ONGC
एमआरपीएल MRPL

मंगलूर रिफाइनरी एण्ड पेट्रोकेमिकल्स लिमिटेड
MANGALORE REFINERY AND PETROCHEMICALS LIMITED

अनुसूची 'अ' के अंतर्गत भारत सरकार का उद्यम SCHEDULE 'A' GOVT. OF INDIA ENTERPRISE.
(ऑयल एण्ड नेचुरल गैस कॉरपोरेशन लिमिटेड की सहायक कंपनी A SUBSIDIARY OF OIL AND NATURAL GAS CORPORATION LIMITED)
सीआईएन/CIN : L23209KA1988GOI008959
पंजीकृत कार्यालय : कुत्तेतूर पोस्ट, बाया काटीपल्ला मंगलूरु - 575 030 (भारत) दूरभाष: 0824-2270400, फैक्स: 0824-2271404, E-mail:mrplmlr@mrpl.co.in
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आई.एस.ओ. 9001, 14001 एवं 50001 प्रमाणित कंपनी AN ISO 9001, 14001 AND 50001 CERTIFIED COMPANY

L/MS/MoEF&CC/6593
19th August, 2021

The Director
Ministry of Environment, Forest & Climate Change,
4th Floor, E&F Wing, Kendriya Sadan,
Koramangala, Bengaluru – 560 034

Dear Sir,

विषय Subject:- Submission of Compliance to the Environmental Clearance along with monitoring data

Please find enclosed herewith point wise compliance to the following Environmental Clearance issued to MRPL by Ministry of Environment, Forest & Climate Change (MoEF & CC), New Delhi.

1. Letter No. 10-49/2009-IA.III dated 1st April, 2011 (SPM Project)

Also environment monitoring data of SPM area in Annexure-I and Annexure-II, for November-2020 is enclosed.

धन्यवाद Thanking You,

भवदीय Yours sincerely,

मंगलूर रिफाइनरी एंड पेट्रोकेमिकल्स लिमिटेड
For Mangalore Refinery & Petrochemicals Limited,

19/8/2021

एम.एस सुदर्शन M.S Sudarsan
मुख्य महा प्रबंधक (स्वास्थ्य, संरक्षा एवं पर्यावरण)
Chief General Manager (Health, Safety and Environment)

Encl: As above

Cc: Zonal Office, CPCB, Bengaluru
Head Office, KSPCB, Bengaluru
Regional Office ,KSPCB,Manglore

Compliance to the Environmental Clearance for Single Point Mooring and storage facilities within New Mangalore Port Trust for MRPL issued by Ministry of Environment, Forests & Climate Change, New Delhi

Letter No. 10-49/2009-IA.III dated 1st April, 2011

Sl. No.	6 – Specific conditions as per MoEF Environmental Clearance	Compliance
i	Consent for Establishment shall be obtained from State Pollution Control Board	Complied. Consent for Establishment obtained from Karnataka State Pollution Control Board vide KSPCB letter No. KSPCB / HPI / 143 / CFEx / 2011-12 / 823 dated 30.01.2012
ii.	The Project shall be executed in such a manner that there shall not be any disturbance to the fishing activity.	Noted and complied.
iii.	It shall be ensured that there is no displacement of people, houses or fishing activity as a result of the project.	Noted and complied.
iv.	Regular Mock Drills shall be conducted to check the effectiveness of the on-site disaster Management Plan.	Regular Mock Drills w.r.t. SPM are being conducted in coordination with Coast Guard and NMPT.
v.	Markers should be installed at every 30 m to indicate the position of the pipeline.	Installing Markers at regular interval will become a hindrance and safety hazard to fishing activity hence it not practical possible to implement.
vi.	The approval of the competent authority shall be obtained for adequacy of fire fighting equipments etc.	Noted
vii.	The smooth and safe operation of the system will be ensured by incorporating a computerized SCADA (Supervisory control and Data Acquisition).	SCADA system is provided as a part of the project for smooth and safe operation.
viii.	During operation phase, proper precautions should be taken to avoid any oil spills and no oily wastes shall be discharged into the water bodies / mangrove areas.	Noted and complied.
ix.	Regular patrolling of the pipelines needs to be done.	Being conducted by the concerned officials of MRPL.
x.	No construction work other than those permitted in Coastal Regulation Zone Notification shall be carried out in Coastal Regulation Zone Area.	Noted and complied.
xi.	Oil spills if any shall be properly collected and disposed as per the Rules.	Tier-I facility provided at SPM for combating Oil Spills, if any.
xii.	The project proponent shall set up	A separate Environment Management Cell

