



O

Edward Butler, AIMS-NT




AIMS: Australia's tropical marine research agency.



V

- Oceans cover >70% of planet
- Life began in the oceans
- Still an unexplored frontier
- It's interesting and gets you places others don't...!

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Halifax -vs- Bergen

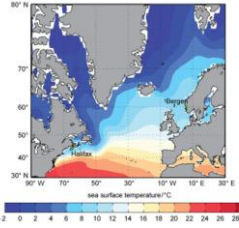
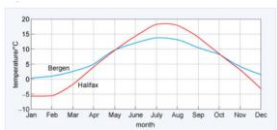




Figure 2 Monthly mean atmospheric temperatures for Bergen, Norway and Halifax, Nova Scotia.

'The Gulf Stream'

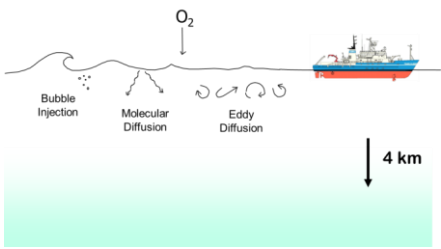
UK Open University - The Oceans

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How to get oxygen to the bottom?



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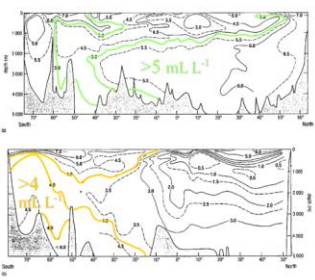


O


a)

b)

Sections showing dissolved oxygen (mL L^{-1}) in (a) western Atlantic and (b) Pacific (~ 170° W)

