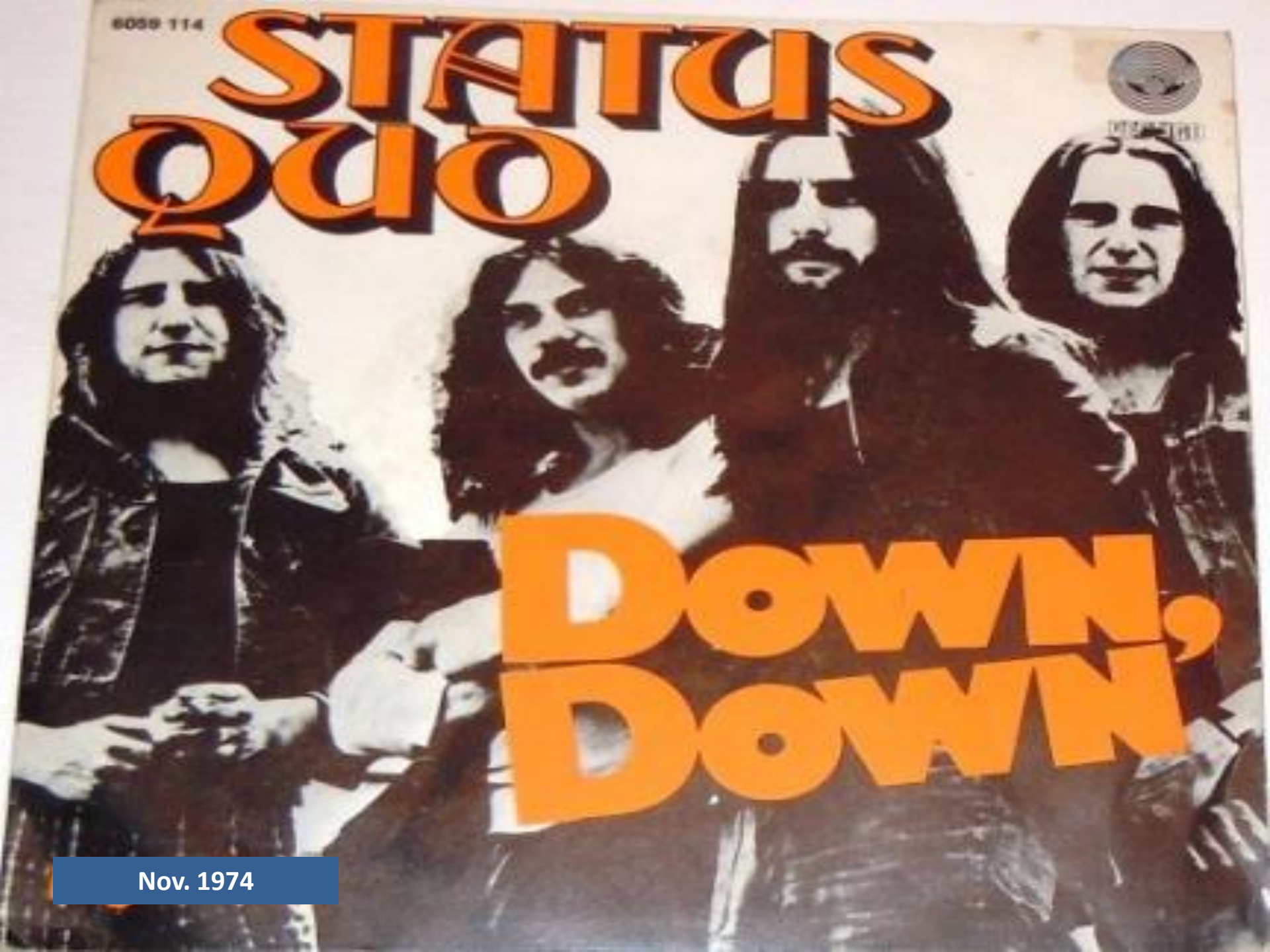
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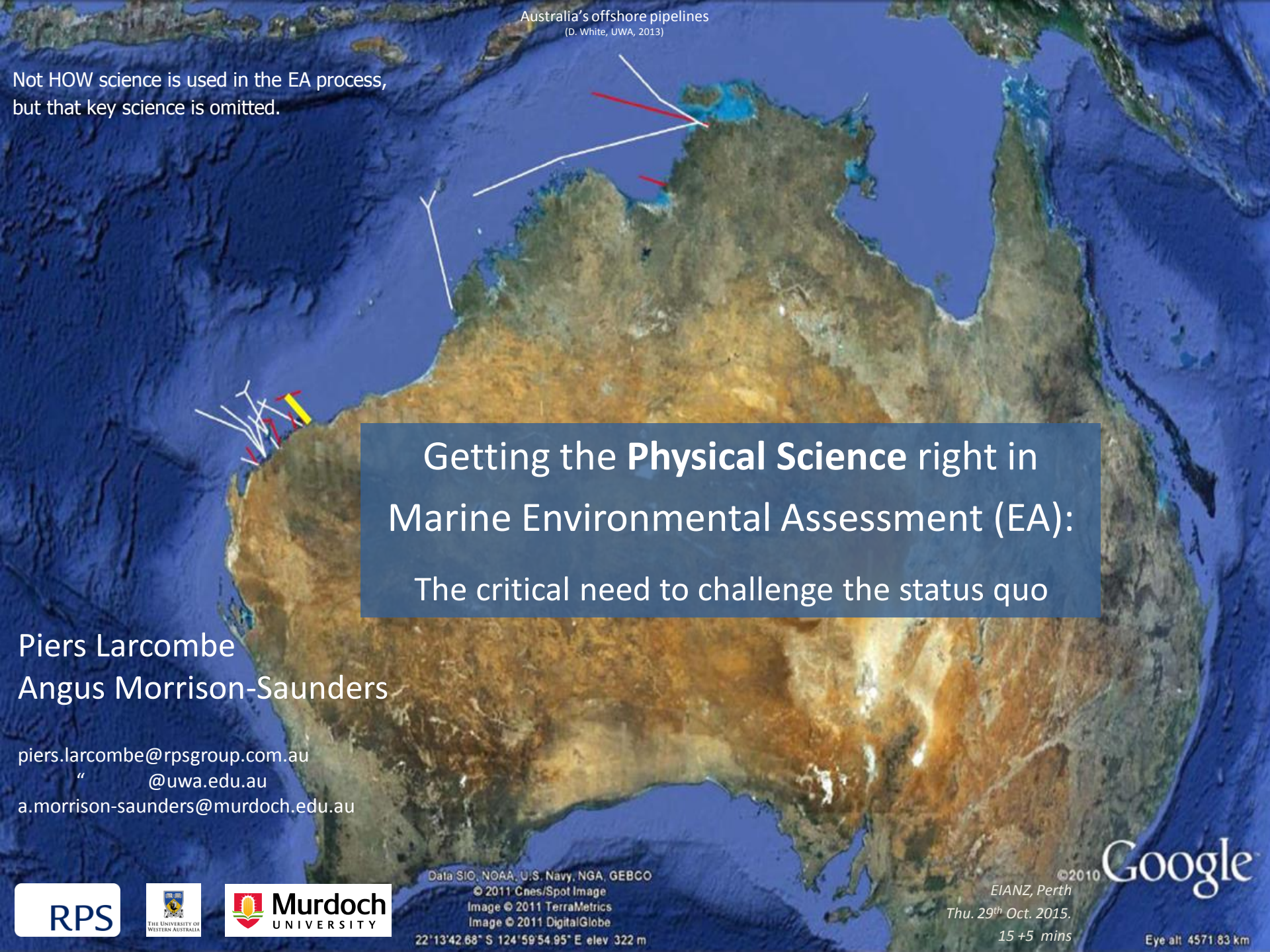

