- Read in (Import) your data
- Check your data
- Data to diversity metrics
- Run statistical tests
- Final plots

data analysis template

Caroline Troy

Last compiled on 16 August, 2021 15:50

upload, check, ggplot calculate richness, then diversity Biodiversity R package for richness in package use function - “diversity result” - should be able to just input the data plot diversity between the different locations

Fill in this file as you analyze your project. Remember you should

- add code chunks by clicking the *Insert Chunk* button on the toolbar or by pressing *Ctrl+Alt+I* to answer the questions!
- **knit** your file to produce a markdown version that you can see!
- save your work often
  - **commit** it via git!
  - **push** updates to github # Overview and metadata

What is the main goal of your project? How did you collect the data? You can copy this to/from a paper.

Read in (Import) your data

Useful functions here may be **read.csv**. Data from https://docs.google.com/spreadsheets/d/13leVuJGlgz1bd86xVVpXcxAGvQVinhwPJem-apzGXdk/edit?usp=sharing

```
ShermanCreek <- read.csv("https://docs.google.com/spreadsheets/d/e/2PACX-1vSA7x7HaSNwtlMSZ9aNrGixLik6mY1gRQIJgizAAJjhbMcDxQ5wHKcI2c0XWrnohnMta87aALfQ3Vv_/pub?gid=0&single=true&output=csv",
                         stringsAsFactors = T, blank.lines.skip = T)
ShermanCreek
```

```
##     Year Sampling_location Epifauna.infauna Quadrat Fiddler_Crab.Uca_pugnex.
## 1   2019            Riprap         Epifauna       1                        0
## 2   2019            Riprap         Epifauna       2                        0
## 3   2019            Riprap         Epifauna       3                        0
## 4   2019            Riprap         Epifauna       4                        0
## 5   2019            Riprap         Epifauna       5                        0
## 6   2019            Riprap         Epifauna       6                        0
## 7   2019            Riprap         Epifauna       7                        0
## 8   2019            Riprap         Epifauna       8                        0
## 9   2019            Riprap         Epifauna       9                        0
## 10  2019            Riprap         Epifauna      10                        0
## 11  2019            Riprap         Epifauna      11                        0
## 12  2019            Riprap         Epifauna      12                        0
## 13  2019            Riprap         Epifauna      13                        0
## 14  2019            Riprap         Epifauna      14                        0
## 15  2019            Riprap         Epifauna      15                        0
## 16  2019            Riprap         Epifauna      16                        0
## 17  2019            Riprap         Epifauna      17                        0
## 18  2019            Riprap         Epifauna      18                        0
## 19  2019            Riprap         Epifauna      19                        0
## 20  2019            Riprap         Epifauna      20                        0
## 21  2019            Riprap          Infauna       1                        0
## 22  2019            Riprap          Infauna       2                        0
## 23  2019            Riprap          Infauna       3                        0
## 24  2019            Riprap          Infauna       4                        0
## 25  2019            Riprap          Infauna       5                        0
## 26  2019            Riprap          Infauna       6                        0
## 27  2019            Riprap          Infauna       7                        0
## 28  2019            Riprap          Infauna       8                        0
## 29  2019            Riprap          Infauna       9                        0
## 30  2019            Riprap          Infauna      10                        0
## 31  2019            Riprap          Infauna      11                        0
## 32  2019            Riprap          Infauna      12                        0
## 33  2019            Riprap          Infauna      13                        0
## 34  2019            Riprap          Infauna      14                        0
## 35  2019            Riprap          Infauna      15                        0
## 36  2019            Riprap          Infauna      16                        0
## 37  2019            Riprap          Infauna      17                        0
## 38  2019            Riprap          Infauna      18                        0
## 39  2019            Riprap          Infauna      19                        0
## 40  2019            Riprap          Infauna      20                        0
## 41  2019           Mudflat          Infauna       1                        0
## 42  2019           Mudflat          Infauna       2                        0
## 43  2019           Mudflat          Infauna       3                        0
## 44  2019           Mudflat          Infauna       4                        0
## 45  2019           Mudflat          Infauna       5                        0
## 46  2019           Mudflat          Infauna       6                        0
## 47  2019           Mudflat          Infauna       7                        0
## 48  2019           Mudflat          Infauna       8                        0
## 49  2019           Mudflat          Infauna       9                        0
## 50  2020            Riprap         Epifauna       1                        0
## 51  2020            Riprap         Epifauna       2                        1
## 52  2020            Riprap         Epifauna       3                        0
## 53  2020            Riprap         Epifauna       4                        0
## 54  2020            Riprap         Epifauna       5                        1
## 55  2020            Riprap         Epifauna       6                        0
## 56  2020            Riprap         Epifauna       7                        0
## 57  2020            Riprap         Epifauna       8                        0
## 58  2020            Riprap         Epifauna       9                        0
## 59  2020            Riprap          Infauna       1                        0
## 60  2020            Riprap          Infauna       2                        0
## 61  2020            Riprap          Infauna       3                        0
## 62  2020            Riprap          Infauna       4                        0
## 63  2020            Riprap          Infauna       5                        0
## 64  2020            Riprap          Infauna       6                        0
## 65  2020            Riprap          Infauna       7                        0
## 66  2020            Riprap          Infauna       8                        0
## 67  2020            Riprap          Infauna       9                        0
## 68  2020           Mudflat          Infauna       1                        0
## 69  2020           Mudflat          Infauna       2                        0
## 70  2020           Mudflat          Infauna       3                        0
## 71  2020           Mudflat          Infauna       4                        0
## 72  2020           Mudflat          Infauna       5                        0
## 73  2020           Mudflat          Infauna       6                        0
## 74  2020           Mudflat          Infauna       7                        0
## 75  2020           Mudflat          Infauna       8                        0
## 76  2020           Mudflat          Infauna       9                        0
## 77  2020         New_Marsh         Epifauna       1                        0
## 78  2020         New_Marsh         Epifauna       2                        1
## 79  2020         New_Marsh         Epifauna       3                        1
## 80  2020         New_Marsh         Epifauna       4                        0
## 81  2020         New_Marsh         Epifauna       5                        0
## 82  2020         New_Marsh         Epifauna       6                        0
## 83  2020         New_Marsh         Epifauna       7                        0
## 84  2020         New_Marsh         Epifauna       8                        0
## 85  2020         New_Marsh         Epifauna       9                        3
## 86  2021         New_Marsh         Epifauna       1                       22
## 87  2021         New_Marsh         Epifauna       2                        5
## 88  2021         New_Marsh         Epifauna       3                       22
## 89  2021         New_Marsh         Epifauna       4                        0
## 90  2021         New_Marsh         Epifauna       5                        7
## 91  2021         New_Marsh         Epifauna       6                        5
## 92  2021         New_Marsh         Epifauna       7                        3
## 93  2021         New_Marsh         Epifauna       8                       10
## 94  2021         New_Marsh         Epifauna       9                        3
## 95  2021         New_Marsh         Epifauna      10                        2
## 96  2021         New_Marsh         Epifauna      11                        1
## 97  2021         New_Marsh         Epifauna      12                        1
## 98  2021         New_Marsh         Epifauna      13                        2
## 99  2021         New_Marsh         Epifauna      14                        0
## 100 2021         New_Marsh         Epifauna      15                        7
## 101 2021         New_Marsh         Epifauna      16                        0
## 102 2021         New_Marsh         Epifauna      17                       10
## 103 2021         New_Marsh         Epifauna      18                        9
## 104 2021         New_Marsh         Epifauna      19                        8
## 105 2021         New_Marsh         Epifauna      20                        1
## 106 2021            Riprap         Epifauna       1                       29
## 107 2021            Riprap         Epifauna       2                        3
## 108 2021            Riprap         Epifauna       3                        6
## 109 2021            Riprap         Epifauna       4                        1
## 110 2021            Riprap         Epifauna       5                        6
## 111 2021            Riprap         Epifauna       6                        3
## 112 2021            Riprap         Epifauna       7                        4
## 113 2021            Riprap         Epifauna       8                        1
## 114 2021            Riprap         Epifauna       9                       30
## 115 2021            Riprap         Epifauna      10                        0
## 116 2021            Riprap         Epifauna      11                        3
## 117 2021            Riprap         Epifauna      12                        0
## 118 2021            Riprap          Infauna       1                        8
## 119 2021            Riprap          Infauna       2                        0
## 120 2021            Riprap          Infauna       3                        0
## 121 2021            Riprap          Infauna       4                        0
## 122 2021            Riprap          Infauna       5                        2
## 123 2021            Riprap          Infauna       6                        4
## 124 2021            Riprap          Infauna       7                        0
## 125 2021            Riprap          Infauna       8                        0
## 126 2021            Riprap          Infauna       9                        5
## 127 2021            Riprap          Infauna      10                        0
## 128 2021            Riprap          Infauna      11                        0
## 129 2021            Riprap          Infauna      12                        0
## 130 2021           Mudflat         Epifauna       1                        0
## 131 2021           Mudflat         Epifauna       2                        0
## 132 2021           Mudflat         Epifauna       3                        0
## 133 2021           Mudflat         Epifauna       4                        0
## 134 2021           Mudflat         Epifauna       5                        0
## 135 2021           Mudflat         Epifauna       6                        0
## 136 2021           Mudflat         Epifauna       7                        0
## 137 2021           Mudflat         Epifauna       8                        0
## 138 2021           Mudflat         Epifauna       9                        0
## 139 2021           Mudflat          Infauna       1                        0
## 140 2021           Mudflat          Infauna       2                        0
## 141 2021           Mudflat          Infauna       3                        0
## 142 2021           Mudflat          Infauna       4                        0
## 143 2021           Mudflat          Infauna       5                        0
## 144 2021           Mudflat          Infauna       6                        0
## 145 2021           Mudflat          Infauna       7                        0
## 146 2021           Mudflat          Infauna       8                        0
## 147 2021           Mudflat          Infauna       9                        0
##     Amphipod.Gammarus_spp.. Sandworm.Nereis_spp..
## 1                         0                     0
## 2                        20                     0
## 3                         3                     0
## 4                         1                     0
## 5                        10                     0
## 6                        10                     0
## 7                        30                     0
## 8                         0                     0
## 9                         0                     0
## 10                        6                     0
## 11                        1                     0
## 12                        0                     0
## 13                        0                     0
## 14                        0                     0
## 15                       20                     2
## 16                        0                     2
## 17                        0                     1
## 18                       10                     0
## 19                        0                     0
## 20                        0                     0
## 21                        0                     0
## 22                        0                     1
## 23                        0                     0
## 24                        0                     0
## 25                        0                     0
## 26                        0                     1
## 27                        0                     1
## 28                        0                     0
## 29                        0                     0
## 30                        0                     2
## 31                        0                     0
## 32                        0                     0
## 33                        0                     0
## 34                        0                     0
## 35                        0                     0
## 36                        0                     0
## 37                        0                     2
## 38                        0                     0
## 39                        0                     0
## 40                        0                     0
## 41                        0                     0
## 42                        0                     0
## 43                        0                     2
## 44                        1                     1
## 45                        0                     1
## 46                        0                     0
## 47                        0                     0
## 48                        0                     9
## 49                        0                     0
## 50                        0                     0
## 51                        5                     0
## 52                       11                     0
## 53                        4                     0
## 54                       58                     0
## 55                        0                     0
## 56                        0                     0
## 57                       23                     0
## 58                        3                     0
## 59                        1                     4
## 60                        2                     0
## 61                        1                     0
## 62                        0                     8
## 63                        0                     0
## 64                        3                     0
## 65                        1                     0
## 66                       31                     0
## 67                        8                     0
## 68                        0                     0
## 69                        0                    10
## 70                        0                     4
## 71                        0                    11
## 72                        0                     0
## 73                        0                     1
## 74                        0                     0
## 75                        0                     4
## 76                        1                     0
## 77                        0                     0
## 78                        0                     0
## 79                        0                     0
## 80                        0                     0
## 81                        0                     0
## 82                        4                     0
## 83                        0                     0
## 84                        0                     0
## 85                        0                     0
## 86                        8                     0
## 87                        7                     0
## 88                       46                     0
## 89                       31                     0
## 90                       44                     0
## 91                       33                     0
## 92                       38                     4
## 93                       41                     0
## 94                        1                     3
## 95                        0                     0
## 96                        6                     0
## 97                        0                     0
## 98                        7                     0
## 99                       40                     0
## 100                       2                     0
## 101                       7                     0
## 102                      30                     0
## 103                       7                     0
## 104                       8                     0
## 105                      50                     0
## 106                       0                     0
## 107                       0                     0
## 108                      16                     0
## 109                      41                     1
## 110                     124                     0
## 111                     133                     0
## 112                      25                     0
## 113                      17                     1
## 114                       0                     0
## 115                      60                     0
## 116                      40                     0
## 117                      30                     0
## 118                       0                     0
## 119                      33                     0
## 120                       2                     0
## 121                       0                     0
## 122                       1                     3
## 123                      13                    23
## 124                       3                     3
## 125                       0                     0
## 126                       0                     0
## 127                       0                     5
## 128                       0                     0
## 129                       0                     5
## 130                       0                     0
## 131                       0                     0
## 132                       0                     0
## 133                       0                     0
## 134                       0                     0
## 135                       0                     0
## 136                       0                     0
## 137                       0                     0
## 138                       0                     0
## 139                       0                    17
## 140                       0                    12
## 141                       0                     5
## 142                       0                    31
## 143                       0                     0
## 144                       0                    12
## 145                       0                     8
## 146                       0                    10
## 147                       0                    14
##     Anthurid_Isopod.Cyathura_polita. Caprellid_amphipod.Caprella_spp..
