

Mapping of coastal resources and identifying suitable areas for expanding integrated multi trophic aquaculture (IMTA) in Maharashtra

Work done between April - October 2018.

Assessment of coastal resources and survey was carried out in the coastal districts of Maharashtra to assess seasonal variation of water quality in the month of May and October 2018. Water quality, current flow and depth were measured in the coastal waterbodies. Water quality assessment was completed for May sampling. The mangrove extent and location in the coastal districts of Maharashtra was mapped from the Sentinel data of year 2018 and the comparison with forest survey of India data indicated the mangrove growth in Sindhudurg, Ratnagiri and Raigad districts and slight reduction in Thane districts. (Table 1).

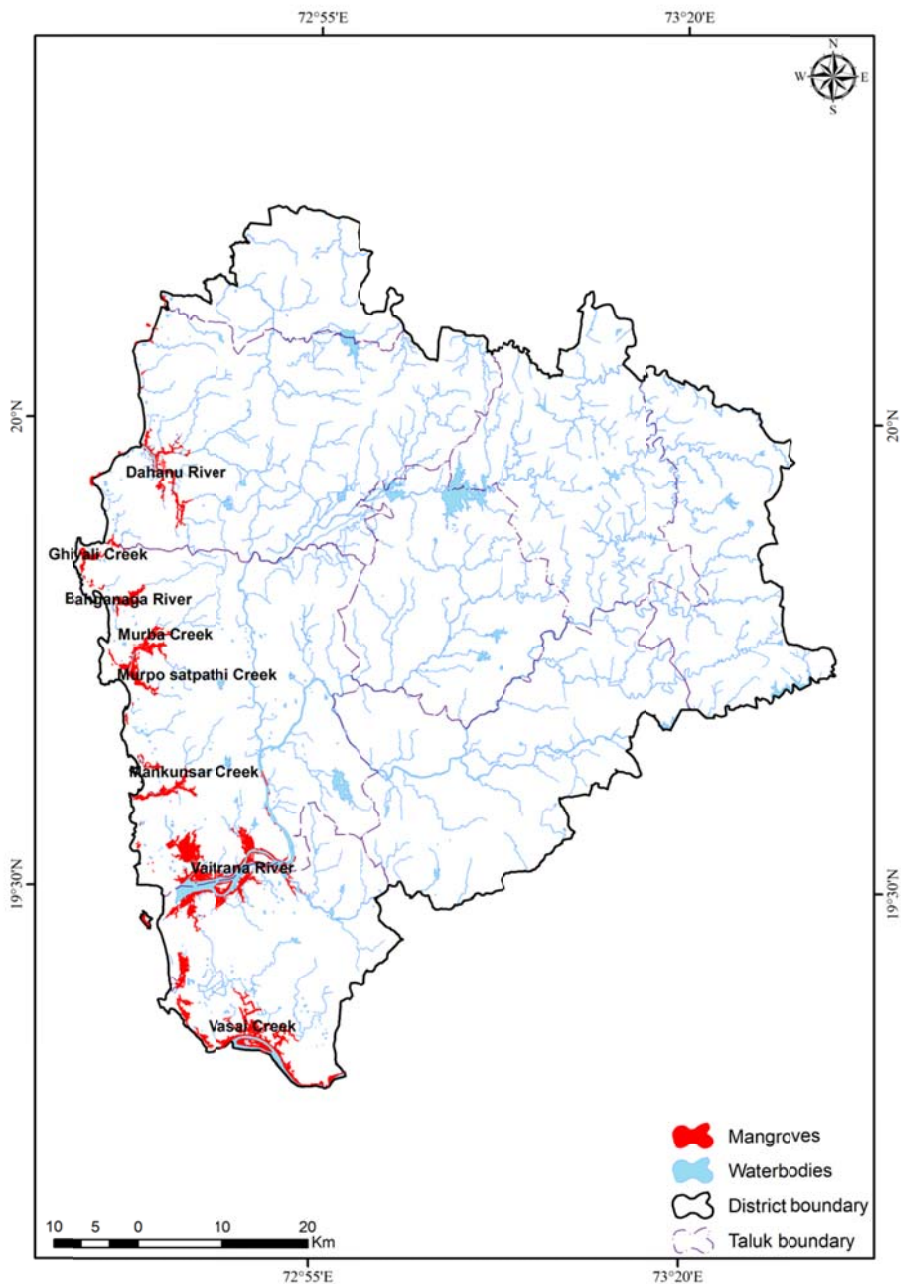


Fig. 1 Mangroves and waterbodies in Palghar district of Maharashtra

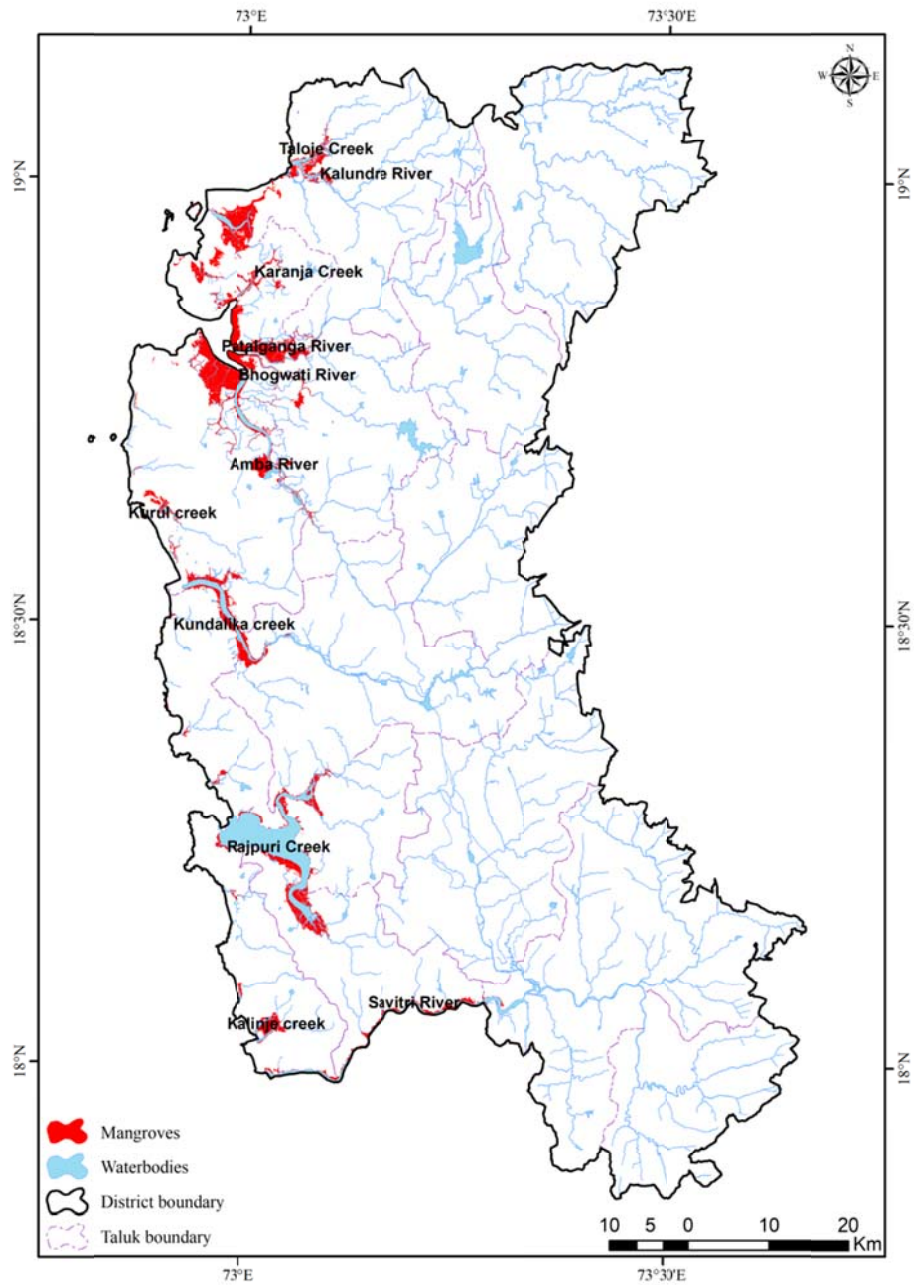


Fig.2 Mangroves and waterbodies in Raigad district of Maharashtra

Table 1 Mangroves in the coastal districts of Maharashtra

S.No	District	Mangrove area in 2018 (km ²) mapped by CIBA	Comparison with FSI data of year 2017
1.	Palghar Thane	39.80 46.43	90 (for Thane including palghar)
2.	Raigad	141.21	106
3.	Rathnagiri	37.58	30
4.	Sindhudurg	13.71	12

