

An underwater photograph showing significant marine pollution. Large pieces of clear and blue plastic bags are visible, along with smaller debris like sticks and leaves. A single fish is seen swimming through the trash. The water is a deep blue-green color.

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

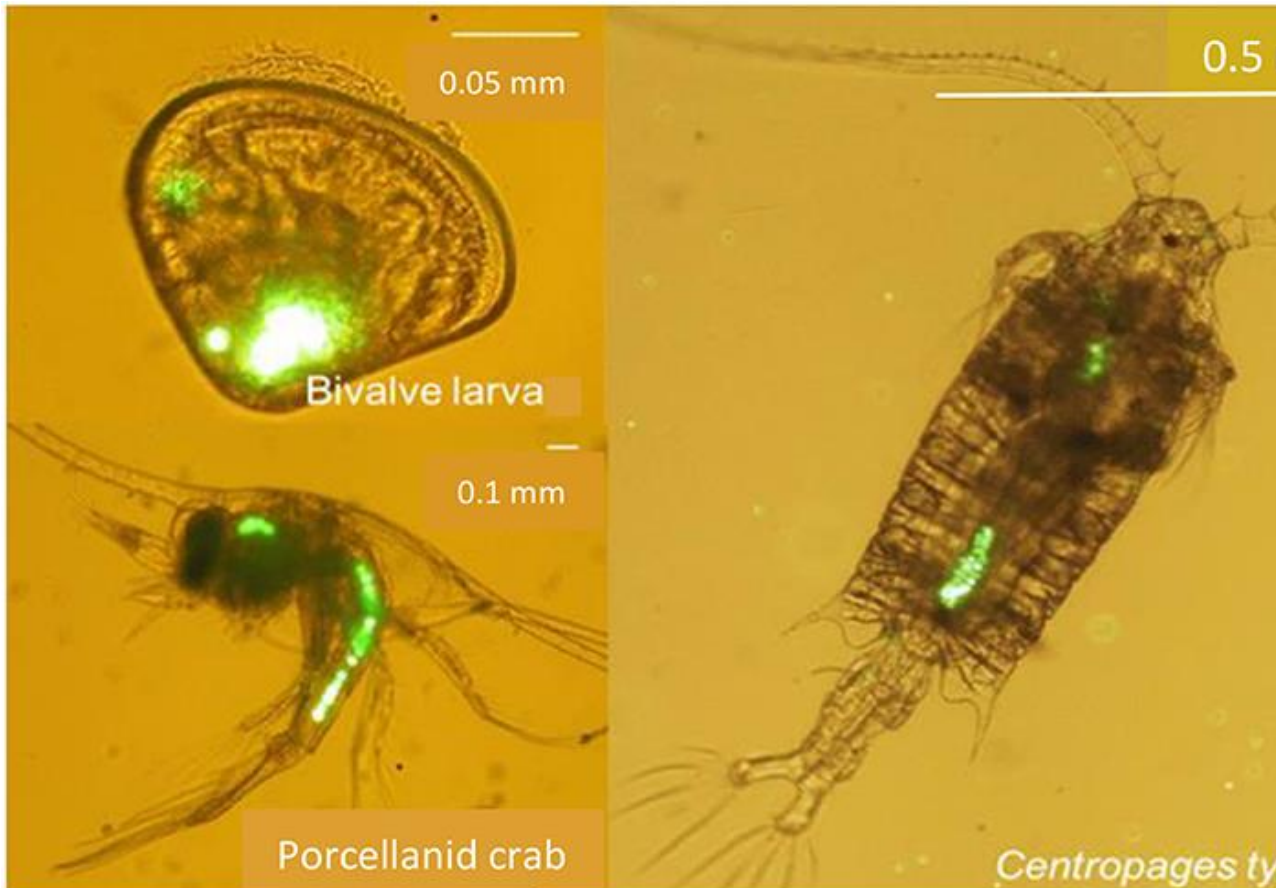
TEAM FISH FOOD:

BENIEL I

MADHAN VK



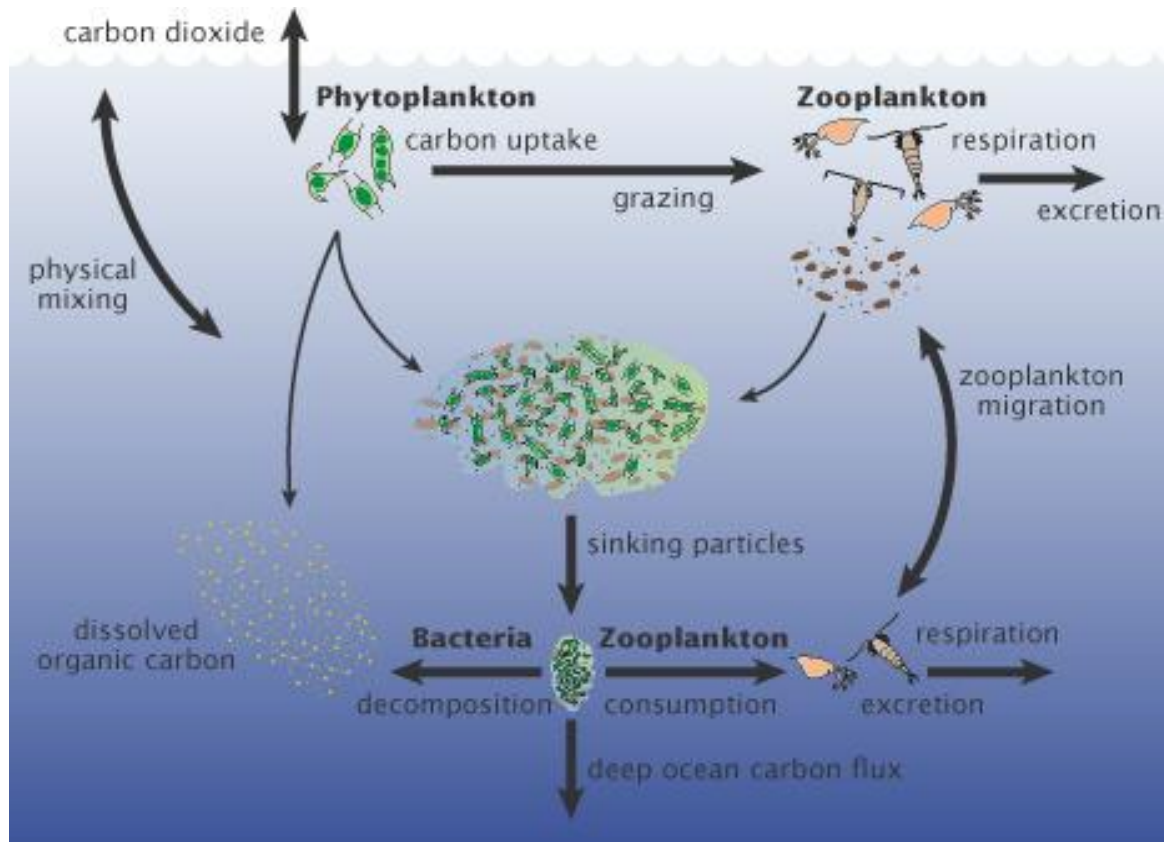
# Problem Statement



- 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:

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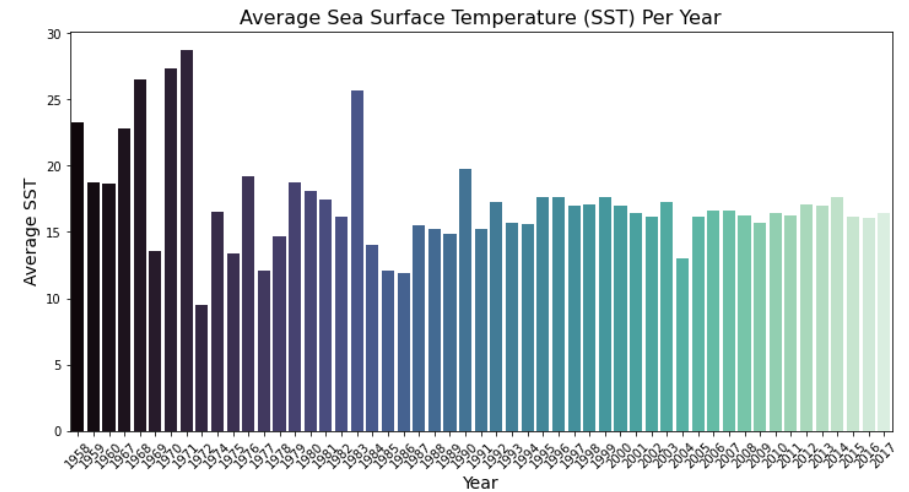
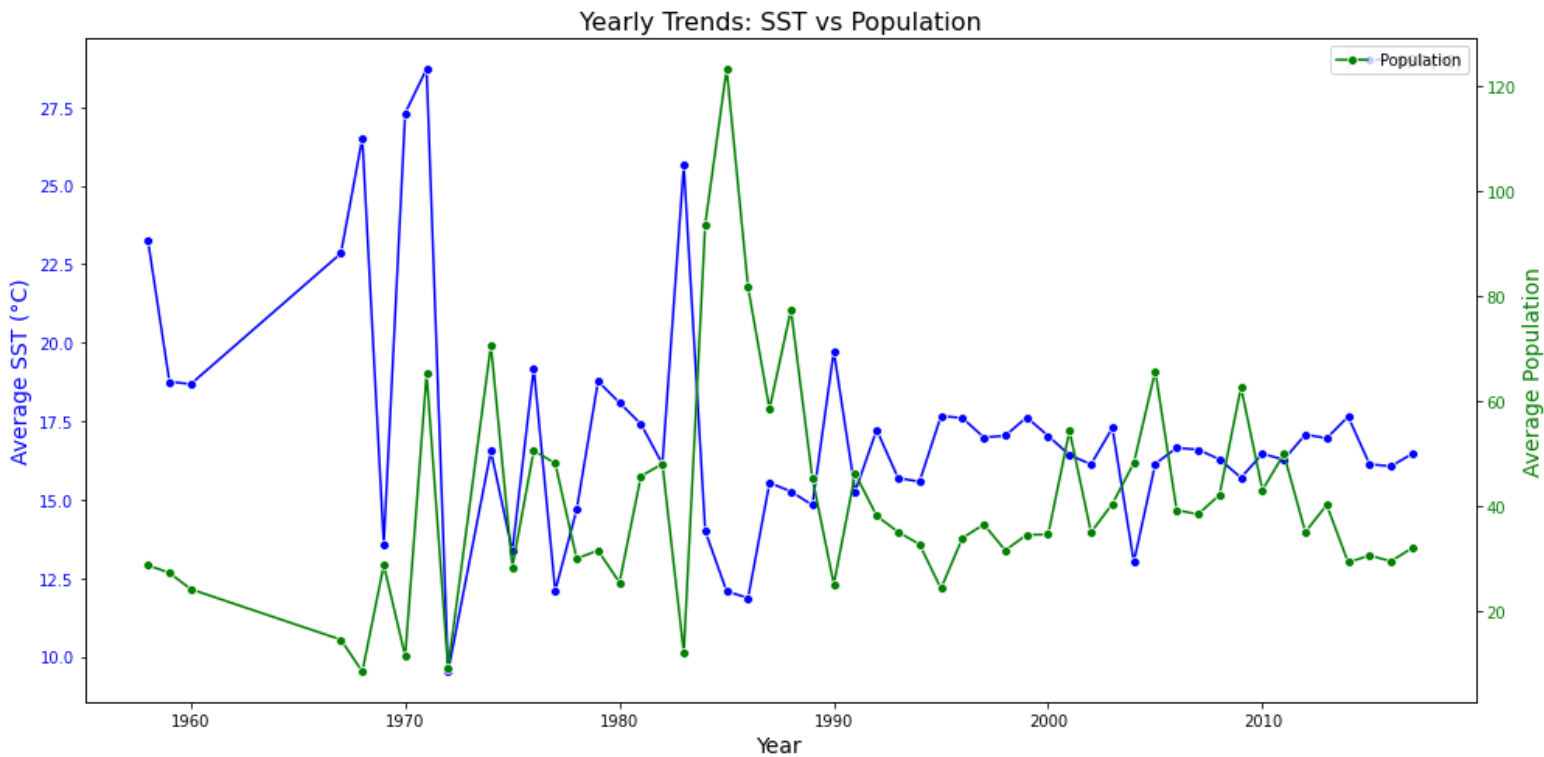
	Microplastic	Plankton	Vessels
Purpose	Record plastic density across oceans	Record plankton population across oceans	Records fishing hours across oceans
Size	11,671 rows and 22 features	37,722 rows and 49 features	56 million rows and 6 columns
Time Period	1972-2022	1958-2017	2012-2020
Dataset Type and 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

