

Pattern of Macrobenthic diversity along the shelf region & eastern margin of the Arabian Sea

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- ❖ Macrobenthic communities
- ❖ Distribution
- ❖ Standing stock
- ❖ Comparison with earlier data
- ❖ Relation with Demersal fishery
- ❖ Implications
- ❖ Future studies

Arabian Sea is one of the most biological productive (PP $\sim 0.6\text{gC}/\text{m}^2/\text{d}$) region of the world oceans.

Strong seasonality of the monsoon induced large-scale changes in marine productivity (Brock et al., 1994; Madhupratap et al., 1996)

About $\sim 4 - 8\%$ of carbon fixed by primary producers is exported to 100m

Objectives

- ❖ To understand the seasonal variability in diversity, abundance and biomass of macrobenthic fauna.
- ❖ Relationship between the faunal abundance & food availability.
- ❖ Distinguish **anthropogenic** versus natural driven changes in the benthic environment.

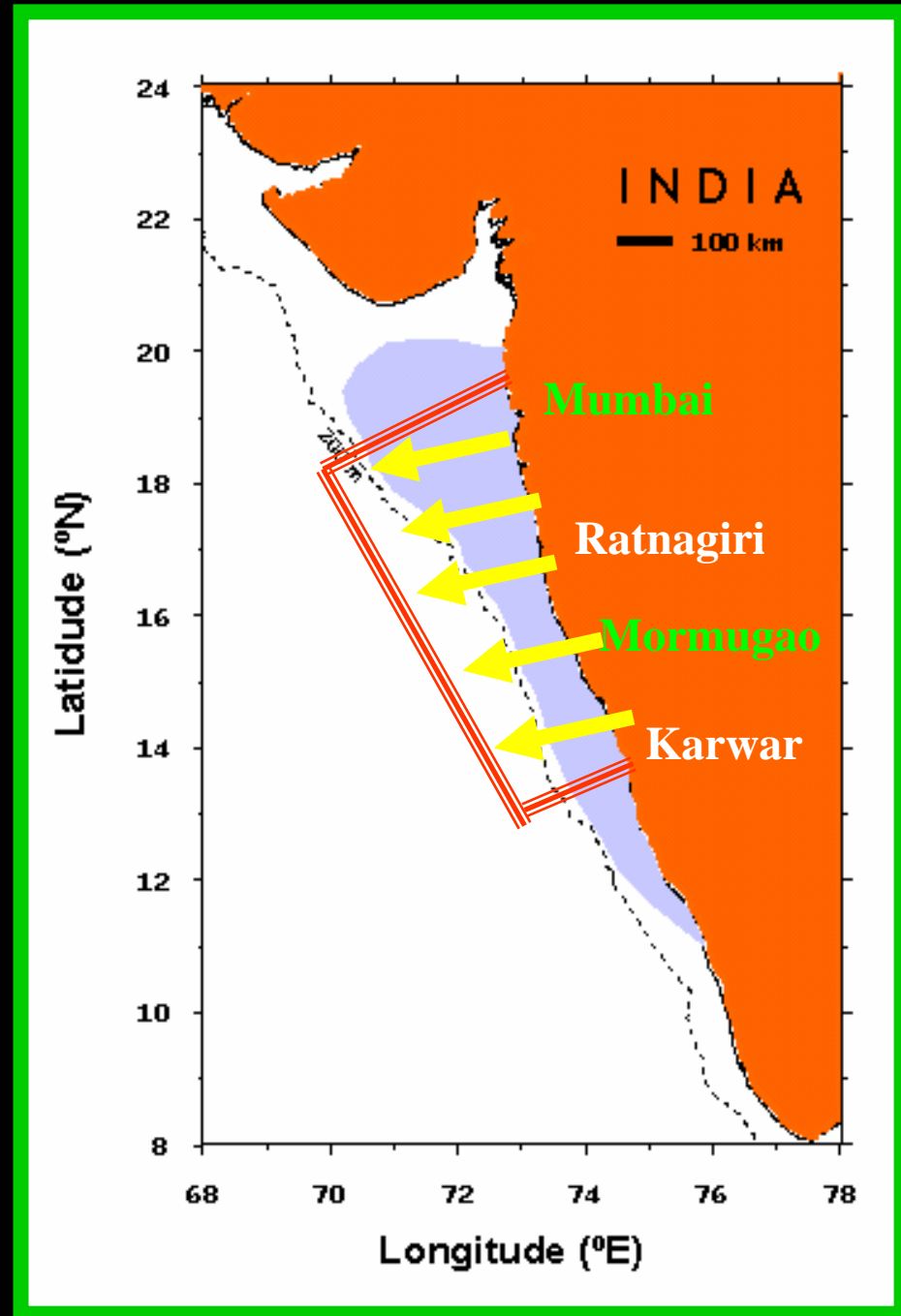
Study Area

Sampling: 122
Stns. from 20-500m
depth

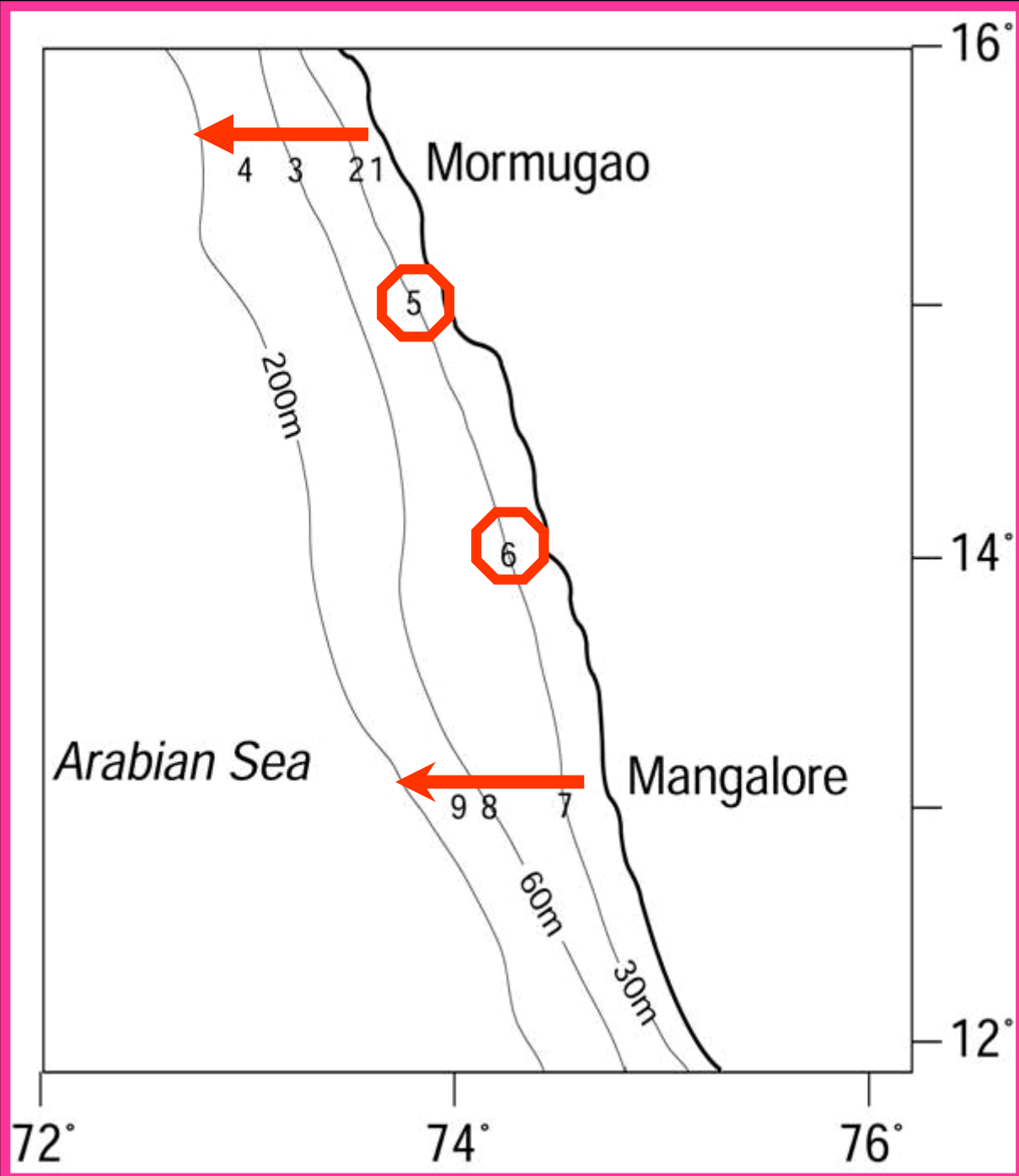
Seasonally: 9 stn

One-time: 20 stn

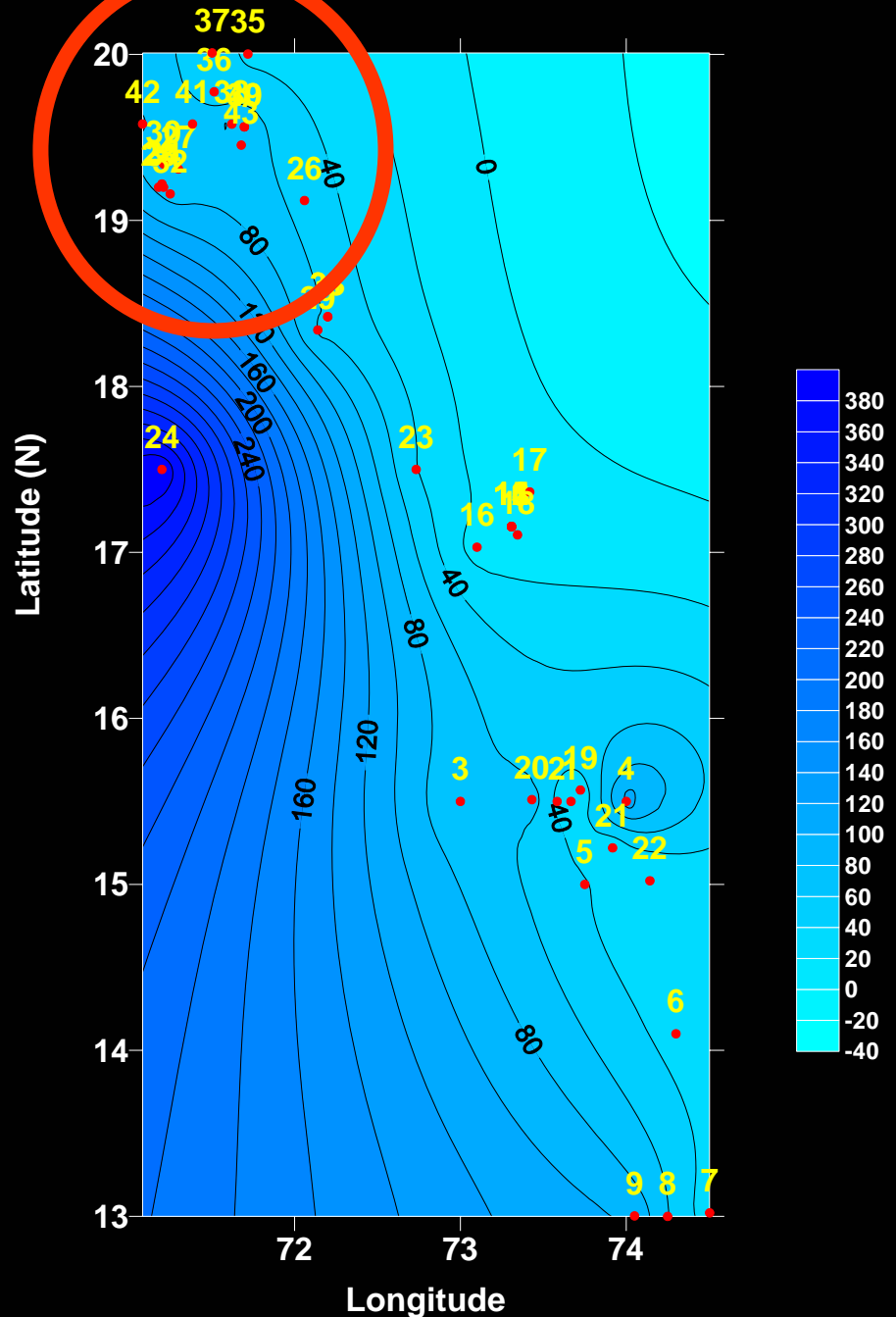
Long-term: 93 stns.



