Nonmetric Multidimensional Scaling- Top 50 biomass species

Data

- Top 50 biomass species
- average across depth strata using the NOAA IEA technical document (https://noaa-edab.github.io/tech-doc/inshoresurvdat.html#data-analysis-29)

	Sea… <chr>	Reg… <int>	Y… <int>	alewife <dbl>	bass.striped <dbl>	butterfish <dbl>	cod.atlantic <dbl>	crab.atlantic.rock <dbl>
1	Fall	1	2000	5.380384	0	0.3518519	1.9828704	0.2225000
2	Fall	1	2001	11.422884	0	2.8428307	0.3520811	2.8416667
3	Fall	1	2002	4.145476	0	3.3043183	2.2230952	0.0600000
4	Fall	1	2003	4.924375	0	3.5231250	10.3700000	0.0000000
5	Fall	1	2004	6.528253	0	3.2305702	4.6161111	0.0000000
6	Fall	1	2005	3.781491	0	0.7742105	13.4031579	0.2315789

6 rows | 1-10 of 59 columns

Set up data for NMDS

- split community matrix into two dataframes- one for grouping variables and one for species biomass
- calculate dissimilarity matrix with Bray-Curtis distances

```
#set up final grouping data into dataframe
ME_group_data<-trawl_data_arrange[, c(1,2,3,55,56,57,58)]
ME_NMDS_data<-as.matrix(trawl_data_arrange[,4:53])

#calculate distance matrix
ME_NMDS_distance<- vegdist(ME_NMDS_data, method="bray")
```

Run the NMDS and extract scores

- change in community composition
- uses rank order
- stress < 0.2 is good, < 0.1 is great, <0.05 is excellent representation in reduced dimensions

```
ME_NMDS=metaMDS(ME_NMDS_distance, # Our community-by-species matrix
                k=2, # The number of reduced dimensions
                method="bray",
                trymax=200) #increase iterations
```

```
## Run 0 stress 0.2121976
## Run 1 stress 0.2057908
## ... New best solution
## ... Procrustes: rmse 0.03260853  max resid 0.3907521
## Run 2 stress 0.207885
## Run 3 stress 0.2066022
## Run 4 stress 0.2126567
## Run 5 stress 0.2117096
## Run 6 stress 0.2090653
## Run 7 stress 0.2127132
## Run 8 stress 0.2061185
## ... Procrustes: rmse 0.008997804  max resid 0.07750829
## Run 9 stress 0.2120618
## Run 10 stress 0.2121856
## Run 11 stress 0.2061184
## ... Procrustes: rmse 0.008992806  max resid 0.07749652
## Run 12 stress 0.2064777
## Run 13 stress 0.2058398
## ... Procrustes: rmse 0.003094323  max resid 0.03803567
## Run 14 stress 0.2078695
## Run 15 stress 0.2135671
## Run 16 stress 0.2061183
## ... Procrustes: rmse 0.008977382  max resid 0.07733821
## Run 17 stress 0.2118637
## Run 18 stress 0.2065612
## Run 19 stress 0.2124997
## Run 20 stress 0.2065748
## Run 21 stress 0.2133277
## Run 22 stress 0.2057111
## ... New best solution
## ... Procrustes: rmse 0.00395844  max resid 0.03825867
## Run 23 stress 0.2120847
## Run 24 stress 0.2063852
## Run 25 stress 0.2061811
## ... Procrustes: rmse 0.01033487  max resid 0.08282011
## Run 26 stress 0.2129884
## Run 27 stress 0.20681
## Run 28 stress 0.2139782
## Run 29 stress 0.2057848
## ... Procrustes: rmse 0.002541256  max resid 0.0229569
## Run 30 stress 0.2123711
## Run 31 stress 0.2120959
## Run 32 stress 0.2090882
## Run 33 stress 0.2065496
## Run 34 stress 0.2314908
## Run 35 stress 0.2078696
## Run 36 stress 0.2078851
## Run 37 stress 0.2065612
## Run 38 stress 0.2064649
## Run 39 stress 0.2068109
## Run 40 stress 0.2068101
## Run 41 stress 0.2066023
## Run 42 stress 0.2228289
```