## 1                                  0                                 0
## 2                                  0                                 0
## 3                                  1                                 0
## 4                                  0                                 0
## 5                                  6                                 0
## 6                                  0                                 0
## 7                                  0                                 0
## 8                                  0                                 0
## 9                                  1                                 0
## 10                                 1                                 0
## 11                                 0                                 0
## 12                                 0                                 0
## 13                                 0                                 0
## 14                                 0                                 0
## 15                                 0                                 0
## 16                                 1                                 0
## 17                                 0                                 0
## 18                                 0                                 0
## 19                                 0                                 0
## 20                                 0                                 0
## 21                                 1                                 0
## 22                                 0                                 0
## 23                                 0                                 0
## 24                                 0                                 1
## 25                                 0                                 0
## 26                                 1                                 0
## 27                                 2                                 0
## 28                                 0                                 0
## 29                                 0                                 0
## 30                                 0                                 0
## 31                                 0                                 0
## 32                                 0                                 0
## 33                                 0                                 0
## 34                                 0                                 0
## 35                                 0                                 0
## 36                                 0                                 0
## 37                                 0                                 0
## 38                                 0                                 1
## 39                                 0                                 0
## 40                                 0                                 0
## 41                                 2                                 0
## 42                                 0                                 0
## 43                                 0                                 0
## 44                                 0                                 0
## 45                                 3                                 0
## 46                                 0                                 0
## 47                                 2                                 0
## 48                                 0                                 0
## 49                                 0                                 0
## 50                                 1                                 0
## 51                                 0                                 0
## 52                                 0                                 0
## 53                                 0                                 0
## 54                                 2                                 1
## 55                                 0                                 0
## 56                                 0                                 0
## 57                                 0                                 0
## 58                                 0                                 0
## 59                                 0                                 0
## 60                                 0                                 0
## 61                                 0                                 0
## 62                                 0                                 0
## 63                                 0                                 0
## 64                                 0                                 0
## 65                                 0                                 0
## 66                                 0                                 0
## 67                                 0                                 0
## 68                                 0                                 0
## 69                                 0                                 0
## 70                                 0                                 0
## 71                                 0                                 0
## 72                                 1                                 0
## 73                                 0                                 0
## 74                                 0                                 0
## 75                                 0                                 1
## 76                                 0                                 0
## 77                                 0                                 0
## 78                                 0                                 0
## 79                                 0                                 0
## 80                                 0                                 0
## 81                                 0                                 0
## 82                                 0                                 0
## 83                                 0                                 0
## 84                                 0                                 0
## 85                                 0                                 0
## 86                                 0                                 0
## 87                                 0                                 0
## 88                                 0                                 0
## 89                                 0                                 0
## 90                                 0                                 0
## 91                                 0                                 0
## 92                                 0                                 0
## 93                                 0                                 0
## 94                                 0                                 0
## 95                                 0                                 0
## 96                                 0                                 0
## 97                                 0                                 0
## 98                                 0                                 0
## 99                                 0                                 0
## 100                                0                                 0
## 101                                0                                 0
## 102                                0                                 0
## 103                                0                                 0
## 104                                0                                 0
## 105                                0                                 0
## 106                                0                                 0
## 107                                0                                 0
## 108                                0                                 0
## 109                                0                                 0
## 110                                0                                 0
## 111                                0                                 0
## 112                                0                                 0
## 113                                0                                 0
## 114                                0                                 0
## 115                                0                                 0
## 116                                0                                 0
## 117                                0                                 0
## 118                                0                                 0
## 119                                0                                 0
## 120                                0                                 0
## 121                                0                                 0
## 122                                0                                 0
## 123                                0                                 0
## 124                                0                                 0
## 125                                0                                 0
## 126                                0                                 0
## 127                                0                                 0
## 128                                0                                 0
## 129                                0                                 0
## 130                                0                                 0
## 131                                0                                 0
## 132                                0                                 0
## 133                                0                                 0
## 134                                0                                 0
## 135                                0                                 0
## 136                                0                                 0
## 137                                0                                 0
## 138                                0                                 0
## 139                                1                                 0
## 140                                0                                 0
## 141                                3                                 0
## 142                                0                                 0
## 143                                0                                 0
## 144                                0                                 0
## 145                                0                                 0
## 146                                0                                 0
## 147                                0                                 0
##     Softshell_Clam.Mya_arenaria. Macoma_balthica Blue_crab.Callinectes_sapidus.
## 1                              0               0                              0
## 2                              0               0                              3
## 3                              0               0                              0
## 4                              0               0                              7
## 5                              6               2                              0
## 6                              1               0                              4
## 7                              0               0                              3
## 8                              0               0                              5
## 9                              0               0                              1
## 10                             0               0                              0
## 11                             0               0                              0
## 12                             0               0                              3
## 13                             0               0                              0
## 14                             0               0                              0
## 15                             0               0                              0
## 16                             0               0                              0
## 17                             0               0                              0
## 18                             0               1                              2
## 19                             1               0                              1
## 20                             0               0                              0
## 21                             0               0                              0
## 22                             0               1                              0
## 23                             0               0                              1
## 24                             0               0                              0
## 25                             4               4                              0
## 26                             0               0                              3
## 27                             5               0                              0
## 28                             0               0                              0
## 29                             0               1                              0
## 30                             0               3                              0
## 31                             0               0                              0
## 32                             0               0                              0
## 33                             0               0                              0
## 34                             0               0                              0
## 35                             0               0                              0
## 36                             0               0                              0
## 37                             0               0                              0
## 38                             0               0                              0
## 39                             0               0                              0
## 40                             0               0                              0
## 41                             0               0                              0
## 42                             0               0                              1
## 43                             1               0                              0
## 44                             0               0                              1
## 45                             0               0                              0
## 46                             0               0                              0
## 47                             0               0                              0
## 48                             0               0                              0
## 49                             0               0                              0
## 50                             0               0                              4
## 51                             0               0                              3
## 52                             0               0                              5
## 53                             0               0                              1
## 54                             0               0                              2
## 55                             0               0                              4
## 56                             0               0                              3
## 57                             0               0                              1
## 58                             0               0                              1
## 59                             0               1                              0
## 60                             0               0                              0
## 61                             0               0                              1
## 62                             1               0                              0
## 63                             0               0                              1
## 64                             0               0                              0
## 65                             0               0                              0
## 66                             0               0                              1
## 67                             1               0                              1
## 68                             0               0                              0
## 69                             0               0                              0
## 70                             0               0                              0
## 71                             0               0                              0
## 72                             0               0                              0
## 73                             0               0                              0
## 74                             0               0                              0
## 75                             0               0                              0
## 76                             1               0                              0
## 77                             0               0                              0
## 78                             0               0                              0
## 79                             0               0                              0
## 80                             0               0                              0
## 81                             0               0                              0
## 82                             0               0                              0
## 83                             0               0                              0
## 84                             0               0                              0
## 85                             0               0                              0
## 86                             0               0                              0
## 87                             0               0                              0
## 88                             0               0                              0
## 89                             0               0                              0
## 90                             0               0                              0
## 91                             0               0                              0
## 92                             0               0                              0
## 93                             0               0                              0
## 94                             0               0                              0
## 95                             0               0                              0
## 96                             0               0                              