Seasonal sampling area



Long-term sampling stations

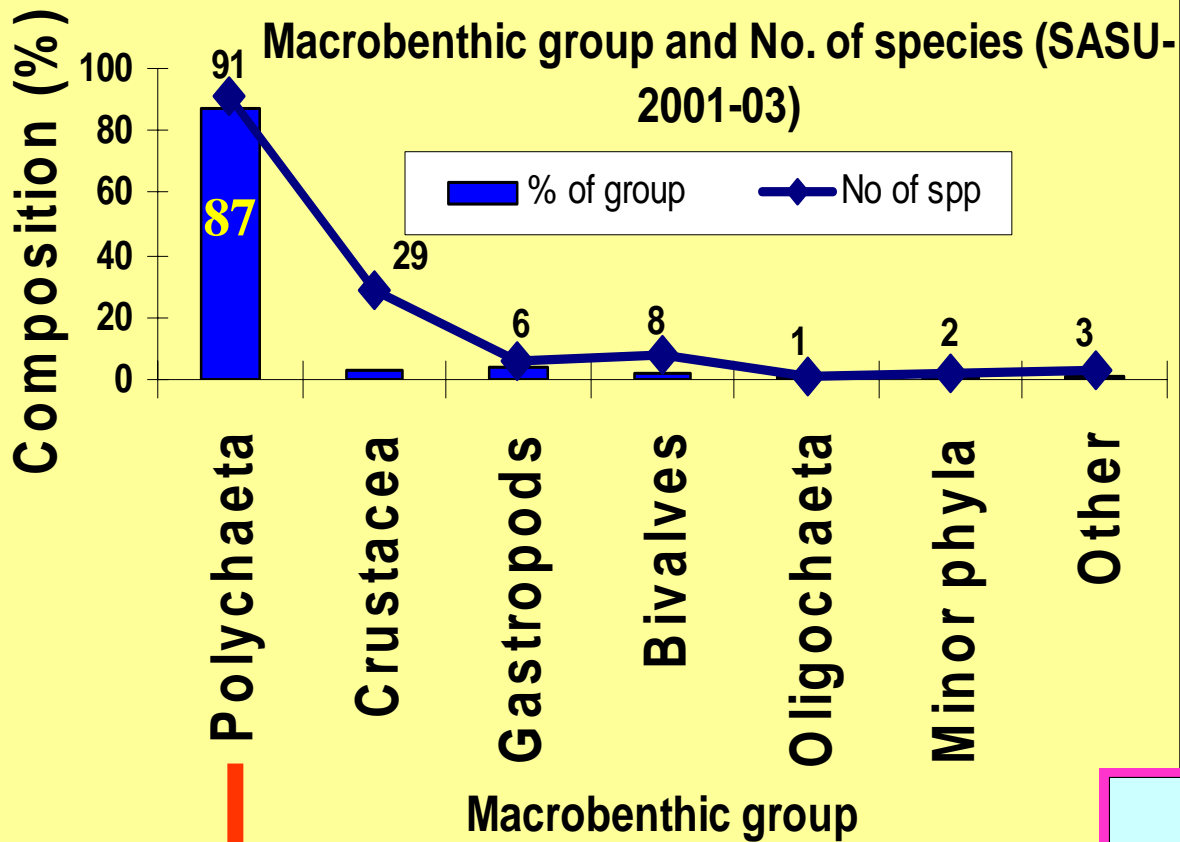


- Samples were collected on board Sagar Sukati; Sagar Kanya; Sagar Purvi; Sagar Paschimi

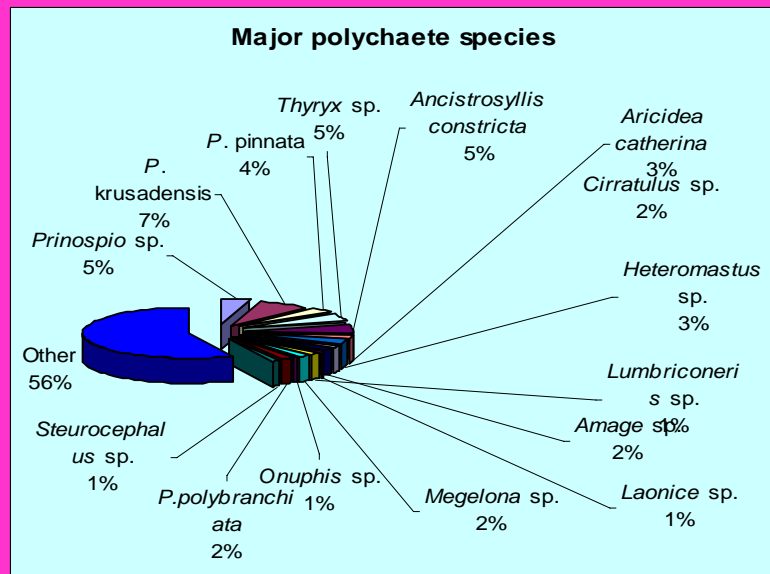
- van Veen grab & Box core were used, but to have uniformity, only grab samples are considered



