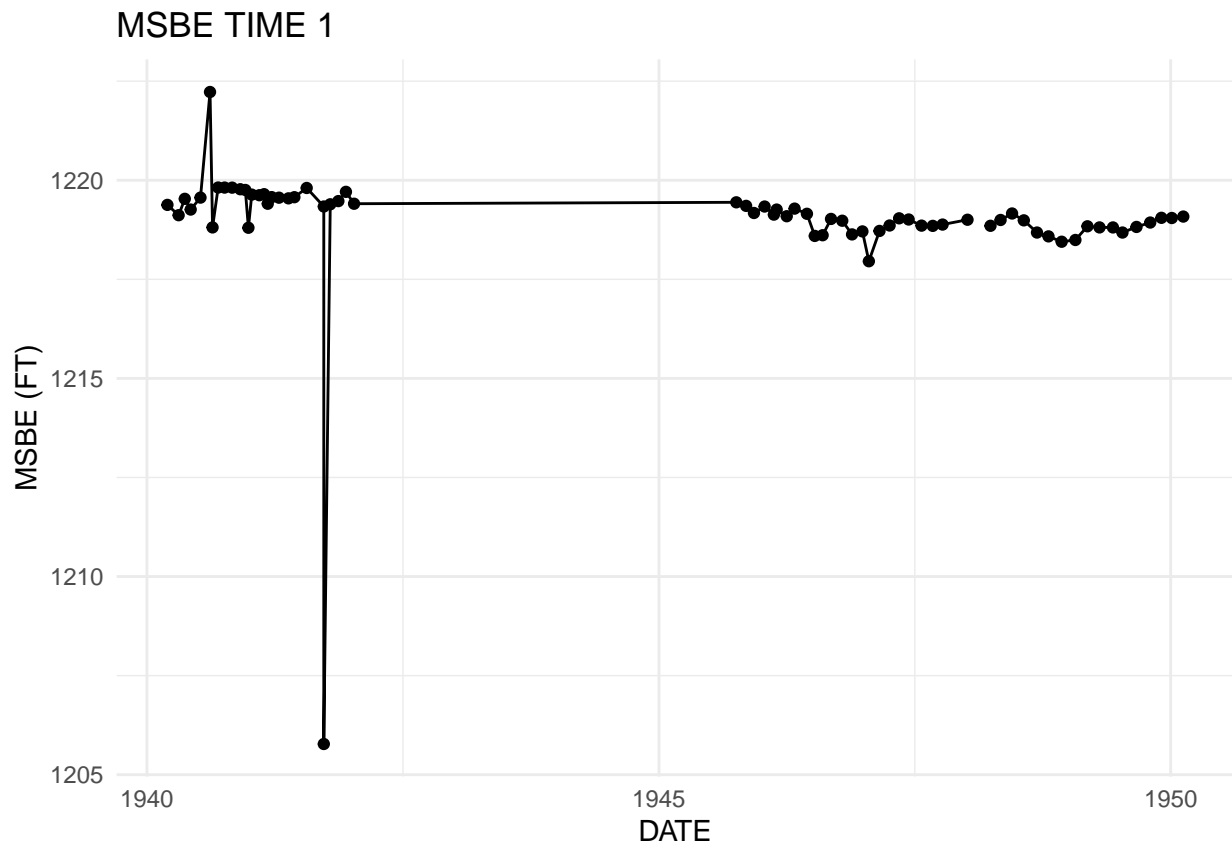


```
##  
## $MSBE_full_plot
```



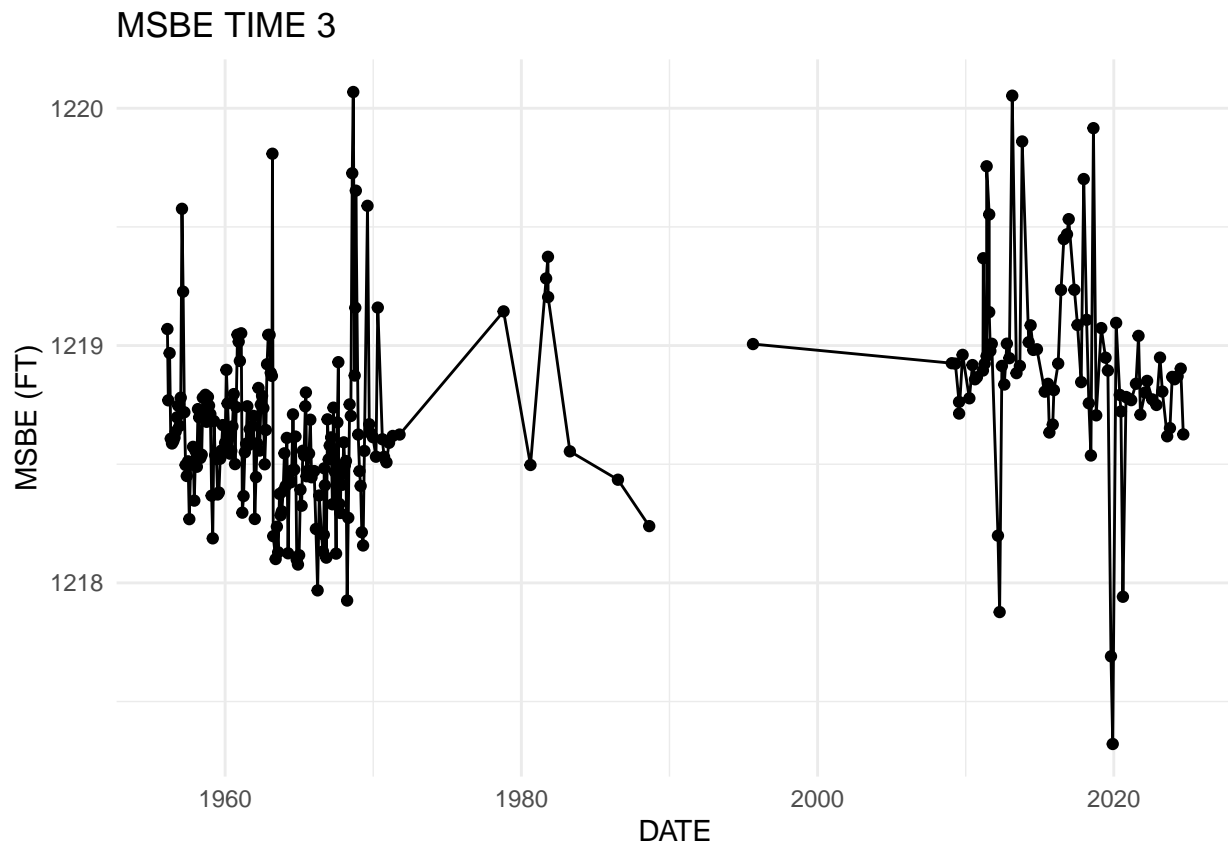


```
##  
## $MSBE_time1_plot
```



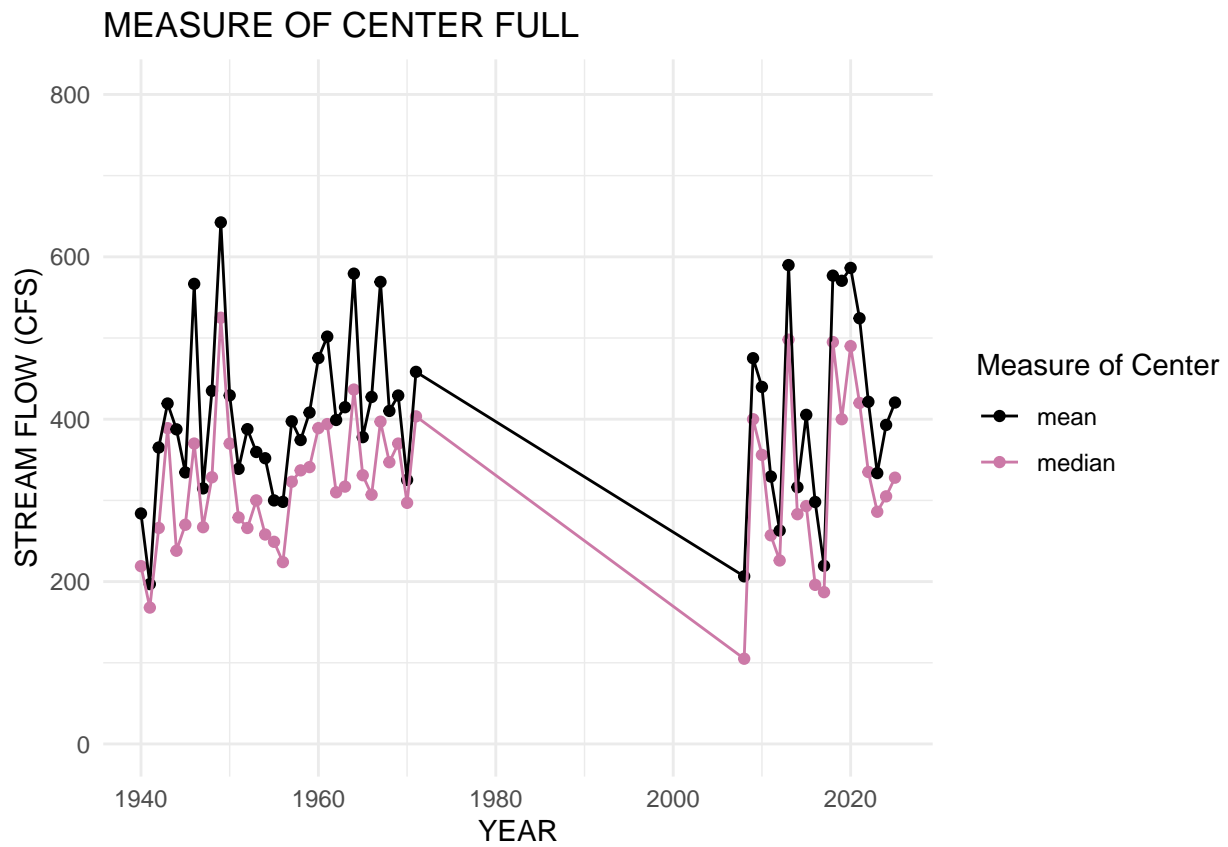
