

**Supplementary Materials:**

# **Ecosystem variability along the estuarine salinity gradient: A case study of Hooghly River estuary, West Bengal, India**

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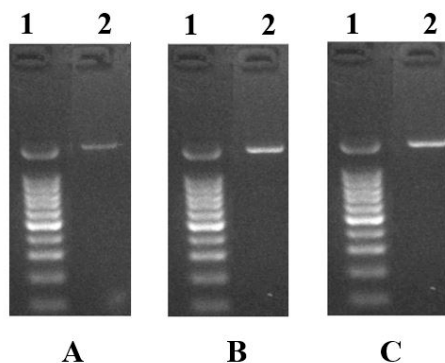
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**Supplementary Figure S1:** 1.2% Agarose gel showing single 1500 bp of 16S rDNA amplicon. Lane 1: 100bp DNA ladder; Lane 2: 16S rDNA amplicon of (A) BRK2, (B) DKS and (C) GS1 strains.

**Supplementary Figure S1:**



## **Supplementary Tables**

**Supplementary Table S1:** Consensus Sequence of the three strains BRK2, DKS and GS1 characterized, their National Center for Biotechnology Information (NCBI) accession numbers and origin.

**Supplementary Table S2:** Physiochemical and biological parameters at six selected stations (BRK, DK2S, KDM, KDP, KCB, GS) in Hooghly River estuary.

**Supplementary Table S3:** Phytoplankton species recorded at six selected sampling stations in HRE during Oct 2017, Feb 2018 and Jun 2018.

**Supplementary Table S4:** Zooplankton taxa recorded at six selected sampling stations in HRE during Oct 2017, Feb 2018 and Jun 2018.

**Supplementary Table S5:** Zooplankton species/group identified for the present study, propensity of their feeding and relevant references.

**Supplementary Table S6:** Pairwise Pearson correlation matrix between total zooplankton, major groups (Rotifera, Copepoda, Cladocera), with biotic (bacterial density, Chl *a*) and abiotic parameters (pH, EC, temperature, salinity, DO, total hardness, nitrate, phosphate, potassium, sodium and calcium).