	separate environmental management cell for effective implementation of the stipulated environmental safeguards under the supervision of the Senior Executive.	already exists in MRPL and headed by Chief General Manager (CGM).
xiii.	The Project proponent shall take up mangrove plantation / green belt in the project area.	Noted.
xiv.	The fund earmarked for environment management plan shall be included in the budget.	Fund earmarked for Environment management is included in the budget.
7. General conditions as per MoEF Environmental Clearance		
i.	Adequate provision for infrastructure facilities including water supply, fuel and sanitation must be ensured for construction workers during construction phase of the project to avoid any damage to the environment.	Noted and complied.
ii.	Appropriate measures must be taken while undertaking digging activities to avoid any likely degradation of water quality.	Noted. Proper measures taken while undertaking digging activities to avoid any likely degradation of water quality
iii.	The construction material shall be obtained only from approved quarries.	Noted
iv.	Adequate precautions shall be taken during transport of the construction material so that it does not affect the environment adversely.	Noted Adequate precautions were taken during transport of the construction material so that it does not affect the environment adversely.
v.	Full support shall be extended to the officers of this Ministry / Regional office at Bengaluru by the project proponent during inspection of the project.	Full co-operation is being extended to the officers of the Ministry / Regional office during their inspections
vi.	A six monthly monitoring report shall need to be submitted by the project proponents to the Regional office of this Ministry at Bengaluru regarding implementation of the stipulated conditions.	Being submitted.
vii.	Ministry of Environment & Forests or any other competent authority may stipulate any additional conditions.	Noted
viii.	The Ministry reserves the right to revoke this clearance if any of the conditions stipulated are not complied with the satisfaction of the Ministry.	Noted
ix	In the event of a change in project profile or change in the implementation agency, a fresh reference shall be made to the	Fresh reference will be made in the event of any change.

	Ministry of Environment & Forests.	
x	The project proponents shall inform the Regional office as well as the Ministry, the date of financial closure and final approval of the project.	Under the Nava Ratna Powers, ONGC Board on 22-07-2010 has approved the project including the Financial Closure.
xi	A copy of the clearance letter shall be marked to concerned panchayat / local NGO, if any, from whom any suggestion / representation has been made received while processing the proposal.	Complied
xii	KSPCB shall display a copy of the clearance letter at Regional office, District Industries Centre and Collector's / Tehsildar's office for 30 days.	Done by KSPCB
Other conditions as per MoEF Environmental Clearance		
8	These stipulations would be enforced among others under the provision of Water Act, 1974, the Air Act 1981, the Environment Act 1986, the Public Liability Act, 1991 and EIA Notification 1994, including the amendments and rules made thereafter.	Noted
9	All other Statutory Clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Civil Aviation Department etc. as applicable by the project proponents from the respective competent authorities.	All Statutory Clearances from the concerned Competent Authority are obtained.
10	The Project Proponent shall advertise in at least two local Newspapers widely circulated in the region. The advertisement should be made within 10 days from the date of receipt of the clearance letter and a copy of the same should be forwarded to the Regional office of this Ministry at Bengaluru.	Complied. Advertised in two local News Papers dated 22.04.2011 and informed MoEF, Bangalore Office vide our letter dated 26.04.2011.
11	Environmental clearance is subject to final order of the Hon'ble Supreme Court of India in the matter of Goa Foundation Vs Union of India in Writ Petition (Civil) No.460 of 2004 as may be applicable to the project.	Noted
12	A copy of the clearance shall be sent by the proponent to concerned panchayat, if any from whom suggestions / representations, if any were received while processing the proposal.	Noted
13	The proponent shall upload the status of compliance of the stipulated EC	Being done