Not HOW science is used in the EA process,
but that key science is omitted.

Getting the **Physical Science** right in Marine Environmental Assessment (EA):

The critical need to challenge the status quo

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RPS

The University of Western Australia

Murdoch University

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
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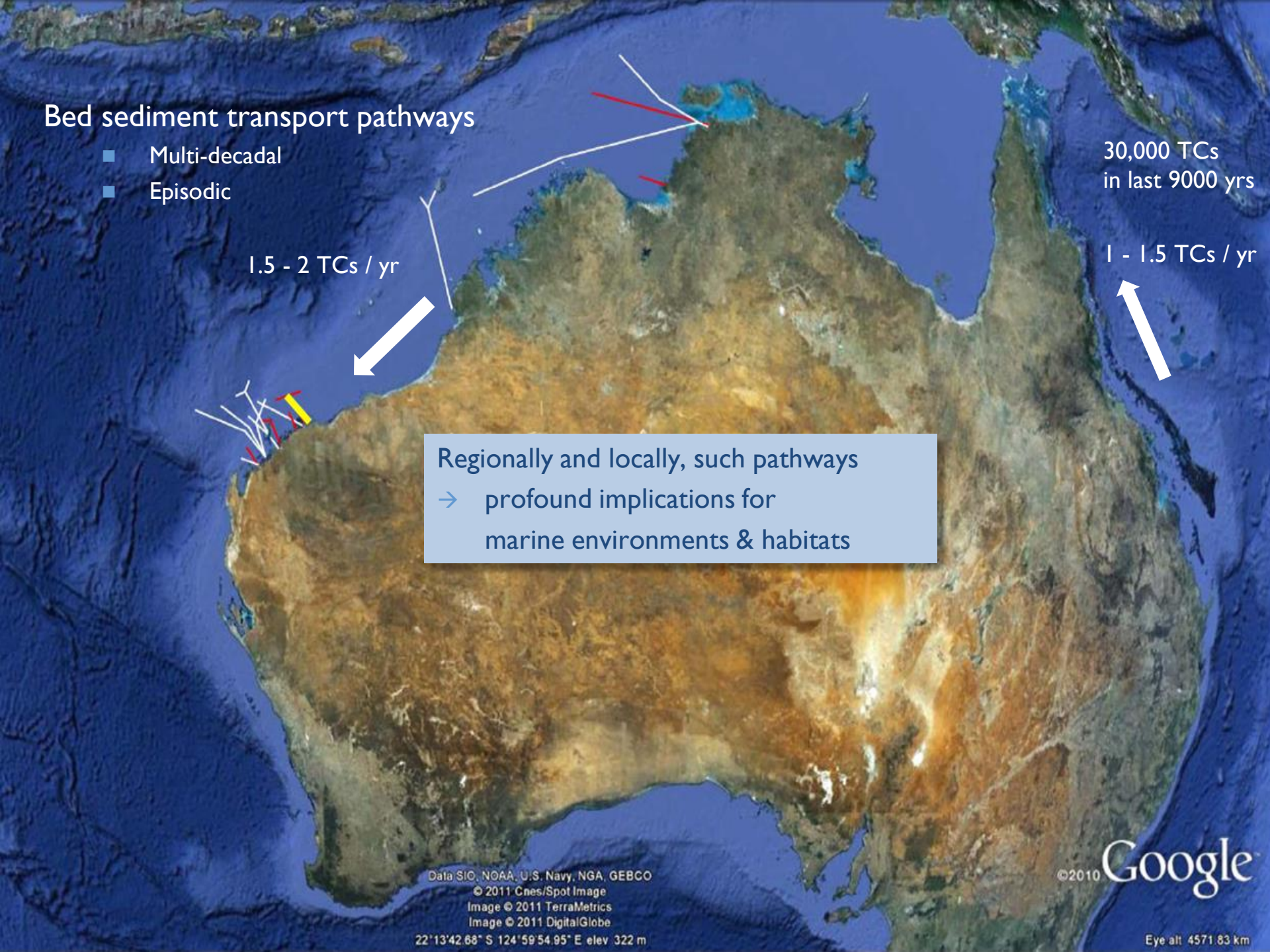
22°13'42.68" S 124°59'54.95" E elev 322 m