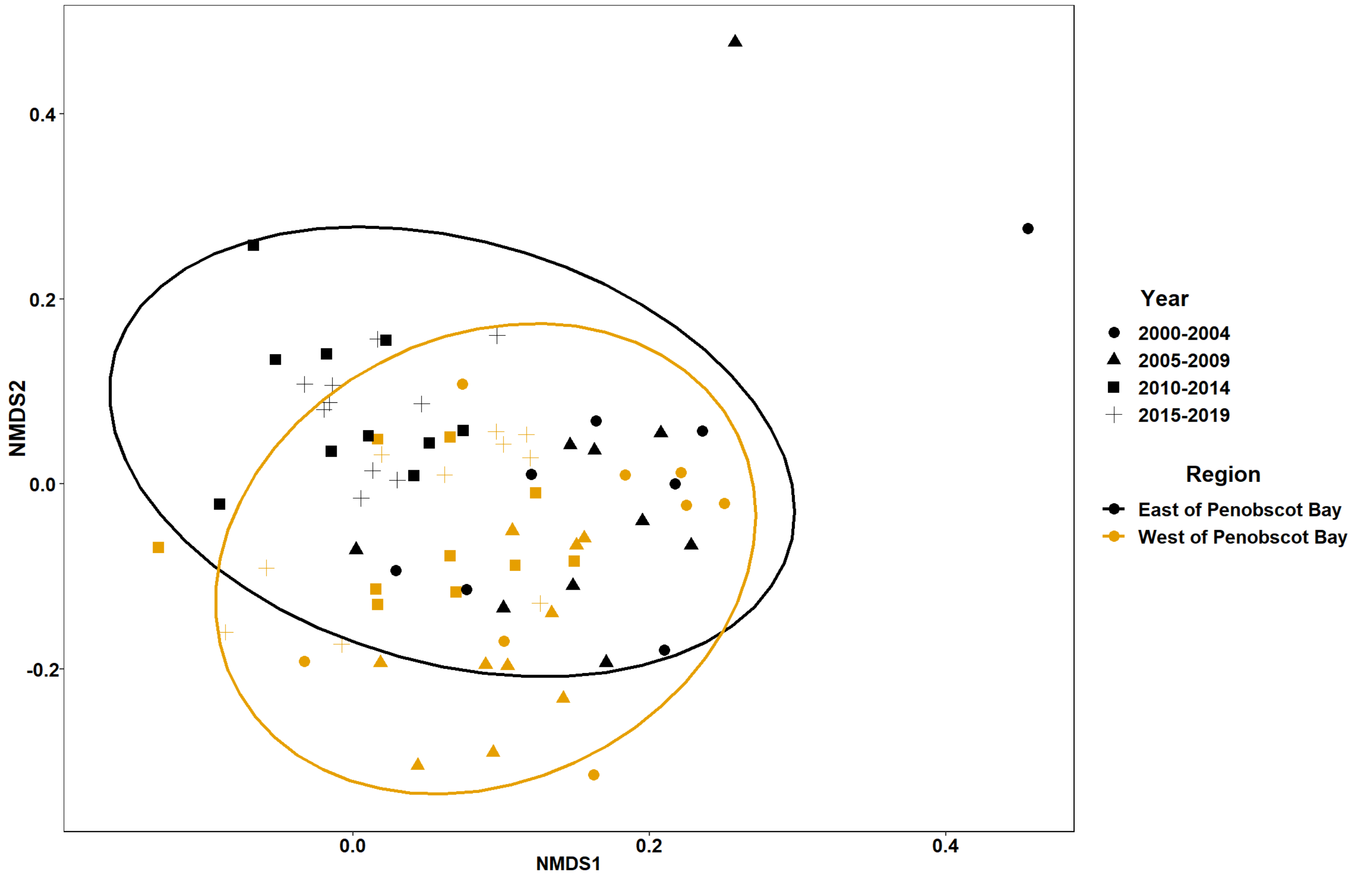
```
## Run 43 stress 0.2117409
## Run 44 stress 0.2346884
## Run 45 stress 0.2065999
## Run 46 stress 0.2065853
## Run 47 stress 0.2065871
## Run 48 stress 0.20787
## Run 49 stress 0.4165635
## Run 50 stress 0.206812
## Run 51 stress 0.2063172
## Run 52 stress 0.212956
## Run 53 stress 0.2273767
## Run 54 stress 0.2121424
## Run 55 stress 0.2131374
## Run 56 stress 0.2090879
## Run 57 stress 0.2286814
## Run 58 stress 0.2063667
## Run 59 stress 0.2220723
## Run 60 stress 0.2063955
## Run 61 stress 0.2063136
## Run 62 stress 0.229283
## Run 63 stress 0.2078751
## Run 64 stress 0.2064627
## Run 65 stress 0.2126292
## Run 66 stress 0.2061264
## ... Procrustes: rmse 0.007105145  max resid 0.07700621
## Run 67 stress 0.2120917
## Run 68 stress 0.2129648
## Run 69 stress 0.206487
## Run 70 stress 0.2061524
## ... Procrustes: rmse 0.00734878  max resid 0.07782809
## Run 71 stress 0.2060866
## ... Procrustes: rmse 0.00739737  max resid 0.0739193
## Run 72 stress 0.416565
## Run 73 stress 0.2120858
## Run 74 stress 0.2302658
## Run 75 stress 0.2065616
## Run 76 stress 0.2145424
## Run 77 stress 0.2065613
## Run 78 stress 0.2117192
## Run 79 stress 0.2065547
## Run 80 stress 0.2078697
## Run 81 stress 0.2138939
## Run 82 stress 0.2064631
## Run 83 stress 0.2068108
## Run 84 stress 0.2120437
## Run 85 stress 0.2283524
## Run 86 stress 0.2057105
## ... New best solution
## ... Procrustes: rmse 0.0002644395  max resid 0.00239894
## ... Similar to previous best
## *** Solution reached
```

```
#extract NMDS scores for ggplot
data.scores = as.data.frame(scores(ME_NMDS))
#add columns to data frame
data.scores$Stratum = trawl_data_arrange$Stratum
data.scores$Region = trawl_data_arrange$Region
data.scores$Year = trawl_data_arrange$Year
data.scores$Season= trawl_data_arrange$Season
data.scores$Year_groups= trawl_data_arrange$YEAR_GROUPS
data.scores$Year_decades= trawl_data_arrange$YEAR_DECADES
data.scores$Region_new=trawl_data_arrange$REGION_NEW
data.scores$Region_year=trawl_data_arrange$REGION_YEAR
data.scores$Season_year=trawl_data_arrange$SEASON_YEAR
```

