Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects

Second world ocean assessment (WOA II) – review by States

Instructions

NOTE: Only comments submitted in accordance with the six instructions below will be accepted and transmitted to the writing teams for consideration.

1. Each Member State may submit **one** set of written comments.
2. Comments must be submitted using the template provided in this document.
3. The document containing the comments must be saved in either **.doc** or **.docx** format
4. All comments must be in **English**.
5. Comments must be submitted either through the Permanent Mission to the United Nations, or through designated National Focal Point for the Regular Process.
6. Comments must be submitted to the secretariat of the Regular Process by e-mail (doalos@un.org; temnova@un.org; legesseh@un.org) no later than **midnight (New York time) on 5 June 2020.**

About the process for review by States

- States may comment on any aspects of the draft, including content, structure and references. States may provide general comments or comments on specific wording, tables, figures, maps, etc. Line numbers are provided to facilitate line-by-line review, should States so desire.
- All comments received from a State will be shared with the writing teams and the Group of Experts under the name of that State without featuring any sub-divisions (offices, departments, ministries etc.) of that State.
- The comments received from States will be shared with other States along with the second draft of WOA II and the agreed responses by the Group of Experts to the comments. States will then have the opportunity to review and raise any remaining questions they may have with the Group of Experts.
- Relevant background documents are made available on the website of the Regular Process: http://un.org/regularprocess/WOA-II-review-by-states

Tips on using the template

- The template below uses a table format. This format allows for an unlimited number of comments to be added for each chapter or sub-chapter. To add more comments on a chapter or sub-chapter, simply add more rows.
- States may copy text from the draft into the table if they wish to use “track changes” in editing text.
- The template is shared in **.doc** and **.docx** format. These formats can be used with Microsoft Office products, in Google Docs and open-source office suites such as LibreOffice.

- To enable cross-departmental collaboration across departments or agencies, States may wish to consider adding the template to a shared drive or cloud storage solution, where multiple collaborators can add their comments simultaneously.

Template

The Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects	
First draft of the second world ocean assessment (WOA II)	
Comments submitted by Australia	
Contact person: *Please fill out the below with the details of a person the secretariat can contact in case there are any questions.*	
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Checklist:	
	This document contains all comments on the first draft of WOA II from Australia
	All comments are submitted in the template provided below.
	The document is submitted in either **.doc** or .**docx** format.
	All comments in this document are in English.
	This document is submitted by (1) the Permanent Mission of Australia to the United Nations.
	This document is sent to the secretariat of the Regular Process (doalos@un.org; temnova@un.org; legesseh@un.org) no later than midnight (New York time) on **5 June 2020.**

Overall comments on the first draft of the second world ocean assessment (WOA II)	
	Australia considers that the first draft of the WOA II report is well written and has some useful policy recommendations, many of which Australia is aware of and addressing.
	Australia acknowledges that with a report as wide-ranging as this, some terms, such as 'sustainable', will be used in interchangeable ways. We suggest that as part of the overall review of the first draft, consideration could be given to clarifying the use of the term 'sustainable' when it is used in different contexts – such as whether it refers to ecological, economical, or social sustainability.
	Given the progress of ocean-related matters since the draft report was being developed, the draft could benefit from an overall review to incorporate latest relevant information over the past year, particularly over the first half of 2020. A number of recent main updates are highlighted in the relevant chapters below.
Chapter 1: Overall summary	
Section	**Comment**
Key points	Suggest including a comment on the impacts of COVID-19 restrictions on ocean and coasts, both here and in a new section of the chapter.
Section 2: Drivers, point c	The link between technological advances and oversubscription of fisheries seems tenuous. Technology is definitely helping fishers be more efficient and work farther afield, but it is failure of management that leads to overfishing and oversubscription in fisheries. Perhaps something like deep-sea mining or deep oil and gas extraction which rely more directly on technology would be better examples here?
Section 6.2: Hazards from the ocean	Should note sea-level rise as a potential major driver of coastal erosion.
Section 7.2: Marine capture fisheries	This section cites research about the estimated increase in landings – citation needed. Section introduces a key point also reiterated in chapter 15 – that is, with appropriate management and governance stocks could be rebuilt within a ten year recovery timeframe. Citation needed, particularly if it is a key premise of the Chapter 15 outlook. Statement seems general in nature and likely gives false hope. More specifically, 'rebuilding' occurs according to a set of objectives which becomes relevant to the recovery period. Our experience in RFMOs (and probably domestic fisheries?) shows us that a rebuilding objective can take a long time – in some cases 20, 30 or more years.
Section 7.3: Aquaculture	Could note the negative impacts on benthic environments that can arise from aquaculture.
Section 8.5: Tourism and	Infrastructure for cruise ships is also a growing issue in developing countries.