	conditions including results of the monitored data on their website and shall update the same periodically.	
14	The project proponent shall also submit monthly reports on the status of compliance of the stipulated EC Conditions including results of the monitored data to the respective office of MoEF, the respective Zonal office of CPCB and the SPCB.	Noted for compliance.
15	The environment statement for each financial year ending 31st March in Form – V as is mandated to be submitted by the project proponent to the concerned SPCB as prescribed.	Environment Statement for refinery is being submitted for each financial year ending 31st March in Form-V to KSPCB regularly.

ANNEXURE – I

TABLE 1. LATITUDE AND LONGITUDE OF THE FIVE SAMPLING STATIONS WITH RESPECT TO DEPTHS OF SPM, MRPL AT ARABIAN SEA OFF PANAMBUR NMPT COAST.

Location	Coordinates	~Depth (meters)
Single Point Mooring	12°54' 03.2"N, 74°39'60.0" E	30.0
Station 1 (St. 1)	12°56' 00.2"N, 74°47'02.6" E	11.0
Station 2 (St. 2)	12°54' 33.0"N, 74°46'00.3" E	13.0
Station 3 (St. 3)	12°53' 23.9"N, 74°44'22.6" E	18.0
Station 4 (St. 4)	12°55' 25.9"N, 74°43'35.1" E	19.0
Station 5 (St. 5)	12°53' 46.9"N, 74°40'24.5" E	29.0