©2010 Google

Eye alt 4571.83 km

EIANZ, Perth
Thu. 29th Oct. 2015.
15 +5 mins


Bed sediment transport pathways
Multi-decadal
Episodic
1.5 - 2 TCs / yr
30,000 TCs
in last 9000 yrs
1 - 1.5 TCs / yr
Regionally and locally, such pathways
→ profound implications for
marine environments & habitats
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
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22°13'42.68" S 124°59'54.95" E elev 322 m
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Bed sediment transport pathways

– what are they?

Analogy: Traffic ≡ bed sediment grains
Roads ≡ transport pathway

Parks, reserves, lakes don't have cars

- ≡ sediment-free habitats.

Road Network

- Completely inter-connected
- Empty road ≡ lag surface
- Busy road ≡ sediment present
- Traffic jam ≡ sediment immobile.

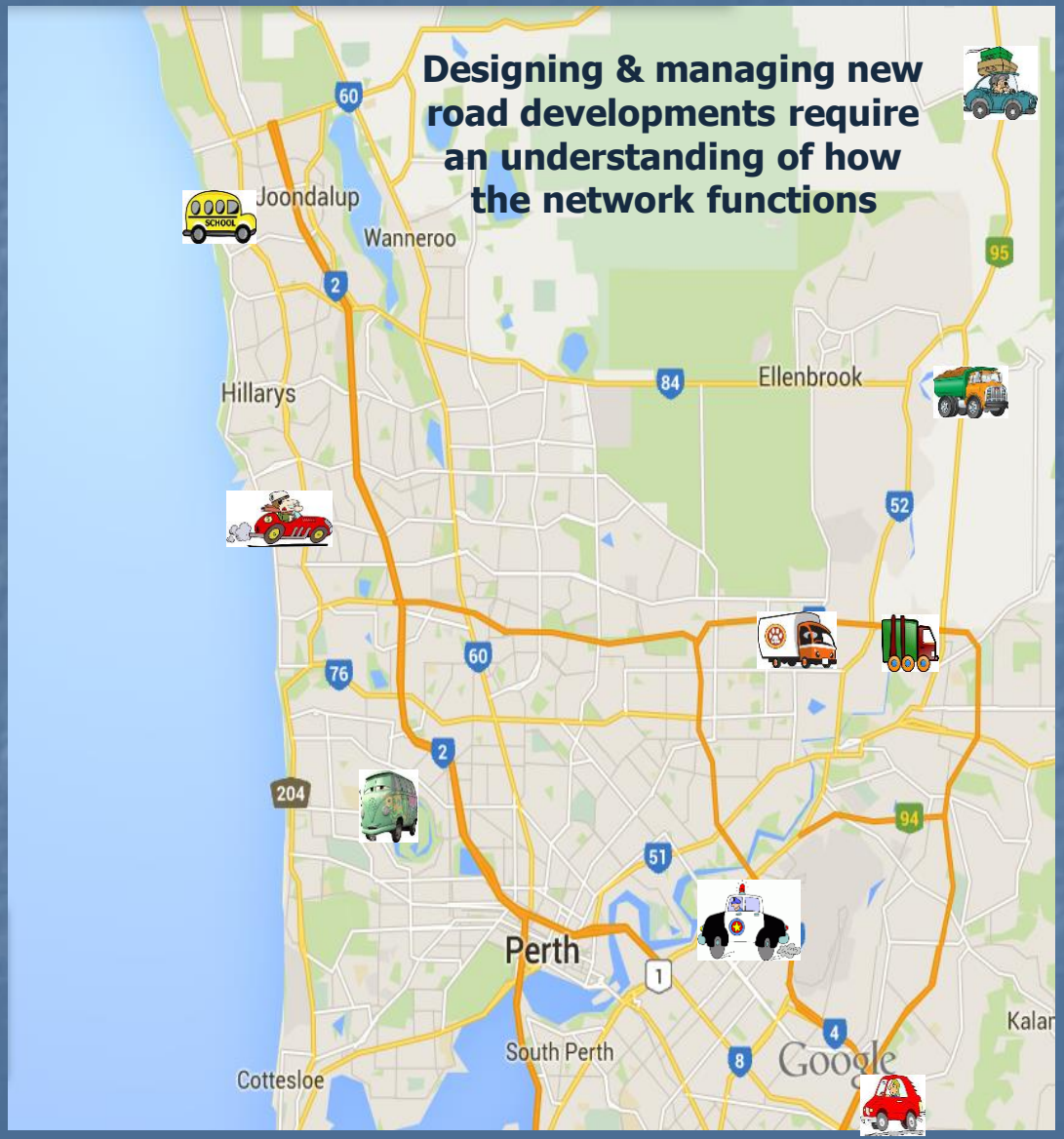
KEY is that each road type

- ≡ different benthic habitat.

... each (habitat) controlled by:

- the nature of traffic
- & the long-term net movement of vehicles.

So ... EA **requires** us to know how sediment moves through the system, controlling habitats



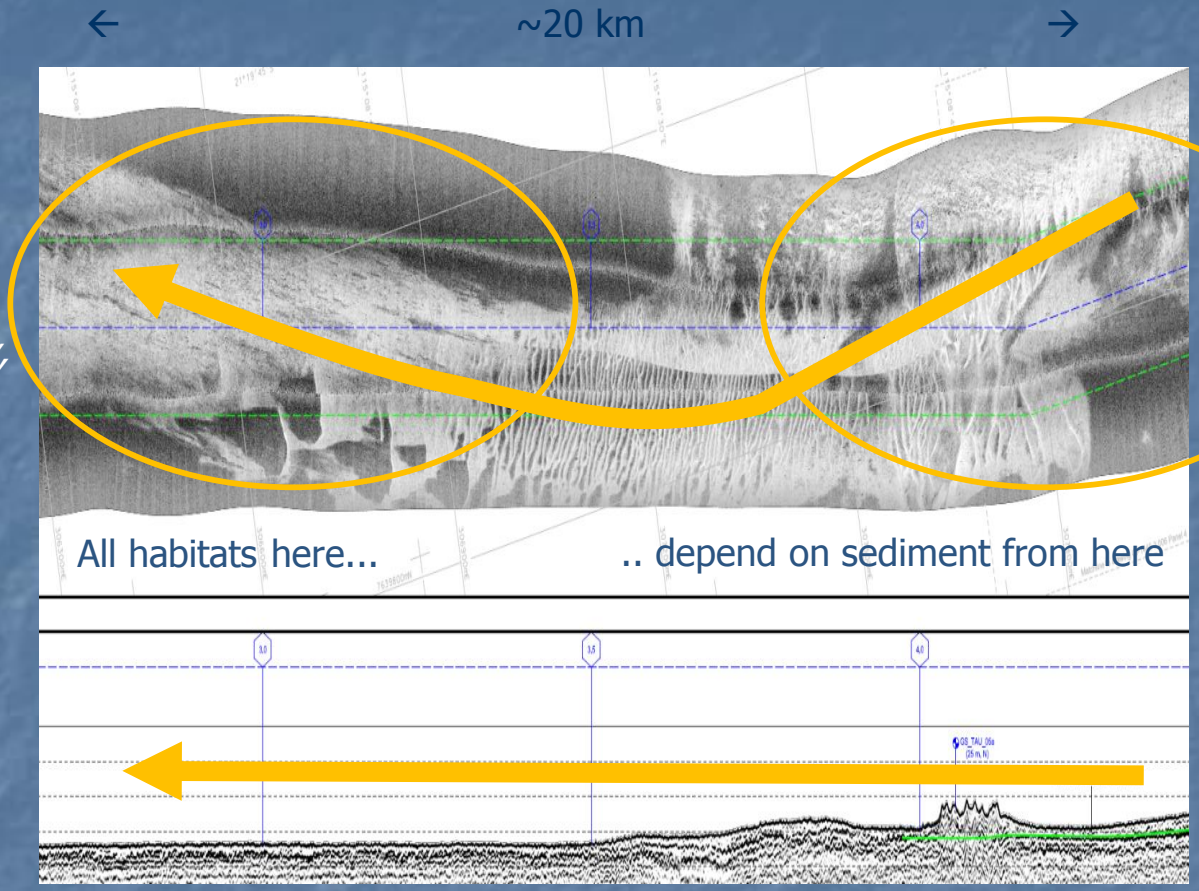
Habitat = *f* (sediment transport pathway)

