Geographical variation in Pb concentrations of *Ulva* in the bay is different from that of *Undaria*. The Pb concentrations in *Ulva* from the SE area show a variance of between 0.29 and 1.71 ppm (dry weight). These concentrations are lower than those in the SW area (2.28-2.69 ppm, dry weight), although shipping activity in the latter is much less extensive. The sources of Pb contaminations in *Undaria* and *Ulva* are further investigated by Pb isotopic data and a factor analysis for heavy metal components (Cr, Mn, Cu, Zn, Cd, Pb) in *Undaria*.

Lead isotopic data for *Undaria* from two port localities, and two non-port localities and *Ulva* from one port locality and one non-port locality are acquired by thermal ionization mass spectrometry (TIMS). $^{206}Pb/^{207}Pb$ values in *Undaria* from non-port areas (Yura and Ikuho) are 1.1576 and 1.1638, respectively. These values are very similar to those in *Ulva* from port (Tarui) and non-port (Yura) areas: 1.1574 and 1.1649, respectively. However, *Undaria* from port areas (Kobe Port and Tarui) show $^{206}Pb/^{207}Pb$ ratios from 1.1372 to 1.1522, which are much lower ratios than those from non-port areas, suggesting that *Undaria* from port areas and non- port areas receive Pb from various sources and that *Ulva* and *Undaria* can maintain different Pb isotopic ratios in the same habitat. With the exception of one sample from Tarui, $^{206}Pb/^{207}Pb$ values in *Undaria* and *Ulva* (1.1486-1.1696) were similar to the ratios in the coastal seawater in Japan (Miyazaki and Reimer, 1993); however $^{208}Pb/^{204}Pb$ ratios in the latter are much lower (34.85-37.57) compared with the current report. Plots of $^{208}Pb/^{206}Pb$ versus $^{207}Pb/^{206}Pb$ ratios appeared to overlap with the field of airborne particulate in Osaka City (Osaka City, 2007) and those ratios in most specimens overlap with the field of road runoff in Osaka City (Osaka City, 2007).

Two significant factors accounting for about 77% of the variance were distinguished for the analyzed data. The first factor was characterized by high levels of Pb and Cu and the second factor was high level of Mn. Those scores of river water contaminated from road runoff (Osaka Pref, 2004) in the first and second factors differ greatly from those of *Undaria*. Those scores of *Undaria* from Amagasaki, where is near an abandoned industrial area and a sewage plant, corresponded closely to those from the SE area.

These observations suggest that $^{208}Pb/^{206}Pb$ and $^{207}Pb/^{206}Pb$ ratios in the algae from the areas affected by human activities in Osaka Bay are lower than those from the natural area and are controlled by mixing processes involving various components including sewage water and seawater rather than one source such as road runoff.

Durability of sand capping effect in the inner area of Ariake Bay

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The sand capping method appears to be useful for improving the environment of bottom sediment in the inner area of the Ariake Sea. It is usually thought that its effect becomes dull in only a few years. The present study investigates the secular change of the bottom sediment environment in sand capped sections, which were constructed by Saga Prefecture from 2001 to 2003. The relation between the habitation of benthos and the grain size distribution was investigated.

Sediment sampling was conducted in nine sand capped sections for evaluating the profile of sediment environment in 2005 and 2006 and in three sections for investigating benthos in 2007. Sediment column was taken with an acryl pipe. Three column samples were taken from each section, two samples were taken inside and one sample was taken outside a section. A sediment column was divided into pieces of 5 cm thick. The grain size distribution of each piece was examined with sieves. A surface sediment sample was taken using an Ekman-Birge type bottom sampler and put through a screen of 1mm meshes. The residue was fixed with 10 % formalin solution and benthic organisms were sorted, identified and weighed.