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# EDA

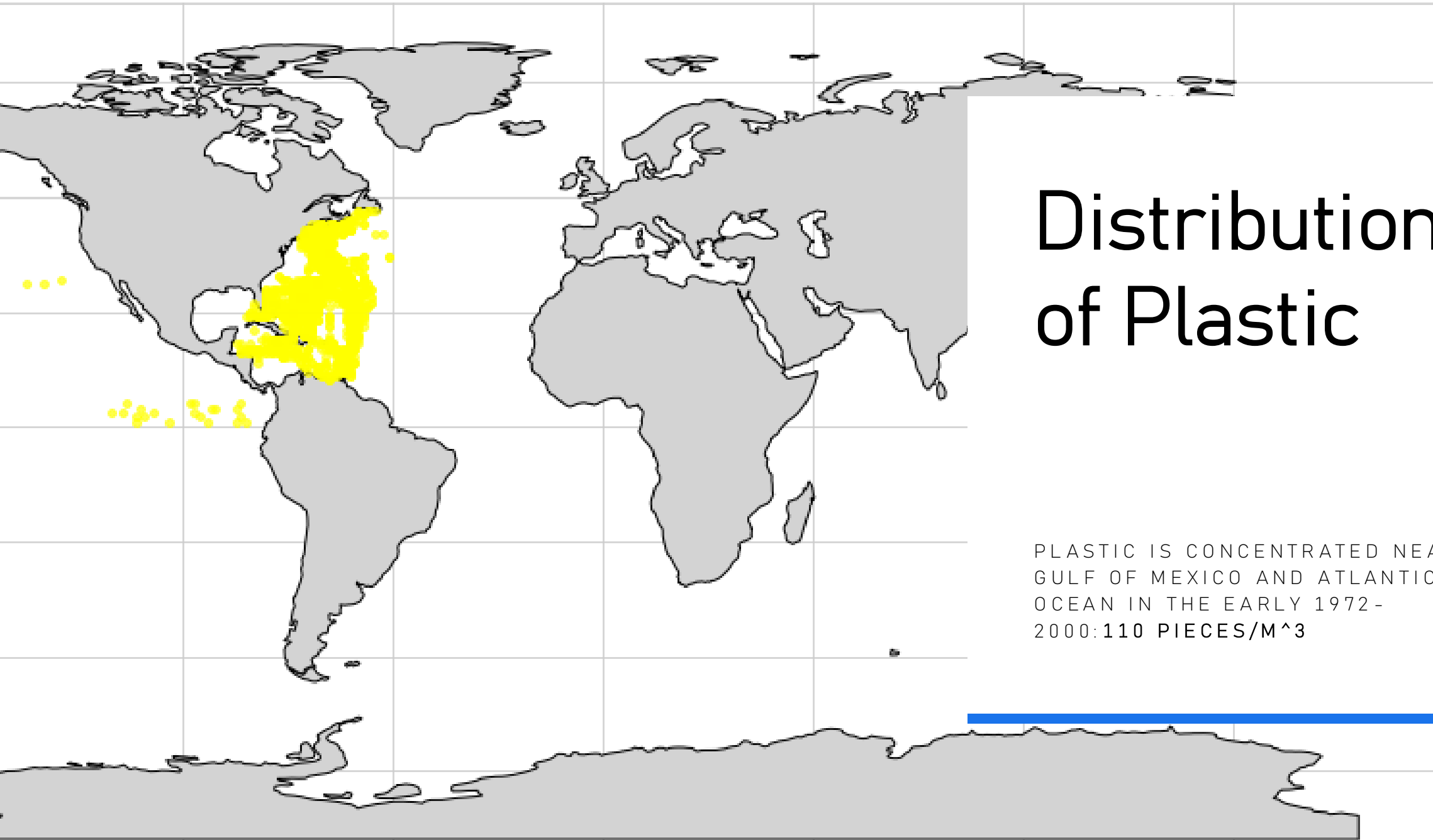
Removing	Removing columns
Replacing	Replacing NAN values with mode values
Rounding	Rounding of latitude and longitude values to nearest integer for better matching
Converting	Converting text document to csv
Merging	Merging based on Latitude, Longitude and grouping year