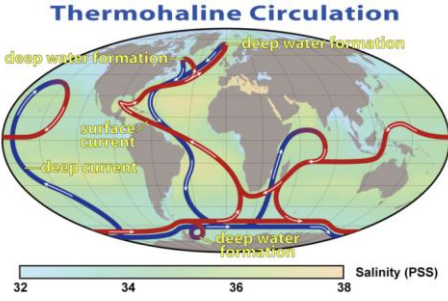


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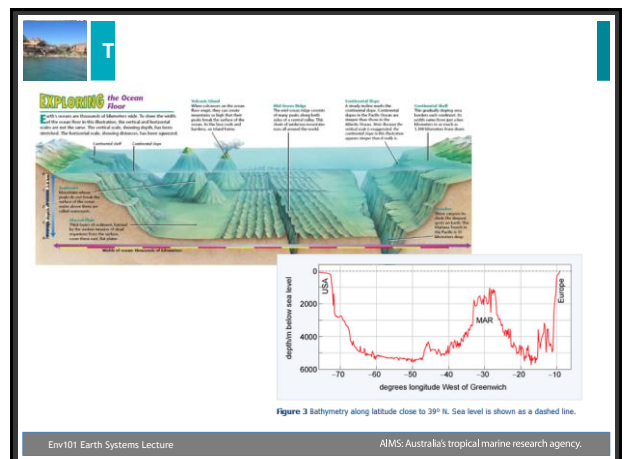
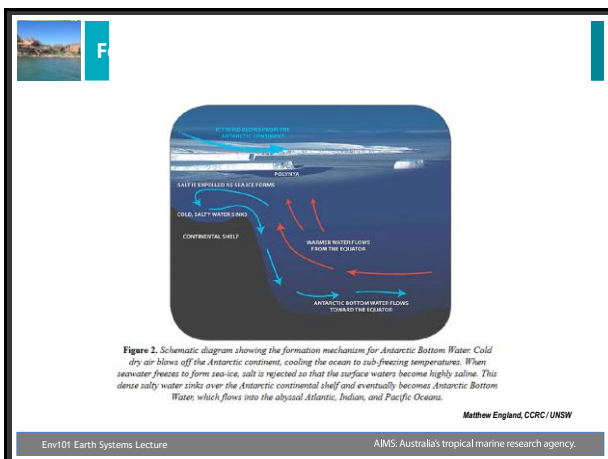
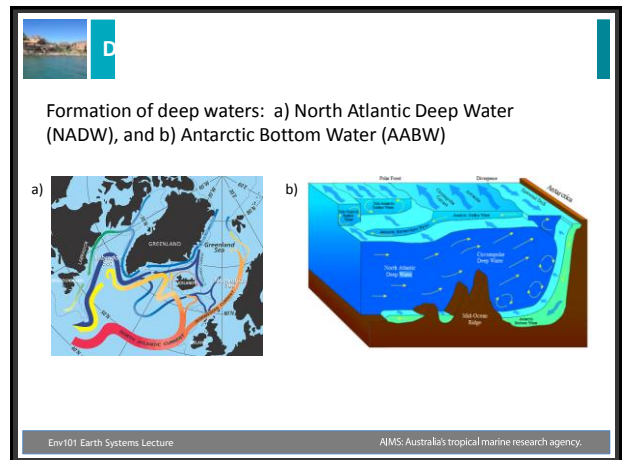
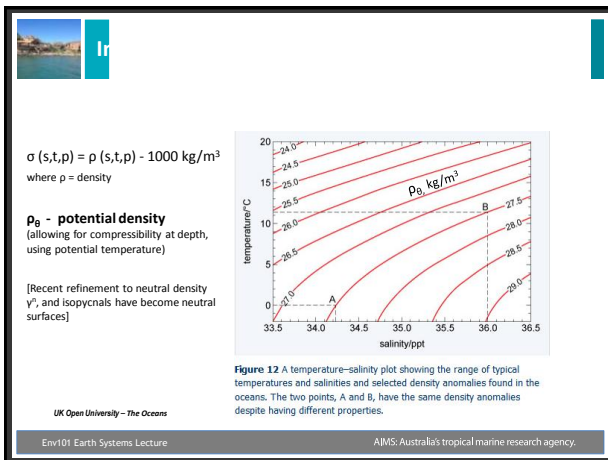
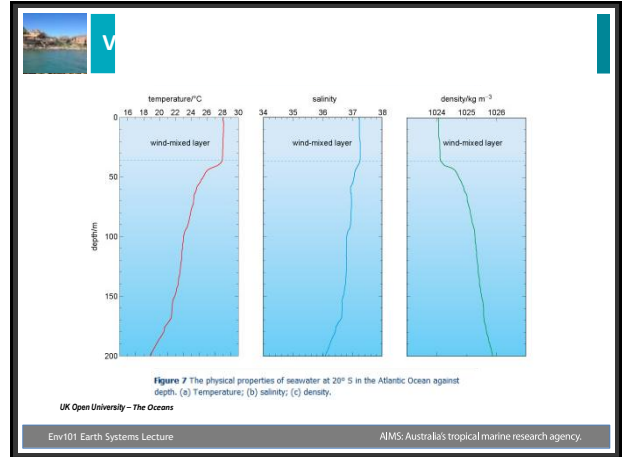
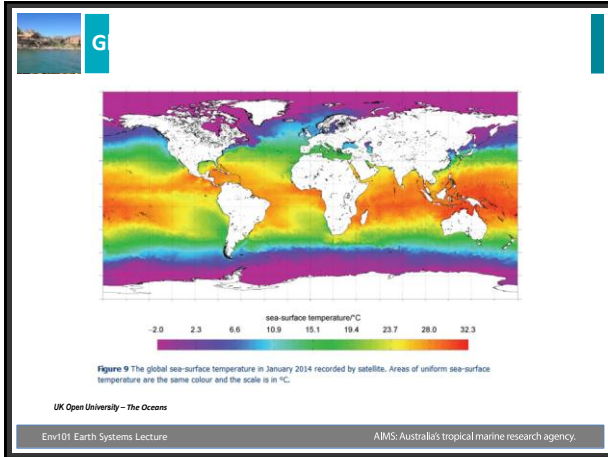
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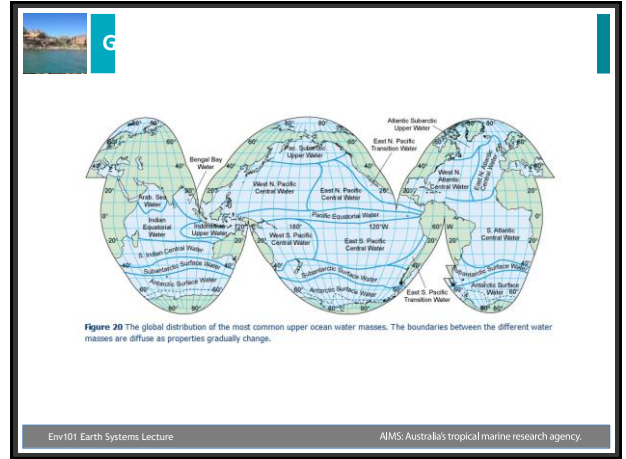
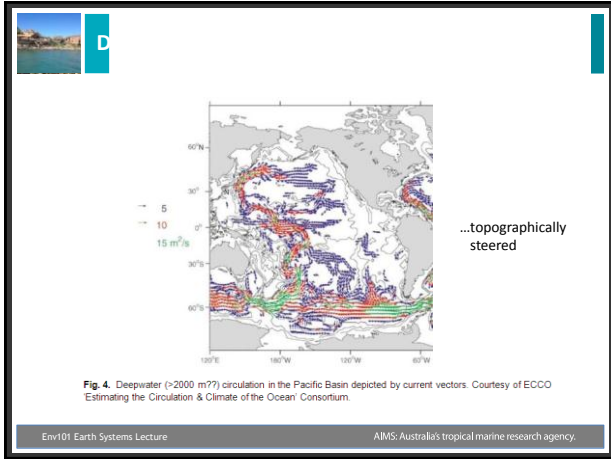
Thermohaline Circulation