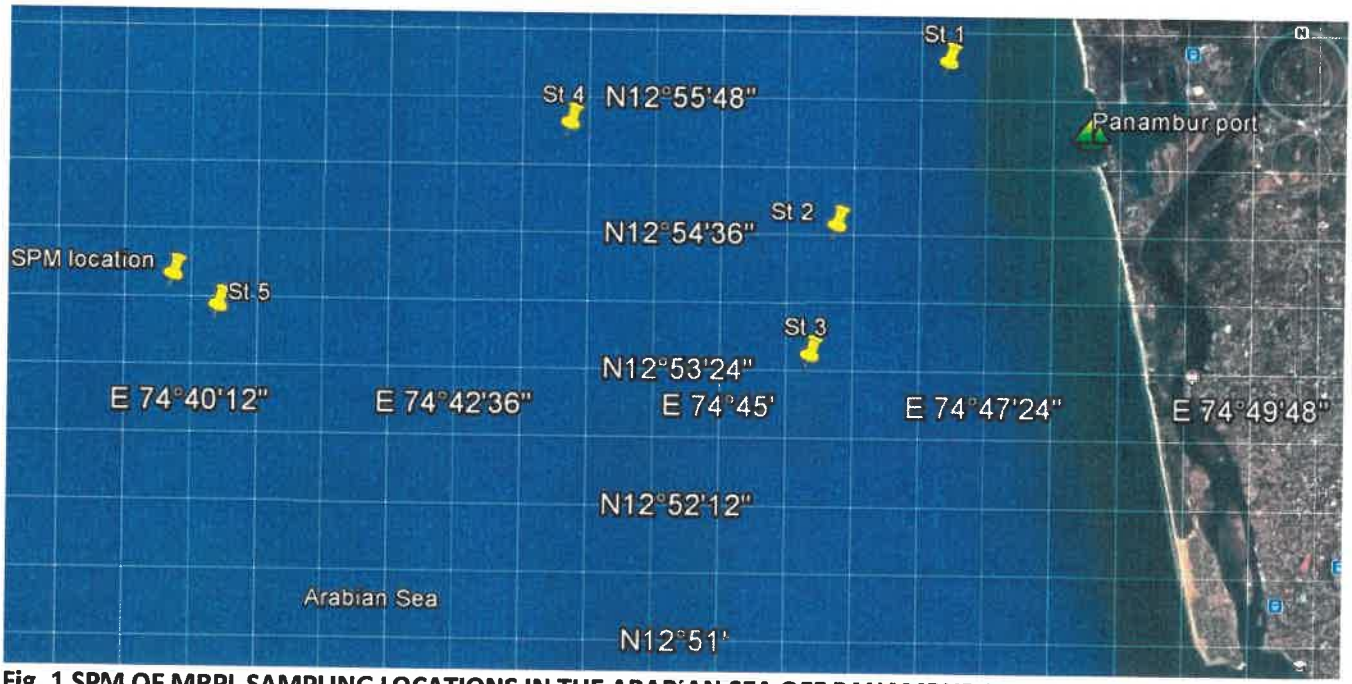

Fig. 1 SPM OF MRPL SAMPLING LOCATIONS IN THE ARABIAN SEA OFF PANAMBUR NMPT COAST.

ANNEXURE – II

TABLE 2.1. PHYSICO-CHEMICAL AND BIOLOGICAL PARAMETERS AT SURFACE (S) AND SUBSURFACE STATIONS (SS) (1-5) OF NEAR SPM AREA OF M/S. MRPL IN THE ARABIAN SEA OFF PANAMBUR NMPT COAST ON 30 NOV. 2020

S.No.	Parameters / Unit	Location	Stations				
			1	2	3	4	5
1.	Water temp. (°C)	Surface	29.1	28.9	27.5	27.7	27.6
		*Subsurface	28.8	28.7	27.3	27.5	27.5
2.	pH at 25°C	Surface	8.05	8.14	8.32	8.17	8.20
		*Subsurface	8.03	8.12	8.28	8.16	8.18
3.	Salinity (psu)	Surface	33.4	33.5	33.7	33.7	33.9
		*Subsurface	33.2	33.4	33.5	33.2	33.5
4.	DO (mg/L)	Surface	6.4	5.9	5.8	5.7	5.3
		*Subsurface	5.0	5.1	5.0	4.9	5.1
5.	BOD_3 at 25°C (mg/L)	Surface	2.7	2.8	2.4	0.5	1.5
		*Subsurface	0.7	0.7	0.6	0.2	0.5
6.	COD (mg/L)	Surface	24.72	24.47	23.91	22.54	23.01
		*Subsurface	25.19	25.60	24.38	23.05	22.97
7.	Water Transparency Extinction co-efficient (m)	Surface	0.357	0.420	0.648	0.725	0.741
		*Subsurface	NA	NA	NA	NA	NA
8.	TSS (mg/L)	Surface	14.5	10.9	7.2	5.4	4.0
		*Subsurface	16.0	13.2	6.7	6.5	6.3
9.	TDS (mg/L)	Surface	27200	26800	26600	26400	26400
		*Subsurface	27000	26700	26600	26500	26400
10.	Ammonia-N (mg/L)	Surface	0.052	0.047	0.036	0.014	0.012
		*Subsurface	0.073	0.061	0.040	0.010	0.0005
11.	Nitrite-N (mg/L)	Surface	0.06	0.05	0.03	0.004	0.03
		*Subsurface	0.11	0.09	0.07	0.04	0.005
12.	Nitrate-N (mg/L)	Surface	1.4	1.2	0.7	0.3	0.1
		*Subsurface	1.9	1.5	0.4	0.1	0.1
13.	Phosphate-P (mg/L)	Surface	0.04	0.06	0.04	0.04	0.04
		*Subsurface	0.07	0.07	0.06	0.05	0.04
14.	Silicate-SiO_2 (mg/L)	Surface	0.004	0.004	0.003	0.002	0.002
		*Subsurface	0.005	0.005	0.003	0.002	0.002
15.	Oil and grease (mg/L)	Surface	1.0	0.8	0.5	0.5	0.2
		*Subsurface	0.6	0.4	0.2	0.1	0.1

