Med Sea Photo Survey Analysis

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Our Data - Data collection

Marine Conservation

1. New in Israel
2. Many anthropogenic threats
3. Climate change
4. **Good** Data = better conservation

Data source:The Morris Kahn Marine Research Station

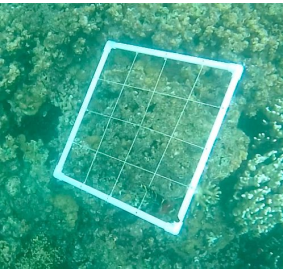
Object Recognition Algorithm & Sampling Method

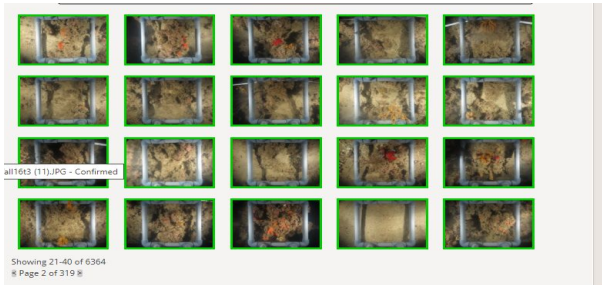
Photo Survey

- Photo-quadrats (25 cm2) every 2 meters along a 25 meter transect line.
- 4 transect lines at each site (& depth).
- Upload photo to Coralnet website for Automated annotation.

Stratified Random Annotation Model

- Using stratified random annotation point generator - 4 x 4 matrix - generate 16 rows for every photo.
- Taxa group is automatically classified at 90% confidence level, if not classification entered manually.





Data Description

- Sample Date - 90 sampling days
- Season - Fall, Spring
- Site -5 different sites
- Depth -10,25,45
- Transect - 1-4
- Object Name \ Organism - 63 different organisms
- Taxonomy Group - 11 tax groups

	site_depth	season	depth	sample_date	transect	object_name	taxonomy_group	sample_year	sample_month	site	freq
0	Achziv10	Fall	10	2015-11-18	1	Algae matrix	Algae	2015	2015-11	Achziv	10
1	Achziv10	Fall	10	2015-11-18	1	Amphiroa sp.	Algae	2015	2015-11	Achziv	2
2	Achziv10	Fall	10	2015-11-18	1	CCA	Algae	2015	2015-11	Achziv	1

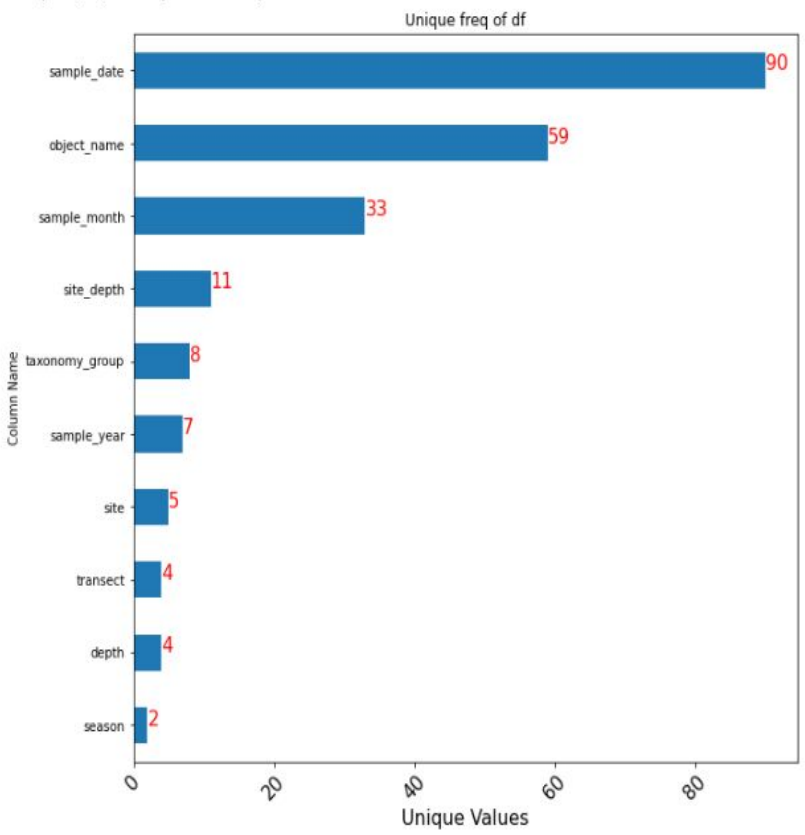
Steps and Research Questions

- Data exploration
- Descriptive Statistics
- Is there a correlation between the different organisms ?
- How rich Is the organisms diversity along the different sites and years? is there a big difference ?
- Which of the sites is the most stable?

