**Appendix 1**. Summary of measured physicochemical and microbiological properties of ten coastal beaches water quality in Ghana.

|  |  |  |
| --- | --- | --- |
| **Parameters [units]****(Code)** | **Ranges (mean±standard deviation)****[Natural backgrounds]** | **Beaches based on ranges** |
| Temperature [°C](Temp) | 26.94-30.82 (28.67±1.19)[27-33 ] | Aboadzi-Kpeshi |
| Electrical Conductivity [mS/cm](EC) | 23.43-52.60 (44.23±9.18)[20-52.60] | Anyanui-Densu |
| Salinity[PSU Scale](Sal) | 14.01-76.67 (43.51±9.05)[34-36] | Anyanui-Densu |
| pH | 8.03-9.05 (8.64±0.25)[6-9] | Esiama-Domunli |
| Dissolved oxygen concentration [mg/l](DO) | 3.68-6.44 (4.84±1.13)[7-10] | Amisa-Densu |
| Dissolved oxygen saturation [%](DOStat) | 52.0-109.60 (73.69±18.20)[500-600] | Amisa-Densu |
| Redox potential [mV](Eh) | 61.8-265.0 (148.26±60.12) | Domunli-Kpeshi |
| Total dissolved solids [mg/l](TDS) | 11.71-31.60 (22.53±5.33) | Anyanui-Densu |
| Total suspended solids [mg/l](TSS) | 4.0-76.33 (18.20±21.19) | Ghana-Côte d’Ivoire border (Gh-Côte)- Densu |
| Phosphate [mg/l](Phos) | 0.04-0.54 (0.18±0.16)[0.001-0.020] | Domunli-Amisa |
| Nitrates [mg/l](Nit) | 1.63-3.57 (2.50±0.60) | Anyanui-Amisa |
| Chlorophyll-a [µg/l](Chl a) | 0.43-6.13 (2.49±1.49) | Muni-Ghana-Togo border (Gh-Togo) |
| *Total coliform* in water[CFU/100 ml](TC\_w) | 36-11,160 (4061.6±4159.14) | Anyanui-(Kpeshi and Densu) |
| *Escherichia coli* in water[CFU/100 ml](E.coli\_w) | 1.0-5,580 (705.6±1718.58) | Anyanui-Kpeshi |
| *Enterococcus* spp. [CFU/100 ml](Ent.spp\_w) | 0-5,580 (615.6±1746.50) | Anyanui-Kpeshi |

**Appendix 2** Microbiological and epidemiological studies in seawater.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Indicators examined**  | **Pathogens examined** | **Indicator/pathogen correlating** | **Symptoms** |  | **Country** | **Source** |
| TC | *Salm* | TC/*Salm* | GI |  | UK | PHILS 1959 |
| *E*. *coli* | *Salm* | *E*. *coil*/*Salm* |  |  | Denmark | Grunnet 1969  |
| ent, *E*. *coli* | *-* | ent | Ear |  | USA | Cabelli (1982) |
| TC, *E*. *coli, ent*,TVC | *Salm*, *S*. *aur*, *Campobacteria Salm* | TC, *E*. *coli*, *ent*, TVC/*Salm*, FC, Cl, *perf*/*Salm* | - |  | Greece | Papadakis 1988 |
| TC,FC, FS | *Salm* | TC,FC,FS/*Salm* | - |  | Spain | Polo 1996 |
| TC, ent, *E*. *coli* | *V*.*vuln* | TC, ent/*V*. *vul* | - |  | Denmark | Hoi 1998 |
| FC, *E*. *coli,* ent,staph, coliph | *-* | - | - |  | South Africa | Von Schirnding (1993) |
| *E*. col, staph |  | *E*. *coli***/** staph | S/GI |  | Hong Kong | Chenug (1990) |
| ent, *E*. *coli* | *-* | Ent/*E*. *coli* | GI |  | Egypt | El Sharkawi and Hassan (1982) |
| Tcol\_w, *E*. *coli\_w*, *Entspp\_w.* | - | *Tcol\_w/Ecoli\_w,**E*. *coli\_w*/*Entspp\_w.* |  |  | Ghana | **This study** |
|  |   |  |  |  |   |   |

TC=*total coliforms*, FC=*faecal coliforms*, FS=*Faecal streptococci*, ent=enteroccocci,Ecoli=*Escherichiacoli*, *Salm*=*Salmonella* spp.,*Cl*.*perf*=*Clostridium perfrigens*, *V*.*vuln*.=*Vibriovulnificus*.staph=staphylococci, coliph=coliphages, Tcol\_w=*total coliforms* in seawater, *E*. *coli*\_w=*Escherichiacoli*in seawater, Entspp\_w=*Enterococcus*spp. in seawater.

GI=gastrointestinal, Ear=Ear, S=Skin (Modified Godfree et al. 1997, Efsratiou 2001).