recreation	
Section 9.3: Implementation and regulatory gaps	'*Many small island developing States and least developed countries lack the detailed knowledge and skilled human resources needed for ocean management because of the large 10 ocean areas under their jurisdiction and their limited resources and capacity*.' Suggest reframing this statement – while capacity is an issue in SIDS, the current construction could be construed as being insensitive.
Chapter 2: Approach to the assessment	
Section	**Comment**
Section 4: Use of terminology	Definitions for key terms "continental shelf", "open ocean", "deep sea" and "areas beyond national jurisdiction" are noted and agreed.
Chapter 3: Scientific understanding of the ocean	
Section	**Comment**
Section 2: Description of changes in the data …	Suggest noting the significance of the Nippon Foundation-GEBCO Seabed 2030 project: the new data will improve oceanographic modelling and better inform the management of seabed environments.
Section 3.7: The Southern Ocean	This paper may be relevant to this section 2020 Hindell MA, Reisinger RR, Ropert-Coudert Y, Huckstadt LA, Trathan PN, et al., 'Tracking of marine predators to protect Southern Ocean ecosystems', Nature, 580, (7801) pp. 87-92.
Section 5: Key remaining knowledge gaps And/or Section 6: Key remaining capacity-building gaps	We also currently don't integrate data sets well to better understand systems. For example, physical and chemical processes likely have flow on effects for biological elements of ocean ecosystems, but we rarely integrate data streams to try to understand these interactions.
Section 5: Noise	Sentence at line 22 "Understanding of the impacts of anthropogenic noise on marine biodiversity 22 has increased over the last two decades, with a range of direct and indirect impacts observed across a number of taxa."

	Should be supported with references. A relevant reference for the Great Barrier Reef which could be used can be found here (http://hdl.handle.net/11017/3245)
Chapter 4: Drivers	
Section	**Comment**
Section 2.5: Climate change: Page 49, line 18.	Suggest authors use the title of the report: 'The IPCC Special Report, The Ocean and Cryosphere in a Changing Climate' Page 49 line 29: There is no Chapter 9 in the IPCC report, this should read 'Cross-Chapter Box 9'.
Section 2.5: Page 49, line 29.	There is no Chapter 9 in the IPCC report, this should read 'Cross-Chapter Box 9'.
Section 5: Key remaining knowledge and capacity-building gaps	One thing that is not present here is the potential use of oceans as clean energy sources. Are there potential implications of turbines and other in water infrastructure on habitats and species? Do we understand how these energy systems might alter ocean ecosystems?
Chapter 5: Physical and chemical state of the ocean	
Section	**Comment**
Keynote points	The first point should be expanded to specify thermal expansion, e.g.: "Thermal expansion from a warming ocean, together with land ice melt, are the main causes …"
Introduction	Should this set the scene with the past/palaeorecord? E.g.: • Large changes in sea level are generally a result of changes in the size of the ice sheets • Over the glacial cycles of the past 800,000 years, sea level varied by more than 120 metres. • During past warm periods, sea level was metres above present-day values. For example, sea level was between about 5 metres and 10 metres above current levels during the last interglacial (warm) period (129,000 to 116,000 years ago). During this time, global average surface temperatures were less than 2°C warmer than just before the mid-19th century. • During cold periods, major ice sheets formed over North America and northern Europe and Asia and increased in size in Antarctica. As a result, sea level fell to more than 120 metres below present-day values. • After the last glacial maximum about 20,000 years ago, sea level rose at

	over 1 metre/century for many thousands of years (with peak rates of about 4 metres/century) as these ice sheets decayed. • About 6,000 years ago sea levels stabilised with only small rates of change over the last thousand years.
Section 2.7: Sea ice	Overall: There is considerable variability in the maximum and minimum sea-ice extent in the Arctic and Antarctic. Perhaps a range should be included (e.g. Antarctic maximum extent of 19-20 x 10^6 sq. kms). And there is certainly no need to include the decimal place (e.g. 18.5 x 10^6 sq. km should probably be written as 18 x 10^6 sq. km, given the large interannual variability).
Section 2.7: Sea ice	Overall: There are inconsistencies in citing observed extents. E.g. for the Arctic this is written as 6.4 million sq. km, whereas for the Antarctic this is written 18.5 x 10^6 sq. km.
Section 2.7: Sea ice: Page 71, line 17.	"The trends in Antarctic sea ice are …" – should this be "The trends in Antarctic sea-ice extent are …"?
Section 2.7: Sea ice: Page 71, lines 18-20.	"Unlike in the 18 Arctic, the expected changes in sea ice due to climate change overall in Antarctica are muted 19 and may even be increasing." This sentence should probably be re-written – or perhaps deleted for a more enlightening explanation. Net Antarctic sea-ice extent showed a statistically significant increase from 1979-2015. From 2016 onwards, net Antarctic sea-ice extent has been consistently below average and set new record low values. Given that this sudden variability in Antarctic sea-ice cover is largely attributed to changes in the ocean mixed layer, it is highly relevant to expand this explanation. See for example, Meehl et al. 2019, and Reid et al. 2019. The net overall changes in sea-ice cover have been very regionally variable. Meehl, G. A., Arblaster, J. M., Chung, C. T. Y., Holland, M. M., DuVivier, A., Thompson, L., … Bitz, C. M. (2019). Sustained ocean changes contributed to sudden Antarctic sea ice retreat in late 2016. Nature Communications, 10(1), 14. https://doi.org/10.1038/s41467-018-07865-9. Reid, P., S. Stammerjohn, R. A. Massom, S. Barreira, T. Scambos, and J. L. Lieser, 2019: Sea ice extent, concentration, and seasonality [in "State of the Climate in 2018"]. Bull. Amer. Meteor. Soc., 100 (9), S178-S181.
Section 2.7: Sea ice: Page 71, lines 20-24.	A dichotomy is drawn between trends in Arctic and Antarctic sea-ice cover. However, the contrast is difficult to understand in this context. It is suggested that Antarctic sea-ice cover is limited in its expansion during winter by the ACC and during summer its retreat is limited by the continental edge – both statements are true. But the analogy breaks down when you ask why the winter-time Antarctic sea-ice cover is not reducing – as it is in the Arctic.

