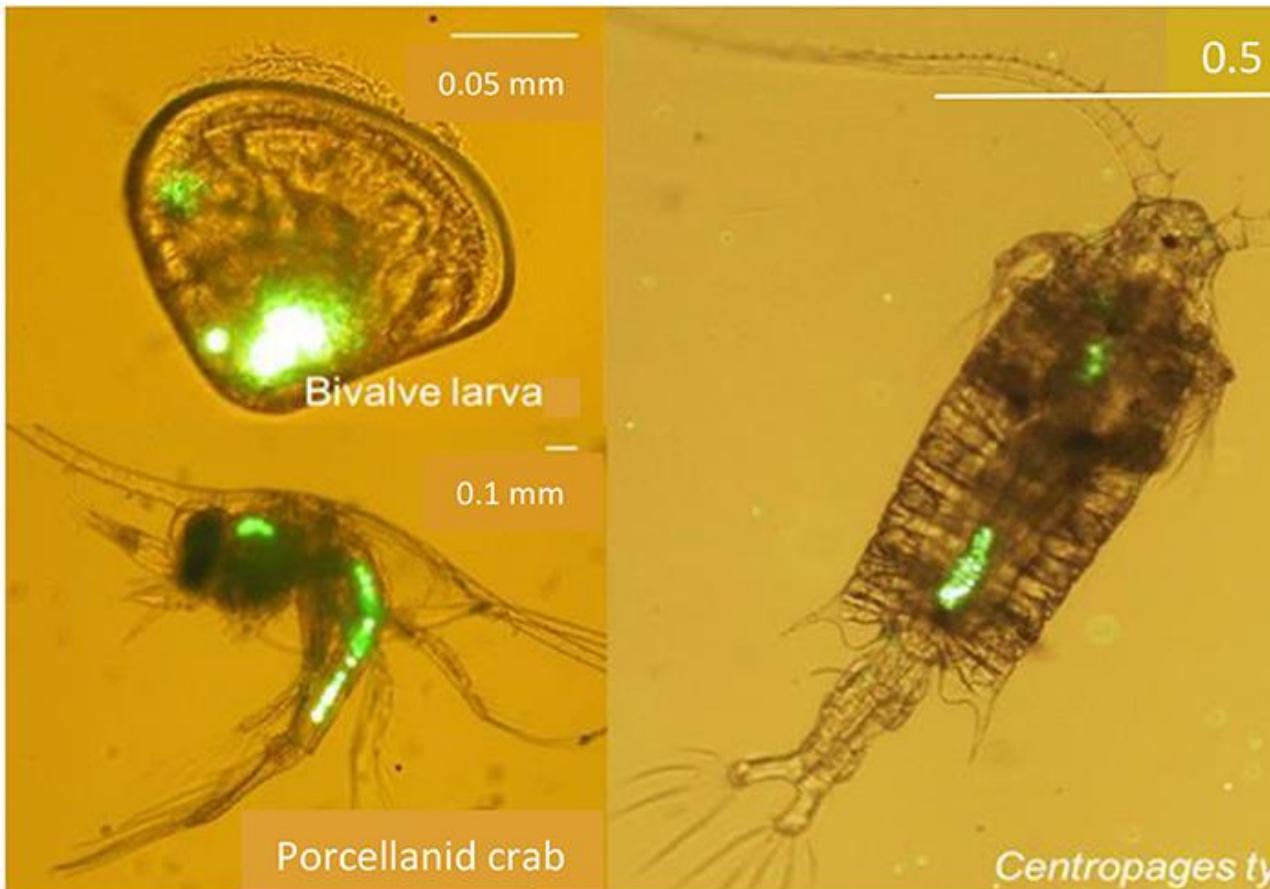




Toxic Waters: Marine Pollution and its impact on Phytoplankton's

TEAM FISH FOOD:
BENIEL I
MADHAN VK

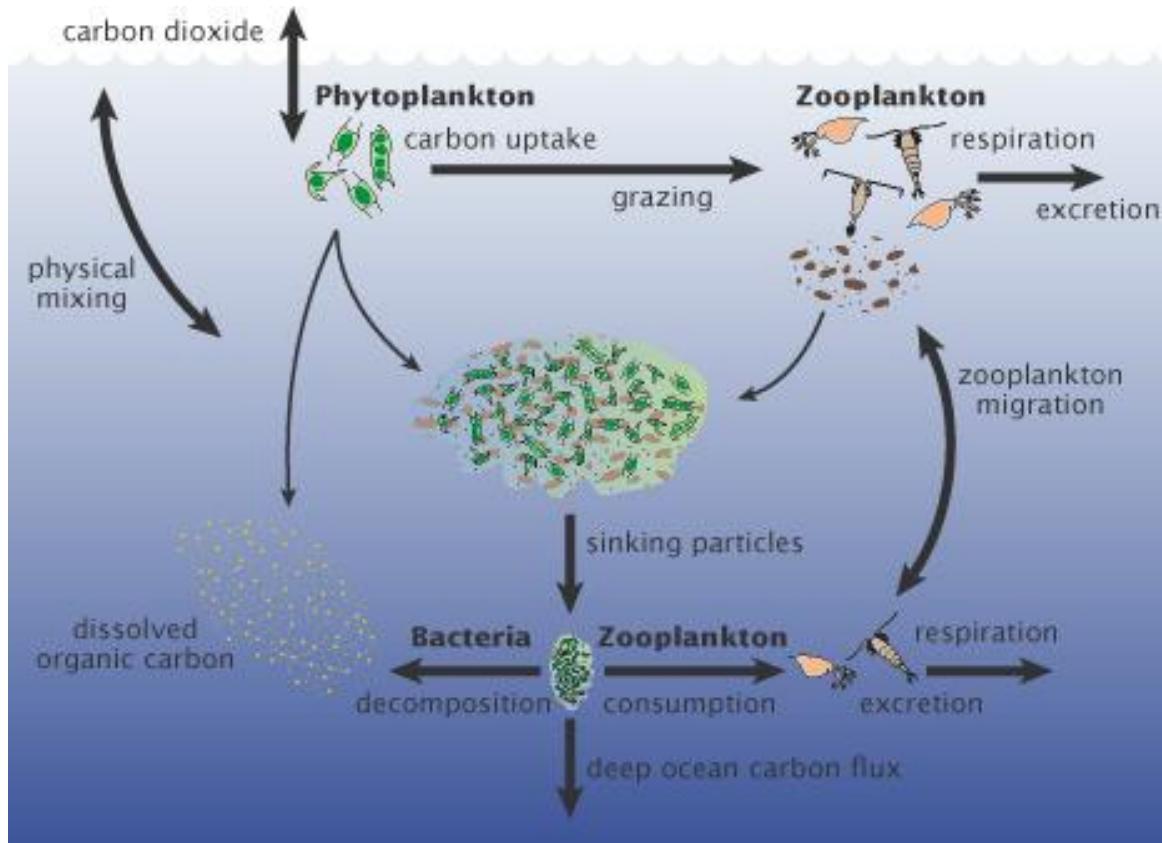
Problem Statement



- With the growth of plastic on the ocean we are trying to analyze the impact to marine biodiversity, specifically plankton.
- Checking whether Fishing vessel lines have changed in the pollution hotspots