**Supplementary Table S1:**

Sample No 1		Consensus Sequence of Strain BRK2 (1284bp)
Sample location	Barrackpore	GCGCCTTGGGTTCCCTCAGCACGTCTACCGGCTACACTAGGTAAGTTGTCAGGGCACGGGTCACCAAGGGGACGA TGTGTAGCCGGCTGAGAGGGAGATCGACCACAATGTGACAGTGACACGGCCAGACTCTCCGGGAGGCAGCAGTA GGGAATCTTTCTGCAATGGACGAAAGTCTGACGGAGCATCGCCGCTGAGTGATAAAATTTTCGGATCGTAAAGCTCT GTTGTTAGGGGAAGAACAAAGTTCCGTTTCAATAGGGCGGTACCTTGACGGTACCTAACAGAAAGCCACGGCTAACTA CGTGCCAGCAGCCGGTAATACGTAGGTGGCAAGCGTTGTCGGGAATTATTGGGCGTAAAGGGCTCGCAGGCGGTT TTTTAAGTCTGATGTGAAAACCCCGGCTCAACCGGGGAGGGTCATTGAAACTGGGGAACCTGAGTGCAGAAGAGG AGAGTGGAATTCACGTGTAGCGGTGAAATGCGTAGAGATGTGGAGGAACACCACTGGCGAAGGCGACTCTCTGGT CTGTAACGACGCTGAGGAGCGAAAGCGTGGGGAGCGAACAGGATTAGATACCCTGGTAGTCCACGCCGTAAACGA TGAGTGCTAAGTGTTAGGGGTTTCCGCCCTTAGTGCTGCAGCTAACGCATTAAGCACTCCGCTGGGGAGTACGGT CGCAAGACTGAAACTCAAAGGAATTGACGGGGGCCGACAAAGCGGTGGAGCATGTGTTTAATTGAAGCAACGC GAAGAACCTTACCAGGTCTTGACATCTCTGACAATCTAGAGATAGGACGTCCCTTCGGGGGCAGAGTGACAGGT GGTGCATGGTTGTCGTAGCTCTGTGTCGTAGATGTTGGGTTAAGTCCCGCAACGAGCGCAACCTTGATCTTAGTTG CCAGCATTAGTTGGGCACTCTAAGGTGACTGCCGGGTGACAAACCGGAGGAAGGTGGGGATGACGTCAAATCATCA TGCCCTTATGACCTGGGCTACACAGTGCTACAATGGACAGAAACAAAGGGGCAGCGAAACCGGGAGGTTAAGCCAA TCCCAAAATCTGTTCTCAGTTTCGAGTCGACGTGCGCAACTCGACTGCTGAAGCTGAATCGTAGTAATCGCGATCAC ATGCCCCGGGAGTACTTCCCGGGCTTGACACGACGCGCGGTGCGAGCACGAGAGTGTGTAACAGCCGAATCGG TGAAGGAAGCTTTTAGGAGCCAACCGCCGAAGTGGGACAGATGTTGGGGT
Sample code	BRK2	
Sample description	River	
NCBI Accession No.	ON834463	
Sample No 2		Consensus Sequence of Strain DKS (1465 bp)
Sample location	Dakshineswar	TGCTCAGATTGAACGCTGGCGGACGGCCTAACACATGCAAGTCGAGCGGATGAGAGGAGCTTGCTCCTCGATTACG GGCGGACGGGTGAGTAATGCCTAGGAATCTGCCTGGTAGTGGGGGACAACGTTTCGAAAGGAACGCTAATACCGCA TACGCTCTACGGGAGAAAGCAGGGGACCTTCGGGCCTTGCGCTATCAGATGAGCCTAGGTCGGATTAGCTAGTTGGT GAGGTAATGGCTACCAAGGCGACGATCCGTAAGTGGTCTGAGAGGATGATCAGTCACACTGGAAGTGCAGACGGT CCAGACTCTACGGGAGGCAGCAGTGGGGAATATTGGACAATGGGCGAAAGCCTGATCCAGCCATGCCGCGTGTGT GAAGAAGGTCTTCGGATTGTAAAGCACTTTAAGTTGGGAGGAAGGCGAGTAAGCTAATACCTTGCTGTTTGACGTTA CCGACAGAATAAGCACCGGCTAAGTTCGTGCCAGCAGCCGCGTAATACGAAGGGTGCAAGCGTTAATCGGAATTAC TGGGCGTAAAGCGCGGTAGGTGGTTGTTAAGTTGGATGTGAAAGCCCCGGGCTCAACCTGGGAAGTGCATCCAA ACTGGCGAGCTAGAGTATGGCAGAGGGTGGTGGAATTTCTGTGAGCGGTGAAATGCGTAGATATAGGAAGGAAC ACCAGTGGCGAAGGCGACCACTGGGCTAATACTGACACTGAGGTGCGAAAGCGTGGGGAGCAAACAGGATTAGAT