	Accordingly, the dichotomy statement needs to be better explained or removed and replaced with a suitable explanation of the contrasting trends. Perhaps Parkinson, 2019, or Stammerjohn et al. 2012. Parkinson, Claire L. "A 40-y record reveals gradual Antarctic sea ice increases followed by decreases at rates far exceeding the rates seen in the Arctic." would be of assistance. See also: Proceedings of the National Academy of Sciences of the United States of America 116 (2019): 14414 – 14423; and Stammerjohn, S., R. Massom, D. Rind, and D. Martinson. 2012. Regions of rapid sea ice change: An inter-hemispheric seasonal comparison. Geophysical Research Letters 39, L06501, http://dx.doi.org/10.1029/2012GL050874.
Section 2.7: Sea ice: Page 71, lines 24-27.	Please note that while the text over these lines refers to trends in sea-ice extent, the figure used to explain these trends (Figure 10) shows trends in sea-ice concentration. The two are not synonymous.
Section 2.7: Sea ice: Page 71, lines 27-29.	This sentence is unclear – suggest rephrasing to improve clarity.
Section 2.7: Sea ice: Page 72, Figure 10.	This figure is rather crude and probably needs to be reproduced at a higher quality.
Section 2.7: Sea ice: Page 72, line 10.	Suggest a reference of Massom et al. 2018. Massom, R.A., T.A. Scambos, L.G. Bennetts, P. Reid, V.A. Squire, and S.E. Stammerjohn, 2018: Antarctic Ice shelf disintegration triggered by sea ice loss and ocean swell. Nature. 558, 383-389, doi:10.1038/s41586-018-0212-1.
Chapter 6: Trends in the biodiversity of main taxa of marine biota (overall introduction)	
Section	**Comment**
[Nil input]	
…	
Chapter 6A: Plankton	
Section	**Comment**
[Nil input]	
Chapter 6B: Marine invertebrates	

Section	Comment
Section 3.2: Assessment and state of marine invertebrate biodiversity: Page 118, line 6.	Seems to be a repeat of part of an earlier dot point on previous pages.
Section 4: International governmental responses: Page 121, lines 3-9.	• Not clear what policy change implementation is being referred to. An expectation under what? Suggest replace with "In relation to the Great Barrier Reef in the South Pacific, a comprehensive joint-government strategy the Reef 2050 Long-term Sustainability Plan is directing investment into protection of the Reef and mitigation of pressures. To support this, an integrated monitoring, modelling and reporting program is under development to measure the condition of values over time and support future management decisions". • Replace *"…downgrading of the reef condition from.."* with the correct, more specific, *"downgrading of the outlook for the Reef's ecosystem..."* • Suggest giving 'reef' a capital letter when referring to the Great Barrier Reef as a whole. This is a style guide consideration. • Replace *"Management Protection Authority"* with *"Marine Park Authority"*.
References – Page 123, line 'GBR-(2019)'	• Author should be "GBRMPA" not just GBR • For additional publication details, see http://elibrary.gbrmpa.gov.au/jspui/handle/11017/3474.
Chapter 6C: Fish	
Section	**Comment**
[Nil input]	
Chapter 6D: Marine mammals	
Section	**Comment**
Section 2: Cetaceans – Line 36-37	Direct take is not an ongoing threat to Antarctic minke whales following the cessation of Japan's Southern Ocean whaling.

Section 6.1: Consequences of change on human communities, economies and well-being – Line 38-40	Japanese catches in Antarctic waters no longer occur following their 2019 withdrawal from the whaling convention. Text reads as though this is ongoing. Japan is whaling only in their Exclusive Economic Zone.
Section 6.1: Consequences of change on human communities, economies and well-being – Line 40-43	While NAMMCO manage more marine mammal species than the IWC (seals etc.), the global body (IWC) should be referenced before the regional agreement.
Section 7: Outlook	This section should mention the bio-accumulation of persistent organic pollutants including polychlorinated biphenyls (PCBs) in some cetaceans, and the possibility of population collapse for orcas. See https://science.sciencemag.org/content/361/6409/1373.abstract and others
Section 9: Capacity building gaps	Could include the challenges in integrating regional, national, and international laws to protect migratory species (i.e. how range states can best collaborate).
Chapter 6E: Marine reptiles	
Section	**Comment**
[Nil input]	
Chapter 6F: Seabirds	
Section	**Comment**
[Nil input]	
Chapter 6G: Marine plants and macroalgae (merged with Chapter 6H and incorporates elements from Chapter 7H)	
Section	**Comment**
5.2 Current status and	'This species 25 lost around 50 per cent of its total biomass during heat waves an anomaly that reached 2.66 degrees above the mean normally observed for the respective period (Gouvea and others, 27 2017).' - which period? Needs