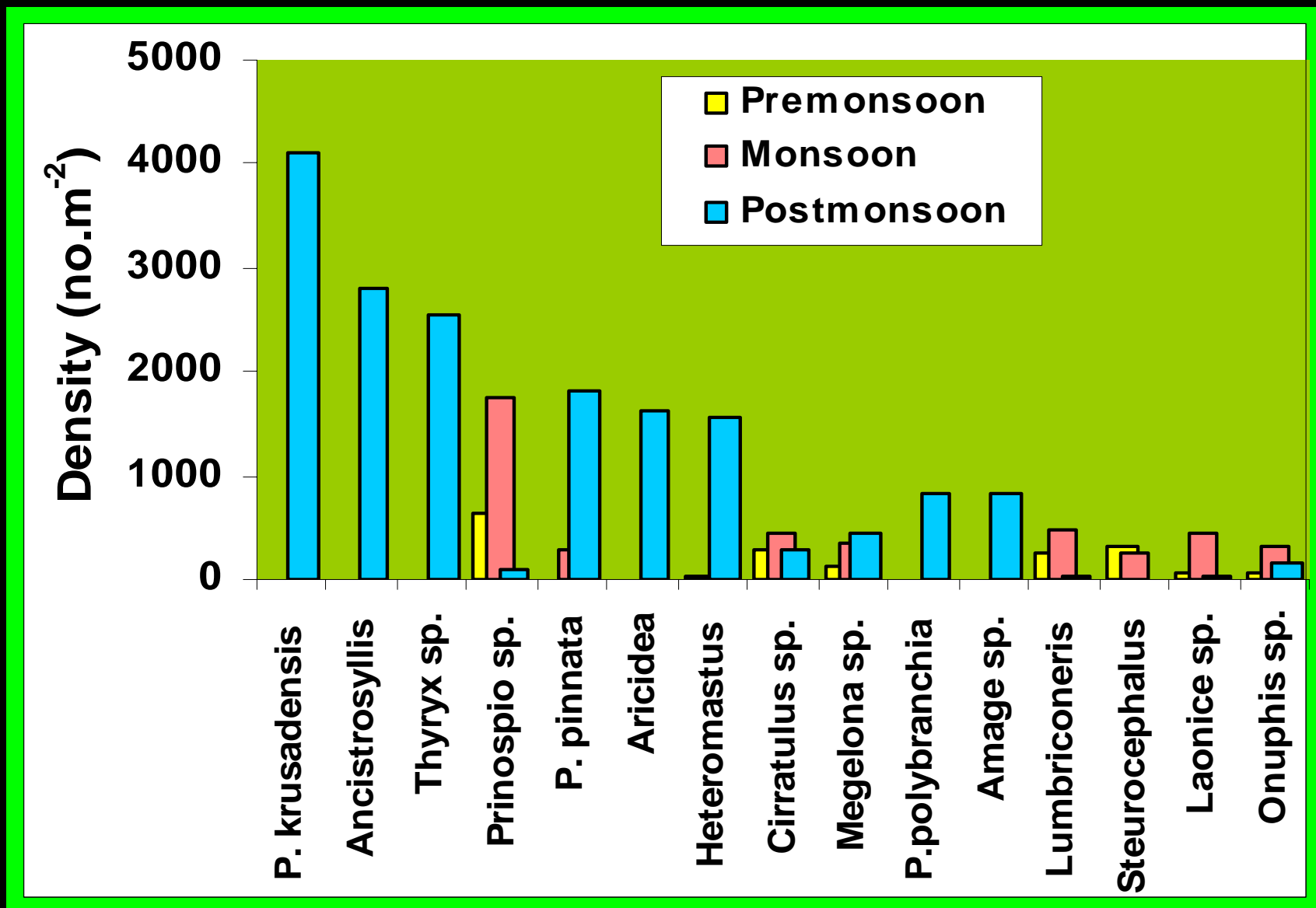
Box core

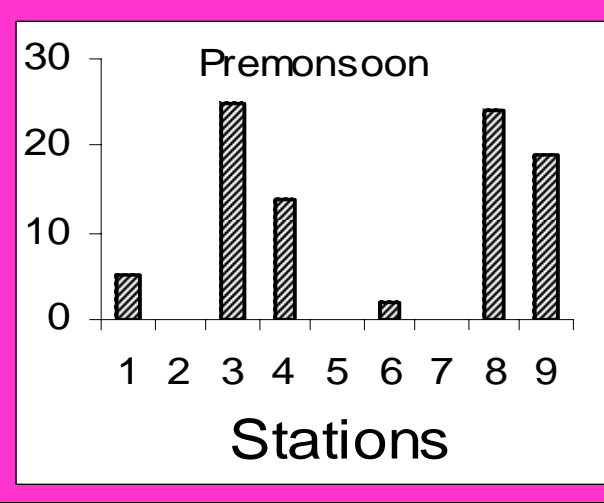
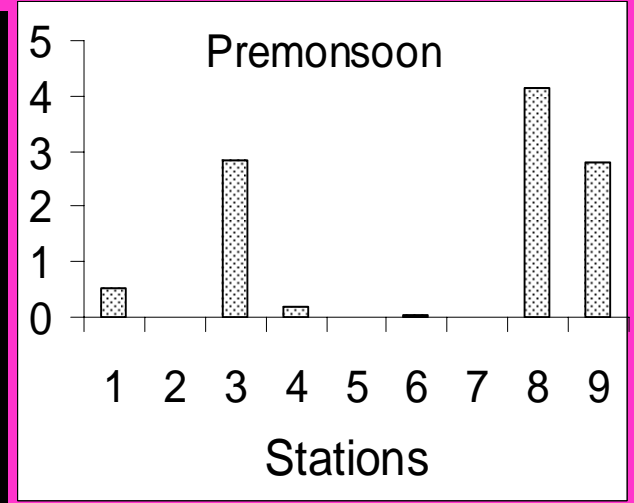
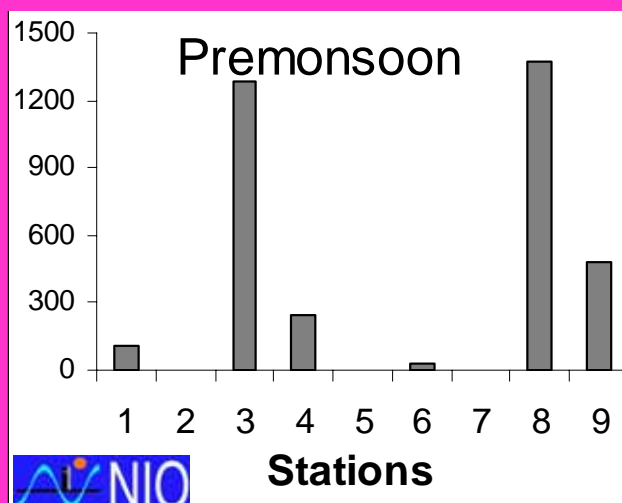
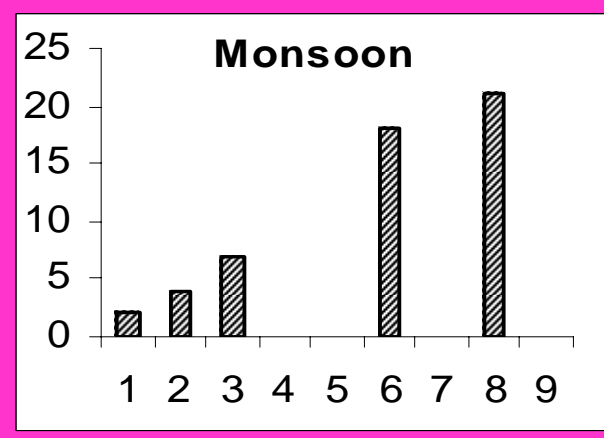
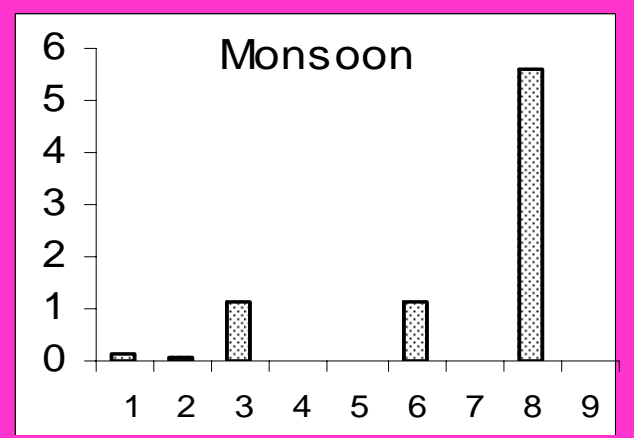
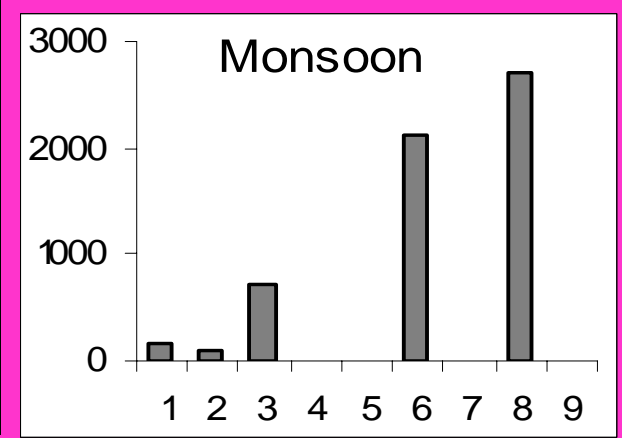
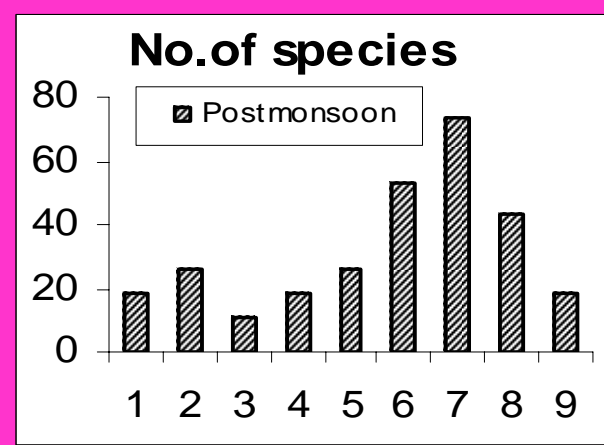
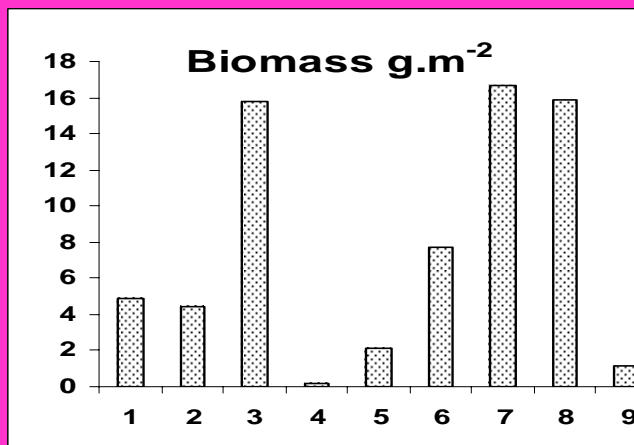
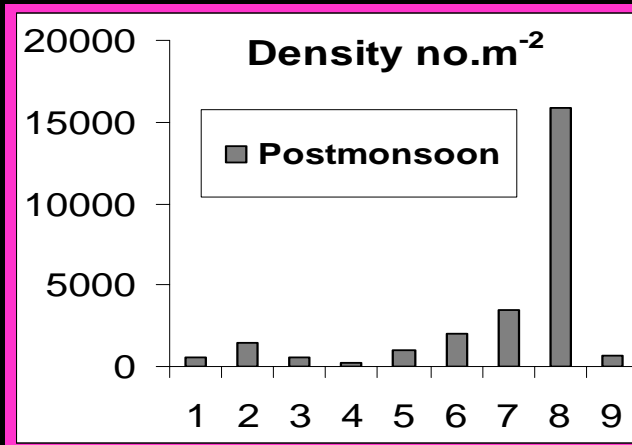


Total 140 species;
 91 polychaetes;
 29 crustaceans;
 08 bivalves;
 06 gastropods