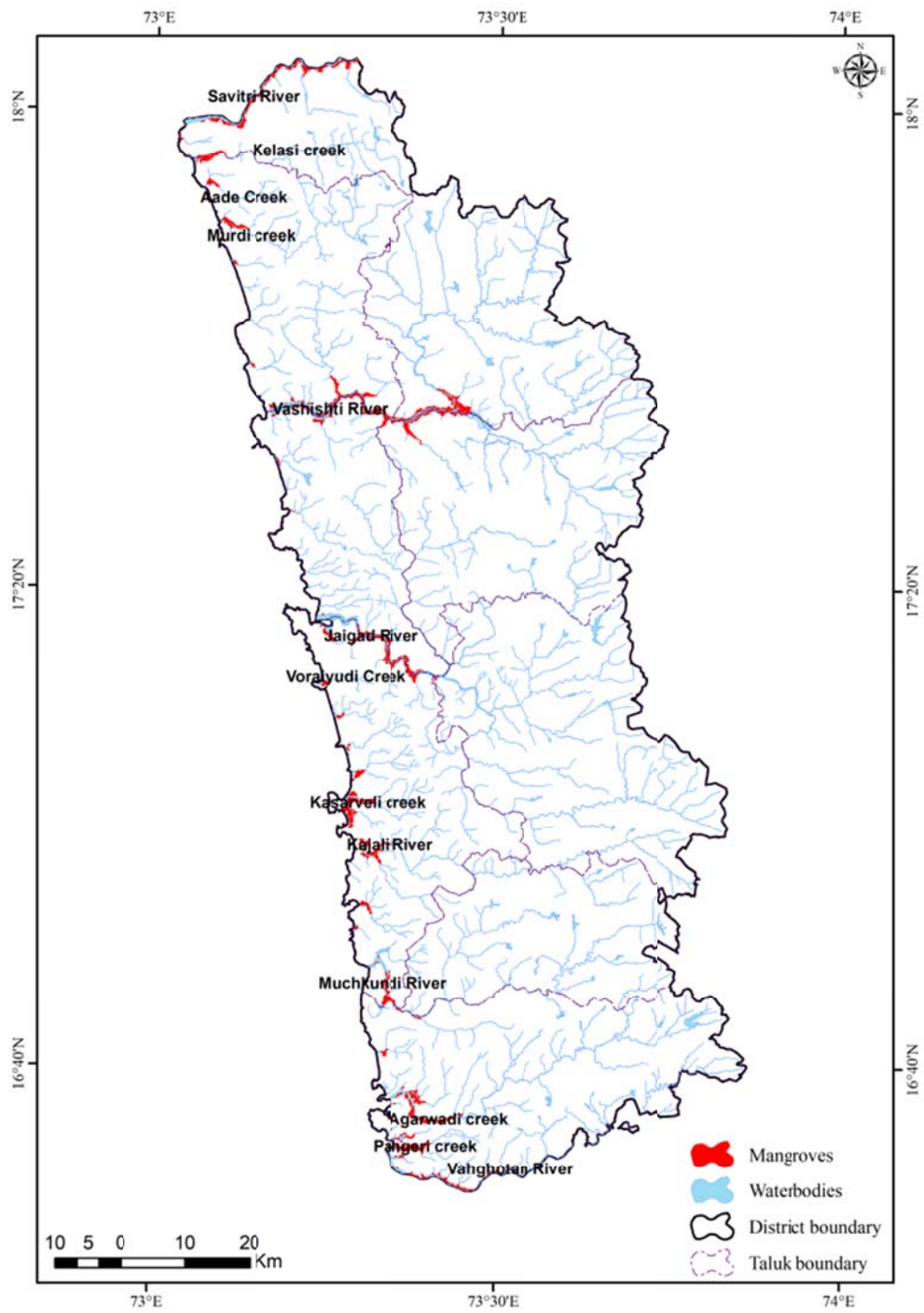


Fig.3 Mangroves and waterbodies in Rathnagiri district of Maharashtra

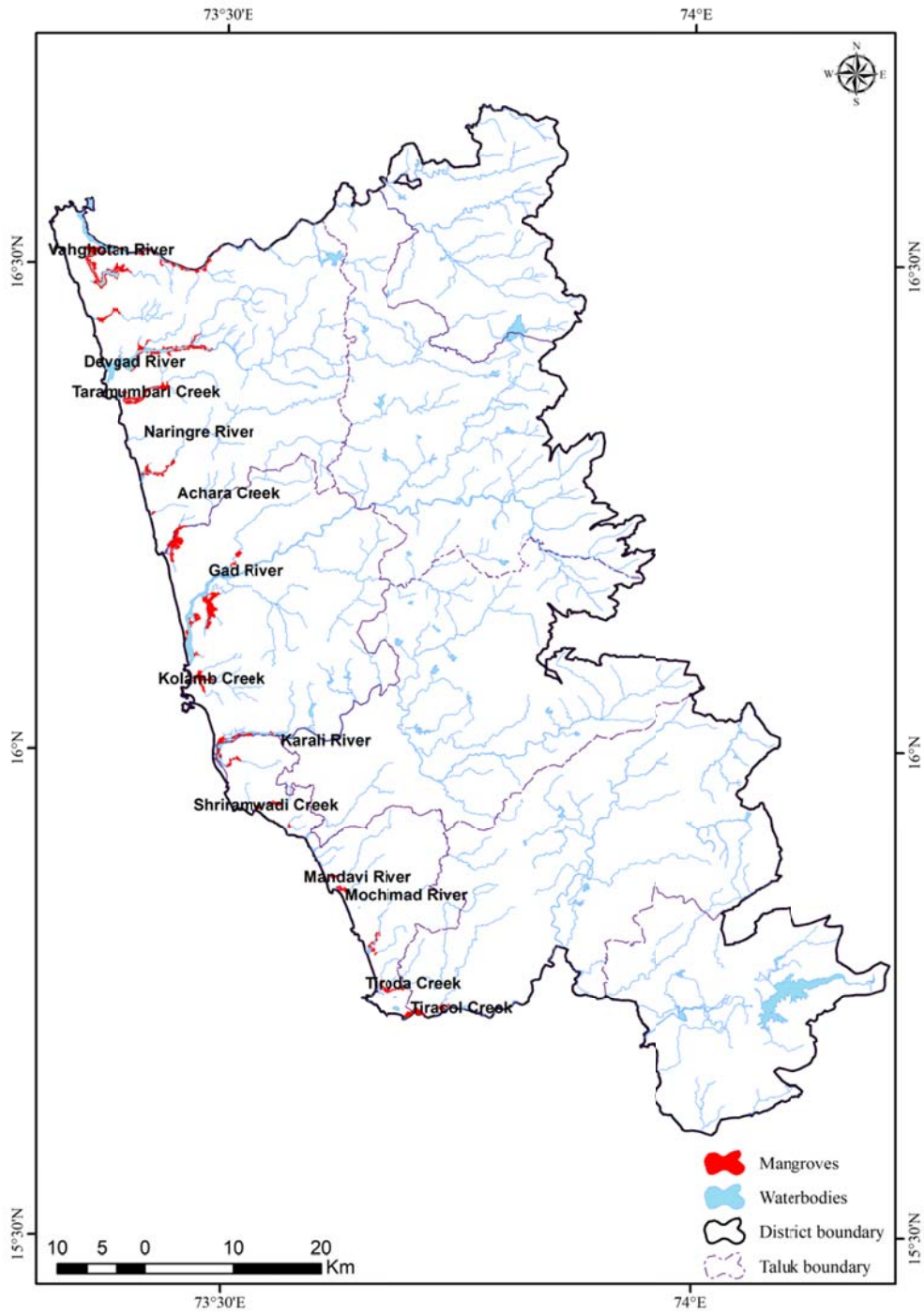


Fig.4 Mangroves and waterbodies in Sindhudurg district of Maharashtra

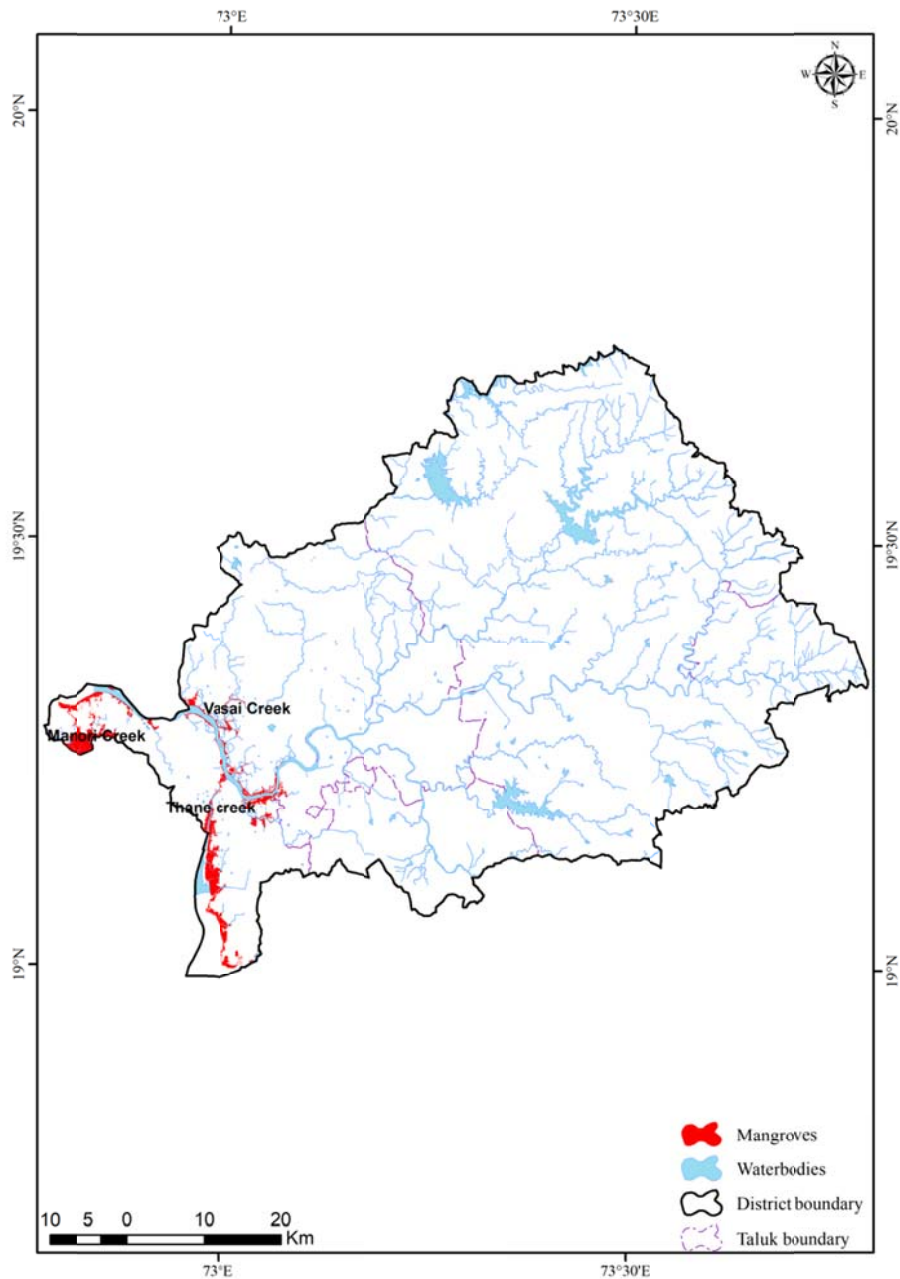


Fig.5 Mangroves and waterbodies in Thane district of Maharashtra

Physical, chemical and biological characteristics of water bodies have been assessed based on the survey held in May 2018. Results are given in the following Tables (2-12). Water quality was suitable in Singhudurg, Palghar, Raigad and Ratnagiri. Thane creeks have very low or nil oxygen level which is not suitable for any aquaculture operations. Based on the depth of water, current flow rate and water quality the suitable villages have been identified for cage culture operations.

S.No	Creek	Village	Depth (m)		Current flow ft/s	Width (m)	Water Temp (°C)	Turbidity (NTU)
			HT	LT				
1	Savitri River	Dhanshey	3	1.8	0.2	874.6	31	40
2		Mhapral	8	5	0.3	392	32.3	6
3		Peve	10	6.2	0.2	333	31.08	352
4	Kelshi Creek	Mandivali	1	0.3	0.1	68.2	32	6
5		Kelshi	3	1	0.1	78	32.3	3
6		Kelshi	3.5	2	0.1	134.8	33.6	10
7	Aade Creek	Aade	2.1	0.7	1.9	132.7	32.8	25
8		Aade	3.7	2.4	1.1	46.8/70.7	33.1	8
9		Aade	1.8	0.4	0.8	99.3	32	20
10		Wadi	1.5	0.1	-	30.8	33.2	1
11	Murdi creek	Murdi	1.3	0.3	0.1	47.3	31.6	38
12		Adkhal	6.1	4.2	0.1	230.9	31.3	7
13	Vashishti River	Maldoli	15	7.2	0.7	390.9	30.2	13
14		Gangrai	14	6.8	0.1	674.2	31.7	58