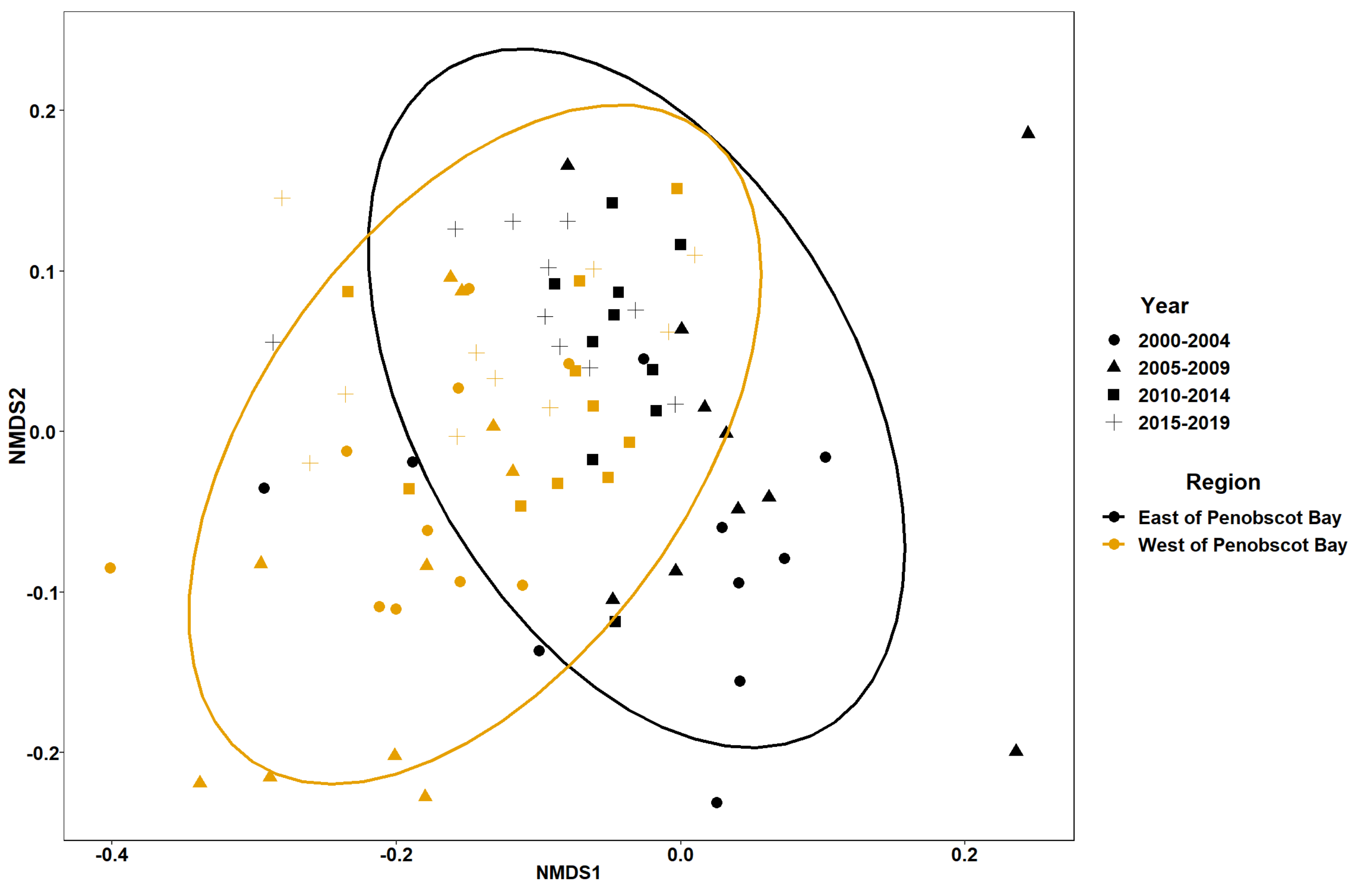
Plots

Region

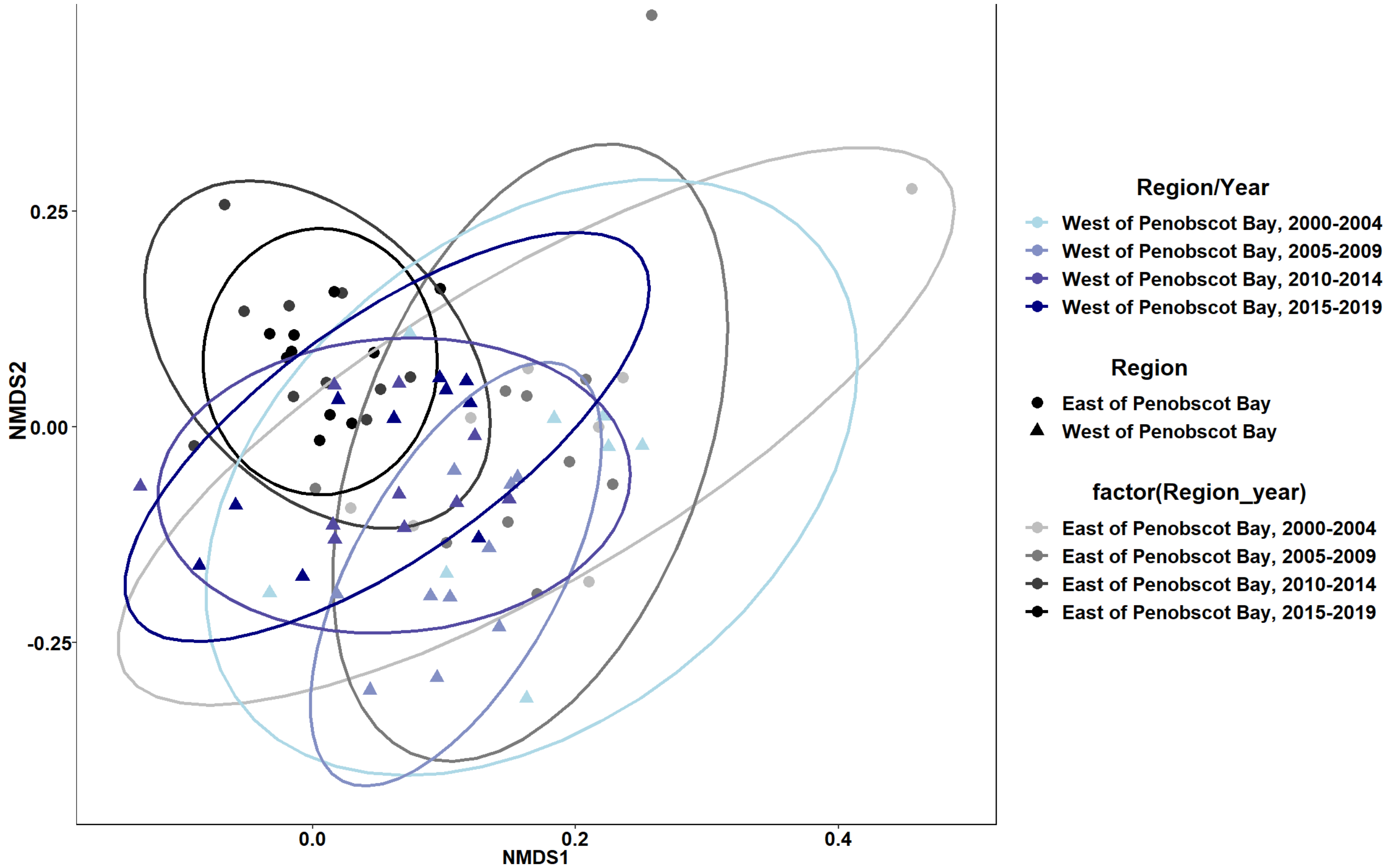
Spring



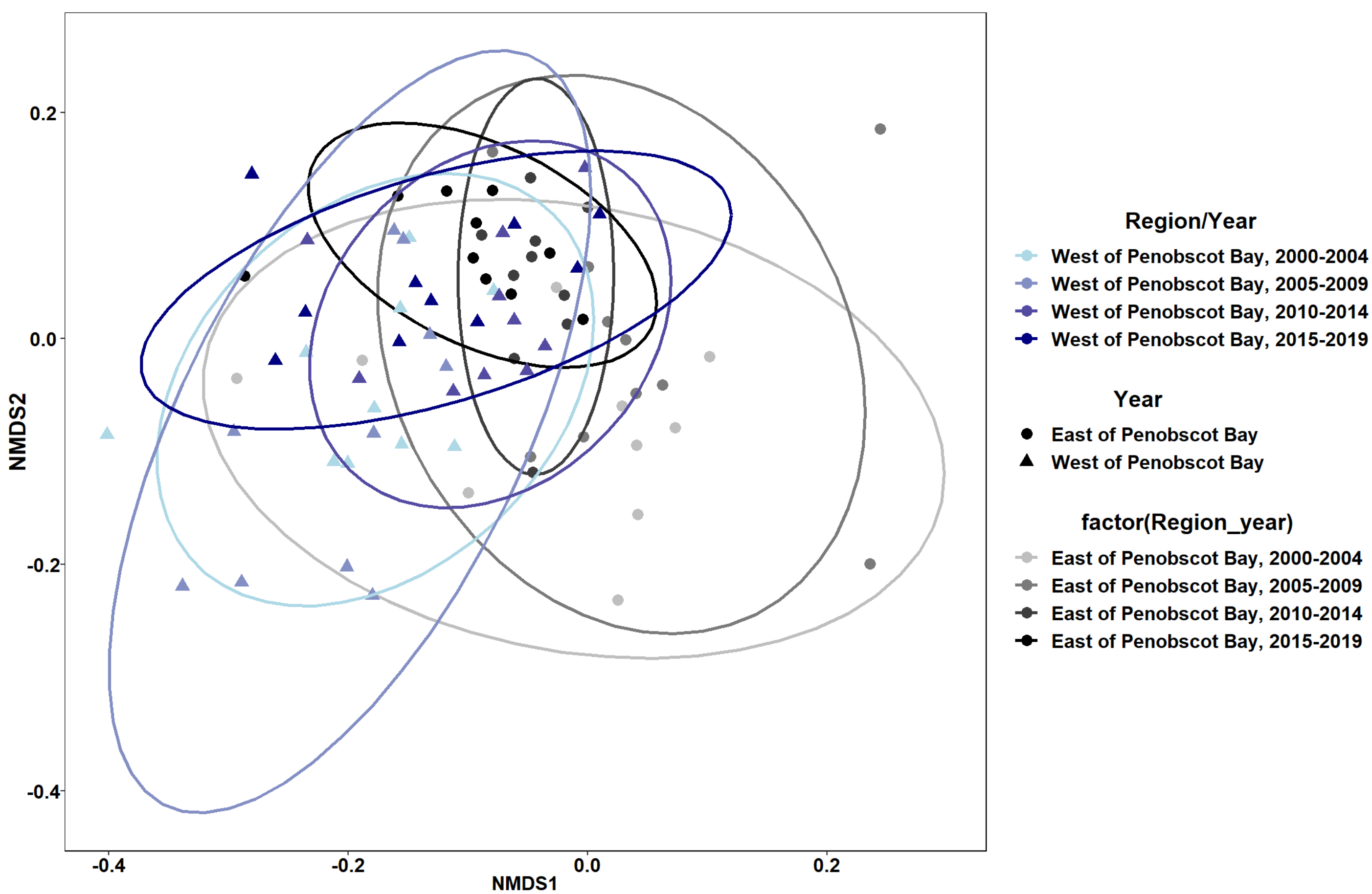
Fall



Spring

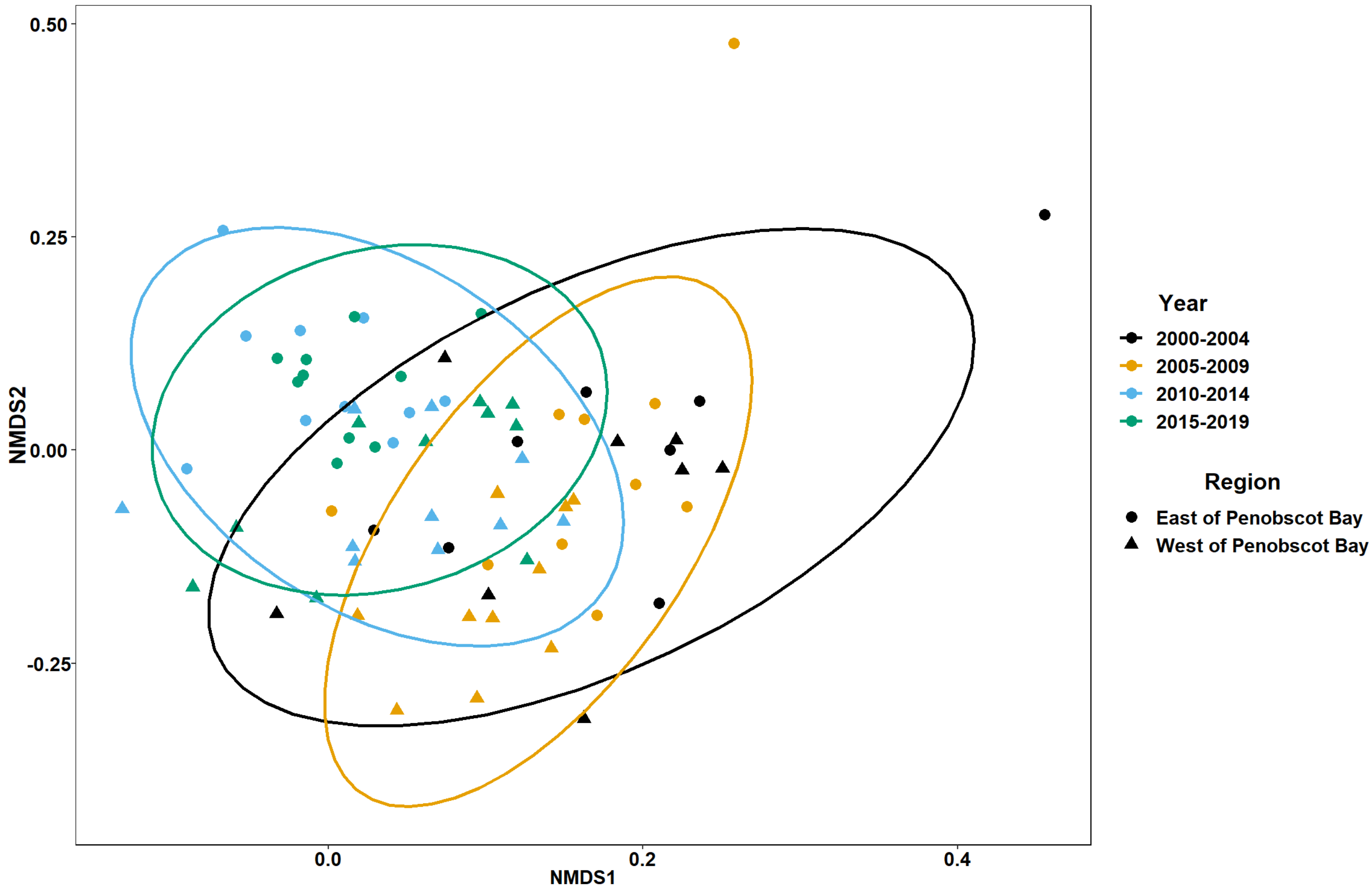

0.25
0.00
-0.25
NMDS2
0.0
0.2
0.4
NMDS1
Region/Year
West of Penobscot Bay, 2000-2004
West of Penobscot Bay, 2005-2009
West of Penobscot Bay, 2010-2014
West of Penobscot Bay, 2015-2019
Region
East of Penobscot Bay
West of Penobscot Bay
factor(Region_year)
East of Penobscot Bay, 2000-2004
East of Penobscot Bay, 2005-2009
East of Penobscot Bay, 2010-2014
East of Penobscot Bay, 2015-2019

