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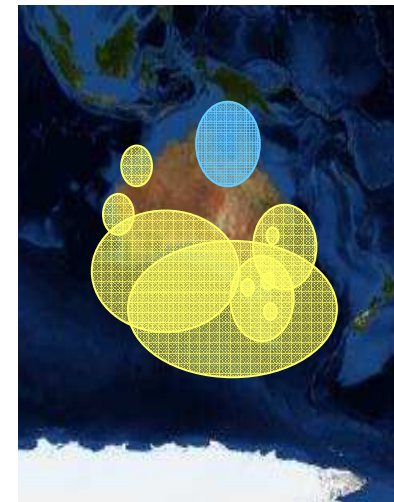
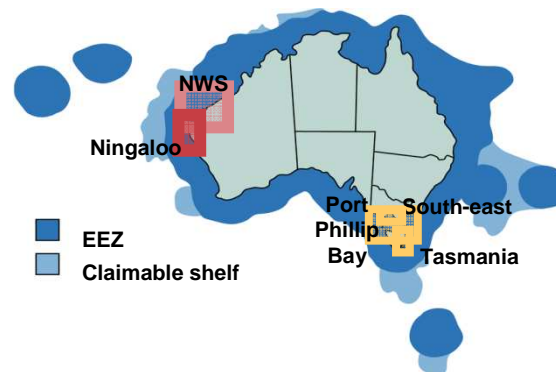
# Biochemical Tracers in Ecological Modelling

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**Ecological Modelling Team**  
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# Quantitative Ecosystem Models in CSIRO

- **EwE-probably a dozen models around Australia, several calibrated, different scales**
- **Atlantis-several around Aus, Southeast models most highly developed and extensive**
- **In Vitro-North West Shelf and a “working” SE model**



# Data requirements

- **Biophysical parameters**

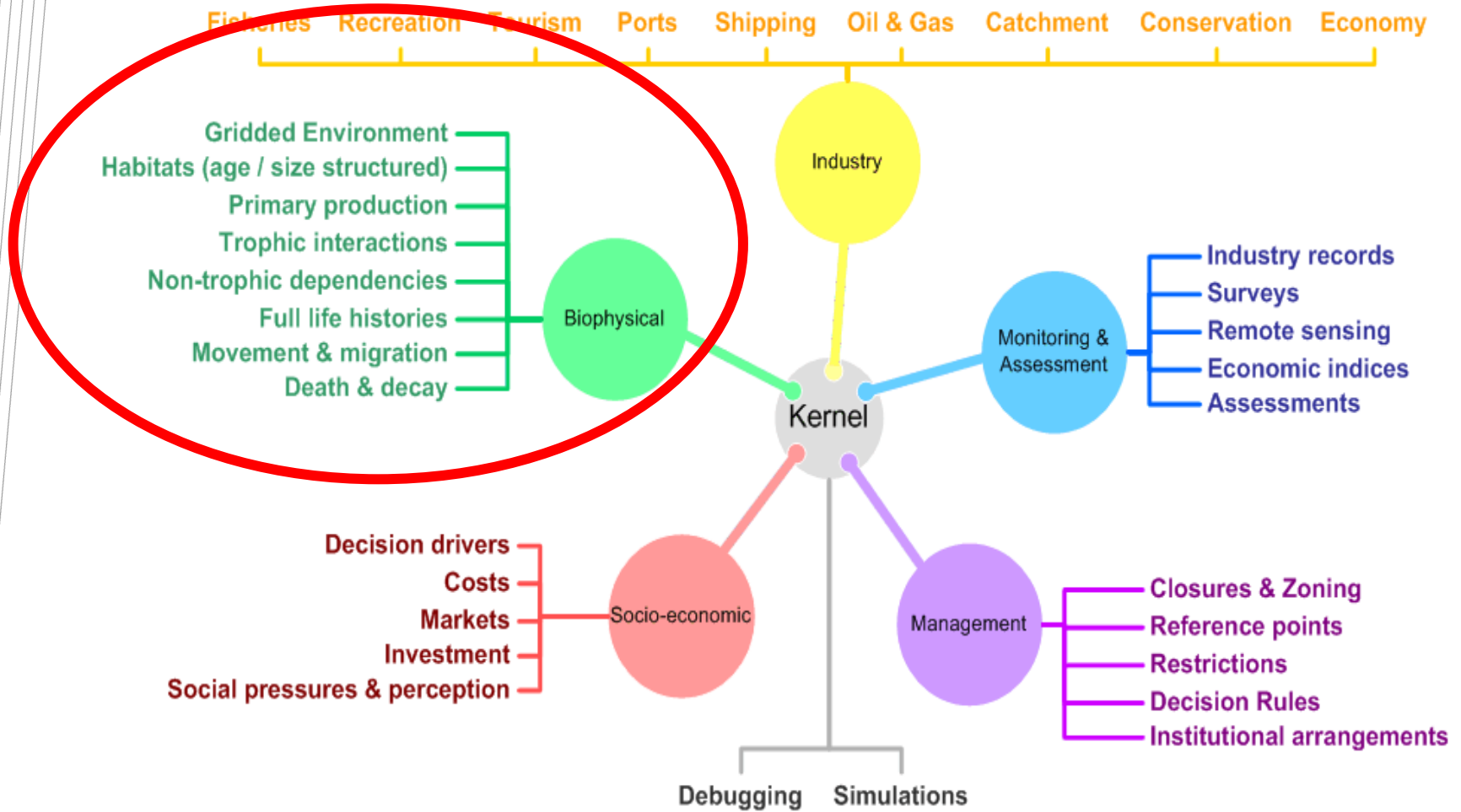
- Dietary including consumption rates
- Growth and ageing
- Biomass/abundance
- Movement or migration rates
- Habitat associations