Three different types of plankton. Adapted from:
<https://kids.frontiersin.org/articles/10.3389/frym.2021.588638>

Motivation



- Phytoplankton are the primary producers of oxygen in the ocean and regulate earth temperature.
- A decline in phytoplankton population will lead ecosystem imbalance in the marine kingdom and the earth getting hotter.
- “Give me a half tanker of iron, and I will give you an ice age.” – John Martin

Phytoplankton uses. Adapted from:

<https://earthobservatory.nasa.gov/features/Phytoplankton>

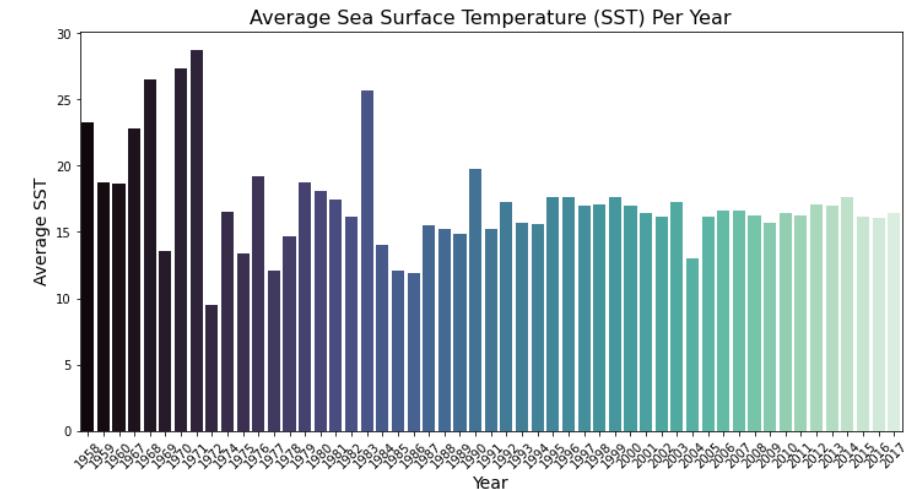
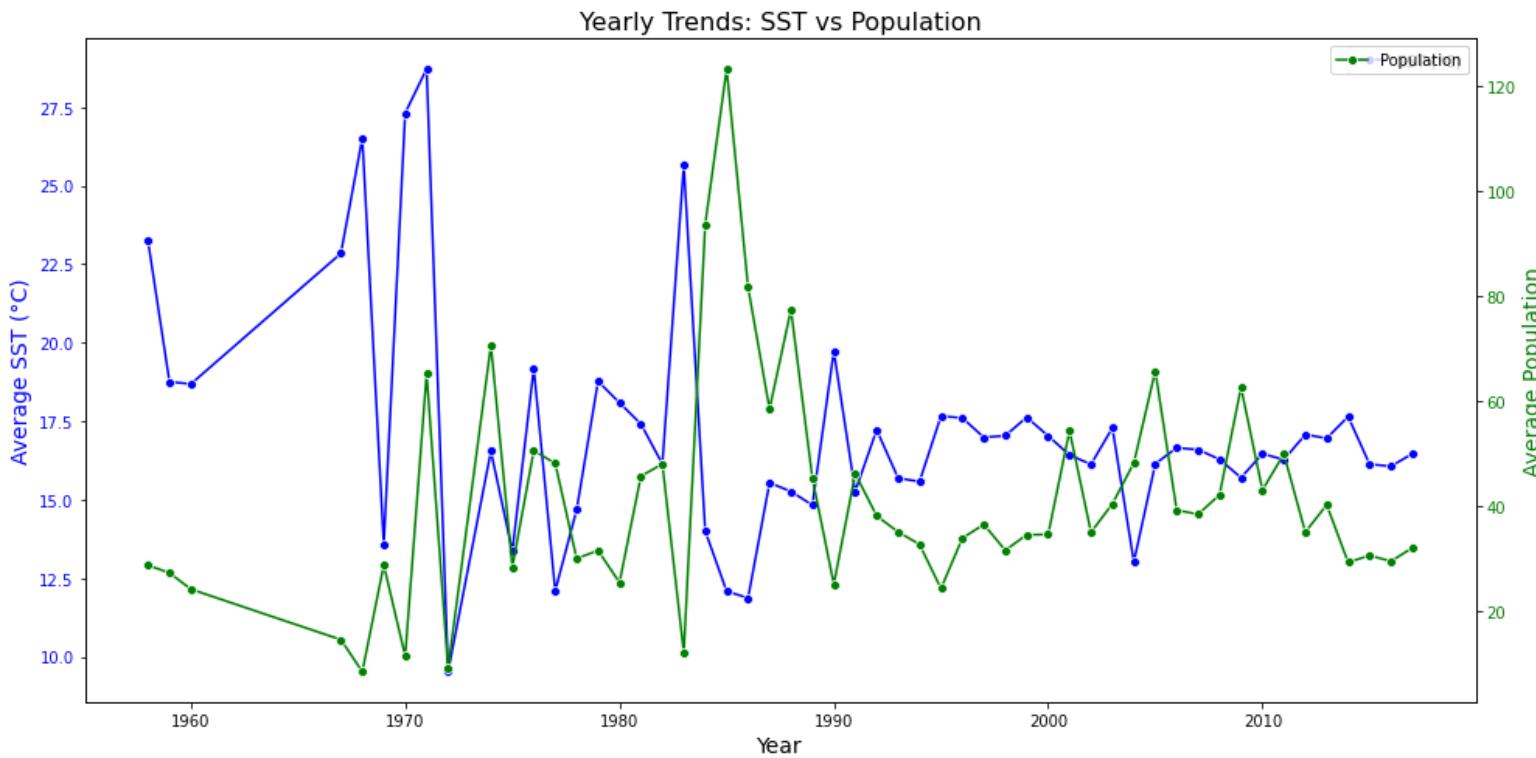
Datasets we used:

	Microplastic	Plankton	Vessels
Purpose	Record plastic density across oceans	Record plankton population across oceans	Records fishing hours across oceans
Size	11,671 rows and 22 features	37,722 rows and 49 features	56 million rows and 6 columns
Time Period	1972-2022	1958-2017	2012-2020
Dataset Type and Coverage	Satellite based and Global coverage	Satellite based and Global coverage	Satellite based on global coverage
Important Features	Latitude, Longitude, year, Density class(categorical)	Latitude, Longitude, year, Total chlorophyll(categorical), Sea surface Temperature	Latitude, Longitude, fishing hours, date
Source & Format	NCEI, CSV file	PANGEA, Text file	Global Fishing Watch, CSV file