```
##  
## $MSBE_time2_plot
```



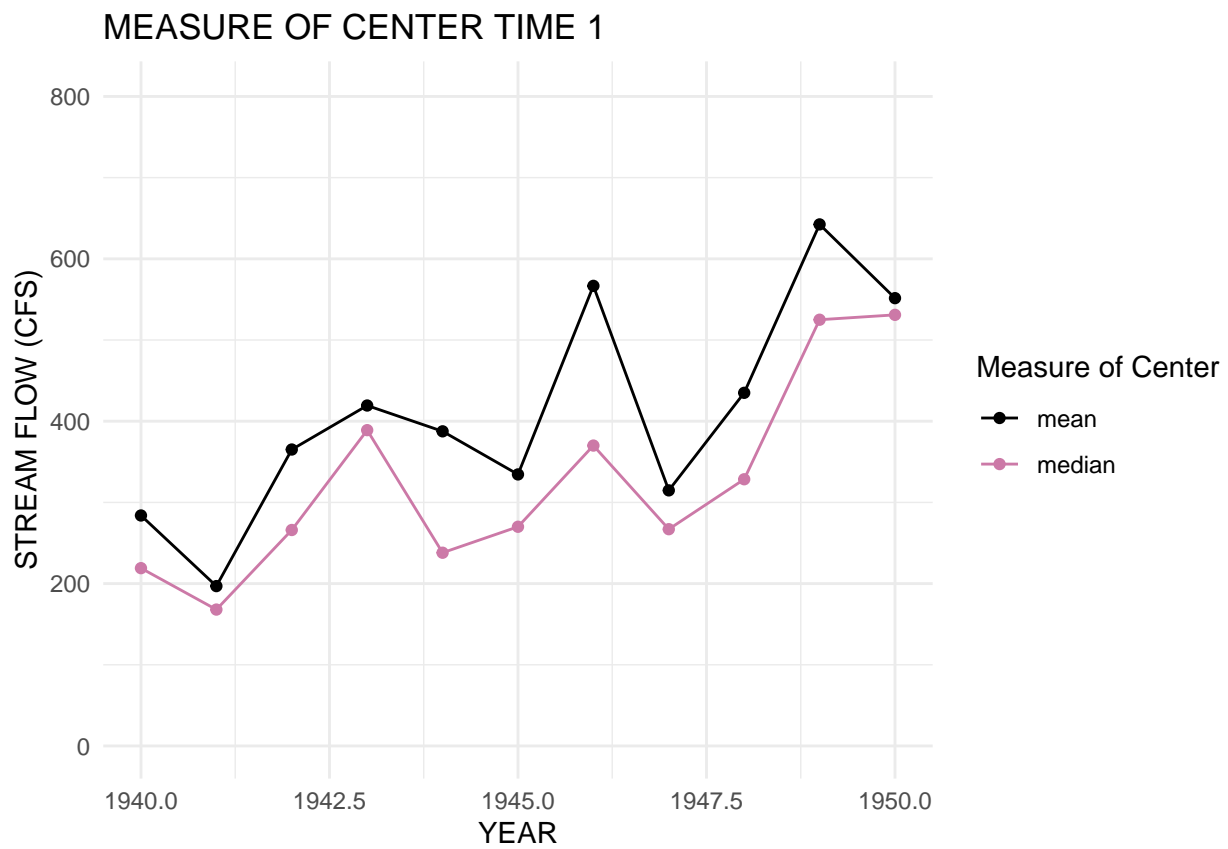


## Measure of Center Manipulation and Visualization

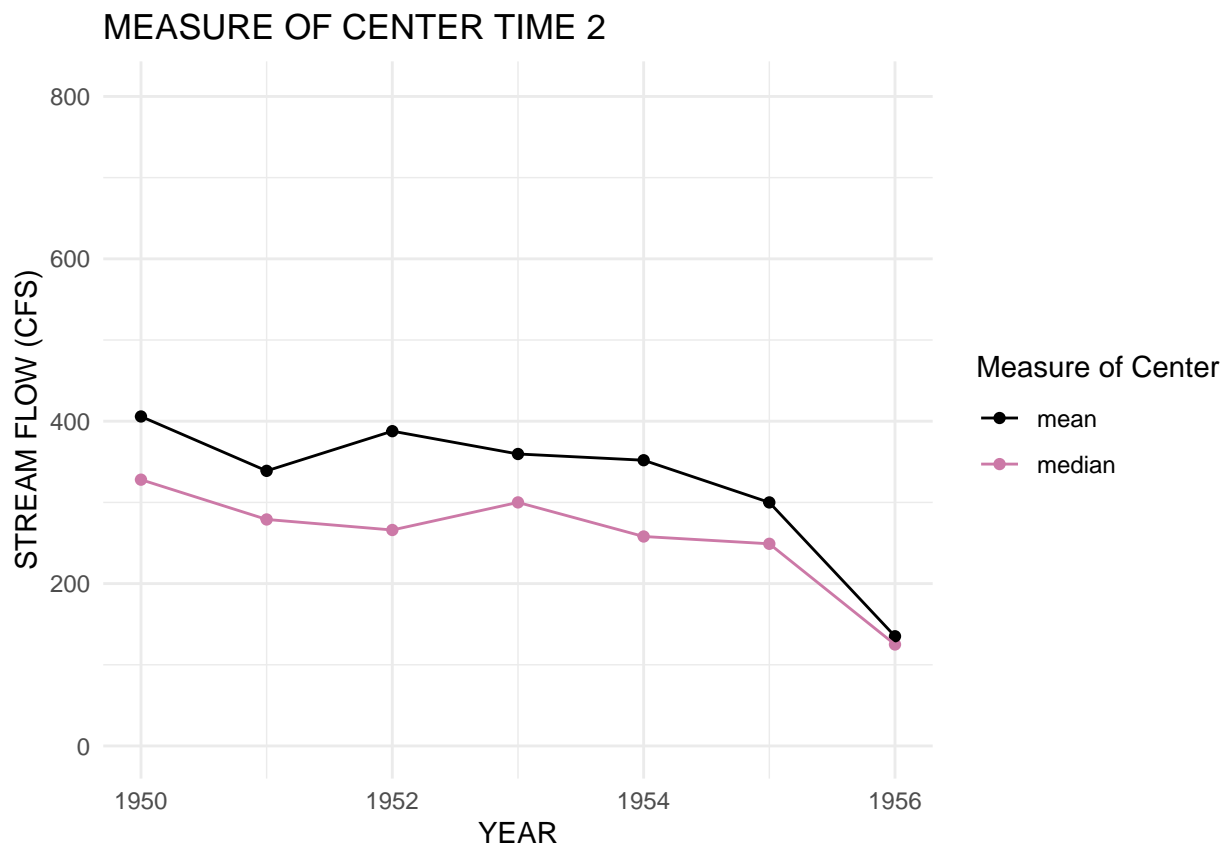
```
## $measure_of_center_full_plot
```