Fall

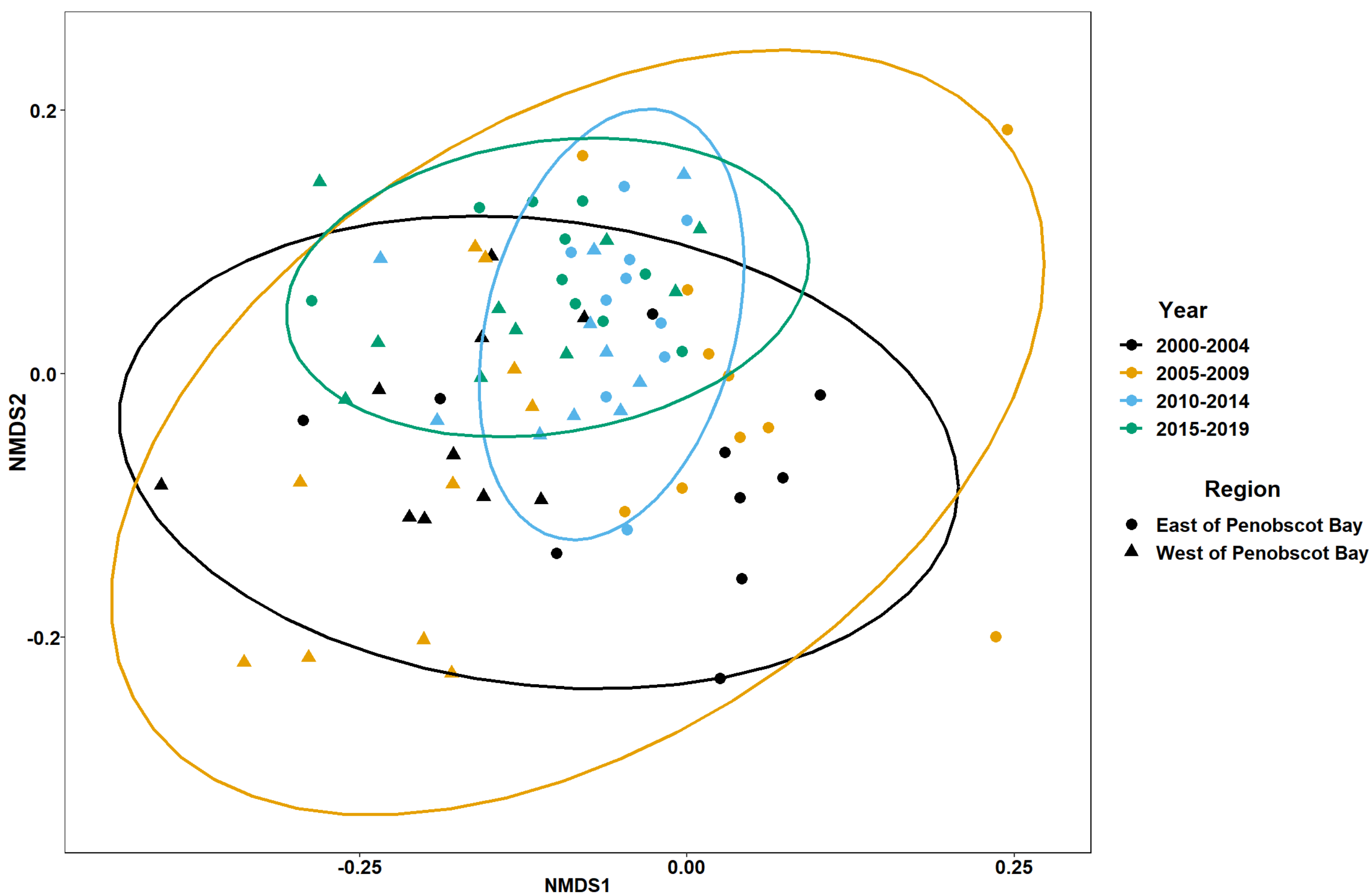

0.2
0.0
-0.2
-0.4
NMDS2
-0.4
-0.2
0.0
0.2
NMDS1
Region/Year
West of Penobscot Bay, 2000-2004
West of Penobscot Bay, 2005-2009
West of Penobscot Bay, 2010-2014
West of Penobscot Bay, 2015-2019
Year
East of Penobscot Bay
West of Penobscot Bay
factor(Region_year)
East of Penobscot Bay, 2000-2004
East of Penobscot Bay, 2005-2009
East of Penobscot Bay, 2010-2014
East of Penobscot Bay, 2015-2019