ACCCTGGTAGTCCACGCGTAAACGATGTGCTAGTACCGGTTGGGATCCTTGAGATCTTAGTGCGCAGCTAACGCATT AAGTCGACCGCTGGGGAGTACGGCCGCAAGGTTAAACTCAAATGAATTGACGGGGGCCGCAACGCGGTGGAG CATGTGGTTAATTGAAGCAACGCGAAGAACCTTACCAGGCCTTGACATGCAGAGAAGTTCCAGAGATGGATCGGT GCCTTCGGGAAGTCTGACACAGGTGCTGCATGGCTGTCGTAGCTGCTGTGCTGAGATGTTGGGTTAAGTCCCGTAAC GAGCGCAACCTTGTCTTAGTTACCAGCAGCTTAAGGTGGGCACTTAAGGAGACTGCCGCTGACAAACCGGAGGA AGGTGGGGATGACGTCAAGTCATCATGGCCCTTACGGCCTGGGCTACACAGTGCTACAATGGTGGTACAAAGGT TGCCAAGCCGCGAGGTGGAGCTAATCCATAAAACCGATCGTAGTCCGGATCGCAGTCTGCAACTCGACTGCGTGAA GTCGGAATCGCTAGTAATCGTGAATCAGAATGTACGGTGAATACGTTCCCGGGCCTTGACACACCGCCCGTCACAC CATGGGAGTGGGTTGCTCCAGAAGTAGTAGTCTAACCTTCGGGGGACGGTTACCACGGAGTGATTGACTGAGG GG
Sample code	DKS	
Sample description	River	
NCBI Accession No.	ON834475	
Sample No 3		Consensus Sequence of Strain GS1 (1487 bp)
Sample location	Gangasagar	CAGCTCAGGACGACGCGCGGCGTGCCTAATACGTGCAAGTCGAGCGCAGGAATCATCCGAACCTTTTCGGGGGGA CGTTGATGGATGAGCGGCGGACGGGTGAGTAACACGTAAGAAACCTGCCCTCAGGTGTGGGATAACACAGAGAAAT CGGGGCTAATACGGGATGGGTATCGGACCGCATGGTCCGAGGATGAAGGCGCTTGGGCGTCGCTGGGGATGGCT TGCGGTGCATAAGCTAGTTGGTGGGTAATGGCCACCAAGGCGACGATGCATAGCCGACTTGAGAGGGTGATCGG CCACACTGGGATTGAGACACGCGCCAGATTCTACGGGAGGCAGCAGTAGGGAATCTTCCACAATGGACGAAAGTCT GATGGAGCAACGCCGCTGAACGATGAAGGCTTTCGGGTGCTAAAGTTCTGTTGTAAGGGAAGAACAAGTCCGCA GGCAATGGCGGCACCTTGACGGTACCTTGCGAGAAAGCCACGGCTAACTACGTGCCAGCAGCCGCGTAATACGTAG GTGGCAAGCGTTGTCGGGAATTATTGGGCGTAAAGCGCGCGCAGGCGGCTCTTAAGTCTGATGTGAAAGCCCCCGG CTCAACCGGGGAGGGCCATTGGAAGTGGGAGGCTTGAATATAGGAGAGAAGAGTGGAAATCCACGTGATAGCGGTG AAATGCGTAGAGATGTGGAGGAACACCAAGTGGCGAAGGCGACTTTTGGCTATAACTGACGCTGAGGCGCGAAAG CGTGGGGAGCAAACAGGATTAGATACCCTGGTAGTCCACGCGTAAACGATGAGTGTAGGTGTTGGAGGGTTTCCG CCCTTCAGTGCTGAAGCTAACGCATTAAGCACTCCGCTGGGAGTACGGTCGCAAGGCTGAAACTCAAAGGAATTG ACGGGGACCCGCAAGCGGTGGAGCATGTGGTTAATTGCAAGCAACGCGAAGAACCTTACCAACTCTTGACATCC CCCTGACCGGTACAGAGATGTACCTTCCCTTCGGGGGCAAGGGTGACAGGTGGTGCATGTTGTCGTAGCTCGT TCGTGAGATGTTGGGTTAAGTCCCGCAACGAGCGCAACCTTGTCTTAGTTGCCACCAATTCATTGGGCACTCAAGG AGACTGCCGTGACAAACCGGAAGAGGTGGGGATGACGTCAAATCATATGCCCCCTTAGGATTGGGCTACACACG TGCTACAATGGACAGTACAAAGGGCAGCGAACCCGAGGTGGAGCCTATCCAGAAAGCCGTTCTCAGTTGAGATTG CACGCTGCAACTCGCTGCATGAAGTCGGAATCGTAGTAATCGCATGTCAACATACTGCGGTGAATACGTTCCCGGG TCTTGACACACCGCCGCTACACACGAGAGTTGTAACCCGAACTCTGTGAGGTAACCTTAGGGAGCCAGCCGC CAAAGGTGGAGACAGATGATTGG
Sample code	GS1	
Sample description	Estuary	
NCBI Accession No.	ON834476	

