

Chapter 5: Marine and Island Marine Water Quality

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Chapter 5: Marine and Island Marine Water Quality

MARINE WATER QUALITY MONITORING

The Department of Environment (DOE) continues with the marine water quality monitoring programme that was started in 1978 for Peninsular Malaysia and in 1985 for Sabah and Sarawak. Marine water quality monitoring plays an important role in determining the degree of pollution from land-based sources as well as from sea based sources that can pose threats to the marine resources which contribute to the stability and diversity of the marine ecosystem.

The marine water quality monitoring programme included in-situ measurements and laboratory analyses for parameters as listed in **Table 5.1**. The Malaysian Marine Water Quality Criteria and Standards (MWQCS) are as shown in **Table 5.2**.

MARINE WATER QUALITY FOR COASTALS AREAS

In 2009 a total of 738 samples from 158 coastal monitoring stations were collected for analysis as shown in **Table 5.3**. The most number of samples

that exceeded Class 2 of the Marine Water Quality Criteria and Standards (MWQCS) were oil and grease (50.7%), followed by total suspended solids (47.2%) and *Escherichia coli* (45.7%).

Total suspended solids remained a significant contaminant of coastal water with 92 percent of samples from Pahang, followed by Sarawak (89%) and Selangor (83%) exceeded the MWQCS. Sabah recorded the lowest percentage (6%) exceeding the MWQCS while Labuan recorded no contamination of total suspended solids (**Table 5.3**).

For oil and grease contamination, Selangor recorded the highest percentage (100%) exceeding the MWQCS, followed by Langkawi (81%), Kedah (75%) and Kelantan (75%), while Sabah, Sarawak and Labuan were free from oil and grease contamination. *E. coli* contamination was recorded highest in Selangor (91%), followed by Pulau Pinang (88%) and Melaka (80%).

Heavy metals pollution was comparatively low with copper (Cu) exceeding the MWQCS by 39.3



Recreational activity on the beachfront

Table 5.1 Malaysia: Marine Environmental Quality Parameters

In-situ Measurement	Unit	Parameter (Laboratory Analysis)	Unit
Temperature	°C	<i>Escherichia coli</i> (<i>E. coli</i>)	MPN/100ml
pH	-	Oil and Grease (O & G)	mg/l
Dissolved oxygen	% Sat	Total suspended solids (TSS)	mg/l
Dissolved oxygen	mg/l	Arsenic (As)	µg/l
Conductivity	µS/cm	Cadmium (Cd)	µg/l
Salinity	ppt	Total Chromium (Cr)	µg/l
Turbidity	NTU	Copper (Cu)	µg/l
Tarball	g/100m	Lead (Pb)	µg/l
		Mercury (Hg)	µg/l

percent, followed by lead (28.1%) and mercury (26.9%). Copper contamination was evident in Perak (100%) and Johor (78%).

Total suspended solids in the marine waters can be attributed to run off from land-based activities such as uncontrolled land clearing for development and agriculture activities as well as coastal development. The main sources of *Escherichia coli* were untreated or partially treated animal and domestic wastes and also uncontrolled sewage from coastal premises including hotels and restaurants. The presence of oil and grease in the coastal waters were from discharges by shipping vessels and leakages and disposal of engine oil by boat operators. As for heavy metals they were mainly land-based uncontrolled industrial discharges.

MARINE WATER QUALITY FOR ESTUARIES

A total of 360 samples from 75 estuary monitoring stations were collected and analysed (Table 5.4). The most number of samples exceeding the

MWQCS (Class E) were *Escherichia coli* (56.9%), followed by oil and grease (47.6%) and total suspended solids (17.7%).

Escherichia coli remained a significant contaminant of estuary waters with Pulau Pinang recorded the highest percentage (87%) exceeding the MWQCS followed by Selangor (83%) and Perak (80%).

For oil and grease contamination, Selangor recorded the highest percentage (100%) exceeding the MWQCS, followed by Negeri Sembilan (88%) and Kelantan (70%), while Melaka dan Sabah were free from oil and grease contamination. Total suspended solids contamination was recorded highest in Selangor (37%), followed by Sarawak (36%) and Perak (30%).