15		Donavali	9	5.3	0.1	551	31.38	10
16		Cheveli bundar	15	7.3	0.1	303.9	31.8	9
17		Dabhol	13	3.1	0.3	558.8	31.25	50
18	Jaigad River	Kudli	6	2.5	0.1	433.5	31.1	103
19		Thavasal	7.2	4.5	0.1	1398.6	30.1	13
20		Kasari	2	1	0.1	954	31.3	32
21		Saitvadi	12	4	0.1	710	31.93	10
22		Gadnaral	7	3.2	-	356.7	33.6	4
23		Voraiyudi Creek	Voraiyudi	2.3	1	0.4	35.6	31.9
24	Kasarveli creek	Mayekarwadi	3	1.5	-	41.6	33.55	13
25		Kasarveli	3	1	-	391	29.3	20
26	Kajali River	Nachane	2.7	1	0.2	144.5/27.3	28.9	15
27		Chinchkhari	2.3	1	0.9	97.4/49	28.65	12
28		Phansop	3	1.2	0.6	50.8/262.3	29.3	30
29	Muchkundi River	Musliwadi	3	1.5	0.1	750.4	30.4	4
30		Dabhil Ambere	2.5	1.5	0.1	379.5	30.8	3
31		Purnagad	3	1.4	0.3	276	30.9	4
32		Kondsar Bk	6	3	0	65.56	31.23	3
33	Agarwadi creek	Agarwadi	3.5	1.5	0.5	457.8	30.88	11
34		Jaithapur	6.5	3	0.7	294	30.5	9
35		Waghran	3.5	0.5	-	194.9	30.4	3
36		Hurse	3.5	1.5	0.7	167.7	30.1	37
37	Pangeri creek	Ansur (Aadi)	2.8	0.5	1.2	128/146.3	33	18
38		Ansur (Pangera)	3.2	1	0.1	158.2	31.6	20
39		Ansur (Danda)	2.5	1	1.9	87.9	34.4	9
40	Vahghotan River	Shirse	3.4	2.2	0.1	204.9	33.13	5
41	Pangeri creek	Karivane	2.8	1	0.1	257.4	33.43	11
42	Vahghotan River	Vijayadurg	7	3.4	0.2	892	32.7	11
43		Vijayadurg	4.9	2.7	2.3	721.9	32	13
44		Shirse	3.5	2	2.1	925	31.68	11
45		Wadapwadi	1.7	1.2	2.5	774	32.63	7
46		Jambhari	4.6	2.5	2.3	733.7	31.3	3
47		Sagwe	3	1.7	2.5	585.3	31.1	8
48		Katali	4.5	2	2.8	537.5	30.7	12
49		Wadaker Poi	7.8	6.6	2.8	277.9	30.7	10

