PSP Forecast 2021 Report

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Read in predictions made during the 2021 season

```
predictions <- pspforecast::read_forecast()

summary(predictions)
```

```
##    version            location             date                name
##  Length:533         Length:533         Min.   :2021-04-12   Length:533
##  Class :character   Class :character   1st Qu.:2021-05-17   Class :character
##  Mode  :character   Mode  :character   Median :2021-06-02   Mode  :character
##                                        Mean   :2021-06-08
##                                        3rd Qu.:2021-06-27
##                                        Max.   :2021-08-23
##
##       lat             lon          class_bins        forecast_start_date
##  Min.   :40.71   Min.   :-70.77   Length:533         Min.   :2021-04-18
##  1st Qu.:43.75   1st Qu.:-69.95   Class :character   1st Qu.:2021-05-21
##  Median :43.82   Median :-69.74   Mode  :character   Median :2021-06-06
##  Mean   :43.99   Mean   :-69.21                      Mean   :2021-06-12
##  3rd Qu.:44.24   3rd Qu.:-68.35                      3rd Qu.:2021-07-01
##  Max.   :44.97   Max.   :-66.98                      Max.   :2021-08-27
##  NA's   :3       NA's   :3
##  forecast_end_date    predicted_class      prob_0          prob_1
##  Min.   :2021-04-22   Min.   :0.0000   Min.   : 0.00   Min.   : 0.000
##  1st Qu.:2021-05-27   1st Qu.:0.0000   1st Qu.:88.00   1st Qu.: 2.000
##  Median :2021-06-12   Median :0.0000   Median :97.00   Median : 3.000
##  Mean   :2021-06-18   Mean   :0.0863   Mean   :87.72   Mean   : 8.002
##  3rd Qu.:2021-07-07   3rd Qu.:0.0000   3rd Qu.:98.00   3rd Qu.: 9.000
##  Max.   :2021-09-02   Max.   :3.0000   Max.   :99.75   Max.   :56.000
##
##      prob_2            prob_3
##  Min.   : 0.0000   Min.   : 0.00000
##  1st Qu.: 0.0000   1st Qu.: 0.00000
##  Median : 0.0181   Median : 0.00038
##  Mean   : 2.7384   Mean   : 1.50701
##  3rd Qu.: 2.0000   3rd Qu.: 0.74098
##  Max.   :60.0000   Max.   :95.00000
##
```

Correct Class 3 Predictions

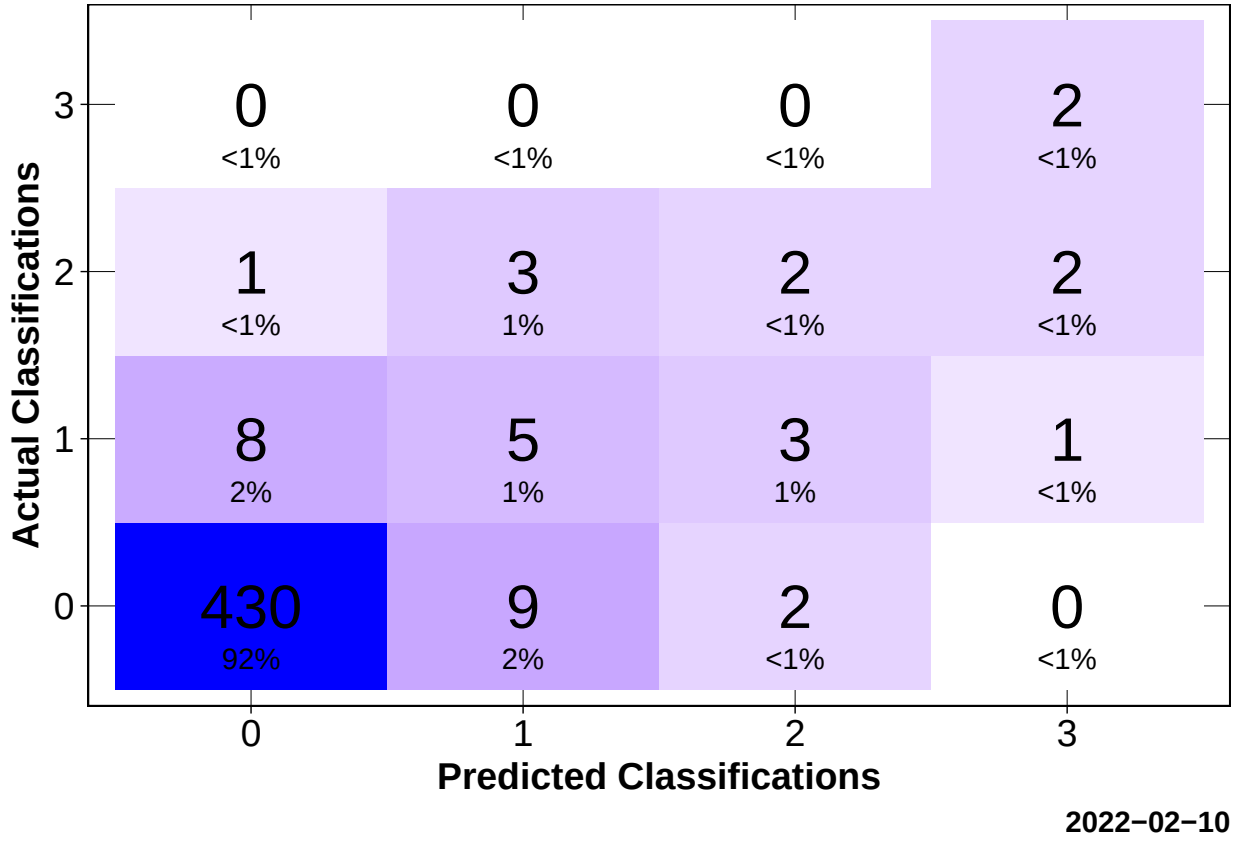
```
closures <- pred_w_results %>%
  filter(actual_class == 3)

closures
```

```
## # A tibble: 2 x 17
##   version location date       name        lat   lon class_bins forecast_start_d~
##   <chr>   <chr>    <date>     <chr>     <dbl> <dbl> <chr>      <date>
## 1 v0.1.3  PSP12.28 2021-05-03 Bear Isl~  43.8 -69.9 0,10,30,80 2021-05-07
## 2 v0.1.3  PSP12.28 2021-05-11 Bear Isl~  43.8 -69.9 0,10,30,80 2021-05-15
## # ... with 9 more variables: forecast_end_date <date>, predicted_class <dbl>,
## #   prob_0 <dbl>, prob_1 <dbl>, prob_2 <dbl>, prob_3 <dbl>,
## #   measurement_date <date>, toxicity <dbl>, actual_class <dbl>
```

