Figure3A

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Intro

Compares the taxonomic losses of communities when transitioning from Summer-Autumn to Winter-Spring and vice versa to reproduce the analyses and the Figure 3C from the original publication Seasonal dynamics of the coastal microbiome and its association with environmental factors.

1. Set the environment

```
library(tidyverse)
library(vegan)
source("../scripts/resources/custom_bray_curtis.R")
```

2. Load data

asvs_workable.tsv contains the rarefied ASV abundance profiles, with samples as rows and ASVs as columns.
date2season2community.tsv is table mapping the date, season, and community columns.

```
ABUND <- read_tsv("../data/asvs_workable.tsv.gz", show_col_types = FALSE) %>%
         column_to_rownames("Date")

DATE2SEASON2COMMUITY <- read_tsv("../data/date2season2community.tsv", show_col_types = FALSE)
```

3. Compute D diff, B and C components

Computes the D, B, and C components as defined in (Legendre et al. 2018)[https://onlinelibrary.wiley.com/doi/full/10.1002/ece3.4984]

```
ABUND <- (ABUND > 0) + 0

ABUND_dist_list <- custom_bray_curtis(mtx = ABUND,
                                      comp_log = T,
                                      ncores = 40)

ABUND_D_diff_mtx <- ABUND_dist_list[["mtx"]][["D_diff"]]
ABUND_B_loss_mtx <- ABUND_dist_list[["mtx"]][["B_loss"]]
ABUND_C_gain_mtx <- ABUND_dist_list[["mtx"]][["C_gain"]]

# populate lower matrix
ABUND_D_diff_mtx[is.na(ABUND_D_diff_mtx)] <- 0
ABUND_D_diff_mtx <- ABUND_D_diff_mtx + t(ABUND_D_diff_mtx)

ABUND_B_loss_mtx[is.na(ABUND_B_loss_mtx)] <- 0
```

```r
ABUND_B_loss_mtx <- ABUND_B_loss_mtx + t(ABUND_B_loss_mtx)

ABUND_C_gain_mtx[is.na(ABUND_C_gain_mtx)] <- 0
ABUND_C_gain_mtx <- ABUND_C_gain_mtx + t(ABUND_C_gain_mtx)
```

4. Format all dist tables to long

```r
ABUND_D_diff_long <- ABUND_D_diff_mtx %>%
                     as.data.frame() %>%
                     rownames_to_column("Date") %>%
                     pivot_longer(names_to = "Date_vs",
                                  values_to = "D_diff",
                                  cols = 2:(dim(ABUND_D_diff_mtx)[2] +1)) %>%
                     filter(is.na(D_diff) != T) %>%
                     mutate(Date_formatted = as.Date(Date),
                            Date_formatted_vs = as.Date(Date_vs))

ABUND_B_loss_long <- ABUND_B_loss_mtx %>%
                     as.data.frame() %>%
                     rownames_to_column("Date") %>%
                     pivot_longer(names_to = "Date_vs",
                                  values_to = "B_loss",
                                  cols = 2:(dim(ABUND_B_loss_mtx)[2] +1)) %>%
                     filter(is.na(B_loss) != T) %>%
                     mutate(Date_formatted = as.Date(Date),
                            Date_formatted_vs = as.Date(Date_vs))

ABUND_C_gain_long <- ABUND_C_gain_mtx %>%
                     as.data.frame() %>%
                     rownames_to_column("Date") %>%
                     pivot_longer(names_to = "Date_vs",
                                  values_to = "C_gain",
                                  cols = 2:(dim(ABUND_C_gain_mtx)[2] +1)) %>%
                     filter(is.na(C_gain) != T) %>%
                     mutate(Date_formatted = as.Date(Date),
                            Date_formatted_vs = as.Date(Date_vs))
```

Merge tables

```r
ABUND_dist_long_ext <- left_join(x = ABUND_D_diff_long,
                                 y = ABUND_B_loss_long,
                                 by = c("Date","Date_vs")) %>%
                       left_join(x = .,
                                 y = ABUND_C_gain_long,
                                 by = c("Date","Date_vs")) %>%
                       mutate(days = abs(as.numeric((difftime(Date_vs, Date, units = "days"))))) %>%
                       mutate(BC_value = abs(B_loss - C_gain),
                              gains = if_else(Date < Date_vs & C_gain > B_loss, 1, 0),
                              gains = if_else(Date > Date_vs & C_gain < B_loss, 1, gains),
                              losses = if_else(gains == 1, 0, 1)) %>%
                      left_join(x = ., y = DATE2SEASON2COMMUITY %>%
                                             mutate(Date = as.character(Date)) %>%
                                             select(Date, Community),
                                by = "Date") %>%
                      left_join(x = ., y = DATE2SEASON2COMMUITY %>%
                                           mutate(Date = as.character(Date)) %>%
                                           select(Date, Community),
                                by = c("Date_vs" = "Date"), suffix = c("", "_vs")) %>%
                      mutate(s_comparison = paste(Community,
                                                  Community_vs,
                                                  sep = " vs "),
                             s_comparison =  factor(s_comparison,
                                                     levels = c("S1 vs S2", "S2 vs S1",
                                                                "S1 vs S1", "S2 vs S2")))  %>%
                     filter(Date != Date_vs)
```