# 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

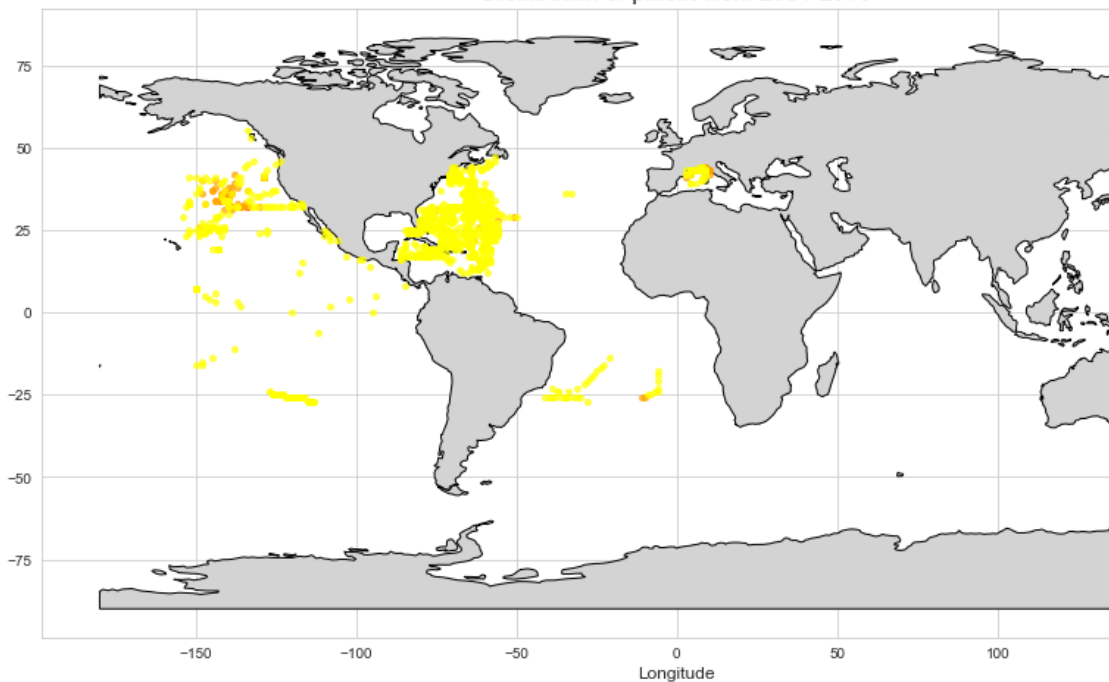
Distribution of plastic from 1972-2000



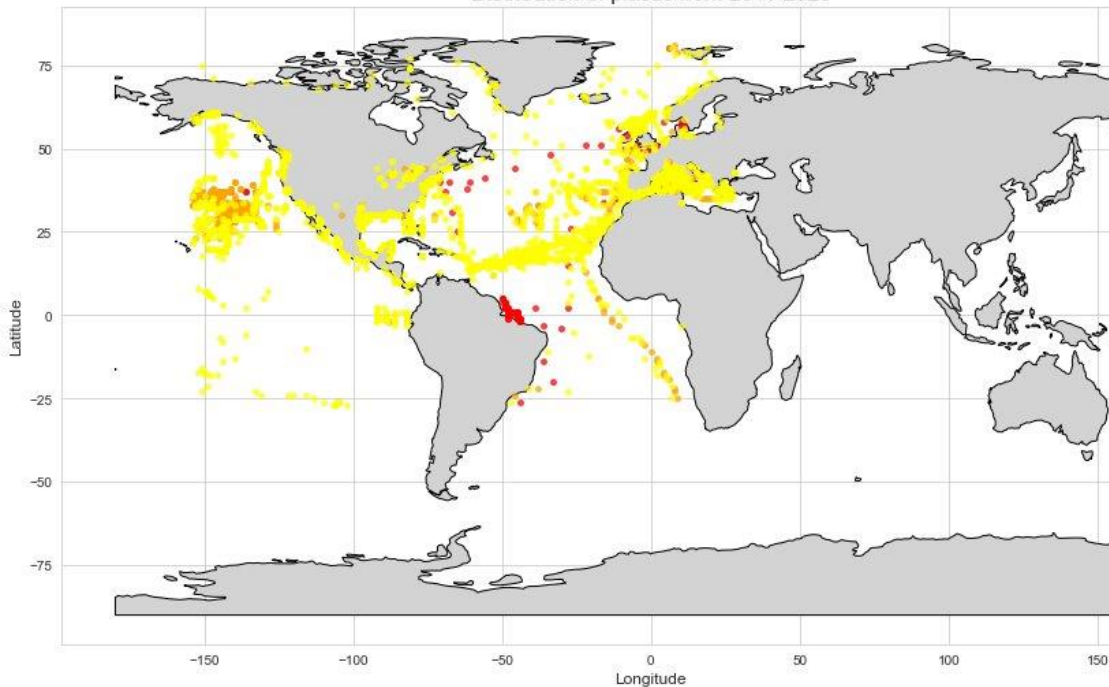
# Distribution of Plastic

PLASTIC IS CONCENTRATED NEAR  
GULF OF MEXICO AND ATLANTIC  
OCEAN IN THE EARLY 1972 -  
2000:110 PIECES/M<sup>3</sup>

Distribution of plastic from 2001-2010

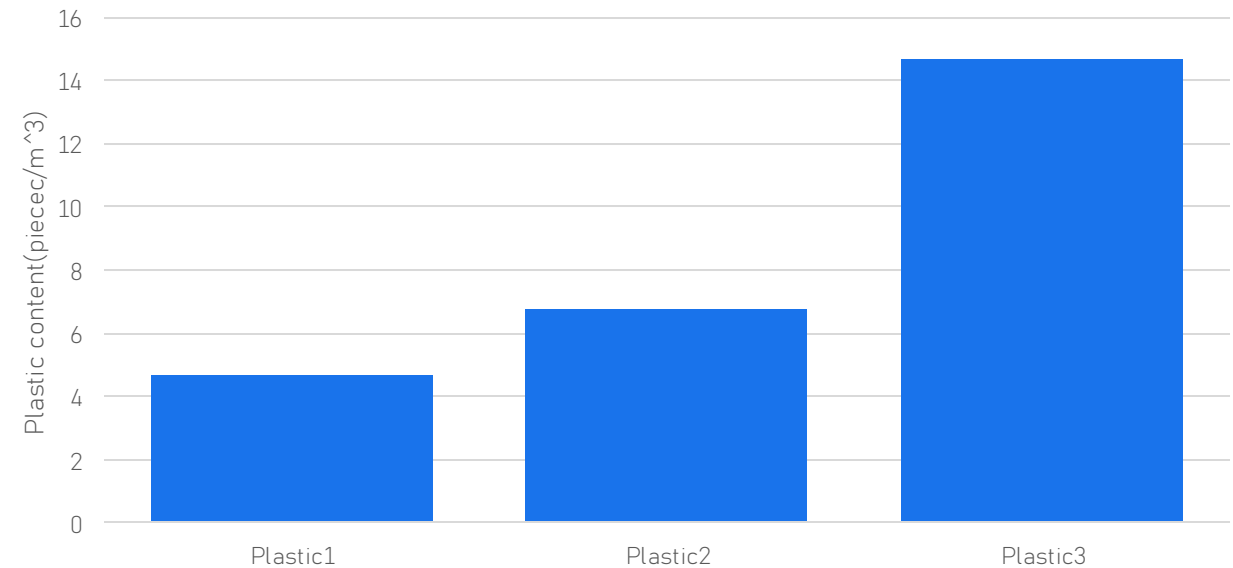


Distribution of plastic from 2011-2020



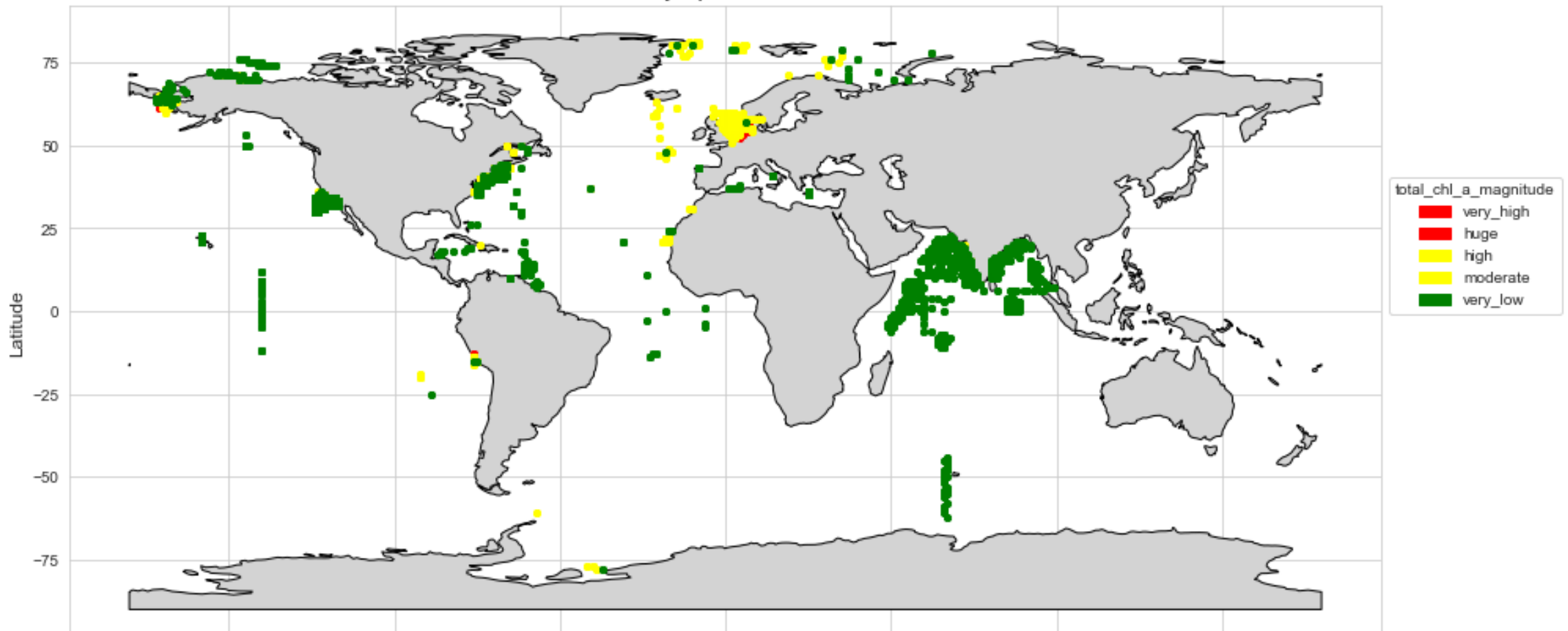
- PLASTIC IS CONCENTRATED NEAR GULF OF MEXICO AND ATLANTIC OCEAN AND PACIFIC OCEAN IN THE YEARS 2001-2010: **890.92 PIECES/M3**
- PLASTIC IS CONCENTRATED NEAR PACIFIC OCEAN AND SPREAD ALL OVER ATLANTIC OCEAN IN THE YEARS 2011-2022: **2.3 MILLION PIECES/M3**