Class 3 Predictions (correct and wrong)

```
## # A tibble: 5 x 14
##   version location date       name        forecast_start_date forecast_end_date
##   <chr>   <chr>    <date>     <chr>       <date>              <date>
## 1 v0.1.3  PSP12.28 2021-05-03 Bear Island 2021-05-07          2021-05-13
## 2 v0.1.3  PSP12.28 2021-05-11 Bear Island 2021-05-15          2021-05-21
## 3 v0.1.3  PSP12.28 2021-05-16 Bear Island 2021-05-20          2021-05-26
## 4 v0.1.3  PSP12.15 2021-05-17 Gurnet      2021-05-21          2021-05-27
## 5 v0.1.4  PSP12.15 2021-05-24 Gurnet      2021-05-28          2021-06-03
## # ... with 8 more variables: predicted_class <dbl>, prob_0 <dbl>, prob_1 <dbl>,
## #   prob_2 <dbl>, prob_3 <dbl>, measurement_date <date>, toxicity <dbl>,
## #   actual_class <dbl>
```

Overall Model Performance



Overall Accuracy

```
accuracy(pred_w_results, truth=as.factor(actual_class), estimate=as.factor(predicted_class))
```

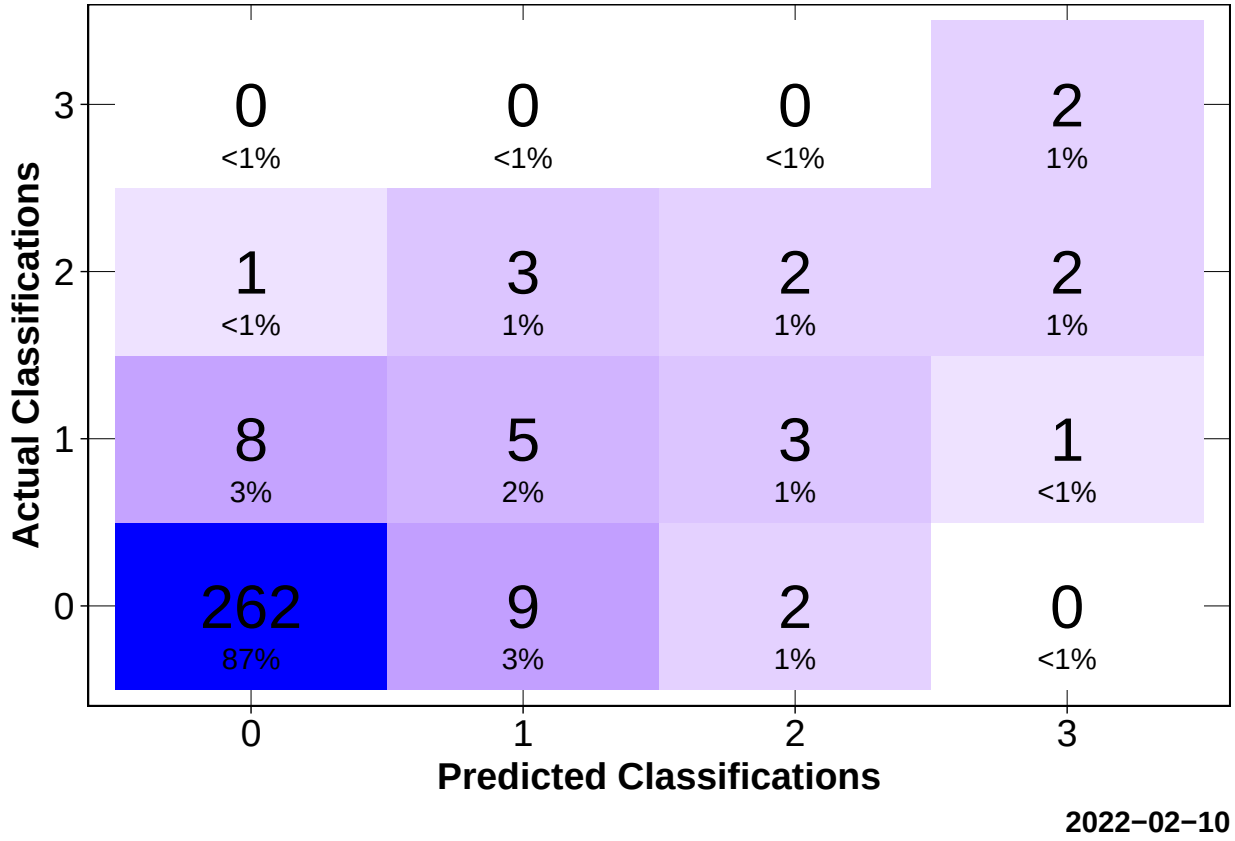
```
## # A tibble: 1 x 3
##   .metric  .estimator .estimate
##   <chr>    <chr>          <dbl>
## 1 accuracy multiclass     0.938
```