0
## 97                             0               0                              0
## 98                             0               0                              0
## 99                             0               0                              0
## 100                            0               0                              0
## 101                            0               0                              0
## 102                            0               0                              0
## 103                            0               0                              0
## 104                            0               0                              0
## 105                            0               0                              0
## 106                            0               0                              0
## 107                            0               0                              0
## 108                            0               0                              0
## 109                            0               0                              2
## 110                            0               0                              0
## 111                            0               0                              0
## 112                            0               0                              0
## 113                            0               0                              0
## 114                            0               0                              0
## 115                            0               0                              0
## 116                            0               0                              0
## 117                            0               0                              1
## 118                            0               0                              0
## 119                            0               0                              0
## 120                            0               0                              0
## 121                            0               0                              0
## 122                            5               1                              0
## 123                            1               0                              0
## 124                            2               0                              0
## 125                            0               0                              0
## 126                            0               0                              0
## 127                            0               0                              0
## 128                            0               0                              0
## 129                            0               0                              0
## 130                            0               0                              0
## 131                            0               0                              0
## 132                            0               0                              0
## 133                            0               0                              0
## 134                            0               0                              0
## 135                            0               0                              0
## 136                            0               0                              0
## 137                            0               0                              0
## 138                            0               0                              0
## 139                            0               2                              0
## 140                            0               2                              0
## 141                            1               0                              0
## 142                            0               0                              0
## 143                            0               0                              0
## 144                            0               0                              0
## 145                            0               0                              0
## 146                            0               0                              0
## 147                            0               0                              0
##     Sea_pill_bug.Sphaeroma_spp.. Ribbed_Mussel.Geukensia_demissa.
## 1                              0                                0
## 2                              0                                0
## 3                              0                                1
## 4                              0                                1
## 5                              1                                1
## 6                             10                                0
## 7                              0                                0
## 8                              0                                3
## 9                              0                                0
## 10                             0                                0
## 11                             0                                0
## 12                             1                                3
## 13                             0                                0
## 14                             0                                0
## 15                            12                                0
## 16                             0                                0
## 17                             0                                0
## 18                             0                                0
## 19                             0                                0
## 20                             0                                0
## 21                             0                                0
## 22                             0                                1
## 23                             0                                1
## 24                             0                                0
## 25                             0                                1
## 26                             0                                0
## 27                             0                                0
## 28                             0                                0
## 29                             0                                0
## 30                             0                                0
## 31                             0                                0
## 32                             0                                0
## 33                             0                                0
## 34                             0                                0
## 35                             0                                0
## 36                             0                                0
## 37                             0                                0
## 38                             0                                0
## 39                             0                                0
## 40                             0                                0
## 41                             0                                0
## 42                             0                                0
## 43                             0                                0
## 44                             0                                0
## 45                             0                                0
## 46                             0                                0
## 47                             0                                0
## 48                             0                                0
## 49                             0                                0
## 50                             0                                0
## 51                             1                                0
## 52                             0                                0
## 53                             0                                0
## 54                             0                                1
## 55                             0                                0
## 56                             0                                0
## 57                             0                                0
## 58                             0                                0
## 59                             0                                0
## 60                             0                                0
## 61                             0                                0
## 62                             0                                0
## 63                             0                                0
## 64                             0                                0
## 65                             0                                0
## 66                             0                                0
## 67                             0                                0
## 68                             0                                0
## 69                             0                                0
## 70                             0                                0
## 71                             0                                0
## 72                             0                                0
## 73                             0                                0
## 74                             0                                0
## 75                             0                                0
## 76                             0                                0
## 77                             0                                0
## 78                             0                                0
## 79                             0                                0
## 80                             0                                0
## 81                             0                                0
## 82                             0                                0
## 83                             0                                0
## 84                             0                                0
## 85                             0                                0
## 86                             0                                0
## 87                             0                                0
## 88                             0                                0
## 89                             4                                0
## 90                             1                                0
## 91                             0                                0
## 92                             0                                0
## 93                             1                                0
## 94                             0                                0
## 95                             0                                0
## 96                             0                                0
## 97                             0                                0
## 98                             0                                0
## 99                             0                                0
## 100                            0                                0
## 101                            0                                0
## 102                            0                                0
## 103                            0                                0
## 104                            0                                0
## 105                            0                                0
## 106                            0                                0
## 107                            0                                0
## 108                            1                                1
## 109                            0                                1
## 110                           35                                2
## 111                           77                                2
## 112                            4                                0
## 113                            0                                0
## 114                            0                                0
## 115                            0                                3
## 116                            0                                2
## 117                            0                                0
## 118                            0                                0
## 119                            0                                0
## 120                            0                                0
## 121                            0                                0
## 122                            0                                0
## 123                            0                                0
## 124                            0                                0
## 125                            0                                0
## 126                            0                                0
## 127                            0                                0
## 128                            0                                0
## 129                            0                                0
## 130                            0                                0
## 131                            0                                0
## 132                            0                                0
## 133                            0                                0
## 134                            0                                0
## 135                            0                                0
## 136                            0                                0
## 137                            0                                0
## 138                            0                                0
## 139                            0                                0
## 140                            0                                0
## 141                            0                                0
## 142                            0                                0
## 143                            0                                0
## 144                            0                                0
## 145                            0                                0
## 146                            0                                0
## 147                            0                                0
##     Eastern_oyster.Crassostrea_virginica. Sea_grape.Molgula_spp..
## 1                                       0                       0
## 2                                       0                       0
## 3                                       0                       0
## 4                                       0                       0
## 5                                       2                       0
## 6                                       0                       1
## 7                                       2                       0
## 8                                       0                       0
## 9                                       0                       0
## 10                                      0                       0
## 11                                      0                       0
## 12                                      0                       0
## 13                                      0                       0
## 14                                      0                       0
## 15                                      0                       0
## 16                                      0                       0
## 17                                      0                       0
## 18                                      0                       0
## 19                                      0                       0
## 20                                      0                       0
## 21                                      0                       0
## 22                                      0                       0
## 23                                      0                       0
## 24                                      0                       0
## 25                                      0                       0
## 26                                      0                       0
## 27                                      0                       0
```

```
## 28                                    0                         0
## 29                                    0                         0
## 30                                    0                         0
## 31                                    0                         0
## 32                                    0                         0
## 33                                    0                         0
## 34                                    0                         0
## 35                                    0                         0
## 36                                    0                         0
## 37                                    0                         0
## 38                                    0                         0
## 39                                    0                         0
## 40                                    0                         0
## 41                                    0                         0
## 42                                    0                         0
## 43                                    0                         0
## 44                                    0                         0
## 45                                    0                         0
## 46                                    0                         0
## 47                                    0                         0
## 48                                    0                         0
## 49                                    0                         0
## 50                                    0                         0
## 51                                    0                         0
## 52                                    0                         0
## 53                                    0                         0
## 54                                    0                         0
## 55                                    0                         0
## 56                                    0                         0
## 57                                    5                         0
## 58                                    3                         0
## 59                                    0                         0
## 60                                    0                         0
## 61                                    0                         0
## 62                                    0                         0
## 63                                    0                         0
## 64                                    0                         0
## 65                                    0                         0
## 66                                    0                         0
## 67                                    0                         0
## 68                                    0                         0
## 69                                    0                         0
## 70                                    0                         0
## 71                                    0                         0
## 72                                    0                         0
## 73                                    0                         0
## 74                                    0                         0
## 75                                    0                         0
## 76                                    0                         0
## 77                                    0                         0
## 78                                    0                         0
## 79                                    0                         0
## 80                                    