### KEY:

Red – used for R functions

Blue – used for changeable information (ie. The names of objects/data frames)

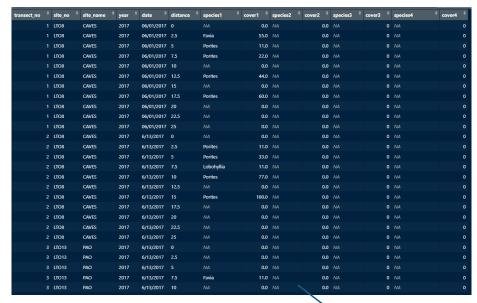
Black – used for non-negotiable parts of the code (must be in there to allow the code to run correctly)

Steps to Follow	Notes	
1. Set working directory and/or load in data		
setwd('Working Directory Folder 1/Folder2/Folder3')	When using the setwd	
data<-read.csv('data.csv', header = TRUE)	function, you must	
	create a pathway of	
	folders leading to the	
	files of interest, this ca	n
	require any number of	
	folders not just 3 as	
	shown in the example.	
	If multiple files are to b	e
	used simultaneously,	
	the final and most	
	specific folder name	
	should be the one that	
	holds all of the files of	
	interest.	Commented [AF1]: Maybe add to the add
		section, how to coalate multiple files
2. Create a matrix of species and species cover		
Library(tidyverse)	Creates a dataframe	
Library(reshape)	which replicates each	
	species by each	
matrix<-data %>%	percentage cover value	e
<pre>group_by( transect_no, site_no, site_name, date, distance ) %&gt;%</pre>	for every 'group_by'	
pivot_longer(cols=c(7,9,11,13),values_to='species',names_to='S_number')%>%	value.	
pivot_longer(cols=c(7,8,9,10),values_to='percentage',names_to='P_number')		
	IE. For each distance o	n
	the transect we have	
	four possible species	
	and their associated	
	four possible	
	percentage cover	
	values. Therefore 16	
	possible combinations	
	for each grouped value	

Extract identifiers from columns to pair species names and species cover	
matrix\$species_num <- as.numeric(gsub("[^0-9]", "", matrix\$S_number))	Creates two additional columns which are a
matrix\$cover_num <- as.numeric(gsub("[^0-9]", "", matrix\$P_number))	copy of S-number and P-number columns from previous step. Uses a gsub function to only include numbers 0-9, removing characters seen in these columns.  This range of numbers can be changed dependent on how many species and percentage cover values that you have for each set of group_by values.
4. Filter data and remove unnecessary rows/columns	
summarised_data <- matrix %>%  filter(species_num == cover_num) %>%  select(-S_number, -P_number, -species_num, -cover_num)	Produces a new dataframe which holds only rows where the species_num and cover_num match using the filter function.  Select is used to remove any unnecessary columns in the data frame after rows where numbers match have been filtered for.
OPTIONAL: Clean data to remove NA's	Will drop all rows with
Library(dplyr)  clean<-summarised_data%>%  group_by(transect_no, site_no, year, date, site_name, distance, species)%>%  drop_na(species)%>%  dplyr::summarise(total=sum(percentage_cover))	Will drop all rows with NA's  Can also remove distance if wanting to look across entire transect.

### **Example Outputs & Explanations**

1. Set working directory and/or load in data

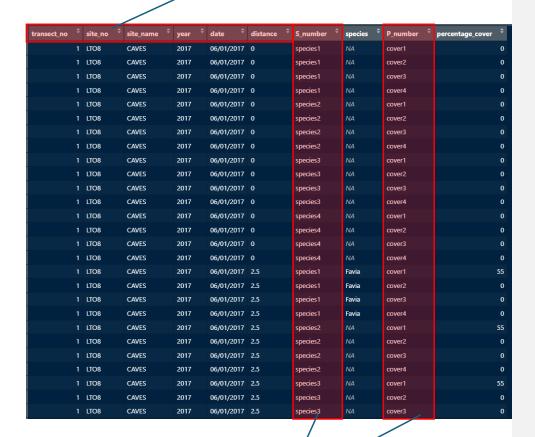


The output of the read.csv function should display data in the same format as the excel/csv file being read in.

