“Variation in distribution of phytoplankton and zooplankton biomass during northeast-monsoonal period in coastal areas of Karachi, Pakistan”

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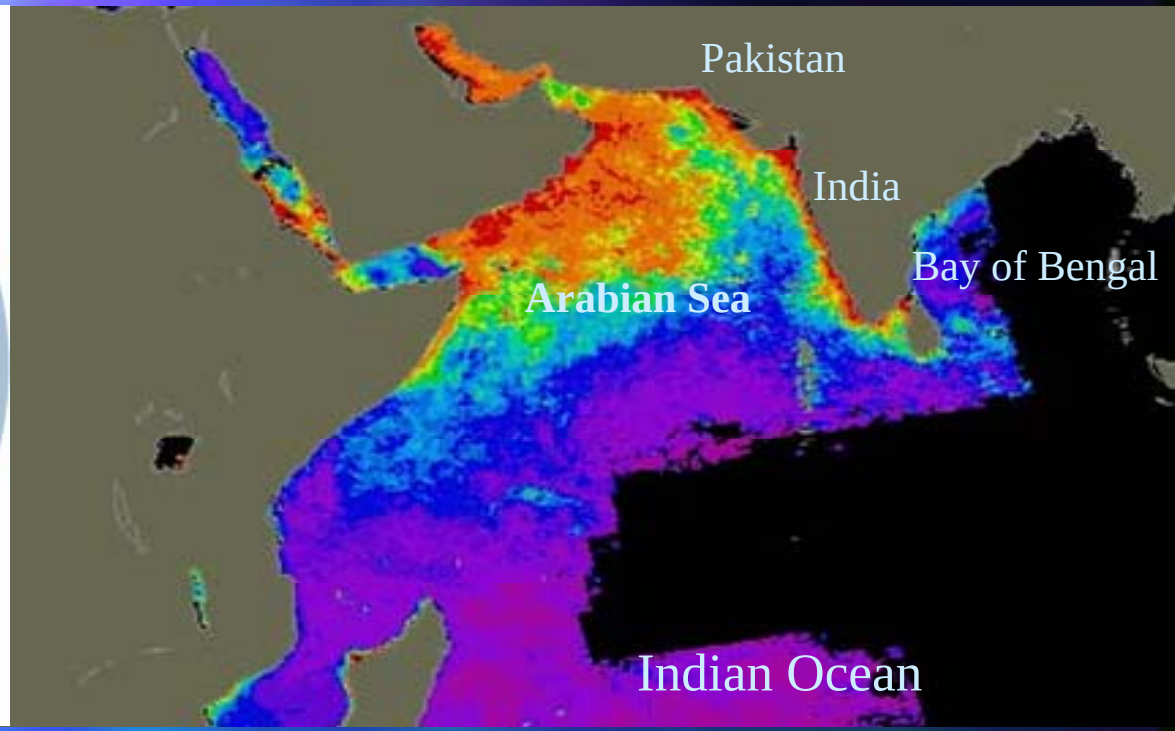
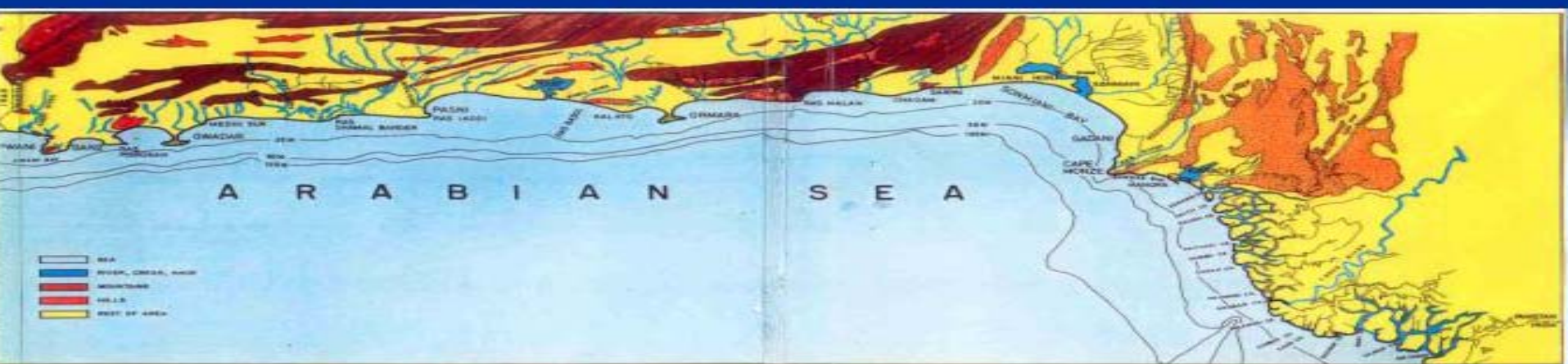
Synopsis:

- Characteristic Features
- Distribution pattern of phytoplankton and zooplankton



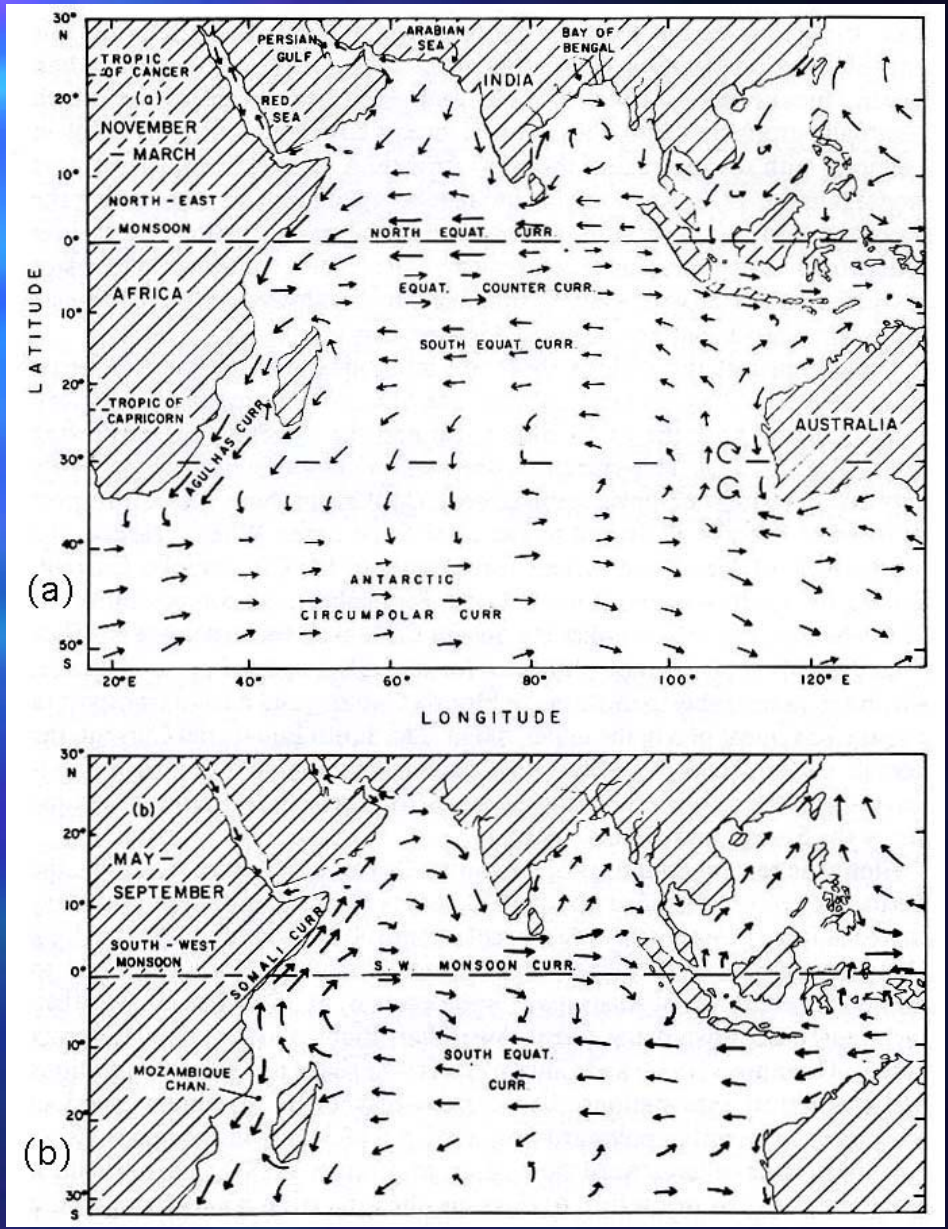
- Indian Ocean is geographically divided by Indian subcontinent into Bay of Bengal in east and Arabian Sea to its west.
- Both have unique physical characteristics they are at same latitudes but in Bay of Bengal all major rivers in India opens so the it has dominating characteristics of fresh water with significantly lower salinities then rest of the Indian Ocean.
- Arabian Sea is an area of high evaporation that receives almost no fresh water from continental land masses nr from other ocean areas. The salty discharge of red Sea adds t the high salanity and resulting in the saltiest waters of Indian Ocean.


