

Exploiting potential: From Plankton2015 to Assessment of Pelagic Productivity

Anthony J. Richardson



IMOS Integrated Marine Observing System





In September 2015, the UN adopted the Sustainable Development Goals, including SDG 14:

“Conserve and sustainably use oceans, seas and marine resources for sustainable development”



From Plankton2015 to Assessment of Pelagic Productivity

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“Essential” Ecosystem Assessments - Uptake

Measures	
EOVs	Essential Ocean Variables
ECVs	Essential Climate Variables
EBVs	Essential Biodiversity variables
EEMs	Essential Environmental Measures



Assessments	
IPCC	Intergovernmental Panel on Climate Change
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
WOA	World Ocean Assessment
SoE	State of Environment

Key point: Assessments increasingly needed and this is not likely to diminish...

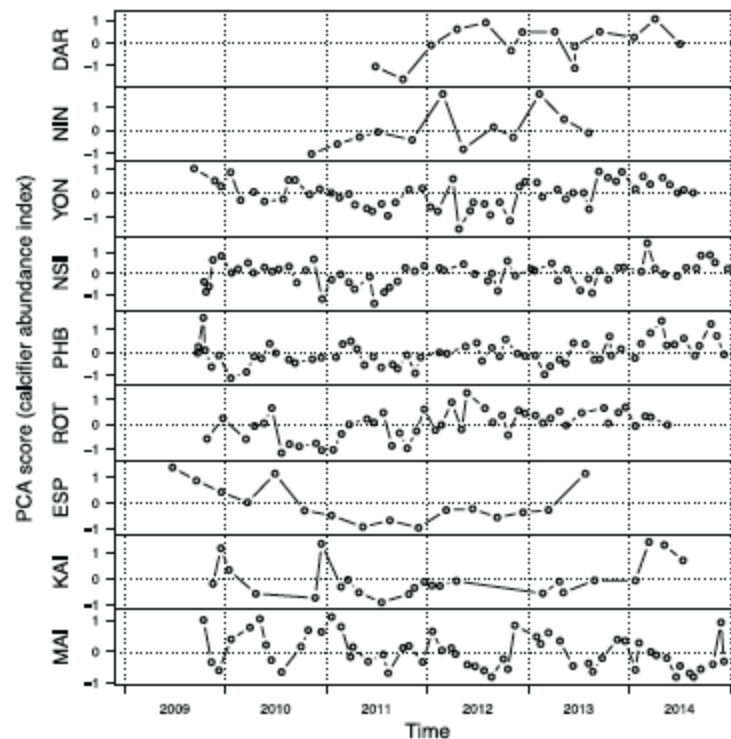
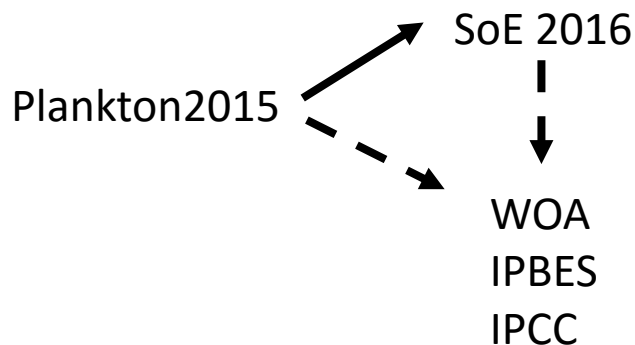
Requirements

1. Robust data (IMOS)
2. Published information (e.g. Regional assessments and papers)
3. Research to convert data streams into EOVs, ECVs, EBVs, EEMs,...
 - Simple, observable, sensitive, appropriate

EBV Class	Some Candidate EBVs
Genes	Allele diversity, population genetic differentiation
Species populations	Distribution, abundance, structure
Species traits	Phenology, mass, migration, demography
Community composition	Taxonomic diversity, species interactions
Ecosystem function	Net primary productivity, secondary productivity, nutrient cycling
Ecosystem structure	Habitat structure, extent, fragmentation

Case study of Plankton2015

- Based on EOVs (Phytoplankton and zooplankton biomass and diversity) developed by Bio-eco GOOS...
- Foundation is IMOS data
- Based on simple measures that lack sophistication but evolving...



http://imos.org.au/fileadmin/user_upload/shared/Data_Tools/15-00245_OA_Plankton2015_20ppBrochure_WEB_151116.pdf

Some potential questions to address

1. What is the overall state of Australia's pelagic systems?
2. Are pelagic systems improving or declining?

Others...

