2. The water quality in aquaculture and the selection of culture site

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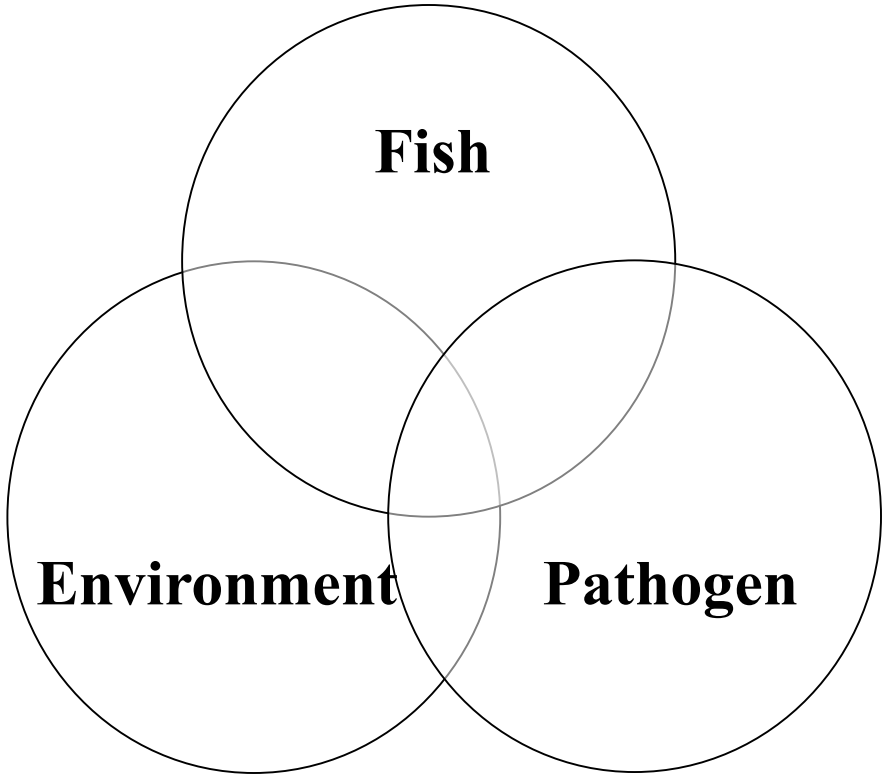