Plastic distribution





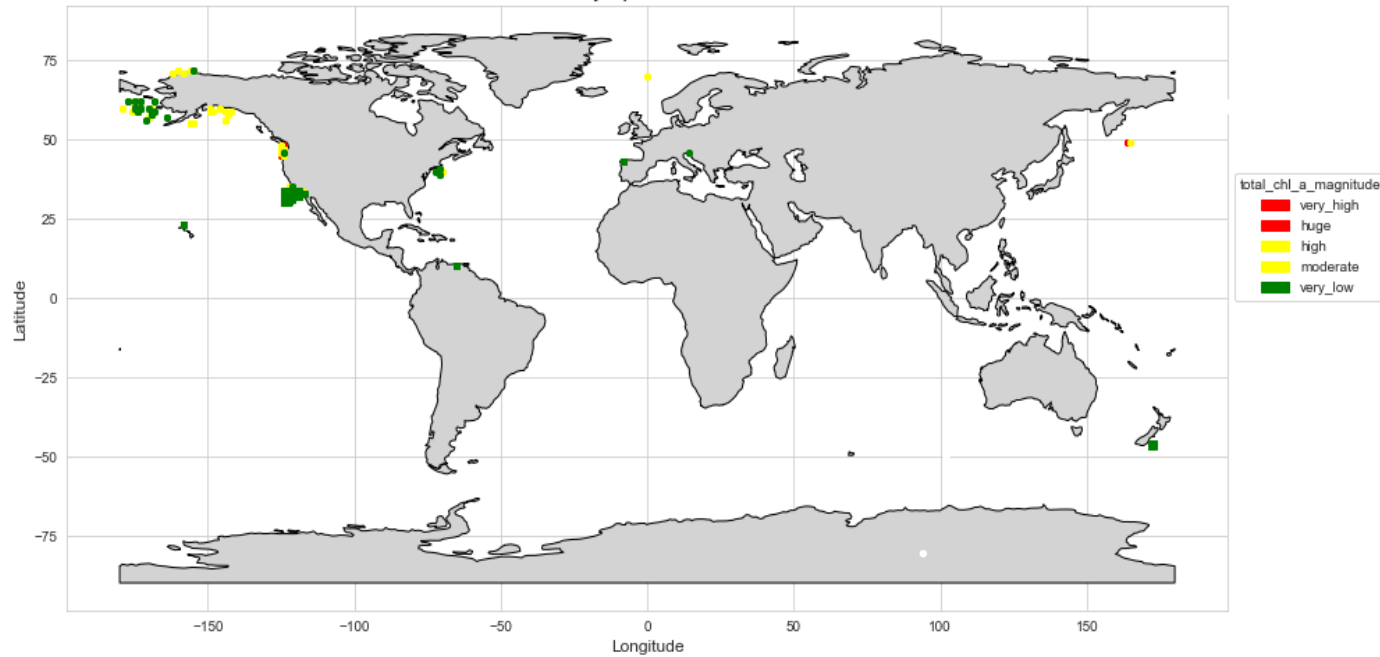
Distribution of Phytoplankton from 1958-2000



## Distribution of Phytoplankton

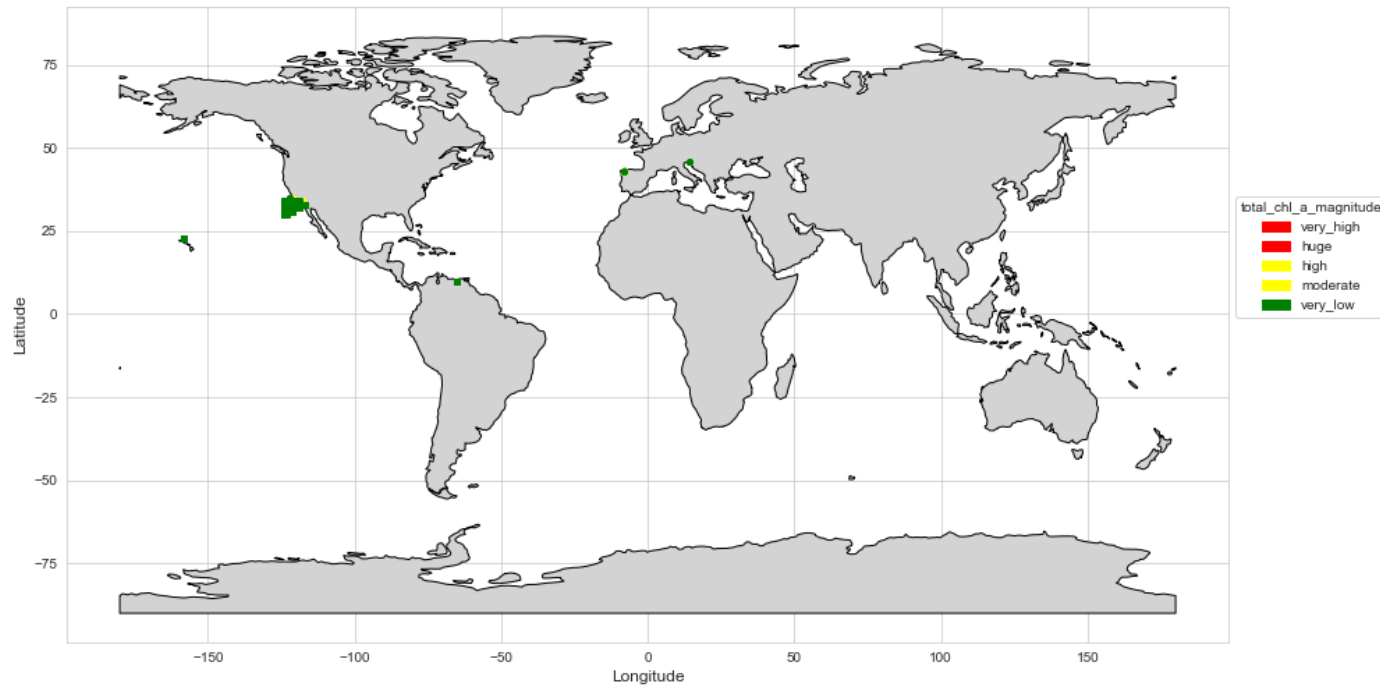
• PLANKTON HEAVILY CONCENTRATED NEAR THE INDIAN SEAS AND THE NORTH SEA DURING 1958-2000: 10,79,727 MG/M<sup>2</sup>