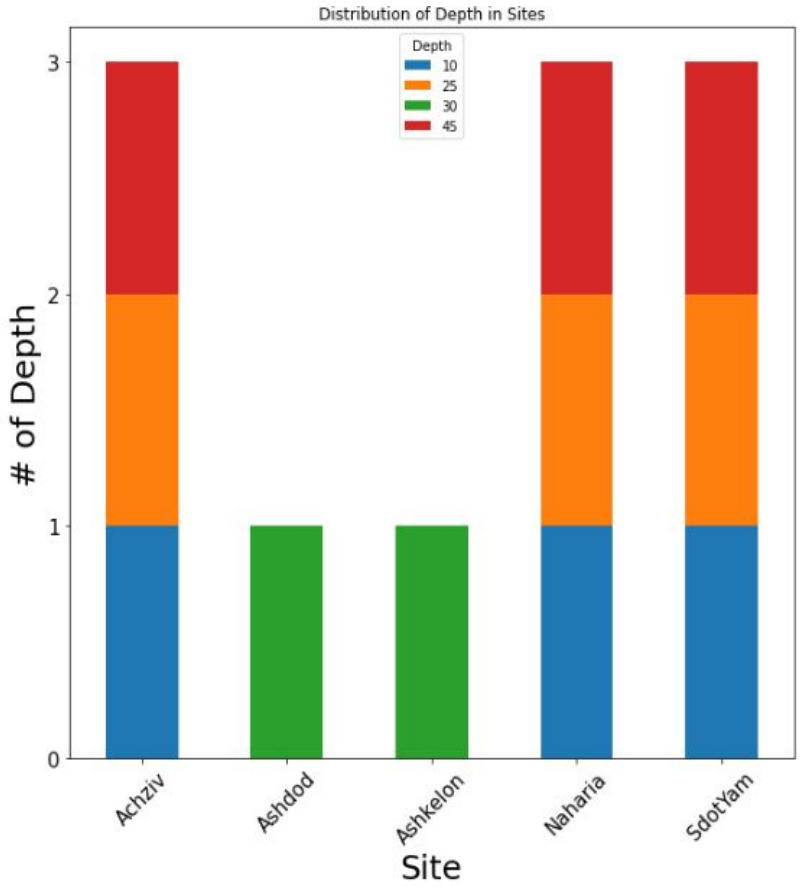
Descriptive Statistics

Unique Values Distribution

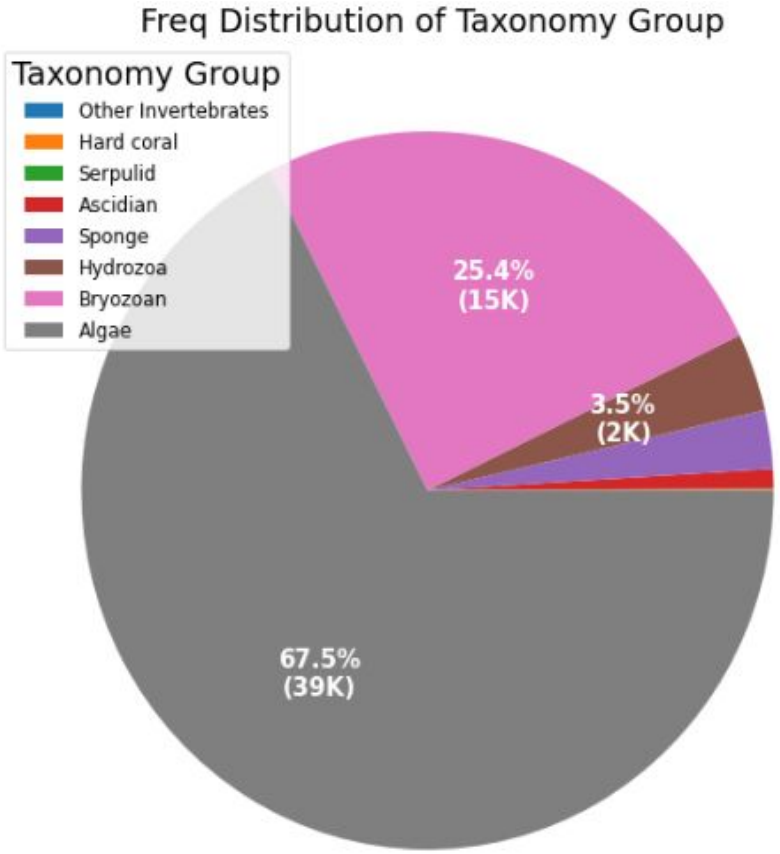
Unique Values in DF

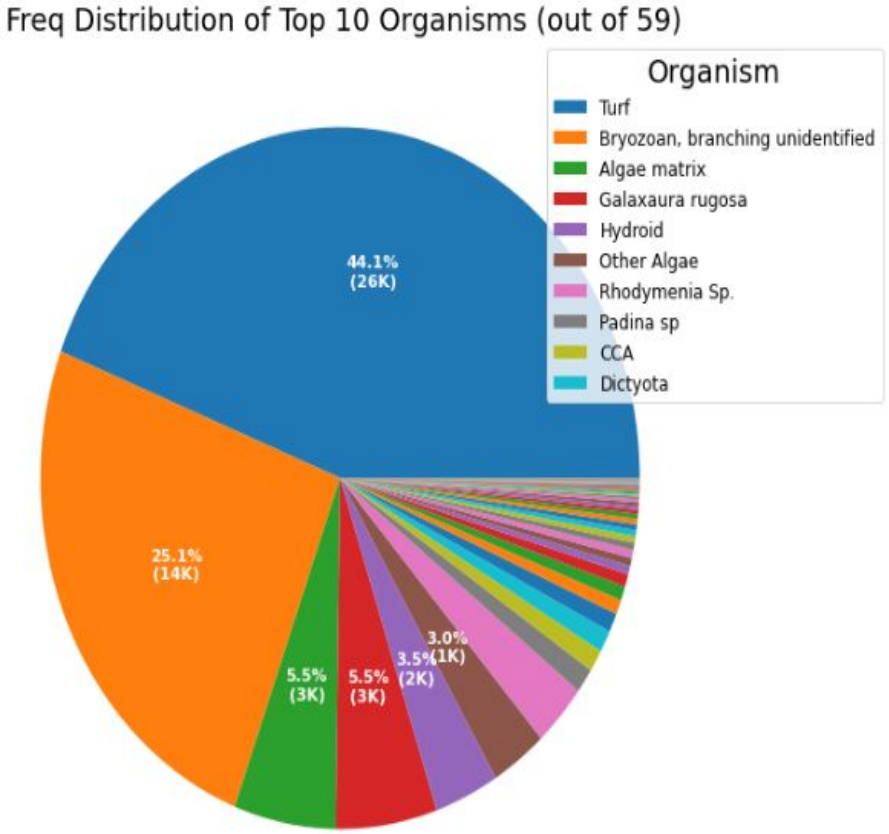


