

Algal bloom of *Diatoma vulgaris* in coastal waters of Dakshina Kannada

Bindu Sulochanan¹, Veena Shettigar¹, Prathibha Rohit² and K. S. Sobhana³

¹Mangalore Regional Centre of ICAR-Central Marine Fisheries Research Institute, Mangaluru-575 001, Karnataka

²Karwar Regional Station of ICAR-Central Marine Fisheries Research Institute, Karwar, Uttara Kannada-581 301, Karnataka

³ICAR-Central Marine Fisheries Research Institute, Kochi-682 018, Kerala

*E-mail: binduchaithanya@yahoo.co.in

A bloom of *Diatoma vulgaris* (1.20×10^5 cells ml⁻¹) was found in the coastal waters off Iddya (12°59'28.5"N 74°47'28.3"E)

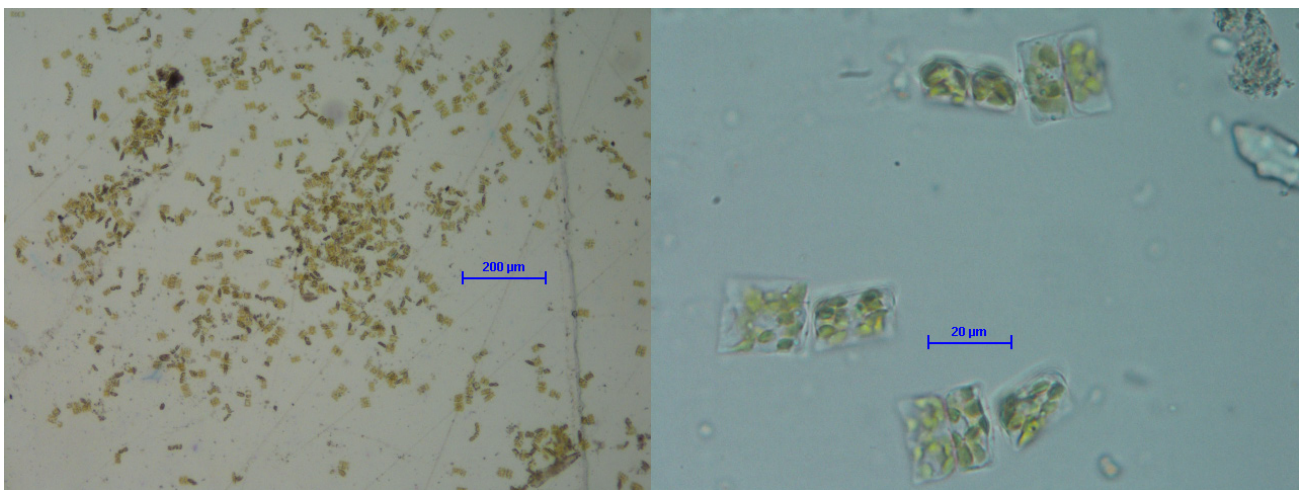
near Surathkal in Mangaluru city on 14th May 2022, and the changes in nutrient status dissipated the bloom within a

week. *D. vulgaris* cells form zig-zag chains and are found attached to submerged rocks, concrete, pipes and other structures as they are benthic diatoms. Diatoms prefer distinct ranges of pH, salinity, nutrient concentration, suspended sediment, flow regime, elevation and are influenced by anthropogenic disturbances. Climate affects diatoms in complex ways and frequency, severity of droughts, floods etc. impacts the occurrence of diatom species and their distribution. Hence, monitoring the occurrence and distribution of diatoms gives an idea about the impact of the changes in the water quality. Diatoms are divided into two major groups based on the structure and shape of the valves, the Centrics (Order: Biddulphiales) and the Pennates (Order: Bacillariales). Diatoms which reproduce efficiently are adapted to changing conditions by forming resting spores which remain on the bottom in shallow coastal waters until conditions favor their germination. Nitrogen, phosphorus, potassium, magnesium, oxygen, hydrogen, carbon, sulfur and iron are essential for the normal development of diatoms as to that of higher plants.