Time

Spring

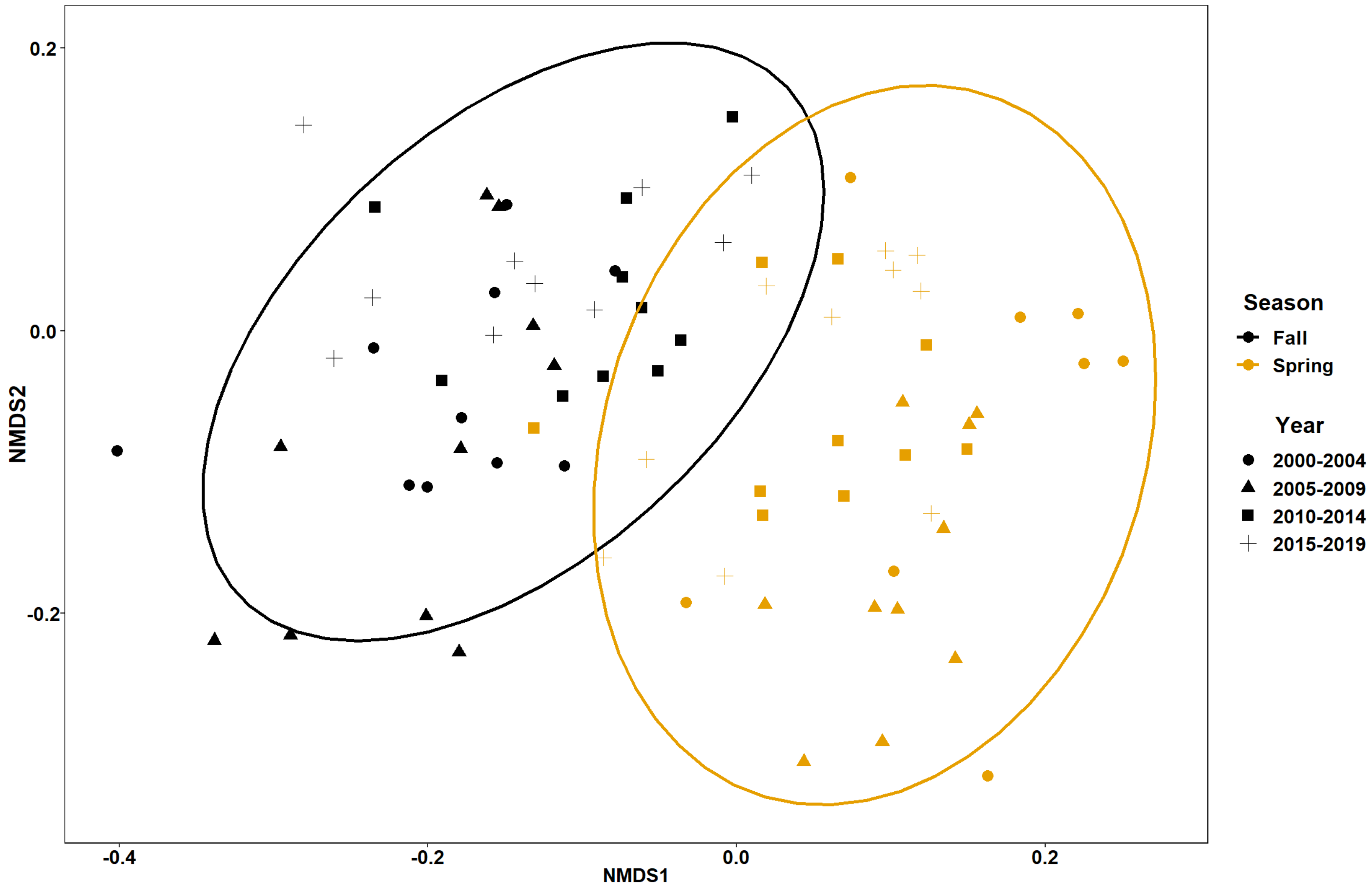


Fall

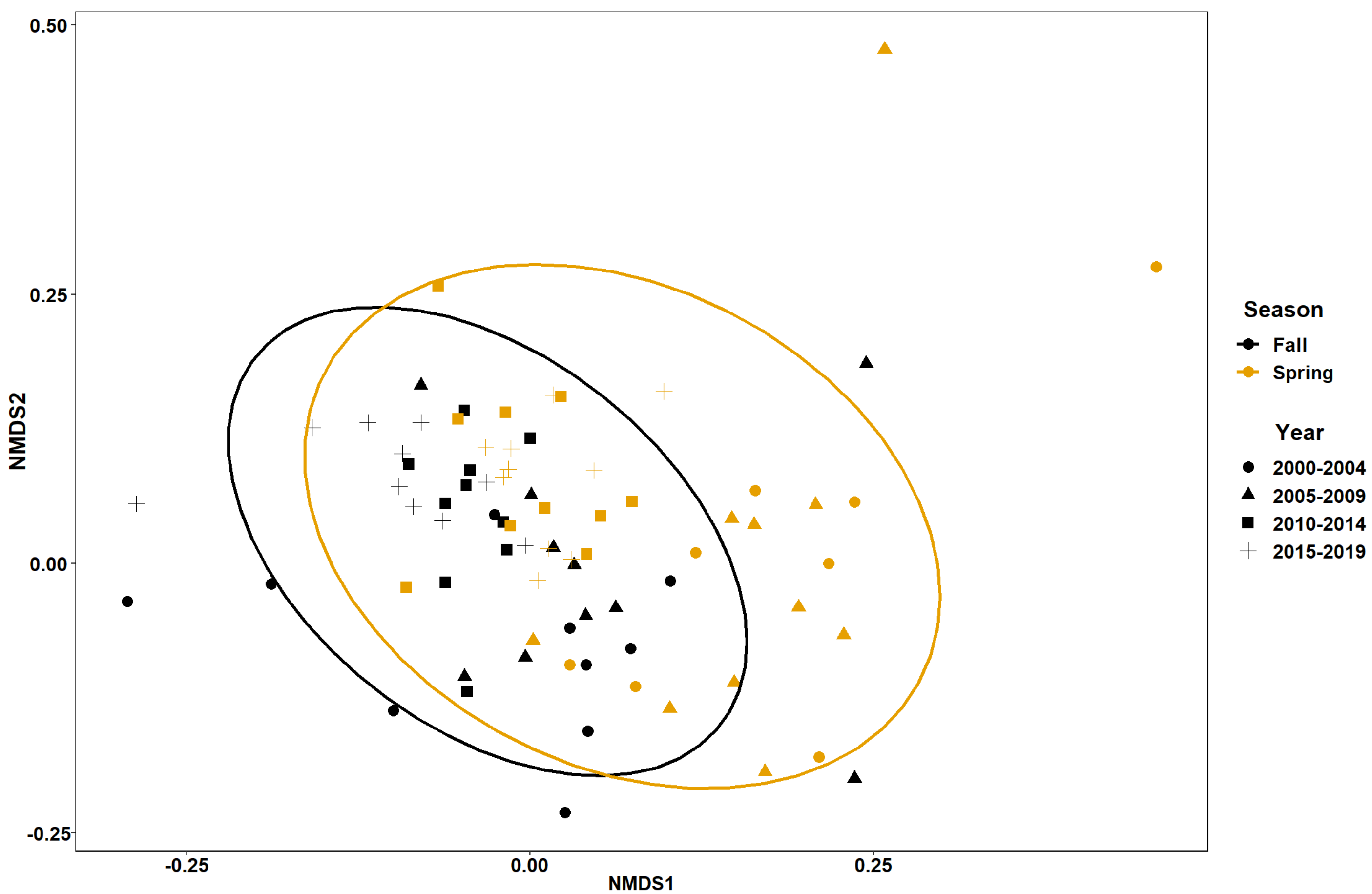


Season

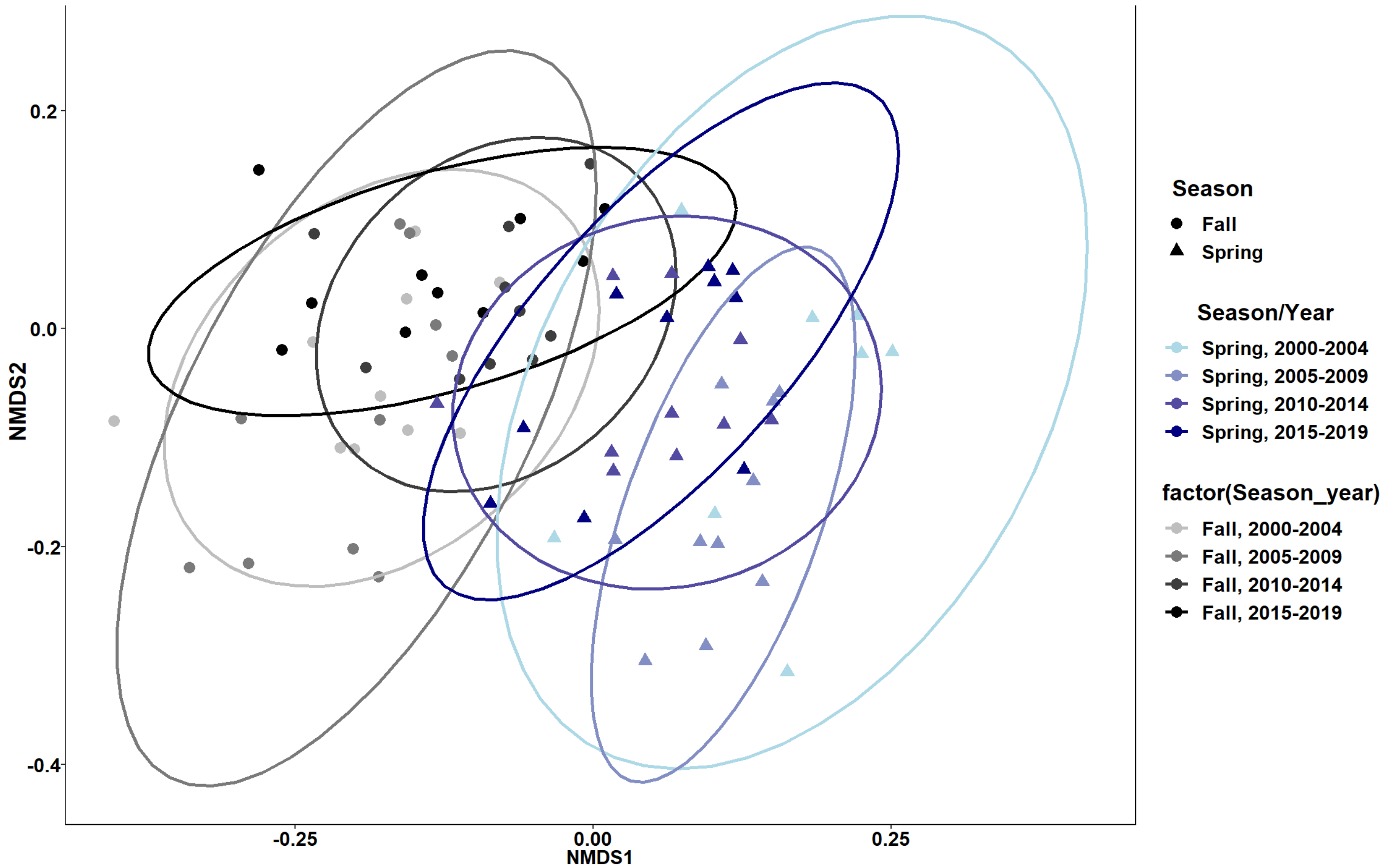
West



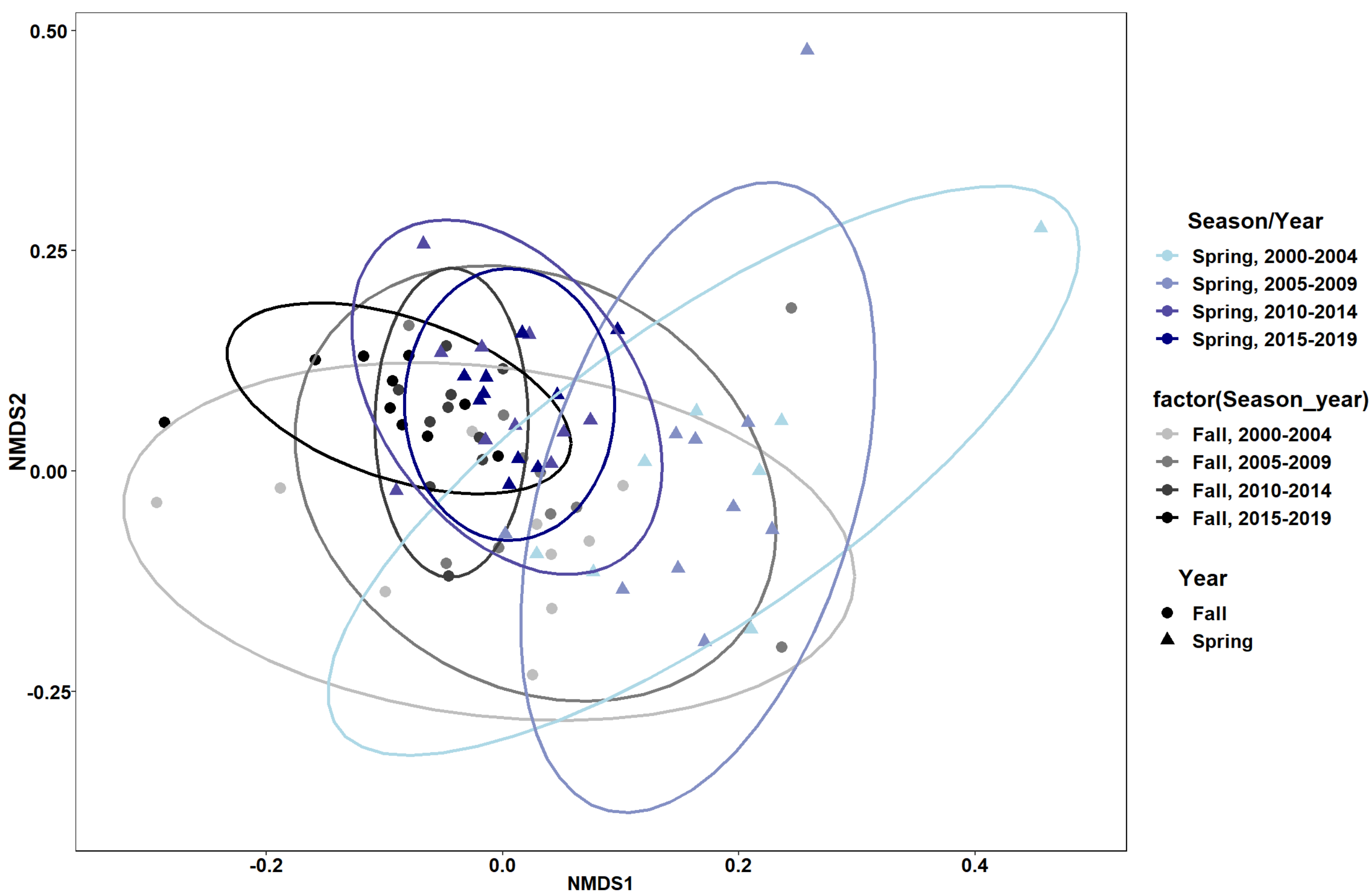
East



West


NMDS2
0.2
0.0
-0.2
-0.4
-0.25
0.00
0.25
NMDS1
Season
Fall
Spring
Season/Year
Spring, 2000-2004
Spring, 2005-2009
Spring, 2010-2014
Spring, 2015-2019
factor(Season_year)
Fall, 2000-2004
Fall, 2005-2009
Fall, 2010-2014
Fall, 2015-2019

East


NMDS2
0.50
0.25
0.00
-0.25
-0.2
0.0
0.2
0.4
NMDS1
Season/Year
Spring, 2000-2004
Spring, 2005-2009
Spring, 2010-2014
Spring, 2015-2019
factor(Season_year)
Fall, 2000-2004
Fall, 2005-2009
Fall, 2010-2014
Fall, 2015-2019
Year
Fall
Spring