Distribution of Depth in sites



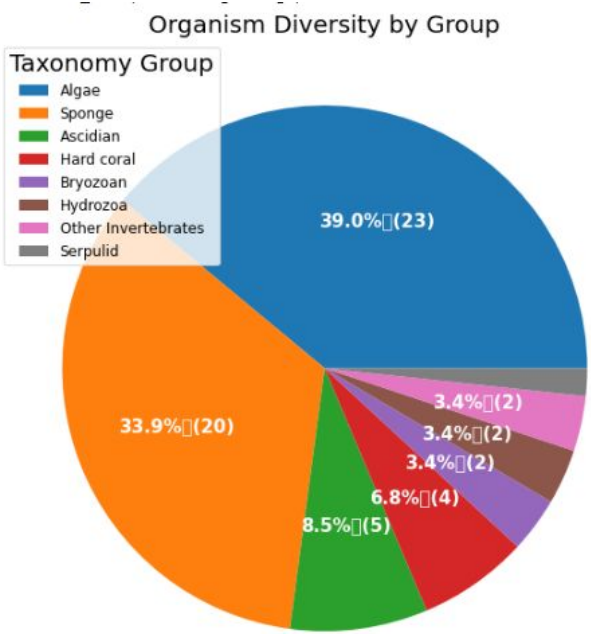
Distributions of Organisms



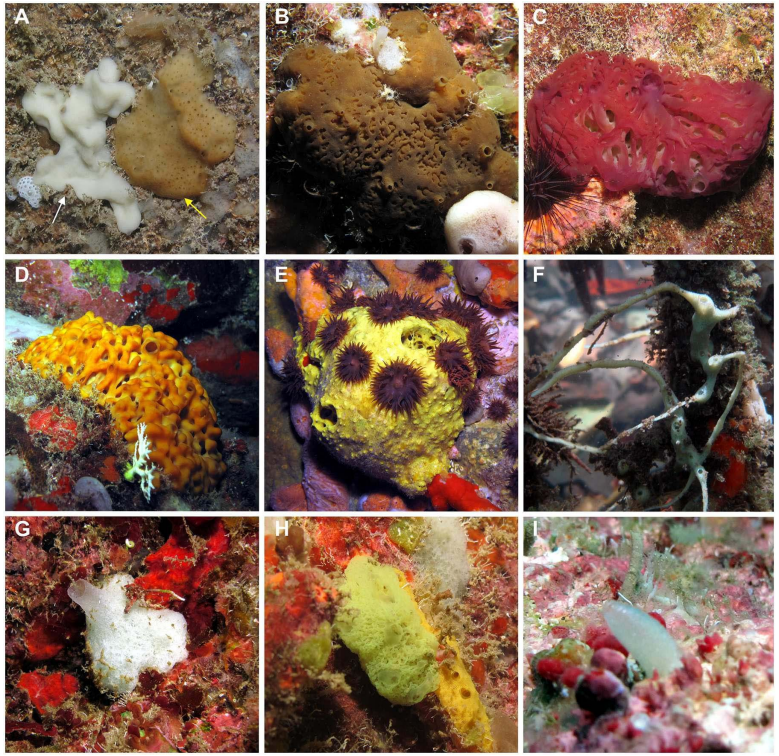


Organism Diversity By Group

- ‘Sponge’ - High diversity low frequency(<3%).