Precision

```
precision(pred_w_results, as.factor(actual_class), as.factor(predicted_class))
```

```
## # A tibble: 1 x 3
##   .metric   .estimator .estimate
##   <chr>     <chr>          <dbl>
## 1 precision macro          0.490
```

Western Maine Performance



Western Maine Accuracy

```
accuracy(western, truth=as.factor(actual_class), estimate=as.factor(predicted_class))
```

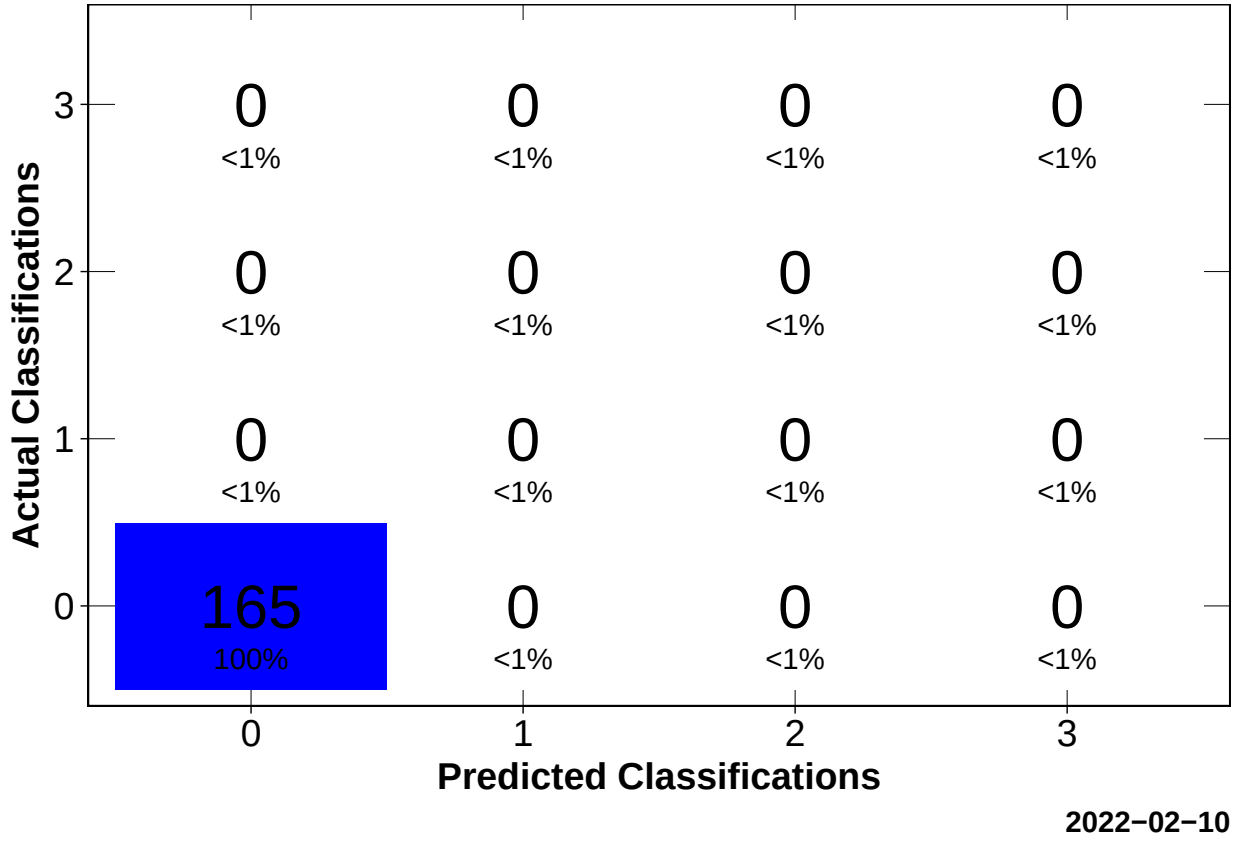
```
## # A tibble: 1 x 3
##   .metric  .estimator .estimate
##   <chr>    <chr>          <dbl>
## 1 accuracy multiclass     0.903
```

Precision

```
precision(western, as.factor(actual_class), as.factor(predicted_class))
```

```
## # A tibble: 1 x 3
##   .metric   .estimator .estimate
##   <chr>     <chr>          <dbl>
## 1 precision macro          0.487
```