Heavy metals pollution was comparatively low with lead (Pb) exceeding the MWQCS by 37.3 percent, followed by copper (37.1%) and mercury (36.2%). Lead contamination was evident in Sabah (100%) and Terengganu (81%).

Table 5.2 Malaysia: Marine Water Quality Criteria and Standards

	Parameter	CLASS 1	CLASS 2	CLASS 3	CLASS E
	BENEFICIAL USES	Preservation, marine protected areas, Marine Parks	Marine Life, Fisheries, Coral Reefs, Recreational and Mariculture	Ports, Oil & Gas Fields	Mangrove,s Estuarine & River-mouth Water
1	Temperature (°C)	≤2 °C increase over maximum ambient	≤2 °C increase over maximum ambient	≤2 °C increase over maximum ambient	≤2°C increase over maximum ambient
2	Dissolved Oxygen (mg/L)	>80% saturation	5.0	3.0	4.0
3	Total Suspended Solid (mg/L)	25 mg/L or ≤ 10% increase in seasonal average, whichever is lower	50mg/L (25 mg/L) or ≤ 10% increase in seasonal average, whichever is lower	100 mg/L or ≤10 increase in seasonal average, whichever is lower	100 mg/L or ≤ 30% increase in seasonal average, whichever is lower
4	Oil and Grease (mg/L)	0.01	0.14	5	0.14
5	Mercury* (µg/L)	0.04	0.16 (0.04)	50	0.5
6	Cadmium (µg/L)	0.5	2 (3)	10	2
7	Chromium (VI)(µg/L)	5	10	48	10
8	Copper (µg/L)	1.3	2.9	10	2.9
9	Arsenic (III)* (µg/L)	3	20(3)	50	20 (3)
10	Lead (µg/L)	4.4	8.5	50	8.5
11	Zinc (µg/L)	15	50	100	50
12	Cyanide (µg/L)	2.0	7.0	20	7.0
13	Ammonia (unionized) (µg/L)	35	70	320	70
14	Nitrite (NO ₂) (µg/L)	10	55	1,000	55
15	Nitrate (NO ₃) (µg/L)	10	60	1,000	60
16	Phosphate (µg/L)	5	75	670	75
17	Phenol (µg/L)	1	10	100	10
18	Tributyltin (TBT) (µg/L)	0.001	0.01	0.05	0.01
19	Faecal Coliform (Human health protection for seafood consumption) - (MPN)	70 faecal coliform/100ml <i>70 E.coli/100 ml</i>	100 faecal coliform /100ml (70 faecal coliform /100ml) <i>100 E.coli/100ml</i> (70 <i>E.coli/100ml</i>)	200 faecal coliform /100ml <i>200 E.coli/100ml</i>	100 faecal coliform /100ml (70 faecal coliform /100ml) <i>100 E.coli/100ml</i> (70 <i>E.coli/100ml</i>)
20	Polycyclic Aromatic Hydrocarbon (PAHs) ng/g	100	200	1000	1000

* MWQCS in parentheses are for coastal and marine water areas where seafood for human consumption is applicable.

Table 5.3 Malaysia: Status of Marine Water Quality Parameters Exceeding Standards for Coastal (%), 2009

Parameter Exceeding Interim Standards (%)											
State	No. of Station	No of Sample	Total Suspended Solids	Oil and Grease	<i>Escherichia coli</i>	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury
Perlis	-	-	-	-	-	-	-	-	-	-	-
Pulau Langkawi	7	42	10	81	43	0	0	0	0	0	33
Kedah	1	5	75	75	40	0	0	25	0	0	100
Pulau Pinang	15	105	31	61	88	0	0	6	1	0	75
Perak	7	42	51	69	20	0	54	60	100	66	NA
Selangor	4	30	83	100	91	9	0	0	26	39	17
N. Sembilan	11	66	52	95	75	2	0	0	5	27	25
Melaka	7	39	48	0	80	0	0	0	44	24	0
Johor	39	122	24	54	49	0	1	5	78	10	15
Pahang	11	80	92	39	21	0	3	0	0	23	5
Terengganu	7	28	25	61	29	0	32	68	61	82	NA
Kelantan	5	20	75	75	25	0	95	45	60	75	29
W.P. Labuan	5	21	0	0	46	0	0	0	62	15	0
Sabah	24	100	6	0	6	0	16	6	68	29	0
Sarawak	15	38	89	0	27	3	14	3	46	3	24
Total	158	738	TSS	O & G	<i>E.coli</i>	As	Cd	Cr	Cu	Pb	Hg
Average (%)			47.2	50.7	45.7	1.0	15.4	15.6	39.3	28.1	26.9