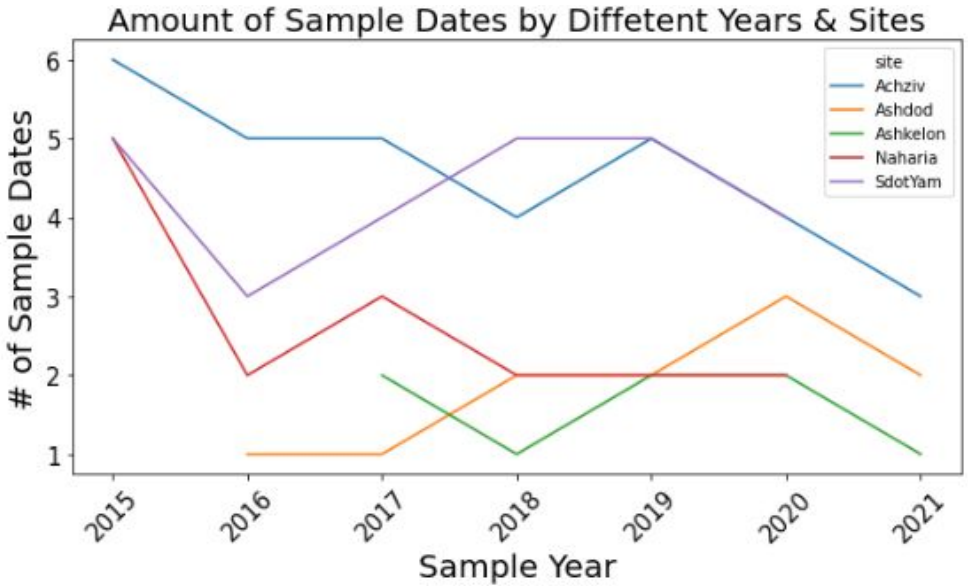


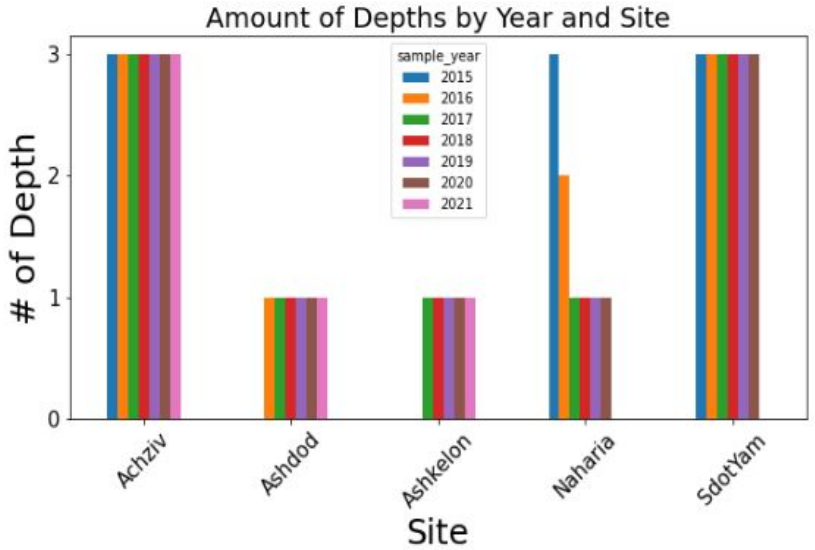
Example of Sponge species



Potential Bias in the Data

- Ashkelon and Ashdod - less sample dates ; one depth only .
- Inconsistent number of sample dates along the years.
- Different sample dates between sites & depths .
- Non organism groups (shadow , sand etc.).



