

## State and Trends of Australia's oceans Report (STAR) Task team

### Overview:

Proposed task	Progress and deliver "State and trends of Australia's open oceans: An assessment based on physical, chemical, and biological indicators"
Operating institutions	IMOS, CSIRO
Co-convenors	Anthony J. Richardson (UQ/CSIRO) Ruth Eriksen (CSIRO)
Other participants	Please see Attachment 1 (proposed) Task Team composition listing invitees, their affiliation and area of expertise.
Timeframe	12 months

### Agreement to commence the Task Team – signed by:



2 May 2018

...../...../..... (Andreas Schiller, CSIRO)



2 May 2018

...../...../..... (Tim Moltmann, IMOS)

### PROJECT DESCRIPTION

#### Background

**Include information about national/international progress in this field of research and its relationship to this Proposal.**

Marine assessments are an important tool for collating, synthesising and reporting meaningful indicators of ecosystem health to a broad, and often non-scientific audience. They are effective and repeatable reporting tools for examining the state and trends of marine systems, at many scales, including regionally (e.g., [GBR Outlook Report](#)), nationally (e.g., [State of the Environment](#)) and internationally (e.g., [World Ocean Assessment](#)). The most robust assessments are data-driven, and typically underpinned by time series of globally accepted ecosystem indicators, such as the Global Ocean Observing System [Essential Ocean Variables](#).

In the Australian context, the Integrated Marine Observing System (IMOS) is uniquely positioned to provide data on key physical, chemical and biological variables on both regional and national scales. The opportunity here is to value-add to the information collected by IMOS – and other ocean observing programs in Australia – by translating data into time series of ecosystem indicators that describe the state and trends of our pelagic environment. The target audience for the assessment report is policy makers, marine managers, and fellow scientists. This Task Team has a very deliberate intent not to replicate existing mature reporting programs by being explicit about what is in, and what is out of scope (see Attachment 1 for details).

The Terms of Reference of the Task Team (TT) will be informed through an independent Steering Committee (SC) that will include Tim Moltmann (IMOS), David Smith (CSIRO), Nic Bax (UTas/CSIRO) and Karen Evans (CSIRO). The SC will provide guidance and oversight of the efforts and outputs of the TT.

#### Objectives:

**Outline the objectives for your task team project**

1. Identify and develop indicators and time series to be used in the inaugural State and Trends Assessment Report, with guidance from the SC and the research community
2. Work collaboratively with TT members, and across the broader research community, to ensure that the Assessment Report has appropriate spatial (regional and national) and temporal (decadal and multi-decadal) coverage and balance
3. Work with the TT to analyse and summarise contributing datasets
4. Ensure the report is externally reviewed, either by the SC or other nominated experts
5. Publish the State and Trends Assessment Report as both a hard copy and on-line version

#### Rationale:

Define the need for the task team project, how it addresses an important problem and how it relates to relevant IMOS Science and implementation plans and scientific questions.

The Task Team model will:

- ensure a consultative and inclusive approach to the scope and content of the Assessment Report, guided by the SC that operates independently of the TT
- allow the Assessment Report to be developed in a realistic time-frame by supporting two face-to face workshops with contributors to the report, “off-line” work, and virtual meetings as required to address specific issues
- harness support and expertise from IMOS in science communication, marine and environmental policy, and use and impact
- establish a template for subsequent reports that deliver information and synthesis of trends and marine ecosystem responses, focusing on the pelagic environment
- aim to support evidence-based decision making on issues of national significance, across the IMOS major research themes
- help make IMOS and other Australian research and operational ocean data more discoverable through the AODN

#### Benefits

Describe the outputs that will arise from the project and how they will achieve the objectives of the project. Outputs may be knowledge, skills, processes, practices, models.

Outputs of the TT, and their benefits, are:

1. Output: Produce a State and Trends Assessment Report for the open ocean. Benefit: This will fill a gap in ecosystem assessments by specifically addressing issues relevant to the pelagic environment. It will also provide a model for subsequent State and Trends Assessment Reports
2. Output: A data-driven assessment of the pelagic environment, expert opinion. Benefit: This will not only challenge participants in the TT, but will help Australia meet its reporting obligations.
3. Output: An integrated assessment of the pelagic environment. Benefit: Planning for impact and use by developing useful data products
4. Output: Produce time series of ecological indicators. Benefit: Can be used by other ecosystem assessments, including but not limited to the SoE, GBR Outlook, and IPCC reports. Help Australia to meet national and global reporting obligations (e.g., against the Sustainable Development Goals, Convention on Biological Diversity)

#### Required expertise

Outline the capacity and capability that the task team will need to achieve the objectives of the project.