Note : NA : Not available

Table 5.4 Malaysia: Status of Marine Water Quality Parameters Exceeding Standards for Estuary (%), 2009

Parameter Exceeding Interim Standards (%)											
State	No. of Station	No of Sample	Total Suspended Solids	Oil and Grease	<i>Escherichia coli</i>	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury
Perlis	2	20	7	57	20	0	0	14	0	0	79
Pulau Langkawi	-	-	-	-	-	-	-	-	-	-	-
Kedah	2	10	13	38	40	0	0	13	0	0	50
Pulau Pinang	7	47	23	50	87	0	17	9	6	0	69
Perak	6	36	30	63	80	0	50	60	87	73	NA
Selangor	10	61	37	100	83	0	0	0	25	42	29
N. Sembilan	2	12	0	88	63	0	0	0	0	50	63
Melaka	5	29	32	0	53	0	0	0	37	26	0
Johor	12	42	10	35	53	0	0	0	55	0	16
Pahang	-	-	-	-	-	-	-	-	-	-	-
Terengganu	12	48	6	63	56	0	36	74	70	81	0
Kelantan	5	20	20	70	75	8	85	15	30	70	33
W.P. Labuan	-	-	-	-	-	-	-	-	-	-	-
Sabah	2	8	0	0	50	0	13	0	100	100	NA
Sarawak	10	27	36	8	24	4	20	0	36	4	24
Total	75	360	TSS	O & G	<i>E.coli</i>	As	Cd	Cr	Cu	Pb	Hg
Average (%)			17.7	47.6	56.9	1.0	18.4	15.4	37.1	37.3	36.2

