WATER QUALITY MONITORING OF MARINE WATERS

Under DENR Administrative Order No. 2016-08 (Water Quality Guidelines and General Effluent Standards)

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Supervising EMS
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DENR

THE SAD STATE OF OUR MARINE ENVIRONMENT


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BROOKS

DENR Administrative Order No. 2016-08

Water Quality Guidelines and General Effluent Standards of 2016

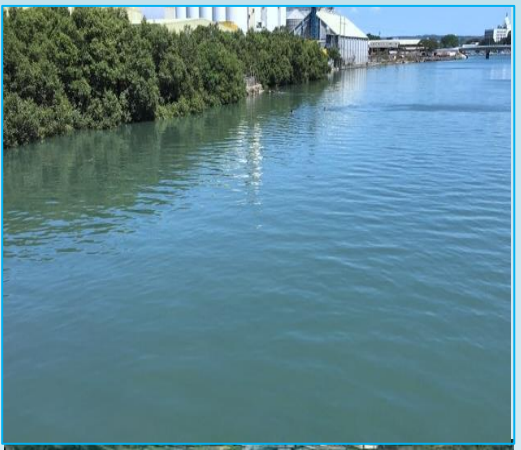
Section 1. Basic Policy

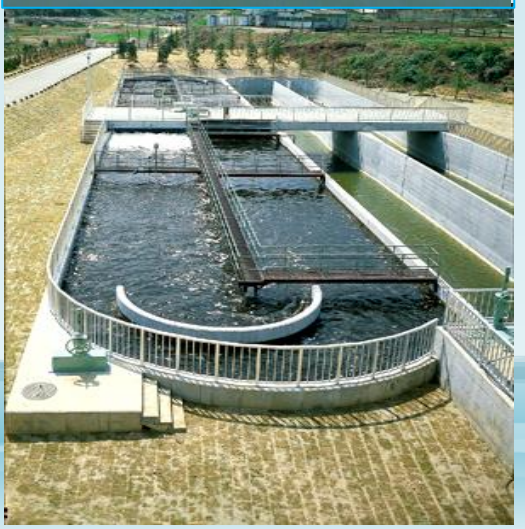
It is the policy of the State to pursue a policy of economic growth in a manner consistent with the ***protection, preservation and revival of the quality of fresh, brackish and marine waters***.

Objectives of Monitoring

- A water quality monitoring program should have clear objectives.
- The objectives would be the basis for deciding the parameters to measure, the number of samples, the frequency of sampling, the type of container, preservation method, sampling techniques and analytical methods to be used.

The monitoring program must be adapted to its objectives and not the other way around.

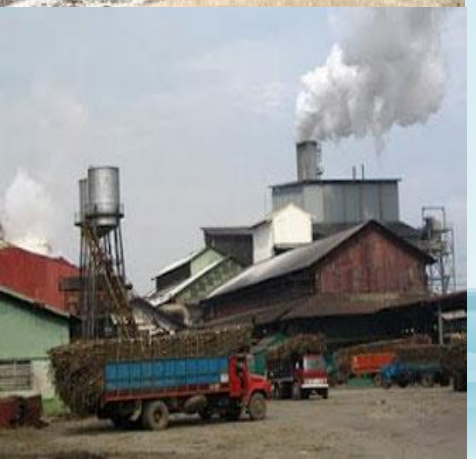




DAO 2016-08

Section 2. Objectives

- **Classification of water bodies in the country**
- **Determination of time trends**
- **Evaluation of stages of deterioration/ enhancement in water quality**
- **Evaluation of the need for taking actions in preventing, controlling, or abating water pollution**
- **Designation of water quality management areas (WQMA)**
- **Setting the General Effluent Standards (GES)**



Section 3. Scope and Coverage

- The WQG applies to **all water bodies in the country: freshwaters, marine waters, and groundwater**.

- The scope of the GES was defined to apply to **all point sources of pollution, regardless of volume,** that discharge to receiving body of water or land and be used regardless of the industry category.

Section 4. Definition of Terms

- **General Effluent Standards (GES)** – means any legal restriction or limitation on quantities, rates, and/or concentrations or any combination thereof, of physical, chemical, or biological parameters of effluent which a person or point source is allowed to discharge into a body of water or land; that is applicable to all industry categories and defined according to the classification of the receiving water body.

- **Water Quality Guidelines (WQG)** – refers to the level for a water constituent or numerical values of physical, chemical, biological, and bacteriological or radiological parameters which are used to classify water resources and their use, which do not result in significant health risk

Section 5. Classification of Water Bodies

For purposes of maintaining water quality according to its intended beneficial usage, water bodies are classified accordingly.

Freshwater: Classes AA, A, B. C, D

Marine waters: Classes SA, SB, SC, SD

Table 1. Water Body Classification and Usage of Freshwater

Classification	Intended Beneficial Use
Class AA	Public Water Supply Class I – Intended primarily for waters having watersheds, which are uninhabited and/or otherwise declared as protected areas, and which require only approved disinfection to meet the latest PNSDW
Class A	Public Water Supply Class II – Intended as sources of water supply requiring conventional treatment (coagulation, sedimentation, filtration and disinfection) to meet the latest PNSDW
Class B	Recreational Water Class I – Intended for primary contact recreation (bathing, swimming, etc.)
Class C	1. Fishery Water for the propagation and growth of fish and other aquatic resources 2. Recreational Water Class II – For boating, fishing, or similar activities *3. For agriculture, irrigation, and livestock watering*
Class D	Navigable waters

Note: For unclassified water bodies, classification shall be based on the beneficial use as determined by the Environmental Management Bureau (EMB).

Table 2. Water Body Classification and Usage of Marine Waters

Classification	Intended Beneficial Use
Class SA	1. Protected Waters – Waters designated as national or local marine parks, reserves, sanctuaries, and other areas established by law (Presidential Proclamation 1801 and other existing laws), and/or declared as such by appropriate government agency, LGUs, etc. 2. Fishery Water Class I – Suitable for shellfish harvesting for direct human consumption
Class SB	1. Fishery Water Class II – Waters suitable for commercial propagation of shellfish and intended as spawning areas for milkfish (*Chanos chanos*) and similar species 2. Tourist Zones – For ecotourism and recreational activities 3. Recreational Water Class I – Intended for primary contact recreation (bathing, swimming, skin diving, etc.)
Class SC	1. Fishery Water Class III – For the propagation and growth of fish and other aquatic resources and intended for commercial and sustenance fishing 2. Recreational Water Class II – For boating, fishing, or similar activities 3. Marshy and/or mangrove areas declared as fish and wildlife sanctuaries
Class SD	Navigable waters

Note: For unclassified water bodies, classification shall be based on the beneficial use as determined by EMB.

Class SA

Muelle Bay, Puerto Galera

Bulalacao Bay, Oriental Mindoro

Class SA

White Island Coastal Waters, Camiguin

Mantingue Island Coastal Waters, Camiguin

Class SB

Green Island Bay, Palawan

Puerto Princesa Bay, Palawan

Class SB

Manila Bay

Panglao Island, Bohol

Class SC

Batangas Bay

Paracale Bay, Camarines Norte

Class SC

Sorsogon Bay, Bicol

Cansaga Bay, Cebu

Classes SA, SB

Calapan Bay, Oriental Mindoro

Olango Channel, Cebu

Classes SB, SC

Lingayen Gulf Coastal Waters, Pangasinan

Boracay Coastline

Classes SB, SC

Dapitan Bay,
Zamboanga del Norte

Macajalar Bay, CDO

Classes SA, SB, SC

San Jose Coastal Waters, Antique

Toledo, Cebu

Balamban, Cebu

PROTECTED SEASCAPE: MALAMPAYA SOUND, Class SA

PROTECTED SEASCAPE: SARANGANI BAY, Classes SB, SC

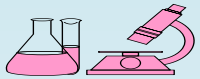
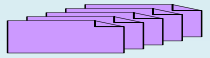
Step	Activity		Responsibility
1	Preparation of a sampling plan to ensure that all the requirements for sampling are met.		Head of monitoring team
2	Collection of water samples from rivers or streams; lakes, ponds or similar water bodies; or coasts or offshore areas		Field personnel/ sampling team
3	Field tests and measurements; e.g., pH, temperature, dissolved oxygen, flow measurements, sample preservation		Field personnel/ sampling team
4	Record field observations, on-site test results and field activities on the field book, field data form and COC form		Field personnel/ sampling team
5	Pre-treatment, preservation, storage and transport of samples to the laboratory		Field personnel/ sampling team
6	Analysis of samples in the laboratory		Laboratory personnel
7	Data processing, interpretation, analysis and storage		Encoder/head of monitoring team
8	Preparation of report		Head of monitoring team

Figure 2.1 Steps in Water Quality Monitoring

Components of a Monitoring Plan

- Background Information
- Objectives of Monitoring
- Monitoring Stations
- Water Quality Parameters for Measurement
- Timing and Frequency of Monitoring
- Water Quality Sampling and Test Methods
- Quality Assurance and Quality Control Procedures

Objectives of Monitoring

- A water quality monitoring program should have clear objectives.
- The objectives would be the basis for deciding the parameters to measure, the number of samples, the frequency of sampling, the type of container, preservation method, sampling techniques and analytical methods to be used.

The monitoring program must be adapted to its objectives and not the other way around.

➢ Sampling Timing and Frequency

- The plan should describe the intended timing and frequency of monitoring.
- The frequency of monitoring would depend on the monitoring objective.
- The timing should consider the effect of temporal variations on water quality.