Seasonal variation of dominant Polychaete species

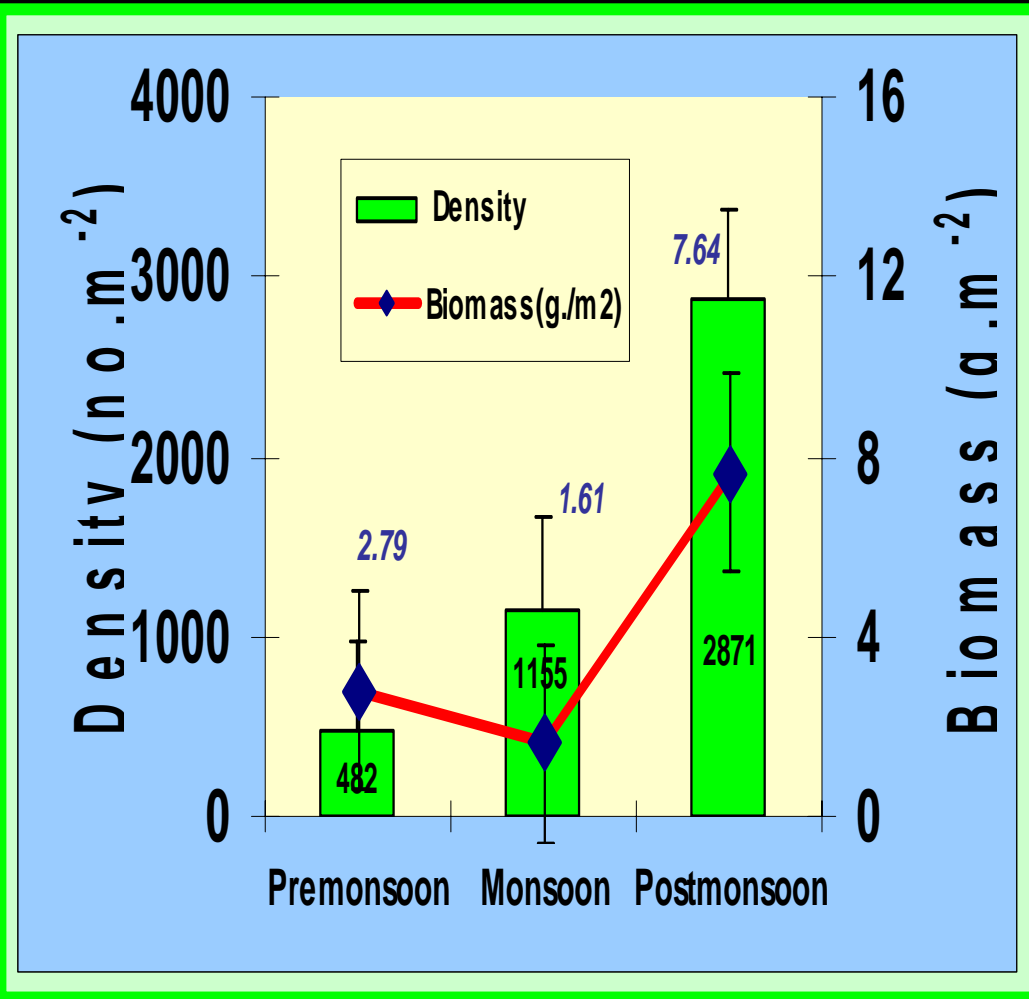




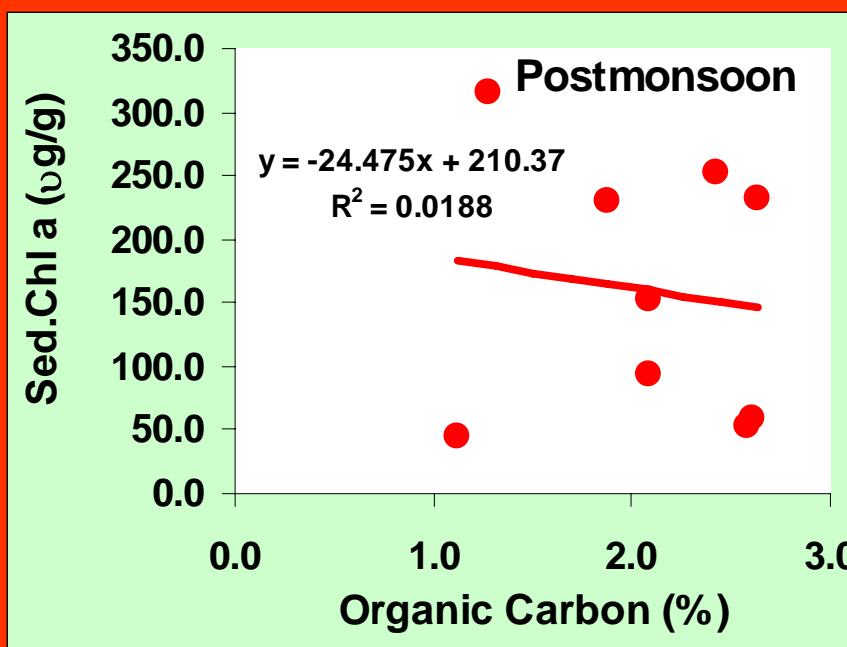
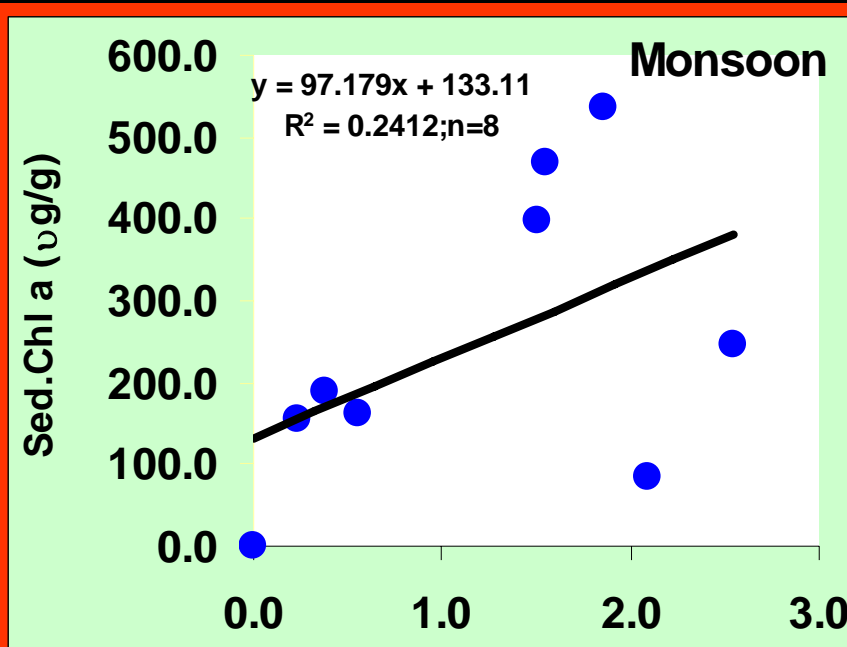
Seasonal variation in macrobenthic stock

The highest number of species (112), faunal density $x=2871$; (max: 15829 no. m^{-2}) & biomass $x=7.64$ (max= 16.6 g. m^{-2} wet wt.) were observed in post monsoon season

Highest faunal abundance was in the coastal stations located in 25–30 m water depth.

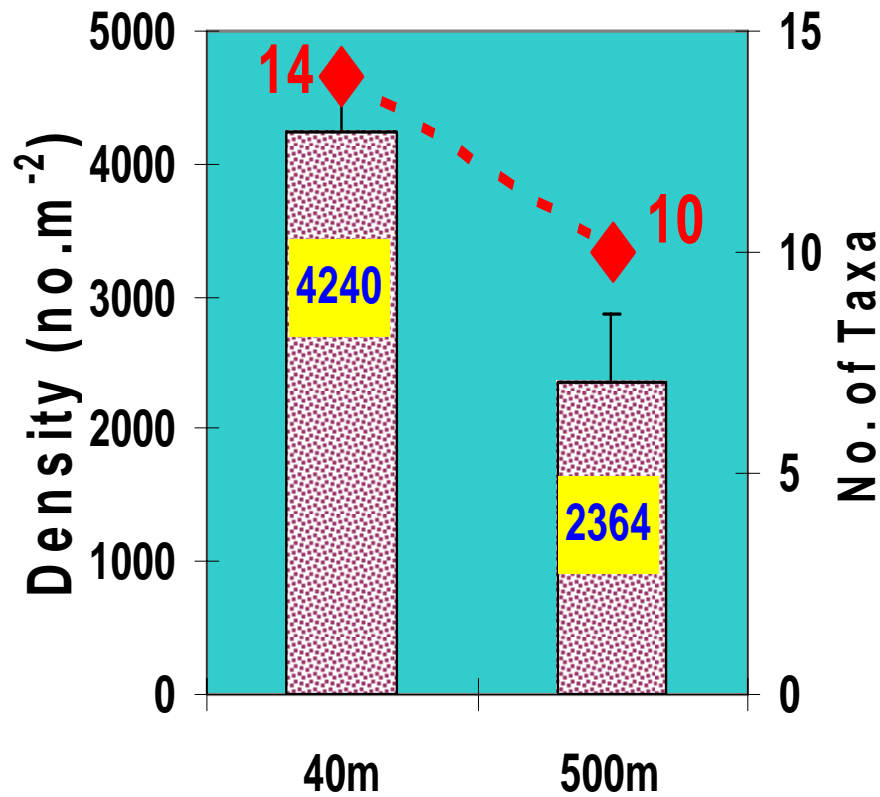


Relationship between Sediment Organic carbon & Chl

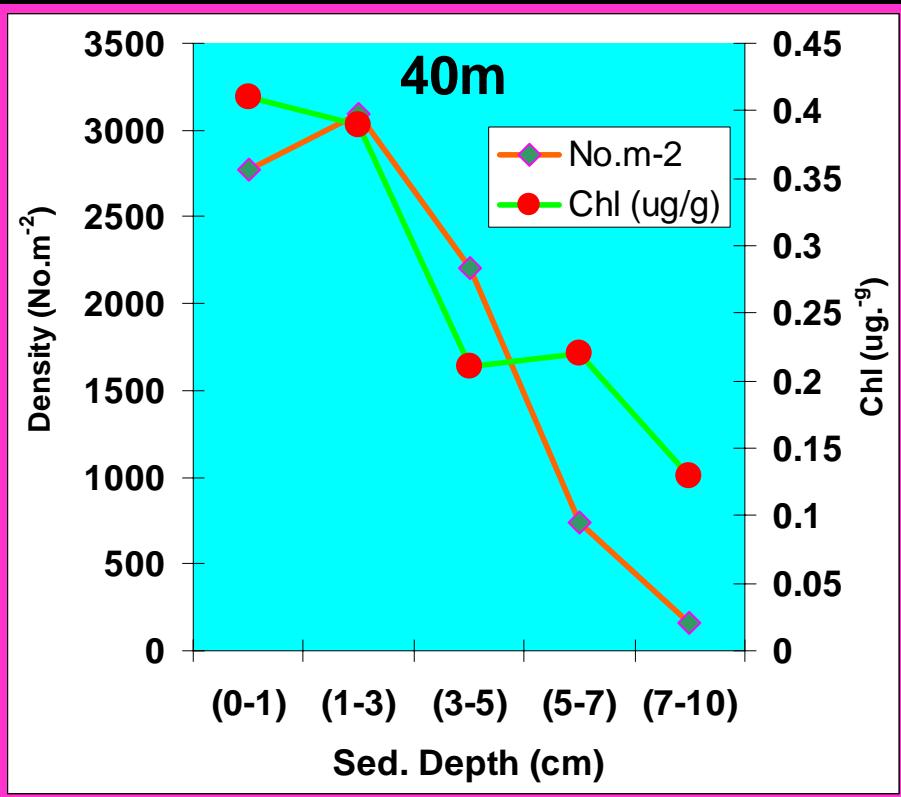


- Benthic organisms were unevenly distributed & exhibited strong temporal variation.
- Polychaeta was the dominant group in terms of species diversity and abundance.
- *Prinospio pinnata*; *P. krusadensis*; *Prinospio. sp.*; *Ancistrasyllis constricta*; *Tharyx sp.* were the most dominant species comprising $\approx 80\%$ of the total faunal density.

Sampling location for experimental studies



Vertical distribution of macrofauna

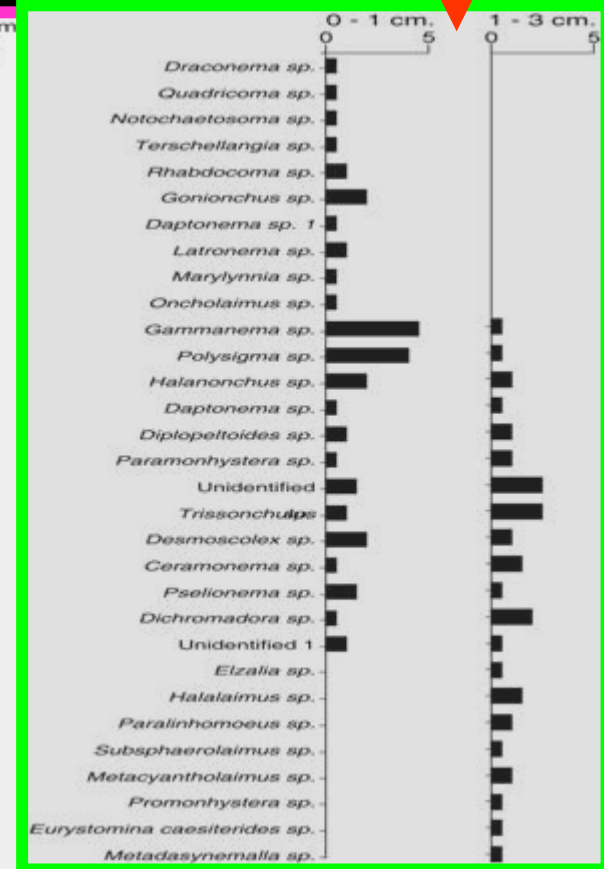
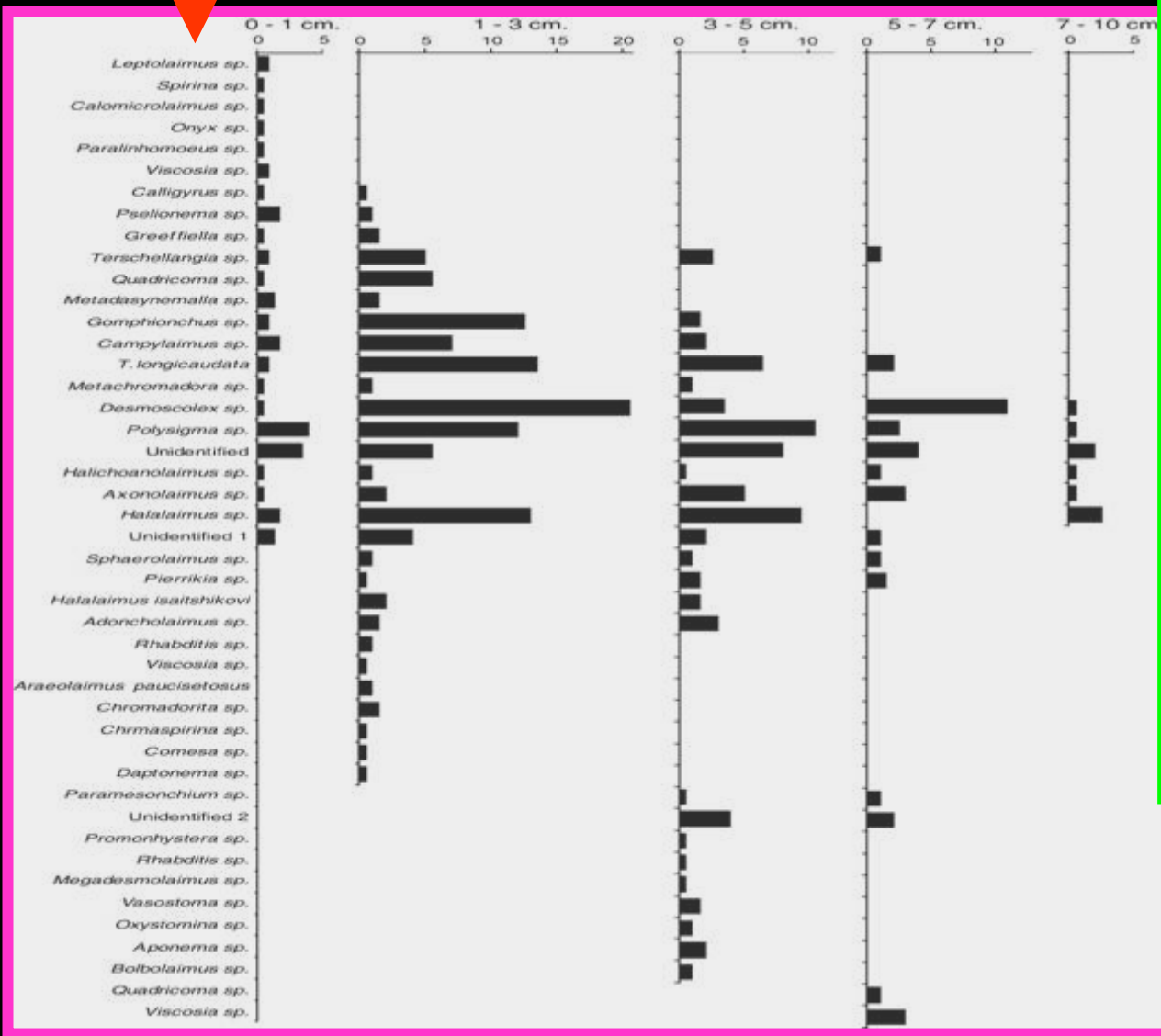