EDA

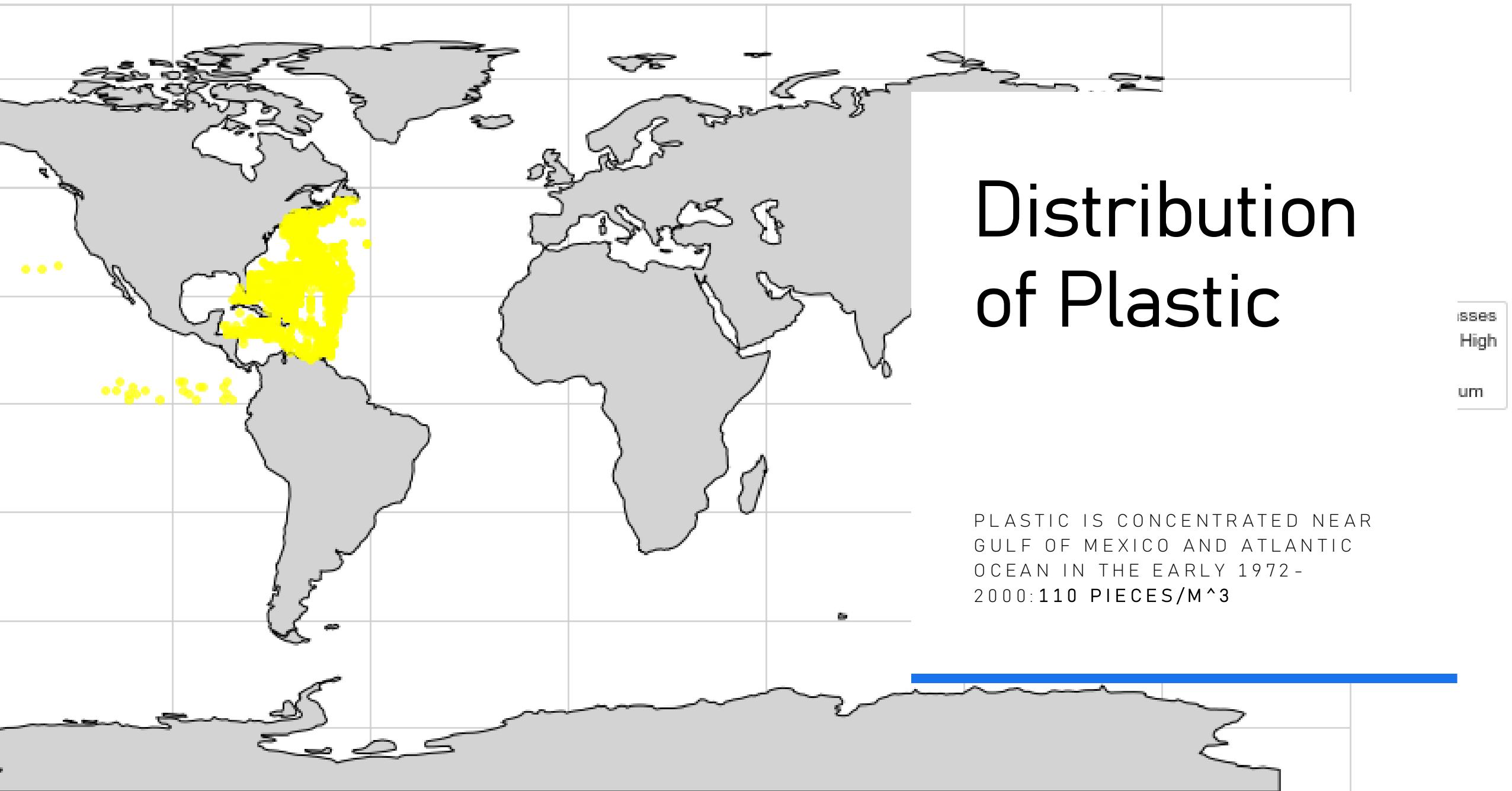
Removing	Removing columns
Replacing	Replacing NAN values with mode values
Rounding	Rounding of latitude and longitude values to nearest integer for better matching
Converting	Converting text document to csv
Merging	Merging based on Latitude, Longitude and grouping year

Does Sea Surface Temperature impact Planktons?



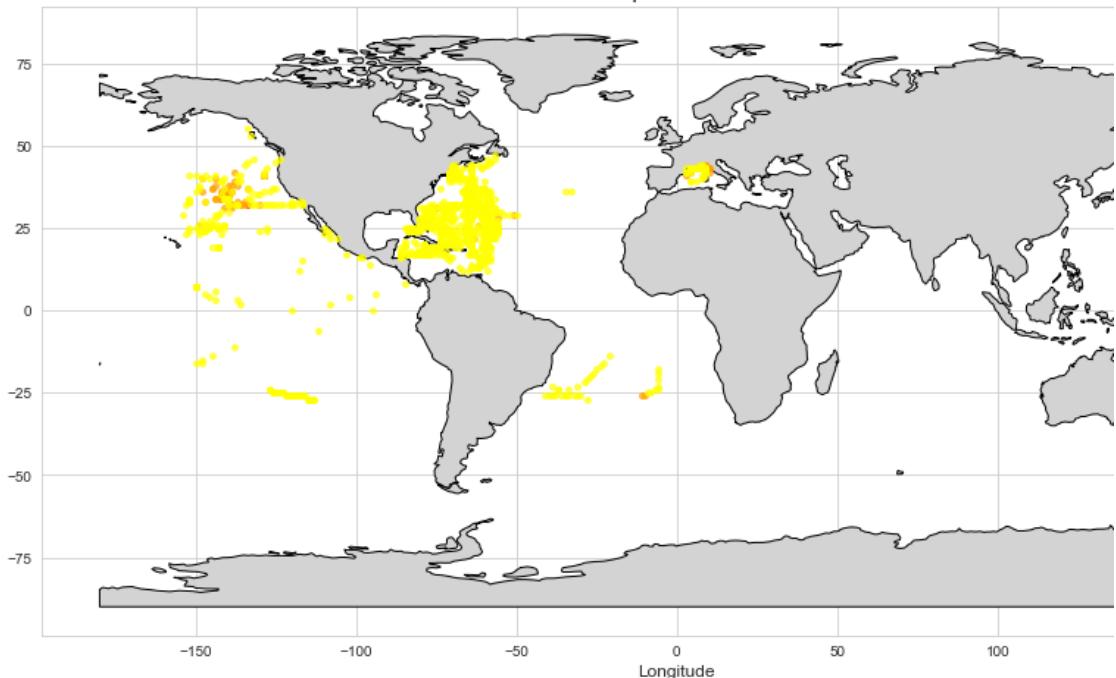
- From the bar graph we can observe that temperature remained the same for a significant period
- From the line plots plankton population does not depend on sea surface temperature