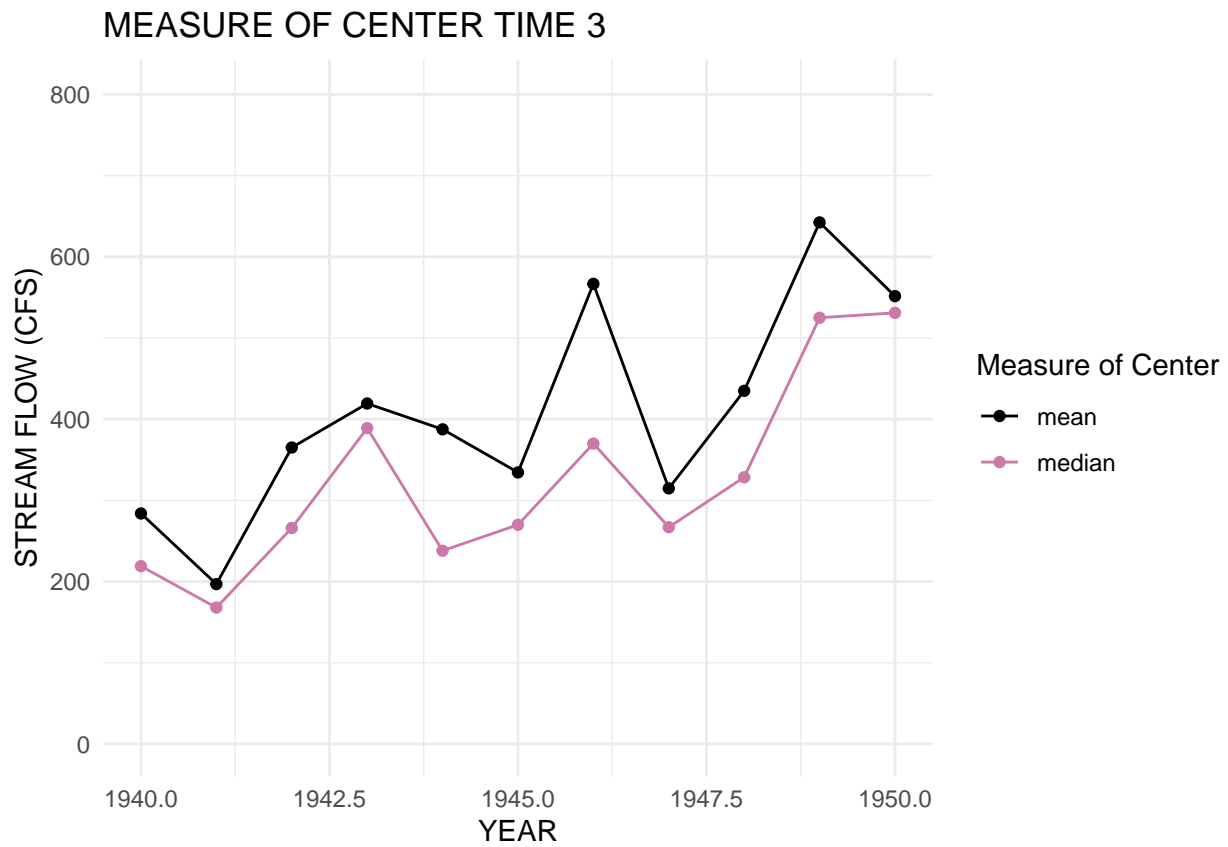
```
##  
## $measure_of_center_time1_plot
```



```
##  
## $measure_of_center_time2_plot
```



```
##  
## $measure_of_center_time3_plot
```