Robert Simmon / Robert A. Rohde NASA.

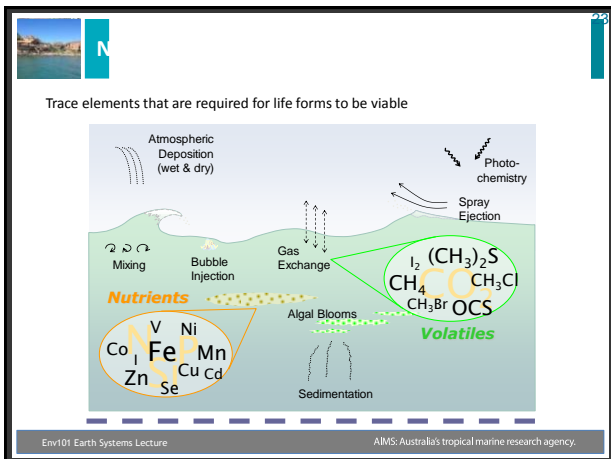
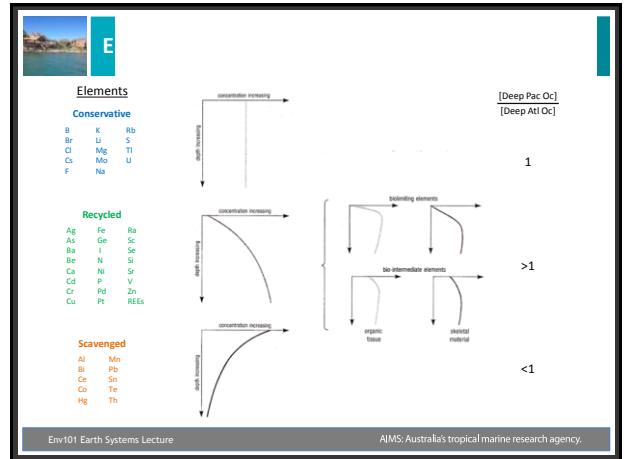
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Chemical Oceanography