PAKISTAN
Iran
Kalmat
Sonmiani
National Institute of Oceanography
Karachi
Mir Pur Sakro
Office & Laboratory under construction
ARABIAN SEA


ARABIAN SEA

Monsoon Reversal

- The monsoon reversal of wind stress in the Arabian is a characterizing feature of this area.
- The strong reversal along the west coast of Oman and in the Gulf of Aden is clearly apparent with the Southwest Monsoon wind stress being much stronger than that of the Northeast Monsoon.
- In the northern side of Arabian Sea bordering Pakistan although upwelling does not take place as in Oman but this clockwise and anticlockwise wind direction does have pronounced effect on the coastal productivity and determines the fate of marine plants and animals.
- The seasonal reversal of the monsoon has dramatic effects on the Arabian Sea because the sea is landlocked to the north, isolating it from large-scale ocean circulation patterns.

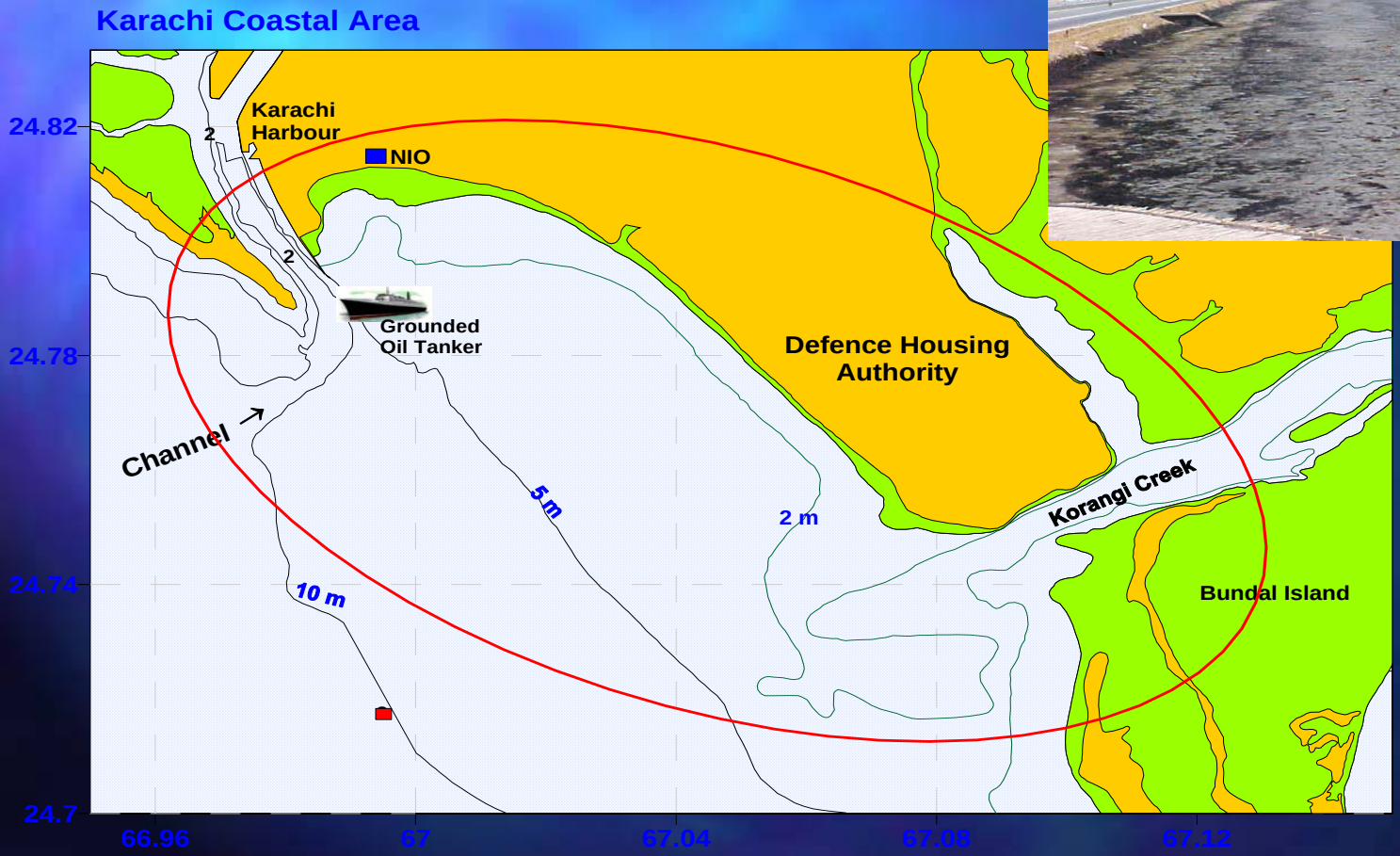


❊This incidence of Tasman Spirit oil spill occurred in July 2003.

❊The tanker M/T Tasman Spirit spilled more than 27,000 tons of Iranian light crude oil when it was grounded in Karachi Harbor channel on 27th July, 2003.


Tasman Spirit


Intertidal region



The coastal area where the tragedy occurred is relatively shallow with depths ranging from 1-20 m.