	_	_	_	_		_			/		_		
transect_r	site_no	site_name	year	date	distance	species1	cover1	species2	cover2	species3	cover3	species4	cover4
1	LTO8	CAVES	2017	06/01/2017	0	NA	0	NA	0	NA	0	NA	
1	LTO8	CAVES	2017	06/01/2017	2.5	Favia	55	NA	0	NA	0	NA	
1	LTO8	CAVES	2017	06/01/2017	5	Porites	11	NA	0	NA	0	NA	
1	LTO8	CAVES	2017	06/01/2017	7.5	Porites	22	NA	0	NA	0	NA	
1	LTO8	CAVES	2017	06/01/2017	10	NA	0	NA	0	NA	0	NA	
1	LTO8	CAVES	2017	06/01/2017	12.5	Porites	44	NA	0	NA	0	NA	
1	LTO8	CAVES	2017	06/01/2017	15	NA	0	NA	0	NA	0	NA	
1	LTO8	CAVES	2017	06/01/2017	17.5	Porites	60	NA	0	NA	0	NA	
1	LTO8	CAVES	2017	06/01/2017	20	NA	0	NA	0	NA	0	NA	
1	LTO8	CAVES	2017	06/01/2017	22.5	NA	0	NA	0	NA	0	NA	
1	LTO8	CAVES	2017	06/01/2017	25	NA	0	NA	0	NA	0	NA	
2	LTO8	CAVES	2017	6/13/2017	0	NA	0	NA	0	NA	0	NA	
2	LTO8	CAVES	2017	6/13/2017	2.5	Porites	11	NA	0	NA	0	NA	
2	LTO8	CAVES	2017	6/13/2017	5	Porites	33	NA	0	NA	0	NA	
2	LTO8	CAVES	2017	6/13/2017	7.5	Lobohyllia	11	NA	0	NA	0	NA	
2	LTO8	CAVES	2017	6/13/2017	10	Porites	77	NA	0	NA	0	NA	
2	LTO8	CAVES	2017	6/13/2017	12.5	NA	0	NA	0	NA	0	NA	
2	LTO8	CAVES	2017	6/13/2017	15	Porites	100	NA	0	NA	0	NA	
2	LTO8	CAVES	2017	6/13/2017	17.5	NA	0	NA	0	NA	0	NA	
2	LTO8	CAVES	2017	6/13/2017	20	NA	0	NA	0	NA	0	NA	
2	LTO8	CAVES	2017	6/13/2017	22.5	NA	0	NA	0	NA	0	NA	
2	LTO8	CAVES	2017	6/13/2017	25	NA	0	NA	0	NA	0	NA	
3	LTO13	PAO	2017	6/13/2017	0	NA	0	NA	0	NA	0	NA	
3	LTO13	PAO	2017	6/13/2017	2.5	NA	0	NA	0	NA	0	NA	
3	LTO13	PAO	2017	6/13/2017	5	NA	0	NA	0	NA	0	NA	
3	LTO13	PAO	2017	6/13/2017	7.5	Favia	11	NA	0	NA	0	NA	
3	LTO13	PAO	2017	6/13/2017	10	NA	0	NA	0	NA	0	NA	
3	LTO13	PAO	2017	6/13/2017	12.5	Favia	11	Porites	11	NA	0	NA	
3	LTO13	PAO	2017	6/13/2017	15	Porites	11	NA	0	NA	0	NA	

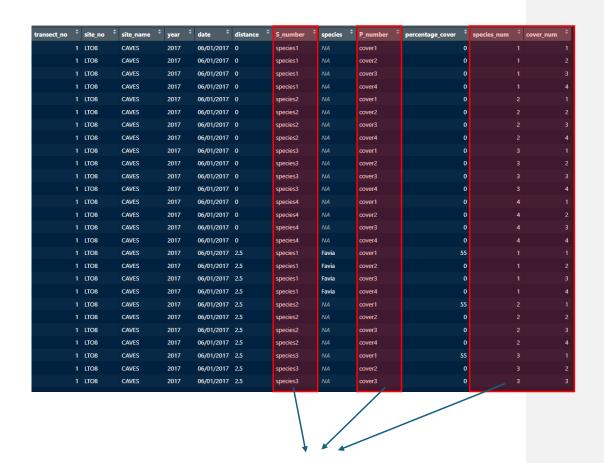
2. Create a matrix of species and species cover

Group\_by columns which remain the same



Shows where each of the four species for each set of group\_by values is paired with each of the four possible percentage cover values for the same set of group\_by values.