- **Socio-economic**

- Fishery dynamics
- Management
- Human influences



# Model elements & data requirements



# Where do tracers fit in?



## • Verification of diets

- Traditional stomach content analysis provides only a snapshot particularly if the sampling is restricted. Fish are opportunistic – so that snapshots reflect environment only at that moment.

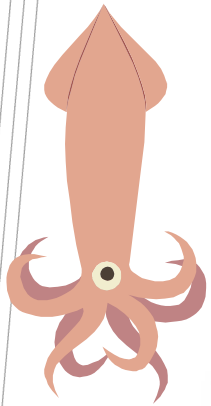
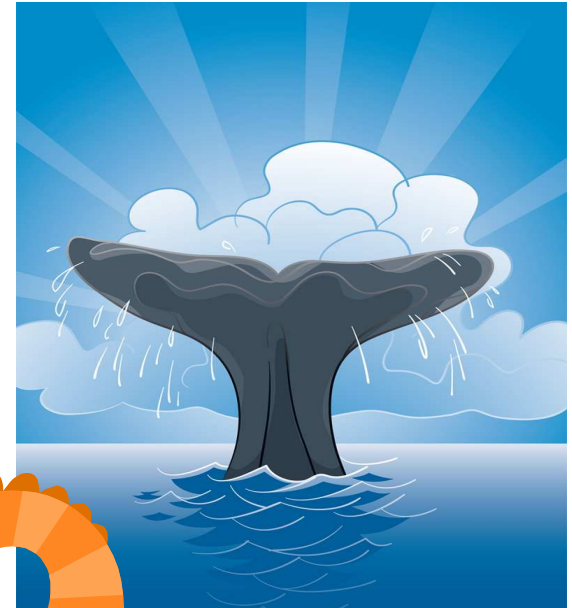
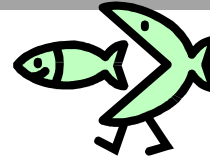
- Orange roughy in a broad dietary survey at a particular location and time showed a higher than normal % amphipods due to a major swarm.

- Location, size and season: Jack mackerel caught on the shelf ate *Nyctiphanes australis* but those caught in deeper water ate myctophids. Smaller fish ate copepods and larger ones ate euphausiids. Also strongly seasonal, ate more euphausiids in spring/summer, more fish in winter.

# Where do tracers fit in?

- **When identification is difficult**

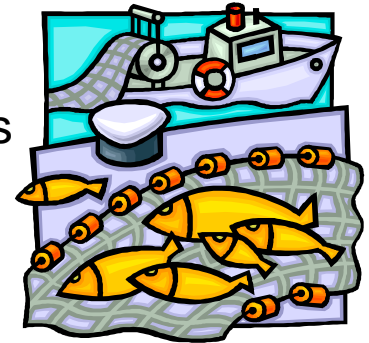
- Size/type of predators e.g. larger predators eg sharks, marine mammals, teeny things
- Regurgitation of stomach contents
- Rapid digestion of prey particularly gelatinous zooplankton types
- Low stomach fullness due to low incidence of feeding or periodicity



# Where do tracers fit in?

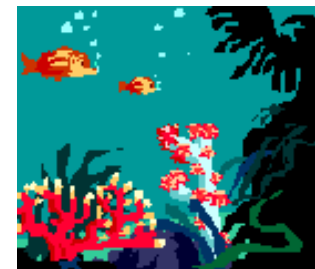
- **Stock discrimination**

- Necessary to understand stock structure for management purposes e.g. recent proposed changes in small pelagic fishery from 4 subregions to 2
- Old genetics studies not always very conclusive
- Fleet dynamics and management can be modelled more effectively if we know distinct stocks



- **Habitat use**

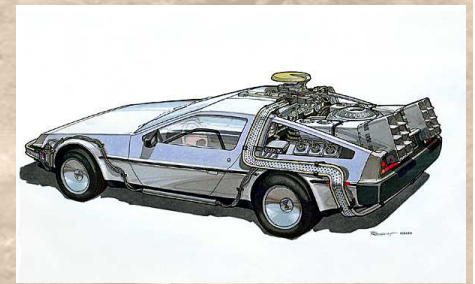
- Spatially explicit models require knowledge of habitat association
- Traditional methods such as trawl surveys cannot always ascertain associations in untrawlable areas such as reefs esp. very deep ones
- Movement patterns can be modelled
- Separate ecosystems e.g. Jocks stable isotope analysis



# Where do tracers fit in?

- **New directions for ecological modelling**

- Climate change and evolution are currently of great interest
- Helps define past climate (and phenotypes or stocks present then)
- From fossil composition can determine seasonal movements (and productivity or foodweb structure potentially)
- Gives insight to past systems in the same way as present systems (and so can see change from then to now)





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