Distribution of plastic from 1972-2000

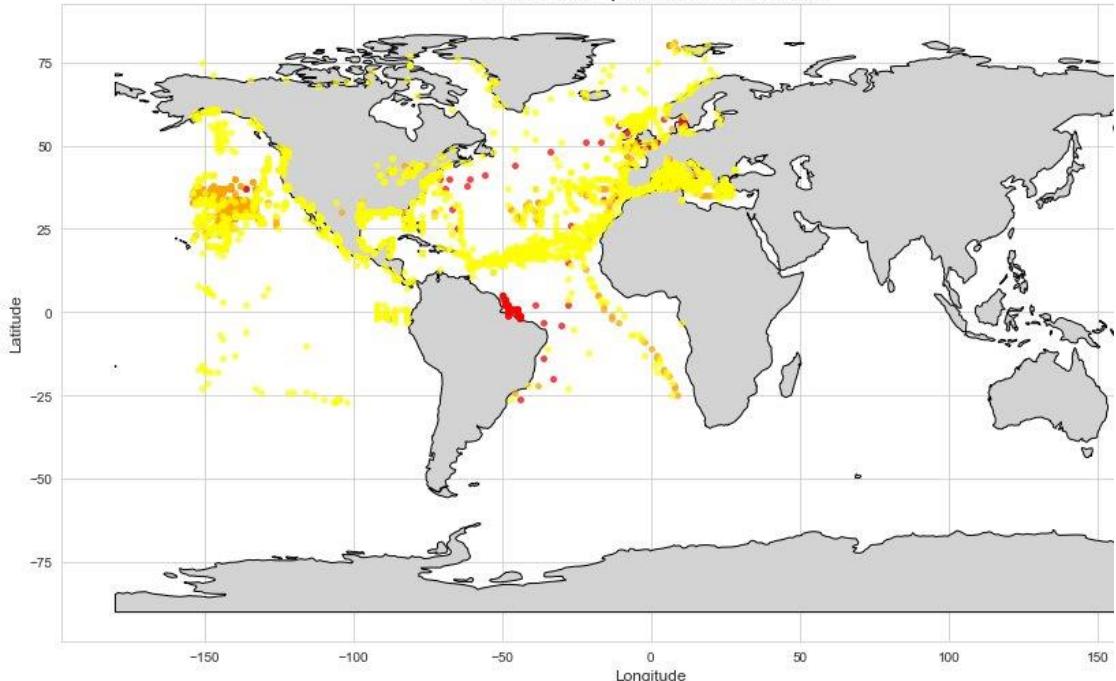


Distribution of Plastic

Distribution of plastic from 2001-2010

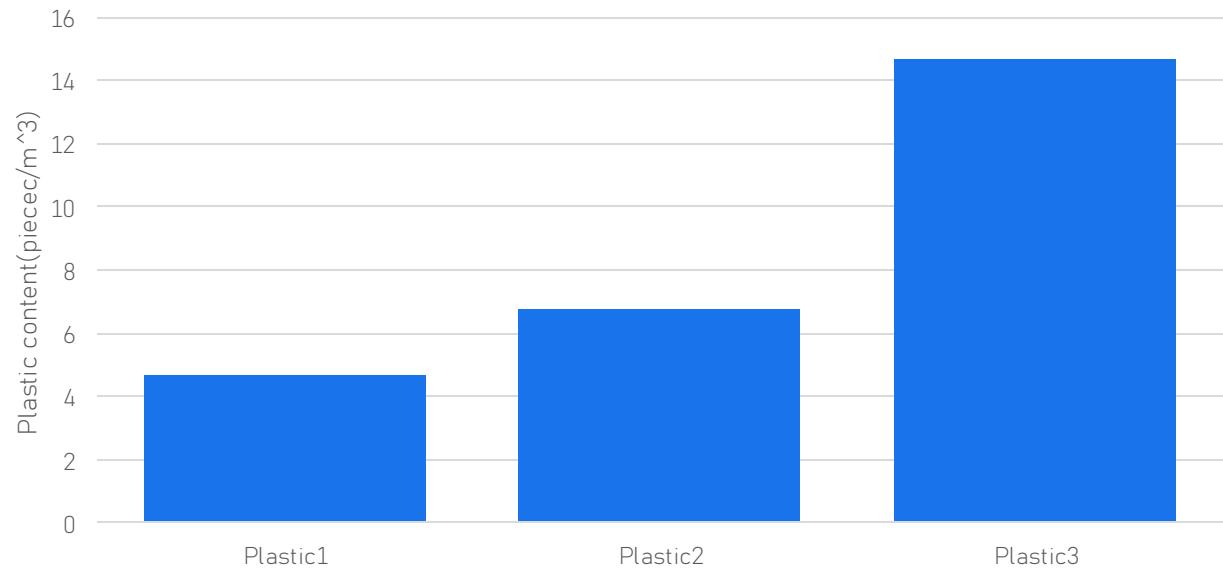


Distribution of plastic from 2011-2020

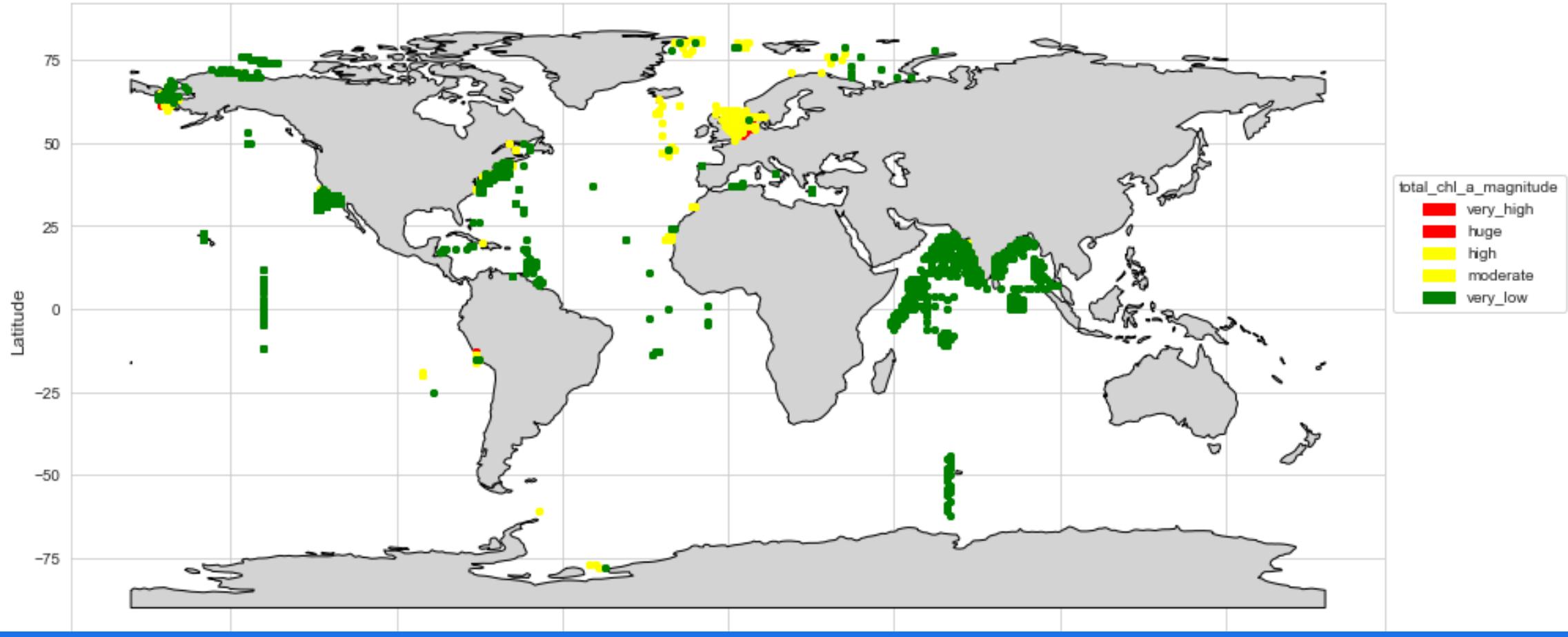


- PLASTIC IS CONCENTRATED NEAR GULF OF MEXICO AND