Key aspects:

- *Sediment type*
- *Presence / absence*
- *Mobility (magnitude, frequency, nature)*
- *Thickness*
- *Form (micro-habitats)*

Superposed & related are:

- *Biology*
- *Chemistry*
- *etc*



Most marine habitats = sediment-dependent (type, presence, absence, mobility, etc)

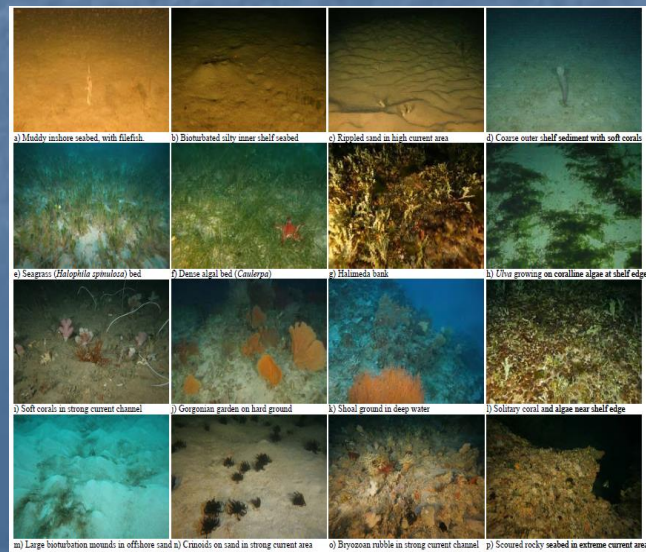
- Mangroves
  - open coasts
  - & in deltaic systems

- Seagrass beds
  - In mobile sands
  - & in muddy embayments.

- Most reef flats

- Detrital coral communities
  (turbid-zone reefs)

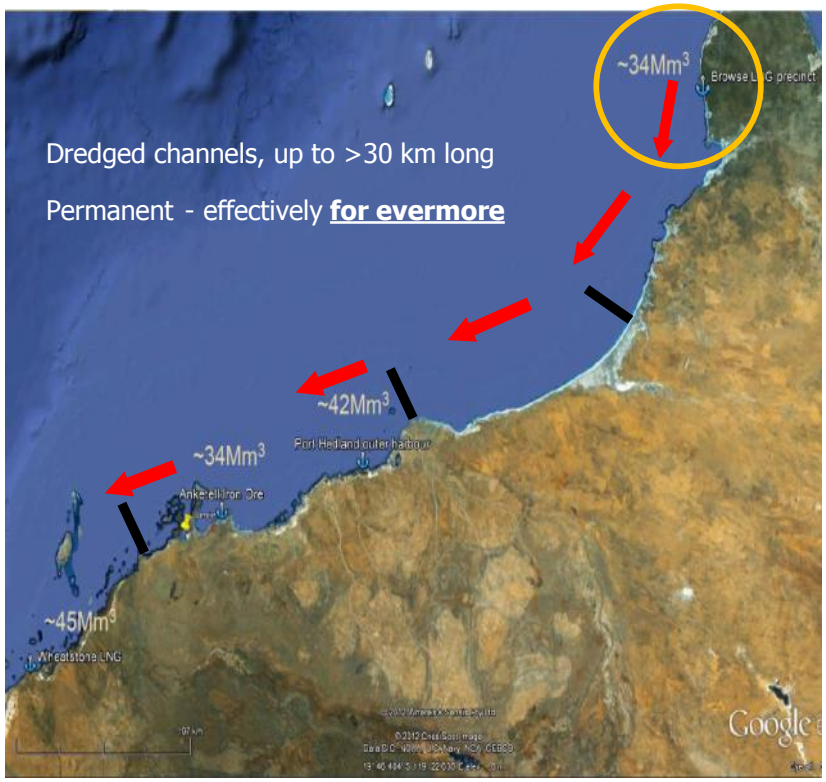
- Middle-shelf benthic systems



The importance of physical science:

1: James Price Point

Northwest Shelf, Australia



Multi-decadal bed sediment pathway to SW

Reports from ~2007.
Surely all relevant information is clear by now!

RPS

The importance of physical science:

1: James Price Point

Large fields of sandwaves

<few m high & 600-1200 m long

→ southward bed sediment transport

7 km-long dredged channel...

Will cut entire nearshore transport pathway, risking:

→ removing surface sediments to S,

→ permanent habitat change

Would be an indisputable result of development, but issue missed in EA process. Why?