10. Plot losses bar plot

```
text_size  <- 12

ABUND_dist_long_ext$s_comparison %>% table()
```

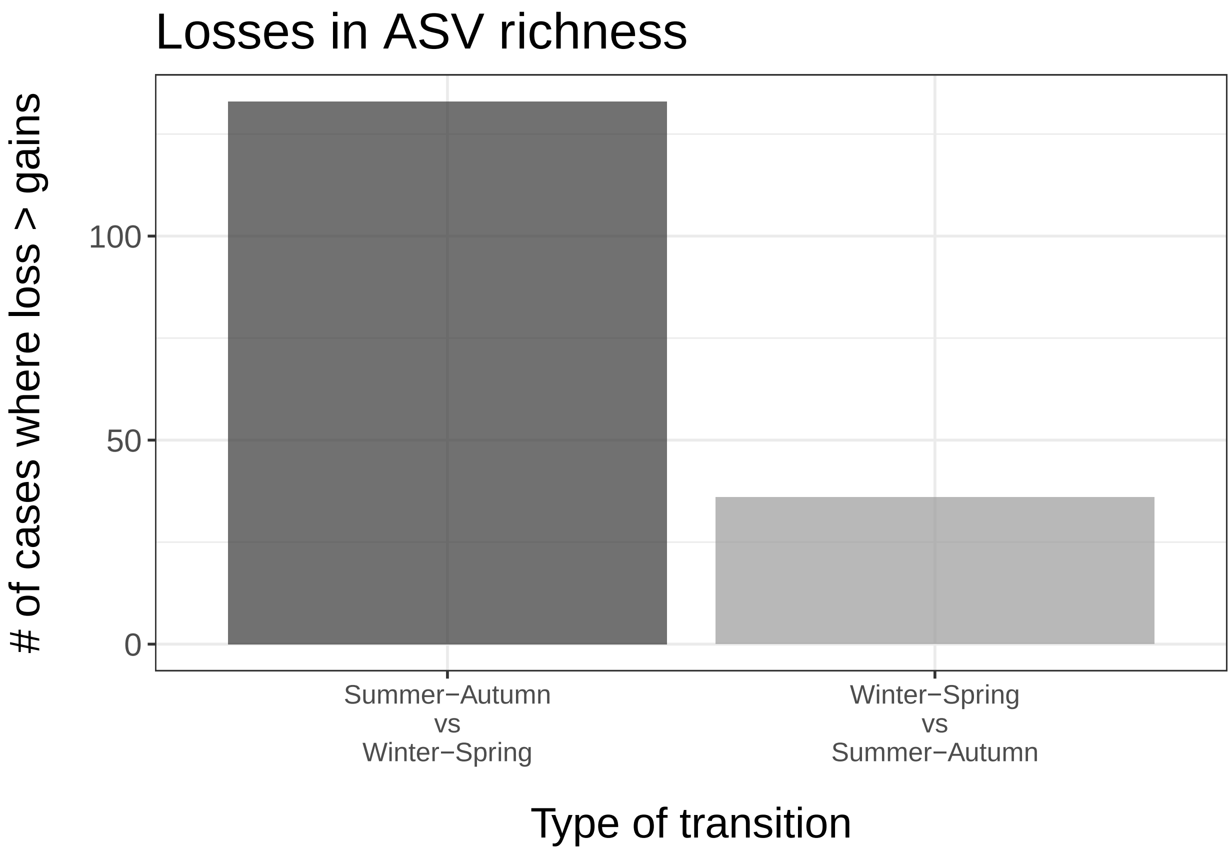
```
## .
## S1 vs S2 S2 vs S1 S1 vs S1 S2 vs S2
##      168      168      132      182
```

```
# gains_counts <- ABUND_dist_long_ext %>%
#   filter(s_comparison == "S1 vs S2" | s_comparison == "S2 vs S1") %>%
#   group_by(s_comparison) %>%
#   summarise(gains = sum(gains))

losses_counts <- ABUND_dist_long_ext %>%
#   filter(Date_formatted < Date_formatted_vs) %>%
  filter(s_comparison == "S1 vs S2" | s_comparison == "S2 vs S1") %>%
  group_by(s_comparison) %>%
  summarise(losses = sum(losses))

barplot_losses <-  losses_counts %>%
  ggplot(mapping = aes(x = s_comparison, y = losses, fill = s_comparison)) +
  geom_bar(alpha = 0.7, linewidth = 3, stat = "identity") +
  scale_x_discrete(labels = c("S1 vs S2"= "Summer-Autumn\nvs\nWinter-Spring",
                              "S2 vs S1" = "Winter-Spring\nvs\nSummer-Autumn")) +
  # scale_fill_manual(values =  c("#FF6347", "#237230")) +
  scale_fill_manual(values =  c("gray20", "gray60")) +
  ggtitle("Losses in ASV richness") +
  theme_bw() +
  xlab("Type of transition") +
  ylab("# of cases where loss > gains") +
  theme(
    # axis.text.x = element_text(angle = 45, hjust = 1, size = text_size),
    axis.text.x = element_text(size = text_size -2),
    axis.text.y = element_text(size = text_size),
    axis.title.x = element_text(size =  text_size +4, margin = margin(t = 15)),
    axis.title.y = element_text(size =  text_size +4, margin = margin(r = 15)),
    strip.text = element_text(size = text_size+4),
    title = element_text(size = text_size + 4, hjust = 0.5, margin = margin(b = 15)),
    strip.background = element_blank()
  ) +
  guides(fill = "none")

barplot_losses
```