Pelagic food chain

Primary producers

Phytoplankton (Net & Niskin bottles)

Primary consumers

zooplanktons (Net samples)

Secondary consumers

Nektons (Trawl nets)

Benthic food chain

Primary producers

Phytoplankton & Seaweeds (core & grab)

Primary consumers

Meiobenthos (Core)

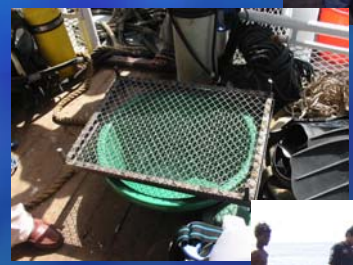
Secondary consumers

Macro & Nekto-benthos (Grab, Dredge & Trawl)

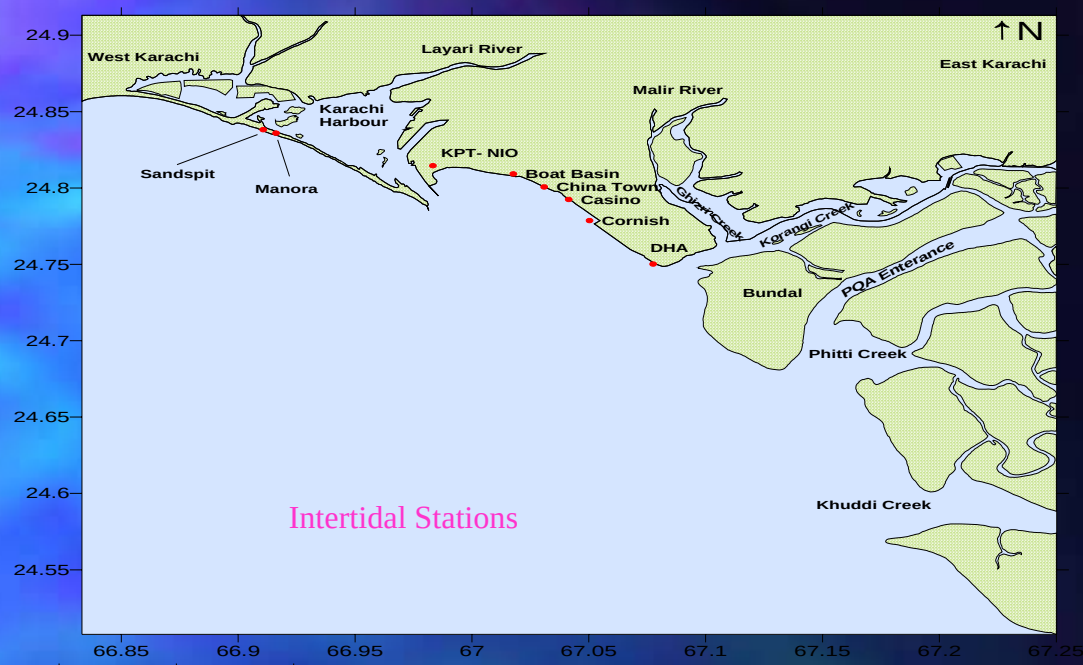






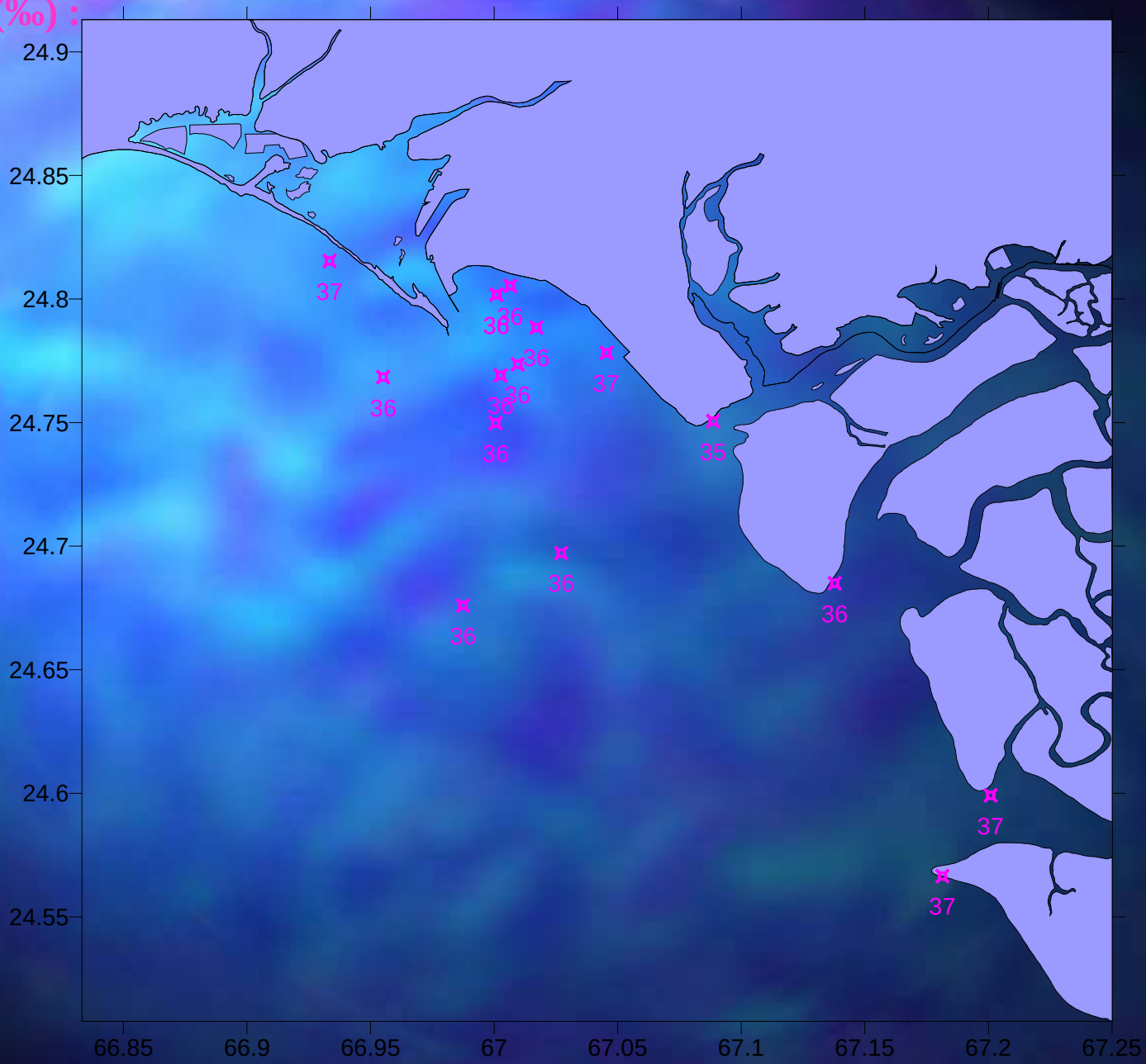



Study Stations:

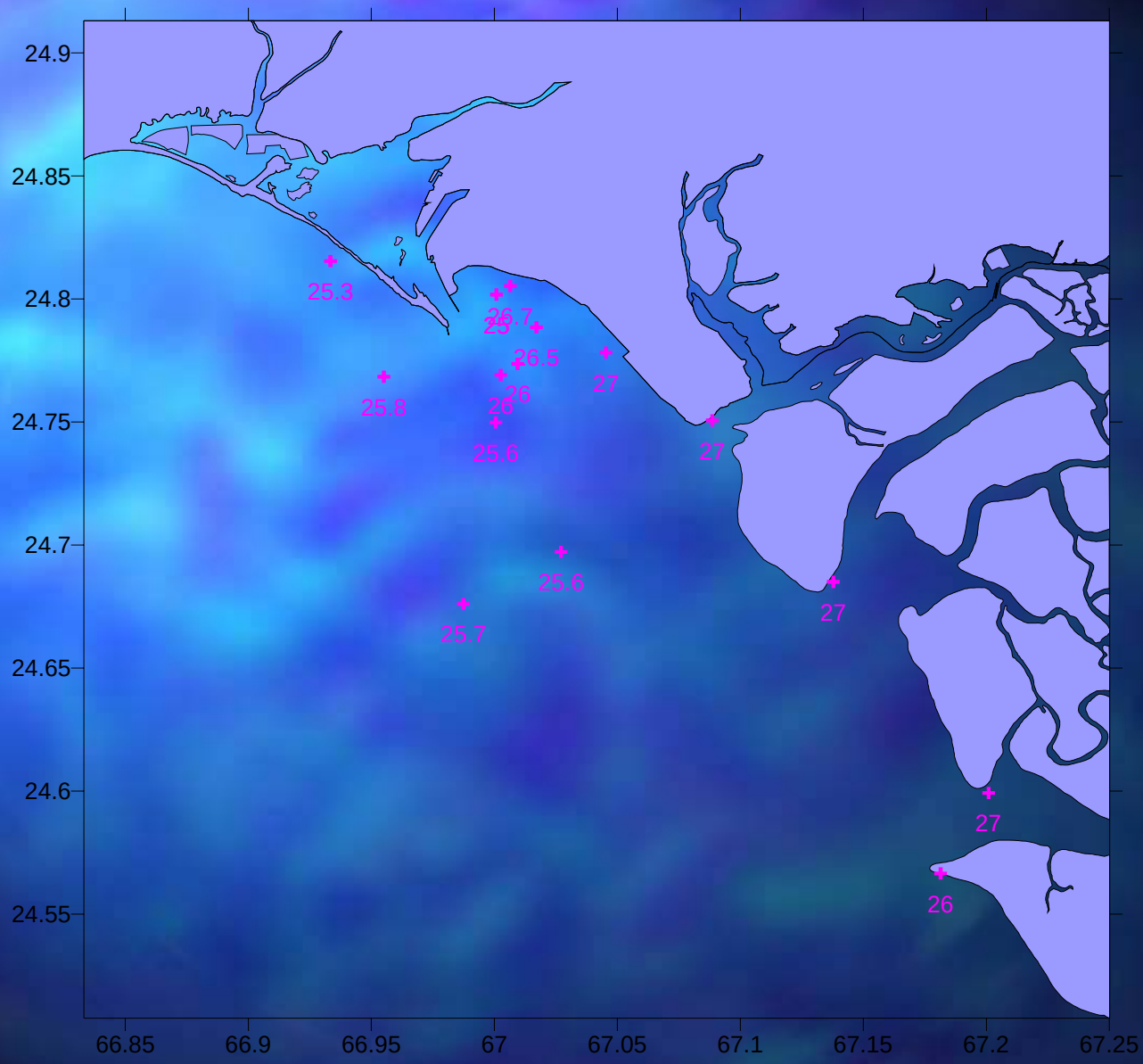


Studies were carried out from eight intertidal and sixteen subtidal stations repeating the stations of Short term study.

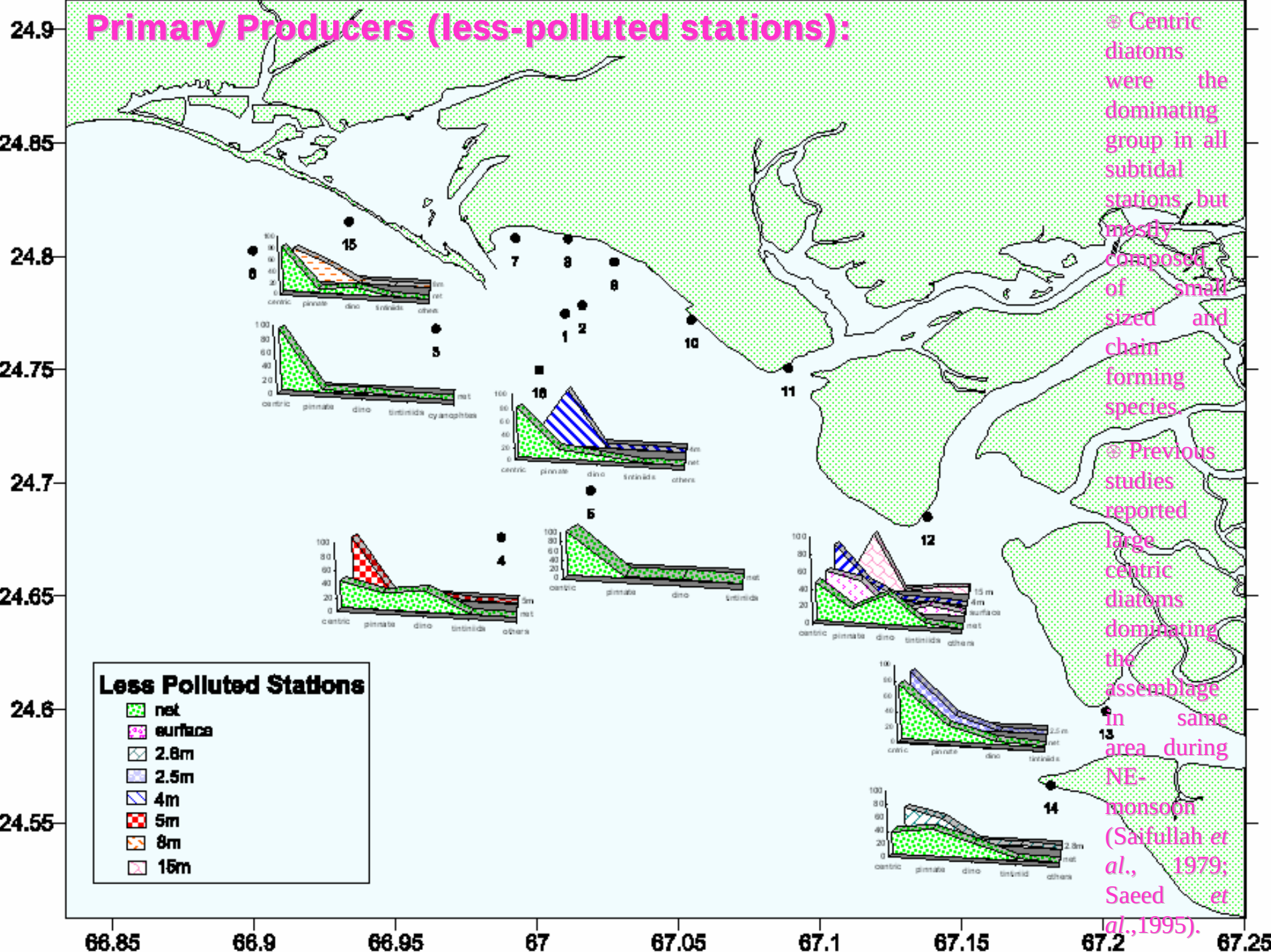
Salinity (‰) :


24.9
24.85
24.8
24.75
24.7
24.65
24.6
24.55
66.85
66.9
66.95
67
67.05
67.1
67.15
67.2
67.25
37
36
36
36
36
36
37
36
35
36
36
36
37
37