*Subsurface – 10 m depth; NA – Not Applicable

Water samples were collected using a Niskin bottle sampler and sediment samples using a Petersen grab. CTD (SBE 19 Plus V2 Sea CAT Profiler) was used to determine the temperature, salinity, dissolved oxygen. Nutrients and biological oxygen demand were estimated following the standard procedure suggested by Strickland and Parsons (1968) and Indian standard (IS) 3025. For trace metal contamination in marine environment, chemical oxygen demand and oil and grease were estimated using APHA 17th edition 2017. The heavy metals in sediment were extracted using ultrapure HNO_3, $HClO_4$ and H_2O_2 acid digestion in microwave digester as per US EPA method. Final qualitative and quantitative analysis was carried out by Inductively Coupled Plasma with Mass Spectrophotometer, ICMS (Reference in Annexure I).

Table 2.2. MICROBIOLOGICAL ANALYSIS OF SEAWATER

Stations		Microbiological analysis of seawater results		
		Total coliforms (MPN per 100mL)	Fecal coliforms (MPN per 100mL)	*Escherichia coli* (per 100 mL)
St.1	Surface	69	37	6
	*Subsurface	24	15	4
St.2	Surface	52	23	< 2
	*Subsurface	19	8	< 2
St.3	Surface	35	14	3
	*Subsurface	21	5	< 2
St.4	Surface	37	16	< 2
	*Subsurface	25	10	< 2
St.5	Surface	43	34	< 2
	*Subsurface	20	12	< 2

*Subsurface – 10 m depth; MPN – Most Probable Number; < 2 – considered as absent

2.3. SEDIMENT CHARACTERISTICS OF SEA BED

2.3.1. TEXTURAL ANALYSIS OF THE SEDIMENT

Stations	Sand (%)	Silt (%)	Clay (%)
St. 1	2.6	0.0	97.4
St. 2	0.0	0.0	100
St. 3	0.0	0.0	100
St. 4	0.0	87.4	12.6
St. 5	0.0	0.0	100

2.3.2. ANALYSIS OF ORGANIC CARBON, TOTAL NITROGEN, TOTAL PHOSPHOROUS, AVAILABLE PHOSPHOROUS IN THE SEDIMENTS

Stations	Organic Carbon (%)	Total Nitrogen as N (%)	Total P as P_2O_5 (%)	Available P as P_2O_5 (kg/ha.)
1.	2.92	18.7	0.026	79.1
2.	1.47	17.3	0.021	65.3
3.	2.03	12.5	0.022	68.5
4.	0.45	11.8	0.015	32.9
5.	0.39	10.4	0.017	33.2

2.3.3. ANALYSIS OF HEAVY METALS IN THE SEDIMENTS

Stations	Concentration in mg/kg dry weight basis				
	Zinc as Zn	Cadmium as Cd	Lead as Pb	Mercury as Hg	Iron as Fe
St. 1	11.4	1.4	2.9	0.006	2.6
St. 2	6.1	0.9	1.5	0.005	1.7
St. 3	4.5	0.5	1.7	BDL (DL 0.005)	0.4
St. 4	8.6	0.2	0.4	BDL (DL 0.005)	0.5
St. 5	7.4	0.2	0.1	BDL (DL 0.005)	0.4
Sediment quality guidelines for trace metals (mg/kg dry weight) from NOAA (USA) and Environment Canada.					
PEL	**271**	**4.2**	**112**	**0.70**	**NS**

PEL=Probable Effects level; NS- Not Specified

Table 2.3.4 MICROBIOLOGICAL ANALYSIS OF SEDIMENTS

Stations	Microbiological analysis of seawater results		
	Total coliforms (MPN per 100mL)	Fecal coliforms (MPN per 100mL)	*Escherichia coli* (per 100 mL)
St. 1	280	10	4
St. 2	260	7	3
St. 3	250	3	4
St. 4	190	< 2	< 2
St. 5	210	< 2	< 2