Distribution of Phytoplankton from 2001-2010

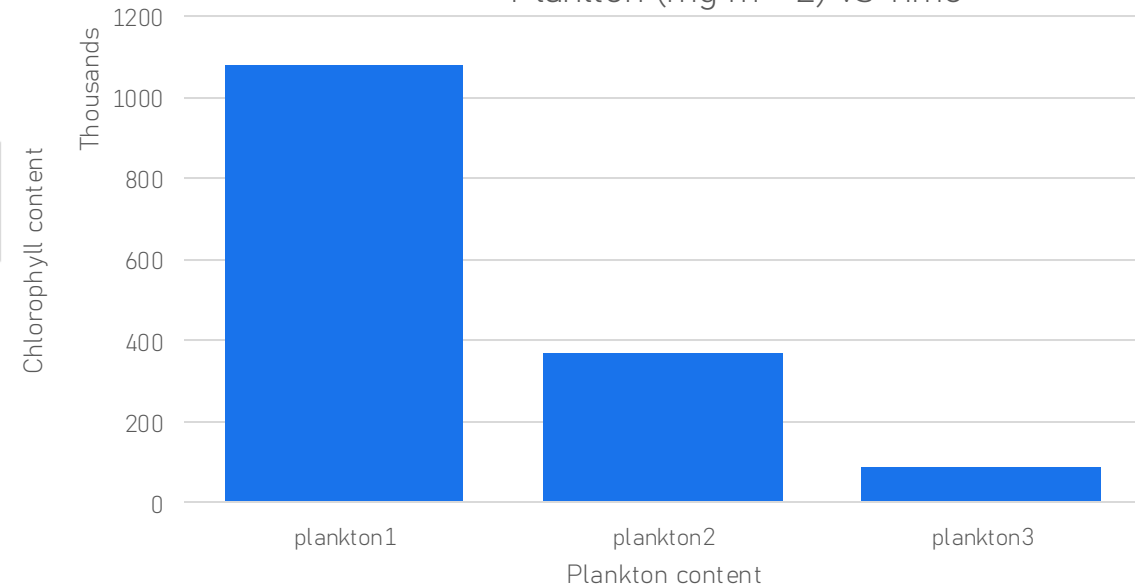


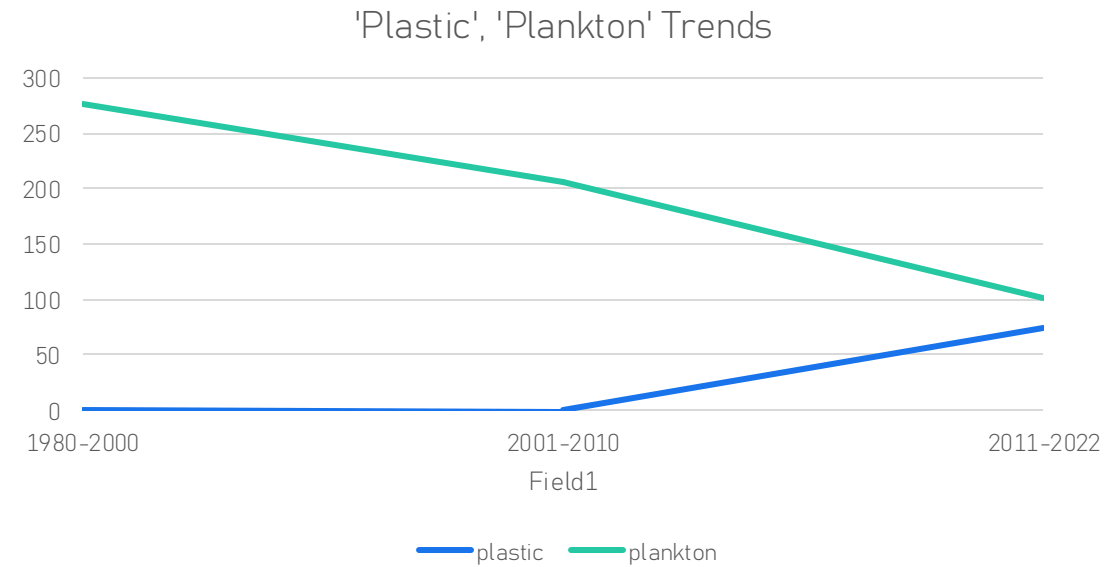
PLANKTON POPULATION IS  
CONCENRATED NEAR PACIFIC OCEAN,  
SAN DIEGO AND ALASKA DURING  
2001-2010:3,69,285 MG/M<sup>-3</sup>