trends	rewriting.
Chapter 6H: Macroalgae (merged with Chapter 6G)	
Chapter 7: Trends in the state of biodiversity in marine habitats	
Chapter 7A: Sand and mud substrates and rocky substrates and reefs (merged with Chapter 7B)	
Section	**Comment**
[Nil input]	
Chapter 7B: Rocky substrates and reefs (merged with Chapter 7A)	
Chapter 7C: Intertidal zone (to precede Chapter 7A)	
Section	**Comment**
[Nil input]	
Chapter 7D: Atoll and island lagoons	
Section	**Comment**
[Nil input]	
Chapter 7E: Tropical and subtropical coral reefs	
Section	**Comment**
Keynote points: Page 238, lines 3-5.	• Sentence structure makes it sound a little like rising ocean temperatures are caused not only by climate change but also by the list of things that come after it Page 238 Suggest rewording second dot point from: *The frequency of disturbances caused by heatwaves, storms, flooding and crown-of- thorns starfish outbreaks has increased as recovery time between disturbances has decreased.* To: *The frequency of disturbances caused by heatwaves, storms, flooding and crown-of- thorns starfish outbreaks has increased, resulting in a decrease in recovery time between disturbances.*
2. Description of the environmental changes (between	The fact that the Great Barrier Reef has experienced three mass coral bleaching events in the past five years (2016, 2017 and 2020) should be mentioned here or in section 4.4. Pacific Ocean

2010 and 2020)	
Chapter 7F: Cold-water corals	
Section	**Comment**
[Nil input]	
Chapter 7G: Estuaries and deltas	
Section	**Comment**
[Nil input]	
Chapter 7H: Kelp forests and algal beds (elements incorporated into Chapter 6G)	
Chapter 7I: Seagrass meadows	
Section	**Comment**
[Nil input]	
Chapter 7J: Mangroves	
Section	**Comment**
[Nil input]	
Chapter 7K: Salt marshes	
Section	**Comment**
[Nil input]	
Chapter 7L: Submarine canyons	
Section	**Comment**
Introduction: Page 310	Figure 1 is difficult to read, please enlarge.
2.2.3 Food Supply	No mention of upwelling of nutrient waters into canyons as a food source for benthic and pelagic life, and potential change under climate change. Consider also connectivity to terrestrial supply (via rivers) in some settings is under change.
2.4.2 Geomorphic Heterogeneity	Consider citing Huang and others (2018) Progress in Oceanography https://doi.org/10.1016/j.pocean.2017.11.007 as an example from Australian continent of canyon geodiversity

Chapter 7M: High-latitude ice	
Section	**Comment**
[Nil input]	
Chapter 7N: Seamounts and pinnacles	
Section	**Comment**
Section 4.6: South Pacific Ocean	Research has also focused on characterising seamounts within Australian Marine Parks, e.g. the Gifford Marine Park in the Coral Sea, to ascertain their ecological significance. See: https://www.nespmarine.edu.au/system/files/Nanson_Miller%20et%20al%20An%20eco-narrative%20of%20Gifford%20Marine%20Park%20Milestone%2014_RPv4%202018.pdf.
Chapter 7O: Abyssal plains	
Section	**Comment**
[Nil input]	
Chapter 7P: Open ocean	
Section	**Comment**
4.4 South Atlantic Ocean	Suggest this section could benefit from re-writing to improve clarity.
4.6 North Pacific Ocean	'… starvation of fish-eating birds' - evidence of this?
Chapter 7Q: Ridges, plateaus and trenches	
Section	**Comment**
Section 2.1.1: Ridges: biodiversity and ecosystem function	Consider addition of following text: "Recent seabed mapping in the deep ocean has improved the resolution of large-scale features, as shown by the mapping undertaken in the southern Indian Ocean in the search for missing Malaysian Airlines aircraft MH370. These data revealed an unknown diversity and complexity of seabed morphology that will likely be reflected in biodiversity of benthic communities (Picard and others, 2018) https://doi.org/10.1016/j.margeo.2017.10.014. Further discoveries of deep ocean seabed complexity will be made as mapping continues, particularly through global initiatives such as the GEBCO-Nippon