Table 2. Physical characteristics of the waterbodies in Ratnagiri district

Table 3. Chemical and biological characteristics of the waterbodies in Ratnagiri district

S.No	Creek /River	Village	Salinity (ppt)	pH	DO mg/l	NH3 ppm	NO2 ppm	NO3 ppm	PO4 ppm	TPO4 ppm	Chlorophyll a mg/m ³
1	Savitri	Dhanshey	38	8	6	0.047	0.003	0.039	0.057	0.084	2.207
2	Savitri River	Mhapral	26	7.2	5.63	0.008	0.012	0.060	0.001	0.097	2.607
3	Savitri River	Peve	28	7.3	6.85	0.014	0.014	0.264	0.125	0.188	2.019
4	Kelshi Creek	Mandivali	4	7.2	6.82	0.017	0.006	0.002	0.003	0.089	3.491
5	Kelshi Creek	Kelshi	30	7.8	5.8	0.010	0.100	0.007	0.001	0.090	3.613
6	Kelasi creek	Kelshi	37	7.4	6.24	0.006	0.003	0.005	0.005	0.084	2.295
7	Aade Creek	Aade	36	7.5	5.83	0.006	0.030	0.023	0.016	0.106	2.144
8	Aade Creek	Aade	35	7.6	5.51	0.016	0.003	0.014	0.006	0.115	2.730
9	Aade Creek	Aade	36	7.4	6.14	0.007	0.003	0.011	0.008	0.067	2.596
10	Aade Creek	Wadi	38	7.8	5.44	0.002	0.031	0.037	0.005	0.048	2.420
11	Murdi creek	Murdi	35	7.3	5.3	0.006	0.001	0.037	0.021	0.062	1.949
12	Murdi creek	Adkhal	35	7.4	5.85	0.004	0.003	0.027	0.002	0.045	2.715
13	Vashishti River	Maldoli	4	7.4	6.25	0.008	0.011	0.030	0.020	0.107	2.299
14	Vashishti River	Gangrai	5	7.2	5.97	0.007	0.014	0.024	0.034	0.111	2.196
15	Vashishti River	Donavali	5	7.2	5.69	0.008	0.010	0.019	0.008	0.103	3.093
16	Vashishti River	Cheveli bundar	11	7.7	5.14	0.006	0.018	0.057	0.030	0.131	1.890
17	Vashishti River	Dabhol	25	7.5	5.34	0.015	0.009	0.043	0.050	0.110	1.564
18	Jaigad River	Kudli	34	7.3	5.48	0.003	0.010	0.048	0.034	0.077	2.015
19	Jaigad River	Thavasal	38	7.7	5.18	0.003	0.006	0.025	0.025	0.095	1.405
20	Jaigad River	Kasari	37	7.2	5.13	0.001	0.012	0.035	0.017	0.086	1.887
21	Jaigad River	Saitvadi	35	7.5	5.27	0.004	0.008	0.030	0.012	0.082	2.394
22	Jaigad River	Gadnaral	36	7.8	5.43	0.004	0.012	0.012	0.001	0.039	2.997
23	Voraiyudi Creek	Voraiyudi	36	7.5	5.77	0.004	0.011	0.040	0.033	0.041	1.812
24	Kasarveli creek	Mayekarwadi	37	7.3	5.51	0.002	0.006	0.022	0.011	0.035	2.026
25	Kasarveli creek	Kasarveli	36	7.4	5.24	0.004	0.008	0.010	0.007	0.035	2.593
26	Kajali River	Nachane	35	7.1	5.07	0.006	0.007	0.025	0.005	0.035	2.865
27	Kajali River	Chinchkhari	35	7.1	5.64	0.004	0.008	0.022	0.002	0.057	3.074
28	Kajali River	Phansop	37	7.5	5.5	0.003	0.008	0.040	0.018	0.063	2.023
29	Muchkundi River	Musliwadi	36	7.7	5.95	0.003	0.420	0.001	0.001	0.041	3.188
30	Muchkundi River	Dabhil Ambere	35	7.7	5.78	0.017	0.002	0.007	0.016	0.125	2.326
31	Muchkundi River	Purnagad	37	7.9	5.7	0.010	0.004	0.016	0.032	0.136	2.096
32	Muchkundi River	Kondsar Bk	32	7.3	5.92	0.008	0.002	0.014	0.007	0.129	3.418
33	Agarwadi creek	Agarwadi	36	7.6	5.88	0.014	0.006	0.011	0.010	0.127	2.163
34	Agarwadi creek	Jaithapur	38	7.6	5.8	0.037	0.001	0.021	0.009	0.108	2.633
35	Agarwadi creek	Waghran	35	7.3	5.05	0.007	0.003	0.023	0.002	0.143	2.857
36	Agarwadi creek	Hurse	34	7.3	5.8	0.009	0.002	0.061	0.002	0.133	2.913
37	Pangeri creek	Ansur (Aadi Village)	38	6.9	5.01	0.012	0.000	0.013	0.001	0.105	3.843
38	Pangeri creek	Ansur (Pangera)	35	7.4	5.15	0.004	0.002	0.009	0.001	0.132	3.894
39	Pangeri creek	Ansur (Danda)	36	7.5	5.52	0.005	0.001	0.012	0.001	0.124	3.030
40	Vahghotan	Shirse	35	7.2	5.63	0.004	0.001	0.032	0.001	0.113	3.071

	River										
41	Pangeri creek	Karivane	36	7.5	5.12	0.008	0.067	0.014	0.008	0.093	2.883
42	Vahghotan River	Vijayadurg	38	7.9	6.24	0.013	0.000	0.013	0.005	0.115	2.295
43		Vijayadurg	36	7.9	5.24	0.009	0.006	0.015	0.003	0.125	1.927
44		Shirse	36	7.8	5.45	0.010	0.006	0.024	0.012	0.122	2.004
45		Wadapwadi	36	7.8	6.64	0.010	0.001	0.021	0.006	0.091	2.742
46		Jambhari	36	7.7	5.57	0.007	0.006	0.026	0.014	0.130	2.049
47		Sagwe	36	7.7	5.78	0.009	0.001	0.016	0.001	0.083	3.126
48		Katali	36	7.8	5.72	0.009	0.001	0.054	0.007	0.102	2.410
49		Wadaker Poi	36	7.3	5.96	0.010	0.000	0.061	0.001	0.127	3.192