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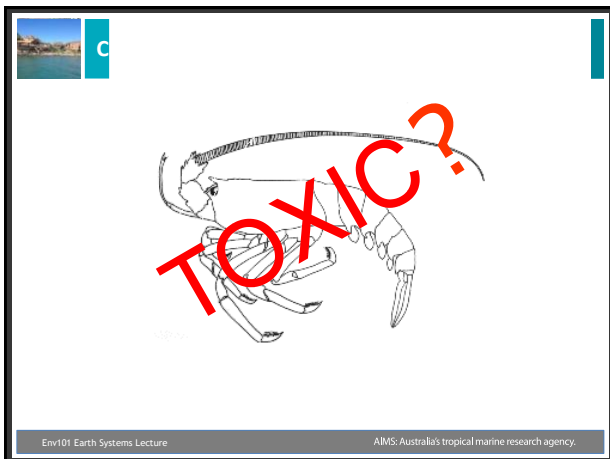
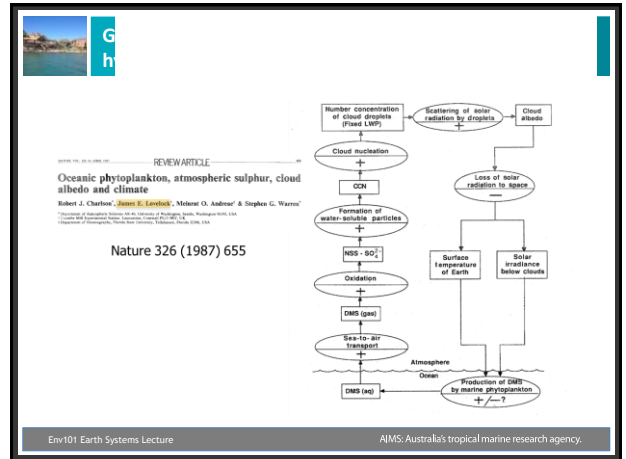
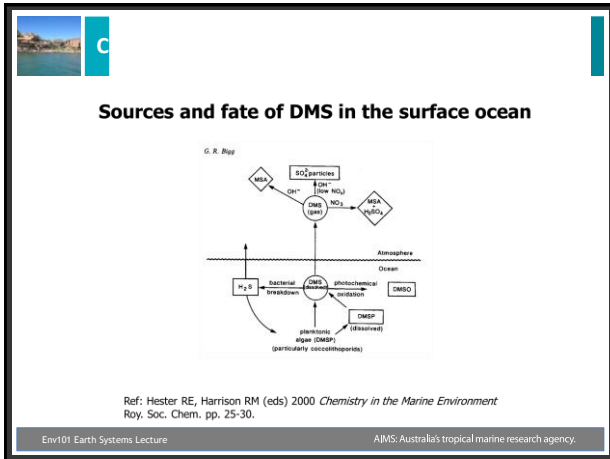
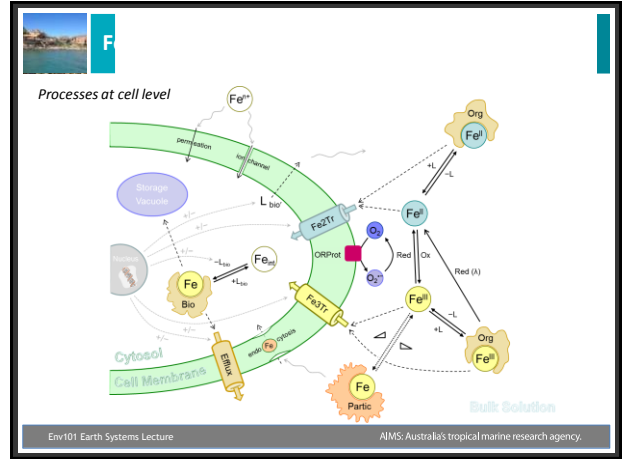
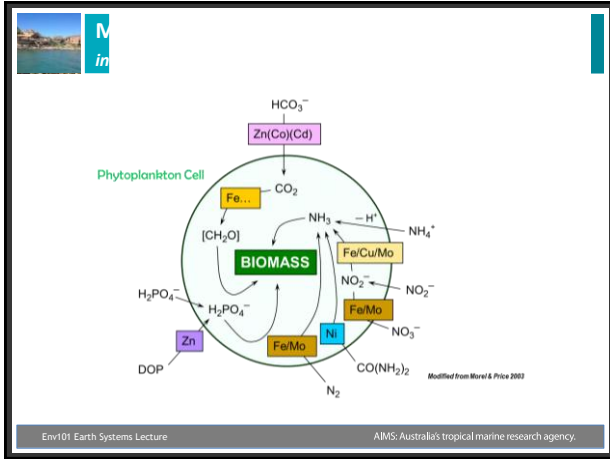