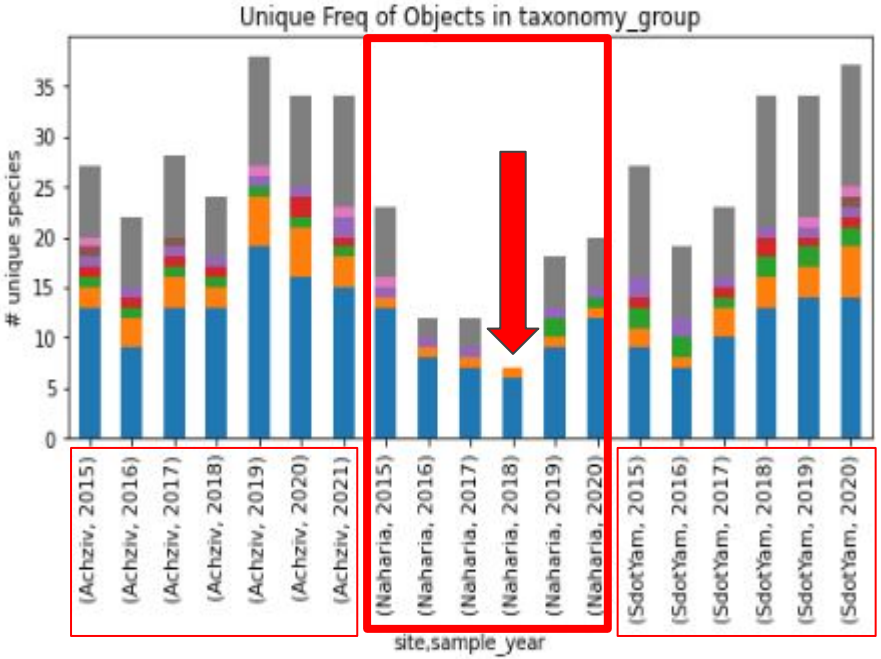


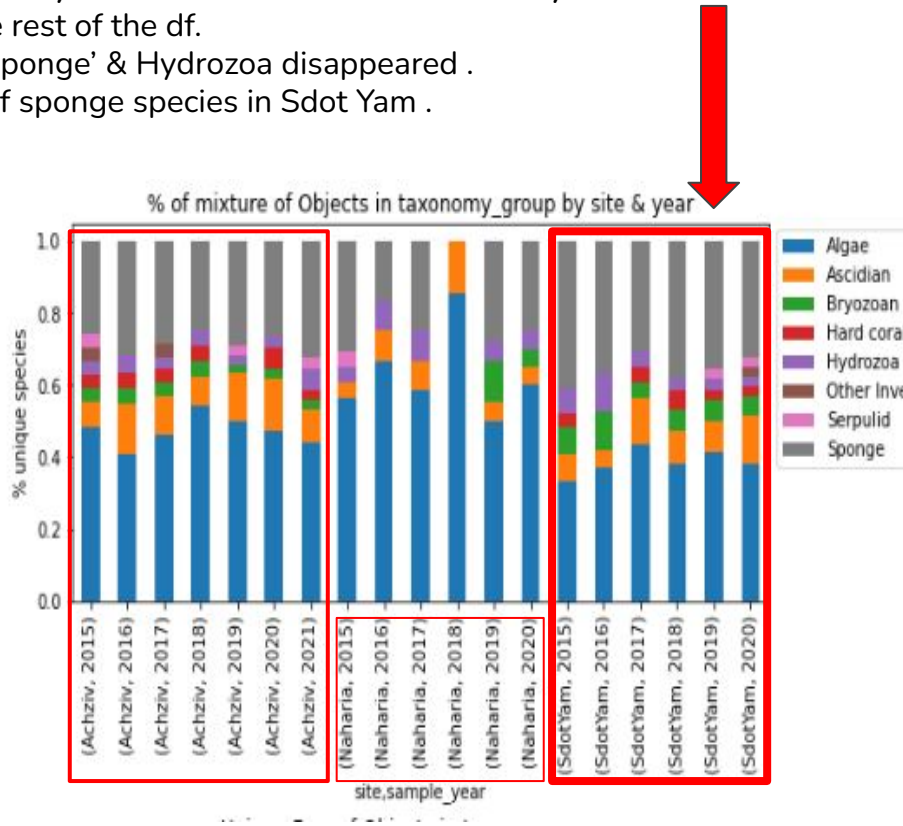
Correlations & Drill downs

Diversity Analysis (1)

Is there any differences in the biological diversity between different sites and years ?

- Separate between Ashkelon & Ashdod to the rest of the df.
- Sharp Drop in Naharia ,2015-2018 ; 2018 'Sponge' & Hydrozoa disappeared .
- Absence of hard coral in Naharia , higher % of sponge species in Sdot Yam .