Table 4. Physical characteristics of the waterbodies in Palghar district

S.No	Creek	Village	Depth (m)		Width (m)	Water Temp(°C)	Turbidity (NTU)
			HT	LT			
1	Ghivali Creek	Ghivali	2.5	1	11	35.5	88
2	Dahanu River	Dahanu	5.6	4	274	32.6	78
3		Dhumkhet	6.2	3.8	376	32.3	55
4		Chandigone	4.7	3.1	301	32.3	67
5		Chandigone	5	3	231	34.1	21
6		Pale	4.1	2.8	145.7	34.6	6
7		Pale	3.7	2.5	126.9	34.8	15
8		Matgaon	3.6	2.3	69	35.8	12
9		Asangaon	3.25	2.5	67.5	36.6	58
10		Dhakati Dahanu	2	1	313.7	32.3	85
11		Agavan	3	1.2	30	33.5	65
12		Banganaga River	Dandi	2.7	1	95.5	33.4
13	Pantembi		2	0.5	130	35.4	28
14	Murba Creek	Vikaswadi	3.7	2.5	160.8	34.1	4
15	Murpo satpathi Creek	Daboli	3	2	60	34.3	23
16	Mankunsar Creek	Bariwada	2.7	1	186	35	70
17		Makunsar	4	1	79.8	34.6	125
18		Zenda Aali	2.5	2	38	33.4	26
19	Vaitrana River	Datiware	3.5	2.5	265	33.6	35
20		Vehaloli	4.2	3	183.4	33.5	35
21		Kharmendi	4	2.8	1126.6	32.7	43
22		Tembhikhodave	8.5	3.5	594.8	32.7	47
23		Kasarali	12	5.2	713.6	32.5	17
24		Karvele	4.4	3	342	32.4	9

Table 5. Chemical and biological characteristics of the waterbodies in Palghar district

S.No	Creek	Village	Salinity (ppt)	pH	DO mg/l	NH3 ppm	NO2 ppm	NO3 ppm	PO4 ppm	TPO 4 ppm
1	Ghivali Creek	Ghivali	40	6.74	7.86	0.002	0.001	0.048	0.027	0.152
2	Dahanu River	Dahanu	34	7.51	5.75	0.004	0.001	0.026	0.044	0.113
3		Dhumkhet	35	7.47	5.81	0.015	0.009	0.002	0.040	0.125
4		Chandigone	34	7.48	5.76	0.006	0.011	0.039	0.064	0.107
5		Chandigone	35	7.35	5.64	0.012	0.016	0.028	0.058	0.073
6		Pale	35	7.2	5.24	0.013	0.004	0.016	0.017	0.085
7		Pale	34	7.18	5.12	0.001	0.008	0.034	0.016	0.121
8		Matgaon	34	7.13	5.3	0.010	0.004	0.059	0.038	0.148
9		Asangaon	30	7.2	5.16	0.011	0.004	0.025	0.026	0.152
10		Dhakati Dahanu	38	7.24	5.49	0.010	0.003	0.061	0.082	0.082
11		Agavan	34	7.15	4.64	0.008	0.003	0.038	0.003	0.140
12	Banganaga River	Dandi	35	6.92	3.52	0.018	1.046	0.171	0.205	0.213
13		Pantembi	37	6.84	18.04	1.758	1.043	1.368	0.751	0.780
14	Murba Creek	Vikaswadi	36	6.76	2.67	0.006	1.118	0.400	0.044	0.195
15	Murpo satpathi Creek	Daboli	36	6.88	5.76	0.008	0.007	0.252	0.017	0.197
16	Mankunsar Creek	Bariwada	36	7.47	6.96	0.002	0.035	0.224	0.065	0.212
17		Makunsar	40	7.54	5.6	0.002	0.004	0.045	0.102	0.192
18		Zenda Aali	55	7.32	3.36	0.048	0.005	0.092	0.030	0.171
19	Vaitrana River	Datiware	35	7.37	6.01	0.001	0.005	0.103	0.091	0.187
20		Vehaloli	35	7.45	6.23	0.001	0.009	0.076	0.046	0.169
21		Kharmendi	36	7.42	5.73	0.002	0.007	0.087	0.035	0.135
22		Tembhikhodave	35	7.43	5.7	0.002	0.006	0.105	0.046	0.136
23		Kasarali	33	7.4	5.4	0.002	0.020	0.141	0.032	0.202
24		Karvele	32	7.32	5.34	0.002	0.017	0.111	0.019	0.159

Table 6. Physical characteristics of the waterbodies in Raigad district

S.No	Creek	Village	Depth (m)		Current flow ft/s	Width (m)	Water Temp (°C)	Turbidity (NTU)
			HT	LT				
1	Bhogwati River (Koproli creek)	Tukaram Vadi	4	1.8	1.4	106.4	32.3	33
2		Bhal	4.7	2	0.6	96	32.3	15
3	Bhogwati River(Koproli creek)		3.3	1.6	0.7	129	33	14
4	Patalganga River(Koproli creek)		3.2	1.7	1.1	381.4	32.6	112
5	Patalganga River (Koproli creek)		4	1.9	1.7	544	32.9	37
6			4.5	2	1.8	536.5	31.6	125
7	Amba River		3.8	1.9	0.5	915.8	32.4	94
8		Mothe Bhal	2.1	1.3	0.4	648.9	31.9	64
9		Tamsi(Boisar)	3.6	1.5	0.4	541.9	31.6	41
10		Mankule	3.5	1.8	0.6	491	32	31.6
11		Shirkichal	4.5	2.1	1.1	468.9	32	32.1
12	Kurul creek	Kurul	3	1.5	0.1	276.6	31.9	14
13		Navedarbeli	1.5	0.5	0	35	30.8	25
14	Kundalika creek	Bonang	4.2	1.5	0.6	53.5	32.5	27
15		Nidi	2.2	1.3	2.4	669.6	33.6	6
16		Bonang	2.3	1.5	3.2	486.4	33.1	8
17		Navakhar Traf Umate	1.6	1	1.5	664	33.1	11
18		Kude	3.2	1.7	2.2	467.6	32.7	1
19		Dapoli	3	1.4	2.6	437	32.6	3
20		Kundalika creek	Agrav	5	3	-	519.5	32
21	Gofan		4	2	0	207	31.15	13
22	Rajpuri Creek (Mandeer creek)	Utchal	3.2	2	0.1	70	35.4	9
23		Kandane Bk	3.5	2.1	0	74.3/59	34.88	2
24		Kandane Kh	3.2	1.8	0.3	220/292	36.6	30
25		Kandane Kh	4.1	2.8	0.7	375/490.8	33.6	6
26		Khajaniwadi	4.3	2.2	0.1	488.5	32.7	5
27		Nandale	5	2.1	0.2	1589/1968.6	30.9	52
28		Mithagar	3	1.7	0	570.97	30.5	45
29	Kalinje creek	Shrivardhan	3.1	1.9	0.1	285.7	34.3	10
30		Bhairavanth Pakhadi	2.8	1.4	0.3	338.4	33.5	20
31		Shrivardhan	4.1	2.1	0.8	223	32.3	24
32		Kurawade	2.8	0.5	1	201.7	32.35	21
33		Kalinje	4.7	3	0.2	240.6	33.6	250
34	Savitri River	Adi	4.5	3.2	1.1	480.4	32.4	248
35		Toradi	5.1	3.7	0.2	477.2	32.8	75
36		Pangol	5.8	3.5	0.4	319.8	32.35	17
37		Kudgaon	5.5	2.5	0.4	507.9	32.05	50

Table 7. Chemical and biological characteristics of the waterbodies in Raigad district