Taxon	Water Depth (m)	
	40	500
Foraminifera(hard)	163	0
Foraminifera(soft)	4158	1060
Nematoda	408	1386
POLYCHAETA		
Spionidae1	815	326
Spionidae2	1060	0
Cirratulidae	245	652
<i>Magelona</i> sp.	734	0
Paranoidae	163	0
<i>Lumbriconereis</i> sp.	163	0
<i>Ancistrosyllis</i> sp.	82	0
Capitellidae	734	0
<i>Nephtys</i> sp.	82	0
Ampharetidae	0	652
Sabellidae	0	163
<i>Cossura</i> sp.	0	163
Pectinidae	0	245
Oligochaeta	82	0
MOLLUSCA		
Mytilidae	0	82
Bivalvia3	0	82
Gastropoda	82	0
Total density	4240	2364

40 m

Vertical distribution of Nematodes

500 m

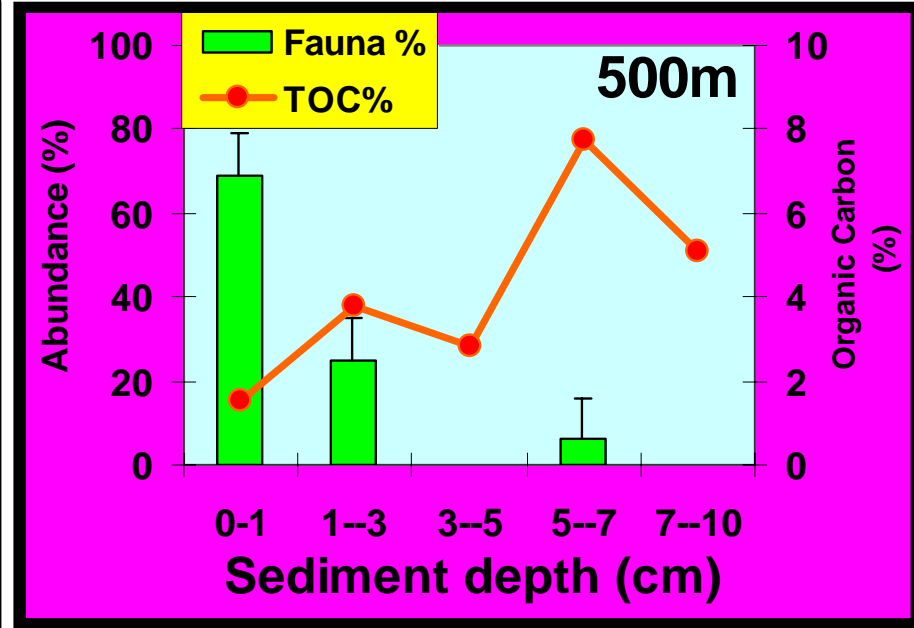
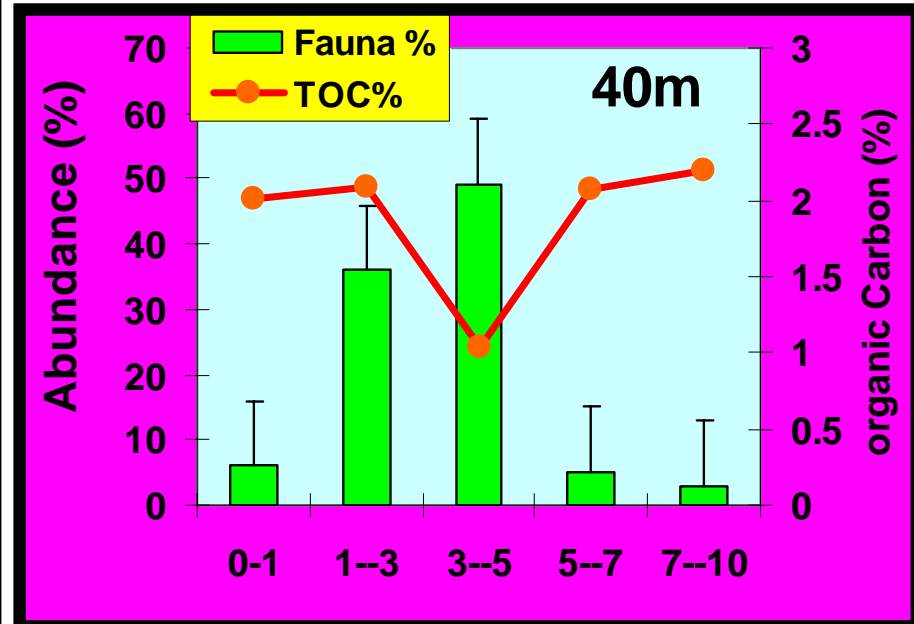


Terchellingia sp., ***Sabatieria sp.***, ***Desmoscolex sp.***, *Sphaerolaimus sp.*, *Halalaimus sp.*, *Viscosia sp.*, *Polysigma sp.* are most common

Ingole et al (in prep)

Distribution of macrofauna & organic carbon

Higher TOC at 500m;
but fauna was absent
below 7 cm sediment
layer



Nematode (nos./10cm²)

A

0 20 40 60 80 100 120

Sediment Depth

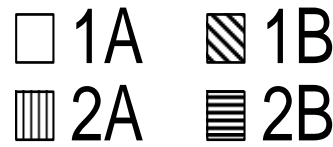
0-1 cm

1-3 cm

3-5 cm

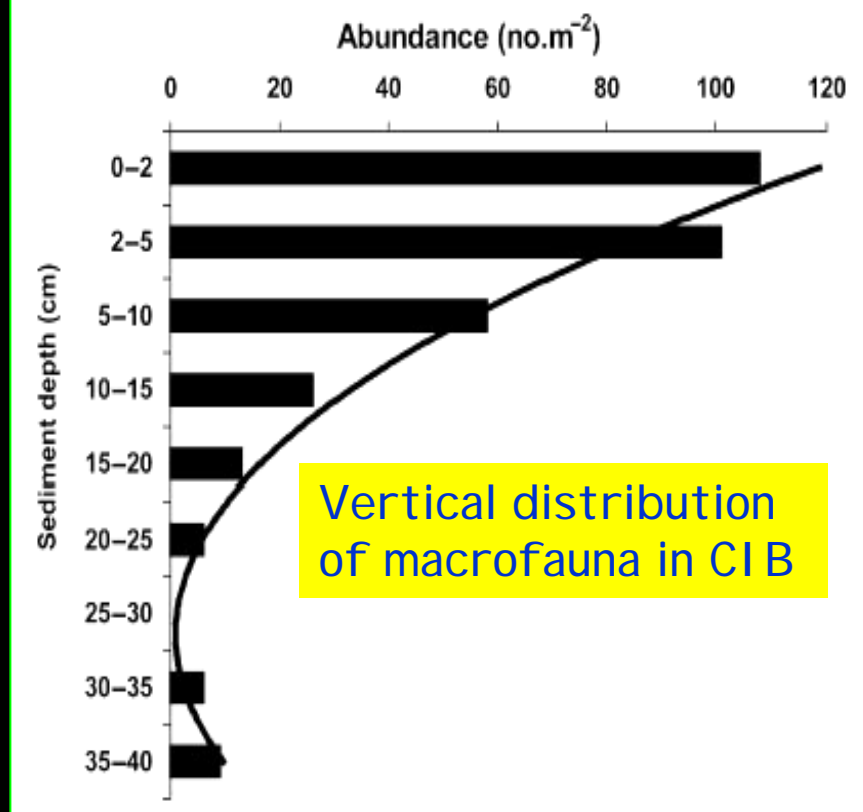
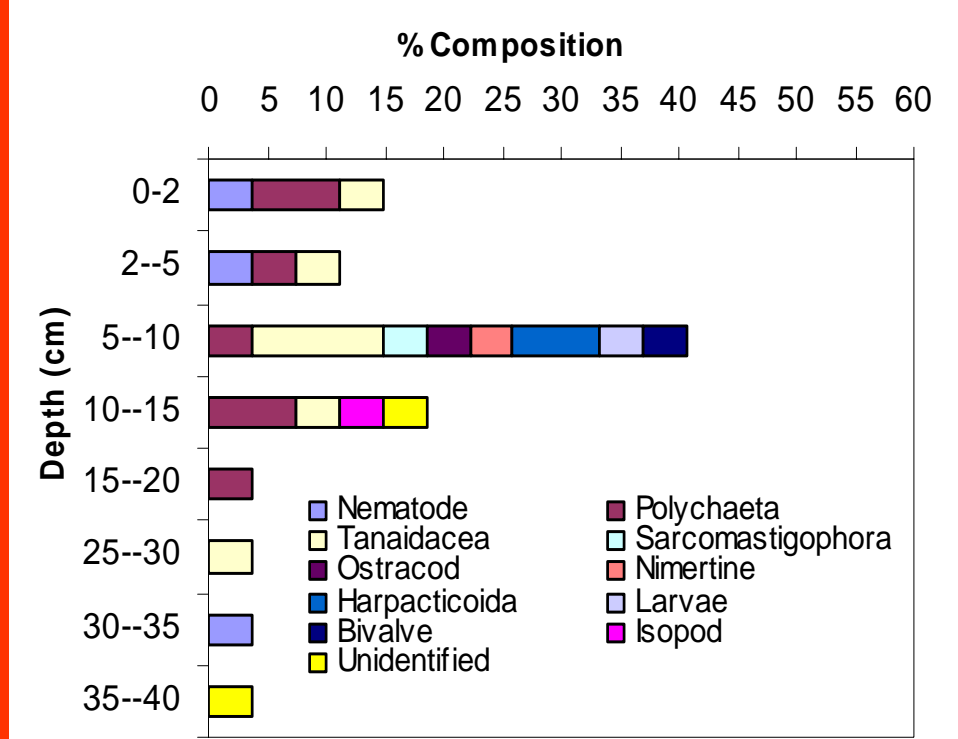
5-7 cm