3. Where are the areas where harvesting is relatively high compared to productivity?
4. Is primary production increasing or decreasing and where?
5. Are different trophic levels responding similar to global change?
6. Is the transfer efficiency of foodwebs changing?

Opportunity: Can we develop an assessment report based more broadly on IMOS data?

EOVs/EBVs/EEMs	Remote Sensing	NRS	Microbes	NIMO	SOOP-AusCPR	SOOP-Bio	ATAAMS	Agencies
Microbial biomass, diversity and distribution			<input checked="" type="checkbox"/> <input type="checkbox"/>					
Phytoplankton biomass, diversity and distribution	<input checked="" type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/> <input type="checkbox"/>			<input checked="" type="checkbox"/> <input type="checkbox"/>			
Zooplankton biomass, diversity and distribution		<input checked="" type="checkbox"/> <input type="checkbox"/>			<input checked="" type="checkbox"/> <input type="checkbox"/>			
Micronekton biomass, diversity and distribution						<input checked="" type="checkbox"/> <input type="checkbox"/>		
Fish biomass, diversity and distribution				<input checked="" type="checkbox"/> <input type="checkbox"/>			<input checked="" type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/> <input type="checkbox"/>

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Environmental context
 + SOOP BGC
 + NRS BGC
 + Remote sensing SST



Productivity and Biodiversity Assessment: Status, trends and future of Australia's Marine Pelagic Systems

STRAWPERSON: Productivity and Biodiversity Assessment: Status, trends and future of Australia's Marine Pelagic Systems

1. State and Trends

1. Productivity
2. Diversity

2. Pressures

1. Climate change
2. Ocean Acidification
3. Eutrophication
4. Harvesting
5. Harmful and nuisance species

3. Scenarios for the Future

4. Management Implications

Space scales

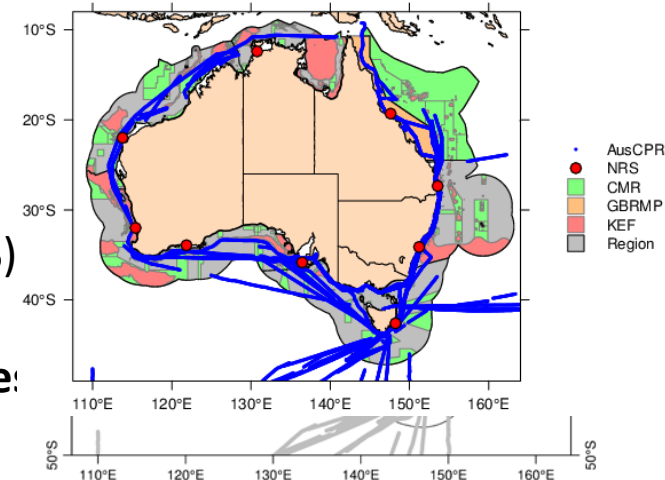
- Marine bioregions
- KEFs
- Key locations (e.g. NRS)

Data type:

- Genetics
- Species
- Functional groups
- Abundance/biomass
- Production

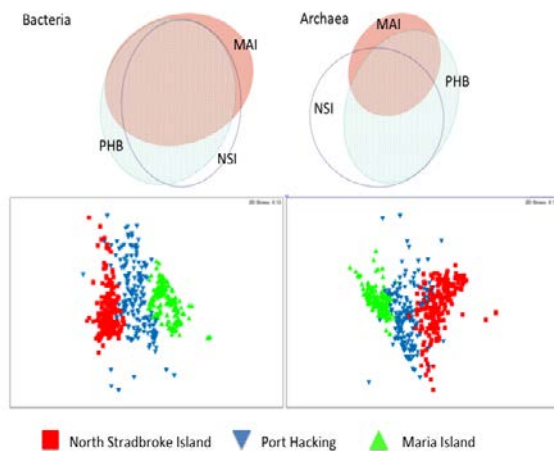
Compare and contrast

- Different trophic levels
- Different regions

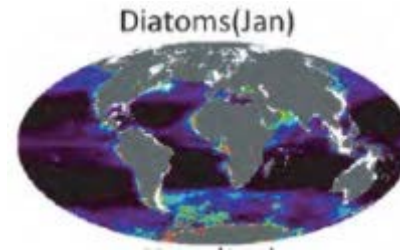


Assessment underpin by research

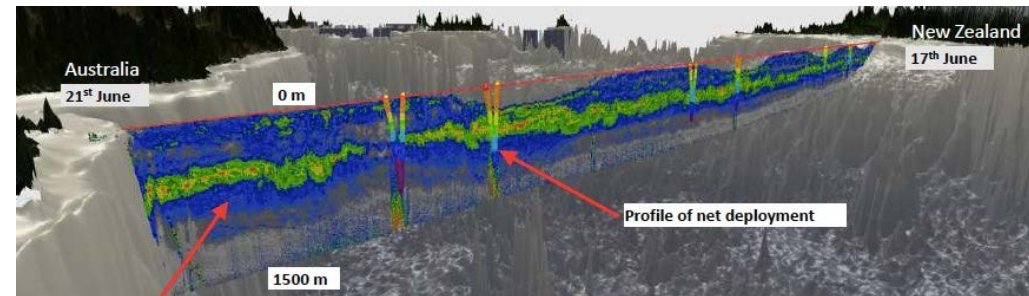
1. What are the “best” metrics for EOVs, EBVs, EEMs? Derived and synthesis products...



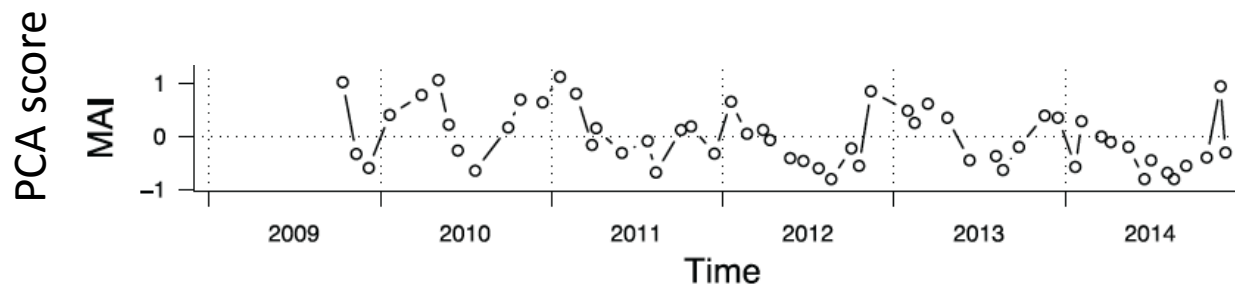
Brown et al. (2015)



Hirata, Hardman-Mountford et al. (2011)



Kloser et al.



Plankton2015

Assessment underpin by research

1. What are the “best” applied metrics for EOVs, EBVs, EEMs?
2. Given the temporal and spatially restricted nature of most EBVs, how do we best integrate models and observations to better assess change?

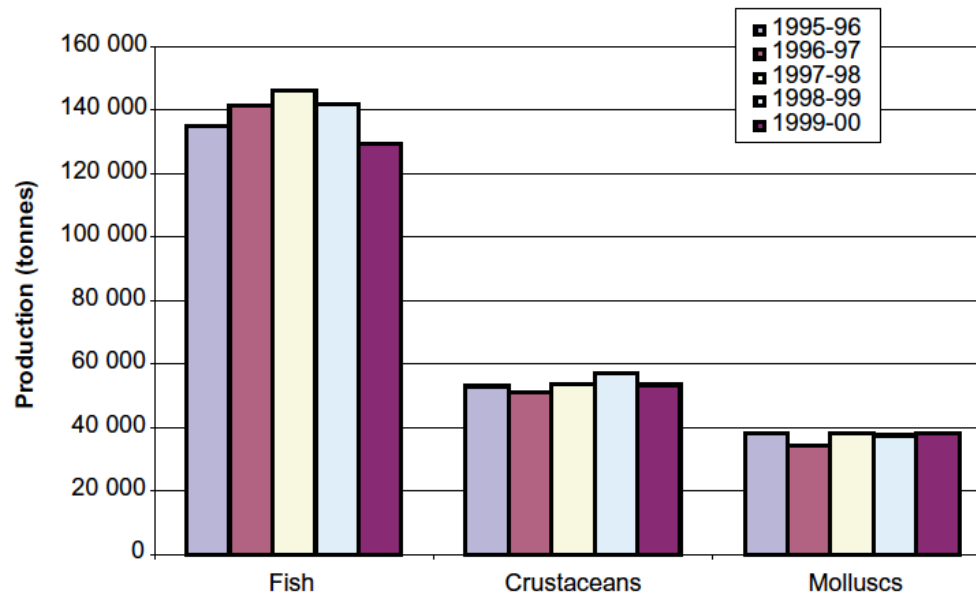


- Model assessment/validation critical (incl. for RS and primary production)
- Model initialisation
- Data constraining model output