*Subsurface – 10 m depth; MPN – Most Probable Number; < 2 – considered as absent

Table 2.4 BIOLOGICAL PARAMETERS AT SPECIFIED FIVE STATIONS OF SEAWATER

2.4.1. CHLOROPHYLL – A CONTENT

Stations		Chlorophyll-a (µg/L)
St.1	Surface	0.56
	*Subsurface	0.51
St.2	Surface	1.73
	*Subsurface	1.64
St.3	Surface	0.68
	*Subsurface	0.74
St.4	Surface	0.52
	*Subsurface	0.85
St.5	Surface	0.49
	*Subsurface	0.60

2.4.3 PHYTOPLANKTON DIVERSITY (No/m^3) AND BIOMASS (mg/m^3)

S.No	Flora	Units	Station-1	Station-2	Station-3	Station-4	Station-5
DIATOMS							
1.	*Asterionella*	No/m^3	2134	1084	3525	1283	1645
2.	*Bacteriastrum*	No/m^3	1953	2542	5380	1624	2131
3.	*Biddulphia*	No/m^3	1257	930	1435	1850	1239
4.	*Cerataulina*	No/m^3	3595	4053	2590	5014	2382
5.	*Chaetoceros*	No/m^3	1482	1620	2371	2620	2255
6.	*Coscinodiscus*	No/m^3	941	1253	1855	3014	1749
7.	*Cyclotella*	No/m^3	629	810	939	742	697
8.	*Ditylum*	No/m^3	523	492	536	691	702
9.	*Fragillaria*	No/m^3	1274	1735	1492	1380	1168
10.	*Lauderia*	No/m^3	749	810	924	773	894
11.	*Leptocylindricus*	No/m^3	126	94	132	144	195
12.	*Navicula*	No/m^3	3720	4530	3902	2840	2902
13.	*Nitzschia*	No/m^3	164	192	185	163	171
14.	*Planktoniella*	No/m^3	348	425	196	310	288
15.	*Pleurosigma*	No/m^3	1510	1830	1642	1902	1746
16.	*Rhizosolenia*	No/m^3	240	193	239	304	284
17.	*Skeletonema*	No/m^3	9	10	13	17	12
18.	*Thalassiothrix*	No/m^3	6246	7232	8200	6410	5932
19.	*Triceratium*	No/m^3	122	235	184	193	157
20.	Other diatoms	No/m^3	198	342	496	352	284
DINOFLAGELLATES							
1.	*Ceratium*	No/m^3	2284	2463	2872	2063	1982
2.	*Dinophysis*	No/m^3	5	8	6	3	5
3.	*Gymnodinium*	No/m^3	341	447	525	610	703
4.	*Ornithoceros*	No/m^3	62	93	124	108	94
5.	*Peridinium*	No/m^3	392	474	364	282	197
6.	*Preperidinium*	No/m^3	240	220	283	304	405
7.	*Noctiluca*	No/m^3	147	183	195	250	183
BLUE GREEN ALGAE							
1.	Blue Green Algae	No/m^3	2	29	42	37	32
Biomass (wet weight)		mg/ m^3					

Note: mg/ m^3 - milligram per cubic meter; No/ m^3 – numbers per cubic meter

Phytoplankton community structure variability

Phytoplankton	S	N	d	J'	H' (log 2)
St.1	28	30693	3.67	0.89	3.81
St.2	28	34329	3.75	0.92	3.97
St.3	28	40647	4.12	0.94	4.20
St.4	28	35283	3.80	0.93	4.08
St.5	28	30434	3.65	0.87	3.85

S	Total number of species (S)
N	Total number of individuals
d	Margalef's index
J'	Pielou's evenness index (J')
H'(log 2)	Shannon-Wiener diversity index

Diversity Shannon-Wiener	bits/individual
High	> 4
Good	3-4
Moderate	3-2
Poor	2-1
Bad	1-0