N

- ▶ **Nutrient ratios** ('ecological stoichiometry') are pivotal in determining what nutrients are limiting to primary production
- ▶ **Redfield ratio:**
 $C_{106}H_{263}O_{110}N_{16}P_1S_{0.7}Si_yMe_z$
- ▶ **Marine macronutrients:** N, P and Si (c.f. terrestrial: N, P, K)
- ▶ Estuaries are often N-limited, i.e. N:P < 16

Alfred C Redfield 1890-1983

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As_T = 13–27 nM (1–2 μg As/L)

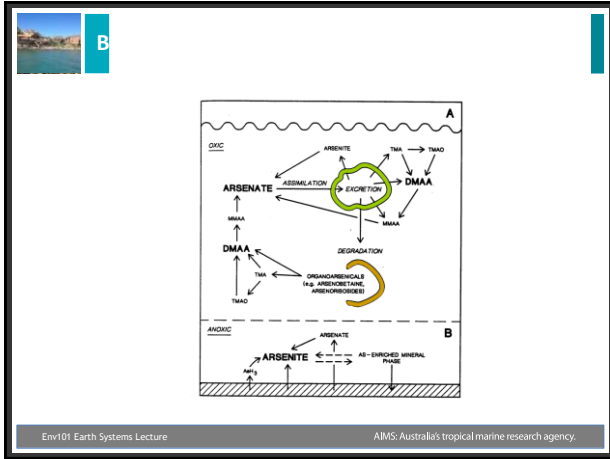
HAsO_4^{2-}

 $\text{As}(\text{OH})_3$ $(\text{CH}_3)_2\text{AsOO}^-$
 (AsH_3) $\text{CH}_3\text{AsO}(\text{OH})\text{O}^-$
 $(\text{CH}_3)_3\text{AsO}$
 ...
 ...

Other As species in marine biota

$(\text{CH}_3)_3\text{As}^+\text{CH}_2\text{COO}^-$ arsenobetaine
 $(\text{CH}_3)_2\text{As}^+\text{CH}_2\text{CH}_2\text{OH} \cdot \text{Cl}^-$ arsenocholine
 $(\text{CH}_3)_3\text{As}$ trimethylarsine

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M

A) methyl arsenicals (MMA, DMA, etc.)
 phosphate vs. arsenate

For marine biota (phytoplankton, etc.), methylation of arsenic is a **detoxification** mechanism to protect phosphorus biochemical pathways (and also sulfur-containing enzymes).