➢ Sampling Timing and Frequency

- The sampling plan should describe how often sample will be taken (frequency) and at what times of the year as water quality changes with the seasons (timing).
- Not advisable to take samples when it is raining, within 24 hours after a heavy downpour or when the water level is at high stage. In these conditions, the water sample will not be representative.
- Recommended frequency and duration of sampling shall be according to the type of monitoring

Recommended Parameters, Frequency and Duration of Sampling

Purpose of Monitoring		Parameters	Sampling Frequency (Mininum)	Minimum Duration of Monitoring
1	Classification	Primary parameters	Once a month	1 year
2	Reclassification	Primary	Once a month	3 years[1]
		Secondary[2]	Quarterly	3 years[3]
3	Trend Monitoring	Primary	Once a month	3 years[4]
		Secondary	Quarterly (every 3 mos.)	3 years
4	Identification of Non-Attainment Areas (NAA)	All relevant parameters	(a) ten monthly sampling in a period of one year within the last two years, or (b) quarterly sampling within the last two years (except for parameters requiring more frequent sampling based on the DENR water quality guidelines)[5]	1 year for monthly monitoring; 2 years for quarterly monitoring
5	Baseline Survey	Primary	Once a month for 12 months	1 year
		Secondary [6]	Once a month for 12 months	1 year
6	Preliminary surveys	Selected according to purpose	As necessary depending on objective	< 1 year
7	Emergency surveys	Selected/ specific to situation	High, will depend on impact area and parameter	very short (days-weeks)
8	Impact Surveys	Selected/ specific to project or site condition	Based on project design and objective	Variable depending on duration of project and impact

Monitoring Stations in Coastal and Offshore Waters

- The monitoring sites at beaches should be representative of the complete bathing beach area.
- For beaches less than one kilometer in length, three monitoring sites per beach may be sufficient.
- For beaches that are more than one (1) km long more sampling sites may be needed. They would normally be spaced 300 meters apart and fixed permanently for the season.

Monitoring Stations in Coastal and Offshore Waters

- For regular monitoring, sampling should be done during normal tide conditions so that the sampling site can be more or less fixed.
- Sampling should be undertaken at the same period of day.
- If there are fresh water inflow sources to the coastal areas, monitoring stations should also be established near the outlet of such sources.

Monitoring Stations in Coastal and Offshore Waters

- Offshore monitoring stations would normally be established by dead-reckoning (DR) method verified by GPS or by using magnetic compass and radar fixes.
- Stations should be established such that the different bathymetric profiles are well-represented, i.e., along 5m, 10m, 20m and 30m depths and considering possible sources of pollution, e.g., industries and sewage outfalls.

Sampling Point and Depth in Coastal and Offshore Waters

- For regular beach monitoring, samples are usually taken within locations representative of the common bathing areas.
- Surface grab sampling is appropriate in areas where the depth is less than 4m.
- Samples for fecal coliform bacteria may be collected just below the surface (0.1-m).

Sampling Point and Depth in Coastal and Offshore Waters

- In offshore areas with depth of between 4m to 10m, one sample can be taken at the surface (0.10m-0.50m), one (1) at the middle layer and one at near-bottom depth (0.5-1 m above the seabed).
- In much deeper areas, samples can be collected at depth increments of 5m using a Kemmerer or Van Dorn sampler.

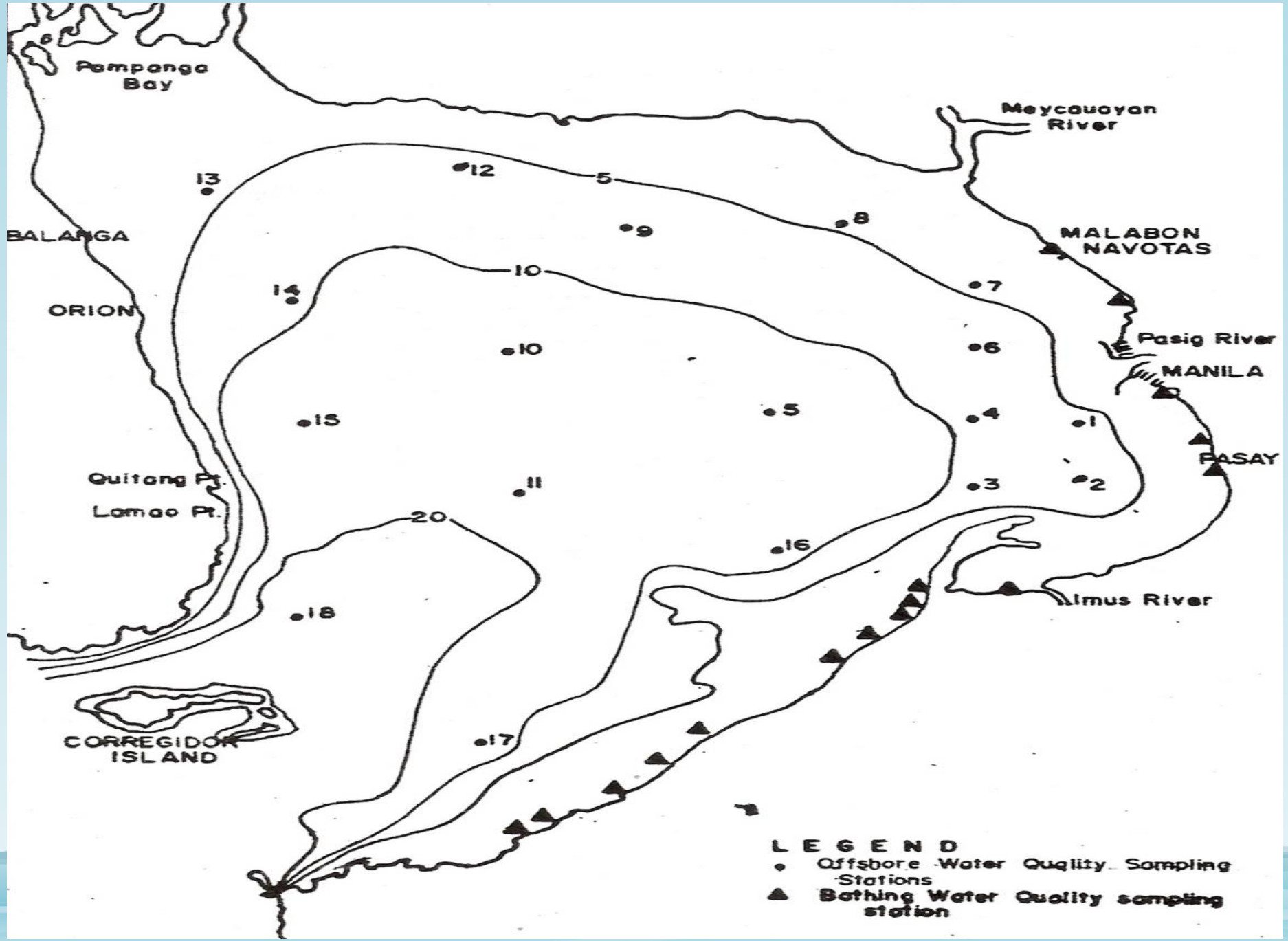
WATER SAMPLERS

VAN DORN

KEMMERER

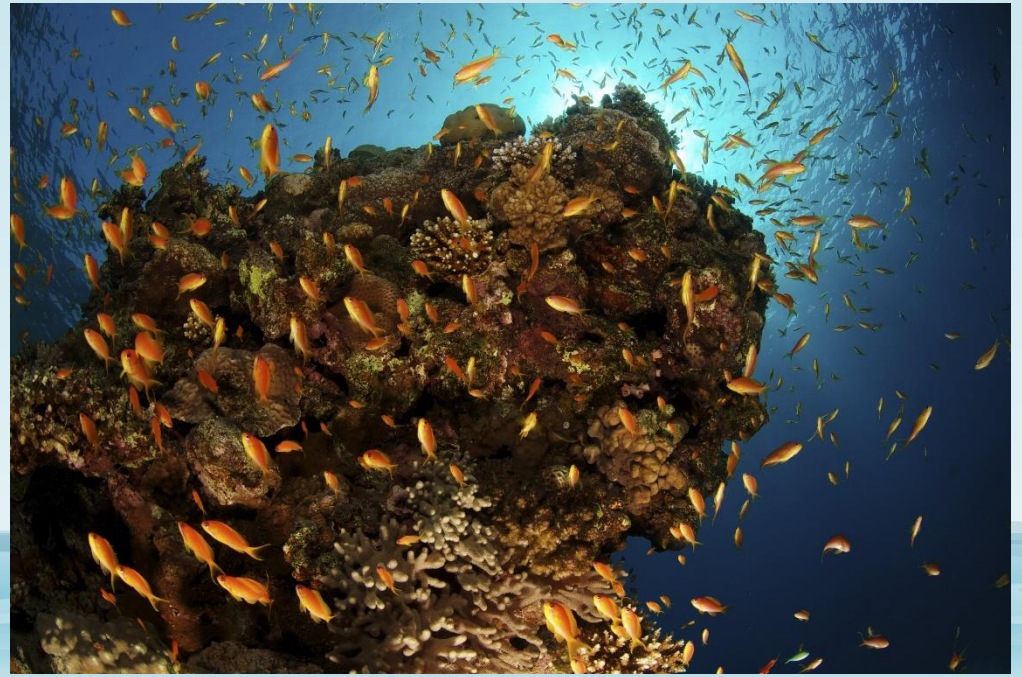
Sampling Point and Depth in Coastal and Offshore Waters