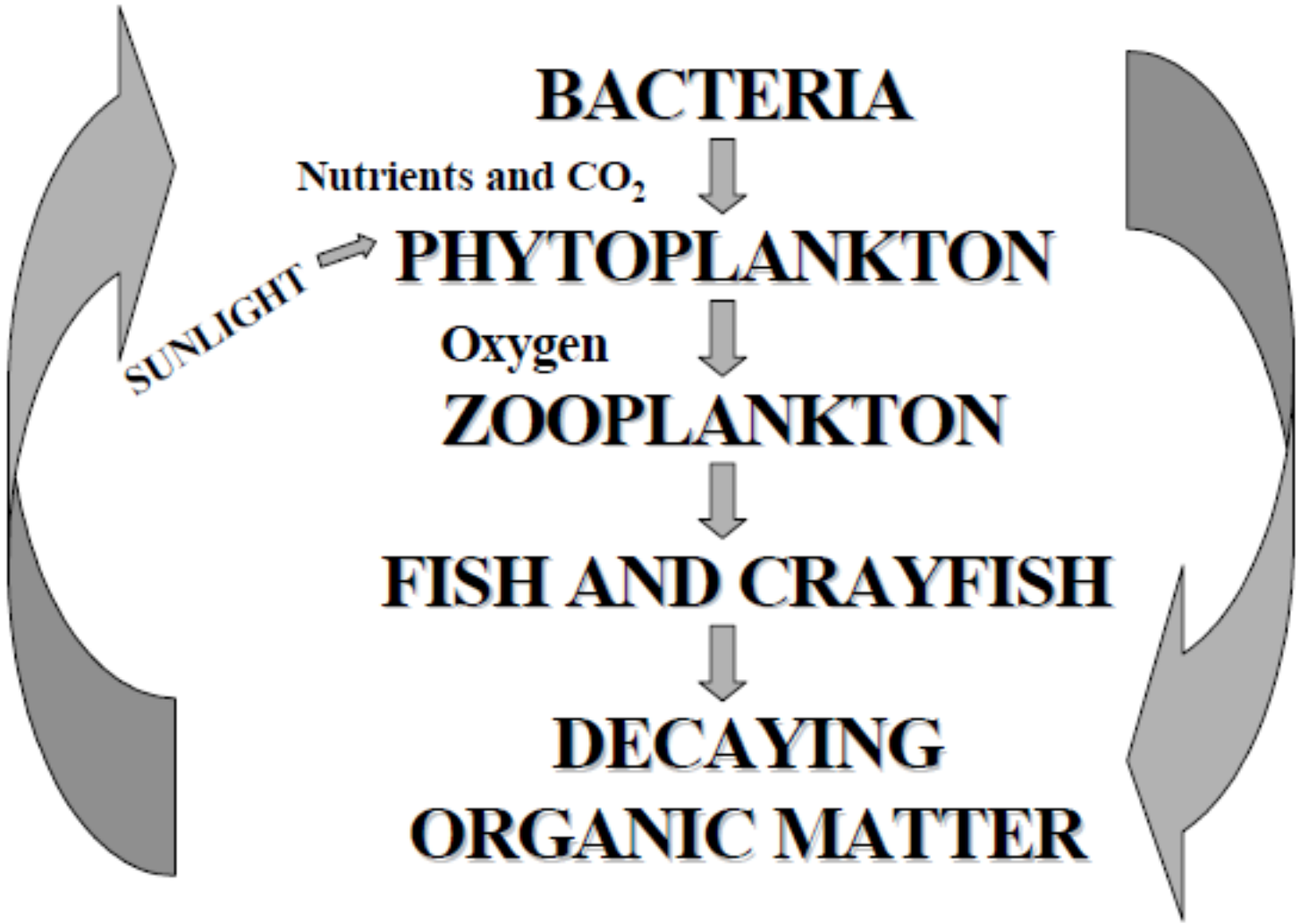
Fundamentals for optimal performance and on-farm disease prevention and control