3. Extract identifiers from columns to pair species names and species cover



The numbers in the S\_number column should match those in the new species\_num column and the same with P\_number & cover\_num. Ensure that this is correct as a sanity check.

The only difference between columns should be the removes of characters from the new columns completed by the gsub function.

# 4. Filter data and remove unnecessary rows/columns

1 LTO8 CAVES 2017 06/01/2017 0 NA 0 1 LTO8 CAVES 2017 06/01/2017 2.5 Favia 5.5 1 LTO8 CAVES 2017 06/01/2017 2.5 NA 0 1 LTO8 CAVES 2017 06/01/2017 5 NA 0 1 LTO8 CAVES 2017 06/01/2017 7.5 NA 0 1 LTO8 CAVES 2017 06/01/2017 10 NA 0 1 LTO8 CAVES 2017 06/01/2017 12.5 NA 0	transect_no	<b>‡</b>	site_no	<b>‡</b>	site_name	<b>‡</b>	year	<b>‡</b>	date ‡	distance ‡	species ‡	percentage_cover	<b>‡</b>
1 LTOB CAVES 2017 06/01/2017 0 NA 0 1 LTOB CAVES 2017 06/01/2017 2.5 Favia 555 1 LTOB CAVES 2017 06/01/2017 2.5 NA 0 1 LTOB CAVES 2017 06/01/2017 2.5 NA 0 1 LTOB CAVES 2017 06/01/2017 2.5 NA 0 1 LTOB CAVES 2017 06/01/2017 5 NA 0 1 LTOB CAVES 2017 06/01/2017 7.5 NA 0 1 LTOB CAVES 2017 06/01/2017 10 NA 0 1 LTOB CAVES 2017 06/01/2017 12.5		1		_		_		_				,	0
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1 LTO8 CAVES 2017 06/01/2017 7.5 NA 0  1 LTO8 CAVES 2017 06/01/2017 7.5 NA 0  1 LTO8 CAVES 2017 06/01/2017 7.5 NA 0  1 LTO8 CAVES 2017 06/01/2017 1.5 NA 0  1 LTO8 CAVES 2017 06/01/2017 10 NA 0  1 LTO8 CAVES 2017 06/01/2017 12.5 Porites 44  1 LTO8 CAVES 2017 06/01/2017 12.5 NA 0		1	LTO8		CAVES		2017				Porites		22
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1 LTO8 CAVES 2017 06/01/2017 10 NA 0 1 LTO8 CAVES 2017 06/01/2017 12.5 Porites 44 1 LTO8 CAVES 2017 06/01/2017 12.5 NA 0		1	LTO8		CAVES		2017				NA		0
1 LTO8 CAVES 2017 06/01/2017 10 NA 0 1 LTO8 CAVES 2017 06/01/2017 12.5 Porites 44 1 LTO8 CAVES 2017 06/01/2017 12.5 NA 0		1	LTO8		CAVES		2017		06/01/2017	7.5	NA		0
1 LTO8 CAVES 2017 06/01/2017 10 NA 0 1 LTO8 CAVES 2017 06/01/2017 10 NA 0 1 LTO8 CAVES 2017 06/01/2017 12.5 Porites 44 1 LTO8 CAVES 2017 06/01/2017 12.5 NA 0		1	LTO8		CAVES		2017		06/01/2017	10	NA		0
1 LTO8 CAVES 2017 06/01/2017 10 NA 0 1 LTO8 CAVES 2017 06/01/2017 12.5 Porites 44 1 LTO8 CAVES 2017 06/01/2017 12.5 NA 0 1 LTO8 CAVES 2017 06/01/2017 15 NA 0		1	LTO8		CAVES		2017		06/01/2017	10	NA		0
1 LTO8 CAVES 2017 06/01/2017 12.5 Porites 44 1 LTO8 CAVES 2017 06/01/2017 12.5 NA 0 1 LTO8 CAVES 2017 06/01/2017 15 NA 0		1	LTO8		CAVES		2017		06/01/2017	10	NA		0
1 LTO8 CAVES 2017 06/01/2017 12.5 NA 0 1 LTO8 CAVES 2017 06/01/2017 15 NA 0		1	LTO8		CAVES		2017		06/01/2017	10	NA		0
1 LTO8 CAVES 2017 06/01/2017 12.5 NA 0 1 LTO8 CAVES 2017 06/01/2017 12.5 NA 0 1 LTO8 CAVES 2017 06/01/2017 15 NA 0		1	LTO8		CAVES		2017		06/01/2017	12.5	Porites		44
1 LTO8 CAVES 2017 06/01/2017 12.5 NA 0 1 LTO8 CAVES 2017 06/01/2017 15 NA 0		1	LTO8		CAVES		2017		06/01/2017	12.5	NA		0
1 LTO8 CAVES 2017 06/01/2017 15 NA 0		1	LTO8		CAVES		2017		06/01/2017	12.5	NA		0
		1	LTO8		CAVES		2017		06/01/2017	12.5	NA		0
1 ITOB CAVES 2017 05/01/2017 15 AVA		1	LTO8		CAVES		2017		06/01/2017	15	NA		0
1 LIO6 CAVES 2017 00/01/2017 13 NA 0		1	LTO8		CAVES		2017		06/01/2017	15	NA		0
1 LTO8 CAVES 2017 06/01/2017 15 NA 0		1	LTO8		CAVES		2017		06/01/2017	15	NA		0