S.No	Creek	Village	Salinity (ppt)	pH	DO mg/l	NH3 ppm	NO2 ppm	NO3 ppm	PO4 ppm	TPO4 ppm	Chlorophyll a mg/m3
1	Bhogwati River	Tukaram Vadi	25	7.2	6.67	0.003	0.008	0.007	0.010	0.126	2.453
2	(Koproli creek)	Bhal	16	7.6	6.6	0.006	0.005	0.087	0.013	0.167	2.143
3	Bhogwati River(Koproli creek)		25	8.0	7.15	0.001	0.016	0.014	0.013	0.105	2.630
4	Patalganga River(Koproli creek)		22	8.1	8.28	0.001	0.007	0.102	0.053	0.176	1.905
5	Patalganga River		25	8.0	6	0.001	0.009	0.082	0.042	0.126	2.207
6	(Koproli creek)		33	7.8	6.61	0.002	0.010	0.055	0.127	0.188	1.431
7	Amba River		33	7.8	6.7	0.002	0.007	0.050	0.035	0.049	2.464
8		Mothe Bhal	34	7.6	6.29	0.002	0.006	0.053	0.064	0.122	1.731
9		Tamsi(Boisar)	33	7.6	6.36	0.001	0.023	0.069	0.031	0.084	2.339
10		Mankule	34	7.5	6.14	0.002	0.007	0.092	0.012	0.108	2.658
11		Shirkichal	34	7.6	5.71	0.001	0.041	0.119	0.015	0.069	2.300
12	Kurul creek	Kurul	37	7.5	5.15	0.001	0.003	0.028	0.016	0.062	1.994
13		Navedarbeli	40	7.1	4.37	0.003	0.004	0.037	0.066	0.083	1.607
14	Kundalika creek	Bonang	25	7.3	6.25	0.002	0.014	0.015	0.077	0.108	2.099
15		Nidi	20	7.4	6.34	0.002	0.005	0.200	0.161	0.171	1.733
16		Bonang	18	7.6	6.89	0.002	0.040	0.195	0.223	0.294	1.534
17		Navakhar Traf Umate	17	7.6	7.94	0.002	0.023	0.264	0.306	0.396	1.292
18		Kude	15	7.6	7.12	0.017	0.006	0.173	0.347	0.383	1.162
19		Dapoli	17	7.4	6.03	0.022	0.007	0.199	0.331	0.389	1.022
20		Agrav	24	7.8	6.41	0.039	0.009	0.126	0.107	0.137	1.357
21		Gofan	7	7.8	3.35	0.021	0.019	0.076	0.249	0.299	1.232
22	Rajpuri Creek (Mandeer creek)	Utchal	48	7.5	6.23	0.012	0.007	0.066	0.006	0.069	3.643
23		Kandane Bk	43	7.5	5.06	0.011	0.002	0.001	0.001	0.078	4.291
24		Kandane Kh	43	7.3	5.1	0.027	0.005	0.001	0.012	0.083	2.876
25		Kandane Kh	42	7.6	5.34	0.026	0.007	0.011	0.016	0.047	2.196
26		Khajaniwadi	42	7.5	6.1	0.013	0.003	0.007	0.007	0.038	3.243
27		Nandale	39	7.6	5.29	0.008	0.006	0.019	0.078	0.093	1.546
28		Mithagar	43	7.5	5.36	0.007	0.002	0.001	0.017	0.081	2.971
29	Kalinje creek	Shrivardhan	39	7.5	5.61	0.003	0.049	0.052	0.015	1.137	2.363
30		Bhairavanth Pakhadi	39	7.4	5.22	0.009	0.002	0.014	0.027	0.063	2.592
31		Shrivardhan	38	7.6	6.11	0.012	0.010	0.040	0.013	0.067	2.747
32		Kurawade	39	7.6	5.76	0.008	0.009	0.454	0.025	0.028	2.118
33		Kalinje	39	7.6	5.05	0.003	0.002	0.014	0.143	0.186	1.757
34	Savitri River	Adi	37	7.6	5.58	0.005	0.011	0.033	0.070	0.108	1.805
35		Toradi	35	7.9	5.58	0.004	0.016	0.011	0.036	0.096	1.945
36		Pangol	32	7.3	5.52	0.003	0.016	0.021	0.005	0.104	3.030
37		Kudgaon	31	7.3	5.53	0.013	0.008	0.051	0.023	0.088	2.034

Table 8. Physical characteristics of the waterbodies in Sindhudurg

S.No	Creek	Village	Depth (m)		Current flow ft/s	Width (m)	Water Temp (°C)	Turbidity (NTU)
			HT	LT				
1	Vahgotan River	Amberi	7	5	2.8	470.8	31	5
2		Giriye	5.2	3	0.4	168.9	31	60
3		Thakurwadi	1.5	0.5	0	743	30	38
4	Taramumbari Creek	Mith Mumbri	3.6	1.8	0.8	127.3	32	8
5		Mith Mumbri	3	1.5	0.6	155.8	31	10
6		Mith Mumbri	0.6	0.3	0.6	334	31	14
7		Warandwadi	2.1	1	0.8	185.7/67.5	32	26
8		Parkarwadi	2.1	1.2	0.8	153.6/41	31	11
9		Tharamumbari	2.4	1	1.7	169.4	31	4
10	Devgad River	Palyewadi	3	1.8	1.5	884	32	8
11		Wadatar	4.5	2.5	1.7	291.4	31	7
12		Wadatar	1.5	1	2.3	486.2	30.7	5
13		Katta	1.7	1	1.5	368.4/138.2	30.6	9
14	Naringre River	Morve	2	0.5	0.1	170.4	31.3	111
15		Morve	3	1	0.1	170.2	32	14
16		Hindale	3	1	0	126.9	32	65
17		Mithbav	2.5	0.5	0	79.4	33	14
18	Gad River(Galval creek)	Tondavali	2	1	0.5	340.9	32	2
19		Hadi	4.5	2	0.1	203.6	33	15
20		Shemadranewadi	3.5	2	0.3	312.5	34	2
21		Revandi	3	1	0.1	461	33.9	8
22	Kolamb Creek	Kolamb	3	1.2	0.3	91.3	32	1
23		Chivla	1.7	0.5	1.1	86.9	32	5
24	Achara Creek	Gaudwadi	1.5	0.3	0.2	125.9	32	10
25		Jamdul	2.7	1.1	1.4	261.3	30	4
26		Achara Bandar	1.8	1	1.5	337	30	1
27		Dogrewadi	1.15	0.3	1.6	161.4	31	1
28		Parwadi	2.8	1.2	1.7	81.7	30	2
29		Parwadi	2	1	2.1	88	31	7
30		Parwadi	2	1	0.4	120.4	31	2
31	Gad River	Juva Pankhol	3.5	2	0.8	587.5	31	4
32		Juva Pankhol	3.1	1.7	0.1	57.87/590	31	7
33		Shemadranewadi	3.9	2	0.7	324	32	3
34		Hadi	3.5	1.25	0.6	295.9/92.4/40 5.7	32	7
35	Karali River(Chipi creek)	Devbaug	2.5	0.5	0	583.3/77.7	33	8
36		Tarkarli	4.5	2	0.5	472.6	33	7
37		Devbag	3	2	0	128.7/289	33	16
38		Karali	3	1.7	0.1	208.5	32	41
39	Shriramwadi Creek	Kochare	2	1	0.2	69	32	15
40		Nivati	2	0.8	0	43	31	3
41	Mandavi River	Dabhoswada(Ven gurla)	2	0.5	0	55.7	31	7
42		Namas (Vebgurla)	1	0.2	0	31.4	32	8
43	Mochimad River	Mochimad	3	1.5	0	98	32	50
44		Nhaichiad	2.5	1.7	0.1	78.4	32	45
45		Tank	3.5	2.7	0.1	152	32	45
46	Tiroda Creek	Khalchikar	2.5	1.2	0	173	33	20
47		Huda	2	0.5	0.1	60	34	44