Eastern Maine Performance

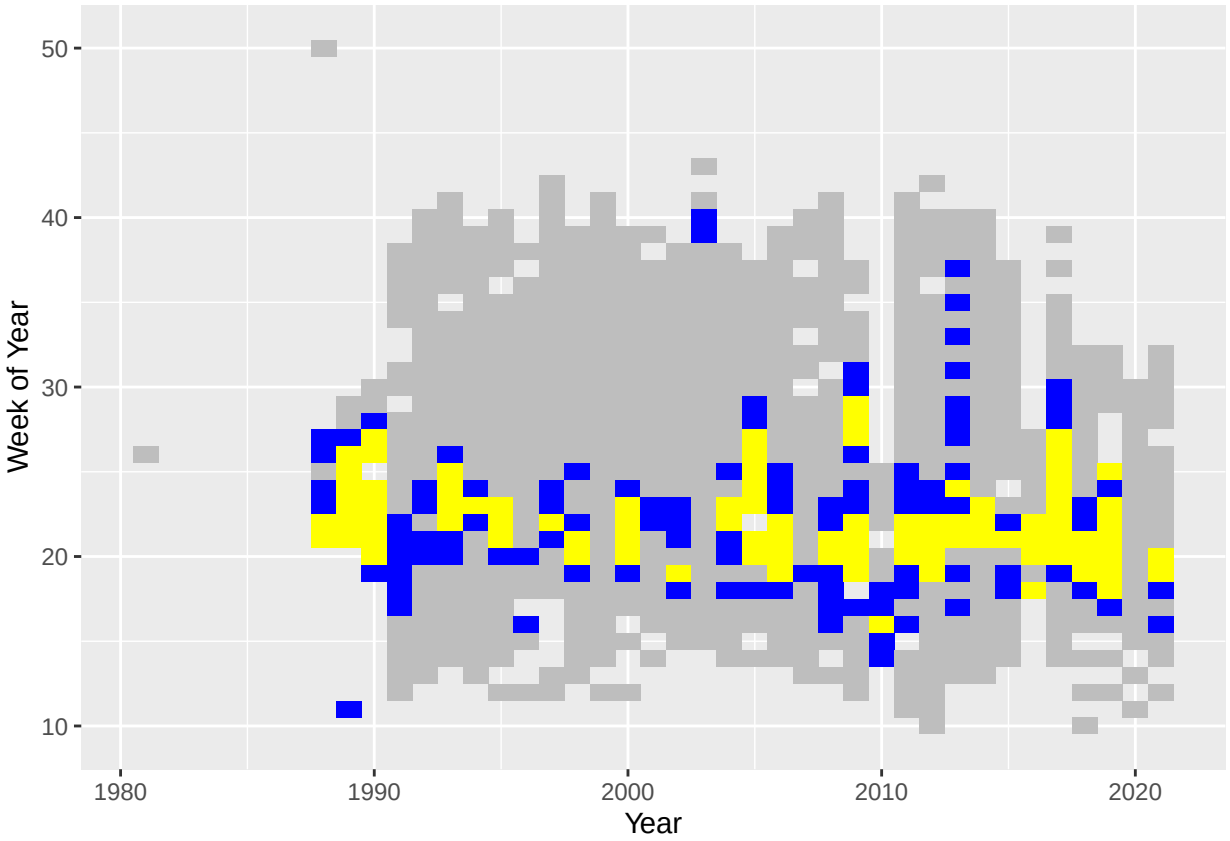


Model Versions

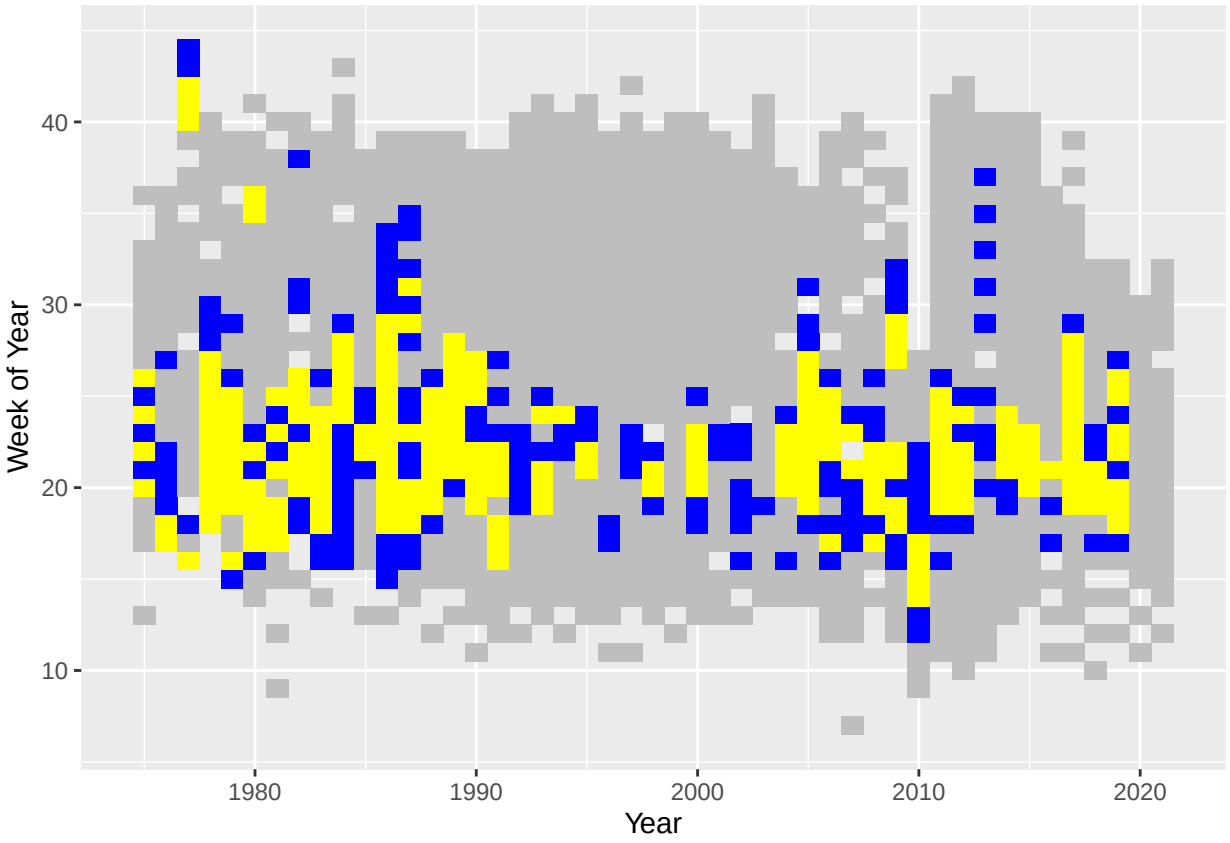
configuration	First Implemented	Description	Reason
v0.1.0	12 April	2 weeks of toxin measurements, 6-10 day step, all 12 toxins	Best performing model going into season.
v0.1.1	26 April	2 weeks of toxin measurements, 6-10 day step, all 12 toxins + sst_cum, doubled size of layers (16 -> 32 nodes)	Adding cumulative sst tuned into bloom seasonality.
v0.1.3	3 May	2 weeks of toxin measurements, 4-10 day step, all 12 toxins + sst_cum	Reduced minimum gap to 4 days in order to include all sites being sampled roughly weekly.
v0.1.4	25 May	2 weeks of toxin measurements, 4-10 day step, all 12 toxins + sst_cum, increased first dropout (0.3 -> 0.4), increased first layer size (32 -> 64 nodes), weighted classes	Weighting classes took away bias toward lowest class and balanced probability distribution.