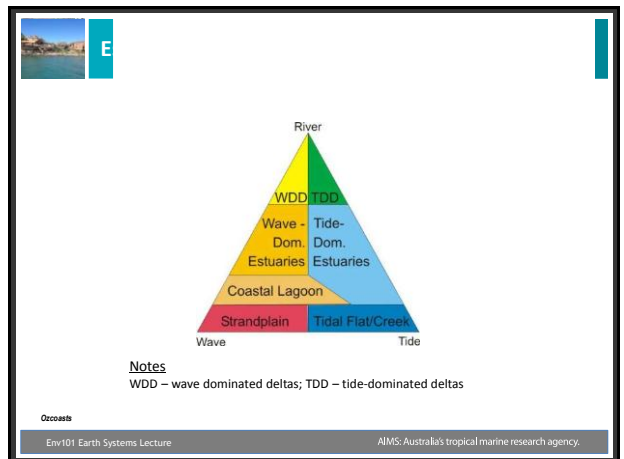
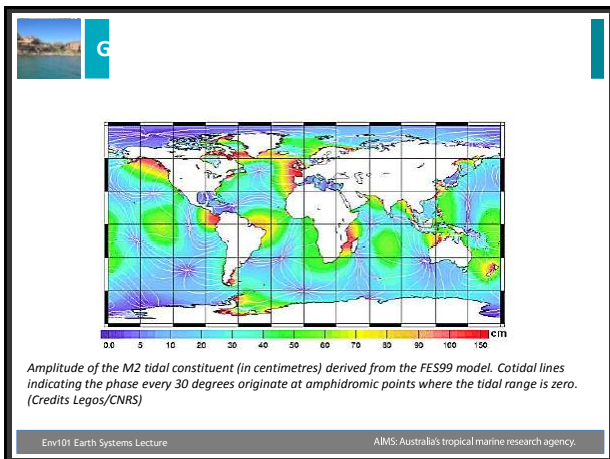
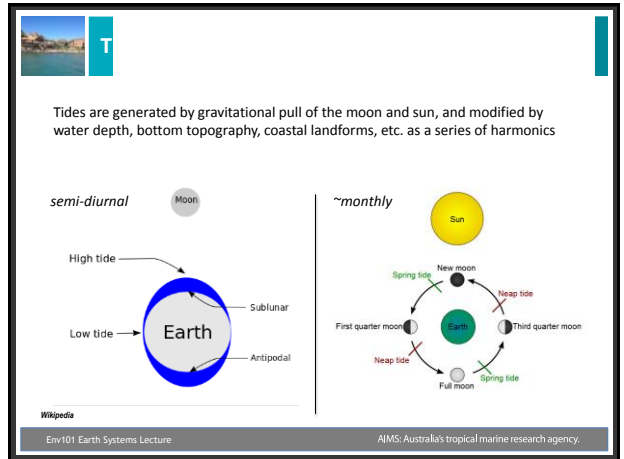
B) other org-As compounds (arsenobetaine, arseno-sugars, etc.)
 – critical compound in biosynthetic pathway is said to be
arsenocholine: $(\text{CH}_3)_3\text{As}^+\text{CH}_2\text{CH}_2\text{OH}$ c.f. $(\text{CH}_3)_3\text{N}^+\text{CH}_2\text{CH}_2\text{OH}$
 OH^- OH^- choline

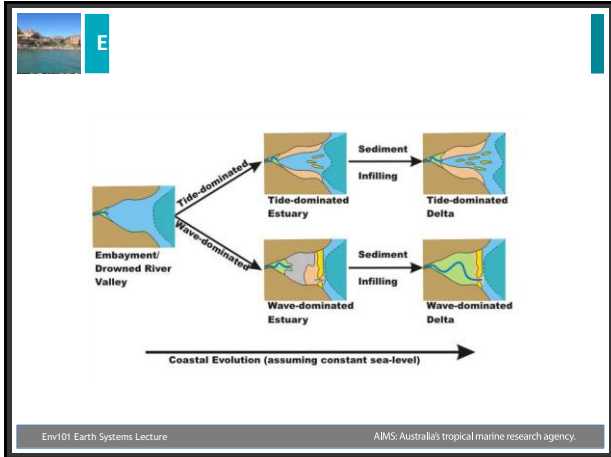
In this instance, arsenic is "mimicking" nitrogen in its intracellular pathways.