	Foundation Seabed 2030 Project."
Chapter 7R: Hydrothermal vents and cold seeps	
Section	**Comment**
[Nil input]	
Chapter 7S: Sargasso Sea	
Section	**Comment**
[Nil input]	
Chapter 8: Trends in the state of human society in relation to the ocean	
Chapter 8A: Coastal communities (elements incorporated into Chapter 8C)	
Chapter 8B: Human health as affected by the ocean	
Section	**Comment**
[Nil input]	
Chapter 8C: Maritime industries (incorporates elements from Chapters 8A, 18, 23, 24)	
Section	**Comment**
Keynote points: page 450, line 17.	For economies distant from markets, and with no land borders, the volume of trade transported by ships is likely to well exceed 90 per cent. For example, over 99 per cent of Australia's imports and exports by volume and over 79 per cent by value are carried by ships. It is worth highlighting the significant dependence of certain countries, such as Australia, on shipping for international trade. The keynote point notes that the shipping sector is recovering from the economic crisis of 2008-2011. It is also worth discussing the recent short term impacts of the COVID-19 pandemic in disrupting supply chains and reducing global container volume demand, as well as the long term impacts on the shipping industry as the global economy potentially heads into a deep recession.
Section 4.2: page 455, lines 26-27.	The analysis of the introduction of the IMO Sulphur 2020 Rule from 1 January 2020 is oversimplified. The price of compliant low sulphur fuel oil has more than halved due to refineries increasing production of low sulphur fuel oil to meet demand and following the drop in crude oil prices due to oversupply during the coronavirus pandemic. The price differential between high and low sulphur fuel oil has been significantly reduced.
Section 4.6: page 459,	It may be worth mentioning that the International Convention for the Prevention of Pollution from Ships (MARPOL) bans the use and carriage of heavy fuel oil for ships operating in Antarctic waters.

lines 13-16.	
Chapter 8D: Maritime cultural services (elements incorporated into Chapters 30 and 31)	
Chapter 9: Pressures from changes in climate and atmosphere	
Section	**Comment**
[Nil input]	
Chapter 10: Nutrient inputs	
Section	**Comment**
Section 4.8: Great Barrier Reef: Page 506.	The paragraph on the Great Barrier Reef uses outdated references. Suggest referring, in the first instance, to the 2019 Outlook Report. Sections 3.3.1, 6.5.1 and 6.5.2 specifically discuss nutrients and land-based run-off. Section 3.6.2 specifically discusses COTS with a range of references to support current understanding. A scientific consensus has not been reached on the potential link between nutrients and COTs outbreaks. Suggest that a more appropriate statement would be: *"Higher nutrients also increase the growth and survival of larvae of the crown-of-thorns starfish (Acanthaster cf. solaris), and could potentially exacerbate outbreaks of this coral-eating pest (Fabricius et al. 2010, Wolfe et al. 2017)"* • Fabricius, K.E., Okaji, K. and De'Ath, G. 2010, Three lines of evidence to link outbreaks of the crown-of-thorns seastar Acanthaster planci to the release of larval food limitation, Coral Reefs 29(3): 593-605. • Wolfe, K., Graba-Landry, A., Dworjanyn, S.A. and Byrne, M. 2017, Superstars: assessing nutrient thresholds for enhanced larval success of Acanthaster planci, a review of the evidence, Marine Pollution Bulletin 116(1): 307-314. Some suggested references which could be of relevance to this assessment include: 3.4.1 specifically discuss mode, lines 32-46 • Section on Trichodesmium and eutrophication etc – the reference to Bell in 1992 is very out of date as well as the key sentence which should be replaced with more contemporary findings see here "Section "3.6.4 Other outbreaks" of the Outlook Report 2019 does not contain commentary on whether or not areas of the GBR are eutrophic. The section does provide some additional, more recent, references regarding *Trichodesmium* monitoring etc. It notes (i) limited broadscale monitoring of this algae, and (ii) long-term gradual increase observed at one monitoring site.
Section 4.8:	• Likely link between eutrophication and bleaching is supported by

Great Barrier Reef: Page 506, lines 36-50.	evidence, however this is not the "main" reason reefs have not recovered. Current text refers to very old references (Bell) and the summarised findings are not contemporary of accurate. Please replace current text with the following tracked change version: River-borne inputs of dissolved inorganic P (P-PO4) can promote the growth of Trichodesmium spp.. While limited broadscale monitoring of Trichodsmium spp. Occurs across the Great Barrier Reeef, long-term data at one site near the Yongala Wreck since 2010 indicates a long-term gradual increase in its abundance (ref 773 from the 2019 Outlook Report). The nitrogen-fixing ability of Trichodesmium suggests that increasing 39 levels of P-PO4 alone may be driving increases in phytoplankton biomass, and there is some evidence that these trends are a factor in the decreasing condition of fringing reefs in the inner GBR lagoon (reference 467 from the 2019 Outlook Report). Nutrients in the water column from natural upwelling and land-based runoff are just one of many factors which combine to provide positive outbreak conditions for the coral predator crown-or-thorns starfish (*Acanthaster* cf. *solaris*) (reference Great Barrier Reef Outlook Report 2019). In 2020 pressures from an ongoing outbreak of crown-of-thorns starfish was amplified by a third mass bleaching in the last fiver years. While the full impact of this event has not been quantified, an estimated 30 per cent of shallow water coral cover was lost following the 2016 mass bleaching event, with further declines across the northern two thirds of the Reef in 2017 (References 90-91 from the Outlook Report 2019).
Chapter 11: Liquid and atmospheric inputs from land, ships and offshore installations	
Section	**Comment**
Section 3: Persistent organic pollutants (including run-off from the use of agricultural pesticides)	More emphasis could be placed on the potential impact on whales (and other marine mammals) at the top of the food chain, given the accumulative nature of these chemicals. There is quite a lot of literature on this now.
Section 3.2: Situation recorded in the First World Ocean Assessment (WOA I):	The reference to 'north-west' is incorrect as the Great Barrier Reef is on the north-east coast of Australia *(unless WOA I made this statement in relation to Ningaloo or other Western Australian reefs and not the GBR, in which case the attribution of reef name is incorrect in the dot point).*