**Supplementary Table S2:**

	Zooplankton abundance	BP 10-5 CFUml- l	Chl-a mgL-1	EC μSCm- l	Salinity (psu)	TH mgL- l	TDS mgL-1	Ca++mgL- l	Na+mgL- l	K+mgL <sup>-1</sup>	Nitrate mgL <sup>-1</sup>	Phosphate mgL <sup>-1</sup>	DO mgL- l	pH	Temp °C
BRKO17	9.8	0.36	83.4	288	0.12	240	120	5.79	9.59	3	7	0.0165	7.9	8.6	27
BRKF18	425.2	0.06	41.7	488	0.42	270	234	4.64	3.57	4.02	6	0.023	6.9	8.5	26
BRKJ18	5.4	0.9	29.9	347	0.22	112	192	2.46	4.2	3.22	7	0.024	6.8	7.89	27
DKSO17	14.6	0.9	74.53875	325	0.14	204	149	6.21	14.19	3.84	9	0.0169	7.8	7.9	28
DKSF18	241.4	0.6	29.19	624	0.45	270	312	4.51	8.15	4.07	9	0.0179	6.5	8.8	26
DKSJ18	48.8	1.7	44.19	221	0.24	180	126	2.87	7.5	3.26	10	0.105	6	7.38	26
KDMO17	13	0.67	79.75125	304	0.13	292	130	12.26	11.21	3.17	7	0.0187	7.6	8	29
KDMF18	55.6	0.32	52.125	614	0.45	298	306	4.4	7.7	4.12	7	0.0146	6.5	8.9	26
KDMJ18	380	1.3	41.83	222	0.23	100	125	2.52	6.2	3.1	7	0.047	6.2	7.5	26
KDPO17	17.4	7	125.6213	8780	4.32	1856	4728	24.1	223.06	49.57	20	0.0318	7.8	9	28
KDPF18	20.4	0.35	125.1	17800	10.64	1780	8879	57.88	1237.77	412.59	20	0.044	7.5	9	26
KDPJ18	3.4	9	142.34	20400	5.3	2760	11200	49.63	108.84	100.98	25	0.082	6.8	7.98	26
KCBO17	13.8	11	219.9675	12450	6.29	1940	6327	31.83	301.72	67.05	30	0.0633	7.8	9.1	28
KCBF18	135.8	9	131.355	32200	17.79	1820	15990	57.28	1652.94	550.98	25	0.1016	7.9	9.2	27
KCBJ18	2.6	16	143.68	23670	9.25	7380	13500	54.42	108.84	100.98	35	0.115	6.8	8.9	28
GSO17	23.8	250	105.2925	24400	13.09	2250	12500	43.61	516.1	114.69	40	0.2444	8.2	9.2	29
GSF18	43.2	160	135.525	43300	24.6	2180	21550	66.45	1886.94	628.98	32	0.1221	8	9.4	28
GSJ18	10.2	300	150.57	30670	15.09	5200	17680	63.92	108.84	100.98	39	0.135	6.9	9.1	29

**Supplementary Table S3:**

<b>Phytoplankton species</b>	<b>BRK</b>	<b>DKS</b>	<b>KDM</b>	<b>KDP</b>	<b>KCB</b>	<b>GS</b>
<i>Pediastrum</i>	+	+	+	+	+	-
<i>Spirogyra</i>	+	+	+	+	-	-
<i>Anabaena</i>	+	+	+	-	-	-
<i>Volvox</i>	+	+	+	-	-	-
<i>Oedogonium undulatum</i>	+	+	+	-	-	-
<i>Oscillatoria</i> sp.	+	+	+	+	-	-
<i>Spirulina</i>	+	+	+	-	-	-
<i>Microcystis aeruginosa</i>	+	+	+	+	-	-
<i>Merismopedia tenuissima</i>	+	+	+	-	-	-
<i>A. granulata</i>	+	+	+	-	-	-
<i>Fragilaria vaucheriae</i>	+	+	+	-	-	-
<i>Leptocylindrus danicus</i>	+	+	+	-	-	-
<i>Thalassionema nitzschioides</i>	+	+	+	+	+	+
<i>Odontella aurita</i>	-	-	-	+	+	+
<i>Paralia sulcata</i>	-	-	-	+	+	+
<i>Pleurosigma formosum</i>	-	-	-	+	+	+
<i>Skeletonema costatum</i>	-	-	-	-	+	+
<i>Asterionellopsis glacialis</i>	-	-	-	-	+	+
<i>Bellerochea malleus</i>	-	-	-	-	+	+
<i>Thalassiosira decipiens</i>	-	-	-	-	+	+
<i>Coscinodiscus granii</i>	-	-	-	-	-	+
<i>C. radiatus</i>	-	-	-	-	-	+
<i>Gyrosigma scalproides</i>	-	-	-	-	-	+
<i>Biddulphia rhombus</i>	-	-	-	-	-	+
<i>Biddulphia sinensis</i>	-	-	-	-	-	+
<i>Coscinodiscus lineatus</i>	-	-	-	-	-	+
<i>Chaetoceros lorenzianus</i>	-	-	-	-	+	+
<i>Thalassiothrix frauenfeldii</i>	-	-	-	-	-	+