New dataframe should display correct number of rows for species and percentage cover values for each transect.

### OPTIONAL STEP

transect_no ‡	site_no ‡	year ‡	date ‡	site_name ‡	distance ‡	species ‡	total ‡
1	LTO8	2017	06/01/2017	CAVES	2.5	Favia	55.0
1	LTO8	2017	06/01/2017	CAVES	5	Porites	11.0
1	LTO8	2017	06/01/2017	CAVES	7.5	Porites	22.0
1	LTO8	2017	06/01/2017	CAVES	12.5	Porites	44.0
1	LTO8	2017	06/01/2017	CAVES	17.5	Porites	60.0
2	LTO8	2017	6/13/2017	CAVES	2.5	Porites	11.0
2	LTO8	2017	6/13/2017	CAVES	5	Porites	33.0
2	LTO8	2017	6/13/2017	CAVES	7.5	Lobohyllia	11.0
2	LTO8	2017	6/13/2017	CAVES	10	Porites	77.0
2	LTO8	2017	6/13/2017	CAVES	15	Porites	100.0
3	LTO13	2017	6/13/2017	PAO	7.5	Favia	11.0
3	LTO13	2017	6/13/2017	PAO	12.5	Favia	11.0
3	LTO13	2017	6/13/2017	PAO	12.5	Porites	11.0
3	LTO13	2017	6/13/2017	PAO	15	Porites	11.0
3	LTO13	2017	6/13/2017	PAO	20	Acropora	33.0
3	LTO13	2017	6/13/2017	PAO	25	Lobophytum	22.0
4	LTO10	2017	6/15/2017	DEVILS	12.5	Lobophytum	11.0
4	LTO10	2017	6/15/2017	DEVILS	17.5	Lobophytum	11.0
4	LTO10	2017	6/15/2017	DEVILS	17.5	Pocllipora	22.0
4	LTO10	2017	6/15/2017	DEVILS	20	Lobophytum	11.0
4	LTO10	2017	6/15/2017	DEVILS	22.5	Porites	11.0
4	LTO10	2017	6/15/2017	DEVILS	22.5	Sinularia	44.0
5	ITO10	2017	6/17/2017	DEVII S	175	Lohonhytum	11 0

#### **Additional Useful Functions**

- Str(data) outputs a list of data frame columns and the operators by which they are read in R. Most commonly, data will be formatted numerically or as factors, characters and integers.
- Data\$column\_name<-as.numeric(Data\$column\_name) used to rectify when
  a column is read incorrectly in R. This code would be used to force R to read the
  specified column as numeric, however similar code can be used to force data
  into character and factor operators. This would done using changes to the
  function such as:</li>
  - o as.character
  - o as.factor
- install.packages("package\_name") This SOP requires packages 'reshape', 'tidyverse' and 'dplyr'. If when running the library(package) function, the output produces an error it may be because the package has not yet been installed. In this instance use the above code.
- library(openxlsx)

write.xlsx(data, file = "Name\_Data.xlsx") - used to save the reshaped data
frame to the device as a new excel file.

Online Code and Data File for Examples can be found using the github:

https://github.com/amberf02/LTO-benthic-data-reshape.git