Water Temperature (° C):

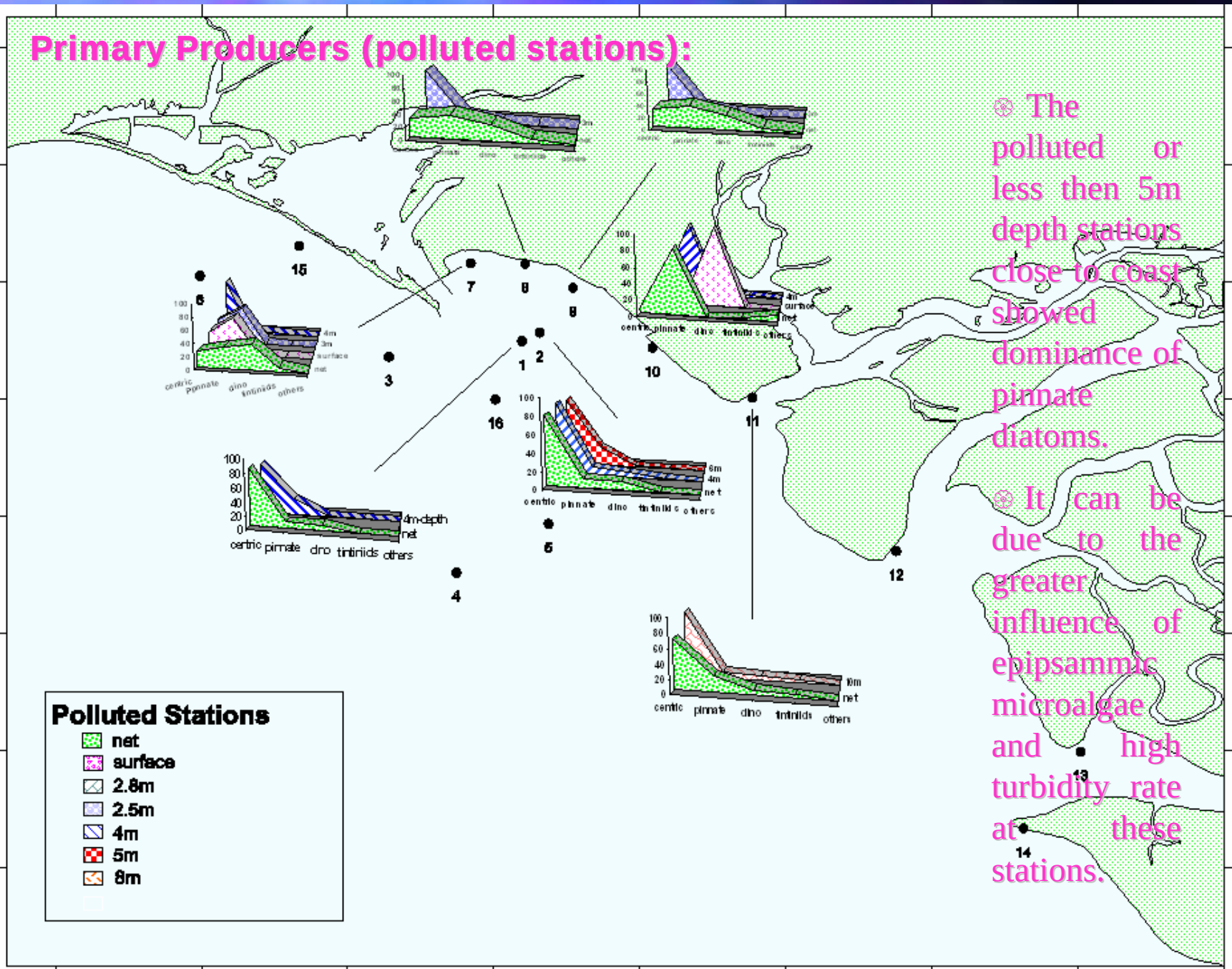


Primary Producers (less-polluted stations):



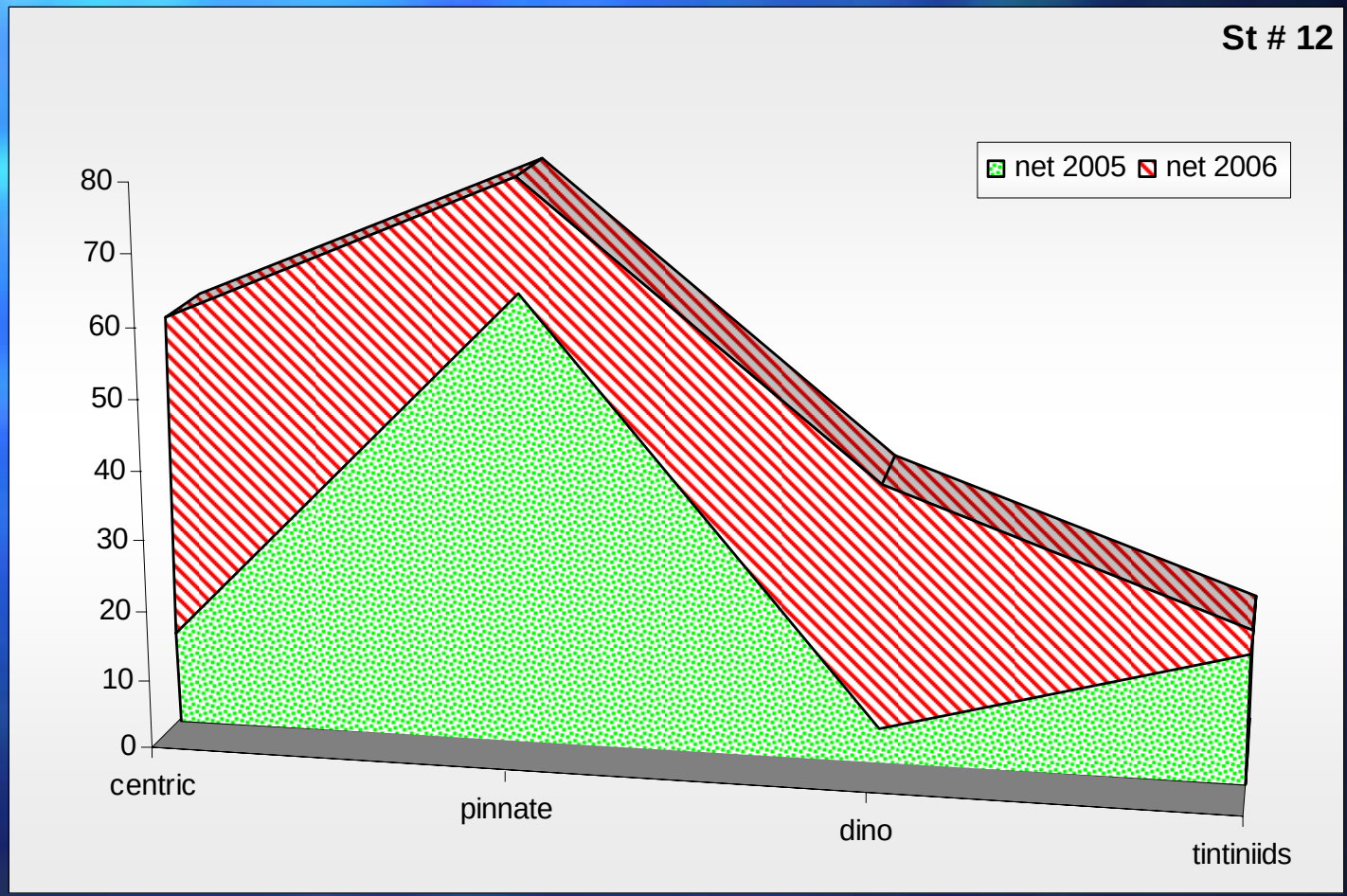
- Centric diatoms were the dominating group in all subtidal stations but mostly composed of small sized and chain forming species.
- Previous studies reported large centric diatoms dominating the assemblage in same area during NE-monsoon (Saifullah *et al.*, 1979; Saeed *et al.*,1995).