Assessment underpin by research

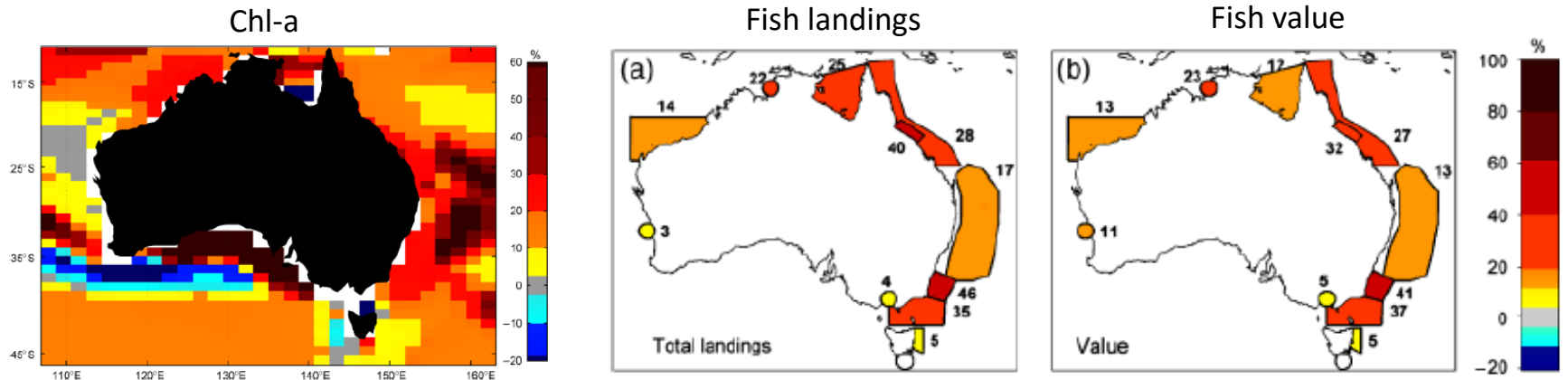
1. What are the “best” applied metrics for EOVs, EBVs, EEMs?
2. How do we integrate data from outside IMOS?
3. How do we integrate data from outside IMOS?

e.g. fisheries data



Assessment underpin by research

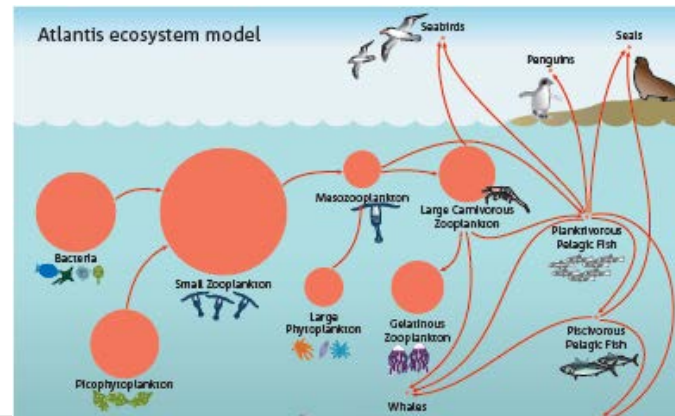
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2. How do we integrate data from outside IMOS?
3. Given the temporal and spatially restricted nature of most EBVs, how do we best integrate models and observations to better assess change?
4. Potential future changes in ecosystem state: models



Brown et al. (2010)

Assessment underpin by research

1. What are the “best” applied metrics for EOVs, EBVs, EEMs?
2. How do we integrate data from outside IMOS?
3. Given the temporal and spatially restricted nature of most EBVs, how do we best integrate models and observations to better assess change? (ZOOM: initialisation, assessment/validation, constraining models)
4. Potential future changes in ecosystem state: models
5. Presentation: Easy, clear, attractive



In summary, we have an opportunity:

- Global momentum behind ecosystem assessments
- Relevant to policy makers and managers
- International and national requirements (e.g. DoEE monitoring KEFs)
- 10 yrs of IMOS data
- **What can we contribute?**
- **How can we make a broad assessment happen?**
- **What partnerships do we need?**
- Stimulate research effort to “operationalise” EOVs, EBVs, EEMs from IMOS data
- Do some fun research 😊