PLANKTON POPULATION IS  
CONCENRATED NEAR PACIFIC OCEAN,  
SAN DIEGO DURING 2011-2017:90464  
MG/M<sup>-3</sup>



Planlton (mg m<sup>-2</sup>) vs Time

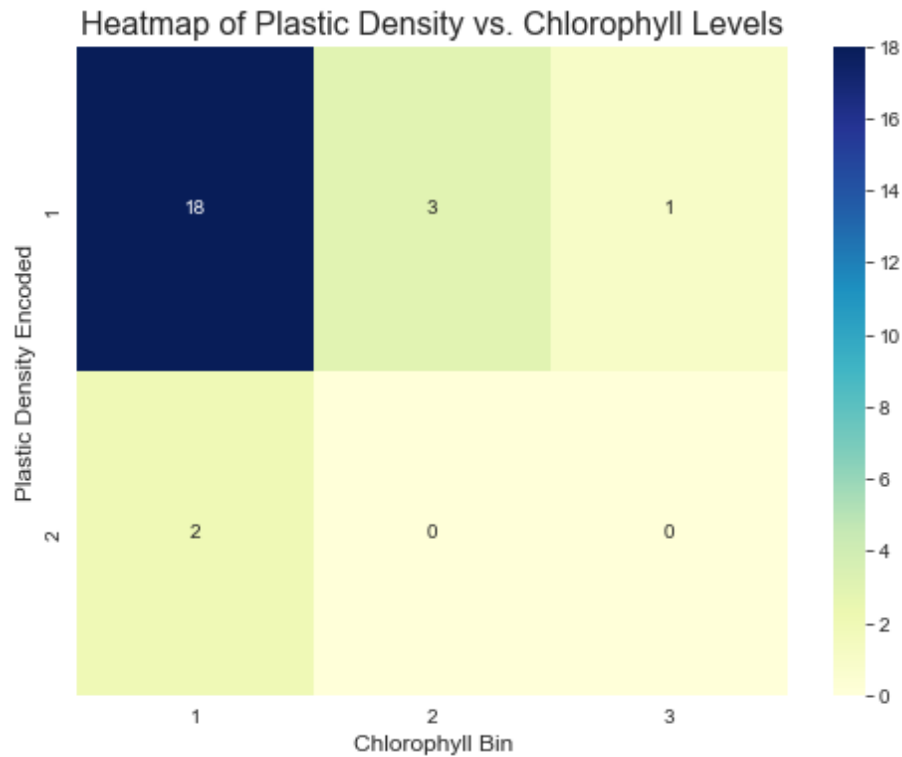




DID INCREASE IN  
PLASTIC AFFECT THE  
PHYTOPLANKTON'S?