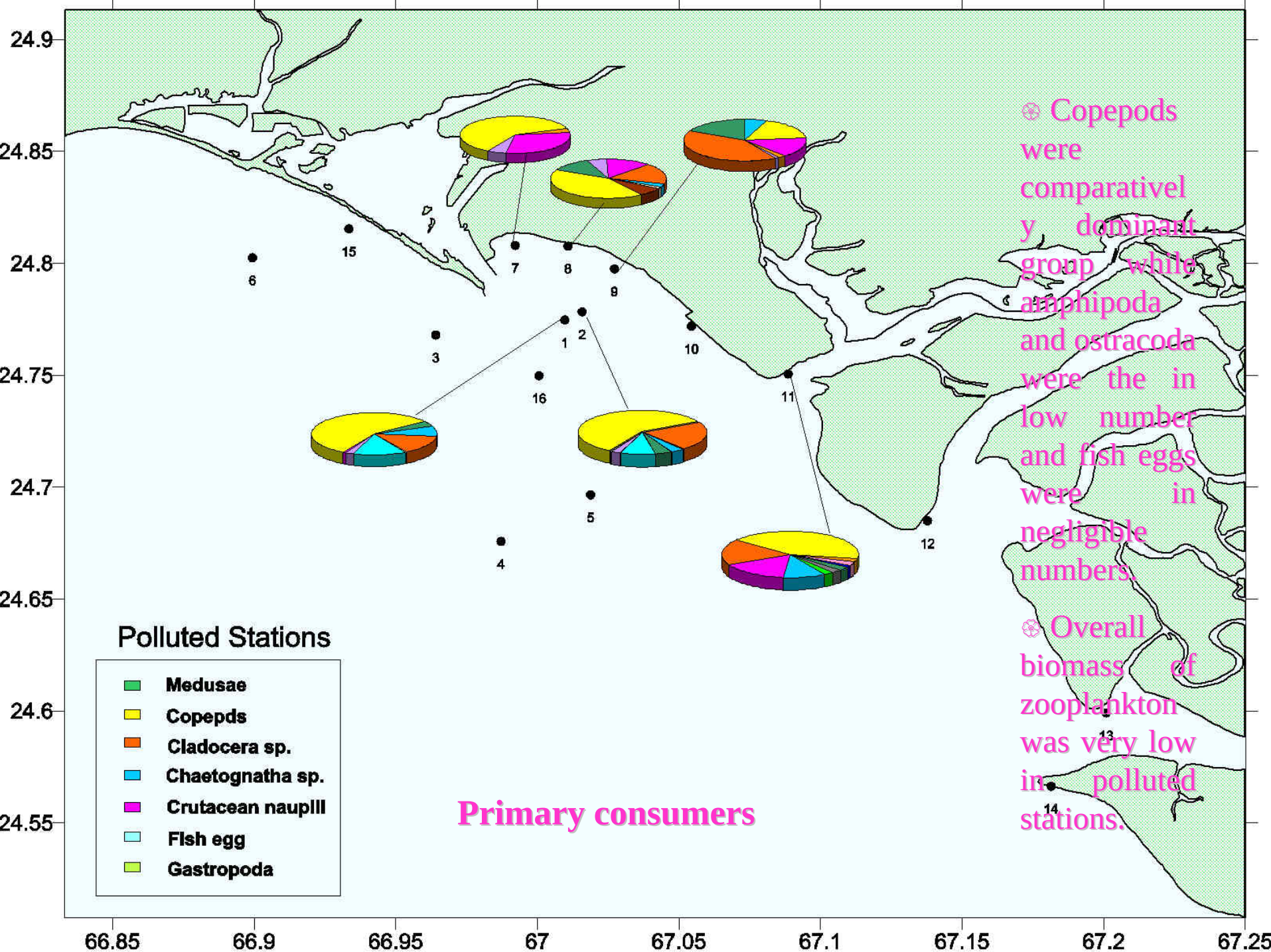
Primary Producers (polluted stations):



- The polluted or less then 5m depth stations close to coast showed dominance of pinnate diatoms.
- It can be due to the greater influence of epipsammic microalgae and high turbidity rate at these stations.