48		Tiroda	5	3	0.1	30	33	5
49	Tiracol Creek	Savarjuva	2	1	0	266	34	16
50		Peer Wadi	1	0.1	0	62.4	34	51

Table 9. Chemical and biological characteristics of the Sindhudurg

S.No	Creek	Village	Salinity (ppt)	pH	DO mg/l	NH3 ppm	NO2 ppm	NO3 ppm	PO4 ppm	TPO4 ppm	Chlorophyll a
1	Vahghotan River	Amberi	35	7.4	5.88	0.008	0.001	0.020	0.008	0.119	
2		Giriye	36	7.27	5.72	0.003	0.000	0.026	0.009	0.129	
3		Thakurwadi	38	37	7	5.05	0.011	0.06	0.022	0.003	
4	Taramumbari Creek	Mith Mumbri	37	7.74	6.06	0.006	0.027	0.012	0.043	0.132	
5		Mith Mumbri	10	36	8	6.06	0.011	0.080	0.023	0.012	
6		Mith Mumbri	14	37	8	6.39	0.011	0.114	0.051	0.005	
7		Warandwadi	26	37	8	5.93	0.021	0.000	0.066	0.028	
8		Parkarwadi	11	36	7.69	6.25	0.007	0.164	0.056	0.160	
9		Tharamumbari	4	36	7.85	6.05	0.009	0.001	0.062	0.016	
10	Devgad River	Palyewadi	38	7.97	5.92	0.004	0.036	0.011	0.017	0.175	
11		Wadatar	36	7.44	6.32	0.010	0.002	0.200	0.047	0.211	
12		Wadatar	5	37	7.91	6.36	0.008	0.085	0.059	0.012	
13		Katta	9	36	7.95	6.26	0.010	0.021	0.053	0.010	
14	Naringre River	Morve	111	36	7.46	4.06	0.013	0.002	0.026	0.008	
15		Morve	14	38	7.35	5.38	0.016	0.001	0.066	0.010	
16		Hindale	65	38	7.26	5.3	0.003	0.011	0.071	0.015	
17		Mithbav	14	38	7.31	5.29	0.005	0.000	0.038	0.013	
18	Gad River(Galval creek)	Tondavali	2	36	7.89	5.43	0.018	0.001	0.021	0.077	
19		Hadi	36	7.78	5.21	0.025	0.000	0.032	0.014	0.120	
20		Shemadranewadi	35	7.69	5.64	0.009	0.003	0.107	0.037	0.144	
21		Revandi	8	36	7.82	5.88	0.063	0.005	0.199	0.037	
22	Kolamb Creek	Kolamb	1	36	7.79	5.63	0.114	0.000	0.145	0.031	
23		Chivla	5	37	8.04	5.93	0.029	0.048	0.054	0.009	
24	Achara Creek	Gaudwadi	10	38	8.27	5.69	0.053	0.001	0.111	0.020	
25		Jamdul	4	36	7.97	5.59	0.018	0.005	0.044	0.004	
26		Achara Bandar	1	35	7.99	5.47	0.011	0.013	0.023	0.005	
27		Dogrewadi	1	35	7.8	5.6	0.018	0.000	0.033	0.004	
29		Parwadi	2	36	7.69	5.89	0.012	0.002	0.029	0.004	
30		Parwadi	7	34	7.63	5.74	0.024	0.007	0.061	0.002	
31		Gad River	Juva Pankhol	36	7.46	5.65	0.036	0.003	0.038	0.004	0.064
32	Juva Pankhol		7	35	7.59	5.47	0.053	0.031	0.430	0.084	
33	Shemadranewadi		36	7.47	5.45	0.065	0.001	0.029	0.001	0.118	
34	Hadi		7	35	7.33	5.55	0.062	0.000	0.018	0.010	
35	Karali River(Chipi creek)	Devbaug	8	32	7.41	5.26	0.043	0.016	0.018	0.005	
36		Tarkarli	35	7.31	5.23	0.039	0.001	0.017	0.011	0.118	
37		Devbag	35	7.43	5.26	0.019	0.000	0.018	0.005	0.115	
38		Karali	41	32	7.53	5.73	0.029	0.008	0.029	0.009	
39	Shriramwadi Creek	Kochare	15	36	7.83	5.75	0.025	0.132	0.084	0.010	
40		Nivati	3	36	8.12	5.47	0.008	0.182	0.353	0.009	
41	Mandavi River	Dabhoswada(Vengurla)	7	35	7.68	5.68	0.016	0.003	0.087	0.006	
42		Namas (Vebgurla)	8	37	7.71	6.22	0.017	0.003	0.032	0.003	

43	Mochimad River	Mochimad	50	35	8.08	5.54	0.013	0.006	0.072	0.037
44		Nhaichiad	45	36	7.28	4.85	0.008	0.000	0.035	0.009
45	Mochimad River	Tank	37	7.83	5.45	0.007	0.001	0.048	0.028	0.110
46	Tiroda Creek	Khalchikar	20	36	7.88	6.32	0.014	0.004	0.082	0.058
47		Huda	44	36	7.57	5.55	0.020	0.001	0.022	0.009
48		Tiroda	35	7.7	6.13	0.014	0.001	0.033	0.004	0.089
49	Tiracol Creek	Savarjuva	16	34	7.55	7.41	0.026	0.391	0.118	0.020
50		Peer Wadi	51	35	7.37	5.51	0.008	0.004	0.032	0.006

S.No	Creek	Village	Depth (m)		Current flow ft/s	Width (m)	Water Temp(°C)	Turbidity (NTU)
			HT	LT				
1	Vasai Creek	Kasheli	10	4	0.1	406	34.1	9
2		Kasheli	10	4	0	456.8	35.4	9
3		Dive (Anjur)	10	3.5	0.1	616	34.6	8
4		Kalher	11	3.7	0.3	549.7	34.1	142
5		Kharbav	11	4	0.1	528.7	32.7	57
6		Maljipada	4	1.2	0	1788	32.2	6
7		Ghodbunder junction	7.2	4.5	0.3	406.5	31.7	51
8		Reti bunder	6	3.6	0.2	302	31.7	16

Table 10. Physical characteristics of the waterbodies in Thane

Table 11. Chemical and biological characteristics of the Thane district creek

S.No	Creek	Village	Salinity (ppt)	pH	DO mg/l	NH3 ppm	NO2 ppm	NO3 ppm	PO4 ppm	TPO4 ppm	Chlorophyll a mg/m ³
1	Vasai Creek	Kasheli	16	7.46	8.84	0.001	0.025	0.520	0.514	0.501	1.251
2		Kasheli	16	7.74	10.63	0.001	0.005	0.562	0.255	0.353	1.310
3		Dive (Anjur)	16	7.78	9.62	0.042	0.009	0.451	0.341	0.361	1.538
4		Kalher	18	7.41	8.52	0.001	0.916	1.127	0.454	0.489	1.084
5		Kharbav	24	7.47	3.92	0.002	0.012	0.491	0.336	0.361	1.442
6		Maljipada	29	7.42	4.21	0.002	0.028	0.464	0.201	0.279	1.548
7		Ghodbunder junction	27	7.42	5.22	0.001	1.105	0.413	0.256	0.302	0.992
8		Reti bunder	27	7.33	4.35	0.002	0.007	0.067	0.278	0.298	1.600

Survey was held in the month of October, current flow and water depth were measured for all creeks in coastal Maharashtra. The following table gives the physical characteristics of the creeks in Sindhudurg district.