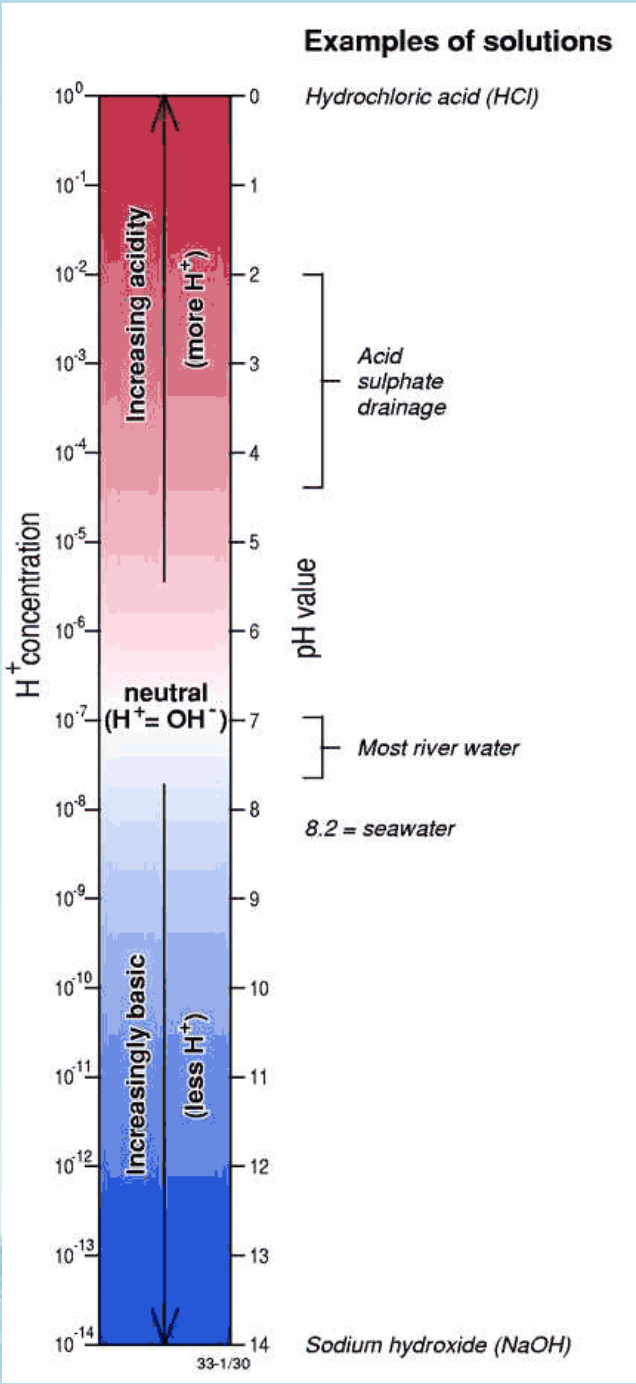
- The Map of the Manila Bay Monitoring Program (1986) shows the monitoring stations established for coastal and offshore monitoring.
- Monitoring stations consisted of 15 sites for bacteriological sampling and beach surveillance and 18 off-shore monitoring stations.
- In addition to the monitoring stations in the beach areas, bacteriological stations were also established near the river outlets of Pasig River, Parañaque and Imus River.



Coastal and Offshore Monitoring Stations of the Manila Bay Monitoring Program, 1986

WATER QUALITY PARAMETERS



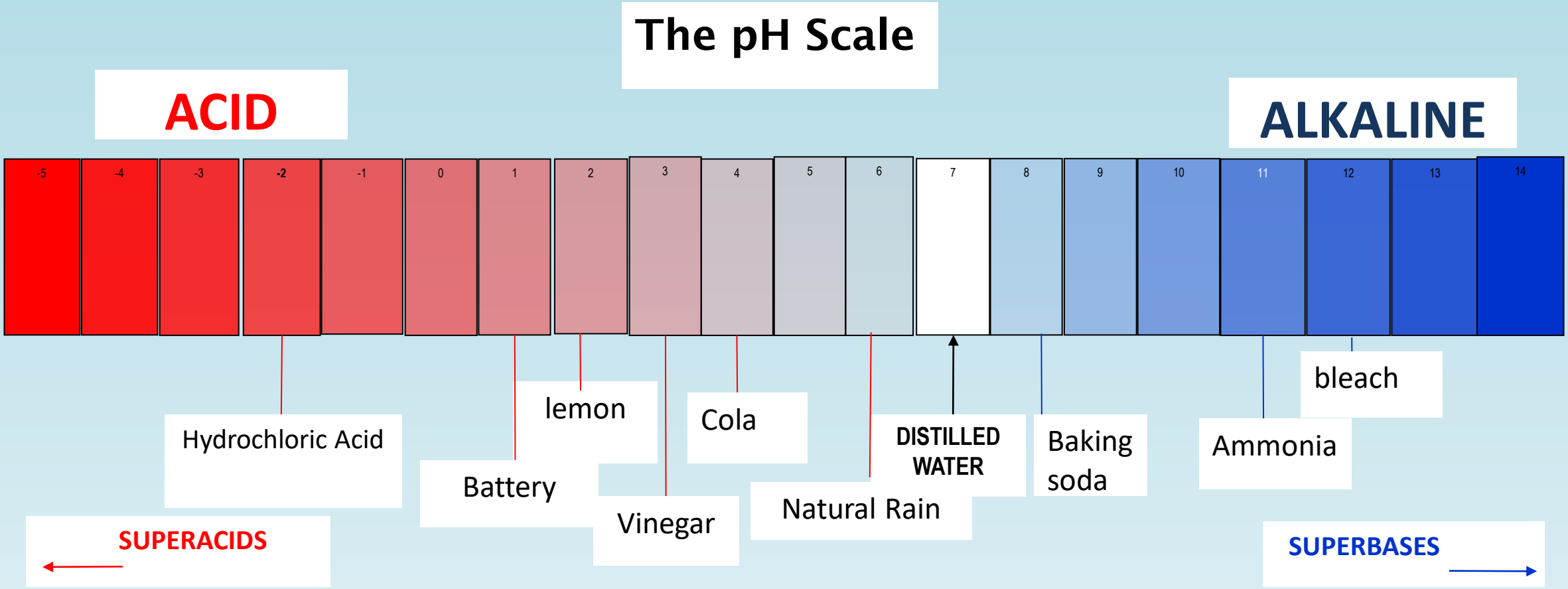


pH

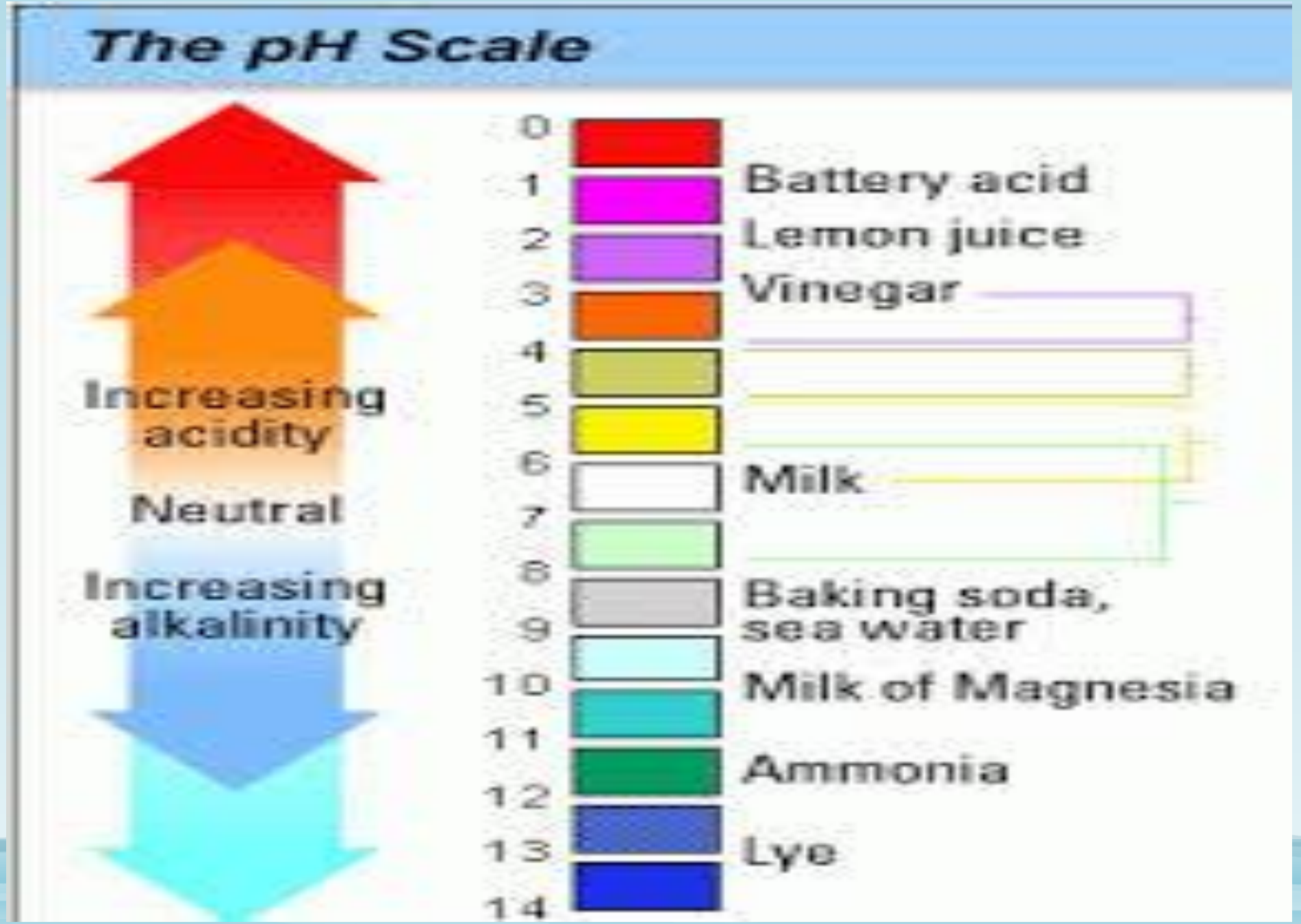
- pH is a measure of the hydrogen ion concentration in liquids. The “p” stands for ‘potential for’ and the “H” stands for ‘Hydrogen’. Thus, pH is written with small letter p and capital letter H.
- Water contains both hydrogen ions (H+) and hydroxyl ions (OH-). The pH test measures the H+ ion concentration of liquids and substances.

pH

- Most substances have a pH in the range 0 to 14, although extremely acidic substances may have pH less than 0 and extremely basic substances may have pH greater than 14.
- Pure deionized water contains equal (H+) and (OH-), and is considered neutral (neither acidic nor basic). Pure deionized or neutral water has a pH of 7.
- Water with pH below 7 is acidic while water with pH above 7 is alkaline or basic.



pH scale showing the values of some common liquids


The pH Scale
Increasing acidity
Neutral
Increasing alkalinity
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Battery acid
Lemon juice
Vinegar
Milk
Baking soda, sea water
Milk of Magnesia
Ammonia
Lye