ATLANTIC OCEAN AND PACIFIC OCEAN IN THE YEARS 2001-2010: **890.92 PIECES/M³**
- PLASTIC IS CONCENTRATED NEAR PACIFIC OCEAN AND SPREAD ALL OVER ATLANTIC OCEAN IN THE YEARS 2011-2022: **2.3 MILLION PIECES/M³**

Plastic distribution



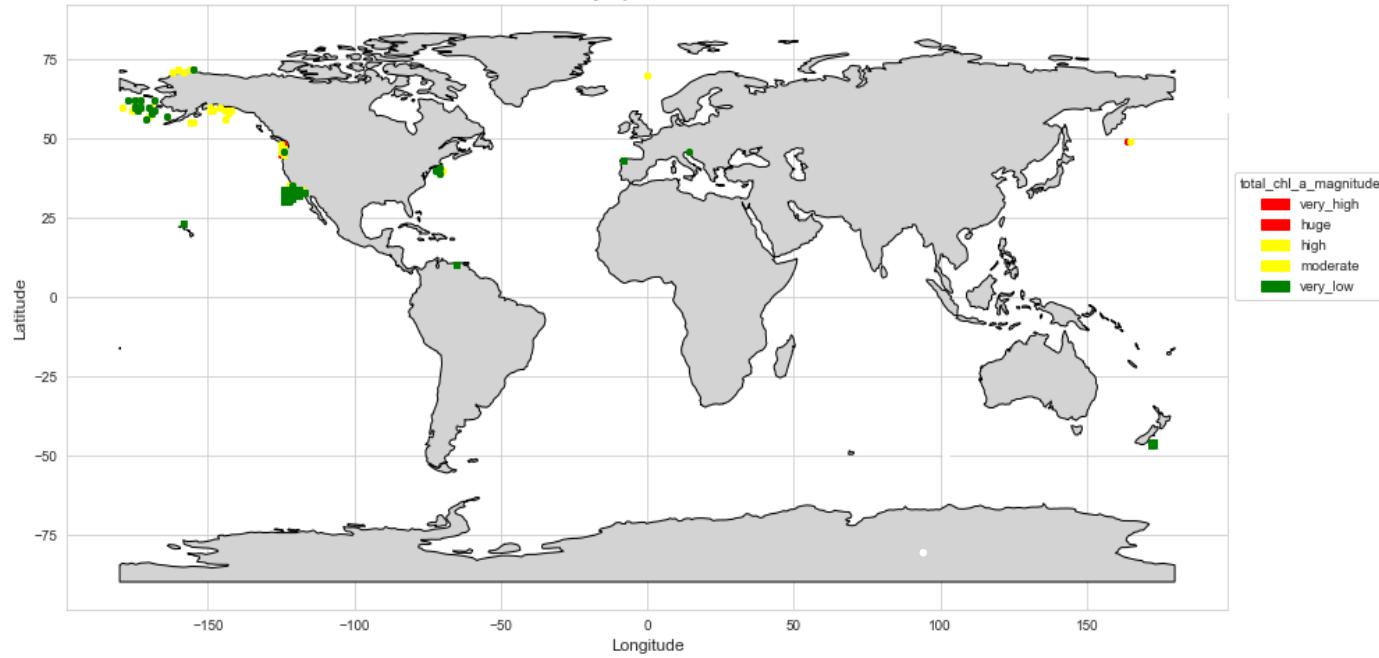
Distribution of Phytoplankton from 1958-2000