The water quality parameters recorded on 14th May 2022 were compared with those recorded from nearby sampling stations during the subsequent days of the bloom to assess the extent of the bloom (Table 1). The ammonium nitrogen in near-shore waters ranged from below detection level (BDL) to 0.002 mg l⁻¹ while in the estuarine stations it ranged from 0.065 to 0.105 mg l⁻¹ indicating utilization of ammonia nitrogen by the diatoms. The highest level of chlorophyll a 717 mg m⁻³ was observed on 14th May 2022 with value higher than 25 mg m⁻³ considered as eutrophic condition. The Kuloor station in the river side too had a high Chl a of

40.99 mg m⁻³. A high DIP/DIN ratio of 54.57 was observed in Idyaa sample. The dissolved oxygen ranged from 2.54-5.83 mg l⁻¹ in the Sea and the lowest was observed in the area of the bloom on 17th May 2022. In the river stations during the succeeding days, the dissolved oxygen ranged from 2.82-3.43 mg l⁻¹. The highest TDS of seawater of 30.2 g l⁻¹ and density 20.8 pt was observed off Panambur. Presence of the diatom was observed in the other stations also but the diversity of other plankton is evident from the lower DIP/DIN ratio recorded during the subsequent days. A higher value of Chl c is an indicator of presence of diatoms. The diversity of plankton in other areas is also indicated by the variability in Chl a, b and c (Table 2).

During extreme events of rainfall, the combined volume of non-point sources of pollution into the ocean system will be greater than the point sources of pollution. During summer season, the beaches will have enough width and volume of sand for filtering the eutrophic water from the land based channels before reaching the sea. The characteristic of the water flow into the ocean is based on the catchment area of the non-point sources of pollution. The non-point sources of pollution outlets and natural channels from the city during extreme events and during monsoon season drain directly into the sea. The variability of the inflow along the coast varies along the shoreline due to the variability in land slope and soil conditions and anthropogenic activities. The rainfall during the first week of May carried water hyacinth, an invasive floating plant found in eutrophic inland water bodies into the sea and on to the beaches along the coast. As the nutrient condition continued to be favorable, the diatoms bloomed with the result that no other algae were observed in the



Photomicrograph of *Diatoma vulgaris*, normal (200 µm-left) and magnified (20 µm-right)

Table 1. Water quality parameters recorded at Near-shore coastal stations (s) and River stations

Date	Station	AT (°C)	WT (°C)	pH	DO (mg l ⁻¹)	TDS (g l ⁻¹)	TSS (mg l ⁻¹)	Salinity (ppt)	Density (ρt)
14.05.2022	Iddya (S) 12°59'28.5"N 74°47'28.3"E	28.9	30.13	8.07	2.54	30.1	576.0	32.83	20.2
18.05.2022	KFDC 12°50'51.2"N 74°50'12.4"E	30.5	30.14	8.15	2.92	29.7	72.0	31.8	19.4
19.05.2022	Bengre (S) 12°51'09.2"N 74°49'14.8"E	25.1	27.03	8.21	5.57	29.7	92.0	31.8	20.4
19.05.2022	Thannerbhavi (S) 12°54'02.4"N 74°48'40.6"E	26.5	27.4	8.24	4.17	28.7	104.0	30.59	19.4
19.05.2022	Panambur (S) 12°56'40.3"N 74°48'02.3"E	26.5	27.54	8.22	5.48	30.2	60.0	32.39	20.8
19.05.2022	Chitrapur (S) 12°57'35.9"N 74°47'54.9"E	25.1	27.27	8.24	5.83	28.3	76.0	30.11	19.1
19.05.2022	Surathkal (S) 13°00'57.6"N 74°47'12.3"E	24.9	27.6	8.24	4.88	29.3	104.0	31.29	19.9
19.05.2022	Coast Guard (GR) 12°52'06.8"N 74°49'22.0"E	25.1	27.68	8.07	3.43	26.5	112.0	27.97	17.4
19.05.2022	Bhokapattana Bengre (GR) 12°53'28.4"N 74°48'58.9"E	26.5	26.2	7.81	3.07	15.9	112.0	15.59	8.6
19.05.2022	TB (GR) 12°53'33.6"N 74°49'13.3"E	26.5	27.72	7.72	2.82	14.8	52.0	14.38	7.3
19.05.2022	Kuloor (GR) 12°55'33.3"N 74°49'34.8"E	28	27.84	7.67	3.04	8.82	140.0	8.2	2.8
25.05.2022	Netravathi River 12°50'31.3"N 74°51'10.1"E	30.1	29.25	7.55	2.83	4.070	20.0	3.47	0
25.05.2022	Someshwar (S) 12°47'50.4"N 74°50'43.8"E	30.0	28.97	8.06	3.43	29.70	128.0	32.1	19.8
25.05.2022	Ullal (S) 12°50'19.7"N 74°49'51.5"E	29.0	28.85	8.28	3.94	29.60	92.0	32.53	20.4