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Land-Sea Interactions (Coastal Processes)

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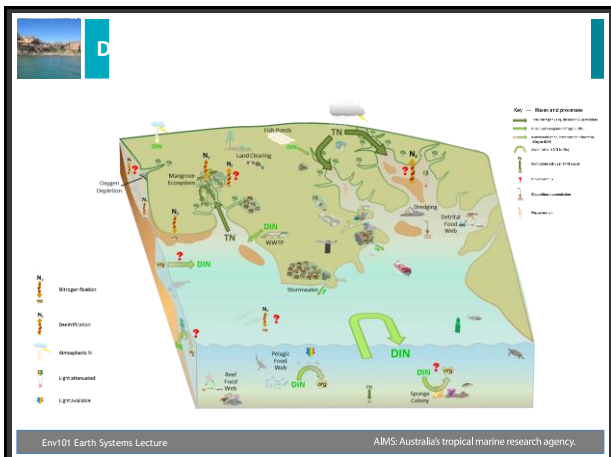
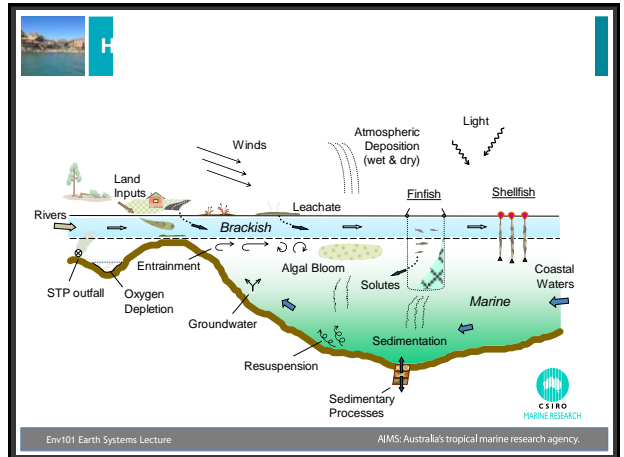
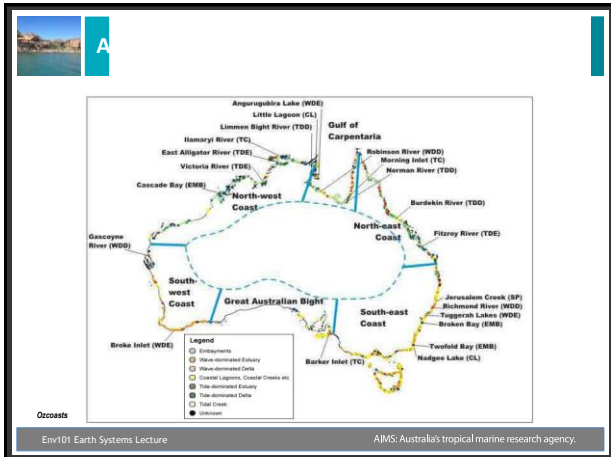


T

	Type of Coastal Waterway	Mixing
	Tide-dominated Delta	High
	Wave-dominated Delta	Low
	Tide-dominated Estuary	High
	Wave-dominated Estuary	Low
	Tidal Creeks	High
	Strandplains/Coastal Lagoons	Low
	Embayments/Drowned River Valleys	Low

Occoasts

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- Wm**
- Climate science
 - Air-sea interactions
 - Coral reefs
 - Seagrass and dugongs
 - Charismatic megafauna: sharks, whales, turtles, ...
 - Marine microbiology: bacteria and viruses
 - Coastal geomorphology
 - Sedimentology
 - Environmental modelling
 - Pollution
 - Polar regions
 - ...
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