Significance of pH in Water Quality Monitoring

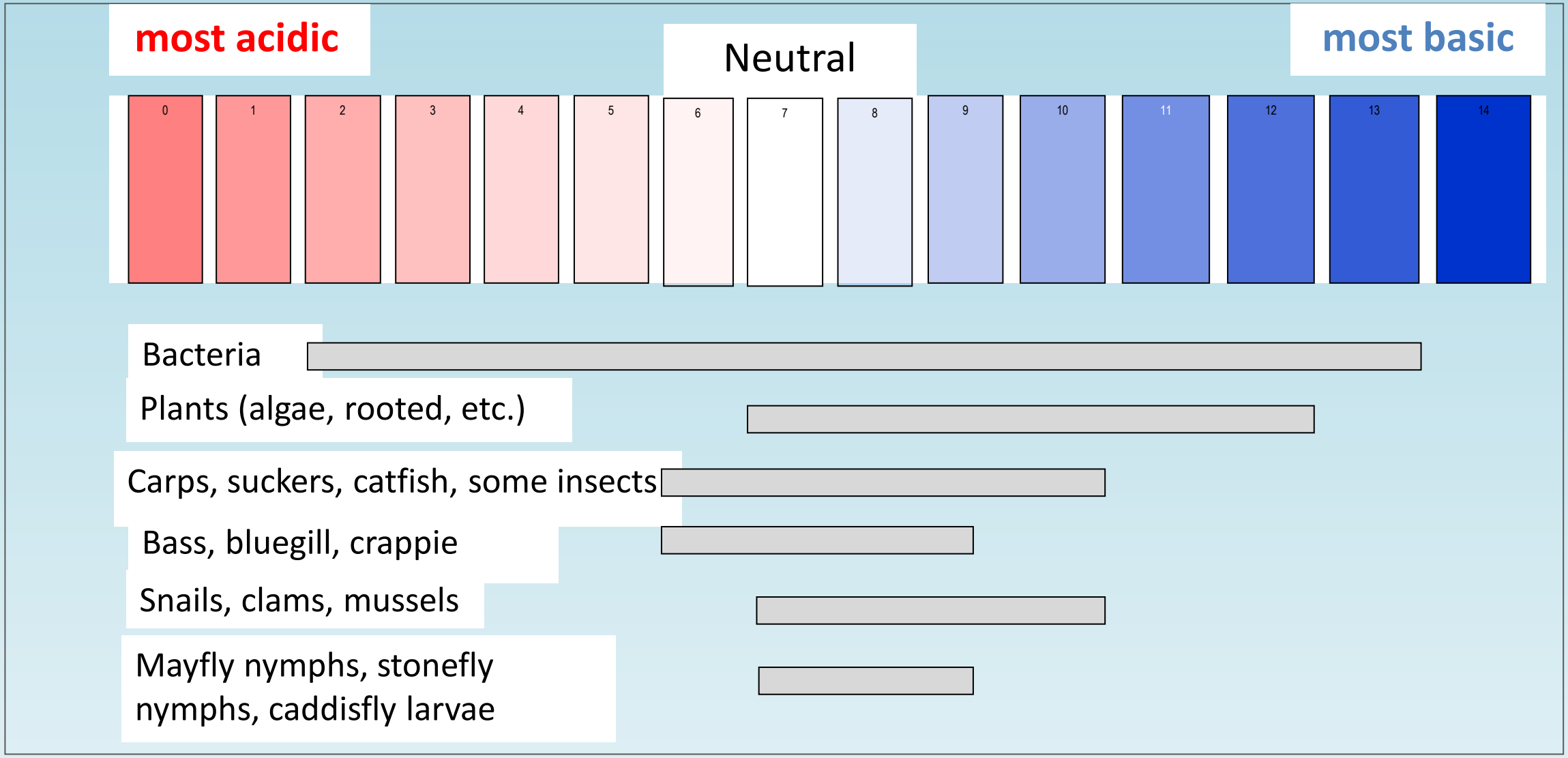
- Changes in pH can greatly affect aquatic organisms. Organisms that have adapted to water of a specific pH may die if sudden changes in pH occur.
- pH changes between 0.2 and 0.3 are already stressful to some species. Chances of survival diminishes as pH falls below 5 or increases above 9.
- A pH of 6.5 to 8.2 is ideal for most organisms; the optimal range for most tropical fishes is 6.5 – 8.5.

Significance of pH in Water Quality Monitoring

- At pH 6.0, the microorganisms which decompose organic matter begin to die.
- The plankton (microscopic plants and animals) which form the base of the food chain begins to decline drastically at this pH level.
- Between 6.0 and 5.5, the number of aquatic invertebrate species declines, most fish species lose their ability to reproduce and algal mats form along the shoreline.

Significance of pH in Water Quality Monitoring

- At stronger acid levels, toxic metals such as aluminum, mercury, lead and cadmium dissolve more readily and therefore are more easily absorbed by fish and other aquatic animals.
- Heavy metals can accumulate on the gills of fish or cause deformities in young fish, reducing their chances of survival.



pH Ranges that support aquatic life

TEMPERATURE

- Temperature is the measure of the intensity of heat and is an important water quality parameter because many biological, physical and chemical processes are affected by it.
- It is usually expressed in degree Celsius (^{O}C) or degree Fahrenheit (^{O}F)

Significance of Temperature in WQM

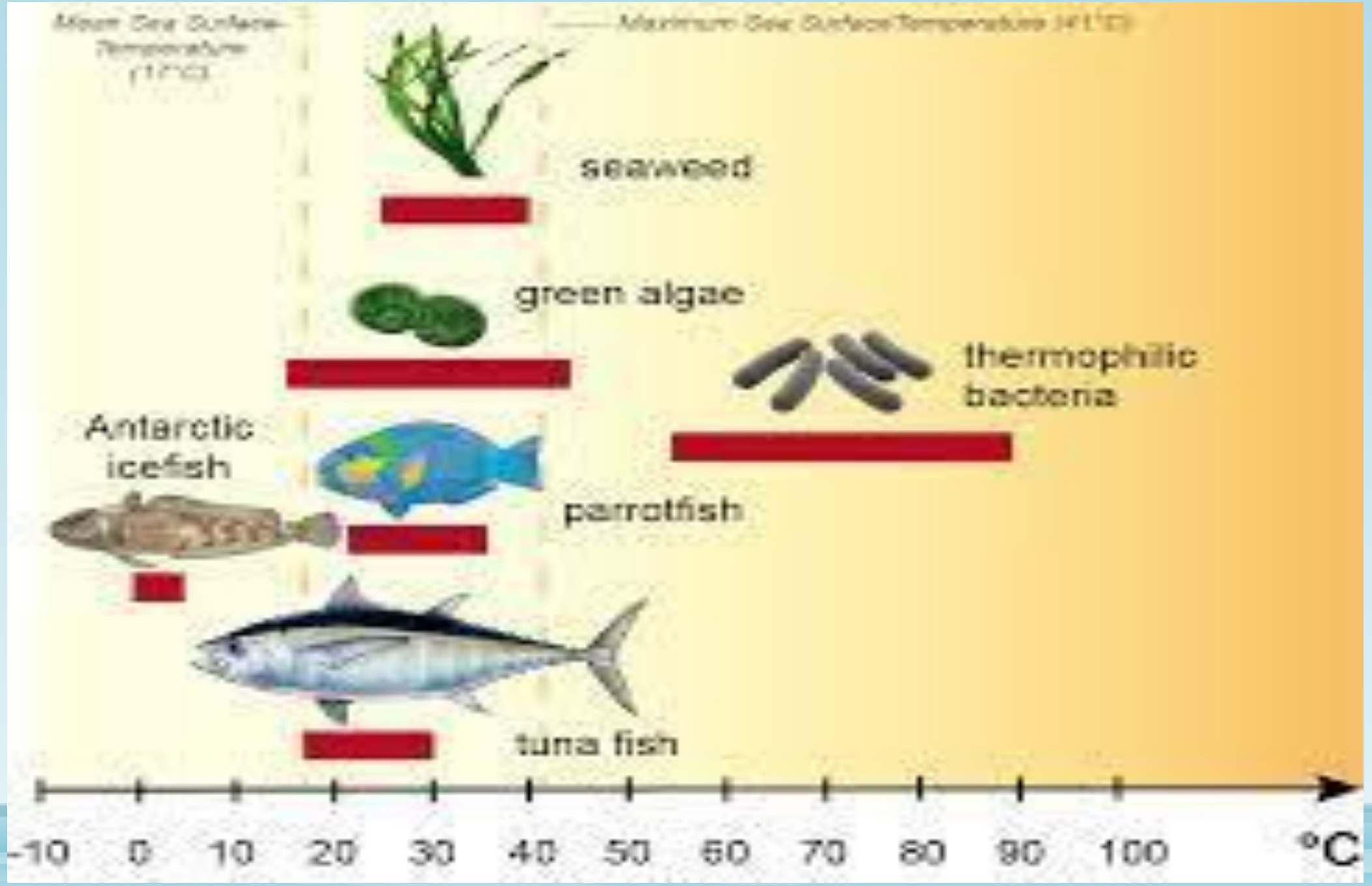
- Temperature is very critical to both plants and animals.
- The amount of biological activity and the rate of chemical/metabolic reaction increase significantly with slight increase in water temperature.
- As water temperature rises, the rate of photosynthesis and plant growth increases.

Significance of Temperature in WQM

- Most aquatic organisms have adapted to survive within a range of water temperatures but few can tolerate extremely hot or cold temperature.
- Some organisms such as trout and stonefly nymphs prefer cooler waters.
- Others like carp and dragonfly nymphs thrive better under warmer conditions. As the temperature of a water body increases, cool water species will be replaced by warm water organisms.

Significance of temperature in WQM

- Ideal temperatures vary with different species but high temperatures in streams disrupt the naturally regulated timing of temperature related events such as migration and reproduction.
- Temperature also affects aquatic life’s sensitivity to toxic wastes, parasites and disease.
- Thermal pollution may cause fish to become vulnerable to disease, either because of stress due to rising temperatures or due to resulting decrease in dissolved oxygen.


seaweed
green algae
thermophilic bactena
Antarctic icefish
parrotfish
tuna fish
-10
0
10
20
30
40
50
60
70
80
90
100
°C

DISSOLVED OXYGEN

- DO is the concentration of oxygen dissolved in the water.
- It is measured either in concentration or "percent saturation."
- Concentration is the milligram of oxygen in a liter of water, expressed as mg/L.
- Percent saturation is the amount of oxygen in a liter of water relative to the total amount of oxygen that the water can hold at that temperature.