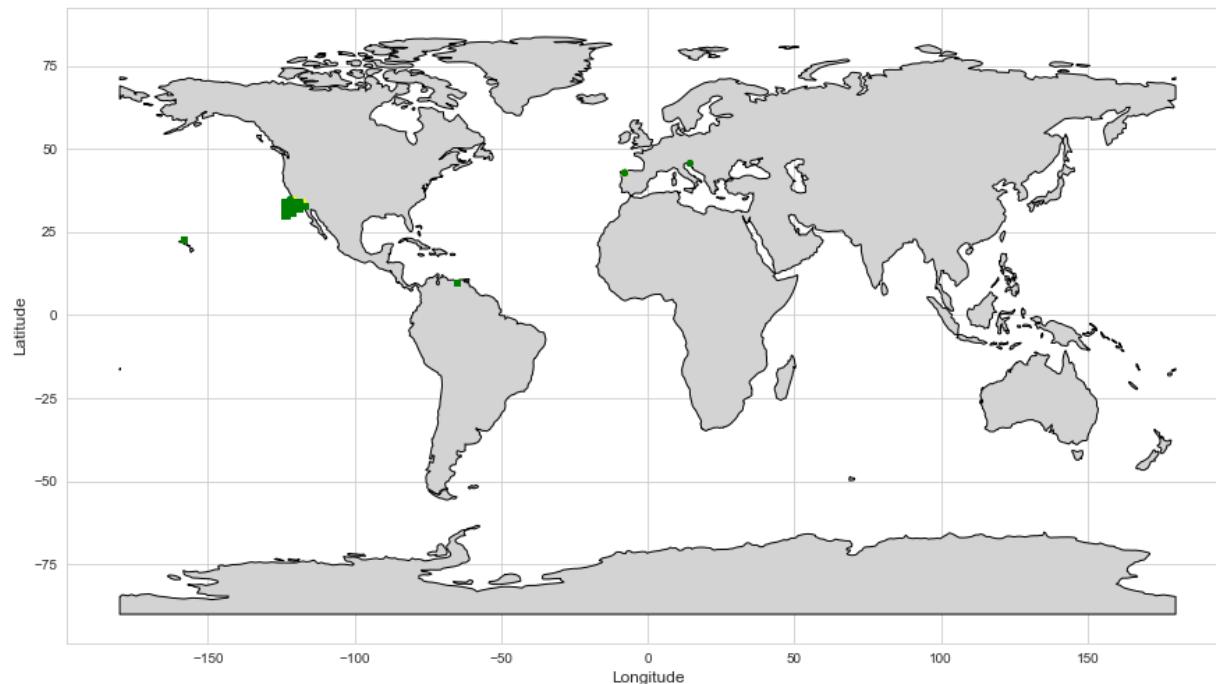
Distribution of Phytoplankton

- PLANKTON HEAVILY CONCENTRATED NEAR THE INDIAN SEAS AND THE NORTH SEA DURING 1958-2000: $10,79,727 \text{ MG/M}^2$

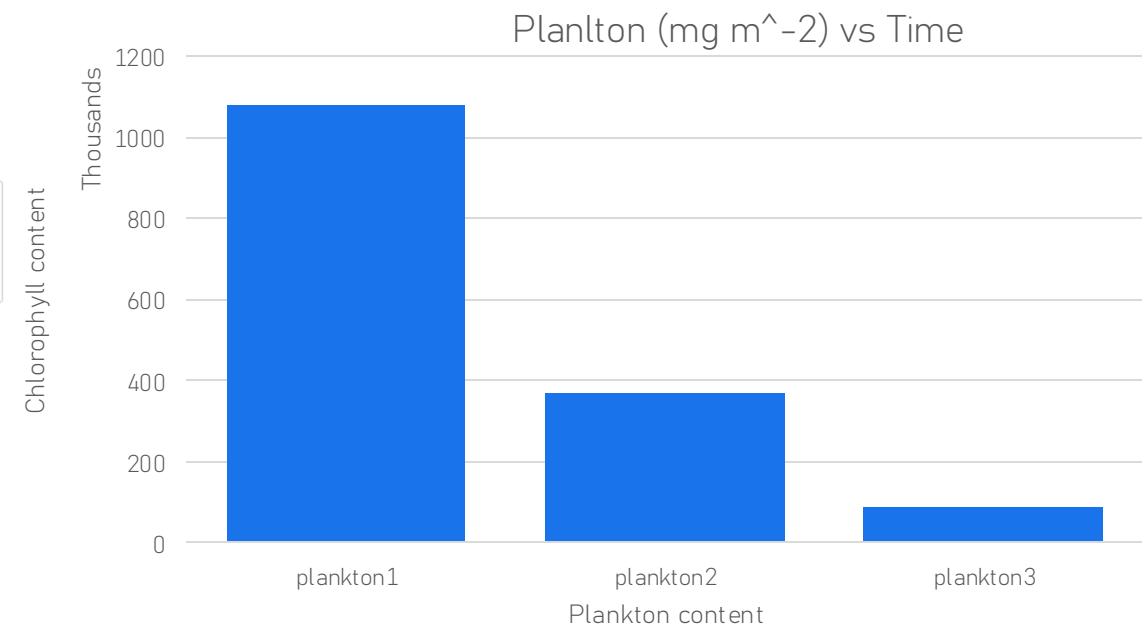
Distribution of Phytoplankton from 2001-2010



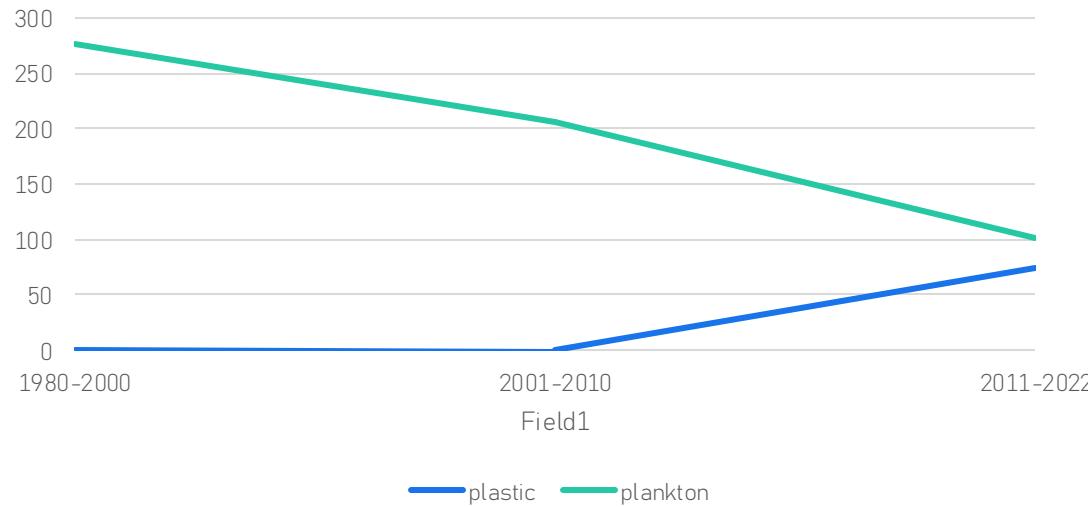
PLANKTON POPULATION IS CONCENTRATED NEAR PACIFIC OCEAN, SAN DIEGO AND ALASKA DURING 2001-2010: $3,69,285 \text{ MG/M}^{-3}$