To be successful, the TT capability will need to encompass members with:

- Expertise in each of the key subject areas identified in the draft outline refined since the 2018 IMOS APM (see details of proposed invitees and associated skills/expertise in Attachment 1)
- These experts will have access to and technical understanding of datasets underpinning the Assessment Report
- Experience in the production of ecosystem assessments
- Strong links with stakeholder groups
- Expertise in science communication to ensure message uptake by intended audience

TT members will also need to have capacity to contribute within the specified timeframes, and it is assumed that acceptance of the invitation, or nomination of a proxy, implies the ability to deliver.

### Methods

Outline the methods to be used including protocols or activities; the data to be obtained or knowledge, skills or capacity to be generated. Provide support for any new methods and/or techniques to be employed.

- Identify candidate time series data-sets of Essential Ocean Variables encompassing physical, chemical and biological oceanographic variables
- Use robust statistical techniques to produce time series
- Use time series that are sufficiently long to separate signal from noise
- Quantify uncertainty as far as possible
- Ensure that the spatial footprint of various time series is clear

### Task team composition

Please specify the expertise of the different contributors and their responsibilities within the team and the level of involvement of the team members

See Attachment 1: Proposed contributors to the Status and Trends Assessment Report (STAR) Task Team. Contribution to the report is broken down into 5 major topics, with a subset of TT members overseeing the on-going synthesis and collation aspects of the report.

### Mode of operation for the task team

Specify how the activities of the task team will be undertaken, i.e. are there going to be any face to face meetings, or is it going to be by correspondence or teleconference. How many meetings will the task team envisage within the timeframe? How are the activities going to be coordinated?

*The first workshop:* Discuss the strawperson outline (Appendix 1), brainstorm any changes/additions, and discuss individual contributions. Richardson and Eriksen will provide a template for physical, chemical and biological contributions for discussion and refinement. Discuss time series of suitable length that contribute to our understanding of state and trends and more descriptive “boxes” that highlight emerging findings about marine status and trends in the pelagic environment, and the linkages between variables.

*Between workshops:* Guide independent progress by individual contributors through virtual meetings (as required).

*The second workshop:* A second workshop to edit and review progress on the Assessment Report prior to submission to the SC

The concept of the *State and Trends of Australia’s Oceans Report* is now well established within IMOS, with dedicated discussions at the 2017 and 2018 Annual Planning Meetings. We believe the most effective mode of operation will be to host 2 face-to face meetings, approximately 6 months apart. Between workshops, participants will work on their sections and bring these to the second workshop. In the second workshop itself, we will split up into smaller groups and review the contributions,

providing feedback on the structure and content of the different sections. We will meet in plenary to discuss how to bring the individual contributions together.

### Milestones

Indicate the timeframe required for this task team project and the milestones with information on the approximate time required to completing each activity.

Milestone	Due	Status	Comments
1. Convene the Task Team membership	May 2018		
2. Hold first Task Team meeting	July 2018		
3. Mid-term progress report: Synthesis of Task Team meeting	August 2018		
4. Hold second Task Team meeting	December 2018		
5. Synthesis of Task Team meeting	January 2018		
6. IMOS Planning meeting – outline of progress to date and seek feedback from IMOS Community	12-14 February 2019		
6. Final report: The published <i>Status and Trends of Australia's Open Ocean</i>	30 June 2019		

### Deliverables

Please outline if there are other deliverables for this project beside a final report

Two products are proposed as final outputs from this TT:

1. A glossy report, of approximately 20 pages (see [Plankton 2015](#) for a potential “feel” of the end document)
2. Associated online delivery system, hosted by IMOS

### Communication

Outline how the results from the task team will be communicated

See Deliverables

### Resources required

Costs could be minimised by timing meetings to link with other IMOS-related meetings (conferences, QC summits, etc.). However if there are any specific costs anticipated which cannot be covered under other funding sources, please detail here.

Costs will be minimised by holding meetings in Hobart, where the majority of the participants reside.

Item	Explanation	Cost
Venue	CSIRO or IMAS (book early)	\$0
Catering	\$30 per person per day x 20 people x 2 days x 2 workshops	\$2,400
Accommodation	IBIS, Lenna, Quest. \$150 per night x 10 people x 2 workshops	\$3,000
Flights	\$500 x 10 people x 2 workshops	\$10,000
Workshop dinner	Brick Factory, Barcelona \$40 per person x 20 people x 2 workshops	\$1600
Publication		\$2,000
<b>TOTAL</b>		<b>\$19,000</b>

The components of the Budget are draft only. In summary within an estimated total cost of \$19,000, there will be two meetings in Hobart (circa \$8,500 each) plus circa \$2,000 to write up / publish the results.