0                         0
## 81                                    0                         0
## 82                                    0                         0
## 83                                    0                         0
## 84                                    0                         0
## 85                                    0                         0
## 86                                    0                         0
## 87                                    0                         0
## 88                                    0                         0
## 89                                    0                         0
## 90                                    0                         0
## 91                                    0                         0
## 92                                    0                         0
## 93                                    0                         0
## 94                                    0                         0
## 95                                    0                         0
## 96                                    0                         0
## 97                                    0                         0
## 98                                    0                         0
## 99                                    0                         0
## 100                                   0                         0
## 101                                   0                         0
## 102                                   0                         0
## 103                                   0                         0
## 104                                   0                         0
## 105                                   0                         0
## 106                                   0                         0
## 107                                   0                         0
## 108                                   0                         0
## 109                                   3                         0
## 110                                   4                         0
## 111                                   5                         0
## 112                                   7                         0
## 113                                   2                         0
## 114                                   0                         0
## 115                                   7                         0
## 116                                   7                         0
## 117                                   1                         0
## 118                                   0                         0
## 119                                   0                         0
## 120                                   0                         0
## 121                                   0                         0
## 122                                   0                         0
## 123                                   0                         0
## 124                                   0                         0
## 125                                   0                         0
## 126                                   0                         0
## 127                                   0                         0
## 128                                   0                         0
## 129                                   0                         0
## 130                                   0                         0
## 131                                   0                         0
## 132                                   0                         0
## 133                                   0                         0
## 134                                   0                         0
## 135                                   0                         0
## 136                                   0                         0
## 137                                   0                         0
## 138                                   0                         0
## 139                                   0                         0
## 140                                   0                         0
## 141                                   0                         0
## 142                                   0                         0
## 143                                   0                         0
## 144                                   0                         0
## 145                                   0                         0
## 146                                   0                         0
## 147                                   0                         0
##     Barnacles.Semibalanus_spp.. Sand.Flea Mud.Snail Bloodworm
## 1                             0         0         0         0
## 2                            11         0         0         0
## 3                             0         0         0         0
## 4                             0         0         0         0
## 5                             1         0         0         0
## 6                             4         0         0         0
## 7                             3         0         0         0
## 8                             0         0         0         0
## 9                             0         0         0         0
## 10                            0         0         0         0
## 11                            0         0         0         0
## 12                            0         0         0         0
## 13                            0         0         0         0
## 14                            0         0         0         0
## 15                            0         0         0         0
## 16                            0         0         0         0
## 17                            0         0         0         0
## 18                            0         0         0         0
## 19                            0         0         0         0
## 20                            0         0         0         0
## 21                            0         0         0         0
## 22                            0         0         0         0
## 23                            0         0         0         0
## 24                            0         0         0         0
## 25                            0         0         0         0
## 26                            0         0         0         0
## 27                            0         0         0         0
## 28                            0         0         0         0
## 29                            0         0         0         0
## 30                            0         0         0         0
## 31                            0         0         0         0
## 32                            0         0         0         0
## 33                            0         0         0         0
## 34                            0         0         0         0
## 35                            0         0         0         0
## 36                            0         0         0         0
## 37                            0         0         0         0
## 38                            0         0         0         0
## 39                            0         0         0         0
## 40                            0         0         0         0
## 41                            0         0         0         0
## 42                            0         0         0         0
## 43                            0         0         0         0
## 44                            0         0         0         0
## 45                            0         0         0         0
## 46                            0         0         0         0
## 47                            0         0         0         0
## 48                            0         0         0         0
## 49                            0         0         0         0
## 50                            0         0         0         0
## 51                            0         0         0         0
## 52                            0         0         0         0
## 53                            0         0         0         0
## 54                            0         0         0         0
## 55                            0         0         0         0
## 56                            0         0         0         0
## 57                            0         0         0         0
## 58                            0         0         0         0
## 59                            0         0         0         0
## 60                            0         0         0         0
## 61                            0         0         0         0
## 62                            0         0         0         0
## 63                            0         0         0         0
## 64                            0         0         0         0
## 65                            0         0         0         0
## 66                            0         0         0         0
## 67                            0         0         0         0
## 68                            0         0         0         0
## 69                            0         0         0         0
## 70                            0         0         0         0
## 71                            0         0         0         0
## 72                            0         0         0         0
## 73                            0         0         0         0
## 74                            0         0         0         0
## 75                            0         0         0         0
## 76                            0         0         0         0
## 77                            0         0         0         0
## 78                            0         0         0         0
## 79                            0         0         0         0
## 80                            0         0         0         0
## 81                            0         0         0         0
## 82                            0         0         0         0
## 83                            0         0         0         0
## 84                            0         0         0         0
## 85                            0         0         0         0
## 86                            0         0         0         0
## 87                            0         0         0         0
## 88                            0         0         0         0
## 89                            0         0         0         0
## 90                            0         0         0         0
## 91                            0         0         1         0
## 92                            0         0         0         0
## 93                            0         0         0         0
## 94                            0         0         0         0
## 95                            0         0         0         0
## 96                            0         0         0         0
## 97                            0         0         0         0
## 98                            0         0         0         0
## 99                            0         0         0         0
## 100                           0         0         0         0
## 101                           0         0         0         0
## 102                           0         1         0         0
## 103                           0         0         0         0
## 104                           0         0         0         0
## 105                           0         0         0         0
## 106                           0         6         0         0
## 107                           0         0         0         0
## 108                           0         0         0         0
## 109                           0         0         0         0
## 110                           4         0         0         0
## 111                           4         0         0         0
## 112                           3         0         0         0
## 113                           0         0         0         0
## 114                           0        15         0         0
## 115                          20         0         0         0
## 116                           5         0         0         0
## 117                           0         0         0         0
## 118                           0         0         0         0
## 119                           0         0         0         0
## 120                           0         0         0         0
## 121                           0         0         0         0
## 122                           0         0         0         0
## 123                           0         0         0         0
## 124                           0         0         0         0
## 125                           0         0         0         0
## 126                           0         0         0         0
## 127                           0         0         0         0
## 128                           0         0         0         0
## 129                           0         0         0         0
## 130                           0         0         0         0
## 131                           0         0         0         0
## 132                           0         0         0         0
## 133                           0         0         0         0
## 134                           0         0         0         0
## 135                           0         0         0         0
## 136                           0         0         0         0
## 137                           0         0         0         0
## 138                           0         0         0         0
## 139                           0         0         0         0
## 140                           0         0         0         0
## 141                           0         0         0         1
## 142                           0         0         0         0
## 143                           0         0         0         0
## 144                           0         0         0         0
## 145                           0         0         0         0
## 146                           0         0         0         0
## 147                           0         0         0         1
##                                                                     Group...Notes
## 1
## 2
## 3
## 4
## 5
## 6
## 7
## 8
## 9
## 10
## 11
## 12
## 13
## 14
## 15
## 16
## 17
## 18
## 19
## 20
## 21
## 22
## 23
## 24
## 25
## 26
## 27
## 28
## 29
## 30
## 31
## 32
## 33
## 34
## 35
## 36
## 37
## 38
## 39
## 40
## 41
## 42
## 43
## 44
## 45
## 46
## 47
## 48
## 49
## 50
## 51
## 52
## 53
## 54
## 55
## 56
## 57
## 58
## 59
## 60
## 61
## 62
## 63
## 64
## 65
## 66
## 67
## 68
## 69
## 70
## 71
## 72
## 73
## 74
## 75
## 76
## 77
## 78
## 79
## 80
## 81
## 82
## 83
## 84
## 85
## 86                                                                           CK
## 87                                                                           CK
## 88                                                                           CK
## 89                                                                           CK
## 90                                                                           AB
## 91                                                                           AB
## 92                                                  AB - Unknown white worm sp.  - 1
## 93                                                                           AB
## 94                                                                           AE
## 95                                                                           AE
## 96                                                                           AE
## 97                                                                           AE
## 98                                                                           AE
## 99                                                                           AE
## 100                                                                          AE
## 101                                                                          CL
## 102                                              CL - Is sandhopper same as sand flea?
## 103                                                                          CL
## 104                                                                          CL
## 105                                                                          CL
## 106                                                                          CK
## 107                                                                          CK
## 108                                                                          CK
## 109                                                                          CK
## 110                                                                          AB
## 111                                                                          AB
## 112                                                                          AE
## 113                                                                          AE
## 114                                                                          CL
## 115                                                                          CL
## 116                                                                          CL
## 117                                                                          CL
## 118                                                                          CK
## 119                                                                          CK
## 120                                                                          CK
## 121                                                                          CK
## 122                                                                          AB
## 123                                                                          AB
## 124 AE - just says "clam" twice, with 1 has mark for each - softshell or macoma?
## 125                                                                          AE
## 126                                                                          CL
## 127                                                                          CL
## 128                                                                          CL
## 129                                                                          CL
## 130                                                                          CK
## 131                                                                          CK
## 132                                                                          AB
## 133                                                                          CL
## 134                                                                          CL
## 135                                                                          CL
## 136                                                                          CL
## 137                                                                          CL
## 138                                                                          CL
## 139                                                                          CK
## 140                                                                          CK
## 141                          AB - just says "clam" in notes - soft-shell or macoma?
## 142                                                                          CL
## 143                                                                          CL
## 144                                                                          CL
## 145                                                                          CL
## 146                                                                          CL
## 147                                                                          CL
```