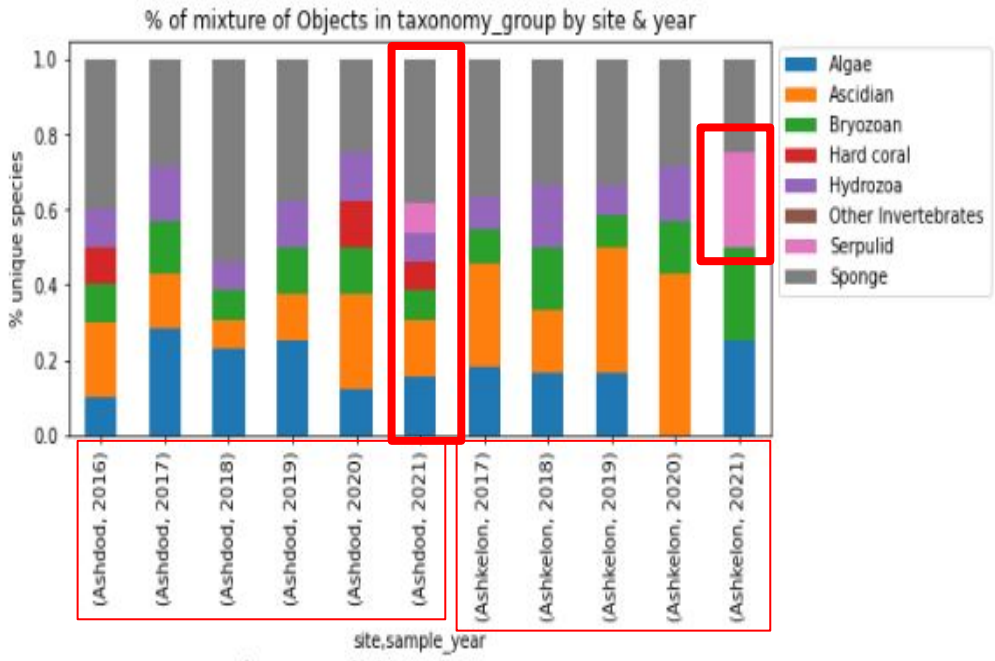


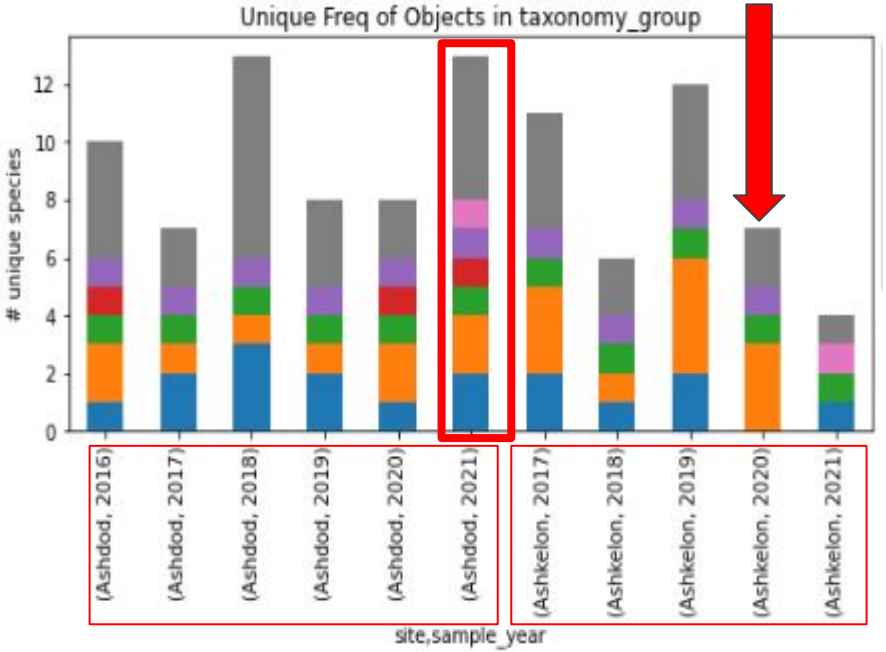


- How rich Is the organisms diversity along the different sites and years?

Diversity Analysis (2)

- Changes along the years - Ashkelon 2020 , Ashdod 2018
- Low % of Algae species compared to other sites.
- ‘Turf’ (44% of data) is missing in Ashkelon & Ashdod .
- No corals in Ashkelon





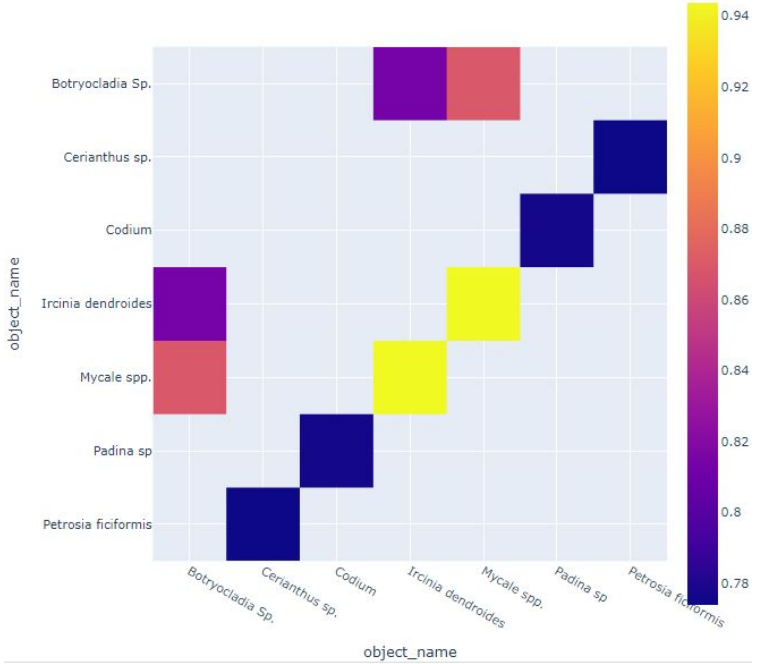
Linear Correlations between organisms

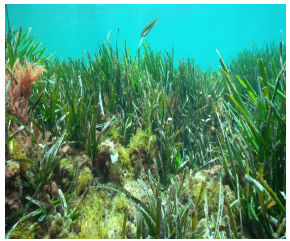
$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

Using pearson correlation function we found:

- Mid-strong correlation in **opposite** ratio between ‘Turf’ and ‘Bryozoan’.
- Strong Positive correlation (>0.7) between 3 pairs of Organisms.
  - **('Codium', 'Padina sp', 0.78)**
  - ('Botryocladia Sp.', 'Ircinia dendroides', 0.80)
  - ('Petrosia ficiformis', 'Cerianthus sp.', 0.77)

Pearson corr matrix - corr > 0.7 (or < - 0.7)





- Which of the sites is the most stable?