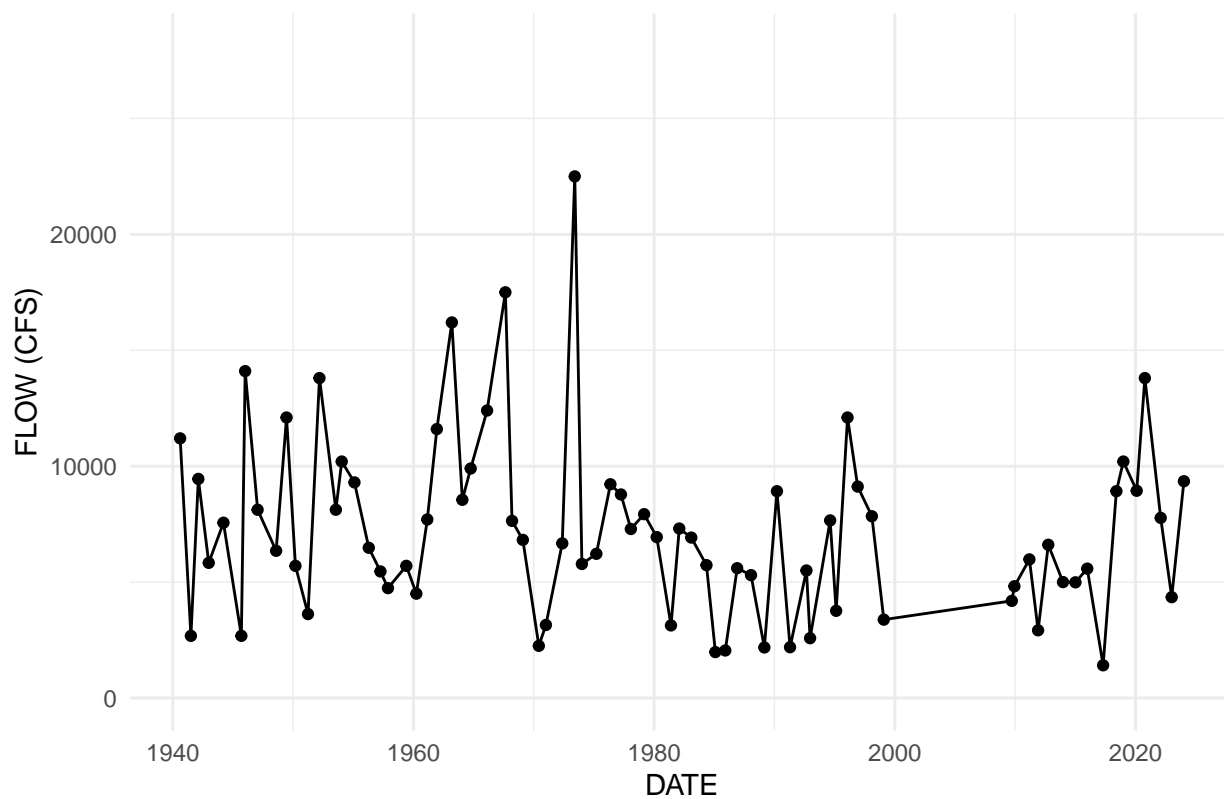


## Peak Flow Manipulation and Visualization

```
## $peak_flow_full_plot
```

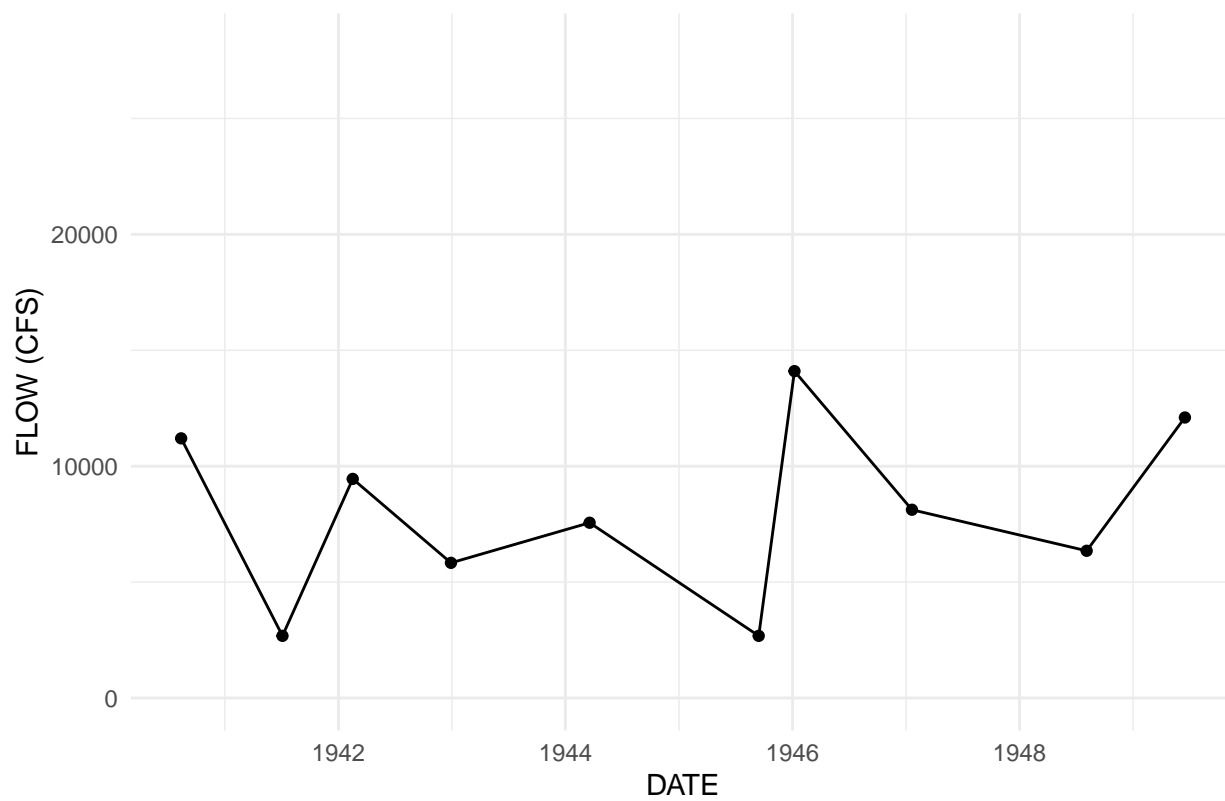


## ANNUAL PEAK FLOW FULL TIME



```
##  
## $peak_flow_time1_plot
```

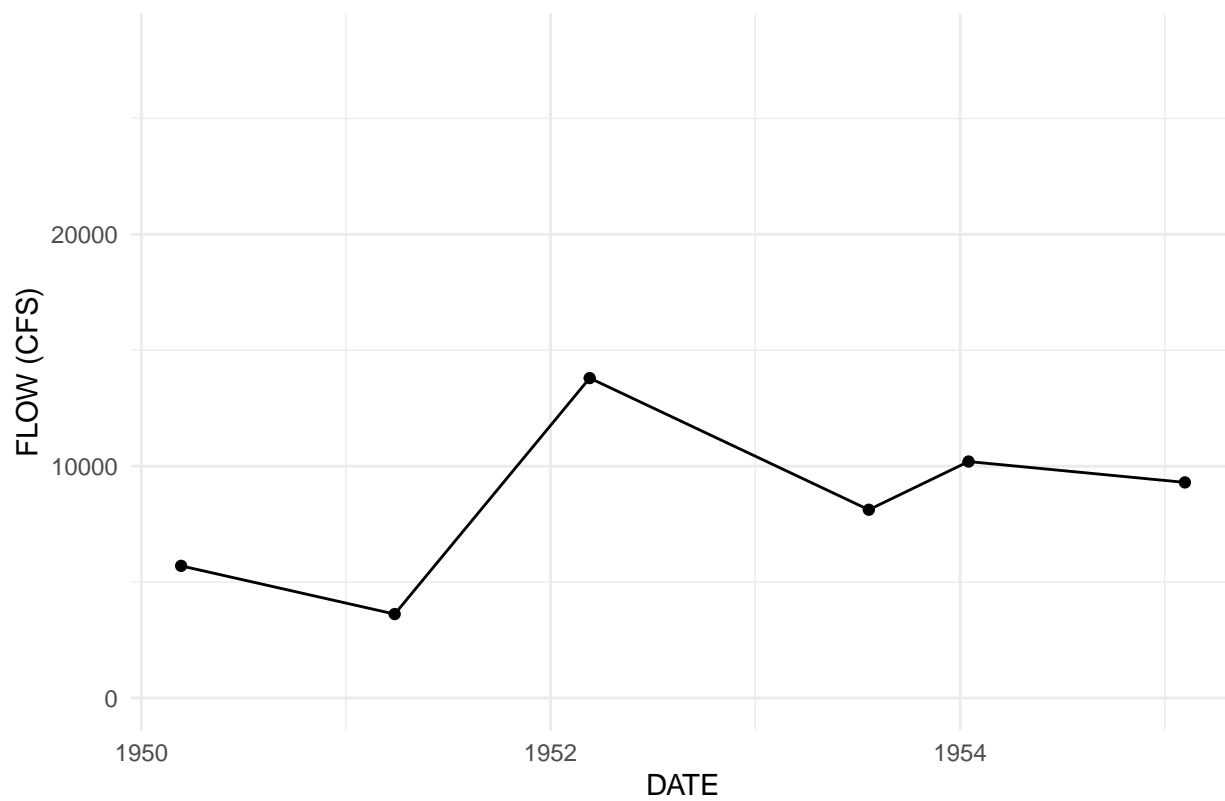