- Good husbandry
- Good nutrition
- Good genetic stock
- Good management
- Good environment
- Good bio-security





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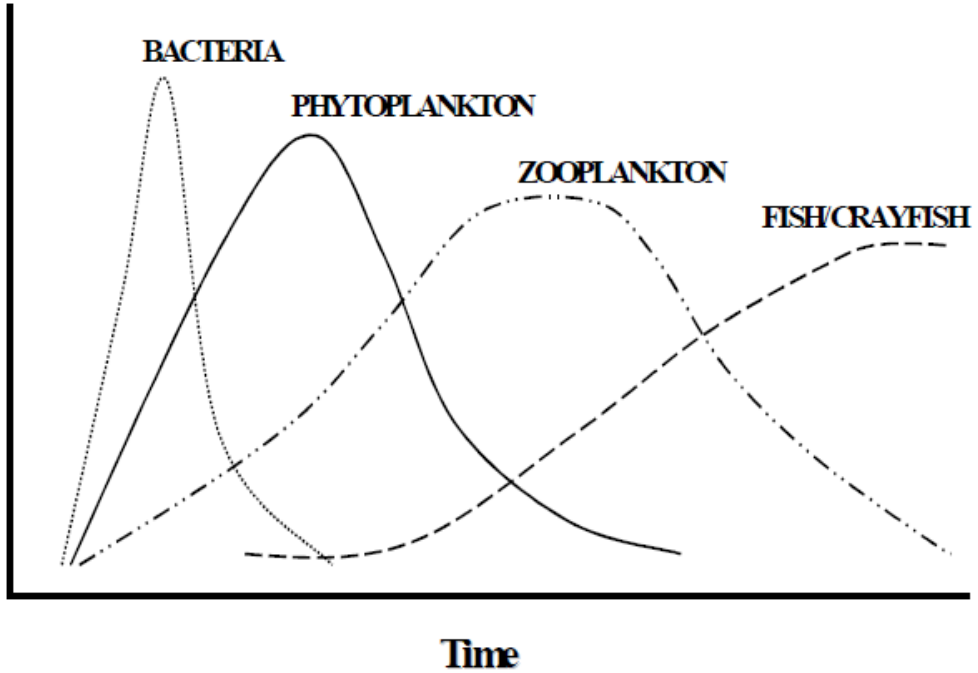
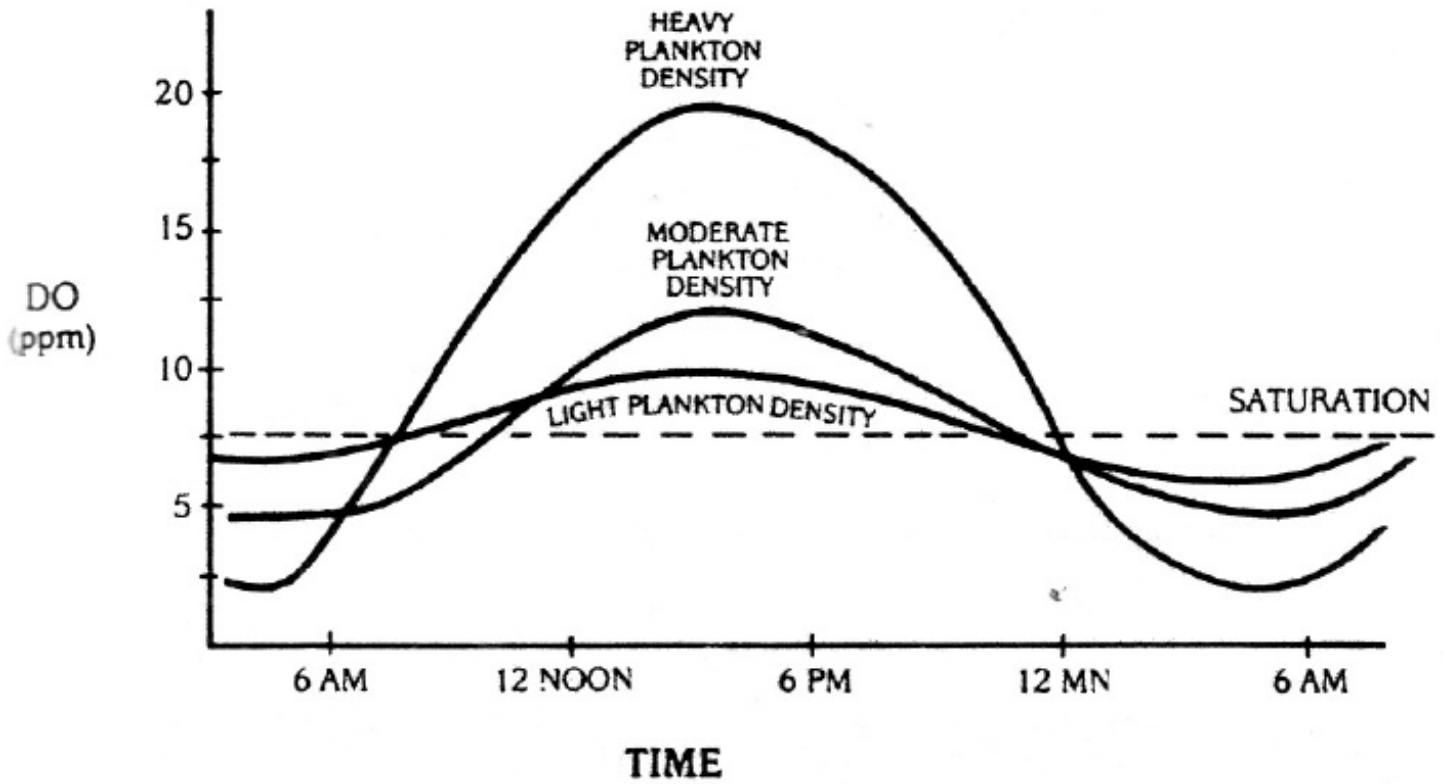
Succession

- The aquatic organisms within an aquaculture pond will vary over time
- It is therefore important to have a good understanding of the population dynamics within your pond to stabilise population numbers of aquatic organisms and to ensure that the system will not crash.