2.4.4 ZOOPLANKTON DIVERSITY (No/m^3) AND BIOMASS (mg/m^3)

S.No	Fauna	Units	Station-1	Station-2	Station-3	Station-4	Station-5
1.	*Tintinids*	No/m^3	2620	2912	3497	2853	2960
2.	*Radiolarian*	No/m^3	1754	1910	1548	2015	2274
3.	*Medusae*	No/m^3	420	595	492	483	461
4.	*Siphonophores*	No/m^3	291	343	726	635	593
5.	*Ctenophore*	No/m^3	542	482	1130	946	932
6.	*Chaetognaths*	No/m^3	274	354	502	473	398
7.	*Polychaetes*	No/m^3	919	1120	915	730	1040
8.	*Cladocerans*	No/m^3	2470	2835	4201	3653	2981
9.	*Copepod*	No/m^3	21490	24302	20532	19532	21553
10.	*Copepod nauplius*	No/m^3	23905	25430	23853	20821	23004
11.	*Lucifer*	No/m^3	2147	2247	2563	2836	2092
12.	*Oikopleura sp.*	No/m^3	1535	1730	1950	1829	1921
13.	*Fritillaria sp.*	No/m^3	361	465	503	438	394
14.	Fish Eggs	No/m^3	257	448	693	1042	702
15.	Copepod egg	No/m^3	20842	24568	27405	24194	23562
16.	Decapod Larvae	No/m^3	34523	35713	34672	32543	31539
17.	Bivalve Larvae	No/m^3	17	43	89	78	73
18.	Echinoderm Larvae	No/m^3	2	21	33	19	24
19.	Fish larvae	No/m^3	349	429	284	392	385
20.	Chaetognath Larvae	No/m^3	13	16	33	25	29
21.	Polychaete Larvae	No/m^3	1024	1353	1930	1525	1710
22.	Other Zooplankton	No/m^3	698	720	745	810	742
Biomass (wet weight)		mg/ m^3	116453	128036	128296	117872	119369

Note: mg/ m^3 - milligram per cubic meter; No/ m^3 – numbers per cubic meter

Zooplankton community structure variability

Zooplankton	S	N	d	J'	H' (log 2)
St.1	22	116453	3.74	0.92	4.20

St.2	22	128036	4.06	0.95	4.27
St.3	22	128296	4.10	0.96	4.29
St.4	22	117872	3.79	0.88	4.19
St.5	22	119369	3.85	0.90	4.24

S	Total number of species (S)
N	Total number of individuals
d	Margalef's index
J'	Pielou's evenness index (J')
H'(log 2)	Shannon-Wiener diversity index

Diversity Shannon-Wiener	**bits/individual**
High	> 4
Good	3-4
Moderate	3-2
Poor	2-1
Bad	1-0

2.4.5 MACROBENTHOS DIVERSITY (No/m^2) AND BIOMASS (individual/m^2)

S.No	Parameters monitored	Units	Station-1	Station-2	Station-3	Station-4	Station-5
MACROBENTHOS DIVERSITY							
I POLYCHAETES							
1.	*Nephthys sp.*	No/m^2	125	143	179	165	186
2.	*Nereis sp.*	No/m^2	70	195	144	153	160
3.	*Glycera sp.*	No/m^2	130	185	202	199	204
4.	*Clymene sp.*	No/m^2	147	204	305	284	312
5.	*Prionospio sp.*	No/m^2	42	77	93	69	74
6.	*Sabellaria sp.*	No/m^2	97	84	102	95	107
7.	*Eumice sp.*	No/m^2	35	56	89	88	74
SUBTOTAL		No/m^2	646	944	1114	1053	1117
II MOLLUCS							
1.	*Meretrix sp.*	No/m^2	194	838	320	402	592
2.	*Perna viridis*	No/m^2	143	427	239	360	293
3.	*Donax sp.*	No/m^2	82	89	100	104	92
4.	*Arca sp.*	No/m^2	79	105	148	162	107
5.	*Trocus sp.*	No/m^2	110	124	139	183	153
6.	*Teritella sp.*	No/m^2	132	175	240	195	204
7.	*Cerithedia sp.*	No/m^2	64	93	115	184	97
8.	*Cardium sp.*	No/m^2	88	143	240	362	248
9.	*Dentalium sp.*	No/m^2	91	192	185	249	340
SUBTOTAL		No/m^2	983	2186	1726	2201	2126
III CRUSTACEA							
1.	*Metapenaeus sp.*	No/m^2	693	914	1590	892	1054
2.	*Portunus sp.*	No/m^2	792	1053	1296	954	988