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,

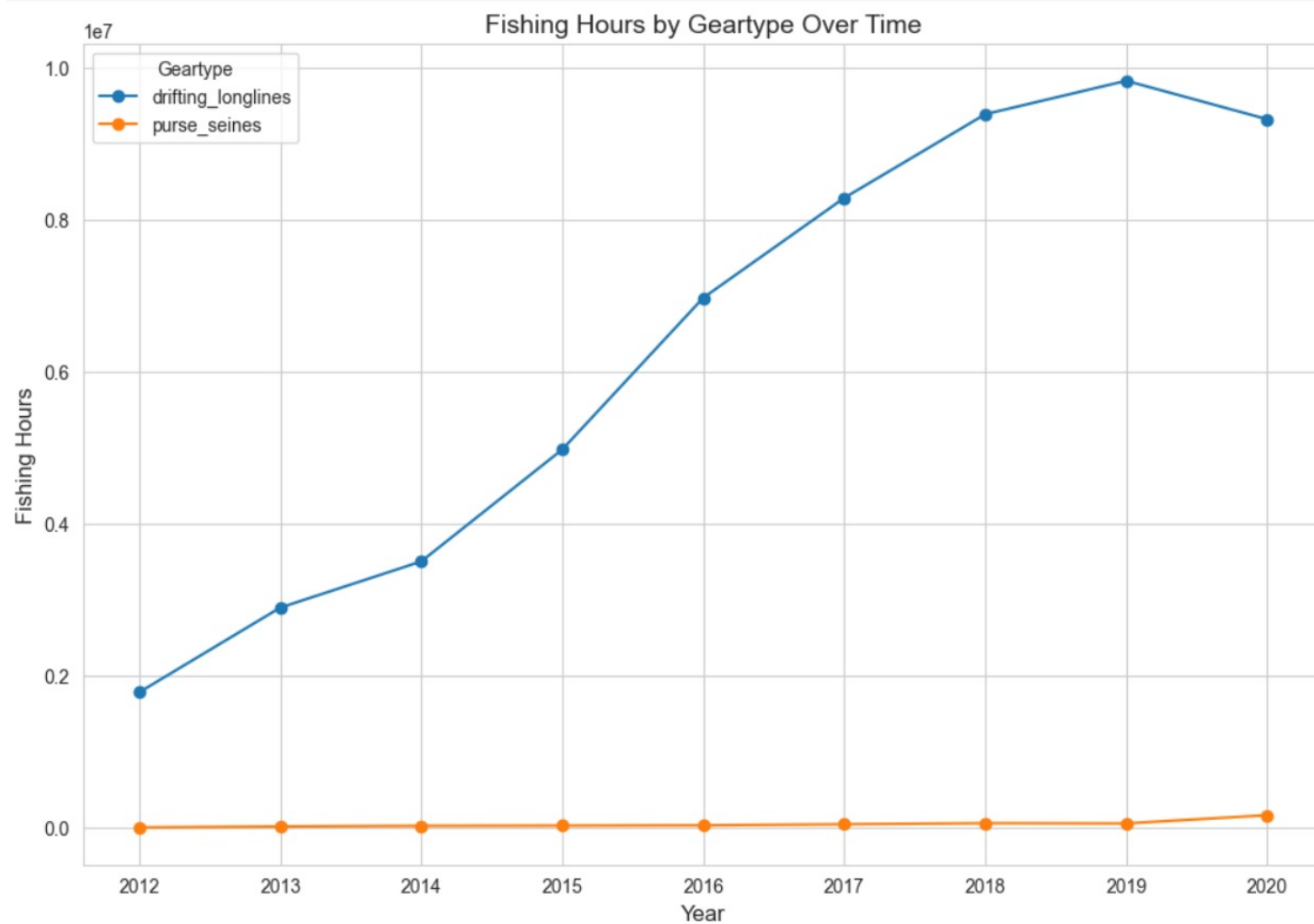
p-value: 0.5572134508986154

## Chi-Square Statistic:

0.4363636363636363,

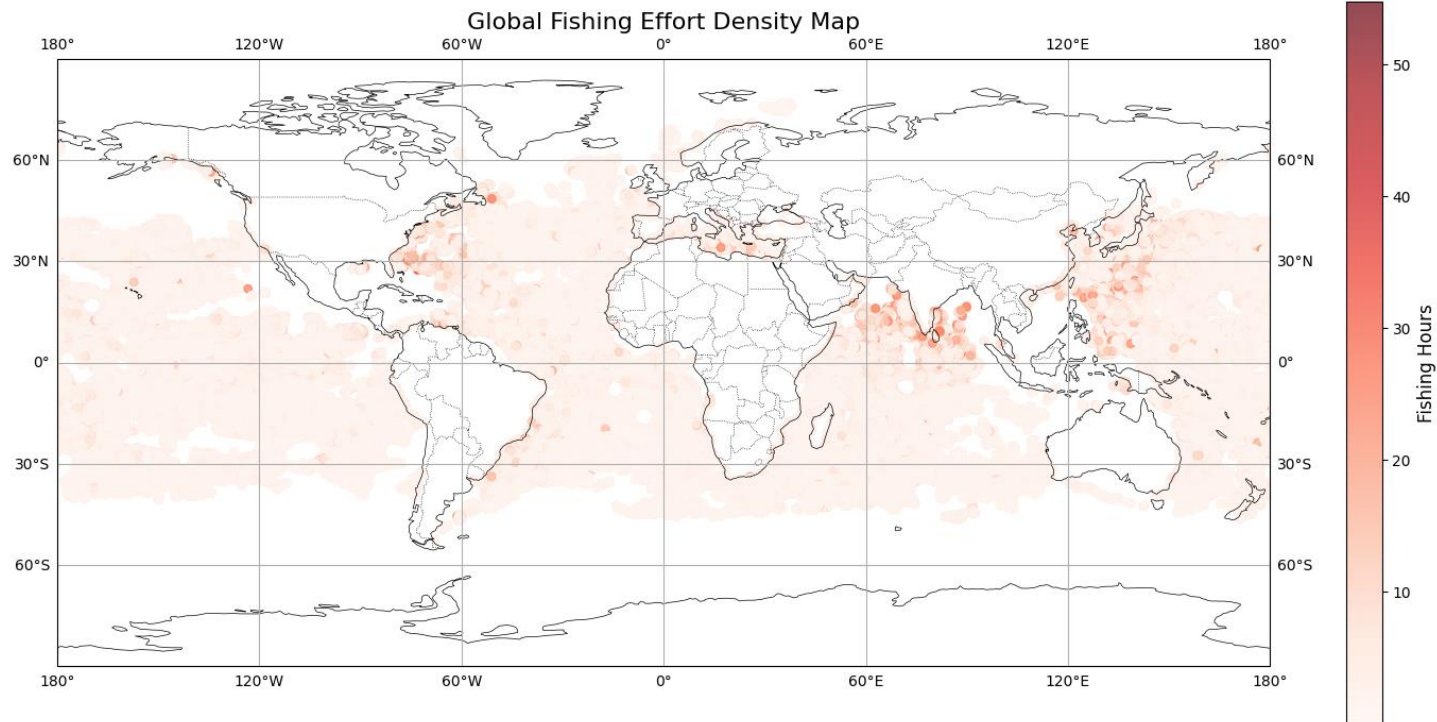
p-value: 0.8039792503313262





Did  
fishing decrease  
overtime due to  
pollution?

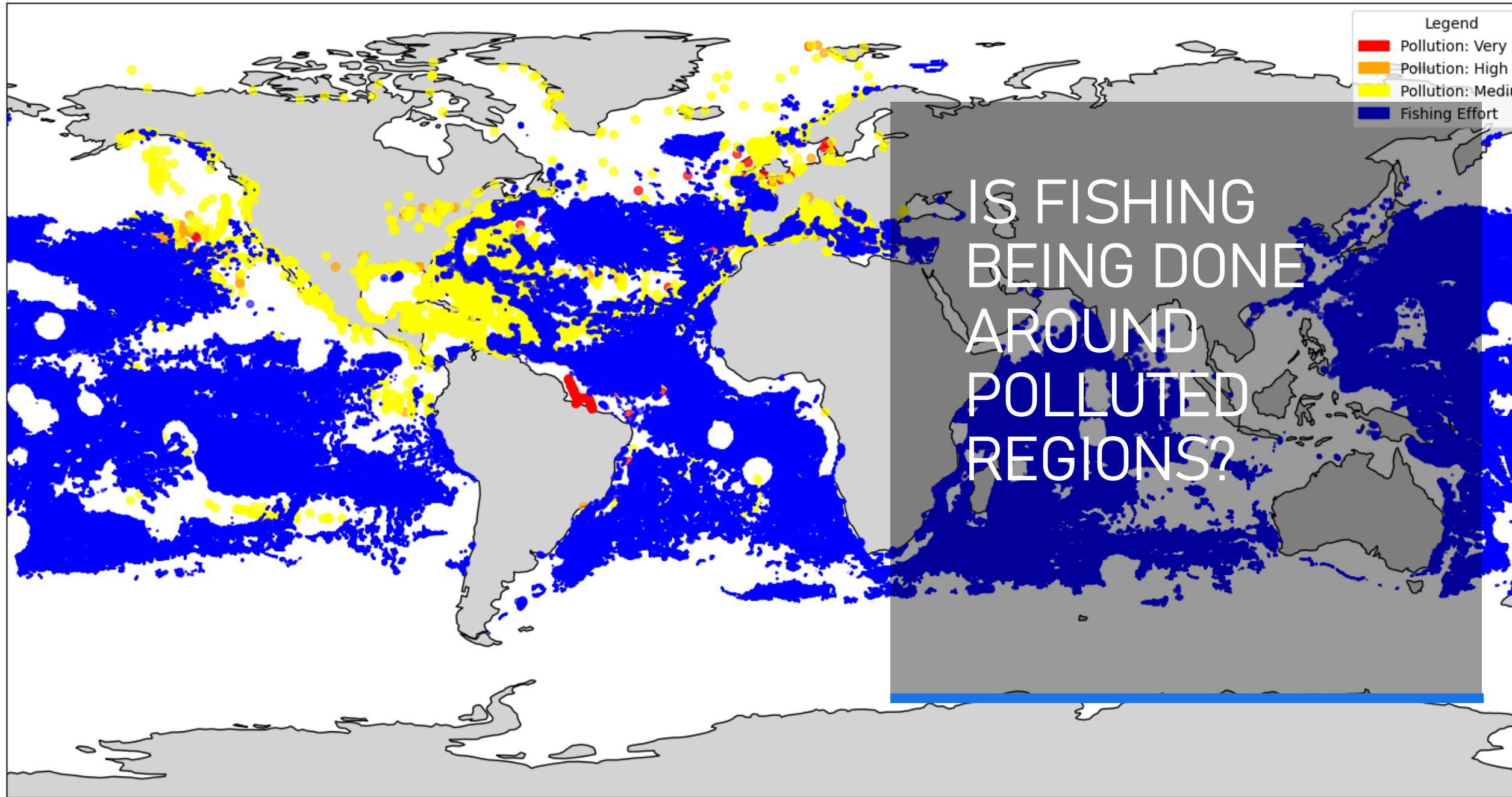
Drifting Longlines – Tuna  
Purse Seines – school fish



Does Fishing  
occur in  
Heavily  
polluted  
Areas?

Overlay of Fishing Effort and Pollution Levels

Latitude



IS FISHING  
BEING DONE  
AROUND  
POLLUTED  
REGIONS?

Longitude

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# 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 occurs 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.





*"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."*

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# Thank You