Changes in Oxygen level due to different algae density



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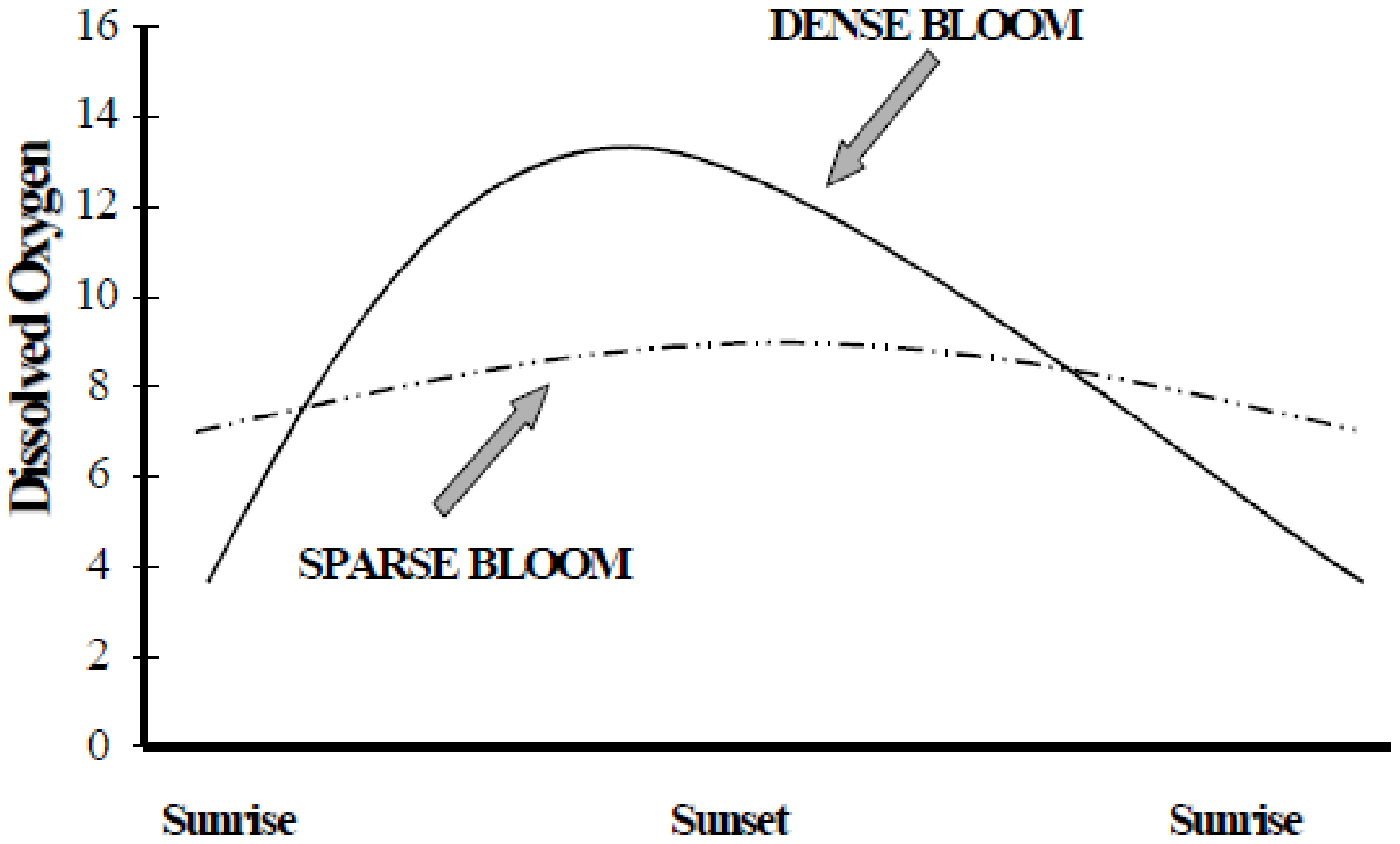
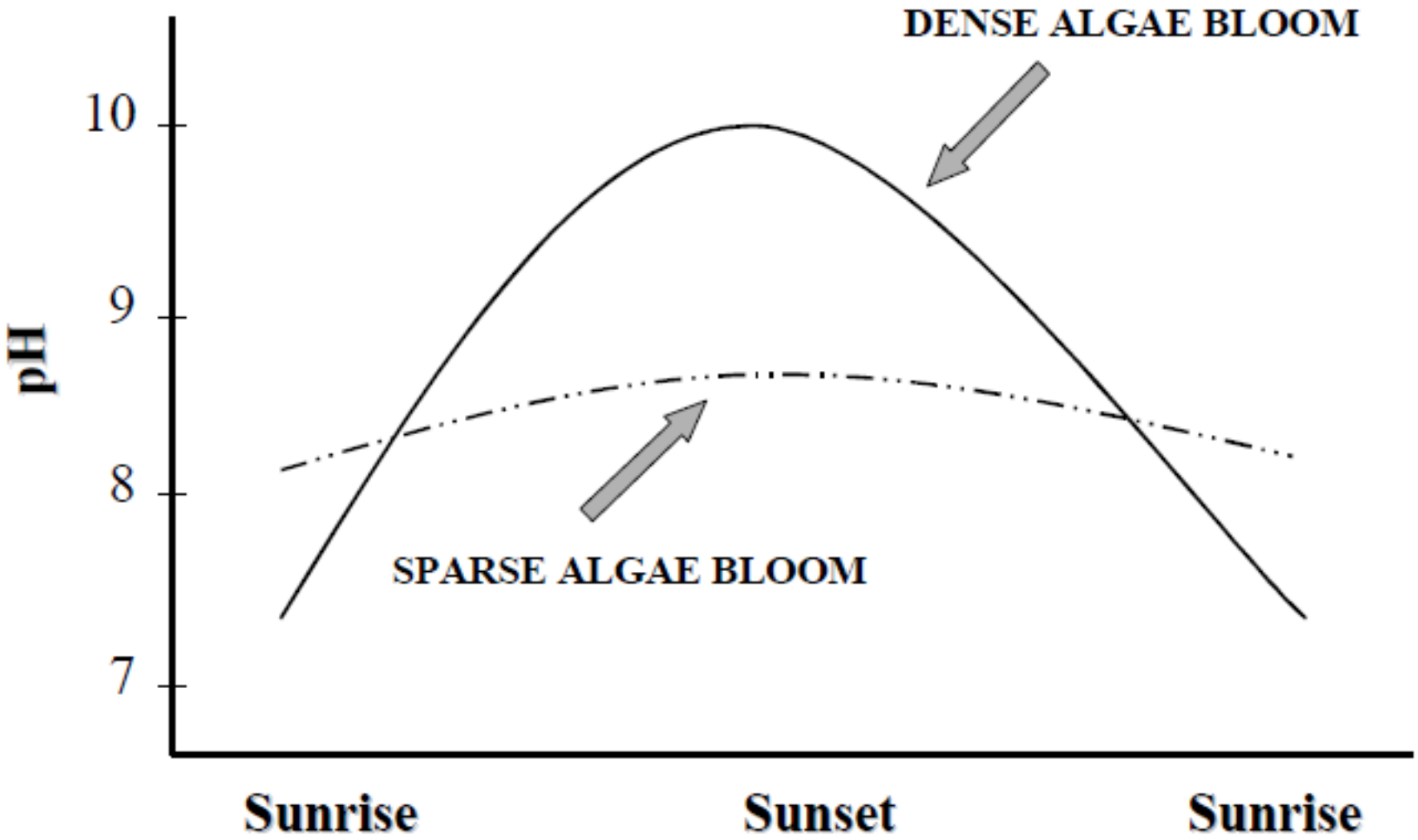
Oxygen dynamics