3.	*Urothoe sp.*	No/m^2	424	650	482	595	540
4.	*Sphaeroma sp.*	No/m^2	352	502	689	709	692
5.	*Eurydice sp.*	No/m^2	581	671	810	727	646
SUBTOTAL		No/m^2	2842	3790	4867	3877	3920
IV ECHINODERMATA							
1.	*Ophiothrix sp.*	No/m^2	12	45	83	65	73
SUBTOTAL		No/m^2	12	45	83	65	73
V MISCELLANEOUS							
1.	Crabs	No/m^2	5	16	38	21	25
2.	Shrimps	No/m^2	4	14	40	19	23
3.	Fishes	No/m^2	8	120	165	80	96
4.	Mud tubes	No/m^2	14	25	48	20	52
5.	Sand tubes	No/m^2	69	30	125	137	120
6.	Egg cases	No/m^2	392	420	582	420	398
SUBTOTAL		No/m^2	492	625	998	697	714
Biomass		(Individuals/m^2)	89.4	97.5	108.5	95.7	129.2

Note: No/ m^2 – numbers per square meter; Individuals/m^2 – Individuals per square meter

Macro benthos diversity structure variability

Macro benthos	S	N	d	J'	H' (log 2)
St.1	22	4975	1.32	0.84	3.12
St.2	22	7590	1.97	0.88	3.47
St.3	22	8788	2.40	0.93	3.80
St.4	22	7893	2.05	0.90	3.53
St.5	22	7950	2.14	0.89	3.67

S	Total number of species (S)
N	Total number of individuals
d	Margalef's index
J'	Pielou's evenness index (J')
H'(log 2)	Shannon-Wiener diversity index

Diversity Shannon-Wiener	bits/individual
High	> 4
Good	3-4
Moderate	3-2
Poor	2-1
Bad	1-0

2.6 Bioassay test to estimate the toxicity (LC50) of surface seawater collected from the 5 stations

S.No.	Medium	Bivalve mollusc Green mussel, *Perna viridis*, 20 – 30 mm (Mortality)			
		24 h	48 h	72 h	96 h
1	Control (Aged Sea water)	Nil	Nil	Nil	Nil
2	Test Medium (St.1 Surface water)	Nil	Nil	Nil	Nil

S.No.	Medium	Bivalve mollusc Green mussel, *Perna viridis*, 20 – 30 mm (Mortality)			
		24 h	48 h	72 h	96 h
1	Control (Aged Sea water)	Nil	Nil	Nil	Nil
2	Test Medium (St.2 Surface water)	Nil	Nil	Nil	Nil

S.No.	Medium	Bivalve mollusc Green mussel, *Perna viridis*, 20 – 30 mm (Mortality)			
		24 h	48 h	72 h	96 h
1	Control (Aged Sea water)	Nil	Nil	Nil	Nil
2	Test Medium (St.3 Surface water)	Nil	Nil	Nil	Nil

S.No.	Medium	Bivalve mollusc Green mussel, *Perna viridis*, 20 – 30 mm (Mortality)			
		24 h	48 h	72 h	96 h
1	Control (Aged Sea water)	Nil	Nil	Nil	Nil
2	Test Medium (St.4 Surface water)	Nil	Nil	Nil	Nil

S.No.	Medium	Bivalve mollusc Green mussel, *Perna viridis*, 20 – 30 mm (Mortality)			
		24 h	48 h	72 h	96 h
1	Control (Aged Sea water)	Nil	Nil	Nil	Nil
2	Test Medium (St.5 Surface water)	Nil	Nil	Nil	Nil