Toxicity at Sites over time

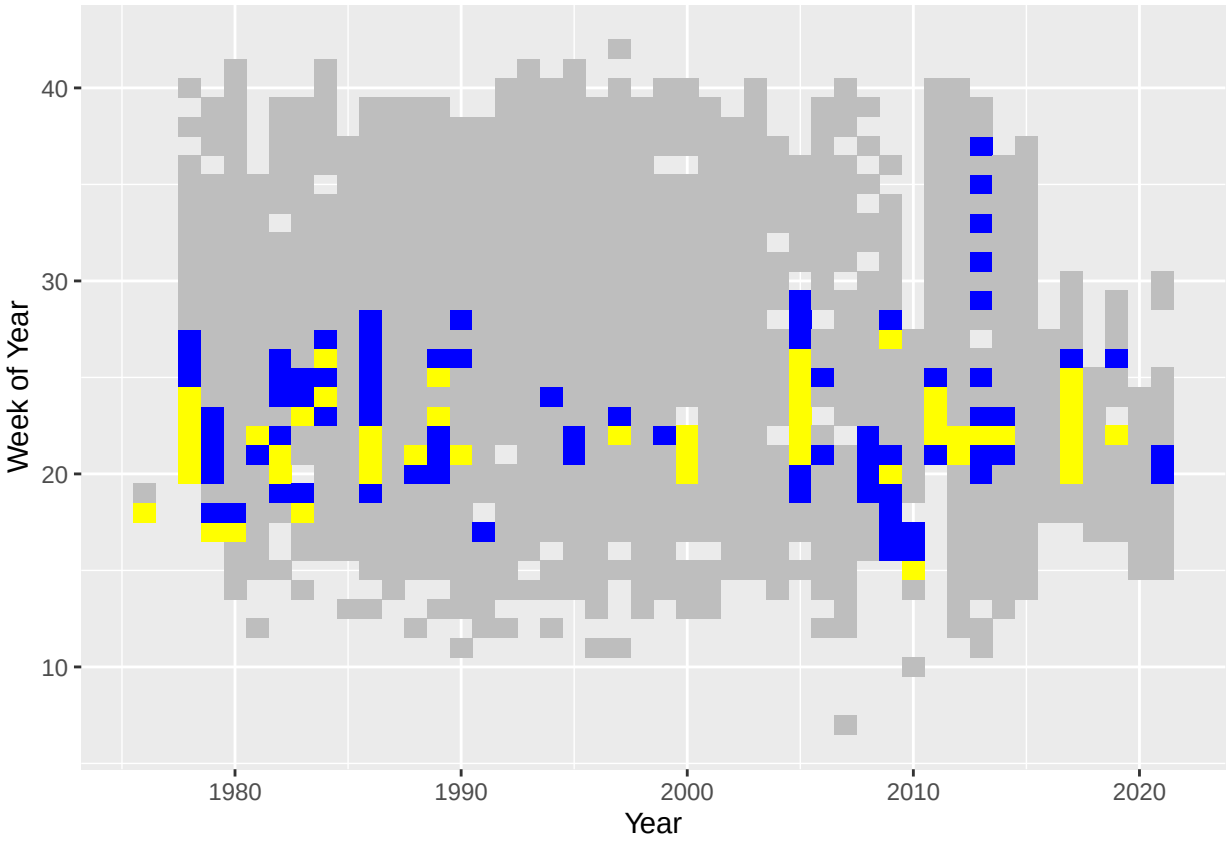
Bear Island



Lumbo's Hole



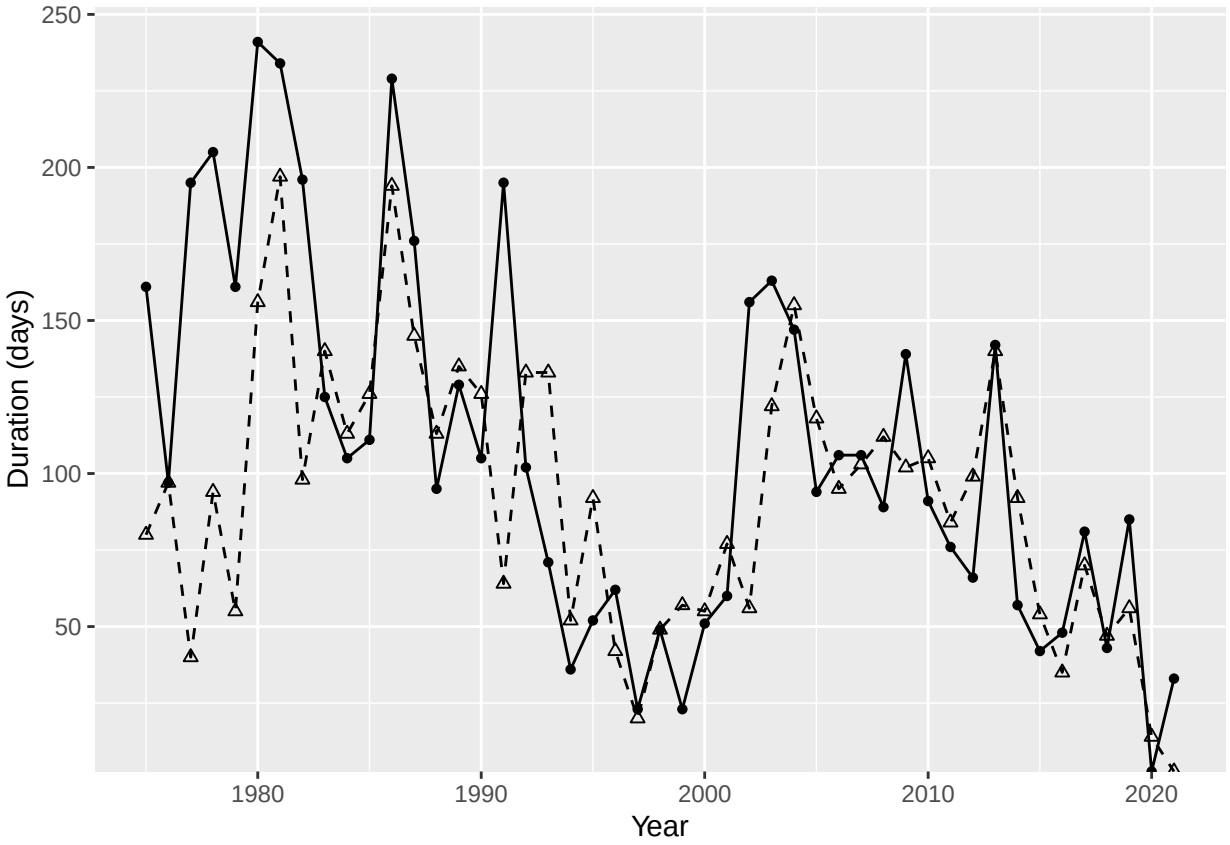
Gurnet



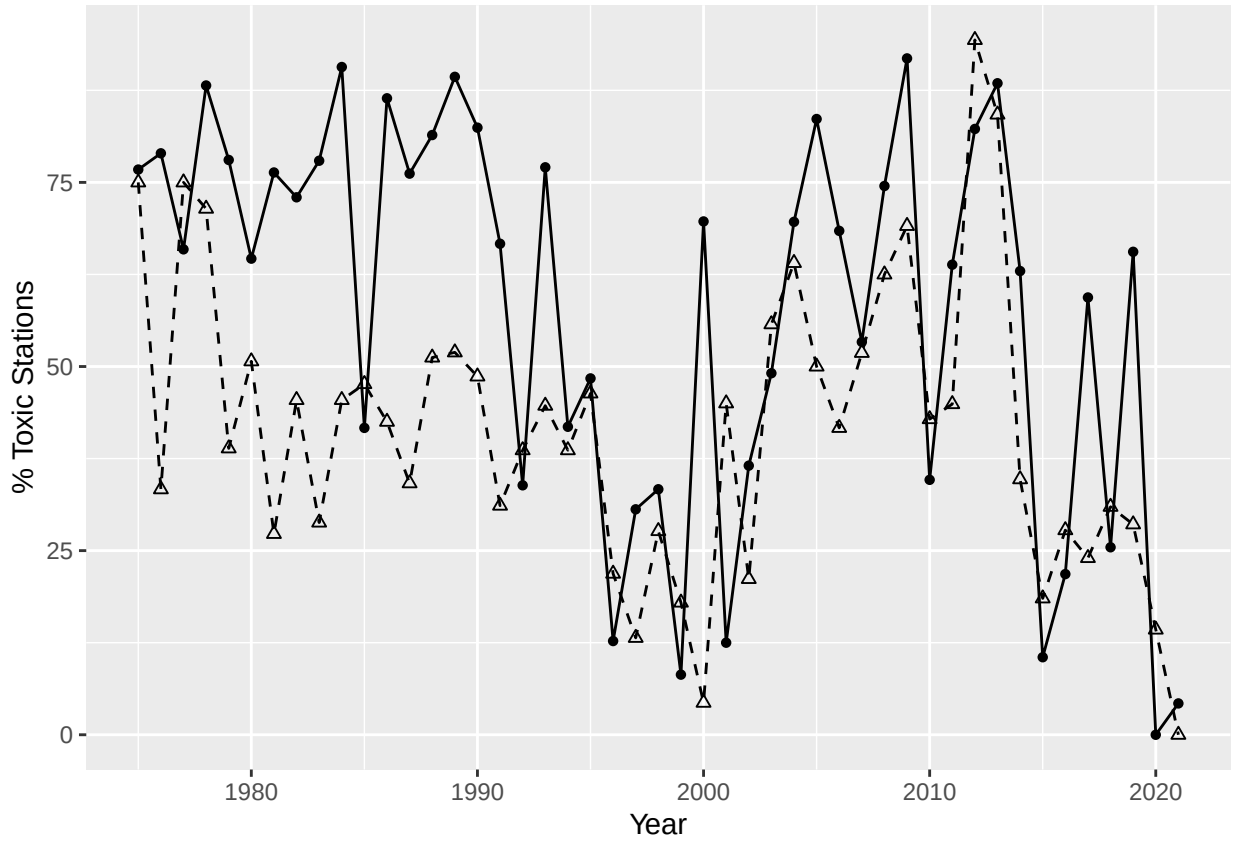
HAB Index Metric Plots

PSP Season Duration

```
## Don't know how to automatically pick scale for object of type difftime. Defaulting to continuous.
```