6. Print session info

```
sessionInfo()
```

```
## R version 4.4.2 (2024-10-31)
## Platform: x86_64-pc-linux-gnu
## Running under: Ubuntu 20.04.6 LTS
##
## Matrix products: default
## BLAS:   /usr/lib/x86_64-linux-gnu/blas/libblas.so.3.9.0
## LAPACK: /usr/lib/x86_64-linux-gnu/lapack/liblapack.so.3.9.0
##
## locale:
##  [1] LC_CTYPE=en_US.UTF-8       LC_NUMERIC=C               LC_TIME=en_US.UTF-8        LC_COLLATE=en_
##  [5] LC_MONETARY=en_US.UTF-8    LC_MESSAGES=en_US.UTF-8    LC_PAPER=en_US.UTF-8       LC_NAME=C
##  [9] LC_ADDRESS=C               LC_TELEPHONE=C             LC_MEASUREMENT=en_US.UTF-8 LC_IDENTIFICATI
##
## time zone: Etc/UTC
## tzcode source: system (glibc)
##
```

```
## attached base packages:
## [1] parallel  stats     graphics  grDevices utils     datasets  methods   base
##
## other attached packages:
##  [1] doParallel_1.0.17 iterators_1.0.14  foreach_1.5.2     vegan_2.6-8       lattice_0.22-6    permu
##  [7] lubridate_1.9.3   forcats_1.0.0     stringr_1.5.1     dplyr_1.1.4       purrr_1.0.2       readr
## [13] tidyr_1.3.1       tibble_3.2.1      ggplot2_3.5.1     tidyverse_2.0.0
##
## loaded via a namespace (and not attached):
##  [1] utf8_1.2.4        generics_0.1.3    stringi_1.8.4     digest_0.6.37     hms_1.1.3         magri
##  [7] evaluate_1.0.1    grid_4.4.2        timechange_0.3.0  fastmap_1.2.0     Matrix_1.7-0      tinyt
## [13] mgcv_1.9-1        fansi_1.0.6       scales_1.3.0      codetools_0.2-20  cli_3.6.3         rlang
## [19] crayon_1.5.3      bit64_4.5.2       munsell_0.5.1     splines_4.4.2     yaml_2.3.10       withr
## [25] tools_4.4.2       tzdb_0.4.0        colorspace_2.1-1  vctrs_0.6.5       R6_2.5.1          lifec
## [31] bit_4.5.0         vroom_1.6.5       MASS_7.3-61       cluster_2.1.6     pkgconfig_2.0.3   pilla
## [37] gtable_0.3.5      glue_1.8.0        highr_0.11        xfun_0.48         tidyselect_1.2.1  rstud
## [43] knitr_1.48        farver_2.1.2      htmltools_0.5.8.1 nlme_3.1-166      labeling_0.4.3    rmark
## [49] compiler_4.4.2
```