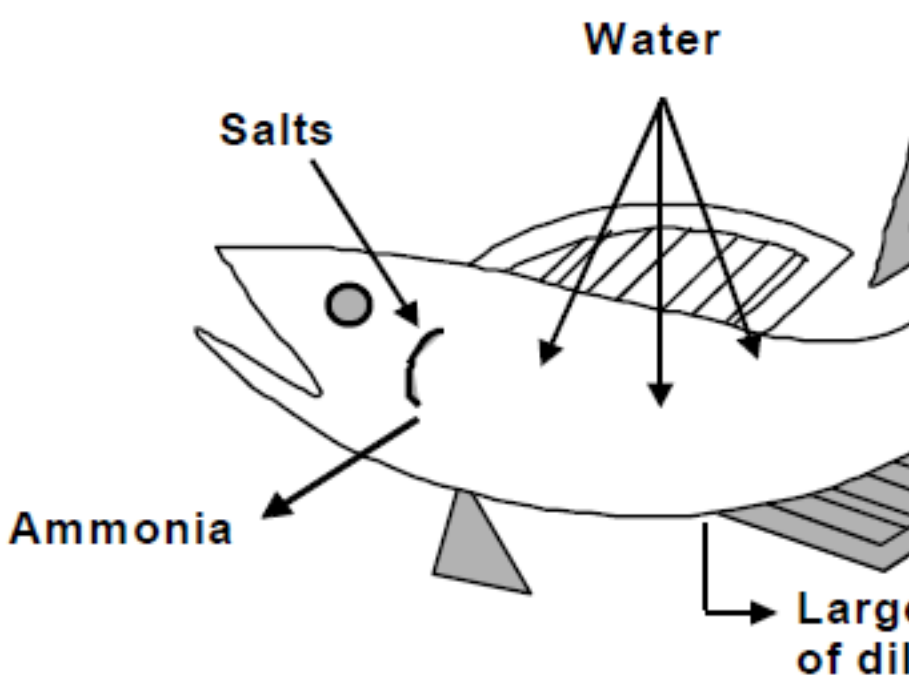


pH daily fluctuations

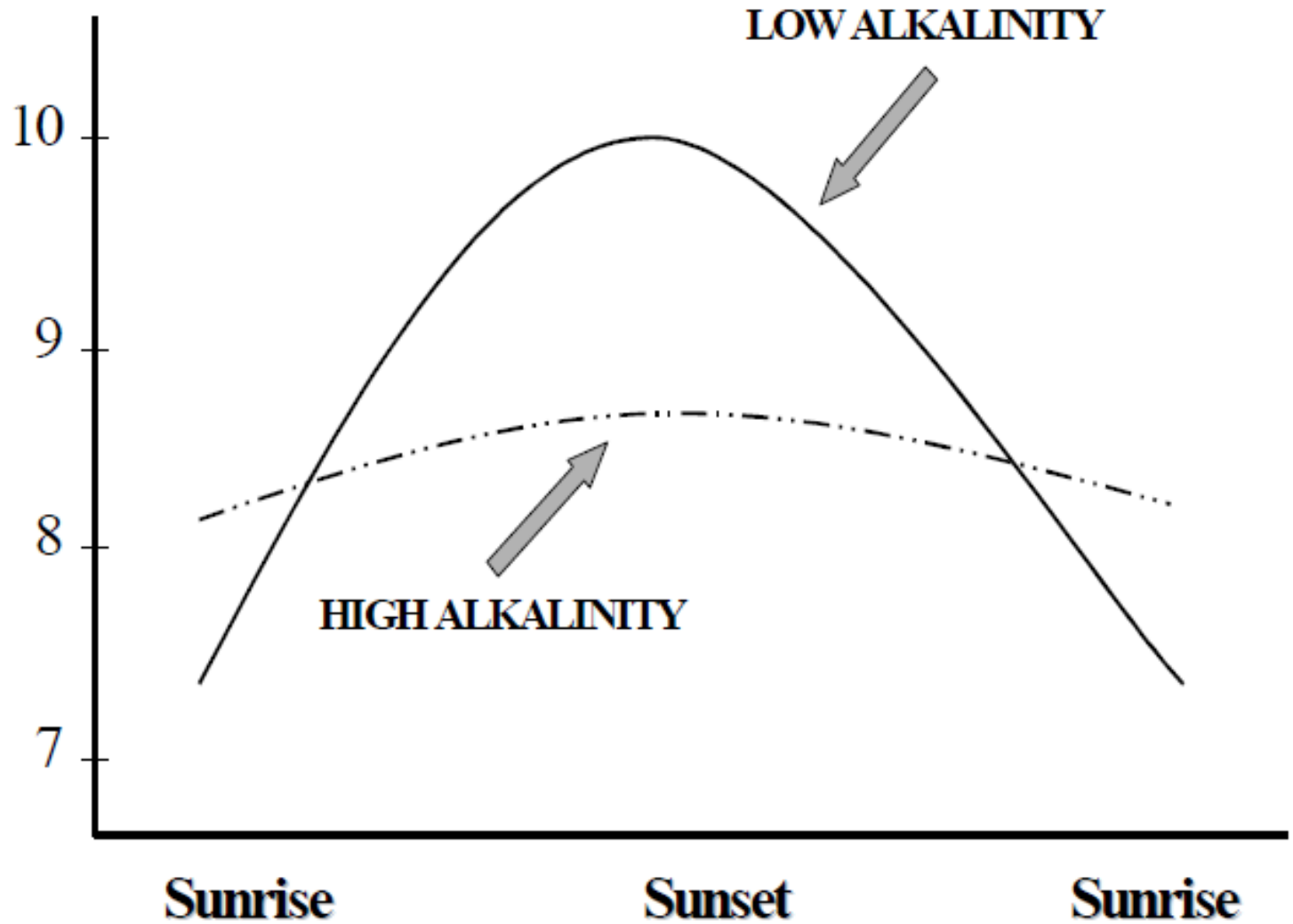


Osmoregulation

- A freshwater fish will gain water via osmosis.
- Excess water is excreted in the urine and ion uptake is through the gills
- If salinity is too high, the fish will start to lose water to the environment. As freshwater fish are not physiologically adapted to osmoregulate within a saline water source, decreased growth and survival can occur under these conditions



Alkalinity changes in different types of pond



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Water quality limits

Element	Form in Water	Desired Concentration
Oxygen	Molecular Oxygen (O_2)	5 – 15 mg/l
Hydrogen	H^+ [$-\log(H^+) = pH$]	PH 7 – 9
Nitrogen	Molecular Nitrogen (N_2) Ammonium (NH_4^+) Ammonia (NH_3) Nitrate (NO_3^-) Nitrite (NO_2^-)	Saturation or less 0.2 – 2 mg/l < 0.1 mg/l 0.2 – 10 mg/l < 0.3 mg/l
Sulfur	Hydrogen Sulfide (H_2S) - rotten egg gas Sulfate (SO_4^-)	Not detectable 5 – 100mg/l
Carbon	Carbon Dioxide (CO_2)	1 – 10 mg/l