EA ♥ 'Characterisation' & 'Models'

Understanding & testing physical science

RPS

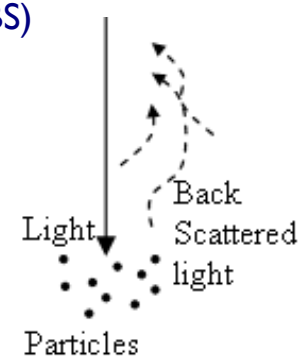
The importance of physical science:

2: Turbidity (NTU, FTU)

~25 years - mainstay of EA

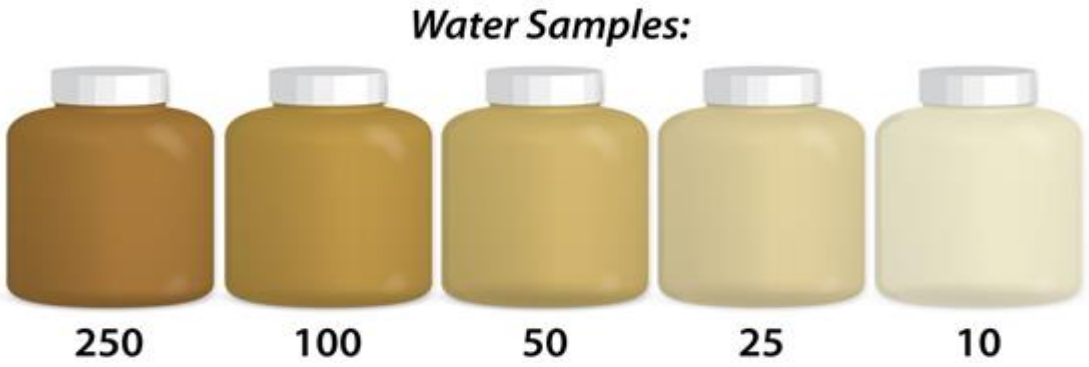
Q - Still useful for marine EA?

Optical backscatter (OBS)



Turbidity **ISN'T**

- TSS concentration (SPM)
- Light availability
- Sediment transport (or rate)
- Sediment flux to the seabed
- Etc

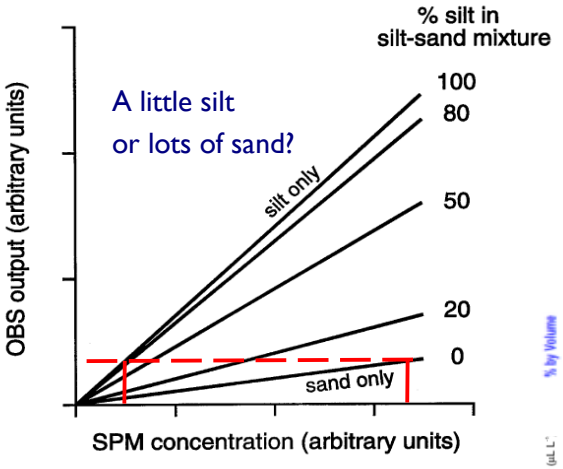


In natural environments:

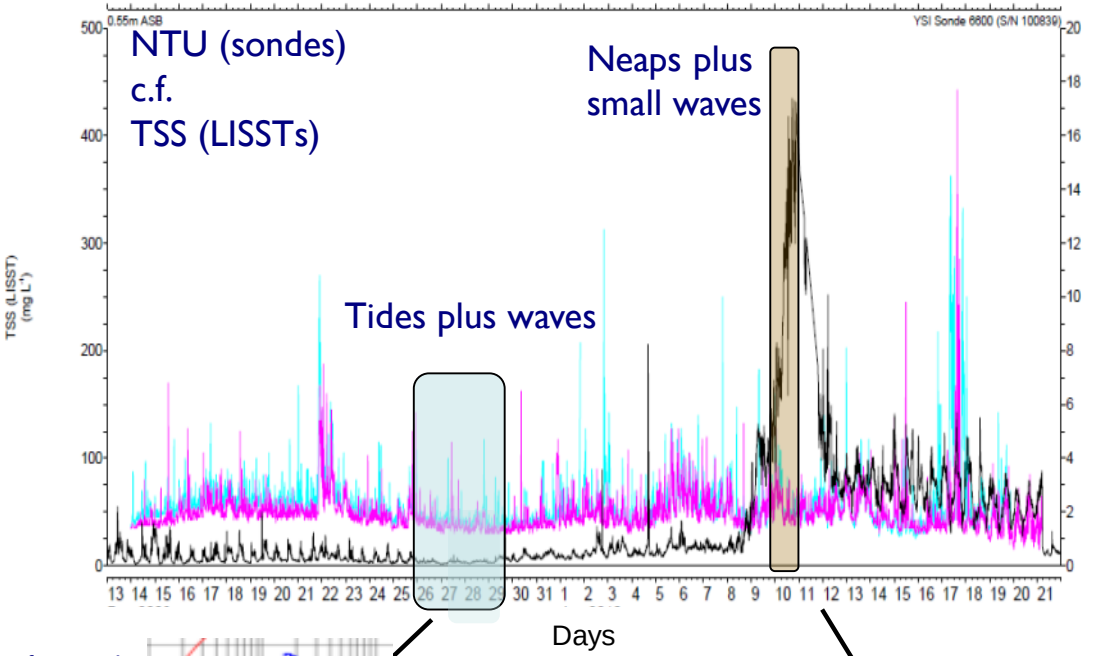
Turbidity = *f* [particle size, nature of PSD (esp. multimodal, i.e. mixtures), shape, surface roughness, flocculation, Refractive Index, composition, concentration...]