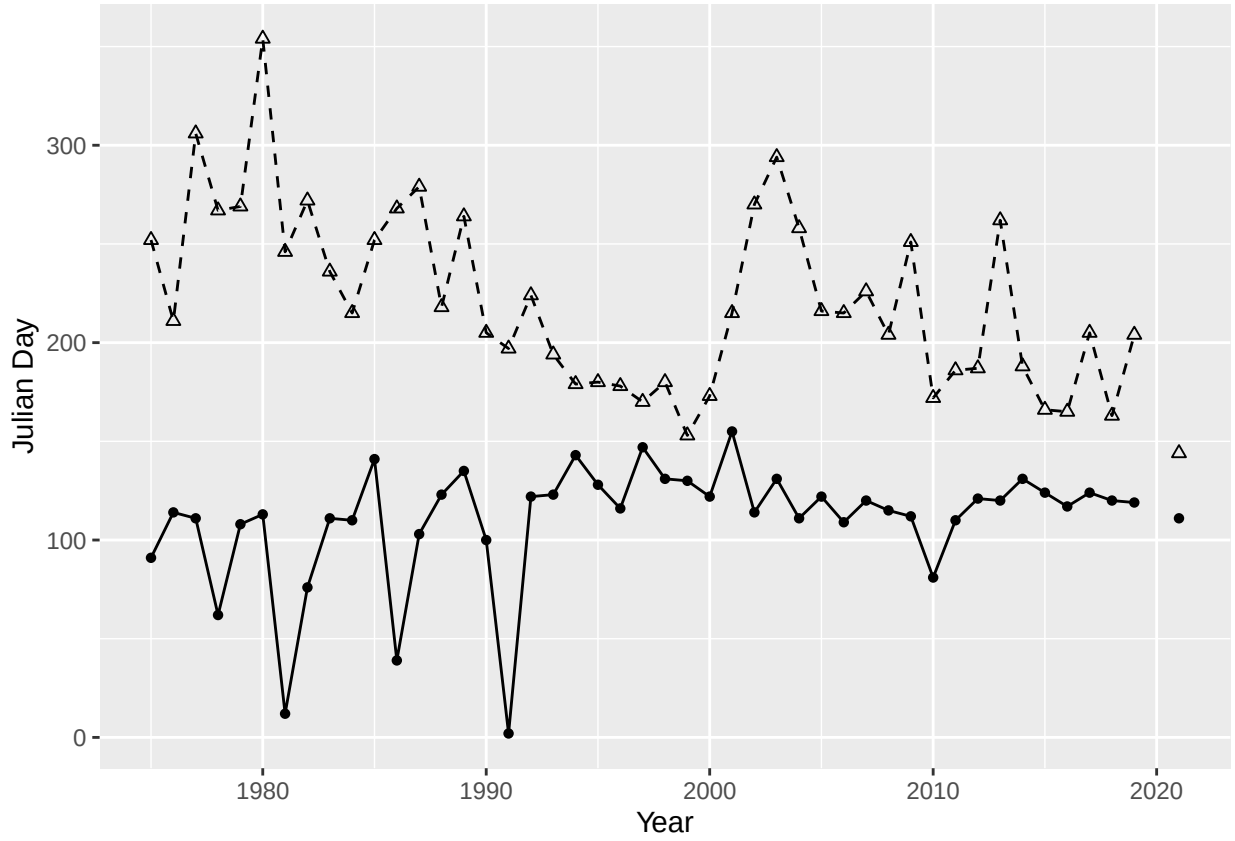


Percent stations with measurement >40



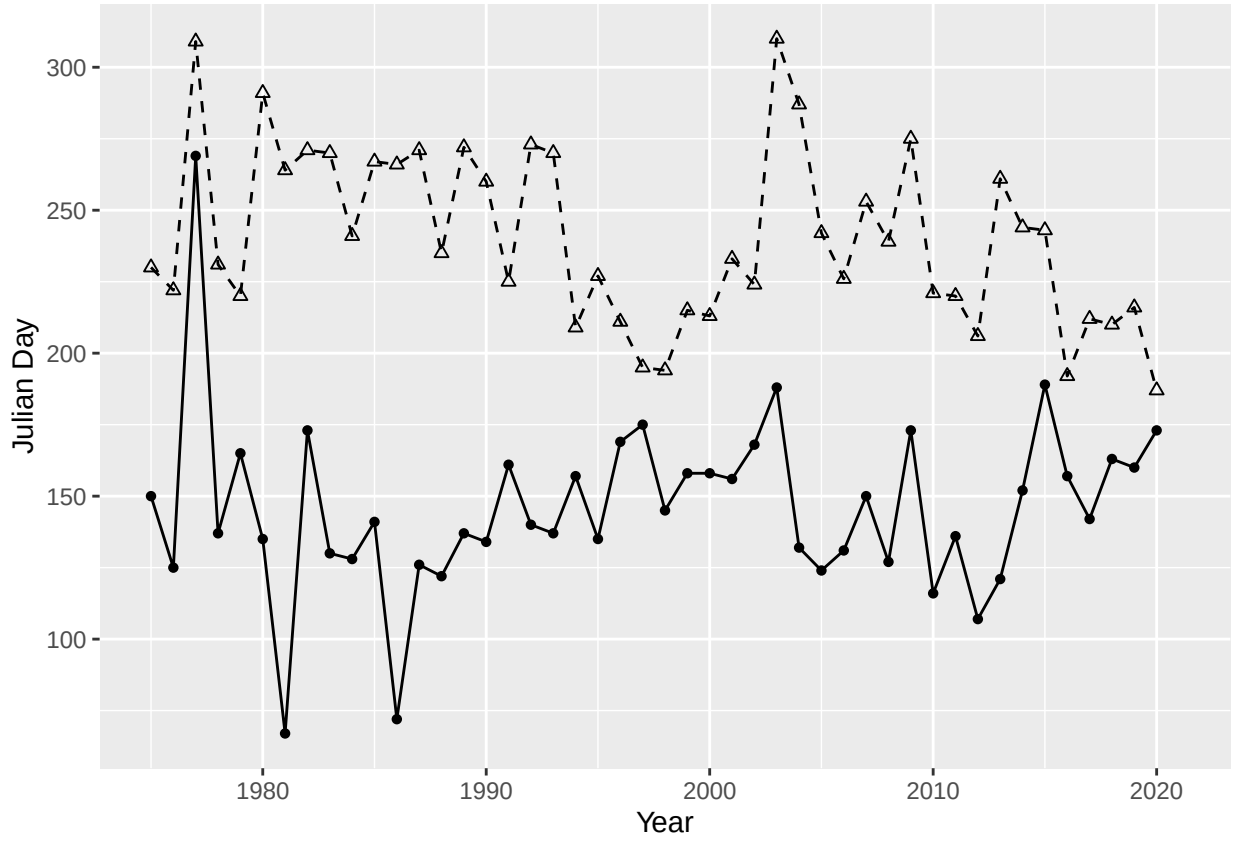
Western Maine Season Onset and End

Western Maine saw no toxin measurements >40 during 2020.



Eastern Maine Season Onset and End