## ANNUAL PEAK FLOW TIME 1



##

## \$peak\_flow\_time2\_plot

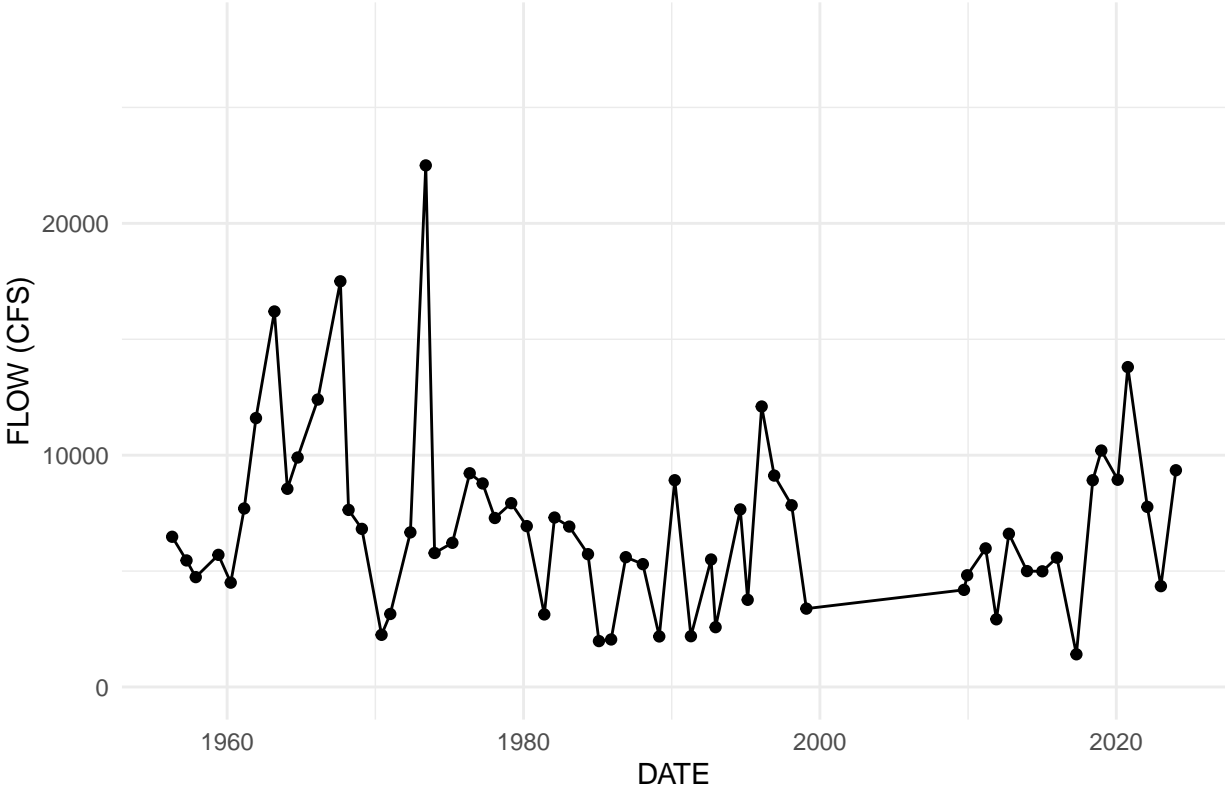
## ANNUAL PEAK FLOW TIME 2



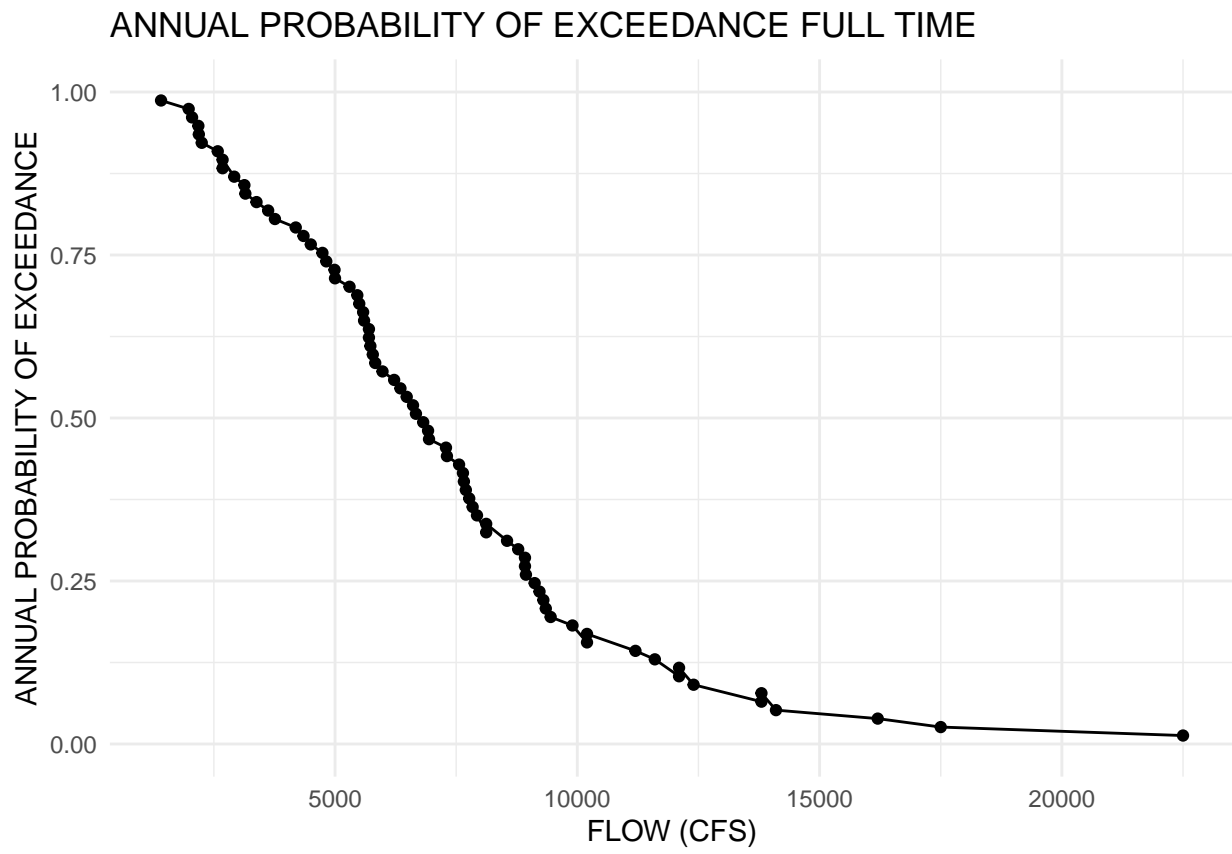
##

## \$peak\_flow\_time3\_plot

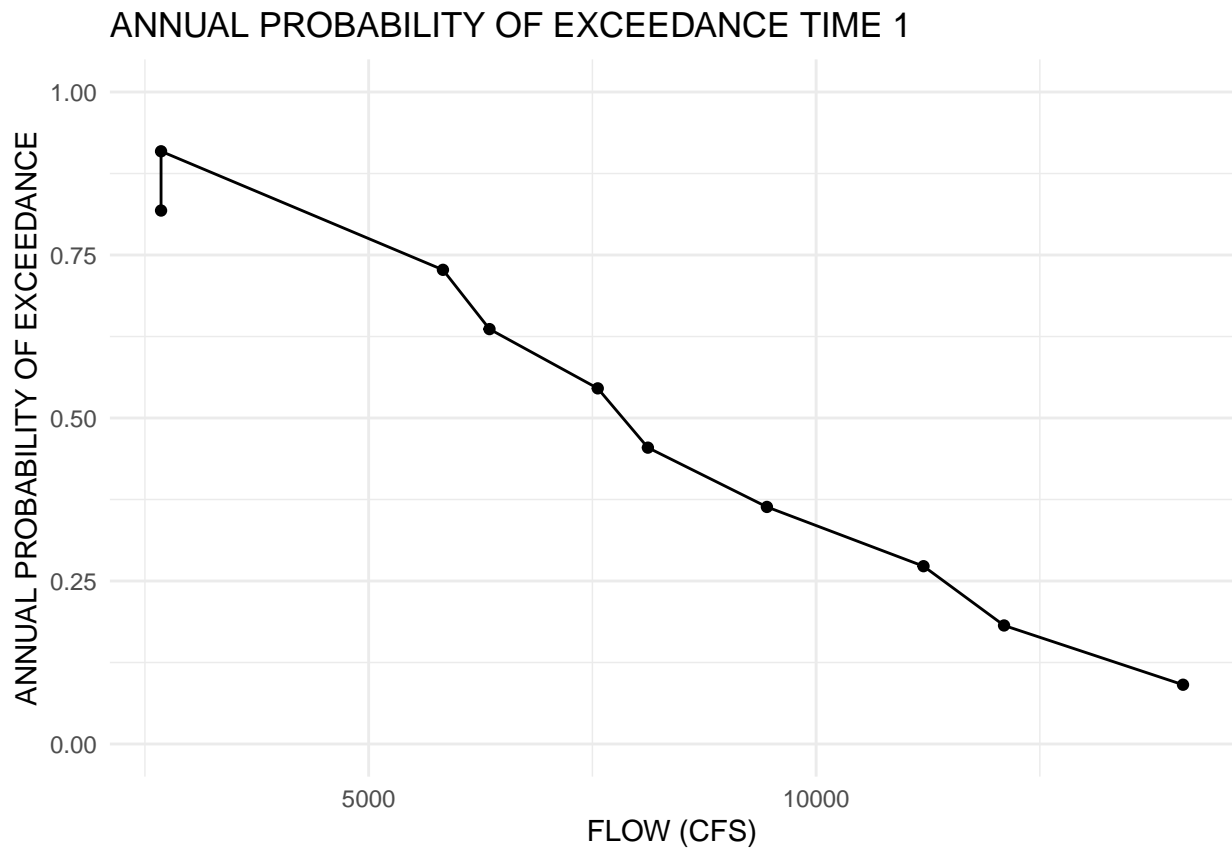