Check your data

Useful functions here may be **str**, **summary**, or **head**.

```
head(ShermanCreek)
```

```
##   Year Sampling_location Epifauna.infauna Quadrat Fiddler_Crab.Uca_pugnex.
## 1 2019            Riprap         Epifauna       1                        0
## 2 2019            Riprap         Epifauna       2                        0
## 3 2019            Riprap         Epifauna       3                        0
## 4 2019            Riprap         Epifauna       4                        0
## 5 2019            Riprap         Epifauna       5                        0
## 6 2019            Riprap         Epifauna       6                        0
##   Amphipod.Gammarus_spp.. Sandworm.Nereis_spp..
## 1                       0                     0
## 2                      20                     0
## 3                       3                     0
## 4                       1                     0
## 5                      10                     0
## 6                      10                     0
##   Anthurid_Isopod.Cyathura_polita. Caprellid_amphipod.Caprella_spp..
## 1                                0                                 0
## 2                                0                                 0
## 3                                1                                 0
## 4                                0                                 0
## 5                                6                                 0
## 6                                0                                 0
##   Softshell_Clam.Mya_arenaria. Macoma_balthica Blue_crab.Callinectes_sapidus.
## 1                            0               0                              0
## 2                            0               0                              3
## 3                            0               0                              0
## 4                            0               0                              7
## 5                            6               2                              0
## 6                            1               0                              4
##   Sea_pill_bug.Sphaeroma_spp.. Ribbed_Mussel.Geukensia_demissa.
## 1                            0                                0
## 2                            0                                0
## 3                            0                                1
## 4                            0                                1
## 5                            1                                1
## 6                           10                                0
##   Eastern_oyster.Crassostrea_virginica. Sea_grape.Molgula_spp..
## 1                                     0                       0
## 2                                     0                       0
## 3                                     0                       0
## 4                                     0                       0
## 5                                     2                       0
## 6                                     0                       1
##   Barnacles.Semibalanus_spp.. Sand.Flea Mud.Snail Bloodworm Group...Notes
## 1                           0         0         0         0
## 2                          11         0         0         0
## 3                           0         0         0         0
## 4                           0         0         0         0
## 5                           1         0         0         0
## 6                           4         0         0         0
```

```
str(ShermanCreek)
```

```
## 'data.frame':    147 obs. of  21 variables:
##  $ Year                                 : int  2019 2019 2019 2019 2019 2019 2019 2019 2019 2019 ...
##  $ Sampling_location                    : Factor w/ 3 levels "Mudflat","New_Marsh",..: 3 3 3 3 3 3 3 3 3 3 ...
##  $ Epifauna.infauna                     : Factor w/ 2 levels "Epifauna","Infauna": 1 1 1 1 1 1 1 1 1 1 ...
##  $ Quadrat                              : int  1 2 3 4 5 6 7 8 9 10 ...
##  $ Fiddler_Crab.Uca_pugnex.             : int  0 0 0 0 0 0 0 0 0 0 ...
##  $ Amphipod.Gammarus_spp..              : int  0 20 3 1 10 10 30 0 0 6 ...
##  $ Sandworm.Nereis_spp..                : int  0 0 0 0 0 0 0 0 0 0 ...
##  $ Anthurid_Isopod.Cyathura_polita.     : int  0 0 1 0 6 0 0 0 1 1 ...
##  $ Caprellid_amphipod.Caprella_spp..    : int  0 0 0 0 0 0 0 0 0 0 ...
##  $ Softshell_Clam.Mya_arenaria.         : int  0 0 0 0 6 1 0 0 0 0 ...
##  $ Macoma_balthica                      : int  0 0 0 0 2 0 0 0 0 0 ...
##  $ Blue_crab.Callinectes_sapidus.       : int  0 3 0 7 0 4 3 5 1 0 ...
##  $ Sea_pill_bug.Sphaeroma_spp..         : int  0 0 0 0 1 10 0 0 0 0 ...
##  $ Ribbed_Mussel.Geukensia_demissa.     : int  0 0 1 1 1 0 0 3 0 0 ...
##  $ Eastern_oyster.Crassostrea_virginica.: int  0 0 0 0 2 0 2 0 0 0 ...
##  $ Sea_grape.Molgula_spp..              : int  0 0 0 0 0 1 0 0 0 0 ...
##  $ Barnacles.Semibalanus_spp..          : int  0 11 0 0 1 4 3 0 0 0 ...
##  $ Sand.Flea                            : int  0 0 0 0 0 0 0 0 0 0 ...
##  $ Mud.Snail                            : int  0 0 0 0 0 0 0 0 0 0 ...
##  $ Bloodworm                            : int  0 0 0 0 0 0 0 0 0 0 ...
##  $ Group...Notes                        : Factor w/ 9 levels "","AB","AB - just says \"clam\" in notes - soft-shell or macoma?",..: 1 1 1 1 1 1 1 1 1 1 ...
```

```
summary(ShermanCreek)
```

```
##       Year      Sampling_location Epifauna.infauna    Quadrat     
##  Min.   :2019   Mudflat  :36      Epifauna:79      Min.   : 1.00  
##  1st Qu.:2019   New_Marsh:29      Infauna :68      1st Qu.: 4.00  
##  Median :2020   Riprap   :82                       Median : 7.00  
##  Mean   :2020                                      Mean   : 7.49  
##  3rd Qu.:2021                                      3rd Qu.:10.00  
##  Max.   :2021                                      Max.   :20.00  
##                                                                   
##  Fiddler_Crab.Uca_pugnex. Amphipod.Gammarus_spp.. Sandworm.Nereis_spp..
##  Min.   : 0.000           Min.   :  0.000         Min.   : 0.000       
##  1st Qu.: 0.000           1st Qu.:  0.000         1st Qu.: 0.000       
##  Median : 0.000           Median :  0.000         Median : 0.000       
##  Mean   : 1.565           Mean   :  8.245         Mean   : 1.524       
##  3rd Qu.: 0.000           3rd Qu.:  6.500         3rd Qu.: 0.000       
##  Max.   :30.000           Max.   :133.000         Max.   :31.000       
##                                                                        
##  Anthurid_Isopod.Cyathura_polita. Caprellid_amphipod.Caprella_spp..
##  Min.   :0.0000                   Min.   :0.00000                  
##  1st Qu.:0.0000                   1st Qu.:0.00000                  
##  Median :0.0000                   Median :0.00000                  
##  Mean   :0.1973                   Mean   :0.02721                  
##  3rd Qu.:0.0000                   3rd Qu.:0.00000                  
##  Max.   :6.0000                   Max.   :1.00000                  
##                                                                    
##  Softshell_Clam.Mya_arenaria. Macoma_balthica  Blue_crab.Callinectes_sapidus.
##  Min.   :0.0000               Min.   :0.0000   Min.   :0.000                 
##  1st Qu.:0.0000               1st Qu.:0.0000   1st Qu.:0.000                 
##  Median :0.0000               Median :0.0000   Median :0.000                 
##  Mean   :0.2041               Mean   :0.1224   Mean   :0.449                 
##  3rd Qu.:0.0000               3rd Qu.:0.0000   3rd Qu.:0.000                 
##  Max.   :6.0000               Max.   :4.0000   Max.   :7.000                 
##                                                                              
##  Sea_pill_bug.Sphaeroma_spp.. Ribbed_Mussel.Geukensia_demissa.
##  Min.   : 0.000               Min.   :0.0000                  
##  1st Qu.: 0.000               1st Qu.:0.0000                  
##  Median : 0.000               Median :0.0000                  
##  Mean   : 1.007               Mean   :0.1633                  
##  3rd Qu.: 0.000               3rd Qu.:0.0000                  
##  Max.   :77.000               Max.   :3.0000                  
##                                                               
##  Eastern_oyster.Crassostrea_virginica. Sea_grape.Molgula_spp..
##  Min.   :0.0000                        Min.   :0.000000       
##  1st Qu.:0.0000                        1st Qu.:0.000000       
##  Median :0.0000                        Median :0.000000       
##  Mean   :0.3265                        Mean   :0.006803       
##  3rd Qu.:0.0000                        3rd Qu.:0.000000       
##  Max.   :7.0000                        Max.   :1.000000       
##                                                               
##  Barnacles.Semibalanus_spp..   Sand.Flea         Mud.Snail       
##  Min.   : 0.0000             Min.   : 0.0000   Min.   :0.000000  
##  1st Qu.: 0.0000             1st Qu.: 0.0000   1st Qu.:0.000000  
##  Median : 0.0000             Median : 0.0000   Median :0.000000  
##  Mean   : 0.3741             Mean   : 0.1497   Mean   :0.006803  
##  3rd Qu.: 0.0000             3rd Qu.: 0.0000   3rd Qu.:0.000000  
##  Max.   :20.0000             Max.   :15.0000   Max.   :1.000000  
##                                                                  
##    Bloodworm                                                        Group...Notes
##  Min.   :0.00000                                                           :85   
##  1st Qu.:0.00000   CL                                                      :24   
##  Median :0.00000   CK                                                      :16   
##  Mean   :0.01361   AE                                                      :10   
##  3rd Qu.:0.00000   AB                                                      : 8   
##  Max.   :1.00000   AB - just says "clam" in notes - soft-shell or macoma?: 1   
##                    (Other)                                                 : 3
```

Data to diversity metrics

Use **BiodiversityR** to get taxonomic results. You'll need to make year a factor.

```
ShermanCreek$Year <- as.factor(ShermanCreek$Year)
```

```
if ("BiodiversityR" %in% row.names(installed.packages()) == F){
  install.packages("BiodiversityR")
}
library(BiodiversityR)
```

```
## Loading required package: tcltk
```

```
## Loading required package: vegan
```

```
## Loading required package: permute
```

```
## Loading required package: lattice
```

```
## This is vegan 2.5-7
```

```
## BiodiversityR 2.13-1: Use command BiodiversityRGUI() to launch the Graphical User Interface;
## to see changes use BiodiversityRGUI(changeLog=TRUE, backward.compatibility.messages=TRUE)
```

To use diversityresult function, break ShermanCreek into an environmental and community dataset (see dune example under **?diversityresult**)

make new_marsh new marsh without space

```
if ("plyr" %in% row.names(installed.packages()) == F){
  install.packages("plyr")
}
library(plyr)

ShermanCreek$Sampling_location <- revalue(ShermanCreek$Sampling_location, c("New_Marsh"= "New marsh"))
```

```
ShermanCreekenv <- ShermanCreek[,1:4]
ShermanCreekcommunity <- ShermanCreek[,5:(ncol(ShermanCreek)-1)]
```

Then find richness and Simpson's diversity (inverse) for each quadrat

```
richness_each_quadrat <- diversityresult(x = ShermanCreekcommunity,
                                         index = "richness", method="each site")
ShermanCreek$richness <- richness_each_quadrat$richness

simpson_each_location <- diversityresult(x = ShermanCreekcommunity,
                                         index = "inverseSimpson", method="each site")
simpson_each_location$inverseSimpson[is.infinite(simpson_each_location$inverseSimpson) == T] <- NA
ShermanCreek$invSimpson <- simpson_each_location$inverseSimpson
```