7-10 cm



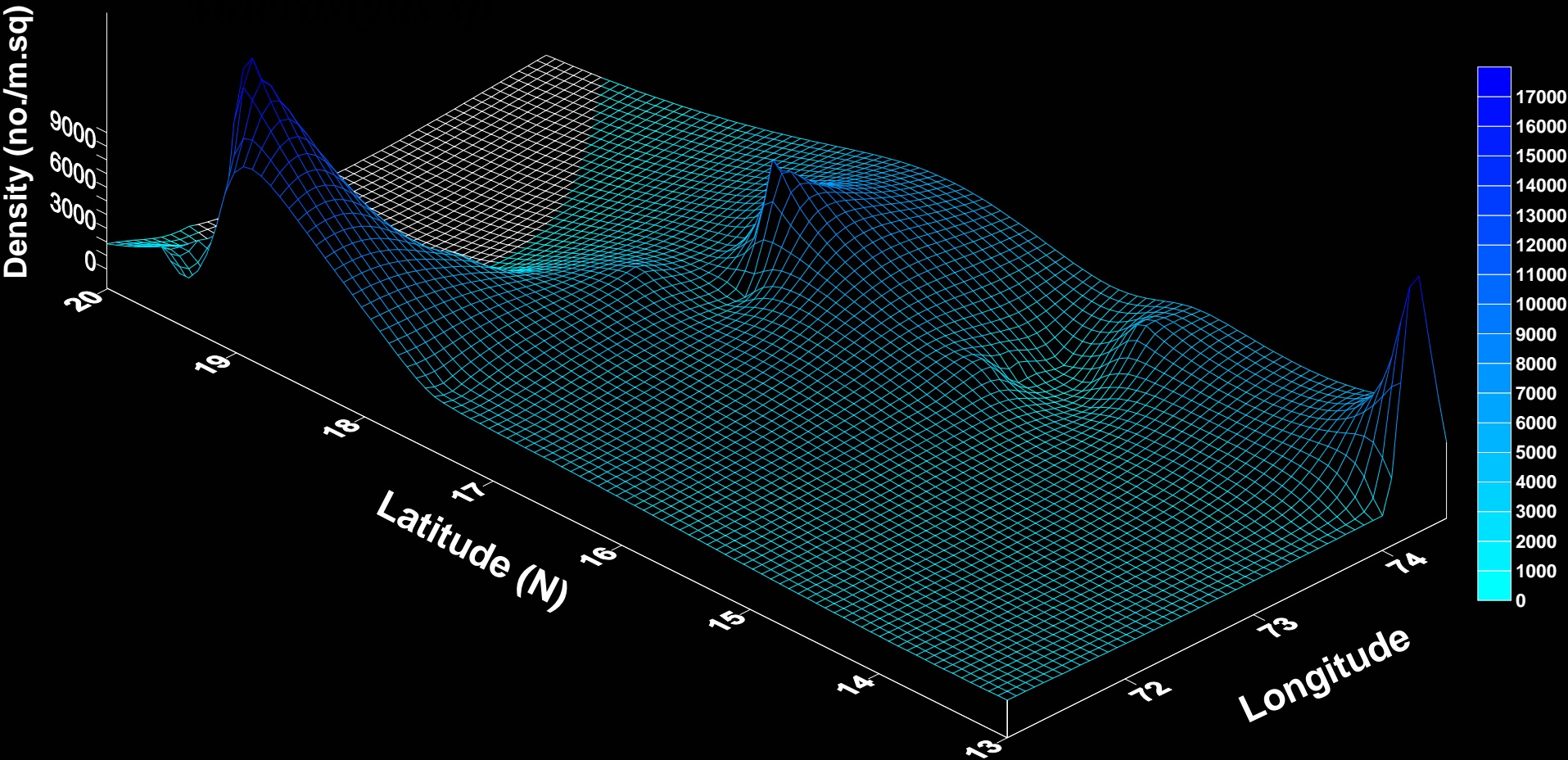
Water depth: 40m

Depth-wise distribution of Nematode feeding types [1A- Selective deposit feeder, 1B- Non-selective deposit feeder, 2A- Epistrate feeder and 2B- Predatory/Omnivores).



Vertical distribution of macrofauna in CI B

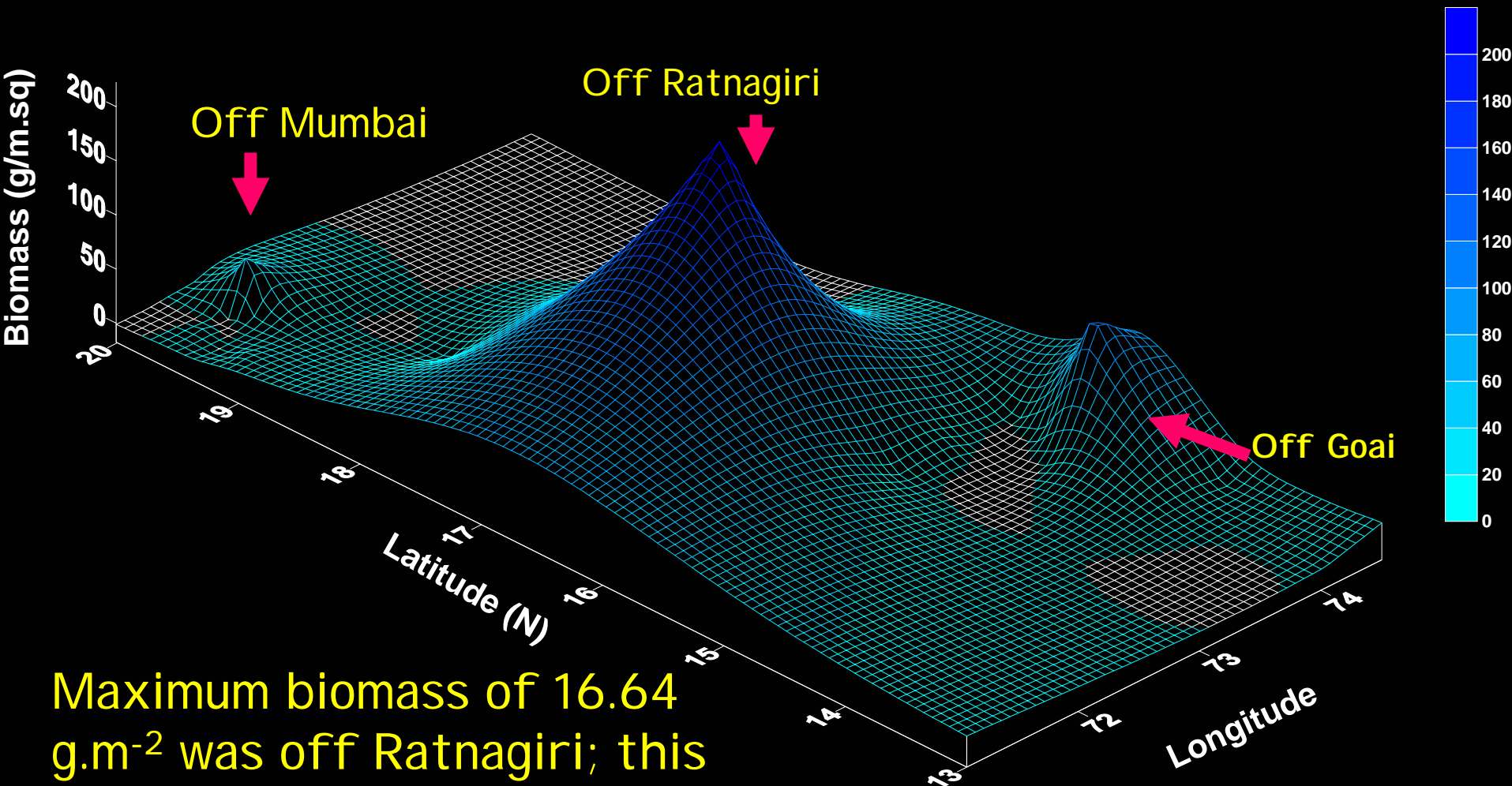
Burrowing activities of large macrobenthic polychaete species like Maldanid, Capitellids could be the key function in processing & supplying the food material to the other deposit feeders as they are known to ingest & process the fresh labile matter (Levin et. al 1997)