Note : NA : Not available

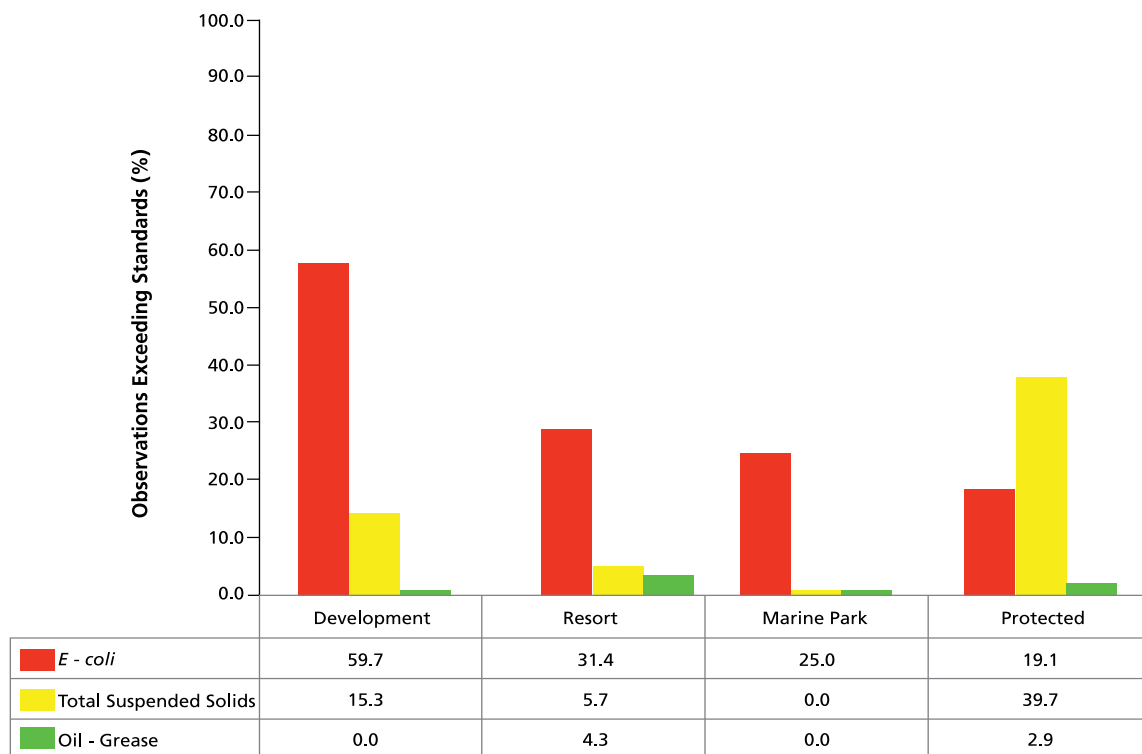


Figure 5.1 Malaysia : Island Marine Water Quality Status, 2009

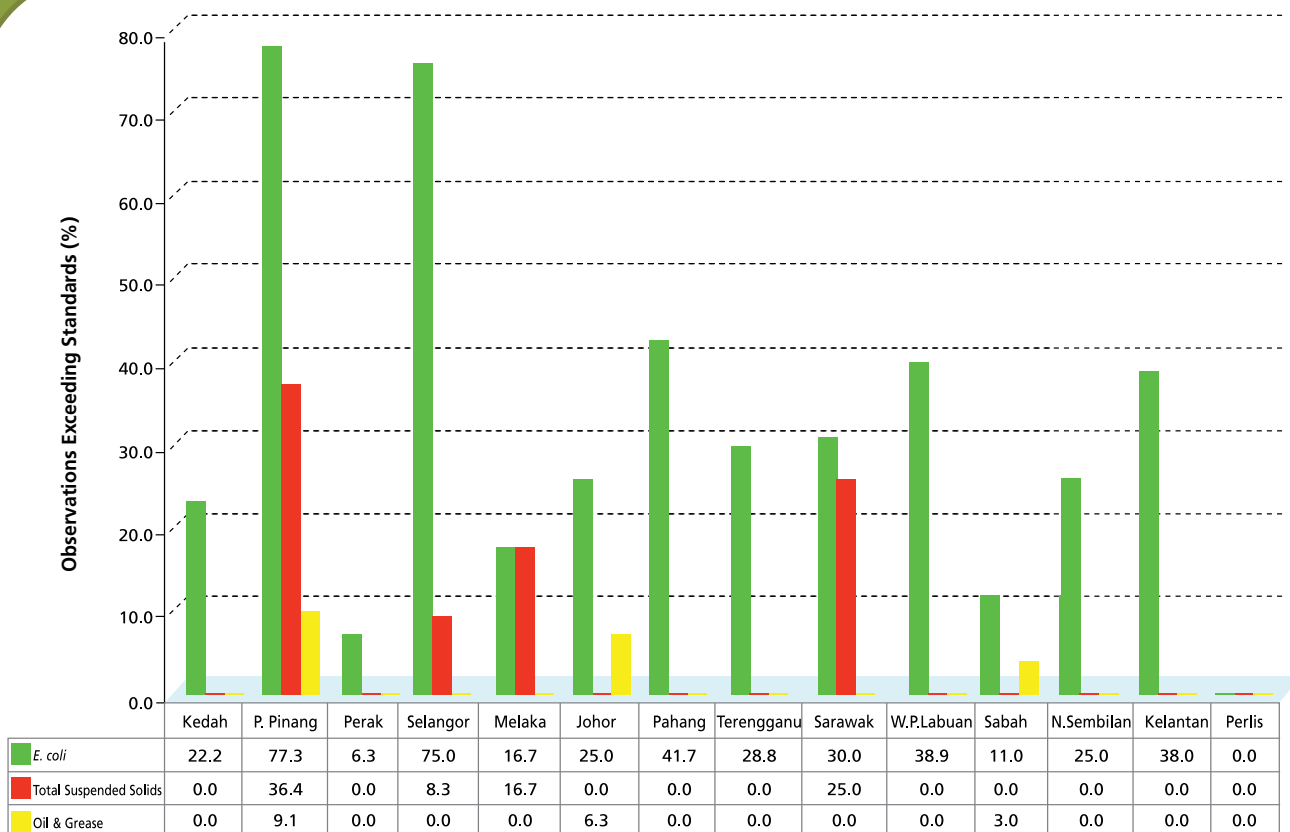


Figure 5.2 Malaysia : Status of Island Marine Water Quality by State, 2009

ISLAND MARINE WATER QUALITY STATUS

The waters around 73 islands were monitored in 2009 that were categorized as development islands (3 islands), resort islands (31 islands), marine park islands (21 islands) and protected islands (18 islands). A total of 368 samples were collected and analysed. The main pollutants analysed were total suspended solids, *E. coli* and oil and grease. The analyses were based on Malaysia Marine Water Quality Criteria and Standards (MWQCS) by using Class 1 for marine park and protected islands and Class 2 for resort and development islands.

E. coli recorded the highest number of samples exceeding the MWQCS in all category islands monitored except for protected islands. In development islands 59.7 percent exceeded the standards followed by resort islands 31.4 percent and marine parks 25 percent. In terms of total suspended solids, protected islands and development islands recorded total suspended

solids exceeding the standards by 39.7 and 15.3 percent respectively while marine parks recorded no contamination. For oil and grease, resort islands recorded the highest percentage (4.3%) exceeding the standards followed by protected islands (2.9%), while there was no contamination in marine parks and development islands (**Figure 5.1**).

As shown in **Figure 5.2**, *E. coli* contamination was highest in Pulau Pinang island marine waters where 77.3 percent of the samples exceeded the standard of 100 MPN/100 ml followed by Selangor (75%) and Pahang (41.7%) whilst Perlis recorded no contamination. As for total suspended solids, Pulau Pinang recorded the highest samples exceeding the standard at 36.4 percent, followed