Calcium	Calcium Ion (Ca^{2+})	5 – 100 mg/l Can be higher in crustacean ponds
Magnesium	Magnesium ion (Mg^{2+})	5 – 100 mg/l
Sodium	Sodium ion (Na^+)	2 – 100 mg/l
Potassium	Potassium ion (K^+)	1 – 10 mg/l
Bicarbonate	Bicarbonate ion (HCO_3^-)	50 – 300 mg/l

Boyd (1998) "Water Quality for Pond Aquaculture"

Water quality limits

Element	Form in Water	Desired Concentration
Carbonate	Carbonate ion (CO_3^{2-})	0 – 20 mg/l
Chloride	Chloride ion (Cl^-)	1 – 100 mg/l
Phosphorus	Phosphate ion (HPO_4^{2-} , $H_2PO_4^-$)	0.005 – 0.2 mg/l
Silicon	Silicate ion (H_2SiO_3 , $HSiO_3^-$)	2 – 20 mg/l
Iron	Ferrous iron (Fe^{2+}) Ferric iron (Fe^{3+}) Total iron	0 mg/l Trace 0.05 – 0.5 mg/l
Manganese	Manganese ion (Mn^{2+}) Manganese dioxide (MnO_2) Total manganese	0 mg/l Trace 0.05 – 0.2 mg/l
Zinc	Zinc ion (Zn^{2+}) Total zinc	< 0.01 mg/l 0.01 – 0.05 mg/l
Copper	Copper ion (Cu^{2+}) Total copper	< 0.005 mg/l 0.005 – 0.01 mg/l
Boron	Borate (H_3BO_3 , $H_2BO_3^-$)	0.05 – 1 mg/l

Boyd (1998) "Water Quality for Pond Aquaculture"