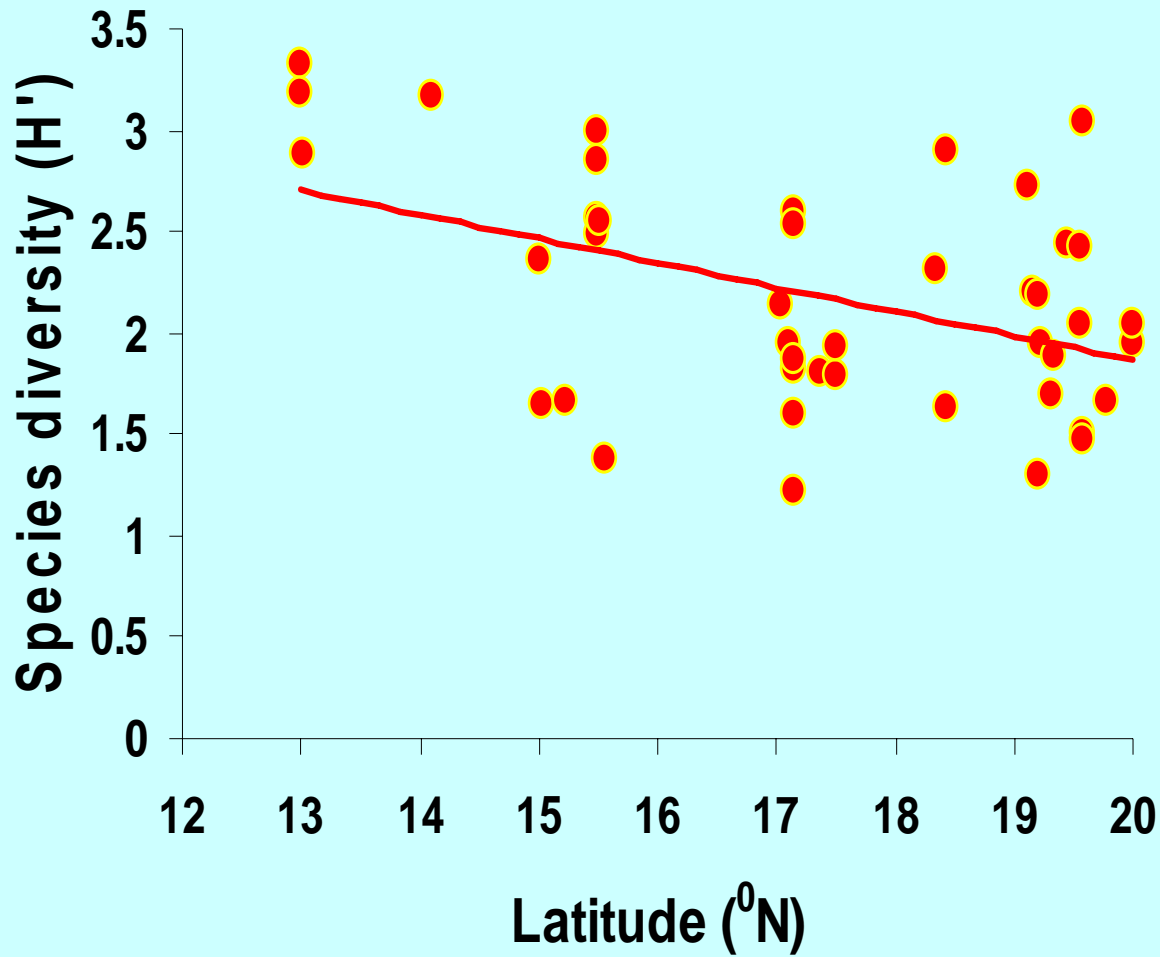
Harpacticoida

Pattern of macrobenthic density distribution

Distribution of macrobenthic biomass



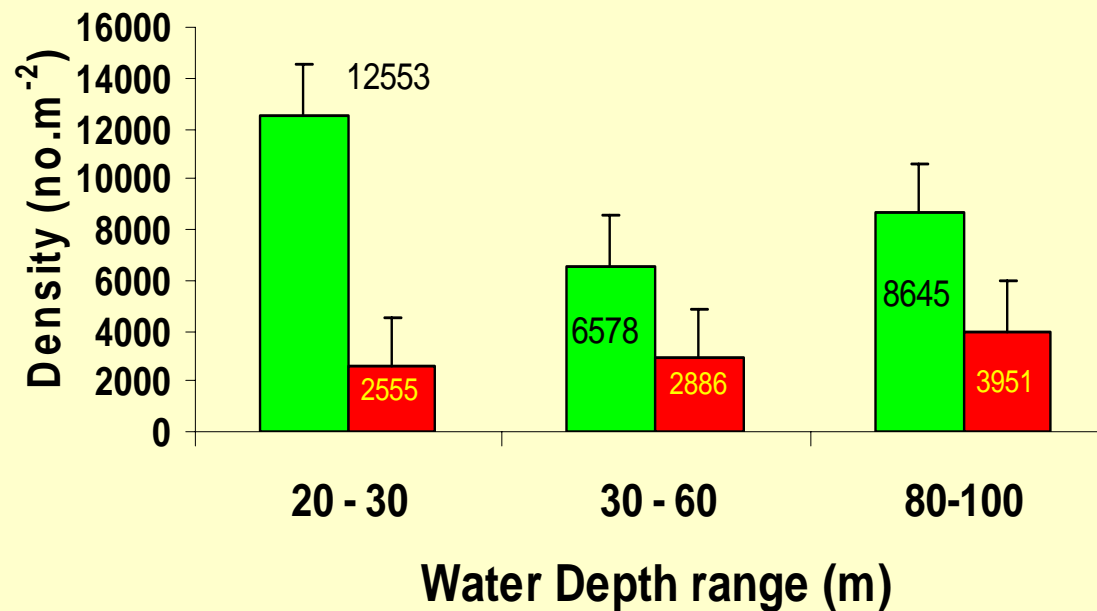
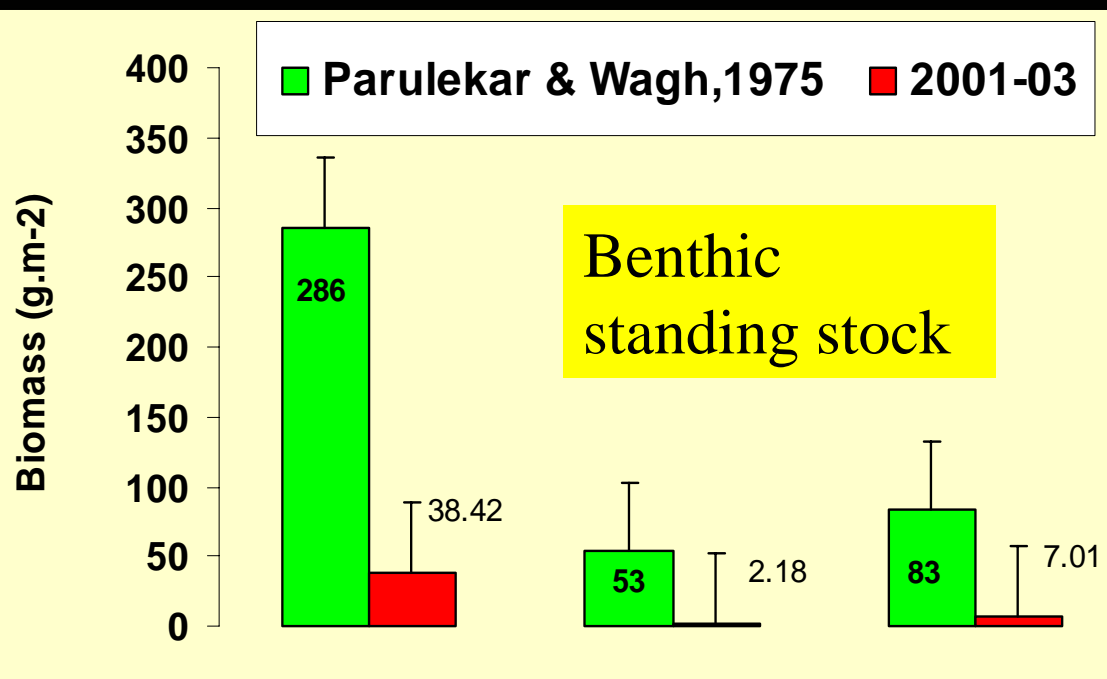
Maximum biomass of 16.64 g.m⁻² was off Ratnagiri; this area is known for rich demersal fishery



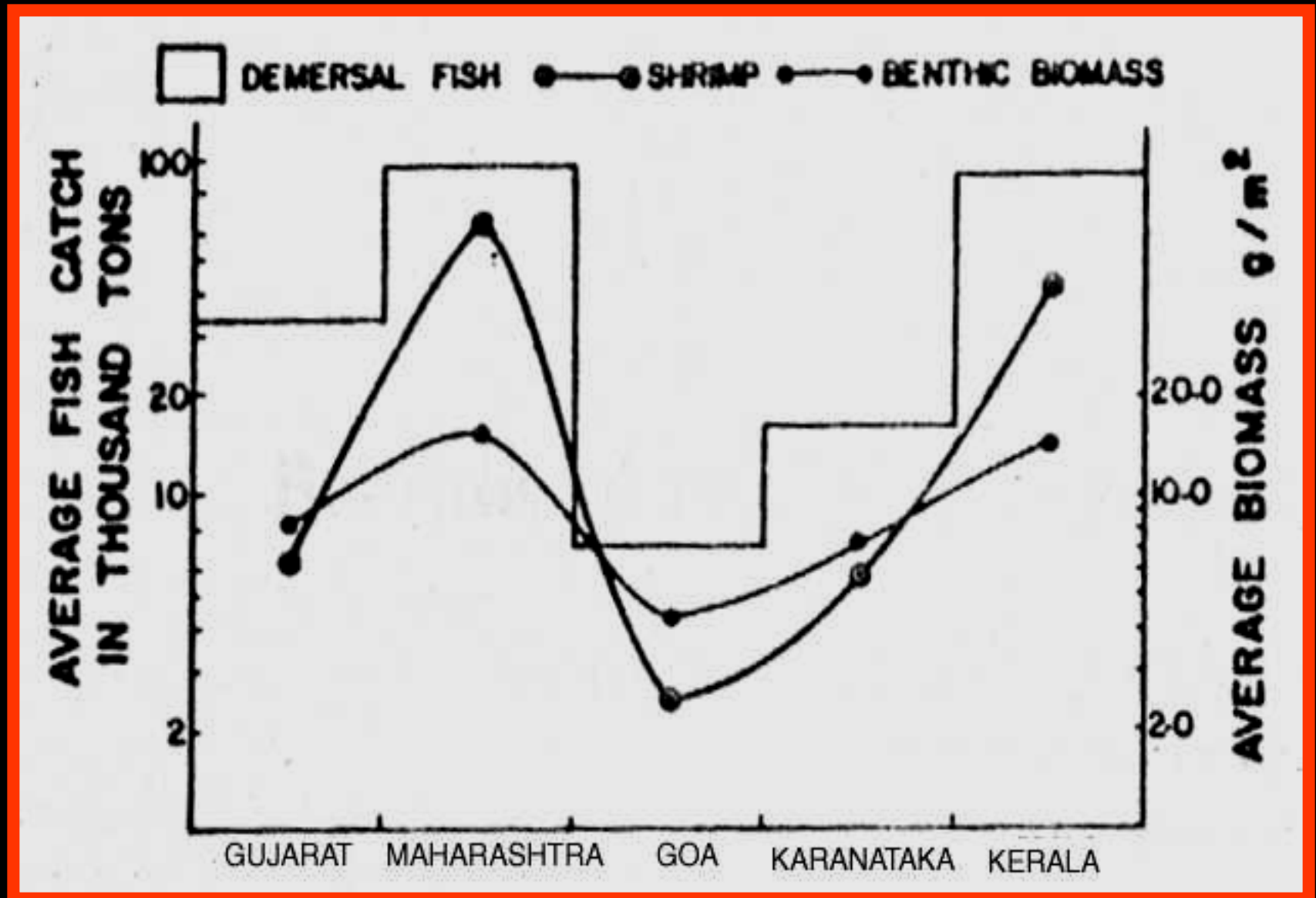
All together
232
macrobenthic
species were
identified &
few more are
unidentified.