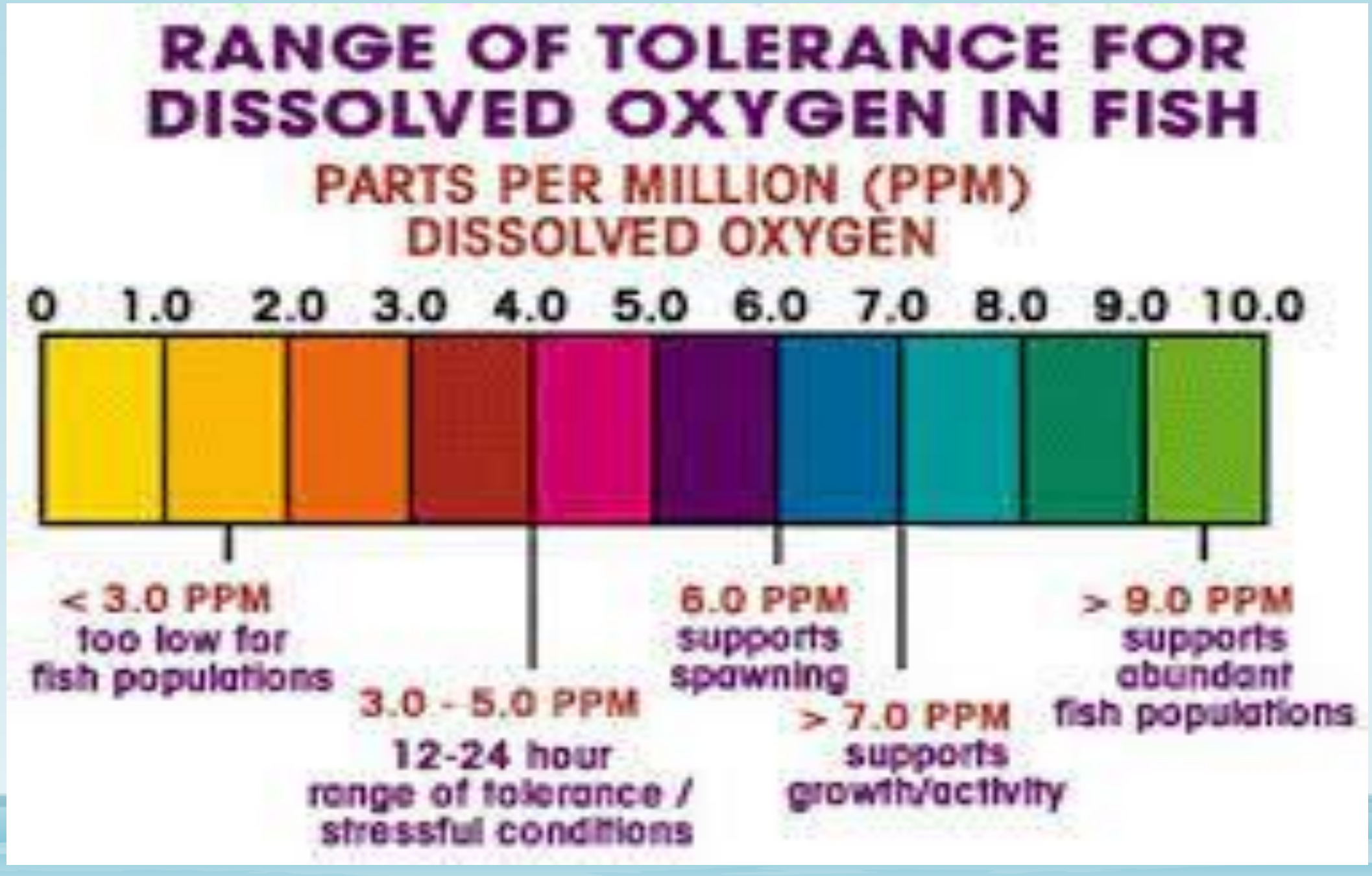
DISSOLVED OXYGEN

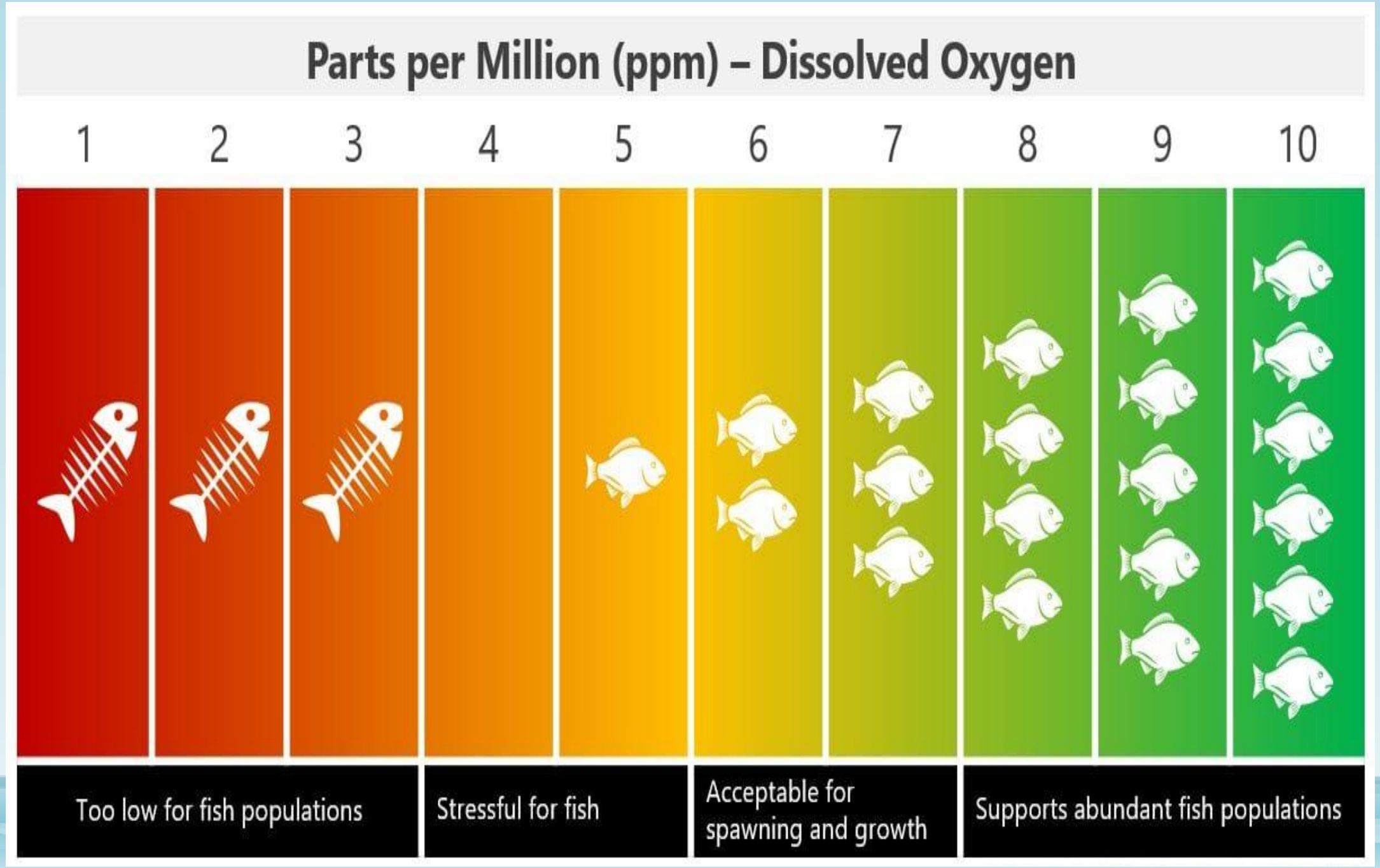
- Much of the DO in water comes from air.
- Oxygen can also be mixed into the water by waves or lakes or fast-moving rivers.
- Algae and rooted aquatic plants also add oxygen through photosynthesis.

Significance of Dissolved Oxygen in WQM

- DO is a primary monitoring parameter in ambient water.
- It is an important measurement of aquatic health because aquatic organisms get all of their oxygen from water.
- Generally, a higher DO level indicates better water quality.
- Healthy freshwater bodies usually have DO levels of 8 mg/L or higher although a DO of at least 5 mg/L is sufficient for many aquatic species.

RANGE OF TOLERANCE FOR DISSOLVED OXYGEN IN FISH




Parts per Million (ppm) – Dissolved Oxygen
1
2
3
4
5
6
7
8
9
10
Too low for fish populations
Stressful for fish
Acceptable for spawning and growth
Supports abundant fish populations

TOTAL SUSPENDED SOLIDS

- **TSS** are solids or substances suspended in water including clay, silt, decaying plant, algae, plankton, sand, microbes, animal matter, industrial wastes and sewage that cause water turbidity.
- These are the solids that can be trapped by a filter.