## ATTACHMENT 1: Outline summary-State and trends of Australian Ocean Environment.

See also

[http://imos.org.au/fileadmin/user\\_upload/shared/IMOS%20General/APM\\_2018\\_PRESENTATION\\_S/D2.02.PLANKTON.pdf](http://imos.org.au/fileadmin/user_upload/shared/IMOS%20General/APM_2018_PRESENTATION_S/D2.02.PLANKTON.pdf)

### State and trends of Australia's oceans:

*An assessment of our pelagic environment based on physical, chemical and biological indicators*

**Rationale and opportunity:** While there are many marine assessments regionally (e.g., *GBR Outlook Report*), nationally (e.g., *State of the Environment*) and internationally (e.g., *World Ocean Assessment*), all are examining the state and trends of marine ecosystems. The ambition is for these assessments to be data-driven, underpinned by time series of ecosystem indicators. In the Australian context, the Integrated Marine Observing System (IMOS) is uniquely positioned to provide data on key physical, chemical and biological variables. The opportunity here is to value-add to the information collected by IMOS – and other ocean observing programs in Australia – by translating data into meaningful time series of ecosystem indicators that describe the state and trends of the pelagic environment.

**Scope:** The focus will be to fill the gap in assessing the pelagic environment, as most current assessments concentrate on benthic biodiversity, such as corals, seagrass, mangroves and kelps. The *State and trends of Australia's oceans* will derive time series of indicators that encompass the physical (e.g., temperature, salinity, boundary currents), chemical (e.g., nitrogen, phosphate, silicate, pH, aragonite saturation), and biological (e.g., archaea, bacteria, phytoplankton, zooplankton, mid trophic levels and fish) components of the pelagic environment. This will require integration of diverse datasets collected using a suite of observing platforms including remote sensing, microscopy, bottles, ocean sensors, molecular techniques, bioacoustics and animal tracking. The primary area of interest is the Australian EEZ, and the six bioregions used for marine spatial management, but the Southern Ocean will also be included. Wherever possible, ecosystem state and trends will be based on time series and associated uncertainty estimates. The target audience is policy makers, marine managers, and scientists. A primary aim is that this assessment will help Australia to meet national and global reporting obligations (e.g., against the Sustainable Development Goals, Convention on Biological Diversity). This ambitious undertaking will provide unique ongoing time series of indicators together with insights that have not been included in previous assessments. It is envisaged that *State and trends of Australia's oceans* will be a regular assessment, with subsequent iterations evolving in response to governmental and assessment needs.

**Out of scope:** To distinguish this report from other assessments, the *State and trends of Australia's oceans* will:

- Not be a report card and not apply a rating system (good/poor quality) because such a rating system is not relevant for many parts of the environment (what is poor quality for temperature, bacteria and plankton?)
- Not be based on expert opinion, but use time series of indicators
- Not include shallow-water benthic habitats such as corals, seagrass, mangroves, kelps and estuaries
- Not include fish data from commercial and recreational fisheries
- Not include pressures such as pollution, fishing or shipping

**Structure:** Each section will have the same structure: 1. An initial paragraph on why the particular variable is important; 2. Presentation of time series of key ecosystem indicators for the particular variable. If there are not time series of sufficient length, then we will provide context by highlighting what is known about the variable in the text or in a Box; 3. Where linkages between variables and

their drivers are known from existing science, these will be highlighted. Where drivers are not currently known, time series of indicators will still be shown, but interpretation will be more cautious; 4. A short discussion of what the results mean for ecosystems and marine management.

**Delivery:** End-user delivery will be critical; we envisage multiple delivery methods, including a short glossy report and an online delivery system. To ensure this Assessment is accessible, the total length will need to be about 20 pages.

**Next steps:** IMOS is supporting a Task Team that will progress and deliver the *State and trends of Australia's oceans*. The composition of the Task Team is currently being considered, with consideration given to people who could lead particular sections of the assessment. Unfortunately, because of size limitations, not everyone who has expressed interest or who has relevant expertise will be able to be part of the Task Team. However, Section leaders will be charged with garnering input from researchers beyond the Task Team who are keen to provide input. The Task Team will convene twice in 2018.