Table 12. Physical characteristics of waterbodies in Sindhudurg district in Maharashtra

S.No	Creek	Village	Depth (m)		Current flow ft/s	
			HT	LT	Average	Actual
1	Vahgotan River	Tirlot	1.5	0.5	0	0
2		Padel	1.5	0.5	0	0.1
3		Girye	3	1.5	0.2	0.4
4		Girye	7	4	0.4	0.8
5		Thakulwadi	5.7	3.5	0.2	0.4
6		Amberi	7.2	4	0.1	0.2
7		Wadaker Poi	3.6	2	0.1	0.3
8		Waghotan	3.6	2	0.2	0.6
9		Mutat	2.5	1	0.2	0.4
10		Palekarwadi	3.5	2	1	1.3
11	Devgad River	Mond	1.5	0.5	0.1	0.2
12		Tembavil	4	0.5	0.4	0.6
13		Kalvi	4	2.5	0.4	0.8
14		Katta	3.5	2	0	0.2
15		Biruwadi	4	2	0.2	0.4
16		Darwadi	1.5	2	0.2	0.4
17		Malai	3.5	2	0	0.2
18	Taramumbari Creek	Warandwadi	1.5	0.5	0	0.2
19		Mithmumbari	4	1.5	0.2	0.4
20		Belwadi	3.8	2	0.6	0.8
21		Mithmumbari	4.5	2.5	0.6	0.8
22		Tharamumbari	1.5	0	0.3	0.6
23		Elaye	2.5	1	0	0.2
24		Khakshi	1	0	0	0.2
25	Naringre River	Tambaldeg	3.5	2.5	0.2	0.4
26		Tambaldeg	2.8	1.5	0.2	0.4
27		Tambaldeg	1.5	0.9	0	0.2
28		Morve	2.5	1	0.2	0.4
29		Hindale	2	0.5	0	0.2
30		Girawal	1.5	0.1	0	0
31		Hindale	2	0.5	0	0.2
32	Gad River	Kothewada	6.5	4	0	0.2
33		Govkarwada	4	2.5	1.4	1.7
34		Kothewada	4	2	0.4	0.6
35		Pankhol	3.5	1.8	1.3	1.7
36		Pankhol	3	1.8	0.8	1.6
37		Tondavali	3	1.7	0.2	0.4
38		Thalashil	3.5	2	0	0.2
39		Khot Juva	3.5	2	0	0.2
40	Achara Creek	Gaudwadi	2.1	0.2	0	0.2
41		Jamdul	4	1.8	0.4	0.6
42		Achara Bandar	5.5	2.5	0.4	0.6
43		Dogrewadi	2	0.3	0	0.2
44		Parwadi	3.8	1.5	0	0.2
45		Parwadi	2.5	1	0.2	0.4
46		Parwadi	1.7	0.5	0	0
47	Gad River	Chindar	3.5	2	1.3	1.7

		Labdewadi				
48	Munge Creek	Munge	3.5	2	0.6	1
49	Gad River	Masure	4.5	2.5	0.2	0.4
50	Karali River(Chipi creek)	Chipi	4	2	0.4	0.6
51		Chipi Juva	4.5	2.5	0	0.2
52		Thevili	2.5	1.2	0.2	0.4
53		Devbaug	3.2	2	0.5	0.8
54		Waghavane	3.9	1.2	0	0.2
55	Shriramwadi Creek	Mayne	3	1.5	0	0.2
56		Niviti	2.5	1.2	0.2	0.6
57	Karali River(Chipi creek)	Parule	3.5	2	0	0.2
58		Karli	4	2	0	0.2
59	Gad River	Revandi	1.5	0.5	0	0.2
60	Karali River(Chipi creek)	Dhamapur	3.2	1.5	0.1	0.2
61		Kalse&Walaval	4	2	0.1	0.5
62		Nerur	3.6	1.8	0.1	0.4
63		Sarambal	2.7	1	0	0.2
64	Mandavi River	Dabhoswada(Ve ngurla)	2.5	1.2	0	0.1
65		Namas (Vebgurla)	1.2	0.3	0	0.1
66	Mochimad River	Mochimad	4	2.7	0	0.2
67		Mochimad Ansure	4.5	2.4	0.6	0.8
68		Tank	4.8	2.6	0	0.2
69	Tiroda Creek	Shiroda Keruwadi	2.5	1	0	0
70		Huda	2	0.7	0	0

Based on the survey, the following table gives the suitable villages for cage culture and crab culture in the coastal villages.

District	Table 13. Suitable villages for aquaculture in Maharashtra		
Ratnagiri	Mandangad	1. Peve	1. Dhanshey 2. Mhapral
	Dapoli	2. Kelshi	3. Aade 4. Adkhal 5. Mandivali 6. Wadi 7. Murdi
	Chiplun	3. Cheveli bundar	8. Maldoli 9. Gangrai 10. Donavali
	Guhaghar	4. Kudli 5. Thavasal	11. Dabhol
	Ratnagiri	6. Saitvadi 7. Gadnaral 8. Mayekarwadi 9. Musliwadi 10. Dabhil Ambere	12. Kasari 13. Voraiyudi 14. Kasarveli 15. Nachane 16. Chinchkhari 17. Phansop 18. Purnagad
	Rajapur	11. Jaithapur 12. Hurse 13. Shirse 14. Vijayadurg 15. Shirse 16. Jambhari 17. Sagwe 18. Katali 19. Wadaker Poi	19. Kondsar Bk 20. Agarwadi 21. Waghran 22. Ansur (Aadi Village) 23. Ansur (Pangera) 24. Ansur (Danda) 25. Karivane 26. Wadapwadi
Thane	Bhiwandi	1. Dive (Kevani)	1. Kasheli 2. Dive (Anjur) 3. Kalher 4. Kharbav
	Thane		5. Maljipada 6. Ghodbunder junction 7. Reti bunder

Palghar	Dahanau	1. Dhumkhet 2. Pale 3. Matgaon 4. Asangaon	1. Dahanu 2. Dhakati Dahanu 3. Agavan 4. Chandigone
	Palghar	5. Zenda Aali	5. Ghivali 6. Dandi 7. Pantembi 8. Bariwada 9. Makunsar 10. Vikaswadi 11. Daboli 12. Datiware 13. Vehaloli 14. Kharmendi 15. Tembhikhodave 16. Karvele
	Vasai		17. Kasarali
Raigad	Pen	1. Tukaram Vadi 2. Bhal	1. Tamsi(Boisar) 2. Mankule 3. Shirkichal 4. Mothe Bhal
	Alibag	3. Kurul 4. Bonang	5. Navedarbeli 6. Kude 7. Agrav 8. Nidi 9. Navakhar Traf Umate
	Roha	5. Utchal 6. Kandane Bk 7. Khajaniwadi	10. Dapoli 11. Gofan
	Tala		12. Kandane Kh
	Murud		13. Nandale 14. Mithagar
	Shrivardhan	8. Kalinje	15. Shrivardhan 16. Bhairavanth Pakhadi 17. Kurawade
	Mhasla	9. Adi 10. Toradi 11. Pangol 12. Kudgaon	
Sindhudurg	Devgad	1. Girye 2. Thakulwadi 3. Amberi 4. Wadaker Poi 5. Waghotan 6. Palekarwadi 7. Kalvi 8. Katta 9. Biruwadi 10. Darwadi 11. Malai 12. Belwadi 13. Mithmumbari	1. Tirlot 2. Padel 3. Mutat 4. Mond 5. Tembavil 6. Warandwadi 7. Elaye 8. Khakshi 9. Morve 10. Hindale 11. Girawal 12. Gaudwadi 13. Dogrewadi

		14. Tharamumbari (crab) 15. Tambaldeg 16. Jamdul 17. Achara Bandar 18. Parwadi 19. Munge	
	Malwan	20. Kothewada 21. Pankhol 22. Tondavali 23. Thalashil 24. Chindar Labdewadi 25. Masure 26. Devbaug 27. .Dhamapur 28. Kalse&Walaval 29. Nerur	14. Govkarwada (high current flow) 15. Khot Juva (Sand mining) 16. Thevili 17. Revandi
	Vengurla	30. Chipi 31. Chipi Juva 32. Mayne 33. Parule 34. Mochimad 35. Mochimad Ansure 36. Tank 37. Dabhoswada (Crab) 38. Namas (Crab)	18. Waghavane 19. Niviti 20. Karli (Near barmouth) 21. Shiroda Keruwadi 22. Huda
	Kudal		23. Sarambal