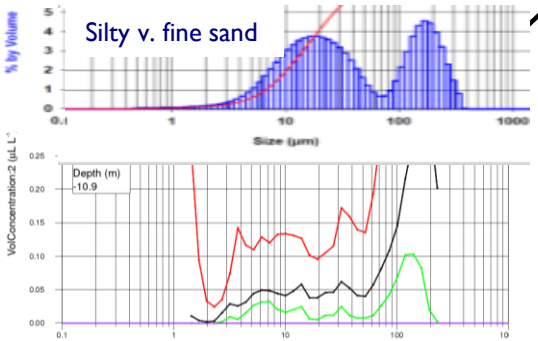
(Bunt et al., 1999)

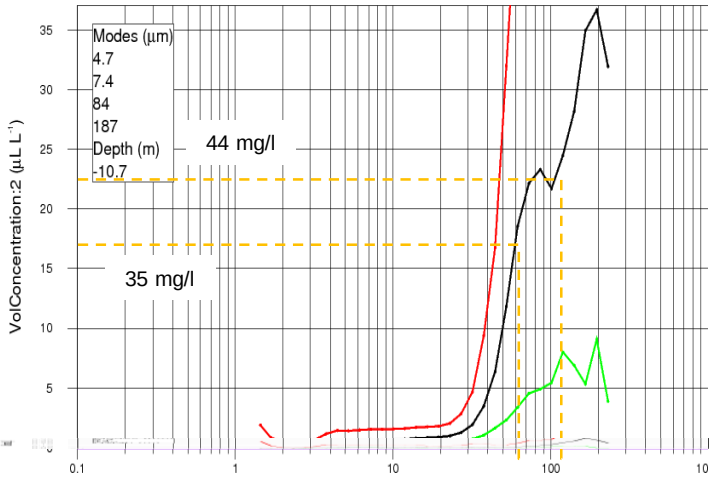
Turbidity...



Green & Boon, 1993







Issue = Can be blind to major sedimentary events, maybe of critical environmental relevance

Settling of
v. fine-medium sands
(63 - ~250 µm)
at concs. >100x

Quantitative use unjustified

Qualitative tool at best

Environmental Assessment

- Current Marine Regulatory & Guideline Documents

(e.g. dredging)

Key Federal document on dredging has limited physical & sedimentary science.

Similarly:

- WA EA guidelines
- GBR/Qld documents & associated influential reports

MESSAGE…

If you are relying on existing EA Guideline documents to guide your EIA practice,

you are getting poor scientific advice!

Terrestrial environments.
Habitat understanding matters…

e.g. Habitat of the Wollomi Pine

- highly valued, location secret
- & we work to understand it

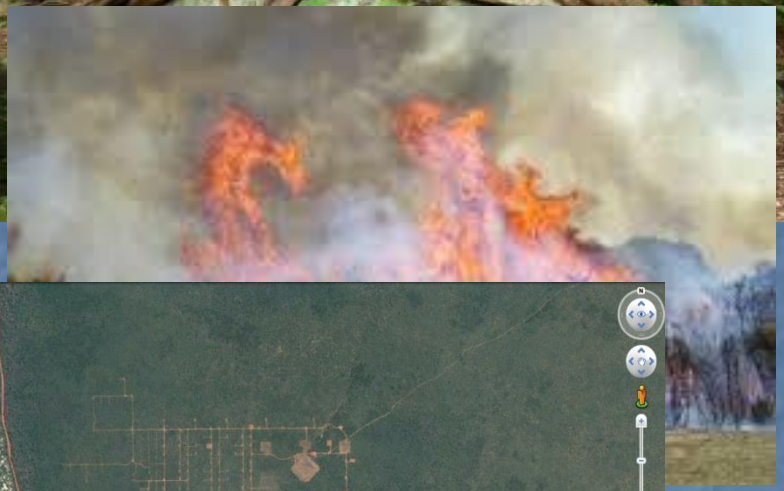
e.g. Bushfire

- Once = 'ecological disaster'.
- Now = understood as part of natural pattern of habitat renewal.

e.g. James Price Point (SAR 2010)

"Once equipment is removed from site, rehabilitation would commence to ensure that the condition of the site reflects the existing surrounding environment.

"This would involve contouring the surrounding landscape and revegetation of native flora species."