ANNUAL PEAK FLOW TIME 3



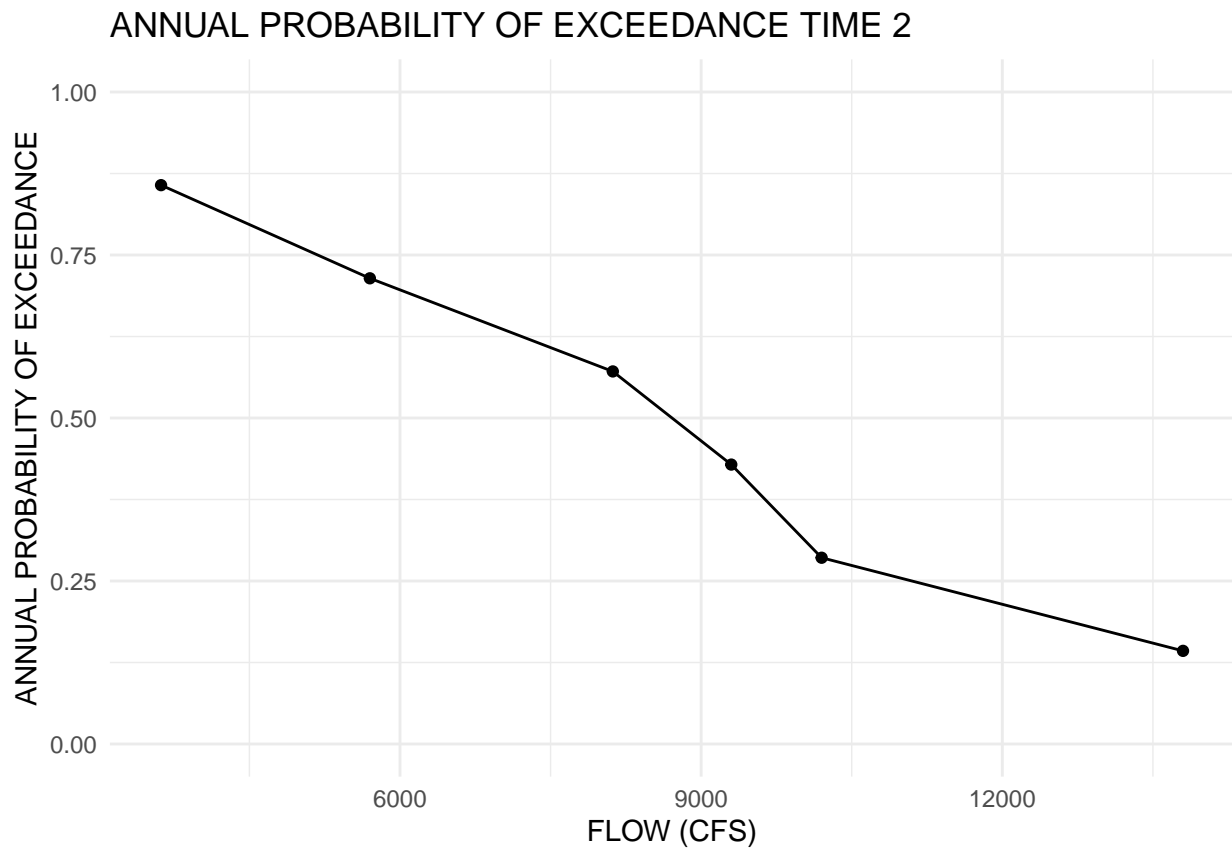
##  
## \$APE\_full\_plot



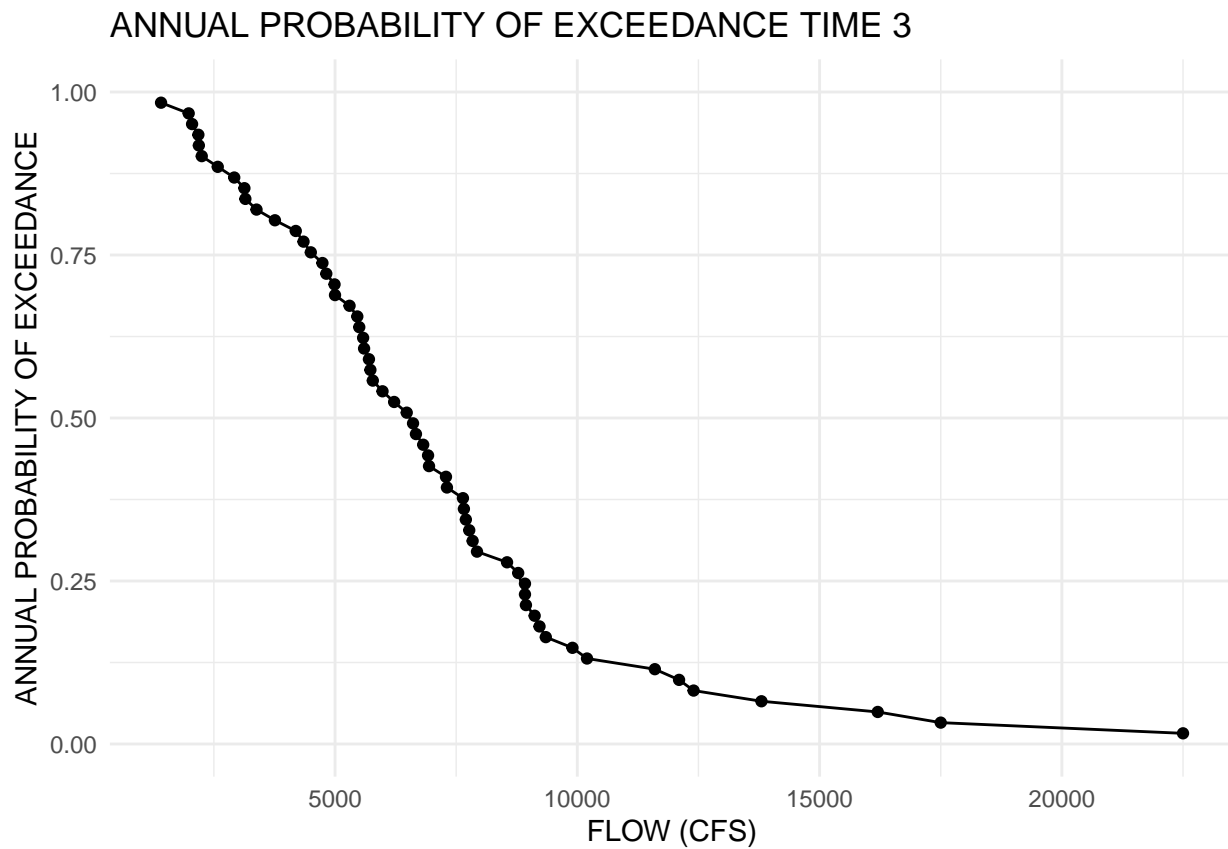
```
##  
## $APE_time1_plot
```



```
##  
## $APE_time2_plot
```



```
##  
## $APE_time3_plot
```