Page 519, lines 31-32.	
Section 7.3: Description of the environmental changes: Page 544, lines 23-25.	Besides the introduction of the IMO Sulphur 2020 Rule from 1 January 2020, it would also be worth mentioning that the IMO has banned the carriage of high sulphur fuel oil on board ships for propulsion purposes from 1 March 2020. There are also unilaterally applied emission control zones along the coast lines of the United States and China.
Chapter 12: Solid waste	
Section	**Comment**
[Nil input]	
Chapter 13: Erosion and sedimentation	
Section	**Comment**
Section 2.2: Changes in pressure: Page 599.	Could be clearer linking of the four examples at end of this section to the core argument of increasing anthropogenic pressure.
Section 2.3: Changes in state: Page 599, line 19-20.	Check wording, sentence structure.
Section 4.3: Indian Ocean …	Suggest adding reference to population density along these coasts, as presented for other regions.
Section 4.5: South Pacific	As above
Chapter 14: Coastal and marine infrastructure	
Section	**Comment**
Keynote points: lines 17 – 19.	Re dot point reading '*Coastal and marine infrastructure development in general has created new opportunities for coastal dwellers and supported sustainable socioeconomic coastal development'*, if that statement is intended to convey that such development is generally **ecologically** sustainable (as well as economically and socially sustainable), we would question that. If it not intended to convey that, we suggest re-drafting to make that clearer.

Section 2.3: Other adaptations affecting coastal populations as a result of sea level rise: lines 29 – 31.	Sentence reading '*Adaptation strategies …. the risks to individuals, communities and societies …*', we suggest adding '***ecosystems***,'.
Section 2.6: Changes in submarine cables and submarine pipelines: Page 611, line 21.	The average installation rate of communications cables is listed as "70,00 km per year". Is this 7,000 or 70,000?
Section 3: Consequences of the change on human communities, economies and well-being	Paragraph beginning '*In general, coastal infrastructure development increases the resilience of the coasts …*', if that is intended to convey that **ecological** resilience is generally increased, we disagree. If it is not intended to convey that, we suggest redrafting to make that clear.
Chapter 15: Capture fisheries	
Section	**Comment**
Section 1: Introduction: Page 621.	'*Many regional fisheries management organizations or arrangements (RFMO/As) covering the high seas were not fully effective in assessing stocks, enforcing quotas, or providing observer coverage to account for catches, bycatches or discards (Cullis-11 Suzuki and Pauly, 2010; Crespo and Dunn, 2017; ICES, 2018a).'* We consider some terms are improperly used here and the statements are out of context: • We are not aware of any RFMOs that cannot enforce a *quota*. A quota is relatively easy to enforce. If the authors meant to say *catch limits*, referring to the 'global' limit in the RFMO, then we would agree. • We are unclear what is meant by 'not fully effective in assessing stocks'. Many RFMOs do have regular stock assessments. In some cases a full assessment is not possible (or indeed, required) and low data methods may need to be used (low data can be because of low effort, such as the case in SPRFMO; or

	because of a lack of monitoring as is the case in IOTC neritics). • Observers provide verification but there are other ways to obtain and verify this data.
Section 1: Introduction: Page 622.	'*Management reforms, such as rights-based approaches, have the potential to yield significant increases in annual catches (2–16 MT) and 2 profits (31–53 billion dollars) (Costello and others, 2016).*' This statement seems out of context – management reforms lead to improved sustainability and improved profitability, but do not in and of themselves 'yield significant increases in annual catches.' – this is not necessarily the goal. Likewise, rights-based approach do not have this direct effect.
Section 11: Key capacity-building gaps: Page 629.	As flagged above, the content in this section seems unfounded. We suggest that – if this is the conclusion the authors seek to draw – further citations and/or evidence is provided. Otherwise, we suggest a more reliable conclusion should be drawn.
Chapter 16: Aquaculture	
Section	**Comment**
[Nil input]	
Chapter 17: Seaweed harvesting and use	
Section	**Comment**
[Nil input]	
Chapter 18: Desalination and sea salt production (elements incorporated into Chapter 8C)	
Chapter 19: Seabed mining	
Section	**Comment**
[Nil input]	
Chapter 20: Hydrocarbon exploration and extraction	
Section	**Comment**
[Nil input]	
Chapter 21: Anthropogenic noise	
Section	**Comment**