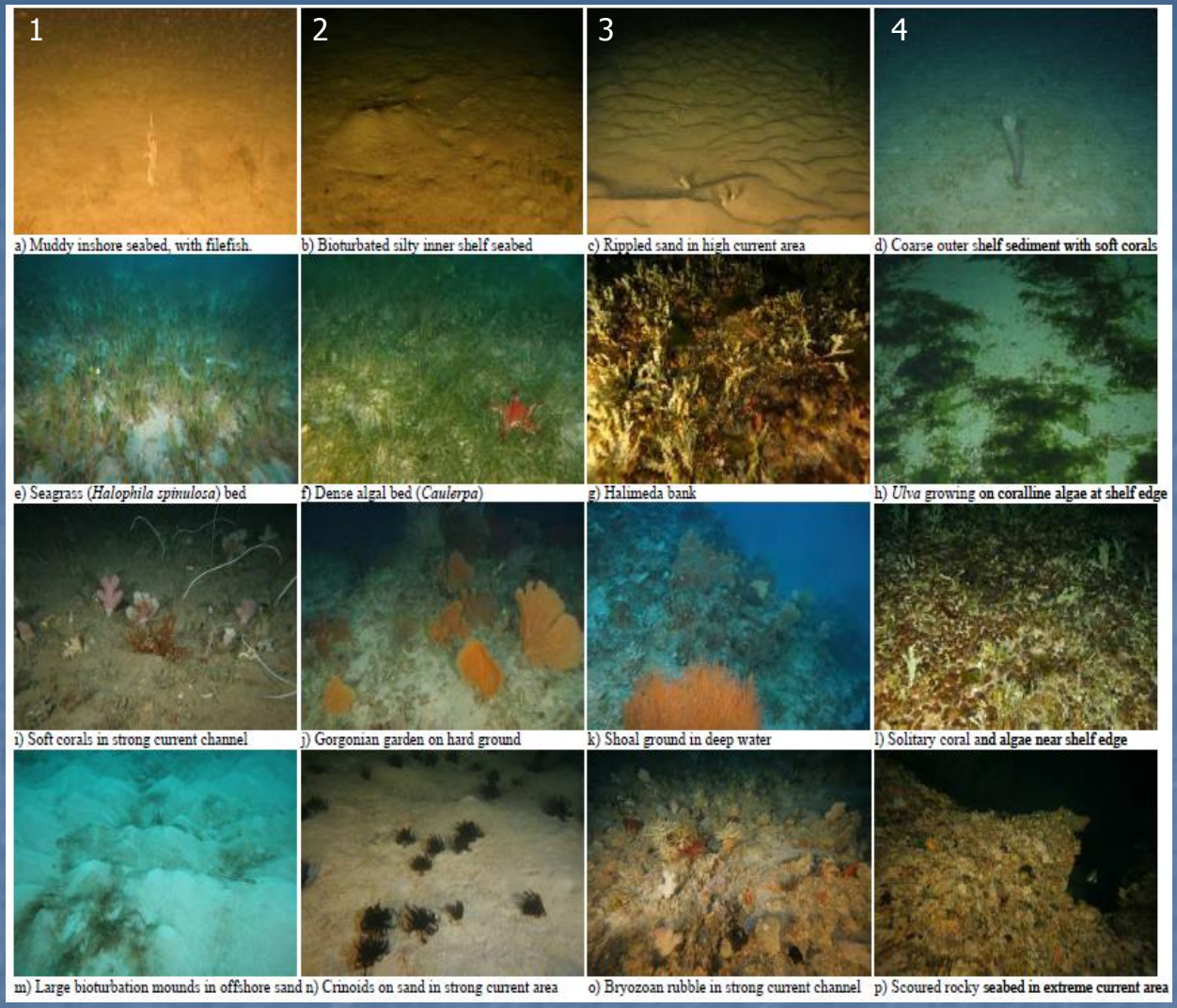
Pitcher et al. (2007)

Sediment-dependence matters!

All these marine habitats are intimately related to sediment.

Exactly how is unknown

yet this knowledge is critical to our approach to management.



As EA practioners,

you wouldn't (and don't) work like this on land.

So why is it ok to work like this offshore?

Marine EA...

Observation

Physical science underpins habitats & ecosystems but is weakly implemented in marine EA.

Weak in understanding benthic habitats & resilience, measurement techniques & programs...

EA principles include:

"best practicable science, methodologies & techniques appropriate to the problems being investigated, relevant, cost effective, efficient, focussed"

Implication

Out of sight, out of mind?
&/or lag in level of knowledge c.f. terrestrial?

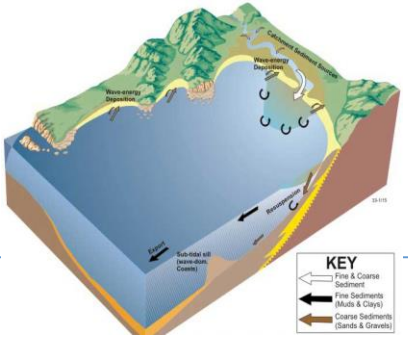
Have we just been lucky so far?
Environmentally-perhaps, costs-perhaps not.

Meeting international and national regulations **requires an improved approach**

Conclusion

Responsibility lies with YOU, the EA practioners:

1. Probably means some behaviour change
2. Fully acknowledge the key significance of the physical environment
3. Encourage measures to
   - establish the logic
   - perform the background science
4. Help **future regulations** use these concepts to underpin the EA approach & practical application.



Risks are great:

1. Misdirected effort
2. Unnecessary environmental damage
3. Regulation bypassed by 'habitat science'.

All would discredit the EA process

Situation demands a paradigm shift.

Physical science is fundamental to EA conduct.