TOTAL SUSPENDED SOLIDS

TSS is affected by the following factors:

- High flow rates or wave action
- Soil erosion
- Runoff
- Wastewater and septic system effluent
- Decaying plant and animals
- Bottom-feeders

Significance of Total Suspended Solids in WQM

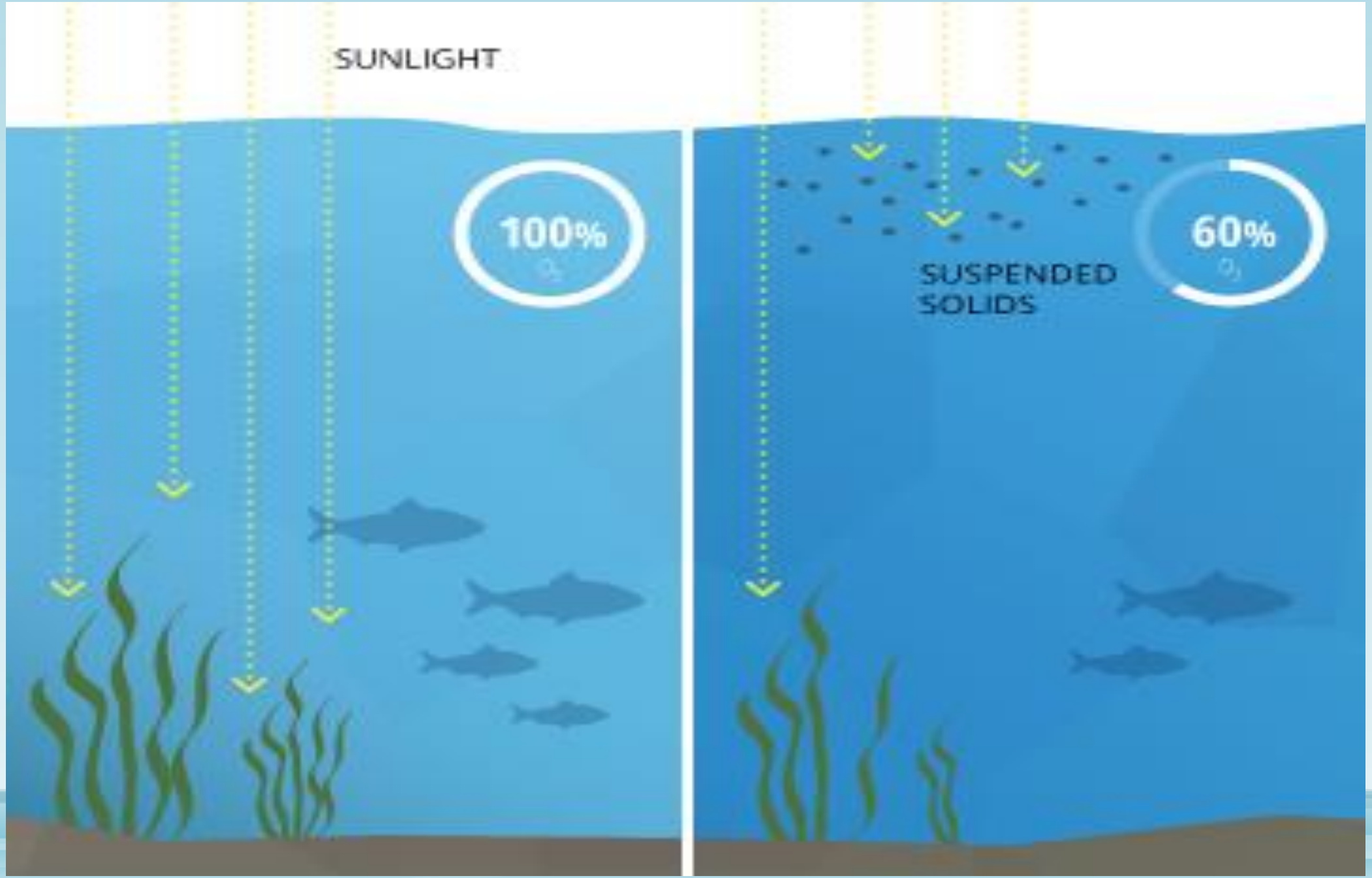
- High concentration of suspended solids in water decreases the passage of light through the water and can block light from reaching submerged vegetation. Consequently, the rate of photosynthesis will slow down.
- When the rate of photosynthesis is reduced, plants release less DO into the water.
- If light is completely blocked, the plants will die.

Significance of Total Suspended Solids in WQM

- As the plants decompose, bacteria will use up even more oxygen from the water and further lower down the DO. Low DO can lead to fish kills.
- TSS decrease water clarity, the fishes lose their ability to see and catch food, resulting in retardation of growth.
- TSS increases water temperatures because suspended particles absorb more heat. High temperature reduces the concentration of DO because warm water holds less DO than cold water.

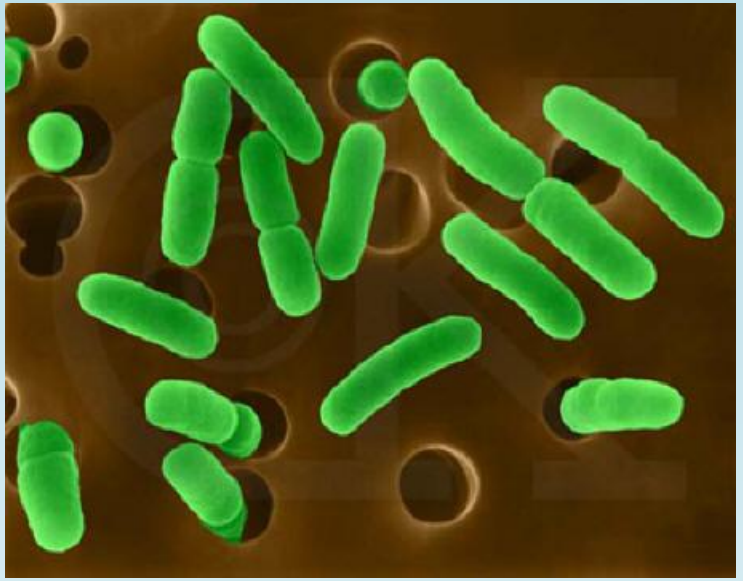
Significance of Total Suspended Solids in WQM

- Suspended sediment can clog fish gills, reduce their growth rates, decrease resistance to disease and prevent egg and larval development.
- When suspended solids settle to the bottom of a water body, they can choke the eggs of fish and aquatic insects and their larvae.
- Settling sediments can fill in spaces between rocks which could have been used by aquatic organisms for homes.


SUNLIGHT
100%
SUSPENDED SOLIDS
60%

FECAL COLIFORM

- Fecal coliform bacteriological test tells whether the water is free from disease-causing bacteria.
- Coliform bacteria grow in the digestive tracts of humans and other warm-blooded animals, and serve as indicators of fecal contamination and as a marker for other, possibly pathogenic microorganisms.



FECAL COLIFORM

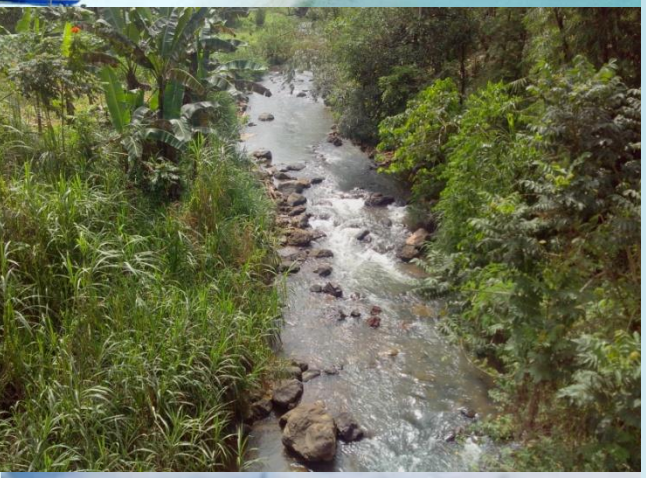
- Fecal coliform are measured by counting the most probable number of bacteria colonies that grow from a 100 milliliter water sample (MPN/100ml).
- Sources of coliform bacteria include domestic and industrial wastewater discharges, septic tanks, domestic and farm animals, and wildlife.

FECAL COLIFORM

- The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of man or other animals.
- At the time this occurred, the source water may have been contaminated by pathogens or disease producing bacteria or viruses which can also exist in fecal material.

FECAL COLIFORM

- Some waterborne pathogenic diseases include typhoid fever, viral and bacterial gastroenteritis and hepatitis A.
- The presence of fecal contamination is an indicator that a potential health risk exists for individuals exposed to this water.
- Fecal coliform bacteria may occur in ambient water as a result of the overflow of domestic sewage or nonpoint sources of human and animal waste.



Section 6. Water Quality Guidelines

- The WQG were categorized as primary or secondary parameters.
- Primary parameters are the required minimum water quality parameters to be monitored for each water body.
- Secondary parameters are other water quality parameters to be used in baseline assessment as part of the Environmental Impact Assessment and other water quality monitoring purposes.
- The WQG shall be applied to freshwaters, marine waters, and groundwater.

Table 3. Water Quality Guidelines for Primary Parameters

Parameter	Unit	Water Body Classification								
		AA	A	B	C	D	**SA**	**SB**	**SC**	**SD**
BOD	mg/L	1	3	5	7	15	n/a	n/a	n/a	n/a
Chloride	mg/L	250	250	250	350	400	n/a	n/a	n/a	n/a
Color	TCU	5	50	50	75	150	5	50	75	150
Dissolved Oxygen[(a)] (Minimum)	mg/L	5	5	5	5	2	6	6	5	2
Fecal Coliform	MPN/100mL	<1.1	<1.1	100	200	400	<1.1	100	200	400
Nitrate as NO_3-N	mg/L	7	7	7	7	15	10	10	10	15
pH (Range)		6.5-8.5	6.5-8.5	6.5-8.5	6.5-9.0	6.0-9.0	7.0-8.5	7.0-8.5	6.5-8.5	6.0-9.0
Phosphate	mg/L	<0.003	0.5	0.5	0.5	5	0.1	0.5	0.5	5
Temperature[(b)]	^oC	26-30	26-30	26-30	25-31	25-32	26-30	26-30	25-31	25-32
Total Suspended Solids	mg/L	25	50	65	80	110	25	50	80	110

Notes:

MPN/100mL – Most Probable Number per 100 milliliter
n/a – Not Applicable
TCU – True Color Unit

(a) Samples shall be taken from 9:00 AM to 4:00 PM.

(b) The natural background temperature as determined by EMB shall prevail if the temperature is lower or higher than the WQG; provided that the maximum increase is only up to 10 percent and that it will not cause any risk to human health and the environment.