by Sarawak (25%), Melaka (16.7%) and Selangor (8.3%). However, total suspended solids for islands in other states were in compliance. Oil and grease was detected in Pulau Pinang with 9.1 percent of samples monitored exceeded the standards, followed by Johor (6.3%) and Sabah (3%). Other states were free of oil and grease pollution.



Coastal development

TARBALL MONITORING

Tarball residues on beaches are usually caused by oily discharges from fishing boats as well as passing vessels. In 2009 it was found that all the 135 monitoring stations were free from tarball pollution.

ASSESSMENT OF MARINE WATER QUALITY STATIONS

The assessment of the marine water quality stations status for coastal, estuaries and islands was conducted by examining the analytical results against the Malaysia Marine Water Quality Criteria and Standard (MWQCS) for TSS, Oil and Grease and *E.coli*. **Table 5.5** shows the 10 best coastal and estuarine water quality and **Table 5.6** shows the 10 best islands water quality.

Table 5.5 Malaysia: 10 Best Coastal and Estuary Sites 2009

State	Sites	Category
Sabah	-Mangrove Paradise	Coastal
	-Pantai Teluk Brunei 4	Coastal
	-Pantai Pasir Putih	Coastal
Sarawak	-Pantai Damai	Coastal
	-Kuala Sungai Semantan	Estuary
Pahang	-Pantai Sepat	Coastal
	-Pantai Lagenda	Coastal
Johor	-Kuala Sungai Kim Kim	Estuary
Terengganu	-Pantai Rantau Abang	Coastal
Perak	-Pantai Teluk Dalam	Coastal

Table 5.6 Malaysia: 10 Best Islands Monitoring Sites 2009

State	Sites	Category
Perak	-Pangkor (Pantai Puteri Dewi)	Resort
	-Pulau Sembilan	Marine Park
Sabah	-Pulau Manukan	Marine Park
	-Pulau Banggi	Resort
Terengganu	-Tenggol	Protected
	-Pulau Perhentian Kecil	Marine Park
	-Pulau Perhentian Besar	Marine Park
Sarawak	-Pulau Talang-talang Besar	Protected
Melaka	-Pulau Besar	Resort
Johor	-Pulau Nanga Besar	Marine Park



Pristine marine environment near Pulau Besar off the coast of Melaka