Achziv 10
Achziv 25
Achziv45
Sdaot Yam 10
Sdaot Yam 25
Sdaot Yam 45
Naharia 45

Fish survey:

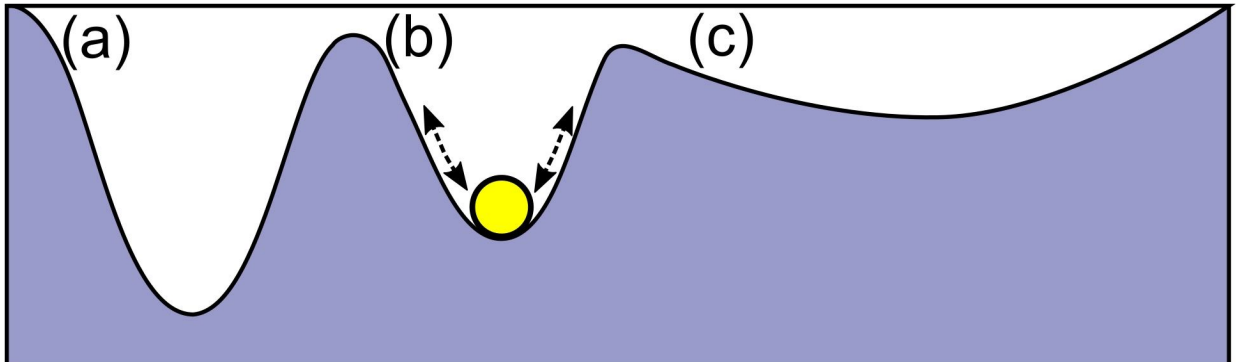
- Manually identified
- The same exact location
- Similar data structure

Eological stability:

Regulation mechanisms:

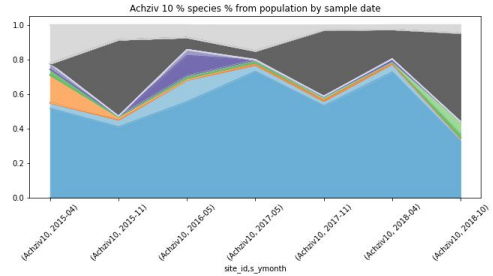
- Stability
- resilience

Siganus rivulatus-סיכן משויש

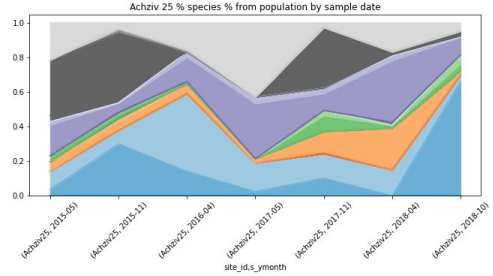


Big changes over time and depth within a site

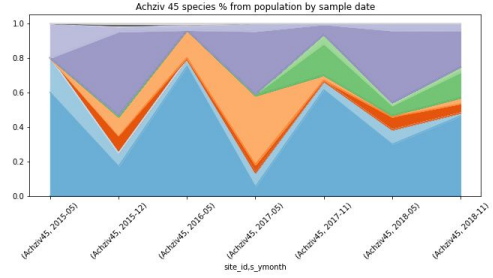
Achziv Site



10 m



25m



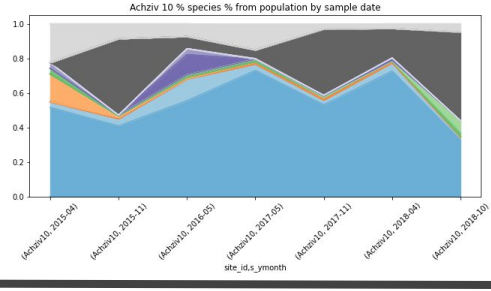
45m

Depth

Sampling Time line

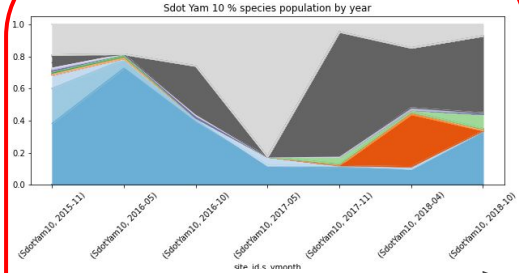
Delta of population trends across timeline and depth within the sites