Table 4. Water Quality Guidelines for Secondary Parameters - Inorganics

Parameter	Unit	Water Body Classification								
		AA	A	B	C	D	**SA**	**SB**	**SC**	**SD**
Ammonia as NH_3-N	mg/L	0.05	0.05	0.05	0.05	0.75	0.04	0.05	0.05	0.75
Boron	mg/L	0.5	0.5	0.5	0.75	3	0.5	0.5	5	20
Fluoride	mg/L	1	1	1	1	2	1.5	1.5	1.5	3
Selenium	mg/L	0.01	0.01	0.01	0.02	0.04	0.01	0.01	0.1	0.2
Sulfate	mg/L	250	250	250	275	500	250	250	275	500

Table 5. Water Quality Guidelines for Secondary Parameters - Metals[(c)]

Parameter	Unit	Water Body Classification								
		AA	A	B	C	D	**SA**	**SB**	**SC**	**SD**
Arsenic	mg/L	0.01	0.01	0.01	0.02	0.04	0.01	0.01	0.02	0.04
Barium	mg/L	0.7	0.7	0.7	3	4	0.1	0.7	1	4
Cadmium	mg/L	0.003	0.003	0.003	0.005	0.01	0.003	0.003	0.005	0.01
Chromium as Hexavalent Chromium (Cr^{6+})	mg/L	0.01	0.01	0.01	0.01	0.02	0.05	0.05	0.05	0.1
Copper as Dissolved Copper	mg/L	0.02	0.02	0.02	0.02	0.04	0.02	0.02	0.02	0.04
Iron	mg/L	1	1	1	1.5	7.5	1.5	1.5	1.5	7.5
Lead	mg/L	0.01	0.01	0.01	0.05	0.1	0.01	0.01	0.05	0.1
Manganese	mg/L	0.2	0.2	0.2	0.2	2	0.4	0.4	0.4	4
Mercury	mg/L	0.001	0.001	0.001	0.002	0.004	0.001	0.001	0.002	0.004
Nickel	mg/L	0.02	0.02	0.04	0.2	1	0.02	0.04	0.06	0.3
Zinc	mg/L	2	2	2	2	4	0.04	0.05	0.8	1.5

Note:
(c) Unless otherwise specified, the above parameters are expressed as total metals.

Table 6. Water Quality Guidelines for Secondary Parameters - Organics

Parameter	Unit	Water Body Classification								
		AA	A	B	C	D	**SA**	**SB**	**SC**	**SD**
Benzo(a)pyrene	µg/L	0.7	0.7	0.7	1.5	3	0.7	0.7	1.5	3
BTEX										
Benzene	mg/L	0.01	0.01	0.01	0.05	0.5	0.01	0.01	0.05	0.5
Toluene	mg/L	0.7	0.7	1	4	5	1	1	4	5
Ethylbenzene	mg/L	0.3	0.3	0.3	1.5	2	0.2	0.2	1.5	2
Xylenes	mg/L	0.5	0.5	0.5	1.5	1.8	0.5	0.5	1.5	1.8
Cyanide as Free Cyanide	mg/L	0.07	0.07	0.07	0.1	0.2	0.02	0.02	0.1	0.2
Organophosphate as Malathion	µg/L	1	1	1	3	6	1	1	3	6
Oil and Grease	mg/L	<1	1	1	2	5	1	2	3	5
Polychlorinated Biphenyls[(d)]	µg/L	<0.1	<0.1	0.2	0.5	1	0.3	0.3	0.5	1
Phenol & Phenolic Substances[(e)]	mg/L	<0.001	<0.001	<0.001	0.05	0.5	<0.001	<0.001	0.05	0.5
Surfactants (MBAS)	mg/L	<0.025	0.2	0.3	1.5	3	0.3	0.3	1.5	3
Trichloroethylene	mg/L	0.07	0.07	0.07	0.9	2	0.07	0.07	0.9	2

Table 6. Water Quality Guidelines for Secondary Parameters-Organics

Parameter	Unit	Water Body Classification								
		AA	A	B	C	D	**SA**	**SB**	**SC**	**SD**
Total Organochlorine Pesticides[(f)]	µg/L	n/a	n/a	50	50	50	50	50	50	50
Aldrin	µg/L	0.03	0.03	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Chlordane	µg/L	0.2	0.2	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Dichlorodiphenyltrichloroethane (DDT)	µg/L	1	1	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Dieldrin	µg/L	0.03	0.03	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Endrin	µg/L	0.6	0.6	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Heptachlor	µg/L	0.03	0.03	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Lindane	µg/L	2	2	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Methoxychlor	µg/L	50	50	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Toxaphene	µg/L	4	4	n/a	n/a	n/a	n/a	n/a	n/a	n/a

6.3 Important Considerations. The WQG are set regardless of the assimilative capacity of water bodies, and to ensure that assimilative capacities are not exceeded, the WQG set forth in Tables 3-6 are:

a) Annual average of at least **10** data sets for primary parameters except for fecal coliform.

b) Annual average of at least **4** data sets for secondary inorganic parameters.

c) Geometric mean of at least **3** data sets per quarter for fecal coliform. Further, maximum allowable limit for fecal coliform is twice the WQG per sample.

d) Maximum allowable limit for secondary metals and organics parameters.

f) For water quality parameters that are naturally occurring in the Philippines, the natural background concentration as determined by EMB shall prevail if the concentration is higher that the WQG; provided that the maximum increase is only up to 10 percent and that it will not cause any risk to human health and the environment.

EMB WATER QUALITY MONITORING PROGRAMS ON MARINE WATERS

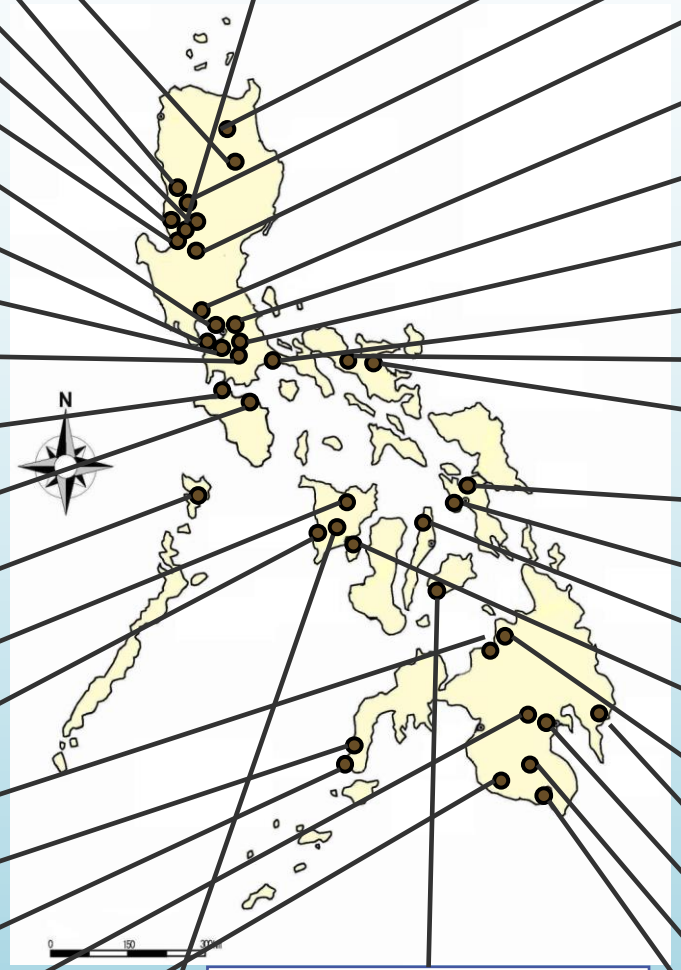
CHAPTER 2
WATER QUALITY MANAGEMENT SYSTEM
Article 1
General Provisions

Sec. 5. Water Quality Management Area. - The Department, in coordination with national water resources board (NWRB), shall designate certain areas as water quality management areas using appropriate physiographic units such as watershed, river basins or water resources regions.

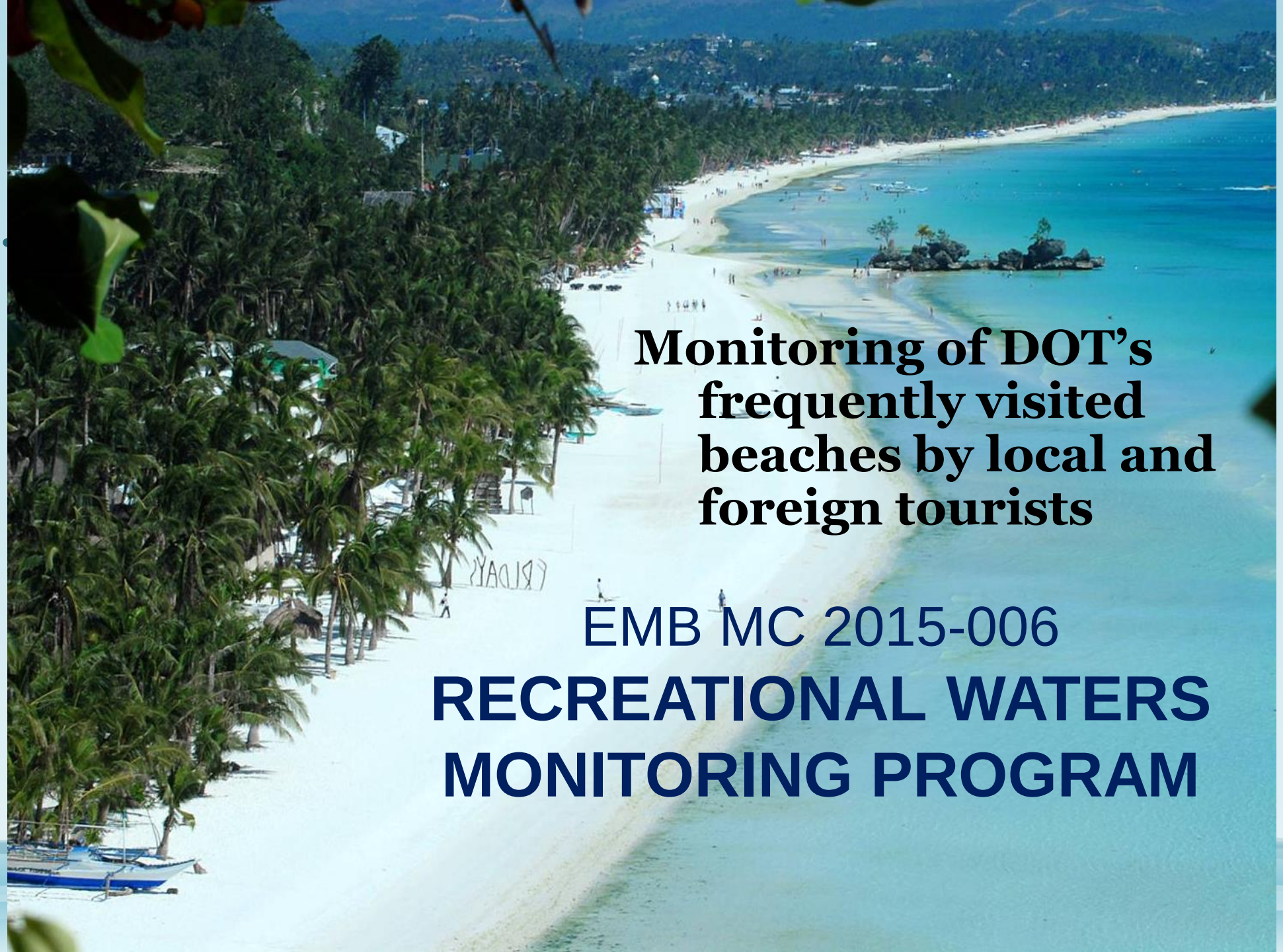
DESIGNATION OF WATER QUALITY MANAGEMENT AREAS