**Supplementary Table S4:**

<b>Zooplankton taxa</b>	<b>BRK</b>	<b>DKS</b>	<b>KDM</b>	<b>KDP</b>	<b>KCB</b>	<b>GS</b>
<b>Rotifera</b>						
<i>Adineta ricciae</i>	+	-	-	-	-	-
<i>Anuraeopsis fissa</i>	+	-	-	-	-	-
<i>Brachionus angularis</i>	+	-	+	-	-	-
<i>Brachionus calyciflorus</i>	+	-	-	-	-	-
<i>Brachionus forficula</i>	+	-	-	-	-	-
<i>Rotatoria</i>	+	+	-	-	-	-
<i>Lecane luna</i>	+	-	-	-	-	-
<i>Filinia opoliensis</i>	+	-	-	-	-	-
<i>Filinia longiseta</i>	-	-	+	-	-	-
<i>Keratella tropica</i>	+	+	+	-	-	-
<i>Keratella cochlearis</i>	-	+	+	-	-	-
<i>Platyias quadricornis</i>	+	-	-	-	-	-
<i>Platyias patulus</i>	-	+	-	-	-	-
<i>Polyarthra vulgaris</i>	-	+	+	-	-	-
<i>Hexarthra</i>	-	-	+	-	-	-
<b>Cladocera</b>						
<i>Bosmina longispina</i>	+	+	+	-	-	-
<i>Moina sp.</i>	+	+	+	-	-	-
<b>Copepoda</b>						
<i>Acartiella sewelli</i>	+	+	+	+	+	+
<i>Mesocyclops leuckarti</i>	+	+	+	+	+	+
<i>Macrosetella gracilis</i>	+	+	+	+	+	-
<i>Paracalanus sp.</i>	-	-	-	-	+	+
<i>Eucalanus sp.</i>	-	-	-	+	+	+
<i>Pseudodiaptomus annandalei</i>	-	-	-	+	+	+
<i>Acartia sp.</i>	-	-	-	+	+	+
<i>Harpacticus sp.</i>	-	-	-	-	+	+
<i>Halicyclops tenuispina</i>	-	-	-	+	+	+
<i>Pontella andersoni</i>	-	-	-	+	+	+
<i>Eucalanus subcrassus</i>	-	-	-	+	+	+
<i>Euchaeta marina</i>	-	-	-	+	+	+
<i>Euterpina acutifrons</i>	-	-	-	+	+	+
<i>Temora turbinata</i>	-	-	-	+	+	+
<i>Tortanus gracilis</i>	-	-	-	+	+	+
<i>Corycaeus catus</i>	-	-	-	+	+	+
<i>Canthocalanus pauper</i>	-	-	-	+	+	+
<i>Halicyclops tenuispina</i>	-	-	-	+	+	+
<i>Acrocalanus sp.</i>	-	-	-	-	-	+