PLANKTON POPULATION IS CONCENTRATED NEAR PACIFIC OCEAN, SAN DIEGO DURING 2011-2017: 90464 MG/M^{-3}



'Plastic', 'Plankton' Trends

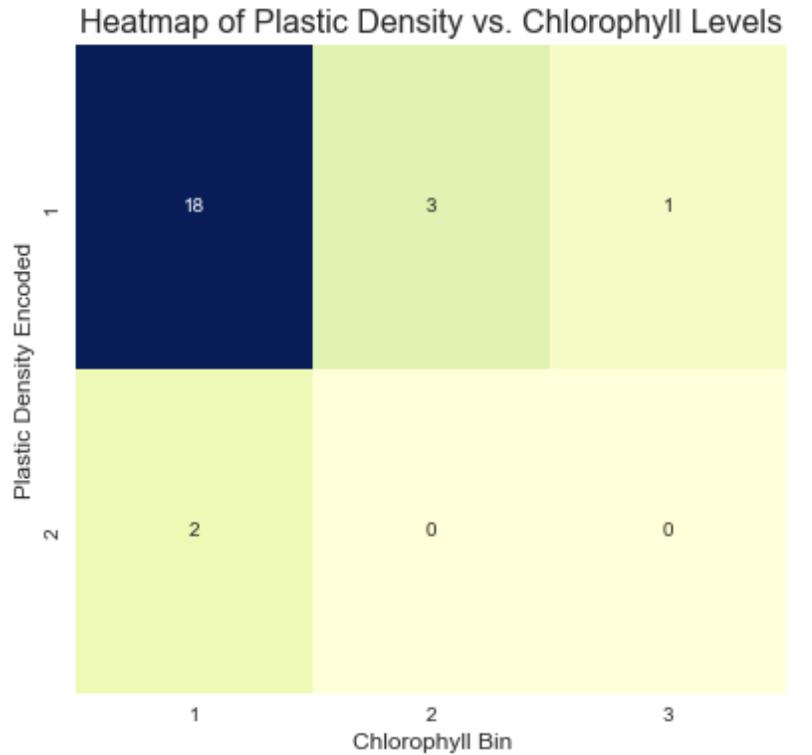


DID INCREASE IN
PLASTIC AFFECT THE
PHYTOPLANKTON'S?

Year Range	Plastic	Plankton
1980-2000	0.21	276.38
2001-2010	0.86	206.48
2011-2022	74.119	102.17



Test Results



Spearman Correlation:

-0.13442056254198995,

p-value: 0.5311696616090269

Pearson Correlation:

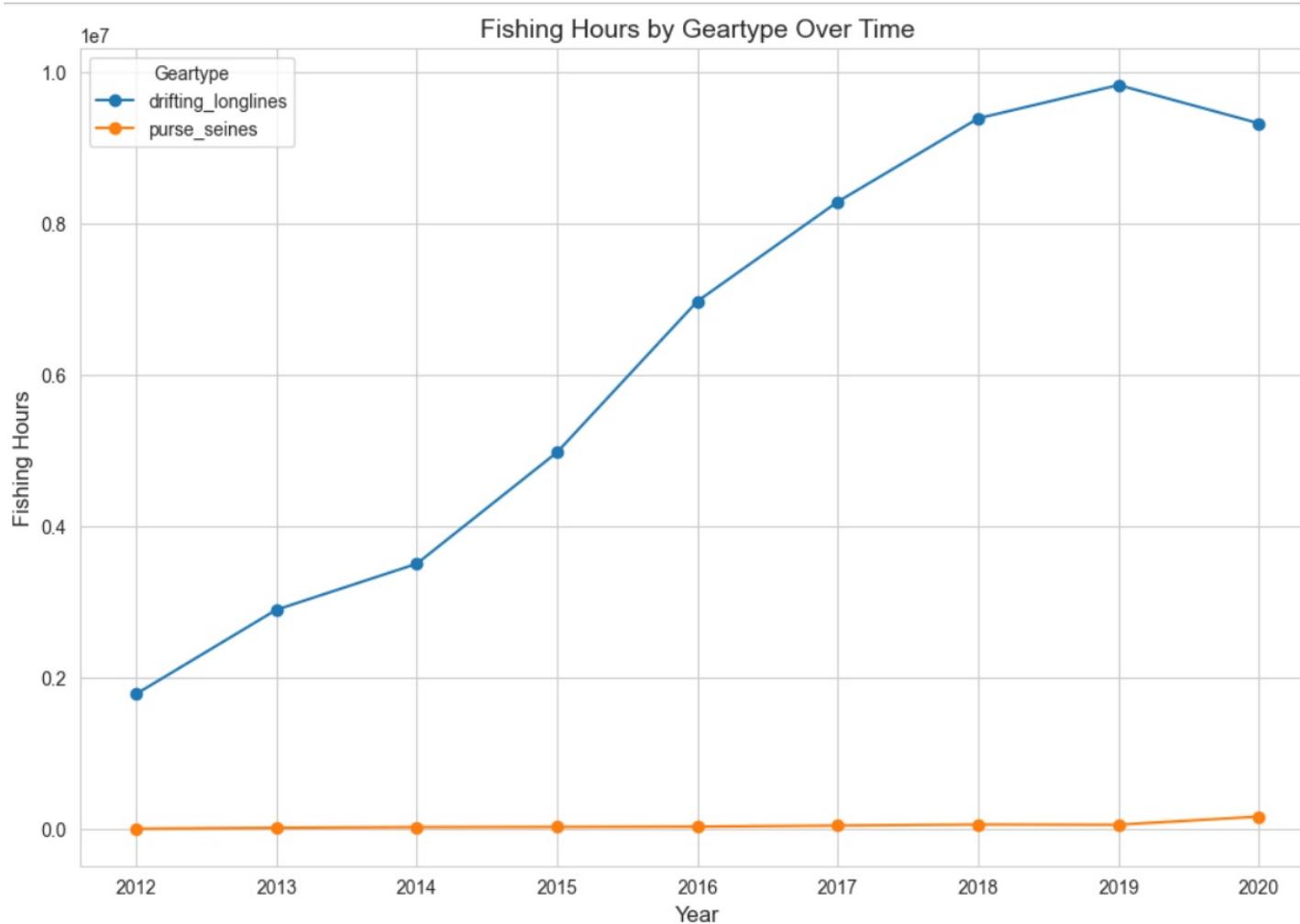
-0.1260682264148248,

p-value: 0.5572134508986154

Chi-Square Statistic:

0.4363636363636363,

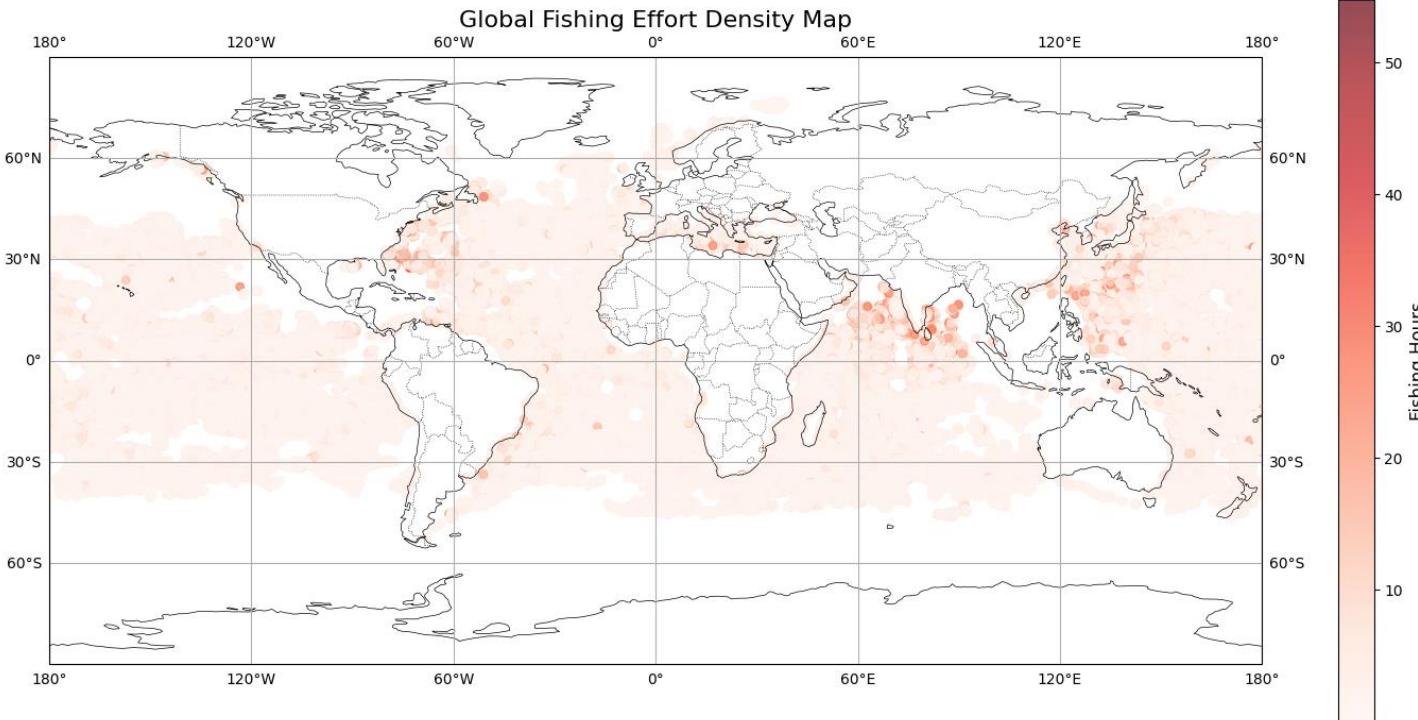
p-value: 0.8039792503313262



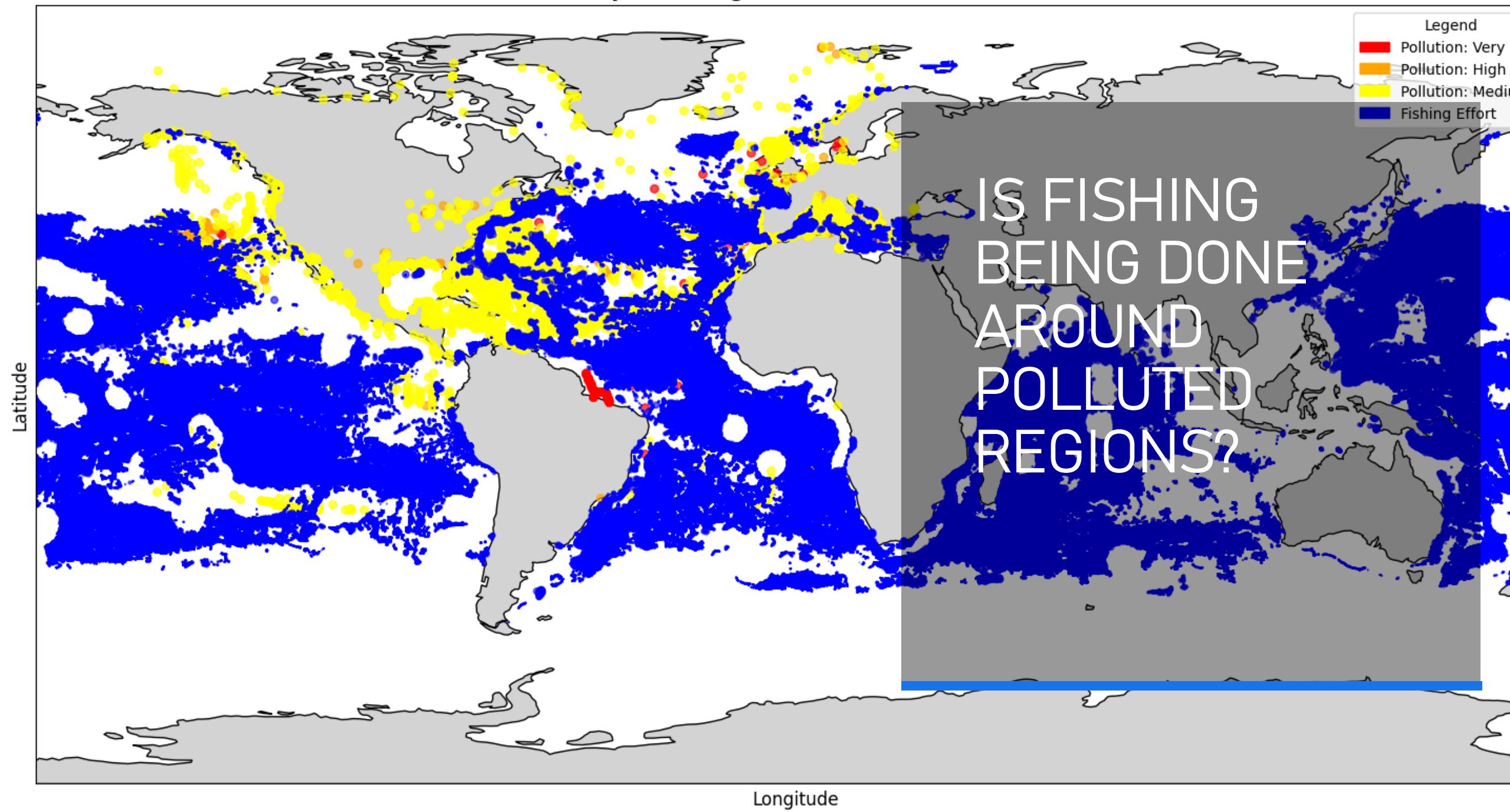
Did
fishing decrease
overtime due to
pollution?

Drifting Longlines – Tuna
Purse Seines – school fish

Does Fishing
occur in
Heavily
polluted
Areas?



Overlay of Fishing Effort and Pollution Levels



CONCLUSION

- Decline in phytoplankton over the years and has a potential link to increasing plastic pollution, even though the correlation isn't statistically significant.
- Fishing has not decreased despite the rise in pollution levels and it often occur in heavily polluted regions, which could further harm marine ecosystems.
- Regulating fishing and making sure that the marine plastic does not increase further is a must to save the ocean biodiversity and marine life.



A photograph of a person from behind, looking into a large circular aquarium. Inside the tank, various marine life is visible, including several fish, a starfish, and a large, translucent, ribbed organism, possibly a jellyfish or a nudibranch. The water is a clear blue.

"The health of phytoplankton mirrors the health of our oceans. Protecting them is not just about saving marine life— it's about safeguarding the future of our planet."

Thank You