The ratio of fine sand (0.075-0.25 mm) of the surface sediment (0-0.05 m) increased from 2005 to 2006 at most of sections. The apparent change in grain size distribution might be occurred owing to huge disturbance of sea water caused by the typhoon (T0514) which crossed the Ariake Sea on September 6 in 2005. The effect of sand capping on grain size distribution was recognized except for section SW01, in which the ratio of sand ranged 0.075-2 mm was larger from the surface to deeper layer for capped and non-capped point, i.e. outside the section. Species, population and weight of benthos at sand capped point were obviously larger than non-capped point in NE02 and Ne03.

Table 1 Grain size distribution of surface sediment (0-0.05 m, in 2006) and benthos (in 2007)

Section	Const-ruction	Grain size distribution (%)					Wet weight (g/m^2)				
		- 0.005mm	0.005-0.075mm	0.075-0.25mm	0.25-0.85mm	0.85-2mm	Mollusca		Anne-lida	Arthro-poda	other
							Bivalvia	Gastropoda			
NE01	2001	0.9	8.1	48.1	32.9	10.0					
NE02	2002	3.3	20.4	47.4	19.0	10.0	18862	147	93	4	267
NE03	2003	0.8	10.8	63.4	21.9	3.0	12142	178	0	0	360
SE01	2001	0.2	2.0	84.2	12.5	1.2					
SE02	2002	0.7	4.4	66.5	22.7	5.8	1787	218	0	22	111
SE03-1	2003	0.8	4.6	80.9	12.8	0.9					
SE03-2	2003	0.5	3.7	87.8	5.4	2.7					
NW01	2001	2.1	7.8	45.0	35.6	9.5					
Sw01	2001	0.6	3.6	39.4	40.2	16.2					

Studies on variability of phytoplankton concentrations in the Bay of Bengal and associated physical processes using remote sensing data

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The Bay of Bengal (BOB) surface water is considered as oligotrophic but bottom nutrient levels are higher relative to global ocean. Despite large influx of river water into the BOB, it is considered as moderately productive ecosystem (150—300 gC m^{-2}/yr) based on SeaWIFS global primary productivity estimates. The climatology of surface Chlorophyll-a (Chl-a) concentration as obtained from SeaWIFS show clear seasonal cycle with maximum concentration (>0.5 mg/m^3) during post-monsoon season (September to November). Most fascinating features of BOB is the seasonal reversal of monsoon current and the summer upwelling across the east coast of Sri Lanka associated with the strong southwesterlies which pull up the thermocline.

Surface Chl-a concentration during summer (JJAS) and winter (NDJF) of 2000 and 2001 were derived from SeaWIFS data and were studied in relation to zonal Ekmann transport based on estimate from QuickSCAT wind field, SST from NOAA-AVHRR and SeaWIFS derived photosynthetically available radiation (PAR). It is observed that coastal upwelling due to Ekmann transport is not sufficient to overcome the stratification and to enhance the surface production. As most of the sky remains cloudy during summer monsoon season, it becomes an inhibiting parameter for the growth of primary production despite the fact that PAR is higher in summer compared to winter months. The strengthening of seasonal thermocline in summer results in nutrient limitation of phytoplankton growth. Monthwise SST- Chl-a relationship for 2000 and 2001 show SST Chl-a anti-correlation and particularly during summer and winter months. Monthly sea surface height anomalies (derived from TOPEX/POSEIDON satellite altimeter data) overlaid on the monthly Chl-a (based on SeaWIFS) clearly show that a prolonged positive/negative sea level anomaly can lead to sparse/dense Chl-a levels. Monthwise composite of net surface flow with Chl-a concentration in the monsoon current province during 2000 show a strong linear relationship between the two. Chl-a concentration during some special weather events such as tropical cyclones which occurred during November and December 2000 were also examined as these short weather events significantly alter the biological state of the BOB surface water.

Thus, the above study clearly depicts the biological response of the BOB surface water to various physical forcing and their variability in time and space. Further, the study also points to the important use of multiple satellite data sets/observations, with or without model simulations, in understanding the complex bio-physical environment in the Bay of Bengal, one of the largest fresh water and sediment input sites of the world ocean.

Approach to improve nutrient situation in the Seto Inland Sea, Japan

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