This gives us richness and Simpsons's for each quadrat and adds it to our original dataset

```
head(ShermanCreek)
```

```
##   Year Sampling_location Epifauna.infauna Quadrat Fiddler_Crab.Uca_pugnex.
## 1 2019            Riprap         Epifauna       1                        0
## 2 2019            Riprap         Epifauna       2                        0
## 3 2019            Riprap         Epifauna       3                        0
## 4 2019            Riprap         Epifauna       4                        0
## 5 2019            Riprap         Epifauna       5                        0
## 6 2019            Riprap         Epifauna       6                        0
##   Amphipod.Gammarus_spp.. Sandworm.Nereis_spp..
## 1                       0                     0
## 2                      20                     0
## 3                       3                     0
## 4                       1                     0
## 5                      10                     0
## 6                      10                     0
##   Anthurid_Isopod.Cyathura_polita. Caprellid_amphipod.Caprella_spp..
## 1                                0                                 0
## 2                                0                                 0
## 3                                1                                 0
## 4                                0                                 0
## 5                                6                                 0
## 6                                0                                 0
##   Softshell_Clam.Mya_arenaria. Macoma_balthica Blue_crab.Callinectes_sapidus.
## 1                            0               0                              0
## 2                            0               0                              3
## 3                            0               0                              0
## 4                            0               0                              7
## 5                            6               2                              0
## 6                            1               0                              4
##   Sea_pill_bug.Sphaeroma_spp.. Ribbed_Mussel.Geukensia_demissa.
## 1                            0                                0
## 2                            0                                0
## 3                            0                                1
## 4                            0                                1
## 5                            1                                1
## 6                           10                                0
##   Eastern_oyster.Crassostrea_virginica. Sea_grape.Molgula_spp..
## 1                                     0                       0
## 2                                     0                       0
## 3                                     0                       0
## 4                                     0                       0
## 5                                     2                       0
## 6                                     0                       1
##   Barnacles.Semibalanus_spp.. Sand.Flea Mud.Snail Bloodworm Group...Notes
## 1                           0         0         0         0
## 2                          11         0         0         0
## 3                           0         0         0         0
## 4                           0         0         0         0
## 5                           1         0         0         0
## 6                           4         0         0         0
##   richness invSimpson
## 1        0         NA
## 2        3  2.1811321
## 3        3  2.2727273
## 4        3  1.5882353
## 5        8  4.5956284
## 6        6  3.8461538
```

lets build species accumulation curves to see how well we sampled

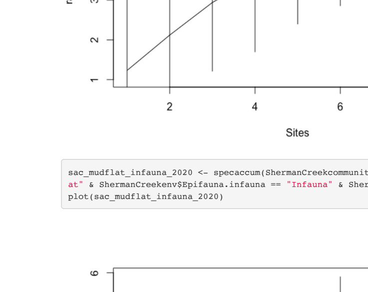
```
sac_all <- specaccum(ShermanCreekcommunity, "random")
#plot(sac_all)
```

This suggests we did a decent job sampling! But its for all of the samples! We need to break up for each subset.So

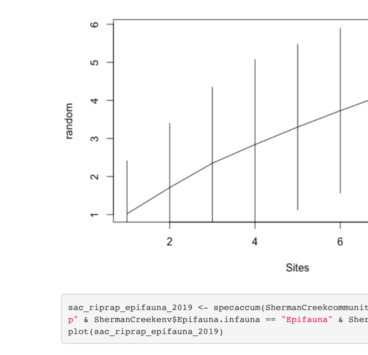
```
sac_mudflat <- specaccum(ShermanCreekcommunity[ShermanCreekenv$Sampling_location == "Mudflat",], "rando
m")
#plot(sac_mudflat)
```

or even

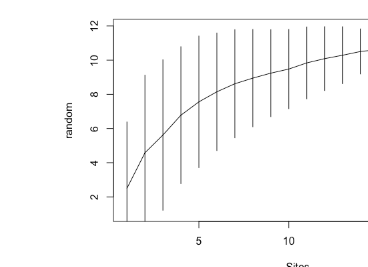
```
sac_mudflat_infauna_2019 <- specaccum(ShermanCreekcommunity[ShermanCreekenv$Sampling_location == "Mudfl
at" & ShermanCreekenv$Epifauna.infauna == "Infauna" & ShermanCreekenv$Year == "2019",], "random")
plot(sac_mudflat_infauna_2019, main = "mudflat infauna 2019")
```



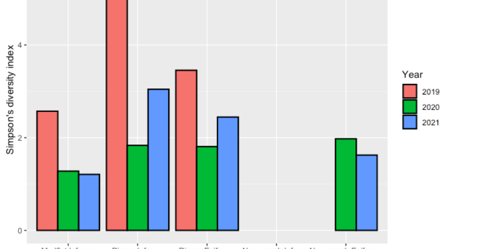

```
sac_mudflat_infauna_2020 <- specaccum(ShermanCreekcommunity[ShermanCreekenv$Sampling_location == "Mudfl
at" & ShermanCreekenv$Epifauna.infauna == "Infauna" & ShermanCreekenv$Year == "2020",], "random")
plot(sac_mudflat_infauna_2020)
```



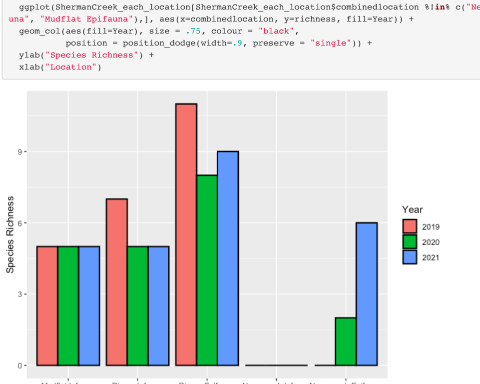

```
sac_riprap_epifauna_2019 <- specaccum(ShermanCreekcommunity[ShermanCreekenv$Sampling_location == "Ripra
p" & ShermanCreekenv$Epifauna.infauna == "Epifauna" & ShermanCreekenv$Year == "2019",], "random")
plot(sac_riprap_epifauna_2019)
```



```
ggplot(data = ceiling_cities_2017, aes(x = ceiling(Ceiling/Cost/Cost/Cost
```




```
ggplot(ShermanCreek_each_location[ShermanCreek_each_location$combinedlocation %!in% c("New Marsh Infauna", "Mudflat Epifauna"),], aes(x=combinedlocation, y=richness, fill=Year)) +
  geom_col(aes(fill=Year), size = .75, colour = "black",
           position = position_dodge(width=.9, preserve = "single")) +
  ylab("Species Richness") +
  xlab("Location")
```



As a way to combine everything above, maybe we plot species accumulation curves wiht donfidence intervals, then compare them. See https://rpubs.com/Roeland-KINDT/694021 and try it.

```
#add code here
if ("ggsci" %in% row.names(installed.packages()) == F){
  install.packages("ggsci")
}
library(ggsci)

BioR.theme <- theme(
        panel.background = element_blank(),
        panel.border = element_blank(),
        panel.grid = element_blank(),
        axis.line = element_line("gray25"),
        text = element_text(size = 12),
        axis.text = element_text(size = 10, colour = "gray25"),
        axis.title = element_text(size = 14, colour = "gray25"),
        legend.title = element_text(size = 14),
        legend.text = element_text(size = 14),
        legend.key = element_blank())

Accum.1 <- accumcomp(ShermanCreekcommunity[ShermanCreekenv$Sampling_location == "Riprap" & ShermanCreekenv$Epifauna.infauna == "Infauna",], y=ShermanCreekenv[ShermanCreekenv$Sampling_location == "Riprap" & ShermanCreekenv$Epifauna.infauna == "Infauna",], factor='Year',
    method='exact', conditioned=FALSE, plotit=FALSE)
Accum.1
```

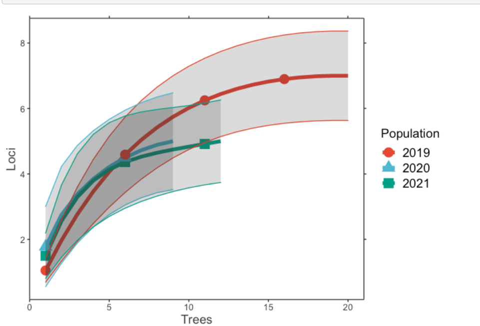
```
## , ,  = Sites
##
##       obs
## Year   1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
##   2019 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
##   2020 1 2 3 4 5 6 7 8 9 NA NA NA NA NA NA NA NA NA NA NA
##   2021 1 2 3 4 5 6 7 8 9 10 11 12 NA NA NA NA NA NA NA NA
##
## , ,  = Richness
##
##       obs
## Year           1         2         3         4         5         6         7
##   2019 1.0500000 1.9684211 2.7692982 3.4654283 4.0684340 4.5888287 5.0360810
##   2020 1.7777778 2.7500000 3.3809524 3.8492063 4.2142857 4.5000000 4.7222222
##   2021 1.5000000 2.5606061 3.2954545 3.7959596 4.1338384 4.3636364 4.5252525
##       obs
## Year           8         9        10        11        12        13        14
##   2019 5.4186791 5.7441950 6.0193498 6.2500774 6.4415893 6.5984391 6.7245872
##   2020 4.8888889 5.0000000        NA        NA        NA        NA        NA
##   2021 4.6464646 4.7454545 4.8333333 4.9166667 5.0000000        NA        NA
##       obs
## Year          15        16        17        18 19 20
##   2019 6.8234649 6.8980392 6.9508772 6.9842105  7  7
##   2020        NA        NA        NA        NA NA NA
##   2021        NA        NA        NA        NA NA NA
##
## , ,  = sd
##
##       obs
## Year            1          2          3          4          5          6
##   2019 0.17219564 0.30262908 0.39928619 0.46920740 0.51852310 0.55248148
##   2020 0.58747410 0.70937684 0.71537688 0.70571735 0.69808702 0.69482635
##   2021 0.33269365 0.52933197 0.63358987 0.67825874 0.68693163 0.67586531
##       obs
## Year            7          8          9         10         11         12
##   2019 0.57547176 0.59104867 0.60196678 0.61023409 0.61719109 0.62361468
##   2020 0.69609399 0.70084720 0.70953267         NA         NA         NA
##   2021 0.65589962 0.63419767 0.61556293 0.60323235 0.59925436 0.60467888
##       obs
## Year           13         14         15         16        17         18
##   2019 0.62983928 0.63588209 0.64155961 0.64658688 0.6506565 0.65350051
##   2020         NA         NA         NA         NA        NA         NA
##   2021         NA         NA         NA         NA        NA         NA
##       obs
## Year           19         20
##   2019 0.65494149 0.65494149
##   2020         NA         NA
##   2021         NA         NA
```

```
accum.long1 <- accumcomp.long(Accum.1, ci=NA, label.freq=5)
head(accum.long1)
```

```
##   Grouping Obs Sites  Richness         SD       LWR       UPR labelit
## 1     2021   1     1 1.5000000 0.33269365 0.8060132 2.1939868    TRUE
## 2     2021   2     2 2.5606061 0.52933197 1.4564389 3.6647732   FALSE
## 3     2021   3     3 3.2954545 0.63358987 1.9738092 4.6170999   FALSE
## 4     2021   4     4 3.7959596 0.67825874 2.3811367 5.2107825   FALSE
## 5     2021   5     5 4.1338384 0.68693163 2.7009241 5.5667527   FALSE
## 6     2021   6     6 4.3636364 0.67586531 2.9538060 5.7734667    TRUE
```

```
plotgg1 <- ggplot(data=accum.long1, aes(x = Sites, y = Richness, ymax = UPR, ymin = LWR)) +
    scale_x_continuous(expand=c(0, 1), sec.axis = dup_axis(labels=NULL, name=NULL)) +
    scale_y_continuous(sec.axis = dup_axis(labels=NULL, name=NULL)) +
    geom_line(aes(colour=Grouping), size=2) +
    geom_point(data=subset(accum.long1, labelit==TRUE),
               aes(colour=Grouping, shape=Grouping), size=5) +
    geom_ribbon(aes(colour=Grouping), alpha=0.2, show.legend=FALSE) +
    BioR.theme +
    scale_colour_npg() +
    labs(x = "Trees", y = "Loci", colour = "Population", shape = "Population")

plotgg1
```




```
Accum.2 <- accumcomp(ShermanCreekcommunity[ShermanCreekenv$Sampling_location == "Riprap" & ShermanCreekenv$Epifauna.infauna == "Epifauna",], y=ShermanCreekenv[ShermanCreekenv$Sampling_location == "Riprap" & ShermanCreekenv$Epifauna.infauna == "Epifauna",], factor='Year',
    method='exact', conditioned=FALSE, plotit=FALSE)
Accum.2
```