**Supplementary Table S5**

Phylum	Subphylum	Order/Group	Genus/ species	Feeding mode	References
Rotifera		Ploima	<i>Adineta ricciae</i>	Bacterivory	Leasi and Ricci, 2010
			<i>Anuraeopsis fissa</i>	Bacterivory, Detritivory	Ooms-Wilms et al.,1995; Pourriot, 1977
			<i>Brachionus angularis</i>	Bacterivory, Herbivory	Kumar and Rao, 2001; Ooms-Wilms et al.,1995
			<i>Brachionus calyciflorus</i>	Bacterivory,Herbivory	Kumar and Rao, 2001; Rothhaupt, 1990; Starkweather et al.,1979
			<i>Brachionus forficula</i>	Herbivory	Kim et al., 2000
			<i>Rotatoria</i>	Bacterivory, Herbivory, Detritivory	Ooms-Wilms et al.,1995;Bogdan and Gilbert 1982; Glime, 2013
			<i>Lecane luna</i>	Bacterivory	Ooms-Wilms et al.,1995
			<i>Filinia opoliensis</i>	Bacterivory	Glime, 2013
			<i>Filinia longiseta</i>	Bacterivory, Herbivory, Detritivory	Glime 2013Ooms-Wilms et al.,1995; Koste,1978
			<i>Keratella tropica</i>	Bacterivory, Herbivory, Detritivory	Ooms-Wilms et al.,1995 Marce et al., 2005
			<i>Keratella cochlearis</i>	Bacterivory, Herbivory, Detritivory	Ooms-Wilms et al.,1995; Marce et al. 2005
			<i>Platylabus quadricornis</i>	Herbivory	Sarma and Nandini, 2002
			<i>Platylabus patulus</i>	Herbivory	Fulton and Paerl, 1987
			<i>Polyarthra vulgaris</i>	Bacterivory, Herbivory, Detritivory	Bogdan and Gilbert, 1982; Glime, 2013
			<i>Hexarthra</i>	Herbivory	Kim et al., 2000
Arthropoda	Crustacea	Cladocera	<i>Bosmina longispina</i>	Bacterivory, Herbivory, Detritivory	DeMott and Kerfoot, 1982; Kim et al., 2000
			<i>Moina</i>	Bacterivory, Herbivory, Detritivory	Kim et al., 2000
		Copepoda	Cyclopoida	Omnivory	Kumar and Rao, 1999; Burke 1977; Kleppel, 1993; Adrian and Frost, 1992
			Calanoida	Omnivory	Paffenhöfer et al., 1982; Burke, 1977; DeMott, 1989; Bhattacharya et al., 2014
			Harpacticoida	Omnivory	Seifried and Dürbaum, (2000); Turner et al., 2001

**Supplementary Table S6:** Pairwise Pearson correlation matrix between total zooplankton, major groups (Rotifera, Copepoda, Cladocera), with biotic (bacterial density, Chl *a*) and abiotic parameters (pH, EC, temperature, salinity, DO, total hardness, nitrate, phosphate, potassium, sodium and calcium).

	Rotifera	Copepoda	Cladocera	Zooplankton Abundance L <sup>-1</sup>	Bacterial density CFU ml <sup>-1</sup>	Chl-a mg L <sup>-1</sup>
Rotifera	1					
Copepoda	0.006	1				
Cladocera	0.009	0.67	1			
Zooplankton Abundance L <sup>-1</sup>	0.01	0.99	0.73	1		
Bacterial density CFU ml <sup>-1</sup>	-0.37*	-0.2	-0.17	-0.21	1	
Chl-a mg L <sup>-1</sup>	-0.6***	-0.4*	-0.43*	-0.48*	0.31	1
pH	-0.58**	-0.21	-0.002	-0.2	0.45*	0.58**
EC µS Cm <sup>-1</sup>	-0.68***	-0.27	-0.31	-0.29	0.63***	0.68***
Temp °C	-0.15	-0.49	-0.39	-0.5	0.6***	0.48*
Salinity PSU	-0.63***	-0.22	-0.29	-0.24	0.64***	0.61
DO mg L <sup>-1</sup>	-0.1	-0.39	-0.28	-0.39	0.25	0.5**
TH mg L <sup>-1</sup>	-0.58	-0.34	-0.26	-0.35	0.45	0.65***
TDS mg L <sup>-1</sup>	-0.68***	-0.28	-0.32	-0.3	0.65***	0.6***
Nitrate mg L <sup>-1</sup>	-0.72***	-0.38	-0.35	-0.4*	0.71***	0.79***
Phosphate mg L <sup>-1</sup>	-0.538**	-0.21	-0.28	-0.23	0.76***	0.4*
K+ mg L <sup>-1</sup>	-0.483	-0.1	-0.22	-0.12	0.24	0.43*
Na+ mg L <sup>-1</sup>	-0.45	-0.08	-0.22	-0.1	0.23	0.41*
Ca++	-0.73***	-0.35	-0.35	-0.37	0.55**	0.76***

\*P<0.1

\*\*P<0.05

\*\*\*P<0.