Percentage distribution of different groups during 2005 & 2006




24.9
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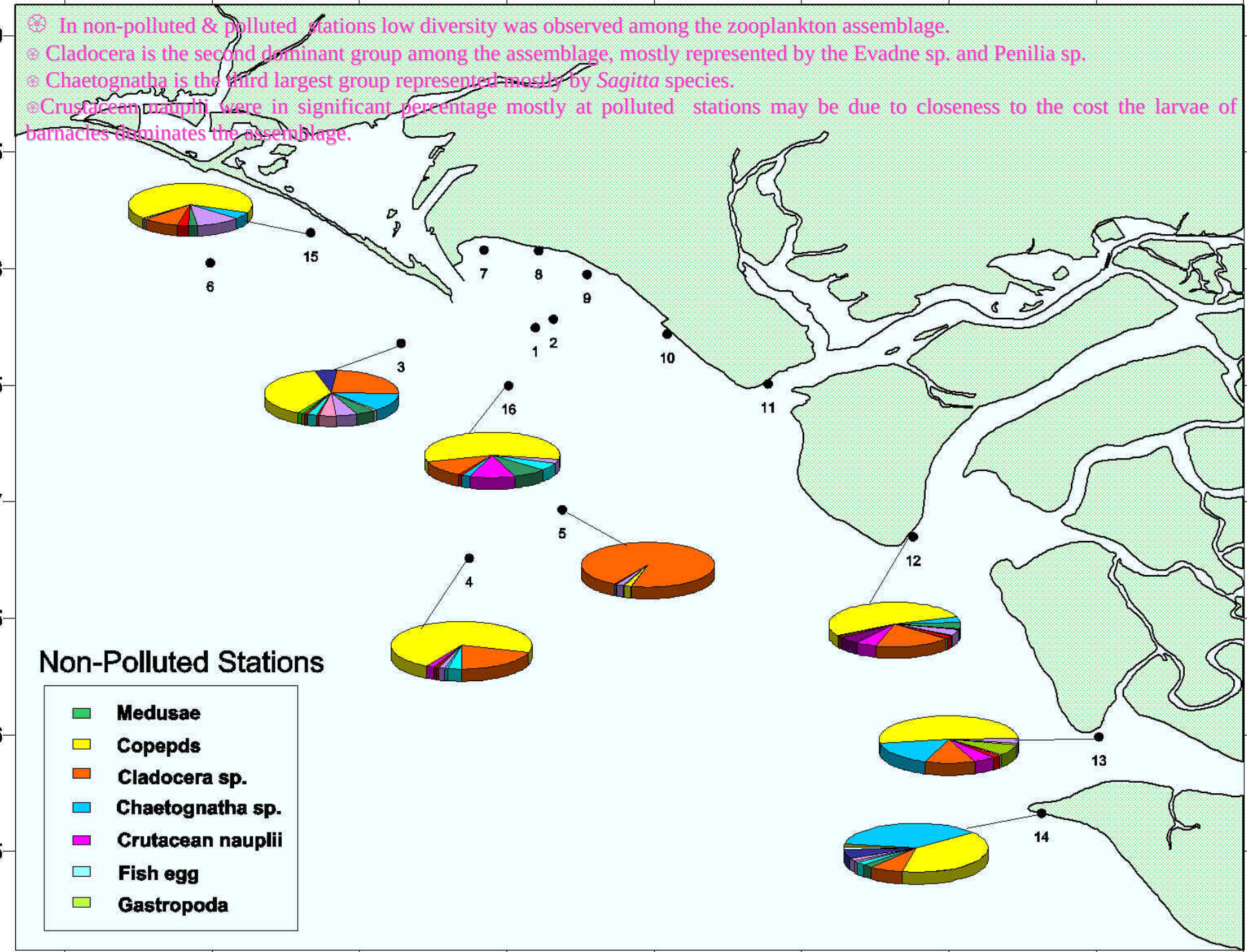
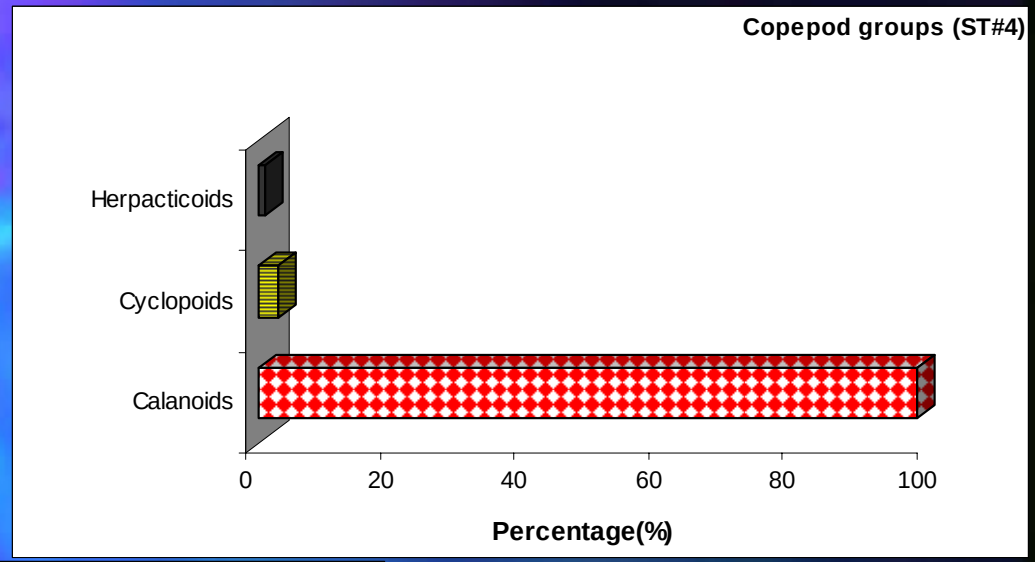
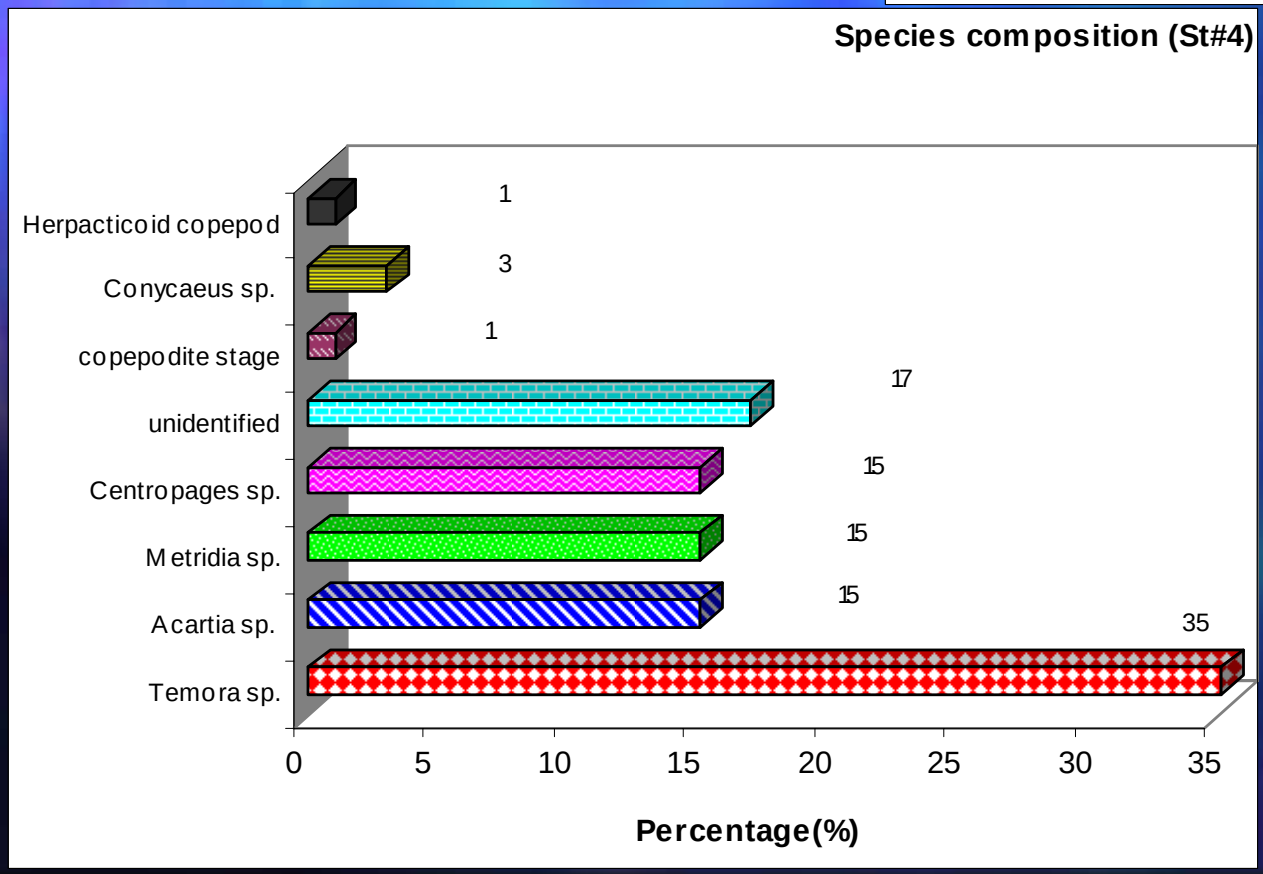
67.05
67.1
67.15
67.2
67.25
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
Polluted Stations
Medusae
Copepds
Cladocera sp.
Chaetognatha sp.
Crutacean nauplII
Fish egg
Gastropoda
Primary consumers
❁ Copepods were comparatively dominant group while amphipoda and ostracoda were the in low number and fish eggs were in negligible numbers.
❁ Overall biomass of zooplankton was very low in polluted stations.