- An area covering the same physiographic unit which affects the physico-chemical and biological reactions and diffusion of pollutants in the bodies of water draining the said area.
- A WQMA is managed by the ***Governing Board composed of representatives from the LGUs, NGAs, NGO, water utility, business sector***, etc.
- Aims for the improvement of water quality to meet the guidelines under which they have been classified or to improve their classification so that it meets its projected or potential use.

Designated WQMAs



- Calao-Delinquente-Diadi River System WQMA (DAO 2015-13) (Region 2)
- Upper Amburayan River System WQMA (DAO 2018-02) (CAR)
- Balili River WQMA (DAO 2013-05) (CAR)
- Naguilian River System WQMA (DAO 2016-18) (Region 1)
- Bued River System WQMA (DAO 2016-03) (CAR)
- MaNaTuTi River System WQMA (DAO 2018-10) (NCR)
- Imus – Ylang Ylang – Rio Grande Rivers WQMA (DAO 2013-02) (Region 4A)
- Cañas-Maalimango Rivers WQMA (DAO 2016-19) (Region 4A)
- Areas within LLDA jurisdiction (RA 9275)
- Calapan River WQMA (DAO 2013-03) (Region 4B)
- Sabang Bay WQMA (DAO 2016-06) (Region 4B)
- Coron Bay WQMA (DAO 2016-05) (Region 4B)
- Jalaur River System (DAO 2014-08) (Region 6)
- Tigum-Aganan Watershed (DAO 2006-18) (Region 6)
- Tagoloan River Basin WQMA (DAO 2016-16) (Region 10)
- Tumaga River WQMA (DAO 2013-01) (Region 9)
- Ayala River WQMA (DAO 2016-15) (Region 9)
- Davao River WQMA (DAO 2013-04) (Region 11)
- Lake Sebu WQMA (DAO 2016-14) (Region 12)
- Bolo River System WQMA (DAO 2021-33) (Region 1)
- Panglao Island Coastal Waters WQMA (DAO 2021-34) (Region 7)
- Boracay Island WQMACA (DAO 2019-15) (Region 6)
- Pinacanauan de Tuguegarao River WQMA (DAO 2013-06) (Region 2)
- Lower Amburayan River System WQMA (DAO 2018-03) (Region 1)
- Sinocalan-Dagupan RS WQMA (DAO 2011-14) (Region 1)
- Marilao-Meycauayan-Obando River System WQMA (DAO 2008-07) (Region 3)
- San Juan River System WQMA (DAO 2012-04) (NCR)
- Las Pinas-Paranaque River System WQMA (DAO 2018-12) (NCR)
- Iyam-Dumacaa River System WQMA (DAO 2018-11) (Region 4A)
- Naga River Watershed WQMA (DAO 2016-04) (Region 5)
- Lake Buhi Watershed WQMA (DAO 2013-16) (Region 5)
- Ormoc Bay and its Associated Watersheds WQMA (DAO 2013-21) (Region 8)
- Dupong, Matlang and Merida WQMA (DAO 2018-04) (Region 8)
- Butuanon River Watershed (DAO 2014-05) (Region 7)
- Iloilo-Batiano RS WQMA (DAO 2009-11) (Region 6)
- Cagayan de Oro River Basin and Adjacent Rivers (DAO 2013-18) (Region 10)
- Taguibo River WQMA (DAO 2012-11) (Region 13)
- Talomo River WQMA (DAO 2016-17) (Region 11)
- Silway River WQMA (DAO 2010-10) (Region 12)
- Sarangani Bay WQMA (DAO 2009-12) (Region 12)



Monitoring of DOT's frequently visited beaches by local and foreign tourists

EMB MC 2015-006

RECREATIONAL WATERS MONITORING PROGRAM

CLASSIFICATION OF WATER BODIES

With LGUs and other Stakeholders

THE MANILA BAY AREA

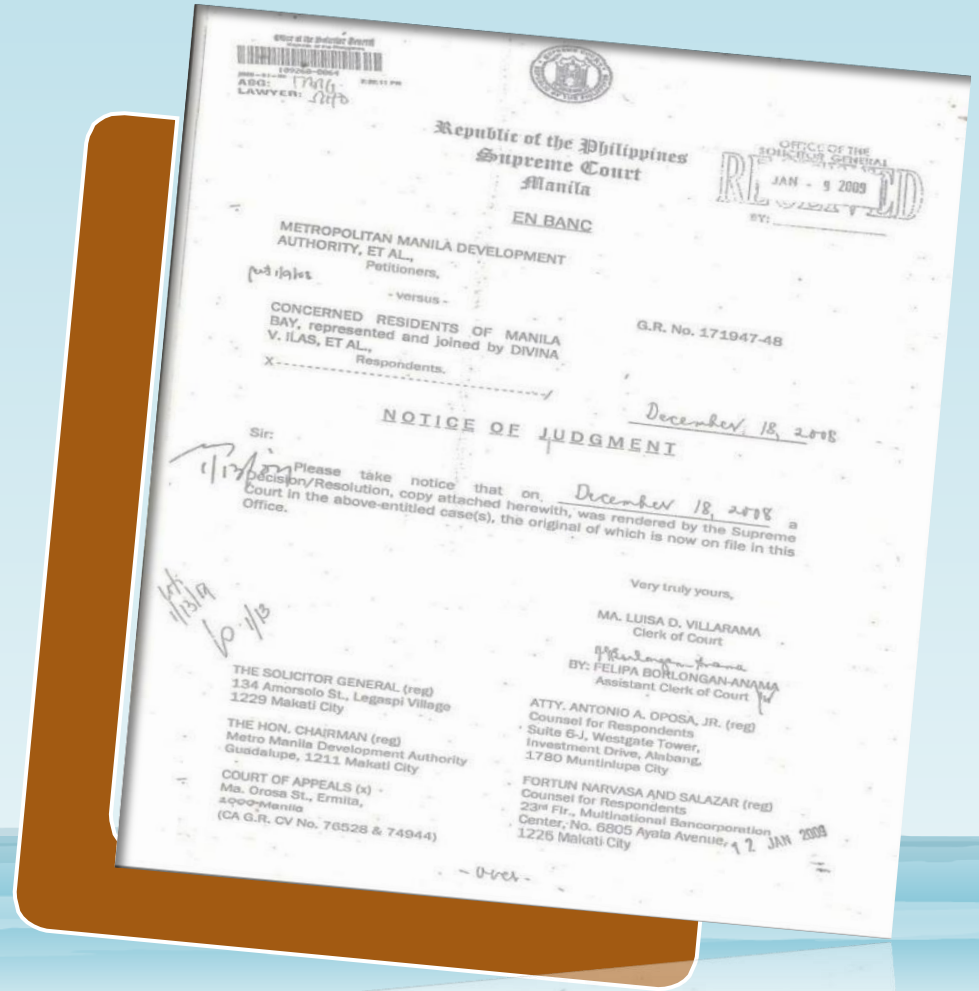
The Manila Bay Area (MBA)

- Coastline: 190 kilometers
- Surface Area: 1,870 km^2 or 187,000 has.
- Drainage Area: 17, 540 km^2 or 1.7M has.
- Comprising 3 regions - the National Capital Region, Central Luzon and CALABARZON.
- Its entire watershed is drained by major river systems
- 187 LGUs

Supreme Court Order Mandamus on Manila Bay

Directed mandamus government agencies to clean up, rehabilitate and preserve Manila Bay and restore and maintain its water to SB level.

Class SB sea waters per Water Classification Tables under DENR Administrative Order No. 2016-08
fit for swimming, skin-diving, and other forms of contact recreation.



Republic of the Philippines
Supreme Court
Manila

EN BANC

METROPOLITAN MANILA DEVELOPMENT AUTHORITY, ET AL.,
Petitioners,
- versus -
CONCERNED RESIDENTS OF MANILA BAY, represented and joined by DIVINA V. ILAS, ET AL.,
Respondents.
G.R. No. 171947-48

NOTICE OF JUDGMENT

Sir:
Please take notice that on December 18, 2008 a decision/Resolution, copy attached herewith, was rendered by the Supreme Court in the above-entitled case(s), the original of which is now on file in this Office.

Very truly yours,
MA. LUISA D. VILLARAMA
Clerk of Court
BY: FELIPA BORLONGAN-ANAMA
Assistant Clerk of Court

THE SOLICITOR GENERAL (reg)
134 Amorsolo St., Legaspi Village
1229 Makati City

THE HON. CHAIRMAN (reg)
Metro Manila Development Authority
Guadalupe, 1211 Makati City

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Manila Bayanihan Para sa Kalinisan

Let us work together in protecting the marine environment!