Achziv 10m

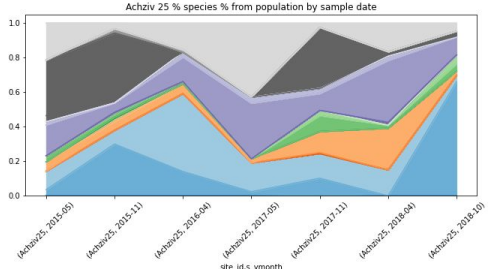


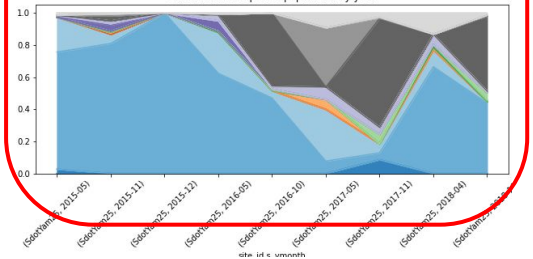
Sampling Time line

Sdot yam

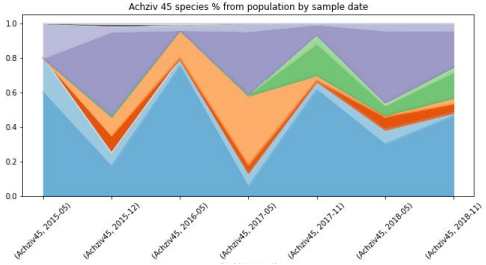


25m

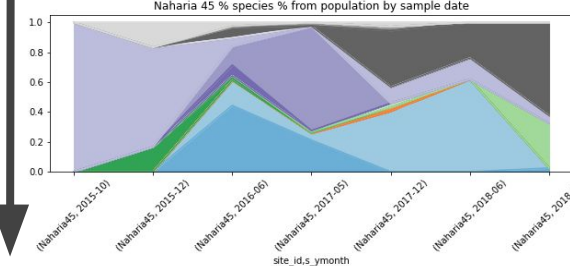


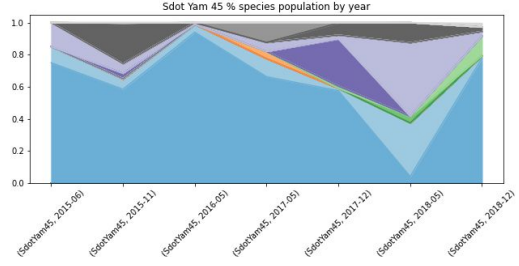


45m



Depth





- Balistes capriscus
- Carcharhinus plumbeus
- Chromis chromis
- Coris julis
- Dasyatis pastinaca
- Dasyatis sp
- Diplodos cervinus
- Diplodus cervinus
- Diplodus puntazzo
- Diplodus sargus
- Diplodus vulgaris
- Echeneis sp
- Epinephelus aeneus
- Epinephelus costae
- Epinephelus marginatus
- Epinephelus sp
- Fistularia commersonii
- Gobius bachiun
- Gobius bucchichi
- Gobius sp
- Gobius vittatus
- Muraena helena
- Mycteroperca rubra
- Parablennius rouxi
- Parupeneus forsskali
- Pteragogus pelycus
- Pterois miles
- Rhabdosargus haffara
- Salpa salpa
- Saprisoma cretense
- Sardin sp
- Sargocentron rubrum
- Sciaena umbra
- Scomber sp
- Seriola dumerili
- Serranus cabrilla
- Serranus scriba
- Shark
- Siganus luridus
- Siganus rivulatus
- Siganus sp
- Sparisoma cretense
- Symphodus mediterraneus
- Symphodus sp
- Symphodus tinca
- Synodus saurus
- Taeniurops grabatus
- Thalassoma pavo
- Torquigener flavimaculosus

What is the population stability index (PSI)?

PSI is a measure of how much a population has shifted over time or between two different samples of a population in a single number. It does this by bucketing the two distributions and comparing the percents of items in each of the buckets, resulting in a single number you can use to understand how different the populations are. The common interpretations of the PSI result are:

- PSI < 0.1: no significant population change
- PSI < 0.2: moderate population change
- PSI >= 0.2: significant population change

And in other words..

$$PSI = \sum \left((Actual\% - Expected\%) \times ln\left(\frac{Actual\%}{Expected\%}\right) \right)$$

https://github.com/mwburke/population-stability-index/blob/master/walkthrough-example.ipynb

```
df['PSI'] = (df['New Percent'] - df['Initial Percent']) * np.log(df['New Percent'] / df['Initial Percent'])
```

And the most stable site is..

Achziv 10	0.0765
Achziv 25	0.1316
Achziv45	0.1993
Sdaot Yam 10	0.2023
Sdaot Yam 25	0.3374
Sdaot Yam 45	0.4114
Naharia 45	0.3712