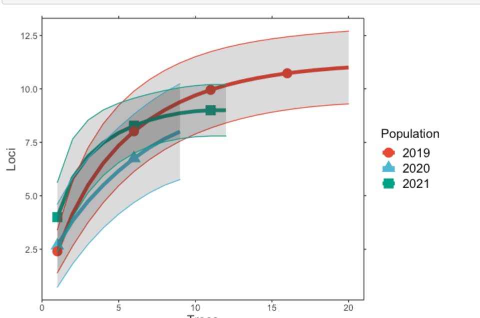
```
## , ,  = Sites
##
##       obs
## Year   1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
##   2019 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
##   2020 1 2 3 4 5 6 7 8 9 NA NA NA NA NA NA NA NA NA NA NA
##   2021 1 2 3 4 5 6 7 8 9 10 11 12 NA NA NA NA NA NA NA NA
##
## , ,  = Richness
##
##       obs
## Year           1         2         3         4         5         6         7
##   2019 2.4000000 4.1631579 5.4947368 6.5281734 7.3495872 8.0147059 8.5602167
##   2020 2.6666667 3.8333333 4.7380952 5.5000000 6.1666667 6.7500000 7.2500000
##   2021 4.0000000 5.8333333 6.8363636 7.4828283 7.9406566 8.2792208 8.5340909
##       obs
## Year           8         9        10       11        12        13        14
##   2019 9.0111296 9.3853715 9.6965295 9.955412 10.170898 10.350387 10.500052
##   2020 7.6666667 8.0000000        NA       NA        NA        NA        NA
##   2021 8.7252525 8.8636364 8.9545455 9.000000  9.000000        NA        NA
##       obs
## Year       15        16        17        18    19 20
##   2019 10.625 10.729412 10.816667 10.889474 10.95 11
##   2020     NA        NA        NA        NA    NA NA
##   2021     NA        NA        NA        NA    NA NA
##
## , ,  = sd
##
##       obs
## Year            1          2          3          4          5          6
##   2019 0.48275512 0.72534484 0.83838380 0.88566754 0.90144199 0.90265637
##   2020 0.93232682 0.96848930 0.96434038 0.96060016 0.97104121 0.99102727
##   2021 0.77940854 0.87397228 0.81447374 0.73513034 0.66643992 0.61656409
##       obs
## Year            7          8          9         10         11         12
##   2019 0.89710590 0.88827827 0.87786321 0.86686012 0.85598253 0.84577263
##   2020 1.01484788 1.04173864 1.07537573         NA         NA         NA
##   2021 0.58687435 0.57406205 0.57208472 0.57469167 0.57720726 0.57720726
##       obs
## Year           13        14         15         16         17         18
##   2019 0.83662698 0.8288115 0.82248666 0.81774183 0.81463256 0.81321638
##   2020         NA        NA         NA         NA         NA         NA
##   2021         NA        NA         NA         NA         NA         NA
##       obs
## Year          19         20
##   2019 0.8135853 0.81589598
##   2020        NA         NA
##   2021        NA         NA
```

```
accum.long2 <- accumcomp.long(Accum.2, ci=NA, label.freq=5)
head(accum.long2)
```

```
##   Grouping Obs Sites  Richness         SD       LWR       UPR labelit
## 1     2021   1     1 4.0000000 0.77940854 2.3741823 5.6258177    TRUE
## 2     2021   2     2 5.8333333 0.87397228 4.0102591 7.6564076   FALSE
## 3     2021   3     3 6.8363636 0.81447374 5.1374012 8.5353261   FALSE
## 4     2021   4     4 7.4828283 0.73513034 5.9493733 9.0162833   FALSE
## 5     2021   5     5 7.9406566 0.66643992 6.5504873 9.3308259   FALSE
## 6     2021   6     6 8.2792208 0.61656409 6.9930906 9.5653509    TRUE
```

```
plotgg2 <- ggplot(data=accum.long2, aes(x = Sites, y = Richness, ymax = UPR, ymin = LWR)) +
    scale_x_continuous(expand=c(0, 1), sec.axis = dup_axis(labels=NULL, name=NULL)) +
    scale_y_continuous(sec.axis = dup_axis(labels=NULL, name=NULL)) +
    geom_line(aes(colour=Grouping), size=2) +
    geom_point(data=subset(accum.long2, labelit==TRUE),
               aes(colour=Grouping, shape=Grouping), size=5) +
    geom_ribbon(aes(colour=Grouping), alpha=0.2, show.legend=FALSE) +
    BioR.theme +
    scale_colour_npg() +
    labs(x = "Trees", y = "Loci", colour = "Population", shape = "Population")

plotgg2
```




```
Accum.3 <- accumcomp(ShermanCreekcommunity[ShermanCreekenv$Sampling_location == "New marsh" & ShermanCreekenv$Epifauna.infauna == "Epifauna",], y=ShermanCreekenv[ShermanCreekenv$Sampling_location == "New marsh" & ShermanCreekenv$Epifauna.infauna == "Epifauna",], factor='Year',
    method='exact', conditioned=FALSE, plotit=FALSE)
Accum.3
```

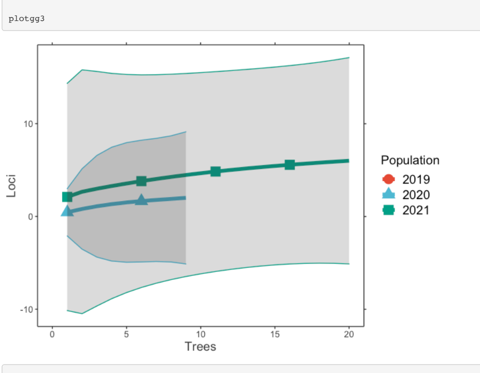
```
## , ,  = Sites
##
##       obs
## Year   1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20
##   2019 0 NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA NA
##   2020 1  2  3  4  5  6  7  8  9 NA NA NA NA NA NA NA NA NA NA NA
##   2021 1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20
##
## , ,  = Richness
##
##       obs
## Year            1          2         3         4         5         6         7
##   2019         NA         NA        NA        NA        NA        NA        NA
##   2020 0.44444444 0.80555556 1.0952381 1.3253968 1.5079365 1.6547619 1.7777778
##   2021 2.10000000 2.65789474 2.9868421 3.2771930 3.5482456 3.8017544 4.0385965
##       obs
## Year           8         9        10        11        12        13        14
##   2019        NA        NA        NA        NA        NA        NA        NA
##   2020 1.8888889 2.0000000        NA        NA        NA        NA        NA
##   2021 4.2596491 4.4657895 4.6578947 4.8368421 5.0035088 5.1587719 5.3035088
##       obs
## Year          15        16        17        18  19 20
##   2019        NA        NA        NA        NA  NA NA
##   2020        NA        NA        NA        NA  NA NA
##   2021 5.4385965 5.5649123 5.6833333 5.7947368 5.9  6
##
## , ,  = sd
##
##       obs
## Year            1          2          3          4          5          6
##   2019         NA         NA         NA         NA         NA         NA
##   2020 0.20049081 0.34078974 0.43127169 0.48286657 0.50717164 0.51632971
##   2021 0.96372233 1.03424606 0.99480852 0.95547177 0.92494699 0.90180529
##       obs
## Year            7          8          9         10         11         12
##   2019         NA         NA         NA         NA         NA         NA
##   2020 0.52227834 0.53500994 0.56033957         NA         NA         NA
##   2021 0.88434082 0.87113427 0.86107848 0.85337194 0.84749085 0.84314947
##       obs
## Year          13         14         15         16        17         18
##   2019        NA         NA         NA         NA        NA         NA
##   2020        NA         NA         NA         NA        NA         NA
##   2021 0.8402561 0.83886899 0.83915497 0.84135205 0.8457371 0.85259954
##       obs
## Year           19         20
##   2019         NA         NA
##   2020         NA         NA
##   2021 0.86222185 0.87486781
```

```
accum.long3 <- accumcomp.long(Accum.3, ci=NA, label.freq=5)
head(accum.long2)
```

```
##   Grouping Obs Sites  Richness         SD       LWR       UPR labelit
## 1     2021   1     1 4.0000000 0.77940854 2.3741823 5.6258177    TRUE
## 2     2021   2     2 5.8333333 0.87397228 4.0102591 7.6564076   FALSE
## 3     2021   3     3 6.8363636 0.81447374 5.1374012 8.5353261   FALSE
## 4     2021   4     4 7.4828283 0.73513034 5.9493733 9.0162833   FALSE
## 5     2021   5     5 7.9406566 0.66643992 6.5504873 9.3308259   FALSE
## 6     2021   6     6 8.2792208 0.61656409 6.9930906 9.5653509    TRUE
```

```
plotgg3 <- ggplot(data=accum.long3, aes(x = Sites, y = Richness, ymax = UPR, ymin = LWR)) +
    scale_x_continuous(expand=c(0, 1), sec.axis = dup_axis(labels=NULL, name=NULL)) +
    scale_y_continuous(sec.axis = dup_axis(labels=NULL, name=NULL)) +
    geom_line(aes(colour=Grouping), size=2) +
    geom_point(data=subset(accum.long3, labelit==TRUE),
               aes(colour=Grouping, shape=Grouping), size=5) +
    geom_ribbon(aes(colour=Grouping), alpha=0.2, show.legend=FALSE) +
    BioR.theme +
    scale_colour_npg() +
    labs(x = "Trees", y = "Loci", colour = "Population", shape = "Population")

plotgg3
```




```
Accum.4 <- accumcomp(ShermanCreekcommunity[ShermanCreekenv$Sampling_location == "Mudflat" & ShermanCreekenv$Epifauna.infauna == "Infauna",], y=ShermanCreekenv[ShermanCreekenv$Sampling_location == "Mudflat" & ShermanCreekenv$Epifauna.infauna == "Infauna",], factor='Year',
    method='exact', conditioned=FALSE, plotit=FALSE)
Accum.4
```