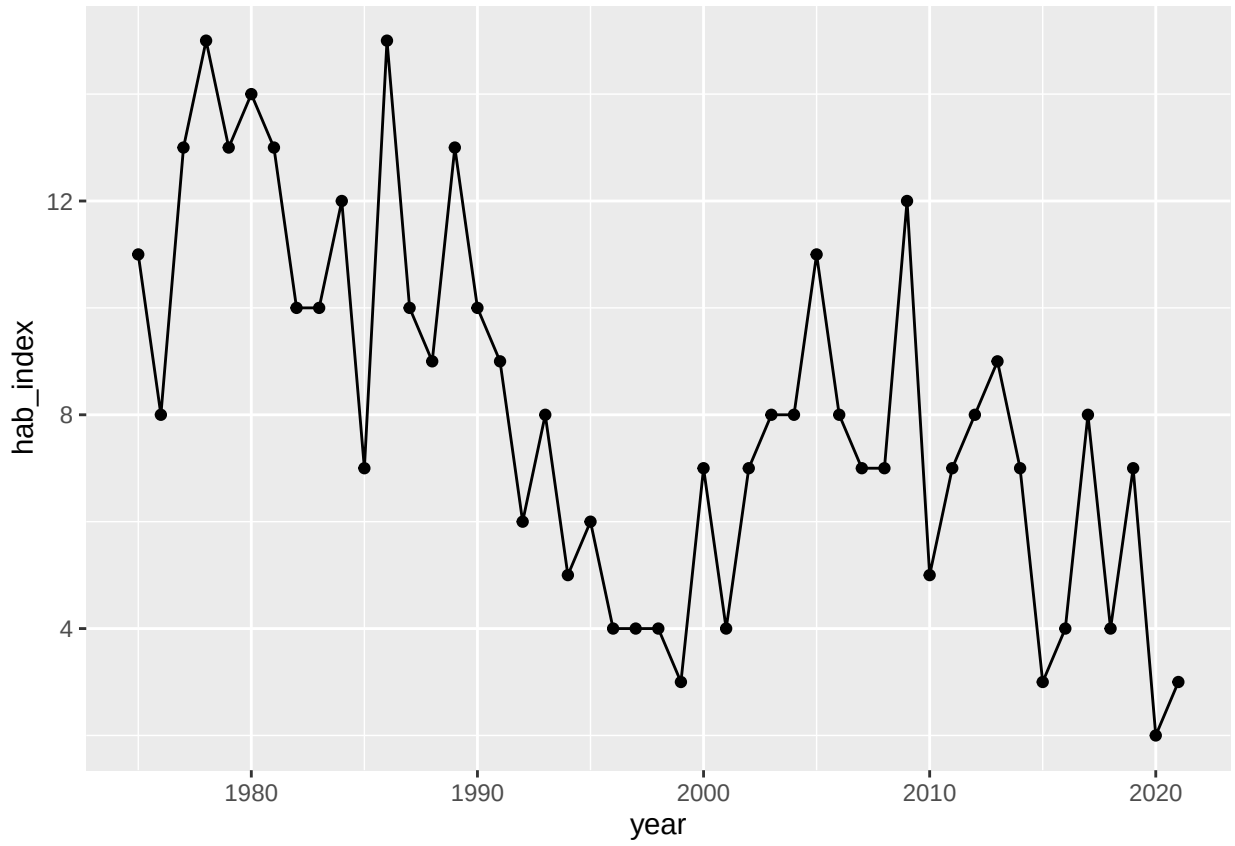
Eastern Maine saw no toxin measurements >40 during 2021.



HAB Index for each region

Calculated per methods found in Anderson, 2014

Western Maine HAB Index



Eastern Maine HAB Index