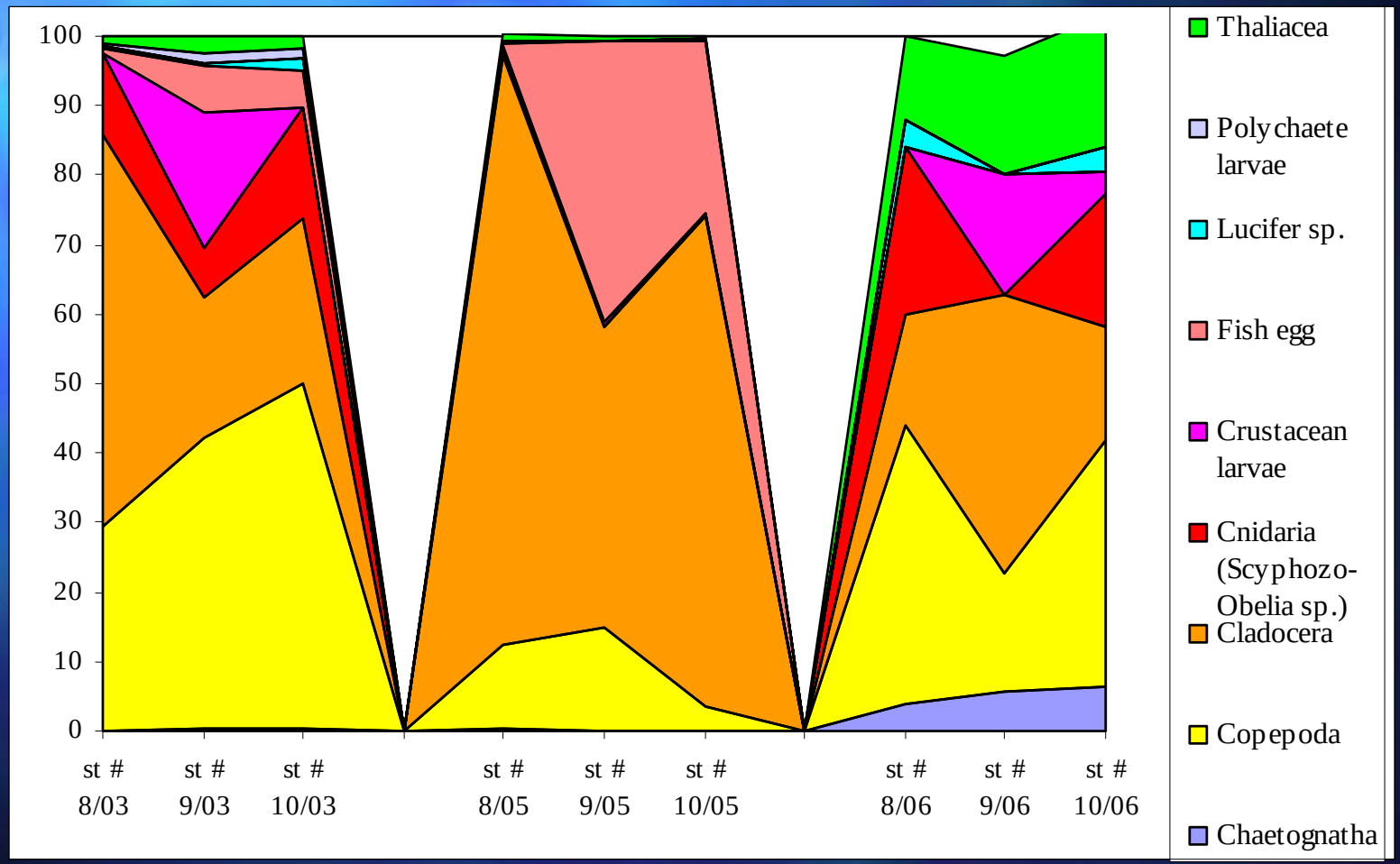
- In non-polluted & polluted stations low diversity was observed among the zooplankton assemblage.
- Cladocera is the second dominant group among the assemblage, mostly represented by the Evadne sp. and Penilia sp.
- Chaetognatha is the third largest group represented mostly by *Sagitta* species.
- Crustacean nauplii were in significant percentage mostly at polluted stations may be due to closeness to the cost the larvae of barnacles dominates the assemblage.




Copepod groups (ST#4)
Herpacticoids
Cyclopoids
Calanoids
0
20
40
60
80
100
Percentage(%)


Species composition (St#4)
Herpacticoid copepod
1
Conycaeus sp.
3
copepodite stage
1
unidentified
17
Centropages sp.
15
Metridia sp.
15
Acartia sp.
15
Temora sp.
35
0
5
10
15
20
25
30
35
Percentage(%)

Percentage distribution of zooplankton species at station # 8,9 & 10 in 2003,2005 & 2006



Conclusion:

- **The increasing human population in coastal areas and incidences like oil spill has adverse effect on the marine organisms specially affecting the species diversity and richness and normal distribution pattern of intertidal floral and faunal communities.**

- **Our coastal marine ecosystem is relatively poorly understood and recorded. Several physical phenomenon are effecting the distribution of these planktonic organisms i.e. apart from salinity, temperature and turbidity currents, wind direction and tidal regimes are important player in determining the fate of the planktonic communities.**

- **To predict oil spill biological impacts certain key factors like volume, timing of release (season), dispersal characteristics, duration of spilled oil and also weather conditions at the time of spill.**

- **Spill occurring in southwest monsoonal period (which is considered highly productive period for benthic and pelagic communities) is destructive to species involved in breeding and wiped off the early juvenile life stages of marine organisms.**

- **The results of this study showed low diversity pattern and replacement of large sized phytoplankton by small sized chain forming species. Pinnate diatoms were found to be dominating in samples of polluted stations mostly represented by *Nitzschia* sp. Comparative data analysis of 2005 and 2006 low biomass in 2005 following the spill while gradually increasing in the samples of 2006.**

- **Similar distribution pattern was observed in zooplankton samples they were less diversed, and the dominating copepods composed of calanoids, cyclopoids and herpacticoids were only represented by 5-6 species. Amphipods and isopods were completely absent which have been reported in earlier studies from same area.**

Conclusion Cont.:

- Cladocera seems to be more resistant to oil pollution then other groups as they were more in number at polluted stations.
- **Cladocera the second dominating group mostly represented by two *Evadne* sp. followed by *Penilia* sp.** Chaetognatha was found to be the third dominant group represented by *Sagitta* sp. almost at all stations .
- Copepod and Chaetognaths distribution in 2003, 2005 and 2006 samples showed a marked decrease in biomass of the 2005 samples , whereas increase in percentages of Cladocera and fish eggs was observed.
- A similar trend of diversity among the zooplankton groups was observed in samples of 2003 & 2006, while 2005 samples showed a significant decrease in diversity as well as total biomass of zooplankton.
- It is concluded that the whole coastal ecosystem has been destabilized but the reversal pattern of wind helped to restrict the effect of oil in the intertidal area from where it was removed mechanically this helped in removal of oil from the area. Temperature and nature of oil also helped in disintegrating the oil droplets and the northeast monsoonal period after the incident was helpful in diluting the oil in coastal water.

Thank you

Shin-ichi Uye & Shibuya Scholarship

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