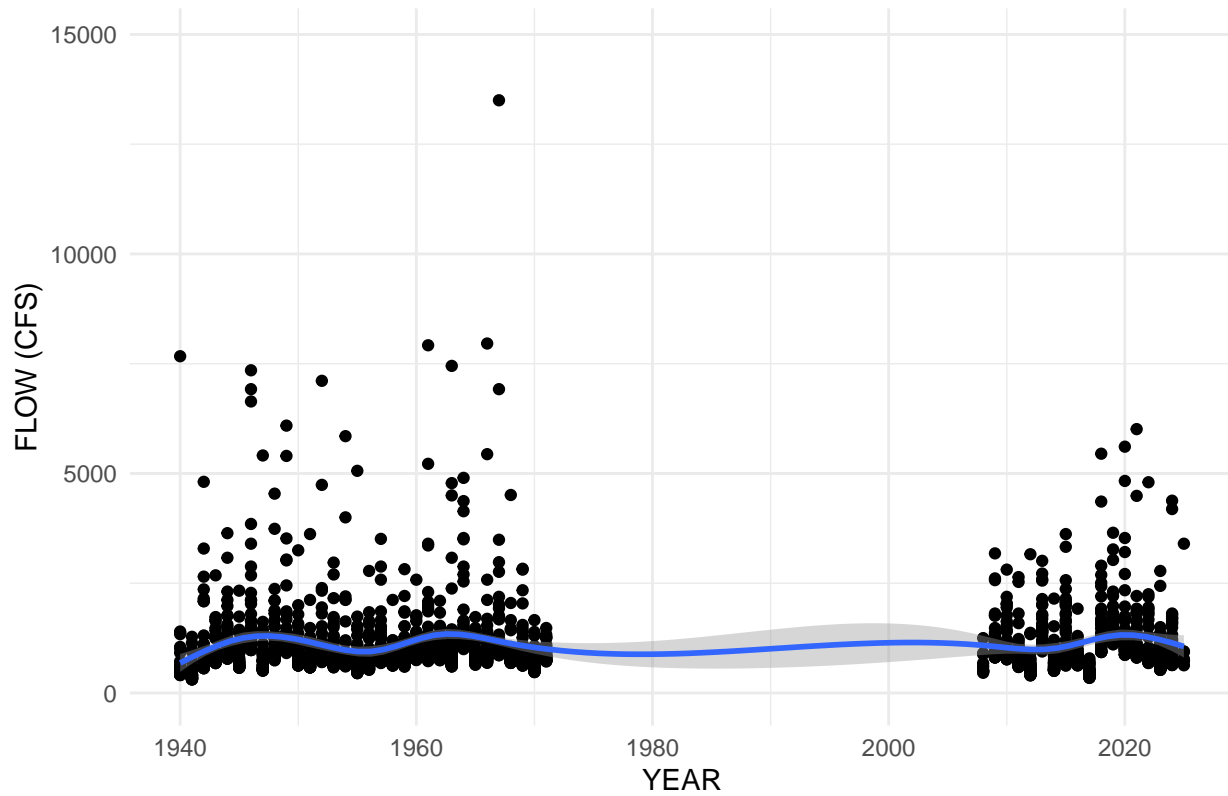
### Annual High Flow Manipulation and Visualization

```
## $high_flow_full_plot
```

```
## `geom_smooth()` using method = 'gam' and formula = 'y ~ s(x, bs = "cs")'
```