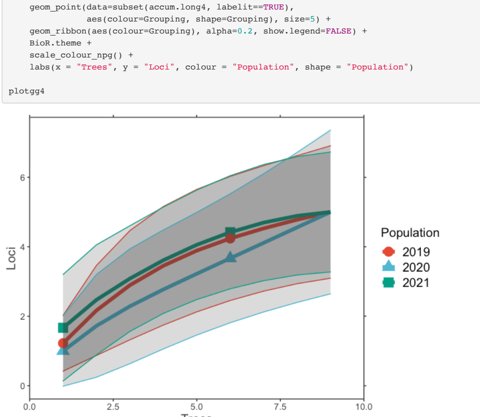
```
## , ,  = Sites
##
##       obs
## Year   1 2 3 4 5 6 7 8 9
##   2019 1 2 3 4 5 6 7 8 9
##   2020 1 2 3 4 5 6 7 8 9
##   2021 1 2 3 4 5 6 7 8 9
##
## , ,  = Richness
##
##       obs
## Year           1         2         3         4         5         6         7
##   2019 1.2222222 2.1666667 2.8928571 3.4523810 3.8888889 4.2380952 4.5277778
##   2020 1.0000000 1.7222222 2.2857143 2.7698413 3.2222222 3.6666667 4.1111111
##   2021 1.6666667 2.4722222 3.0833333 3.6111111 4.0555556 4.4166667 4.6944444
##       obs
## Year           8 9
##   2019 4.7777778 5
##   2020 4.5555556 5
##   2021 4.8888889 5
##
## , ,  = sd
##
##       obs
## Year            1          2          3          4          5          6
##   2019 0.35552932 0.57338786 0.69510059 0.75489738 0.77975879 0.78969863
##   2020 0.44882379 0.65386976 0.73035156 0.75697680 0.78027080 0.82013484
##   2021 0.67804870 0.70012267 0.67227323 0.67675450 0.69677528 0.71983507
##       obs
## Year            7          8          9
##   2019 0.79844482 0.81455527 0.84287106
##   2020 0.87938940 0.95442977 1.04185055
##   2021 0.73907819 0.75265098 0.76301689
```

```
accum.long4 <- accumcomp.long(Accum.4, ci=NA, label.freq=5)
head(accum.long2)
```

```
##   Grouping Obs Sites  Richness         SD       LWR       UPR labelit
## 1     2021   1     1 4.0000000 0.77940854 2.3741823 5.6258177    TRUE
## 2     2021   2     2 5.8333333 0.87397228 4.0102591 7.6564076   FALSE
## 3     2021   3     3 6.8363636 0.81447374 5.1374012 8.5353261   FALSE
## 4     2021   4     4 7.4828283 0.73513034 5.9493733 9.0162833   FALSE
## 5     2021   5     5 7.9406566 0.66643992 6.5504873 9.3308259   FALSE
## 6     2021   6     6 8.2792208 0.61656409 6.9930906 9.5653509    TRUE
```

```
plotgg4 <- ggplot(data=accum.long4, aes(x = Sites, y = Richness, ymax = UPR, ymin = LWR)) +
    scale_x_continuous(expand=c(0, 1), sec.axis = dup_axis(labels=NULL, name=NULL)) +
    scale_y_continuous(sec.axis = dup_axis(labels=NULL, name=NULL)) +
    geom_line(aes(colour=Grouping), size=2) +
    geom_point(data=subset(accum.long4, labelit==TRUE),
               aes(colour=Grouping, shape=Grouping), size=5) +
    geom_ribbon(aes(colour=Grouping), alpha=0.2, show.legend=FALSE) +
    BioR.theme +
    scale_colour_npg() +
    labs(x = "Trees", y = "Loci", colour = "Population", shape = "Population")

plotgg4
```



other places to check for ideas on tests.

- https://rstudio-pubs-static.s3.amazonaws.com/210845_860b29c5e0a643f987a80179b61bcf16.html
- https://cran.r-project.org/web/packages/iNEXT/vignettes/Introduction.html

We can also consider how density/abundance varies over time. To do this we need to figure out how many quadrats/units were sampled for each site

```
#get total # for each year/location/epi
ShermanCreek_each_location_melted <- melt(ShermanCreek_each_location,
                                          id.vars = 1:3, measure.vars = 4:19)
#get total # of sites for each year/location/epi
quadrats_per_site <- dcast(ShermanCreek, Year + Sampling_location +
                           Epifauna.infauna ~ "QuadratCount", drop = F)
```

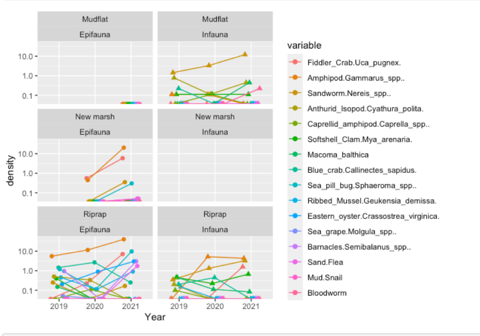
```
## Using invSimpson as value column: use value.var to override.
```

```
## Aggregation function missing: defaulting to length
```

```
#merge
ShermanCreek_each_location_melted <- merge(ShermanCreek_each_location_melted, quadrats_per_site, all.x=T, all.y=T)
ShermanCreek_each_location_melted$density <- ShermanCreek_each_location_melted$value/
  ShermanCreek_each_location_melted$QuadratCount


ggplot(ShermanCreek_each_location_melted, aes(y= density, x = Year,
                                              color = variable, shape = Epifauna.infauna)) +
         geom_point(position = position_dodge(.5), stat="identity", size=2) +
    geom_line(position = position_dodge(.5), aes(group=variable)) +
  scale_y_continuous(trans='log10') +
  facet_wrap(~Sampling_location + Epifauna.infauna, ncol=2) +
  guides(shape = F)
```

```
## geom_path: Each group consists of only one observation. Do you need to adjust
## the group aesthetic?
```




```
ShermanCreek_each_location_melted_NewMarsh <- subset(ShermanCreek_each_location_melted, Sampling_location == "New marsh" & Epifauna.infauna == "Epifauna" & variable %in% c("Amphipod.Gammarus_spp..","Sandworm.Nereis_spp..","Fiddler_Crab.Uca_pugnex.","Sea_pill_bug.Sphaeroma_spp..") & Year %in% c(2020,2021))

ShermanCreek_each_location_melted_NewMarsh$Species <- ShermanCreek_each_location_melted_NewMarsh$variable

ShermanCreek_each_location_melted_NewMarsh$Species <-   revalue(ShermanCreek_each_location_melted_NewMarsh$Species,
          c("Fiddler_Crab.Uca_pugnex." = "Fiddler Crab",
            "Amphipod.Gammarus_spp.." = "Amphipod",
            "Sandworm.Nereis_spp.." ="Sandworm",
            "Sea_pill_bug.Sphaeroma_spp.." = "Sea Pill Bug"))

ggplot(ShermanCreek_each_location_melted_NewMarsh, aes(y= density, x = Year,
                                              color = Species)) +
         geom_point(position = position_dodge(.5), stat="identity", size=4) +
    geom_line(position = position_dodge(.5), aes(group=variable), size=1.3) +
  scale_color_manual("Species", values = c("Fiddler Crab" = "#F08080", "Amphipod" = "#3CB371", "Sandworm" = "#00FFFF", "Sea Pill Bug" = "#0000FF")) +
  scale_y_continuous(trans='log10') +
  guides(shape = F) +
  ggtitle("Select New Marsh Epifauna Density") +
  # labs(title ="Relationship between net migration and GDP",
  #      subtitle = "Data from ENTER YEARS HERE",
  #      caption = "Enter caption here",
  #      tag = "Figure 1",
  #      x = "GDP per capita (US $)",
  #      y = "Net migration") +
  ylab("Density") +
  xlab("Year")
```

Run statistical tests

The most useful function here is **lm**; it covers most tests from classical statistics.

```
#lm()
```

Final plots

Clean up any of your **ggplot2** plots here!