AT: Air Temperature; WT: Water Temperature; DO: Dissolved oxygen; S: coastal station; GR: Gurupura River

Table 2. Nutrients and biological parameters recorded at Near-shore coastal stations (s) and River stations

Date	Station	Nitrate (mg l ⁻¹)	Nitrite (mg l ⁻¹)	Silicate (mg l ⁻¹)	Phosphate (mg l ⁻¹)	Ammonia (mg l ⁻¹)	DIP/DIN	Chl a (mgm ⁻³)	Chl b (mgm ⁻³)	Chl c (mgm ⁻³)
14.05.2022	Iddya (S)	0.006	0.002	0.472	0.434	BDL	54.57	717.38	-17.56	381.1
17.05.2022	KFDC	0.008	0.003	0.047	0.044	0.008	2.34	28.99	26.74	82.08
19.05.2022	Bengre (S)	0.008	0.003	0.046	0.030	BDL	2.62	9.34	6.12	16.93
19.05.2022	Thannerbhavi (S)	0.011	0.002	0.043	0.048	BDL	3.67	11.14	5.90	19.94
19.05.2022	Panambur (S)	0.011	0.004	0.047	0.032	BDL	2.12	24.64	25.05	78.40
19.05.2022	Chitrapur (S)	0.005	0.004	0.049	0.047	0.002	4.35	18.32	5.55	25.36
19.05.2022	Surathkal (S)	0.007	0.004	0.048	0.040	BDL	3.54	12.36	2.47	9.63
19.05.2022	Coast Guard (GR)	0.007	0.003	0.061	0.155	0.065	2.06	6.79	4.56	11.85
19.05.2022	Bhokapattana Bengre (GR)	0.010	0.004	0.114	0.206	0.107	1.70	8.00	0.78	5.94
19.05.2022	TB (GR)	0.009	0.003	0.088	0.113	0.079	1.24	9.28	1.56	8.48
19.05.2022	Kuloor (GR)	0.009	0.003	0.106	0.093	0.057	1.34	40.99	32.77	105.4
25.05.2022	Someshwar(S)	0.003	0.003	0.032	0.116	0.015	5.47	13.11	4.08	13.90
25.05.2022	Ullal (S)	0.004	0.003	0.026	0.064	0.012	3.27	3.938	0.86	6.72
25.05.2022	Netravathi River	0.020	0.003	0.399	0.054	0.047	0.76	4.449	4.72	21.58

collected sample on 14th May 2022. This was evident from the high DIP/DIN ratio as well as the high Chlorophyll a and c value obtained in the sample compared to the other days (18th to 24th May 2022) when samples were collected along the shore. Though the salinity observed on the consequent days in the sea ranged between 30.59-32.53 ppt, the presence of other plankton was also noticed

in the other locations along with *D. vulgaris*, indicating that the eutrophic conditions at the location triggered the bloom. It has been reported that *D. vulgaris* survives both in fresh and marine conditions (World Register of Marine Species Id 149347).