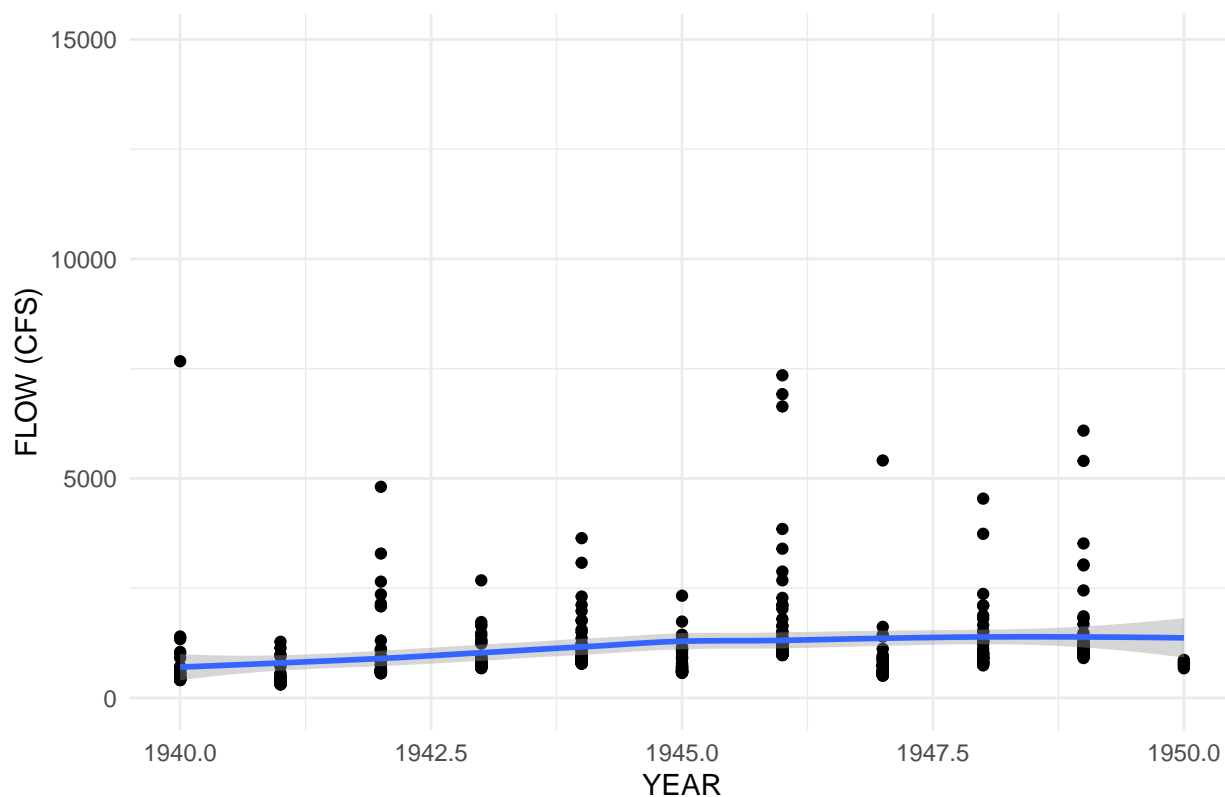


## TOP 10% DAILY FLOW PER YEAR FULL TIME



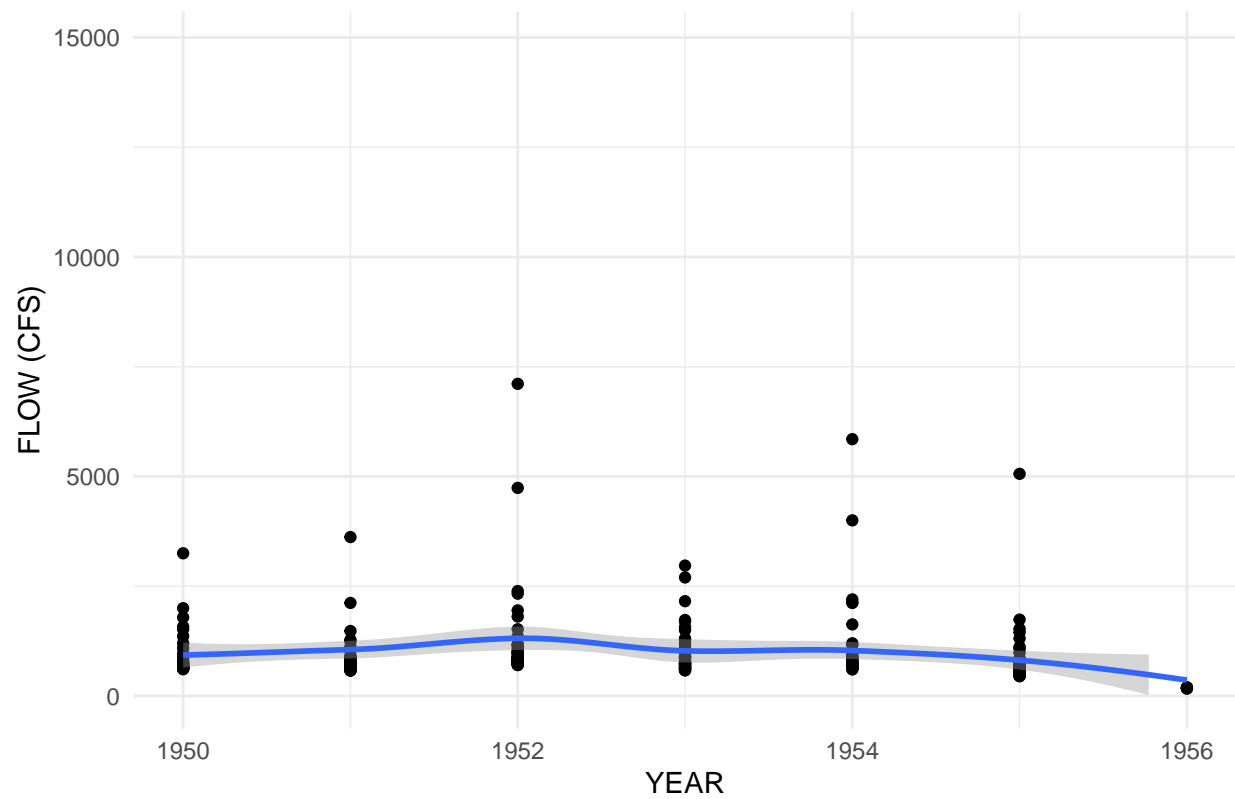
```
##  
## $high_flow_time1_plot  
## `geom_smooth()` using method = 'loess' and formula = 'y ~ x'
```

# TOP 10% DAILY FLOW PER YEAR TIME 1

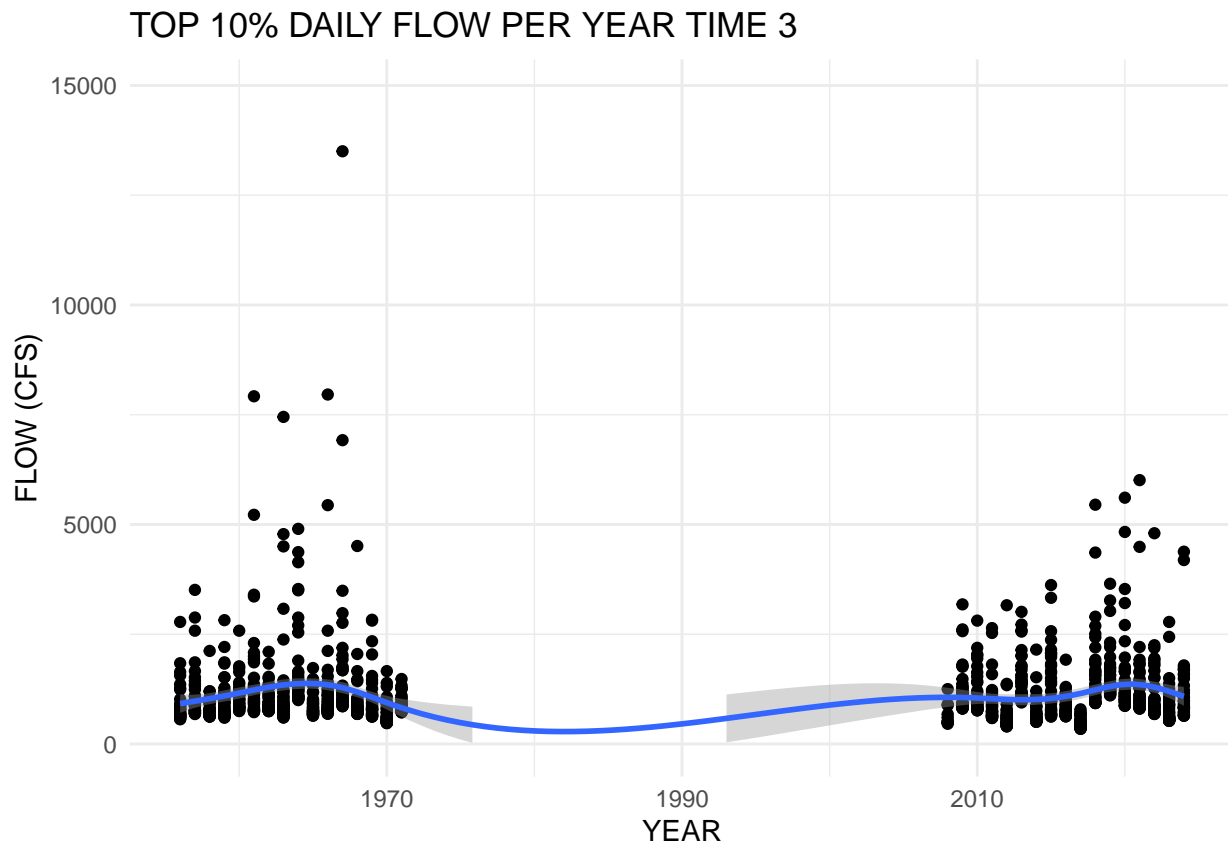


```
##
## $high_flow_time2_plot
## `geom_smooth()` using method = 'loess' and formula = 'y ~ x'
```

## TOP 10% DAILY FLOW PER YEAR TIME 2



```
##  
## $high_flow_time3_plot  
## `geom_smooth()` using method = 'gam' and formula = 'y ~ s(x, bs = "cs")'
```



IHA Prestatistical Analysis Manipulation

DF Stats Create

IHA Stats

IHA Group 3 Stats

Field Measurements Manipulation and Stats

Measure of Center Stats

Peak Flow Manipulation and Stats

High Flow Stats

Schmidt and Wilcock 2008 Metrics

Stats DF Export