Keynote points (lines 6 – 8)	While noise does not persist in the marine environment once the source is removed, that is not to say that the impacts do not persist (e.g. physiological damage or mortality). Suggest this is a distinction worth making.
Section 1: Introduction: Page 686, para 1.	Perhaps worth re-emphasising here (paragraph 1) that this topic was the subject of the 19th Meeting of the UN Open-ended Informal Consultative Process on Oceans and the Law of the Sea. https://undocs.org/A/73/124 https://www.un.org/Depts/los/consultative_process/icp19_report.pdf.
Section 1: Introduction; Section 2: Description of the environmental status	Suggest mentioning early studies show that warmer and more acidic oceans due to climate change reduce sound absorption, amplifying underwater noise.
Section 2: Description of the environmental status: Page 688, lines 43-50; page 689, lines 1-5.	Marine traffic as a contributor to ocean noise: It would be worthwhile to reference the International Maritime Organization (IMO) *Guidelines for the Reduction of Underwater Noise from Commercial Shipping to Address Adverse Impacts on Marine Life* adopted in 2014. These non-mandatory Guidelines provide general advice about reduction of underwater noise to designers, shipbuilders and ship operators. Australia supports the IMO's Marine Environment Protection Committee to review the Guidelines with a view to reduce underwater vessel noise. Commercial shipping traffic follows established routes which transect or are proximal to sensitive marine habitats, for example the Great Barrier Reef in Australia. Measures can and have been taken in localised areas to reduce noise from vessels, however given projected growth in commercial shipping, mitigation strategies at an international level are required to effectively reduce a potentially corresponding increase of underwater vessel noise across the entire ocean basin.
Section 2: Description of the environmental status: page 690, lines 23-40.	Would it be worth noting here some of the limitations and challenges associated with impact studies … e.g. The knowledge we do have is often limited due to experimental conditions or design (unrealistic or unknown sound exposures, artificial tanks, absence of controls) or those focused on a single species which preclude generalisation and extrapolation to other regions, seismic surveys, species, or biological responses. *See section 5 in A critical review of the potential impacts of marine seismic surveys on fish & invertebrates* https://www.sciencedirect.com/science/article/pii/S0025326X16309584.
Section 2: Description of the	Request sentence starting on line 48 be amended accordingly: The use of LFA sonar has been restricted **by some States' navies** due to

environmental status: page 692, line 48.	concerns over its impact on divers and marine mammals
Section 4.4: Indian Ocean …	For the drafting team's information and use as applicable, seismic surveys are being undertaken within Australia's exclusive economic zone and continental shelf for the exploration of oil and gas, specifically offshore Western and Northern Australia in the Indian Ocean.
Section 4.7: Southern Ocean	Suggest looking, and citing as appropriate, previous working papers submitted by the Scientific Committee on Antarctic Research on Anthropogenic Noise in the Southern Ocean. Additionally, for the drafting team's information and use as applicable, seismic surveys are being undertaken in the Southern Ocean for the purpose of scientific research, for example, Voyage IN2020_V01 R V Investigator to Kerguelen Plateau.
Section 5: Outlook: page 697, lines 1-7.	Another key summary point from the 19th UN meeting on Anthropogenic noise was the suggestion that the UN General Assembly in a resolution could characterize anthropogenic underwater noise as a form of transboundary pollution to be mitigated and addressed. During the general exchange of views, delegates also highlighted, *inter alia*, consideration of including ocean noise in the negotiations on the conservation and sustainable use of BBNJ.
Chapter 22: Marine renewable energy	
Section	**Comment**
Section 1.1: Climate change and the clean energy challenge: page 708, para 1.	Suggest strengthening the statement on page 708 para 1: *Reducing GHG emissions is an important step towards reducing climate change impacts.* The Intergovernmental Panel on Climate Change 2018 Special Report on Global Warming of 1.5°C finds that limiting global warming to 1.5°C would require "**rapid and far-reaching**" transitions in land, energy, industry, buildings, transport, and cities. **Global net human-caused emissions of carbon dioxide (CO2) would need to fall by about 45 percent from 2010 levels by 2030, reaching 'net zero' around 2050.** This means that any remaining emissions would need to be balanced by removing CO2 from the air.
Section 3: Key remaining knowledge and capacity-building gaps: page 717, lines 36-37.	Establishing environmental baselines (e.g. seabed mapping and characterization, sediment composition, shallow/deep geology) and monitoring of biotic elements is necessary to confirm that the relevant activities will not have an adverse impact on biodiversity. Need standards for the analysis of environmental monitoring data for MRE development sites. i.e. Quantifying baseline conditions enables the design of operational monitoring programs that measure change caused by known disturbances. Need to identify the area over which biological effects may occur to inform baseline data collection.