Negative trend
towards north

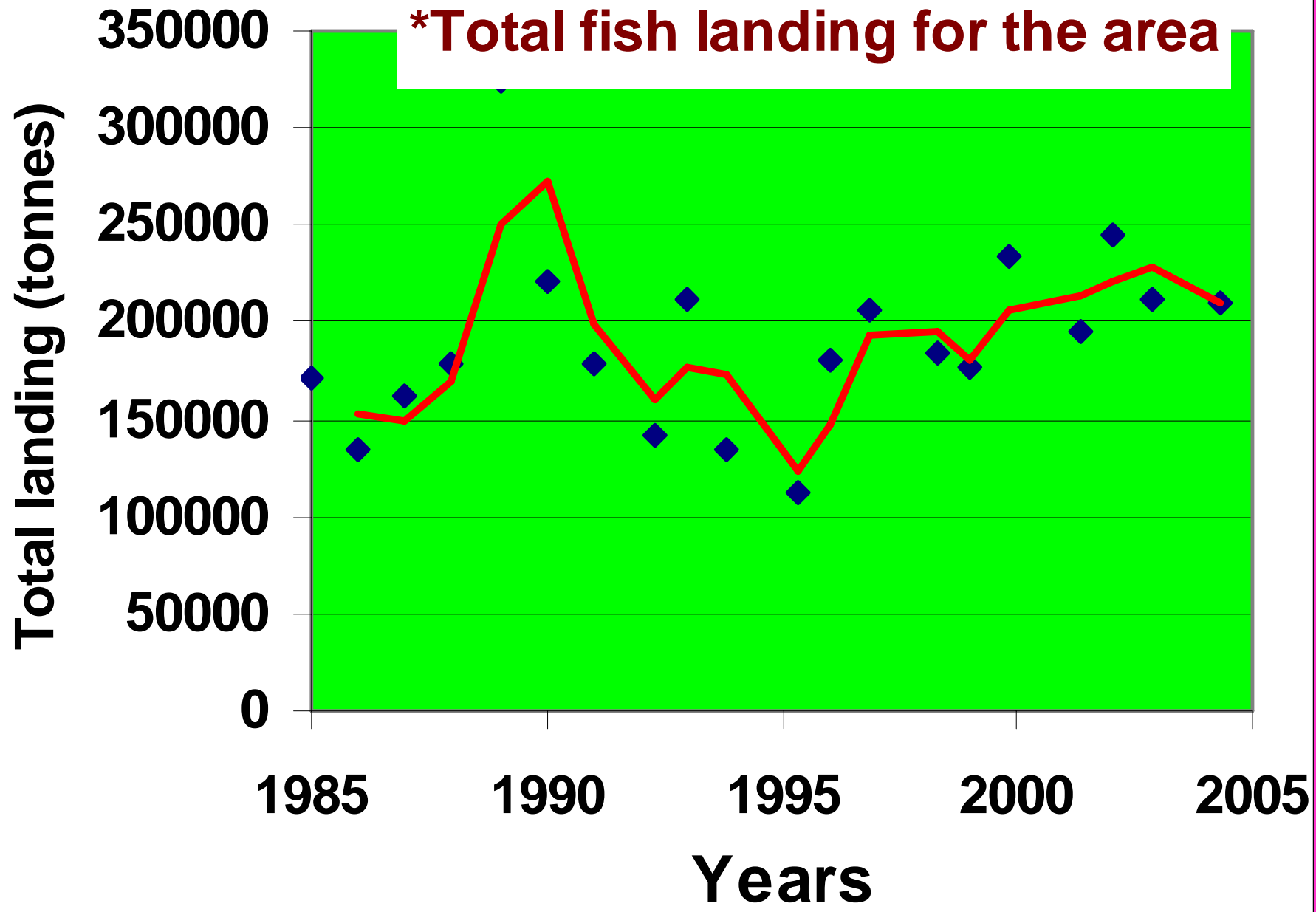
Comparison
with earlier
data



Relationship between demersal fish catch & benthic Biomass

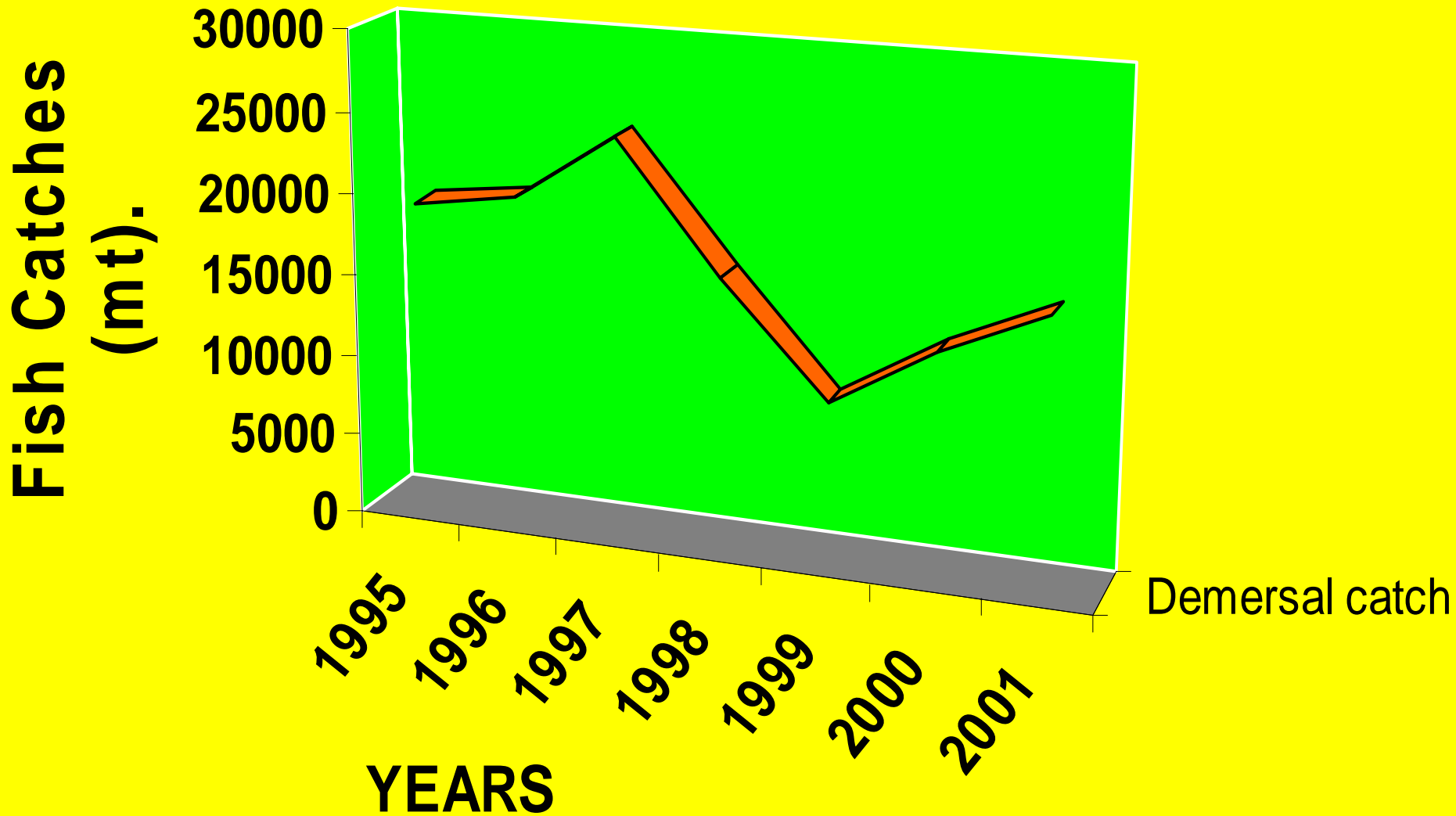


***Total fish landing for the area**



***Source: CMERI 2005**

There is a decrease in bottom fishery: BUT WHY?



* Source: Dept. of Fishery, Goa Govt.

OR is it due to the over fishing of stock?

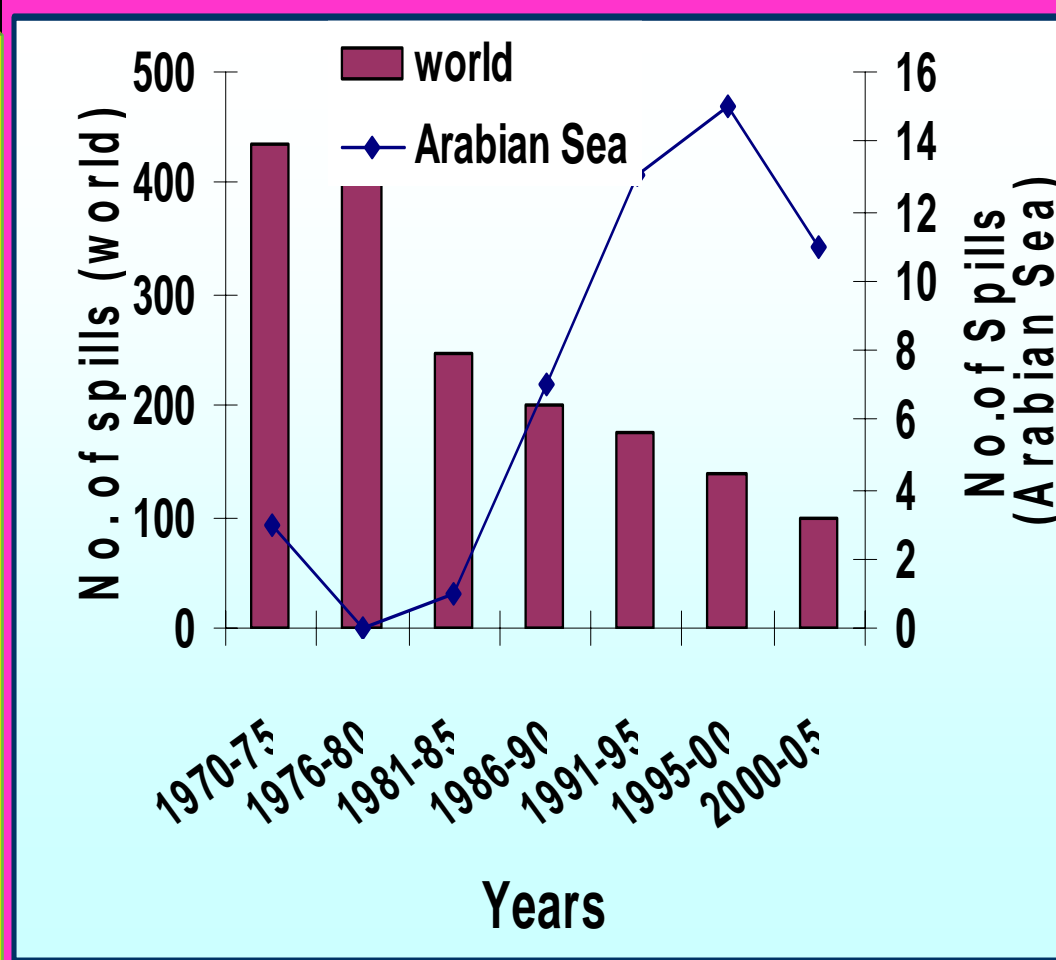
- Coast of fishing Operations.
- Negative growth in fish catch & lowering of CPUE is indicative of greater fishing pressure.

OR is it due to increased Oil Spill ?

706 MT Oil is added in Marine Environment yr-1 from different sources

70 % Global Oil transportation is through Arabian Sea.

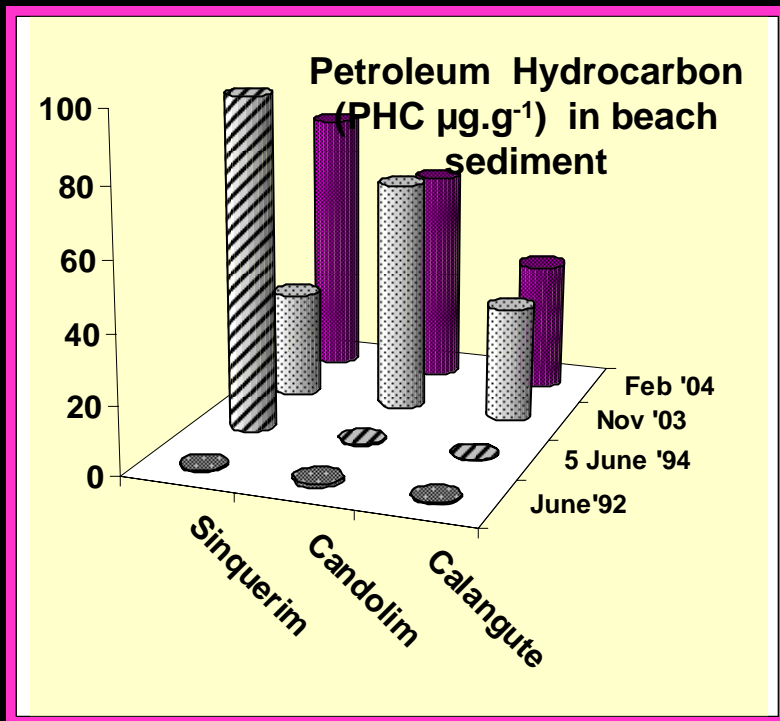
It is major risk zone, with two choke points.



Incidence of Oil spills

Increased incidence of oil spill in the Arabian Sea

Petroleum hydrocarbon in sediment ($\mu\text{g/g}$)



04 incidence of oil spills
in 10 years

Ingole et al., (2006) Env. Int.32:284-291

Future studies



Although the habitat as well as species composition keeps on changing at every 50m water depth; the benthic biology of the deeper Arabian Sea is not fully understood.

We need to know about the distribution of key species. The rate of organic matter processing by each of the major species

More studies with Lander & ROV

Acknowledgement:

- ❖ ONGC for funding
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- ❖ SI BER & Dr. Naqvi for making it possible