## Sections

### 1. Physical status and trends

A. SST: Time series/maps of mean annual SST since 1860 around Australia (EEZ), for each bioregion, and for the long-term IMOS National Reference Stations (NRS: PHB, MAI, ROT) since 1940s

B. Salinity: Time series of salinity for the long-term IMOS NRS

C. Boundary currents: Time series of boundary current strength (EAC, Leeuwin)

### 2. Chemical status and trends

A. Nutrients: Time series of nitrate, phosphate and silicate concentration from the long-term IMOS NRS

B. Carbon: Time series/maps of pH/aragonite saturation over past 100 yrs (modelled and measured)

### 3. Biological status and trends

A. Primary production (phytoplankton): Time series of biomass, production, size from satellite in EEZ/bioregions

B. Secondary production (zooplankton): Time series/maps of biomass and size for bioregions and NRS

C. Tertiary production (fish): Time series/maps of mid-trophic level biomass, movements and migrations

### 4. Ecosystem health

A. Biodiversity: Time series/seasonality/regional differences in archaea, bacteria, phyto-, zooplankton, fish larvae

B. Nuisance species: Time series/seasonality/regional differences in harmful algal blooms, jellyfish and salps

C. Pathogens: *Vibrio* spp. et al.

D. Climate change: Range shifts, phenology, community shifts, impact of acidification

E. Marine heatwaves: Impacts on biology of heatwaves

### 5. Management applications

A. Model assessment

B. Ecosystem assessments

C. Supporting aquaculture and fisheries industry

D. Water quality indicators and human health

## ATTACHMENT 2: Proposed contributors Status and Trends Task Team

#	Section	Person	Area (expertise)	Organisation
1	1. Physical status and trends	Richard Brinkman or alternate	Physical oceanography (shelf, modelling)	AIMS
2		Chari Pattiaratchi or alternate	Physical oceanography (coastal, boundary currents and links to biology)	UWA
3		Bernadette Sloyan	Physical oceanography (boundary currents)	CSIRO
4	2. Chemical status and trends	Bronte Tilbrook or alternate	Carbon chemistry; IMOS time series	CSIRO
5		Ed Butler	Nutrients	AIMS
6	3. Biological status and trends, and 4. Ecosystem health	Justin Seymour	Microbial genetics	UTS
7		David Antoine	Remote sensing	Curtin
8		Peter Thompson	Phytoplankton/Primary productivity	CSIRO
9		Jason Everett	Zooplankton (including size)	UNSW
10		Paul van Ruth	Plankton	SARDI
11		Rudy Kloser or alternate	Bioacoustics; IMOS time series	CSIRO
12		Michelle Heupel	Tracking; IMOS time series	AIMS
13		Ana Lara-Lopes	Fish larvae/overview	IMOS
14	5. Management applications	Indi Hodgson-Johnston	Law/economics/policy	IMOS
15		Gustaaf Hallegraeff	HABs/aquaculture	UTas
16	Synthesis	Anthony Richardson	Synthesis, zooplankton	UQ/CSIRO
17		Ruth Eriksen	Synthesis, phytoplankton	CSIRO
18		Wayne Rochester	Analysis	CSIRO
19		Claire Davies	Analysis	CSIRO
20		Roger Proctor or alternate	Data	IMOS/AODN

**ATTACHMENT 3: Some members of the marine research community who have shown interest in being involved in the State and Trends Assessment Report or have key expertise that could be crucial.**

<b>Section</b>	<b>Person</b>	<b>Organisation</b>
<b>1. Physical status and trends</b>	Jessica Benthuisen	AIMS
	Craig Steinberg	AIMS
	Ming Feng	CSIRO
	Madeleine Cahill	CSIRO
	Ken Ridgway	CSIRO
	John Middleton	SARDI
	Moninya Roughan	UNSW
	Amandine Schaeffer	UNSW
	Neil Holbrook	UTas
	Nicole Jones	UWA
<b>2. Chemical status and trends</b>	Andrew Lenton	CSIRO
<b>3. Biological status and trends, and 4. Ecosystem health</b>	Lev Bedrossy	CSIRO
	Mark Brown	UNewC
	Martin Ostrowski	MacU
	Rob Johnson	BoM
	Ryan Downie	CSIRO
	Mark Baird	CSIRO
	Tom Trull	CSIRO
	Alistair Hobday	CSIRO
	Steve Brett	Microalgal Services
	Paul van Ruth	SARDI
	Iain Suthers	UNSW
	James Smith	UNSW
	Natasha Henschke	UNSW
	Bronwyn Gillanders	UoA
	Reg Watson	UTas
	Kerrie Swadling	UTas
	Greta Pecl	UTas
	Penny Ajani	UTS
	Paul Thomson	UWA
	<b>5. Synthesis/Management</b>	David Souter
Tim Ward		SARDI/SGEDI
Al Jordan		DPI/MEMA