Chapter 23: Marine transportation (elements incorporated into Chapter 8C)	
Chapter 24: Tourism and recreation (elements incorporated into Chapter 8C)	
Chapter 25: Invasive species	
Section	**Comment**
[Nil input]	
Chapter 26: Marine genetic resources	
Section	**Comment**
[Nil input]	
Chapter 27: Marine hydrates	
Section	**Comment**
[Nil input]	
Chapter 28: Cumulative effects (renamed from "cumulative impacts")	
Section	**Comment**
Section 2: Cumulative effects assessments.	Reference to Dunstan and others, 2019 - Dunstan, P.K. and others (2019). Draft guidelines for analysis of cumulative impacts and risks to the Great Barrier Reef. Report to the National Environmental Science Programme. Marine Biodiversity Hub. This product is not yet publicly available, however it may be publicly released when the final WOA II report is released. We would appreciate if this is only referenced when public via: https://www.nespmarine.edu.au/project/project-e1-guidelines-analysis-cumulative-impacts-and-risks-great-barrier-reef.
Section 3.1: Great Barrier Reef, Australia: Page 773, line 7.	The 2019 Great Barrier Reef Outlook Report (and perhaps also (2009, 2014 editions) would be highly appropriate references to add here (i.e. where Uthicke reference appears).
Section 3.1: Great Barrier Reef, Australia: Page 773	• Replace reference to Uthicke at line 7 with Great Barrier Reef Outlook Report 2019.
Section 3.1:	• After the first sentence at line 14 add the following

Great Barrier Reef, Australia: Page 773, line 14.	*"However the GBRMPA also invests in reducing key threats which occur outside its jurisdiction, but impact the Reef (such as climate change, land-based run off) through key partnerships, position statements and education. The GBRMPA is a key partner in the Reef 2050 Plan, which has a focus on reducing the key threats identified in the 2019 Outlook Report."*
Section 3.1: Great Barrier Reef, Australia: Page 773, lines 48-50.	• Suggest rewording as follows: *"Formal application of this CEA framework, with a set of guidelines for its implementation, has been formalized in a Cumulative Impact Management Policy for the Great Barrier Reef. Ref here: http://hdl.handle.net/11017/3389"*
Chapter 29: Marine spatial planning	
Section	**Comment**
Section 5: Progress in implementing marine spatial planning	Based on the footnote, the 22 coastal states of the EU may be more accurately reflected in the planned/started/in progress column and not the full/partial MSP approved column. Alternatively, the footnote may benefit from further clarity.
Section 5.2: Case Study – Australia: Pages 796-797.	Outlook Report 2019 could be used as a reference in this section as well as it provides good overview information on these topics (e.g. in its chapters 1 and 7). For example, add it to the brackets containing the Kenchington and Day reference.
Section 5.2: Case Study – Australia: Page 796, line 20 onwards.	This arrangement is not unique. See for example other authorities such as the Murray Darling Basin Authority and the Australian Fisheries Management Authority which also "liaises and coordinates policies with other departments of the Commonwealth of Australia" and states/territories.
Section 5.2: Case Study – Australia: Page 797, line 26.	Unclear what is meant by "However, little of this action developed," as considerable progress has been made.
Section 5.2: Case Study – Australia:	MBP was based on conservation values, which are: key ecological features, protected species (/habitats for those species), and protected places. They could include an ecosystem, but that was just one example.

Page 797, line 28 onwards.	Section should be updated as it appears outdated and considerable progress has been made, including establishing the national representative set of marine protected areas for all regions surrounding mainland Australia, financial assistance for impacted industries, and ongoing scientific work to monitor the changes. This could be linked back to section three (and the recommended steps outlined there as a worked example).
Chapter 30: Management approaches (incorporates elements from Chapter 8D)	
Section	**Comment**
Section 2.1: Introduction to the ecosystem approach	Page 808 of the WOA II makes a reference to the precautionary approach as part of customary international law. In support of this assertion, the WOA II refers to the 2011 Advisory Opinion of the Seabed Disputes Chamber of the International Tribunal for the Law of the Sea on 'Responsibilities and Obligations of States Sponsoring Persons and Entities with respect to Activities in the Area'. Australia considers that the precautionary approach is not a part of customary international law, and does not consider that it should be. Further, we do not agree that the Advisory Opinion referred to in the WOA II supports the assertion that the precautionary approach is now considered part of customary international law. Relevantly, paragraph 135 of that Advisory Opinion states: 135. The Chamber observes that the precautionary approach has been incorporated into a growing number of international treaties and other instruments, many of which reflect the formulation of Principle 15 of the Rio Declaration. In the view of the Chamber, this has initiated a trend towards making this approach part of customary international law. This trend is clearly reinforced by the inclusion of the precautionary approach in the Regulations and in the "standard clause" contained in Annex 4, section 5.1, of the Sulphides Regulations. So does the following statement in paragraph 164 of the ICJ Judgment in Pulp Mills on the River Uruguay that "a precautionary approach may be relevant in the interpretation and application of the provisions of the Statute" (i.e., the environmental bilateral treaty whose interpretation was the main bone of contention between the parties). This statement may be read in light of article 31, paragraph 3(c), of the Vienna Convention, according to which the interpretation of a treaty should take into account not only the context but "any relevant rules of international law applicable in the relations between the parties". A reference to the initiation of 'a trend towards making [the precautionary] approach part of customary international law' does not indicate that the precautionary approach is already considered part of customary international

	law.
Chapter 31: Overall benefits from the ocean (incorporates elements from Chapter 8D)	
Section	**Comment**
[Nil input]	